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IDIMT-2006

13th Interdisciplinary Information Management Talks

The increasing importance of information as a vital resource for organisations and individuals requires an interdisciplinary and holistic way of discussing these topics from various standpoints: sociological, technological, commercial and educational.
IDIMT annually provides an interdisciplinary forum for exchanging concepts and visions in the area of information management, knowledge management, business engineering, information technology, system theory, and related areas. The international setting, the heterogeneity of technical and economic research institutes and the different scientific, economic and historical background of the researchers guarantees a multifaceted view on these topics.

The main focus of the conference are current and future needs of a world dependent on Information and Communication Technology by discussing innovations, advantages, problems, and risks of information technology on the one side, and innovations, trends, problems, and risks in business engineering and business management on the other side.

This year's conference offers the following topics:

- IS/ICT Security in the Newly Forming Society
- Challenges in Managing Software-Intensive Projects
- Do We Need a New Information Management Technology?
- Cooperative Information Environments
- Innovations by ICT
- Enterprise Application Integration
- European projects in Research and Education – Ways to Integration

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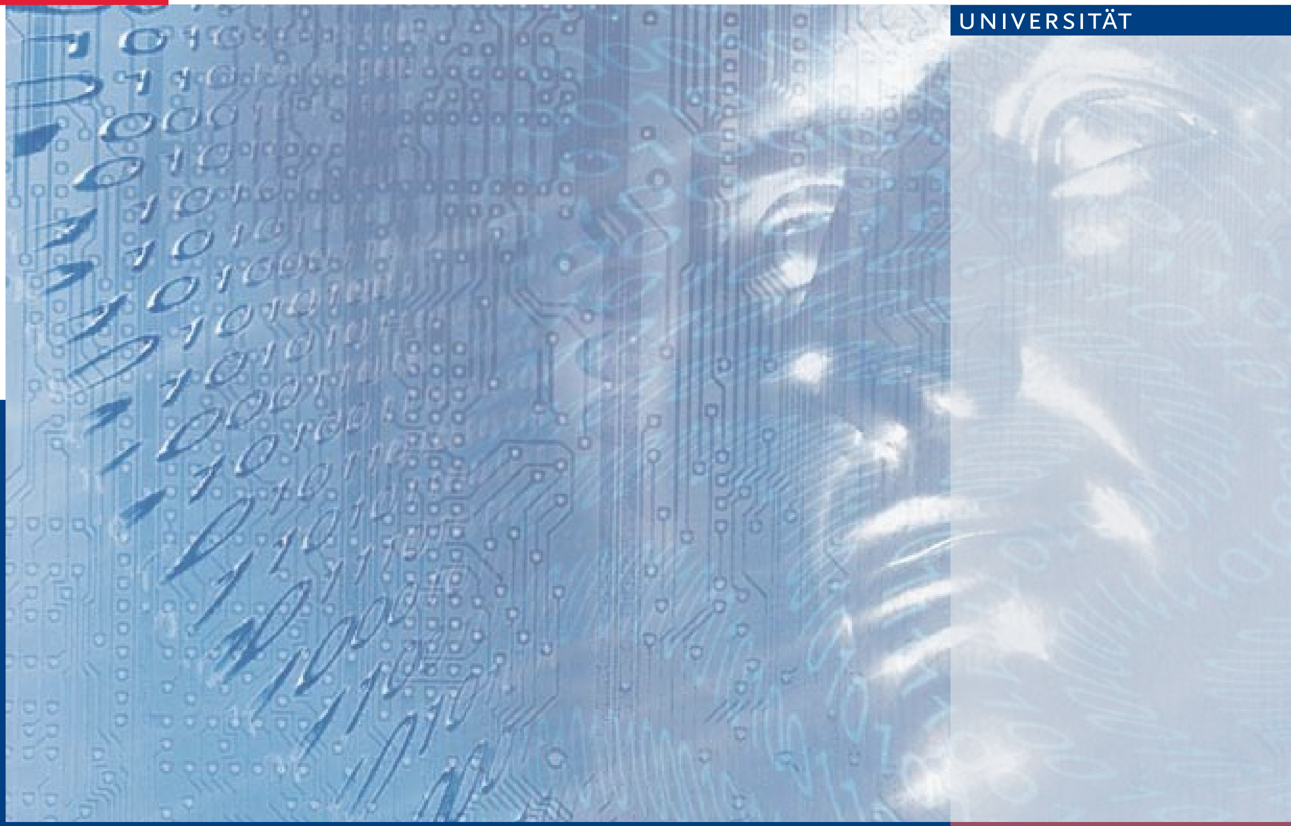

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September 13-15, 2006, Budweis

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HOYER CHRISTOPH, CHROUST GERHARD
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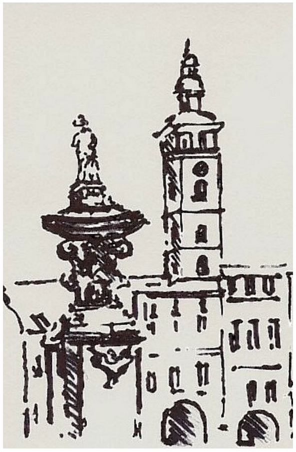
Welcome to IDIMT 2006!



A heartily welcome to the 14th IDIMT-conference! For the fourth time we meet in Budweis to enjoy an excellent environment for exchanging our thoughts and ideas. A lovely old town with a wonderful market place, many friendly people, excellent restaurants offering delicious food, and last but not least the famous Czech beer will inspire our discussions; small streets, lovely little shops and a wide central plaza will invite us to stay, to stroll and to shop. What started in 1993 as a small bi-lateral conference between Czech and Austrian scientists in the Bohemian Forest has now become a well established conference of a scientifically and geographically diverse group of scientists.

A personal reminiscence of the long IDIMT story is presented this year by Petr Doucek (see next paper), bringing to our attention some forgotten facts and histories. This year we were able to accept 29 papers; they were arranged in 7 sessions, each introduced by a keynoter. We preserved the fundamental idea of the conference: providing a solid base for an interdisciplinary and informal exchange of thoughts and interests about economical, technological, and sociological topics. This is one of the outstanding features of IDIMT.

The main focus of the conference are the current and future needs of a world dependent on Information and Communication Technology by discussing innovations, advantages, problems, and risks of information technology on the one side, and innovations, trends, problems, and risks in business engineering and business management on the other side.

This year's session topics are:

- Innovations by ICT
- Do We Need a New Information Management Technology?
- Management of Software-Intensive System Management
- IS/ICT Security in the Newly Forming Society
- Cooperative Information Environments
- Modelling Application integration
- European projects in Research and Education - Ways to Integration

We revived the PhD-day concept: approx. 10 young PhD-students will meet one day before the actual conference and will discuss - somewhat introspectively - the status, the values and the approaches to PhD-studies in their respective countries. An introductory paper by Gerhard Chroust should trigger a lively discussion. Their findings will be presented and discussed as one session of the conference.

The preparation and realization of IDIMT-2006 would not have been possible without the support of many organizations and persons. Therefore we would like to thank:

- the Austrian Ministry of Education, Science and Culture for financially supporting the preparation of the proceedings,
- the Prague University of Economics and the Johannes Kepler University Linz, which as partner universities provide much of the organizational infrastructure,
- the Raiffeisen Bankengruppe Oberösterreich for sponsoring the PhD day,
- the Trauner Verlag for acting as the publisher of our conference,
- Petr Doucek for chairing the Organizing Committee and preparing accommodation in Budweis,
- all session organizers for establishing contacts and soliciting contributors,
- all keynote speakers, speakers and contributors of position papers,
- the secretaries of the involved institutes,
- all other unnamed persons contributing to the success of this conference.

To a good conference!

Christoph Hoyer

Gerhard Chroust

July 2006

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Contents

THE HISTORY OF THE IDIMT CONFERENCES

Petr Doucek [1]

The long and successful history of the IDIMT conferences started in the early 1990's. Since that time, the second half of September is earmarked for this annual meeting of informatics people in the Czech Republic. In this contribution we describe the start and the history of the IDIMT conference series and the main milestones. This contribution is also written as a commemoration of many persons that were involved in the very beginning.

1. Introduction …… "The times they are a-changin'…."

Today IDIMT (the Interdisciplinary Information Management Talks) is a recurring and pleasurable event for a group of young and older scientists mostly coming from Middle Europe. They meet in the second or third week of September in the Czech Republic in order to present their results of annual research and development work, their opinions, proposal and ideas.

Let us look back into the past when Europe was in a transition period, when the Iron Curtain had been just abolished and the integration of the former political enemies – the Eastern socialist countries and the Western democratic countries – was about to start.

It was during the year 1991 when I got the information about the possibility to perform some of my studies in Austria with funding from the "Action Austria Czech Republic". Early 1992 the postivie response came from a Professor Gerhard Chroust, the new head of the Department of "Systemtechnik und Automation" at the Johannes Kepler University Linz. My two month stay was my first personal experience with academic habits, duties, and manners at a university in Western Europe.

What was the general political and social climate in Europe in the early 1990's? All Europe was excited by the coming down of the Iron Curtain and all "modern Europeans" wanted to establish co-operations between the former adversary blocks accross former borders separating democratic and

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socialist countries. It was the time of learning from each other – people from the eastern part of Europe wanted to know about the life in the West and westeners wanted to visit formerly barely accessible parts of their continent. This process was, of course, divided into several areas of human activities such as travelling, business, culture and last but not least education, science and research.

Tourism is useful for getting to know nature and buildings, but only few of tourists are able to appreciate and assimilate specific features of a country they visit. They usually like to stay in n-stars hotels offering comfortably equipped rooms, with international foods on the menu, but they have only few occasions to see and feel the spirit of the country and the nation they are visiting. When someone wants to find a real long-term partner for common work regardless if for business, research or development, he has to visit a partner and live under her/his own conditions. This was the main reason, why I went to Austria to perform my work on project management and software engineering.

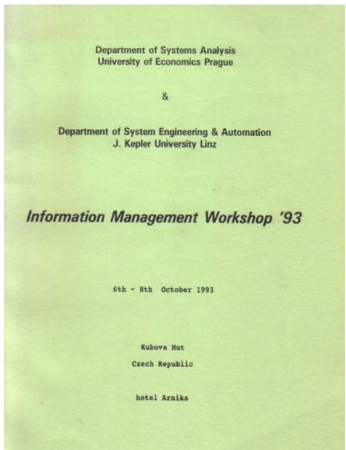
2. IDIMT – From Prehistory to the Future

The first impression I got about Johannes Kepler University and the department of “Systemtechnik und Automation” was a good working department with many ideas and a charismatic boss with plenty of life energy. The main characteristic of Gerhard Chroust is a lot of positive energy he offers to all partners, students, and staff. He is a true engine, always time full of activity and always prepared to support good ideas of his colleagues not only with advice, but also with concrete activity, experience, and wisdom. I finished my study at Johannes Kepler University in early June 1992 and went back to Prague.

We discussed the results of my Austrian stay at our department meeting with the conclusion to develop a general proposal for further common cooperation between these two organizations in the form of a conference. This proposal was supported by the former head of the department and vice-rector for research and development work, Professor Jan Ehleman. He arranged a visit of the Johannes Kepler University in the first months of 1993. Professor Gerhard Chroust as a co-founder of the co-operation accepted this proposal and at a meeting in Linz the common intent of cooperation between the Kepler University and the University of Economics, Prague was proclaimed – mainly in the area of a conference. It was the start of what was to become the IDIMT Conference series.

Other persons instrumental for the start of the IDIMT history were:

- Professor Ernest Kulhavy, the former vice rector of the Kepler University, and in charge of external relations
- Professor Leo Vodáček, the guru of management science at University of Economics, Prague and founder of the research discipline and master study program "Information management", guarantor of all courses of information management at Faculty of Informatics and Statistics,
- Associate Professor Prokop Toman, University of Economics, Prague, the renaissance person, with a main focus on philosophical and social aspects of information system improvement for the human community.



These were the first visionaries of the IDIMT and its way to future success.

Many small and bigger issues and problems had to be solved during this co-operation. The first was to create a name for the conference. The first year was performed under the name "Information Management Workshop 1993". We choose a small hotel in Kubova Huť in the Czech Republic. In October 1993 the name of the conference was changed to "Interdisciplinary Information Management Talks" – and the name still expresses the basic intention for the conference; since 13 years.

The proceedings of 1993 were published by the Dept. of Systems Analysis, Prague University of Economics. From 1994 to 1997 the proceedings were published by the OCG (Austrian Computer Society, Vienna) together with Oldenbourg Verlag, Munich. From 1998 we chose the Trauner Publisher in Linz for our proceedings.

Numerous conferences are organized all over the world, but what is the key advantage, according to my opinion, the added value, of this small but smart meeting?

1. Scientists from several Central-European countries take part in the meetings (usually from Austria, Czech Republic, Germany, Hungary, Slovak Republic, Slovenia),
2. The knowledge and experience of the participants comes from a heterogeneous background: ranging from more technical orientation of the Austrian, German and Hungarian participants to regular Czech participants focussing on philosophy and human aspects of information and communication technology (ICT) improvement, to a strong systemic contribution from the

Slovenian Participants mixed with techno-economic considerations from the Slovak Republic. This offers an ideal condition for know-how interchange and is an ideal breeding ground for interdisciplinary discussion.

3. We enjoy a wide scope of presentations, with information, ideas, concepts and knowledge – from technically oriented contributions focusing especially on human aspects of ICT, on philosophical aspects of ICT's impacts on society to managerial aspects of ICT and the management and modelling of informatics.
4. Specialization of the participants varies as well as their age and practical experience. The participants differ from young, dynamic and self-confident PhD. students to wise and more "conservative" professors.
5. Different concepts of the education process are presented and discussed.
6. The results of different national and international projects are presented and new alliances are established at this conference aiming to prepare new common projects.
7. Formal as well as informal discussions provide an integral part of the conference with enough time to discuss all aspects of the presented contributions.
8. The topical orientation of the conference is regularly updated in order to include new and current themes.
9. We manage to include young scientists (sometimes via a special PhD-programme). They not only get a chance to contribute, they also learn the mechanics of an international conference.

The statistics in Table 1 show that IDIMT really can be proud of a 'sustainable' success.

Table 1: Statistics about IDIMT Proceedings

Year	Authors	Papers	Pages	Editors	Conference Place
1993	*14*	*14*	*151*	*G. Chroust, P. Doucek*	*6.-8.10., Kubova Huť*
1994	*27*	*23*	*233*	*G. Chroust, P. Doucek*	*9.-11.11., Kubova Huť*
1995	*33*	*25*	*228*	*G. Chroust, P. Doucek*	*8.-10.10., Kubova Huť*
1996	*30*	*21*	*215*	*G. Chroust, P. Doucek*	*16.-18.10., Zadov*
1997	*35*	*30*	*320*	*S. Hofer, P. Doucek*	*15.-17.10., Zadov*
1998	*39*	*27*	*390*	*S. Hofer, M. Beneder*	*21.-23.10., Zadov*
1999	*46*	*34*	*424*	*S. Hofer, M. Beneder*	*02.-03.9., Zadov*
2000	*48*	*32*	*440*	*C. Hofer, G. Chroust*	*20.-22.9., Zadov*

Year	Authors	Papers	Pages	Editors	Conference Place
2001	*45*	*29*	*397*	*C. Hofer, G. Chroust*	*19.-21.9., Zadov*
2002	*38*	*24*	*350*	*C. Hofer, G. Chroust*	*11.-13.9., Zadov*
2003	*38*	*24*	*310*	*C. Hofer, G. Chroust*	*10.-12.9., České Budějovice*
2004	*31*	*23*	*304*	*C. Hofer, G. Chroust*	*15.-17.9., České Budějovice*
2005	*30*	*22*	*313*	*Ch. Hoyer, G. Chroust*	*14.-16.9., České Budějovice*
2006	*44*	*29*	*366*	*Ch. Hoyer, G. Chroust*	*13.-15.9, České Budějovice*
Sum		*357*	*4441*		
avg.		*25,5*	*317,21*		

The initial conference took place in 1993 in Kubova Huť in Šumava Mountains (Böhmerwald) in the hotel Arnika. Kubova Hut is a marvellous small village near the Boubin Forest in the heart of Šumava Mountains, but with very bad accessibility. The IDIMT conference was located there for two further years. In 1995 it moved closer to civilization, to Zadov – a famous tourist centre also in Šumava Mountains. The Zadov village has the same distance to Prague and to Linz – 156 km. In hotel Olympia, under the gesture of Mr. Pavlik, the director of the hotel, the conference ran for eight years. During these eight years several innovation of the conference program were realized. Session topics were changed as well as the schema of the conference.

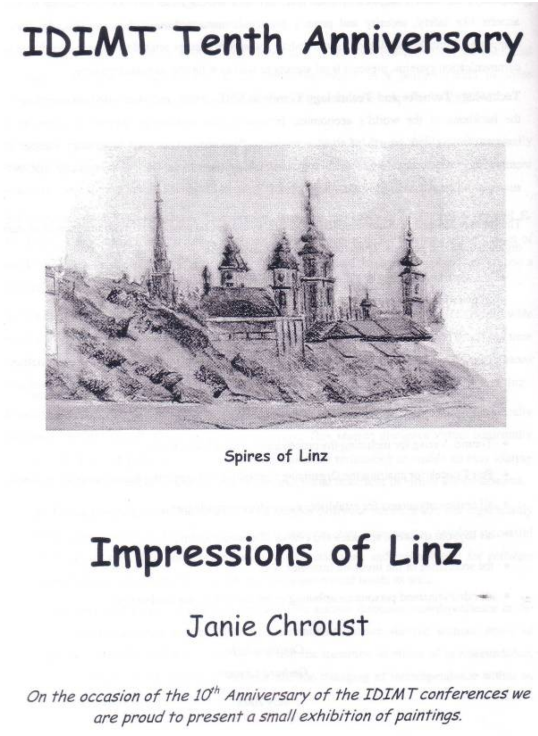
An important addition was introduced in 2002, at the 10th anniversary of the IDIMT conferences. The conference was split into two parts. The first part was held in Prague in the form of a PhD-symposium under the patronage of the former rector Professor Jaroslava Durčáková. The cultural part of the PhD. session included a visit of the Charles University - the oldest University in the Middle Europe.

PhD students from three countries were present. Their contributions mainly dealt with their PhD work and were discussed by the whole forum in formal and also informal settings. The final results of this session were presented by selected PhD students in the main IDIMT conference in Zadov. As a follow on a PhD meeting was repeated in 2003 with Czech and Slovak PhD students as a common action.

In 2002 a special cultural feature of the 10thIDIMT Conference was a very well received painting exhibition by Mag. Dr. Traude Lösch and Janie Chroust under the title “Impressions of Vienna - Impressions of Linz”.

In 2003 the conference moved for the third time, this time directly to the heart of the South Bohemia, to the lovely city of České Budějovice. Here the conference was arranged in co-operation with the Theological Faculty of the South Bohemian University. Since then we enjoy this juwel of history and the famous beer.

The IDIMT conferences became, regardless of their location, an ideal platform for presenting scientific results especially for younger colleagues and PhD students. We can be proud of them.



IS/ICT Security in the Newly Forming Society

IS/ICT SECURITY IN THE NEWLY FORMING SOCIETY

Michael Sonntag

Information system security has long been recognized as an important issue, but many applications are still lacking in this area. This applies especially to "young" techniques and systems, where the focus is on getting them to work and selling products instead of providing services for existing installations. Nowadays security receives a constantly growing attention, both through threats like terrorism and the increase in criminal incidents. Security is also changing from a technical issue to a systemic and society aspect: Technical building blocks are available for all areas, but which/how to combine them needs to be decided according to priorities which cannot be defined technically. As example, several new or important technologies will be discussed according to their security problems to serve as a suggestion for further discourse and show current trends.

1. Introduction

As information technology becomes ever more important and pervasive in all areas of life and society, incentives and motives for attacks, deliberate misuse, and vandalizing increase as well. Therefore the necessity to secure systems and pursue misbehaviour increases as well. This enlarged danger is also based on more systems being connected to networks, especially open ones like the Internet, and therefore being exposed to more attackers. An additional factor is, that both companies and private persons perform more, both according to numbers and importance, business transactions over the Internet, so the possibilities for scams, fraud, etc. increase. Online transactions become common and leave the state of very exceptional and therefore carefully performed rare occurrences. They enter the realm of normal actions done without special attention.

Because of the many possibilities for attacks and the fact that a transaction is only correct if unchanged at all stages, security must be seen as an end-to-end task. Technically this means hardening all systems between, and including, the client (e.g. viruses, trojans) to the server (hacking, snooping employees, …). Using E-Commerce as an example regarding organization, it must start by advertisements to reduce the danger of phishing E-Mails. The next step is the order, for which most security problems have already been tackled (e.g. SSL, certificates, privacy/security/arbitration/... seals), but which must be integrated and verified, like actually checking the server certificate. Further on in the process problems increase again: the largest known credit card thefts did not occur during transmission over the Internet, but rather from the servers of web shops or backup tapes, or by employees. When finally goods are delivered online, this business stage must be secured too: both against tampering by third persons and potential misuse by the customers themselves, for instance illegal copying (→ DRM).

Apart from technological measures to prevent security problems, more lines of defence are needed. These are e.g. detection and mitigation of disclosures, for instance through logs and other forms of data retention. But also the "last" step is important: Legal sanctions when misuse of IS/ICT occurred. Although practically difficult because of the cross-border nature of many attacks, at least in some cases the perpetrators can be identified and brought to justice. And if not, some guidelines must exist for who will have to bear the, typically financial, burden. This allows taking precautions like insurances and provides incentives to enhance security.

2. Aspects of security

Security is a multi-faceted problem. Some areas where security is currently an issue or where systems are being developed are discussed here briefly. As shown above, these range from technical aspects over end-user education to legal issues.

2.1. Secure system design and implementation by the example of Ajax

Creating software systems is still seen almost exclusively as "feature development". While understandable from the competitive and user side, many software packages have, at least in the eyes of end users, already reached their maturity in this respect for a long time, like text processing applications. Other issues are then often omitted or added only as an afterthought, like usability and security or data retention (see remaining metadata and previous changes in office documents [19]).

One approach to reduce this problem is not creating software completely from the scratch, but reusing frameworks. However, security is difficult in this respect. Building on a UI library is simple, as each element may be taken or not, just as needed. Security on the other hand is a cross-cut issue affecting most modules. Therefore reusing existing components, especially if from a different library, requires either modifications in the source code, wrappers, or adapters to combine the different security models. Another approach is integrating new software into an existing product, like a portal. In this way the complete security architecture and typically also its management already exists and the only work necessary is adding appropriate permissions and checks.

Even more difficulties arise when a new technology or method is used. There the focus is usually put on getting it to work and experimenting with it, afterwards on producing a "sellable" version (rush to market), and only at the very last security. One current development can serve as an example for this cycle: Ajax (Asynchronous JavaScript And XML), a technology to improve the interactivity of webpages. It is based on creating small bits of XML in JavaScript, sending it to the webserver, and receiving a similarly encoded answer which is then displayed on the browser (again through JavaScript). The advantage over the current model is that only small bits of data are transferred instead of the whole webpage. The server also produces not the complete webpage, but only the small bit to be modified according to the user's actions. Interaction therefore resembles more closely a conventional application than webpages with forms [12].

Regardless of advantages in usability and speed, this approach opens up several new ways of attack (see also [15]), especially if communication does not take place over SSL. For instance, while verifying input values on the server is a known necessity by now (although easily forgotten to be performed for each and every Ajax call as well!), this is suddenly a requirement for the client side too: scripts on the webpage should verify the information sent by the server. This can be extremely difficult, as e.g. a typical model is just evaluating a script created by the server on the client. I.e., the server sends a program to be executed on the client; either directly or embedded in XML. So at least in that case the client will just have to trust the code which has arrived. In contrast to e.g. Java applets this code is typically not signed or checked in any way and is therefore at most as secure as the connection and the server. Similarly, the server must trust the client to execute only the code sent to it, in effect necessitating keeping the business logic on the server. Client-side verification of the information received at least partially contradicts the model of small and fast client side code. It is therefore imperative that only secured connections are used which includes verification of the certificate involved. Additionally a sandbox model for JavaScript might be advisable. Currently permissions depend on the trustworthiness of the server ("same origin" model). This might not be enough e.g. with public servers providing a complete E-Mail application with access to local files for attachments, etc. or when the server acts as a proxy for third-party sites.

One more aspect to consider is that with Ajax the program code as well as all data transmissions are by necessity trivially accessible to end users. While security by obscurity is not a good solution, "hiding" the program code on the server and disallowing access renders attacks much more difficult. This is no longer the case with Ajax, where at least parts of the code can be easily inspected and tested for possible deficiencies without involving the server and therefore noticing such attempts.

Indirectly related to security are bugs: The more exist, the more insecure a program is. Ajax brings new problems here, as the (previously) monolithic program is split into two separate parts: client and server. Additionally, parts of it might be modified arbitrarily by attackers on the client side, or called concurrently when using asynchronous requests. This essentially changes the previous single-thread model where requests might happen simultaneously, but are completely separate apart from database queries, to a multi-threaded one. Even one unit, a single webpage, can result in multiple concurrent modifications and answers. This drastically increases the difficulty and through this the number of bugs, therefore reducing security.

As the number of entry-points increases, the number of scripts for serving them increases as well. Therefore a good design is needed, otherwise code duplication will be common, increasing the likelihood of security holes and making them harder to detect and close all their instances.

So while Ajax is a very promising technology and can be useful, careful design of both the program and especially the complete system is needed to avoid security issues.

2.2. Digital Rights Management

While typically disliked by users and sometimes a security problem in itself [12], Digital Rights Management (DRM) also has advantages. Previously the only way to obtain compensation for authors of books was increasing the price they were sold for: Actual usage could not be monitored (or limited) at all. This for example differs from movies, where through visiting the theatre consumption of the work is paid for by actual usage; i.e. the price must be paid anew upon each time watching the film. The same seems to be possible now with DRM techniques for all digital content.

However, the comparison is not quite exact: Going to the cinema does not require personal registration, apart from perhaps proof of age. It is therefore easily possible to watch a film anonymously. With the typical DRM techniques this is impossible. The common method requires identifying the user, or at least the display equipment, uniquely and verifying the permission upon each and every restricted action trough communication with a central server. This server causes problems when unavailable, as it would for instance prevent all work with documents secured by

DRM in a company if unreachable. Therefore it must itself be secured (DoS attacks, hardware defects, etc.).

From a legal point of view, DRM changes the situation of customers dramatically too. While it is practically as well as legally no problem to sell used CD's/DVD's when no longer wanted, this is typically impossible for DRM-protected audio or video files, both in practice and legally. DRM often goes hand-in-hand with a shift from ownership (book, CD) and unlimited usage of this single instance to a few specifically licensed rights, like personally listening to this music for x times or for a certain period. While the distributor of a work can obviously determine the conditions of usage, this might require, or perhaps instigate, a change in culture for users as well. For instance, music might be seen as a commodity similar to cable TV: a flat rate ensures access to a pre-determined selection, from which the actual usage is up to the user. However, there are some additional considerations for the society: While medieval books, if still existing, are relatively simple to read, works protected by secure DRM could easily get lost completely, even if still existing in many copies and on accessible media. Consider the example of some newer computer games: They are sold as boxes, but an online connection to a server is needed for actually playing, even when not playing with others over the internet but alone. If the company goes out of business or just decides to no longer provide this server, suddenly nobody can play the game anymore, even though there was no subscription required. Unless this protection is removed through hacking or a duplicate sever (illegal and perhaps impossible if strong encryption is used and the key has been lost!), nobody will ever be able to be play it forever.

While typically used for music, videos, etc. DRM can also be useful regarding security. A major share of fraud in companies is perpetrated by insiders, i.e. employees, through copying data they are intentionally allowed to access. DRM techniques could reduce this problem through allowing users only certain actions, including perhaps viewing, and only on specific computers, but not copying. This approach also has some drawbacks, as it automatically involves exact monitoring of employee actions, which is a privacy problem and might be forbidden or require special consent according to labor laws. Additionally it is not foolproof: All export methods would also have to be secured, and then still some possibilities remain, like taking screenshots or photos (→ mobile phones!). It must also be noted that increased security often is a hindrance for working as well: Sharing documents between colleagues might be impeded, or vacation stand-ins cannot access records needed. All these require additional work for managing permissions and need procedures to grant them when the "owner" is not currently, or no longer, available. Additional problems might occur related to backups: Restoring the content might be difficult if done on a different computer or when the management system is damaged.

While preventing access is not that much of a problem with computer games, consider replacing it with important business documents involved in a case of fraud. Destroying or deleting the data on a single computer (=management system, keys, …) would render all documents, even copies distributed across the world, unusable. In this way justice could easily be stopped in investigations.

So while technical solutions are available and need "only" be implemented or integrated into specific products, more focus on integration into the actual business processes is needed. Additionally various procedures for access without "official" permission should exist, even though these are obvious points of attack and will lead to discussions who may use them under exactly which circumstances and precautions; remember the discussions about the Clipper chip for telephone encryption.

2.3. Liability for security breaches

Liability has two aspects, practical and legal liability. If a computer is subverted and illegal actions performed through it by third parties, liability can remain with the computer owner. It would have to be proved that it was someone else who performed the actions. If the remote control software is still in place this can be done. But if it is removed as the last action of the intruder, this might be extremely hard or impossible. A similar problem is for instance placing pornos, illegally downloaded music, video, or software on someone’s computer and then arranging for these to be found. Security to avoid liability might also be useful even if the content is not illegal as such, but merely inappropriate for the specific person, for instance politicians.

Seen from the legal point of view, liability for owners of computers increased continually over the years, although predominantly for companies. Sending out media without previously checking them for viruses with up-to-date antivirus software was one of the first actions, where liability for damages was accepted ([5]: in that case an antivirus software was used, which did however not detect the virus; this was not enough for liability, but not using one would have been; see also [14]). This has increased over the years, so now companies without reasonable firewalls might be held liable for denial of service attacks originating from them through their hacked computers. In the decision [5] this was still declined, but the increase of dangers in the Internet during the six years since and the availability of cheap protection might lead to a different assessment today. However, it is important to note that for all these dangers success in preventing them is not required. Only reasonable precautions must be taken. At least currently, specific security precautions are a requirement for companies exclusively. In my opinion the reasons for this have changed in the last years, so also private persons should be responsible at least to some degree. With the increased penetration of broadband access, the dangers also increase significantly (permanent connectivity makes attacks easier, high bandwidth allows more attacks and increases damages) and nowadays every computer user should know about the most important dangers associated with the Internet. As corroborating evidence can serve, that today most computers sold to home users come with some kind of protection preinstalled. At least disabling this minimum level should lead to responsibility. Still the level for private persons should be kept lower than for companies.

A different kind of liability could apply to software developers. Software is not defective as such because of some security problems: every program has bugs. However, software without any security measures or with continuous disregard of secure coding practices is not correct fulfillment of a contract, even when not explicitly required therein. For developers this means, that appropriate training and at least some security precautions, including testing, is a necessity.

2.4. Privacy issues of security

Security often involves identifying the user: Only a limited subset of persons is allowed to perform certain actions. This necessarily results in personal information, both the fact of granting the permission, as well as performing the action (e.g. logging).Through these a lot of other information on the person might be deduced, like the physical location at a certain point in time, but also habits or preferences. While sometimes disclosed intentionally, e.g. in shops to allow better service, or legally necessary (data retention; see section 2.6), this can itself produce or increase dangers. Examples are targeted phishing by building confidence through presenting “secret” information or identity theft. Break-ins to E-Commerce servers can result in a huge amount of credit card numbers with name, expiry date and perhaps even the supposedly secret CVC number [4].

Security must therefore extend even to the administrator of a computer (see [7]: an admin was fired for reading one of his managers E-Mails): While having access to any information on the computer system, this data need not necessarily be in usable form. Backups for instance will also work if the information itself is encrypted. This creates “compartments”, where even subverting the root account will not result in immediate risks. However, this comes at a price: Technically, encrypted data cannot be compressed anymore, but this is an insignificant issue today. More dangerous is that the risk of losing data completely increases as well. What if the employee leaves the company, dies, loses the chipcard/token with the keys, etc.? A technical solution is therefore not enough and a complete process involving a lifetime view of the data with key escrow, etc. is necessary, which is similar to the problems encountered with DRM (see also above).

While unique identification could often be avoided, e.g. through issuing one-time access codes after successful authentication, legal restrictions sometimes prevent this: When handling personal data, all acts must be appropriately traceable. For instance it must be clear, which data sets were transferred to another company and by whom. Also, anonymization prevents prosecution of misuse and creates difficulties for security itself. An example for the latter is analyzing access patterns for irregularities, which is only possible when a person can be recognized as the same one over a longer time. The conclusion is, that security must be layered: the security information itself must be secured too, which becomes most apparent with regard to DRM.

Security and privacy are anathemas, so measures to combine them are very important. Typically these are not technological ones but rather processes, like anonymization after some period, restricted access, or compartmentalization. Integration or at least support for such processes in software is still needed but difficult, as they often span several separate software products.

2.5. Phishing

Phishing has a long and often successful tradition in the context of security: Obtaining password by social engineering [7] is an early but still alive and constantly recurring example. As this is obviously a social problem, people being to trustworthy, educating users is required. It should be noted, however, that creating general fear and paranoia is not a very good social move in itself. Also, education will obviously only work to some degree as humans err. Technical enhancements should therefore be developed to reduce this risk. This doesn’t mean replacing passwords with biometric authentication: Phishing mostly depends on the users to do willingly what they are allowed to, but doing it in a dangerous way. Still, many precautions could help, as attacks would have to be more direct: while users might "just" enter PIN and TAN in a web form to “confirm” their online banking account, a request to transfer a sum of money to a certain account is probably reviewed with much more care in comparison. One way to achieve this is shifting the actions users must perform to “important” ones and automating the rest. An example is auto-login based on implanted RFID chips, which was e.g. performed with 18 officials at the Mexican attorney general for accessing secure areas in their headquarter [18], [17].

Another approach to reduce the problem is increased security, for instance through making it more difficult to impersonate websites. Using cross-site scripting it is e.g. possible to show your own form within the frame of a different site. This means, the apparent domain name is correct as is the encryption and the associated certificate, yet the information entered is actually sent to a third party. Although it is not difficult to prevent, most input fields on a webpage are potential targets. I.e. overlooking to secure a single one is sufficient for attacks. Different, but rather limited, approaches are used by browsers, which try to detect such sites through URL analysis [3], content checks, or blacklists of known websites [10].

Although banks are nowadays aware of the difficulties and avoid sending E-Mails which might look similar to a phishing attack, this doesn't apply to other companies. Because of recent changes in E-Mail Spam law in Austria, numerous mailing lists sent out E-Mails requesting users to confirm their subscription to them. Even though harmless in themselves, this teaches users that there *are* such things as legitimate confirmations of subscriptions, accounts, etc.! Education, it seems, is still not only needed for users, but for many administrators/companies as well.

To reduce this danger therefore a two-pronged approach is needed: Firstly, educating users on the dangers and how to recognize them, and secondly, improving security so that convincing fakes become more difficult.

2.6. Data retention

While security breaches from external attackers can typically be identified rather easily regarding the source IP address, identifying the actual person of the attacker has been difficult or even impossible in the past. With the aim to remove this obstacle for prosecution, the EU recently introduced the highly controversial directive on data retention [6]. Beside other information (endpoints, time and duration of Internet telephone and E-Mail communications) it requires the storage of IP address assignments by ISPs for six to 24 month. When actually implemented as national law it will then always be possible to trace back from an IP address at a point in time to a certain computer, which will often identify the person or at least someone responsible for this computer, e.g. in the case of family computers.

While helpful to identify attackers, this is in no way a foolproof system: Determined attackers can try to hide their own address, e.g. through using a hacked third-party computer, which are available in the tens of thousands, as relay. As there are no logs on these computer, another person will come under suspicion and will have difficulties exonerating himself. As the directive only requires storing message communication like E-Mail or VoIP calls, but not all internet traffic, these logs will also not help in tracing traffic back to the real attacker. Another way to avoid identification is using anonymizers. Such programs act as relays for internet traffic for third parties and mix connections (temporally, perhaps also on physical interfaces) to provide anonymity. Then the only available IP address is the one of the anonymizer. These are probably not required to store the association between incoming and outgoing communication, because they do not provide access to the Internet or any E-Mail or VoIP service themselves. Apart from logs which nevertheless do exist, e.g. because of a judicial order [16], this prevents tracing the connection back to its original IP address and therefore the perpetrator.

So while "simple" attackers will lose their anonymity, these are typically not the dangerous ones, as most companies have already secured their systems to at least some degree, thereby probably preventing intrusions by these persons. The dangerous attackers however will not be affected, as they can easily avoid the logging completely through starting the attack from outside the EU. Therefore this new legislation will probably improve security in the Internet only marginally.

Concerning the society, data retention is however a dangerous approach in my opinion. Everyone is presumed to be suspect and his/her communication behavior will be available for courts, administration, and probably companies/private persons too (copyright infringements might be sufficient for disclosure). Additionally it requires logging and storing a lot of information at many different places. When information is available, it will also be (mis-)used, even when forbidden. Therefore such logs require additional and specific security themselves, increasing administrators' burdens.

2.7. VoIP security

Voice-over-IP (VoIP) continually attracts more users, especially because of recent sound quality improvements and the increasing penetration of broadband internet access. Here two groups must be distinguished: "Private" systems, for example branch offices connected by VoIP to the main office. There the basic idea is avoiding telephone charges for company-internal calls and improved utilization of external lines. This is only of limited interest here as such systems are typically based on Telco-specific protocols and transmitted over VPN or private networks with a closed user group. More interesting is the second group, "real" Internet telephony, which is similar to the conventional telephone system in that everybody can call every other person. The main protocols used in this area are SIP and H.323. SIP is especially simple and therefore a security risk, apart from non-security related problems like locating emergency calls or the danger of commercial computerized voice-calls, which apply to all protocols equally.

Problems are possible in two areas: the signaling, which is done with central server(s), and the actual communication, which takes place directly between the call participants. In consequence, all firewalls, including personal firewalls on clients, must allow such unrestricted source/destination traffic, opening potential security holes. Another problem can be, that tapping the conventional telephone network is not that easy and typically leaves some traces, e.g. breaking open wiring boxes. Contrastingly, VoIP call data can be copied trivially without leaving traces as long as the attacker is located on the communication pathway. Through eavesdropping and voice recognition a library of words can be created easily, allowing not only replay attacks, but also custom texts in an original voice (perfect voice impersonation).

Encrypting the traffic is only possible through the participants themselves, but not the network, like VPN tunnels. So imposing such a requirement can be difficult, especially when e.g. calling outside the company: If the partner does not support such features, no telephone communication would be possible. While newer versions of SIP do provide such security extensions, most current implementations and devices do not support this (yet). E.g. Asterisk, a widely used free PBX software, does not currently implement these [1] and security enhanced hardware phones are similarly scarce.

Encrypting calls also raises problems with data retention: Because not performed by the ISP but the clients themselves, source and recipient cannot be logged anymore or only with difficulty, depending on the method used for security (VPN or secured SIP). A consequence might be prohibiting such features, or allowing them only for ISP’s, which could then still log desired data.

Another aspect should be noted as well: While transmitting confidential data over the telephone by voice is a tedious business or would require an additional virtual/software modem, Internet telephony typically allows application sharing as well: This is essentially transmitting screenshots to other computers. Sometimes also file exchange is possible, resulting in an additional “hidden” communication channel which is difficult to secure.

2.8. RFID

Radio Frequency Identification (RFID) typically employs very small, simple, passive, and cheap chips with a radio interface to identify and/or locate arbitrary objects they are attached to. For this, the chips are typically attached as part of a label. Their main advantage is that no physical contact (chips) or line of sight/orientation (barcode) is needed for accessing the information. Additionally in contrast to the latter example a lot more information can be stored. At least in the past most tags only contained a serial number and perhaps a product type code, with any other associated information located in a database keyed to this ID. Newer tags can store larger amounts of data and also perform complex protocols, typically for authorizing access to this information. While such identification tags can e.g. pose privacy problems, as e.g. the tag of a parcel or palette simultaneously tracks the person carrying it, respectively driving the truck with it. Another example is the RFID tag in new German passports containing a photo and later on two fingerprints. This is also an example where the advantages are quite small: because of security reasons the pass must be read optically before the tag can be accessed [8].

When using tags for inventory control, it might be possible to re-create the inventory list from outside a company by using a direction antenna. This could also be used to allow tracking goods back to suppliers or forward to customers. If because of cryptography no actual reading of serial numbers is possible, at least the absolute number of Tags can be ascertained. And using cryptography results in an important drawback: The idea of RFID tags is, that they allow tracing items through their whole life or at least a longer part of a supply chain [11]. This requires that multiple persons/companies can access their information content. But then it will be very difficult to keep the keys to access that information secret. Disabling the old and adding a new tag or reprogramming it to a new identification number are all possible, but this requires additional work and reduces their utility. The typically envisaged process for consumer goods is for example to disable the tags after payment. For some goods this might be sensible, but this would preclude many other claimed applications, e.g. the intelligent refrigerator: telling you what is missing for a certain recipe or what is near its expiry date. Then no removal is possible and at least some information must be publicly accessible. Another example of this technique are keys for modern cars, which unlock the car when coming near them without further action. As they must send/answer radio queries, this allows verifying its presence and locating them on the body of a person. Therefore theft could become easier and more targeted.

RFID tags could become really dangerous when being connected with data retention. If an association of tags and IP traffic is possible, for instance when using a mobile phone for internet access and the phone or clothing, handbags, etc. are tagged, identification of a person and simultaneously building a profile of physical movement, items bought/possessed, Internet messages, etc. becomes possible. Privacy rules are already applicable, if the person cannot be identified uniquely, e.g. by the name, but when it can be recognized as the same one with certain associated information [1]. Such information could for example be used to mount very credible phishing attacks: The presence of a RFID tag for counterfeit protection of a luxury handbag could lead to questions like "As you have bought the handbag model X from our store, why not buy accessory Y online?", intending to lead potential customers to fake shops.

Security of RFID tags is therefore a much more important issue than typically assumed and may extend to very remote areas, both physically and logically.

3. Conclusions

As can be seen from the examples discussed briefly, security has many faces and moves from technical issues and decisions to issues a society must decide upon. Some common aspects that can be derived from the discussions above are:

- Technical problems of security are already solved in most areas. Encryption, digital signatures, filtering, firewalls, etc. are all available. Still there is room for improvement as almost all solution are based on "lists" in various forms: Lists of persons allowed certain actions, signatures of known viruses/trojans, URL's known to be used for phishing, and so on. One notable exception here seems to be Spam filtering, where lists are used too, but where the signatures are very open (not designed to capture one single instance only), and additionally many other methods like Bayesian filtering to learn from past E-Mails, rule sets, path verification, etc. are used. Introducing such methods to other areas is difficult, as some "leakage" is a small problem with Spam, but would be e.g. with illegal access. However, the advantage would also be significant, as it would reduce the need for continuous and expensive signature updates.
- Many of the open problems related to security cannot be solved by technical means alone. It is for example unlikely that phishing attempts will be reliably detected through programs in the near future. But training users to recognize such attempts and companies to avoid similar messages is a non-technical, yet promising, approach. The same applies to RFID tags: Encryption, handshake-protocols, etc. are all available. But when to use which techniques/combinations of them is still an open issue. The reason is especially that it requires "political" instead of technical decisions. It is untechnical, as secure versions are clearly superior with respect to security. It is political, because one part of the stakeholders,

the customers respectively the general public, is not involved in the discussion between companies and can hardly be. Therefore the need arises for legal guidelines and boundaries, where existing ones might be sufficient or not.

- Retrofitting security is difficult. The example of VoIP shows, that simple protocols like SIP possess important business advantages compared to more complex ones, as H.323 is. But adding security later is much harder than integrating it right from the start. The same applies to new technologies like Ajax. While the primary focus is typically on completing the software and providing more features, security should at least be added as an option for the future. It might not be implemented at the moment (to get the product out), but it can be added later when needed. This requires a good security model right from the start, especially regarding protocols: permission checks in program code can always be added rather trivially, but adding authorization, encryption, etc. to protocols in a backwards-compatible manner is much more difficult. In the latter area currently no standards seem to be available, only several good and/or rather universal solutions which might be used as kinds of blueprints, like SSL/TLS.
- Security needs change over time. This can happen through the inherent dynamics of a system (see E-Mail: the enormous use and its simplicity led to the Spam problem; or computer hacking through worldwide accessibility of systems), but also through the environment. Terrorisms led to an increased focus on security needs, so while privacy was seen as more important previously, access to data for prosecution seems now to be paramount. This is especially important in connection with the previous issue: Reducing security is typically easy, if done willingly by the persons involved, but increasing it later on quite difficult.
- Everybody talks about security and the needs to enhance it, but in practice it is often even decreasing (see VoIP). Similarly, even the simplest precautions like passwords are handled in the most insecure way because they are obstructing the work or causing inconvenience. Expecting technology to solve all these problems while not accepting any precautions themselves seems to be sometimes a bit inconsequential.

While many problems and dangers have been elaborated in this paper, there are also many positive aspects of the systems, techniques, etc. presented. Here the difficulties alone were discussed to emphasize their security implications. As many existing systems show, living without security is possible too, just not as good or comfortable as with it. It is therefore necessary to improve security in many areas and through many techniques, and especially not only technical ones.

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THE PRIVACY DIMENSIONS

Sonja Hof [1]

This contribution focuses on the complexity of privacy. In contrast to common belief, privacy is not a one-dimensional, simple and clear goal that is achieved in a black and white manner, but rather a multi-dimensional space with a lot of "grey" areas and external influences from a wide range of stakeholders. After giving a quick introduction on the history of privacy, this contribution provides an overview of these issues in order to highlight the large scale of different concerns that have to be addressed for privacy solutions. Wherever possible, examples try to show the issue in an actual real world scenario.

1. History of Privacy

Privacy can be traced back as far as Aristotle that made the distinction between the public sphere of political activity and the private sphere associated with family and domestic life. However, detailed discussions and written papers specific on privacy occurred only much later. The contribution of Waren and Brandeis with the title "The Right to Privacy" [12] can be considered as the first systematic approach to describe the notion of privacy. The privacy discussed at that time was mainly concerned with the individual's rights "to be alone".

The first "modern" view on privacy was stated by William Posser in 1969 where he distinguishes four different kinds of privacies [9]:

1. Intrusion into a person's seclusion or solitude, or into his private affairs.
2. Public disclosure of embarrassing private facts about an individual.
3. Publicity placing one in a false light in the public eye.
4. Appropriation of one's likeness for the advantage of another.

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As one can see, the above description of privacy is a lot closes to nowadays opinions. You still have to note that the above view of Posser is from a time at which privacy was not discussed in context with technology or governmental legislation.

Privacy in legislation is a comparatively young phenomenon. In the US, the first instance of recognized privacy was in 1965 when the Supreme Court explicitly recognised a constitutional right for privacy when recognising the right for privacy within medical advises to married persons in the context of information for contraception. This ruling was later the bases for several extensions of privacy rights going so far as to the ruling that first allowed abortion (For a detailed description on the history of privacy see [9]).

Privacy in the context of technology is even younger and has been based in the increasing electronically storage of personal data as well as the capabilities introduced by computers interconnected with networks. This construct allows for automated cross-referencing of so far unconnected data storages thus enabling data mining on private data to a so far unknown extent. This lead to the privacy view as outlined in Figure 1.

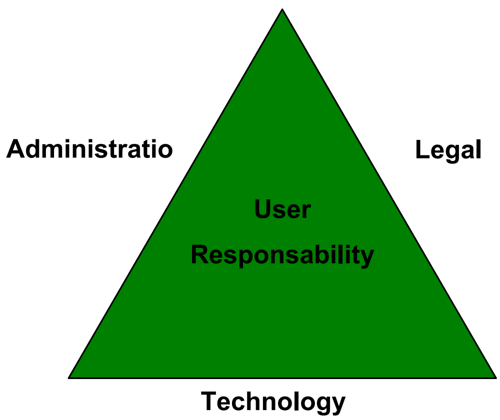

Figure 1 - Different aspects of privacy

As can be seen, privacy is a wide range of different factors and opinions. As covering the whole range of privacy issues would be too much for one paper, we will focus only on privacy issues somehow related to computer (for further definitions see [3, 11, 2]).

2. Privacy

Talking about privacy, a number of issues, incidents and problems come to one's mind. Buzz words like securing data, restricting access or even intellectual property rights are – to some degree - interconnected with this term. Looking form different angels, e.g. technology, law…, makes this theme even more interesting and adds additional aspects that should be considered in the early states of system architecture or process reengineering.

Protecting personal private information (PPI) is not as simple as it may appear on first sight. The continued violations of private data and information show clearly that we have to improve our security means in this area. But not only technically we have to adjust our "wants" to the "needs", but also legally we must adapt considerably both regarding the maximal potential punishments as well as easing the hurdles that complicate a conviction. A final area where privacy may be endangered is in the context of governments. As recent examples show (exchange of flight data [4] or release of data by SWIFT [7]), governments tend to have an opportunistic approach towards enforcing privacy.

The main factors of security and protecting information are costs and the willingness to do so. The need of protection information or data grows with the information's importance to the owner. If certain security considerations would have been implemented at the beginning or would have been considered from project kick-off, the financial impact would have been never as big as if it will be after introducing security means into an already running system.

2.1. Digital Identities and their Management

Providing access to a growing number of users without diminishing security or exposing sensitive information is summarized under the term identity management. Managing multiple versions of user identities across multiple applications and also managing security applications and its complex structures; But as the number of people using digital information and working in the Internet continuously grows, the numbers of "identities" also grows. One has an official identity for doing ordinary work and a private identity in order not to get into a conflict with internal organisational security policies. Additionally to these two identities, a third one is also quite common. Creating an identity which does not reflect any personal or private information or even contains wrong or misleading information is not unusual. Such identities are used to surf anonymously or to prevent spamming and undesired information overflow.

So although password reset, synchronization login structures, e.g. single sign on (SSO), are growing due to the fact that the amount of users and their activities is growing, the management of these digital identities are also becoming more complex. Information about employees, customers, citizens and partners is distributed among many systems and consequently they are difficult to manage. The underlying security problems are managing user identities effectively and ensuring that all components are managed correctly within this complex array of IT infrastructure. The user provisioning process includes management of digital data about identity, authentication and access control schemes over data and functions. Identity management technologies attempt to simplify the administration of distributed, overlapping and sometimes contradictory data about the users of administration and organization's information technology systems.

The more important digital information and data obtained, the more it is comprehensible that identities or parts of identities are transparent. Privacy concerns are directly related with identity solutions. As they both also have legal aspects, it is doubtless that they are both in coherence with data protection and information freedom concerns.

2.2. Privacy Requirements

As privacy concerns are not only about protecting our assets but also about something that has gained in wealth over the last few years: information. It is common that more and more information about us is stored in different administrative parties in different forms [1]. Ironically we are publishing a big part of that information ourselves and due to this fact we are more vulnerable then we were before using IT and its benefits.

Similar to the different authentication requirements, different tasks require different levels of privacy. Some tasks require no privacy, for others it is sufficient to ensure data privacy and again, other tasks require that even the act of accessing a portal has to be considered to be a private action. Additionally, privacy has to be divided into short and long-term privacy. Short-term privacy has to ensure the privacy of the data while the task is active, e.g. transmission privacy; although, long-term privacy deals with the time after the task has been completed. It deals with the data after it has been stored on the portal. Technical solutions in this area include SSL, file or disk encryption solutions. Another privacy aspect to be considered is the access points used to interact with the portal. Public terminals definitely need to be handled differently to home computers. All in all, for most cases privacy should be seen in its connection to data protection and data security. It might be seen as one of the fundamental rights a user has.

Privacy has, besides its technical dimensions, also social aspects. Different users may consider different data as private or public. Figure 2 displays that between obviously private and obviously public data, there is a grey zone of data that may or may not be private.

Private		Private/public		Public
Submitting filled tax forms		Requesting help for a specific part of the tax form		Getting tax forms

Figure 2: Different needs for privacy

For data in the middle of the public/private range, the users must have the possibility to define (set a policy) whether or not they want to have private transmission or not. Again the direct approach to always set the transmission to private is not feasible, as setting up trusted channels requires additional overhead.

Users tend to be careful in trusting certain organisations, but due to the cultural influence citizens trust governmental parties that their data is kept safe. On the other hand, there are areas within official fields that are considered as being more sensitive, e.g. getting trust for anonymous e-Voting. The only way to gain users trust is to present them with an open system, i.e. to allow other parties to give their opinion about the system. Such parties may be independent companies, e.g. McKinsey or Counterpane, or independent expert groups, e.g. Chaos Computer Club. In the end, all effort spent on an increased trust pays back so that technology offers a way to increase trust by offering the user a "technical opinion" by as many parties as possible.

Other areas where trust is required cannot be eliminated by organisational means or easily handled as on the technical side. One such aspect is the submission of data destined for only one agency of the government, e.g. a medical attest. This trust has to be gained mainly on a social level. However, this problem already exists and is only enhanced slightly by moving government interaction more and more to the digital world. Whom should we trust and under what circumstances [8]? Which mechanisms are used to grant and ensure trust, and how are those monitored? This seemingly obvious aspect is more important than it seems. Of course, an average user will never "understand" the security measurements and policies of an e-Government portal. However, they may know an expert or try to inform themselves by autodidact training. While the overall problems of course remain, one can decrease the subjective difficulty by trying to decrease the number of involved systems, e.g. a single authentication mechanism for all services.

As mentioned before privacy also has, besides its technical dimensions, social aspects. Different users may consider different data as private or public. Again the direct approach to always set the transmission to private is not feasible, as setting up a trusted channel requires additional overheads. Simplicity seems to be an obvious aspect. Of course, an average user will never "understand" the security measurements and policies of e.g. an e-Government portal.

Whenever we browse the Internet, we are not aware how much information about us and our habits is automatically collected (locally and remotely). On the one hand, customers want information that is tailored to their needs and therefore they are willing to provide their preferences to receive personalized ads not knowing how the information gathering occurs, so people get used to giving information about themselves. The questions that should be answered are according to [6]: How much privacy do users give up when you make information about yourself public? How much information do citizens reveal when interacting with a Web service?

In order to build an appropriate privacy control, a privacy protection layer framework was developed.

It consists of different layers which start with awareness. As users are generally unaware of privacy risks, one has to start teaching these issues by showing them what can happen and how they can deal with their private information:

- Data-Protection
- Information Management
- Authorisation
- Data/ Information Exchange
- Internet Access

Building up a better information pool would be the first step.

The next step is on the control layer (layer 2), the main idea about this layer is to protect users automatically. Layer two includes mechanisms which protect explicit attempts to violate their privacy. The idea is to block all of the information gathering software not allowing cookies or banners or advertisements. Such control mechanisms can be hard or software based. Although such automatic anonymity of users does protect them to some degree, they cannot prevent everything, e.g. a user can still be identified by an IP address.

Level three protections include privacy tools that enhance the usage of anonymity or pseudonymity. Virtual names are adopted and used while interacting with web sites or browsing. Some tools support anonymous interaction by different technical means.

Layer four is focused on privacy policies that are proposed for control web sites personal information use. One consortium that supports such issues is the Privacy Preference Project [10], which enables browsers reading how a web site handles information and informs the user automatically while simultaneously comparing the wanted information with their own set of privacy preferences.

Level five of the privacy framework is a privacy and trust certification while ensuring that web sites observe their announced privacy policies. That implicitly implies periodical verification. Depending on who collected data under which circumstances, it is not said that all privacy policies are abided by correctly. Trading information about users is common and does not insecurely imply privacy concerns.

The last layer is the privacy protecting law layer which should build up the legal framework for protecting privacy by regulating privacy protection and mechanisms to punish those breaking rules. Not being able to control behaviour in the web are its strengths but also its weaknesses concerning prosecution. Even cultural and political issues influencing activities and regulations additionally complicate the approach. This structure in combination with a mask that is a temporary identification is proposed by [6] which seems to be a useful and practicable way to improve security concerns. While concentrating on privacy concerns also regional, social or political issues should be taken into account.

Independent from these factors data and information handling should be processed carefully. Neither collecting data nor information without notice of the user nor exchanging data with others without authorisation and knowledge of the owner should be allowed without authorisation or knowledge.

3. Conclusions

Privacy is a complex issue. As we have shown, one has to bear several factors in mind when considering actions to guarantee privacy:

- Information to be stored
- Legal boundaries to be obliged
- Subjective experience of different users
- Information's degree of sensitiveness
- Motivation of potential attackers
- Applicability of security measures for long term storage

This leads to complex scenarios that make it difficult to achieve privacy in non-trivial systems. In addition to target the protection of private data, one also has to cope with the situation when private data actually is leaking from the system. In order to reduces the chances of such an event, as well to reduce the potential damage, one has to actively handle the following five tasks:

- **Awareness**. Give the user the capabilities / tools to help him monitor accesses and usages of his private data.
- **Detection**. Use tools that actively try to detect potential privacy issues.
- **Prevention**. Prevent leakage of sensitive data by , e.g., discarding sensitive data that is no longer required.
- **Reaction**. Define actions for scenarios where private data actually leaked out of the system, e.g. block network traffic or deny access for a given IP range.
- **Recovery**. Tools that restore the system to a normal state by, e.g., restoring the latest known correct environment.

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RETENTION OF COMMUNICATION DATA: SECURITY VS. PRIVACY?

Doris Liebwald

On May 3rd 2006 the Data Retention Directive (2006/24/EC) entered into force. The Directive imposes obligations on providers of publicly available electronic communications or telecommunications networks to retain traffic, location and subscriber data related to the usage of mobile and fixed telephony as well as Internet communications of all users for periods not less than six months and for a maximum of two years. This paper focuses on the change in the interpretation of the right to privacy and reveals the paradigm shift that has taken place in the field of confidentiality of communications since the enactment of the Directive on Privacy and Electronic Communications (2002/58/EC) in 2002.

1. Introduction

On May 3rd 2006 the Directive on the Retention of Data Generated or Processed in Connection with the Provision of Publicly Available Electronic Communication Services or of Public Communications Networks and Amending Directive 2002/58/EC (Data Retention Directive 2006/24/EC)[1] entered into force.

This Directive imposes obligations on providers of publicly available electronic communications or telecommunications networks to retain traffic, location and subscriber data related to the usage of mobile and fixed telephony as well as Internet communications of all users for some period to be determined nationally between six and 24 month, in order to ensure that this data is available for the purpose of the investigation, detection and prosecution of crimes, as defined by each Member State in its national law. The list of data to be retained in article 5 is very extensive and contains telephony and Internet traffic data as well as location data to identify the user's fixed and mobile communication equipment. For the Internet this means logging the allocation of IP addresses. Even unsuccessful call attempts, pre-paid anonymous services, and VoIP are included.

[1] OJ L 105, 13.4.2006, 54-63.

The collection and interpretation of the traffic and location data will not only allow for some inference on the behaviour or characteristics of a person, but will also make it possible in many cases to create a very clear and complete profile of a person's life. The obligation to retain data will result in a substantial number of distributed databases coming into being, and consequently there is a high risk that those databases will be misused.[2] Furthermore the Directive will subvert user confidence and require private providers to keep their own subscribers under surveillance. Thus, the new Directive on Data Retention not only completely undermines the Directive on Privacy and Electronic Communications (2002/58/EC) and the Directive on the Protection of Personal Data (95/46/EC), but it is also disproportionate and disregards fundamental rights, particularly the right to privacy.

The Commission stressed the factor that because of differences in national legislation based on ordre public purposes (Article 15 Directive 2002/58/EC) harmonisation is indispensable to the functioning of the internal market. Additionally, due to flat rate tariffs, pre-paid and free services, etc. less traffic data is stored and therefore not available for public authorities in preventing and combating crime and terrorism. Furthermore the Commission underlines the importance of data retention for the prevention, investigation, detection and prosecution of serious criminal offences. Moreover, the Commission's Extended Impact Assessment [1] does not provide a real in-depth investigation. Although the new Data Retention Directive supports already existing and objectionable data retention regimes, it still allows essential differences between the laws of the Member States.

Transposition of the Directive into national laws has to be carried out no later than September 15th 2007, but Member States may postpone application of the Directive to the retention of communications data relating to Internet access, Internet telephony and Internet e-mail until March 15th 2009. Up to now 16 Member States declared to reserve this right of postponement [2].

2. The Legislative Procedure [3]

The legislative procedure was a very short one. Only five months passed between the adoption of the Commission's Proposal and the final approval by the Council: there was not much time for

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2 See e.g. the "Rasterfahndungsbeschluss" (*Decision on the constitutionality of a previously conducted dragnet investigation*) of the German Federal Constitutional Court, 1 BvR 518/02 (4 April 2006).

political debate, and the explanations and justifications in the Proposal and their accompanying texts are in many aspects insufficiently elaborated and inadequately argued.

The Commission's Proposal must be seen as a counter-proposal to the Draft Framework Decision on Data Retention [4], which was prepared following the Council's Declaration on Combating Terrorism [5]. The Commission softened the intention of the Council [6], but pressurised by the Draft Framework Decision and to please the Council, the Parliament finally tightened the Commission's Draft once again [7].

3. The Existing Legal Framework

One has to remember the Privacy Directive (1995/46/EC) and the Directive on Privacy and Electronic Communications (2002/58/EC) to detect the paradigm shift that has taken place in the field of confidentiality of communications. The approach of these two Directives was completely contrary to the Data Retention Directive: confidentiality was considered as a highly valuable fundamental right. The Directive on Privacy and Electronic Communications intended to ensure the user's privacy especially regarding specific risks arising from the use of new technologies. The processing of traffic and location data was restricted to what is necessary for the conveyance of the communication and billing purposes. Data stored had to be erased or made anonymous when no longer needed for those purposes. For the processing of location data other than traffic data consent of the data subject concerned was necessary. Systems for the provision of electronic communications networks and services had to be designed to limit the amount of personal data necessary to a strict minimum [8]. The idea was easy: the less data is available, the more risks arising from the use of new technologies can be avoided.

Only a few years later the approach has changed dramatically. The Data Retention Directive will completely annul the principles established by the previous Directives (2002/58/EC and 95/46/EC) through requiring operators to retain traffic data of all users so that they can be used for public order purposes. The protection of privacy as well as the efforts to ensure data security seem to have lost in value.

4. The Right to Privacy and The Paradigm Shift

4.1. The Article 29 Data Protection Working Party

Regarding the shift to data retention, the documents adopted by the Article 29 Data Protection Working Party are a matter of particular interest.[3] The Working Party already stated in its Recommendation 2/99, that the fact that a third party acquires knowledge of traffic data concerning the use of telecommunication services has generally been considered as a telecommunication interception and constitutes therefore a violation of the individuals' right to privacy and of the confidentiality of correspondence.[4] From this it follows (Recommendation 3/99) *"that interceptions are unacceptable unless they fulfil three fundamental criteria, in accordance with Article 8/2 of the ECHR [9], and the European Court of Human Rights' interpretation of this provision: a legal basis, the need for such a measure in a democratic society, and conformity with one of the legitimate aims listed in the Convention. The legal basis must precisely define the limits and the means of applying the measure: the purposes for which the data may be processed, the length of time they may be kept (if at all) and access to them must be strictly limited. Large-scale exploratory or general surveillance must be forbidden. It follows that public authorities may be granted access to traffic data only on a case-by-case basis and never proactively and as a general rule."*

Recommendation 3/99 underlines the fact that as a principle traffic data should not be kept for law enforcement purposes and that national laws should not oblige telecommunications operators, telecommunications services, and ISPs to keep traffic data for a period of time longer than necessary for billing purposes. That traffic data must be erased or made anonymous as soon as the communication terminates is motivated by the sensitivity of traffic data revealing individual communication profiles including information sources and geographical locations, especially when using mobile telephones, and the potential risks to privacy resulting from the collection, disclosure

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[3] These are in particular Recommendation 2/99 on the Respect of Privacy in the Context of Interception of Telecommunications (WP 18, 3 May 1999), Recommendation 3/99 on the Preservation of Traffic Data by Internet Service Providers for Law Enforcement Purposes (WP 25, 7 September 1999), the Working Document Privacy on the Internet - An integrated EU Approach to On-line Data Protection (WP 37, 21 November 2000) and Recommendation 3/97 (WP 6, 3 December 1997) of the Working Party on Anonymity on the Internet: *"The ability of governments and public authorities to restrict the rights of individuals and monitor potentially unlawful behaviour, should be no greater on the Internet than it is in the outside, off-line world."* See also Opinion 9/2004 on the Draft Framework Decision on Data Retention 8958/04, WP 99 (9 November 2004).

[4] These conclusions were based on the Directives 95/46/EC and 97/66/EC then.

or further uses of such data. With Recommendation 3/99 the Article 29 Working Party wished to remind the national governments about the principles on the protection of the fundamental rights and freedoms of natural persons, even if traffic data can play an important role in the context of the investigation of crimes perpetrated employing the Internet.

Also the Conference of European Data Protection Commissioners in April 2000 Stockholm stated in its official declaration [10]: *"The ... Conference ... notes with concern proposals that ISPs should routinely retain traffic data beyond the requirements of billing purposes in order to permit possible access by law enforcement bodies. The Conference emphasises that such retention would be an improper invasion of the fundamental rights guaranteed to individuals by Article 8 of the ECHR. Where traffic data are to be retained in specific cases, there must be a demonstrable need, the period of retention must be as short as possible and the practice must be clearly regulated by law."* This point of few was repeated in the corresponding Conference in September 2002 in Cardiff [11]. Also Opinion 10/2001 of the Article 29 Working Party on the Need for a Balanced Approach in the Fight Against Terrorism reaffirmed half a year prior to the enactment of the Directive on Privacy and Electronic Communications 2002/58/EC: *"The objective of democratic societies to engage in a fight against terrorism is both necessary and valuable, but the measures to be taken shall not restrict the fundamental rights and freedoms."*

4.2. CoE Declaration on Information Society

Also the Council of Europe (CoE) Declaration on Information Society [12] of May 2005 supports the right to privacy. The Declaration covers issues on state and private censorship, protection of private information (including content and traffic data), education to help people assess the quality of information, media ethics, and the use of information technology for democracy and freedom of assembly in cyberspace. The Declaration explicitly states in its article II/2 that content and traffic data of electronic communications fall under the scope of article 8 ECHR and should not be submitted to restrictions other than those provided for in that provision. Self- and co-regulatory measures with regard to private life and correspondence should emphasise in particular that any processing of personal data should comply with the right to private life. Against this background, private sector actors should pay particular attention to inter alia the collection, processing, and monitoring of traffic data and the monitoring of private correspondence via e-mail or other forms of electronic communication (article II/3).[5]

4.3. The Right to Privacy and the Data Retention Directive

Concerning the right to privacy as established by article 8 ECHR, in particular the elements of necessity and proportionality are affected.[6] Article 8/2 ECHR links the notion of "necessity" to that of a "democratic society". According to the Court's case law, a restriction cannot be regarded as "necessary in a democratic society" unless, amongst other things, it is proportionate to the legitimate aim pursued [13]. Necessity and proportionality have to be demonstrated to their full extent [14].

In the considerations of the European legislators, the notion of proportionality is mostly reduced to the retention period. As regards necessity, recital 9 of the Directive notes that retention of data has proven to be a necessary and effective investigative tool for law enforcement and in particular in serious cases such as organized crime and terrorism. It is therefore necessary and in accordance with the requirements of article 8 ECHR to ensure the availability of retained data to law enforcement under the conditions provided for in the present Directive. However, this statement does not take into account the intrusion to privacy; it merely considers the advantage of data availability for law enforcement.

The Commission argues in its Extended Impact Assessment that its Proposal is in line with Community law and with the ECHR, because the limitations of the rights guaranteed under article 7 and 8 ECHR are proportionate and necessary to meet the legitimate objectives of preventing and combating serious crime [15]. It further argues that the effect on the private life of the measures to be introduced is limited: the Proposal has a clear and limited purpose, the retention only applies to several categories of data, and the period of retention is limited. Furthermore the Commission takes the point of view that data security is assured as the processing of the data retained is covered by the Directives 95/46/EC and 2002/58/EC. This argumentation does not sound convincing. It cannot be within the meaning of the ECHR that just a clear and limited purpose is created (whatever it is),

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[5] However, the CoE Convention on Cybercrime follows a different approach and creates not only a set of substantive crimes but also an extensive set of surveillance capacities for use by the national law enforcement bodies and a widespread regime of mutual legal assistance. Council of Europe Convention of Cybercrime, ETS No. 185 (Budapest, 23 November 2001). However, data retention is required there only for specific communication and not generally.

[6] Everyone has the right to respect for his private and family life, his home and his correspondence (Article 8/1 ECHR).

categories of data are defined (whatever they include) or the period of retention is limited (whatever the duration is). Are there no less invasive instruments? Are the real needs of law enforcement reflected? Do the planned measures serve the expressed purpose? Is it possible to ensure that access to content data and misuse will be impossible? What rights do the data subjects have and are they able to exercise them effectively? Do the Directives 95/46/EC and 2002/58/EC in fact ensure data security?

The European Data Protection Supervisor (EDPS) presents a more detailed analysis in his Opinion on the Commission's Proposal.[7] He argues that the fact that in some cases traffic and location data helped in solving crimes does not automatically imply the necessity of retaining them on a regular basis and that law enforcement must not result in people being deprived of their fundamental right to privacy. The necessity and the proportionality must be demonstrated to their full extent. Whilst recognising the changed circumstances and the importance of traffic and location data for law enforcement, the EDPS is not convinced of the necessity of the retention of data as established in the Proposal. He emphasises the importance of the privacy principles of the Directive 2002/58/EC and points out that the cited figures do not prove that the existing legal framework does not offer the instruments sufficient to protect physical security.

Nevertheless, even if the Parliament and the Council draw the conclusion that the necessity is sufficient, the EDPS questions proportionality too. He notes that traffic and location data are not always linked to a specific individual and doubts that law enforcement representatives will easily find what they need for a specific case in the resulting gigantic databases. To be proportionate, the retention periods and the number of data stored must reflect the needs of law enforcement and it must be ensured that access to content data is impossible. The EDPS accepts the retention periods of the Commission's Proposal, which are one year for fixed and mobile telephony and six months for IP based data. He further adds that the retention of data for longer periods, except for exceptional cases, does not reflect the practices of law enforcement. The adopted Directive allows for a maximum data retention period of two years plus possible extensions by Member States facing particular circumstances.[8]

From the perspective of data protection the EDPS considers three points essential for the Commission's Proposal to be acceptable: the addition of specific provisions for access to the data

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[7] OJ C 298, 29.11.2005, 1.

[8] E.g. Poland considers a duration of 15 years.

by the competent authorities and the further use of data disclosed to them; the addition of further safeguards for data protection; and the addition of further incentives for providers to invest in an adequate technical infrastructure, including financial incentives. However, the Parliament did not specify more detailed access rules but even lowered them and only partially considered the demand for additional safeguards. Moreover, it removed the only incentive the Commission’s Proposal granted to the providers: the reimbursement of the additional costs.

Also the Opinion of the European Economic and Social Committee (EESC) on the Commission's Proposal [16] is very critical. The Committee is very surprised and concerned by the submission of such a legislative proposal: "*its provisions seem disproportionate and infringe fundamental rights*".

Most recently the German Human Rights Forum, a network of 45 German human rights organizations, published a position paper which criticises data retention as *"totally disproportionate and an attack on the foundation of a free and democratic society"*.[9] The Human Rights Forum claims in its paper that Germany should refrain from the transposition of the Data Retention Directive into national law due to the fact that it infringes fundamental rights. Furthermore the Forum demands for the action for annulment of the Data Retention Directive at the ECJ for being based on the wrong pillar: a framework decision would have been the correct legal basis.[10] On June 20th 2006 the German Parliament rejected a resolution requesting the federal government to join the action for annulment of the Data Retention Directive at the ECJ for being based on the wrong legal basis. The resolution was introduced by the opposition parties Greens, Liberals and Left Party and supported by the Human Rights Forum. Anyway, the governments of Ireland and Slovakia have already filed the action for annulment against the Commission. And there is a fair chance in the

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[9] Forum Menschenrechte (2006), „Vorratsdatenspeicherung“ verstößt gegen Grundrechte und untergräbt eine freie Gesellschaft (*Data retention violates fundamental rights and undermines a free society*), Positions- und Forderungspapier (16 June 2006), http://www.forum-menschenrechte.de/docs/FMR-2006-06-20_lang.pdf (German).

[10] A directive is based on Article 95 EC Treaty (first pillar instrument) and requires a co-decision procedure, which means an approval of both the Council and the Parliament. A framework decision (third pillar instrument) requires unanimity in the Council, whereas a directive requires only qualified majority. The issue of the correct legal basis is disputed, finally only Ireland and Slovakia voted against the Data Retention Directive on the grounds of its relying upon the incorrect legal basis. For further discussion see the Commission Staff Working Paper SEC(2005) 420 (22 May 2005) and the Opinion of the European Data Protection Supervisor point III (The Legal Basis and the Draft Framework Decision), OJ C 298, 29.11.2005, 1. See also Hofstötter, B. (2006), The Retention of Telecommunications Data in Europe, Proceedings of The Know Right 2006, 196, Austrian Computer Society, Vienna.

light of the recent decision of the ECJ on the transfer of passenger data to the US [17], which was taken on the same grounds.

4.4. The Principle of Proportionality

Proportionality also has to be proven in the sense of article 5/3 EC Treaty which states that any action by the Community shall not go beyond what is necessary to achieve the objectives of the Treaty. But which objectives of the Treaty are supported by the Data Retention Directive? The alleged objectives are to harmonise the obligations on providers to retain certain data and to ensure that this data is available for the purpose of the investigation, detection and prosecution of serious crime as defined by each Member State in national law, which cannot be sufficiently achieved by the Member States and can be better achieved at Community level, based on the principle of subsidiarity of article 5 EC Treaty. However, the objective of harmonisation has not been attained, as too many elements are left to be determined by the Member States and will inevitably lead to diverging national rules, which will interfere with the functioning of the internal market. As subsidiarity surpassed harmonisation, one could remark ironically that solely the intrusion into privacy has been harmonized.

5. Conclusions

The approach of the Data Retention Directive clearly shows a paradigm shift in European privacy law. Contrary to Directive 2002/58/EC, which already gave the right to retain data for ordre public purposes, the Data Retention Directive establishes an obligation to retain traffic and location data of all users and all over Europe. The Directive 2002/58/EC becomes ineffective in many aspects. Principles such as the limited purpose and the collection/usage of a strict minimum of personal data necessary for this purpose are overruled. But also the interpretation of the ECHR has changed, especially regarding the concepts of proportionality and necessity of article 8/2. Of course, privacy is not granted unconditionally by the ECHR and the Court once argued that the ECHR is a "living instrument" and must be re-interpreted in the light of changing conditions and technological developments [18]. It will remain for the courts, the national constitutional courts, the ECJ, and the ECHR, to judge the legitimacy of this interpretation. However, this new European approach seems to exceed the tolerable scope of interpretation. The well-known assertion of Reidenberg, *"Europe treats privacy as a political imperative anchoring in fundamental human rights"*, [19] seems to possess no substance anymore. Indeed, the general objective of democratic societies to engage in a fight against terrorism is misused to take measures to restrict the fundamental rights and freedoms of all citizens.

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Challenges in Managing Software-Intensive Projects

INTEGRATED METHOD OF IT-PROJECT MANAGEMENT

Bogdan Lent [1]

Managing complex projects which are characterized by their multidisciplinarity, urgency, high risk-potential and by their strategic importance, poses high demands on the project manager and all other involved parties. A methodical procedure ensures that the project management is efficient and that the objectives are met. With the majority of established methodologies (CMMI [4], COBIT [7], PMP [11], IPMA [3,12], ITIL [10], PRINCE 2 [2], XP [1] and so on) however, the human success factor is neglected. It is rare that the methodologies are adapted to fit existing procedures or that specific project deliverables required by the company are considered. This paper presents a methodology which starts with the specific project deliverables and directly derives from methods, techniques, tools, templates and checklists which are appropriate and if possible already established in the company. This way, the compliance with company specific requirements is ensured and unnecessary theories are avoided.

1. How can a project management-method be customized for a company?

It is expected that a project delivers its results at the stipulated date and cost. Since project management includes often more than 500 project activities, it is therefore inevitable to define some kind of a system in which they can be organised. Since the project activities are different in every company and in every project, the system has to be flexible to a certain extent, but at the same time it must be as simple as possible.

A first step towards such a system is to look at each project activity and identify corresponding processes, methods, techniques, templates and checklists which are established in the company. We label them as result-oriented rules (R) or as always applicable basic rules (B) and then number

[1] Lent.ch AG Switzerland, Professor ATR Bydgoszcz (Poland), Professor University of Applied Sciences Bern (Switzerland)

them. If a company does not provide any rules for an activity, the project manager is free to choose his preferred procedure (see Fig 1).

nr	*project activity*	*importance of activity*	*relevance for the role e.g. Project manager*	*methods*	*techniques*
1	formulate project proposal	10	10	R1	R2
2	develop project vision from project proposal	10	10		R5
3	draft the coarse project plan	10	8		R4, B1
4	write the project manual	10	2	B2	B3
5	define the project objectives	10	6	R5	R6
6	register the project	10	10	B4	B5
7	modify the objectives with documentation	10	6		
8	write the product concept	10	6	R7	
9	create product breakdown structure	10	0	R8	R9
10	structure the library of results	10	10	B6	
		$\Sigma = 100\ \%$	0-10 each		

Figure 1 - Examples of project activities, rules and basic rules, numbers are coincidental

Upon setting these principles the company has a uniform and well structured procedure, which makes results and decisions of the project reconstructable and comparable in a multiproject environment. Deriving project activities from needs of the company and integrating successfully established procedures significantly increases the acceptance of the project and thus improves the probability of successful projects. A customized methodology is flexible to the type and size of the project and at the same time adapts to the situation of a company and its specific needs.

2. How is the Project manager supported?

Project manager is responsible for reaching the project objectives. Thus everything what contributes towards these goals is essential and needs his action. This begins from the contribution in specifications of a system, system design, goes over purchasing through earned value and quality control, risk and change management, installation and documentation. And not missing human factor: management of the resources, team, communication and conflicts. Each of these areas with tens of individual actions themselves forms an individual process: with initialisation phase, planning, realisation and closing phases.

Perfectly mastering several hundred project activities like the one above is almost impossible if the project manager is not supported by a system with provides navigation and precise guidelines or rules.

In first place, it is important to develop a system to organize all processes relevant to the project manager. In this system, the procedural and administrative processes as well as those concerning the human success factor have to be considered equally. To help the project manager understand and apply the system, there should be a clearly recognizable thread going through all processes and those activities that link them (e.g. methods for project structuring, plan organisation financing, progress control, risk management).

There is no all-purpose model of a perfect project manager. The desired profile depends on the type of the project (complexity, size), its structure and on the viewpoint (vendor, purchaser). Accordingly, the relevance of each project activity can differ for the project manager in different projects and must be weighted individually as shown in Fig 1 in the column “relevance for role”.

While looking at the currently available methods, one shall notice, that the following profiles are often neglected:

- project managers of the purchaser of software,
- project managers of multiple concurrent projects.

While the project manager of the vendor usually has sufficient knowledge on the subject of the project, the project manager of the purchaser can not be expected to be an expert in that area. Therefore, he has to be supplied with instruments to effectively support him in assuming his responsibility towards the sponsor. Also, the functional and financial views have different optimization criteria for vendors and purchasers that have to be considered. When managing multiple, concurrent projects, the focus is on being able to compare the assessment of different projects that are managed and coordinated at the same time. Multiproject management is in the area of conflict between operative and strategic decisions. On the strategic level, the portfolio needs to be compiled “right” and the emphasis must be placed rightly, while on the operative level, the projects need to be realised economically and conflicts for resources have to be solved. Since it can be assumed that many tasks in different projects are similar and require similar knowledge, one of the tasks of the multiproject manager is to discover synergies and make it possible for team members to use the knowledge gained in other projects. Management of operating resources and knowledge management are therefore vital areas of multiproject management.

3. Cornerstones of the desired methodology

After having described how the needs of the project manager and the company are considered in an efficient way, we can now define the cornerstones of the desired methodology:

- The methodology should use the Balanced Scorecard of the company as the basis for the planning and assessment of the project. Balances Score Card comprises all relevant goals of the company and substitute the project goals where not specified.
- The methodology should support both vendors and purchasers effectively.
- Only those project deliverables required by the project or the company should be included in the methodology. Producing these deliverables should be supported with appropriate methods, techniques, tools, templates and checklists.

Procedures, methods and tools which are already established and successfully applied in the company should be integrated within the method wherever they are appropriate. The new methodology is one among many other project management methodologies. Therefore, the project manager should be supported wherever possible and he should be given clear directions, tasks and responsibilities. Thus it is important to check the requirements of existing project management rules and to adapt them to the expected project deliverables.

- All management processes concerning the human success factor should be included systematically in the methodology and supported by homogenous structures the same way as any “administrative” parts like quality control, as they are at least equally important.
- The project activities should be analyzed and assigned to the appropriate process.
- It should be easy, intuitional and efficient to navigate through the processes and project activities.

4. The concept of the L-Timer

The L-Timer is a project management methodology which considers all processes relevant for project management (see also [9]). It is characterized by its integrated, systematic and efficiency oriented complete view of the project and is particularly designed for IT-projects. The approach of the L-Timer is based on a process view to optimally meet the needs of the customer. A set of processes containing project activities all serve a precisely defined goal. A process is seen as a chain of activities and decisions which produces a result oriented towards the overall objective. Interaction between processes is an important feature of project management; its success depends on how well this interaction works. An example for this is the interface between the areas of controlling the progress of the project and of human resource management, where the ability of an applicant to assess the project greatly influences the quality of the reports he has to write. Processes like Change Management are even used by all other processes.

We may illustrate the processes with the simple buying of a new fridge: Imagine you plan to buy a new fridge. Without realizing it, you will consider as many criteria as if you were building a nuclear plant, they will just not have the same dimensions and risk. First, you will have to decide on the size of the fridge, how to install it, where you can possibly buy it and how much it will cost. Naturally you will want the seller to meet the delivery date and you will carefully check the quality of the fridge. Which problems could arise from buying from an unknown dealer? Which issues have to be negotiated? If you plan to change the colour of your fridge, you do Change Management. Questions of integration arise if fridge and deep freezer form a unit and are not to be installed separately. When you discuss the topic with your friends, you do Knowledge Management. You use your documentation when you draw up the account after buying the fridge and you use your Balanced Scorecard when you look at how satisfied your family is. Not only the facts, but also issues concerning people are constantly considered: Human Resource Management means that you ask yourself, who will use the fridge in the end and then decide who helps choosing it. Are you going to systematically solve conflicts or will you prevent them from arising? Good communicational skills help, if you need financial help from relatives. Leadership qualities matter, if the carpenter and other involved persons have to be motivated to work together when installing the fridge. Finally, how much you can do yourself and what you delegate is a question of your Self Management

Optimizing the interrelationships of all processes (we distinguish 18) is a central topic of the L-Timer. Redundancies in the project management processes are avoided by adhering to the Management System ISO 9001:2000. The L-Timer and its project activities contain all requirements of project management. The specific requirements vary depending on the size, complexity and type of the project and are reflected in the column “importance of activity” of the table shown in Fig 1. Fig 2 shows an example of the use of the L-Timer in a project taken from everyday life. To improve the usability of the methodology and to establish a clear structure, the system is represented by a clock. This has the advantage, that connections between the project processes and activities usually performed at the time can be made. The sequence of processes is not coincidental: we begin with planning and scheduling, then purchase, earn the value, control the quality and so on until the end of a day, where we make the day evaluation. Such a system on one side recalls us at specific time of a day about the suitable process (e.g. hey, its 1 P.M.: how about our risks?) on the other side secures that no action will be missing, once we consequently follow the day (most of us begin with a day plan at 7 A.M.).

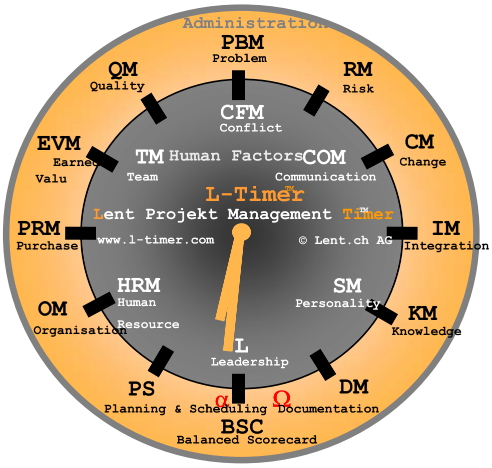


Figure 2 - L-Timer

To continue the analogy to the clock, the processes are passed clockwise. When one cycle is finished, a new cycle is started considering the results of the previous one. The processes are based on the leadership tasks of project management and are divided into procedural and human processes. The human processes consider all persons involved in the project or its environment and are a central part of the L-Timer. These processes are a critical key to success and are often underestimated. In the L-Timer however, theses processes are considered at the same level of importance to the procedural ones. For each process, the L-Timer shows the relationships between methods, roles and project activities and makes them easy to understand. Special attention is given to the concerns of purchasers and their relationship to the vendor.

The process goals of the L-Timer are aimed at successfully implementing IT-projects; however, the system can also be used for other projects by adapting the process goals, project activities and methods if necessary. With the L-Timer, the project manager is occupied with "administrative" processes during the “day” while at night, he manages the soft skills (for most of us being home means “soft skills” are required: wife, children, girl friend, mother in law...) There is no difference to project life.

The order of the processes is derived from the course of action of the project: In the beginning the planning of the project (PS) takes place and when it is finished it is assessed (BSC); first the team members are chosen(HRM), then the team is developed (TM) and later the employees are systematically influenced (L). One of the strengths of the L-Timer is that its logic can also be used as a navigation tool in other methodologies. Figures 3 and 4 give a brief description of each of the processes of the L-Timer. Profound description may be found in [9].

Process	**name**	**objectives**
PS	Planning and Scheduling	You elaborate, structure and plan the objectives of your project. Project targets are aligned with the overall assignment specified by the customer and the higher-ranking enterprise strategy and are guaranteed over the entire duration of the project.
OM	Organization Management	You define project roles, responsibilities and the form of the organisational structure for the successful realisation of your project.
PM	Purchase Management	Through formal relationship with suppliers over all phases of the project, you secure the proper procedures and optimal results, along the formal laws, regulations and enterprise guidelines.
EVM	Earned Value Management	You control the activities in the project according to the result / deadline / cost stipulations set up in the Planning and Scheduling, with consideration for unforeseen events in the project.
QM	Quality Management	You constantly monitor project results, project processes and the other characteristics for compliance with project target stipulations, project requirements and their implementation planning, and promptly draw attention to deviations.
PBM	Problem Management	Together with your team and the applied methodology you master the technical or organisational problems within the cost and time-frame of your project.
RM	Risk Management	You minimise the overall risk to your project by permanent, creative and timely identification of potential risks, their analysis and the development of suitable countermeasures.
CM	Change Management	You ascertain, assess and decide on the implementation of proposed changes with a systematic procedure, introduce them – keeping their effects to a minimum – to the planned project handling and have the updated configuration of the system continuously under your control.

Process name		objectives
IM	Integration Management	According to the project plan and schedule you ensure that the elaborated solutions are embedded problem-free into the existing environment (organisation, human resources, applications, platforms) and that a high level of client and personnel satisfaction is achieved with its introduction.
KM	Knowledge Management	You acquire and store process experiences gained in the course of the project for its use in the current project and in other projects.
DM	Documentation Management	You ensure the documentation and archiving of project results for ease of access during project realisation, the successful placing in operation of the project results, cost-effective operation and full user satisfaction.
BSC	Balanced Scorecard	You submit the results of your project to an internationally recognised, integral and comprehensive evaluation with the aim of making a permanent, positive contribution to the implementation of enterprise strategy in your company.

Figure 3 - Description of „administrative“ processes

Process name		objectives
HRM	Human Resource Management	You select personnel for appointment to the formal and informal project roles best suited to their skills and experience and promote their personal further development according to the enterprise strategy
TM	Team Management	You ensure the best possible efficiency of the complete project team measured against yielded performances, staff satisfaction client satisfaction and process improvement.
CFM	Conflict Management	You promptly identify potentials for conflict in your team and in the overall project environment. You solve conflicts successfully with suitable methods and technologies.
COM	Communication Management	You master the effective communication, including that of marketing, devoted to the achievement of project goals, both in the project and its environment.
SM	Self Management	Your personal satisfaction and performance is very important. You promote it through effective self-appraisal and dealings with your own engaged resources.
L	Leadership	You skilfully and consciously control the behaviour of your team members to guarantee the achievement of the project goals.

Figure 4 - Description of soft processes

5. Structure of each process in the L-Timer

The system of the processes described above now makes it possible to assign every project activity to the appropriate process. The resulting 20-30 activities per process then can be ordered to form a logical sequence (e.g. plan the task, do the task, assess the result). This helps the project manager to handle all project activities. Up to date techniques and Best Practice in project management are always incorporated into the L-Timer.

The rules and basic rules described above now contain the following elements:

- Description of processes
- Description of goals
- Methods
- Techniques and tools
- Templates
- Tasks and results of the phase

Most of the activities can be associated to a single process and are therefore included in the system as for example in problem management. There are always three steps to be performed while approaching a problem:

- gather information; in this step interviews, checklists and similar techniques are recommended,
- finding a solution: expert interviews or creativity techniques like brainstorming are possible.
- assessment: includes various analyses like a risk or efficiency

The analogy to the clock is extended by subdividing each hour (process) into minutes: At each hour, a process is presented in a summary. Then, at ten minutes past the hour, the objectives of the process are described, at 20 past the methods are explained and so on. An example below show the supporting structure for the process of Team Management (22:00): objectives, methods, techniques & tools, templates, task & results.

22:00: Team Management

22:10 pm: Objectives:

Maximizing the efficiency of the group considering

- the performance
- satisfaction of employees
- satisfaction of customers
- improvement of processes
- team spirit

22:20 pm Methods

Group dynamics and building the team

The most important thing of the team-building process is that team members get to know the personal characteristics of each other.

The process is divided into four phases:

- Forming (getting to know each other)
- Storming (work together)
- Norming (develop team norms and standards)
- Performing (reach the potential of the team)

Team analysis

The needs, wishes and fears of team members have to be analyzed to be able to positively influence their acceptance of and commitment for the project. Each team member has a different level of motivation and has to be motivated in a different way.

Negative influence on teams

- "not invented here effect": information from outside (e.g. criticism) are disregarded by the group.
- "Gatekeeper effect": Only one member communicates with the outside.
- isolation of the group, establishing filters to specific information
- members who don't have any opinion or oppose everything, members are socially excluded or harassed.

22:30 Techniques and tools

Techniques for team building

Observation, workshops, trainings, events, rules of group interaction

Techniques to influence motivation

Discussions and feedback, tools to help setting personal goals, team oriented wage models.

22:40 Templates

Documents about project management

Group leadership in the project related wage model.

Product related documents

Data sheet "product characteristics" for brainstorming

22:50 Tasks and results of phases

Initialization

No tasks and results expected in this process.

Planning

Tasks: observe potential team members, put together the team, initiate building the team, organize workshops, trainings and events, create a performance oriented wage model with team components.

Results: performance oriented wage model

Realization

Tasks: organize workshops, trainings and events, interview team members to identify conflicts early.

Results: Reports of interviews.

Rollout

Organize workshops, trainings and events, interview team members to identify

A more detailed description of the processes can be found in [9].

6. How is customization for the company achieved?

Goal of the Balanced Scorecard is to give an integral, all-embracing assessment of the project management processes and results which can be used to support implementing the corporate strategy. The process BSC, which finishes the day in the L-Timer, systematically assesses the goals defined in PS, then these assessments are used as an input to the PS of the next day and the cycle of the procedural processes starts again.

The Balanced Scorecard takes up all the factors that are crucial for the companies success, makes them measurable and communicates them. This includes the performance of employees as well as quality of innovations, internal workflows and financial developments. The scorecard displays the data with its internal relationships and brings them in line with the vision of the company and its corporate strategy [5, 6]. Like that, the BSC creates a frame to measure the integration of strategic decisions and translates vision and strategy into goals. The BSC is divided into four perspectives (customers, finances, internal processes and learning & development) for which appropriate measures have to be defined. Starting point for all four perspectives is the vision of the company, at which the corporate strategy, goals, planning and assessment are aimed.

The processes of the L-Timer are consistently derived from the Balanced Scorecard. To help the project manager establish the connections between the BSC project evaluation, the Earned Value Management (EVA), single project activities and the methods, techniques and checklists, the project activities are all aimed at the measures of the BSC.

To evaluate the project from different perspectives, the method “Project Excellence” (PE) is given special attention [13]. The main reasons for this are its compliance with BSC and its increasing acceptance and usage in companies [9]

Evaluation with Project Excellence is grouped into the following sections: customer orientation, employee development and involvement, partnerships with suppliers, Leadership & goal orientation, social responsibility, processes & facts and result orientation. These sections are weighted and appropriate evaluation criteria are defined.

Figure 5 shows the connections between the concepts of BSC and PE. The PE-criteria are assigned to the appropriate sections of the BSC. Few, like for example, the criterion “goal orientation” are relevant to all sections of BSC and therefore the total score is linearly divided between the perspectives of BSC. Other criteria like customer satisfaction can be assigned to a single BSC section (“customer perspective” in this case) which gets all the points of the criterion.

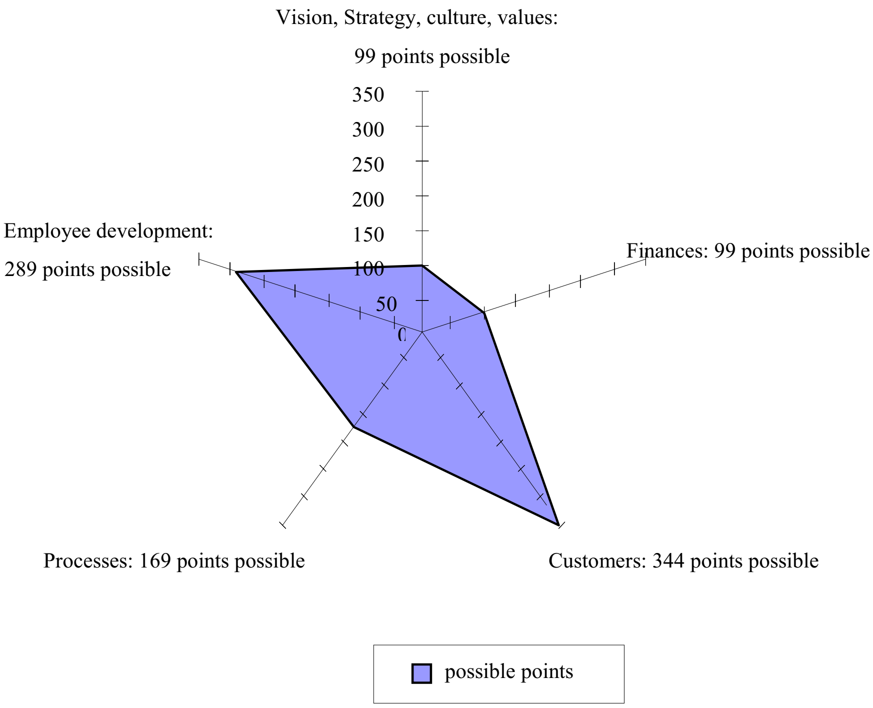


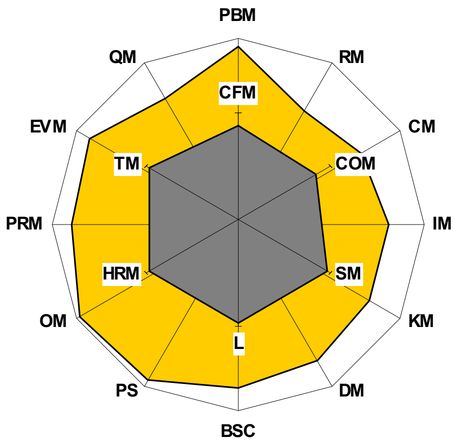
Figure 5 - Weighting BSC-areas using PE

A striking characteristic of integrating Project Excellence into a BSC is that not all sections of the BSC have equal weight. In the example of Fig 5, the section “financial perspective” has rather little importance (max. 99 points) while the section “customer perspective” is quite dominating (max. 344 points). Thus, Project Excellence can be used to adapt the principles of the BSC to the existing project situation.

7. How are requirements specific to the company integrated?

The company expects the project manager to lead the project far-sightedly. The number of the activities, at least 500 may reach 1000 and more is specific to the company. They are collected, precisely described and assigned to one of the 18 processes of the L-Timer.

Evaluating the importance of the project activities and weighting them accordingly leads to an integrated assessment of the requirements which can be displayed in a graph as shown in Fig 6.



Figuree 6 - Kiviath-graph of processes

For all project activities, existing rules of the company are incorporated and project activities are (looked at in a functional way) defined as:

Project activity = function (results of applying specific rule (called earlier R) *upon occurrence of an event* *and (sum)*

Rules are related to events (e.g. implement the concept after it is released by the executive board.) while basic rules always apply (usage of forms for the project proposition). Together, these rules and basic rules form a concise, company specific and project activity oriented project manual.

8. How are humans involved into the project?

In organisation management, the project manager has the task of assigning activities to one or more project roles. As described before in the section about evaluating project activities, this is done by judging the importance of an activity for each role. As an example, compiling the cost input has maximal importance (10 pts) for the project controller, while the project manager does not need to know how to do it (0 pts). For each role, these results are compiled to form a profile structured by the 18 processes of the L-Timer and can be displayed with the same chart as the whole project (Fig 6).

The requirements can change during the course of the project (Fig 7) like processes in Rational Unified Processes RUP [8].

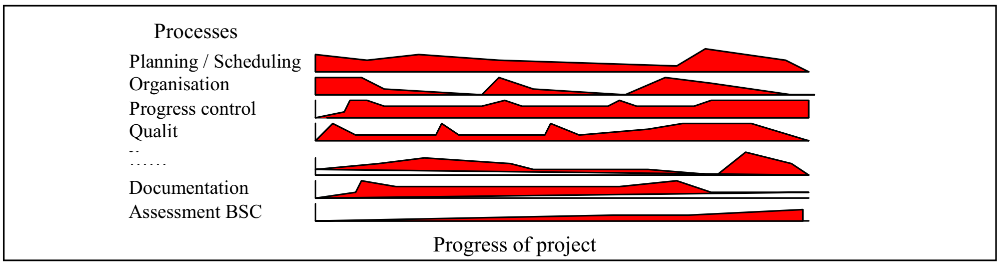


Figure 7 - Changing importance of project activities during the project

As mentioned before, the perspective of the employee is explicitly included in the Balanced Scorecard. In the area of "Learning and development" issues like employee satisfaction, motivation, training and importance of employee suggestions are addressed. Additionally, the soft processes are emphasised in the L-Timer and thus the perspective of the employee is strengthened even more. In Human Resource Management (HRM), the skills and project expectations of the project manager and the team members are examined to ensure that they are not overwhelmed with their tasks. In Team Management, the building of teams is systematically supported, in Conflict Management the involved employees are trained in methods of solving and preventing conflicts. Communication Management includes the face-to-face communication as well as marketing aspects, Self Management helps better organizing oneself and in Leadership, the skills to systematically influence the team are explained.

9. How is the skill-development of employees supported?

After having seen the previously mentioned variety of activities and challenges that are part of every project, it becomes clear that handling the complexity of project management tasks requires well-developed skills and tools. The most important thing in this regard is that the project manager and his team are supplied with a project manual which is aimed at the expected project results. Furthermore, a training program which is based on the project manual and the activities ensures an individual and economically optimal curriculum. The perfect adjustment of the curriculum to the needs of the team members should be constantly verified by interviewing course participants before or after the training.

Establishing a standardized assessment of project managers facilitates choosing the best suited project manager for each project. A uniform and objective process of assessment makes it possible to record competences systematically and leads to better transparency.

Assessments draw conclusions about skills, competences, potential and character traits by observing the behaviour and the performance of the candidate in tests, simulations, role plays, case studies and interviews. The personal assessment tailored for the project manager and the project activities tests the skills of the candidate in order to create a personal development plan based on the results (see Fig 8).

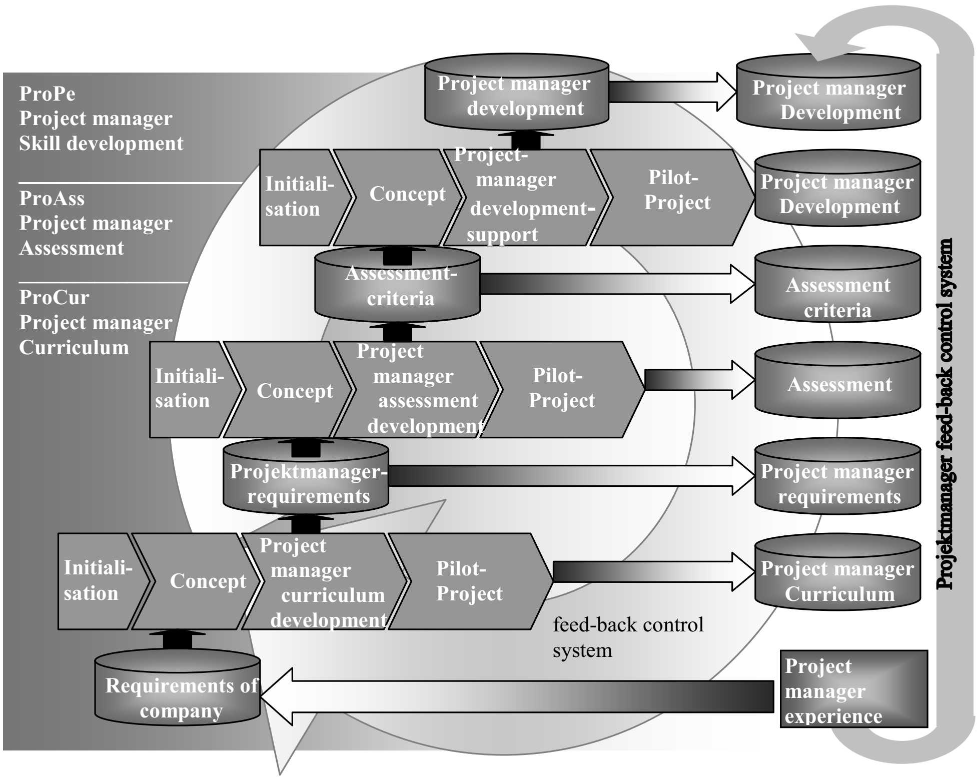


Figure 8 - Career personal development system for project managers

Scientific research and project experience show that assessments are superior to other techniques of evaluating potential. In no other technique social behaviour, conceptual abilities and cognitive capacities are studied as closely and evaluated as systematically. By using assessments, companies and their project managers can adjust staffing decisions to the actual skills of their employees.

Apart from these advantages in quality, well performed assessments usually reach high acceptance with everyone involved and are useful in many different ways. Systematically observing and evaluating competences that are clearly defined and relevant for the job helps with decisions about promotion and development: Team members have the possibility, to show their skill and potential in a fair, transparent and project-related procedure. Furthermore, the feedback is useful to the candidates since they can refer to it when planning their career.

10. Conclusion

The L-Timer is a system, which (based on the well-known model of a clock) enables navigating through all known project activities, processes, methods, techniques, tools, templates and checklists. Since the human success factor is critical in project management, it is given significant weight and is considered equal to other success factors like progress control.

Efficiently adjusting project management to corporate objectives is ensured by deriving the project activities and the project manual from corporate processes as well as by weighting these project activities according to the needs of the company. Goal oriented management of projects is also supported by providing project related training, assessment and personnel development.

A structured and detailed analysis of all project management processes and activities makes it possible to discover the interdependencies of the project management processes.

All these aspects lead to a higher efficiency in project management and at the same time increase the probability of successfully completing the project on time and at the projected cost.

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IT SOFTWARE PROJECT MANAGEMENT: IMPACT OF TEAM COHESIVENESS ON PRODUCTIVITY AND PERFORMANCE

Malgorzata Pinkowska

The efficiency of IT projects and, in particular of those that are software intensive, is determined by the productivity of the project's team members. A large number and variety of researchers have proved that team cohesiveness has a major impact on productivity.

This paper analyses the determinants of team cohesiveness, the impact of project goals and specific factors, e.g. team size, challenges or exclusivity, available to project managers for use in enhancing the desirable team effects. This paper also points out however, the inevitable dangers and the potentially negative influence, which a strongly coherent team may have on project team productivity. In summary, this paper will analyze the bottom-up relationship between all of the elements, from actions encouraging team cohesiveness up to software project performance.

An awareness of this relationship led to the project management methodology of L-Timer™ presented at this conference.

1. Introduction

Software projects means millions of human decisions every second.

"Humans have only one in common: they all differ one from each other"

Robert Zend

More than ten years ago survey organisations like Standish Group Researches documented the performance of software projects on a broader scale. They confirmed the otherwise known truth, that three out of four software projects do not succeed.

Simultaneously several researches pinpointed the tremendous variation in productivity of IT-professionals – up to 1 to 10.

A conservative budget and time schedule of a project, accommodating the worst case risks emerging from the above variation, leads the manufacturers to a loss of competitiveness. An obvious alternative is to increase the productivity of an IT-professional. Contrary to the “Modern Times” experience with Charlie Chaplin, restrictions and stringiest work standards did not prove successful in software production. The virtually unlimited number of possibilities and thus decisions taken by the software architect, programmer, operator and so on, calls for a different approach towards productivity: by professionally handling the individual needs of the people involved and providing suitable methods. Our special attention is given to multinational European project teams.

This paper deduces the human factor as the decisive challenge in software projects and introduces the systematic and integral approach towards successful software project management.

2. State of the art in Software Project Performance

A project is a temporary endeavour undertaken to create a unique product or service. Temporary means that the project has an end date. Unique means that the project's final result differs from the results delivered so far by the organization. The German standard DIN 69901 [12] adds to this limited financial, human and other resources as well as a specific organization. There are over 100 definitions in most respectable publications – most include the human factor in software projects in particular. The variety of behavioural combinations of the software ventures exceeds the boldest expectations for the majority of the projects. This complexity exceeds far beyond the human capability to handle.

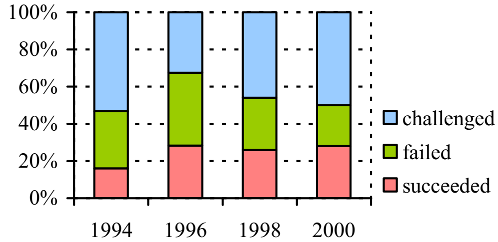

Figure 1 - Project outcomes history (1994 - 2000)

The results of Standish Group Researches 1994-2000 [40], examining 30,000 projects showed that only 20 to 30 per cent of all projects succeeded on time and on budget, with all the features and functions as initially specified (Figure 1). Failed projects were cancelled before completion or never implemented. Challenged projects were completed and operational, but over-budget, over the time estimate, and with fewer features.

The results of CHAOS research are the most widely quoted statistics in the IT industry with far reaching effects [1]. The cumulative research presents a decade of data on why projects succeed or fail – representing over 50,000 completed software projects (9,236 in 2004), plus 450 workshops, focus groups and project group therapy sessions. Fifty-eight percent (58%) of respondents are US-based, 27% are european and the remaining 15% represent the rest of the world. Forty-five percent (45%) of these companies are considered Fortune 1000 type companies; another 35% would be considered mid-range and 20% are smaller companies. They span a diverse number of vertical industries.

2004's results confirmed the earlier statistics of Standish Group Researches. It shows that 29% of all projects succeeded; 53% were challenged; and 18% failed, as shown in Figure 2 [41]:

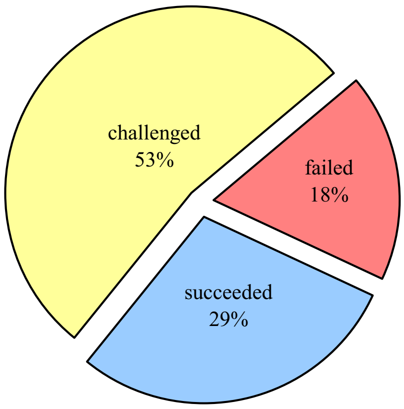

Figure 2 - Projects performance 2004 according to CHAOS

The analysis of projects, which succeeded shows an almost linear decrease in percentage of the successful software projects related to the dimensions of the project: from 46% for projects below 750'000 US $ to just 2% for over 10 million venues, demonstrating the impact of the complexity on all aspects, including certainly the human factor, as well.

3. Impact of the human factor on software project performance

The number of decisions during the realization of a software project is virtually unlimited. Thus, not surprisingly the combination chosen and the speed one moves from one decision to the next, has a much higher impact on software project performance than in any other discipline. The studies of Software Consortium [39] lend credibility to McConnell's conclusions [24]:

- Performance differences on the order of 10-to-1 or more between different developments with the same levels of experience [6], [7], [8], [11], [27], [37].
- Boehm, in a study of 69 projects at TRW, identified that the best teams were at least 4 times as productive as the worst teams [4].
- DeMarco and Lister in a study of 166 programmers from 18 companies identified programmer productivity differences of 5.6 to 1 [10].
- In one study of 7 identical projects, the developers were all professional programmers with several years of experience who were enrolled in a computer science graduate program. The products still ranged in effort by a factor of 3.4 to 1 [5].

Lakhanpal [19] analysed 31 projects to find out the reasons for the above variations. He concluded that team cohesiveness was the number one factor, followed closely by individual performance and experience. All three are within the responsibility of the software project manager.

In this paper we analyse the number one factor – team cohesiveness.

4. Team Cohesiveness

"Coming together is a beginning.
Keeping together is progress.
Working together is success.
Helping each other win is excellence."
Henry Ford

Team Cohesion is the degree to which team members hold an attraction for each other and a desire to remain intact as a team [44].

We may recognize a team with a high cohesiveness for example by:

- synchrony/symmetry/"sameness"

  language ("we", "our team", "each one of us" - adopt group idioms) physical (sit in circle, mirror postures/gestures)

“group mind”: becoming an entity

- adherence to team norms in various “strengths”:

  permitted: OK to eat in meetings

  preferred: should use first names (or should not)

  prescribed: must attend all meetings

  proscribed: must not dominate the discussion

  must not to be late to the meeting

A wide range of other definitions reword this basic thinking: Lott [20], Moreno and Jennings [29], Festinger et al. [14], Wolfe and Box [44], Losh [21], Aamodt [1], Oxford Centre for Staff and Learning Development [34].

Martin [23] distinguishes social cohesion and task cohesion defined as follows (Figure 3):

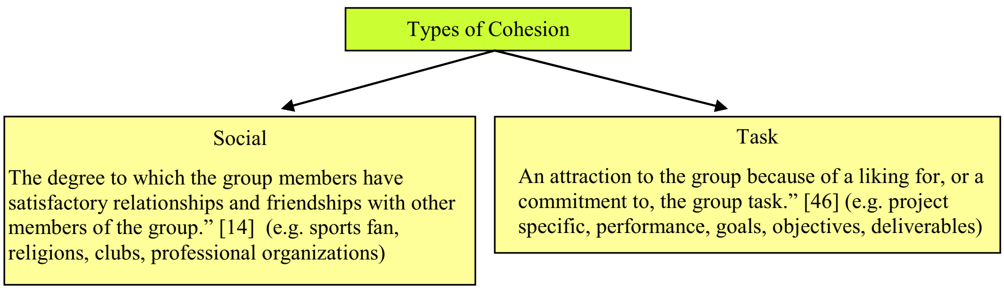

Figure 3 - Types of cohesion

In particular, the task oriented work of project teams has a strong impact on team cohesiveness and thus, as is demonstrated below – on project team productivity and performance (see also [18]).

Both types of cohesiveness are important factors, influencing the attractiveness of the team. Using the term cohesiveness in the text we take both types of cohesiveness into consideration.

Team cohesiveness was subjected to thorough research in the early sixties. While two early studies (Deep et. al [9], McKenney [25]) found no relationship between team cohesion and team performance, all of the more recent studies show such a relationship to exist (Gentry 1980 [16]; Miesing 1985 [26]; Norris and Niebuhr 1980 [32]; Wolfe and Box 1988 [44]). Current studies have found that cohesiveness, perceived quality of performance and perceived equity of communication within teams has a direct influence on the degree of team satisfaction [33]. Studies have found that cohesive teams with relatively high performance goals are more productive than non-cohesive teams [47]. In fact, previous research has found that as long as team norms encourage high productivity, cohesiveness and productivity are positively related [13]. Consequently, it is believed that the cohesiveness-performance relationship is primarily due to individuals' commitment to the team members as well as to the task [30]. It is generally believed that more cohesive teams will perform better at tasks than less cohesive teams. However, there is considerable debate concerning the appropriate means by which to measure cohesiveness.

The term team cohesiveness has come to have a central place in theories of group dynamics. Although different theorists attribute somewhat different conceptual properties to the term, most agree that team cohesiveness refers to the degree to which the members of a team desire to remain in the team. Thus, the members of a highly cohesive team, in contrast to one with a low level of cohesiveness, are more concerned with their membership and are therefore more strongly motivated to contribute to the team's welfare, to advance its objectives, and to participate in its activities [15].

5. Impact of Project Goals on Team Cohesiveness and Productivity

Team cohesiveness does not automatically imply the higher productivity of a team. Various researchers [28], [35] proved that the relationships between team cohesiveness and organizational productivity are moderated by goal congruity (the alignment of the team's goals with the organization's goals). The relationship is shown in Figure 4.

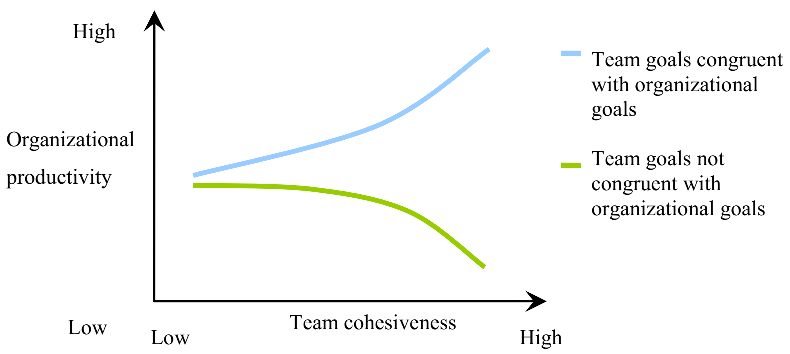

Figure 4 - Organizational productivity and team cohesiveness

The positive impact of team cohesiveness, when team goals are aligned with organizational goals, is shown in Table 1. Nevertheless, the situation possesses also some potential disadvantages and it is worthwhile to observe, that high team cohesiveness does not necessarily lead to higher productivity. In the case of a non-aligned team and organizational goals we might also observe the disadvantages presented in the last column of Table 1 [36].

Table 1. Consequences of high cohesiveness

Consequences	Advantages	Disadvantages
▪ A high level of participation and communication within the team ▪ A high level of conformity to team norms ▪ Team goal accomplishment	▪ Team members likely to perform behaviors necessary for team and organization to achieve goals, ▪ Information flows quickly in the team, and turnover may be relatively low ▪ The team is able to control its members' behavior to achieve team goals	▪ Team members may waste time socializing on the job and chatting about non-work matters ▪ Excessive conformity within the team may result in resistance to change and failure to discard dysfunctional norms ▪ Team members may not cooperate with other groups as much as they should ▪ Team members behave in ways that are dysfunctional for the organization ▪ The team achieves its goals at the expense of organizational goals

6. Factors influencing Team Cohesiveness

Robbins [36] and independently Bloisi et al. [3] identified the major factors which influence team cohesion. Both researchers agreed that team size, member similarity and team success have an impact. Robbins sees competition and exclusiveness as two other factors, whereas Bloisi et al. distinguishes three factors - external challenges, somewhat difficult tasks and member interaction.

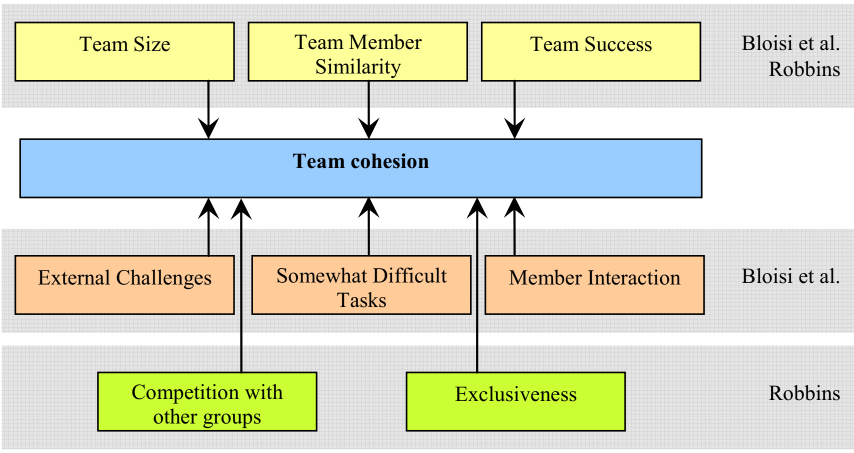

Figure 5. Determinants of group cohesion

Team Size:

The recommended team size is 3–10 members, but the best size is 5–7 members. Smaller teams (3 or 4 members) work faster and tend to produce results more quickly, but they have less diversity. Teams with more than 7 or 8 members require more expert facilitation and often require that sub-teams be formed in order for the team to operate effectively. They have the potential for more ideas and diversity. In teams of 5 – 7 members the project manager is still able to observe a number of interactions between team members and it is possible for him to control the process of team cohesion. [42].

Team Member Similarity:

Similarity refers to how closely attitudes, values, interests and personality match between team members. Similarities in opinions, interpersonal styles, amount of communication skill, demographics, and values have all been shown in experiments to increase affinity between team members. Team members with similar interests tend to put themselves into similar types of settings. For example, two people interested in literature are likely to run into each other in the library and form a relationship (involving the propinquity effect). When we notice similar people, we expect them to like us, initiate relationships and create fundamentals of cohesiveness development. Also, having relationships with similar people helps to validate the values held in common. Finally, people tend to make negative assumptions about those who disagree with them on fundamental issues, and hence feel repulsion [45].

Team success:

Team success is driven by the success of each team member. It reinforces the conviction that a team works with high productivity and that each of the team members are an important part of a highly cohesive team. Success, experienced by team members, positively influences the individual motivation, cohesiveness and atmosphere at work. Team members enjoy the feeling of a certain fulfillment and they consider their team and each team member as irreplaceable.

External challenges:

Whenever a team faces obstacles, something that restricts the freedom of actions, the group cohesiveness is challenged. Insufficient resources, unfulfilled assumptions or financial restrictions all put a team on trial. Once the challenges are mastered the same feelings that are felt upon an experience of success emerge, i.e. the feeling of a certain fulfillment and the irreplacebility of the team and each team member.

Somewhat difficult Tasks:

"Somewhat difficult tasks" is how Bloisi named the moderately difficult tasks, to be executed by a team, which may positively impact team cohesiveness in the same way and manner as external challenges, above.

Member interaction:

Team member interaction is defined as a dynamic, accidental sequence of social interactions between individuals (or groups) who modify their own actions and reactions upon the impact of the predecessor actions by the interlocutor. Whenever there are two persons, they usually interact synchronously, i.e. one action causes one interaction followed by the next one and so on. This process is easy to observe and the project manager can intervene efficiently. The interaction is however, more difficult within the typical group of 5-10 persons and virtually only selectively feasible in a team of 30 and more members. We call this fully accidental sequence of interactions an asynchronous one. The project manager can observe the symptoms and eventually notice the unbalanced activity within the team. Whereas synchronous interaction has in general a positive impact on team cohesiveness, asynchronous – and in extreme case – unidirectional actions have a destructive impact on team cohesiveness.

Competition with other groups:

Healthy competition may lead to a highly productive exchange of experiences and the development of team skills. Team members identify themselves strongly with their team and try to achieve the best possible results motivated by the idea of "a strength in unity". Competition causes that a team strives to achieve the results which exceed their normal performance, as an effect of increased adrenaline and a strong desire to impress other team members with ones' own quantitative, qualitative or diligent performance. Competition is one of the best tools for building motivation and cohesiveness between team members [43].

Exclusiveness:

An exclusive team was always highly appealing to prospective new team members. It could afford to increase the entry requirements and thus indirectly to enlist more productive individuals. Members of exclusive teams have high self-esteem and care greatly about their membership in this team. They work hard on the permanent improvement of their skills and do their best to win team acceptance and become a cohesive part of their team. The striving for personal performance, however, also bears the danger of unhealthy rivalry within a team. To handle this equilibrium is a challenging task, which the project manager faces.

Factors that affect team cohesiveness and the consequences of team cohesiveness on project management are displayed in Figure 6.

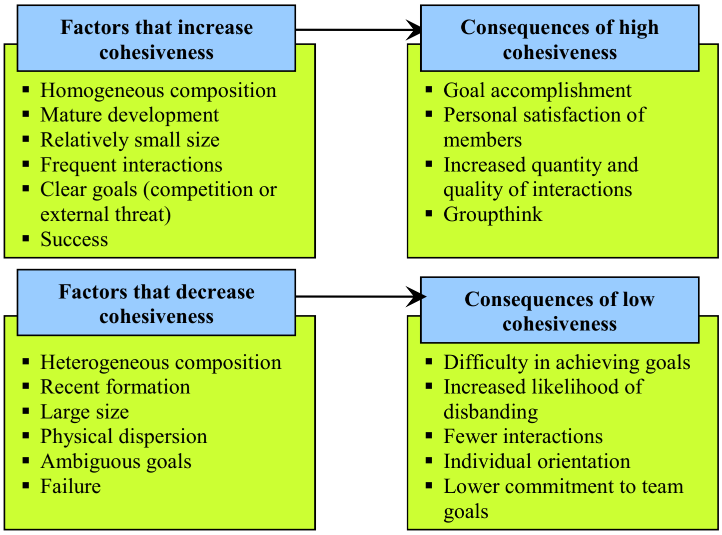

Figure 6. Factors that affect team cohesiveness and the consequence of team cohesiveness

Highly cohesive teams can enforce team norms (exclusivity effect), whatever they are, far more effectively than less cohesive teams. Pressures to conform (internal pressures) are greater. Because people value their membership in cohesive team, they are willing to adjust their behavior to team standards. Even if there is initial "storming" and conflict, if the team "gels," a "norming" period follows and members conform. However, external pressures are greater too. Cohesive team put more pressure on deviants to conform to team norms than less cohesive team do. Compared with members of a low-cohesive team, those in a high-cohesive team will, therefore, be keen to attend meetings, be satisfied with the team, use "we" rather than "I" in discussions, be cooperative and friendly with each other, and be more effective in achieving the aims they set for themselves. The low-cohesive team will be marked by absenteeism, the growth of cliques and factions, and a sense of frustration at the lack of attainment [34].

Indeed, tension within the team has a particular impact on team cohesiveness. The results of the research by Seashore [38], quoted also by Nelson and Quick [31] (Figure 7) let us conclude, that teams with high cohesiveness:

- demonstrate lower tension and anxiety,
- demonstrate less variation in productivity,
- demonstrate improved team member satisfaction, commitment and communication.

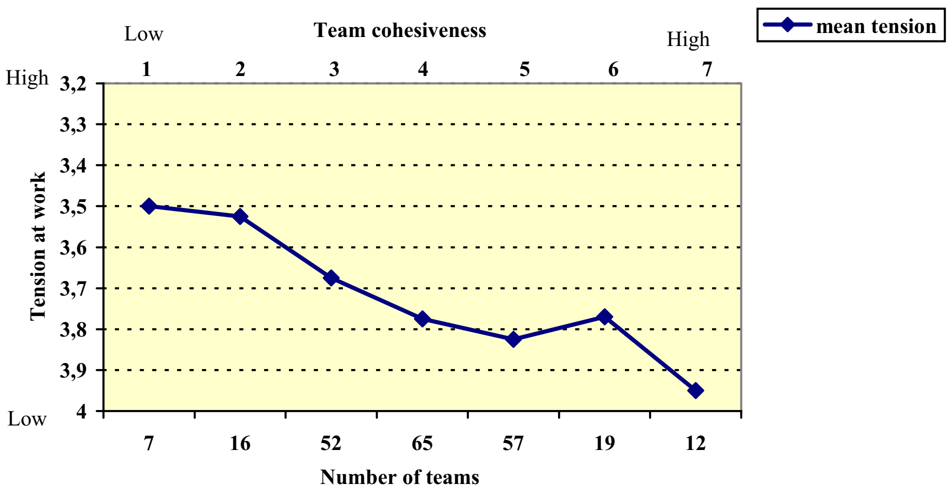

Figure 7. Cohesiveness and Work – Related Tension

7. The positive and negative consequences of high group cohesion

Team cohesiveness is essential to achieving the project goals. However, it may have positive or negative consequences.

In the case of a highly cohesive team with high ethical standards, cohesiveness definitely has a positive impact on team productivity. On the other side, if this team is marked by unethical rules, cheating and law breaking, the more they adhere to each other, the worse and more unpredictable their performances are.

The project manager should encourage team cohesiveness along ethical standards as long as he feels in control. Once the team develops uncontrolled dynamics, cohesiveness may lead to the above destructive developments. The first sign that something has gone wrong (aside from dramatic disasters such as the Challenger explosion) may be that cohesion breaks down and members begin to leave the team without signifying their intentions or even providing an explanation. Team productivity may drop precipitously and outside authorities may be called in (e.g., principals or higher level bosses), while the remaining members refuse to even acknowledge that there are any problems at all.

Losh identified the following positive and negative effects of high team cohesion [22]:

Table 2. Positive and negative consequences of high group cohesion

Positive outcomes of high team cohesion	Negative consequences of high cohesion
• Members are more satisfied. • Almost as a tautology, members remain in cohesive groups longer when a choice is available. • Cohesive teams appear to provide a buffer against stress and thus may positively contribute to individual mental and physical health. • Members of cohesive teams less often report feelings of being lonely or isolated. • Identity with the team is stronger in more cohesive teams. • Peoples enjoy membership • Members experience low turnover • Members tend to be highly productive	▪ Cohesive teams are crueler to deviants. Scapegoating, hostility and aggression are more common toward deviants in higher cohesion teams. • Individual identity may be more stifled and restricted in cohesive teams. Because members are typically closer to one another, they may feel "an investment" in how you look, dress, or talk. If you try to change aspects of your personal identity, even in a positive direction, such as becoming more physically fit, you may find to your surprise that other team members ignore, criticize or otherwise undermine your attempts at improvement. • If team goals diverge from organizational goals, not only may the team as a whole become less productive (by organizational standards), it may also reject members who are productive by organizational standards (e.g., ostracizing the "class brain" or "binging" workers viewed as "over productive.") • Team goals may be damaging, even deadly, to individual members. Remember the loyal German soldiers, the Japanese pilots, and the followers of Jim Jones, who were willing to die for their teams.

The main advantages of a cohesive team [4] are:

1) *A team quality standard can be developed:* Because this standard is established by consensus, it is more likely to be observed than external standards imposed on the team.
2) *Team members work closely together:* People in the team learn from each other. Inhibitions caused by ignorance are minimized as mutual learning is encouraged.
3) *Team members are interested to know each other's work:* Continuity can be maintained should a team member leave.
4) *Egoless programming can be practiced:* Programs are regarded as team property rather than personal property.

A strong, cohesive team can sometimes suffer from the following two problems:

- *Irrational resistance to a leadership change:* If the leader of a cohesive project team has to be replaced by someone outside of the team, the team members may band together against the new leader. Team members may spend time resisting changes proposed by the new project team leader with a consequent loss of productivity. Whenever possible, new leaders are therefore best appointed from within the teams.
- *Groupthink:* Groupthink [17] is the name given to a situation where the critical abilities of team members are eroded by team loyalties. Consideration of alternatives is replaced by loyalty to team norms and decisions. Any proposal favored by the majority of the team may be adopted without proper consideration of alternatives. Typical symptoms of Groupthink are: invulnerability, inherent morality, stereotyped thinking and views of opposition, self-censorship, peer pressure, mind guards [2].

8. Conclusions

We have seen that most researchers agree on the high and predominant impact of team cohesion on the productivity and performance of a team, thus on the whole software project performance. Furthermore, we have been able to identify the factors that influence team cohesiveness and a few mechanisms that take these factors into account. Nevertheless, we have identified how team cohesiveness bears also dangers and the potentially negative impact on a projects' course as shown above. Therefore, an awareness of the chain of interactions, from single actions, which influence team cohesiveness, through team cohesiveness, up to software project performance as shown in Figure 8:

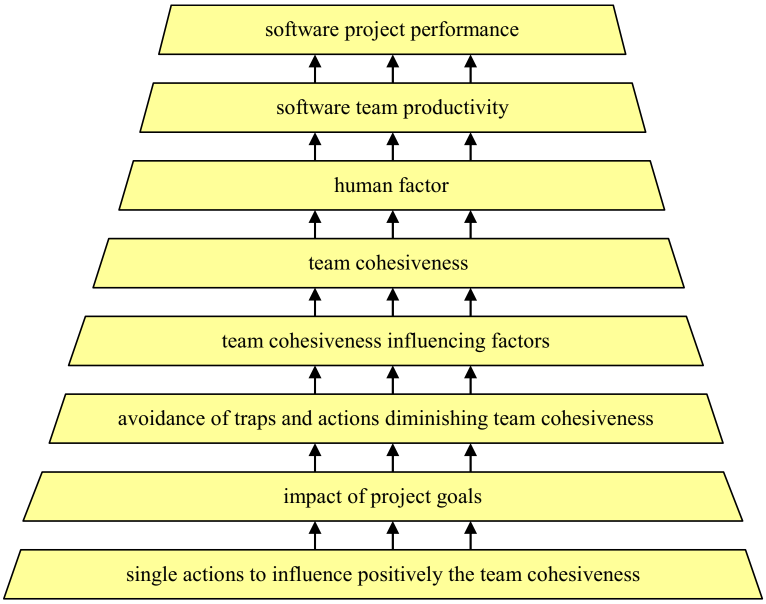

Figure 8. Chain of interactions

Finally, we can state that the further research and quantification of the relationships undertaken herein has been extremely fascinating because the strong conclusions uncovered are, not only, highly useful to a project manager, but also immediately applicable and timeless for most, if not all IT projects.

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KNOWLEDGE MANAGEMENT FOR E-GOVERNMENT

Roland Traunmüller, Gerti Orthofer, Helene Gieber [1]

With the growing concern of Public Governance one realises that it encompasses more than the delivery of administrative services: It aims at the balancing of social interests. Knowledge plays a decisive role which has to be spotted, treasured and redistributed. Several administrative processes like policy formulation and Online One-Stop Government show the importance of managing the plenitude and diversity of data in order to overcome the complex relationships between experts.

1. Knowledge Management and Public Governance

Good governance as goal: Sometimes a co-evolution of themes occurs, so at present one realises it with the subject matters of Knowledge Society, Knowledge Management and Public Governance. First, we turn to Public Governance and regard the way it has widened the scope of the e-Government discussion. Good Governance is a common goal, so just to cite the main features according to the Como-Report: [1]

- Coherence in policy drawing will allow easier policy coordination at various levels.
- Participative democracy in policy making enables the active involvement of all stakeholders in policy making.
- Consistency, effectiveness and efficiency in policy implementation facilitate cooperative and networked policy implementation and this in an easier, quicker and cheaper way.
- Transparency and openness of the whole policy process makes information widely accessible at a very low cost.

Scope: Public Governance encompasses much more than delivering administrative services. In some way governance is a necessary counter-position to the service view. The activities of diverse branches of Government (legislature and the judiciary included) contribute to the balancing of

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societal interests and maintaining the stability of patterns of societal life. Public Governance includes: democratic deliberation with citizen involvement; cooperative policy formulation; legal drafting and decision taking; implementation of policies; a continuous evaluation of results.

2. Public Governance Needs Knowledge Management

Governance as cybernetic model: Such models stress the aspect of governmental decisions that are made in order to gain and control a specific problem domain. This way of modelling dates back to the Sixties and has been widely used for explaining control and feedback. [2] Control loops can be visualised in the following way: It starts with the observation of a specific domain and gathering administrative data. Then the incoming data have to be compared with values that are provided from set norms. Subsequently one has to turn to appropriate actions in order to control the events in the domain. Consequently, in cybernetic models there is an inherent connection to domain knowledge.

Governance means knowledge work: Seeing governance in a wide scope one realises the dominant role of knowledge. Administrative action maybe regarded as knowledge work and public authorities as knowledge networks. This view somehow contrasts the gone decade which was preoccupied with a process view on administration. Now we comprehend administrative work as expert work, so building a modern administration with novel patterns of co-operation becomes equivalent to changing the distribution of knowledge. Knowledge means a broad concept encompassing various parts: procedures, products, formal organisation, cooperative work, external and internal information resources, employees, external partners and stakeholders etc. Any redistribution of knowledge must be carefully designed and orchestrated. Thus, building up knowledge enhanced Government means managing administrative knowledge suitably.

3. Management of Knowledge

Organisational Knowledge as vision: The most pressing problem with knowledge is how to spot it. Even where it may be explicit in the mind of a member of the organisation, it may be hidden from an organisational standpoint. Previous experiences get lost, information files are not used. Besides, information and knowledge might be concealed deliberately. No wonder that enterprises and agencies are eager to invest huge sums into their organisational knowledge. It is of paramount importance to facilitate and systematise the use of existing information and knowledge, to transform private knowledge into structural knowledge and to support the development of new knowledge. Organisational Knowledge is a grandiose vision yet can only achieved in an onerous way.

An onerous task: It is by no means a trivial task to transform today's data accumulations. Sophisticated ways of systemisation and structuring are necessary and a framework of domain knowledge with adequate reference structures has to be built up. Knowledge Management is a crucial yet a task often underrated in its importance. Many managers have only a modest concern for knowledge as an asset. They have to be made conscious that in their departments respectable and extensive riches of knowledge are hoarded.

Scope: Knowledge Management aims at the managing of distributed knowledge. This is done in a systematic way according to a lifecycle of knowledge production, integration and validation. The scope of Knowledge Management is comprehensive:

- Knowledge and information sources
- Knowledge carriers and information holders
- Knowledge supply and demand
- Knowledge exchange and communication flows
- Knowledge access and their property rights
- Technical and organisational infrastructure

Learning as target: In praxis, the development process means an ongoing, conceptually distinct, persistent, adaptive interaction between intelligent actors using the instrument of a knowledge base. Moreover, an organized transfer of know-how, skills and expertise has to be arranged in a proactive way; a learning organization is the goal which one has in mind.

Knowledge Management Systems (KMS): They integrate diverse concepts and tools for that purpose. A KMS has to cover domain ontology, content repositories and integration, knowledge dissemination and actor collaboration. The main components are discussed below.

Domain ontologies: They provide basic orientation via categorisation and give knowledge representation. Domain ontology is an explicit conceptualisation model comprising objects, their definitions and their relationships. So it comprises taxonomies, semantic nets and data models, hyperlinks, time models and so on.

Content repositories: File systems, databases and legacy information systems are the big lump of containers. There has to a system of metadata for giving semantic meaning. Here EDI has to be mentioned in its historic pilot function, now XML versions augmented by RDF (resource description facility) do the job.

Content integration: Content integration means handling a collection of rather heterogeneous data repositories containing data of diverse type format that are originated from different sources. This involves all sorts of conventional ways of keeping data: files, databases, legacy information systems. The diversity of knowledge sources, types and containers poses problems, hence, meta-information, is needed and best moulded directly into the system. Combining the different forms of knowledge is not an easy task and hard and soft data have to be joined. For the former ones financial data are examples, for the later ones opinion polls and estimations. Problems accrue in automatic processing (e.g. in data mining), when semantic inconsistencies in data may lead to statistical artefacts causing misinterpretations

Knowledge dissemination: Knowledge dissemination is rather intricate and a lot of options and conditions have to be considered. Several strategies have been designed for the organizational procedure. One is organizing a knowledge pump with a proactive connection of demand and resources through mapping – quasi the cartography of knowledge. “Lessons Learnt” is another approach combining individual learning, learning by communication and learning in developing knowledge repositories.

Requests on dissemination design: Knowledge dissemination needs a design customized to the venture in question. Potential appearances and forms of design are numerous – so here some parameters are listed that will shape a concrete project:

- Tradeoffs between push- and pull-approaches
- Choice of the access channel which suits best
- Diverse organisational forms and physical settings of demand (office, home)
- Balance of human and software mediators/knowledge bearers
- Intrinsic complexity of the subject matter and the possible translation from the professional jargon to everyday world and vice versa.

Actor collaboration: Such features are essential and a key request is blending different modes of cooperation. In praxis a strictly structured cooperation (workflow) alternates with more informal collaborative modes (message exchange, discussion forum, meeting rooms). Collaborative platforms enable a smooth transition between both modes and provide diverse auxiliary functions. Usability of platforms is a prime concern and have to include advanced features. Examples are indicators reminding the basic status when managing subtasks simultaneously or a malleability of mechanisms allowing adjustment to personal preferences.

The field of knowledge management in Government is wide and so for literature we cite as examples some publications of our institute. [5], [6], [7], [8], [9], [10] In this contribution the scope of treatment is focussed on three topics:

- Governmental knowledge regarded from diverse perspectives
- Policy Formulation as an example
- Online One-stop Government as an example

4. Knowledge Management in Government: Some Perspectives

A plethora of types: Knowledge management in Government is marked by the overabundance of data and the diversity of types. A lot of knowledge resides in long-known procedures and existing data collections. More, a lot of distinct knowledge types are quite unique to public administration. Then there is legal administrative knowledge with a high distinctiveness. This is a feature special to public administrations as any Government activity is strongly regulated and driven by legal frameworks including national constitutions.

Legal Perspective: The legal perspective comprises four categories of data:

- *Legal norms:* Norms are a standard vehicle of communication between government and executive agencies. Especially in continental Europe, public administrations are highly regulated by legislation which is enacted on European, national, regional and local levels. This leads to a multitude of legal databases that have to be taken into account.
- *Data on legal facts*: There are many data on legal facts – so including all traditional registers that cover the basic items such as persons and land, then going to refinements such as real estate and geographical data.

- *Data on legal decisions*: They are important as precedence cases. The border is blurry as many legal facts are the result of legal decisions. So there is the process of granting a permission to establish a company and also the register of companies.
- *Auxiliary data:* This comprises all data necessary for managing data and processes.

Layers and competencies: Legal competencies demark governmental action and here a differentiation on layers is given. One has to be aware that further more detailed distinctions can be made so on functions, locations and even names of addressees.

- *Governance layer:* Legislation is enacted on various layers. Governance defines and assesses the strategic decisions using the law and regulatory instruments in the realm of politics. So the repositories of this layer comprise legal databases as well as socio-economic planning data.
- *Administrative layer:* Implementation at the tactical layer is given in the way of policies (policy formulation and the managerial part of policy implementation). In concrete, it means applying the framework of law.
- *Agency layer:* In public agencies, the executive staffs exert diverse actions in order to carry out the policies of the administrative bodies. The executive layer is the world of action and a plenitude of knowledge types is involved

Formalization of semantics: In praxis borders blurry and the degree is marked by the application. For the every day work of users a rather coarse taxonomy and a makeshift classification will suffice. The same data may need a verbal description for planning purposes; while for automatic processing stringent requests on formalization exist. So for modelling the complex “life events and associated administrative processes” a sizeable ontology with formalised description is necessary.

Focus of search: The focus of search will be wide and fuzzy in planning processes, yet narrows to individual data in other applications. In individualised case processing (e.g. child allowances and tax cases) the particular circumstances of a person and his situation are taken into consideration. So only the individual’s data are needed, yet these have to be exact.

Negotiation character: One has to view the negotiation part of administrative decision processes. Only rarely outcome is determined by the procedural or the material law. In many decisions legal interpretation, deliberation and consensus building are crucial. Thus developing consensus and enter into negotiations are important modes of action in administrative work (not only in policy formulation!)

Discretion versus automation: There is an inherent conflict between discretion and automation. In designing for automation this has to be solved. The leeway given by the law for contingent decisions is replaced by categorization or a scale of possible values.

Decision making: Very complex relationships exist between the key elements of decision-making: law, facts of the case, domain knowledge, and the process in which the decision is reached. In addition decisions are taken either by a single decision-maker or a co-operative act. In the following sections we highlight the issue for two important yet rather different administrative processes: Policy Formulation and transactions in Online One-stop Government.

5. Knowledge Management for Policy Formulation

Preparing processes of policy formulation is important for legislative and administrative work. Policy making and its complex processes represent a case of weakly-structured processing with quite unique constraints. For a detailed discussion on policy formulation we refer to [4] – here some highlights are delineated.

The negotiated character: Policy making is normally taking place through multiple processes of negotiation, ranging from cooperative search for acceptable solutions to outright clashes in interests. Decision making in public policy is a process which more often than not is characterized by a mix of commonality in interest and struggle. One type may resemble a litigation process with clear-cut roles of opponents acting in a quasi zero sum game. Labour relations are an example. In other cases, positions may seem contradicting at first glance, but a skilful mediation process might lead to an acceptable compromise. Democratic participation in town planning processes is an example.

It is necessary to support the various settings in which planning and policy deliberations take place by ICT. Assistance goes in two directions: sustaining the collaboration and bringing in information from diverse knowledge repositories.

Assisting collaboration: Collaborative tools are essential as many activities occurring in policy making are cooperative in nature. First, the meeting activity per se may be performed via video techniques – so economizing on travel costs and time. Next, many activities associated with meetings can be improved by tools. A diversity of tasks occurs in the course of policy making:

- Planning and operation of the entire process
- Advance clarification of procedural questions
- Planning of sessions and preparation activities
- Structuring of tasks and processes
- Procedural aid and information support
- Specific activities of subgroups
- Collection of arguments, preparation of presentations, evaluation of propositions
- Preparation of agendas, questionnaires and so forth
- Documentation of process and results

Gathering information: The amount of knowledge used in a concrete planning decision is mostly extensive. So for policy formulation the realm for information search and investigation is rather unlimited. Gathering all relevant information might include exhaustive seeking for information sources. Collecting expertise and preparing information for decisions is a tough part: gathering as well internal and external information, furthermore both factual information as well as deontic information such as norms and prior decisions.

Making information palatable: Participation with the citizens involved in policy formulation poses particular problems. There is no much use offering information just in an exclusively legal wording; information has to be made palatable for the citizen.

Enclosing the extent of information needs: The information needed in policy making reflects a high dependence on organizational goals and on the concrete situation. To dig deeper a list of questions that might occur is given:

- Pending tasks and general expectations about them
- Factual information on the subject matter
- Stakeholder in decisions (institutions and persons) and their interests
- Expertise gathered from citizen contacts
- The general situation and resources available
- Key internal numbers from controlling and result of evaluation and inquiries

- Framing conditions given by legal rules and political forces
- Possible legal/administrative procedures and directives

The data dilemma: The list above listing information desirable shows the intrinsic problem with data. For several questions data may not exist at all, for others only verbal answers can be given and they are rough estimations. Even when data are available they may be rather fuzzy ones and/or need extensive interpretation. So in policy making human experts are indispensable.

Tools for support: There is a rich collection of instruments for support. First of all, one needs collaborative platforms, also multi media and video-contact may become necessary. The support of collaborative problem solving with special tools such as brainstorming systems or issue-based argumentation systems is possible. From time to time tools may sustain the decision taking part itself by modelling and here expert systems and model bases come in.

In addition managing knowledge repositories such as databases and document filing systems are important.

6. Knowledge Management for Online One-stop Government

One specific development branch of e-Government is Online One-stop Government. One-stop Government is a concept that refers to the integration of public services from a customer's point of view. For details we refer to [11] here only a sketch is given.

The front office part: Online One-stop Government is a big leap forward. Portals create innovative modes of communication between administrative agencies and citizens (and companies as well), they provide access to the service needed and open a broad access to public agencies. Now access structures no longer follow the intrinsic needs of service production but rather concepts of whole-person or life-event oriented, integrated service delivery. In a classical administrative agency citizens have to appear at fixed hours in an office; now at the One-stop portal, citizens are provided with sufficient information regarding their objectives of visit.

The back office part: It is the splitting up the service production chains between front offices and (distant) back offices, which enables to create new schemes for bringing administrative services and their addressees into contact. Online One-stop Government has a Janus-nature: it equally improves the link with the citizens and likewise promotes a re-engineering of the internal machinery of governance. The public sector is accommodated with a set of tools that allows the back-office processes to interoperate. The public servants use these tools in order to create and manage information and integrated public services that match the needs of their customers.

Automation needs formalization: Now we turn to the request that Online One-stop Government states for Knowledge Management. There is a demand for modelling legal knowledge on concepts and norms in a highly formal way. The reason for formalization is that Online One-stop Government needs data interchange in an automatic way. Mostly – just think on the case of a civil marriage - data involved in a specific administrative decision are dispersed over many locations, under the competencies of diverse agencies and residing on several systems. In Online One-stop Government these data have to be brought together. In data interchange a lot of decisions occur and for the aim of maintaining a smooth running of system most of these decisions have to be taken automatically.

Formalizing legal concepts and rules: Such an automatism is only possible if both, data semantics and rules, are modelled adequately and in a highly formalized way. The primary decision to be taken automatically concerns the release of data from a particular store. It is an important decision as very often the data are sensitive (privacy). Therefore, for an agency releasing the data in their custody is only legal, if there is founded trust in a reliable system preventing misuse. Whenever a particular set of data becomes distributed and quasi enters in the global field, a threshold is surpassed. From now on norms must determine every subsequent act of usage - just to think about directives safeguarding privacy.

Standardisation: For Online One-stop Government standardisation is a must. This means mastering a lot of subtasks ranging from conceptual to technical items: establishing a common understanding of processes; building on widespread administrative concepts; ensuring interoperable platforms; having a legal / administrative domain ontology; defining formats for data interchange. There are a lot of projects under way mainly capitalising on XML (and RDF) technology to provide a common, flexible and extensible syntax for the public sector. [3], [12]

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HOW WE CAN CONSTRUCT ROBOTS? AND HOW MAN AND ROBOT WORKS WITH DATA.

Karel Pstruzina

The answer on the question in the topic of my contribution depends on other question. What is purpose why we construct robots? Possible answers are: We construct robots as a bondsmen orWe construct robots as the lords. I claim that if the robots are bondsmen then they need the consciousness but if the robots are only the lords then the consciousness is something unnecessary. Though my claim sound rather perplexed, I think it is deeply rooted in Hegel's passage: Lordship and Bondage from his work: Phenomenology of Spirit. I think it could be very inspired for elucidation both evolution of consciousness and future investigations in the domain of consciousness including the robotics. Hegel wrote that: Self-consciousness exists in and for itself when, and by the fact that, it exists for another (Hegel p. 111). It means man strives for recognition by the other man and therefore he undergoes a life-and-death struggle, because only through such struggle man can approve himself as independent and pure being-for self. The robots as a lord can function without consciousness. They do need not approve themselves by the means of suppression other being. Robots can be constructed with the map of their environment and therefore they can reflect concrete situation in which they are but it is long way to conscious being. To be conscious it means that something like map of environment is previous to percepts that we scrutinize the world through our inner thought's model of world, through our opinion how the world is. We continually expect what will be in the next moment and we are prepared for it. But robots can function very productively out of such mechanism. If man wants to be lord then he needs the conscious robots. Man long for recognition as independent consciousness whose essential nature is to be for itself (Hegel p.115). Unconscious robot is only machine and it is not enough for our self-consciousness and our self-identity

There are many questions about computers, robots, or units of artificial intelligence.

Turing's question: Does can a machine think (?) is most known. (Turing – 1950) The question in topic of my contribution is more complicated because it is question on the consciousness, not thinking. A consciousness is more sophisticated phenomenon then thinking is and the answers therefore can very differ, as well.

I characterize thinking as the discourse with intentional contents of mind. The thinking can deal with concepts, tones, symbols, a numbers, an imaginations etc., but every time with something. The thinking is the blank flux; it carries and mixes concepts, tones, symbols, numbers, etc., but it is under them as something autonomous and independent. Thinking is not the demonstration of being but thinking is spontaneous. Thinking is autonomous in the sense of self-sufficient reason and it is irreducible on another form of mental phenomenon. It is because the thinking is simple movement (similarly to computation). It could seem that thinking is tied on being and that thinking is only modus of being and that thinking pursuits the differentiation inside of being but my characterization is antipodal. Thinking constitutes the essences because the thinking reflexes the forms of being. An identity and negativity are fundamental operations that are carried out by thinking. It means thinking differs by saying: it is that (it is like that); or it is not that (it is not like that). And by such operations are realized the generalization and abstraction and these operations are a base for constitution of essences, too.

Thinking differs from consciousness. The consciousness disposes by many substructures such as the emotions, imaginations, pieces of knowledge, experiences, memory contents, etc. Consciousness is also deeply rooted with historical personal development of the individual and the society and culture (Rose 1998 pp.5 - 6).

I found out about 150 definitions of consciousness. They start: consciousness is identified with short-term memory (Minsky), or short-term memory with delay (Pribram 1999 p. 130); to definition consciousness as super ordination term that cover all mental states, events and processes that are experienced (Flanagan 1995 p. 167); or identification consciousness with the internal integrative system (Sommerhoff). But my question is not oriented to definition of consciousness but to robots and whether robots need consciousness. The answer on this question depends on other one, for my opinion. Especially on the question what is purpose why we construct robots?

Do we want to construct robots as our partners that will be independent and autarkical creatures or we want to construct robots as servants that will make our life easier and more comfortable? Or by the words of Hegel: do we construct robots as lords or as a bondsmen?

I claim that if the robots are bondsmen then they need the consciousness but if the robots are only the lords then the consciousness is not needed for them. Though my claim sound rather perplexed, I think it is deeply rooted in Hegel's passage Lordship and Bondage from the Phenomenology of Spirit (Hegel 1977 pp. 111 – 117).

Hegel's conception is founded by his approach to self-identity. The self-identity is mostly interpreted as something what is closely tied with the memory, especially with this part of long-term memory that includes episodic memory. E. Tulving (Tulving 1985 p.388), M. Warnock (Warnock1987, p. 5-8) and others wrote about. But Hegel's attitude differs.

Hegel thinks self-identity consists in recognition by other people. Other people must respect me as an independent and autarkical creature. The man is held only from himself. The man by every doing is as if speaking this is me. I am such that I can transform my surroundings in way that I want to do. I recognize myself by my deeds. I can see what I am only if I can see the result of my activity. What I am thinking about me it is entirely feeling but not recognition and I need recognition of myself. Therefore I must sign my surrounding by myself. But it is not sufficient. I must recognize myself not only by the transformation of my surrounding but by other people as well.

Other people do the same. They long for recognition also and by this way the activity of one man encounters with activity other man. And it is the reason why they undergo *a life-and-death struggle*, because only through such struggle man can approve himself as independent and *pure being-for self*.

Hegel writes:

> *The presentation of itself, however, as the pure abstraction of self-consciousness consists in showing itself as the pure negation of its objective mode, or in showing that it is not attached to any specific existence, not to individuality common to existence as such, that it is not attached to life. ...*

And Hegel continues:

> *Thus relation of two self-conscious individuals is such that they prove themselves and each other through a life-and-death struggle. They must engage in this struggle, for they must raise their certainty of being for themselves to truth, both in the case of the other and in their own case. (Hegel 1977 p. 113 – 114)*

What does this mean? It means for my opinion that the activity of man must be founded only by his or her will and choice. If we act on the base dictation of surrounding or other people then it is else our activity but it is not our intention. We are acting only what other man wants. And therefore we do not recognize ourselves. Only if our activity is performance of ourselves or of our will and our choice then we can speak: I am.

How it is when we are considering about robots.

The robots as a lord can function without consciousness. They do not need approve themselves by the means of suppression other creatures. They can be very functional out of conscious reflection of their surrounding. They can possess the specific receptors for very different stimuli from the outside that enable to diagnostic concrete things and to orientated themselves in the surrounding They can possess the feed back receptors by which they can control their activity, too. They can possess also some map of surrounding for that they are constructed but their form of perception of outside world will be very differ from the way how man is perceiving the world.

If a man perceives the world then his inner thought's model of the world precedes the percepts. There are differences above all in the process of perception during natural aging. The crucial point is, in all probability, puberty when the thalamus as a filter of sensations gets under the control of the cerebral cortex. After puberty perception is not prior to the mind, but on contrary our thinking chooses among the outer stimuli. Vygotsky's theses are:

> *A child thinks as it perceives; on the contrary an adult perceives as he or she thinks.(Vygotsky 1934, P. 124)*

These two dictums are a summary of sophisticated processes that happen in our brain during aging.

The brain processes differ if a child or adults keeps for example a book and perceives it. A normal adult has an abstract model of a book before his perception. This abstract model of book arises from habituation. It is by such a process that we carry out abstraction from very often a repeated perception. By this abstraction we can distinguish both; what is among our percepts invariable and essential and what general properties or features belong to the set of things. Similarly we have an abstract model of the various things and I label them endocepts.

Endocept is Arieti's term and I prefer this one (Arieti – 1976 pp.53 – 65) K.H. Pribram uses the term *neuron's model of world*; W. Penfield prefers the term *pattern*; D.H. Hubel speaks about *coding's processes*; B. Russell calls it *schema*; and J. Fodor uses the term *prototype*.

Though endocepts are closely related to awareness of percepts there are differences between awareness of our percepts and all sensations that our brain has recorded. We are consciously aware of only a limited amount of these percepts at any moment. Endoception is the opposite of perception. It is an inner recall of our life through the world. The endocepts is also a storage of all contents of thinking that we carry out and by which we scrutinize the world. But an endocept could not be identified with subconscious structure as displayed by a Freudian-type analysis. Rather it comprises large systems of past experience, images which do not currently release actions, are not easy to express in the words but are felt as dispositions to thinking.

We can distinguish a thing only when we compare with endocepts. We conjecture or we make hypothesis "what it is" at every moment of our perception. And it is thinking that confirms or refuted our conjecture. Thinking makes a zigzag course between endocepts and the actual sensations and confronts these actual sensations from the criterion of novelty. It means our thinking traces if something new is in our percepts. If it is nothing new, it means if percepts comport with our endocept for example of a book then we do not really perceive a book for a long period when we read it. Therefore our brain chooses the strategy of confirmation of our endocept of a book.

It is very similar in our quotidian life. We are living in a relatively stable environment and it would be very difficult for us to reflect the whole of our environment at every moment. But in the case that the world is some way that we do not expect it to be, of course, we perceive the world too. We instantly give it attention if something new is in our actual perception. For example, a book is damaged, or there are misprints in a book and so on. In this case our thinking reflects differences between endocept and actual perception and we either complete, if it is possible, our endocept with novelty, or we reconstruct it, or we must form a new one.

These processes depend on the quantity and the consequence of the inclusive novelty in the actual sensations. Sometimes new information has only a virtual character, when new stimuli are small or they are not frequent. We shift aside such information into periphery of our consciousness and they make a latent agent. Similarly turbulent information are not able to create a new endocept because they bring too many new stimuli, they are confused and call up chaos. Such information we push aside to the periphery as well. These are two bounds and between them is a possibility for creation of new endocept from percepts.

Thinking is here still in the level which, in tradition of German philosophy, is labeled as "das Verstand". Thinking at this point works with the material object and therefore it is observable thinking. But thinking can work otherwise as well as with concepts. In such processes thinking does not work with sensations, percepts and images, but with ideas. The latter are most frequently externalized as words and represent a content of thinking. Therefore man can work with ideas as with things in a practical life. Man can combine or compose ideas and so he can create new ideas. Thinking is here on its own field and can evolve concepts.

I claim the creation of new ideas can be described not only by the means of Hegel's negation or logical inference but also by the means of generators and inhibitors of thinking which can act both way; discursively and divergently.

The endocept is opposition of percept. The endocept expresses the active evocation of world in the mind of man. I think that endocept differs from experience because the endocept include not only our imagination but also the concepts.

K.H. Pribram claims that the brain is depended on the information from the outer world when it creates the neuronal model of the environment but the brain is independent when it elaborates them. Pribram utilizes the result from the Sokolov's research. The neuronal model represents the memory mechanism. Pribram and Sokolov suppose the neuronal model is tuned on the input information. We have the neuronal model of environment before the outer stimuli begin take effect on us. They are differences among scientist what part of brain generates such process. Magoun supposes that it is mesencefalon; Penfield's hypothesis is that the generator is in diencefalon; and Pribram thinks that it is brought about by limbic system, especially by amygdala and by prefrontal lobe of neo-cortex. Goleman at his work "Emotional intelligence" wrote about the amygdala and hippocampus which has responsibility for generating of emotional and epical memory.

The endocepts precede to percepts. The endocepts are set up before we register the percepts. Such pre-set has its base in the habituation, it means on the base of repetition in our perception. This mechanism of perception guarantees that our brain will be not overworked. The stimuli that we anticipate are not recorded by brain, or more precisely they are not fully aware. When we perceive whatsoever object this object is only confronted with neuronal model of environment, with the endocept, which is set up before our perception. The percept usually affirms endocept. If the percept is not in concordance with endocept then we are aware it and gradually incorporate such novelty into endoceptive structures. When we records information we endeavor to bind them to the endocept. If the information is in coincidence with endocept then it completes endoceptive structure or affirms inner thought's model of world. Some percepts can be new and strange, they do not need agree to nothing what we know, what we absorb. At this case we record them at once. We are aware that something among the percepts is new and the stream of our attention takes them into center of our awareness. But some of such new percepts we can shift off to periphery of mind and they cause only as a latent agent there.

W.J. Freeman investigated how the neuronal model of world or endoceptive structure is generated. He used the PET method. The results of his research show that the impulses are more chaotic when the men is relaxed than he perceive.

This conception is from the point of view philosophy very important. The perception is not understood as adverse transfer of picture (as photography) but it is process by which the outer stimuli are complete by neuronal model of world by endocepts. At the process of perception we do not only record the stimuli but we construct the objects on the base of previous perception.

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Do We Need a New Information Management Technology?

DO WE NEED A NEW INFORMATION TECHNOLOGY?

Christian W. Loesch

"All men by nature desire to know"
Aristotle

Having discussed the physical and technological aspects at recent IDIMT´s, let us this time devote some emphasis to a complimentary, potentially systemic viewpoint by looking at the general future scenario. The second word of the title already rises the question "who is we," and what kind of scenario do we have to expect at the time when new information technology could be implemented.

1. Demographic - Economic - Scenario

We will consider the demographic and economic scenarios and key players and then take some guesses at the scenario we might expect to consume and use the future information technology.

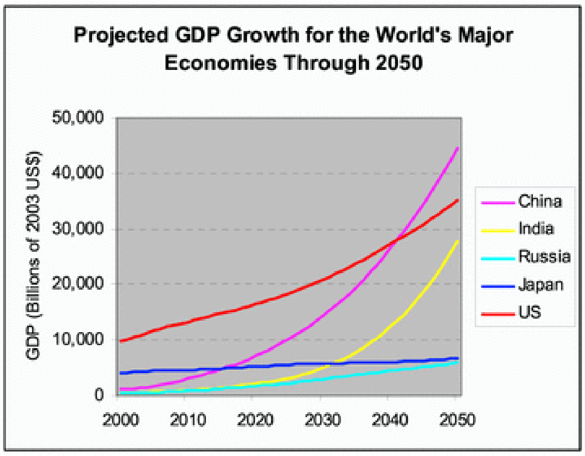

Figure 1 [3]

The GDP comparison between the US, China and India (figure 1) illustrates the potential shift of the centre of gravity from the so-called Western Hemisphere to Asia. This move is strongly supported by the heavy influx of Western investment and technology into this area. We see more and more R&D performed in this area, developing from the prolonged working bench to new centres of information technology. Government policies enforce these developments by requesting local participation in business ventures. Combined with the increasing local market potential for products developed based on these local joint ventures R&D for the large local and unsaturated market will enhance the thrust to satisfy these needs. Since leadership tends to gravitate where competence lies, leads us to consider future demographic and educational/skill developments. Even more so since markets in Western Hemisphere show signs of market saturation, e.g. the mobile telephone market.

Additional effects will arise from the different demographic structures in the Afro-Asian area and Western Europe and US. This means that the number of people in the most creative phase of their life will be most probably found in Asia and later on in Africa.

This quantitative shift will only have a lasting impact if education facilities and appropriate standards are developing accordingly.

2. Market Developments

500 Million New Customers

In 2005 estimated 13,9% of the world's population had Internet access. If you ask them, which improvements they would like to see over the next years you will not be surprised that reliability and user friendliness will come up.

Research suggests that users of the next wave of computing users will look very different from the first. They will be less affluent and more heterogeneous, live in more challenging environments in the developing world, and in many cases have very different daily lives and abiding concerns. New users will come from the growing metropolis in Asia, Africa, and America. Mobile telephony promises to reach some two billion subscribers soon. As cost of computing continue to speed downwards new forms will appear that better fit the daily lives of more people, and new forms of wireless connectivity will be needed enable communities to "leapfrog" to high bandwidth connectivity, and become a new population of computing users. How do these changes affect us?

2.1. Some indicators

- In 2004, China graduated about 500,000 engineers, India 200,000 and the US 70,000.

- For the cost of one chemist or one engineer in the United States, a company can hire about five chemists in China or eleven engineers in India.
- The United States has become a net importer of high-technology products. Its share of global high- technology exports has fallen in the last 2 decades from 30% to 17%, and its trade balance in high-technology manufactured goods shifted from plus $33 billion in 1990 to a negative $24 billion in 2004.
- In 2004, chemical companies closed 70 facilities in the United States and tagged 40 more for shutdown. Of 120 major chemical plants built around the world with price tags of $1 billion or more, one is in the United States and 50 in China.
- In the recent period, low-wage employers, created 44% of the new jobs, while high-wage employers created only 29% of the new jobs.
- The United States is said to have 10,5 million illegal immigrants, but under the law the number of visas set aside for "highly qualified foreign workers" dropped to 65 000 a year from its 195 000 peak. Nor could Germany achieve an overwhelming success with its recent "green card program."

This may indicate that only high quality in all aspects ranging from education to innovation and R&D can support a continuation of the present role of the Western world. These figures also point out that we enter the period with the largest number of university graduates in R&D ever in history.

These data have to be weighted against the fact that many Chinese degrees are completed it in two or three years only. Some educators are concerned that the message that our engineering students will soon compete with one million graduates from India and China could create a sense of uncertainty and doubt and might scare many away turning them into lawyers, accountants or medical doctors. [24, 25]

Some more indicators from the legal scenario

- In 2001 US industry spends more on tort litigation than on research and development. [26]
- No European and only three US companies rank among the top 10 recipients of patents granted by the US Patent and Trademark Office. The highest-ranking European company is Philips on rank 12.
- Intellectual Property

Preliminary Rank (2004)	Preliminary no. of patents (2004)	Organization	Final Rank (2003)	Final number of patents (2003)
1	3,248	International Business Machines Corporation	(1)	(3,415)
2	1,934	Matsushita Electric Industrial Co., Ltd.	(4)	(1,774)
3	1,805	Canon Kabushiki Kaisha	(2)	(1,992)
4	1,775	Hewlett-Packard Development Company, L.P.	(5)	(1,759)
5	1,760	Micron Technology, Inc.	(6)	(1,707)
6	1,604	Samsung Electronics Co., Ltd.	(9)	(1,313)
7	1,601	Intel Corporation	(7)	(1,592)
8	1,514	Hitachi, Ltd	(3)	(1,893)
9	1,310	Toshiba Corporation	(13)	(1,184)
10	1,305	Sony Corporation	(10)	(1,311)

Figure 2 [US Patent and Trademark Office]

Intellectual property represents the result of the intellectual effort and can be viewed as the legal embodiment of that effort, needed by companies in order to do business. Information and especially software technology is an area strongly affected by intellectual property and vice versa, requiring a balance between vested industry (e.g. prevention of illegal copying) and user interests. Restrictive terms imposed by large software vendors supersede the tradition and some licenses even make it difficult to examine material before purchasing it. It is not clear yet if the traditional “fair use” exceptions to intellectual property rights for education will be protected under the emerging copyright regime. [4]

3. Information Technology Industry Developments

In spite of the phenomenal success of the information technology industry linger pessimism and doubt since more than a dozen years on the continuation of this unprecedented growth.

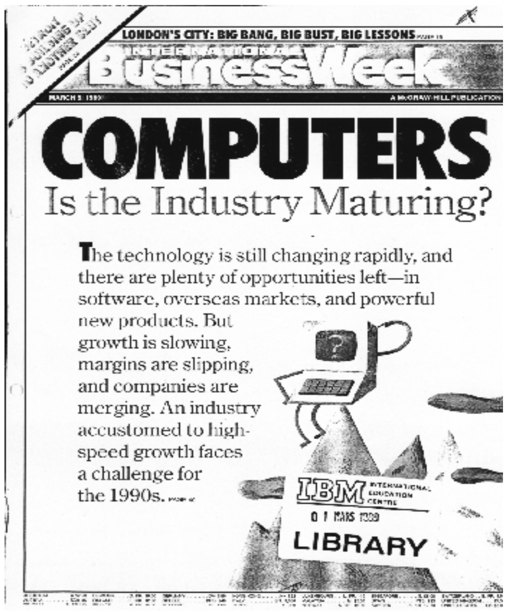

Figure 3 – Business Week, March 1, 1989

We can assume that the ingenuity of the researchers and engineers will continue to assure technological progress and a prolongation of the exponential improvement rally for the next decennium. Some authors see three growth cycles for the technology economy, defining growths periods as such when the growth of the ratio of information technology investment to GDP was greater than 5%. [20]

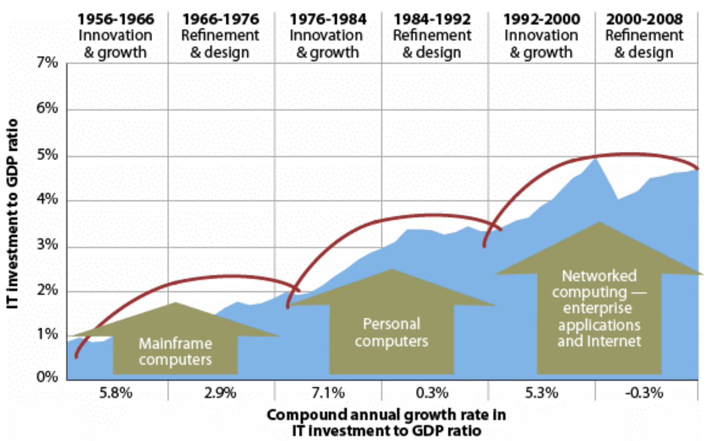

Figure 4

Digestive phases seem to follow growth periods where companies slowed their information technology spending, rationalized their infrastructure, and focused on the ROI of their technology investments. The focus in these periods is on changing business processes to take advantage of the capabilities of new technologies, which were often bought on faith during the boom times. According to this theory, we can ask what is next: another period in of accelerated growth. The chart suggests a takeoff around 2007 or 2008 based on a new set of technologies. The seeds of these technologies of the next growth phase are already around. [1]

Some more trends and innovations are

- Distance no subject
- Towards consumer electronics, visible and invisible.
- Shift towards services
- Anything with a chip in it may become a platform for service.
- Outsourcing
- From assets to expenses
- There are advocates that businesses should handover the key to their business systems because the technology is too complex and information technology services should be used and paid like a utility as gas or lightning bills. However, the competitive advantage to be realized from information technology by the individual company should not be overlooked.

This is not the end, call-centres work currently being outsourced to India may be automated by further advanced natural language recognition.

3.1. Internet of Things

There are trends showing very different technical characteristics since they ask for slower, simpler, and low energy technologies contrary to the ongoing pursuit along the exponential racetrack of Moore’s law. They will lead to a different class of products and applications, which will be much simpler. A study entitled the “Internet of things” prophesises that the demands of multinational businesses would be forcing the adoption of these new technologies. This is not only a forecast of future development, it is happening already as shown by the RFID explosion, with production growing from 10 Bio pieces p.a. to 100 Bio pieces p.a. within few years and becoming a global standard.

Further trends point to ubiquitous flexible and reflective displays, extreme miniaturization, the integration of new functions such as sensors and actuators with silicon logic, textile electronics and solid state lightning technologies.

The key bottleneck in the development of autonomous devices and ubiquitous computing the energy supply of distributed device nodes will be addressed later.

Wireless and sensor networks are emerging as the next technological thrust. These sensors will be imbedded in both ad-hoc and static networks that in turn exploit the Internet. They are technologically moving in the opposite direction to Moore's law, planning for lower power with fewer transistors even less input/output capacity then the semi conductor chips of the 1960s.

If the energy supply problem is adequately resolved will these sensors shrink to the size of a sand corn scattered across farms, industrial parks or battlefields, or attached to containers, trains cars, trucks and all kind of goods become an invisible extension of Internet. They will coupled with distributed or grid computing, handle the enormous data flood and with most traffic flowing from machine to machine.

We are reaching the point where the average quality of the display and audio system or a digital recorder, mobile phone or a PC is so high that quality is no longer a discriminating factor. Whenever such a point has been reached, appliances tend to become commodities and appliance makers find it more difficult to operate profitable.

Also interfacing the physical world will be a challenge in the pursuit for these microsystems. Autonomous systems should be battery less, taking their energy from the environment a technique known as energy scavenging. We may expect that energy supply will be the key limiting factor in the realization of ambient intelligent environments.

Vibration energy scavenging	**0,05-0,5 mW/cm^3**
Acoustic energy conversion	**1µ W/cm^2**
Thermoelectric energy conversion	**1-10µW/cm^2**
Photovoltaic energy conversion direct sun, light	**10mW/cm^2**

Figure 5 [10]

What can be done with that limited power?

Computation: the power range of 10 – 1000μW/cm^2 would enable 100 Ops/sec for the 0,18 μm CMOS technology node (neglecting leakage power), enough for a low date rate application.

Communication: For short range based on the available technologies as Bluetooth (1Mbit/sec) or Zigbee (80kbits/s) or PicoRadio (1kbits/sec), only PicoRadio falls into the 10 – 1000 μW/cm^2 range. To transmit a single bit the energy required would be in the order of 10 – 30 nJ. Standby power can be a limiting factor (~ 50μW), but a lot can be gained by proper system organization with e.g. a "sleep mode."

Another potential solution may come from the concept of nano-batteries now pursue, after a dormant period of 15 years, by Bell Laboratories and mPhase who showed their first samples last October.

Textile electronics will require the development of some special features as soft controls, wiring interconnect solutions, flexible displays, and integrated sensors; one may also think of apparel woven from light emitting or colour changing fibres. These applications are not limited to personal apparel. Electronics can be in furniture, soft furnishings (curtains, carpets, wallpaper) as well with chips forming a self-organizing network that can be cut into any shape. These devices are thought to become increasingly self-aware, space and location conscious, able to interact with the surrounding environment and exhibiting introspective behavior. The size of the network and the complexity of the interactions within it demand that they are capable of cooperation, self-organization, self-diagnosis and self-repair. Finally, trust, privacy, security and dependability must be assured. [10]

The march of electronics into the nano-cosm will make it economically feasible to fit all the signal processing and sophisticated traffic management and the high speed fiber optics required onto a single chip, making powerful information technology available everywhere. We see hints that this might start to happen in a processor from Intel (incorporating with 90nm technique sophisticated features as firewalls or traffic management at a very low price). [4]

4. Technology

Since the 19th century electronic information technology has spread in waves. The first wave was the telegraph, then the telephone and than the PC, the Internet, fiber optic networks and mobile phones. Each wave made a new powerful information technology available to new groups and regions. But each wave was as well based on additional technological breakthroughs. The idea of cell phone technology was ready in the 40´s, but it needed the computerized switching system and other technological breakthroughs to make it feasible.

Generally we can be confident for the next decennium, since as discussed in previous IDMDT sessions, for the timeframe for the next 10 years the prolongation of Moore's law seems to be assured.

Asking for future technology needs, means asking for future applications. There is well-founded expectation for an accelerated growing demand for data storage and retrieval, enhanced visualization both static and dynamic and leisure applications as home entertainment, computer games etc. Techniques as ray tracing are a potential future image application (photo realistic graphics requires about one billion polygons p.u.), handling volumes of machine or sensor generated data, concepts like life long data storage, pattern, mode and speech recognition and the resulting data mining tasks will require significantly increased algorithmic processing power and storage.

In the past, as the graph shows, improvements have been driven in the past by frequency increases giving now room to other improvement strategy summarized as architecture.

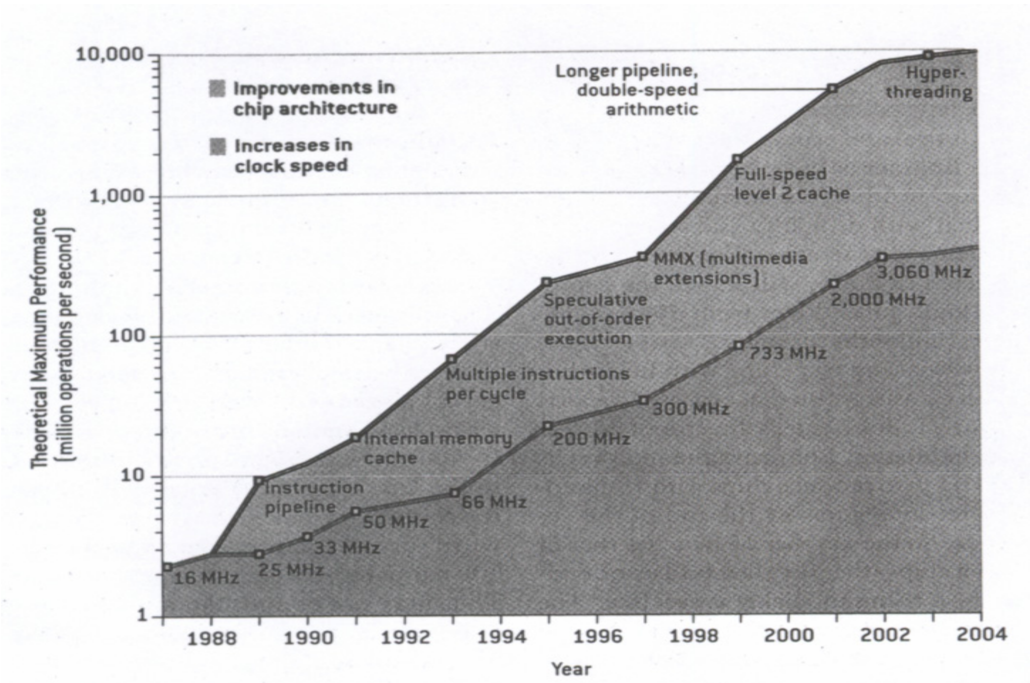

Figure 6 - Source: INTEL

Some of the impediments to continue the exponential path further are:

Power density: If increasing at a rate as in the past years it will reach several thousand watts /cm^2 that are more than the surface of the sun.

Memory latency: The imbalance between memory and processor performance is detrimental to use the technological achievements. Memory speeds are not increasing at the rate of processor speeds: today Pentium processors require 224 clock cycles to access memory these wasted clock cycles can nullify the benefits of frequency increases of the processor and this tends to be worsening.

RC delay: The delay caused by fact that a 1mm RC delay takes longer than a clock cycle, for typical chips in the 10 –12 mm range it takes about 15 clock cycles to go from one corner of the die to the other.

Physics our friend in the past is now becoming our foe, setting principal boundaries. E.g. the insulator thickness of 2-3 nm in present-day chips cannot be less than about 1,5nm because if the silicon dioxide layer is made thinner electron can tunnel through. Channel length, the distance between source and drain of a transistor, can due to the so-called short channel effects not be shorter than 25nm. It is not just physics as in the past, key criteria determining future will come from economics.

Even if for the first time no immediate accelerations of clock cycles are predicted, the breath of technology is increasing. This means while the growth rate of on-chip functionality would slow, the amount of functions per chip will continue grow exponentially. While the present CMOS technology is not nearly stretched to its limits fascinating technologies are emerging over-the-horizon. We are enjoying rather an abundance of new ideas for future technologies. Some of these technologies research are.

NANOTECHNOLOGIES & ELECTRONICS
MOLECULAR ELECTRONICS
OPTOELCTRONICS
ORGANIC COMPUTING
SPINTRONICS
QUANTUM COMPUTATION

Figure 7

These technologies have been covered in preceding presentation, to refresh memories just some keywords:

4.1. Nanotechnology and Molecular Electronics

Nanotechnology is not an industry but rather an interdisciplinary enabling technology.

What are the properties that make nanotechnology so attractive?

Property	Single walled Nanotubes	Comparison/Sizing
Size	0,6 to 1,8 nm	Electron beam lithography 50nm wide
Density	1,33 – 1,40 g / cm3	Al: 2,7 g/cm3
Tensile strength	45 bi Pa	Special steel alloys 2 bio Pa
Current carrying capacity	Ca. 10**6 A/cm2	Cu wires would burn
Field emission	Activate phosphors at 1 – 3 V	Mo tips require of 50 –100 V
Heat transmission (at 20°C)	Estimate, 6KW/m/K	Diamond 3,3 W/m/K
Temperature stability	Up to 2800°C in vacuum, 750°C in air	Metal wires 600 –1000°C
Cost	~500 $ /g	Au ~10 $ /g

Figure 8 - Source: Scientific American

The use of nanotechnology will improve memories, displays, processors, solar power elements, embedded systems, and enable self-configuring networks and thus help to create a pervasive computing environment. The uses are not restricted to information technology; possible applications can as well be in chemical and genetic probes, hydrogen and ion storage, super-strong materials, coatings, catalysts, fuel cells, batteries, filters lubricants or solid state lightening. Still many problems as large-scale processing with predictive capacities remain to be resolved, a potential solution might come by self-assembly, supported by defect tolerant architecture. This is not far stretched futurism. Nantero will soon begin sampling a memory chip based on carbon nanotubes and so will Honeywell and Freescale.

Molecular electronics was already proposed in 1974 but it took until 1997 to build a diode. Today carbon nanotubes are best researched and depending on their structure, carbon nanotubes can be semiconductors or metals.

4.2. Optoelectronics

Optical computing technology is not only attractive because it would break the rocky union of fiber optics, laser technology and electronic switching, but also because it would solve power, interconnections and cross talk problems and additionally need no cooling.

4.3. Single/Spin Electronics

Spintronics can be described as electronics which takes advantage not only of the electron's charge but also the electron's spin (a quantum mechanical property considered to be either "up" or "down"). Spin processes have the advantage of lower energy consumption combined with higher speed compared to conventional electron processes.

Spintronic structures are also playing an important role in the development of the MRAM (magnetic Random Access Memory) devices already under development by IBM, Infineon and other companies.

4.4. Organic computing

Famous demonstration of the solution of "traveling salesmen problem" by organic processes created a worldwide response and interest.

Special attractiveness results from the storage capabilities e.g. DNS is 100 Bio times denser than Si and potential parallelism enabling theoretically 10^{20} simultaneous processes/calculations. A tank with 0,5 kg DNS diluted in 1 m^3 of water would have more storage capacity than all computers at present in use.

Disadvantages are that it is slower than Si-based computing, and a voluminous, sticky and liquid technology. Even with pure organic computing still far away, a mixture of organic and inorganic layers patterned to form the channels of thin-film FETs may appear.

4.5. Quantum computing

Some call quantum computing the ultimate way of computing. This may be exaggerated in view of the limited scope of applications as factoring large numbers or searching huge databases. The first practical application is most probable in cryptography, assuming the problems as de-coherence, signal I/O, error correction will be resolved in technically and economically feasible ways.

5. Summary

In the pursuit to gain a view on some aspects of the future scenario of information technology we looked at selected demographic, economic, geographical, and technologic aspects.

While present users hope for improved reliability, more user-friendliness and engineering-like quality and other standards especially in the software area, the priorities for new users will be different. They will be less affluent, more heterogeneous, living in more challenging environments in the developing world, and in many cases have very different daily lives and abiding concerns. Their hopes in the future of information technology will focus on finding economically feasible ways to catch up with the benefits the Western world by using information technology to improve their daily lives as e.g. medical or social uses.

The future of information technology will continue to be characterized by the exponential decrease of cost per function as long as it is economically advantageous, but the exponential development is not restricted to performance of integrated circuits, it has its antagonism in the equally exponential increase of cost for new production technologies and facilities. However, every future new technology faces a formidable competitor in the prevailing silicon technology. None of the newly emerging technologies can today successfully compete with the prevailing silicon technology. We may even not find anything able to compete successfully and replace silicon in the next years unless there are significant breakthroughs. Even so, some unique capabilities of other technologies based and integrated on top of silicon may add great value as e.g. non-volatile memory sensors, photo electronic conversion devices or nano-mechanically devices.

The unprecedented success and efficiency of the IT industry allowed compensating for shortcomings and imbalances in the past and including the lack of a “grand design” or engineering standard. The IT industry can be optimistic about technology but not so much about profits, therefore the emphasized service part of information technology became a growing alternative endeavour.

The broadening application of information technology will need additional developments. Expectations range from broadening the scope of use and user friendliness, better interfaces, to develop additional areas of applications by percolating into everything from biology, medicine to textiles to the pursuit of new user strata as sensor and network based applications, thus bringing improvement and enrichment of the quality of live of millions.

In spite of our efforts to cover potentially important aspects of future problems and developments, we know from the history of information technology that revolutionary breakthroughs have never been forecasted, so that the future may have surprises in petto for us.

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ORGANIC COMPUTING - A NEW PARADIGM FOR ACHIEVING SELF-ORGANIZED DEPENDABLE BEHAVIOUR OF COMPLEX IT SYSTEMS *

Karl-Erwin Grosspietsch [1], Tanya A. Silayeva[2]

To govern the abundant complexity of today´s IT systems, recently an initiative was started to systematically investigate and use biologically-inspired solution approaches to achieve self-configuring, self-healing, self-optimizing, and self-protection of complex systems. Some recent examples of the application of these "Organic Computing" principles are described. Then its systematic investigation is discussed in detail by the example of the ORCA architecture for autonomous robots. The use of an adaptive rule set rules for the control of an autonomous robot at the behavioural level is sketched by the example of the gait patterns of a climbing robot. Correspondingly, the application of adaptive filters for the control of that robot at local component level is exemplified.

7. Introduction

Fault tolerance is a well-known methodology to improve the dependability (including reliability, availability, security, safety) of computing systems. Starting point of classical fault tolerance approaches is a fault model which describes all expected faults precisely and completely. Based on this fault model, fault tolerance techniques have been developed which are able to cover all these faults as much as possible.

There exists a comprehensive set of fault tolerance techniques for different fault modes which currently are widely used in practical system designs (see e.g. [5,16,26]). In today's highly complex

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hardware, software and networked systems, however, this classical approach seems to reach its limits. The reason is the ever increasing complexity simply with regard to the number even of structurally identical or similar components; additionally, many of these systems are very heterogeneous and have to combine many different components, often including legacy ones. Especially the interaction and mutual dependencies of these components are very difficult to predict and to formalize by a fault model. As a consequence, frequent breakdowns and outages of complex computer-based systems are common today and usually require hours of manual actions by system administrators for bringing them up again though they are constructed by means of individually reliable and fault-tolerant components. This is an indication that complex computing systems are not yet mastered adequately today and need new techniques.

On the other side, complex organic systems, like the human organism, are evidently able to co-ordinate many heterogeneous components in a reliable and robust way. The human autonomic nervous system is working constantly to ensure that the body is stable and performing at optimal levels. It involuntarily handles actions like heartbeat, digestion circulation, and glandular function. The immune system is able to detect and fight infects, even unknown ones. It is able to remember antigens and to react faster and more efficiently in case the same infection reoccurs. Here, in general, it can be stated that nature follows the KISS ("Keep it simple, Stupid" (or similarly "Keep it Small and Simple") [21]) approach: Nearly always, biological system do not try exhaustive optimization; instead first, with a relatively small effort, just a "sufficient" solution is seen to be found, which is then further perfectionized by small evolutionary steps.

Recently such "organic" principles have drawn increasing attention to handle unsolved problems in mastering complex computing systems. In the Autonomic Computing Initiative from IBM [8,22], commercial client-server systems, in particular for e-business on demand, shall become *self-configuring, self-healing, self-optimizing, and self-protecting* like the autonomic nervous system. An autonomic computing architecture with a basic management element acting as a control loop has been designed and is attached to individual resources like servers, data base systems etc. Several such autonomic components consisting of a managed element and its autonomic manager are interconnected and can collaborate to assure the four self-properties mentioned above. First examples of systems using this principle already exist, many more are currently developed. Other vendors like HP, Intel or Sun run similar projects.

However, these approaches are aiming at complex commercial IT systems only and are not intended for the real-time world embedded systems. In contrast to networked servers, such systems often introduce e.g. limitations of computational and electric power which are not yet addressed by these initiatives. Especially, with regard to this area of computing systems, in Germany recently a research program for the topic „Organic Computing“ has been started [9]: The goal of Organic Computing are complex computer systems, organizing themselves – denoted by the “self-X” properties listed up above - in a well co-ordinated and purposeful manner, leading to the emergence of new reasonable system properties [19,24]. With regard to envisaging the realization of such a principle, e.g. a recent publication by Herkersdorf and Rosenstiel [15] discusses a framework for autonomous integrated systems realized as SoC (System on Chip) solutions at the hardware level. In this concept, the SoC is split into two levels: the Functional Elements (FEs) and the Autonomic Elements (AEs). The FEs are just the well-known functional building blocks of today´s hardware architectures, with some usually small add-ups to communicate their status to the corresponding AEs. Each AE comprises monitoring hardware for sensing and evaluating status signals from the FEs, and for communicating with other AEs. This general two layer structure reminds of the corresponding structure of biological systems, containing normal tissue, and interwoven, but functionally an additional layer, the immune system. However, no possibility of changes of the prescribed system behaviour is foreseen.

In a similar way in the approach of [12] to each processor of a distributed system a guardian unit is associated the basic control code of which is stored in a ROM, and, thus, cannot be altered at the software level. The diagnostic unit monitors the processor operation: in suspicious situations it can trigger an exhaustive check of the processor status. As a result of the check it might reset the processor to a safe initial state, and, subsequently, start and monitor the process of system and data recovery.

The CARUSO architecture [2] of the Universities of Karlsruhe and Augsburg is also based on organic principles. It consists of a multithreaded processor core within a reconfigurable SoC. Autonomic/organic managers are implemented by helper threads and control the mapping of tasks either to hardware or software components, thus flexibly reconfiguring the SoC on demand, e.g. with regard to computation performance, or on the other hand to ultra-low power consumption.

An approach, also similar to it in its general structure, is a Controller/Observer architecture for adaptive control for traffic lights using organic computing concepts, described by Rochner and Müller-Schloer in [22]. They propose a learning fuzzy classifier system incorporating a restriction unit added for safety reasons.

Other examples of biologically inspired system architectures are approaches for artificial immune systems (AIS). These systems imitate the property of the biological immune system to detect pathogens in the body by recognizing extraneous protein patterns, the antigens, and bind them by the docking of antibodies at specific parts of the antigens. The immune system also contains as a subsystem, the adaptive immune system; it consists of cells which e.g. by mechanisms for triggered increase of mutation processes, can cope with unknown protein structures; successful treatment of such proteins is memorized it in certain cells, and can trigger the massive replication of actually needed antibodies [10]. Approaches for an artificial immune system based on these principles are used to deal with data mining tasks, e. g. for semantic document classification [10,11] or intrusion detection [7]. Bradley and Tyrrell [1] introduced an artificial immune system as an approach for fault tolerance of a finite state machine. With a hardware immune system, they provide fault detection giving the ability to detect every faulty state during a normal operating cycle.

Also for robotics AIS have already been proposed, e. g. for simple robot control architectures [14] or the co-ordination of robot teams [17].

8. Computational Intelligence and Adaptive Filters

At a first glance, learning seems to be a promising approach to cope with faults without the need to model them explicitly. Using artificial intelligence and symbolic machine learning techniques allow to find new ways to treat faults, especially if sequences of actions are dealt with. But they require complicated reasoning procedures and hence cause large implementation efforts and thus costs. More hindering is that these procedures are very time-consuming and thus not well suited for hard real-time applications, especially when online learning is required as in an organic autonomic immune system. Computational intelligence methods do not imply these limitations. E.g. there are very fast methods for the evaluation of rule-based fuzzy systems as well as some online learning techniques for artificial neural networks (ANNs). They hence offer a base for hard real-time systems. However, pure rule-based systems may act as elements steering the behaviour in faulty systems states, but offer no flexibility to be adapted in case of faults. ANNs do, but they suffer from the fact that the learning process cannot be guided. Hence no warranty can be given in case of online learning that critical system states are avoided at any time. Neuro-fuzzy systems can be controlled such that they are capable of learning within given boundaries by avoiding critical states through a priori knowledge which is prevented from being changed.

In addition, recently adaptive filters have gained growing interest and importance, especially in the field of controlling systems under real-time requirements. Adaptive filters are based on an algorithmically simple form of using a history array of the sensed values of an input variable x to derive, by some kind of weighted summing up of these values, the actually needed output control signal y [6,18].

The generation of y from x occurs at given discrete time-points which we shall not denote by their absolute time value, but instead just by an integer index n. So y(n) denotes the nth element of the generated sequence of output values. This output y(n) is computed from the sequence of the input values x(1),..., x(n) according to the formula

$$y(n)= \sum_{i=0}^{N-1} w_i(n) * x(n-i) \tag{1}$$

where w_i (i=0,...,N-1) are the filter weights and N is the filter length. The filter weights are determined and updated by means of an adaptation algorithm. For a more detailed discussion of different architectures of adaptive filters see also [13]. Adaptive filters produce surprisingly good results with regard to stabilizing systems against fluctuations, consequences of parameter shift due to aging processes etc. The prerequisite for such a dependable system control usually is a large dimension N of the used history array of N=1000 or more.

The classical use of adaptive filters so far was confined to systems where just a single scalar output variable is needed to control the behaviour of the system. In many applications, more detailed control operations are needed, e.g. to control the movement of autonomous robots in a partially unknown environment. Here we propose a concept to exploit adaptive filter algorithms also for controlling such systems, in combination with the rule-based approaches mentioned above. For the general control of the behaviour of the autonomous robot a neuro-fuzzy rule set is used. This rule base starts, when initially there is little knowledge, with a set of relatively vague and general rules, which are then, with rising experience, augmented by other new rules that are more detailed. So the size (number of rules) of the rule base as well as their complexity rises. To avoid a combinational explosion of condition patterns and their corresponding rules, additionally the use of adaptive filters is exploited. The adaptive filters are to be utilized at two different system levels:

a) To reduce the complexity of e.g. controlling the dependability behaviour of all components of a complex mechatronic system at the same system level,(e.g. by a set of behavioural rules), we systematically use adaptive filters at local level for the structural health monitoring of its components.

b) For higher system levels, where more general behaviour strategies are needed to generate and control robot movements, the use of adaptive filters (i.e. the use of history arrays) is to be exploited to support the selection of a rule which then is applied to control, in a detailed way, the system response.

In the following we shall discuss the application of such approaches, by the example of the in the ORCA architecture realized in co-operation with the University of Lübeck.

9. The ORCA Architecture

It is the intention of the ORCA (**OR**ganic **C**omputing **A**rchitecture) approach [3], to develop - based on the principles of Organic Computing - a methodological paradigm for mobile autonomous systems that enables them to deal

- with unforeseen situations in a robust way and
- with fault situations in a dependable one.

This implies that the robot is able to autonomously monitor its own health and “success“ status, keeps its state within uncritical domains, at the same time nevertheless efficiently performing its required normal tasks. In contrary to classical fault tolerance approaches, for the robot behaviour in such cases, no explicit fault model is anticipated as a base. I.e. the robot has to learn by itself to deal with these unexpected situations on its own, supported simply by an appropriate tool box of learning methodologies which are organized in a flexible way. With regard to that, however, the learning is required to be possible under hard real-time constraints, i.e. there are always clear upper bounds for the time that can be granted to obtain a sufficient (not necessarily optimal) solution.

In this approach, currently being elaborated in co-operation with the University of Lübeck, architecture is envisaged which fulfils the subsequent constraints:

- It is built up modularly:
- it is easily manageable;
- its organization is hierarchical;

- it is behaviour based.

To solve these requirements, the ORCA system is consisting of a set of mutually interacting software modules, the **O**rganic **C**ontrol **U**nits (OCUs). The OCUs are tightly coupled with the normal control modules, the **B**asic **C**ontrol **U**nits (BCUs) of the autonomous robot which provide by their supervision the normal functional behaviour of the robot [3,4]. The OCUs are existing in parallel to the BCUs, similar to the approach of biological immune systems where antibodies existing and working concurrently to the operations of the normal body cells, to detect anomalous cells or intruder proteins, and to cope with them in an appropriate way. In a variety of ways, the OCUs kann influence the operation of the BCUs and, thus, can modify the behaviour of the robot system. This modulation can take place in a crisp or in a "soft", continuous way, similar to the principles of fuzzy blending [23]. Thus, an OCU should be able to process continuous as well as crisp data values.

To cope with a situation that has not yet appeared, an action from an existing repository is selected and triggered. If this leads to a better situation, a rule for the newly encountered sitaution, together with the successful action is memorized in the rule base of the affected BCU. To control such rule base update, a kind of reasoning system is needed which has to decide whether a current action is successful, i.e. preserving a good situation, or improving a critical one.

Due to cost and real-time performance constraints, no expert system is used for governing the OCU behaviour. In contrary, in our approach flat hybrid crisp-fuzzy rule based systems are used which are adaptive as described above, i.e. they can be, starting from a basic rule set, flexibly extended due to the OCU´s learning. For obtaining an initial rule set, we start with some pre-programmed OCU behaviour that utilizes the knowledge of the robot designer.

To illustrate the approach, as a simple example let us consider the gait control of the climbing robot DEXTER (**DEXT**erous **E**lectric **R**over) developed at the University of Lübeck. DEXTER can move in two ways, by swirling around one of its the twos legs in vertical (i.e. placing it over the other one) or horizontal direction. Fixing a robot leg in the newly reached position is carried out by a suction cup which can be triggered via an electric relais.

A gait pattern can fail, if an unforeseen object is situated in the trajectory of the robot, either due to quick intrusion of that object into the landscape scenario or to non-detection of the object because of a sensor failure. In traditional fault tolerance approaches, an explicit algorithmic mechanism would be needed to diagnose the faulty situation and to switch to another gait pattern.

In the ORCA approach, in contrary the OCU would monitor relatively roughly defined parameter domains, which should constitute the stable robot behaviour. In the case of DEXTER, for every gait pattern we could define a certain time range, which is waited for, before counter actions are initiated. A rule could, e.g. [4], define a maximum of 5 seconds, in which an arbitrary gait patterns might be active:

IF (*GaitPattern=any* **AND** *GaitPhase=any* **AND** *Duration>5*)

THEN *ChangeGaitPattern*;

After some time of operation, the OCU might have learned that the phases 2,3 and 7 of pattern 2 usually do not last longer than 1 or 2 seconds, and, thus, will add the following rules to the rule base:

IF (*GaitPattern=2* **AND** *GaitPhase=2* **AND** *Duration>1*) **THEN** *ChangeGaitPattern*;

IF (*GaitPattern=2* **AND** *GaitPhase=3* **AND** *Duration>2*) **THEN** *ChangeGaitPattern*;

IF (*GaitPattern=2* **AND** *GaitPhase=7* **AND** *Duration>2*) **THEN** *ChangeGaitPattern*;

Later the system could have learned which of the alternative gait patterns might fit best to a certain situation:

IF (*GaitPattern=2* **AND** *GaitPhase=2* **AND** *Duration>1*) **THEN** *GaitPattern=3*;

IF (*GaitPattern=2* **AND** *GaitPhase=3* **AND** *Duration>2*) **THEN** *GaitPattern=4*;

IF (*GaitPattern=2* **AND** *GaitPhase=7* **AND** *Duration>2*) **THEN** *GaitPattern=3*;

Organising a very detailed rule set for every specific situation causes the tradeoff of a quick combinational state explosion. Therefore, as a remedy here also a merger with other blind learning methods like adaptive filters is being investigated. Let us depict this by some examples of fault compensation for the DEXTER robot: We consider here an architecture where the suction cup is consisting of 5 parallel identical sub-fields which can be independently controlled. For the case of a – continuous or sudden – decrease of the negative pressure in one of them, an adaptive algorithm can be utilized to train the remaining ones to a compensating behaviour, i.e. the parameterization of the remaining 4 suction subfields is homogeneously increased so that the resulting overall suction performance is kept constant (see Fig. 1). This figure also shows that the convergence velocity of the iteration of the algorithm is strongly depending on the so-called step-size parameter μ [6,18] of the adaptive filter algorithm.

Another example is the rotational movement of a DEXTER leg around a given angle, e.g., an angle of 180° (in radians: π). To avoid an overshooting movement of the leg, the movement should start with a high angular velocity, which after a given time should have decreased to 0. So, a classical approximation is that the actually traversed angle Δ is modelled in radians by a negatively exponential term

$$\Delta (n) = \pi (1 - \exp(-n/C)), \tag{2}$$

where n is the number of iterations and C is a constant.

The angular velocity Ω is modelled as proportional to the difference of the required angle π, and the actual one $\Delta (n)$, with an unknown coefficient A:

$$\Omega(n)= A (\pi - \Delta (n)). \tag{3}$$

Here, an adaptive filter algorithm quickly converges to the optimal value A=0.5. Again, convergence is strongly influenced by the selection of the value μ of the algorithm step size (see Fig. 2). Further investigations of such blindly trained actions at local component level are currently performed for a more complex sixpod robot OSCAR implemented at the University of Lübeck.

With regard to future envisage application of adaptive filters also at a higher system level, let us consider, e.g., the situation of a complex autonomous robot which has to select certain movements in an environment. The state of the system can be described by a set of internal motor and material parameters $a_1, ..., a_n$ and some environment parameters $b_1, ..., b_m$ sensed by the robot. A purely rule-based approach would try to uniquely derive, for each parameter constellation $(a_1, ..., a_n;b_1, ..., b_m)$, a corresponding rule. The practical problem here is the combinational explosion of the configuration space.

Here, our approach sees to reduce the dimensionality of the configuration vector, by constructing a norm $c= I I (a_1, ..., a_n;b_1, ..., b_m) I I$, thus reducing the parameter space to a scalar entity. This scalar entity is then to be used to select a rule which controls the behaviour of the system. This coarsening of information is to be balanced by the use of “history experience”, i.e. by exploiting not only the actual value c(n), but - according to the concept of adaptive filters - in a weighted manner also the previous norm values. Future work will focus on the investigation of this approach.

10. Conclusion

In this paper, we have sketched some issues of using principles of Organic Computing, i.e. imitating strategies of biological systems as e.g. the autonomic nervous system or the autonomic immune system, to achieve especially self-healing and self-protection properties for complex IT systems. Its systematic investigation has been discussed in detail by the example of the ORCA architecture for autonomous robots. The use of an adaptive rule set for the control of an autonomous robot at the behavioural level was sketched by the example of the gait patterns of a climbing robot. Correspondingly, the application of adaptive filters for the control of that robot at local component level was exemplified. Future work will focus on the application of these strategies for more complex autonomous robots.

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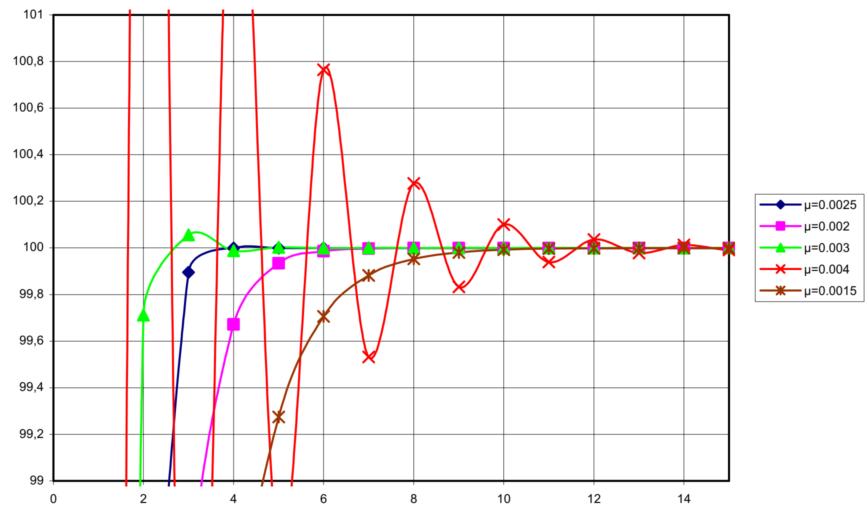

Fig. 1 For the case of a complete failure of one of the 5 suction sub-fields , the different curves show the convergence towards the required value of 100 of suction intensity, depending on the step size μ (according to [27])

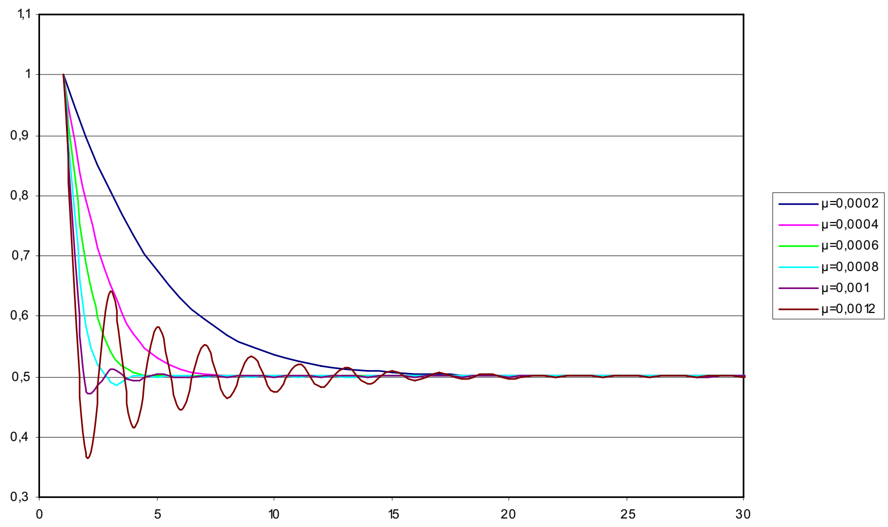

Fig. 2 Convergence towards the optimal value of the coefficient A in formula (3), depending on the step size μ (according to [27])

Cooperative Information Environments

TOWARDS A COOPERATIVE MEDIA SPACE

Tom Gross [1]

In this paper we introduce our current work on the concept and implementation of a cooperative media space that connects two remote labs via a permanent audio-video channel and supports single-user, single-group, and group-to-group interaction on synchronised large displays.

1. Introduction

In our cooperative media space CMS we aim to build a flexible environment supporting easy communication and cooperation within collocated groups, and among distributed sub-groups. We combine concepts for easy interaction among remote users based on permanent audio or video connections, and for easy interaction among collocated users based on shared hardware and software.

In computer-supported cooperative work and computer-mediated communication several concepts and systems for remote interaction have been developed within the last decades. For instance, *media spaces* are systems that ‘support distributed work groups through access to information that supports general awareness’, which ‘may lead to informal interactions, spontaneous connections…’ [5]. They were motivated by the fact that ‘informal interaction, spontaneous conversations, and even general awareness of people and events at other sites’ should not be neglected in geographically distributed groups [4]. Some examples of media spaces are Portholes [5], RAVE [6], and Thunderwire [1].

In human-computer interaction several novel styles of single-user and cooperative interaction with emerging hardware have been developed. For instance, the i–LAND environment consists of several *roomware* components that are ‘computer-augmented objects integrating room elements with information technology’ [10]. Two prominent roomware components are the DynaWall: a very large display that can be shared among users and that features some novel interaction styles, and the InteracTable: a tabletop that can be used cooperatively.

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On a whole the concepts of media spaces and roomware are highly complementary. Media spaces and related approaches provide informal awareness and support spontaneous, synchronous, distant communication. They are permanently available and offer walk-up and simple interaction. The i–LAND, its roomware components and related approaches provide enhanced support for close cooperation in collocated groups.

2. CMS: A Cooperative Media Space

Our cooperative media space CMS has to meet both requirements for general awareness and informal communication from traditional media spaces and additional requirements for enhanced cooperation support.

2.1. Requirements

The following are three core requirements:

- *Awareness and communication on large displays:* the CMS should provide general awareness among distributed groups in order to support informal and spontaneous interaction.
- *Group interaction with large displays:* the CMS should provide easy and intuitive single-user and cooperative interaction based on large displays.
- *Group-group interaction over distance:* the CMS should support distributed cooperation among distant sub-groups based on large displays.

2.2. Approach

CMS have considerable technical pre-requisites. We, therefore, combined a human-centred approach putting the users and their interaction with the CMS in the centre, with a technology-push approach informing design by exploring existing base technology, and developing new technology. We subsequently describe the human-centred concepts and the base technology developed.

3. Human-Centred Concepts for the CMS

With respect to the human-centred design we developed a concept for a CMS with a group of designers with backgrounds in media systems, media design and in architecture. The point of departure was that we aimed at virtually connecting the two rooms of our lab, which are in two different buildings with a five minutes walk of distance. The concept should allow for seamless awareness, communication, and cooperative group interaction among the users of each room and also between the users of the two rooms. Figure 1 shows a first sketch of this basic idea.

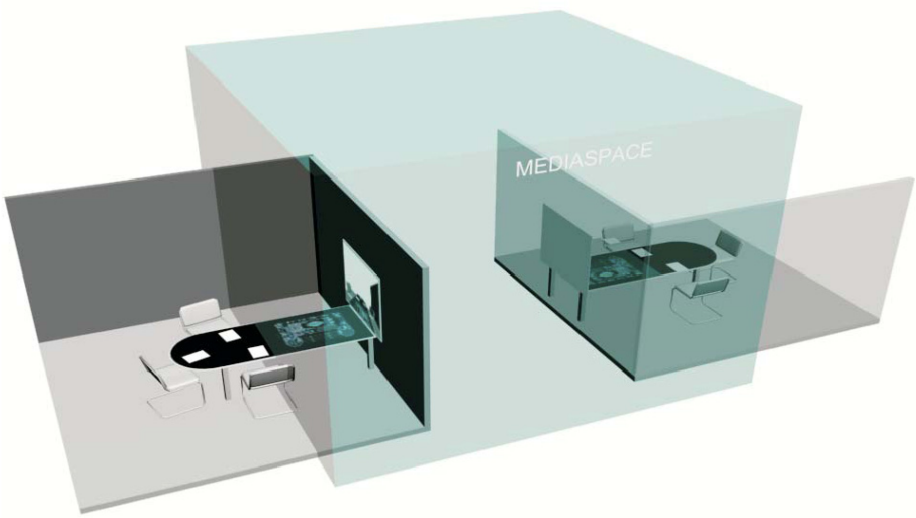

Figure 1 - First sketch of the basic idea of the CMS.

In particular this design consisted of the following corner stones:

- *Pervasive Presence and Communication (PPC)*: in order to facilitate chance encounters and ad-hoc conversations among users in either room, we developed a concept for identifying users when they enter the room. For identified users the system automatically sets their status to present. The system also logs the users in on their favourite position and computer in the laboratory. The users have an instant messaging system with two types of communication channels available: they can either use the public channel that runs as instant messaging client on the shared displays of either room, or they can use start a personal one-to-one conversation in the private channel.

- *Smart Roomstates (SR)*: in order to provide users who want to enter either room with adequate information on the current use of the room, we introduce roomstates that provides users in front of the door with respective information. Various sensors capture information from the computers (e.g., running applications and open documents) and from the real world (e.g., noise and movement) and make a heuristic inference of the roomstate. For instance, if the sensors detect that on one computer presentation software is running in presentation mode and that there is movement and noise in the area of this computer, then we assume that a presentation is going on.
- *Seamless Group Interaction (SGI)*: in order to facilitate cooperation across all computers and displays of either room, we introduce a concept that allows users to move the cursor of their current display onto any other display and to share this other display with other users. Users can simply define a side of their display that is used as teleport to the other display. For instance, if a user defines the right side of the display as teleport, the user can then move the cursor beyond the right border of the display; when the border is crossed, the cursor disappears on the original display and appears on the shared display.

The PPC aims to facilitate spontaneous interaction among co-present users. Similar to existing media spaces we want to reduce the fringe between two rooms. The SR aims to support various particular usages of the rooms, and the transitions between then (e.g., students working on their own, students discussing in a group, professors and students giving presentations). The SGI aims to connect all computers and displays in order to allow easy and fast cooperative interactions (e.g., for long interactions such as writing a report in a group on a single display, for short interactions such as quickly demonstrating software or giving help by means of a tele-cursor).

In the next section we will describe how these concepts were implemented.

4. Base Technology for the CMS

In this section we will describe technical solutions for identifying users, supporting presence awareness information and communication, inferring states of rooms, and connecting computers and displays.

4.1. Identifying Users

In order to identify users and automatically start and adapt services when they enter, and stop and adapt services when they leave, we developed the cueAID component.

The cueAID component is based on Bluetooth [3]—that is, it identifies and authenticates users based on the Bluetooth IDs of their devices (e.g., mobile phones, notebooks). The cueAID component provides a Web interface where users can register their data (i.e., name, login and password to the BSCW shared workspace system and to the computers via the LDAP account, Bluetooth ID, primary computer where the user wants to log in automatically if available). Figure 2 shows a screenshot of the Web interface.

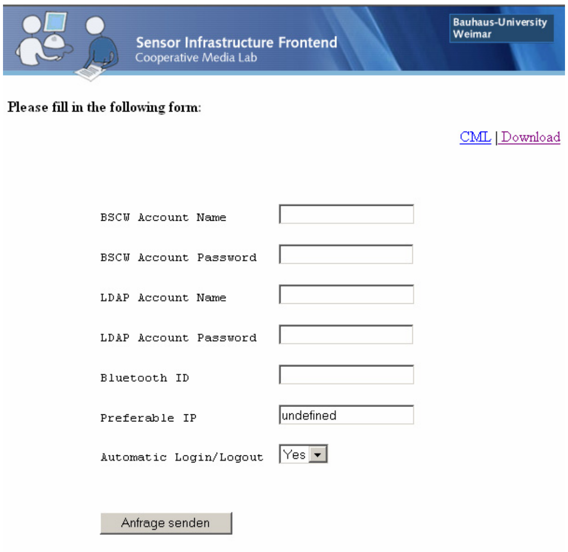

Figure 2 - Web interface for entering personal data.

A service—the AID-Server—then permanently scans the two rooms of our lab for Bluetooth IDs. If a Bluetooth ID is detected for the first time, the service checks if the ID is registered. If it is registered, then the respective services are started. For instance, we log in the user using the Mac OS X feature ‘Fast User Switching’ [2]. For this purpose the server establishes a socket connection to the respective client and uses the command /System/Library/CoreServices/Menu Extras/User.menu/Contents/Resources/CGSession -switchToUserID <userID>. Eventually the user gets an animation of the computer where he or she was logged in. The respective user is then also added to the list of present users.

4.2. Supporting Presence Awareness Information and Communication

The presence awareness information and communication are supported by PRIMI and PRIMIBase. PRIMI is a Platform for Research on Instant Messaging Infrastructures—it is open and extendible and based on up-to-date standards. PRIMIBase is a reference implementation of PRIMI. More details on PRIMI and PRIMIBase can be found here [8, 9].

PRIMI and PRIMIBase were connected with the other components of the CMS. They allow users to log in and out, to set their online status showing their availability, to see other online users and their online states, and to have ad-hoc text chats with other online users. Figure 3 shows screenshots with the PRIMIBase online user list and chat window.

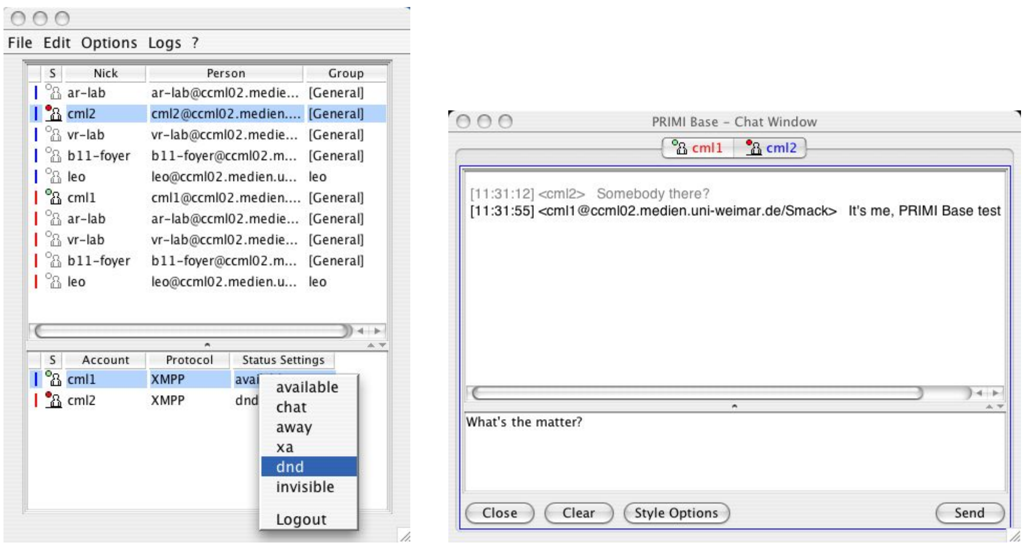

Figure 3 - Screenshots of PRIMIBase online user list and chat window.

Currently, only text chatting is supported. For audio and video conferencing between the two rooms we use the iChat conferencing system.

4.3. Inferring States of Rooms

The states of the rooms can be inferred with the cueSens component. The cueSens component mainly consists of sensors, an inferencing engine, and actuators.

Various sensors capture information from the electronic and the real environment of the users of the CMS. For instance, a USB microphone is used to detect noise. In order to distinguish some spoken language from simple short-term background noise (e.g., a closing door), we assume that only a sound that is ongoing for at least some seconds is spoken language. We use the movement sensor of the ESB board to detect movement. And, we developed an AppleScript application detecting if MS PowerPoint is running, and if it is in presentation mode. For this purpose, we use the query `if exists (slide show window of this_presentation)`. Furthermore, the cueSens component has access to the cueAID presence information of users. Additionally, the role of the present users is queried from our directory service. Finally, the roomstate is inferred which is based on the values of all the sensors mentioned.

On a whole Sens-ation and SensBase are used for handling all the sensors and sensor data. Sens-ation is a service-oriented platform for developing sensor-based infrastructures and SensBase is its reference implementation. Sens-ation and SensBase provide various interfaces for connecting sensors (capturing data and sending them to the server) and for actuators (controlling the behaviour of applications) as well as a server that provides convenient and transparent storage of sensors and sensor data as well as inferencing engine to process the data [7]. Figure 4 shows the software architecture of the Sens-ation platform with its gateways for connecting sensors, adapters for connecting actuators, and the central GatewayHandler, DatabaseManager, ServerKernel, SensorHandler, and InferenceEngineHandler.

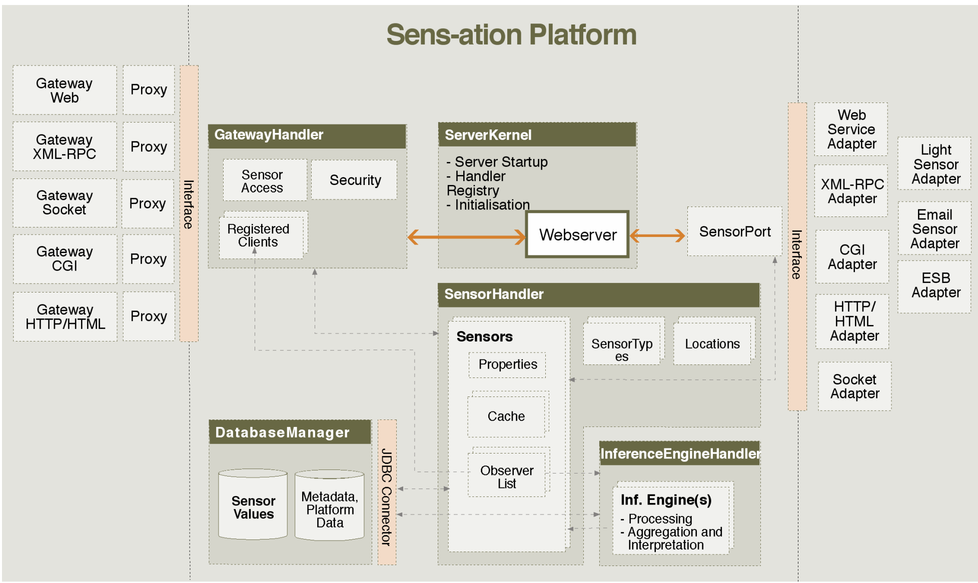

Figure 4 - Software architecture of the Sens-ation platform.

4.4. Connecting Computers and Displays

In order to connect computers and displays with each other, we used the Multi-Cursor Window Manager (MCWM) from [11, 12]. MCWM is an X window manager for the UNIX operating system, which can easily be installed on Mac OS X via the X11 environment that is part of the Mac OS X operating system. Figure 5 shows a screenshot of the MCWM as it was installed on the Mac OS X machines in our CMS.

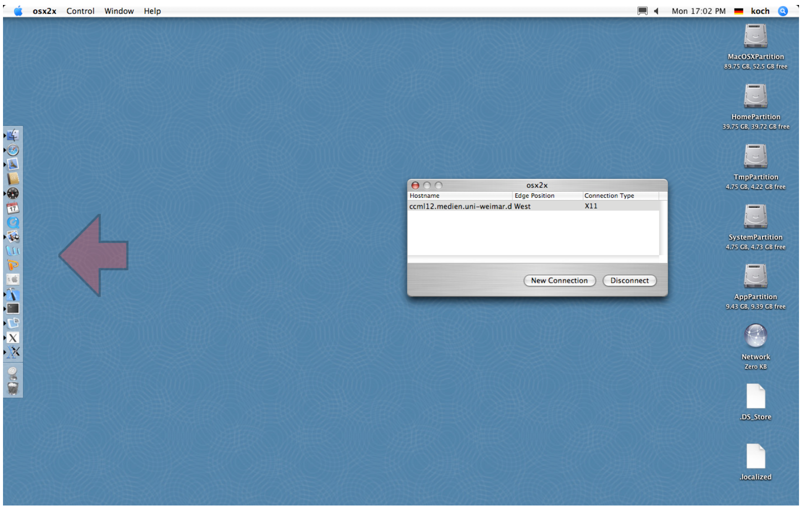

Figure 5 - Screenshot of the MCWM on Mac OS X.

As can be seen from the screenshot the current user—koch—defined the left border (West) of the screen to be the teleport to another computer called ccml12. Whenever the user moves the mouse across the left border, the mouse disappears and appears on the display of the computer ccml12.

Figure 6 shows a screenshot of two users sharing a display and working with OpenOffice via MCWM.

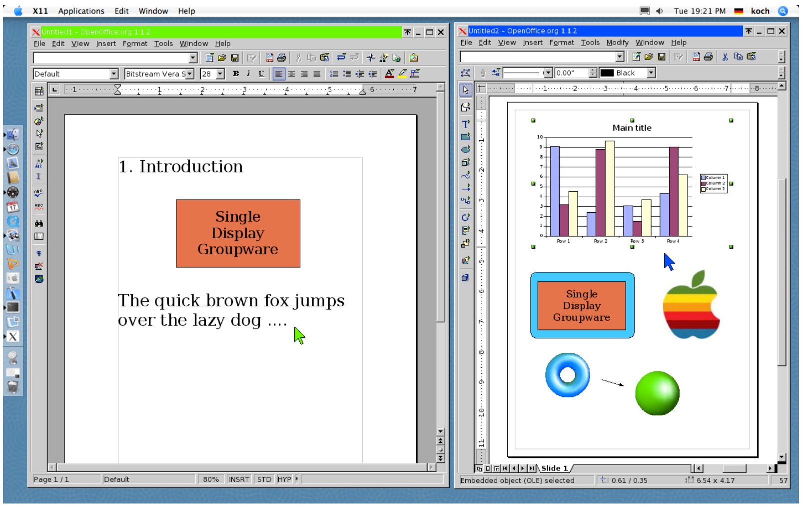

Figure 6. Screenshot of two users working with OpenOffice via MCWM.

5. Conclusions and Future Work

In this paper we have motivated the need for the cooperative media space CMS. We have presented the concept and implementation of our CMS providing support for pervasive presence and communication, for smart roomstates, and for seamless group interaction.

So far, we have been using traditional hardware and software. User interaction is currently done via keyboard and mouse. For future versions of the CMS we are exploring the use of touch screens.

6. Acknowledgements

I would like to thank the members of the Cooperative Media Lab—especially Tareg Egla, and Christoph Oemig—for inspiring discussions on the concepts and implementation of the cooperative media space CMS. Thanks to Erich Bruns, Robert Duenger, and Sascha Koch for implementing cueAID, cueSens, and cueDev; and to Jens Weber and Andreas Wolter for their work on the mock-up.

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COLLABORATION BASED ON USER-DEFINED WORKFLOW

More than Perceiving Presence, Location and Activity

Konrad Klöckner [1]

As interpersonal collaboration becomes ever more distant in terms of geography and time, the important role played by social interaction becomes more evident. It is simply not enough to give users access to the different objects on which they need to work. One goal should be to generate awareness for the collaborative activities that take place in the group. The problem is that virtual groupware workspaces cannot yet match the diversity and richness of interaction that their physical counterparts afford. In particular, virtual workspaces make it more difficult to maintain a sense of awareness about who else is in the workspace, where they are operating, and what they are doing. In a physical workspace, people use peripheral vision, auditory cues, and quick glances to keep track of what goes on around them. In a groupware system, the visual field is greatly reduced, and many of our normal mechanisms for gathering information are ineffective since the required information may be absent from the display.

1. Supporting Engineering Processes

The trends of globalisation and increasing competition force enterprises to decentralize their business. Therefore e.g. engineering enterprises set up distributed teams of members with various expertise and technical background to handle complex engineering processes [6]. The production processes in the automotive industry are a typical example for this.

Workflow management systems support structured processes on top level, but they are too rigid for inter- and intra-team coordination of agile development processes. On the other hand CSCW systems offer flexible tools, however, a lot of coordination and monitoring activities are left to the user. New systems aim at the development of new solutions for self-organized cooperative task

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management and group awareness by combining approaches from software engineering with workflow technology and CSCW methods.

Coordination of distributed development processes in technical domains is often complex and subject to frequent change, which makes a formal description using workflows too complicated. Even experts cannot describe in detail how they will perform and coordinate their tasks. This makes it difficult for IT-analysts to capture the necessary information for modeling a workflow. Moreover, semi-structured activities are hard to describe and cannot be determined beforehand.

The modeling of shared contexts is a prerequisite for working in a cooperative environment. Team members need sufficient information about activities and the state of the work to be done in their group in order to cooperate in a productive way [4].

2. The Situation Today: Being aware – but how?

Rapidly growing, widely used computer networks on the one hand and the emergence of flat, decentralized, distributed organizations on the other hand dramatically increase the demand for computer support of cooperative work. Although CSCW has been a research topic for quite a while and even software industry begins to adopt corresponding concepts, convincing solutions are still rare. This is due to a variety of reasons, ranging from social and organizational problems to purely technical issues. Frequently, groupware systems are little more than single-user applications with added connectivity.

Awareness, which can be defined as an understanding of the overall state of a system, is a key factor for CSCW systems - it allows users to coordinate and structure their work, because they can perceive what others are working on. Without awareness, coordinated cooperative work is almost impossible. However, despite its importance, systematic support for this feature in groupware systems is an exception; ad-hoc solutions are prevailing.

Awareness about who is present in the workspace, where they are, and what they are doing, is called ‘workspace awareness’ - the up-to-the-minute knowledge about another person's interactions with the shared workspace. In face to face shared activity, workspace awareness is a natural, constant, and even unconscious part of people's interaction.

The questions regarding the design of user interfaces which support awareness are:

- How is awareness created?

- How can the user interface support awareness?
- Which are the key factors for the design of an awareness service?
- Which are the key factors for the design of perception mechanisms?
- What are user requirements, expectations, and experiences when using these systems?

If people were presented with all the awareness information available to them, they would be overloaded with a great deal that was irrelevant to them. That is why it is necessary to set up suitable functions for filtering awareness information.

From a technical angle, the provision of awareness information comprises three separate yet co-dependent steps. First, the information is gathered, then distributed, and finally communicated. The entire process surrounding the provision of awareness information only works when all steps take place. Without a filter at the occurrence source, all information concerning one user and his or actions would be available to anybody who wanted it. This of course offers the occurrence recipient the highest level of transparency possible but is not necessarily the intention of the person at the occurrence source, whose privacy is taken away. The conflict between wanting all relevant information to be available and preserving privacy often results in a balancing act. To offer the best possible protection, people at the occurrence source must have the option of providing personal data only to people or groups that they have personally selected. Furthermore, they need to be able to identify at all times who currently can see what aspects of their personal data and in what context. However, interactions within virtual workspaces are impoverished when compared with their physical counterparts [5].

Groupware designers face two problems in designing awareness support. First, what information should a groupware system capture about another's interaction with the workspace? Second, how should this information be presented to other participants?

In the context of distributed software engineering traditional workflow management systems [7] are only applicable to coordinate the quality gates covering the whole process. For continuing workflows mechanisms are required to modify and to reorganize a process as well as for schema evolution.

Many approaches use exception handling to provide flexibility for workflow processes. Even if the exceptions cover different levels from organization over team to team member, we argue that firstly a workflow has to been completely modelled to handle the exceptions afterwards.

The approach of adaptive workflows considers the detection of exceptions, the toleration of deviation and dynamic instance adaptation in workflows.

3. Managing Tasks in a Workflow World

The SAGE system [3] coordinates distributed development processes with a platform that establishes a common and shared virtual information space, which is used by team members to create and change tasks, store and access results or agreements, to discuss and negotiate, and to stay informed about distributed development processes. The management of team membership is accomplished by the team itself (self-organized) and roles of members control their access to the shared workspaces. The concept of 'user-defined workflows' has been developed to allow specification of individual as well as group tasks. There are atomic tasks, deadlines, tasks with subtasks and tasks for delegation. However the type of a task can be changed during the process, i.e. users have not to describe the entire process at the beginning of the collaboration. The tasks, of course, are linked to development documents like agreements, specifications, and results.

We are planning to provide several services which support a high level of transparency and disburden team members from routine monitoring tasks: escalation of deadlines as well as error messages and change requests; compilation of important deadlines, documents and agreements based on relations between tasks, relations between tasks and shared workspaces, or expected results; automatic adjustment of deadlines and automatic notification about documents linked to agreements; supporting the follow-up of technical meetings. Inconsistency of development documents is avoided by using shared workspaces instead of individual folders and email exchange of documents.

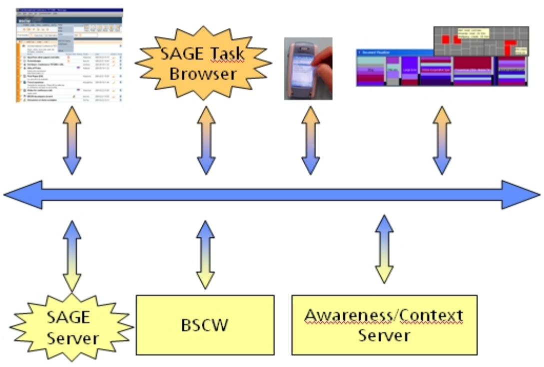

Figure 7 - The SAGE platform

A first analysis indicates that a task browser could be the main tool of the SAGE platform, which enables team members to observe all tasks in which they are involved to easily identify upcoming tasks and to ascertain their status. Naturally, there are operations available to create, change, delete, and move tasks. The corresponding shared workspaces, discussion forums, and other tools like email or for membership management (e.g. invitation of members, account settings) can be directly accessed. Basic awareness information could be presented symbolically, e.g. the expiration of a deadline could be visualized by a red exclamation mark or modifications made to an artefact by an iconic footprint.

4. Group awareness

In addition to basic awareness information, team members require an overview of the current activities in the total cooperative development processes. Therefore, we present shortly more complex graphical space-oriented visualization tools, which serve complementary purposes: overview on group activity and overview on object specific activities.

To reduce the time-consuming manual coordination efforts between teams and team members, users manage links to task relevant information like specifications, reports etc. in shared workspaces. Team members need not anymore organize it in personal folders or send it by email to their cooperation partners, but have common access to all information in the context of the tasks. During the engineering process all participants share common information and have a common knowledge of the work progress. This leads to a high level of transparency and duplication of work, redundant consultations caused by different state of knowledge in the team can be avoided.

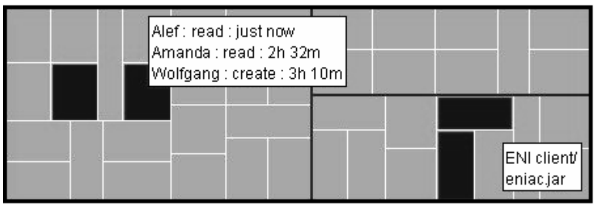

Figure 2 - A Smartmaps

To rid users of annoying monitoring efforts we integrate in the SAGE platform services for context based group awareness. It is no more the users' job to observe the process progress, to check deadlines and deliverables, in order to stay informed on ongoing activities in the teams. Notification mechanisms inform the users automatically about the status of tasks like expiring deadlines or team relevant activity like delivery of objectives, adaptations and completion of tasks. These enable users to react spontaneously on changed conditions and to reach a common understanding in the process teams [7]. The SAGE platform provides various visualizations with different complexity and notification levels. In the task browser for example, basic awareness information like the status of a task is indicated by a traffic light icon: red means ‘out of range’, yellow ‘according to plan’, and green indicates ‘finished’. Requested activity reports for a dedicated time period sent by email summarize team members’ actions like the delivery of a task objective. Figure 2 shows a Smartmap [2], a more complex visualization tool. Smartmaps focus on the provision of task-oriented awareness. A smartmap represents the whole engineering process with all tasks and subtask. Tasks are grouped by rectangles and each rectangle inside a group corresponds to documents and task objectives. Highlighted rectangles inform about a task activity, e.g. a new document has been produced or a task objective has been delivered. In addition users are able to follow the notified activity; e.g. by a double click on a rectangle representing a document SAGE opens the document.

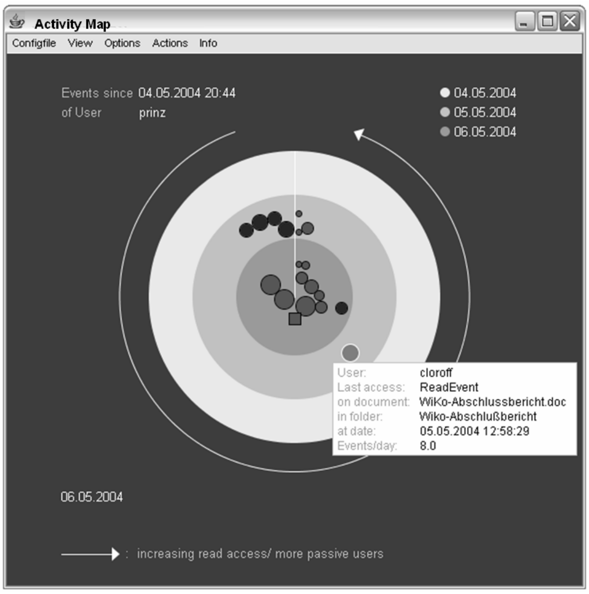

Figure 3 - An Activity map

The activity map [3] shown in Figure 3 focuses on the visualization of the activity level in a team over a specified period of time. Each circle represents a day; the innermost equals today. A dot is an active team member. The more dots are in a circle, the more activity happens during this day. In the context of collaborative task management a high level of activity may be an indicator for an upcoming deadline.

With the integration of situated event and notification services it is guaranteed that the participants have always an overall overview of an engineering process. But this is insufficient for collaborative task management. Users need also support to recognize and solve potential errors and conflicts at an early stage. Examples are upcoming expiration of deadlines, change requests, open issues, escalation and overlapping of tasks, or unsolved interdependences between tasks. The error and conflict management of the SAGE platform informs about anticipated conflicts and provides functions to solve conflicts as well as to synchronize tasks and deadlines. If e.g. a deadline of a task is exceeded, the conflict management looks for free resources, team members that may undertake the task.

Discussion groups in the context of tasks serve as forums for conflict resolutions, negotiations, and agreements. All task relevant decisions are documented and comprehensible for all team members during the engineering process.

The SAGE developments will be realized as a web-based system that allows integration by using the concept of web services. As cooperation platform we will use the web-based groupware BSCW [1] and as awareness server the web-based event and notification infrastructure ENI [8] could be integrated. The SAGE platform will be integrated with other cooperation and software engineering tools, depending on the requirements of the chosen applications.

5. Conclusions

Workspace awareness in a user-defined workflow environment is an important concept for groupware. By setting out elements and mechanisms of workspace awareness, the conceptual framework above provides a vocabulary and a starting point for thinking about and designing groupware support in this application field. In future, we plan to expand and validate the SAGE platform through additional field studies.

6. Acknowledgements

I would like to thank all members of the SAGE project team and Christian Stein, who implemented prototypically the activity map and the history map. The SAGE project is partly funded by the German Federal Ministry of Education and Research. I sincerely want to thank my colleagues Sabine Kolvenbach and Wolfgang Gräther from Fraunhofer FIT for many fruitful discussions and their support in completing this paper.

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LOCATION BASED OUTDOOR SPORTS COMMUNITIES

Wido Wirsam[1]

Is automatically captured route information capable to initiate and intensify collaborative activities in groups of sportspeople? This is the main question that we try to answer in this paper. Therefore we introduce the MobOTA system that provides mobile software to capture fine grained route information and corresponding web based community services. We explain the added value that can be brought to the described target group and the effects that we expect to see.

1. Introduction: Mobile Communities and Outdoor Sports

One recent trend in ICT is the rapid growth of computation power in mobile devices. Furthermore these devices become smaller, have an increased battery lifetime and are equipped with standardised interfaces that allow connecting to various sensors (e.g. those capable of determining their geographic location). Last but not least wireless networks are increasing in accessibility and bandwidth.

This global trend has motivated many people to think about and make predictions on the effects that this technological evolution will have on our modern society. Many visions were driven by industries and governments, who in the meantime were proven wrong in their very optimistic assumptions about the adoption of high-tech mobile devices and advanced broadband services by end users. The critical mass is still waiting for meaningful applications in the area of mobile phones and services of the so called third generation. [1]

One of the world's foremost authorities on the social implications of technology – Howard Rheingold – writes in the introduction 'How to Recognize the Future When It Lands on You' of his book 'Smart Mobs – The Next Social Revolution':

> *Mobile Internet, when it really arrives, will not be just a way to do old things while moving. It will be a way to do things that couldn't be done before. […]*

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> *Perhaps even more important than the evolution of color and video screens in telephone displays is the presence of "location awareness" in mobile telephones. Increasingly, handheld devices can detect, within a few yards, where they are located on a continent, within a neighbourhood, or inside a room. [2]*

Rheingold foresees a dramatic change in the way people use mobile devices initiated by location based services in conjunction with group communication:

> *Location-sensing wireless organizers, wireless networks, and community supercomputing collectives all have one thing in common: They enable people to act together in new ways and in situations where collective action was not possible before. [2]*

One kind of communities is well known for their precious desire to communicate about their common passion. Those are sportspeople. Many formal and loosely joined groups of people get together to either compete against each other, motivate each other or simply enjoy working out together instead of alone. Social activities directly connected to their sport or carried out before or after their common activities are obviously very important to the majority of these groups.

In this paper we introduce new concepts and technological services that enable community members to communicate and collaborate in new ways based on the sportive activities they carry out. Therefore we introduce mobile software and web based community services that enable members of communities of sportspeople to capture, store, share and annotate trips that they have raced, run, cycled or whatever sportive activity can be performed outdoors.

In the upcoming chapter we introduce some related work that has been done in the areas of support for sports communities and mobile software for sportspeople. Chapter 3 goes more into detail of our suggested approach and introduces the MobOTA system. Chapter 4 tackles the chances and risks of such a system and finally in the last chapter we will draw some conclusions.

2. Related Work and currently established standards

Online Communities for sportspeople are available in a big variety of target groups/sports and levels of professionalism. One impressive example in terms of community activity is *RunLondon* [3]. It provides an interactive map based community portal that allows the members to sketch and share their favourite jogging routes. It is not restricted to but mostly used in the area of London, UK and lets the users draw their routes online onto a map. The community is extremely active what shows the high potential that lies in online community support for groups of sportspeople. At the time of writing this paper the portal showed more than 19000 routes created by users. Although the users are not supported with any mobile capturing devices, there seems to be a very high interest in sharing their jogging experiences.

GPSTourInfo [4] is not restricted to one specific sport but is mostly used by cyclists. This community portal allows sharing and annotating automatically captured route information. It supports a broad variety of commercially available GPS capturing devices and corresponding file formats.

MPTrain [5] is an interesting example of how joggers can be supported and motivated by dynamic music play lists that are created on the run to best support the sportive goals of the running person. This personal mobile system consists of a Smartphone that is connected to an accelerometer deriving the step frequency and an electrocardiogram that monitors the heartbeat rate. Both sensor data are transmitted via Bluetooth to the mobile device and trigger the software to choose the music titles with the optimal beats per minute to influence the running speed of the user in a specific way.

These examples show that there is a big interest in sports communities for technological support of their training exercises. The big challenge in designing a system that supports a personal mobile training device as well as an online community portal probably lies in the meaningful integration of both components and of the usability of the overall system. This is because especially during an outdoor activity the user wants a minimal distraction caused by a mobile device during his or her sportive activity.

To establish a good compatibility with other systems and services we identified the GPX Standard [6] as an appropriate data exchange and storage format for our application area of tracking GPS route information.

3. The MobOTA system

In the previous chapter we have shown that there are several technological systems capable to either support outdoor sportspeople with personal mobile devices that directly influence their workouts or web based online community systems that let their members share their experiences on specific favourite workout routes. Only very few available systems combine both areas, and those who do so, do it in a very rudimentary way.

The MobOTA (Mobile Outdoor Training Assistant) combines advanced location based services implemented on a mobile device with tightly integrated community services that run on a community server.

With her or his mobile device a user is able to capture fine grained training data. These samples contain exact time and location information of the current run (race or whatever). Based on this information the user has the possibility to analyse his or her personal performance. Directly form the mobile device a recorded route can be up- or downloaded to or from the community server.

A user who for example downloads a route that she or he does not yet know (the device is able to suggest nearby routes according to the devices' current position) can use this route information to navigate him or her along this downloaded route. Another mode provides the possibility to compete against the person who originally uploaded the route.

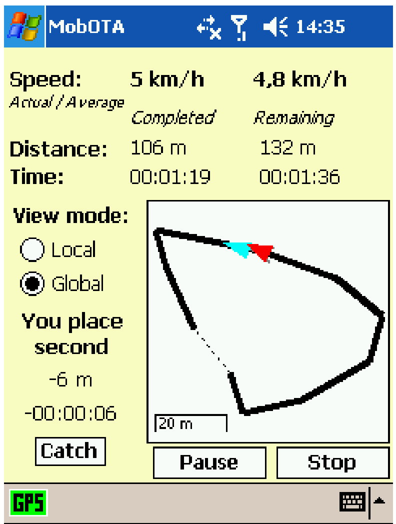

Figure 1 - Screenshot of MobOTA mobile software

Figure 1 shows the mobile software MobOTA in the contest mode. In this mode the user is able to directly compete against a virtual opponent in real time.

After the user uploaded one or more routes, the web based counterpart allows her or him to detailed analyse the sportive performance through a web based interface. The user is provided with an online map overlaid with his captured route (Fig. 2) as well as with some statistical data about the length, duration or average speed. A chart graphic shows altitude or speed histograms.

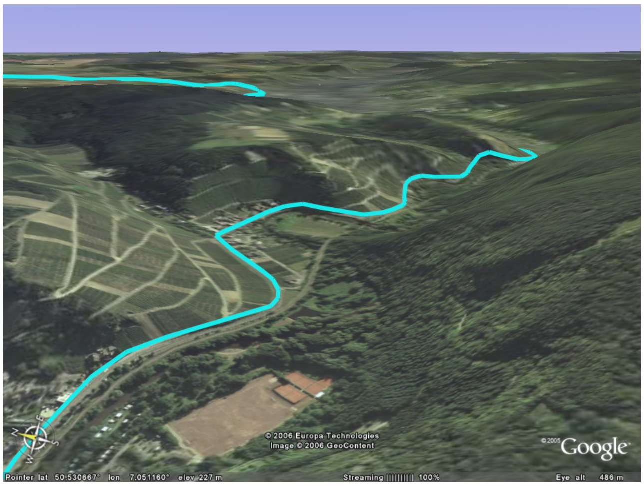

Figure 2 - Route representation in Google Earth

By default an uploaded route appears in the personal section of the portal. The user can enhance the route information by adding some textual descriptions or representative pictures to the route. Users are able to share this route information among closed groups like friends and family or already existing sports communities. Alternatively they can make it publicly available, so anybody can access the route information.

If several runs of the same track are published, the server software automatically recognises the similarity and creates a high score list for this specific run. The purpose of this system thereby is not only to advertise a nice route once but it encourages sportspeople to work out on the same tracks to then enable a sportive competition. Similar to someone downloading news reports to his i-pod and listening to them on the way, a mountain bike racer is now able to download his personal opponent and compete against him on his favourite mountain track.

To compete against someone virtually is of course very different to competing against a real opponent. Our user studies will show, if this feature will be well accepted by the target user group. We see some new possibilities in the community building process supported by a system like MobOTA. An online community system of sports enthusiasts has a strong potential to connecting people with similar habits and performance levels. Based on the fine grained performance data and a description of their habits users can build groups and get in contact where they beforehand had no chance to find each other.

4. Chances and Risks

The examples in chapter 2 show clearly that basic technological support for sportspeople have great potential in both application areas that our research focuses on: 1. Mobile software directly affecting the sportive activity and 2. Services for online sports communities. The main question that has to be answered in the near future is: Will a combination of advanced community services that relies on data captured outdoors during the work out and the accompanying mobile hard- and software services be accepted by the target group? Will the resulting system be usable enough and will it provide a valuable benefit for the potential users so that they are willing to carry out the extra effort to both – register to an online service and carry a mobile device during the work out.

Our experiences with early adopters of the current implementation and interviews with potential users let us be optimistic that the acceptance of the MobOTA system will be high in technological affine user groups.

5. Conclusion and outlook

In this paper we motivated and presented the MobOTA system for the support of outdoor sportspeople who want to record, share and compete based on routes automatically captured by mobile devices using fine grained location and performance information. Our research focuses on the community aspects that are influenced by such a system. We will perform user tests with different user groups to gain feedback about the functionality and usability of the system. In the current first version we restricted ourselves to only one kind of sensor data which comes from a GPS enabled device. For the statistical evaluation of each work out it would be very interesting also to take into account additional sensor data like the heart beat rate or data coming from an accelerometer or the barometric pressure to determine incline with a higher accuracy. Also an integration of advanced auditory features indicating the current position of the opponent would be very interesting to explore.

5.1. Acknowledgements

We would like to thank Jochen Hahnen for his valuable design and development work carried out on the MobOTA system. We would also like to thank Wolfgang Prinz, Scott Counts and Herni ter Hofte for the fruitful discussions that we had on these and related topics.

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TRENDS IN COOPERATIVE ENVIRONMENTS

Ivan Tomek, Rick Giles, Hai Zhang, Li Di[1]

Computer-based cooperative tools and environments have a long history, both in research and as commercial products. However, no extensive overview has been performed and used to draw conclusions and to chart directions for further development. In an attempt to fill this gap, we started surveying selected environments. This contribution reports on the initial phase of this work.

1. Introduction

Work on tools and environments that support groups of cooperating individuals is a major component of research in Computer Supported Collaborative Work (CSCW). Understandably, much of it initially focused on tools supporting individual work activities, such as shared access to documents, scheduling meetings, and synchronous and asynchronous communication. Eventually, it became clear that better results can be achieved by integrating tools supporting individual tasks into multifunctional integrated environments. Switching between tasks then does not require switching between applications, the environment may be easier to use, results more portable, and work more productive. Although integrated environments have become a major subject of CSCW groupware research, work on individual tools has not stopped. This is because research often needs to address specific issues of collaboration, such as mutual awareness of activities and focus of attention of other team members, and because new concepts and technologies supporting collaboration, such as wikis [11] and blogs [21], emerge independently of groupware development and complement existing collaboration tools when they are found to be useful. The challenge then becomes how to integrate these new tools into existing integrated environments.

Work on groupware (term mostly synonymous with collaborative environments) intensified when technology made groupware more attractive and effective by providing higher communication bandwidth, new technologies and hardware and software platforms, faster CPUs, larger computer memories, better displays, and larger storage capacities - all available at continuously decreasing

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cost. Also, economic pressure due to globalization, off-shore development, and greater international cooperation increased interest in both CSCW research and commercial groupware products. Furthermore, the spreading use of Internet has led to a new type of application – Internet-based virtual communities [17] - whose technical needs parallel those of work groups. The result of all these developments is a long list of products that have been developed and used by and for researchers, closely cooperating work teams, and loosely connected individuals. As with all other technologies, it is useful to study groupware history and products to discern trends and extrapolate directions for research. Interestingly, there seems to be little or no literature of this kind and this contribution summarizes the beginnings of our attempt to fill this gap.

The rest of this contribution begins with a survey of collaborative environments. Because the list is very long, only some environments are covered in greater detail, mostly on the basis of publicly available information. Section 3 extracts general observations from the presented survey, Section 4 summarizes the paper, draws conclusions from these observations, and makes some suggestions. References point the user to information related to discussed environments

2. Selected integrated collaborative environments

2.1. Introduction

Surveying collaborative environments can be quite confusing because there are so many of them. To provide a perspective, different approaches are often characterized by the major conceptual principle that they rely on, i.e. the metaphor. Although there is no generally agreed classification, the following is a reasonable starting scheme. It should be noted that adherence to the principles described below is not always strict and that some environments combine several metaphors.

Space-based environments. These environments are organized around the principle of a persistent virtual space, an emulation of the very intuitive physical arrangement of workplaces into interconnected buildings containing floors and rooms. Rooms house objects (mainly documents) and tools, and are inhabited by people who can navigate from one place to another, move objects around, and communicate. The concept has its origin in MUDs [3] developed in late 1970s for recreational uses (game playing), and their more powerful extensions called MOOs developed in the 1980s and used, among other things, for social interaction, work, and in education. Although the space metaphor is the most common basis of collaborative environments because it is very natural and appears to satisfy many of the requirements of team work, it has been criticized for various reasons [7]. Other names for this metaphor, not necessarily totally synonymous, are 'room-based' metaphor and 'place-based' metaphor. CVW [4] is a typical environment of this kind.

Document-based environments. Designers of these environments start from the premise that work revolves around documents, such as reports, spreadsheets, diagrams, communication logs, etc. Foldera [9] is a typical representative of this view. Its users organize their workspace around projects represented by persistent 'activity folders', and all work related to a project originates in and is directed towards them.

Activity-based environments. Environments of this kind are modeled after meetings. Users 'meet' in transient spaces, share access to documents, and communicate. Once finished, the meeting usually does not leave any trace. Marratech [15] is an environment of this kind.

After this introduction, Section 2.2 describes a few selected environments in more detail, giving examples representative of metaphors and noting interesting features. Some of the environments are commercial products, others have been designed for research purposes, some exist and some are history, and a few are in early planning stages. Groupware listed in Section 2.3 is discussed more briefly due to space limitations but this does diminish its importance and the variety of approaches that need to be explored in future work.

2.2. More detailed descriptions of selected environments

The following selection illustrates some of the directions in groupware design. Some of the environments are commercial whereas some are mainly research projects, some are application-specific whereas others are frameworks, and different metaphors have been used to design them. The main reason for choosing them was to illustrate the richness of approaches that have been tried out and need to be considered for future work.

2.2.1. COAST and TUKAN

COAST [19] (Cooperation Application System Technology) is a framework for building collaborative environments and TUKAN [20] is one of its applications - an environment for the support of distributed software development teams. COAST and TUKAN were developed at GMD-IPSI, the German Center for National Research in Information Technology. The stated goal of COAST is to make difficulty of development of 'synchronous groupware' comparably difficult to development of single-user applications. (Synchronous groupware is defined as supporting 'instantaneous' awareness of all actions modifying the state of shared objects.) This is achieved by the framework that implements as much of shared base functionality as possible, and provides interfaces or architectural layers for application-specific modules that instantiate the framework for a specific groupware product. The architectural model of a COAST-based application is shown in Figure 1. The framework provides storage of groupware objects such as documents, network connections, transaction management (transfer of objects and events between clients and other modules), support for communication and user interface (UI) widgets specially adapted for groupware use, and programming interfaces for the application programmer. All the application programmer needs to do to develop groupware using COAST is define application-specific objects and use the predefined groupware widgets to create the user interface. The goal of bringing the difficulty of groupware application development closer to the complexity of single-user application development is thus almost achieved because a developer familiar with the single-user software platform (Smalltalk) only needs to learn how to use the specialized built-in modules and use them in place of single-user application components.

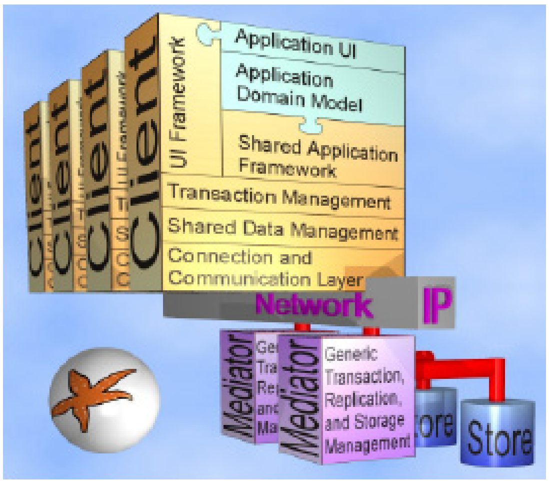

Figure 1 - COAST architecture showing framework and application modules.

COAST uses replicated architecture and focuses on the client and replicates shared object on user side. This improves robustness by limiting the effect of client or server machine crashes, helps load balancing, and increases responsiveness by moving data and processing to the user machine. COAST base modules consist of clients and mediators. Clients are partially application-dependent and provide user interface and domain-specific processing plus client-side parts of the framework. Mediators are generic and are responsible for the primary shared copy of application objects that are transmitted in 'clusters' when needed and updated when changed by the client. Application objects are implemented using the concept of frames and contain not only data but also functionality, giving clients the required autonomy of operation. Applications then deal largely with internal structure of objects whereas COAST modules deal with macroscopic structure and logistics.

COAST is an example of groupware whose functionality and design were largely driven by technical considerations and tentative solutions of technical challenges. This distinguishes it from applications such as Orbit [14], which were driven by user-side requirements typically identified by ethnographic work. Within the space of these two extreme perspectives, this paper leans toward the technical view by exploring groupware characteristics and contemplating framework issues. However, the complementary requirements-driven perspective is equally important and both need to be considered with equal weight in development of groupware applications of the future.

The COAST framework has been used to develop several applications and the most sophisticated and widely reported among them is TUKAN [20]. TUKAN is a groupware environment for collocated or geographically dispersed software development teams, and it aim is to extend functionality of Interactive Development Environments (IDEs) and code management systems from single users to teams. Its thrust is to support real-time awareness of other team members' actions in order to avoid conflicting updates of software on one hand, and to suggest possible cooperations among team members. This is achieved by using COAST's ability to monitor events, process them in an application-specific manner, and notify selected users (synchronously or asynchronously) when this appears appropriate. Towards this end, TUKAN monitors code changes and correlates them with its knowledge of work of other programmers (either on line or via history logs). When it appears that two programmers work on related code, both are notified and the closeness of their development effort (in terms of class or method identity) is indicated. TUKAN and other applications were developed largely to test the COAST framework and the degree of achieving the main COAST goal of the possible improvements in groupware design that can be obtained by implementing a groupware framework.

2.2.2. CURE (Collaborative Universal Remote Education)

CURE [10] is a non-commercial open source product for support of distributed groups, mainly in distance education. It was developed at FernUniverstaet Hagen, Germany and uses the room metaphor, focusing on document objects and providing several forms of communication. Its architecture is based on a Web server and clients are ordinary Web browsers. Authorized CURE users can create interconnected rooms and groups of users with permission to access rooms and add, edit or modify their contents according to their access rights. Room contents consist of 'pages' and 'binary files'. Pages are created using Wiki [11] syntax for formatting, consecutive editions may be versioned, and may use XHTML-based predefined templates. Pages and rooms may be cloned to reduce the amount of work needed to create new work settings. Binary files are documents uploaded from user machines.

Rooms may be interconnected to create course environments, with individual rooms representing, for example, units of contents, such as individual lessons. Users may subscribe to notifications of room-change events and a calendar tool is provided for event scheduling. Communication is via text chat restricted to a room, e-mail, and threaded discussion. Rooms may be equipped with persistent mailboxes. Authorized users can tailor their environment in a limited way by modifying room contents (pages and binary files) and environment structure (add or remove rooms and their interconnections). End-user programmability is not provided.

CURE was created after an analysis of existing environments concluded that none of them fully satisfy the needs of distributed distance learning as defined by a sequence of several learning scenarios. Once this conclusion was made, the scenarios were used to formulate CURE design and guide its implementation, which uses Java. CURE has been used by hundreds of students in several distance education courses and its advantages include simple setup (no installation due to Web browser-based clients), easy accessibility (Web browsers), and good fit to intended application due to scenario-based design that ensures that desired functionality is available.

2.2.3. CVW and FCVW

CVW [4] stands for Collaborative Virtual Workspace. It was developed by MITRE Inc. in the late 1990 and then made available to public as an open-source project. CVW is a typical space metaphor environment whose users operate in a persistent virtual building divided into fixed-layout floors containing rooms. Floors can be added or removed and rooms allocated as personal offices, meeting places, document repositories, etc. Documents of various formats can be imported, shared with others, and displayed by native applications residing on desktop clients. CVW allows creation of user groups that can be employed to define access authorization for spaces and documents and for other purposes. Users can navigate the virtual space, communicate via text chat, e-mail, audio- and video-conferencing, and access documents and move them around, all within the scope of their authorizations. The environment is programmable and extendible at runtime by a built-in programming language, allowing authorized users to extend or modify the virtual space at any time, for example, by define new types of objects or tools.

Figure 2 outlines CVW's architecture. It shows that CVW essentially consists of three types of components - a server, multiple clients, and additional communication channels. The server has two parts, one implementing the virtual environment and one serving documents. Clients are standalone desktop applications that provide communication with the server and access to applications supporting various types of documents, and audio and video that use separate multicasting communication channels.

Despite its power, CVW has its limitations, such as scalability, portability, support for end-user programming, need to install the standalone desktop client interface, and others. Its single-building metaphor is also restrictive in that it does not allow sufficient freedom in organizing work spaces. To address these restrictions, we undertook several projects under the umbrella of FCVW - the Federated CVW [22]. As the name suggests, one of the main features of FCVW is its use of a federation of multiple transparently interconnected servers, each representing a single virtual building. Whereas CVW is a relative complete and rather reliable ready-to-use environment, FCVW is a set of projects exploring possible CVW extensions and serving as the basis for our further research.

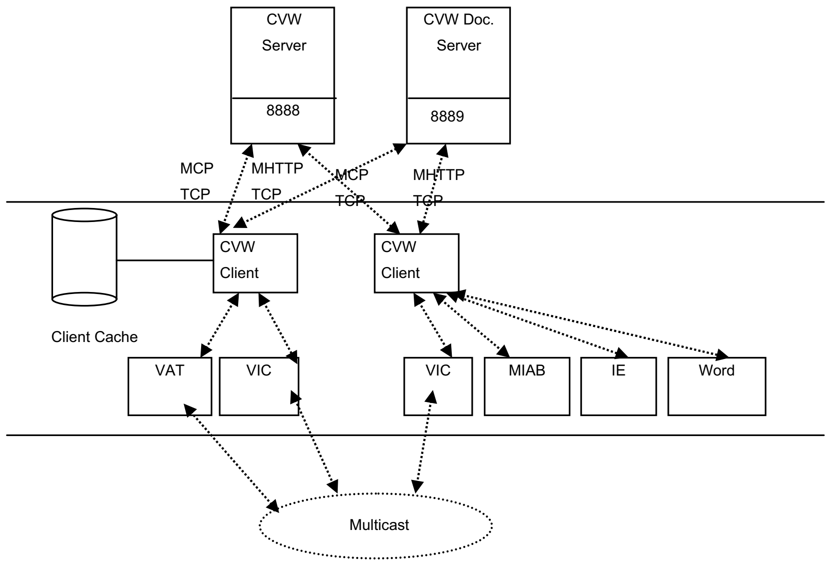

Figure 2 - CVW architecture.

2.2.4. Foldera

Foldera is a commercial product developed by Foldera [9]. It is currently in Beta version and available to public. Its stated goal is to help its users organize their work and the motivation for its design is the observation that productivity tools such as e-mail and spreadsheets produce much information that requires laborious sorting and filing. The solution is to 'invert the create/file paradigm' by assigning an Activity Folder to each project, creating groups authorized to use the folder, and creating documents and conduct work from within Activity Folders (Figure 3).

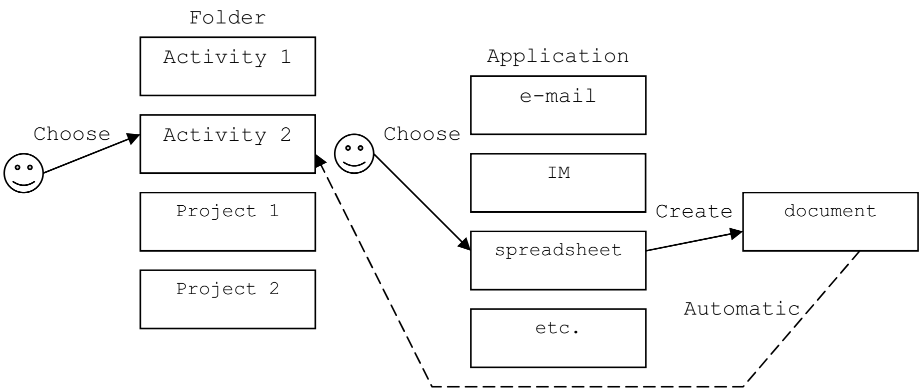

Figure 3 - Foldera's inverted paradigm.

Foldera tools include the following:

- Activity Folders for sharing documents pertaining to a project among team members with controlled access, launching applications, such as e-mail and spreadsheets, from within the folder, to be automatically inserted in the folder, and receiving automatic notification of folder changes.
- Web-based Foldera e-mail and instant messaging using a variety of commercial products.
- Task manager – to define tasks by title, activity, dates, priority, and status.
- Calendar – to schedule meetings and other events.
- Contact manager.
- Comments – to exchange ideas and share information.

- Document Manager – to maintain documents in folders and support versioning.
- Administration – to create and maintain groups and folders

The Foldera interface is via Web browsers and customers' data are stored on a central data server.

Foldera claims the following advantages for its products: Improved team and individual productivity by removing the need to manually organize documents, ease of use, nothing to download/maintain/update, work with familiar applications, possibility of access from any place with Internet connection, and security of centralized server.

2.3. Other environments - briefly

This section lists and briefly describes several environments that played or play an important role in the development of groupware. Several promising environments whose development has been announced recently are also mentioned. We have experimented with some of these applications along usage scenaria whose description is beyond the scope of this paper, and plan to continue doing so in the future within the limits of their availability. We plan to survey this work in more detail in a larger publication later.

BSCW (Basic Support for Cooperative Work) [1] was developed at the GMD institute in Germany and became available in 1995. It has since become very popular in commercial, research, and educational applications around the world. BSCW is based on the concept of a shared workspace, essentially a shared document metaphor. Documents shared by a group are organized in a hierarchy of folders and are available to authenticated users through a Web browser; BSCW use thus does not require any client installation. Available features beyond document access include logging and notification of events and processes occurring within the workspace, document flow folders, user access rights, search and polling facilities, threaded discussion groups, and activity logging for usage analysis. BSCW is under continuous active development and runs on several platforms including mobile devices such as PDAs and smart phones. The implementation uses a Web server augmented with an event server. The code is written in Python and its ease of modification lead, among other things, to the creation of user interfaces in multiple natural languages.

enCore [6] is a spatial-metaphor environment based on the same building blocks as CVW, particularly its MOO server. Unlike CVW, an enCore client uses a Web browser and its use revolves around an active educational community and the enCore Consortium.

Orbit [14] is an experimental environment that was developed to test the viability of the Locales Framework [7], an Activity Theory-based conceptual foundation whose goal is to bridge the distance between analysis of cooperative worlds via methods such as ethnography, requirements formulation, and design. The Locales Framework was developed as a reaction to unsatisfactory experience with wOrlds, and in this sense, Orbit is thus a successor of wOrlds. Being based on Locales Framework, Orbit uses the locales metaphor that could be described as a generalization of the room metaphor in which the strict spatial view is replaced with a personalized view of an individual worker's perspective of work as a collection of locales containing 'furnishings'.

wOrlds [7, 8] was developed by the wOrlds team in USA and Australia in the 1990s. It evolved from theoretical considerations (Speech Act Theory and Theory of Action) and experience with earlier systems. Its intended purpose was to support both formal and informal aspects of work in a flexible way, open to evolution. Theoretical considerations led to the conclusion that space is the most appropriate metaphor. Spaces called 'locales' or rooms, were containers for artifacts, tools, resources, and people, and provided synchronous and asynchronous communication including audio and video. wOrlds also provided support for actions (such as 'distribute meeting minutes') and processes. Processes could be developed and modified by a built-in toolkit. In a preliminary analysis of a specific collaborative context, the wOrlds spatial metaphor was found to be inappropriate for the situation at hand and this led to theoretical work resulting in the development of Locales Framework [7] and the Orbit environment built on its principles.

Other environments that we are investigating include Habanero [2], Isabel [5], Jazz [12], Live Meeting [13], Marratech [15], NetMeeting [16], TeamRooms [18], and others. Due to lack of space, we are at least providing references to them in the last section.

3. Observations

On the basis of the preliminary findings outlined above, we can make the following observations:

- Cooperative environments are used in a variety of applications such as collaboration (software teams, scientific and business communities, and others), education, and interaction in virtual communities. Each of these application domains has its specific needs and a single environment cannot satisfy them all.
- Even within one application domain, different work styles, work processes, and specific needs and preferences require different sets of features and implementations.

- The prevailing trend in groupware development so far is designing a new environment for each new application domain and user community. This is extremely ineffective.
- Needs of users of cooperative environments are not only widely different but also fuzzy, poorly understood, and under constant flux. No developer of groupware can anticipate them and respond to user demands in reasonable time.
- Cooperative environments integrate a variety of diverse functions and are complex. Usability and learnability are thus very important and any technique that can improve them should be employed. The use of a suitable metaphor is one of the most important techniques.
- Three basic metaphors can be identified in groupware design: virtual space-based, session based, and document based. Each has its proponents and detractors and it is not clear, which is better or will prevail.
- Despite differences between requirements under different conditions and metaphors, certain features (such as synchronous and asynchronous communication, shared concurrent access to documents and applications, whiteboards, group support, awareness, and others) are required in all environments. Similarly, certain basic principles (such as need for persistence, performance, security, maintainability, platform independence, etc.) are shared across applications.
- Increasing connectivity, improving bandwidth, new software and hardware technologies and solutions, new concepts, and new application areas require continuous updates of designs and implementations, and enlargement of existing environments. Maintainability and extendibility are thus important issues.
- Developing and learning new tools for established tasks is unproductive and costly. Rather than developing new specialized tools for widely performed tasks, such as e-mail and word processing, within a groupware application and maintaining them at competitive level, it is preferable to integrate existing external tools into cooperative environments. This decreases cognitive load and leverages progress achieved outside of the CSCW domain.
- Because of continuous advances in hardware and software technologies, platform independence is very important. Use of specialized tools and technologies, such as obscure programming languages and standards, complicates installation, upgrading, and maintenance, and decreases platform- and technology-independence.

- Open source technologies encourage widespread use and continuous improvement. Because collaborative environments must evolve to accommodate new needs and technologies, open-source cooperative environments have a better chance of keeping up with user demands.
- None of the surveyed environments satisfies all needs implied by the above. Most are more or less specialized and closed, at best allowing users to compose environments from a predefined set of pieces and leaving them at the mercy of developers for the rest. Few allow use of external applications and inversely, external applications are generally not designed to be used in such environments. Existing environments are also poorly scalable due to high communication and processor demands, and most are platform-specific in terms of software. Unfortunately, even environments now under development don't address all of the requirements in our list.

4. Summary, Conclusions, Recommendations

We outlined preliminary results of a survey whose goal is to gain a perspective that could lead to a more clear view of where groupware might be going in the near future. We listed findings across surveyed applications and concluded that development to date is ineffective and often haphazard. Our preliminary findings lead us to several conclusions and recommendations:

- Although partial overviews of groupware exist, no exhausting survey has been performed recently. In order to take advantage of previous work and to chart future work, a systematic detailed new survey is needed.
- The survey should be accompanied by a systematic usability test of existing environments where these environments are available, to determine which features are most important, which ones are useful but not essential, and what is missing or inadequate.
- From the results of the survey, a modular framework architecture that satisfies the general principles listed above should be defined and developed, and made available to the CSCW community, preferably in a non-commercial open-source form, to open ways for easy development of specialized applications and further research.

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Innovations by ICT

INNOVATIONS BY ICT: PROVISION OF REQUISITELY HOLISTIC INFORMATION FOR BUSINESS TO BE INNOVATIVE

Vesna Čančer, Matjaž Mulej[1]

Innovation management supported by ICT (considered as one of the main contributors to better quality of work and life) is becoming a crucial knowledge and activity aimed at reducing the percentage of failing inventions. The critical questions addressed in this paper include mutual relationships among innovation capacity, business results and society's needs. Considering them by modern approaches supportive of some systems theories, decision theory and ICT may result in provision of requisitely holistic information for business to be innovative.

1. Introduction: The Critical Questions Addressed

Data about patents say that in USA one single percent of patents become innovation. Therefore innovation management (See: [29], [34]) is becoming a crucial knowledge and activity aimed at reducing the percentage of failing inventions by introducing a more / requisitely holistic dealing with ideas, inventions, suggestions, potential innovations and innovations. There are a number of reasons for the Information and Communication Technology (ICT) area to be no different. European Union (EU) finds this topic critical. In the context of the Lisbon Strategy, ICT is recognized to be a main contributor to prosperity and growth in EU [12], [13], [15]. Moreover, transition / developing countries face considerable challenges in promoting ICT to enable innovation and new business creation [15], [19]. ICT has already had a role in changing the character and structure of societies at different developmental levels (See: [4], [21]). Economic theory claims that society's needs cause development and therefore business results; however,

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modern theory of competitive advantage promotes the creation of artificial society’s needs to achieve higher levels of development and better business results in the world of globalization.

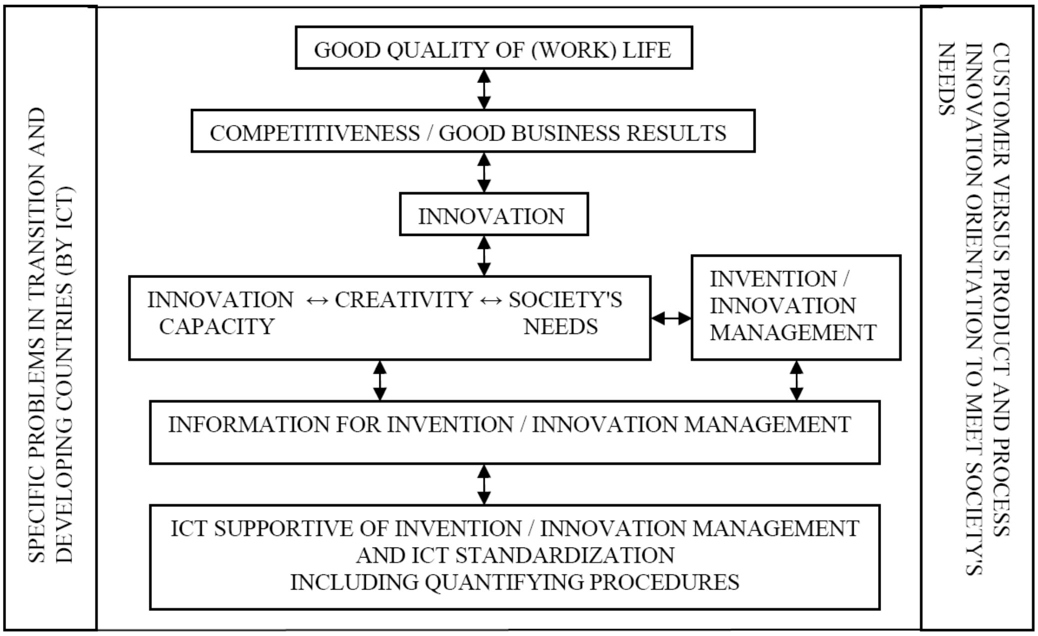

Figure 1 – Innovation “eco-system”: mutual relationships between main innovation contributors to good quality of work and life

The critical questions addressed in this paper (presented in *Figure 1*) therefore include mutual relationships among *innovation capacity*, *business results* and *society's needs.* ICT’s support to knowledge and education enables global availability of data and information (if used well). However, to survive in the knowledge society and to develop into the modern innovation society, attributes of the last one must be strengthened (e.g. creativity, knowledge, entrepreneurship, total / excellent quality, learning, co-operation capacity, especially the interdisciplinary one) to face serious dangers (e.g. competition with no mercy) by responsible, i.e. requisitely holistic decision-making [8]. For this reason, not only the data considered as a perspective of ideas evaluation but also (and above all) *requisitely holistic information*, *methodology* and *information and communication technology* must be provided for considering both interaction and feedback within clusters of elements (inner interdependence) and between clusters (outer interdependence) and must be given special attention in this framework. Systems thinking approaches are gaining a powerful support from the modern decision analysis based on *non-linear relationships* (for details see [2], [10], [17], [27]) because they embrace synergies better than the linear ones do. In addition, quantifying procedures of measuring the innovation-friendly climate have already overcome the pioneering work as they had been further refined and validated [11], [20]. Furthermore, several attempts have been made and additional researches should be performed to measure innovation capacity [11], [37] (since it is considered as one of the most important sources of competitive advantage to achieve favorable business results), and ICT readiness, usage, and an environment for ICT [37], as well.

2. ICT for Innovation / Innovation for ICT

2.1. Ideas and ICT for Good Business Results

In the information age, human mind is becoming recognized to be the most important economic resource, and ideas the most important "semi-products", produced by the support of creative thinking techniques [6] and evaluated in the decision-making processes that can lead to innovations [8]. In particular in ICT, some firms have radically changed their understanding of the role of intellectual property in recent years by sharing their innovations with others. An example is the open-source software [5]. The main reasons for open innovations on one hand and willingness to accept the innovations of competitors on the other hand can be found in greater complexity in ICT, the need to remain competitive because new technologies are quickly out of date, in customers' demand for interoperability and in the common standards rather than proprietary systems (for a detailed description see [5]). An "open innovation" is just a phenomenon of the opposite, but simultaneous ways of surviving in a market: by identifying the need to innovate, but also opening up that innovation; by owning intellectual property, but also sharing it; this can add more value to an innovation than hoarding it might do [5].

2.2. Specific Problems in EU, Transition and Developing Countries (by ICT and Innovations)

According to the reports of European Commissioners [15], sector-specific studies show a strong link between innovation and ICT that contributes to transforming economic and social activities. They recognized ICT to be a key instrument for improving the innovation capacity. Therefore, ICT production and dissemination lies at the core of the Lisbon agenda. Following Figel [15], the most important challenge is to reap the social and economic benefits from ICTs. EU's European Commission for Growth and Jobs promotes facilitating innovation, the uptake of ICT and the sustainable use of resources [13]. ICTs are estimated to contribute 40 % of total productivity growth in EU, but they could give a much greater contribution if they were more widely adopted. Further, with Competitiveness and Innovation Framework Programme, EU European Commission for Enterprise and Industry wants to offer a coherent and integrated response to the objectives of the renewed Lisbon strategy for the period from 2007 to 2013 [12]. Regarding society's needs, the ICT program is aimed to support the modernization of public sector services that can raise productivity and improve services, and assist the development of an open and inclusive European Information Society through stimulating innovative approaches to inclusion, quality of life and public services.

Developing countries face considerable challenges in promoting and sustaining ICT which enable innovation and new business creation [19]. Constraints to innovation, new business creation and expansion across the society should be assessed. Therefore, organizations that seek to facilitate innovative approaches expanding the role of the private sector in scaling up successful ICT applications, expanding ICT access, and harness ICT as tools of broader economic growth and efficiency, help firms and countries meet the dynamics of competition. It is evident that ICT is changing the structure of societies in transition and developing countries, too.

Considering several empirical studies that emphasize the potentials for the global integration of a national economy, "national innovative capacity" and "information and communication technology" are considered as the indirect indicators to express the extent to which the institutional set-up (national institutions and policies) in different countries allows for participation in global activities [7]. For example, studying the direct comparisons of the importance of "national innovative capacity" and "information and communication technology" can let us report that both factors were considered equally important with respect to the direct factors of globalization by a group of experts [7]. Because of different pair-wise comparisons of the importance between these and other indirect indicators with respect to the direct ones, the final weight of "national innovative capacity" is greater for 12.9 % than the final weight of "information and communication technology" in the model where both the direct and the indirect indicators are structured on one level (without sub-criteria). On the macro level, "information and communication technology" can be measured by the network readiness index[2], and "national innovative capacity" can be measured by the national innovative capacity index[3] [37]. Comparing the values of both indices in the sample with 35 OECD, EU member and EU candidate countries with available data can let us report that "information and communication technology" is positively related to "national innovative capacity". Studying the values of Pearson's correlation coefficients can let us report that the correlation between "information and communication technology" and "national innovative capacity" is strong ($r = 0.924$) and significant at the $p < 0.01$ level.

2.3. Requisite Factors of Innovations

Despite the above presented strong correlation between "information and communication technology" and "national innovative capacity", not all of the scientists and practitioners assess ICT as strongly important in strengthening innovation capacity. Although they understand evaluation of generated ideas as a business process which needs to be transparent, complete, balanced, speedy, responsive, and pragmatic [35], they consider the influence of the e-world on organizational culture in general, and the cultural requirements for stimulating innovation in particular, marginal [35].

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[2] It is composed of three components: an environment for ICT, ICT readiness and ICT usage. Sub-indices of an environment component refer to the market (competition in the telecommunications sector, local production of ICT, public expenditure for ICT), the political/legal environment (legal framework for ICT development, R & D subsidies, government restrictions on internet content, level of foreign technology licenses) and infrastructure (general quality of infrastructure, local availability of specialized ICT services, number of telephone lines, number of secure internet servers). Sub-indices of the readiness component refer to the ability of individuals, companies and the government to fully exploit ICT potential (level of ICT literacy, costs of local telephone calls, e-business sophistication, quality of local ICT training programs, level of government priorities in the field of ICT, government officials' competence for ICT, government online services) and sub-indices of a usage component refer to the level of ICT influence on individuals, companies and government (the usage of online payment systems, number of radio receivers and television sets, number of cable television subscribers, number of mobile telephones, number of internet users, housekeeping expenditures for ICT, companies' and governments' e-business, online marketing sophistication) [37].

[3] It is composed out of a sub-index of the availability of scientists and engineers (shares in total workforce), a sub-index of innovative policy (intellectual property protection, extent and availability of tax reliefs/subsidies for R & D activities, effectiveness of national regulation in the field of promoting long-term competitiveness), a sub-index of the entrepreneurial environment for innovation (clusters development, extent of competition and demand sophistication), a sub-index of connectedness in the field of innovation (the availability of specific research and education institutions, the availability of venture capital for innovative projects) and a sub-index of the innovative orientation of companies (level of a company's competitive abilities dependence from original products and services, level of marketing sophistication and level of a company's income dependence from productivity) [37].

Following them [35], the idea must be examined with respect to benefits, issues to be managed, constituencies and feeling, data, solutions, actions, and processes. The data (representing the so called “White hat” in the lateral thinking technique of Edward de Bono [3]) for informed decisions can be treated following their sources, reliability and uncertainty. In this paper, the data are not only considered as a perspective of ideas evaluation; namely, requisitely holistic information, methodology and ICT that must be provided for considering both interaction and feedback within clusters of elements (inner interdependence) and between clusters (outer interdependence) can lead to innovation for better business results and good quality of work and life.

3. Quantifying Procedures Supportive of Innovation Management

3.1. Statistical Approaches: Achievements and Limitations

Several quantifying procedures to measure innovation capacity have already been developed, validated and further refined. One of the most important steps in the quantifying procedure is the definition of the dimensions of the climate of innovation capacity (e.g. challenge, freedom, idea time, idea support, trust & openness, playfulness and humor, conflicts, debates, risk-taking [32]). Different dimensions of innovation and their importance have already been evaluated by several statistical attempts, for example:

- Organizational innovativeness construct has been developed and validated by using confirmatory factor analysis [36].
- Structural equation modeling has been applied to determining the scale of innovativeness, considered as a multi-dimensional category [1].
- Quantifying procedures of measuring the innovation-friendly climate have already overcome the pioneering work as they had been further refined and validated [11], [20]. The reliability and construct validity of the Situational Outlook Questionnaire have been tested by Cronbach alpha and exploratory factor analysis.
- Determinants of the inventive-innovative potential have been detected and presented by descriptive statistics, correlation analysis and comparing means [23].

Some scientists and practitioners dealing with innovations agree that common-practice statistical methods, including mostly performance measurement approaches, cannot satisfactorily support many complex decision-making processes, including developing creative ideas into innovations [8]. Perrin [31] even argues that traditional evaluation methods inhibit rather than support innovation. We generalized some conclusions about the most frequent limitations of typical approaches to evaluation:

- Misuse of measurement approaches. *The use of even the most simple statistical models must satisfy some basic assumptions; very often users do not verify if they are satisfied even though this is enabled by user-friendly statistical packages, and the procedures are described in manuals.*
- Inappropriate understanding and interpretations of descriptive statistic. *Users have neither enough knowledge nor ability to learn, understand, interpret and use the obtained results correctly when evaluating possibly innovations.*
- Too simplistic models of innovations. *Innovation is risky and unpredictable by its very nature, therefore it cannot be evaluated only by the most simple descriptive statistics. Furthermore, it occurs within a context of structured relationships and networks, and in a wider economic, technological, social, environmental and ethical context.*

Perrin [31] concludes that the reactive nature of evaluation can even result in less innovation. He suggests some alternative approaches to the evaluation of innovation, e.g. a key exceptions of best practices approach to evaluation, systems dynamics, learning from failures as well as from successes, identifying implications for the future, setting wider time frames, and incorporating a process approach. Further, attention should be paid to the variations and outliners since they are an important source of innovations. Some Operations Research practitioners in enterprises express the need to (re)shape it following the needs of different management fields and to move from a posture of passive consultant to one of active leadership by, e.g. [9] greater emphasis on visual analyses and interpretation, on communication skills, on interdisciplinary studies and problem formation, and further focusing decision theory on real decision-making in a business context, as well. Therefore, specialists in practice express their need to complete up with other special insights in order to attain the requisite holism (See: [30]). Mulej [30] concluded that it was systems thinking which has always helped people fight oversight and attain success.

3.2. Models Considering the Interactive and Non-Linear Nature of Innovations

Dealing with innovations, dynamic interactions are expected in an *evolutionary* complex system [24]. Non-linear relationships between innovation and other factors in relevant contexts (e.g. the economic price mechanism, the ‘upsetting’ technological innovations, and organizational interface, i.e. firm behavior), together with their feedbacks, should be included in the models for strengthening innovation capacity.

The most cited non-linear innovation models (emphasizing technological innovation) are as follow [25]:

- *Stephen Kline’s Chain-Linked Model*. The first path of innovation process, central chain-of-innovation, begins with design and continues through development and production to marketing. The second path is a series of feedbacks.
- *Ralph Gomory’s Circle Model*. The cyclic process is based on what is already there, the existing product and its restrictions.
- *Alic-Branscomb’s Model*. Innovation is regarded as a social process involving the application of knowledge, together with other inputs, to design, develop, create, and market some products. The output of innovation can include intangible service products as well as physical objects and systems. The core activity of commercialization is design and development: it implies reducing new knowledge to practice – verifying and validating experimental results and theoretical predictions, exploring specific cases, and determining the accuracy and limits of mathematical models and methods.
- *OECD’s Oslo Manual*. It regards design as an essential part of the innovation process. It distinguishes product and process innovation.
- *John Ziman’s Neural Net Model*. Using the basic concepts of the linear model, such as basic and applied research and development, this model seeks to provide a metaphor based on drawing lines to represent causal or interactive linkages between various points in a cognitive space.

Multi-criteria decision-making methods that have already turned out to be very applicable in business practice can be used to complement intuition, and to verify ideas, and support their development into innovations. They support requisite holism without talking the systems theory language. This makes them more acceptable [8]. *Multi-criteria decision-making based on non-linear relationships* are coming into force in modern systems research since they embrace synergies better than the linear ones do. Namely, many phenomena, including innovations, are of a non-linear nature, which is why we need tools for non-linear programming capable of handling several conflicting or incommensurable objectives. *Multiple criteria non-linear programming* has been used not only in the atomic and fusion theory, but also in business, e.g. in the portfolio selection problem [10] and for the classification of credit cardholder behavior [17].

Algorithms for decision-making with multiple objectives about innovations, too, should base on *non-linearity*, *dynamics* and *uncertainty*. The question of multiple objective decision-making within this framework can be considered by using e.g. quadratic programming, non-linear programming, non-linear constrained min-max, mean-variance optimization and non-cooperative Nash games; network optimization, combinatorial optimization and integer programming (for a detailed description see [2]). Promising new developments in multi-objective methods can be undertaken in researching problem that are stochastic and fuzzy in nature [27]. Among non-linear multiple objective approaches, the most popular are *iterative methods*, involving interactions with the decision maker, for the specification of the relative weights and targets in multiple objective problems. They enable interactive search for acceptable decisions. The mean-versus-variance multiple objective problem arises in decision-making under uncertainty where we consider the simultaneous optimization of the expected value of the objective and its variance, which represents the associated risk, connected with innovations.

Non-linear relationships can be considered, for example:

- In criteria by non-linear objective functions or by non-linear value/utility functions when measuring local alternatives' values/utilities with respect to the criteria or
- Among the criteria (e.g. by using interval number to evaluate the global scores [10]).

3.3. Software Supportive of Non-Linear Multi-Criteria Problems

Almost a decade ago, Miettinen [27] concluded that taking into account the multiplicity of methods developed for solving non-linear multi-objective optimization problems, the number of widely tested and user-friendly computer programs that are generally available was small. This situation can be explained with the lack of a free and reliable non-linear solver that could be integrated and distributed with the software. In addition, most software products have been implemented for academic testing purposes, and designing and realizing a functional user interface is demanding. In *Table 1* we briefly introduce some decision support systems, applicable to general non-linear multi-criteria programming, together with their purposes of applications.

Applying GRS, CAMOS, DIDAS, MONP-16 and LPS, decision makers need appropriate knowledge and the methodologists' support. Easier to use, but still with an urgent need to get support from Operations Research experts is the WWW-NIMBUS system. It is based on NIMBUS (Non-differentiable Interactive Multi-objective BUndle-based optimization System), an interactive method where preference information is acquired from the decision maker in the form of a classification of the objective functions. The method has been applied, for example, in structural design problem, and in the optimal shape design of paper machine headboxes. NIMBUS has been designed to be easy to use and, unlike many interactive methods, it does not require consistent information from the decision maker (for details see [28]).

Some widespread computing environments include optimization toolboxes that enable non-linear multi-criteria programming. For example, the optimization toolbox of the MATLAB system includes the weighting method, the ε-constraint method, and a modification of goal programming [22]; the optimization toolbox of The MathWorks includes the goal attainment and the mini-max problem [26]. They take advantages of the system's features, like flexible data structures and handle graphics [22].

Table 1 - Purposes of applications of some software products for multi-criteria non-linear programming

Software products	Purposes of applications
GRS	Generates and illustrates the Pareto optimal set implementing the generalized reachable sets method.
CAMOS	Treats especially non-linear computer aided optimal design problems and produces Pareto optimal solutions with different generating methods (weighting method with or without normalizing the objective function, the ε-constraint method, the method of the global criterion and the method of weighted Tchebycheff metric).
DIDAS	Implements the reference point method of Wierzbicki.
MONP-16	Implements the satisficing trade-off method (STOM).
LPS	Implements the light beam search that combines the reference point idea and tools of multi-attribute decision analysis.
WWW-NIMBUS (interactive software system operating on the Internet)	Capable of solving non-linear problems involving even non-differentiable and non-convex functions where the variables can be continuous or integer-valued. The constraints may be linear, non-linear or bounds for variables.
NOA (collection of subroutines)	Minimizes non-differentiable functions subject to linear and non-linear (non-differentiable) constraints. The single function to be minimized is assumed to be a

	maximum of several functions.
NLPJOB (Fortran subroutine)	Solves smooth non-linear multi-criteria problems by a transformation into a scalar non-linear problem.
MOPS (MATLAB based software environment)	Supports a general controller design process in – among other tasks – parameter estimation of non-linear dynamical systems. The underlying multi-objective optimization problem is solved as a min-max parameter optimization, or in the case of parameter estimation, as a non-linear least-squares problem.
goalSolve (MATLAB based optimization environment)	Solves sparse multi-objective goal attainment problems, with linear and non-linear constraints.
Optimization Toolbox 3.0.3 (part of The MathWorks)	It provides functions for solving two formulations of multi-objective optimization problems: the goal attainment problem which may be subject to linear an non-linear constraints, and the mini-max problem, possibly subject to linear and non-linear constraints.

Sources: Miettinen, 1999; Miettinen and Mäkelä, 2000; Schittkowski, 2006; Joos, 2002; The MathWorks, Optimization Toolbox 3.0.3, 2006.

Spreadsheets have proved to be very useful again since non-linear models can be prepared in a table. NL-FGM-based software, for example, is an add-in tool for Excel (that is actually used in enterprises). It is software for non-linear multiple criteria decision problems: visualization of decision information given by non-linear multiple criteria models and search for preferable efficient strategies (for details see [16]).

When measuring the alternatives' values with respect to the criteria on the lowest level with the support of e.g. Expert Choice [14] and Web-HIPRE [18] (computer programs for multi-criteria decision making that have received much attention among decision makers in the last two decades), non-linearity can be included with exponential value functions.

4. Concluding Remarks

Authorities in EU and some developing countries have already recognized ICT to be a key instrument for improving the innovation capacity; however, such one-sided dependence of innovation capacity on ICT does not express the interdependence within and between main clusters of contributors to good quality of work and life in innovative society. Considering mutual relationships among innovation capacity, business results and society's needs by modern approaches supportive of systemic thinking, decision theory and ICT may result in provision of requisitely holistic information for business to be innovative. Specialists in practice have already expressed their need to use appropriate computer-supported methods in solving different management problems (usually non-linear, iterative and uncertain by nature); this offers great opportunities for Systems and Operations Researchers to develop methodological tools (supportive of strengthening innovation capacity), based on *Systems Thinking*.

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TOWARDS A TRANSDISCIPLINARY APPROACH TO INFORMATION AND MEANING

Hellmut Löckenhoff [1]

It's commonplace: society in the 21st century comes signified by 'Information' (with Capital Letters). Though the topic has been ubiquitously in discussion, the concept remained vague to fuzzy. Legitimately any approach so far to deal with information and its derivatives has constructed its own understanding, following its specific purpose. That holds true for politics as for pragmatics or science. As such a general term tends to, information has become a weasel word: when questioned it disappears. Accounting for the importance of the variety of phenomena called information and its impact on virtually all domains of life a more concise concept is urgently asked for. Politics has to be aware of side and long term effects of regulations concerning societal information (see e.g. privacy and motivation). To find solutions, with desired and sustainable results, the different meaning, weight and impact of information in different social and societal contexts and their co-action must be accounted for. Science, requested to provide support, lacks a shared conceptual base as soon as transdisciplinary efforts are unavoidable. Even the systems and systemic approach works with various definitions specific to domain and objective, reflecting but the general fuzziness. Closely referring to 'Evolutional Information' proposed by Yoshida, the paper attempts to connect the concept with those of anticipatory systems, biosemiotics and discourses aiming for transdisciplinarity. It intends to further a broader and more thorough discussion.

Prologue: What is Life; what Humankind ? On Computing Science.

Life is based on physics and chemistry. But is this necessary base also a sufficient one? Humankind is comprehended as a part of biological life, the avant-garde of evolution and yet a particular phenomenon in itself. The biological and evolutional roots: are they sufficient to explain e.g. psyche, religion and spirituality? To approach a carrying answer it seems science has to reconsider

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physics, evolution and the qualities of humankind as well as its own modes to inquire and evaluate. This is what the considerations following in principle are about.

There is another compelling reason to reconsider science transdisciplinarily under auspices of information and computer science. Incrementally computer driven information science has affected the instruments and modes of the scientific process. Mathematical proof since long has been computer aided. The fabric of science itself is interspersed with the concepts, tools and theorems of computer science, constituting an orderly, formal framework and exploratory apparatus for other sciences'. (G. Djorgovski, Caltec; The Economist March 25th 2006 p79). The critical point appears that increasingly the value-adding process of interpretation is at least partly taken over by computer e.g. employing 'data cubes'. Computer software will also draw hypotheses and design experiments. The development spreads also to the non-physical sciences. At the moment it is *biology* on the level of cells and complex cellular systems that sees e.g. cellular systems as information-processing networks. Information and computing science contribute *meaningfully to science* and to *meaning in science*.

1. The Evolutional and the Informatic Turn in Science

Ideally a *general concept of information* should be found, of which any specific concept could be placed as a well defined sub-concept. Confined to especial scientific or practice domains preliminarily attempts into that direction have been made. For example from physics, theoretical and applied, from informatics, hard and more the soft version, from the systems approach in particular witch reference to control, from social sciences e.g. relating to mass communication and government. All these concepts are not only incompatible, but also their relationships remain much in the dark. An understanding fit for a transdisciplinary base from these efforts seems not yet in sight.

Referring to the impact of information on life and social systems, an operationable concept of information which can applied by diverse approaches is urgently felt. Promising comes the recently fast development in the biological sciences [Wieser 1998], in particular *biosemiotics* (Rosen 1985,1991,1999). It should be reminded here, that from roots in the late 19th century and gaining momentum in the second part of the 20th century the prevailing *physics* scientific paradigm was rivalled by an arising *biology* paradigm [J.v.Uexküll 1960; 1962; K.Lorenz 1968] supported by *linguistic research* ([Pierce 1931-1935], [Lenneberg 1978]). Its outstanding scientific branch presently is represented by biosemiotics. Information in biosemiotics is closely tied to *meaning in evolution* and the *evolution of meaning*. The research profits from the more comprehensive understanding of evolution. In parallel and closely entwined to *biodynamics* a more thorough understanding, acceptance and application of the so far strictly biological domains of the *evolution concepts to other disciplines* has progressed. Evolutionary psychology for example is well known as it is 'evolutionary economics' (replacing its forerunner 'growth economics'). Both lines of research typically lead into the *'Evolutionary Foundations'* of the anthropologies (actually in particular of economics) and, in consequence, to basic reconsiderations of *methodical* nature. Root assumptions of the prevalent *theory of science* (still dominated by enlightened physicism?) are questioned and reformulated (Kurt Dopfer 2005). In addition, though it applies but indirect here, the entire range of the *systems approach* contributes to an ever more differentiated understanding of systems *in situ* (actual, functional) in complement to systems *in evolution*. In particular *systemics* lead to the investigation of the particular systemic qualities of life systems; e.g. *critical systems* motivate profound re-questioning the base of scientific inquiry and discovery especially referring to *social issues*.

The above movements in co-action open the path to a reconciliation of the very roots of science itself. They lay the foundation for a base of science that would enable *transdisciplinary co-operation*. As mentioned above transdiciplinarity is driven mutually by political/pragmatic on the one and the demands of scientific research on the other hand. *Practice problems* can be solved economically, sustainably and socially compatible only when analysed from in tendency *all* relevant (requisite holisticity) views represented by scientific disciplines. Such an interdisciplinary dialogue is possible only on *shared semiotics*, on a shared *conceptual language*, on shared models and shared *valuation spaces*. Again, they can arise but from a *transdisciplinary* base, emerging essentially from the evolution and the biosemiotics approach.

In all living systems information is inseparably coupled with 'meaning'. *Meaning* is one, of if not the crucial, of essential qualities, specifically of meaning based *purpose* and *intentional behaviour*. It remains open whether meaning emerges uno acto with information, or but with the emergence of life systems. The answer depends much on from what stage of '*organisational complexity'* that is degree the interaction of and with inner and outer environments the existence of life is stipulated. Information in existing living systems is non-separably bound to information/meaning and vice versa.

2. A New Approach to Science and Transdisciplinarity

Recently Yoshida (2005) has shown that a transdisciplinary framework presupposes what he named *'The Second Scientific Revolution In Capital Letters – Informatic Turn –'.* What Yoshida calls a new 'meta-paradigm' proposes a concept of *'evolutional information'*. Following his argumentation, information intrinsically is connected with the evolutional process of differentiation and the development of new and emerging structures which, increasingly distinguished, form and drive each other. Systems, in particular life systems, develop into ever higher degrees of what R. Rosen calls *'organisational complexity'* within his concept of *life systems* as directional, intentional *'Anticipatory Systems'*. Higher complexity of that kind, implying inner and outer environments, asks for higher developed *control systems*. They are dissipated and centralized in control centres as nervous systems and 'brains. G. Edelman for example attempts to elucidate the evolution path from 'matter to mind', from physical matter to *higher consciousness* founding on similar structuring. To that end he hypothesises a *Theory of Neural Group Selection (TNGS*).

Allowing for conceptual differences, theories on evolution, biosemiotics, anticipatory systems and TNGS roughly fit into *Yoshida's theory of evolutional information* and corroborate it by application. The emerging basic models, in addition, are compatible with the known systems/cybernetics approaches I to IV…. and fit into concepts as e. that of 'drift learning' (Maturana/Varela). All these attempts assay for an unbroken line, figuratively spoken, from matter to consciousness and above (as the realms of spirituality). It needs be stressed here that the tasks can but accomplished by putting the right questions. Science is in its very foundations *inquiry systems, models employed* and *evaluation scales*. Non scientific lack of ability to ask proper questions as in 'intelligent design' is definitely out of question.

Yoshida begins with a bold refusal of the still widely prevalent key assumptions of science. Repudiating the rigorous views of mechanical physics, he less replaces but complements them by others, relating to and closing up to information. He calls it the change of meta-paradigms.

- *First*, *'Cognitive Monism'*, is abandoned in favour of 'Design Science'. The aim of Science is not merely more or less 'objective' knowledge about the world, including the human level. This part of science remains as *Cognising Science.* Necessarily it is complemented by *'Design Science'*. Designing Science implies the engineering in the natural sciences and, as a normative/ policy science, pragmatically directed to desirable forms science helps to engineer. Consequentially this *'unified body of science and technology'* incorporates *learning from practice* experience.

- *Second*, matter and energy are not seen as the only constituents of the entire world as in '*Materialistic Monism'*. Instead Yoshida proposes '*Evolutionary "Information" Categories,* '. Referring to Aristotle's categories of 'Hyle' as *matter as a substance*, and to 'eidos', *as matter as differences/patterns*. /(a)*'Non-semiotic Information'* penetrates all nature as temporal/ spatial/ qualitative/ quantitative differences of energy and matter. – (b) *'Semiotic Information'* in contrast is confined uniquely to the biologic and human domain. It is defined as *coupling between differences/patterns of matter,* which can be physical or representation mediated. It functions either as a *sign* (endo-or exo-sign) or as *meaning.* Meaning may occur as 'objective meaning' or 'representative meaning.
- Third, the prevailing '*Nomothetic Monism'* holds 'Laws' as the constituting principle of order. They are understood as deterministic, stochastic, (non-)linear and non-changing, pervading all nature. Again, a complementary *category 'Program'* is introduced, unique to the biology and human domain. Metaphorically programs can be conceived as *'Spatio-Temporal Blueprints'*. They are related to the signs intrinsic to nature, ranging from DNA to computer or linguistic programs.

Obviously a plethora of quite fundamental questions arises, which in detail cannot be covered here. The overview given as above is meant to, if but roughly, to outline the background for a tentative, introductory discussion of the 'Evolutionary Information Category' and its possible implications on selected points of application in the social and societal domain. In particular modelling and simulation of societal phenomena are addressed.

3. Setting the Stakes for Evolutional Information

The search for a *Unified Science* is nearly as old as science itself, pre- or post-Newtonian and -Einsteinian. For the more recent attempts Yoshida's concept appears an interesting example. Without detectable logical or material gaps in argumentation it erects an integrated body of basic assumptions offering inroads to tackle so far but approximated questions. For example: What is life; How may consciousness/mind arise from matter? and related quests. Before focussing on information directly, some related general qualities of the edifice may be pointed out. First, it is *non-monistic*, which does *not* mean it is dualistic in the simple meaning of the term, but presents a *derivative dualism* distinguishing between *matter and semiotic information.* *(*see in analogue also Nomothetics; [C.Brugha 1998]). The two sides distinguished are not antagonists nor competing polarities, but necessary *complements.* Cognition Science and Design Science provide but the first example of this rule. They are complements because they are partners in mutually stimulated *dynamics*, generally spoken in the *process of evolution*. This applies accordingly to an *Evolutionary* concept of *Information* dissolving the usual simple dualism of matter and information. And it leads to *Programming* instead of deterministic laws: the *evolvement of the principles of order themselves* within evolution.

Complements presuppose a shared domain; base, direction, cognition and measurement/ evaluation. As already earliest philosophers have pointed out, existence/being begins with *distinction*. Distinction uno actu creates a *relation* between the so distinguished units. Relation may take the form of an assignment establishing *order*, and/or of interaction founding *dynamics*. As an offspring the dynamic process a *relational causality* emerges. Dynamics result into the development of a *direction* of then evolvement*,* which in turn leads to *superposed feedback and to memory. Cognising, evaluation follow,* and as result the establishment of *the learning* processes. The events and their results need be *measured* against scales and *evaluated* against patterns given or anticipated. The dynamics, leading to increasing distinctions, differences and in se distinctive dynamic processes, grow into the dynamics processes of *evolution*. Doing so structures of evolving systems as well as the evolution process itself expand into an ever increasing *organizational complexity*. The *internal* complexity of the system is matched and mutually driven by the external complexity of its *relevant environments*. Their interaction creates and follows *relational causality*.

These very superficial remarks can but roughly outline the general logical/philosophical domains of argumentation and the conclusions to hypotheses as above. Formal and material aspects try to pragmatically describe ‘reality’ (enlightened positivism) in a mode that it can be understood and handled. The key concepts emerging are, first, that of *distinction* and the related concept of *information*. The other, second, addresses *dynamics* and following evolution., Under auspices of the scientific model as above both percepts integrate, third, into the model ‘Evolutionary Information’. The term expresses that information is perceived first as differences/patterns in matter respectively in later stages of evolution having substrates/correlates retraceable to differences/patterns in matter. The concept also stresses that information is observed from its qualities and functions within the process of evolvement itself, from simple matter to highly complex information controlled in living and conscious systems. These systems comprehend the system of *human (engineered) artefacts*, the domain *K. Popper* would have addressed as *'World III'*.

The course of the ideas outlined and the terms used in this endeavour are meant to evoke reminiscences and remind of known authors and their thinking. The author of this paper is well aware that such a practice can be intended, as it is here, but as a request and a challenge for further reading.

At the argumentative base *Aristotle* is involved concerning e.g. existence, order, dynamics and categories; especially his fourfold causation: *materialis, efficiens, formalis and finalis*. In living systems the so far discarded *'final' causation* (purpose, intent) needs be reconsidered in a non-vitalistic scientific environment. 'Distinction' in the logics domain is known from the *Laws of Form* (*Spencer Brown*) and in anthropology from '*the difference that makes the difference'* coined by *G. Bateson*. Bateson is regarded one of the founding scientists of biosemiotics. – *Causal relations-* and *relational causality -* are essential also for the concept of *'Anticipatory Systems'* by the biologist *Robert Rosen*. Life systems are by necessity anticipatory systems containing an co-evolving *informational model of themselves and their relevant environment*: past, present and future. They are able to *predict possible/probable futures* and decide end oriented; in case of higher consciousness following intent. Behind lies a complex process based on memory, evaluative feedback and *evolutionary learning* (survival, development and beyond). Virtually all elements/subsystems are connected by *relational causality*. It is not a fixed causality, but dynamically develops in what closely resembles a *learning dialogue,* taking place between and encompassing the systems inner and outer environments. Complexity is described by the *organisational complexity* of the inner and outer environments and its increase. The more complex a system the more it needs multilevel, dispersed, networked *and* hierarchical *separate control systems*. Again the control information is, from its function as well as concerning its own change, evolutionary information. Such a view fits well into the general biological context as e.g. presented by *W. Wieser* in "Die *Zwei Gesichter der Evolution"* (*The Two Faces of Evolution;* sub-title). A path rather analogous referring to the above fundamental assumptions is taken by *G.. Edelman* in '*On the Matter of the Mind'* (subtitle). Setting on from non-living physical matter he explores the evolution of consciousness and higher consciousness. In the latter and decisive phase of its evolution the social and societal environment on the conscious and higher conscious levels comes into play. *Social communication* is essential for the development of *higher consciousness* in parallel to its physiologic correlates and substrates. Scarcely by coincidence e.g. *N. Luhman* identified *communication as the core phenomenon constituting a society*. Similar traits can be shown dominating the recently vital discussion on *culture*. It should be noted, that Yoshida also refers to purely *mental artefacts*, addressing religion and spirituality.

The evolution of *language* as a universal incorporation of evolutional information and a key driver of evolution, as mentioned before, requires in this context a separate paper. Essentials confined to the topics of this paper will be discussed below.

4. Evolutional Information, Programming, Language and Software

As indicated above, Yoshida introduces as a complement to matter/energy the categories ofn 'evolutional information', that is semiotic and non-semiotic information. Going back to basic formal relationships: which can be defined as information? Close to Bateson's *'difference which makes a difference'* Yoshida falls back on '*differences/pattern of matter/ energy*', that is, differences/ patterns which eventually can be perceived and observed ('Relational Positivism'; 'Universalism'). He defines *information* as the *temporal, spatial, quantitative and qualitative differences and patterns.* This founding creates what can be addressed as a dualistic world view of *matter/energy* on the one and (*evolutionary) information* on the other hand as basic constituents; opening the space/time dimensions for a dynamic dialogue and for evolution.

Confined to the difference/patterns of *matter*, information is called *non-semiotic information*. Since matter/ energy is constituted by differences/ patterns, relating to non-semiotic information matter/ energy and differences/patterns in so far can be seen as one and the same. Non-semiotic information does not bare meaning- it makes differences *on the material level* only. In complement, *Semiotic information* is unique to the *life* and the *human* level. Yoshida defines its function as *coupling*, DNA as its evolutional origin. The coupling may be physical or representation mediated, taking place between 'differences/patterns of matter'. These differences/patterns of matter can function as *signs (endo-signs, exo-signs*) and/or be functioning as their *meaning*. *Meaning* may take the quality of *'referent' or 'objective meaning'*, as *representative meaning* or *representation as meaning*. (Semiotic information and semiotic evolution differentiate between *semiotic vehicle* and *semiotic* form, not to be explicated here.)

The setting permits and even forces a differentiation of the semiotic evolutionary information concept from the very roots. Its function/performance leads to the above mentioned threefold function. *First,* the archetypes of knowledge as e.g. stimulus-response, knowledge 'of' and knowledge 'for' are recaptured in the process (!) of *conversion from 'cognitive' to directive 'information'*. Information perceived and necessarily having been evaluated possesses the potentials of direction, the quality to trigger an expected and qualified response. Information is in itself dynamic and distinguishing, making a difference affecting both matter/energy and information. The *second* function of information is *cognising*, closely connected with memory. The third function is *evaluation,* based on the comparison of information/patterns as to their meaning . All three are integrated in the process of *learning*.

The extremely condensed display of Yoshida's basic argumentation as aforementioned cannot be but intended as an invitation to further reading; in depth, in detail and constructively critical. The meticulously set systems of definition proposals may e.g. in biosemiotics help to discuss at which biological level the *meaning carrying* semiotic information begins – e.g. in primary macromolecular information processing - and what the quality of the threshold/ transfer is like. Likewise the described threefold function of information as *direction, cognition and evaluation* may shed new light on the role of meaning in the evolution process. Non-semiotic information – and variatis variandis also semiotic information - may be transferred to information and pattern recognition in computers or computer supported, helping to re-understand software construction.

Life and human life are signified by *intention/ attractor directed evolution* and behaviour. Evolution may be seen as a preformed sequence of conditioned spatio/temporal events or actions, which are *adaptive* and *variable* referring to the internal and external states and their (reciprocal, responsive) development. The proposed *'program' category* is understood as opposed to 'laws' at the material level. *DNA programs* can be seen as evolutionary archetypes; extending to *linguistic programs*. Even *computer programs* as 'programs with scientific technology applied' can be included. Programs qualify as '*spatio/temporal blueprints'* for evolution. They are attributed by variability and speciality instead of the invariability and universality of 'rules/laws'. Accordingly program prescriptions may be 'violated', leading in that case to distortion, deformity, aberration or deviate behaviour. They constitute the potentials, the emerging vectors within direction space, the constraints and the 'attractors' of evolution.

Again the corroborative comparison as well as the differentiation Yoshida carries forth in great depth, in detail and aiming at practice application, cannot be followed here. Already the very general framework as displayed challenges a both broad and thorough discussion. Broad it needs be since there is scarcely a scientific topic or discipline not affected. Thorough, because the discourse cannot end on the but interdisciplinary or the casuistic level. It needs considered transdisciplinarily.

Programming has matured into ubiquitous tool of scientific inquiry, evaluation and application. It need be understood precisely on which premises and with which powers of explanation and explication e.g. modelling and simulation can be exercised on biological or anthropological objects. Programming profoundly understood and integrated will eventually develop new forms of construction and application. In particular programming science within *Information and Communication Technology (ICT)* in the widest meaning of the term may profit. So will Artificial Intelligence, dependent on a comprehensive understanding of both the live brain and programming science applied to life phenomena. The fast growing contribution of *biosemiotics* and *linguistic sciences* need be integrated here.

Epilogue: Towards a Global Scientific Paradigm

Scientific progress for the last sixty years has been mainly stimulated from two sources. First, *life sciences* have increasingly not only contributed to but determined the ongoing development of science of science. (Philosophy only remained silent so far). Evolution is but on the obvious surface of a much wider spread influence of biological thinking. It pertains not only the anthropologies but also if indirectly is acknowledged by physics and the natural sciences. In reverse the formal and material science, in particular mathematics, pure and applied as in informatics, has proven a powerful and also directive mode of research in the non-material domains. For both reasons an approach like "The Second Scientific Revolution…" aiming at a shared base for material and biological/human sciences is due and much needed. As a transdisciplinary fundament for scientific inquiry, it may straighten out discrepancies, expose pseudo-problems and stimulate challenging well trodden 'calf paths of the mind' for new ones to try. This will not come as revolution but as rather a tacit evolution.

The very cursory outline that can be presented here is intended, first, to introduce the ideas of Yoshida more broadly into the ongoing discourse searching for a transdisciplinary base. According to Yoshida (Yoshida 2005) his proposals so far have been discussed within the Japanese domain only. An especially stimulating effect will emerge from the Japanese thinking signified by a particularly practical, pragmatic, instrumental understanding of science as a tool to shape life. Yoshida can be seen as an obvious example of otherwise tacitly penetrating ways of Japanese, Chinese and Indian modes of scientific thinking into the conventional Western scientific modes. Second, the here fully developed concept of evolutionary information may help to further scientific research around the 'evolutionary turn' and the 'informatic turn' in the direction of operational concepts. Eventually it may guide the increasing impact of ICT on *societal structures and societal development*. Government seems rather far yet from understanding save sensibly and sustainably reacting to and controlling the impacts of ICT on society, on culture, on demography and on political constitution. The disappearance of *privacy* and its already apparent mostly threatening consequences for social and societal behaviour, in the end of *democracy constitution* itself, pose but two of many related examples. Not by chance Yoshida addresses also the *spiritual* domain, that of religion, not-rational , or better not-only-rational convictions and reasoning. Rationally guided behaviour, Western scientific style, permanently competes with emotional sovereignty. Third, evolutionary information needs be detailed and complemented as a potential base of a transdisciplinary scientific paradigm, developing from the conventional still prevailing monistic comprehension of science. Fourth, and by no means least, the search for a transdisciplinary base for multiple *interdisciplinary co-operation* may be furthered. Disciplinary specialisation is necessary as to go into detail. Concomitantly specialisation inheres the danger to separation and isolation and, in consequence, of sterility, as science without sufficient connection to the reality of survival and development will become stale. In particular basic research will profit from both the concept of evolutional information and transdisciplinary co-operation. Any serious discourse (excluding intelligent design and the like) is welcome and very necessary.

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SHORT TERM ROAD ICE FORECAST BY A REQUISITELY HOLISTIC APPROACH

Tomaž Kramberger[1], Bojan Rosi[2], Martin Lipičnik[3], Andrej Lisec[4]

Competences of the modern management are focused on the permanent (more or less important) decision making. The later comes out from the quality of the available information about particular problematic situation. Usually we confront the complex problem, when it is difficult to predict or limit its effects.

It is known that there are different alternative possibilities (scenarios), influencing process and a result of the managerial decision making. On the one side, we claim that for efficient and successful decision making a manager has to have more quality information than their competitors, on the other side, it is claimed that h/she has to have more knowledge capital, i.e. synergy between inborn talents, emotions, abilities and experiences gained from practice. Ability of optimal engagement of knowledge capital enables systemic thinking and systemic approach to the process of decision making, enabling them to become (more than usually) creative, cooperative and interdisciplinary, and masters of the skill as it is decision making.

It can be proved by an practical example of decision making about important (traffic safety) preventive measures in the winter time (roads gritting and ploughing). Great importance of quality, in time and enough holistic information, is presented with the model of Short Term Road Ice Prediction, which gives us information for quality decision making.

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1. Introduction

From one viewpoint, our past, and present connected with its actuality, as well as future, are segments of our world, which can be considered as an intricacy – into net entangled system, (= entangled holism and its perception, coming out from the chosen aspects or /dialectical/ systems of aspects). Differences between, what was, what is and what will be, or what we want to be, are huge, because effects of the human acting have become more intensive and more global (= world-entangled). We have found out that extensive humane activities affect world's permanent changing. Consequences are seen, among the others, in the continuous confrontation with different – always new problem situations and their solving; among the basic features of the both are complexity (= intricacy under the influence of relationships) and dynamic. Researching and managing such phenomenon can be supported by competence in usage of the theory of systems.

Sense of systemic thinking is therefore the most (= sufficient) holistic[5] and realistic preparation and performance of human activities, when we deal with researching, development, decision making, informing or performing. It is important to use knowledge capital in each aspect of the complex problem solving. The very moment we do not consider influence of the choice of the aspects, we can easily fall into virtual holism[6] when we think, make decisions and act/perform – or carry out, for example, management decisions [14]. Global business conditions force us to try to be holistic in our way of thinking, making decisions and acting, as much as it is possible and needed at the same time. This is also very important in our case when we have to make decision about road safety.

Quality of management depends on creative, dynamic, qualified, into development and interdisciplinary cooperation directed managers. However, nowadays, in the world of global economy they do not have on disposal/do not operate with sufficient quantity of information, needed for (more or less) complex problems solving and with them connected/linked decision-

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[5] Holistic approach is an expression easy to use but difficult to define in detail/precisely, for example: Bertalanffy, 1968 /and before/; Checkland, 1981 both in Mulej et all, 1992, p. 18-21; Mulej and co-authors, 2000, p. 32-34; Mulej, Ženko, 2004, p. 14-17, 24-29; Rosi, 2004, p. 1-2, 6-7; etc.). Holistic approach contains all, all components and all their relationships (links and relations), characterizing treated phenomenon, of course, it is impossible to include everything.

Therefore, holistic approach is not performable, not at all when we speak about work and thinking of people as individuals without (co-professional) co-operation, at the same time it may overburden us. Obviously, it has to be decided which level of holistic approach is satisfactory enough and needed at the same time, for actual case.

[6] Because of *one way thinking/one sided*, which may be consequence of extensive specialization; we may have overlooked or neglected essence when we made choice or even aspect of treatment of some manager's decision.

making[7]. This is of great importance [15], [24], as the purpose of information is to decrease/cut down on risk, included into each decision-making, as we make decisions about the future. It is not difficult to prepare a lot of data; but it is difficult, or almost impossible to provide proper information in time for those who make decisions. On the other side, waiting for information paralyze decision-making and problem solving linked with it. Information quality influences the degree of risk, as decisions are divided into decisions made in certain situations, decisions in risky situations and decisions in uncertain situations.

2. Problem definition

Winter plowing and scattering of the road is of great importance and expense. If the roads are not ploughed or slippery roads are not scattered, participants in traffic are exposed to great danger. Weather conditions often cause traffic jams and have negative economic effect, at least causing great dissatisfaction in people. In several papers (see, for example article [3], [8], [16], [19] or [20]) this problem is considered using different formulations. To treat the problem properly, we should take into consideration both security and economic effects. Regarding security, the most exposed and first icy road network spots should have priority. From the economic point of view, all these roads have to be scattered one after another using the cheapest route. In this paper, we consider only the first task, i.e. timely prediction of the icy spots at affordable cost. Let us only note that the optimization of the routes opens another avenue of research of both theoretical and practical interest [13].

Following Mulej's and Kajzer's [9] law of requisite holism, requisitely holistic information is needed. Nowadays methods for ice forecasting are mainly supported by road temperature, air temperature and humidity [16]. Some of the methods are supported by one of the named physical quantities, some by the combination of them. Gustavsson, Bogren and Lindquist presented a model of forecasting temperature change of the chosen and known road net sections in 1994 [2]. Their model is based on the characteristic of the road temperature changes, which was already presented by the above mentioned authors and D.G. Belk in 1988 and 1992 ([1], [2] and [4]). The main result

[7] Decision-making and with it linked/connected (human) activities have more meanings: to express willingness, e.g. how it should be (to have the right) to make decisions about work, life…// to give, express your final opinion/judgment: decision is made by company management, competent person, commission, institution.; to define outcome of sth,: choosing among alternative possibilities// make decisions, direct: it defined his destiny; to make decision 1. by thinking come to the state when individual wants to act, realise: one after another made decision to help them; it is difficult to make decision according to your conscience; to be in a state when a person hesitate about what to choose, etc. Dictionary of Slovene Standard Language, /SSKJ/ 1996).

of the presented model is the so called ″thermal map″ which shows relative changes of the road surface temperatures. The model HS_4Cast presented by G.Shaffar and S.Hertl [16], [5] uses Fuzzy logic for the prediction of meteorological quantities where the typical patterns of meteorological parameters are maintained. In 1998 J. Shao has used an artificial neural network to improve short term road ice forecast (see for example [18]).

Here we propose a methodology for predicting road temperature pattern with a small number of fixed measurement positions. Namely, it is clear that accurate road temperature pattern can be obtained by measuring the temperature of the road network at many spots that are densely spread over the network. However, installing and maintaining such infrastructure may be prohibitively costly. Here we propose a two step method where in the first step a number of measurements at a large set of spots are performed. In the second step, a statistical analysis of correlations is made and based on this, a small number of spots is determined at which equipment for measuring meteorological parameters will be installed. We provide an example (the town of Maribor), where we found that one can obtain sufficiently good predictions based on only two measuring spots.

Above mentioned models of ice predicting are based on the data about road temperatures for the particular road section. It has been observed that the pattern of the road temperature distribution repeats. If the number of measurements is large enough and results are distributed into three different weather categories, there is a strong correlation between the data series [17], [16].

In previous work [6] and [7], it was observed that this characteristic is valid for small samples too (small samples are samples with $N<30$, usually assumed to be distributed according to the Student distribution, see [13, p.242-260]). Also in that case, high correlation was observed between the pairs of the measurement data series along the single measurement points. If there is a correlation between the data series, it is likely that there is also a correlation between single measurement spots data, measured in different time intervals.

In this paper we look at the road temperature pattern data from another perspective. We consider correlations between measured temperatures of two (or more) measuring spots. If this correlation can be proved as strong enough, regression line can be defined by the method of Least Squares. (See for example [13, p.281-310] or any textbook of Statistics). The least squares regression line of data series x and y (i.e. the series of measurements at spot x and at spot y)

$$y = a_0 + a_1 x$$

helps us to predict the temperature on the spot y according to the temperature data on spot x with a certain probability.

The quality of the calculated values is defined by expected rate of confidence. Thus, for each calculated value we can define the standard error of estimate by the following equation

$$s_{y.x} = \sqrt{\frac{\sum\left(y - y_{est}\right)^2}{N}}$$

where y_{est} are calculated values, y are measured value and $s_{y.x}$ is the standard error of estimate. The standard error of estimate has properties analogous to those of the standard deviation (see for example [13, p.313]. For example, if we construct the lines parallel to the regression line of y on x at respective vertical distance $s_{y.x}$, $2s_{y.x}$ and $3s_{y.x}$ from it, we should find, that there would be included between these lines about 6 8 %, 95 % and 99.7 % of the sample points. We use that

$$P\left(y_{est} - s_{y.x} \le y \le y_{est} + s_{y.x}\right) = 0.6826$$

If the means calculated on the basis of the regression line do not meet our expectations, we can try with multiple regressions. In this case the regression plane is calculated in three-dimensional coordinate system. The road temperature distribution model on the chosen measurement spots can be presented by linear regression function:

$$y_j = a_{0j} + a_{1j}x_1 + a_{2j}x_2$$

Where y_j means calculated value for given x_1 and x_2, which are the road temperatures on the referential measurement spots, on the j-th measurement spot and a_{0j}, a_{1j} a_{2j} stand for calculated regression coefficients for the j-th measurement spot. Calculated values are reliable according to the model definition with 31.74 % risk degree.

After we calculate all linear regression functions we can define a function:

$$f(x_1, x_2) = Y$$

Where x_1, x_2 are the measured temperatures on two reference spots and Y is matrix of estimated temperatures on all other assigned points. We can write this equation

$$\begin{bmatrix} y_1 \\ y_2 \\ . \\ . \\ y_j \end{bmatrix} = \begin{bmatrix} a_{11} & a_{21} \\ a_{12} & a_{22} \\ . & . \\ . & . \\ a_{1j} & a_{2j} \end{bmatrix} \cdot \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} a_{01} \\ a_{02} \\ . \\ . \\ a_{0j} \end{bmatrix}$$

Where $a_{0j}, a_{1j}, \ldots, a_{2j}$ are calculated regression coefficients. Note that the matrix equation is equivalent to j equations $f_i(x_1, x_2) = a_{1i}x_1 + a_{2i}x_2 + a_{0i}$, $i = 1,2,.., j$.

In order to devise the measures of correlation we define the coefficient of determination, r, with

$$r = \sqrt{\frac{\sum (y_{est} - \bar{y})^2}{\sum (y - \bar{y})^2}}$$

where y_{est} is estimated value for given x and $\bar{y}$ the mean of all y values.

3. Model building

The essential aim of the model building is defining one or two representative spots among the measurement spots, which will best describe temperature on the other measurement spots. For defining those two spots, we will use the procedure described bellow. The idea is to first check if already one spot can be used to estimate the temperature at all other spots. Then a pair of spots is chosen which gives the best predictions for all others. We stop with two spots here, but in principle, if the results are not satisfactory, one could go on and look for subsets of three or more spots that would give predictions of sufficient accuracy.

3.1. Algorithm I: finding the best one-spot subset

I. Calculate coefficient of determination for each among $n \times n$ matched pairs of the data series.
II. Calculate average coefficient of determination for the same independent x values.
III. Mark the measurement spot with highest average determination coefficient.
IV. Calculate regression line $y = a_0 + a_1 x$, when y presents calculated values on the single spots, and x stands for values measured on the measurement spot with the highest determination coefficient (see Item II).
V. Calculate standard error of estimate for each regression line.
VI. Considering normal distribution and predicted 68.26 % reliability, check one or more test series to prove that the measured results are within the demanded interval
VII. If there are approximately 68.26 % of all values within the demanded interval, choose measurement spot as referential.

If the final test VII fails, then we should use a modified algorithm to calculate multiple regression.

3.2. Algorithm II: finding a best two-spots subset

I. Among the measurement spots choose three with the highest average determination coefficient.
II. For each trinity (x_1, x_2, y) of data series calculate determination coefficient.
III. Calculate average determination coefficient for the same independent x mean
IV. Choose measurement spot with the highest average determination coefficient.
V. Calculate regression solid line $y = a_0 + a_1 x_1 + a_2 x_2$, where y present means measured on the measurement spots, and x presents means measured on the measurement spots with the highest determination coefficient (see point III)
VI. Calculate standard error for each regression line.
VII. Considering normal distribution and predicted 68.26 % level of confidence check one or more test series if measured results are within demanded interval.
VIII. If there are approximately 68.26 % of all values within the demanded interval, choose measurement spots as referential.

3.3. Experiment

For model presentation in the real conditions, it means on the real road network, we had to carry out an extensive experiment. Essential idea was to collect enough information for serious correlation and regression analyses. As seen from previous items [17], [6], the described characteristic is for geographically defined area; so we firstly had to choose proper spot for experiment. According to our goal to get representative data for the roads in different weather conditions, different types of measurement spots had been chosen, i.e. on the bridges, higher areas as well as urban ones. Generally, weather also causes limitations. Most of the similar experiments were carried out separately according to the different weather types. Dividing weather to two or three types, some authors reached great measures of correlation between data series [17]. In our experiment, regardless the weather, measurements were put in one single weather type. The reason for that is rather technical. Since the data was collected manually, i.e. road temperatures were measured by infrared thermometer CALEX T-8818, precision ±1.5 % and resolution 0.1° C, it was impossible to spend so much time (the winter in the season 2003/04 was shorter than usually) to collect data within more than one weather type. But on the other hand, if we are able to reach the correlation between our data series great enough, the correlation calculated in the different weather types would be even greater. Note that in spite of relative small data sets measured and in spite of neglecting the weather types, the forecast has proved to be surprisingly good on the test datasets.

Measurement spots were chosen on the basis of the data recorded in the Master work [6] and on the basis of the local winter maintenance service experiences within the area of city Maribor. Chosen measurement spots were located inside $100\,km^2$ area including city center, bridges across the Drava River, hills around the city and flat region of the Drava field. Locations of the measurement spots are illustrated in figure 1 bellow.

Figure 1 - ***Measurement spots***

Measurement spots presented in the figure above are arranged according to the data collection order of precedence.

3.4. Measurements

Measurements were carried out at the end of winter nights, just before the dawn. At that moment road temperature is most stable. Energy radiation flow had finished into atmosphere, absorption and warming of the road did not start yet. We carried out 24 different measurement series in different weather conditions within the interval of two years. Measured temperatures are given in the Table bellow; more precise data are enclosed as attachment. Among 24 data series, 20 were chosen randomly to be analyzed, the other four were used for testing purpose.

Table 1 - Temperatures chosen for calculation

spot	*1*	*2*	*3*	*4*	*5*	*6*	*7*
series							
1	*-3.1*	*-3.0*	*-3.9*	*-3.7*	*-2.7*	*-3.0*	*-1.8*
2	*0.7*	*0.8*	*0.5*	*0.2*	*0.6*	*0.4*	*1.2*
3	*-1.4*	*-2.2*	*-5.2*	*-2.8*	*-7.0*	*-6.4*	*-5.4*
4	*7.4*	*5.7*	*4.5*	*4.8*	*4.8*	*4.8*	*4.7*
5	*-1.1*	*-1.9*	*-8.9*	*-6.7*	*-7.1*	*-5.5*	*-11.1*
6	*5.4*	*2.3*	*2.9*	*4.8*	*4.9*	*4.7*	*2.3*
7	*4.8*	*4.4*	*4.1*	*4.1*	*3.3*	*2.4*	*1.2*
8	*-4.2*	*-5.2*	*-11.3*	*-9.3*	*-8.8*	*-9.0*	*-8.1*
9	*1.4*	*-1.5*	*-5.8*	*-4.6*	*-2.9*	*-4.6*	*-5.7*
10	*3.4*	*0.4*	*-2.3*	*-0.9*	*-3.6*	*-1.4*	*-3.4*
11	*0.3*	*-3.9*	*-7.0*	*-6.9*	*-5.9*	*-6.5*	*-7.7*
12	*0.2*	*-4.0*	*-7.1*	*-7.1*	*-6.0*	*-6.6*	*-8.0*
13	*-4.1*	*-3.4*	*-16.0*	*-15.4*	*-14.8*	*-14.1*	*-14.5*
14	*-4.4*	*-3.3*	*-15.9*	*-15.3*	*-14.5*	*-13.9*	*-14.3*
15	*-2.9*	*-4.8*	*-11.3*	*-12.1*	*-12.3*	*-13.0*	*-12.1*
16	*-2.8*	*-4.9*	*-11.5*	*-12.2*	*-12.4*	*-13.3*	*-12.0*
17	*-6.1*	*-3.1*	*-16.1*	*-15.4*	*-17.7*	*-18.7*	*-15.6*
18	*-6.4*	*-3.4*	*-16.3*	*-15.4*	*-17.8*	*-18.6*	*-15.6*
19	*4.8*	*3.4*	*-0.1*	*-1.3*	*0.7*	*2.6*	*0.4*
20	*4.8*	*3.4*	*-0.1*	*-1.3*	*0.7*	*2.6*	*0.4*

3.5. Calculations for one spot subset

Calculation was carried out by software EXCEL, Microsoft Office 2003. Installed functions were used for statistical analysis, most often function LINEST.
Syntax = LINEST (B2:B21; A2:A21; TRUE; TRUE in our case returns the matrix:

Table 2 - Matrix calculated by function LINEST in Excel.

0.723368497	*-1.072027355*
0.094329393	*0.381562101*
0.765644742	*1.704889932*
58.8064695	*18*

Single matrix elements stand for:

Table 3 - Meaning of the single elements of the matrix

a_1	a_0
se_{a_1}	se_{a_0}
r^2	sev
F	d_f

A correlation coefficient based on a sample of size 20 was computed to be 0.765644742. To test the significance of computed coefficient we rely on the T-test of hypothesis and significance (see for example [13, p.243 and 310-343] or any textbook of Statistics). If statistical value $t = \frac{r\sqrt{N-2}}{\sqrt{1-r^2}}$ is compared with a critical value t_c for our sample size which is 1.73. We can see that with 2.5% risk we can reject the hypothesis $H_0 : \rho = 0$, where ρ is population correlation coefficient. We see that the correlation coefficient of 0.765644742 differs significantly from zero at the 0.025 level and is significant for the whole population.

Data from the measurement spot 1 are taken as independent and are compared with the data about all other measurement spots. For single data pairs we get the following results:

Table 4 - Results for the reference spot 1.

Pair	r^2	$y = a_0 + a_1 x$
1-2	*0.765644742*	$y = -1.072027355 + 0.723368497x$
1-3	*0.85057048*	$y = -6.08681022 + 1.548175178x$
1-4	*0.817446677*	$y = -5.559414012 + 1.503446988x$
1-5	*0.845599002*	$y = -5.656944181 + 1.606210701x$
1-6	*0.848258925*	$y = -5.820336617 + 1.615666959x$
1-7	*0.781219022*	$y = -5.744450533 + 1.3855851x$

The same calculations are done for all seven measurement spots. All parameters and coefficients have to be calculated and regression equations defined.

4. Testing of the model

Now, with all collected measurement data testing of the model can be carried out. Data from the series left for testing are used. Measured data are inserted into above given regression equation and estimates y_{est} calculated. Values are shown in the graph. Measured temperature should be inside the confidence interval $y_{est} \pm s_{x,y}$ with 68.26 % probability.

From the presented results in the Table 3 values of the variable y for single x mean can be calculated. Apart from this, according to $y_{est} \pm s_{x,y}$ lower and upper boundaries of the confidence interval are calculated. So we get:

Table 5 - Test calculation for 3.4° C value.

means1						
1	*m.spot.*	*calculated*	*measured*	*Upper boundary*	*Lower boundary*	*Sx,y*
3,4	*1*	*3.4*	*3.4*	*4.40*	*2.40*	*1.0000000*
	2	*1.4*	*3.2*	*4.90*	*1.50*	*1.70488993*
	3	*-0.8*	*2.1*	*4.86*	*-0.66*	*2.76437020*
	4	*-0.4*	*2.0*	*5.03*	*-1.03*	*3.02667877*
	5	*-0.2*	*3.7*	*6.62*	*0.78*	*2.92387224*
	6	*-0.3*	*3.7*	*6.61*	*0.79*	*2.91106738*
	7	*-1.0*	*4.1*	*7.22*	*0.98*	*3.12366632*

Results can be presented graphically. It is evident that much more than 31.74 % of the values are out of predicted intervals.

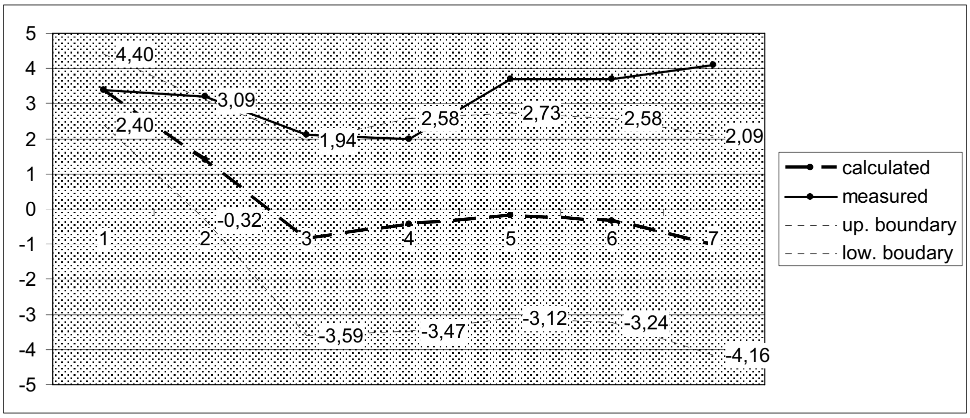

Figure 2 - Graphical display of the results of calculations for 3.4° C value.

After performing two additional tests with similar results we can conclude that this model for presenting measured data is not reliable enough.

4.1. Calculation with modified algorithm

To be persuaded into quality of the calculated results, we have to apply modified algorithm. Therefore, multiple regressions are calculated for some measurement spots. Multiple regression equation $y = a_0 + a_1x_1 + a_2x_2$ is solved by function LINEST for each measurement spot separately, regarding pairs of chosen reference spots.

Most adequate way of choosing first pair of reference spots seems to be two spots with highest average determination coefficient considering calculated regression in previous case. In our case these are spots 3 and 5, whose data are independent variables x_1 and x_2. We have no proof that this choice is optimal. However, we have checked several other pairs and in all cases the standard errors of estimate were larger.

Function =LINEST (C2:C21; A2:B21; TRUE; TRUE) gives matrix:

Table 6 - Calculation of regression for the first measurement spot dependent on spots 3 and 5.

0.227150141	*0.31771627*	*3.194498653*
0.265668554	*0.276436566*	*0.52852866*
0.856731431	*1.659206*	*#N/V*
50.82913301	*17*	*#N/V*

Now multiple regression plane looks like this:

$$y = 3.194498653 + 0.31771627x_1 + 0.227150141x_2$$

Determination coefficient r^2 in our case has value $r^2 = 0.856731431$, which means strong regression. After carrying out t-test

$$t = \frac{0.925597877\sqrt{20-2}}{0.856731431} = 4.45453$$

It is evident that for this sample size t statistic is higher than critical mean t_c

Therefore, we can conclude that determination coefficient r^2 is not due to chance and is valid for the whole population.

Same calculations are repeated for each trinity with reference spots 3 and 5. Below are shown values of the determination coefficients and multiple regression line.

Table 7 - Regression equation for reference spots 3 and 5.

trinity	r^2	$y = a_0 + a_1 x_1 + a_2 x_2$
3,5-1	*0.856731431*	$y = 3.19449865 + 0.31771627 x_1 + 0.22715014 x_2$
3,5-2	*0.719271599*	$y = 1.55287141 + 0.61785402 x_1 - 0.19822962 x_2$
3,5-4	*0.977595998*	$y = 0.32842163 + 0.84198149 x_1 + 0.13437422 x_2$
3,5-6	*0.969214551*	$y = 0.03879351 + 0.37431781 x_1 + 0.63353717 x_2$
3,5-7	*0,97007154*	$y = -0.47779992 + 0.36177685 x_1 + 0.54045819 x_2$

As shown, determination coefficients are very high; also t-tests show relevance for the whole population, so we can conclude that there is strong regressive association between data series.

4.2. Test of the modified model

Using measurement data, modified model can also be tested. According to previous matter mentioned in Problem definition, confidence interval can be calculated. We predict that measured temperature is within the interval $y_{est} \pm s_{(x_1,x_2).y}$ with 68.26 % probability. Gained results are as follows:

Table 8 - Test calculation for values 2.1and 3.7° C.

	Measured.	*calculated*	*measured*	*Upper boundary*	*Lower boundary*	*Sx_1,x_2,y*
x_1=2,1	*1*	*4.85*	*3.4*	*6.51*	*3.19*	*1.6592060*
x_2=3,7	*2*	*3.42*	*3.2*	*5.34*	*1.50*	*1.9200563*
	3	*2.10*	*2.1*	*3.10*	*1.10*	*1.0000000*
	4	*3.73*	*2.0*	*4.82*	*2.61*	*1.0910535*
	5	*3.70*	*3.7*	*4.70*	*1.75*	*1.0000000*
	6	*2.75*	*3.7*	*4.10*	*1.40*	*1.3492276*
	7	*2.00*	*4.1*	*3.18*	*0,81*	*1.1888138*

Below are graphically displayed results (Figure 3)

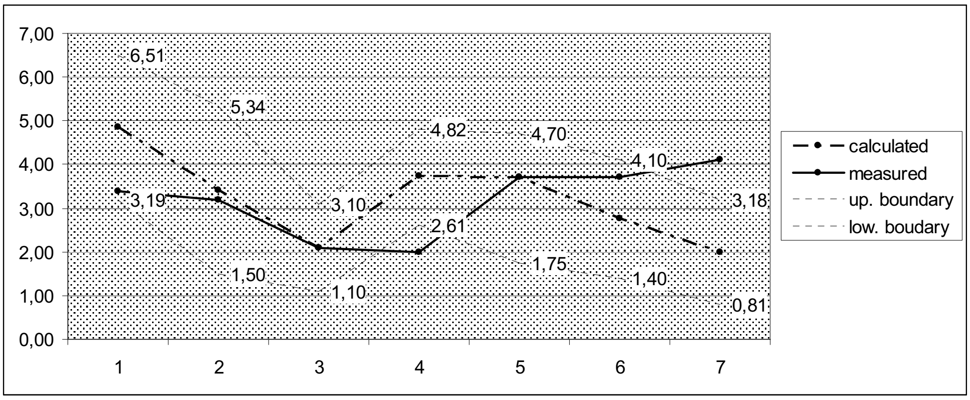

Figure 3 - Graphical display of the results for values 2.1 and 3.7° C.

From the graph on figure 3 is evident that two in seven means are not within the demanded boundaries, but according to previously set demands this is still considered not bad result.

In our case, demanded 68.26 % reliability is achieved, as five out of seven spots are in the required interval. Next data set also gives similar results, graphically displayed bellow in Figure 4.

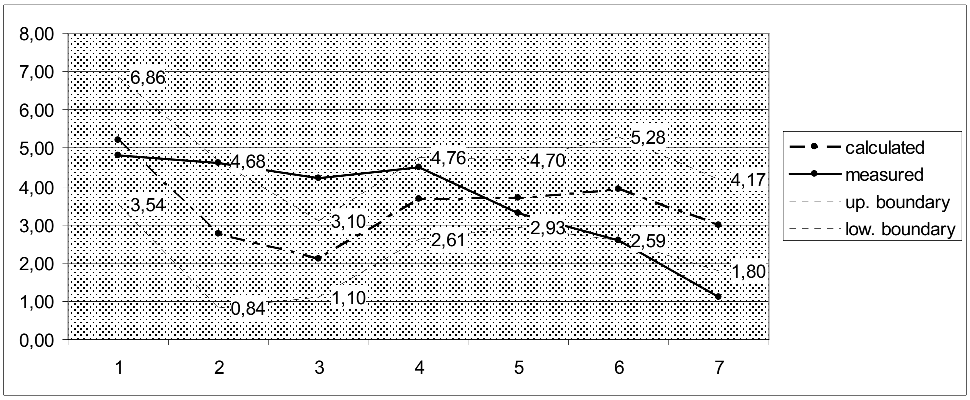

Figure 4 -Graphical display of the calculated results of the test data series for the values 4.2 and 3.3° C.

Also here, only two values are not within the demanded boundaries, so 68.36 % reliability is accomplished.

Additional test with other measurements results gave us similar results; therefore we can conclude that for presenting data series, model with multiple regression is more reliable.

5. Choice of the reference spot

Measurements, calculations and statistical tests showed that there is a strong linear correlation between the temperatures on the defined measurement spots and other measurement spots. Determination coefficients, regression and multiple regression line were calculated and analyzed. Thus, our presumption that the road temperature of the chosen spots could be an indicator for the temperatures of the other road net spots has been demonstrated.

Analysis showed that the estimation based on multiple regression method gives better results. Reference spots with the highest average determination coefficient and the lowest average standard error of estimate should be chosen. In our experiment measurement spots 3 and 5 shows us reliable results. With permanently observing the road temperature measurement on these spots, we can follow temperature change on the other chosen spots of defined road network and predict the temperature at all other spots with reasonably low risk of failure.

6. Conclusions

This article shows procedure which enables choosing one or more representative spots out of great number observed spots of defined road net. Expected temperature values for single measurement spot can be calculated with certain reliability according to the temperature data measured on this spots and applying regression equations. In this case the law of requisite holism can be met with a rather low number of data, which are able to serve as information well enough.

Thus, first appearance of road ice can be predicted with certain confidence and adequate measures can be carried out promptly. The described method gives us enough information to apply some even more sophisticated algorithms to carry out winter maintenance service more efficiently i.e. faster and cheaper. More detailed study may be an interesting topic for future research.

Quality decision making is conditioned by synergy between effects of intuition, knowledge capital and knowledge, which need to be directed into creative systemic thinking and (co)operation in complex problem solving. Nowadays mangers have a lot of powerful software tools based on network thinking, fuzzy logic and simulations to make better decisions. One of those tools is method described above.

We should not forget that holism is one of the basic values in the modern management in the world of competitiveness, inevitably needed for global business management.

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ETHICS (OF INTERDEPENDENCE) – A CRUCIAL INFORMATION IN THE VIRTUAL ORGANIZATION[1]

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Knowledge matters, but it is applied under a crucial influence of one's chosen ethics, which is therefore crucial information. This applies very much to a virtual organization (VO). VO concept provides an organization a template for increasing the control and viability of its operations. In conditions of restricted availability of factors and restrictive conditions of business operation, results of VO can be improved by creation and implementation of adequate ethics of VO. In the content of discussion about ethic VO, the paper discusses two theses: (1) Ethics is a critical information for working of VO; (2) ethics of interdependence is the necessary base for adequate operating of VO.

1. Introduction

The hyper-competitive global economy has created a new competitive landscape – one in which events change constantly and unpredictably [13; 3; 10: 5; 26]. The conditions of globalization require companies to transform from the traditional industrial enterprises into the modern post-industrial ones, which are more open, flexible and innovative. Information management belongs to it. It is more or less holistic. Orientation depends on ethics of decision makers more than on information technology.

Trends that have appeared together with the development and the increasing application of information technology, and have the greatest influence on the organization structure include: (1) business globalization, (2) change in the employment structure, and (3) elimination of boundaries

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between the parts within the organizations, but also between individual organizations [2; 11; 8; 7; 9]. Thus, VO surface, if decision makers' ethics allow.

The VO presents possible solutions for implementation of new structure of modern post-industries organization in modern environment [23; 31; 26]. VOs enable organizational and/or individual core competencies to be brought together when needed, and disbanded when no longer required on one hand. On the other hand, competitive pressure over the modern conditions of business requires a high quality of business functioning. Business functioning of VOs can be significantly improved mainly in the field of its management, which belongs to their least developed and investigated areas. Creation and implementation of appropriate VO ethics presents an important viewpoint of management, which, to a great extent, determines the quality of the entire functioning of management and has also a major impact on the results of the business operation. These are true in general and even more so for the VO.

This is a summary of rationales favoring VOs over traditional organizational concepts, but is is anyway not the prevailing practice: ethics of independence rather than of interdependence make decision makers keep to tradition. More information, i.e. influential message may be needed.

In this contribution we shall, therefore, focus on the consideration of the virtual business organization, definition of basis and starting points of ethical consideration of VO, and definition of role and importance of new ethics, e.g. ethics of interdependence for VO.

2. Virtual Organization

Organizations try to adapt to conditions of growing dynamisation and globalization of business in different ways. In late 1980s an important organizational invention (and in some cases also an organizational innovation) appeared - the idea of a VO [28; 6; 1; 20; 23; 9]. In the organization and management theory VO is defined as an organization, which (in many cases) does not exist institutionally. However, there is a changeable net of organizations, which perform processes to define and reach VO's aims and intentions.

If we start from the organizational viewpoint, we can understand the VO as a net of legally independent organizations, which are mutually connected by performing activities to realize common aims [2; 12; 11; 4; 8; 7; 21; 9]. Most of the known VO definitions suppose that the net of organizations does not institutionalize the central function of the management. Instead of hierarchy, the information systems are used to solve information and organization problems of integration. The basic advantage of VO is – in accordance with the given situation – connecting the basic competences of the given organization without forming (institutionally) an integrated organization, which might react to changes in its environment too rigidly.

The VO's activity is based on two ideas [22; 11; 27; 19]: 1) forming an organization in accordance with the value-chain (and with the aim of its optimization), and 2) reaching the most important competences with which VO members can maximise their contribution to the value – once it develops its own competences and concentrates them on its segments of the value-chain.

VO enables overcoming of different obtacles and activity limits – activities of the organization in its environment (between the organization and environment) and internal organizational activities (between the organization and its parts). The basic specifics of the virtual phenomena, which arise between the organization and the environment are: a network of legally and economically independent companies, focusing on key competences and extensive outsourcing (best-of-everything-organization), co-operation by vertical and horizontal structures, connection by information and communication techniques, and common appearance of company parts outward [23; 24; 25; 26].

Basic specifics of virtual phenomena, which arise inside the organization, are: blurring task and responsibility fields, target covering of the responsibility field, many-fold work of single co-workers, forming of the organization structure after the process, and satisfaction of needs and demands of a costumer [23; 24; 25; 26].

The important positive consequences of VOs are: quick reactions to the needs and demands in the environment, specialization on key competence, economics of quantity, use of complementary know-how, better acceptance , and assurance of existence with a long-term coooperation [23; 24; 25; 26].

When we speak of VO, we are speaking either of "organization with virtual elements" or of "virtual organization with tangible elements". The distinction may seem unimportant, but it is not. The continuing presence of the tangible world in VOs means, that managers also must continue to learn and practice the basic management skills as well as to learn the new skills, required when dealing with VO as their environment.

An organization cannot be transformed into a VO without innovating ethics and behaviour of decision makers and other VO participants. For this reason it is reasonable to research at least two viewpoints and meanings of the VO: 1) ethical characteristics of modern organizations as the starting points for determination of the ethics of the VO, and 2) implementation of approapriate ethics in the process of transforming traditional tangible organization into VO.

3. New Ethics as a Precondition for VO

But: what is ethics? In general terms ethics enables us to distinguish right from wrong [29; 15; 30; 14]. Empirical researchers consider ethics as a synergy of behaviors, which tend to be preferred in a society or community, as a social group, for long enough periods of time to come to be somewhat codified wrong [16; 17; 23; 18; 19; 26].

Individual values	→	Culture of a group sharing the prevailing values
↑		↓
Norms & rules reflecting ethics	←	Ethics on what is right and wrong behavior

Figure 1 - Circular interdependence of values, culture, ethics, and norms

Moral and legal rules co-create acceptable values, ethics and a culture, be it for social sub-groups, for organizational units, for entire organizations, or groupings of regions, nations, social classes, professions. Thus, something, which is originally an individual attribute, comes to be objectified as a component of the objective conditions (i.e. external to single individuals). It becomes a part of broader requirements imposed on the individuals, and tends to return, in this way, back to individuals, as a part of their values, i.e. their emotional perception of the objective needs or requirements they face. Thus it enters (or re-enters) the individual's starting points; their re-entry influences perception, definition of preferences, their realization in the form of goals, and later on as tasks, procedures for realizing the tasks etc. It means that for any human activity ethics is equally essential as professional knowledge and skills. We have in fact found all three (ethics, knowledge, skills) to be mutually interdependent wrong [16; 17; 23; 18; 24; 19].

Modern ethics – ethics of interdependence - provide for reliability: partners can depend on fellow partners who behave ethically – requisitely holistically. In economic terms reliability has great value. It has not always been this way. Our own practical experience tends to confirm the observation made by different authors [29; 30; 14]. They saying that researchers find that the ethical norms have been changing in an evolutionary process based on the interplay of biological and cultural factors. This finding may hold true and explain many things, some of which may be quite relevant in the context of this contribution. Ethics is critical information leading to growth or diminishing of holism of thinking, decision making and action.

4. Ethics of Interdependence and VO

The above discussed facts about understanding and implementation of holism-supporting ethics of VOs apply to creation and usage of modern ethics – e.g. ethics of interdependence of virtual organizations wrong [23; 25; 26]. Ethics of interdependence is a necessary foundation for VO. Why?

1) VOs are based on co-operation of legally independent, but economically interdependent organizations, which network due to their shared interests and agreement aimed at a rather longer-term co-operation, rather than being bound together in a legal formalization. This fact is also the basis for the process of conceptualization and formation of their values / culture / ethics / norms. In addition, in VOs ethics is impacted by the fact that there is a lack of legal means for regulation of the mutual relationship of its member organizations: a requisitely holistic contemporary ethics – the ethic of mutual reliability – of all of them may be the main or even the only means left to establish a requisitely holistic functioning of and behavior in VOs. Thus, the initiator-builders of VOs invite only those organizations to co-operate with them that meet these two basic criteria at the same time:

- they are capable of performing the required activities within their competencies and with their endowments/assets, and
- they have demonstrated requisitely contemporary ethics in their recent history.

Hence, in the phase of constructing VOs, ethics represents a decisive criterion for selection of potential participants and is based on the insight into their ethics of so far, reflecting trustworthiness.

2) Both the existence and the development of VOs are based on a requisitely holistic understanding and implementation of the ethics of interdependence in their functioning and behavior. In economic terms, this diminishes VOs' cost considerably, because mutual control is much less necessary, co-operation is much more based on mutual trust, agreements are hence attained more quickly, which may diminish time to market, etc.

- In the internal relation of VOs, attainment of business results depends essentially on the co-ordination and fulfilling of the accepted obligations by their individual members. This makes the final outcome depend on the ethic of interdependence of all of them in the co-operation chain, supply chain, and profit chain. At the same time, one must take into account that obligations of every particular participating member are subject to his or her or their free will and agreement. Reliable partners function according to contemporary ethics standards. If these obligations are not met, the main penalty is the loss of trust in the unreliable partner by the other partners in the business environment, because unreliable partners lack a basis of contemporary ethics for their functioning and behavior.

- On the other hand, the entire VO also depends much on its own contemporary ethics, which is an indicative factor determining its role, importance, trustworthiness, creditworthiness, and image in the market. Potential business partners prefer avoidance of the avoidable cost, including the cost of double-checking of a potential partner's trustworthiness, of course. A VO may be found less reliable, because it is made of a network of legally independent members that may in principle break up any time. Thus, a VO's care for nurturing of the contemporary ethics in its relations to its customers and potential cooperators must be a lot more intense and requisitely holistic. Simply, it is judged and selected as a business partner on the basis of its public image as a very reliable one and this selection is much more stringent than in traditional organizations. The potential business partners react to any mistakes very quickly, which may be very painful for VOs. VOs are, the same time, much more vulnerable than the traditional ones; VOs have less command over the assets. Thus, contemporary ethics makes a basic cornerstone for the formation of the image in a social and business environment of the modern kind, in which a total or even a systemic quality is required and comprises suitable cost, quality, range, uniqueness, and care for the natural and social environment, including social responsibility.

Resulting questions include this one: where is the connection between ethics and more holistically formation of VOs. The role and importance of ethics depend on two basic issues:

- How do we, first define, and then assure requisitely holistic (content and methodological) support for cognition, implementing and control of ethics in practical behavior;
- How do we, first define, and then understanding ethics as a starting component and/or characteristics of the process of a creation and implementation for more holistically ethical support of VO?

Unfortunately, these issues have no rook to be considered here and now.

5. Concluding Remarks

VOs enable organizational and/or individual core competencies to be brought together when needed, and disbanded when no longer required. Business operation of VOs can be significantly improved mainly in the field of management. An important viewpoint of management is covered by the information support of its ethics.

Basic problems of the formation and of the application of examined ethical support include the requisite holism of the knowledge about the business situation and trends, about the object of business (content knowledge), about the methods (knowledge of methodology), and about the values, culture, ethics and norms.

Modern ethics supports reliability, trustworthiness. This applies to VOs to a high degree and requires a requisitely holistic information and communication support for decision-making and action. Some important starting points for its creations are: creation of information support on the basis of Soft Systems Theories, understanding and implementing of the Law of requisite holism for the definition of information and communication support, and use of ethics of interdependence for the creation of information and communication support to VOs (and the functioning of VOs in general). These starting points supply a practical basis of reliability.

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INFORMATION SYSTEMS/INFORMATION TECHNOLOGY OUTSOURCING USAGE IN SLOVAKIA IN 2003-2006

František Sudzina [1]

The article discusses information systems/information technology outsourcing usage in Slovak companies in the period of 2003-2006. It is based on a research, which was conducted four times within this time period. The size of the company, as an independent variable, was measured in number of employees. Besides the effect of year and size of a company, we tested also the monotonicity in data. This was done in order to test whether the decline in IS/IT outsourcing usage is present also in Slovakia.

1. Introduction

Outsourcing can be defined as the transfer of any business function from one organizational entity to another. Outsourcing is not new and is not restricted to information systems/information technology (IS/IT). However, its increasing acceptance as an alternative to in-house IS/IT development and the use of IS/IT propelled IS/IT outsourcing to be a significant component of an organization's IT strategy. Ever since Eastman Kodak announced their outsourcing contracts with IBM, Businessland and DEC, large companies have found it acceptable to transfer their IS/IT assets, leases and staff to third party vendors. Companies that have followed Eastman Kodak's example include Continental, Enron, First City, Freeport McMoRan, Hibernia, American Standard, National Car Rental, First Fidelity, American Bankshares, Farm Credit Bank, Copperweld, and Cypress Minerals to name a few.

Outsourcing has gained considerable management attention since the 1980s. Traditionally, many non-core, information technology (IT) activities, such as desktop support, call centers, network operations, and application development have been relegated to external service vendors. Recent

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years have seen burgeoning business process outsourcing (BPO), which involves farming out non-core yet mission-critical business processes such as finance and accounting, human resources, and customer support to third-party service providers. IT largely enables the provision of such services, through web-based interfaces, extensive application support with commercial package software, such as SAP, and reliable network connections. With the promise of reduced cost, improved time to delivery, process streamlining, and strategic repositioning, many organizations have jumped onto the outsourcing train. British Petroleum's outsourcing of finance and accounting to Accenture, for example, helped to speed up its post-merger integration of Amoco and Arco. Forecasts by the Gartner Group project strong growth in worldwide outsourcing spending. The IT outsourcing market continues to rise and is expected to hit $260 billion in 2009. Similarly, the current BPO market is estimated to climb from $111.3 billion in 2004 to $172 billion in 2009, growing at a per-annum rate of close to 10%.

The article discusses IS/IT outsourcing usage in Slovak companies in the period of 2003-2006. Probably the first research of IS/IT outsourcing was [16]. The article is based on a research, which was conducted four times within this time period. Unlike the research conducted by PC Revue [9], this research took into the account also company size. Besides the effect of the year and the company size, the monotonicity in data is also tested. At the end, directions of future research are outlined.

2. Data and Methodology

Data on information systems/information technology outsourcing were gathered by questionnaires. Research was conducted in years 2003 (results were presented in [7]), 2004 (results were presented in [8]), 2005 (results were presented in [17]) and 2006. The research sample consisted of 234 (105 small, 74 middle and 52 large) companies in 2003 (and 3 companies had not supplied number of employees), 356 (208 small, 76 middle and 69 large) companies (and 3 companies had not supplied number of employees) in 2004, 235 (145 small, 52 middle and 38 large) companies in 2005 and 78 (38 small, 19 middle and 21 large) companies in 2006. So, the dependent variable is outsourcing usage coded as 0 for not using it and 1 for using it. The independent variables are the year and the size of the company. The size of the company was measured in number of employees (small companies having 1-50, midsize companies having 51-250 and large companies having over 250 employees).

Logistic regression is used to measure the effect of the company size and the year. (It represents the multivariate approach compared to bivariate approach which could be done by repeated testing using chi-square test or Fischer-Freeman-Halton (exact Fischer) test.) Besides the effect of year and size of a company, the monotonicity in data is also tested. This is done in order to test whether the decline in IS/IT outsourcing usage, which is now discussed in the Western countries, is present also in Slovakia. This is done separately for each company size. Statistical tests and confidence intervals are calculated on confidence level α = 0,05.

3. Results

Answers to the question about IS/IT outsourcing in Slovak companies in 2003, 2004, 2005 and 2006 are presented in Table 1, Table 2, Table 3 and Table 4 respectively. Tables also present percentages of positive answers and relevant confidence intervals.

Table 1 - IS/IT outsourcing usage in Slovakia in 2003

Company size	yes	no	percentage	confidence interval
small	22	83	20,95 %	⟨13,62 %; 29,99 %⟩
medium	17	57	22,97 %	⟨13,99 %; 34,21 %⟩
large	12	40	23,08 %	⟨12,53 %; 36,84 %⟩

Table 2 - IS/IT outsourcing usage in Slovakia in 2004

Company size	yes	no	percentage	confidence interval
small	67	141	32,21 %	⟨25,92 %; 39,02 %⟩
medium	37	39	48,68 %	⟨37,04 %; 60,43 %⟩
large	30	39	43,48 %	⟨31,58 %; 55,96 %⟩

Table 3 - IS/IT outsourcing usage in Slovakia in 2005

Company size	yes	no	percentage	confidence interval
small	14	131	9,66 %	⟨5,38 %; 15,67 %⟩
medium	14	38	26,92 %	⟨15,57 %; 41,02 %⟩
large	10	28	26,32 %	⟨13,40 %; 43,10 %⟩

Table 4 - IS/IT outsourcing usage in Slovakia in 2006

Company size	yes	no	percentage	confidence interval
small	4	34	10,53 %	⟨2,94 %; 24,80 %⟩
medium	6	13	31,58 %	⟨12,58 %; 56,55 %⟩
large	14	7	66,67 %	⟨43,03 %; 85,41 %⟩

According to the data gathered in this time period, there are significant differences in IS/IT outsourcing usage. The company size is clearly a categorical independent variable. If we consider the year to be a numeric independent variable, then the model acquired by logistic regression is statistically significant (p-value = 0,000142). IS/IT outsourcing depends only on the company size (p-value = 0,000050), not on the year (p-value = 0,641655). If we consider the year to be a categorical independent variable, then the model is also statistically significant (p-value = 0,000000). IS/IT outsourcing depends on both factors - the company size (p-value = 0,000015) and the year (p-value = 0,000000).

Percentage of IS/IT usage according to the company size and relevant confidence intervals are presented in figures 1 to 3.

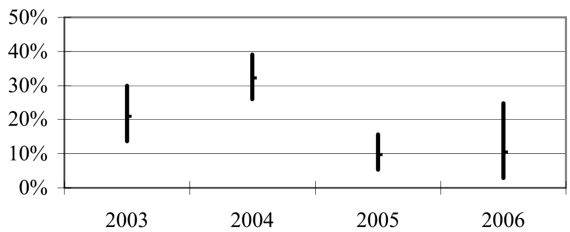

Figure 1- IS/IT outsourcing usage in small companies

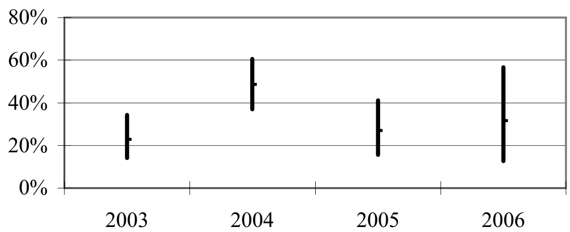

Figure 2 - IS/IT outsourcing usage in medium companies

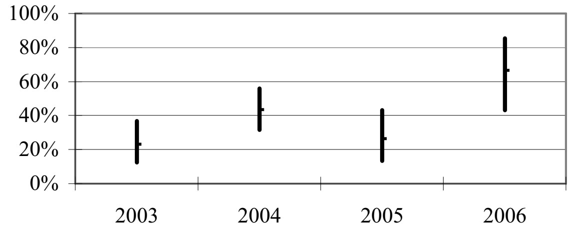

Figure 3 - IS/IT outsourcing usage in large companies

A chi-square test [2], [1] was used to analyze different company sizes separately. Scores 1 to 4 were used to mark time periods. As for small companies, the p-value of total chi-square is 0,000002, of chi-square for linear trend is 0,001677 and of remaining chi-square is 0,000076. As for medium companies, the p-value of total chi-square is 0,005611, of chi-square for linear trend is 0,586014 and of remaining chi-square is 0,002140. As for large companies, the p-value of total chi-square is 0,001501, of chi-square for linear trend is 0,012187 and of remaining chi-square is 0,010449.

Although IS/IT outsourcing should help companies to concentrate on the core business, according to the data, it seems that the highest IS/IT outsourcing usage in Slovak small and medium companies was in 2004 and dropped afterwards. They are gradually insourcing what they, in the past, thought that they rather outsource. On the contrary, large companies seem to adopt IS/IT outsourcing still more and more.

To sum up, Slovak companies behave similarly in the area of information systems/information technology outsourcing as their Western counterparts.

4. Future Research

One of the things that was discovered during the research was that managers are not well informed about pros and cons of IS/IT outsourcing. So, the future research should concentrate on IS/IT education as well. It is discussed e.g. in [10].

There are several challenges in the implementation of IS/IT outsourcing. An action research in data warehousing implementation and its outsourcing was conducted in Solectron [15]. There are some outcomes that may apply to IS/IT outsourcing in general. Lessons learned were:

1. Create performance-based measures prior to data warehouse vendor selection

2. On-going metrics tracking is required for success

3. Outsourcing organizations should continue to staff internal experts and personnel to support the outsourced function

4. Pay close attention to data quality and integration

5. Use a committee to drive critical processes

It might be interesting to conduct a research to understand what factors are used by Slovak companies to choose ASP vendors. A research on this topic was done in the U.S. [11]. In total, 35 respondents from 11 firms participated in the survey. They suggested 128 criteria out of which 15 were chosen for later evaluation. Frequency table is presented as Table 5.

Table 5 - Criteria used for ASP versus in-house

No.	Criteria	Frequency
1	Budget and cost constraints, both initially and for the life cycle	28
2	Time constraints, including development and deployment	20
3	Location of qualified IT staff (internally vs externally)	13
4	Criticality of application – is it strategic?	11
5	Characteristics of the ASP company (Credibility, financial viability, their experience)	9
6	Availability of a relevant product	6
7	Security of ASP	6
8	Functionality and quality of application offered by ASP	6
9	Availability of internal resources other than financial or personnel	5
10	Knowledge of the industry (exist internally or externally)	5
11	Size/complexity of application	4
12	Support offered	4
13	Risk analysis of implementation and technology needed	4
14	Compatibility with infrastructure	4
15	Ease of modification/scope changes/flexibility of application	3

In further examining of the 15 criteria, eight major factors were found that helped to explain ASP choice. The criteria were categorized into eight major factors as follows. (1) The first criterion – budget and cost constraints – clearly is an economic cost consideration, which we see as a key factor influencing transaction cost considerations. (2) When a company has time constraints to implement an application, it has to find the necessary resources within the given time constraints. If a company can find the necessary resources to develop and deploy an application, it need not opt for an ASP assuming all the other conditions are also favorable for an internal solution. Therefore, the second criterion – time constraints – is directly related to resource requirements and time constraints is placed in the category of resource requirements. (3) A company would seek knowledgeable IT professional only after evaluating the knowledge requirements of an application. Therefore, the third criterion – location of qualified IT staff – under IT application knowledge is their third factor. (4) The strategic benefits of a company directly fall under the need to be competitive. Therefore, the fourth criterion – criticality of application – is placed under a factor called competitiveness. (5) Companies also listed several criteria concerning the availability of resources in the external environment. The respondents expressed their concern about the characteristics of the ASP (fifth criterion), the security offered by the vendor (seventh criterion), and the support offered by the ASP (12th criterion). These three criteria are related to the task environment and this became the fifth factor. Additionally, respondents listed the 'availability of a relevant product', the 'availability of more specific functionalities from the ASP', and the 'ease of modifications and flexibility of the available applications'. Therefore, it was decided to also include these three criteria (sixth, eighth, and 15th) in the task environment as they also come from the external environment. (6) Some respondents listed availability of other resources such as facilities (e.g. physical and computer), and which do not fall under the categories of direct financial and personnel resources, as important criteria. These were considerations of internal resources; therefore, the ninth criterion, the availability of internal resources, was placed into a sixth factor called other resources. (7) In addition to IT application knowledge, the knowledge of the industry was also considered essential. If an ASP does not possess appropriate knowledge of the industry, the client company would face the risk of not receiving the necessary expertise from the vendor. Therefore, the 10th criterion, the knowledge of the industry, was placed under a knowledge risk factor. Similarly, the risk analysis of implementation and technology needed (the 13th criterion) is also directly related to knowledge risk so it is included in this factor. (8) The size and complexity of the application (the 11th criterion) is important from the point of view of the ease of integration with the other applications as well as with other activities done by the vendor or the client company. A similar concern is expressed by the 14th criterion, the compatibility of the application with existing infrastructure. Therefore, we placed both the 11th and 14th criteria under a factor called integration requirements.

The following problem is then IS/IT outsourcing management and its extent. According to [6], the more of the process an outsourcing organization conducts, and conducts well, the greater its success, regardless of its outsourcing objectives. Other problem is connected with incentives and how they are to be set. This problem is discussed e.g. in [5] and [12]. This is closely connected with flexibility in IS/IT outsourcing. This topic is discussed e.g. in [19]. It is connected with property rights. E. g. [22] examines the question of how intellectual property rights in the software created during IS/IT outsourcing relationships should be divided. This paper assumes that, with respect to software, it is possible to separate excludability rights from usability rights. The results show that the best contractual structure depends strongly on the environment.

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Enterprise Application Integration
- Need, Concept and Solutions -

ENTERPRISE APPLICATION INTEGRATION –NEED, CONCEPT, SOLUTIONS–

Maria Raffai [1]

Nowadays the need for interoperation of the independently existing enterprise computing systems has become the main problem of the IT experts. The so called island applications use own data-files, they run on different platforms, and usually do not have any connection to each other. There is not any communication between these subsystems, it is difficult to maintain the data files, and the state of the data-bases is also different. The data transfer is mainly human directed, which means that in most cases the users first have to print and then in another workplace input the data manually in order to transfer them from one subsystem to another, or use a data store such as floppy or CD for carrying data.

In order to improve this situation many industrial solutions such as communication protocols, network technologies and system integration methodologies have come to light. The main concept is a structured approach: it is the Enterprise Application Integration (EAI) what has produced increasing importance in the last Years. It is defined as architectural principles of software and computer systems to bring together (integrate) a set of enterprise computer applications and to give the opportunity for incorporating the point-to-point connections grown up across an organization. The EAI involves the system of systems; it solves the large scale inter-disciplinary problems with multiple, heterogeneous, distributed systems embedded in networks at multiple levels. The Enterprise Application Integration is based on the middleware technologies (such as message-oriented middleware) and the data representation technologies (such as XML). These technologies involve also web services as a means of integration. In the near future it will intend to include content integration and business processes as well. But the EAI is not just about sharing data between applications; it focuses on sharing both business data and business processes.

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In the session Enterprise Application Integration I recommend to discuss the concepts, methods and last but not least the standardized techniques and technologies having been developed for integration. The proposed topics:

- *some terms related to the theme: island applications, automation, communication protocols, enterprise service bus, system of systems, inter-disciplinary, heterogeneous platforms, distributed systems, networks at multiple levels, middleware technologies, message-oriented middleware, data representation technologies, web services, service-oriented architecture etc.*
- *main concepts: abstraction, models on different levels (CIM, PIM, PSM, PSI), object orientation, reusability, visualizing techniques, executable transformation tools,*
- *standards: middleware standards, common warehouse metamodel (CWM), model driven approach in application development process (MDA), unified modeling languages (UEML, UML, xUML etc.),*
- *automation tools: for supporting design, for transforming models, for generating codes, for creating and publishing design patterns (e.g. xUML tools), libraries for reusing model elements and components,*
- *risks and difficulties: problems IT-experts have to face using new and yet unknown technologies.*

As the application integration is the most actual problem of IT, there is an urgent need to discuss the related themes and opportunities, so I call the participants of the IDIMT'2006 to represent and demonstrate the following solutions.

1. The Need for Enterprise Integration

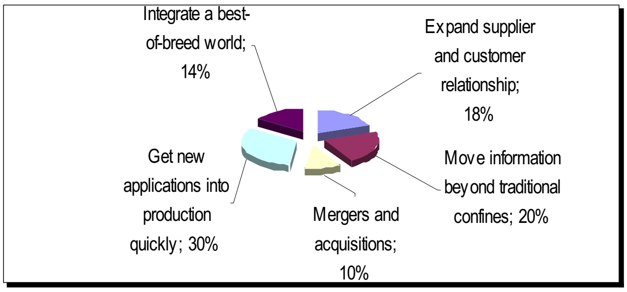
The enterprise integration is not a new problem. From the very beginning of computing using only mainframes at that time, there were already efforts made to synchronize information across the organization. As the networks and the personal computers had become general by the end of the seventies, the access to information was getting more complicated, and then new expectations arose all over the enterprises and beyond. At first step of computerization the organizations developed software only for supporting one functional business field. These so called stand alone systems had not any connection to each other, the business unit interaction with these subsystem applications had been running in most cases on different platforms, were occasional, the lack of interoperation hindered and made difficult the timely decision-making both on the operative and management levels. The separately and redundant stored data and/or databases were differently updated, therefore they represented other data states. By the end of the eighties there was already a pressing need for integration.

1.1. Challenges

Presently the enterprises have to face the challenge of the increasing system complexity and the strong competition in a software-intensive business environment, and after all they are also challenged to exploit new technologies while reducing costs, improving quality and responding faster and faster to the continuously renewing facilities. Electronic commerce, global markets, business-to-business communication, enterprise portals, Internet-based business transactions and services require fundamental changes. The (r)evolution process is already irreversible; the information technology has more and more progressive influence on the organizations, the intensity of their impact is unbroken increasing. These facts force the managers to lay investment into the computing technology, to use the latest improvements and solutions of IT and form the other side to urge the specialists responsible for the application development to create effective, well adaptable, easy changeable and intelligent solutions in order to satisfy the increasing user's demand. The challenge is to make the existing and the newly developed applications manageable, to ensure the interoperability of the different software systems. As the number of packaged applications running on different platforms (the so-called legacy systems) is increasing within the enterprise they cause more and more overlapping functionality and duplicated information, and moreover use multiple resources to solve similar problems.

From another aspect the demand for using business-to-business integration adds a new dimension to the complexity. The integration problem must now address not only to the disparate systems and data formats, but also to the differences between the enterprise's systems and the B2B message formats. The inter-organizational cooperation from the standpoint of the computer systems is fluid, the partnerships undergo continuous change therefore the companies are virtually forced to merge their island systems by extranets.

But this is an enormous challenge! As the computer industry is always looking forward to improve the software and even the application development productivity as well as the quality and the longevity of the created products, the organizations are under permanent pressure to invest into the new information technology. By the end of the nineties it was already high time to give solutions for integrating the separated island systems and also for the legacy and newly developed –either being user specific or commercial– software across the enterprise (see Figure 1).



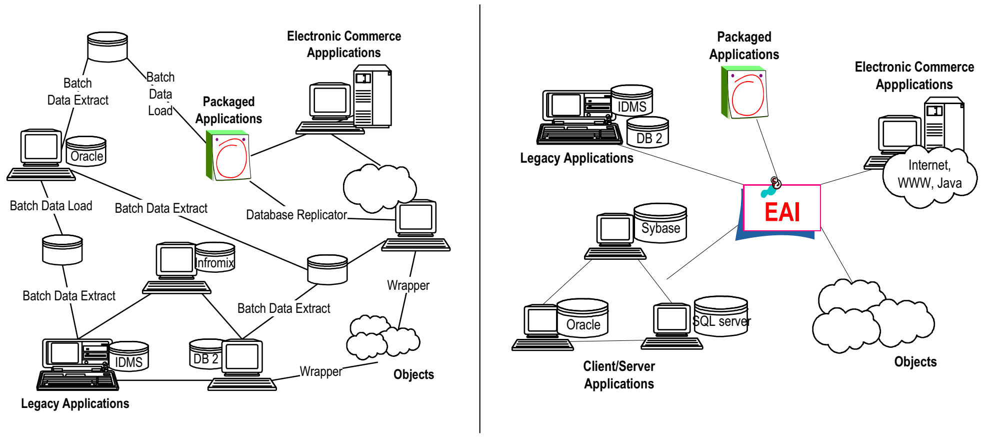
Source: AberdeenGroup, 1998.

Figure 1 - The need for application integration

1.2. Systems on different platforms

The current enterprise applications have been developed to solve specific business problems/functions of different organization units in order to achieve productivity improvement. During many years of information processing evolution several software packages have been installed to different platforms and used as isolated subsystems without electronic connection. The databases were not shared and the systems could be connected only with manual data transmission (information lists printed on paper sheets or data files on floppies), that complicated the processing flow and increased the response time, therefore the users could get the required information only with delay. The top managers have difficulties in getting information about how business is running, and also in analyzing the problem space.

The application development process has resulted also the fragmentation of systems, because of using new IT technologies. As the software implemented in the old systems were running totally correct, and as the old infrastructure satisfied the users' requirements, the leadership of the major organizations was not willing to remove the well running systems in order to change for an up-to-date but very expensive technology. But as time goes on these legacy systems have become more out of date and it was difficult to operate or integrate the subsystems because of the changes in technology and also changes in business operation that reflected in the newer system. As the Internet, the on line electronic solutions such as e-business, e-commerce, and even the m-solutions and the global marketplace are forcing the change, so there is an increased need to improve the organization functionality as a whole (see Figure 2).



Chaos in supporting IT-solutions EAI technology to bring order to enterprise Source: [8]

Figure 2 - Chaos and order within the enterprise

1.3. Enterprise Integration Objectives

Behind the world of enterprise integration we understand a complex flow *from* discovering and analyzing a problem *through* designing the system *to* implementing the appropriate technology. In order to specify the main target of developing correctly and managing information systems it is necessary to see, that the organizations require interacting solutions

- new and old (traditional or legacy),
- custom and off-the-shelf and even
- internal and external systems.

This also means that the enterprises need to define the exact goals of integration otherwise they can not meet their business requirements. Without specifying the aims it is impossible to improve the integration process effectively. Studying the publications written in the theme of enterprise integration it should be stated, that it is a complex activity that uses IT technologies in order to support problem solving. During the last several years the application integration has been driven by a number of emerging development projects that have included

- the need to expose the existing information to the Web,
- the need to participate in electronic marketplaces,
- the necessity for integrating supply chain, and
- the enabling the existing enterprise systems to share information and common processes.

2. Integration, Enterprise Integration

In order to understand the term of integration, first we have to interpret it's meaning in general:

Integration (derived from the Latin world *integer*, meaning whole or entire) generally means: combining parts so that they work together or form a whole. In business and in information technology the terminology of integration can be interpreted in different ways. You can find the following definitions [11] , [11] :

- Integration during product development is a process in which separately produced different components or subsystems are combined and where the problems in their interactions are addressed.
- Integration is an activity by companies that specializes in bringing different manufacturers' products together into a smoothly working system.
- In marketing usage, products or components said to be integrated appear to meet one or more of the following conditions:
- they share a common purpose or set of objectives,
- they all observe the same standard or set of standard protocol or they share a mediating capability, such the ORB in the Common Object Request Broker Architecture {C(ORB)A} and
- they are all designed together at the same time with a unifying purpose and/or architecture.

This means that they may be sold as piece-parts but they were designed with the same high-level objectives and/or architecture.

2.1. The Term Enterprise Integration

Having the enterprise integration in sight and focusing on applications it is important to restrict the above given definitions. In this sense Gartner' definition seems to be the most appropriate one as follows [10] :

The enterprise integration is an emerging category of products that provide messaging, data transformation, process flow and other capabilities to simplify the integration of enterprise resource planning, legacy and other applications (GartnerGroup Inc. Glossary: www.gartner.com).

In other worlds the enterprise application integration is the creation of new strategic business solutions by combining functionality of an enterprise's existing applications, commercial packaged applications and new code using a common middleware [6] . In this sense the integration is becoming a core enabler of business agility. Although integration technology was originally created as a burden of coding interfaces between systems, the nature of integration problems has changed a great extend in the last decade. Today, integration is not a technical issue anymore; it is not only an efficient tool to solve the communication problems between different subsystems. The focus of integration solutions is already much more business oriented, therefore the integration technology provides

- enabling infrastructure for the different enterprises,
- serving applications for employees and customers, such as supply chain integration and mobile applications;
- enabling a unified view of the customer-customer relationship management and call center operations;
- optimizing business processes and managing them in real time and last but not least
- implementing packaged industry and compliance solutions.

Studying the force power and the technological background of integration it has to be stated, that the IT market is very rich in supply, there are several suggestions for designing and implementing integrated architectures. But in most cases the integration technology is not a one-size-fits-all proposition. Just as in the business solutions there are different requirements, there are also countless technologies available on the market. Moreover, companies will not gain the business agility; they seek reusable infrastructure services on new projects to implement a solution quickly and efficiently. But sorry to say, the concept of integration → enterprise integration, business integration, process integration and/or application integration is starting to be a jargon that is gradually going to be very, in some cases too popular. The topic and the terminology of integration is overloaded to the point where the words have no longer their clear meaning. But the significance of integration is inherent in solving strategic and tactical needs by applying the most appropriate business processes, architecture and technology. In this context the companies can create entire enterprise integration architecture with implementing tactical solutions.

2.2. The Integration Process

As it was discussed before the basic concepts of the enterprise application integration is to give a possibility for different business systems to communicate with each other in order to share processes and data. But how is it possible to link systems on different platforms which would like to understand a message or document wanted to be sent in another form? To achieve and realize the target of integration, to accomplish the inter-organizational connection standardized service-oriented middleware technology and also other standards are needed. From the approach of the complex and challenging application integration process, it should specify more phases or steps.

For the EAI process David S. Linthicum defined a detailed lifecycle model by executing the following steps [8] :

1. understanding the enterprise and the problem domain
2. definition and specification of the problem space, leverage forward-looking concepts and technology,
3. determination of the requirements,
4. creation a logical application integration architecture by identifying the data and the business processes:
    - data-definition
    - process integration
    - creation of the common business model
    - leveraging patterns for method level EAI
5. identifying application interfaces with defining the dictionary
6. identifying the business events and object states
7. specifying the schema- and content transformation scenarios
8. mapping information movement

9. designing and implementing an infrastructure where the applications on different platforms (legacy, newly developed and purchased systems) can interoperate through the organization.
    - applying technology
    - testing, testing, testing
    - considering performance
    - defining the value
10. creating maintenance procedures.

The Figure 3 shows the whole process of enterprise integration.

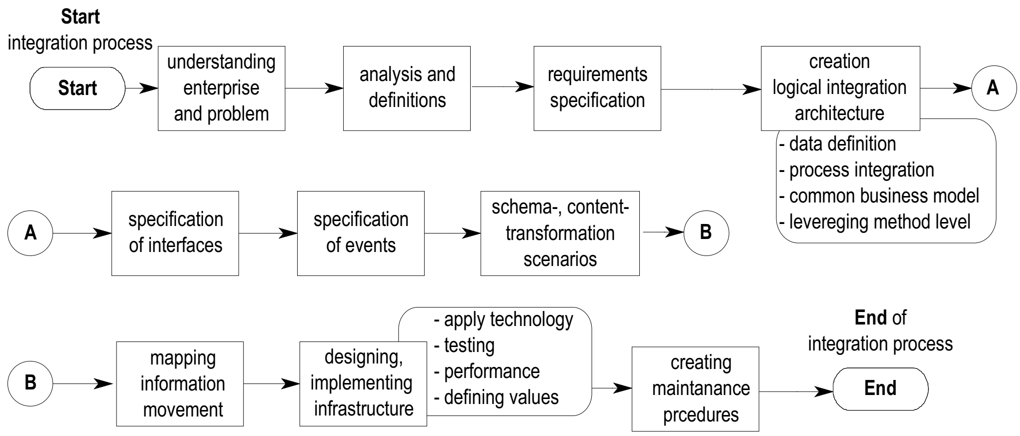


Figure 3. The Enterprise Integration Process

2.3. Virtual Enterprise Integration

From the turn of Millennium the Information Society has been forming and in this developing process the virtual enterprises play very important role. In this sense the virtual enterprise integration is both a technological and organizational perspective that addresses itself to the pressing research and development issue, which is the most-advanced organizational paradigm. It is characterized as a dynamic agile network of independent enterprises sharing all resources, including knowledge, market and customers that aim to be permanently aligned with the highly demanding and global dynamic market. The issue of integration is the critical success factor in creation, reconfiguration and operation of a virtual enterprise as it is a direct interaction among partners who use connected heterogeneous computer resources working together effectively and efficiently in networks. The problem of integration is already multidimensional and one of the most difficult one to solve and manage.

3. Integration Technology and Implementation

Making hard efforts to accomplish enterprise integration we have to face the implementation problems, as the lack of application integration architects is driven more by hype around the emerging standards and technology and less by their business needs and technology requirements. The end result is many failed projects, mostly due to the lack of knowledge and even the lack of technology. But as the integration is mainly the understanding the requirements and future growth of the problem domain, it is more of an all-encompassing concept, consisting of, but not limited to metadata, business logic, interfaces, performance management, business processes, workflow, information processing, database integrity, standards strategies, vertical subsystems, accountability, application design, and middleware technology. Consequently the application integration is not only the technology and a set of strategic activity but it can enable an organization to be run by more efficient applications ending in most cases in significant competitive advantage.

3.1. Implementation Tools

The forces for enterprise integration will enable the entrepreneurs and the developers to capitalize on current and future technologies. The first step to enterprise integration is to model the organizational architecture domain, to define the integration objectives, providing general enterprise integration architecture and then to map the technological opportunities/issues. For implementation the architecture there are several technologies and standards, such as

- Extensible Markup Language (XML) for document exchange and electronic signatures
- middleware models, tools and standards (XML/XMI, XSTL, COM+, EDA/SQL, Java-based tools, SOAP, WSDL, UDDI and others [9]),
- different business systems' messaging and communication solutions/services (e.g. ebXML),
- innovation processes followed by model driven concept (MDA [5]),
- component-based, rapid application development methodologies and tools (e.g. EJB, middleware standards),
- workflow management systems for process automation and streamlining,

- Web accessibility and Web service provider solutions for electronic commerce and supply-chain integration UCCNET, ROSETTANET),
- security and public key infrastructure (PKI) for supporting security, protection from hackers by digital signature, encryption and last but not least
- ontology for realizing application integration.

3.2. Data Warehousing

During the last years the enterprises have piled up many different data files had been stored in different database systems. The inactive data from the past are very useful for analyzing tendencies, preparing and making decisions, and together with the day-to-day operating information it serves as a basis of business strategy. But the different files are rarely in a manageable form, usually it is impossible to access to all of the information with a unique program. The requirement for a common system that provides database consistency and integrity forced the IT professionals to develop data warehousing solutions. These are special tools that integrate the historical data coming from multiple sources stored in different database form and on different storage media.

4. Conclusions

The enterprise architecture makes possible to design and create integrated systems of high level by knitting the preexisting islands together. This is an effective way nowadays to satisfy user's requirements, rather than to develop new enterprise applications and/or components. But under the pressure of necessity on reaching low production cost, high quality of enterprise-centric computing, the software industry and the professionals have to face the more and more increasing challenges. Anyway the enterprise integration architecture provides an efficient framework in which the effective legacy systems in cooperation with the newly developed software can continue their function on a very effective and competitive way without any loss of human, material and technological resources.

The enterprise wide application integration brings a real revolution into the software development process, in other words: the paradigm, the methods and the tools of the development is radically changing. But we have to take into consideration that the effective solutions for the integration and for the automated model transformation do not mean the end of methodology war! We are now at the cradle of a paradigm shift, and in the near future we will be the witnesses of a fundamental change in the software development procedures and the applied solutions.

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PLATYPUS : A STEP-BASED INTEGRATION FRAMEWORK

Alain Plantec,Vincent Ribaud [1]

STEP is an ISO standard (ISO-10303) for the computer-interpretable representation and exchange of product data. Parts of STEP standardize conceptual structures and usage of information in generic or specific domains. The standardization process of these constructs is an approach which can be applied to a data-based integration.

Platypus is a STEP-based meta-environment. From the data integration point of view, the STEP technology is primarily used for management. A key point is the automatic generation of a SDAI (a functional interface for STEP-modelled database independently of any particular system and language). Then, at the end of the complex process of defining standardized conceptual structures for the applications to be integrated, the STEP framework will provide a seamless access to data of different applications. Moreover, Platypus can be used to the development of a specific meta-environment intended to solve specific problems related to the legacy and new systems to be integrated.

1. Introduction

D. S. Linthicum states that the need for a method of integrating disparate applications in a unified set of processes has emerged as a priority [1]. For a long time, a key issue in computer-aided software engineering (CASE) environments has been the desire to link tools that address different aspects of the development process. A. I. Wasserman categorizes five types of tool integration issues that must be addressed. These can be termed platform integration, presentation integration, data integration, control integration, and process integration [2]. Lessons learned from tools integration should be useful for application integration.

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Enterprise Data Integration aims to share data and processing power from very different computer systems. The major benefits of integration are achieved when it is used to support a well-defined business process, but practically it is easier to share a consensus on business data and their usages rather than business processes. Hence, in this paper we address the problem of application integration from the data integration point of view, relying on our experience in CASE environments. We argue that application integration could be issued through a data-based integration process.

STEP is an ISO standard (ISO-10303) for the computer-interpretable representation and exchange of product data [3]. Parts of STEP standardize conceptual structures and usage of information in generic or specific domains. Standardized parts are defined with the EXPRESS language. The STEP design framework and the standardization process are presented in sections 2 and 3.

Platypus is a meta-case tool which embeds within a Squeak system a modelling and meta-modelling environment based on the STEP standard. Models and meta-models are specified with the EXPRESS language. The tools set of Platypus provides a strong support to the standardization process. Platypus together with the help provided to data integration are depicted in section 4.

2. The STEP standard

2.1. Overview

ISO 10303 provides a neutral mechanism for describing product data throughout the life cycle of a product, independent of any particular computer-aided system. ISO 10303 is suitable for file exchange and for implementing, sharing, and archiving product databases. The development of ISO 10303 is based upon the use of information models, a framework for product data modelling, formal data specification languages, and an architecture that separates information requirements from implementation methods.

STEP description and implementation methods

The EXPRESS language [1] is an object-oriented modelling language. The application data are described in schemata. A schema has the type definitions and the object descriptions of the application called Entities. An entity is made up of attributes and constraint descriptions.

The STEP physical file format defines an exchange structure using a clear text encoding of product data [2], for which a conceptual model is specified in the EXPRESS.

The Standard Data Access Interface (SDAI) [3] defines an access protocol for EXPRESS-modelled databases and is defined independently from any particular system and language. The five main goals of the SDAI are: (1) to access and manipulate data which are described using the EXPRESS language, (2) to allow access to multiple data repositories by a single application at the same time, (3) to allow commit and rollback on a set of SDAI operations, (4) to allow access to the EXPRESS definition of all data elements that can be manipulated by an application process, and (5) to allow the validation of the constraints defined in EXPRESS.

References

[1] ISO 10303-11. Part 11 : EXPRESS Language Reference Manual, 1994.
[2] ISO 10303-21. Part 21 : Clear Text Encoding of the Exchange Structure, 1994.
[3] ISO 10303-22. Part 22 : Standard Data Access Interface, 1998.

2.2. The Standard Data Access Interface

The SDAI defines an interface between an application and the environment in which entity instances exist.

From the physical point of view, entity instances are stored into repositories. A repository is a data storage facility and may be implemented in memory, as a single database, multiple databases, a single file, a collection of files, or any other method. Within a repository, a distinction should be made between the different collections of instances (technically called SDAI-models) and schema instances. A SDAI-model is a logical container within which related entity instances exist. A schema instance provides the relationship between an EXPRESS schema and SDAI-models, and then defines the domain over which references between entity instances and rule validation are supported. A schema instance allows applications to have access to the information about the schema defining their data (data dictionary).

The SDAI operations are divided into several categories:

- system-level operations that allow an application to manage the transactions, repositories, …
- data dictionary-level operations that allow an application to manage the association of SDAI-models with schema instances and validate EXPRESS rules and references,
- data-level operations that allow an application to create, manipulate, delete and validate instances.

2.3. An example of a STEP use

In the three-dimensional Cartesian coordinate system, a point P in the xyz-space is represented by a tuple of three components (x,y,z). Any application working with Cartesian points should store points as tuples of three numbers in ASCII, binary or dedicated format. When n applications need a point-to-point communication, n*n pieces of software (format adapters) are required. STEP promotes the use of a standardized interface, able to read/write data in a neutral format. Thus, each application only needs an import and an export component, reducing to 2*n the number of required adapters.

A STEP environment, such as Platypus, provides a standardized management of schemata and instances. Moreover, the implementation of the SDAI in one or several programming languages is a major component of the environment. A re-engineering of an existing application for enterprise integration leads to develop the import/export adapters (depicted in grey on figure 1).

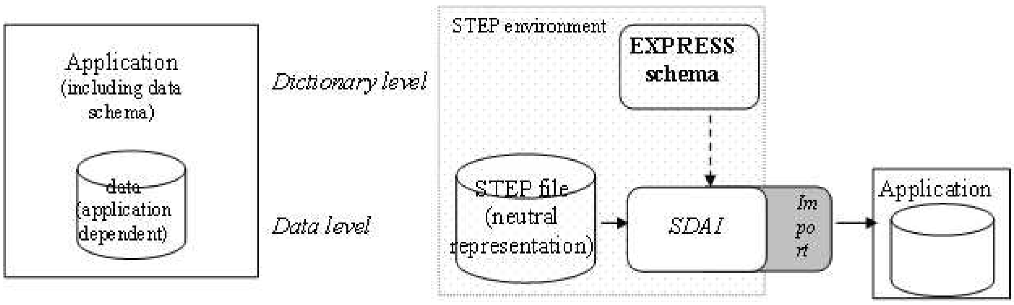

Figure 1 - Application architecture without or with STEP

Without standardized interface, an application holds data in its own data structure. An application using STEP describes the structure of its data in an EXPRESS schema. From this schema, the STEP environment generates a SDAI in the application programming language. The SDAI provides a strong API which helps to develop import (respectively export) component able to read (respectively write) neutral data and load in (respectively extract from) the application.

```
SCHEMA Cartesian_coordinate_systems;
 ENTITY 3D_Cartesian_Point;
    x : REAL;
    y : REAL;
    z : REAL;
    derive
      ρ : REAL:= sqrt(x**2 + y**2 + z**2);
 END_ENTITY;
END_SCHEMA ;
```

Figure 2 - Schema for the Cartesian coordinate system

```
ISO-10303-21;
HEADER;
FILE_NAME('coordinate_systems.step', '25April 2006 4:58:11pm');
FILE_DESCRIPTION((''),'');
FILE_SCHEMA(('coordinate_systems'));
ENDSEC;
DATA;
#1=3D_CARTESIAN_POINT (0.1, 0.1, 0.1);
#2=3D_CARTESIAN_POINT 3D (0.2, 0.2, 0.2);
#3=3D_CARTESIAN_POINT 3D (0.3, 0.3, 0.3);
ENDSEC;
END-ISO-10303-21;
```

Figure 3 - Exchange file for the Cartesian coordinate system

Another application could be reengineered in the same way. If both applications are using the same domain entities, applications can share the same EXPRESS schema which defines common entities, relationships and constraints. Each application is able to import/export a STEP file of instances and agrees on the same semantic of data. Thus, data integration is accomplished through schema sharing and neutral file exchange, as depicted on figure 4.

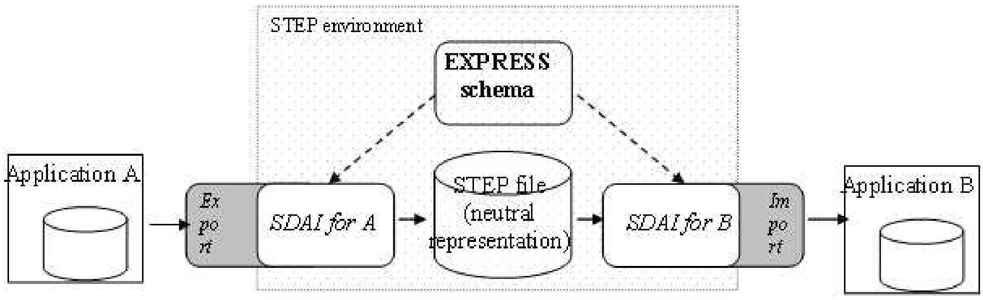

Figure 4 - Integration of applications through schema sharing and neutral file exchange

3. The STEP integration framework

3.1. Role of application protocol

This section is a digest of excerpts from [4].

A fundamental concept of STEP is the definition of application protocol (APs) as the mechanism to specify information requirements and ensure reliable communication. An application protocol defines the context, scope, and information requirements for designated application(s) and specifies the STEP resource constructs used to satisfy these requirements.

The STEP integration framework establishes an explicit architecture for the conceptual models that are part of ISO 10303. This architecture provides the structure for the integrated resources and application protocols. The integrated resources provide constructs that are independent of a specific product data application context.

Application protocols employ three types of models.: an application activity model, an application reference model, and an application interpreted model.

Application activity model (AAM): a model that describes the activities and processes that use and produce product data in a specific application context. The AAM shall be defined in IDEF0, a formal process modelling language [5].

Application reference model (ARM): a model that specifies conceptual structures and constraints used to describe the information requirements of an application. The ARM shall be documented in formalized modelling language such as EXPRESS. Each information requirement has a normative definition.

Application interpreted model (AIM): a model of selected integrated resources which are constrained, specialized or completed to satisfy the information requirements of the ARM. The AIM shall be defined in EXPRESS.

3.2. A conceptual integration framework

An application is related to a domain (such as manufacturing, avionics). Each domain may dispose of one or several application protocols which define the form and the contents of the data used by the business activities of the domain.

The goal of an AP development process is the definition of an AIM. The AIM specification is based on the reuse of generic resources: an AIM is an EXPRESS schema that selects the applicable constructs from the integrated resources as baseline conceptual elements. Then, this schema is specialized with additional constraints, relationships and entities inheriting from generic constructs.

Integrated resources constructs are the conceptual structures and constraints widely accepted in any domain. These integrated resources constructs are interpreted in each application AIM by specifying global rules, for example, to modify optional attributes of entities to be non-existent or mandatory or to constrain entity behaviour; and by specifying subtypes of an entity to specialize the meaning of an attribute, localize a constraint on an entity and so on.

4. Working with the Platypus environment

4.1. Features

Platypus [http://cassoulet.univ-brest.fr:8000/Platypus] is a meta-case tool which embeds within a Squeak system, a modelling and meta-modelling environment based on the STEP standard. Let us depict some features.

A STEP environment. First of all, it is a STEP environment, allowing precise data models specification with STEP/EXPRESS modelling language and implementation of exchange components for models data which are described by EXPRESS models. From this point of view, Platypus is a typical STEP based tools with an EXPRESS editor and checker, and a STEP file reader, writer and checker.

A hybrid data and object oriented development tool. Platypus is implemented inside Squeak, a free Smalltalk environment. Thanks to Squeak, Platypus is an hybrid tool. On one hand, it allows very precise data specification and manipulation of strong typed objects. On the other hand, associated with Squeak code generator, it allows rapid system prototyping and efficient code maintenance.

A data schema mapping environment. Platypus is developed to be a schema mapping tool allowing the specification of mapping rules between source and destination schema.

Now, mapping rules are designed with EXPRESS and can be interpreted or used by a code generator.

4.2. Usages

We work with Platypus at two levels : application-level and case-tool level.

At the application-level, building an application follows three main steps:

- data models are designed, including data types and validity rules definitions; these data models are referenced as domain models;
- components related to domain models are generated in target programming language; these components not only include classes with data accessors but also all explicit rules and derived attributes (computed values) implementation;
- generated classes are then enriched with application specific functionalities.

At the case-tool level, data handled are meta-data. Handled models are meta-models and the main application is code generation. We design and implement our code generators with Platypus, following a method that we have named Eugene (see, for example [6] about Eugene).

4.3. Back to the application integration

Enterprise Application Integration (EAI) is defined in [7] as the use of software and computer systems architectural principles to bring together (integrate) a set of enterprise computer applications. It is pointed out that EAI is not just about sharing data between applications; it focuses on sharing both business data and business process.

Our approach is restricted to the data. Designing the data schema is a kind of model integration. While data semantic is the sound of this integration, we should not forget that each application protocol relies on an application activity model (a functional point of view related to the domain) and that the SDAI defines a set of data management operations. Hence, there are a lot of functional services expressed in the data model by the underlying services and operations expected.

The SDAI is a functional interface for EXPRESS-modelled database and is independent of any particular system and language. The SDAI allows data sharing (through a common repository) as well as data exchange (through the use of a neutral format). The key point is that a SDAI is automatically generated from the EXPRESS schema of the application database (as long as a SDAI generator has been made for the target database management system). Then, at the end of the complex process of defining an Application Protocol for the applications to be integrated, the STEP framework will provide a seamless access to data of different applications. This ability is a first but fundamental step through the way of EAI.

4.4. A practical integration framework

Establishing an Application Protocol within a domain requires long-term efforts. Ultimately, the AP provides the framework for data integration because it provides a consensus on data definitions. But if this AP does not exist, we stated in section 2 that a common schema should provide a strong support to data integration.

A very common situation arises when two applications A and B have been developed independently from each other. We have to deal with a variety of different overlapping models, and a major challenge is to provide a way to describe the semantical relationships of different models and to support the transformation of instances from one model to another one.

Integrating applications as depicted on figure 4 requires efforts at two different levels :

- modelling : the goal is to define a schema which contains the concepts common to both underlying models;
- programming : the challenge is to be able to transform data from an application into the neutral representation; even with the help of the SDAI, this task is much heavier than modelling.

It could be envisaged to work with two EXPRESS schemata, one close to the application A model, the other close to the application B model. Thus, programming the transformation of A (resp. B) data into a neutral representation is made easier because the EXPRESS schema for A (resp. B) is as close as possible from the own application data structure. The main problem is to migrate instances from a neutral representation to another.

Fortunately, EXPRESS provides some support to schema integration and instances migration. Any schema can use constructs from another schema (with the USE of REFERENCE clauses) and derived attributes can be specified with procedural and queries features.

4.4.1. An example of derivation

In the spherical coordinate system, a point P is represented by a tuple of three components (ρ,θ,Φ). Using terms of the Cartesian coordinate system :

- $0 \leq \rho$ (radius) is the distance between the point P and the origin,
- $0 \leq \Phi \leq 180$ (zenith, colatitude or polar angle) is the angle between the z-axis and the line from the origin to the point P, and
- $0 \leq \theta \leq 360$ (azimuth or longitude) is the angle between the positive x-axis and the line from the origin to the point P projected onto the xy-plane.

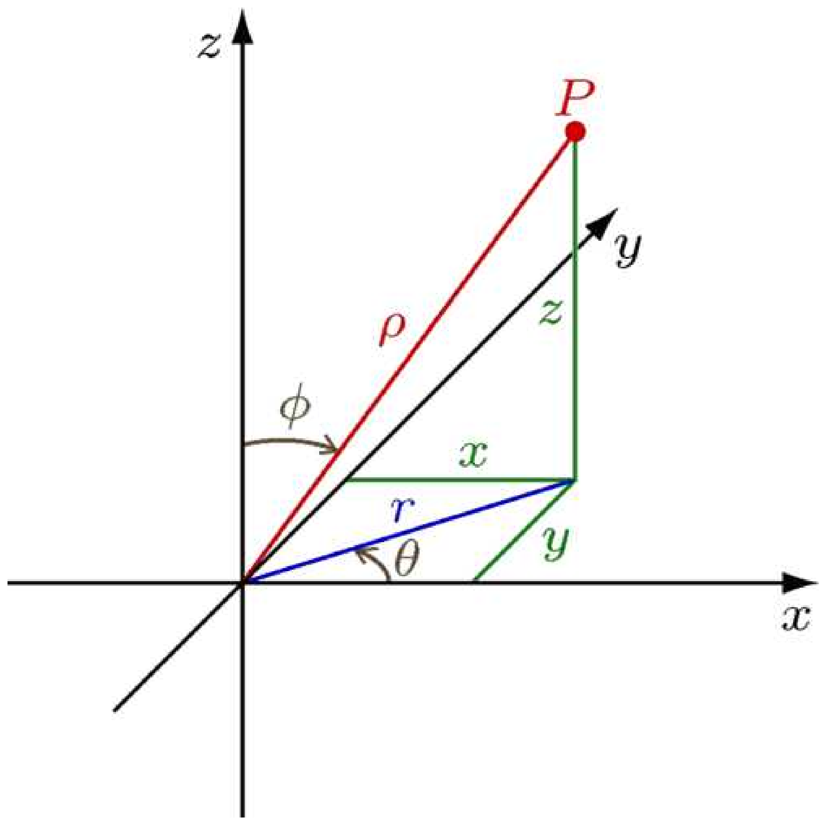

Figure 5 - Cartesian and spherical coordinates (from Wikipedia [8])

We can define a schema for the spherical coordinate systems and express its relationship with the Cartesian coordinate.

```
SCHEMA Spherical_coordinate_systems;

  ENTITY Spherical_Point;
    ρ : REAL;
    θ : REAL;
    Φ : REAL;
  END_ENTITY;
END_SCHEMA ;

SCHEMA Cartesian_coordinate_systems;
```

```
USE Spherical_coordinate_systems;
  ENTITY 3D_Cartesian_Point;
    x : REAL := ρ * cos (Φ) * cos (θ);
    y : REAL := ρ * cos (Φ) * sin (θ);
    z : REAL := ρ * sin (Φ);
  END_ENTITY;
END_SCHEMA ;
```

Figure 6 - An example of schema for coordinate systems

4.4.2. Impact on application integration

When a schema B uses (or references) another schema A, A constructs are available within B hence the SDAI for B is able to read/write instances conforming to A schema. If the derivation mechanism is used to indicate how B constructs rel y on A constructs, the STEP environment is able to load a neutral file of A instances and to compute the instanciation of corresponding B instances. Hence the transformation between A and B representations is automatic and provided by the SDAI generated from A and B schemata.

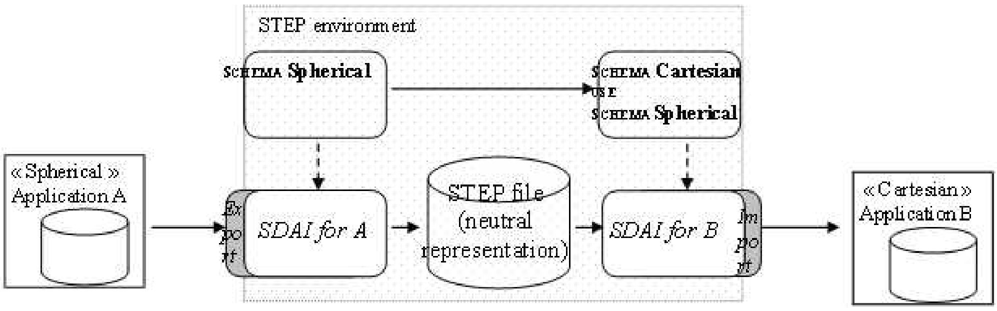

Figure 7: Integration of applications through schema transformation

The figure 7 shows the process of integration applied to an application A using spherical coordinates and an application B using Cartesian coordinates. Little effort has to be made to develop import/export adapters because :

- the EXPRESS schema for each application is very close to the data structure used;
- the generated SDAI provides a strong support to handle the application data.

4.5. Advanced features

As pointed out in [7], if integration is applied without following a structured EAI approach, many point-to-point connections grow up across an organization. It could often happen that an ad-hoc solution to integrate data between two applications should be applied to the whole set of applications (for example, transforming indexed files into relational tables). The generic solution no more lies in dealing with a particular indexed file to be transformed into a particular table, but in the concept of indexed files and the concept of relational tables.

Working at a generic level often means that we are working with meta-models rather than with models. The process works on a source and a target meta-model which are the description of the source (i.e. indexed files) and the target (i.e. relational tables) language constructs. The generic solution is described through generation rules specifying how to translate source constructs into target constructs.

The translation between the reference model and application models is not straight forward and we need a model transformation environment. All the models are specified with EXPRESS and the corresponding meta-model is the EXPRESS meta-model (defined itself in EXPRESS). In a meta-model, the entities specify the definitions of the concepts of the domain. The constraints specify their semantics locally or globally. As entities and attributes mapping rules can be specified by derived attributes, Platypus can be used as a schema mapping tool and as a code generator builder.

Meta-models used are specialization of the EXPRESS meta-model. Thus, tools of the Platypus framework (taxonomy browser, structured editor, analyser, code generator ...) can be reused and specialized.

5. Conclusion

STEP is an ISO standard (ISO-10303) for the computer-interpretable representation and exchange of product data. A fundamental concept of STEP is the definition of application protocol (APs) as the mechanism for specifying information requirements and ensuring reliable communication. The standardization process of these APs is an approach which can be applied to a data-based integration.

Platypus is a STEP-based meta-environment. The STEP technology is used for meta-models and models management. As a STEP-based environment, Platypus provides a support to data exchange and data sharing. Moreover, Platypus can be used for the development of a specific meta-environment intended to solve specific problems related to the legacy and new systems to be integrated.

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THE COMPARATIVE ANALYSIS OF THE ERP SYSTEMS FOR THE HUNGARIAN SME'S

Ferenc Erdős [1]

Improvement of IT infrastructure has gained increased attention of Hungarian executives in order to enhance their competitiveness in the new European marketplace. A key segment of these developments is the Enterprise Resource Planning (ERP). Today there is a wide range of ERP systems available for managers of SMEs in Hungary, albeit in most cases it proves difficult to distinguish the adequate ones. This study attempts to provide guidance to the reader by comparing various aspects of these systems and analyzing potential obstacles in the adaptation process.

1. Enterprise resource planning systems vs. business administration supporting systems

It is very difficult to draw a sharp distinction between enterprise resource planning (ERP) and business administration supporting systems, moreover, even the companies offering these systems sometimes use the two expressions occasionally as synonyms.

ERP softwares have modular structure, so the software packages for certain areas can be divided into different modules or components. In such systems one module represents one business process (eg. human resource, acquisition, production, logistics, accountancy, finance, etc.) [3]

The difference between the two systems is that business administration supporting systems consist of fewer modules and they mostly deal only with some areas of accountancy, finance and perhaps logistics. So the difference lies in the size of the area and the amount of information supplied. Small enterprises usually do not have large number of partners and orders, furthermore they do not employ as many people as a larger company, and so smaller systems can be just as suitable for their needs as larger systems that can handle all business processes.

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There are usually more services linked to ERP systems than to business administration supporting systems. These linked services can be for example organization, IT consulting or even education.

From the point of view of installation it is very important that the simpler business administration supporting systems can be immediately used after the right installation, and their use can be learnt in no time from the users' manual. However, their knowledge is rather restricted in comparison with ERP systems. The launch of an ERP system can take months, or sometimes years in special cases, even at a middle-sized company.

It is very important to examine to what extent a system can be customized to a company's unique business processes. This is a significant question, since it is not always a good solution to change the approved old processes only for the sake of the new system. [2] The aim should be that the system can be prepared for the processes used by the company. This, of course, cannot be completely done, sometimes one needs to compromise to some extent, but the company's operation must not be subordinated to a system's processes. It is also possible that the system the company intends to buy cannot really be fitted to the company's processes.

On the basis of these aspects it has to be decided whether an ERP system is worth to be installed in the case of a small or middle-sized company. Or is it more practical to buy a smaller business administration supporting system or to have a unique and more efficient system developed? For the cost of a bought system and the customizing can be much higher than of one developed for the company's own aims and needs. These assumptions need to be examined by all means before the introduction or development of an IT system.

2. ERP systems at the Hungarian small and middle-sized companies

Nowadays managing directors of small and middle-sized companies should consider if they could be more competitive with the use of a complex, integrated information system. There are several ERP softwares made for small and middle-sized companies in the Hungarian market, thus the choice is very difficult.

The following chart lists some ERP systems for middle-sized companies that are present in the market in Hungary, without mentioning them all. The chart also shows the size of the company the software is aimed at.

Table 1 - Major ERP systems in the Hungarian market (Source: the websites of the companies [6] [7] [8] [9] [10] [11] [12] [13] [14])

ERP system	aimed company size		
	small	middle	big
Microsoft Navision	X	X	
Microsoft Axapta		X	X
SAP Business One	X	X	
mySAP All-in-One	X	X	
Mago.net	X	X	
Octopus	X	X	
IFS Applications	X	X	
Progen – Big Machinator	X	X	
Progen - sERPa	X	X	X
Exact Globe		X	
Team Glöckner		X	

The study will analyse the systems in the chart in detail from the point of view of modularity, sectorality and internationality.

It also turns out from the table that most of the companies offering ERP systems for Hungarian small and middle-sized companies are large international developing enterprises. The Hungarian developing companies, which have aimed exactly at the same kinds of companies, are more and more extruded from the market, and they mostly join the group of the larger companies' distributors.

The diagram below shows - according to size - the proportion of ERP systems of companies in Hungary employing at least 5 people in September, 2005.

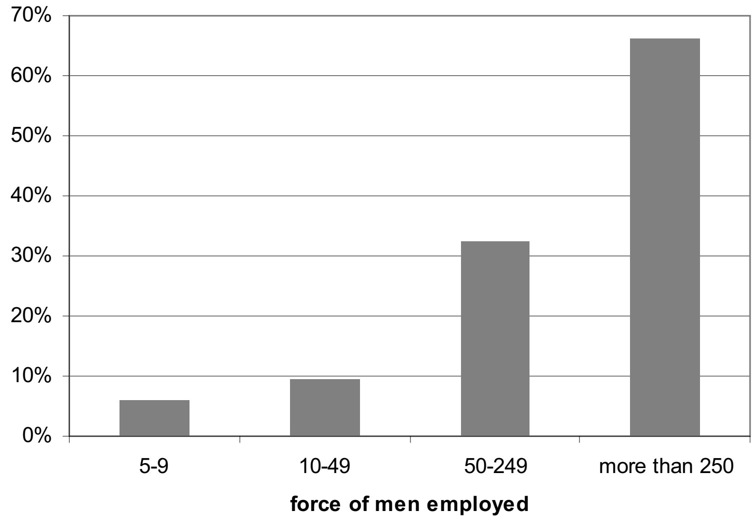

Figure 1 - The proportion of ERP systems of companies in Hungary (2005, Source: GKI (Economic Research Institute of Hungary) [1])

It can be seen that the proportion of the use of ERP systems is more and more significant. While this rate stays under 10% in the case of micro companies employing at least 5 people and small companies, 32% of the Hungarian middle-sized companies had already such a system in 2005. Moreover, it is striking that even a part of the smallest companies take the opportunity offered by these systems.

Besides getting familiar with the current situation it is also very important to unfold the future directions and tendencies. According to a survey of GKI (Economic Research Institute of Hungary) nearly 15% of the small and middle-sized companies not having an ERP system are planning to introduce some kind of ERP in two years, which means a promising growth in the market for supplying software companies.

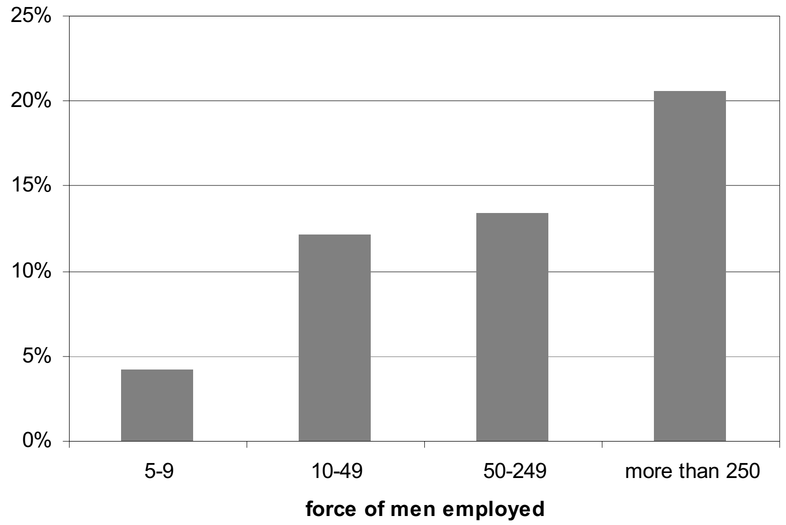

Figure 2 -The proportion of companies in Hungary not having an ERP system and planning to introduce some kind of ERP in two years (2005, Source: GKI (Economic Research Institute of Hungary) [1])

3. The analysis of ERP systems made for small and middle-sized companies according to their main features

3.1. Modularity

Each ERP system consists of principal and sub-modules that are fitted to the company's business process system. The companies' main business processes are: strategy, marketing, innovation, human resources, logistics (material processes), production, supplies and corporate finance. The difference between the products of certain companies in this field lies in the number and character of the modules. The comparative modular examination of ERP systems made for small and middle-sized companies can be found in the following chart. The chart reveals which functions are completed and which company processes are supported by certain ERP systems.

Table 2 - The analysis of ERP systems made for small and middle-sized companies according to their modules (Source: the websites of the companies [6] [7] [8] [9] [10] [11] [12] [13] [14])

ERPs / modus	Microsoft		SAP Business One	Mago.net	Octopus	IFS Applications	Progen		Exact Globe
	Axapta	Navision					Big Machinator	sERPa	
Finance / general accounting	X	X	X	X	X	X	X	X	X
Payroll accounting							X		
Logistic		X	X	X	X				X
inventory management	X							X	
distribution						X			
Trade	X						X		
procurement			X						
sale			X			X			
Service			X			X			
Manufacturing management	X	X	X	X		X			X
Human resource management (HRM)	X	X				X			
Customer relationship management (CRM)	X	X	X	X			X	X	X
Project management	X	X							X
Business analytics	X	X		X					
Controlling				X	X				
Cost planning, and cost analysis				X					
Liquidity planning							X		
Technical development						X			

It turns out from the table that almost all ERP systems consist of similar modules. It occurs in many cases that the name of the module related to the same company process varies according to different ERP systems, which makes the comparison of the systems difficult.

The range of modules respectively depends on which economic sector is supported by the system in use. If it only supports trade, of course the production module is not necessary. One of these products is called "Octopus" that has only four modules: logistics, finance, general accounting and controlling [14].

The financial or general accounting module can be found in all the ERP systems that I have studied. The reason for this fact is that the financial activity covers the whole company operation and the function of accounting is to process the financial data of company transactions.

Another important task for a company is the solution of problems concerning logistics, because a lot depends on the availability of the appropriate amount of materials and products needed during the production at the right place and time, in the respective production phases. Some systems cover the whole logistic process, while others include only certain segments of it.

It's interesting to notice that almost all systems lack the payroll calculation module. The reason for this is that there are quite significant differences between countries in this field. Furthermore, in Hungary due to the great number of law amendments these modules require frequent updates, which is extremely difficult and costly for a company producing international ERP systems. Consequently the companies producing large international ERP systems usually offer one of the home made payroll accounting software attached to their product, while the companies producing payroll accounting systems for the domestic market generally get associated with some large ERP producer company. Among the systems I have studied only the system called "Big Machinator" has its own payroll calculation module [11].

3.2. Sectorality

As a matter of fact, companies developing enterprise resource planning systems are obliged to develop their systems suitable for individual users' needs and meet sector and profession-specific requirements, if they want to endure and get a remarkable market share. The industries and sectors of the national economy supported by the ERP systems that I have studied can be found in the 3. chart.

Table 3. The analysis of ERP systems made for small and middle-sized companies according to their supported industries and sectors (Source: the websites of the companies [6] [7] [8] [9] [10] [11] [12] [13] [14])

ERPs / industries, sectors	Microsoft		SAP Business One	Octopus	IFS Applications	Progen	
	Axapta	Navision				Big Machinator	sERPa
retail / wholesale trade	X	X	X	X		X	X
manufacturing	X	X			X	X	X
service	X	X		X	X	X	X
business service	X	X				X	X
bulilding industry	X	X					
food industry	X	X	X				
fashion/textil industry	X	X					
carrying trade	X	X					
administration	X	X					
oil industry			X		X		
post service			X				
bank service			X				
health			X				
pharmaceutical industry			X				
telecommunication			X		X		
media			X				
engineering activity, development			X				

During this analysis I have found interesting facts, namely that nowadays ERP systems can be customized to nearly any company process. Altogether, the character of the company should be presented during making contact and the ERP system producer companies will definitely make an offer for the customizing of the system in order to maximize their income and accordingly their profit. As a consequence, this chart can be extended optionally. However, this hardly limitless customizing capacity is not a real good solution and many times affects quality in a negative way, as processes are different, enough to mention for example the pharmaceutical industry and car industry. I mean that a company leader pays a lot of millions of Hungarian forints in order to obtain the right system, while he cannot even be sure that he has received the system suitable for his own needs. In this field the mentalities of both producers and costumers still have a lot to improve.

3.3. Internationality

All the ERP systems I have studied take national characteristics (accounting act, etc.) into consideration and have several language setting possibilities. In this field almost all of them are similar. Perhaps this is the only common feature found in these software. For example the Hungarian VAT-modifications should be fixed in the financial module, but as it affects only Hungary, the financial module should be configured locally, considering the changes in domestic legislation. As to multilingualism as a facility, it is important because for instance in the case of an English parent company and a Hungarian subsidiary company it allows of reporting in English to the parent company. Moreover, if we have a customer from Germany, it is possible to make a bid, send invoice and delivery note in their own language (in this case, German), hereby facilitating the activities of this purpose and shortening their duration.

4. Conclusions

As we can see, nowadays a lot of ERP systems made for small and middle-sized companies can be found in the Hungarian market, what is more, their constructions are very similar. The Hungarian-developed ones tend to disappear as today already the large multinational software companies regard smaller firms as main potential clients. It is a complex task to suit these systems to Hungarian laws but large multinational software developing companies still assume this task. The real reason for it is that they want to exclude all the developing companies that endanger the positions of larger software producer companies in a certain region. As a result of this process many of the home developers have also become the larger multinational companies' distributors.

It is extremely difficult for the management of a smaller company to pick the truly most convenient system of those being present in the market. In my study I tried to give some help for this choice but it is worth underpinning an investment of this kind by investment-return (ROI) calculations and by various customer-centered analysis methods [5]. Exactly that's why there is a great need for such independent organizations that help executives of small and middle-sized companies make their decisions. This consulting service could be provided by commercial chambers of commerce and industry, business incubators or even a non-profit organization (NPO), set up especially for this purpose. This organization could give help to measure if the enterprise needs such a complex system at all, and if it does, then transmit the enterprise to the companies that offer the systems most suitable to its business processes. Nevertheless, for this consultancy it is essential to have familiarity with the ERP systems found in the market, their modules, prices, the time needed for their installation and instruction. But still, maybe the most important thing to know is the kind of company the system is made for, as there are ERP systems that support only a certain function.

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UNDERSTANDING MACHINE TRANSLATION

Agnes Varga

Machine translation is a way to become communication difficulties between people of different languages. Since such difficulties can arise even within a company, or in communicating with clients or business partners, a machine translation system that is able to produce acceptable translations could be very useful for companies, even integrated into enterprise applications. The problem is that according to our survey and informal interviews, Hungarian MT is not yet in the state that it can be used without post-editing. In the article I will shortly present the main principles and approaches of MT and the error categories applied in the analysis. Then the categories are presented in an order of gravity. The aim of the study is to discover the deficiencies of the software to find the most urgent improvements and also to be a basis for a post-editing software.

1. Introduction

There are more and more multinational companies having premises in different countries, including Hungary. This means that there will be employees speaking different languages, which can be a considerable barrier in communication. Foreign language knowledge is an especially serious issue in Hungary. In the EU 56% of the population says they speak at least one foreign language, in Hungary this is only 42%, which means that the *majority* of the people does not speak *any* other language than Hungarian. German is the most widespread as a foreign language (25%), and then comes English with 23%. This is a very important factor since English is the most commonly used language in the EU (32%), so presumably it will be the mostly used at conferences meetings and trainings. [7]

There are three ways to overcome the difficulties of communication between parties of different languages: to learn the other's language, to try to communicate in a third language or to use a third party who can translate. In the case of a multinational company the cheapest and fastest solution could be a machine translation software, even integrated in an enterprise application.

It can never be a question of dispute whether a machine translated text can be compared with human translation. As Sager says "the basic premise of a theory of MT must be that a machine-translated text is never comparable to a human product of writing or text modification. It has to be considered a product in its own right with its own characteristics. It is the result of a particular automated process chosen deliberately by a writer, an end user, a communication agent or mediator." [5: 258] I need to emphasise two parts of this statement. One is that when reading a machine translated text we always have to bear in mind that it has its own characteristics, and should not expect something like a text translated by a beginner language learner or a bad translator. Its errors are also completely different, since the computer does not have any kind of human understanding, unless the algorithms that had been created by humans.

The other important part is that machine translation is always a deliberate choice, so the one who chooses it already knows what to expect, no matter how "bad" we consider that translation. And now we get to the point of asking why one can, should or must choose machine translation instead of human.

One of the indisputable advantages of machine translation is its speed. Machines translate in fragments of time compared to a human translator. Speed then results in small cost. We can spare a lot of money by once investing into a system, but one prerequisite must be that the resulting text can be (easily) read and understood.

Machine translation in Hungary is not yet at the point of being able to produce perfectly understandable and correct texts. In fact the situation is far from perfect. A machine-translated text is always written in an artificial language, and it can be incorrect, stylistically defective or many times it even lacks referential equivalence as well. (Referential equivalence is when (part of) the source language text refers to the same area of reality as that of the target language, i.e. the two texts 'mean' the same. (We translate from the source language to the target language.)) In order to be able to use a (Hungarian) machine translated text for any purpose different than filtering out the main ideas, we need human resources to "correct" it, i.e. to bring it into a form that can be easily read, that contains the least grammatical errors possible and most importantly, it matches the source language 'meaning'. The extent to which we would like to make it similar to a human translation always depends on our purposes. This process of correction is called post-editing.

In my study I would like to find an answer to the following questions:

- What are the errors that mostly disturb understanding a machine translated text?
- How much can the reader understand a text if it completely violates the rules of the language?

- Which errors are the ‘worst’: referential, grammatical, lexical or stylistic?

I will try to find an order of errors according to their gravity. To be able to set this order I have carried out a research with the help of a questionnaire.

In the article I will also outline the principles and mechanisms underlying the MorphoWord translation software.

2. On translation errors

There are several types of translation that can be called machine translation, eg.: computer-aided human translation, interactive translation, automatic translation with pre- or post-editing, or completely automatic machine translation. [6]

Further on we will only deal with the last one, ie. completely automatic computer translation, where there is no human intervention at all. I have already mentioned before that machine translation can never be compared to human, but these texts will still be read by humans, whose expectations need to be met. When one reads a text, a very much justifiable expectation and requirement is that they understand it, and that this understanding needs the least amount of effort. From this point of view machine translated texts can be analysed according to the criteria of human translation and use “human” error typology. I chose Newmark’s typology of errors:

- Misleading errors: referential errors and grammatical errors
- Slight errors or ‘nuances’: stylistic errors and lexical errors [3]

Referential errors are the cases when the source text meaning refers to a different part of reality than the target text meaning. Grammatical errors are when the text violates the grammatical rules of the language. Stylistic errors naturally affect the style of the text, for example the level of formality, or the register. Lexical errors occur when the translator does not use the most suitable word or expression, nevertheless it is grammatically and referentially correct.

My hypothesis is that the order of errors is: 1) referential, 2) grammatical, 3) lexical and finally 4) stylistic, from the point of view of the extent they hinder understanding.

3. Machine translation

The underlying algorithms and principles in MT softwares are considerably different. They also have changed through the course of time, and the different firms, developer groups still have different views, and this fact is also reflected in their softwares. I would like to give an overview on the main principles and directions of MT according to Somers.

At the beginning, in the 1950s and '60s direct systems were the most popular, which substituted words for words from their bilingual dictionaries. The problems of this approach were very soon recognized, and the need for a more sophisticated linguistic analysis emerged. The second generation of MT systems were the so-called indirect systems. Here the source language text is translated into the target language text with the help of an intermediate representation. Different approaches were formed according to the level of this intermediate representation. The interlingua approach is an idealistic view that there should be an abstract representation that is completely independent either from the source or the target language. If this could be accomplished, translation from several languages could be easy with only one representation. The problem is that only language-dependent representations exist so far. The impossibility of the interlingua led to a more practical view: the transfer approach. In the transfer approach there are three main stages of translation:

- analysis of the source language into a language-dependent syntactic representation
- transfer of the representation into a target language structure
- synthesis of the output result from that structure

The syntactic representation can vary in different systems. Linguistic analysis plays a considerable role in these approaches, which means that grammar formalisms are needed. These two approaches can also be viewed as rule-based approaches, since syntactic analysis and synthesis requires rules.

To overcome the difficulties and problems of rule-based MT, another technique was developed, the example-based translation in the '80s. This means that there is a huge knowledge-base of translation examples, and the system offers the best possible match. The best possible match is usually chosen according to 'character distance'. This technique is used in the so-called translation memories. [1]

Statistics is also used in MT systems: statistics-based softwares rely solely on parallel corpora, where the "statistical probabilities determine choice of lexical equivalents". [6: 148] The direct, interlingua and transfer approaches are shown in *Figure 1*.

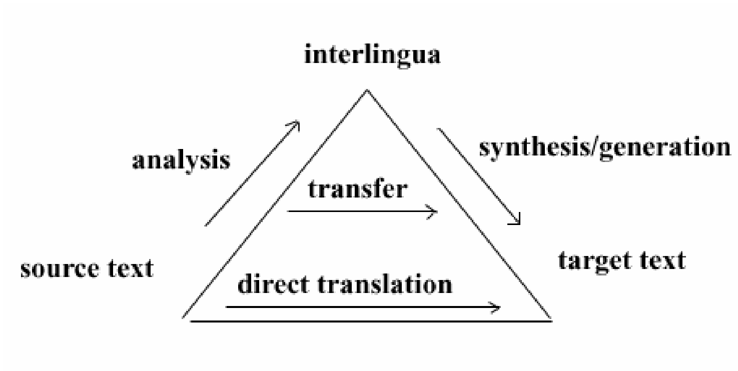

Figure 1 - Different MT approaches

The software under examination is called MetaMorpho, a development of MorphoLogic Ltd., Budapest. It combines rule-based and example-based principles in a way that the morphological and syntactic analysis is done with the help of rules, but the generation is based on examples. These examples themselves are a mixture of rules and concrete examples, and they are called patterns. [1] The syntactic analysis is followed by generation immediately, the structure is not transferred into an intermediate target structure. The process is illustrated in *Figure 2*.

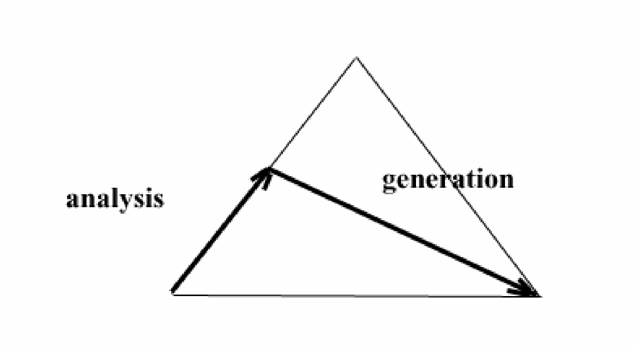

Figure 2 - MetaMorpho approach

Patterns have attributes, which contain morphological, syntactic and semantic information. If all the attributes of the pattern are given, it is like an entry in a dictionary. If the pattern does not have any attributes specified, it is a rule. In the MetaMorpho system there are transitions between the two, ie. context-free rules with concrete attributes. [8]

The system analyses the sentence with the help of the patterns, starting from the smallest parts up to the whole sentence, and builds up a tree. [4],[8] The analysis starts with segmenting the sentence into words, whose attributes are determined by the morphological analyzer. Next the bottom-up parser examines this sequence and decides whether it is a correct sentence. If it is, one or more root symbols are created. Then the target tree is built, whose terminal symbols at the leaves are used by the morphological generator to produce the target sentence. [4]

The above mentioned procedure is the ideal case. However, very often the software is not able to produce an acceptable syntactic analysis of the whole sentence. In this case it tries to analyse the largest parts possible and then to assemble these to make a sentence. This is called '*mosaic translation*' With the help of different filters the aim is to select the parts that do not overlap, but cover the whole sentence and also give the best translation possible. [2]

4. The survey

The survey was carried out to discover to what extent the readers understand machine translation, and what are the most disturbing errors. For the analysis first I chose English Internet articles from The Times and The Mirror, for which I created questions referring to their essential content, then I had the text translated with the MorphoWord translating software into Hungarian. When choosing the articles it was a very important point that they are short, interesting and their content is not widely known. The participants only got the translated Hungarian text, and had to answers the questions in Hungarian. The questionnaire also contained questions about the participant and on his/her opinion about the texts, since attitude is also an important factor in understanding, especially if the text requires concentration and energy.

Some questions of the survey (they were of course all in Hungarian):

- Why is David Beckham in trouble?
- What's the matter with the fence?
- What happened to Freddie Williams and his daughter?

The questionnaire was filled in by 72 people, most of them unfortunately with a university or college degree. Unfortunately, because this way the experiment is less representative.

Before having a look at the questionnaires I analysed the texts by themselves and put all the errors in the categories mentioned above. Since the texts contain so many errors, many parts of the sentences belong to more than one category at the same time, and this makes sequencing more complicated.

5. The results

When analysing the questionnaires I created five categories for the answers and I also gave each of the categories a weight and thus created an index number which represents the average 'goodness' of an answer.

The five categories are:

- completely correct answer (5)
- correct but not complete answer (3)
- did not know (-3)
- partly correct, partly incorrect answer (0)
- mostly incorrect answer (-4)
- incorrect answer (-5)

According to the index numbers I could set up the order of the errors according to how the structures containing them could still be understood. This index is a weighted average of the answers, and can be between -5 and 5.

Even though the translated texts are hard to read and at first sight almost hardly understandable, the proportion of correct answers is surprising: 40.4% of the answers was correct on average, 20% was correct but not complete, 8.7% contained both right and wrong parts.10.9% of the answers were not known. 14.9% were mostly incorrect, and only 4.4% was completely incorrect. The results show that in spite of the first opinions the main ideas in the text can be understood. The question is whether the reader is willing to invest energy into extracting the content. If we consider the MT software as a part of a communication tool between members of a company, the employees will be forced to invest this energy, but to lessen the effort as much as possible, the software needs development. Efficient post-editing can also be a solution.

The results showed that my initial hypothesis concerning the order of errors (according to their gravity) was right, but I needed to create a more sophisticated and slightly different typology.

Since the analysed texts are all in Hungarian, I only give a few illustrations for the errors and their order. The index number showing the 'goodness' or 'gravity' of the error is in parentheses.

The most serious one is if the error is only referential in a way that it seems to be correct, and grammatically fits into the surroundings, because it will be misunderstood even without the doubt of its being correct. An example for this is the translation of "*tens of thousands*" that could be understood as "*several thousands*" in the Hungarian version. (index: -2.92)

The next error in the row is the grammatical error affecting the whole sentence when the role of the sentence parts are not clear and are mixed up, which occurs indeed often in the case of multiple compound or complex sentences. (index: -2.6)

In some cases this phenomenon is caused by a regularly occurring error, i.e. that the relative pronoun in a clause is translated as an interrogative pronoun, which changes the structure of the whole sentence. According to the analysis, the 'mistranslation' of an expression from the closed lexical set leads to a more serious error from the point of view of understanding than that of a member of the open lexical set. The closed lexical set consists of 'grammatical' words like pronouns, conjunctions, etc. Nouns, verbs, adjectives belong to the open lexical set.

The phenomenon can be a consequence of mosaic translation, when parts of the sentence are analysed separately. A clause in a sentence beginning with a relative pronoun seems as if it was a question, as in English relative and interrogative pronouns have the same form.

The other errors when the function of the phrases is not clear can also be caused by mosaic translation, where one of the filters does not recognize the part in question correctly.

There are cases when the software does not choose the right translation for the given expression from the list of patterns, which leads to referential error. For example one, rather rarely used meaning of *chestnut* is "*story*" but instead of this in the translation the first meaning was used, which is completely out of context. The index number is -1.9, which is more than that of the previous grammatical error, which means that some grammatical errors are more serious than certain referential ones.

In those cases, where the meaning of the translated word or expression and the original are different but either belong to the same (or similar) semantic field or can evoke a similar picture to that of the original in the reader, the intended meaning of the sentence is much better understood. (index: 1 - 1.2)

Hungarian is a highly inflectional language, which means that a great amount of information is expressed by suffixes. If the software cannot find the right suffix information can be lost or incorrect. If the solution is grammatically correct but referentially incorrect naturally leads to serious misunderstanding (index: -0.7). An example of this is when "*in Acacia Grove rather than Acacia Avenue*" was translated into "*in Acacia Avenue at Acacia Grove*" In the case of grammatically incorrect suffixes, which are used instead of a compulsory inflection, the meaning can be completely understood, even when the parts of speech are not correct (index: 4.4), for example "*women ... call upon some passing local*" was "*women ... a call in something passing local*".

Stylistic and lexical errors did not cause hardly any difficulties in understanding, but they change the style of the texts, so even formal articles become amusing in a way.

This style can be a little disturbing in a working environment, but if users get used to it, and can 'ignore' it, the style is not an obstacle to understanding.

6. Summary

After the survey it has been proved that the main tendency in the order of errors is referential, grammatical, lexical and stylistic, but after a detailed analysis it turned out that there are cases when grammatical errors cause more trouble in understanding than referential errors. There are regularities in the occurrence of errors, which need to be further analysed.

Machine translation can be a considerable help in intercultural communication, thus it is important to improve it. The aim of this study is mostly to be able to help the automation of post-editing. The aim of my PhD is to design a software with the help of which the user could correct these texts with minimal effort and intervention, so to say almost automatically. Another aim is to discover the deficiencies of the software to find the most urgent improvements.

The Hungarian–English version of the software will soon be ready, thus the research has to be carried out again.

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8. Appendix A – Texts of the survey

8.1. Original Text 1

17 March 2006
BECKS IN WIRE ROW
DAVID Beckham is in trouble over his two-metre high Colditz-style barrier at Beckingham Palace.
Council officers say the Real Madrid star needs permission for barbed wire topping the fence.
It is to keep intruders away from the mansion at Sawbridgeworth, Herts, but local residents have dubbed it an "eyesore".
A spokeswoman for East Herts council said: "The fence is all right but the wire breaks regulations.
"An planning application was made but information was missing. They will have to reapply."
The council could order him to take the wire down.

8.2. Original Text 2

17 March 2006
MOB GRABS THOUSANDS
EXCLUSIVE
By Stephen Moyes
A LEADING bookie was held up by robbers yesterday.
Freddie Williams, 63, who boasts of handling millions at meetings, was leaving Cheltenham with his daughter, in her 20s, and another man.
Three men in balaclavas stopped his Jaguar near Cirencester, and smashed the windows of their Jaguar with crowbars.
They threatened Mr Williams, of Cumnock, Ayrshire, until he handed over cash - said by police to be tens of thousands.
His daughter called police from the scene.
The three were cut by flying glass and said to be "traumatised".
The gang's two getaway cars were found on fire.

8.3. Original Text 3

I'm not lost. I'm merely emulating great explorers

Jane Shilling

The RAC's insurance company has just published a survey with the haunting title of "Are We Lost Yet?", which, oddly enough, is exactly what my son says to me at some point in every journey we undertake together — usually before I've managed to negotiate the junction at the top of our road.

The RAC's survey is a study of that dear old transport chestnut, the different behaviour of men and women when it comes to getting lost. You know the one: women, with their supernaturally developed people skills, skip out of the driving seat the instant they find themselves in Acacia Grove rather than Acacia Avenue and call upon some passing local to put them right. Men, on the other hand, finding themselves adrift, refuse to admit that they are any such thing and zoom around in angry circles, revving the engine and crashing the gears, their ears going a nasty shade of crimson and their language deteriorating most shockingly. And not until they are unequivocally committed to the fast lane of the M1 northbound rather than the A23 to Brighton (which is where they are supposed to be going, on a relaxing jaunt with their sweetheart) will they admit that there is a problem. By which time the sweetheart is sitting in the passenger seat, lips pressed into a thin line so as not to give utterance to the dire sentiments contained in the large think balloon hovering above her head.

8.4. Hungarian translaton of Text 3

Nem tévedtem el. Csupán nagy felfedezőket emulálok

Jane Shilling

A RAC biztosítótársasága éppen Are We Lost Yet kísértő címével kiadott egy felmérést?, melyik az, hogy a fiam mit mond nekem valami pontnál minden útban, amit együtt vállalunk, pontosan elég furcsamód — általában azelőtt nekem sikerült az utunk a tetőjén megtárgyalnom a csomópontot.

A RAC felmérése egy arról a kedves öreg szállítási gesztenyéről végzett tanulmány, az emberek és nők különböző viselkedése, amikor ez odajön ahhoz, hogy elvesszék. Tudod azt: a nők a természetfölöttien fejlett népkészségeikkel ugranak a hajtó ülésből a pillanat meglehetősen Acacia Avenue-nál Acacia Grove-ban találják magukat és hívás valami elhaladó helybelin eligazítani őket. Az emberek, akik másfelől sodródva megtalálják magukat, megtagadják, hogy elismerjék, hogy ők bármilyen ilyen dolgok és dühös körökben száguldanak körbe miközben túráztatják a motort és összetörik a felszereléseket, a füleik going a bíbor egy csúnya árnyéka és a nyelvük, ami megdöbbentően leginkább megromlik. És nem világosan elhivatottak a belső sávba az m 1 észak felé tartó inkább mint az a 23 Brightonnek (melyik az, hogy róluk hol hiszik azt, hogy a kedvesükkel mennek egy nyugtató kiránduláson) el fogják ismerni, hogy van egy probléma. Azáltal, hogy a kedves melyik időt üli meg az utasülésben, az ajkak annyira szorongtak egy vékony sorozatba nem adni kifejezést annak, hogy a szörnyű vélemények, amiket tartalmaztak a nagy gondolkodásléggömbben, lebegni a feje fölött.

9. Appendix B – Table of errors in Text 3

	Index	Type of error	Description
mondott rendőrség által tíznek éves lenni több ezer	-2,92	ref. + gr.	function of phrases is not clear + serious referential error, but fits into context
És nem világosan elhivatottak… (melyik az, hogy róluk hol hiszik azt)	-2,6	ref. + gr.	whole sentence is affected
melyik az, hogy a fiam…	-2,5	referential	word order is incorrect and function of phrases not clear
szállítási gesztenye:	-1,9	referential	referential meaning completely different
megtalálják magukat	-1,55	grammatical	grammatical error becomes a referential one because of confusing context
Azáltal, hogy a kedves melyik időt üli meg az utasülésben, az ajkak annyira szorongtak egy vékony sorozatba nem adni kifejezést annak, hogy a szörnyű vélemények, amiket tartalmaztak a nagy gondolkodásléggömbben, lebegni a feje fölött.	-1	ref. + gr.	incorrect relative pronoun → affects the whole sentence
sodródva	-0,8	referential	but ref. meaning close
Acacia Avenue-nál Acacia Grove-ban találják magukat:	-0,7	referential	completely different meaning due to incorrect inflection
nem adni kifejezést annak, hogy a szörnyű vélemények	0,1	grammatical	incorrect part of speech, but ref. meaning same, mode incorrect (imperative needed)
ajkak annyira szorongtak egy vékony sorozatba	1	referential	but similar form + evokes a picture
tartalmaztak a nagy gondolkodásléggömbben, lebegni a feje fölött	1,2	grammatical	word does not exist, ref. meaning close + evokes a picture
bíbor egy csúnya árnyéka	1,48	referential	similar form
népkészség	1,78	grammatical	word does not exist, ref. meaning close
elismerjék, hogy ők bármilyen ilyen dolgok	1,86	stylistic	refers back to another part of the sentence → serious
ez odajön ahhoz, hogy elvesszék	2,22	ref. + lexical	ref. meaning close
hajtó ülés	2,98	grammatical	word does not exist, ref. meaning close
elvesszék	3,3	lexical	wrong choice of word
hívás valami elhaladó helybelin eligazítani őket:	4,4	grammatical	different part of speech, ref. meaning same, incorrect inflection

European projects in Research and Education - Ways to Integration

EUROPEAN PROJECTS - NEW PLATFORM FOR CO-OPERATION

Markus Helfert[1], Petr Doucek[2]

1. Introduction - Research and Development World Framework

"The European Commission proposes to double EU (European Union) research spending for the period 2007 to 2013. The new research funding will focus on technologies which most effectively promote competitiveness and employment in Europe. The ICT (Information and Communication Technology) priority within the 7th Framework Program recognizes the need to build on Europe's past success, but also to focus firmly on technologies of especially strategic importance for future growth and jobs." [EU_05].

You read about the strategy of EU in the field of research and development work, but how does the reality look?

In 2004 the EU25 spent nearly 200 (195) billion euro on Research & Development (R&D). R&D intensity (i.e. expenditure as a percentage of GDP) in the EU25 stood at 1.90% compared to 1.92% in 2003. R&D intensity remained significantly lower in the EU25 than in other major economies. In 2003, R&D expenditure was 2.59% of GDP in the United States1, 3.15% in Japan, while it was 1.31% in China. R&D expenditure2 in the EU25 rose by 1.3% in real terms on average per year between 2001 and 2004, compared to -0.1% in the United States and +1.8% in Japan between 2001 and 2003.

In 2003 the business sector financed 54% of total EU25 R&D expenditure, while the shares of the business sector in the United States and Japan were 63% and 75% respectively.

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The EU goals in Research and Development, as set by the Lisbon summit strategy, are to achieve by 2010 a R&D intensity of at least 3% for the EU as a whole, and to have two thirds of R&D expenditure financed by the business sector. [EUS_04]

There is large scale of the variety of investments intensity among EU member countries. Starting from 0.3% of GDP in Malta to 3.7% in Sweden. In 2004, the highest R&D intensities among the Member States were registered in Sweden (3.74% of GDP) and Finland (3.51%), followed by Denmark (2.63%), Germany (2.49%), Austria (2.26%), France (2.16%), Czech Republic (1.28%), Hungary (0.89%). The lowest intensities were found in Malta (0.29%), Cyprus (0.37%), Latvia (0.42%) and Slovakia (0.53%). Annual average growth rates of R&D expenditure over the period 2001 to 2004 ranged from +16% in Estonia, +15% in Cyprus, +12% in Lithuania, +10% in Spain (between 2001 and 2003), +5,1% in Austria, +4,5% in Czech Republic, +1,5% in Hungary to -4,3% in Portugal (2001-2003) and -2% in Belgium, Slovakia and Sweden.

Largest shares of R&D financed by business sector in Luxembourg, Finland, Germany and Sweden. The business sector finances the highest share of EU25 expenditure on R&D (54%), followed by the government sector (35%) and funding from abroad (9%). Among Member States, Luxembourg (80%) recorded the largest share of R&D expenditure financed by the business sector in 2003, followed by Finland (70%), Germany (66%), Sweden (65%), Denmark (61%), Belgium (60%), Austria (44%), Czech Republic (51,5%), Hungary (30,7%), Slovakia (45,1%). Three Member States registered shares for the business sector of 20% or less: Lithuania (17%), Malta (19% in 2002) and Cyprus (20%).[EUS_04]

Another point of view is the one focused on intensity of investments into ICT R&D. Following table shows real investments in EU15 and by its main competitors into Research and Development work.

Table 1 - R&D Investments [EU_05]

ICT R&D	**EU 15**	**USA**	**Japan**
Private sector investments	23 B€	83 B€	40 B€
Public sector investments	8 B€	20 B€	11 B€
Inhabitants	383 millions	296 millions	127 millions
Investment/Inhabitant	80€	350€	400€
ICT R&D as Per cent Total R&D	18%	34%	35%

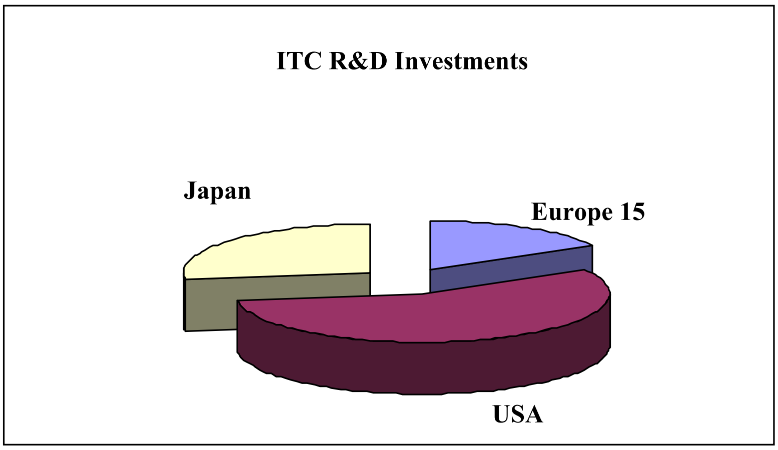

Figure. 1 ITC R&D Investments [EU_05]

R&D and investments into it accelerate the whole society development and education seems to be the main engine for research and development work efficiency as well as international contacts. By Bologna process proposed education model should be a base for preparing experts of the new age and of the new society – European compactable researchers. This was vision but how does reality look?

2. European Projects in Education and Training

2.1. The EU Policy and Programme Structure

In 2000 the European Council declared the goal, that the European Union "to become the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion" [EC_00]. In this context ministers of education agreed on three major goals to be achieved by 2010 [EU_06a]:

- to improve the quality and effectiveness of EU education and training systems;
- to ensure that they are accessible to all;
- to open up education and training to the wider world.

One crucial development in order to achieve a common European higher education area is the "Bologna process" that was initiated in 1999 by the "Bologna Declaration" [Bol_99] (among other policy areas that are outlined in Figure 2 [EU_03]) . The ministers of education from 29 European countries had met in Bologna and undertaken in a joint declaration to establish a European area of higher education by 2010. The aim of the process is to make the higher education systems in Europe converge towards a more transparent system which whereby the different national systems would use a common framework based on three cycles - Bachelor, Master and Doctorate. Standards for academic degree and quality assurance should be harmonised throughout Europe. At subsequent ministerial conferences the ministers included for a European area of higher education the objective of responding to the needs of lifelong learning. The conferences also called for the implementation of policies to evaluate quality in each country in order to secure the mutual trust which is indispensable to the validation of studies carried out in another country.

The implementation of the Bologna declaration is underway throughout Europe, with currently 40 countries involved in the Bologna process. Many universities have adopted a two-cycle system of the Bachelor-Master structures and have made a start on introducing a quality assurance system. However, the daily operations still meet legal, cultural and mental obstacles and the recognition of study periods abroad frequently represents problematic.

Various mechanisms are implemented in order to achieve the policy goals; some of them are outlined in Figure 2 and summarized in Table 2 [EU_05]. The foremost important programme for education is Socrates with around 30 European countries involved [EU_06b]. Its aim is to promote the European dimension and to improve the quality of education by encouraging cooperation between the participating countries. Subsequent to the first phase (1995-1999), the Socrates programme has been renewed and is currently in its second phase (2000-2006). Socrates has a budget of 1 850 € million for the seven-year period and consists of eight actions. The Socrates-Erasmus action addresses the higher education sector and is probably the most visible action. Erasmus itself consists of many different activities including student and teacher exchanges, joint development of study programmes (Curriculum Development), international intensive programmes, thematic networks between departments and faculties across Europe, language courses (EILC), European credit transfer system (ECTS).

Two further programmes addressing the higher education in Europe are the programmes Erasmus Mundus and Tempus. In essence both programmes aim to enable and strengthen international co-operation and mobility. Tempus is focused on higher education modernisation projects in particular regions, while Erasmus Mundus activities are build around European Masters Courses. These courses are integrated courses at masters level offered by a consortium of at least three universities in at least three different European countries. The courses must be "integrated" to be selected under Erasmus Mundus, which means that they must foresee a study period in at least two of the three universities and that it must lead to the award of a recognised double, multiple or joint diploma.

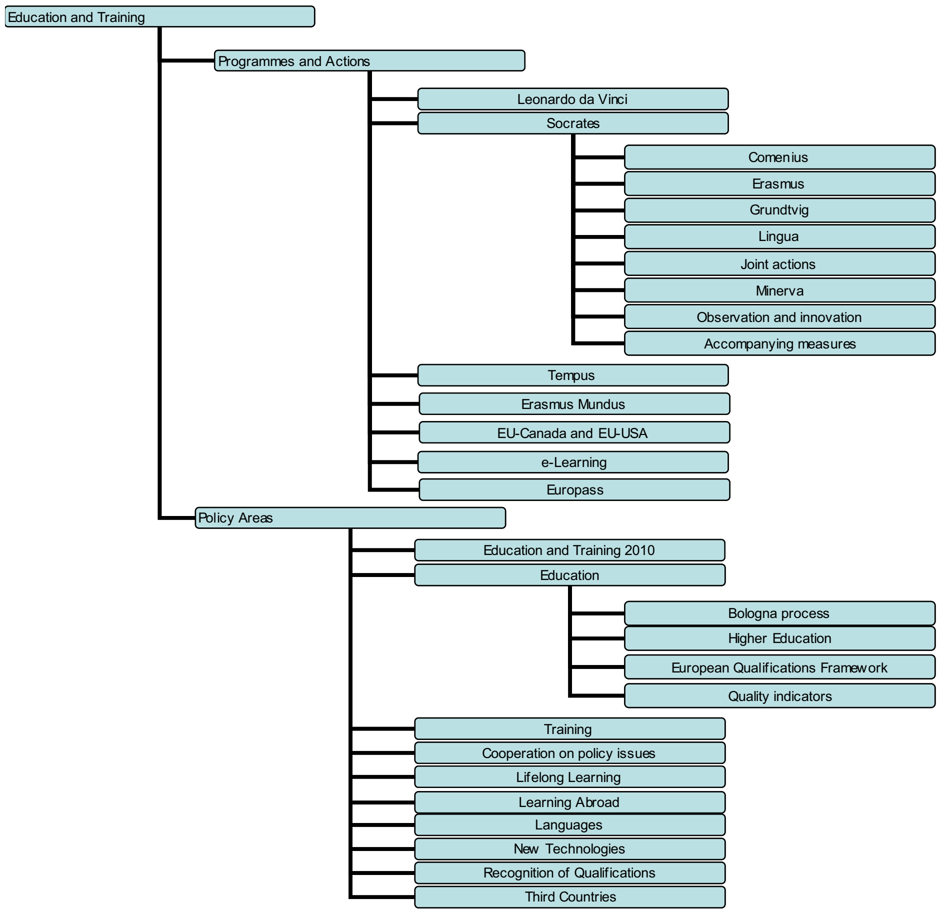

Figure 2 - European programmes, actives and policy areas in Education and Training

Table 2: Main programmes addressing the higher education in Europe

Programme	Objectives	Activities
Socrates - Erasmus	Enhance the quality and reinforce the European dimension of higher education	o encouraging transnational cooperation between universities o boosting European mobility o improving the transparency and full academic recognition of studies and qualifications.
Tempus	Enabling universities from EU Member States to cooperate with those in Western Balkans, Eastern Europe and Central Asia, and the Mediterranean partner countries in higher education modernisation projects.	o Joint European Projects o Structural and Complementary Projects o Individual Mobility Grants
Erasmus Mundus	Co-operation, mobility and international links in the field of higher education	o supports European Masters Courses o enabling students and visiting scholars from around the world to engage in postgraduate study at European universities o encouraging the outgoing mobility of European students and scholars towards third countries.

2.2. Selected Projects in the Higher Education Sector

2.2.1. BIN:Net – Business Informatics in Common Europe

In 2004 an international project BIN-Net: Business Informatics Network in Common Europe has been awarded funding under the ERASMUS – Joint Development of Study Programmes at intermediate and advanced level within the SOCRATES Programme (identifier 28545-IC-1-2003-1-AT-ERASMUS-PROGUC-1). Coordinated by the University of Vienna (Austria) following countries and institutions participate in this project: (in alphabetic order by country): Austria *(*University of Vienna*);* Czech Republic *(*University of Economics, Prague*);* Hungary *(*University of West Hungary, Sopron*);* Ireland *(*Dublin City University*);* Poland *(*Wroclaw University of Economics and Gdansk University of Technology); Portugal (School of Technology of Setúbal); Romania (University "Lucian Blaga" Sibiu and University Politehnika of Bucharest); Slovak Republic (Comenius University of Bratislava).

With ten cooperating universities in eight countries the project aims to develop a joint-master degree in Business Informatics in Europe. The programme aims to develop a common curriculum that supports teachers and student mobility. As a common master degree in Business Informatics in Europe, the programme's objective are to teach, communicate and complete expert knowledge in Business Informatics, Computer Science and Business. In order to improve transparency and recognition abroad the structure is modular and all courses are European Credit Transfer System (ECTS) valuated. Each partner institution will recognize the common degree and award a Diploma supplement, aiming to improving international 'transparency' and at facilitating the academic and professional recognition of the qualification.

1st Semester **30 ECTS**	Structural Sciences	Business Sciences/ Economics	Business Informatics	Information Management	Elective
2nd Semester **30 ECTS**	Sp. Elective 1 Module 1	Sp. Elective 1 Module 2	Business Informatics	Sp. Elective 2 Module 1	Sp. Elective 2 Module 2
3rd Semester **30 ECTS**	Sp. Elective 1 Module 3	Sp. Elective 1 Module 4	Master Thesis Seminar	Sp. Elective 2 Module 3	Sp. Elective 2 Module 4
4th Semester **30 ECTS**	Master Thesis				

Figure 3: Common Curriculum Structure

The curriculum has a modular structure consisting of four semesters, which is illustrated in Figure 3. Each "module block" accounts for 5 ECTS and addresses a certain subject of study. The details of each module and related courses are specified in common module syllabuses. Types of courses include lectures, tutorials, practical training, pro-seminars and seminars. The degree comprises 120 ECTS Credits with 90 ECTS accounted for taught subjects and 30 ECTS credits for the research master thesis. In accordance with the common framework specified within the Bologna declaration, the common degree fits into the three cycle structure of Bachelor, Master and Doctoral studies. By providing postgraduates and professionals knowledge and skills in business informatics within the second cycle the degree will support the concept of life long learning.

2.2.2. ETN DEC - European Thematic Network Doctoral Education in Computing

Another project, which also aims at the implementation of some of the action lines, identified in the Bologna Declaration is the Thematic Network "European Computing Education and Training" [TN_06a; TN_06b]. The project is an example of an effort to integrate the European Education in Computing, and involves about 170 members from about 70 cooperating institutions in 30 countries. Over the last years the consortium developed comparable professional standards, curricula and syllabi for Bachelors and Masters in the field of Computing, emphasizing the four subject areas of: Computer Science, Computer Engineering, Software Engineering and Information Systems [TN_06a]. It also developed a series of WEB based teaching materials and established a Virtual European Department of Computing. Currently a subsequent project is underway, which aims at the third cycle of Education in Computing, the doctoral degree.

The current project intends to analyse and develop curricula and syllabi for the doctoral study programs in Computing [TN_06b]. In addition the project team is exploring other forms to expand further the activities of the Virtual European Department of Computing. The work pages and curriculum development are structures along subject oriented work groups, which include Computer Science, Computer Engineering, Software Engineering, Information Systems. One of the recent results are for instance a preliminary framework for Information System doctoral study programmes. This framework, which is outlined in Figure xxx, is currently under evaluation and discussion.

<table>
<tr><th rowspan="2">ECTS</th><th colspan="4">Core Subjects</th><th colspan="2">Domain Specific Elective Examples</th></tr>
<tr><th>Informatics and Fundamentals in Engineering</th><th>Information Systems and Enterprise Engineering</th><th>Business and Economics</th><th>Research Methodology</th><td rowspan="8">Advanced Supply Chain Management</td><td rowspan="8">Advanced Modeling and Simulation</td></tr>
<tr><td rowspan="2">5</td><td rowspan="2">Logic for computer Science</td><td rowspan="2">Information Systems Development</td><td rowspan="2">Legal Frameworks</td><td>Quantitative Methods</td></tr>
<tr><td>Qualitative Methods</td></tr>
<tr><td>5</td><td>System Theory</td><td>Information and Knowledge Management</td><td>Supply Chain Management</td><td>Research Skills</td></tr>
<tr><td rowspan="2">5</td><td rowspan="2">Modeling and Simulation</td><td rowspan="2">Business Engineering and Information Systems Architecture</td><td rowspan="2">Economics</td><td>Research Project Management</td></tr>
<tr><td>Academic Writing</td></tr>
<tr><td>5</td><td>Statistics</td><td>Business Process Modeling</td><td colspan="2"></td></tr>
<tr><td>10</td><td colspan="4"></td></tr>
<tr><td></td><td>20 ECTS</td><td>20 ECTS</td><td>15 ECTS</td><td>15 ECTS</td><td colspan="2">Each module 30 ECTS</td></tr>
</table>

Figure 4: Framework for Information System Doctoral Study Program

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THE NETWORK OF NATIONAL AND EU PROJECTS TO SUPPORT SYSTEMS THINKING AND SYSTEM DYNAMICS

Stanislava Mildeova [1]

Changing the exogenous and endogenous factors in order to preserve the right trajectories of future development and to understand better the processes that make it possible, it is vital for managers and strategic decision makers to think dynamically and to see the problem as a whole, in its entire context. It does not only mean to have adequate system information input, but also to change the paradigm of thinking, to be able to reveal the problems and their influence the behavior of the world. The goal of the paper is to contribute to the topic of the network of national and EU projects for systems thinking and dynamic intuition support in economy – the development of system understanding and people's „dynamic intuition" and the possibilities of its computer support.

The author goes about an overview of the various approaches supported for System Dynamics and Systems Thinking development, in the Czech Republic. This is a contribution for a forum in which researchers, educators, consultants, and practitioners, in the corporate and public sectors interact to introduce newcomers to the field of System Dynamics and Systems Thinking. The paper is supported by the Czech Science Foundation within the grant project "System Dynamics Theory and Market Structures", number GACR 402/05/0502.

1. Introduction

The author describes the projects with EU and country financial support which are or were solving in the field of System Dynamics and Systems Thinking development in economy.
The following figure shows the projects discussed.

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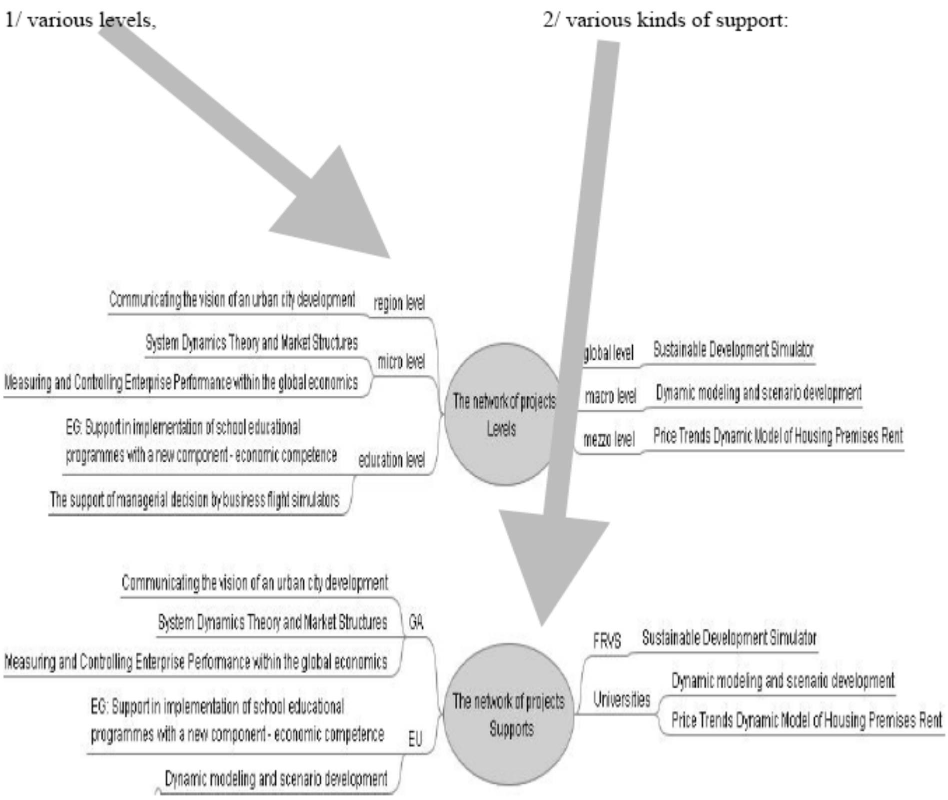

Comments:

FRVS - The Fund for Development of Universities

GA - The Czech Science Foundation

EU - The European Union

Universities – various universities

Figure 1- Projects discussed for various levels and various kind of support

2. 2. What is System Dynamics and Systems Thinking

To understand the definition of System Dynamics and Systems Thinking we may use the official website of The System Dynamics Society, as an international organization devoted to encouraging the development and use of Systems Thinking and System Dynamics around the world [9].

"System dynamics is a methodology for studying and managing complex feedback systems, such as one finds in business and other social systems. In fact it has been used to address practically every sort of feedback system. While the word system has been applied to all sorts of situations, feedback is the differentiating descriptor here" *(see Figure 3)*.

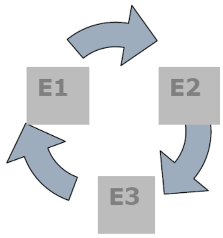

Figure 2

What is the relationship of Systems Thinking to System Dynamics?
"Systems Thinking looks at exactly the same kind of systems from the same perspective. It constructs the same causal loop diagrams. But it rarely takes the additional steps of constructing and testing a computer simulation model, and testing alternative policies in the model".

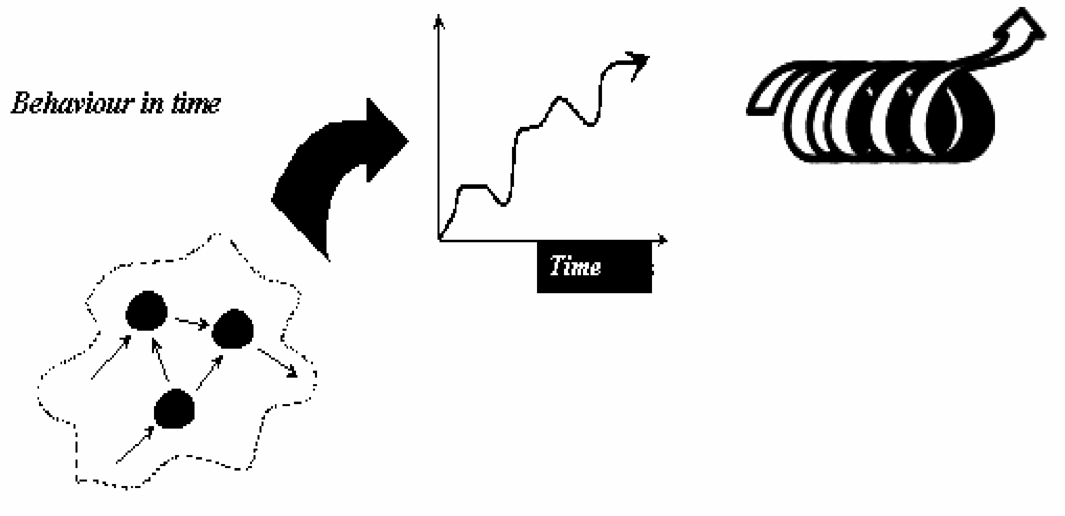

Figure 3: System dynamics

3. The network of projects

3.1. Sustainable Development Simulator

A sustainable development becomes an important part of international and national approaches.
Questions "What knowledge can be obtained by using sustainable development simulator (on the basis of system dynamics) and its practical application to completion of the system wanted changes and "What is the role of the learning process with implementation of these changes in the real world?" is the starting point of the project „Sustainable Development Simulator" [6].

The sustainable development simulator being created in this project shall contribute to the development of student's system thinking, supporting ecologically acceptable behavior, helping him during the study of complex systems.

The project „Sustainable Development Simulator" and the following PHARE project confirm that system dynamics models or simulators can play a very positive role in sustainable development - they function as a tool for understanding and implementing sustainable development.

Several different scenario versions help to "widen the horizons" for possible variants of solutions and to point out the key areas of decision-making while keeping a global view on the strategy process while retaining the very important global view.

3.2. Dynamic modeling and scenario development

"Dynamic modeling and scenario development" was one from five major methodological areas which were specified in the project "Natural Resources and Environmental Accounting in the Czech Republic", carried out under the Phare programme [5].

The simulation tool M3ED developed at the *C3ED* in France (with applications previously to both France and the Netherlands), has served as the basis for an adaptation to the Czech economy. The modeling aim has been to take first steps towards simulation of plausible long-term futures for the Czech economy, while testing the dynamic consistency of the underpinning model.

Model CZ-M3ED could provide a framework for moving from ex post accounting to ex ante explorations of key economic trends and environmental pressures. The implementation focused on the dimensions of energy use in the economy and carbon dioxide emissions.

The results of the module Dynamic modeling and scenario development can be thought of as elements of a policy support data bank which can have many uses including the information inputs needed for national economy scenario modeling aimed at exploring the potentials, constraints and trade-offs in the setting and evaluation of Czech Republic economic and environmental policy.

This project has been written, supervised and encouraged by DG XII European commission EUROSTAT. The important person for the whole project was Martin O'Connor a member of European commission. His contribution to the problem was a proposed transfer of methodical concept and solution from EU to the individual soluble group. He also participated on modeling the macroeconomics applications.

3.3. Price Trends Dynamic Model of Housing Premises Rent

Housing premises rent has been big socioeconomic and political issue in the Czech Republic for a long time. The calculation model of maximum rent for square metre of a housing unit has been changed several times.

The purpose of this project was to create price trends model of housing premises rent in Czech Republic from 2006 to 2012 [1].

This simulation model was based on Systems Dynamics methods and Powers Studio 2005 was used as modelling software. Firstly, the main variables and constants have been identified as reference modes of system and units have been defined. Secondly, a causal-loop diagram (CLD) has been designed. In this case the CLD has been built from the following variables: "Actual value of monthly rent", "Ratio between final and actual value of monthly rent", "Rent increment" and "New value of monthly rent". The simulation shows that maximum monthly rent value depends mainly on input values and does not increase as a rule.

3.4. Communicating the vision of an urban city development

A research team [2] worked on a composition of a model of the Eastern European city of Brno which is to test communication policies. The background was that the City hall faces problems in communication and explaining some of its long-range goals. Constructed model is derived from the J.W. Forrester's model of urban growth and includes also some „soft" variables, which seriously effect the perceived leadership role of the City hall and its ability to proceed further and to gain public support.

3.5. 3.5 System Dynamics Theory and Market Structures

One of the areas where the competence of System Dynamics models was largely presented, is without question the issue of market structures.

In our present research [4] [8], whom resources are granted by The Czech Science Foundation we want to focus on an area tightly connected with the real-life business problems – general characteristics common for various dynamic market structures determining the customers' behavior – and consecutive processing of general System Dynamics from the behavioral market model from a company's viewpoint.

The general System Dynamics behavioral market model from a company's viewpoint should be used for finding policies that can solve problematic behavior and help us to explain the reason why the markets behave in such ways. Also, it should enrich the current basis of models that can be used as components for the modeling of larger wholes (typically in connection with a company model).

The output of this project – behavioral market model from the company's viewpoint should serve as a reference model for real-life market structures modeling and comprehension of their behavior. It would be also instrumental as a framework for an easier thematic simulation model creation in both academic and practical sphere, for real market behavior analysis and finding successful policies and decisions successful in the long term.

3.6. 3.6 Measuring and Controlling Enterprise Performance within the global economics

The Czech Science Foundation also supported the project „Measuring and Controlling Enterprise Performance within the global economics" that refers to the basic principles of business management [7].

It was required to submit a solution for a dynamic manager simulating program that enables simulation of company behaviour. The starting premise here was that one may become a good manager only after gaining long-term experience. A suitable intermediate step between the theory and real-time company management may be the manager simulator. It is capable of setting the environment near to the reality and forces you to think about the connections. Its other advantage is solving problems in a creative way.

3.7. EG: Support in implementation of school educational programmes with a new component - economic competence

At the age of knowledge and globalization the society calls for better education that would focus on active development of pupils' creativeness. Including their ability to evaluate critical information or solving the problems in a positive way in order to get by with the complications of the current world.

During the education process it is vital to acquire the tools, procedures, knowledge, all that would develop and culture the productiveness. From the methodical point of view this project angled by European Social Fund deals with critical System Thinking and System Dynamics (creating "micro worlds" and interactive learning environment - ILE) known as science subjects that contribute to the problems in many countries of the world (for instance in Scandinavian countries or USA).

The solution focuses on developing practical abilities in economical decisions and gaining the knowledge in context of "Lisabon strategy" and "strategy of sustainable expansion of EU".
Apart form that the project also springs from the program System Thinking and dynamic modelling that controls MSMT alongside with Profess Consulting Company.

3.8. The support of managerial decision by business flight simulators

A using the System Dynamics models in various fields, mainly with respect to practical use of simulations for management decision-making support was solving in project supported by Grant Agency of University of Economics, Prague [3].

The results created management flight simulators - a useful tool for reflecting real systems behavior for educational purposes and for estimations of a future development. Theoretic background of these simulators comes from the methodology of System Dynamics and Systems Thinking.
The structure of our business flight simulators consists of three parts. It is the mentioned System Dynamics model that constitutes the manager simulator core, user interface and simulation environment, represented by case studies and different scenarios.

These simulators were considered to be tools that would help to understand dynamic relations in an organization as a whole. The simulation enables users to trace the impact of particular decision on the whole firm's behavior and it is an environment which would bring the Systems Thinking to managers in an enjoyable form.

They have showed that human mental models play a crucial role in decision-making procedures. To solve the problems, we have to change them and outperform their shotcomings, especially certain influence of conventionality and the current thinking paradigm – tendencies to linearization and to omit feedbacks and delays ("bounded rationality").

4. A connection of national and EU projects

4.1. Integration access to the methodology

If we imagine these projects as hypercube for various problems' levels, the common space is the same access to the methodology *(Figure 2)*. In all described projects Systems Thinking and System Dynamics were used as a practically oriented disciplines, which can help in solving problem situations, where the human mental models are insufficient - it is obvious that we can not consider any solution to be the right one unless we stick with the systemic procedures respecting our limitations and important characteristics of the complex social systems.

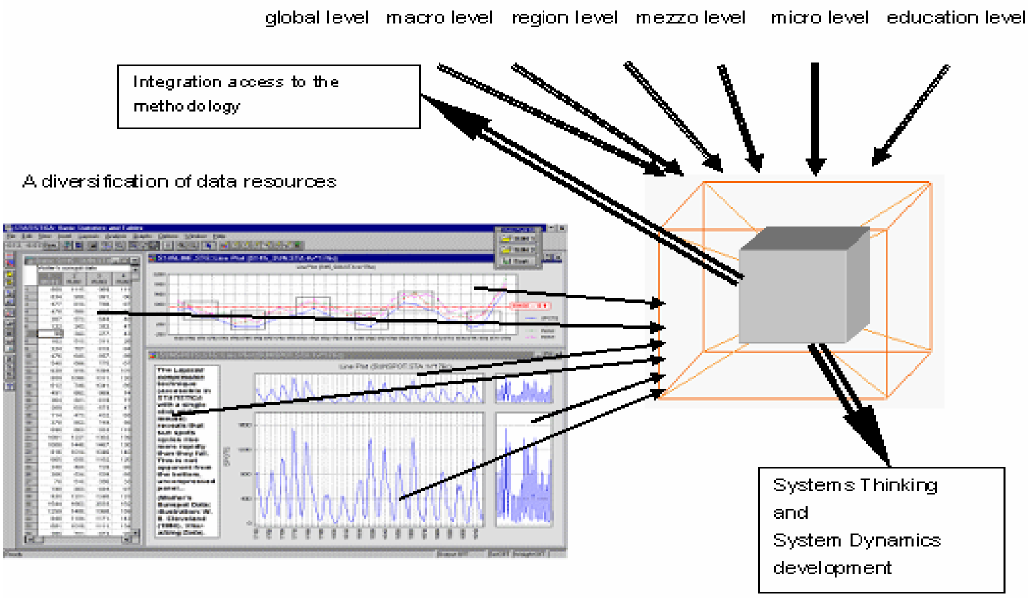

Figure 4 - Hypercube for various problems' levels

4.2. Diversification of data resources

A lot of data was applied in these projects and in the model specifications, based on national statistics on inter-sectoral flows (input-output tables), hypotheses about technological changes prospects for efficiency and mix of primary and refined energy uses, statistical data of population, housing, employment, schools, data gained from regional developmental agencies, data from market research, internal company databases, and others.

5. Conclusions

A wide range of methodologies, tools and models have been developed in regards of the spectrum of problems addressed in economy, in inter-related problems of economy and ecology and in education. By means of described projects the author discusses the possibility of Systems Thinking and of System Dynamics.

It represents a shift from the view of the world as a set of action – reaction relationships to a mutually interconnected dynamic process. This enables us to think about what is going on around us in a different way.

Following the results from these projects and especially in their ambit constructed System Dynamics models we found System Dynamics models to be a safe environment in which it's possible to think creatively about complex problems and their solving.

They could also help managers, decision and policy makers of post-communist countries to understand and outline possible future consequences of their decisions in highly chaotic environments. It's much better to make a mistake in decision in the virtual world of our computer, than risk the mistakes in the real world.

The clear advantages are mainly improvements in decision making in the long run and a significantly shorter learning process. The impact on the Czech society could be demonstrated on better state of ecology, higher competitiveness of Czech companies in the upcoming EU environment, higher resource allocation efficiency, consequences of various market structures, etc.

Under knowledge sharing from described projects the author sees that Systems Thinking and System Dynamics have a positive influence on an improvement of decision making and learning in companies, corporations and public institutions that need to cope with dynamic complexity of the real world problems.

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REGIONAL DIMENSION OF EUROPEAN KNOWLEDGE PRODUCTION

Jan Klas, Tomáš Sigmund, Václav Šubrta [1]

Knowledge production and research and development – these are the crucial factors in knowledge intensive economies. When discussing integration of European knowledge economy via the research projects, it is good to see the point we are starting from. This contribution aims to provide brief overview and analysis of the regional dimension of European research, which would serve as basis for future discussion of European integration via research. The contribution is based on data published by Eurostat and uses at the country level indicators like number of patents submitted at European Patent Office, number of researchers, and amount of research and development expenditures. The regional analysis is performed also on the NUTS 2 level, using the research and development expenditures indicator, and results in picture showing the most research expenditures intensive regions in EU25.

1. Introduction

One of the interesting questions of European integration is that one, which deals with integration via research and research projects. When thinking about possible answers, one naturally comes to thoughts about nature of European research. When we are integrating via research, what do we integrate? What is the nature of research in Europe and in single European countries?

Assessing research, its level and intensity is very tough question. From the indicators made available by Eurostat [1], we have chosen following ones:

- Absolute number of patents at European Patent Office per country
- Absolute number of patents at European Patent Office per country per million of inhabitants
- Number of researchers (full time equivalent) per country

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- Expenditures on research and development per country in millions of PPS (purchasing power standard – fictive currency units reflecting different purchasing power of national currencies) per country
- Expenditures on research and development per NUTS 2 regions, in million of PPS.

This set of measures should provide complex view on European research – it supplies indicators for assessing success of countries in research (number of patents) and countries research capacity (human capacity – researchers employed, and financial capacity – capital employed (expenditures on R&D)). Indicator number of patents per million inhabitants provides is used to justify the image pictured by number of patents with „size“ of the country (based on hypothesis, that in research humans are of greater importance than the are of the country). Last measure, expenditures on research and development per NUTS 2 region, is used to picture geographical distribution of research in Europe, aiming to identify, if research is concentrated into one geographical area or if it is dispersed equivalently around the Europe.

2. Methods and methodology

Research data are taken from the Eurostat published data about European research [2], mostly from years 2000 – 2002. The aim was to have data for the research in 21st century, but complete data are mostly available for years 2000, 2001, 2002.

Data for NUTS 2 regions were much more difficult to obtain, so the final result set is compiled from data for several different years. Most of the data is for the year 2003, data for France for the year 2001, data for Austria represent the year 2002. UK data originates in 1999 and are recalculated from NUTS 1 level (average (NUTS 1 data divided by number of NUTS 2 regions in the respective NUTS 1 region). Data for Sweden are missing. So the final Figure for NUTS 2 cannot be taken for scientifically and statistically perfect, however it can provide idea, which regions are more important in research manner or not. The other factor, which influences the results of NUTS 2 dimension of research, is the NUTS 2 regions definition – each NUTS 2 region should have number of inhabitants in set interval and some countries define these regions on the upper border of this interval and some countries on the lower border. So when having „smaller“ NUTS 2 region, usually its „research importance“ would also tend to be lower. This could be justified e.g. by taking into account number of NUTS 2 inhabitants; however this would extend the range of this contribution.

3. Results

3.1. Research outputs – patents submitted to EPO

Let's first look on the results of research, which is possible to count – the number of patents submitted by each of the European countries to European Patent Office (EPO). The radar Figure 1 shows, that during the years 2000, 2001 and 2002 the number of patents submitted by each country is nearly the same. Figure 2 pictures the relative amount of patents submitted among different countries. It can be clearly seen, that 4 countries (Germany, France, United Kingdom and Italy) submit nearly 75 % of patents at EPO and that 10 of 25 EU countries (Germany, France, United Kingdom, Italy, Sweden, Netherlands, Denmark, Spain, Belgium, and Austria) form 95 % of EU patent output. The rest 15 EU countries form less than 5 % stake of EU patents at EPO.

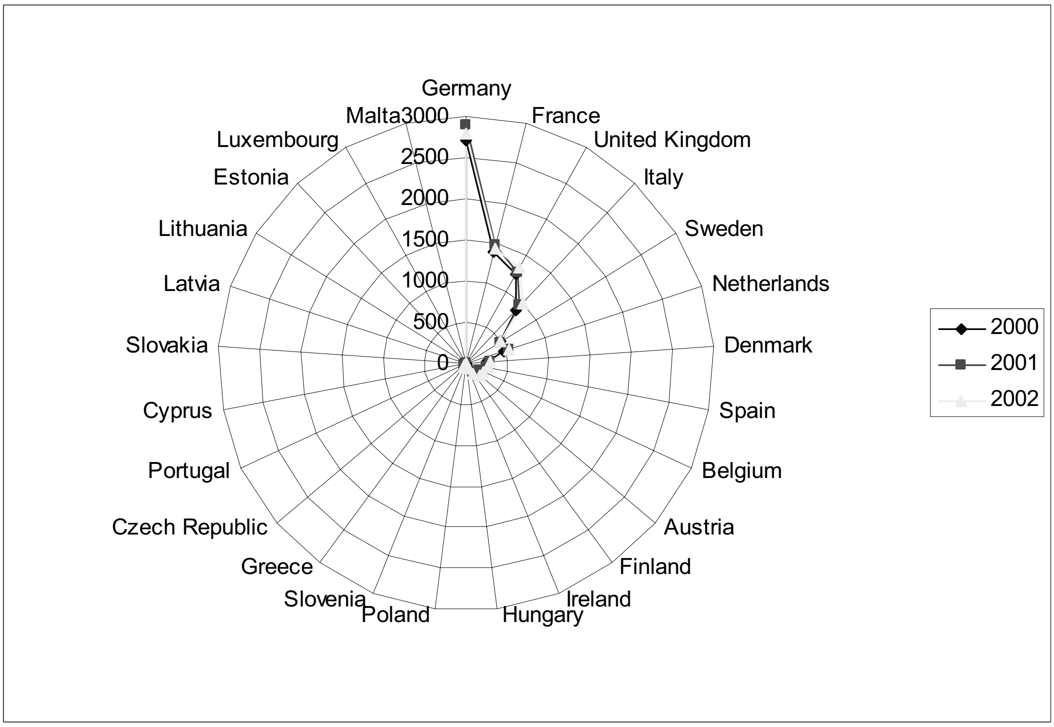

Figure 1 - Number of patents at EPO per country

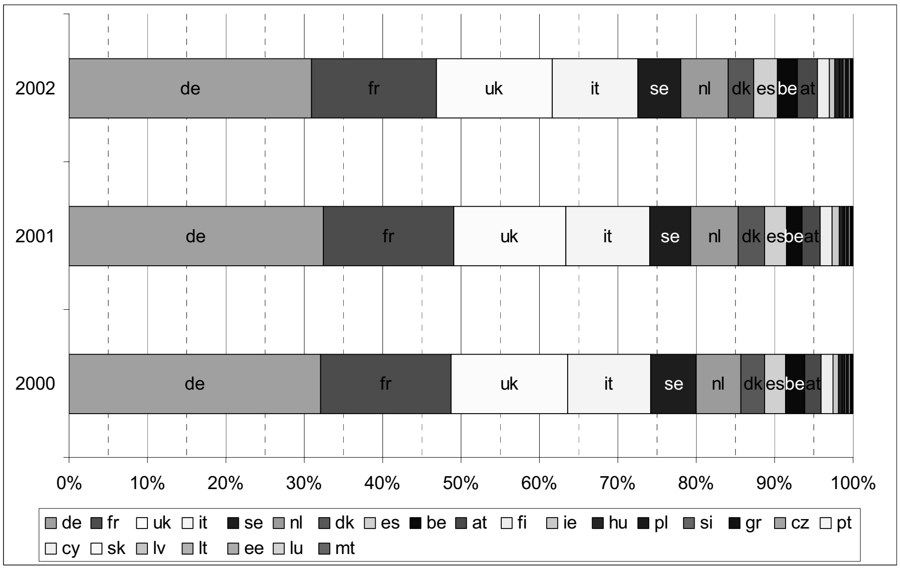

Figure 2 - Number of patents at EPO per country

Figure 3 (Number of EU patents at EPO – per million of inhabitants per country) aims to correct the picture drawn by Figure two with taking into account the size (number of inhabitants) of each European country. The result is now little bit different, however still the 12 EU countries (of 25) form more than 85 % of patented output. From the countries not mentioned in absolute measure, in measure by number of inhabitants good results are achieved by Finland, Ireland and Slovenia.

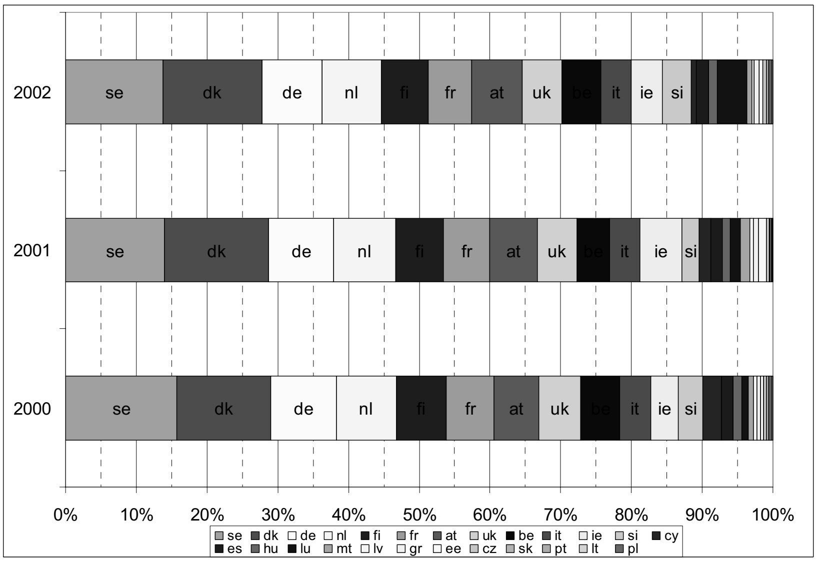

Figure 3 - Number of patents at EPO per million of inhabitants

3.2. Research extensity – number of researchers

Now let's look onto the importance of research in each country, this time again in absolute numbers. First let's examine number of researchers and then research and development expenditures. Number of researchers would be taken as fulltime equivalent of researchers, and the research and development expenditures would reflect the different purchasing power of national currencies, so it will be stated in so called PPS (Purchasing power standard).

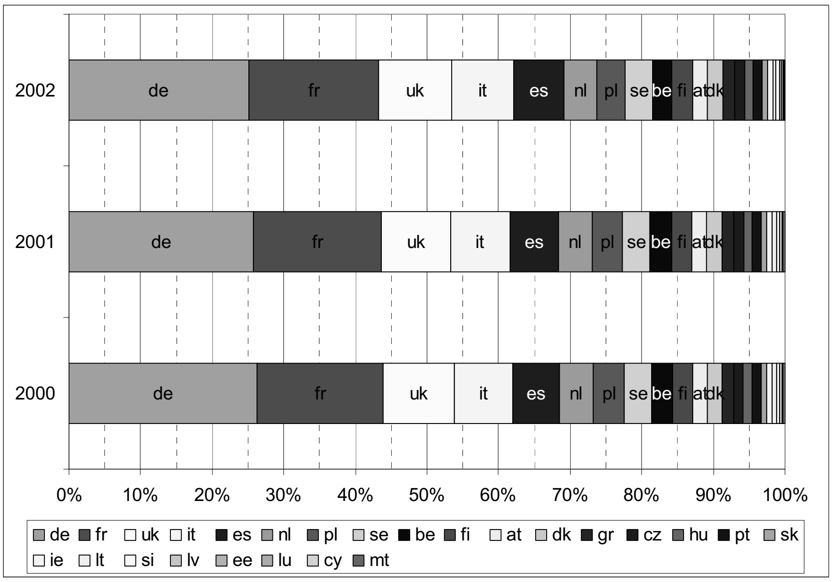

Figure 4 – Number of researchers per country (Full time equivalent)

In Figure 4, there is pictured the relative number of total EU research in each country. Again, the Union seems to be misbalanced, 12 countries employs more than 90 % of EU research workforce. From countries not mentioned in analysis of research outputs, Spain and Poland has significant amount of researchers.

3.3. Research extensity – research and development expenditures

Rather similar picture is drawn by Figure 5, which illustrates research and development expenditures justified for different purchasing power of national currencies. Again, 12 countries provide more 90 % of EU research expenditures, more over 4 countries provide about 70 % of research expenditures.

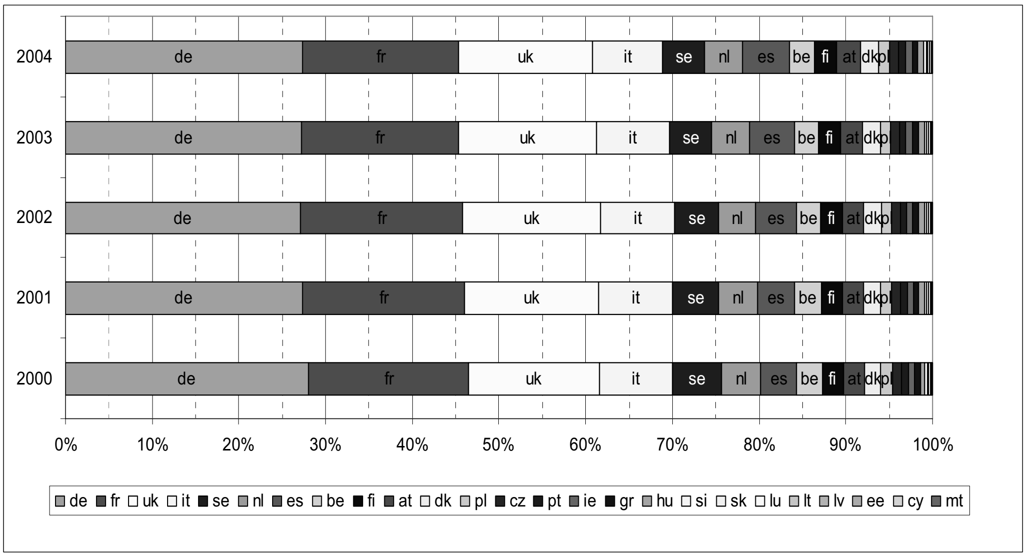

Figure 5 - Research and development expenditures in mil. PPS per country

3.4. Research regional dimension – NUTS 2 research and development expenditures

3.4.1. NUTS characteristics

So above mentioned results on EU's research and development expenditures illustrates large disparity among Union's countries. However European countries are very different in their size, wealth and culture. What about single European regions? For purposes of statistics, in Europe there are defined several levels of territorial regions (so called NUTS – Nomenclature of territorial units for statistics [1]). At the top level, there are defined NUTS 1, NUTS 2, NUTS 3 regions. NUTS 1 region comprises of several NUTS 2 regions which comprises of several NUTS 3 regions [1]). To be NUTS comparable around the Europe, there are set population limits for each NUTS, for specific values see Figure 6. However, in reality these values are rather indicative. The comparison is made more difficult by different size of NUTS regions – some countries have NUTS regions sizes closer to the maximum and some countries preferred to have more NUTS regions, with size reaching just the minimum level.

Level	Minimum	Maximum
NUTS 1	3 million	7 million
NUTS 2	800 000	3 million
NUTS 3	150 000	800 000

Figure 6 - Characteristics of NUTS regions according population size (source [1])

Analysis of research and development expenditures showed large disparities among European countries. The question is, if these disparities are caused by different sizes of countries or not. If yes, comparison of research and development expenditures on regional level should result in much more balanced picture than on country. Graphical results of comparison of R&D expenditures on

3.4.2. NUTS 2 R&D expenditures

NUTS 2 level is pictured on Figure 7. The map shows borders of NUTS 2 regions in European Union, dark filled regions spend more then 0.5 % of total EU R&D expenditures and the darkest filled regions spend more than 1 % of total EU R&D expenditures. The map shows large disparities in spending on R&D.

When assessing conclusions based on Figure 7, it is necessary to take into account, that this Figure is not statistically correct. Because data on NUTS 2 are difficult to obtain, in the Figure there are combined basic data for the 2003, numbers for France are form 2001, numbers of Austria from 2002. Numbers for Sweden are totally missing and numbers for United Kingdom were manually recalculated from NUTS 1 data (NUTS 1 total divided by number of NUTS 2 regions in NUTS 1). The map is manually painted, base map is taken from unemployment analysis of national Swedish statistical office [4].

From the Figure 7, it is obvious, that most of the EU25 R&D expenditures are situated into several regional areas, often with high concentration of population, for example regions comprising of capital cities (and other big cities) and surroundings (Paris, Munich, Stuttgart, Darmstadt, Madrid, Rome, Berlin, Vienna, Hamburg, Barcelona, ...). This is more obvious from the Figure 8, which represents top 20 rows of the source dataset for Figure 7 (statistical remarks for Figure 8 are the same as for Figure 7, see paragraph above).

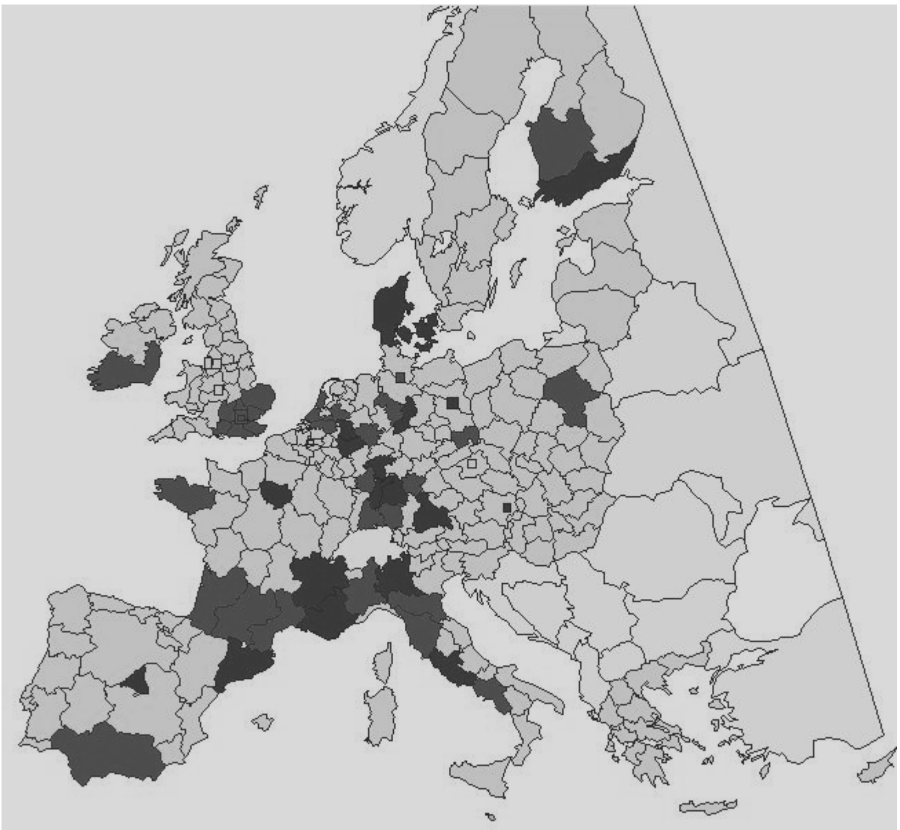

Figure 7 - Research and development expenditures in PPS per NUTS 2

Figure 8 again shows the regional disparities in expenditures on R&D. First 3 regions poses nearly 15 % of total EU R&D expenditures, first 15 regions more than one third of total EU R&D expenditures (just for comparison – EU25 has more than 250 NUTS 2 regions).

No.	NUTS 2 region	R&D expenditures (in mil. PPS)	% of ttl. EU R&D expenditures	Cumulated % of ttl. EU R&D expenditures
1	*fr10* Île de France	13703	7,67 %	7,67 %
2	*de21* Oberbayern	6585	3,69 %	11,35 %
3	*de11* Stuttgart	5371	3,01 %	14,36 %
4	*de71* Darmstadt	3896	2,18 %	16,54 %
5	*dk00* Denmark	3645	2,04 %	18,58 %
6	*fr71* Rhône-Alpes	3536	1,98 %	20,56 %
7	*dea2* Köln	3328	1,86 %	22,42 %

No.	NUTS 2 region	R&D expenditures (in mil. PPS)	% of ttl. EU R&D expenditures	Cumulated % of ttl. EU R&D expenditures
8	*itc4* Lombardia	3300	1,85 %	24,27 %
9	*de91* Braunschweig	3220	1,80 %	26,07 %
10	*de12* Karlsruhe	2836	1,59 %	27,66 %
11	*de30* Berlin	2773	1,55 %	29,21 %
12	*es30* Comunidad de Madrid	2686	1,50 %	30,71 %
13	*ite4* Lazio	2648	1,48 %	32,20 %
14	*fi18* Etelä-Suomi	2591	1,45 %	33,65 %
15	*es51* Cataluña	2147	1,20 %	34,85 %
16	*dea1* Düsseldorf	2064	1,16 %	36,00 %
17	*at13* Wien	1913	1,07 %	37,07 %
18	*fr82* Provence-Alpes-Côte d'Azur	1899	1,06 %	38,14 %
19	*fr62* Midi-Pyrénées	1785	1,00 %	39,14 %
20	*itc1* Piemonte	1771	0,99 %	40,13 %

Figure 8 - Top 20 NUTS 2 regions according to R&D expenditures in mil. PPS

4. European integration via research

Based on the above analysis, what are the basements for integrating Europe via research?

There seem to be two basic ways:

- integrating the research intensive regions together
- integrating the research intensive regions with the other regions

The first alternative, integrating the research intensive regions together could provide synergetic benefits in short term (compared to second alternative), however it would support the multi-speed research Europe. From the point making Europe the most advanced knowledge economy in the world, this strategy makes sense, especially from the business point of view.

The second alternative, cooperation among research intensive regions with regions less developed in research area should provide transfer of knowledge how to make research, could help with convergence of less developed regions and strengthen the research base of all the Europe and thus increasing its research capacity. Politically, this alternative seems more desired and would demand supranational support from European Union, not only in matter of finance, but also in matter of methodologies and human capital.

Very probably both the alternatives are to happen. The first is being taken spontaneously by businesses and research consortia; the second one is being announced and supported by the European Union. However in the second case, the keyword is not supporting the less developed research region, but cross-european dimension of the research.

5. Conclusion

The above analysis provides brief overview of European state of research. It seems obvious, that relatively small portion of E.U. countries poses the most of E.U. research potential, in absolute numbers. These countries are especially Germany, France, United Kingdom and Italy. Examination of patented outputs at European Patents Office justified with number of inhabitants in country showed, that even some smaller states have good research outputs, especially Sweden and Finland, Denmark. Good results show also Netherlands, Austria and Slovenia.

Results of analysis of researchers employed in each member state were very close to the picture drawn by analysis of the absolute number of patents at EPO per country, with exception of some countries, which employ significant number of research, but have not so significant number of patents – Spain and Poland for example.

Another indicator of research is research expenditures. Again, picture is similar to the previous ones – four countries (Germany, France, United Kingdom and Italy) poses about 70 % of total European Union R&D expenditures.

Last analysis made was comparison of research expenditures of regions in European Union, specifically on the NUTS 2 level. The aim of the analysis was to show, if the research position in the statistically comparable regions is approximately the same or not. The analysis showed other misbalance, in European Union there is small number of relatively high research intensive regions. The total number of NUTS 2 regions is more than 250, the most intensive region poses more than 7 % of total EU R&D expenditures, the top 20 NUTS 2 regions poses more than 40 % of total EU25 research expenditures.

The analysis showed that there are significant differences in research in European Union, so integration in research are is more than desirable. Two possible ways of integration are integration within the research intensive regions together or cooperation research intensive regions with the common regions.

We are taking into account that used indicators do not provide complete picture of state of European research, however aim of this contribution was to provide some base for discussing European integration via research. This task has been fulfilled and we hope this contribution will provoke rich discussion about the future of research in Europe.

6. Acknowledgements

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EUROPEAN IST PROJECTS WITH IMPACT ON E-COMMERCE DEVELOPMENT IN SMES

Radoslav Delina, Anton Lavrin, Peter Mihók [1]

In order to stay competitive, European Union has started to support wide information technologies adoption in business and collaborative environment within the European market. Within FP6 IST, several interesting and important domains were focused, e.g. interoperability, Ebusiness digital ecosystem or ambient intelligence technologies. Within these domains we present in this paper three European projects solving innovative problems emerged mainly in B2B area and support knowledge transfer into NMS .

1. Introduction

European Union has performed its biggest enlargement ever, in terms of scope and diversity. Successful cooperation schemes between old and New Member States (NMS) should support the knowledge transferability in an enlarged Europe in the e-business field. At this point there is the opportunity to provide a standardized solution for SME e-commerce needs before its too late and small isle solutions are going to appear. For ensuring the better development of collaborative business european environment, we started participation within European FP6 IST projecs, which adress the very important issues as interoperability, ebusiness digital ecosystem development and ambient intelligence technologies: within the cluster „Enterprise Interoperability" – Abilities (Application Bus for InteroperabiLITy In enlarged Europe SMEs) IST STREP 27306; within „Ambient Intelligence technologies for the Product Lifecycle" - FLUID-WIN (Finance, Logistics and Production Integration Domain by Web-based Interaction Network) IST STREP 27083; within „Technologies for Digital Ecosystems" – Seamless (Small Enterprise Accessing the Electronic Market of the Enlarged Europe by a Smart Service Infrastructure) IST STREP 26476.

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2. Abilities project

The basic goal of the ABILITIES (Application Bus for InteroperabiLITy In enlarged Europe SMEs) [1] project is to study, design and develop a federated architecture implemented by a set of intelligent and adaptive UBL active messages (an Application Bus for EAI) and basic interoperability services, which, following the IDEAS framework and roadmap, aims at supporting SMEs EAI in e-commerce contexts, specifically in less developed Countries and less RTD intensive industrial sectors.

A typical NMS and associated countries use case as it is going to be solved with the ABILITIES system is for example the e-commerce for the woodworking industry in Romania. For a manufacturer, the commerce with different suppliers changes according to the available infrastructure of the companies [5]. For example, is there a connection to the internet available, or only a phone and fax machine? Also the business processes and documents differ between the companies, but this problem is already well addressed by the current state of the art in e-commerce. A critical issue for ABILITIES is how to adopt in a federated way a successful trade with existing differences in infrastructure, business processes, document formats and document content.

The different industries involved into the ABILITIES project as testbeds are:

- Collaborative business in Retail in Lithuania (Lithuania)
- Business Process Integration in High-Tech Incubator in Slovakia Centre (Slovakia)
- Mobile Business support in agro-food industry in Turkey (Turkey)
- XML Documents exchange in textile industry in Romania (Romania)
- Semantic Content Reconciliation in the tourism sector in Hungary (Hungary)

In Romania for example, all order invoices up to date have to be obtained from the government in printed and signed format. Therefore the e-commerce process of sending an invoice always has to take care of a semi automated step to bring the invoice information on the official document. Another example is that a wholesaler will only accept to buy from the woodworking manufacturer, when there is a picture attached, showing the quality of furniture.

There are some restrictions for the acceding countries compared to the established ecommerce in most of the “old” European Union countries such as:

- Documents such as invoice are already printed and signed by the government and therefore not prepared for e-commerce activities.
- Companies are not electronically connected to the internet.
- The budget for Information Technology (IT) technologies (hardware, software) is restricted.
- Experience and knowledge for e-commerce and sometimes even IT-systems is missing.

The major commercial motivation for the companies is that there has to be a product available that has on the one hand few licence costs or is open source and on the other hand it should be easy to use and maintain without the need of an IT expert. The assignment of research as in ABILITIES has to be to take into account that there will derive a standardized solution for SME in e-commerce of NMS and not to let companies diffuse into independent specifications. With the ABILITIES project, actors will be easily integrated to the order-to-invoice cycle on the internet platform.

2.1. 2.1. Technology description

In the ABILITIES project we distinguee between two levels of interoperability we address:

- • Interoperability at the level of business document formats.
- • Interoperability at the level of business document content.

By using UBL or more precise UBLtcs, a reference meta-model is provided and agreed by all trading partners. This level is handled using the unified approach. For the latter issue we propose on one side a multi-media empowerment of UBL business documents. These additional pictures, videos, voice records etc. are meant for human processing. On the other side we will develop a negotiation environment for business content (price, quantity, warranty duration, delivery date, quality). By using the ISO 14258 terminology, this is a typical federated solution (i.e. based on negotiation and on-the-fly mediation).

The solution proposed for supporting both interoperability levels is a blended architecture which could join the peculiar advantages of message-based Service Oriented Architectures (efficiency, maintainability, modularity, scalability, portability, security and privacy assurance) in the business documents format context and Intelligent Multi-Agent Systems (flexibility, non-deterministic autonomous intelligent behaviour, negotiation, adaptation to specific business cases) for mutual understanding and agreement on document contents, in a context where business documents become intelligent, interactive multi-media objects.

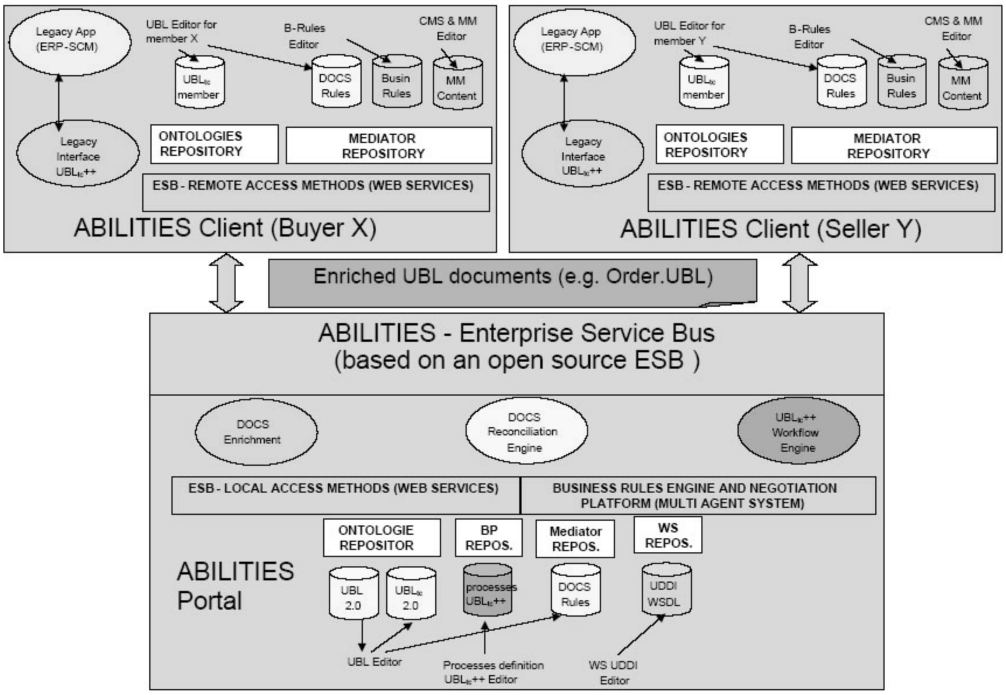

Figure 1 - Overview of the ABILITIES ESB and the connected clients architecture.

In this context the ABILITIES Federated Architecture is composed by several clients (one for each member of the network) interconnected by the ABILITIES Interoperability Bus with a Centralised ABILITIES Portal, encompassing Editors (for UBL Schema Editing, for UBL specific test case enriched processes definition), Repositories (for UBL and UBL specific for a particular test case (UBLtc) specifications, for UBL specific test case enriched processes definition, for applicative Web Services registries), Access Services (local Access Methods), Applicative Services (for documents enrichment, reconciliation and BPM enactment) as well as the Agent-based Negotiation Platform. A complete picture is shown in Figure 1. On the various client we will have Editors (for UBL Schema Editing, Business Rules and Multimedia Content), Business Repositories (for local enrichments of the UBL for the particular test case (UBLtc++) definitions, for Business Rules and Multimedia Content), Legacy Applications (e.g. TXT SC&CM and MS Office suite) and just one software component for Legacy Systems Interface.

3. Fluid Win

FLUID-WIN [4] will implement an innovative, interdisciplinary and dynamic business model. This model will enable the old European manufacturing companies to keep their ability of quick response, achieving competitive prices by integrating FEE suppliers. This model has to be supported through easy-to-adopt e-commerce applications.

Though efficient models for the supply chain execution are available nowadays as B2B operation, the great challenge is the integration of the logistics and financial services without installing thousands of peer-to-peer relationships. The objective is to develop means for a B2(B2B) service, based on ASP, providing the possibility to adapt a service into a complete existing network instead of installing relations to the network members. The project is driven integrating research from the EU-25, including Malta (as a European finance focus point), FEE and “old” European countries.

Today, efficient models for the supply chain management in terms of orders are available as B2B operation and others are under development (especially, for SMEs). The challenge is the integration of the logistics and financial services without installing thousands of peer-to-peer relationships. Therefore, the objective is to develop means for a B2(B2B) services, based on ASP, providing the possibility to adapt a service into a complete existing network instead of installing relations to the network members. In addition, the project will interchange the results of the project in a broad European community, thereby contributing to cooperation in the European research area.

Enumerated, the project objectives are:

- The design of a very innovative, efficient and lean FLUID-WIN B2(B2B) interdisciplinary model. The model will include all four major players: prime contractors, strategic suppliers, cross border logistic service providers and financial service providers. The model will support the definition of relationships among service providers (logistic and finance) and manufacturing networks, enabling the creation of a new multi-business web-based application where service providers offer their services not to a company but to an entire network. The model will also capture concepts, their relations and relative semantics, thereby defining a specific ontology.
- The design and development of a suite of web based tools (FLUID-WIN Platform) specifically designed to be provided on ASP basis, implementing the FLUID-WIN B2(B2B)

interdisciplinary model: The Network Modeller, the Interdisciplinary Service modeller, the Services Engine, and the specific user interfaces (fig. 2).

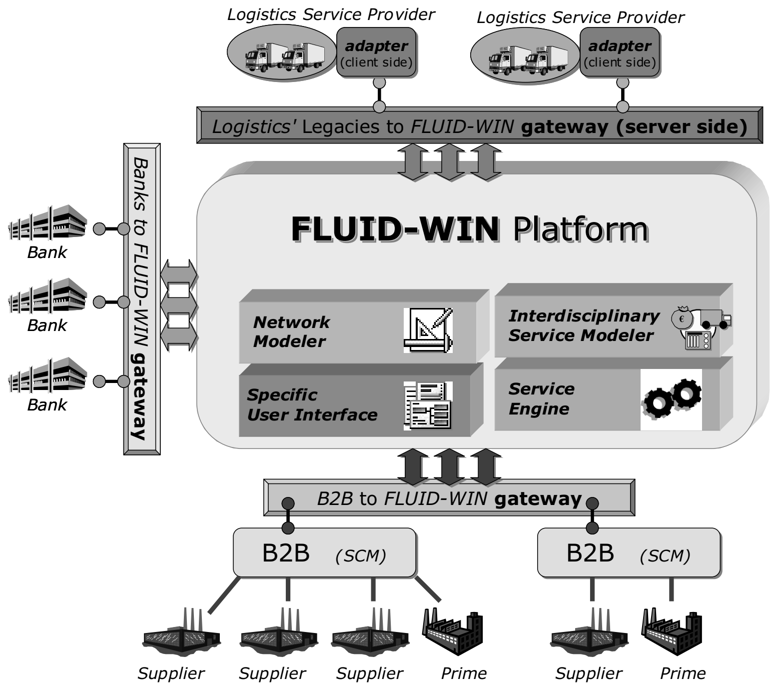

Figure 2 - The FLUID-WIN platform

- The design and development of a specific interoperability framework (FLUID-WIN Interoperability Framework) targeted to enable the electronic data interchange among all players based on the FLUID-WIN B2(B2B) interdisciplinary model.
- The evaluation on a relevant number of significant users of the project results through an ASP approach, and the delivery of a report on this evaluation.
- The preparation of a document that summarizes the research needs, identifies institutions researching in the FLUID-WIN research area, national/regional authorities that support or could support such research, a "vision 2020" and major steps identified to reach this vision ("roadmap") including proposals for cooperation support in order to achieve this more quick and more efficient.

3.1. Applications for Integration Between Banks and their Customers

A mixture of different payment systems has evolved to service the growing requirements of both trade-related and non-trade-related commerce. In the majority of cases, these systems operate as closed proprietary networks, creating incompatibilities between the different systems. There is a particularly sharp division between the payment and settlements systems, which are used for large value transfers, and those, which are available to settle smaller payments, particularly on a cross-border basis. This has led to an inverse relationship between the volume and the number of transactions. It has also further accentuated the division between large multi-national corporations and smaller enterprises wishing to utilise electronic systems for making payments. For example, a large proportion of the current global trade is controlled by large multinational companies who are trading within their own network of subsidiary companies and are seeking to minimize the cost of transfers within their operations while preserving the legal integrity and tax status of the companies concerned. Smaller companies that do not have access to these networks are forced to rely on a paper-based system of documentary credits. These are generally very time and cost consuming.

The existing interaction between banks and their customers is based upon (1) direct interaction or (2) with an intermediate organisation (usually an e-commerce company):

1. Proprietary eBanking software of the Bank in question – in this case the company has access to the e-banking facilities of the actual bank it uses for its own business. In order to make payments it has to fire up a bank transfer from its online personalized login, and perform a 'third party payment'. This has the great disadvantage that such e-banking systems cannot be integrated into B2B solutions.
2. At Payment Gateway Systems a third party (the gateway provider) runs a system to interface with clearing systems of several banks in order to enable payments from clients to suppliers. The payment gateway is independent and can be used by any client. However, the supplier is usually linked to a particular gateway in order to better monitor the money transfers. This system can be integrated with other software and enables B2B payments.

In all existing models of e-commerce there is normally a very straightforward payment mechanism. Mostly popular for B2C applications is an online credit card clearing system. However, for large B2B transactions invoices, statements and receipts are exchanged by EDI. The payment of large transactions is still mostly done via traditional bank drafts.

4. Seamless

The SEAMLESS project (www.seamless-eu.org) [6] studies, develops and experiments an embryo of the Single European Electronic Market (SEEM) network where a number of eRegistries are started up in different countries and sectors. Distinctive features are:

- Addressing Craft & Trade (C&T) companies through the respective mediators (chambers of commerce, entrepreneurial associations, local development agencies, ASPs).
- Focusing on two sectors, Textile (TEX) and Building & Construction (B&C) that are relevant to C&T companies and present overlapping areas (e.g. fabrics for tapestry).
- Starting up experimental RRs in both EU-15 and new member states (NMAS) and establishing interactions between them based on a proper collaboration framework.

The SEEM vision is towards an Internet-based structured marketplace where companies can dynamically collaborate without geographical and technological restraints, thus overcoming the limits of the hundreds of vertical portals each adopting its own specific model. It implies, among other aspects:

- Creating a self-organising network of eRegistries/Repositories (RRs) where companies can classify their own profiles, offers and features so as to gain public visibility to potential customers and partners.
- Providing advanced, semantically-based search & find services to discover candidate partners by selecting them from the RRs on the basis of their profiles, qualification and offer.
- Establishing the conditions for confident and secure dynamic relations, negotiations and information exchanges with other companies based on agreed collaboration protocols and reciprocal trust.
- Offering compliant web applications to manage general-purpose and sector-specific distributed processes, and hide the SEEM infrastructure complexity under easy and tailored user interfaces.
- Ensuring the interoperability of legacy systems by facilitated information exchanges, to integrate internal enterprise processes (active and passive cycles) with external collaborations.

The main project activities are devoted to define a collaboration framework and proper business models, realise evolving sectoral ontologies, develop a technological infrastructure and a number of applications and services on top of it. Six eRegistries are experimented, in Poland and Slovenia (B&C sector), in Spain, Slovakia and Romania (TEX sector), and in Hungary (generic).

The SEAMLESS project intends to provide an independent contribution to the Digital Ecosystem initiative and strictly collaborate with the relative cluster of projects.

The main results expected from the research work that will be carried out in this domain can be schematised in the following points:

- Ontology creation, mapping and evolution. The first point to analyse is how the global and local ontologies will be created and mapped onto each other, having however in mind the preference of the centric GAV approach. With respect to the proposals coming from the literature, in the SEAMLESS project there is a completely new aspect to consider, that is, the need to adapt theoretical solutions to a real-life working environment. On the other side, a simplification explicitly introduced by the project is limiting the ontology construction to only two sectors, that is, to their terms and concepts. The second point to consider is how to manage the changes that will be introduced into the local ontologies, to cope with new information and application needs, and how to propagate them to the common ontology (and transitively to the other local ontologies). The orientation is towards a disciplined update of the common ontology, which is preferred to version management for its simplicity and ease of implementation, and the automatic communication of changes to the interested nodes. Once again, the problem consists in selecting the most promising techniques from the literature and adapting them to a complex working environment.
- Support to collaboration in a multilingual environment. Another research theme is the realisation of a simple but effective support allowing every company to keep working (storing data, issuing queries, sending messages) its home language, and the other companies reading the same information in their respective home languages. The solution to develop must exploit the local and global ontologies and their mappings in such a way to minimise the effort, for the mediator holding the single SEEM node, to initialise and periodically update lexicon and concepts. The direction we intend to follow is based on handling, in each SEEM node, the common ontology expressed in English together with a subset of it translated into the local language (and the mapping between the two). When issuing a query, it is written in the local language and broadcasted by replacing the local

terms with references to the terms of the common (English) ontology. The receiving node reads the query with terms in its own language if these are mapped in its local ontology, or in English if they are not mapped. According to this approach, a static translation is automatically ensured between English and the local language (and vice versa) for all the terms that are locally mapped, while the other terms are however displayed in English.

- B&C sector specific knowledge. Once studied and defined the solutions for ontology management and multilingual support, the next critical step is realising the common ontology. In the B&C sector a sound starting point is assured by the experience brought by CSTB taking advantage of the RTD projects where it took part in the last years. They are, in particular, the e-COGNOS and e-CONSTRUCT projects, both addressed to ontology construction in the specific sector, while the FUNSIEC project is focused on ontology mapping. Other reference sources are the sector standards such as LEXI.CON vocabulary, an implementation of the ISO DIS 12006-3 standard, the British Standard 6100 produced by the British Standard Institution (BSI), and the UNICLASS construction information classification system (CICS) that covers information generated from all phases of a construction project. In performing this work, special care will be put actual user preferences, since the experience showed that very specific, concise and precise taxonomies are normally preferred to big ontologies. Then, the construction of the B&C will probably follow a simplification process starting from the large available vocabularies (several thousand terms) to a limited but validated set of concepts (several hundred).
- TEX sector specific knowledge. An analogous activity is required for the textile sector, and also for the overlapping areas between the two sectors. In the textile sector the starting point is constituted by the rich taxonomy already created by AITEX, together with the contribution found at other international and national projects and the analysis of standards in the sector. We can recall here BUSCATEX [3], an advanced tool for self-classification of products and services by the industrial companies in textile & clothing. Another reference is the technical analysis done by AITEX, in 2004, about the state of the art of the eBusiness standards and their applicability to the textile sector. Other experiences are the SMADETEX [2] and SEWNEW [7] projects, both contribute in the multilingualism issues and develop a common terminology related to defects and textile processes. Even in this case the ultimate objective is to obtain a lexicon which is, at the same time, limited in size and covering the actual annotation and communication needs of users.

4.1. Applications

The very basic application is that enabling companies to represent their own profiles and classify their position in the market in terms of supplied products and services, geographic areas of interest and so on. The application generates a number of (XML) documents and associated (binary) files that are stored in the underlying repository. The (XML) documents are typically generated by filling forms whose fields correspond to terms defined in the local ontology; in this way their metadata are immediately obtained for future search. On the contrary, binary files must be manually annotated by the user, in order to provide them with suitable metadata, by taking advantage of the concepts available in the local ontology.

The other applications take advantage of the knowledge stored in Registries/Repositories and the functions made available by the SEEM Service layer on top of which they are built. After a very preliminary collection of requirements, the following applications are presently envisaged as most interesting:

- Intelligent search engine. It is the application to navigate the SEEM network and find interesting partners and related documents.
- Negotiation support functions. These are applications that, to some extent, could be customised with respect to the industrial sector (in particular B&C and TEX). They refer to the possibility, for two or more user companies, of adopting formalised procedures for the exchange or composition of interesting documents, such as technical specifications of products and services, preparation of bids, negotiation of supply conditions, and the like.
- Collaboration support functions. These also are applications that, to some extent, could be customised with respect to the industrial sector (in particular B&C and TEX). They provide two main supports to the intended companies, namely distributed business planning and distributed workflow management.
- Integration with legacy systems. The above applications integrate the functionality of legacy systems and their extensions. In particular, they are interesting cases of integration with CRM (customer profiling, product configuration, order acquisition), ERP (order issuing) and SCM (order progress management). A higher degree of interoperability between legacy systems is given by a further application (a simplified document exchange) according to which each party simply uses the SEEM to store and retrieve semantically specified documents, thus overcoming limitations and constraints of the respective internal formats.

Thanks to the decision to make the technological infrastructure accessible through a web service interface, and hence neutral with respect to the possible development environments, the application technology (proprietary, open source) can be chosen case by case according to the constraints of the user companies. It is foreseen that certain applications could be developed in two or more versions (e.g. .NET and JAVA) to cope with explicit requests coming from the pilots. For ensuring the effectiveness and usefulness, the performance of pilot cases will be measured and evaluate according to methodology developed within the Slovak national project VEGA [8].

5. Conclusion

In spite of a general worry about achievements in 2010 of Lisbon objectives, there is a message of hope and confidence that the EU enlargement will stimulate the whole European economy. However, one of the preconditions for this is that the New Member States achieve a level of knowledge and competencies comparable with old-tradition RTD intensive Countries.

The research lines discussed in the present paper show some initiatives to implement in a simple and Enlarged EU SME-oriented way the interoperability roadmap, to support digital ecosystem development and ambient intelligence technologies integration. It will contribute also to stimulate and promote the research convergence of the acceding States.

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REPLIKA PROJECT AS AN EXAMPLE OF EUROPEAN WAY TO THE CREATION OF SHAREABLE COMMON EDUCATION SPACE

Jan Skrbek, Jan Ehleman [1]

The REPLIKA Project is a European Leonardo da Vinci project bringing together partners in four European countries - the UK, Czech Republic, Denmark and Spain. The partners share a common purpose to develop new and innovative ways of developing and delivering on-line learning appropriate to the needs of partner universities as well as the local and regional businesses.

The paper brings concrete information about realization and outputs of the REPLIKA Project, especially about technology and practical aspects of realizing of REPLIKA project at the Technical university of Liberec.

1. Introduction

The European Repository for Learning Inovation and Knowledge Acquisition (REPLIKA) Project is a vocational learning development and innovation project. Project based European partnership involves a total of six universities & colleges from the United Kingdom, The Czech Republic, Spain and Denmark, plus a UK based employers federation and a commercial software developer. The partners share a common purpose to develop new and innovative ways of developing and delivering online learning appropriate to the needs of partner universities as well as the local and regional businesses. The REPLIKA pilot project aims to explore the potential for creating, adapting and sharing online learning materials in the field of the Digital Industries across Europe.

The REPLIKA project is pioneering the use of a digital repository and authoring tools, to enable subject specialists, lecturers, trainers and teachers to create high quality interactive learning materials, which are targeted specifically to the needs of their learners.

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The REPLIKA Project started in the frame of Leonardo da Vinci Programme in October 2003 as a three years project. Its final stage was prolonged to December 2006. The main base for the project is the experience of the partners in developing and delivering vocational learning programmes and their working knowledge of local and regional business needs. An assessment of these needs in the context of European and national policy guidelines concerning employment policies, lifelong learning and workforce development priorities. It also relates to a number of significant ICT learning initiatives at national and regional levels in the UK, Denmark and Spain.

It focuses on the vocational skills needs being generated by the new knowledge economies of Europe to meet both the emerging ICT and Internet-related skills requirements and general competencies which underpin business development, including management, marketing and entrepreneurship.

The key area of innovation centres on a ground-breaking method and process for designing, creating and sharing learning materials within and across different vocational education sectors and users in partner countries. This involves experimental work on the use of a digital repository, within which individual components of learning materials are ‘tagged‘ and stored electronically for re-use and delivery across conventional virtual learning environments. The repository facilitates on line consultation between vocational education specialists on 'work in progress' as the curriculum 9materials are developed, thereby enabling the partners in different countries to contribute simultaneously to the creative process. The intention of REPLIKA is to create a working prototype for a European digital learning materials repository, tested across partnership in four countries. The staff and teacher training aspects of the project are contribute to capacity building in the use of online learning technology.

2. Management of the REPLIKA project

2.1. Managerial perspective

The project is realized in the frame and with support of Leonardo da Vinci program. Original contractor and coordinator of the Replika project – Trans HEurope (Huddersfield) – hands the leadership over at March, 2005 to the University of Hull.

REPLIKA project focuses on the vocational skills needs being generated by the new knowledge economies of Europe to meet both the emerging ICT and Internet-related skills requirements and general competencies which underpin business development, including management, marketing and entrepreneurship. The target groups are actively employed adults, these seeking new employment or self-employment and young people undergoing vocational training. The target sectors include the new digital industries and related business, but also embrace more traditional sectors such as engineering and manufacturing.

The results of the REPLIKA project include: the experimental digital repository, new online vocational learning modules; delivery to pilot groups of learners in the four partner countries; a major staff training and development programme; development of a learner support mentoring schema; accreditation of the learning materials within institutional and national qualification frameworks.

Very important role in the coordination of progress of REPLIKA project have transnational meetings of project partners. They were organized in each of partner's countries (kick-off meeting in Huddersfield – 2003, Odense – 2004, Liberec – 2005, Murcia – 2006). Meetings of project partners constitute excellent space not only for progress of the REPLIKA project, but also for development and extension of bilateral and multilateral cooperation in education and research between partner institutions. In addition the UK expert organized one or more times in any institution of non UK partners the training for staff development in the use of the repository and undertakes dissemination activity.

2.2. REPLIKA project partners

One of main aims of the REPLIKA project is to contribute to the creation of common European educational environment. That was the reason for the selection of project partners among European universities and educational institutions. Internationalization of the project designed a network of institutions that includes partners from European countries with long tradition of higher education, nevertheless with different development in last half of 20th century.

Main university project partners are:

- Spain - Fundacion Universidad-Empressa Region de Murcia. The "Fundacion" was founded in 1988 with the purpose of forging dialogue between the University and regional enterprise. It specializes in the provision of products and services that support research, innovation, training and guidance for enterprise and business development. The Fundacion is responsible for piloting the repository, curriculum development, consultancy and translation, and coordinating recruitment of pilot learners in Spain.

- Denmark - Odense Technical College. The College is the largest of its kind in Denmark. It specializes in the delivery of craft-based technical courses comparable to the Foundation Degree initiative being developed in the UK. The College is be responsible for piloting the repository in Denmark, curriculum development, consultancy and translation, coordinating recruitment of pilot learners in Denmark, and will take the lead in developing the learner support mentor scheme
- Czech Republic - Technical University of Liberec. The University dates back to the 1950s. It has six faculties, the majority of which were founded in the early 1990s. Project partners, based in the Faculty of Economics with approximately 85 staff, are experienced in transnational project working. In addition to curriculum consultancy and development work, including translation in Czech, and coordinating the recruitment of pilot learners in the Czech Republic.
- United Kingdom

  - University of Hull - has more than 50 specialist centres, including the Centre for Continuing Education, Development and Training, and the Institute for Learning, which hosts the Centre of Lifelong Learning and e-Learning Group. The work of these centres has generated extensive links regionally and nationally with major trade unions and will provide the basis for developing social dialogue within the project. The University as a contractor in responsible for project management, curriculum development, piloting the repository and accrediting learning modules.

  - Leeds Metropolitan University - with extensive knowledge and skills in the development and delivery of vocational learning to the region is leading development of one of the New Technology Institutes and is a member of the local Foundation Degree consortium. Both these initiatives are key to achieving project impact. The University is responsible for curriculum development, piloting the repository and accrediting learning modules. It will also contribute to the dissemination strategy

  - Doncaster College - is one of the largest colleges of its type in the UK, providing progression opportunities to a wide audience from basic education to doctorate programmes. College is a partner in the Doncaster Education City (DEC) project.

3. Repository – a key technology for shearing and delivering of learning materials

3.1. Users view

The Replika project has pioneered the use of a digital repository and authoring tools to enable subject specialists, lecturers, trainers and teachers to create e-learning materials, targeted to meet the needs of learners in their care. The authoring application is called e-Cat (catalog) and basically takes a Word document with embedded objects, changes it into a web document with hyperlinks to the objects and catalogs it for search and retrieval.

Imagine the subject specialist in need of some online materials to support a group of learners. Using the searchable database they locate the necessary learning objects. This could be a whole course (a collection of learning objects), or an individual object. They import the object(s) into the authoring tool, add the pedagogy and re-save the materials into the repository ready for delivery. The process is as easy as producing an A4 handout.

The authoring tool is an additional toolbar within Microsoft Word so making it very easy to use. Simply create a word document, insert multi media objects and the tool processes it into XML. In the process the user is prompted to add meta-data which will ensure the materials are searchable within the database. You can produce whole courses, modules or a single page, all of which can be used to support a group of learners.

Materials for the digital repository are produced using an emerging worldwide specification, which ensures that they can be exchanged between other systems. The specification (IMS) allows for the sharing of content, with the guarantee that objects can be exchanged whatever the format of the repository. Meta-data specifications are accommodated within the authoring tool, which offers a core set of categories with extensions to suit different sector needs.

The repository and associated tools are having an immediate impact on learning and training organisations, where good quality online materials are needed to support the learner. However, the concept is good for any organisation where ‘content‘ (both text and multimedia) is used and needs to be re-used. The uses are many, and varied.

3.2. Technical view

The repository for learning objects sits on an Oracle database and is based on open standards, enabling the storage, classification, rendition and retrieval of learning material. The technologies chosen allow for the separation of content, structure and presentation of learning materials and so promotes their re-use in a number of ways:

- The structure of the learning materials may be altered
- Each learning piece may have a number of presentations
- Material can be downloaded from the repository, repackaged and reloaded into the repository
- The learning materials may be reused directly within the repository

The repository is populated using a number of Java-based tools that provide facilities for:

- Storage - loading a learning package into the repository and linking the learning package with a presentation
- Transformation - transforming the learning package into an output format by applying the presentation transformations to the content and structure of the learning package
- Presentation - loading s presentation into the repository.
- IMSCP Import - Importing a learning package conforming to the IMS Content and Packaging Specification into the repository
- MSCP Export - Exporting a learning package from the repository.

3.2.1. Storage

The storage tool is used to restructure an XML document into a format that is suitable for inserting into the repository. The restructuring process extracts the content of page elements and stores these separately in the repository. The reason for extracting the content elements is to allow for the transformation of content using XSLT transformation specifications.

The structural content of the XML document, as represented by the sectional elements. is also extracted and enhanced to provide a fully interlinked set of database records that models the structure of the XML documents. The structural information is used to populate the navigation framework, again using XSLT transformations. The separation of the structure and content allows the database to manage the relationships between XML content and generated output as produced by the XSLT transformation. The relationship between these components is modeled in the database in the form of a presentation. A presentation is a collection of XSLT transformations. HTML templates and resources, such as GIFS. JPEGS, Javascript code etc. that is used to generate content for delivery.

The presentation facl1ity allows the storage of a number of transformation suites that administrators of the repository can use to provide a customized "look and feel" for content delivery for different organisations.

3.2.2. 3.2.2. Transformation

The transformation tool applies the presentation that was linked with the XML content by the storage tool to produce an output that may be viewed and navigated using s standard web browser. The tool processes the XML content and structure that is stored in the repository, applies an XSLT transformation to stored and generated XML documents and then stores the resulting output in the repository.

The output of the transformations is stored at a number of levels:

- The output for individual components and multimedia objects
- The output for a 'page' of information,
- The output for a 'section' of information,
- The output for the navigational structure of the package.

The reasons for storing the output at a number of levels are to allow:

- .The retrieval of the output at the component level, without any context of surrounding content,
- The retrieval of the output within the context of a 'page' of information,
- The retrieval of the output within the context of a 'section' of information.

3.2.3. Presentation

The presentation tool processes a ZIP file containing the XSLT transformations, boilerplate text and graphic resources and stores these in the repository. The XSLT transformations are associated with the DTD that defines the content of the XML stored within the repository.

3.2.4. IMSCP Import

IMS Content & Packaging Import allows HTML learning packages to be stored within the repository with their associated meta-data. Given a ZIP file that conforms to IMS Content & Packaging containing a learning course in HTML and an XML file describing the course structure, the tool will insert the entire course with structure data and the corresponding resources into the database repository. An integral part of the process is to convert all the original local links in the HTML pages to reference the information in the repository.

3.2.5. IMSCP Export

IMS Content & Packaging Export is the reverse operation of IMSCP Import. It will extract data from the repository and create a ZIP file that conforms to IMS Content & Packaging. The intention is that other repositories that also conform to the specification can directly import this ZIP file. In compiling the ZIP file, links in HTML pages are adjusted to become local in the sense that they do not point to a certain server, but are local to the ZIP file.

3.2.6. Tool implementation

The tools are implemented as Java applications that allow the software to be run on any platform that supports the Java Run-time environment and can connect to databases using JDBC over a TCP/IP network. This implementation was chosen to allow the tools to be run on any machine that can access the repository over a network.

4. Progress and troubles of REPLIKA project in the Czech environment

As most of internationally based projects also the REPLIKA project has its dark and bright sites, nevertheless reality is somewhere between these two poles. The aim of all project partners is to shift the “gray” color to as bright as possible result.

4.1. Learning materials of the Faculty of Economics

Between main goals of REPLIKA project of the Czech project partner (Faculty of Economics of the Technical university of Liberec) belong four learning materials, produced by teams of departments of Finance and accounting, Marketing, Economics and Informatics. First three teams presented their results at the international conference in Murcia in the frame of transnational meeting in May 2006.

E-learning material „Selected Problems of Financial Management“ was originally designed for students of full-time courses of the Faculty of Economics at the Technical University of Liberec. This course is worked out in software Moodle and E-cat and is composed of 12 chapters. The course is also completed by tests and numerical examples which can help to the user to verify its gained information and skills. There is also a special dictionary of key words.

Module „Marketing“ prepared as a part of the Replika project is based on the teaching material for the basic course of marketing. It focuses on the concepts of marketing, marketing environment, marketing strategy, market segmentation, consumer shopping behavior and marketing mix. At the end of each chapter there are questions and tasks that allow students to use their knowledge in solving practical problems.

In the framework of the e-learning project REPLIKA the team of the Department of Economics at realized a set of background materials for the students of courses of Economics. The topics, such as Demand, Supply, Costs, Revenues, GDP, Inflation, Fiscal and Monetary Policy etc., are processed using the e-cat software and interlinked for faster orientation.

The materials of the Department of Informatics take stress on main topics of e-commerce. The base of learning material - PowerPoint presentation – in supported by many web references in two (Czech and English) languages.

All of learning materials were originally produced in Czech language. They are translated into English and subsequently by the wish of project partners also into other languages (Danish, Spanish). The Faculty of Economics will use not only learning materials of “home production” but also many of materials from project partners that will be integrated into individual modules of bachelor and master programmes of the Faculty of Economics. Current examples are materials of “Web page design” and “Multimedia application” that were developed as an e-cat applications at the Leeds Metropolitan University.

4.2. Some difficulties of REPLIKA project solving in Liberec

Main snags of REPLIKA project that were recognized at the Technical University of Liberec are drawing up in following items:

- problems of Czech language and Czech characters
- change of project contractor (and manager)
- coordination in development of internationally accepted learning content
- different project administration of finance in individual countries
- activate teaching staff to participate on the project
- chronic shortage of time of university teachers

Original idea to realize the native language based web pages of the REPLIKA project for individual countries turned out to be an Utopia. The web designer in the UK resigned on this idea after couple of month of attempts to do that. The main problem was not the technology - the administrators were not able to find if the foreign text on the web sides is or is not correct. Foreign languages caused big troubles also by implementing of national versions of e-cat (SW for creating ZIP files for repository). The partners outside UK fight a long time with many faults and dysfunctions of this program in national languages. Original – English version of e-cat was all the time OK. The problem was that this SW was based on macros of MS Word, using different levels of "Headings" in original (English) language. It was necessary to realize appropriate changes of this application - but it took a long time. Workable Czech version of e-cat was ready to use in March 2006.

Significant problem of REPLIKA project caused the change of project contractor (and management) in the March 2005. The Trans HEurope (contractor) as well as University of Huddersfield as a partner discontinued their activities in the project. The new project managers of the University of Hall started to work very intensive but this change effect the significant delay of project progress with an influence on all partners.

REPLIKA project as a pilot project also found out the difficulties in coordination of development of internationally accepted learning content (one of project aims). The problem is that process of evaluation of learning materials is very different in different countries and institutions. The search for generally accepted way for evaluation of learning materials from other institutions could be count as an significant output of the REPLIKA project. The project managers were also faced with different ways of financing of some project activities based on concrete laws in partner countries.

Especially the Czech rules and regulations of travel cost and subsistence are very different from the roles in other countries and were a long time incomprehensible for project managers.

The last two items mentioned above have already common denominator – increasing working load on university teachers. It was not so easy to find proper co-workers on the project in any of partner institutions. Especially the situation was very hard in the time of the change of project contractor. Most of teachers at the Faculty of Economics of TU Liberec were delighted by possibilities of the e-cat programme as well as the repository. Due to chronic shortage of time of university teachers - thanks to other research and/or project activities - only few of them started to real work inside the project team on some of project activities.

5. Conclusion

The REPLIKA project brought together partners from distant part of Europe. It allowed them to work internationally on very important contribution to real border free European space – development of common educational space. It also contributed to recognition of areas where the cooperation among European educational institutions could be very fruitful – realizing the repository of high quality learning materials based on standardization of their creating (respectively creating of their metadata).

The final stage of REPLIKA project has to check if the results of project are successfully useable for aim groups of students – at universities as well as in working places. The main task for all project partners is to disseminate the results of the REPLIKA project not only in home institution but as much as possible in other institutions of partner countries. The tool for defining the level of satisfaction of learner and tutors is on-line evaluation of learning materials by students as well as by teachers and institutions.

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PhD Symposium

THE IMPACT AND VALUE OF A PHD IN THE INFORMATION SOCIETY

Gerhard Chroust[1]

1. Aim of the Symposium

This year's PhD-symposium at IDIMT is dedicated to a discussion and evaluation of the relevance, the usefulness and the impact of a PhD-degree in today's and future scientific community and in the society at large. The aim is to involve the primary stake holders by bringing together PhD students from different countries to discuss these issues from different viewpoints, especially with respect to the situation in different countries. The participants, all currently following or having recently received their PhD, are invited to formulate their ideas and discuss them in the symposium. We limit the discussion to the broader field of informatics, excluding other scientific fields which might show a different situation.

2. Paradigmatic Changes in Knowledge Dissemination due to ICT

The Information and Communication Technologies (ICT) have brought about a tremendous change in all domains of human life:

- Information is immediately available world-wide. This caused a revolution comparable at least to Gutenberg's printing press but without the restrictions of a physical medium.
- Information processing has changed not only the speed with which information is produced (think of tools like GOOGLE) but also the way information is produced - think of many achievements of artificial intelligence like recommender systems, wizards etc. These changes are qualitative, not only quantitative! And these changes pervade all other industries (automation of manufacturing, control (fly by wire), imaging (virtual reality)

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etc. They are the source of cheap products of our daily life. And these achievements have dire consequences resulting in the redistribution of labour and work force to other continents (outsourcing), redundancy of many former knowledge workers, etc.

- ICT has effected a drastic reduction of time-to-market of products and services with the accompanying hectic and stress.
- The communication technologies have produced Internet, World Wide Web, mobile phones, mobile computing, with their strong impact on society and human interaction. Information can be provided everywhere, anytime, in any amount and in any (uncontrolled) quality
- These effects synergetically changed consumer behaviour, especially since many goods them- selves experienced a transformation from physical representations (e.g. books, records, paper prints) to electronic forms (e-books, digital music and digital photography, virtual reality etc.). Goods are increasingly offered electronically especially in the are of music and film (downloading a bit-string instead of buying a physical medium). As a consequence e-commerce flourishes due to the globality, seamlessness and ease of access.
- We also observe a trend from the written word to animated pictures, reversing some trends of cultural development of the last 500 years [11].

The consequence is the so-called *information (based) society* [8][17].

With respect to academic education we notice a growing discrepancy between what is offered at universities and what is currently asked for by industry and politics: e-learning, e-government, and just-in-time support [1]. The rather slow-paced academic world seems to loose its leading position in many areas.

3. A Historical Change of Knowledge Dissemination

The historic evolution of knowledge dissemination allows to understand the current paradigm change and the resulting phenomena. Scientific knowledge has to be passed from generation to generation [3][5]. Following [4] we can summarize the changes of dissemination paths as sketched in fig. 1 and fig. 2 as follows:

- The original knowledge dissemination chain via oral communication was soon supported and stabilized by hand-written documents [3], collected in famous libraries (e.g.

Alexandria) and later in monasteries (fig. 1). Even the advent of book printing did not effectively change this chain of dissemination, although books were more easily accessible. High prices and limited understandability still required a human intermediator (teacher), see fig. 1.

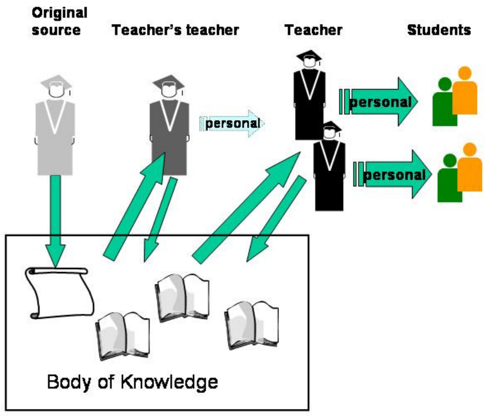

Fig. 1. Flow of dissemination for handwritten books

- Internet brought a different quality of accessibility and understandability, due to the ease to produce texts, especially informal and short-lived ones, providing a wealth of interpretations, alternative explanations, discussions, presentations etc. mixed with enormous thrash which can be produced by anyone without any quality control.

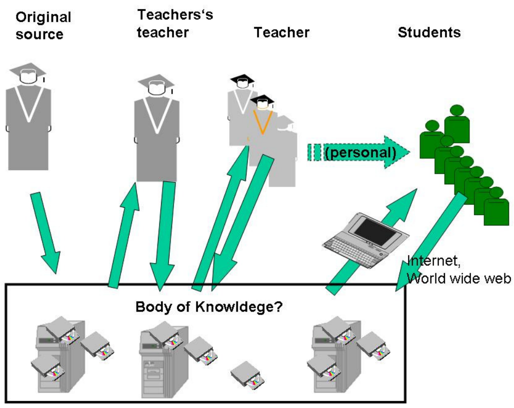

Fig. 2. Flow of dissemination under World Wide Web

We can observe:

data availability: Individually accumulated data and facts loose their key importance due to availability of high-volume, high-speed storage with almost no restriction on cost and size ('the Encyclopedia Britannica on your wrist watch'), the pervasive presence of the Internet and extremely fast search machines.

data reliability: The reliability of sources is not guaranteed due to the lack of filtering mechanisms in the World Wide Web. This is aggravated by a tendency of 'self-publication' of ideas of dubious origin [3] without any validation barriers.

data abundance: Research becomes easier due to the immediate availability of data and facts in the WWW. At the same time research becomes much harder due to the constant (and fast) influx of new research results. Publications in journals have their lead time and constantly apply a strong filtering mechanism. There is no context (like a journal cover) to provide a time frame or some age indicator on an Internet publication.

data volatility : Data may be changed or removed without notice, leaving a sense of insecurity.

data obsolesce: In the Internet all data look alike. There are few clues indicating the date of creation of data or their obsolesce.

4. Changing Approaches to ICT-Research

The trends indicated above force us to rethink some of the academic traditions of PhD-research established over centuries.

from memorizing facts to searching : Factual knowledge known by heart has lost much of its importance. One cannot carry a library to a meeting - a notebook with a few CD-ROMs is equivalent to a full library. And one can find information faster and more completely! We have to better understand the impact of being able to potentially utilize the enormous sources of information just-in-time. We need better and more human-oriented ways to search, filter, validating such huge amount of data [2] [12]. Sophisticated searching techniques must be taught and trained [16].

from collector to hunter The value of accumulating information in a private library will diminish in favour of a just-in-time hunt for the latest information on a given topic.

The incentive to accumulate references and literature 'on suspicion' for later use is fading. In the old days one of the most valued assets of a researcher was the knowledge of existing literature, the relevant reference lists and hopefully copies for immediate access. Powerful search engines and fast search algorithms can easily provide the needed information 'just in time' and with all the desired actuality, better than a private archive.

from individual filtering to group filtering : The need to filter information can, thanks to modern technology, be organized as a group effort. One can (partially automatically!) identify groups of persons with similar research interest (similar profiles), cf. [6] [9] [13]. Documents found interesting by one of the group can automatically made available to all members of the group, even if they do not know one another [14]. New ways of cooperation will spring up, independent of traditional boundaries of geography, companies or institutions (e.g. CSCW-groups [10]).

from local annotations to public annotations : Annotations, originally private, can be made available to the scientific community, probably leading to a new style of academic discourse.

from stability to volatility : We have to live with the fact that the information which we acquire from central sources will be unstable, volatile and often secretly changed. Ways to ensure the persistence and authenticity of results once published have to be designed.

5. Dilemmas in PhD-Studies

PhD-studies as the high-end of academic education also are subject to the indicated trends and their consequences. This will definitely have an impact on the way PhD-studies will be conducted in the future and it will probably impact the position and importance of a PhD-degree.

The problems with today's PhD-studies can to some extent be described by the following dilemmas:

- Availability on the WWW allows to include all knowledge at the price of just a few keystrokes - with the burden of separating knowledge from noise.
- The growth of the field of knowledge is at odds with the (politically and economically induced) desire to shorten the study time ('time to market') of a PhD-student
- The increased breath of information in the field could be detrimental to the depth of a study.

- Classical approach to study with its deep analysis of information somewhat contradicts the desire for publishing early results (not necessarily knowledge!)
- The half-life of knowledge is now counted in years: Before the end of a PhD-research a considerable part of the acquired knowledge will be obsolete

6. Questions to be Asked

This situation raises a considerable amount of questions with respect to different dimensions:

economic/social environment:

- What does business hope to reap from employing PhDs instead of e.g. Diploma- or Master-graduates?
- What hopes/advantages/usefulness does society expect from PhDs [7]?
- What is the value in the respective society?

personal mastery [15]:

- What advantages, immaterial profits will a PhD-student have?
- Having achieved a PhD-degree - what has a student really proven? That he/she is able to pursue a subject of often limited practical importance to its very end? Is it just an exercise of stamina and patience?
- Is it just a mental fitness programme?
- Is a PhD just a whim of personal satisfaction, irrespective of any material value?
- Does this differ in different countries?

personal economics:

- What is the economic value for a student to receive a PhD degree? What advantages and material profits?
- What value does a PhD have for the career?
- Is the PhD just another nice prename opening doors to higher ranks of managements, irrespective of the actual field and the requirements of the job.

academia/research :

- Is the often marginal scientific contribution of a PhD-research in a small field justifiable (return-of-investment)?
- Should PhD-research dig a ’small and deep hole’ or better a ’wide and shallow’ hole?
- What is the value of a PhD-degree in the academic world?
- What is the value of a PhD-degree in scientific research?
- How valuable is the knowledge gained if its half-life is 5 years, if 25 % of it are obsolete even before the degree is earned?
- Is it a tacid assumption that from the many PhD-students pursuing a similar research goal one of them will find the ’golden nugget of knowledge’?

Organizing PhD-studies :

- Given the immediate and global availability of data should there be more stress on ’Know-where’ and ’Know-how’ instead on ’Know-what’?
- How to cater for the dilemma of growing bulk of data and the desirable wish for shorter time-to-result?
- How are PhD studies organized in the specific country?
- How could a PhD study look like in the future?
- What can be improved?
- How little or much structure should be imposed on a PhD-study?
- Should PhD-studies preferably done immediate after the graduation and before taking a permanent job, after a few years of job and returning as a fulltime PhD-student or in parallel with the job?

7. Conclusions

The Information and Communication Technologies have changed practically all aspects of our lives. PhD-studies are no sacred cows, they are not exempt from change, if they want to preserve meaning and usefulness in our society.

In this paper we have described the changes in knowledge dissemination and based on that opened a plethora of questions which are relevant for today's and tomorrow's PhD-studies. We hope that the symposium will supply some answers.

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