Journal of Scientific and Educational Forum on Business Information Processing

Editorial Foreword

The idea of publishing a professional journal in the field of business information science was formalized in the last Year at the ISBIS'2005 Conference, where the participants expressed their need for an international publication possibility. The Scientific and Educational Forum for Business Information Systems (SEFBIS) as an Association of the John von Neumann Computer Society was established five Years ago in order to give a controlled public forum to the members and to give publicity to both the experienced and the young specialists.

After two successful domestic conferences and an International Symposium and after having the expertise's' acknowledgment concerning to the GIKOF Journal the SEFBIS chairmanship decided to extend the publicity to international fields. The initiatives were supported by the special Association of the International Federation for Information Processing. The chairman of the TC 8 Information Systems Committee, D. Roode emphasized that only the nationwide activity of the specialists manifested by meetings, conferences and publication of a high standard can realized the international goals.

As the European Union has more and more member states, it becomes much more important to start with another way of thinking! After that some post socialist countries including Hungary have joined to EU the scientific and educational cooperation turned more and more important. The key issue to the European vision is the information and the information management, which constitutes also the focused theme of our journal. We, the committed leaders of SEFBIS take the responsibility of collaborating with professionals in realizing the knowledge based society, and do our best to provide Europewide access to and interchange of information. Our program reflects the European needs, so we call the professionals to report the scientific results, the new business or the educational solutions with the aim of discussing

- the role and the impact of IS/IT on business and on society,
- the concepts, modeling techniques, methods, visualization languages supporting the IS development processes,
- the solutions that satisfies customers' requirements and ensures security and privacy, and
- the realization of the European Higher Education Space focusing to the field of business information systems (aims, programs, curricula, cooperation, new teaching materials etc.)

Although this first volume of SEFBIS Journal has only few authors from abroad, together with the members of the Editorial Board and with the support of the IFIP TC 8 we can forecast an international wide interest and we can also expect the success. In the hope that in the next Years the SEFBIS Journal becomes more and more known and acknowledged, we welcome the first authors!

Concluding with my sincere greeting for the Readers I whish to obtain new ideas, concepts, to know new effective business solutions and research results from all over the world! I call the attention of the specialists in the field of business information science to make their results public and known internationally!

Chief Editor

The Role of the IFIP's Information Systems Committee

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Mission and Perspective

The IFIP's mission is to be the leading, truly international, apolitical organization which encourages and assists in the development, exploitation and application of Information Technology for the benefit of all people. The principals of IFIP are

- to stimulate, to encourage and to participate in research, development and application of Information Technology (IT) and to foster international co-operation in these activities,
- to provide a meeting place where national IT Societies can discuss and plan courses of action on issues in our field which are of international significance and thereby to forge increasingly strong links between them and with IFIP,
- to promote international co-operation directly and through national IT Societies in a free environment between individuals, national and international governmental bodies and kindred scientific and professional organizations,
- to pay special attention to the needs of developing countries and to assist them in appropriate ways to secure the optimum benefit from the application of IT,
- to promote professionalism, incorporating high standards of ethics and conduct, among all IT practitioners.
- to provide a forum for assessing the social consequences of IT applications; to campaign for the safe and beneficial development and use of IT and the protection of people from abuse through its improper application,
- to foster and facilitate cooperation between academics, IT industry and governmental bodies and to seek to represent users' interest,
- to provide a vehicle for work on the international aspects of IT development and application including the necessary preparatory work for the generation of international standards, and last but not least
- to contribute to the formulation of the education and training needed by IT practitioners, users and the public at large.

Origins

IFIP traces its roots to the very first major international conference on computers and computing which was held in Paris in 1959 under the auspices of UNESCO [1] . Representatives of the main computer societies active in computing got together at that meeting to explore ways of building on the achievements of the conference. As a result thirteen national computer societies agreed to found in 1960 an international federation and named it IFIP: the *International Federation for Information Processing.*

IFIP's principal aims were and are to foster international cooperation, to stimulate research, development and applications and to encourage education and the dissemination and exchange of information on all aspects of computing and communication.

IFIP's creation was well timed. In the 1960s there began a veritable explosion in the growth of the computer industry and in the application of its products. Within the life-span of IFIP information technology (as it is widely known today) has become a potent instrument affecting people in everything from their education and work to their leisure and in their homes. It is a powerful tool in science and engineering, in commerce and industry, in education and administration and in entertainment.

The Organization

Today *IFIP has 46 organizations as Full Members,* 4 Corresponding Members and 10 Affiliate Members, representing countries from all regions of the world. The organization structure of IFIP is shown on Figure 2-1.

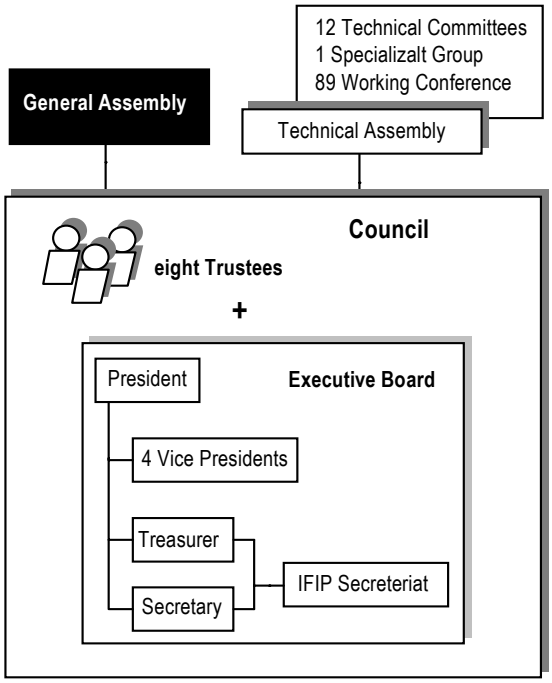

Figure 2-1. The IFIP Organizational Structure

The IFIP is governed by the *General Assembly* (GA), which consists of the representatives from each member organization and the Chairs of Technical Committees. The GA meets once every year. It decides on all important matters, such as general policy, the program of activities, admissions, elections and budget. The responsibility of GA is to represent their Societies' interests at General Assembly and in all other relevant ways and to realize and/or fulfill the strategy, finance and activities.

The GA elects *a President, four Vice Presidents, a Treasurer, a Secretary* and *eight Trustees* who together form the *IFIP Council*. The day-to-day work of IFIP is directed by its Officers: the President, 4 Vice-Presidents, Secretary and Treasurer. The Officers are elected by the General Assembly and constitute the *Executive Board.* TheTable 2-1. shows the elected leaders of the IFIP.

Table 2-1. IFIP Executive Board

Elected duty	Name	Elected cycle
President	Klaus Brunnstein - DE	2002/2007
Vice Presidents	Jean-Claude Laprie - FR	2002/2008
	Dong Yoom Kim – KR	2004/2007
	Niko Schlamberger – SI	2003/2006
	Basie von Solms - ZA	2002/2007
Treasurer	Dipak Khakhar - SE	2001/2008
Secretary	Roger Johnson - GB	2001/2008

The GA Members are expected to:

- Attend all GA meetings. If attendance is impracticable then they will seek a deputy from their Society. If that proves impossible then they are expected to appoint another GA Member as proxy giving instructions, if so desired, as to how that vote is to be used.
- Respond promptly to correspondence from IFIP.
- Ensure that IFIP literature (Annual Report, Bulletin and Newsletter) receives appropriate distribution within their Societies and seek to secure reporting of IFIP activities in their Societies' own publications.
- Publicize IFIP events and publications widely through their Societies and encourage participation by their members.
- Strive to secure good and active participation by their Society in Technical Committees and Working Groups and, when appropriate, on Program and other committees.
- Monitor the attendance and participation of their Societies' representatives in IFIP's activities and where there is a deficiency seek to improve the performance or to replace the representative.
- Request Annual Reports from their Societies' IFIP representatives and hold an annual meeting with them to review the value of their activities to their Society and to prepare for their Societies' Annual Reports to IFIP, dealing particularly with suggestions for improved IFIP

performance. They ensure that these Annual Reports are prepared and submitted to IFIP in good time.

The administrative hub of IFIP who is responsible for the wide range of tasks vital to the operation of such a far-flung international body is the secretariat at *Laxenburg,* near Vienna.

Technical Committees

At the heart of IFIP lie its Technical Committees that count on the active participation of some two thousand people world-wide. There are twelve such Committees. Each Technical Committee has a management team responsible for a given field of activity and for the work of from three to nine Working Groups, a total of 80. These Groups work in a variety of ways to share experience and to develop their specialized knowledge. These include open conferences, smaller working conferences, seminars and tutorials, circulated papers and, increasingly, as befits our subject, electronic conferencing and e-mail. The not subject specific general targets of the Committees are as follows:

- to establish and maintain liaison with national and international organizations with allied interests and to foster cooperative action, collaborative research and information exchange,
- to identify subjects and priorities for research, to stimulate theoretical work on fundamental issues and to foster fundamental research which will underpin future development,
- to provide a forum for professionals with a view to promoting the study, collection, exchange and dissemination of ideas, information and research findings and thereby to promote the state of the art,
- to seek and use the most effective ways of disseminating information about our work including the organization of conferences, workshops and symposia and the timely production of relevant publications,
- to have special regard for the needs of developing countries and to seek practicable ways of working with them,
- to encourage communication and to promote interaction between users, practitioners and researchers, and
- to foster interdisciplinary work and, in particular, to collaborate with other Technical Committees and Working Groups.

Congresses and Conferences

IFIP's flagship event is the World Computer Congress (IFIP WCC), currently held biannually. The next WCC will be held in Santiago de Chile, from 20 to 25 August 2006. The nature of these Congresses has changed substantially over the years. They are no longer of the all-singing and -dancing variety addressing every conceivable facet of our field. Instead they consist of a number of independent conferences dealing with a major specialized subject. These run in parallel so that some more general keynote addresses can be attended by all participants who can also share in social and other activities. In addition there are major international conferences organized by our Technical Committees. These include events dealing with Production Engineering, Security, and Computers in Education and Human Computer Interaction.

Publications, Newsletters

Many IFIP events are linked to publications, annually 30 to 40 IFIP *books.* A vital element of IFIP's communication with its Members and with all who participate in our work is the *IFIP Newsletter.* This is published quarterly in both hard copy and electronic form.

Relationships

IFIP enjoys friendly cooperation with a number of international organizations. First among these is UNESCO with which IFIP maintains a formal consultative relationship. UNESCO has commissioned from IFIP several projects and supports the participation of some scientists from developing countries in IFIP events. IFIP is a Scientific Associate of ICSU (International Council of Scientific Unions). There are four international federations with which IFIP collaborates.

These are IFAC (International Federation of Automatic Control), near neighbors of ours in Laxenburg, IMACS (International Association for Mathematics and Computers in Simulation), IFORS (International Federation of Operational Research Societies) and IMEKO (International Measurement Confederation).

Hungarian Representation

The John von Neumann Society represents Hungary in a number of international organizations of high prestige. Through membership the NJSZT accesses to sources of precious information, is in continuous contact with the members of these international organizations, and can benefit from participating in international projects. Beside the membership in IEEE, IEEE CS, CEPIS, EFMI, IAPR, ECCAI, the NJSZT is an active member of the IFIP as well. The Hungarian representative in IFIP is Dömölki Bálint dr, but the IT professionals' interests are also represented in the different Technical Committees except TC 5.

TC 8: IS Technical Committee

The ESBIS is an Association of the John von Neumann Computer Society (NJSZT) that is dealing with business information systems and intelligent solutions. As the NJSZT is a member organization of IFIP, The SEFBIS Association relates also with a very strong connection to the IFIP. The most relevant Technical Committee to SEFBIS is that of the TC 8. Looking back to the last few Years we are in the position of possessing the professional assistance of the TC8 as a powerful background. In order to understand the role of our association within the worldwide known IFIP TC 8, it is important to overview the mission of Information Systems Technical Committee.

Aims

The TC 8 was founded in 1966, and their aims were revised in 1990 in order to promote and encourage interactions among professionals from practice and research and advancement of investigation of concepts, methods, techniques, tools, and issues related to IS in organizations.

Scope

The TC 8 focuses mainly on solutions for planning, analysis, design, construction, modification, implementation, utilization, evaluation and management of information systems that use IT to support and coordinate organizational activities [4] . These activities can be divided into smaller parts as follows:

- effective utilization of IS/IT in organizational context;
- interdependencies of information technologies and organizational structure, relationships and interaction;
- evaluation and management of information systems;
- analysis, design, construction, modification and implementation of computer-based information systems for organizations;
- management of knowledge, information, and data in organizations;
- information systems applications in organizations such as transaction processing, routine data processing, decision support, office support, computer-integrated manufacturing, expert support, executive support and support for strategic advantage plus the coordination and interaction of such applications;
- relevant research and practice from associated fields such as computer science, operations management, economics, organization theory, cognitive science, knowledge engineering and systems theory.

Organization Structure

The TC 8 is controlled by a chairman, two vice chairs, a secretary, 30 national representatives and it has altogether 7 workgroups. The Table 2-2 shows the elected leaders of the IFIP TC 8.

The effective work of the Information Systems Committee runs in different workgroups that realizes the main goals of TC 8, and that are responsible for performing the actual tasks on the given professional field. The working groups (WG) cover mostly all parts of IS/IT, and gives possibilities for professionals worldwide for cooperation, publicizing the results and discussing

them. The WGs deal with special parts of IS: organize conferences, workshops, publish papers, articles and news in the following fields [2] .

Table 2-2. IFIP TC 8 Board

Elected duty	Name
Chair	J. Dewald ROODE - ZA
Vice Chairs	Erich J. NEUHOLD - DE
	David AVISON - FR
Secretary	Isabel RAMOS _ PT

WG 8.1: Design and Evaluation of IS

The WG 8.1 was established in 1976, with the aim of planning, analysis, design and evaluation of information systems for organizations. It intends to

- identify concepts and develop theories relevant to the planning, analysis, design and evaluation of information systems;
- develop languages, techniques, tools and methods for applying the concepts and theories to (1) planning procedures, (2) requirements analysis and specification and (3) design and evolution of information systems,
- develop methodologies for the analysis, evaluation and selection of IE methodologies,
- take cognizance of relevant work from associated fields; such as computer science, SE, KE, cognitive science, management science, organization and systems theory.

WG 8.2: Interaction of IS and the Organization

The WG 8.2 was established in 1977. The main scope is to develop integrated frameworks that facilitate recognition and transfer or relevant knowledge about the role and uses of IT. Such frameworks can be based on a wide range of disciplines, and should be open to all research traditions and lines of research which further the study of the IT use in organizational contexts. The main aims to focus on are the following:

- building theories and generate evidence about the role and impact of IT in specific organizational contexts,
- improving the ways and means by which organizations design, implement and maintain IT,
- nurturing a critical discourse about the role which IT plays in the lives of people as individuals and as members of complex social institutions, and
- engaging in ethical discourse about the practices and dilemmas which arise in the development, use and consequences of IT, or in research about such technology.

WG 8.3: Decision Support Systems

The main focus of the in 1981 established Workgroup is to deal with the question of IS development technologies in order to increase the effectiveness of decision-makers in those situations where the computer system can support and enhance human judgments. The most interesting themes concern to improving ways of synthesizing and applying relevant work from resource disciplines to practical implementations are the enhancing the decision support capability. The resource disciplines include

- information technology,
- artificial intelligence,
- cognitive psychology,
- decision theory,
- organizational theory,
- operations research and modeling.

WG 8.4: E-Business IS

The E-Business IS: Multi-disciplinary research and practice Workgroup is based in 1986 in order to promote collaboration across disciplines in E-Business research and practice. This working group provides a reference point and a focus for multi-disciplinary research and practice in E-Business. The intention is to extend the community's focus on E-Business to recognize, acknowledge and facilitate research and practice as it crosses the boundaries of IS, organizational, consumer, community, industry and national domains. Where researchers and practitioners focus on specific issues and technologies, e.g. smart-card developments, mobile technologies or organizational adoption of IT practices then that research is more properly located within existing working groups. Where that work is cross or multi-disciplinary it can be located here.

WG 8.5: IS in Public Administration

The WG 8.5 was founded in 1988 to improve the quality of information systems in public administration at international, national, regional and local levels. The Working Group's special emphasis is on the relationship between central and local use of information systems and the provision of citizen services, together with the accomplishment of social goals:

- analyze information processing policies in public administration;
- discuss specific applications of information systems in public administration;
- analyze the impacts of information systems on public administration.

WG 8.6: Transfer and Diffusion of IT

The WG 8.6 is a quite newly established (1994) workgroup with the up to date aims and scopes to foster understanding and improve research in practice, methods and techniques in the transfer and diffusion of information technology within systems that are developed and in the development process. The main topics are:

- Diffusion, transfer, and implementation of both mature and immature information technologies and systems in organizations and among organizations, sectors, and countries.
- Transfer of technology to be incorporated in systems, and system and development technologies to technologists, developers, managers, and sponsors of systems.
- Development of frameworks, models, and terminology for information technology transfer and diffusion; identification of risk factors and barriers to success in technology transfer and strategies for addressing them.
- Methods to evaluate the efficiency, effectiveness, and value of technology transfer programs and approaches, including time and effort estimators and metrics.
- Organization design and process issues related to technology transfer and diffusion.
- Standards and intellectual property issues that inhibit or facilitate information technology transfer.

WG 8.8: Smart Cards

The Smart Cards is the youngest WG that was coming into existence in 1998. It is to be understood as personal, portable, flexible, secure tokens that form an integral part of a larger information infrastructure. The studying of smart cards as an innovative component of widely distributed systems the WG 8.8 deals with all the aspects of smart cards design and applications:

- technology with hardware, software and security specific requirements,
- application design with a special emphasis on development methodology of distributed systems,
- service providing including analysis of transactions, protocols and more generally speaking, the process of a top down design of smart cards projects, and
- the interaction of smart card related technology with society, economics, public services and organizations.

Conclusions, Looking Forward

The development and the application of IS/IT is in revolutionary progress that makes strong influence on business processes and even on the society and the interorganizational relations. In this situation it is particularly important for the IT specialists to have professional communities on international platform, and the possibility for joining to these forums. The relations getting in the IFIP TCs and WG communities give chance for changing thoughts, discussing results, applying the best solutions and cooperating.

References

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Enhancing the Objectivity of IT Audit Assessments
Possibilities of Numerical Representation of IT Audit Results by Means of Risk Assessment Metrics

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ABSTRACT

There are numerous methodologies for carrying out IT audits, as well as creating numerical representations of the audit assessments. The numerical representations always have to rely on the personal assessment and somewhat subjective views of the auditors, thus cannot become totally objective. On the other hand, the uncertainty in the accumulation process – the numerical representation of the audit observations – can be diminished. In the research a modified correlation matrix of the risk factors has been created, to better represent the effects on the overall risk level. By considering the additive and subtractive effects of co-existing risk factors on overall risk level, new risk assessment metrics are being created. With the help of a more objective risk assessment method, IT-management decisions and the allocation of resources concerning information systems can become more effective.

IT auditing

The role of information and ICT in everyday life has been growing constantly in the last decades. Computers and computerized information systems are used more and more every day. The change has been even more radical in business applications. Computerized information systems became widely used for information processing and storage and most organizations in these days use computer systems for their business information needs [4] . As most business data are now stored in computer systems it has become clear that although ICT is an enabler for effective company business, it also presents new types of risks. Therefore, security of the computer information systems and more precise ways to assess their risks has become highly important. The fear of corporate accounting scandals, terrorism, climate change and biological threats has also raised the level of alertness and concludes in a need for more efficient risk measures.

The common way to certify the risk level of business information systems is IS or IT auditing. The information systems (IS) audit is a process during which data and facts are collected to assess the protection of information assets, data security and to check whether the computer systems enable effective ways to obtain the goals of the company and efficient use of its resources. [12] . One of the main goals of IS to identify the risks threatening the company's computer information systems. Audit reports also contain a usually limited risk evaluation, based on the data collected during the audit process. Most of the times these evaluations are based on the auditor's perceptions, and represent a point of view on the risk factors and their measures.

The corporate accounting scandals resulted in the Sarbanes-Oxley Act (SOX) in the United States in 2002 and the revision of EU Directive 8 during the last years. Both regulations have the same goal: to restore the trust of investors for

corporate accounting reports. They contain strict regulations on responsibilities for audit reports, the personal involvement of stakeholders, the total independency of audits and other sensitive issues. Many of the companies' processes must be revised and the responsibilities for audits are more precisely defined [15] . These efforts show the growing need for reliable audit data; and the importance of auditing in general and especially IT auditing seems to be growing rapidly.

The Rrisk Management Process

Risk management is the process that guarantees that the strategic objectives of the company are not endangered by the failures of IT in the organization. The impact of an IT failure can be catastrophic whether it results in an operational crash, a security leak, a project collapse or other management issues. Executives have to understand that IT risks are not only a question of technology, but also a factor that can endanger investments and projects. A common mistake is to overestimate security risks and not to take effective measures against IT-related management or project risks. It is important to understand that: "Risk is as much about failing to grasp an opportunity as it is about doing something badly or incorrectly" [11] Although in some of the literature the definitions are different – like in IRM's model [6] most sources agree that the risk management process is made up of three major steps: risk identification, risk assessment and risk treatment.

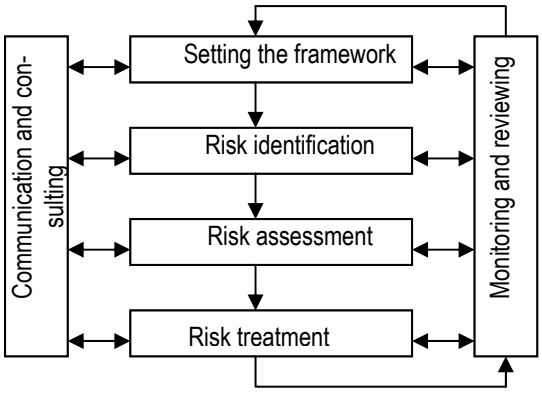

Figure 3-1. The risk management process

There are many methods to identify risks, e. g. objective-based or scenario-based identification. By the use of these methods a more or less comprehensive catalogue of relevant risk factors can be obtained.

During the assessment phase the previously identified risks have to be assessed by their severity, impact, potential caused loss, probability etc. In most cases risk assessment is a great challenge as it has to be made depending on limited information.

These risks must be treated according to assessment. The treatment can be either transfer, avoidance, reduction or acceptance [3] .

In the research IS risk assessment has been in the focal point as this is the most critical step in the process. Risk assessment has to deal with many uncertainties and its final assumptions have an important role in making the decisions on risk treatment.

The Need for Assessment Metrics

There has always been a need from the management of the companies that were investigated that the results of the audits should be represented in numerical ways. The precise measurement of IT-related risks would have multiple benefits for most companies.

IT-management decisions concerning the allocation of company assets and efforts can be put on a reliable basis. If the risk factors are identified and their levels are precisely measured, it becomes much easier to focus on the most important issues and to concentrate company spending on the selected subjects. Company assets are always limited, and the amount of money that can be spent on risk defence is usually restricted. A method that could identify the main risk factors and measure their possible impacts would allow the allocation of these resources in the best possible way, and it would make the optimization of spending possible. Companies are always interested in comparing themselves to other organizations in the same industry. It is beneficial also from a promotional point of view to have certificates of the

effectiveness of the company's risk management. For this purpose benchmarking can be used. To establish a reliable benchmarking system, an unbiased risk assessment method is needed to allow the interchange between different assessments, carried out by different auditors in various circumstances.

To obtain these goals a proper measurement system, metrics is needed. Establishing risk metrics would help organizations by giving a basis for risk analysis and assessment that "…would enable them to make business decision about managing security risks." [14]

IT Risk Assessment Methods

The first initiatives to create risk assessment metrics came as early as the 1970s. The first approaches offered a cost-benefit analysis to identify and manage IT security risks. In the 1980s new methods for risk management were created some of which are also used today. In the last 20 years some problems have been solved and development has been made in creating metrics but there is no standard solution to information security risk measurement [14] . Some of those methods are also available as commercial software tools; others offer more theoretical approaches to the measurement of risks.

There are many different standards and de facto standards related to IT auditing and security. The most widely known are COBIT, BS7799 and ISO 17799, ISO TR 13335, CRAMM, COSO ERM, NIST 800-14, ITIL and Common Criteria. These methodologies are also basis for different risk assessment techniques. COBIT offers a maturity model to assess the different control objectives. CRAMM offers an interactive software tool to identify security requirements and assess them, also in-line with British Standard 7799. Also there are several commercial software products for organizational risk assessment.

Challenges of IT Risk Assessment

The efforts of the past decades to create a standard measurement system for information security risk show that creating a risk assessment methodology and metrics is a huge challenge.

Risk assessments can be qualitative or quantitative and both approaches have their advantages and shortcomings. Naturally, the goal of risk assessments is to provide a precise and reliable measurement of risks. Therefore the quantitative approach would be ideal. On the other hand many of the methods presume that correct numerical representations of the measurements can not be given, so they use subjective scales. Usually these are rankings of the extent of risks (e. g. low risk, medium risk, high risk) based on subjective assumptions.

The advantage of the qualitative approach is that the starting data can be fairly simply collected, the assessment process can be relatively quick and the assessment report can be created in a simple way. The disadvantages are that the starting data that the whole of the assessment is based on can be very subjective – usually contains the private assumptions of the auditor. Therefore the results of the assessment can be unreliable. Also the interpretation of the assessment report can be incidental as it is extremely hard to convert expressions like "medium risk" into actual management decisions.

Quantitative approaches use objective measures for the description of risks. The most common way is to express the values in monetary measurements of impact and probabilities of occurrence.

The benefit of the quantitative methods is that they naturally create numerical representations of the risk assessment and therefore can be easily used to support IT-management decisions. The main difficulty is to collect the necessary data. In many cases it is impossible to measure the level of risks, the probability of occurrences or the potential impact of the threats. All that can result in forced numerical representations for the basic data and the final

outcome based on these data can be deceptive. Although the assessment report can contain detailed numerical data on the level of risks the usability of assessment is questionable. It might be even worse to have an assessment report with precise-looking numerical risk levels that are misleading than to admit that some parts of the assessment can not be characterized with numerical values.

Even if the numbers are correct it is extremely difficult to compare the effects of a highly unlikely event with a great impact factor with a very likely but not too serious event. Another problem is the comparison of data on different scales. Especially, it is extremely hard to compare management risks with the risks of technical failures. Therefore quantitative methods usually concentrate more on the technical aspects that are more or less measurable and pay less attention to management issues.

A further obstacle is that most assessment methods do not cover every aspect of the IT-related control issues. To create a comprehensive assessment many methods have to be used and the comparison of the results of different topics can be questionable.

Furthermore most of the assessment metrics do not take into account the interactions of the different risk factors. Simply adding the different risk levels can be misleading even during a limited survey.

Assessment vs Best Practices

Due to the problems mentioned above a combination of the qualitative and quantitative approaches is needed. According to the ITGI survey the most popular risk assessment techniques are still the business impact and vulnerability-based approaches, but companies are beginning to realize the importance of a broader toolset. Assessment against control objectives and best practices is becoming more popular [11] . This means that management is beginning to realize that a comprehensive risk assessment can only be carried out if all the aspects of IT-related risks are taken into account. This goal can be obtained by combining assessment against best practices and assessments of business impact and likelihood.

To make an assessment against control objectives, the most comprehensive set of IT audit best practices, COBIT can be used efficiently. COBIT (Control OBjectives for Information and related Technology) is a methodology that has become a de facto standard covering all possible aspects of IT governance.

Aim of the Research

During auditing projects users face the problems mentioned above. Although clients would expect a precise and well-interpretable result of the risk assessment process, it is extremely hard to create one. Most of these problems are yet to be solved. There have been initiatives to unify the different approaches to risk assessment [9] and hopefully the convergence of risk management methods has begun.

The goal of the research is to diminish assessment errors in the calculation phase. Therefore data collection or the method by which the input data are created has not been targeted. It has been assumed that the necessary data for the assessment is available and had been created during an IS audit process by the auditor. The goal is to create a tool for IT auditors that helps in making the assessment and enables better usability. The result of the assessment method is a unified risk level indicator that is based on the results of the IT audit. The different risk issues are dealt with as additive or subtractive factors.

Risk Correlation – Partial Solution

During the research COBIT control objectives have been used as a basis to create the necessary risk factors. As COBIT covers all possible areas of IT governance it is a sensible assumption that the risk factors identified using COBIT methodology are representing the most comprehensive set of aspects.

COBIT offers a Maturity Model to assess the maturity or the level of development of each of the control objectives. This is based on the commonly known CMMI (Capability Maturity Model Integration) method developed by the Carnegie Mellon Software Engineering Institute. Although maturity levels are subjective as it is a personal responsibility to make the assessment probably this is the best way to avoid suggestion of a precision that is not justifiable [2] COBIT contains Maturity Models for all of the 34 IT processes to cover all aspects of IT-related governance.

The application of the method is rather simple as the main goal was to provide a tool for self-assessment. The levels of maturity – or how well-formed the respective processes are – can be grade on a scale of 0 (non-existent) to 5 (optimised). Generally this method is a qualitative approach but can be used to create well-established numerical results. Naturally, as the maturity levels are measured on an ordinal scale the results can not be interpreted directly.

The maturity levels can be used to make a distinction whether a risk in the organization linked to the control objective adds to the overall risk of the IT-related issues or decreases it. Based on the maturity levels an assessment method can be developed. The obtained results can be used for benchmarking purposes, as a standard for unbiased comparison and as a helpful tool to establish good IT-management decisions.

The research is focused on the interaction between different risk factors. This is the aspect that can be improved as most methodologies do not concentrate on simultaneous effects. It is important to realize that the simultaneous effect of two or more risk factors can be different than the effects added together.

In the assessment process it can be decided whether the maturity of a control objective will raise or lower the overall risk. Then it would be comparatively easy to calculate the overall risk level. But the interactions have to be taken into account as well. During the research the interactions of risk factors – according to COBIT Control Objectives – has been mapped. A correlation matrix has been set up to determine the co-effects of the risk factors on overall risk level.

The matrix shows the simultaneous effects of two risk factors on overall risk level – or security level as "+" stands for more security and "-" for less security. The top left cell in each segment shows the simultaneous effect if both factors are considered to perform well, the bottom right is to sign the effects of both factors underperforming (seeFigure 3-3).

		AI 1	
		+	-
PO 4	+	+	0
	-	+	-

Figure 3-2. **Example for the cell contents**

The most critical part is the diagonals of each segment as the simultaneous effect of two risk factors on overall risk level can be different depending on the types of risk and their interaction. The co-effects in the modified correlation matrix are results of previous experiences and professional estimates. It offers a simplified representation of first-order relationships between different control objectives, thus the risk factors as well. In this early version the relationships are only mapped between high level control objectives and the assumption has been made that detailed control objectives relate to each other analogically to their parent (see Figure 3-3).

domain_id	id	PO		PO		PO		PO		PO		PO		PO		PO		PO		PO		PO		AI	
		1		2		3		4		5		6		7		8		9		10		11		1	
PO	1			+	-	+	0	+	+	+	-	+	+	+	+	+	0	+	-	+	-	+	+	+	0
				+	-	+	-	+	-	+	-	-	-	+	-	+	-	+	-	+	-	+	-	0	-
PO	2					+	+	+	0	+	+	+	-	+	-	+	0	+	-	+	+	+	-	+	+
						-	-	0	-	-	-	-	-	0	-	-	-	0	-	-	-	0	-	0	-
PO	3							+	-	+	+	+	0	+	0	+	-	+	-	+	0	+	-	+	-
								+	-	-	-	0	-	0	-	+	-	+	-	0	-	0	-	+	-
PO	4									+	+	+	0	+	0	+	0	+	-	+	0	+	0	+	0
										-	-	-	-	-	-	-	-	+	-	0	-	0	-	+	-
PO	5											+	-	+	-	+	0	+	-	+	-	+	-	+	-
												+	-	0	-	0	-	+	-	+	-	+	-	0	-
PO	6													+	-	+	-	+	-	+	0	+	-	+	-
														-	-	+	-	+	-	-	-	-	-	+	-
PO	7															+	0	+	-	+	0	+	0	+	-
																-	-	+	-	-	-	0	-	0	-
PO	8																	+	-	+	-	+	-	+	-
																		+	-	0	-	+	-	+	-
PO	9																			+	+	+	+	+	0
																				-	-	-	-	-	-
PO	10																					+	-	+	-
																						0	-	0	-
PO	11																							+	0
																								-	-
AI	1																								

Figure 3-3. Part of the modified risk correlation matrix

The Risk Assessment Method

Based on the correlations detected in the earlier stages a risk assessment method can be set up. The overall risk level of the organization can be measured in the following way:

$$R = w_{12}r_{12} + w_{13}r_{13} + w_{23}r_{23} + \ldots + w_{(n-1)n}r_{(n-1)n}$$

where R is the overall risk level, $w_{12},\ldots, w_{(n-1)n}$ are the weights of the respective risk factors and $r_{12},\ldots, r_{(n-1)n}$ are the first-order correlative effects of the risk factors (+1, 0 or -1).

The weights of the correlative effects are created from the weights of individual risk factors given by the auditor or the person making the assessment. The weights should add up to 1 and should represent the same distribution as the original weights of individual risk factors. This can be guaranteed by a simple calculation in the first phase of the assessment.

This method creates a risk level index in the range of -1 to +1. The aggregation can be made for the whole of the risk factors or only certain control objectives; therefore it is possible to create risk indicators for different territories as well. By creating a well-defined index of the overall risk level, it is possible to make comparison between different companies or different functional territories within the organization.

Naturally, this method is not the ultimate solution to risk assessment. By taking into the account the interactions of risk factors it is possible to make more precise assessments and create metrics for comparable results. In this method only the first-order correlations are taken into account. The effects of multiple correlations on the result must not be underestimated but the secondary, tertiary etc. correlations are expected to have less effect on overall risk levels.

The method does not solve the problem of data collection. It is designed to rely on the maturity levels defined by the auditor. The goal of this method is to lessen the effects of errors made during the aggregation process.

Benefits of Assessment Metrics

A well-formed risk assessment technique can have multiple benefits to many of the stakeholders of IT-related risk management. The metrics that results in numerical representation of the risk levels of company IT can serve as a basis for benchmarking. Therefore it is possible to make comparisons to other companies' risk levels in the same industry. The results of risk measurement can be used in certifying the level of risk-readiness. The value of a proper certification of the level of risk the company holds is very high. The certificate can be presented to the clients as an instrument to assure confidence.

A reliable assessment of the information risks is an especially powerful tool in the hand of the IT-management to establish their decisions. The assets of companies are always limited; therefore a method that enables the best allocation of money and attention is always welcome. By identifying the most problematic areas and offering a precise measurement system of the level to which the area is exposed to threats it is possible to make well-founded decisions on expenditure and risk-related actions in the organization.

Taken as a whole, risk assessment metrics can help in drawing the attention of the stakeholders to the problematic areas and also to take countermeasures in the most effective and cost-efficient way.

Further Tasks

The research development aimed to create a more reliable assessment method to process the statements of the IT audit report. For this purpose the effects of simultaneous existence of risk factors have been taken into account.

Several challenges still lie ahead in creating a common method for IT audit risk assessment. A common approach is needed to assure that the different organizations using different standards can cooperate and the results are interchangeable. The efforts of the main organizations undoubtedly show the determination to create common methods. The largest challenge is to collect the necessary data for a reliable risk assessment. In most cases this appears to be beyond possibility. The problems mentioned earlier – e. g. comparing different scales and diverging events – might prove to be overwhelming. Nevertheless efforts can be made to create a basis for assessments.

Another type of challenge is the handling of the assessment process itself. A common mistake is to add the different risk elements and calculate an overall risk level by simply totalling the individual rates. This results in misleading numerical representations and unjustified outcomes. During the research this kind of error has been targeted. The mapping of the first-order correlations between control objectives has been done. The tasks lying ahead are:

- Mapping multiple correlations (co-existence of several factors) and their effects on overall risk. The simultaneous effects of more than two factors have not been targeted yet. The consequences can be significant but are expected to add up to less then the first-order correlations.
- Discovering the correlations between detailed control objectives. During the research correlations have only been checked at a higher level. The assumption has been made that the detailed control objectives inherit the correlations of their parent-objectives. This hypothesis has to be checked and the model has to be revised according to the results. Individual checking of control objectives would mean almost 100 000 relations which is an enormous task.
- Creating a software-framework to help the actual usage of the method in real-life situations and help auditors apply the findings.

Although the first steps to establish risk assessment metrics and create more reliable methods for IT risk assessment have been made there are still several difficult problems to be solved. Large effort is needed to solve some of these, but the expected results compensate for the endeavor: Reliable IT risk assessment metrics would raise the precision of the evaluation of IT risks, the reliability of IT audit findings, the validity of IT-management decisions and the effectiveness of the allocation of IT-related assets.

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Seeing the Woods for the Trees
Challenges in business information

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ABSTRACT

Reviewing the successful business visualization solutions there are two important findings: real groundbreaking solutions are rare and the application of the most advanced techniques is spreading slowly and hardly out of academics into everyday solutions. These two findings suggest that the theoretical background should deepen foundations and emphasize design. Visualization industry needs predictive and generative theories. To answer the question why they are still missing or are too general we have to take a closer look at the supportive scientific background and the special biases and challenges in business oriented visualization. Most demanding problems are the non-geometric abstract data and the incorporation of human problem solving processes. I will argue that mental model studies should have more significant role in business information visualization and the right approach to design is the so called activity-centered design.

Introduction

According to Don Norman [6] , who is one of the most influential persons in the human computer interaction (HCI) playground, the power of unaided mind is highly overrated, but human intelligence is capable of inventing tools, so called external aids to overcome its own limits. Concerning today's information systems and the data volumes stored and manipulated it seems nearly impossible for a human decision maker or problem solver to explore all the data, find interesting patterns, outliers, verify hypothesis easily. The different types of computers are mostly interactive, the visual representations utilize the human visual pathway to amplify cognition. This way might be viable because the human mind is well equipped with low-level tools to handle visual and spatial information. What is wrong with this simple definition of computer-based visualization? The definition is of course correct at least by the most prominent researchers in information visualization [2] . The essential idea behind information visualization is clear for all visualization designer concerned. But still there are fields where the level of visualization technology is far behind the desired achievement that could be expected by looking at other fields. This anomalous situation holds even if we take into consideration that the whole discipline is relatively new, and is still in its childhood. The successful application areas belong to scientific applications such as medical imaging, computational physics, weather research etc. [4] . The more abstract data is visualized the less successful applications can be found. The design of information visualization software is still a hit-or-miss process. Part of the difficulty is that the models for information extraction by the human perception are incomplete. As a result the effectiveness of a given visualization can only be assessed by user tests post implementation [14] .

As we arrive at the field of business information visualization the difficulties seem to multiply [16] . Business information visualization has

unique characteristics in the goals and in the structure of underlying data – information to present. My purpose is to show that the weaknesses rooted in the lack of comprehensive specialized theories and the shortness of knowledge flow between the related parties. Most demanding problems are the non-geometric abstract data and the incorporation of human problem solving processes.

The cause of these difficulties is the lack of unified approach and solid theories, which are based evenly in human and engineering sciences as well. Furthermore visualization industry needs predictive and generative theories in the same way as the whole HCI field [9] to be effective. To answer the question why they are still missing or are too general we have to take a closer look at the supportive scientific background and the special biases and challenges in business oriented visualization.

The State-of-Art in Visualization

The business oriented information visualization emerged from the endeavor to extract the inherent information from the ever-growing business databases. This activity aims to increase insight into the data to detect interesting portions and patterns. Interactive visualization can provide better interaction with data, with the model and with the outcome of the model. It can also help the collaboration of the decision makers. As a consequence application of advanced visualization systems will drive new scientific insight and innovation [15] . In the business world the primary relevant originating fields are statistics, databases and pattern recognition and data visualization. Directly and traditionally the explorative statistical data analysis and presentation is counted as the ancestor sciences of business visualization. A special field of interest is opening now in data mining and knowledge discovery. Although these fields may set out problem statements and provide domain specific approach, most of the required knowledge lies outside of their scopes, in other research areas.

To confirm this statement let's try to compare the everyday practice and tools of the average computer user business decision maker and some tools from research labs. Two observations can be made. Firstly, there is a significant gap between the really modern highly usable experimental tools and the productive tools. The transition from research to real application is slow. Secondly, the number of outstanding genuine experimental solutions is low.

The common everyday visualization tools are merely just somehow architecturally modernized versions of classic diagramming techniques. Even the specialized statistical analysis packages offer no more than automatized diagramming by the means of wizards laying out the combinations of the former diagrams. Their solutions are far from real information workspaces. A very similar conservativism can be discerned at the same time if we look at the decision support tools. In many relations decision support refers only to reporting and querying.

The most famous and most advanced solutions in information visualization are well known in the research and academic community. The computational resource barriers once separated them from real world application are disappeared by the advances of computing hardware. So why haven't these solutions made a breakthrough? Or more importantly, why are there only so few successful visualization techniques or metaphors?

There is no simple answer to these complex questions. In the next sections I'll try to show that the visualization process involves a wide range of different disciplines. We must notice that there are still white spots in the map of visualization science.

The Visualization Process

There are different reference models of the information visualization process. Even if they introduce different objects and procedures there is a common ground and a general data flow or transformation model can be constructed. This model describes the stages of the visualization

process from raw data to interactive visualizations and encompasses the user interaction as well. Here I will detail the stages individually to show problematic transformation steps. I'll try to put the stages into scientific context along the whole process.

A major component with determining effect on visualization design is the conceptual framework of the cognition behind visualizations. Here the theoretical uniformity is not strong at all. Different conceptual models are varying in accordance with the disciplinary traditions. The most relevant and productive models come from the HCI research. I will consider a model like that in conjunction with the visualization process model with special explanatory strength at least for my purposes.

The most widely accepted reference model of information visualization is the Haber-McNabb pipeline. This is a dataflow or transformation pipeline model of the process [2] [8] [16] . This model describes the visualization and the user interaction as a chain of transformations (see Figure 5-1).

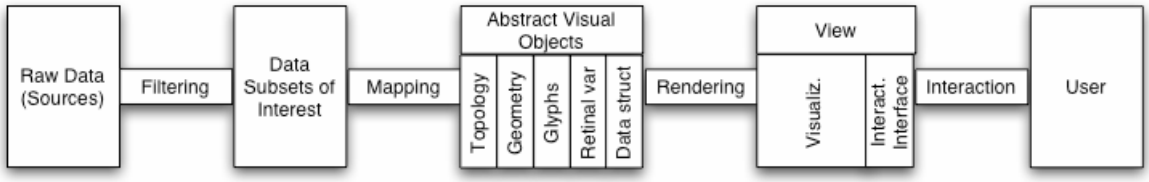

Figure 5-1 The visualization process

The first transformation is called filtering and denotes the selection of a suitable subset of raw data to be used in the visualization. The usual strategy is to highlight the relevant structure and relations of the data and prepare it for an easier mapping in the next stage.

The second stage in my interpretation is the most crucial step: the data subset has to be transformed so that upon it conceptually coherent, so called visual objects or visual structures or representations in general could be built. When the data is abstract most theories leaves us here in the dark by stating what properties a good visual object have to bear, but saying nothing about how to achieve these properties. Why the handling of this stage is problematic? The answer is that we have no strong conceptual frameworks describing the transformation activity and the visual objects [1] [2] [8] . Data subsets can be dealt with mathematical tools, but the working definitions of visual objects come from different disciplines such as mathematics (topology, geometry, set theory, etc.), statistics and computer graphics. This ambiguity is also reflected in the terminology used here (abstract visual objects or visual structures, display primitive or mark etc.). And finally visual objects are not independent from the realization of the visual display, the image in the last stage. There were trials to mathematically formulate some kind of perceptional requirements for special visualizations [12] [14] . These requirements have to be balanced with the mathematical constraints from the domain.

In the last stage the abstract visual objects turn to be interactive views. Visualizations exist in space-time. The rendering phase is responsible for creating a display or view based on the visual objects. In business-oriented visualization the commonly used paradigm is desktop computing (display and interaction technology). This last stage also realizes the user interface. The user interface makes it possible that the user can control and interfere all the visualization phases.

Designer's Challenges

Now we are ready to try to put the visualization process into some scientific context. Figure 5-2 summarizes the scope of the different related scientific fields, disciplines, and research areas. What obvious is that there is no overarching comprehensive scientific discipline, which could provide unified approach to the whole visualization process. The most comprehensive field is information visualization, which mostly deals with the technical details of visualization design. The other weaknesses come from the insufficient communication between these not so closely related research fields. Reviewing the really successful visualization solutions one can state that in those rare cases all the relevant knowledge from the related fields was forged in the best way to the actual visualization.

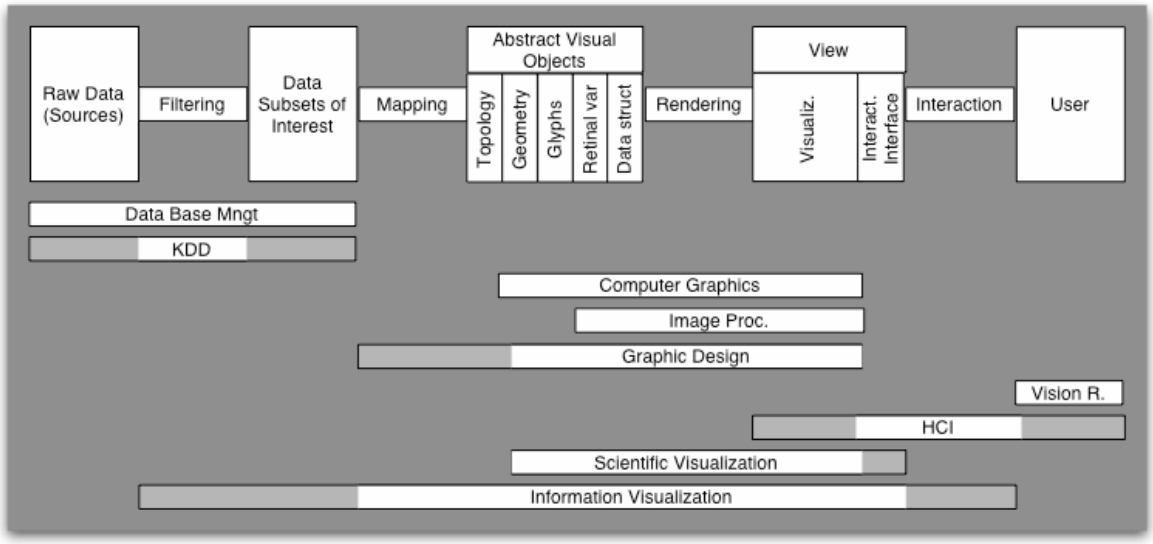

Figure 5-2 Fields connected to visualization

What is missing? The answers can be found in the cognitive theoretical explanations have been given for visualization and its role in human modeling or problem solving. HCI and cognitive psychology deals with visual representations at two levels. The best-known cognition model, the so-called Model Human Processor [7] insists that there is a low level perceptual processing and a higher level cognitive processing. A visualization to be effective has to fit into the mental models required to solve the given problem [3] and it has to be adapted to the characteristics of the human visual perception [13] . Figure 5-3 depicts the extents of this two-level fitting over the visualization process.

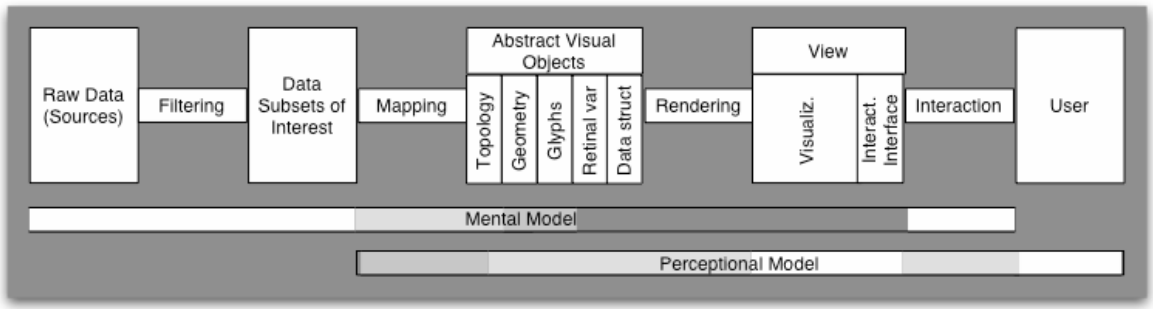

Figure 5-3 Cognitive models and the visualization process

And now we are at the core of the visualization problem. The designed visual objects, their inherent topologies and structure should be based on the concepts and structures of the problem solver's mental model. Further the geometry and the appropriate rendering at the final stage should utilize the visual perceptory system effectively. The visualization is good if the user can encode the visual objects to the information needed at the problem-solving task [11] . Figure 5-4 shows the role of the visualization in business modeling.

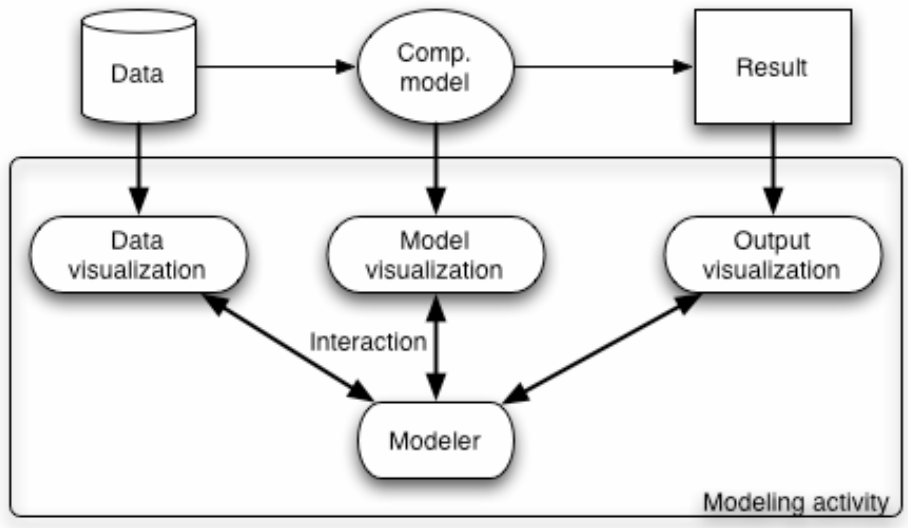

Figure 5-4. Modeling via visualization

Considering business oriented visualizations one can verify that the mental models underlying business decisions are highly abstract and not always easily transformable to geometric objects. Most of the somewhat routinely applied scientific or information visualization solutions have limited use here. It is not trivial to transfer the procedures of scientific or information visualization to the business area [16] . For a given problem there may be no applicable design patterns that fit well in problem solving mental procedures and are simultaneously perceptional strong enough to amplify cognition and provide appropriate interaction between the user and the visualization.

To build pattern libraries, which can serve as grounding for new visualization designs or can be used as frameworks in automated visualization generators attached to business analysis packages a new comprehensive approach is needed. The designers have to be familiar with the tasks of business modelers, problem solvers and at the same time they have to be competent in scientific visualization technologies and HCI based design.

The best approach to visualization design, which can integrate the aforementioned required knowledge, could be the so-called activity based design [5] . This method essentially is the same as the user centered design but with focus slightly repositioned from the users to their activities. The difference is that the capability of the tool and technology - in our case the visualization solution - should be considered too.

These difficulties are present in all type of visualizations used for problem solving and decision-making. Business visualizations have to build visual objects around abstract terms, which imply complex data sources and complex visualization transformations in interactions. This fact obviously makes business visualization one of the most challenging activities for visualization designers.

Conclusions

Information visualization now exemplified by a few leading institutions will bridge the current gap between available technology and the widespread application. Information visualization will be incorporated into innovation processes and will become a significant application area in business information technology.

Information visualization and specially business oriented visualization is a relatively new discipline. There is increasing interest in special visualization for business purposes. Most activity is done in knowledge discovery and data mining. Other analysis fields seem to be content with their current tools. The profile in these latter fields may be raised by strengthening multidisciplinarity or by enabling specialization in business visualization in the respective communities. The way can be paved by special education where results of the somewhat scattered visualization science can meet the problems of business modeling and analysis. The target audience with great possibility can be the business information technologist society.

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Identity-Background Checking
a Solution, which Meets the Requirements of Privacy and Personal Data Protection at Identity Management Domain

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ABSTRACT

Tasks related to identification and authentication of persons and other entities have been necessary always in public administration and business life. Information Society offers new e-services for citizens and businesses, which dramatically change the administration and results additional challenges, risks and opportunities. Citizen's confidence and trust to services has to be enhanced, meanwhile several requirements, like data protection, privacy and legal requirements has to be satisfied. Identity management solutions show colorful variety of software in Europe, they are at a different maturity level. Paper will concentrate on the PKI related identity management solutions, mainly from Hungarian approach. We review its legal and regulation environment, benefits and disadvantages of its applications. Relating identity management services will be presented also.

Introduction

PKI itself can not guarantee the authentication and authorization of the identity at the level that is anticipated by the public administration, it has to be completed. The most important Hungarian regulation approach can be found in Ket (CXL. Law, 2004) and we have to count the concept of identity-background checking also. We present a suggested identity management framework (based on the PKI, but improved it), customized for the Hungarian specialties. The basic problem that should be solved somehow is the following: in the relationship between the citizen and the public administration, there is a very strong requirement for the mutual verification and validation of the identities of partners, usually prescribed by the law, the legal environment and the jurisdiction compulsorily. Regarding the available technologies, there are several opportunities to implement a proper technical solution. However, a technically satisfying solution could collide with the local legal environment and jurisdiction.

At some countries, the law permits a de facto central register of electronic identity of citizens, at other countries; either the laws in Force or the practice of jurisdiction prohibits the centralization of the registered electronic identities, and allows only some kind of distributed solution. The technology should provide services even in distributed or federated cases thereby the partners –the public administration and citizen– could build up a trust relationship mutually. The identity of citizen proved by a certification of PKI technology and issued by a commercial organization –the Certification Authority– could not be regarded convincing enough for the public administration. The certification contains some kind of name or names, but it does not have enough information for unambiguous authentication. The outlined solution provide a correct solution among the constraints raised by the legal environment and the available technology, and avoiding some pitfalls that apparently yield a resolution but it hides some traps because disregarding the basic principles of cryptography.

Identity Management – Overview

Identity management is dealing with managing the type of information, which is available for a certain application [7] . It involves maintaining a person's complete information set, spanning multiple transactions and contexts. Identity management application is part of an end-to-end security solution and addresses the needs for certainty in the areas of authentication, access control and user management [5] . Identity management systems allow people to define different identities, roles, associate personal data to it, and decide about access control of them and when to act anonymously. An identity management system would empower the user to maintain their privacy and control their digital identity [7] . The next business drivers of identity management are the cited in the literature [6] :

- Cost reduction (unsatisfactory management of identity can increase the cost; e.g. waiting for permissions).
- Increased security (inadequate access rights can be an additional risk for an organization).
- Increased compliance (an identity management system can help the organization to comply with laws (e.g. data protection laws and regulatory environment).
- Increased usability (users have ability to control their working environment and customize it).
- Infrastructure consolidation and application development speed (solutions can be built more rapidly, with applying reusable security elements).

Two major areas are distinguished in identity management; namely, enabling user access (authorization, authentication etc.) and user life cycle management (user administration, provisioning etc.). Another splitting is user's perspective aspect (focus on efficiency: one single sign-in to many application) vs. administrator perspective (focus on efficiency of management) aspect. Major building blocks of identity management are the enterprise directory services, authentication, access control and user management [6] . The four elements manage the whole life cycle of the identity within an organization, from creation to termination. Most important requirements against identity management are functionality and privacy [7] .

Decisive IdM Architectures

Approaches of IdM architectures show colourful picture, we discuss briefly only the most frequently cited ones, namely: Liberty Alliance Architecture, IDABC, Sibboleth, Government Gateway Model and Austrian Model.

Liberty Alliance Architecture

Liberty Alliance [10] , a consortium representing organizations from around the world, was created in 2001 to address the technical, business, and policy challenges around identity and identity-based web services. It offers the technology, knowledge and certifications to build identity into the foundation of mobile and web-based communications and transactions. Liberty Alliance Architecture is widely applied and cited at the area of identity management. The following part of the section provides a brief overview of the Liberty Alliance's federated network identity management architecture's components and the main features of the components. A high-level overview of Liberty Alliance Architecture modules can be seen in the Figure 6-1:

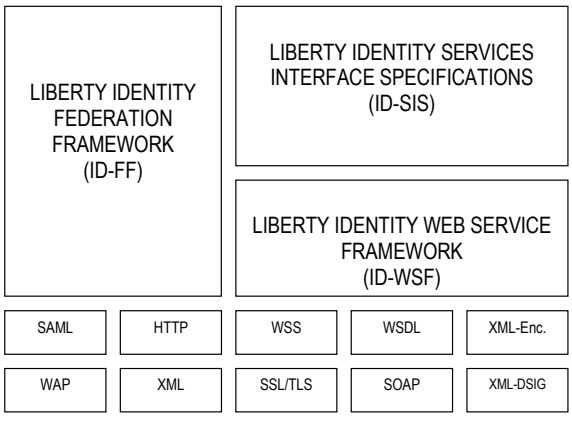

Figure 6-1. High-Level Overview of the Liberty Alliance Architecture

The main modules are the followings:

– Liberty Identity Federation Framework (ID-FF)
– Identity Services Interface Specifications
– Liberty Identity Web Services Framework

Liberty Identity Federation Framework empowers identity federation and management through features such as identity/account linkage, simplified sign on and simple session management. The Liberty ID-FF module supports the federation of identities, including the corresponding management. This framework enables the interoperability of the most varied of platforms and defines the federation for PCs and mobile devices (mobile phones, PDAs etc.). With ID-FF, the user has access to Single-Sign-On in his/her personal CoT ("Circle of Trust"). The ID-FF module also defines the exchange of metadata. The ID-FF module is the central module of the Liberty specifications.

Identity Services Interface Specifications is based on ID-WSF and contains specifications for the following functions: user registration, address book, calendar, location-specific services and alarms ("alerts"). Liberty Identity Services Interface Specifications (ID-SIS) enables interoperable identity services such as contact book service, geo-location service, presence service, personal identity profile service and so on.

Liberty Identity Web Services Framework (ID-WSF) provides the framework for building interoperable identity services, identity service description and discovery, permission based attribute sharing and the associated security profiles. ID-WSF is based on ID-FF and forms the basis to provide personalized services. ID-WSF includes:

– the exchange of individual attributes (permission-based attribute sharing),
– the collection of identity elements in a distributed environment (identity service discovery),
– interaction services ("interaction services").

It also includes additional security profiles, which are to be observed during data exchange (security profiles), such as

– Simple Object Access Protocol Binding (SOAP binding),
– extended client support (extended support for end devices, not IP/HTTP specific) and
– identity services templates (personality profiles specification).

Underlying part of the architecture - extension of industrial standards represents a collection of international standards relevant to Liberty. ID-FF, ID-WSF and ID-SIS are based on these standards. These refer to existing standards; as necessary and when required they will be extended and approved with the appropriate standardization organizations. Liberty Alliance works together with many organizations, e.g.:

– Organization for the Advancement of Structured Information Standards (OASIS),
– World Wide Web Consortium (W3C) or
– Internet Engineering Task Force (IETF).

The following are used as standards: SAML, HTTP, WS-Security, WSDL, XML-ENC, WAP, XML, SSL/TLS, SOAP, XML-DSIG.

The IDABC Approach

IDABC [9] stands for Interoperable Delivery of European eGovernment Services to public Administrations, Businesses and Citizens. It applies the ICT (Information and Communication Technologies) opportunities to support the delivery of cross-border public sector services to citizens and enterprises in Europe, to improve effectiveness of collaboration between European public administrations. The underlying architecture proposed by the IDA (Interchange of Data between Administrations) community, that enables trans-European networks to interoperate, and thus allows Public Administrations in Europe to interchange data. The architecture has crucial importance for the data exchange and the collaboration between Member States and Institutions. Maintaining and building interoperable trans-European services is difficult, when the necessary components are frequently subject to change, as is the case in the world of ICTs. Architecture Guidelines of IDA is regularly updated in order to facilitate the situation. They assist administrations by supplying relevant information and guidance in an appropriate

framework for ensuring interoperability between services. The “Architecture Guidelines” is an IDABC service offering a framework for the establishment of other IDA services, namely TESTA, CIRCA and PKI, and for users who wish to interoperate with IDA and IDABC networks. It also offers general advice on issues related to interoperability between these services and with national applications of the Member States. The Guidelines supplement the generic rules and specifications of the European Interoperability Framework (EIF) on a technical level. Based on the IDABC recommendation the following general principles should be considered for any eGovernment services to be set up at a pan-European level: accessibility, multilingualism, security, privacy, subsidiary, use of open standards, assess the benefits of open source. Based on the IDABC guideline setting-up of eGovernment services at a pan - European level requires the consideration of interoperability issues at three level: organizational, semantic and technical viewpoints. The Guidelines for TransEuropean Telematics Networks for Administrations discuss the implementation issues, user requirements and the roadmap from requirements to application implementation [2] .

Shibboleth

Shibboleth [12] , a project of Internet 2/MACE, that is dealing with architectures, policy structures, practical technologies development, and an open source implementation to support inter-institutional sharing of web resources subject to access controls. The key concept within Shibboleth includes:

- Federated Administration,
- Access Control Based On Attributes,
- Active Management of Privacy,
- Standards Based,
- framework for Multiple, Scaleable Trust and Policy Sets (Federations) and
- a standard (yet extensible) AttributeValue Vocabulary.

Federated Administration means that the Identity Provider (origin) campus (home to the user) provides attribute assertions about that user to the Service Provider (target) site. A trust fabric exists between campuses, allowing each site to identify the other speaker, and assign a trust level. Identity Provider sites are responsible for authenticating their users, but can use any reliable means to do this. At the Access Control Based on Attributes approach access control decisions are made using those assertions. The collection of assertions might include Identity, but many situations will not require this (e.g. accessing a resource licensed for use by all active members of the campus community, accessing a resource available to students in a particular course).

The Active Management of Privacy means that the Identity Provider (origin) site, and the browser user, controls what information is released to the Service Provider (target). A typical default is simply "member of community". Individuals can manage attribute release via a web-based user interface. Shibboleth apply standards, it will use OpenSAML for the message and assertion formats and protocol bindings which is based on Security Assertion Markup Language (SAML) developed by the OASIS Security Services Technical Committee. Shibboleth approach offers framework for multiple, scaleable trust and policy sets (Federations). Shibboleth uses Federations to specify a set of parties who have agreed to a common set of policies. A site can be in multiple Federations. This moves the trust framework beyond bilateral agreements, while providing flexibility when different situations require different policy sets. Shibboleth has defined a standard set of attributes; the first set is based on the eduPerson object class that includes widely-used person attributes in higher education.

Government Gateway Model

Microsoft Gateway to e-Government project was launched in August 2000. The goals were, to make all Government services accessible on-line by 2005, provide universal access to the Internet and ensure the UK is the best place in the world for e-commerce [11] Government Gateway is the common channel linking the

public with government systems via Web sites, government portals and Internet-enabled applications. It is designed not only to benefit government and public sector departments, but also three million UK businesses and 60 million citizens. Main features of the gateway model are the followings:

- aims to centralize authentication of citizens and businesses,
- heavy PKI origins: costly and complex for users, low take-up,
- looking to ease user registration and increase take-up,
- have registration & enrolment process.

Government Gateway provides a secure, easy-to-use means for people and businesses to enroll for services and file forms including income tax and value added tax returns. Anyone able to use a Web browser can access the system, and it is easy for the Government to operate, manage and maintain. When launched, the UK online e-Government initiative faced challenges in addition to connecting a huge number of users. It had to integrate a single access path, serving all users, with departmental IT infrastructures that had operated independently for many years. The role of the Government Gateway is to provide departmental systems with an outward-looking perspective, responsive to the needs of individual citizens and businesses of every size and type.

The Austrian Model

By the Austrian e-government strategy, the unambiguous and secure identification of citizens/businesses and administration units as communication partners is a decisive factor implementing e-government services. Therefore electronic signatures - in some sensitive cases secure or by the EU directive notion qualified electronic signatures are required for communication to public administration.

The Austrian government has got a software application developed for a middleware –it is called Security-Capsule which is the link between different signature tokens (smart cards, USB-Tokens, mobile phones) and the various e-Government applications. The sectors of public administration that offers smart cards (e.g. Social Security Authority, Passport Office, Banks, teaching institutions), can integrate this software into their e-government related services and converting the smart cards or tokens issued by particular sectors of public administration to official citizen cards, which can be used in all e-Government processes.

In the Austrian approach, the use of smart card and PKI technology is intertwined in an inseparable way. The smart card or token can be any type of their genre assuming that is suitable for storing a digital signature certification. This principle makes allowance for using the smart cards/tokens issued by various sectors of the Austrian government as e.g. the Social Security, National Health Service and by other governments of EU member states to use uniform way. For the use of the smart card/token in relationship with the Austrian public administration, a specific registration procedure is required to be performed. During a registration procedure on the smart card/token, two key pairs are stored (A-key-pair for “secure or qualified” signature and B-Key-pair for an advanced digital signature), and furthermore a person identifying data tuple. The data tuple consists of a unique identifier of the person (Basic Concept), the public key of the digital signature on the smart card, public key of B-Key-pair, the *valid through* data and the whole tuple is signed by the proper Authority. The tuple on the smart card will be used as a person binding, i.e. a one-to-one and unambiguous mapping between the person and the smart card that ensures that only the owner of the smart card and the person, having the knowledge of the password to the smart card can act on the behalf of the particular person. In principle, the sector specific identifier within the public administration differs in each sector of public administration as the procedure for generating it makes use of the basic concept, the character string as the denomination of the certain sector of public administration.

During the procedure, these data is fed as input to a hash function –that does not have an inverse function– constructing the required identifier. By this way, the person is identified in any official procedure by the person binding and his/her digital signature on the document. The authority can unambiguously identify and authenticate the person through this information. There is well-elaborated mechanism for a trusted hierarchy assigning the legal responsibility to another person or legal entity to act on behalf of the person in official procedures of e-government services.

The communication between the person as a client in the sense of IT and the e-government services takes place in a secure format using proper protocols as SSL, TSL etc. At each official procedure, there is a front-end for security control, the so called Security Entrance that provides the necessary checking for the following information item as the digital signature, client credentials, identity checking through the person binding transmitted, deducting the procedure-specific-identifier for the particular official procedure; and if necessary the assignment hierarchy for legal responsibility.

At the interface of an e-government service provider, the identification mechanism uses a cryptographically safe SSL communication tun

nel. Initializing the SSL connection, the public key of the smart card is used to build a data block for authentication. Thereby at the same time, the client, the browser and the person as well is authenticated, and made unnecessary to exploit the User-ID and password assuming that the integrity of the card in the sense of cryptography is ensured. At the basis of the Austrian e-Government workflow are XML-forms provided by online applications via a central portal which can easily be displayed by the web browser. If preferred by the user some fields on the form can be filled in automatically because of the Security Capsule which stores personal information of the cardholder (e.g. name, birth date, id-number). The data for the remaining fields needs to be provided by the citizen. If necessary, attachments like birth certificate or electronic payment confirmations can be added. Upon completion of the form the Security Capsule requests the citizen to sign with the citizen card. After entry of a PIN number the complete form is delivered to the back office application. When the back-office process is concluded the administrational notification will be electronically signed by the authority, encrypted with the citizen's public key and delivered to the citizen's electronic delivery service. Comparison of the above described IdM approaches is demonstrated in the
Table 6-1.

Table 6-1

Table 6-1. Comparison of the IdM Approaches

	Liberty Alliance Architecture	IDABC	Shibboleth	Gov.ment Gateway	Austrian Model	Hungarian Model
PKI enabled	yes	yes	yes	yes	yes	yes
Standards applied	SAML, HTTP, XML, WS-Security, SOAP, WSDL,XML-ENC,WAP SSL/TLS, XML-DSIG	SOAP, RB, IIOP, TTP, bXML, S/MIME, TCP/IP SSL/TLS,	HTTP, XML, XMLSchema XMLSignature SOAP, SAML	HTTPS, SOAP, XML Schema, COM/XML	TSL, XML, SAML, HTTPS	LDAP, SSL
Sector Orientation	Business, Public	Public	Public	Public,Busn.	Public	Public
Verification Opportun.	Partly Supported	Supported	N/A	Supported	Supported	Supported
SSO: Single Sign-On	yes	yes	yes	yes	yes	yes
Digital Traceability	No	Weak	N/A	Weak	No*	No

*In principal, but there is opportunity for surprise attack

The PKI Technology

For political and economic reasons, there is a strong pressure to implement more and more public administration services using information technology appearing as e-government services. The remote access to the e-government services makes it necessary that the citizen should identify and authenticate itself by a reliable and secure manner that ensures the mutual trust for both the public administration and the citizen. However, we have to talk about client instead of citizen as not only natural persons but other legal entities may have contact to the public administration.

In the commercial world and within single organizations, the PKI technology developed during the last decades has achieved success. However, the PKI technology has accomplished only modest success in the relationship of client and public administration in the form of e-government. In the various form of contact between the clients and government, there is a very critical and significant difference to the use of PKI by enterprises, especially the internal utilization of PKI for the secure and reliable communication and business management among the staff of the organization.

The definite difference is the privacy and protection of personal data. A person can be identified unambiguously or with high probability by using some natural bits of information as e.g. the given name, second, name, date and place of birth, mother's maiden name and home address. There are some identification numbers or characters used within certain sectors of public administrations as tax number, social insurance number, personal identification number etc. Although these unambiguous and easy to handle identifiers cannot be used together because of the legal environment in some countries and jurisdiction, they cannot be stored in the same data store and cannot be linked to each other. This statement is valid largely for the member countries of EU with slight differences.

Within a certain organization for internal use, the content of digital certificates and data related to the person owning the certificate does not create conflict regarding the privacy issue. The digital certificates and the other data published in a public data store; in a directory that is typically realized by the LDAP (Lightweight Directory Access Protocol) technology could be accessed and read by other members of the organization. The typical data that occur in this context are the e-mail address, the personal names, titles, job description, department name, telephone numbers etc. The access to this type of data for other members of the organization is very important for business reason, in order to support the workflow and business processes. For general public to publish only restricted set of the before-mentioned data set has been crushed by the spam. The appearance of the other personal data on public LDAP servers would hurt more or less the privacy of persons, naturally depending on the local jurisdiction. To make this point clear, some legal rules for the public administration in Hungary consider the name and official telephone of civil servants as a public data. Whether the e-mail address is personal or public data depends on the uniqueness and dependence on the individuality of person, maybe the e-mail provided for official use is public data but other e-mail addresses should be considered as personal data, the debate is on this topic continually carried on, and still has not been concluded.

If a citizen as a client of the public administration acquires a digital certificates at one of the commercial certification authority (CA) for managing his/her own business with the public administration, the public directory of the certification authority will not contain other data as the name of the citizen and digital certificate containing the public key and maybe an e-mail address that is strictly coupled to the digital certificate. Optionally, the name of organization, department/business unit, country code, and identification number/serial number, name of city or town may appear as public information. But the publication of these data is a little bit risky because of privacy issues excepting the person would give permission for the publication. The

public key and the serial number of the certification at a particular CA can be considered as an unambiguous, unique identifier of a person. For identification and authentication, these data seem to be perfect from both view points of the public administration and information technology. Though, what the public key identifies? The popular view is that the person is identified. The question is: Which person is identified? Using public key included in the certificate, only the name and maybe the e-mail address of the person are public. What is the process that can identify unambiguously the person on the side of the public administration in this situation? The generally available information (given name, second name etc) is not sufficient for the unambiguous identification. Although the e-mail address is unique but there is no mechanism to map the e-mail address onto a person. What are the alternatives in public administration?

– The public administration creates a central database of e-mail addresses and couples to the certain person.
– The public administration creates a central database of public keys and links to the certain person.
– As the public administration use the existing central databases, in which the tax numbers, social insurance numbers are the personal identification numbers, a person can be unambiguously mapped onto the identifier in each single database. The identifier and public key should be linked together in each database.

Disregarding the Big Brother approach that the state collects all personal data, one of the lawful solutions is a voluntary registration mechanism when the person and his/her public key within the digital certificate linked together. The major task is to find a registration, certification, identification and authentication mechanism which conforms to the international (EU) directives and national laws and regulations. Several countries in the EU have a central registry of citizens in the form of databases and their permanent and maybe temporal address. The tax offices, the social insurance agencies have similar databases containing the identifier that is specific to the sector, moreover several items of the personal data suitable for identifying the person and considered as a natural identifier. There is a temptation to use these databases to support the identification and authentication within each sector of public administration involved in the e-government using PKI technology. It seems feasible approach to join the public key of a person's certificate and identifier specific to a particular sector of public administration. Arguing that the public key is public –nomen est omen– and there is no hurting the privacy of a person by this way. However, there is a serious logical fault in this argument. Through the public key of a person's certificate all the separate and insulated databases could be joined together by a primitive algorithm without any serious effort. All the activities related to the public administration of a single person could be tracked easily, and the data collection about a person would become trivial.

This solution is strictly prohibited by the law and the practice of jurisdiction –in EU generally, in the member states especially. A following problem area is to support the commercial certification authority by creating market for their services. At the same time, the state, the EU member state should remain neutral considering the competition on the market ensuring market opportunity for the commercial organization. All the efforts to introduce the PKI technology to ease the tasks associated to the e-government concentrates on the resolution of above outlined conflict. The various national models try to find an appropriate solution that satisfies both the technology and the legal environment.

In Hungary, the Gordian knot of the above mentioned problem is sliced to by the following way:

– The request for a certificate enclosing a digital signature and the registration with conforming rigorous Certification policy (CP) at a commercial Certification Authority that enables the certification holder to do business with government through e-government services. To avoid the centralization of personal data is

automatically guaranteed and designates a movement towards a federated PKI architecture.

- At a single CA, the person's naturally identifying data is stored a secure database beside the certificate and the public data that will be published in a directory. The certificate contains an indicator that signals the appropriateness for public administration, to handle issues through e-government services. The identifiers specific to certain sectors of public administration (tax number, social insurance number, etc.) are not stored neither in the certificate nor in the personal registration database, not even some coded format that might be created by a cryptographic algorithm or a hash function.
- The CAs should own by the Force of Law a so called CRL site. At this site, the CA should provide specific services that for an identifycation request from public administration answers by a "Yes" or "No". The CA receives a data package including the naturally identifying data of a person, public key and / or the serial number of the certificate. The service carries out a check on the database, retrieves information and unifies to the provided data. If there is match the answer "Yes" in all other cases the answer "No".
- During an interaction with public administration, a citizen can identify and try to get himself authenticated by a certificate enclosing a digital signature. The e-government service of a specific sector during the interaction requests the sector particular identifier (tax number, social insurance number), the public key of the digital signature and some naturally identifying data. The e-government service based on the gathered data call for an answer from the certificate issuer CA and performs an internal check on its own internal database. After gaining answer satisfying and fitting to the available data from both resources, i.e. internal and external the person is authenticated, moreover authorized to execute transactions through the e-government service.

Conclusion

The original aim of PKI technology was to provide services regarding identification, authentication and authorization for e-commerce and for enterprises' internal IT infrastructure. Within the e-commerce, the PKI technology would have enabled that any contract would be un-repudiated and before the court it could have been enforced, it would have been especially important in the copyright related products and commercial artifacts. Nevertheless, the various pre-payment method, bank card solutions, and direct transfer between the bank accounts electronically, furthermore the enhanced security of before-mentioned type of transacttions played down the urgent need for application of digital signature and the related technology in practice. Together with the developed logistics of Post services, the e-commerce was able to increase its volume without the extensive proliferation of digital signature and PKI infrastructure.

For internal use of PKI within enterprises has got an impetus. The market leaders of software manufacturers on the office, document handling and e-mail technology have built in their product the major element of PKI technology as e.g. local Certification Authority, issuing certificates of digital signatures and identification, e-mail systems integrated with LDAP technology for storing the person's data. There are no legal problems with this approach as the publication of personal data happens within a restricted and closed community. The PKI technology in such an environment serves well the interests of enterprise workflow management, operates smoothly together with the other software application and at the same time ensures a secure, reliable and trusted IT environment.

On the other hand, the public administration faces lots of legal issues as the circle that may want to do business with it is not closed, it could be rather regarded open. The procedures of public administration obey to strict regulations, laws and other legal rules, for this reason the e-government service should find the narrow path between the legal opportunities and solu-

tions provided by the PKI technology. The public administration is between Scylla and Charybdis.

The Austrian approach for utilizing the PKI infrastructure and the smart card technology for the e-government services is fairly sound. However, there are two minor faults.

The first one is that the whole procedure starts from a centrally stored identifying number, naturally there is a strong attempt using cryptographic methods to eliminate any trail that would help to reconstruct the original data. Though, the starting point is anyway a central state register, and this idea is not satisfying in several countries and jurisdiction regarding the data protection and privacy laws and regulations. The objections that are raised are worth considering in the light of 9/11 and afterwards the attempts for restricting the civil rights and extending the power of national security forces on the activities of data collection about persons even by liberal governments and jurisdiction.

The second one is more technical, namely the use of hash function for information protecttion. The original purpose of the hash function was to ensure the integrity of the data, message not for protecting the data form algorithmic attack. As the famous attack for password recovering in the Unix systems demonstrates –the so called dictionary attack– if the structure and space message is known and constrained the attack could be successful. The success depends only on the computing power uses up. The procedure to create the person binding and the sector specific identifier uses a hash function in the case of Austrian e-government. The data used as starting point and their structure is well known and publicized. Theoretically, there is a chance for surprise attack as there is no rigorous mathematical proof for the security of the hash function applied, and the hash function is used for other purposes as it was designed enhancing the potential threat and vulnerability of the method.

The Hungarian approach avoids several pitfalls

- There is no central registration of citizens acquiring certificates for either qualified or advanced digital signature.
- The registration process does not use any sector specific identifier of the Hungarian public administration at the commercial Certification Authority. The central register of citizens and addresses could be queried by the person's naturally identifying data, and the central register responds only by a "yes" or "no", thereby supplying an enforcement of the authenticity of the transmitted data. The personal data, identifier stored in the central register do not play any role generating the certificate, the digital signature and the personalization of a token (smart card, USB token etc.)
- The certification issued by the commercial Certification Authority contains sufficient information for interfaces and automated software solutions at the various sectors of the Hungarian public Administration to carry out the procedure for authentication and validation of the certificate of digital signature and other supplied and retrieved data from the databases of the particular sector of government. For example, the URL of Certification Authority where the data exchange could be performed.
- The applied cryptographic procedures related to the PKI technology are the wide-spread, technically sophisticated, sound and according to the state of the art are reliable and resistant to the known algorithmic attack.

The Hungarian solution is technically sound and conforms to the legal environments without any compromise, for this reason it is worth considering to push the international proliferation of this approach.

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Deterministic and Stochastic Optimal Resource Allocation and its Distributed Implementation

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Abstract

In real life it is common that the duration time of project activities cannot be estimated correctly. In this paper a novel algorithm is introduced by which an optimal resource allocation with minimal total cost for any arbitrary project could be determined. Moreover, this algorithm also handles the competences of the human resources. A distributed problem solving environment is also introduced that implements the above mentioned optimal resource allocation algorithm with a parallel branch and bound method. The system is built on the Jini technology [44]. It is a dynamic, service-oriented infrastructure that utilizes spare cycles of networked workstations in an efficient way and solves computation intensive problems more easily due to the parallelization.

Introduction

Our novel method schedules the activities in the alternative paths of an optimal resource allocation satisfying a given target function and taking into account that the duration times of the activities are probability variables, which have an expected value and standard deviation [30]. According to former studies 10-12% cost can be saved if the duration times of activities are handled as probability variables instead of deterministic values, hence the uncertainty of duration times can be managed and the total project time can approximately be determined if a significance level is given [27]. After all, the total project time is often influenced by unanticipated events. In the case when resources and the duration time of activities are changing at projects in progress, a new resource allocation for the running activities and for those still not started can be determined with this method. In this paper we introduce a new algorithm, which refines any feasible solution to determine an optimal resource allocation. This algorithm can be used when the duration times of activities are deterministic or stochastic variables. We discuss first the deterministic version and the stochastic version of the resource allocation method and then the new method which can handle the competences of the human resources will be described,.

The main defectiveness of any Project Management software is that they cannot handle the human competences. In real life an activity is prepared by a group or a subcontractor. What is the optimal size of the groups in term of resource allocation? How can we collect the adequate people in order to prepare activities earlier? In this paper an algorithm is introduced, which can handle the competences of the human resources.

In the filed of combinatorial optimization or artificial intelligence the method called “branch and bound” is very popular. It is often used in such NP-hard optimization problems where the search of the solution with simple enumeration would need long time and large resource capacity that exceeds the capabilities of today’s computers. Typical examples are the knapsack or traveling agent problems, but our resource allocation optimizing problem is of this kind as

well [4]. One of the advantages of branch and bound (B&B) is that it is only a framework method that defines only the iterative steps and the rules that must be applied at each step [10, 11, 41]. Every B&B algorithm can be characterized with four rules: the branching, bounding, problem selection and elimination rules. The rules are only directives and say nothing about the concrete implementation thus the B&B method can be adapted to a variety of problems. We also use this method to find the optimal solution for resource allocation. A more detailed description of the B&B algorithm can be found in [13, 36, 41].

In our system we use a parallel B&B that can significantly decrease the computation time or can achieve a closer solution to the optimal one in the same time when all the solutions are feasible. Moreover, the distribution of the task to different computation sites will result in lower resource (e.g. CPU, memory) consumption at each site, thus can make a problem solvable that was unsolvable on a single machine because of the resource limitations. At a certain class of applications (e.g. at the ones needing many synchronization and inter-process communication) the parallelization does not decrease, rather increase the overall execution time, but the benefit of resource sharing can be more important. The parallelization issues of the B&B algorithm were discussed in many papers [13, 29], the one that we use in our distributed problem solving environment will be discussed in more detail in section 6 from a theoretical approach and in section 7 from the implementtation point of view.

Background

When carrying out a project or a small-scale series production management, we would like to finish a project with minimal total project time and minimal total project cost using resources optimally. For determining the total project time we can use some of the common scheduling methods. Although the scheduling can be easily and quickly solved by a simple computer, the resource allocation problem is much harder and requires more time consuming computation.

For that very reason the heuristic methods are more popular then algorithmic ones. Heuristic methods find a feasible solution. These methods could be much faster, but some times the optimal solution would be important (equalized consuming resources, equalized production etc.) [2, 3, 6, 8, 22, 32, 42]. Algorithmic methods find an optimal solution, but intermediate steps are usually infeasible solutions. If the computational demand is too high we cannot stop the algorithm in order to get the current feasible solution, because the intermediate step is not surely feasible [4, 21, 30]. The evolution methods are starting from a feasible solution and refine the solution, but the optimality is usually not guaranteed [27]. The introduced Rall-Opt method also starts from a feasible solution and refines the solution in every step. But this method guarantees the optimal solution in finite steps and the intermediate steps are all feasible. In the next section this new algorithm will be described in detail.

Deterministic Resource Allocation

As it was mentioned earlier our novel resource allocation algorithm solves the given problem with certain resource constraints starting from a feasible solution and continuing until the optimal resource allocation is found. This method primarily handles renewed resources (e.g. human resources). Moreover, considering that the total project time is often influenced by unanticipated events a new resource allocation for the running activities and for those still not started can also be determined with this method. The algorithm can also be used when the availability of resources are not a constant function, or to determine a resource allocation with minimal total project time (TPT) and minimal total project cost, or is capable of using different resources and can be applied in parallel projects. This deterministic resource allocation method schedules the activities in the alternative paths of an optimal resource allocation, satisfying a given target function. In this method the existence of a fea-

sible solution is assumed. The algorithm finds the optimal solution in finite steps, according to the given target functions.

Problem Definition and Notations

Before determining the optimal resource allocation, a target function has to be specified. This function could be the earliest start time of the activities, or the smoothness of the level of required resources and so on. In this paper the activities will be scheduled as early as possible.

$$\min_{\forall(i,j)\in P} x_{(i,j)}$$

subject to $x_{(i,j)} \le w_{(i,j)}\text{-}z_{(i,j)}$, where $x_{(i,j)}$, $w_{(i,j)}$, $z_{(i,j)} \in \boldsymbol{R}_0^+$

$$\phi(z_{(i,j)}+x_{(i,j)}) \le c, \text{ where } c \in \boldsymbol{R}_0^+,\ \phi \in$$

$$\boldsymbol{R}_0^+ \rightarrow \{r_1, r_2, .., r_n\},\ r_1, r_2, .., r_n \in \boldsymbol{R}_0^+,\ n \in \boldsymbol{Z}^+$$

$x_{(i,j)}$ is the used slack time of the $(i,j) \in \boldsymbol{P}$ activity (it is the difference between the start time determined by a feasible solution and the earliest start time of the activity). $\boldsymbol{P}$ is the set of optimizable activities, $w_{(i,j)}$ is the upper bound of the start time of the activity, $EST_{(i,j)} \le z_{(i,j)}$ is the lower bound of the activity. ϕ is the total amount of resources in a given time, c is the resource constraint. The lower and the upper bound can be determined Brucker [5] and Heilmann [23] algorithms.

Searching an Optimal Resource Allocation

Finding an optimal resource constrained resource allocation is an NP-hard problem. Usually a heuristic method finds a feasible solution in a very short time [20, 27].

An optimal resource allocation could be determined from a feasible solution if a target function is given. For instance if the tasks should start as early as possible the target function could be determined and the problem can be solved with a branch and bound algorithm.

In the following chapter this method will be expanded when the constraint of resources is not a constant function. A typical example for this when employees work on the weekends, and that time usually we have fewer amounts of human resources than on weekdays.

Optimal Resource Allocation 1.

If the availability of resource(s) is constant only within specific intervals of time then let φ_i be the availability function of the resource i and let φ_{imax} be the global maximum value of this function. Furthermore let the value of virtual demand of resource i at the moment t be the difference between φ_{imax} and $\varphi_i(t)$. In this case during the search of a feasible solution the virtual demands of resource(s) have to be ordered to the bottom of the chart of resource(s), and not allowed to be scheduled at a later time. After that the availability of resource(s) will be constant throughout the whole project. During the search of optimal resource allocation the virtual demands of resources will not be optimized, and then the method described in the previous chapter can be used.

Optimal Resource Allocation 2.

In many cases planning the duration time of activities and the availability of resources is very difficult, when the resource requirements and the duration times of activities are changing in the actual project. In this case the terminated activities are not necessary to be scheduled. Only the running and still not started activities should be optimized [30, 37].

How to Use the Rall-Opt Method

The first step of our method is to determine the logical relationship among the activities. After that we have to estimate the duration time of activities, and then we can use any scheduling algorithms (CPM, MPM etc). In the scheduling phase the lower and the upper bound of start time of activities can be estimated (and can be further refined in the phase of feasible resource allocation search). Then, if we would like to handle the resources, we have to estimate the demands of resources of activities, and have to determine the resource availabilities for different resources. We can find a feasible solution by any heuristic, or evaluation method. We can refine the lower bound of start time of activities with Brucker's method [5]. If the total project time unchanged, after finding feasible solution the

upper bound of start time of activities could be the latest start time of the activities. If the start time of any activity is greater than the latest start time then the upper bound will be the actual start time. We can determine the upper bound more accurately with Heilmann's method [23]. If a feasible solution exists and we would like to determine an optimal solution, we have to determine a target function (starting time of activities as early as possible). After that we can use our method, which determines the optimal solution. This method uses a parallel branch and bound technique. In the next section we describe the handling of the total cost of the project or production. With this method an optimal total cost of the project can be determined considering the offered remuneration.

Finding Alternative Solutions

In some cases the offered remuneration is lower than the estimated total costs. There are three possibilities to handle this problem. We can sign away the implementation, or we can accept it, knowing that we will loose money, but can get it back later in another project. In this case we have to determine the optimal resource allocation with minimal total cost. In the scheduling phase we can use some cost minimizing methods [9, 26]. After the scheduling phase we can determine the lower and the upper bound of the start time of the activities. After scheduling we can determine a feasible solution and then the optimal resource allocation. The third possibility is to accomplish the project and find alternative implementation of activities that requires lower variable costs. During the search for alternative implementation of activities the most important aspect should be the quality, the decrease of costs is only the second one. If the total cost is lower than the offered remuneration we have to find the optimal resource allocation for the problem. Sometimes we cannot find alternative implementations, e.g. when a minimal quality level is given. In this case we can decide to either refuse or accept the implementation based on the extent of possible loss of money.

The flowchart of Figure 7-1 represents the possibility of finding alternative solutions and the diagram of Figure 7-2 shows a modification of the Rall-Opt method.

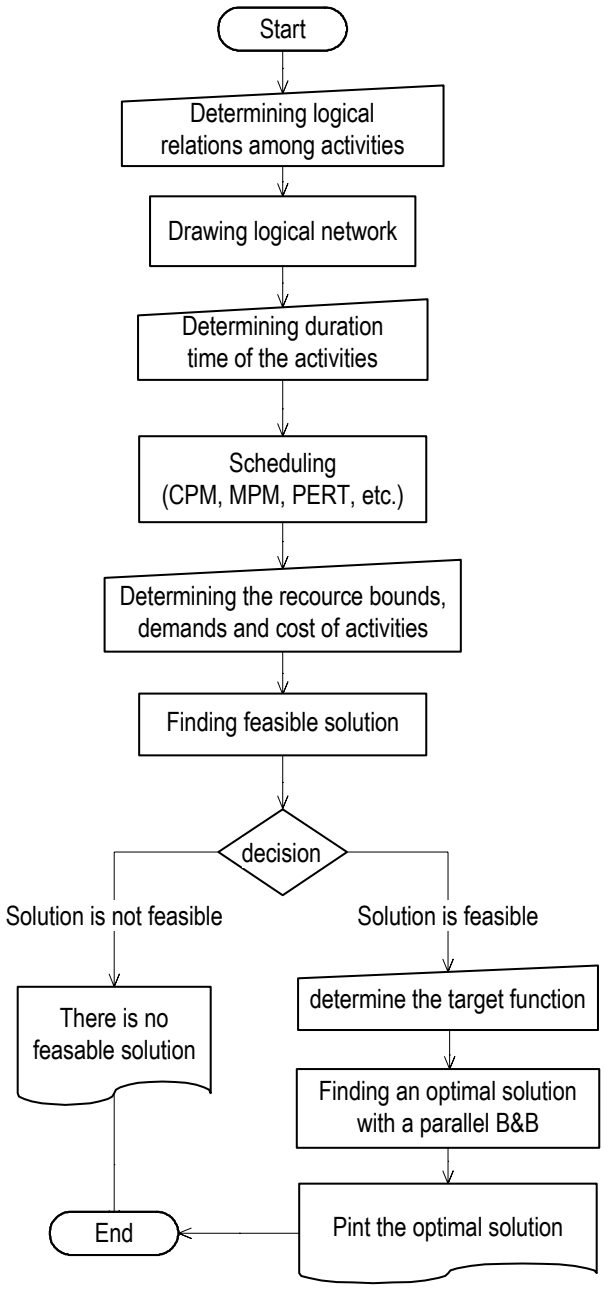

Figure 7-1. The flowchart of Rall-Opt method

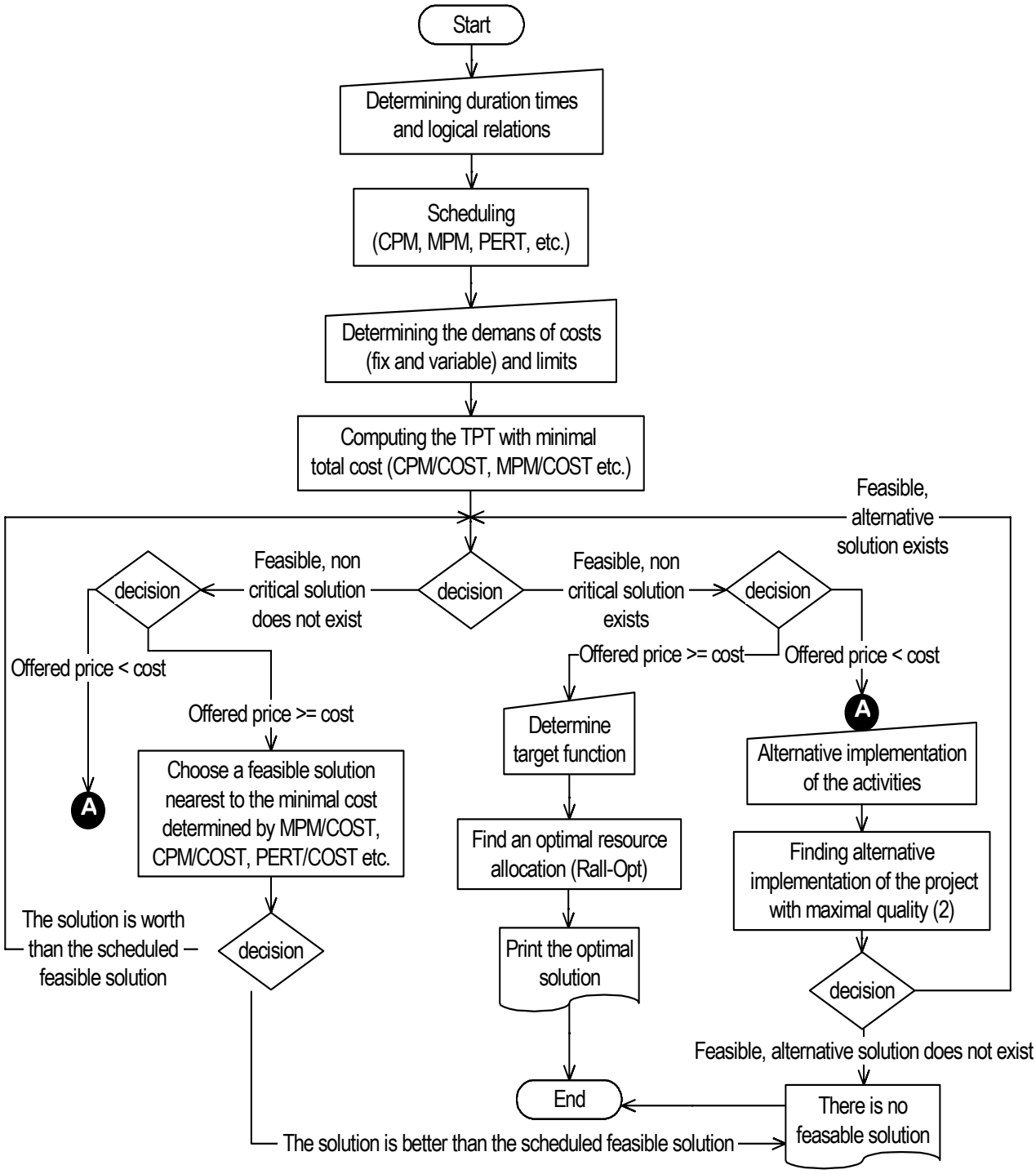

Figure 7-2. The modified Rall-Opt method

In this chapter we assumed that the duration time of activities that require variable costs and resources are deterministic values. If the estimates of these variables were inadequate we have to actualize the network and the resource allocation. If the project or the small scale series production has much uncertainty we should refine our plan several times.

There is another way to handle the uncertainty of the estimate of the parameters (duration times [1, 12, 15-17, 25, 28, 31, 34, 35], required variable cost or resources) of the resource allocation problem. We can assume that the estimations of the parameters of resource allocation problem are stochastic variables. In the next chapter we can see a stochastic model of the resource allocation problem.

Stochastic Resource Allocation

In this chapter a model is introduced which can uniformly handle the uncertainty of the parameters of resource allocation. It is shown that the terms of uncertainty in measurement processes are applicable in project management, too.

Stochastic time scheduling

In stochastic time management the duration time of activities are handled as stochastic probability variables. Two cases are feasible:

– the distribution of the duration time of activities is approximately known, or
– the distribution of the duration time of activities is completely unknown or at most very slightly known.

If the distribution of the duration time of activities is known, the expected value, variance and standard deviation (standard uncertainty) of the duration times are to be determined as follows [27]:

$$E\left(t_{i,j}\right)=\bar{t}_{i,j}, D^2\left(t_{i,j}\right)=\sigma_{i,j}^2=u^2\left(t_{i,j}\right)$$

If the distribution of the duration times is unknown, then in the project planning the PERT method can be used and in order to facilitate the calculations it can be assumed that the distribution of the duration times follow a β-distribution.

In the small-scale series production the preparation of a new product can be regarded as a project. In this case there is no information about the distribution of the duration times and many times it cannot be assumed that the distribution of duration times follows a β-distribution. In most cases it is difficult to estimate or determine the expected value, variance and standard deviation (standard uncertainty) of the duration times. The fact that a product is manufactured several times can be of assistance. In this case the expected value can be estimated as follows:

$$E(X_i)=\overline{X}_i=x_i=\frac{1}{N}\sum_{j=1}^{N}X_{i,j}\text{ , }i\text{=1,2,..,}M$$

where M is the number of activities, N is the number of production series and $X_{i,j}$ is the activity i in production j. The variance of duration time of the activity i is:

$$u^2(x_i)=s^2(x_i)=s^2(\overline{X}_i)=\frac{s^2(X_i)}{N}$$

Note: The variable cost and demand on resources of activities can be estimated similarly.

After having determined the expected value and standard deviation (standard uncertainty) of the duration times (possibly the variable cost and demand on resources of the activities), then the expected value and standard deviation (combined standard uncertainty) of the total project time can also be determined, provided that these probability variables follow the same distribution [1, 12, 15-17, 25, 27, 28, 31, 34, 35, 45].

Stochastic cost-resource allocation

If the total project time needs to be decreased it causes the increase of variable cost of the activities on the critical path. First the stochastic time scheduling with deterministic variable costs will be introduced, which method does not handle the uncertainty of variable cost of the activities. Then a review of some possible methods to determine the variable costs and resources is given.

Stochastic time scheduling with deterministic variable costs

In practice we can assume that the estimation of the activity duration times follow a β-distribution. In most cases some stochastic cost minimizing method is used to determine a project with the minimal total cost or minimal total project time. At the same time the expected values of the duration times of the activities in the PERT method may be different from the estimations in CPM.

Furthermore let us assume that there is a functional relationship between the duration times of the activities and the variable cost of the activities [9, 35]. Let us assume that quantities $a_{i,j}$, $m_{i,j}$, $b_{i,j}$, $t_{i,j}$ and $\sigma_{i,j}$ of the activities could be determined ($a_{i,j}$ is the optimistic, $b_{i,j}$ is the pessimistic and $m_{i,j}$ is the most likely estimate (modus), $t_{i,j} = \frac{1}{k+2}\left(a_{i,j} + km_{i,j} + b_{i,j}\right)$ is the expected value of the duration time of activities. In practice we can assume that k is equal to 4 (namely in this case there is some practical advantage of estimation), thus $\sigma_{i,j} = \frac{1}{6}\left(b_{i,j} - a_{i,j}\right)$ is the standard deviation of the activities [1, 12, 15-17, 25, 28, 31, 34, 35, 45].

According to the minimization methods of the total project duration time the expected value, modus, standard deviation of duration time of activities will decrease when the required variable cost of activities increase. Nevertheless, the total fix cost (e.g. rents) can be decreased when the total project time is decreased. Therefore a minimal total project time and duration of project with minimal total cost can be determined. After minimizing we can determine the lower and the upper bound of the start time of the activities if a significance level is given. After scheduling and cost-minimizing phase the feasible solution and then the optimal resource allocation can be found [14, 19, 33, 39, 40].

Stochastic Cost/ Time Management

During planning we usually had not enough exact information about costs and resources. Generally the costs and resources could only be estimated. Unfortunately there is no perfect stochastic model to estimate the expected values and standard deviations of different costs and resources.

In the production there is some information about costs and resources from previous productions and the expected value and standard deviation of the costs and resources could be determined.

Handling the uncertainty

In this chapter it is shown how to plan the project if one has to handle the uncertainty of the duration times.

Step 1
Change the expected value of the duration times to make it of minimal variable costs. (If there is a deterministic or stochastic function between the duration times of activities and the required variable costs than the "normal" duration time of the activities with minimal required variable costs can be determined with a simple minimizing method assumed that the duration time - cost functions are convexes.)

Step 2:
Draw the PERT-chart and determine the expected value, variance and standard deviation of duration times and the total project time.

Step 3
Decrease the expected value of duration times of activities in the critical paths. Determine the total project times with minimal total cost and duration times.

Step 4
Determine the diagram of resources. Find a feasible and then an optimal solution of the resource allocation problem. (The authors described some methods to find optimal resource allocation for different cases earlier. For instance on-line resource allocation, optimal cost resource allocation etc. [30, 36]. By these methods optimal resource allocation from feasible solutions can be found when a target function is given.)

Step 5

The techniques of network planning and resource allocation are also usable after the planning at the implementation and control. If duration times or demands on resources change, the new optimal resource allocation can be determined with the on-line resource allocation. During the production the expected values of activities have to be replaced by the real values of duration times and value 0 has to be chosen for the standard deviation. This time the uncertainty of the total project time will be decreased. At the end of the program the stochastic network will become deterministic.

In the previous sections in the resource allocation we did not take into consideration that sometimes we have to allocate human resources too. In a project or production there are many employees with different skills and different competences. We can assume that the duration time of activities is influenced by the skills and competences of workers. In the following chapter a new method will be introduced which can handle the competence of human resources.

Handling Competences of HR

Some Business Engineering methods (BE) support storing of the knowledge and competences of the human resources. In the one of the most popular BE solutions (ARIS) [43], measures of knowledge and competence can be ordered to humans, or a group, or an activity. In this methodology the degree of coverage can present the measure of competence of a worker who is doing an activity.

It is easy to deliberate that we would like to collect human resources with maximal degree of coverage. But which is the optimal size of the group? To answer this question first of all we have to introduce new concepts.

In some cases we have to use different resources (e.g. materials, human resources etc.). These *resources are perfect complements*. In these cases we have to synchronize the resource sheets. But in some cases the resources are not complement perfectly (skilled work, builder's labour etc.). For instance some special work can be carried out with builder's labourer, but they possibly finish their work later, and with lower degree of quality. We can assume that the degree of coverage is correlated to the duration time of activities or the demanding of resources.

If the resources are not perfect complements, we can use only one resource sheet. We can convert resources according to workers' degrees of coverage. We can assume that if the workers' degrees of coverage factor are low then the duration time of activities or the demanding of resources will increase. There is an important consequence of this hypothesis. We have to collect human resources with similarly high competences to execute an activity. We can solve this problem if we present the workers and the activities with a bipartite graph. The nodes will be the workers (N_1) and the activities (N_2). $N_1 \cap N_2 = \varnothing$, $N_1 \cup N_2 = N$. There is an arc from $n_i \in N_1$ to $n_j \in N_2$ if n_i worker can execute n_j job. Thus worker's degree of coverage is higher than 0 in this job. If the weight of arc is the degree of competence then we can determine the optimal matching with a lot of algorithm [38].

With this method we can modify the duration time of activities to determine a more reliable scheduling and resource allocation. The flow for handling the bipartite graph is shown in Figure 7-3.

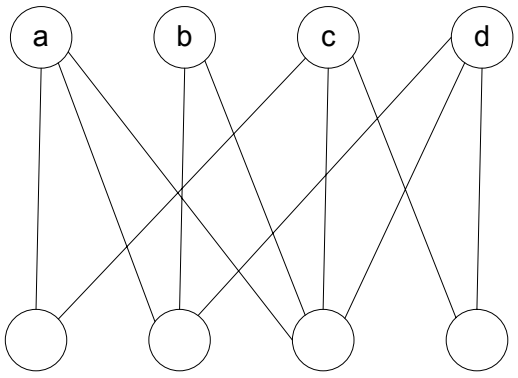

Figure 7-3. The bipartite graph

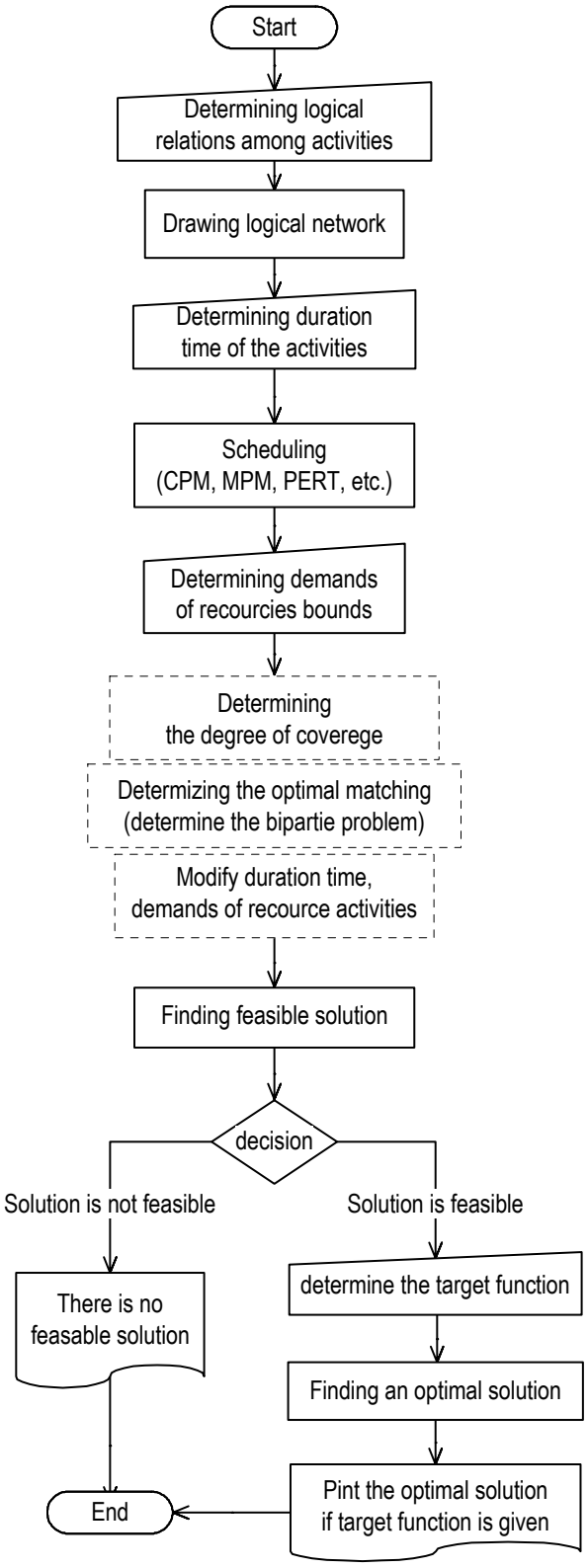

Figure 7-4. Handling human competences with Rall-Opt method

AdApting B&B for the Rall-Opt

In the Rall-Opt method finding the optimal solution by a given target function is a crucial point. At projects with hundreds of activities this search would need long time and what is more serious large computational capacity. Clearly this problem is NP-hard and thus the brute force search of the optimal solution by simply enumerating all possible solutions is not feasible by large problems. One most commonly used method is the branch and bound method. With this method we can prune large sections of the search-tree by comparing the solution of the current node to the computed upper or lower bound and thus the global optimum can be found in a shorter time as if we would look through the whole tree. One of the advantages of B&B is that it is only a framework method that defines only the iterative steps and the rules that must be applied at each step, thus it is quite straightforward to adapt it to a variety of optimization problems.

The first step is to define the problem states that will form the nodes of the search tree. Each problem state contains the whole problem description thus the solution of an arbitrary problem state is a feasible solution of the initial problem. By the Rall-Opt method a problem state p_i contains the descriptions of all the activities and some other values that are required for moving activities in the resource chart; the form of p_i is:

$$p_i = \left\{ A, P_i, T_i, T_{Si}, c, Q_i, U_i \right\}$$

where

A: is the base set of activities,

P_i: the set of all optimizable activities; if $P_i = \emptyset$ then a leaf is reached, no more branching can be made

T_i: set of breakpoints in the resource chart with current resource allocation

T_{Si}: previous-activity relations of activities in P_i

c: global resource bound

Q_i: set of activities that is to be optimized in the next step, $Q_i \in \wp(P_i)$

U_i: elements of P_0 that cannot be moved because of some conditions, e.g. $U_i = P_0 \setminus P_i$

In the current implementation we have chosen to minimize the overall project duration time which is equivalent with the minimizing of the sum of activity slack times. Thus the solution f_i of a given problem state p_i can be simply formed as the following:

$$f_i = \sum_{P_0} x_{(i,j)}$$

Where $x_{(i,j)}$ is the slack time of activity *(i,j)* that is element of P_0, the set of all initially optimizable activities (e.g. the activities on the critical path are not element of P_0). The lower bound g_i of a problem state is computed in a similar way but operating on the current set of optimizable activities:

$$g_i = \sum_{U_i} x_{(k,l)}$$

Here U_i is the set of activities in P_i that were optimizable initially but reached some bounds and cannot be moved in the further steps. For these activities the slack time is fixed and cannot be decreased any more so the lower bound is the sum of these slack times.

Now we have all the main elements for the branch and bound algorithm, namely the problem state definition (*p*), the target function (*f*) and the lower bound function (*g*). For the complete algorithm, however, three more values must be defined: *H* is the set of active problem states that are waiting for expansion, p^* is the incumbent, which is the problem state with the best solution so far, that is noted with f^*. With all these notions the branch and bound algorithm that is adapted to our optimal resource allocation problem is the following:

1. We put the initial problem state p_0 to *H* and compute $f_0 = \sum_{P_0} x_{(k,l)}$.
2. Based on the *selection rule* we choose an active problem state p_i from *H*.
3. If $Q_i \neq \emptyset$, *where* $Q_i \in p_i$, then

a. we move the activities in Q_i to as early as possible constrained by the parameters T_{Si} and *c* of p_i.

b. count $f_i = \sum_{P_0} x_{(k,l)}$ for p_i

c. update f^* and p^* if f_i is a better solution

Note: The condition of step three is not satisfied only at the initial problem state, since $Q_0 = \emptyset$, otherwise $Q_i \neq \emptyset$.

4. Upon the *branching rule* create new sets $Q_{1...}$ Q_n from P_i, so that $Q_j \subset \wp(P_i)$, $j = 1,\ldots n$ and *n* is the number of child nodes. If there is such an activity that cannot be scheduled into earlier time in the further steps the move it from P_i to U_i.
5. For each Q_j, $j = 1,\ldots n$:
   a. create new problem state $p_j = \{A, P_i, T_i, T_{Si}, c, Q_j, U_i\}$
   b. count the lower bound g_j upon the lower bound function:
   c. if $g_j < f^*$, then put p_j into *H (bounding rule)*
6. If $H \neq \emptyset$ then continue at step 2.; otherwise the algorithm is finished and the problem state with the optimal solution is p^*.

During the branch and bound algorithm the problem state with the best solution (called incumbent) is continuously updated and at termination it will hold the global optimum. The algorithm will terminate in finite steps since we repeatedly remove all activities from P as they reach some bounding conditions. In this algorithm the branching and selection rules are the points where the behavior and efficiency of the algorithm can be altered by selecting different strategies. The branching rule is currently simply to select all the optimizable activities at one and the algorithm uses the best-first selection rule to choose the next problem state to expand, this is one of the most efficient strategies, however, it requires the most memory to store the active (not yet expanded) problem states. It was one of the main reasons that a parallel branch and bound algorithm and a supporting distributed environment were also developed as it is described in the following section. As we are only in the early phase of implementation the measurement of algorithm performance with different strategies is a subject of future work.

The Distributed PS Environment

The main idea of the parallelization of the originnal sequential algorithm is that all the problem states contain all the information about the initial problem, thus they can be evaluated independently, and only minimal communication is required among the distributed entities. This parallel algorithm is quite suitable for Network of Workstations (NoW) type distributed architecttures. These architectures are with order of magnitude cheaper than using supercomputers, thus a company can harness the benefits of parallel computing with legacy networked computers. Creating a dependable middleware for NoW systems are really a challenging task, because these systems are very dynamic, workstations can come and go every time. Our system called JaBBa [36] is based on the Jini technology, which is one of the most promising distributed technologies nowadays [21,29,30, 37]. With the help of Jini technology one can easily build networked services. A service can be anything with a well defined interface. Jini is based on the Java programming language thus it is 100% object-oriented and allows fast software development. In Jini the networked services can be discovered automatically with multicast messages and it provides a very robust infrastructure, thus if a service appears or disappears the interested party is immediately notified and can handle these events [41].

Architecture and Behavior

This system is a general problem solving environment based on a parallel B&B frame-algorithm. In our case “general” means that several problem solver libraries can be attached to the system thus it is capable to solve several kind of optimization problems. The branch and bound algorithm adapted to the Rall-Opt method is also implemented as a native library that is dynamically loaded at runtime, when the user would like solve a Rall-Opt problem. The high level system architecture is outlined in Figure 6.5. Users can access the system via a manager service that on one hand accepts the XML description of the problem to solve from the user, and on the other hand manages the whole problem solving procedure by the available workstations. The manager service can accept tasks from several users and than it is its responsibility to schedule them to the available worker computers. The result is also returned to the user as an XML document, thus it can be processed with arbitrary third-party tools.

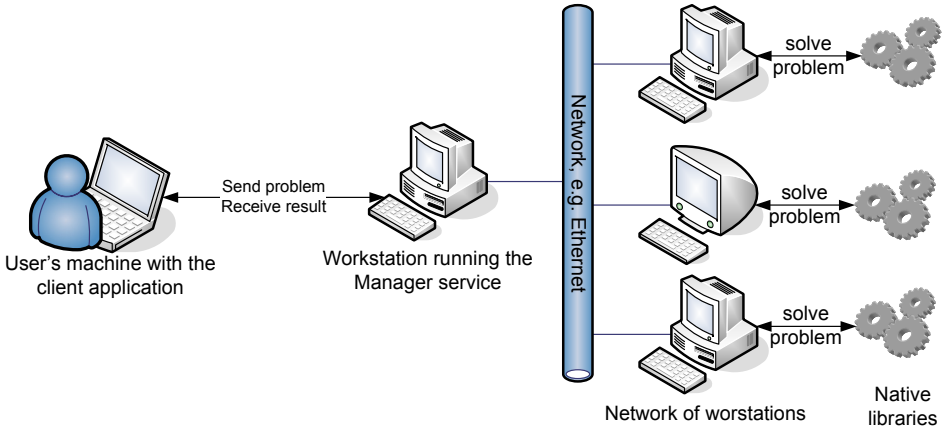

Figure 7-5. Architecture of the JaBBa problem solving environment

The manager service discovers the participating workstations automatically and then registers them as available worker machines. Moreover the state of the worker machines is continuously monitored via the Jini remote event mechanism thus the disappearance of a service is immediately known to the manager. Whenever a new problem arrives it is allocated to the currently available services. The manager can also handle those cases when a worker machine crashes meanwhile a problem solving is in progress, it restarts the computation from the last known feasible solution while there is at least one worker available. With these mechanisms the manager is fully capable to handle the dynamic behavior of the network of workstations.

The Parallel Branch and Bound

The Rall-Opt algorithm was implemented in a native library using the C++ programming language. Each worker machine works by the algorithm described earlier but to make it parallel it was extended by such interruption points where the current run can be stopped and problem states can be moved from and to the active set. Whenever a worker machine is set by the manager to solve a Rall-Opt problem it loads the native library and initiates the computation based on the given initial problem-state. When a worker machine happens to run out of resources it can transfer a portion of its job to another worker machine, thus the problem solving will be shared among more machines. The helper services will be assigned by the manager service thus it can keep track of the computation progress and limit the number of participating machines. We are currently doing research to replace the manager service's simple first-come-first-serve scheduling policy with advanced distributed scheduling and load-balancing policies that can behave more adaptively based on e.g. system load and can serve more clients at one time.

Summary

In this article we showed how can be the optimal resource allocation in a project determined with our Rall-Opt method if a feasible solution is given. On the other hand we described that if the uncertainty of the major variables (duration times, cost and resources) is taken into account when scheduling and allocating a project, then the duration times, costs and resources can be estimated more accurately. The accuracy of the estimation could further be improved if the competence of the human resources is taken into consideration. This way the total project time, total cost and total demands on resources can be determined more accurately, too. Furthermore, as we have more and more information available about the major variables (distribution function of duration time of activities, demands of variable costs and resources or human competences) the more accurate estimation of the resource allocation can be defined.

We also introduced how did we adapted the branch and bound frame method to the optimal solution search within the Rall-Opt method. Supporting this new algorithm we also implemented a distributed environment based on the parallel version of the mentioned B&B algorithm that can utilize spare cycles of networked workstations used e.g. within a company or project team, to carry out the necessary computations. This system presents a cost effective solution for distributed computing, thus companies or research groups can benefit from parallel computation without investing in expensive multiprocessor computers or servers.

Appendix

Number of Activities	30	50	80	100	130	150	180	230	250	310	340	380	390	430	440	480	550	1000	1635	5212
Measure 1 (ms)	15	22	28	32	36	40	42	44	45	50	52	54	58	62	78	120	188	342	812	4524
Measure 2 (ms)	14	21	27	31	35	39	41	43	44	49	51	53	57	61	76	114	157	335	805	4507
Measure 3 (ms)	12	20	27	30	35	39	40	43	43	49	51	52	57	60	76	109	152	335	801	4501
Measure 4 (ms)	12	20	26	30	34	38	40	42	42	48	50	52	56	60	75	108	152	334	785	4421
Measure 5 (ms)	12	19	26	30	34	38	39	42	42	47	50	52	56	58	75	107	151	330	775	4321
Measure 6 (ms)	11	19	26	29	34	37	39	40	41	47	49	51	56	57	74	107	151	329	771	4212
Measure 7 (ms)	10	18	26	29	33	37	39	40	41	46	49	50	55	57	72	106	142	327	770	4201
Measure 8 (ms)	10	18	24	29	32	36	38	39	40	46	48	49	54	55	68	102	140	325	765	4136
Measure 9 (ms)	10	17	24	28	32	36	37	39	39	46	48	48	54	54	64	102	138	320	764	4102
Measure 10 (ms)	10	17	24	27	30	35	37	38	39	45	47	47	53	54	64	101	137	315	760	4024
Mean	**11,60**	**19,10**	**25,80**	**29,50**	**33,50**	**37,50**	**39,20**	**41,00**	**41,60**	**47,30**	**49,50**	**50,80**	**55,60**	**57,80**	**72,20**	**107,60**	**150,80**	**329,20**	**780,80**	**4294,90**
Std. Deviation	1,78	1,66	1,40	1,43	1,78	1,58	1,62	2,05	2,01	1,64	1,58	2,25	1,58	2,90	5,09	5,83	14,81	7,91	18,84	185,01
Rel. Std. Deviation	**0,15**	**0,09**	**0,05**	**0,05**	**0,05**	**0,04**	**0,04**	**0,05**	**0,05**	**0,03**	**0,03**	**0,04**	**0,03**	**0,05**	**0,07**	**0,05**	**0,10**	**0,02**	**0,02**	**0,04**

Table 7-1. Run-time of Rall-Opt program in one computer

Number of activities	Number of computers				
	1	2	5	10	20
30	100%	67%	49%	20%	21%
50	100%	104%	38%	16%	22%
80	100%	96%	21%	16%	16%
100	100%	52%	42%	18%	11%
130	100%	85%	41%	10%	13%
150	100%	108%	29%	17%	6%
180	100%	64%	46%	29%	12%
230	100%	118%	50%	30%	8%
250	100%	69%	41%	20%	14%
310	100%	52%	23%	29%	14%
340	100%	97%	42%	16%	10%
380	100%	101%	49%	10%	6%
390	100%	108%	23%	25%	12%
430	100%	104%	29%	15%	9%
440	100%	77%	25%	15%	13%
480	100%	81%	45%	28%	12%
550	100%	62%	56%	26%	12%
1000	100%	87%	30%	13%	12%
1635	100%	98%	21%	27%	6%
5212	100%	95%	48%	19%	14%
Mean	**1,00**	**0,86**	**0,37**	**0,20**	**0,12**
Std. Deviation	**0,00**	**0,20**	**0,11**	**0,06**	**0,04**

Table 7-2. Speed-up effect

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Efficient Processes
Does ERP support or hinder?

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ABSTRACT

The majority of enterprises expect from buying an integrated enterprise resource planning (ERP) system that they get the efficient organization of their processes as well. Often this is an illusion. The presentation points out that the rigid activity control rules built in the ERP-modules hinders the change of control model when it would be needed for the sake of effective and efficient adaptation (e.g. when the lean management or the controlling-by-objectives is designed to be introduced). Beside the explanation and analysis of the problem we will outline the solution as well: how we can obtain an adaptive business process control having flexible activity control and effect management.

Efficient Processes

The *process* is a *rule*-harmonized set of *activities* consuming and transforming *resources* for the sake of implementation of a *goal*. The goal is the desired state of resources. Rules define and constrain the execution of the process. The process, when executed, has effects, the most important one is the product itself. Beside the product there are numbers of other effects (economical, quality assurance, user satisfaction etc.).

The final result achieved by the process is the *product*. The natural manifestation of the goal is the product (natural because there can be other objectives set: profit margin, user satisfaction etc.). The product has external characteristics determined by outside expectations, requirements and the designer's ambition. The product has a *structure*. *Statically* this means the composition of the product from components. *Dynamically* it is the system of building-up steps, which assembles and/or produces step-by-step the product from its components. The process is the dynamic building-up of the product. The product cannot exist without its building-up process. The definition of the product is complete when in addition to the specification of externally observable characteristics its building-up process is specified as well. The product having given external characteristics can be produced different ways. In the business practice the building-up process to be followed must be exactly defined.

The natural layer of *rules* controls the building-up process of the product:

- What are the prerequisites (pre-conditions) to be fulfilled in order to start the execution of a process step?
- What to do with the product when produced?
- How the process-step is to be supervised?
- What to do when the process comes to a halt?
- What effects are to be taken into consideration?

The prerequisites generally are also products, which must be similarly defined. This definition chain follows until the "product" is to be purchased. The "building-up" process of a product to be purchased is the purchasing. If the product is needed from the environment, then a product is a prerequisite of the process, which transits the product to its customer and collects the payment. This process is called selling. The product sold to a customer is called *sold product*.

A *business process* is a chain of processes, which is to be executed for the sake of a sold product or in order to operate and control the whole enterprise. The types of business processes are:

– product selling (value chain)
– support (infrastructure and support background of the enterprise)
– development (product or support)
– financial management
– tax management

A business process represents only the capability of the execution of something. An execution (instance) of a business process is called *undertaking thread*. The mission of a business process is not only to be executed. It must facilitate the effective and efficient *adaptation* to its environment.

The business adaptation takes place at least on three layers:

– *Direct adaptation:* the sold product must fit the prescribed requirements.
– *Operative adaptation:* the aggregate effect of all business processes in a given period must match to the expectation formulated by owners in the business plan (mainly profit-and-loss and cash-flow expectations, but other objectives relating to the market, quality, strategic advance etc. can also be set).
– *Strategic adaptation:* the enterprise must be prepared to exploit or handle forecasted significant changes in the environment, by possessing suitable products and business processses which guarantee the effective and efficient direct and operational matching to the changed conditions in the future

The *efficient process* facilitates the suitable business adaptation by:

– fulfilling the goals that are generated from the environment and
– attaining this through economical use of resources.

Computer Assisted Process

The implementation of a process is depending significantly on the supporting technology. The implementation design is completely different in manual environment from that with computer based support. This is why the design of implementation is always bound to a supporting technology. This technology determines communication rules and provides components for the execution. These components are “black-boxes”. The design must fit to these constraints.

Every process step is to be accomplished predetermined places. The prerequisites must be available at the spot of execution. At those places one has to know what and how to produce from what components, by means of which objects, and where to transmit the product. The process step is to be scheduled into the flow of activities of the execution. For the sake of this scheduling a control mechanism is to be operated which

– controls the material handling (replenishment and transfer),
– follows the state changes of prerequisites,
– offers the triggering of such an activity (process step) to which all the prerequisites are fulfilled,
– communicates what to accomplish and
– waits for the signaling of the execution.

The person executing the process step has to know the procedure to be followed and the requirements for quality control. He must keep it in mind or he has to get a visual reminder.

Without a control mechanism the process is never compiled into one unit, and its execution cannot be guarantied. Consequently the activation of the process, i.e. its execution is feasible only via the coordination of the *activity control*.

The management information system as computer-based supporting system determines the framework and facilities of the activity control. ERP systems provide some activity control for various business processes (mainly sub processes). They yield this control closed into a set of black boxes. The behavior of these black

boxes can be tuned to some extent by means of parameters, but only one of provided versions can be activated.

The Need for Change

The ERP systems are the outcome of an evolutionary progress. Their concepts and operating ways have arisen from the best practices in Western countries in the 70's and 80's. So in the domain of manufacturing, the MRP (Material Requirement Planning) and MRP II (Manufacturing Resource Planning) were the dominant approaches which matched well to the general business environment (mass production, economies of scale, the myth of the efficient utilization of resources). In the domain of controlling the accounting was developed to be more analytic, transformed into managerial accounting [3] . Based on some simplification schemes (standard costing) the planned unit cost calculation, the comparison of plans and facts and the formal analysis of deviations were facilitated. The overhead costs were allocated according to predetermined overhead rates to products. This approach did not disturb the world of standard functional modules developed formerly but added some new modules, opening new markets for the vendors of ERP-systems (controlling module, business intelligence module etc.).

Since those days the business environment has dramatically changed: the demanded quantities have decreased radically, the importance of special user needs, the timely and short-term delivery and the quality-price ratio has increased, the price competition has become stronger. In this environment, where there is nearly no efficiency reserve in the manufacturing, the direct contribution margin can only cover leaner supplying and control processes (less overhead cost).

In Japan since the 60's a radically new production management model has been introduced: the Toyota Production System (TPS). The West has recognized the importance and meaning of this pulling model only at the turn of the millennium (in contrast to the pushing model of MRP) when this approach under names of Lean Manufacturing/Management [4] or Demand Flow Technology [2] has begun to be trendy. Nowadays in the business environment this pulling model helps to make better the efficient and competitive enterprise behavior. The ERP systems based on the former (MRP-based) approach definitely impede this change of control model.

Similar example can be observed in the domain of controlling. In ERP-systems the control of primary processes was the goal and only externally prescribed financial and accounting tasks were carried out. Due to this the controlling was based on accounting feedback: the more and more sophisticated controlling tasks were supported by more and more analytical accounting calculations. The feedback, however, is only a part of the control loop. The plan should represent the aim to be achieved. But the planning is generally done outside the ERP-system, only its final result is recorded in the system. Plans, frequently as unrealistic wishes, can be compared with the facts only in very aggregated levels. Deviations cannot be explained and no information can be got for their correction. In this case the ERP-system impedes also the change of control model.

ERP-Systems Incapable of Pulling-Type Production Control

The MRP-based production control captures the *building-up process with states*: the availability (mainly production) of the material (components and purchased items) requirements at lower levels of BOM (Bill of Material) is the prerequisite to step to the current level of BOM. The production of built-in items is scheduled such a way that good capacity utilization can be reached in the work centers (larger batches, shorter start-up times when changing the item to be produced). Due to the scheduling in batches, and the necessary waiting time during queuing, the total time until a batch of finished product is available is much longer than the necessary time to build this quantity of finished products. The larger lots result in higher inventories. The stocks of intermediate items *push* forward the production.

The finished product is manufactured in a quantity predetermined by batches during scheduling. Due to the long lead-time the enterprise cannot accept short delivery deadlines, and these potential orders are lost. The long lead-time presses the company to manufacture on forecast, expecting that orders will arrive. But this is not necessarily become true, so the stock of finished goods is increasing. If the final product can be manufactured in several versions, the customer may want the product in different color or with other accessories, which may cause that the inventory remains on the same level, and the enterprise loose a prospect, though the resources were used.

The Lean approach grasps the product as a value-generating stream like a river, which integrates the water flows. The *process is captured as a chain of activities triggering state transitions* in which it takes care of the lead times of activities (its nature of value adding behavior), built-in part needs and quality requirement issues. It aims to create a flow system with proper throughput satisfying customer needs where the effective demand *pulls* the fulfillment of prerequisites. The planned pace of finished goods determines the Takt time (goods per minute) that synchronizes the propagation of inner needs in the flow. If the demand is decreasing, the Takt time remains and only the work content is decreased so fewer resources (people, machine time) will be needed and the pulling of preconditions (the demand for built-in parts) automatically will be decreased. This activity control allows even piece by piece production with a lead-time very close to the necessary work time of production. The customer is satisfied because he gets the quantity demanded (even Just in Time within a range of daily output). The inventory level will be much lower because there are no unnecessary finished goods (the production is set to the real demand), so the material requirements are also diminished, as well as the demand for purchased items.

The two activity controls differ significantly. ERP systems presently do not support the state transition driven activity control. So any kind of computer assistance can be used only in the system design (preparation) phase of Lean production control, independently on the production control. The manufacturing is controlled via a proper layout, the so-called kanban system for raw-in-process inventory management and visual supervision, which can be done without any computer assistance. This management approach requires strong discipline, good drill, and a balanced demand. So the Lean manufacturing in its original form cannot be applied anywhere.

The pulling-style activity control can be implemented in computerized environment as well. In order to realize this, an intrinsically different approach is needed from the mainstream approach of ERP-systems. Not only the production control module would be changed, but relations to other modules would also be disturbed by such a change, which the developers of ERP systems are not eager to undertake.

Do ERP-Systems Support Adequately the Controlling Activity?

In ERP-based systems only terminated things, final states can be taken into account: e.g. how many finished goods are to be sold in a month, what amount of purchase is needed for this, how much overhead costs are to be taken into consideration in contrast to the realized sales, purchases, overhead costs. The overhead costs are allocated according to some predefined ratios, so the cost of goods sold comprises other elements than real varying costs. The plan is compiled in an aggregated form according to profit-and-loss categories (the sum of sales, the sum of cost of goods sold etc.). The comparison between the plan and facts can be done only after closing the accounting of a month (later than the end of month) by estimating the work-in-process. During the current month we are not supported by the system because we do not know how the plan is accomplished. So we cannot forecast. The plan cannot flexibly be modified, adapted to the changed opportunities and capabilities. We cannot “subtract” the effect of abandoned actions and “add” those of new or

changed actions. Hence the possibility of adaptive control is lost. Our performance is compared to a last year wish and not to the maximum attainable level in the given and changed circumstances. This is why that kind of controlling is basically a post-mortem reporting, not the means of a real adaptive control.

A change of process approach is needed for the sake of transition to a more advanced control style, the so-called controlling-by-objective (CBO) [7] . Processes must be caught by the effects produced during their whole life cycle on all levels of manifestation instead of handling only the final states. Essential levels of manifestation are: the level of estimation (wish), the level of commitment and the level of facts.

The estimation is the assumption, that an undertaking thread is completely executed. It can be entered only after the current period of accounting (only for future months). The simulated effect of the estimated undertaking thread during its whole life cycle is considered as *estimated effect (a forecast)*.

The estimation is overridden ("extinguished") by the start of the effective execution the undertaking thread. This is the moment to enter into the level of commitment. Until the undertaking thread is closed (completely finished) estimated effects will coexist with *realized effects* (facts) simultaneously.

Closing some steps of the undertaking thread generates the realized effect. This is already the past, the level of the facts. The execution of an effect-generating step overrides the simulated (estimated) effect. In some cases (e.g. development) we have to say how the estimation can "survive" if some steps did not ended in the forecasted period:

- The forecast is the sum of the facts and estimations.
- CBO opens the way toward real adaptive control.

In conventional ERP-systems the planning is a formal activity. The comparison of the plan and the fact evaluate the operation retrospectively. The planning used to be an independent activity (not part of the ERP-system, frequently based on Excel). The ERP-system only stores the plan and supports the easy modification of planned data (multiplication by a constant, distribution of whole year estimation into monthly fractions according to some profile).

In contrast to this approach, in CBO the planning is an interactively generated series of simulation variants of type "what would happen if?". Its forecasts are based always on the facts and the expectable effects based on the estimates and the foreseeable committed but not yet finished actions. Hence it facilitates the decision on what to aim in the future in the quickly changing environment of possibilities and capabilities.

The CBO-based activity control can be implemented in computerized environment. The current ERP-systems do not allow the handling of undertaking threads. The planning process could be supplied by an independent module (which is independent in reality from the ERP systems), the smooth and automatic transition between levels of estimation, commitment and facts could be solved through a radical change in the basic modules of ERP systems. We can say that this is not a task what the developers are willing to accomplish.

The General Formulation of the Control Model Change Problem

A sequence of activities become to a process only by means of its activity control. It chains the activity steps such a way that the product, i.e. the primary goal of the process be built up. The direct adaptation is realized by the execution of this process. Economical and other goals set for the sake of operative adaptation are achieved as the aggregated effects in a given period of process executions.

The control is an influencing activity, which aims to diminish the deviation between the target and the fact (that is the effect produced by the execution of the process). That goal is feasible which can be simulated as an estimated effect (otherwise we talk about "wish"). So the control

is the effort aiming to minimize the deviation between the estimation and the realized effect.

In the business life nowadays the direct adaptation is more than the manufacturing of the product. This product must be delivered in contracted (and short) deadline and on affordable price. This makes the activity control more sophisticated. The time wasted (because of scraps or the time lags in supporting or availability) cannot be made up. The estimated scrap must be calculated into the outcome if the deadline is to be respected. The process is to be controlled such a manner that no stoppage occurs due to lack of preparation (though the inadvertent breaks or absence of workers can be handled by creating reserves). In order to improve the unit cost, the efficiency of the process is to be continuously augmented: the total time of value adding steps must be diminished and any kind of waste is to be avoided (superfluous movements, preparations, scraps). This continuous improving activity changes continuously the control model itself.

The operative adaptation means the need for handling of supplementary effects. These effects must be generated during the state transitions of undertaking threads. The requirement would be the support of a system of business processes having flexible activity control and effect handling. In contrast to this the current ERP systems

- have rigid activity control (built in the black box)
- the business process is served by functional phases (separate sales, production control, purchasing, accounts receivable, accounts payable, general ledger):
  - at order time the delivery deadline cannot be guarantied or this is too long for precaution which is a handicap in the competition,
  - the production is scheduled based on the delivery deadline which can be kept or not depending on the purchase lead-times and the capacity available,
  - in order to utilize productive capacities the production is often going to stock,
- the modules developed for functional phases generate only the accounting and cash-flow effects, but these are provided in a simplifying framework (e.g. standard costing),
- in vain the data are well detailed according to the undertaking thread at the level of production control, the posting to the accounting is aggregated,
- other effects must be obtained by separate data gathering (not integrated into the ERP-system).

All these represent such an architectural problem, which cannot be solved by adds-in to the ERP systems.

The Change of Architecture

An architectural problem can be solved only by the development of a new system. In this new system those elements must be disengaged from the architectural trap, which impede the software system in effectively assisting the control of the business due to their inflexibility, rigidity. The architecture is the result of decisions on the following issues [5] :

- How are the system elements organized?
- How does the system realize the required functionality?
- How does the system meet the desired performance, reliability, and other quality characteristics?
- What technologies does the system require?
- Are the internals of the system structured to be resilient to changes in functionality, technology, and platform and so on?
- Are standards in place to ensure that the system is developed consistently?

If we have a goal, we need methodologies and development tools for implementing the models {e.g. RUP (Rational Unified Process) [6] and agile development environment such as MDA (Model Driven Architecture) [1] }. The RUP based approach reflects well the essence from technical point of view. However it does not provide any advice in relation to the functionality to be realized by the system. The analysis, design, and the implementation can be assisted by CASE (Computer-aided Systems Engineering) tools; see [9] The majority of CASE tools

"translate" the UML artifacts (Unified Modeling Language) to an object-oriented programming language, which communicate with relational data base management systems. The systems designed with a CASE-tool can be implemented with a rapid application design and development (RADD) tool (e.g. Magic, Caché).

The goal is to be searched in the environment of the system, but never in the system itself. Business applications have to support the business processes, the effective and efficient adaptation of the enterprise (as written in the former sections *Efficient and Computer assisted processes*).

The computer assisted process establishes the unity of the business process by advising tasks which can be started by the actor responsible for the appropriate phase of the process, and by expecting that the accomplished tasks be signaled to the system. This way the system can follow the state of prerequisites for the start of other tasks.

Business processes belonging to the value chain and to the development are controlled by the build-up design of the product. This is a sequence of process steps controlled by rules (prerequisites), similar to the value chain in the Lean approach. If process steps are assigned to identical length time intervals, paces, than a synchronization frame can be established to the control of the process. The build-up design of the product represents the process with minimum number of paces. In reality, however, at the places of realization of process steps the capacity is constrained (finite) and more than one process step can be carried out there. This is why the effective build-up process lasts in some cases longer than the theoretical processing time, because some paces of the build-up design must be shifted into later paces due to the lack of capacity.

Based on this control scheme we can engage well-grounded way to the delivery of the product. The follow-up of the process is also facilitated. The tasks, which can be started, are shown in the sequence of paces at different places of execution. This is valid even to purchasing and selling. The support (overhead) activities can be controlled via cost and purchasing limits. Here no build-up design is prepared. If the support process is rationalized (which is a task different from the operation of the system), other limits can be set. Handling of financial and taxation processes are well defined by external prescriptions. The generation of effects according to CBO can be attached to the execution of process steps.

A system with good architecture offers those functions to the users, which they need in order to operate the business process. These are the use cases [5] . The use cases are implemented by collaboration: the user communicates with a control object via a boundary object and this control object manipulates the required entity objects (which constitute the element structure).

The majority of entity objects are the representation of concepts and relations in the business life. In the business some concepts and concept combinations occur typically. Some concepts are closely related to each other. This gave the idea based on which archetypes and archetypical patterns were created [1] . Archetypical patterns are good candidates for components and the element structure can be made available grouped into these components.

Benefits, Conclusions

The new architecture allows

- the activity control model to be specified by the user,
- the probably jointly changing concepts and relations in the business environment to be handled separately from other parts of the system (based on archetypical patterns),
- the addition of any number of new effect types by the user in order to support the multidimensional evaluation of operative adaptation,
- the smooth and automatic transition among levels of estimation, commitment and facts, providing this way the ability of continuous forecasting and the real-time adaptive control, the CBO,

– the ability of pull-type realization not only for manufacturing but any kind of value adding process, i.e. providing the product demanded by the customer in the needed quantity, for the contracted and short delivery time and with minimum inventory level,
– the application of the Lean principle even to the software system as well, hence the new software permits of meeting the requirements by the execution of parameterized metamodels (less software development effort),
– the operating of other (quality, environment etc.) control systems by defining the appropriate effect types,
– the tasks and responsibilities of objects (people, organizations, machines, systems) to be clearly determined and the procedures to be accurately presented any time,
– the easy continuous improvement of processes (decreasing the execution time, avoiding waste) only by updating the build-up design of the product instead of the total reorganization of the whole process,
– benchmarks to be generated based on the build-up design of the product and improvement projects (kaizen) to be launched based on the corresponding benchmark values of competitors, and
– the strategic development actions to be easily specified and justified leading to improved strategic adaptation.

To sum up: an adaptive business process control system with flexible activity control and effect handling can be achieved.

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Decision Making in ICT Industry
a Cellular Telecommunications Problem

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ABSTRACT

This article is based on a PhD dissertation dealing with a special decision making problem: how to allocate necessary technology for cellular networks in a city environment and how to avoid opposition of inhabitants. People like and need high-tech and IT services, however very few intends to realize dangers like environment pollution – involved radiation! – as unavoidable side effect of modernization. ICT technologies have strongly affected industrial development, causing large changes in life of human communities. Decision makers have to find a compromise between installing high-tech and avoiding drawbacks to customers. Mobile phones rapidly became to be integrant part of ICT technology systems, thus the problem of allocating transmitting nodes is essential to solve. The article demonstrates a decision model and solution used in an Israeli local development environment.

Introduction

Almost daily, we are exposed to headlines in the media discussing the impact of exposure to radiation of radio frequencies on the public health. Experts show fear and mistrust in the government system, in local authorities, that is supposed to protect us from environmental harm. As a result, the public increases its pressure on the local authorities to forbid installing transmitters in residential areas and to remove existing antennae, needed for high quality service of cellular phones. Objection to the erection of a network of cellular antennae also stems from their damage to the city scenery in particular and to the scenery in general.

However, data available from 2002 indicate that 423 million cellular telephones were sold around the world in comparison to 400 million sold in 2001, i.e., an increase of 6%, according to announcements issued by Gartner Dataquest, one of the world's leading technological research firms, that also stated that further growth is expected in 2003. Gartner forecast today (01.2006.) shows higher than expected growth in mobile communications: overall connections will top 3 billion in 2008, with about 850 million equipments sold in 2005. Growing number of the accessible customers causes rapid development in all related services, like m-commerce, m-information systems for business, and so on. Do not forget: according to a Tel Aviv Stock Exchange data analysis by the Ernst & Young Company, the annual expenditure on communications as a percentage of the average GDP in western countries is 3.4 %, while in Israel it is 4.6%; an industry worth to investigate.

This is not the first time in history in which we are heavily interested in a wide spreading technological progress but parallel fearing it (see e.g. [18]). We remember the more distant past, the early days of the steam engine and the fear of the iron horse, our present inability to manage mass transportation without trains and the fear of the microwave, without which it is impossible to manage any modern house. To mention direct ICT threatens: fear from a display, fear from electronic noise of a PC, and now the smart phones, nowadays in all hands around.

Physiological effects of GSM antennae radiation has been investigated worldwide: we just refer to easily available works of BUTE researchers (Budapest Technical University, Department of Microwave Telecommunications). As an example, Mátay and Zombory show geometrical dissemination of radiation in case of different antennae forms and different channel numbers used in GSM technology [8] . The calculated worst effects are compared to Hungarian Standard (MSz 16260-86) from human radio-frequency exposure. Even these researchers called attention to dubious behavior of the public, as all demands to use mobile phones and wireless connection, but nearly all are ready to protest to have a mast of antennae at their neighborhood. American researchers like Carpenter and Dreibelbis call attention of rapidly growing number of cell phone users and warn to necessary research on effects of kids, using these phones – according to their statistics, more than 30% of users are under age of 21 [4] [7] .

When technology runs forward, people get acquainted with new features of products, with new products, new services: same happens with in rapid development history of mobile technology. The problem is always the measure of technical side-effects, in our case; the necessary antennae network system, and the electromagnetic radiation. Decisions on technology always cause a complex problem and everyone is interested: amateurs, professionals, families and children. Different theories of (public) decision making –from M. Weber, through H. Simon to K. Arrow– are suggesting pessimism on rationality of these decision environments.

The first part of this article will shortly review technological and environmental aspects associated with the radiation safety of cellular transmission nodes and developing the subject of cellular telecommunications as an industry of the other hand. The second part details a decision making problem of building up-to-date m-systems in a city environment of Mode'in, in Israel.

Nodes of Cellular Transmissions

As in other domains, so is in this case. The technology developed in recent years serves the public and also works in this case in its favor. Technological progress resulted in cellular instruments (phones, palm-tops, etc.) becoming ever smaller particularly due to their down-sized batteries, as well the instruments themselves. The transmission node must therefore be closer to the user; the strength of the broadcast from the cellular antenna will be smaller as will the strength of the broadcast/reception from the cellular instrument held next to people's heads while talking.

A cellular communications network is a cordless communication system that operates on radio waves. Electromagnetic waves spread from the source of transmission (antenna) in space, and are received by a mobile telephone. The mobile telephone converts the electromagnetic wave to vocal signals and enables communications. Similarly, the mobile telephone converts the vocal signals into an electromagnetic wave that is broadcasted by the antenna to space. Every antenna has a limited range for transmitting and receiving, and therefore those in charge of planning cellular communications networks divide the geographic space they are interested in covering into cells, hence the name "*cellular phone"* comes. An antenna is erected in each cell that provides service to those who use cellular communications in its proximity, at a distance sufficient for receiving and transmitting (see Figure 9-1).

Each cellular communications service provider company establishes a network of transmission sites in order to reach optimal coverage of the targeted area. The transmission site (station, transmission node, transmitter and antenna) is intended for receiving and transmitting the signals in the range of the radio waves. Each transmission station covers a geographic area determined according to the antenna's technical data (height, direction of supplier).

Height is one of the main factors determining the range of the transmitter's coverage. The higher the antenna and the more powerful the transmitter, the larger a geographical area it covers. Similarly, every antenna (station) has a maximum capacity of individual calls that can be made through it at the same time. The greater the number of users of cellular phones in a particular area, the more antennae is needed to provide communications.

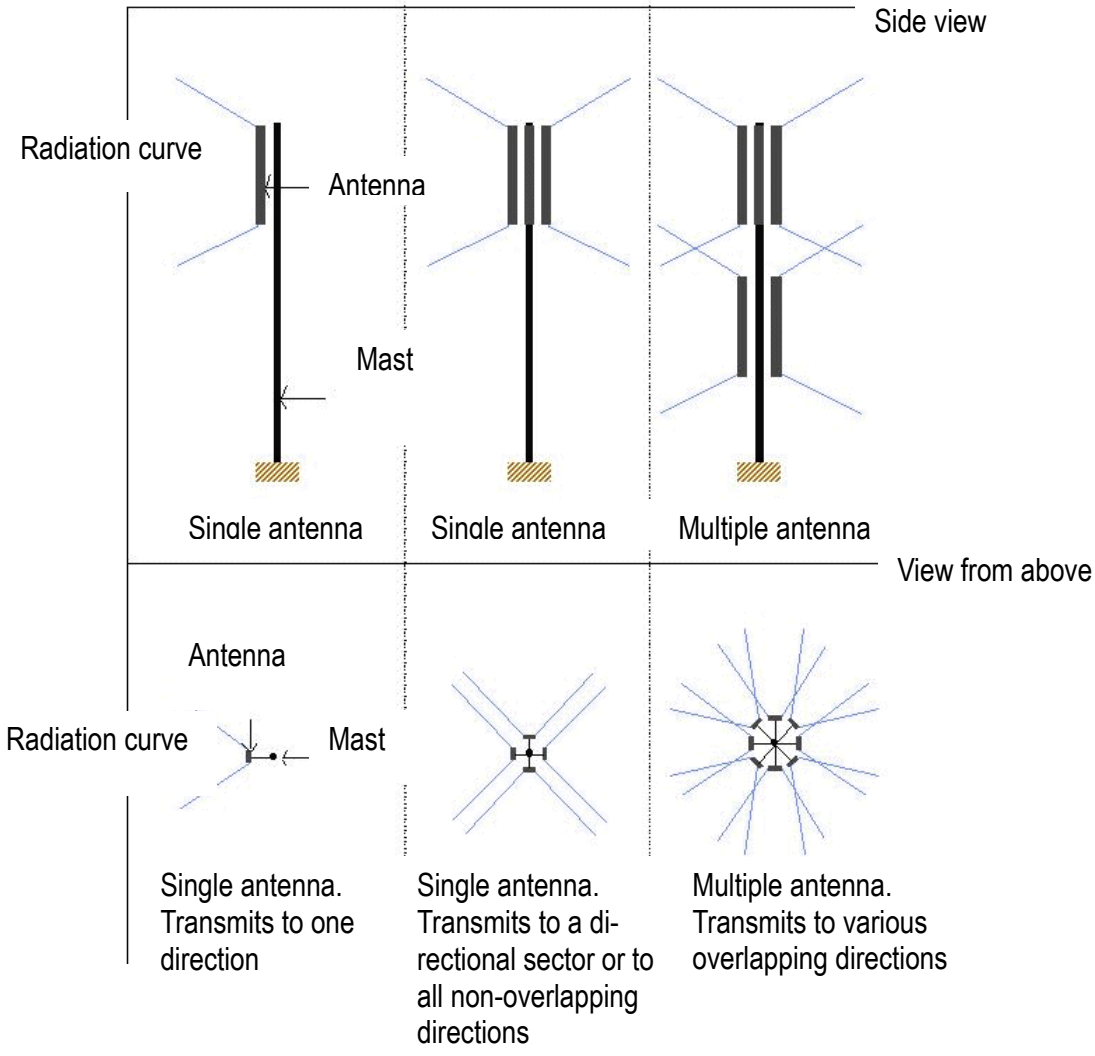


Figure 9-1. Antenna constructions (Source: Ministry of the Interior, Israel, 2002)

The summary: Cellular communications technology demands several transmission sites according to the number of users and according to their location in the area. The more antennae we build in the environment the more of a scenic problem and causes fear of radiation. Cellular antennae emit electromagnetic radiation to the environment in the radio wave range (800-1800 Mhz).

The radiation in this range is non-ionizing radiation, whose influence on the health and on functioning of the human body is fairly well known (heat), but still affords a subject for much research. Based on current knowledge, the World Health Organization set a threshold for exposure of the public at large (including children, patients and so on) to radiation at radio wave frequency [22] The Israel Ministry of Environment adopted the above threshold as that for healthy exposure (hereafter, the health threshold).

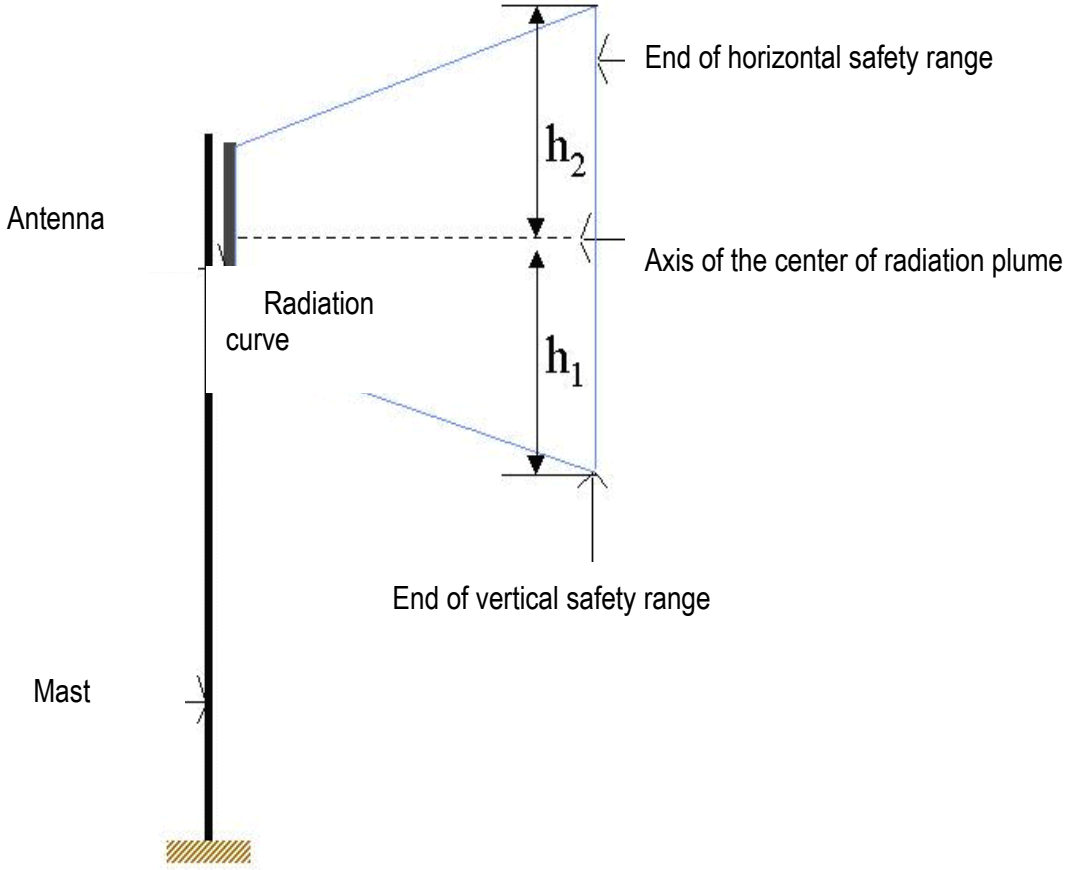
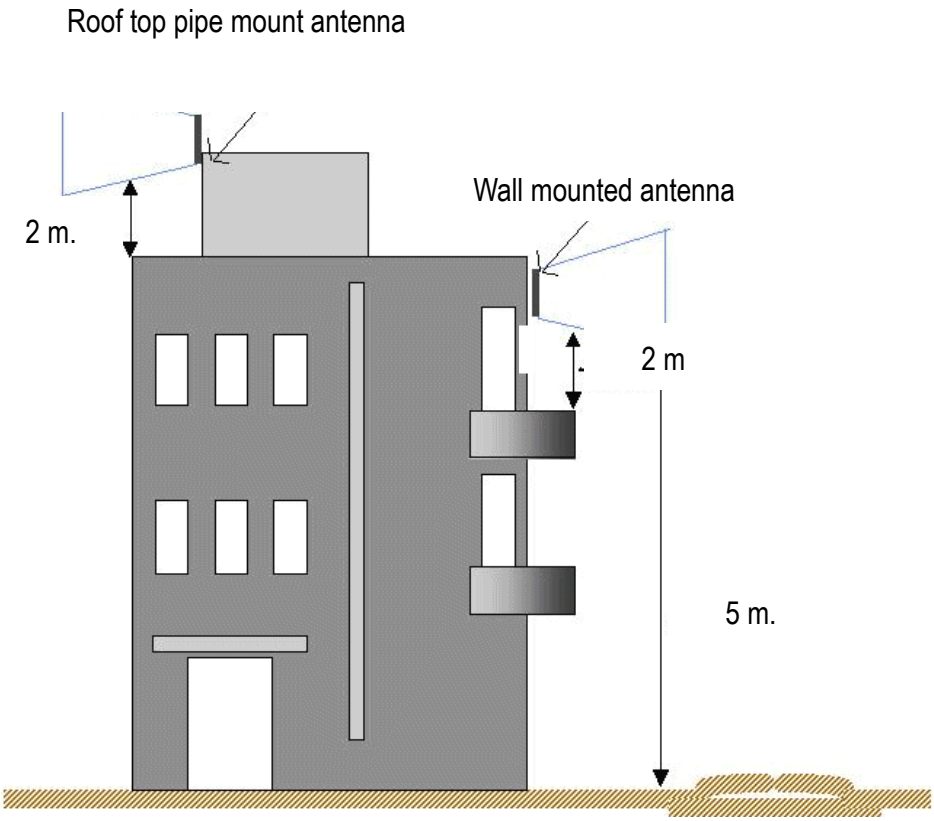


Figure 9-2. Horizontal safety range (side view, source: Ministry of the Interior, 2002)

The Ministry of Environment acts according to the principle of prudent avoidance intended mainly to minimize exposure of the public to radiation as far as possible. This office strives for the erection and operation of transmission nodes to be in such a way as to prevent the broad public from being exposed continuously to levels of radiation higher than the environmental threshold. Once a year, periodic tests are held at all the cellular transmission sites. Electromagnetic radiation measurements are conducted by licensed testers who were approved by the Head of Environmental Radiation at Ministry of the Environment to conduct electromagnetic radiation measurements.

The Radiation Problem

Every antenna has a radiating element from which an electromagnetic wave (radiation) spreads. The expanding wave is horizontal with a slight bent upwards. Antennae usually transmit in a particular direction, although there are antennae that operate in all directions. The lower the strength of the antenna's transmission, the shorter the distance to which it transmits, the smaller the area covered and the lower the levels of radiation around the transmission node. Thus the level of exposure to electromagnetic radiation decreases as illustrated in Figure 9-2. The safety range can be calculated for each antenna, for the direction of transmission for the main plume. This distance depends on a variety of factors, such as wavelength, transmission capacity and additional technical data. This is the minimal distance between the transmitter and the place from which the level of radiation is lower than the permitted level determined by the Ministry of Environment.



(Source: Ministry of the Interior, 2002)

Figure 9-3. The height of a wall-mounted antenna and a roof top pipe mount

According to the safety range, the transmission sites can be divided into small and large sites.

– The safety range of a *small site* is up to 50 cm. These are transmission sites with the lowest strength, located in acoustic ceilings, advertising signs, street lamps and so on.
– The safety range of transmission nodes planned for an urban environment is 6 meters from the radiating source.
– The safety range of *"large"* transmission nodes in an open space is 10 meters. Since the electromagnetic wave expands horizontally, it does not come under the antenna from which it was sent. Therefore, the area under the

antenna is one with the lowest levels of radiation – a fact many times not known for the public.

It is important to note that, contrary to common opinion in the past, the denser the network of base stations, the lower the general transmission strength from both the sites and from the cellular phones themselves.

Nowadays, due to the minimization of the phones and their low energy consumption, the intention to distribute many antennae in a relatively smaller area cell, the radiation emitted from the antennae and from the cellular phones themselves will be lower and will thus endanger public health less.

The Ministry of Environment in Israel examines and approves the erection and operation of cellular transmission nodes and issues an individual permit for each transmission node at least once a year. All the sites must fulfill the Ministry's professional demands and not expose the public to radiation levels above those approved by the Ministry – 40 micro watts per cm (in the cellular domain).

The receiving of a radiation permit for a transmission node (operating permit) depends on:

- issuance of a building permit by the relevant local authority or the requested transmission site or a waiver of the need for a building permit,
- all the conditions mentioned in the erection permit are fulfilled,
- the Head of Environmental Radiation in the Ministry of the Environment examined and approved the report on the strength of the electromagnetic radiation conducted around the site. *In situ* measurements at the site are confirmed by companies that received ministerial permission to perform a survey assessing the dangers and measurements in the area.

People are exposed daily to natural or artificial electromagnetic fields of various frequencies. Following accelerated technological development and the introduction of new instruments, like PCs, smart printers, TV sets, monitors, digitally networked security systems and others, the exposure to electromagnetic fields is increasing. The Ministry of Environment has readied itself to deal with non-ionizing radiation since the early '90s, based on authority delegated to it in the framework of the "Pharmacists Regulations – Radioactive Elements and Their Products, 1980", updated in 1991. There is no doubt that the use of electrical and electronic equipment is having a benefit to people's welfare, but on the other hand, in recent years, there has been concern over the possibility of damaging health as a result of exposure to magnetic and electronic fields, particularly in the domain of the electricity network – 50 Hz frequency (ELF).

The implications of high voltage wires on the health of the population in their proximity have mainly been researched through epidemiological surveys. Many studies on exposure to ELF fields present several contradictions. It is not possible to determine with certainty that there are health hazards from the electrical and magnetic fields near high voltage wires and transformation stations. Based on the recommendations of the World Health Organization[1], the Ministry of Environment determined a health exposure threshold for the magnetic field. Similarly, that Ministry operates according to the principle of prudent avoidance, one of whose main objectives is to minimize, as far as possible, exposure of the public to electromagnetic radiation through existing technologies and at a reasonable cost, and to reduce the area in which building limitations exist due to radiation.

Environmental Awareness

In recent studies, the issue of environmental awareness has increased due to the tremendous decline in the environmental quality and in technology particularly in the last century, which is not a natural process but a consequence of modern life. Human activity since the industrial revolution has severely damaged the ecological balance. Manufacturing and consumption by

[1] See e.g. www.ICNIRP.org, the International Commission on Non-Ionizing Radiation Protection website

industrialized societies as well as developing societies led to the exploitation of natural resources and energy to the point of their total exhaustion – all well known facts and arguments from literature of sustainable development theories and environmental cases. When a city government, or any local decision making body faces the problem of a "visible" technological change in the environment, it can be sure about protesting movements immediately.

But people need decisions, an the decision making methods need information. When making political decisions, use of results of decision sciences has always been a question: will the impact be higher, if we transfer more and more "proven" evidences to a stake-holding, but basically lay community? The "traditional" decision theories (see e.g. [9] [10] [11] [17]) normally offer rational, linear methodologies, when collecting facts, data and finding a proper (mathematical) model is essential. Decision makers hope political leaders and also the public will believe in "optimal" solution. D. Deri's normative models dictate how to take decisions, and why should they be taken one way rather than another [5] . The argument for a model like that is that this is rational or logical. In practice, behavioral (empirical) models are more preferred, as they simply describe existing processes and explain whatever needs explaining, usually leading to the choice of the agreed alternative.

From the information supply viewpoint we could use these models either rationally, or with limited rationality. The "satisfying" model [15] has changed the way of thinking of decision makers, showing that there are very few situations in which they have perfect knowledge about the problem to solve. Environmental cases –like our problem, fear of GSM radiation– very frequently need this type of semi-rational or behavioral approach.

Arrow stated a very pessimistic approach in his "General Theorem of Impossibility" [1] , saying none community decisions can be consequent and consistent. We all know: policy makers are enormously influenced by simple ideas and arguments, and the prevalent policy narratives are extremely difficult to break with "strict" research findings (see e.g. [10] [16]); not to forget, a series of environmental or high-tech problems does not have proven scientific background! Although improvements in information technology support information sharing at high level, there is little evidence that it increases impact unless it is translated into the cultural context within which it is to be used. Strategies to promote dialogue between communities and external agents are vital for sustainable social change.

The Case Problem

The case presented here is drawn from a dissertation thesis. From 1996 I have headed the operations department at the new city of Modi'in, establishing a network of public TC services with an eye to the future growth of the city to 240,000 residents. In 2002 he had to face a special electromagnetic radiation fear problem in this new city: people wanted to use their cellular phones everywhere, but did not want to see antennas, transmission hubs around their houses – a typical "*Not In My BackYard*" case. Experts offered alternatives: a huge antennae-farm on a nearby hillside or numerous smaller nodes on city buildings, even on top of palm trees! This city-wide problem served as a good example to make a survey to explore problems in the public decision making process, and then for building a model, proposing a protocol to support a multi-party decision process.

Some Hungarian publications (see e.g. [21] show results of a survey in 1988-90 about how the civilians vote for a hazardous waste-management system in city of Dorog. They found the attitude similar: "We want the service, but not the plant here". Today we can follow the case of the NATO radar station in the South-Danubian area: all of us agree that NATO has good arguments to plant a radar station, "a nationwide interest" is not debated - but no one seems to be happy to have it near their homes. Disparity will always exist between the desires of individuals in society and what society wants. Those determining public policy - like local governments, even na-

tional governing bodies - must assure this balance when taking decisions. A classical Saaty "Analytical Hierarchy Process" model from the '80-s (see e.g. in. [14]) proposes eight steps and uses an algebraic weighting model to calculate risk adjusted strategic values for each alternative. In this Modi'in case the researchers and practitioners selected the so-called "muddling through" (incremental) model (see [13]), which is based on agreement over former policy and also the limitations of the human factor, regarding the knowledge and ability to predict the future, based on step-by-step enrichment of the information background. Experiences showed that decision-making in a pluralistic democracy is well manifested through this model, as the "good" decision is being the decision agreed to by those involved (call them stakeholders) - rather than the "optimal" decision that is the ideal of the rational approach.

What we have learnt: when the environment is "risky", people start behave irrationally, they accept limited rationality, and their *information asymmetry* causes different reactions. Experts' reports are soon neglected and politicians run after mass-emotions. Environmental issues push these type of decisions into the frontline of media every day: researchers of information management and information brokering have to support public decision makers with useful ideas and methodology. The muddling through model (proposed by D. Lindblum [13]) is an alternative to the rational model. His basic assumptions were:

- Determining values and objectives are not divorced from the means available (and used) for their realization. Dependency exists between determining the objectives and identifying the means used, and therefore the two actions should be performed together and with mutual adjustment.
- It is important to arrive at a "good enough" decision, which is one, agreed to by all relevant parties (rather than the optimal decision that is the ideal of the rational approach). Decision-makers must reach agreement on the values they wish to apply, since in many cases such agreement between the pertinent factors cannot be achieved.

The principle of muddling through is then to adopt a strategy of slight change from the familiar situation, whose results are easier to forecast, easier to correct and easier to agree on. In fact, agreement over the policy or decision is necessary amongst the decision-makers. In Modi'in the local government, opinion leaders of civil organizations, technicians all worked together and proper information dissemination supported the entire process. The solution was executed after a one year decision making process: small antennas in city sites (like cross-road traffic light masts) and some larger antennas in a farm-like arrangement, outside the city.

D. Braybrooke and C. Lindblom stated that when a policy of far-reaching innovation is adopted, the dangers of the unexpected and undesired results and of large-scale nonimplementation will be considerable [2] . They therefore propose that determining policy will be basically conservative, and the innovations should be limited to the marginal incremental changes. The decision that will be taken, in fact, by the decision makers, will be an additional tier, a marginal increment to the previous decision. This step by step method includes learning, drawing conclusions and gathering more and/ higher quality information that cannot be collected prior to implementing the decisions. Only thereafter should slight change (agreed upon by all those involved in the decision-making process) be implemented.

Summary

Cellular phones –as an electronic equipment and as an industry– has proved the most fast technological development of history: enormous capital is invested into ICT and services. Technology has started as a "personal" product and nowadays it turns towards industrial, company focus, offering far more profit to investors. Phones use EM radiation which –according to miniaturizing– needs a relatively dense network of antennae and transmitting stations to estab-

lish. The common fear from “artificial radiation” leads communities to protest against installing this technology in their proximity – however, they all intend to enjoy benefits! We demonstrate here a decision making model of a compromise between inhabitants of a city and cellular network installers – a compromise to reach mutual benefit, when up-to-date technology is to be built for a demanded, wide scope of use, but how to avoid side-effect consequences is not clear for the public and for experts, too.

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Data Warehouse Supported Customer Relationship Management in Electric Energy Distribution

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ABSTRACT

In the environment where the demand of customers is prevailing and the competition is merciless and global the ideal of new trends in sales management represents the concept of strategic sales management. The change of the organization from that founded on the product to that turned to the customer is possible only by CRM (Customer Relationship Management). It is a public secret that CRM is the most wanted business term on the Internet and if the organization wants its web site to be visited, it is necessary to place this abbreviation somewhere. This paper deals with the characteristics of customer relationship management in electric energy distribution companies depending on which the software system supporting the management and the background data warehouse can be built. The paper pays special attention to the creation of meta-data (meta-data bases) of data warehouses in the given field of business.

Characteristics of CRM

Defining CRM is different in sales management, but often it is described as a process having four substantial steps (Peppers & Rogers):

- preliminary identification of needs and customers' wishes,
- differentiating customers to the needs and importance of realizing organization targets,
- interaction with customers from the view of the precise identification of their needs and
- shaping products, i.e. services that are offered to some groups of customers, on the basis of "learned" by the help of interaction.

CRM is not a technology, but it requires a technology. If we want to implement such a technology that will help the organization to turn to the customer, then the solution must supply the following three services:

- marketing is managed by knowledge,
- service of support to customers with the history of their activities (buying, interest, habit, and so on), and
- automated process of selling.

Therefore, the most trivial interpretation of the CRM notion means that it is a strategy focusing on better familiarizing with the needs and behavior of the customer in order to build a stronger connection with him and realize the relation that is the key of success of a contemporary business organization, and which is supported by contemporary computer technology. The differences between the old and new approach to the function of selling are seeing on the Table 10-1.

Table 10-1. The Old and the New Approaches

Old approach	New approach
Win new customers	Keep existing customers
Receive orders	Become preferred provider
Managing all customers in the identical way	Managing every single customer in his/her own way because of maximal long-range profitability
Sell to anyone	Concentrate on the customers who can provide high profit

There are technological components of CRM, but to think about it, primarily, as a technological term is a big mistake. It is more useful to understand CRM as a process for receiving much information about customers, sales, successfulness and responsibility of marketing, market trends and so on. The idea of CRM is to help business in creating the value and satisfying the customer using technology and human resources, and it can be attained by:

– providing better services to customers,
– developing more efficient call services,
– more effective selling of products,
– giving help to selling staff to conclude business quicker,
– simplifying the process of marketing and sales,
– winning new customers and
– increasing the customers' income.

However, simple buying software and its installation can do all this. For CRM to be really useful, the organization must first makes decisions what kinds of information about customers wants and what it wants to do with the information. Then, it must take care about the different ways of receiving information from customers, where and how these data are stored and used. One organization, for instance, can be in interaction with customers by e-mail campaigns, web sites, call centers, mobile selling staff, marketing, advertisements, and so on. A solid CRM connects all these forms of mutual interaction. There are some data that a CRM project should collect:

– reactions to campaigns,
– data on delivery and satisfying time limits,
– data on selling and buying,
– data about customers,
– registering web data,
– filing services and
– data on web selling and so on.

In the last years there was a sudden need to think in a new way about doing business that should induce the organizations to change radically the way of business and the relations with customers. The increase of market transparency and globalization caused the need of keeping off the customers as the most important question of contemporary organizations. The necessary conditions of such an orientation forced the need for CRM software, after all, for the part relating to sales management, e.g. the adequate customer relationship management. The automating operative processes (operative CRM), the analytical solutions (analytical CRM) and the electronic business with providers and customers (collaborative CRM), the collected information are necessary for understanding customers' behavior, adequate relationship management and fruitful strategic organization management. Analyzing the characteristics of CRM software (Siebel, People Soft, Oracle, SAP, J.D. Edwards), some mutual and the most important uses of electronic CRM solutions can be cited:

– more effective segmentation of customers and target group optimization,
– better anticipation of market development,
– profitability analysis of every individual customer,
– constant increase of customers' loyalty,
– quality increase of services for customers,
– better possibility of sales, using mobile equipments,
– intelligent product configuration, using the Internet technology
– shorter selling cycle and bigger profitability of sales process,
– synchronization of information from many different sources, and
– faster reaction to market changes.

Data Model for CRM Supporting

The philosophy of the data warehouse is very different than the philosophy of classical databases that are regularly used today for recording current (and updated) data. Instead of immediate current data, Data Warehouse contains a complete history of value changes of recorded characteristics on the basis of which different predictions can be formulated. Therefore, data warehouses can be efficiently applied in the preparation and strategic and tactic business decision-making. There are many methods for data warehouse design, and also many data are

available both at physical and abstraction levels, the most famous are relational and multidimensional models.

The need for data warehouses is formulated at the end of the '70s when the need for decision support systems appeared. Such systems existed at the end of the '60s when they were called Executive Information Systems. In the '80s, besides their continual development, their English name was also changed: MIS – Management Information Systems. Very soon, it was evident that the system based on the classical databases cannot satisfy the expectations in the field of decision support from objective structural limitations of databases. DSS (Decision Support Systems) applications could process efficiently only the current data. There was a possibility for processing filed data, but it was not very effective. Databases and classical information systems were planned for quick and efficient data memorizing (store housing), data processing and generating answers to the short SQL queries. DSS applications asked for not only the current state but also all the previous states for several months and years back. It could be done by the increase of memory capacities with an avoidable increase of time for processing. For analysis of the huge volume of data and discovering data trends it was necessary to provide big computers, but the results were halfway ones. Then the researches began to find out the appropriate structures for memorizing a huge volume of data, along with the most often used aggregate value of these data, all with a view of making easier the application of statistical data for data analyses. The classical OLTP processing (OLTP – On line Transaction Processing) could not provide such requirements. The type of processing that could successfully do the tasks expected by DSS systems was called OLAP processing (OLAP – On Line Analytical Processing). OLAP processing relied on the newly constructed system for data management called: Data Warehouse (DW).

Data Warehouse by Data Models

There are some differences in conceiving the notion of the data warehouse if we listen to the pioneers, the founders of these fields. R. Kimball talks about the data warehouse: "The conglomeration of an organization's data warehouse staging and presentation areas, where operational data are specifically structured for query and analysis performance and ease-of-use." [3] . W. H. Inmon's definition is cited even more often: "A data warehouse is a subject oriented, integrated, nonvolatile, and time variant collection of data in support of management's decisions." [2] . R. Kimball's definition is more general, and Inmon's one is more accepted and it determines the field of application of the data warehouse. The epithet subjectively oriented is related to the fact the data warehouse includes the date of only narrow thematic fields, not the complete business. The integral character of the data warehouse covers the fact that data are collected from different operational systems and they are memorized after their standardization. The nonvolatile characteristic states the unchangeability of data in the data warehouse. Data change in operative systems, namely, they don't cause data change in the data warehouse, but only the widening and integrating of new data with the old ones. The time characteristic reflects the fact that the data in the data warehouse are stored with the associated timestamp, e.g. the time mark of data origin. In later analyses, this will enable the analysis on the time basis. Data Warehouses are loaded from the operative systems with the data necessary for strategic decision-making. Their size can be measured in gigabytes (GB) and terabytes (TB). Fewer data warehouses of the local type supporting decisions of the smaller (limited) importance are called Data Marts. To some opinions, the data warehouse that helps the functioning of CRM applications also represents only data marts because it covers only one (the most important to many opinions) function of the enterprise. Data marts use only one part of the data warehouse and they can be of different types

depending on the purpose of using. The most important data marts types are [1] :

– *OLAP data mart* is realized by the software for database management of a multidimensional organization that uses a data cube, worked out on the basis of a star like scheme; they are used for in advanced defined and often used queries.
– *Exploration warehouse* is a typical data mart for researching and ad hoc processing, applying special processing in strong servers and by an optimized processing of ad hoc query gives answers for a short time. It is used for hypothesis development.
– *Data mining warehouse* is used for controlling and proving hypotheses constructed by the help of the exploration warehouse. Special techniques of data mining are used.

The task of building Data warehouse can be done on the basis of two basic approaches: top-down and bottom-up. The CIF (Corporate Information Factory) architecture is used for the realization of the top-down approach [1] , and the bottom-up approach results in Bus architecture, also called a multidimensional architecture [6] . In the CIF architecture the data warehouse takes the central place that is in fact the database with relations in 3NF including only elementary (non-aggregate) data. On the basis of it, different data marts, being of multidimensional architecture, can be generated and provided by data. The bus architecture is a set of coordinated data marts (super marts) that can be built according to the necessity. To this approach of building architecture, the central data warehouse doesn't exist because it would be an unnecessary redundancy – data repeating. The data of information systems e.g. classical data bases can be described at three application levels, i.e. they can build three kinds of data models [10] : (1) conceptual (level), (2) logical (level) and (3) physical (level) models. The same levels, the same data models can be defined for data warehouses, too [11] . For the Bus architecture, the multidimensional model (MDM) is used as a conceptual data model, and Object Definition Language (ODL) can be applied for specifying the CIF architecture in building the conceptual model or Entity Relationship Diagrams (ERD), for data warehouse and MDM for data marts (see Figure 10-1).

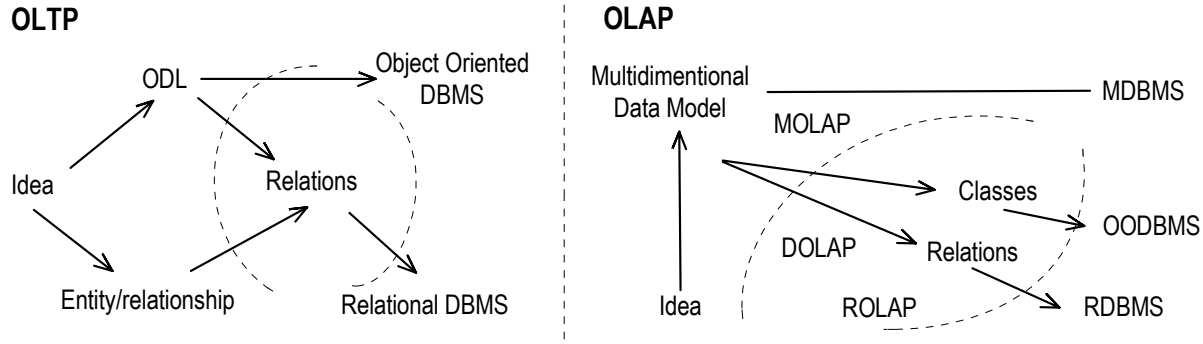

Figure 10-1. The OLTP and OLAP architecture levels

MDM is sometimes called a data-cube model and this name is applied both to three dimensional and n-dimensional data sets. In the element (cell) of the cube are found numerical data or the set of data (measures). The borders of the n-dimensional cube represent the dimensions on which numerical data can be grouped according to aggregation functions. The dimensions are sometimes organized in the hierarchy, for instance, time dimensions: a year, half a year, a quarter, a month, a week or a day. The attribute is an element of the dimensional hierarchy, for instance a month, and a tag is one concrete variable of the observed attribute, for instance April. The detailed description of the cube (granularity, to Kimball: grain) is determined by

the element (cell) of the cube, and it is the smallest "unit" of the numerical data, that can be got if all dimensions are used for addressing. If there is more than one numerical data in the cell, their granularity must be the same. The conceptual model has the operators that are used in generating different reports, and they realize the most often used functions: roll up, drill down or roll down, pivoting, selection, filtering, slicing and dicing. For the documentation of MDM models, graphical representation usually is the ERD model used. Namely, the MDM models differentiate only in the structure from the classical ERD models [13] , namely:

– The structure of the MDM model is simple: the entity of facts is in the center of the structure and the entities of dimensions are connected to it (star scheme) or to the hierarchy of dimensions (snowflake scheme).
– There is only one type of the link 1:N in the MDM model, where the end is "more" on the side of the entity of facts for every link, and from that side the link is obligatory, and the end to the dimension is of the type "one", from that side the link is optional: so the links in the MDM model are not marked.

The schemes constructed by ERD divide into star schemes and snowflake schemes, as the above cited. The difference is that for the star schemes it is not possible to define the hierarchy of dimensions ([9] , see Figure 10-2) while for the snowflake schemes the hierarchy of dimensions are regularly presented, if it is wanted and needed. The hierarchies of dimensions with the snowflake schemes enable to generate reports for every defined hierarchical level of any hierarchical dimension.

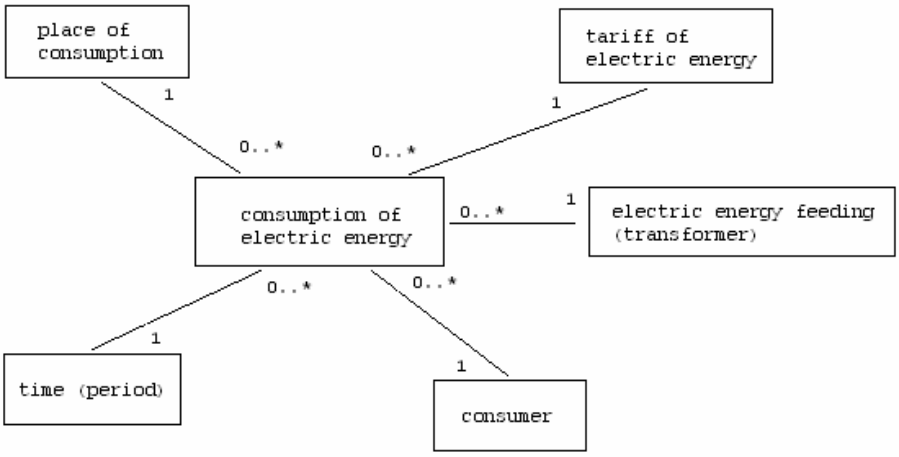

Figure 10-2. Star scheme model

The number of different reports is rather large, equal to the result of the following variables: the number of numerical data in the basic cell, the number of dimensions, and the total number of hierarchical level for all dimensions. In the data warehouses the process of data loading results different hierarchical level in every dimension that is not counted as a rule. In the case of a great number of hierarchical levels the process of loading can considerably slow down; not speaking about the necessary memory space and the time for answering to the queries. Ralph Kimball [5] suggests the following process for modeling data warehouses:

– choice of a business process from the business model,
– determining the level of granularity,
– choice of an attribute for dimensions, determining the hierarchy of dimensions,
– determining numerical data (measures) in the elementary cells.

The Starter Model for Supporting CRM

The starter model for supporting CRM enables a successful realization of customer business management, and it is independent of the enterprise and business fields ([1] Figure 10-3). The starter model represents a base for building concrete CRM solutions (applications). Contacts with consumers are established through different channels: from direct personal contacts by e-mails, but most often by post. The company and the customer can initiate the contact, that can be realized for many reasons: for information, coordinating data, offer, activities of the campaign, changing messages, and so on. For winning the sympathy of customers, contacts must be of personal character: customers are addressed by their names, not surnames. The campaigns are mostly of mass character, today: they are applied for the categories of consumers, but personification is preferred. All this is done, of course, for the purpose of increasing efficiency and successfulness of the campaign.

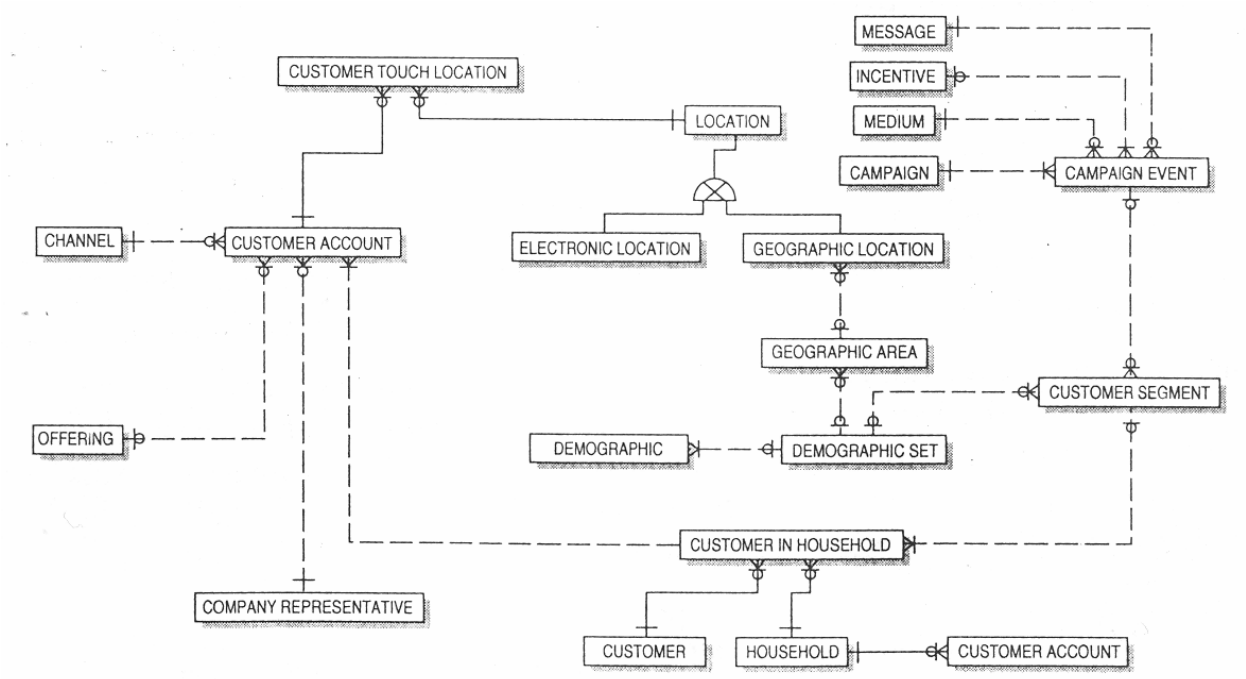

Figure 10-3. The starter model for supporting CRM

Metadata of the Data Warehouses

Simply to say, metadata are the data about data: they describe the components and characteristics of data using in an application, e.g. where and in what form (system of coding) they are stored, which connections are there between these data, where they originate from and what role they have in business operations.

In the '70s and '80s the term data dictionary was used, now we use the term of the metadata dictionary or repository[2]. In essence, today's metadata have really outgrown the notion of the former data dictionaries that described only the users' data. Contemporary meta databases include the following three kinds of data [12] .

- data describing business (the data of business logic or the data of logic of business)
- data describing data transformation (from the operation systems in DW), and
- administrative metadata (data on the possibility of navigation in data).

The data for describing business logic correspond mostly to the data in data dictionaries of the '70s and '80s. While the data dictionaries

[2] The comment of the Chief Editor.

describe the elements of data models: entities, attributes and connections between the entities, data for describing operations besides the previously cited, presented business rules, as well as the description of processing dictated by business operations. The competence for data capture and data maintenance belongs to the user of the applications.

Data for describing data transformation include the knowledge, i.e. the documentation about data and algorithms for data uniformity in the process of periodical DW uploading. Besides the description of DW structure, the source place where the data originate from and the destination of DW data, transformation data include the conditions and timing of transferring, as well as the processes of transformation. In the case of the CIF architecture, there is also a description of data mart uploading (conditions, timing and operations). If some software tools realize the ELT process, metadata are taken from the documentation.

The administrative data are more detailed than the description of navigation possibilities in database. The query paths indicating the navigation in database describe only the physical characteristics of the data seating themselves on external memory media, and the administrative metadata. This information keeps the time needed for uploading data into DW, the time for generating answers to queries and for generating reports with all the used patterns by the users. These data reflect the efficiency of uploading and functioning DW, e.g. applications, and on the basis of them we can uncover the data that are rarely used by queries.

The degree of metadata maintenance (updating) determines the quality and usefulness of CRM applications. The software for realizing meta databases implements the active or passive metadata management. The active metadata management can be done by software solutions that are the integral part of DW. With the active metadata management every type of data is registered in the meta-base before getting into DW, and from that moment it is automatic (thanks to the integral DW solution and metadata management). The advantage of this approach is an instantaneous promptness from the standpoint of data, their transformation and processing. The passive metadata management represents a software solution, independent of DW (CRM applications). It is projected and realized especially, and so it can be better in the field of business logic data than the finished integral solutions. However, it has irrefutable fault, and it is the maintenance. With these solutions, the user updates data (it is not automatic) and very often it happens that after the beginning enthusiasm in the maintenance of meta database updating, that activity is neglected.

Some Problems in CRM

Among other specificities of electric industry there is a fact that it is impossible to accumulate electric energy so it has to be distributed at the moment of receiving it. For functioning the electric power industry, it is necessary to provide the appropriate high-voltage, middle-voltage and low-tension grids. With a view of irreproachable functioning grids, it is needed to maintain them continuously, expand them according to the development of consumption and the increase of consumers, and there are unexpected damages that must be eliminated very soon. Timing and managing operations connected to the regular maintenance and damages elimination, coordination of maintenance groups and damages elimination (24-hour duty service) represent unavoidable widening of the standard CRM functions.

The energy distribution companies, realizing the function of supplying consumers with electrical energy, have the other specific characteristics in everyday work that widen the number of channels of CRM applications. Data gaining and remote control of the most vital elements of energy distribution grids (transformer stations of the voltage levels of 110/20 kV) and the remote control of electric meters and management of electric energy with the consumers has been an organized practice in the western countries for many years.

The remote control in Subotica was introduced 15 yeas ago in one transformer station in Backa Topola (34 km from Subotica) with the control center in Subotica. Nothing has happened in this field since then. The similar situation is with the remote control of electric meters and electric energy management with the consumers [7] . There is one own development, a hardware software solution [8] functioning since 1997 and including two distributive transformer stations of the voltage level of 20/0.4 kV and their consumers, about 200 households. There are not any prospects for further widening of remote reading now, although the functions realized in this system enable a fine analysis of the consumption function, as well as electric energy consumption management. There is a possibility for realizing some CFM functions, as the survey and memorizing the instant, 15 minutes, daily, weekly consumption, as well as the consumer balance of account and the category the consumer belongs to.

CRM is a complex philosophy including different scientific fields, starting from the psychology of behavior through shopping, marketing, sales till information and communication technologies. The successful realization of CRM functions is conditioned by an irreproachable functioning of all the above-cited (there are many of them, the most important of them were listed) factors of philosophy. Customer relationship management has the biggest, from the technical standpoint the most complex support by data warehouses that include the following groups of activities:

1. Initial and periodical data warehouse uploading, data extraction from the operational systems, data transformation to standardized form, and uploading of standardized data into data warehouse.
2. Generating the necessary reports.

On the basis of the previously presented facts we can conclude that the business of energy distribution companies is a pretty involved system and mostly covered by the appropriate software support – operative systems of the different nature. To many opinions, for the biggest problems in functioning data warehouses, only three letters: ETL can be accused. This abbreviation, according to Kimball [4] , can point to the existence of even 38 subsystems in functioning data warehouses.

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Exploring eBusiness Solutions with Online Cases

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ABSTRACT

People generally say teaching is much more an art then a solid science. Especially teaching „Business Information Systems" has to be an art, as this field has only some decades of history. The „case study" method itself has thousands of years of use, and business colleges reinvented it about 30-40 years ago. A live business system can not be directly investigated and normally no in-depth experiments are eligible or available. Thus a business information system – like an eBusiness re-engineering situation, an eCommerce change-management solution, etc. –might only be directly studied via a client interface, using the Web "live". The article summarizes possible applications of the method on the field of information systems' teaching in Higher Education (HE), and focuses on „online case-work" solutions in an international English-language eBusiness graduate class at Pecs University.

Introduction

People frequently say: teaching is a kind of art, as classroom situations, variations of the knowledge-transfer and processes of development of personality are so numerous, that algorithmic solutions can not work. Rather problematic field for using the method is „business information systems" with an only 30-40 years of historical data. Building information systems, re-organizing commercial systems to eCommerce, introducing an ERP system – all are very complicated situations, where analytic methods would probably fail when seeking for a roadmap to success.

Business education applies simple simulation (in many cases aided by computer software), or, the sub-computerized variation, a case method. People sometimes call it an „American invention", which is, of course, not true: Thukidides has trained the „Athen War with Melos" as a „case" to ancient Greek politicians.

The article is to present a direct use of the case method aided by online computer work, to teach business solutions in e-Business. After some discussions of the method itself and possible applications in teaching different aspects of business information system, a practical solution is described. For two years an international MSc class is taught with the method and feedback results encourage the author to present and develop the treatment.

The Case vs. Theory Problem

Ch. Boulakia says [2] : "Once you've gotten into business school, you'll find that it is drastically different from any classroom environment you've ever been in." What is this main difference, mentioned everywhere? The case method is nothing else, but the application of an old-new training process. Some schools – like Harvard – are "deifying" it, saying the one and only one appropriate method is this, for re-training young, but experienced managers. Others, like Wharton School of Business at the University of Pennsylvania, are having a more theory-based approach, and give more lecturing aside. It means: the case method has many advantages as well as disadvantages, and using it in MSc and/or MBA environments needs minimum a caution.

In theory, the case method is a quite simple tool: students are presented with a situation and

asked what they would do if they were in the decision-maker's shoes. In business, the “situation” is often adapted from a real-life business problem within the last 5 years. In IT, examples of such an age are dangerous: that will be the conclusion of this article, and the reason for the author to introduce the “online case” solution.

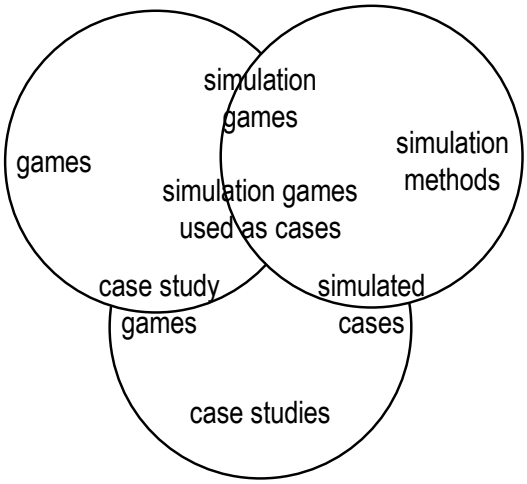
For HE educators of discrete sciences, like Math, OR, Stat the case method is rather frustrating, as there is not a “correct answer”, instead of calculations maximum what-if modeling exist – “solving a case” is never equivalent to “solving an equation”. We have to say: in classical “scientific” situations one has time to collect data, has analytic tools relevant to the problem – here only a very sketchy amount of raw data is presented and one will never find the cure method of cancer. We simply should behave as business decision makers, as a CIO with some IT advisor, and the objective is only to enhance our knowledge on a typical problem environment, and learn from past decisions which have really been made by real experts in the real situation.

Science, research, cases – issues on it are everywhere in literature. In [10] we find “theory can be absent from studies”. [11] says that theory can be used to “guide” the case study in an exploratory way. Creswell declares [4] that theory is employed toward the end of the study providing a "theory-after" perspective in which other theories are compared and contrasted with the theory developed in the case study. Remember: normally we have 2-3 times 1-2 hours to deal with a complex problem in a semester. Probably Creswell has the right answer: employ parts of learnt theories and value these ideas through the case!

Advantages? Yes, there are! Where to first apply any learnt math-stat method, any comparative data analysis, and other “theories”? Others: skills, like group work, simulating business roles, use of communication techniques, arguing, presenting – all are from the basic tool case of today’s managers.

Disadvantages? Yes, there are! Time of the class can be wasted by following a direction which was not to be taken and the preparation of data is also useless. Dealing with cases and businesses where the problems mentioned are out-of-date. Free-riders in the team not really assessed, etc.

Some authors (like [5] [1] , etc.) categorize these pedagogical methods as we show it on: authors refer to it as a “Reidl model” from 1977. From this, one can understand that borders between methods used in class - in many cases – are permeable, and the experience in “art of teaching” orientates the tutor which aspect of the transfer process comes forward to have more efficiency.



Source: Ellington et al., see in [1]

Figure 11-1. The Reidl-model, describing relations between methods

Those applying the case method, would say it is a fantastic learning tool, if prepared and executed well in an appropriate knowledge transfer process – discussion below will go further on with propositions.

What is the Case Study?

A case study is a description of a (business) situation, with a holistic view, but presenting a “bounded” system. Boundaries are normally set in terms of time, place, events, and specific processes. A case always sets forth a “problem”, which is critical to stakeholders mentioned, and “solving” the case is the answer of these

decision-makers relevant to the problem arisen.[3] Data given is normally rich in content and involve multiple source of information - either given by the case itself, or, as an assignment, are to be collected by the students.

Cases emerged in management trainings around 1910: Harvard professor Copeland talked on real cases to groups at the Business School. His first case-book collection was published in 1921: Dean W. B. Donham centered the method into Harvard curricula at that time.

Listen to some basic definitions:

"A case typically is a record of a business issue which actually has been faced by business executives, together with surrounding facts, opinions and prejudices upon which executive decisions have to depend. These real and particularized cases are presented to students for considered analysis, open discussion, and final decision as to the type of action which should be taken." (Charles I. Cragg, in [6]

„It is useful to think of a case as a connecting link which draws together the experience of the executive on the job, the executives in management development programs, and the researcher in his efforts to understand the process of management. Written cases are catalysts to speed the process of learning from experience." (Andrew R.Towl in[6]

"A good case is the vehicle by which a chunk of reality is brought into the classroom. A good case keeps the class discussion grounded upon some of the stubborn facts that must be faced in real life situations." (Paul R. Lawrence in [6] Authors mention different types of cases. In [8] two types are mentioned:

a. the *"single cases"* are stand-alone stories;
   - the intrinsic variation is very focused, dealing with something unique,
   - the instrumental variation presents a general phenomenon, using a particular case to show a collection of features;

b. the "collective case" is to provide general understanding, using a number of instrumental cases, which either "occur" on different places, at different companies, time, etc. - too few or too many are both difficult to achieve good results.

Others make a difference between "research" and "teaching" cases, in what material is presented and how it is presented:

- a "*research* (or finished, analytical) case" is intended for professionals, it is more formal, includes the researcher's opinions and judgments and gives detailed factual information to work with;
- a "*teaching* (or open-ended) case" is intended for readers to have an opportunity to determine a solution on their former experiences, at different levels.

In a teaching case authors normally use a "reporter", a participant, who tells the story, but avoids any opinion or analysis. Case writers give "teaching notes" to facilitators, detailing objectives, tools to use in class, further literature or other resources.

Important to say, how much time we have for preparation – discussion – evaluation. From this point of view in teaching different MIS courses (with 80% traditional F2F lecturing) I prefer two types of casework:

- A *"one step case"* is distributed to students a week before class; this is 2-4 pages long with 5-7 focused, activating questions. Normally we spend 25-35 minutes with intensive moderating, and 20-30% of class can be activated with questions-answers. Those presenting extra data, a prominent opinion, may collect extra scores. These cases are strictly focused to a learnt method, a formerly presented solution, application software, IT management problem, etc.
- A *"take-away"* case is a buffet menu of 4-6 pages written, downloadable cases, with a broad and rich company description, and with assessments asking for further data collection, and a strict structure of a written report (with a separated part for personal opinion and ar-

[3] Can one make a comparison between a „drama script" and a „business case"? Probably yes.

guments). Reports are evaluated in details and some curiosities, well-done parts are presented to the full class later. Also I involve questions from the case problem in the final test.

Below we try to differentiate further case situations:

- A *„discussion case"* is a simple discussion of a business article. Learnt terms, methods can be cited, refreshed and basic data analysis, assessment or comparison can be made.
- An *„armchair case"* can be a fictional situation to demonstrate a general modeling or decision problem. This is rather a complicated example, than a story.
- A *„data-analysis case"* can be a financial or business annual report, to analyze data, use methods and to present variations. Real data motivates participants to use analytic models.
- A *„full situation case"* is a description of a complex business situation, with real/alias names, roles, market companies, and with an explicit problem-environment.
- A *„business game* (Jesuist case)" is rather a computer-based, working model, where students can actively play decision making roles. Data input is based on individual/team decision; output is generated by software. Games are always based on a competitive situation. In some cases a "simulated company" is physically built up and also processes executed.
- A *„live case"* makes it possible to impact an existing business. Inputs generate real responses, processes are "'live" ones. Our example uses Web-based companies to touch.
- Last: „*shadow managing*" is then more that a classroom-case - students enter a real company to study a specific decision making process through "following" a manager in his/her all-day working. This solution is a success when politicians, governmental leaders give a possibility for a support like this.

Business IS and the Cases

All of us know: everybody (even computer software) can teach "information systems", IT and information systems, applications to any age group, at any level, with any method. What makes it necessary to use a case in a IS/IT curriculum - what makes the case different from a textbook or a "normal" lecture in teaching IS/IT? Some possible answers are given below:

- Sources and characters are different.
- This is a must to seek for and to collect further data.
- Extent and presentation of content is different.
- Activities and classroom-behavior is different:
  - participants have to speak, to express an opinion,
  - one can convince others with live presentation and arguing.
- Speed of getting outmoded as time flies is different.

Going further with investigation:

Source of information

IS/IT lecturing has many problems with "literature sources". Everything is new, very few real textbooks are available, usual manuals and application texts are not for education use. A case offers something different: participants "talk about", "report" chunks of information, this is the primary source of data, however filtered by the author of the case.

A pressure to collect data

As a real situation is a "story", it calls for immediate data collection, from inside and outside. A well-constructed case inspires to start research and the mediator can use this situation to teach further methods (like Internet search technologies). An IT textbook is normally 1-3 years old – why not to have some fresh information from online journals and relevant websites? Authors of different texts frequently see things through rose-colored spectacles: any student can check demo software, a price, a valid company data when studying a case!

Special content

An IT/MIS textbook is simply transferring data, some knowledge elements - a case always calls for a decision. Length of the text, form of the content presentation depends on this, as it has to be enough and in appropriate form to make decisions.

Character of classroom work
Case method aims to activate participants, not to simply „listen and make notes". One has to use software to calculate, to search for information, to watch a demo or real software working. Students have to act and react, they argue and defend their opinion through presentation or debate, and they practice teamwork roles – all different from e.g. working with a software tool at the lab.

Obsolescence of the case content
A case is always anchored to a date, to an event. The IT/MIS situation can easily turn outmoded. A textbook composes content generally and shows theories, methods which are rather accepted, common, validated by many applications.

Working With a Case: a Roadmap

Here I describe a typical process life cycle of working with a case at a usual IT/MIS type course, which I use with "one step" cases described above. Steps show a basic framework and, of course, individual intentions can take place.

Before the class work

– The teacher selects a case, prepares (updating, forming), checks some further information sources to start with and hands over the text to the student group
– Students individually study the basic texts and prepare for questions and tasks, using their textbook, the Internet, other related material.

At the class

– The moderator expresses some crucial points of the case and starts discussion. Good if he/she presents some very fresh information. He can call for data collection, initiates teamwork and gives ground to discussion („facilitating").
– Students/teams can put questions to each other, first, then to the facilitator ("Do I understand well…" etc.). If needed, they go for more information, "solving the case".

After class work

– The moderator evaluates teamwork results. Reports can be written or in presentation form. This is useful to generally summarize success/failure of data collection, parts unattended, problems left out of discussion. Written reports are to hand over.
– Students compare case information to textbook and lecture content, preparing for the final test or exam.

In other cases (see the "live case" description below) – having more time and aiming more individual student-workload, a case can last for 2-3 weeks to work out. This is rather the Harvard-type solution, when weeks of teamwork, active modeling, data capture, tests and presentation give the frame of the teaching – training process. Usual Hungarian Masters courses does not give this possibility to tutors, but for working with practicing managers and/or executives at some MBA classes the best solution is this "learning by doing" methodology.

Normally we teach the same courses in higher education environments (in non-IT programs): Data Modeling, System Analysis and Design, Application Systems, Project Management, Business Information Systems (management, auditing, leadership problems, etc.). Now we can put a question: which type of courses is appropriate to use cases in class? Answering the questions below can help:

Can real knowledge be transferred?

Con: This is just a chat, a student can hide in a team (free-rider), and debates are illusory

Pro: Collecting new information is a good and useful practice. Presenting, communicating, arguing are proper skills for the future. Former knowledge can be assessed through the discussion.

Can I work with a case in an IT/MIS course?

Con: Hungarian faculty seldom have a corporate in-situ practice background. Those who have some practice in business IS/IT or in programming, had gained it many years ago – risky to mention or use it in class. If case discussion shifts to a new

direction, a doubtful –and inexperienced!– teacher can "lose face" easily. People say "I have a textbook; I have a lecture presentation, please, listen, make notes and come for the exam." Many of this type of teachers have a fear of losing authority in class if questioned in a debate.

Pro: Yes, I am updated, I know the company, I know the case background, I have prepared – and feel ready for questions and debate! Moreover: I feel curious to listen to students' opinion; will ask for their new ideas!

Can a full course be devoted to cases, or better to mix methods?

Con: Less time is left for theoretical content, class is frustrated with an unknown teaching technique, and (in full-time courses) "they do not have business/IS/IT experience"

Pro: Yes, only in graduate courses, in MBA program, where students are either have some site visits, practical placements history, or they really work (adult education) with existing information systems, with IT environments. A full "case course" in IS/IT seems unnecessary and unuseful: formal knowledge transfer is always needed.

Is case method an "alien solution" in class, in the program, in the school?

Con: Nobody else uses the method in school. Performance and assessments are not comparable to traditional solutions. Colleagues and faculty leadership are not convinced; they feel it dangerous and/or does not know the method.

Pro: Somebody has to pioneer the well-known method, even if in the IS/IT field it seems new. Try, publish, create IT/IS case-banks focused to relevant Hungarian cases. Let the method be put on the right place in the toolbox for HE MIS educators.

Experiences with a Master Course

Pécs University Faculty of Business and Economics offers a full-English language international program on BA and another on MSc level. Here I describe only one solution: Masters level students (an international group of 25-30) attend to a 2+2 structured eBusiness–eSolutions course, where we use a special "live case" method.

The idea was to utilize the 1:1 student-PC situation (laboratory work) and the strong motivation of students to search and surf the Web when presenting e-commercial or other e-business solutions.

The course lasts 14 weeks and 50% of time is lecturing, faculty presentations with some live Internet-based "shots". It means when a tool is described in lecture time (like "Catalogue pattern of a website") then immediately 2-3 typical examples are presented on the Web, shortly explained, some questions are faced to students, and then lecturing is going on. This style keeps lecture time motivation live in class.

Practicum time is following the e-curriculum with some introductory technical occasions (2 weeks, Session A) and then team-building and understanding the methodology starts the case-work Session B. Teams have 3-4 weeks to work out a specific problem, distributing roles, utilizing existing skills and building new ones. Faculty role is "coaching" in these weeks, wandering from team to team in the lab, giving small advises, and, sometimes, calling attention of the entire class for a special, extraordinary solution, a data source, etc.

Teams have every week some focused tasks to get closer the final report and a tangible outcome of the week (a 2-hours laboratory session and home work) has to be reported. With these partial reports they build "Team Websites", which they use as a knowledge base while working (all necessary data, links, raw datasets, etc. is to be kept here). All session output results are evaluated publicly.

Last week goes for preparing an "Executive Meeting Presentation", where they use the team

knowledge base, former reports, and run a PPT+Web based "live presentation". To understand, what I mean on "live casework" here is a short example (details of tasks, etc. are neglected from Figure 11-2.): one can realize how many team activities can be run "online".

Some conclusions

E-Business, as a course topic is extremely appropriate to work live on the Web while in class. To keep students away from idle surfing, a detailed assessment direction is given, however the roadmap to "success" has to be build by the team. Team members learn skills and techniques, and a large amount of special information is collected and can be shared to class, adding value to the parallel lecture series.

These "live cases" are open-ended, they do not have a prior statistical history, and depth of data analysis depends on the team intention and activity. The client-side of an eBusiness activity can not only be studied but experienced, when a student queries a catalogue of a Web-shop, when registers to a travel site, when sends an email to a marketplace or to a Web-provider for a demo.

Role of the coaching faculty is essential. Even an experienced teacher can make some typical mistakes when preparing and executing "live cases", like

- the aim to achieve by the case is not clear,
- the selected company, organization, portal is not informative, poor in content, or is not working properly,
- more assignments, tasks are given than time is enough for,
- the faculty is "not well prepared" to the case (improvisation is not for casework with 3-5 teams is class…),
- the faculty is less educated in complicated new IT/MIS/e-terms,
- the basic techniques of coaching, motivating are not known by the teacher, and/or
- the selected focus does not interest the team – the targeted industry, company must be a challenging one (international teams prefer to select a target from their national companies).

CASE: International eBusiness Activities of a Global Cosmetics Firm

Vision: Your expert consulting team has a task to *study and analyze* a real business company, which has started to work in e-business and to report & present result to executives. All business activities have to be covered shortly: traditional workings, business plans, financial reports, company structure, projects toward e-solutions, etc.

Assignment #1:

- Create a team knowledge base website, distribute roles within the team
- Look for portals, databases where general company data is available
- Collect statistical data on world cosmetics industry, present data sources
- Select 2-3 businesses, compare available data sources, select final.
- OUTPUT: Data, links, useful sources, frame of teamwork, a company selected.
- Report is due next week.

Assignment #2:
- Collect more business data on selected company.
- Find the e-business project: planning, stakeholders, project report, outside reports, etc.
- Find media feedback, evaluation of results, projects and actions.
- Compare shortly competitive company data
- OUTPUT: Company documents. References. Benchmarking to other companies.

Assignment #3:
- List all e-activity forms the company runs. Give evidences.
- Select the most important project and start evaluating:
- if it is a B2B solution: explain terms which are new for you; find report on the process; find partner companies and compare process to learnt methods; try to register as a supplier or buyer; evaluate interfaces; ask for information, measure response time, evaluate response content; download a demo as a new user and evaluate, register payment method;
- if it is a B2C solution: compare patterns they use to learnt categories; find website evaluation systems on the Web and apply minimum one; register as a frequent user and check services; evaluate response time and content; find 3rd party vendors, partners, etc.
- Start creating final presentation.
- OUTPUT: Analysis of the e-solutions; direct referring to learnt methods; planning the final structure of team presentation.

Assignment #4:
- Find documents showing how the business structure, the organization and leadership has changed
- Find some general comments, articles how organization changes and how cost-benefit analysis can be made through an eBusiness project.
- Be proud with results!
- OUTPUT: A complete report, well-structured; a "live" website with references, documents, links. A 10-15 lines Executive Summary.

Figure 11-2. *A frame of case-session B*

According to our experiences[4] there some more problems can appear:
- Only English language sites can be used (some teams regularly collect information from Chinese, French, Swedish sources, but then work is hard to monitor).
- A lot of inter-term reports and presentations need tutoring time and efforts.
- For some students continuous communication (team, tutor) is a high (shocking?) burden, also they can not run a presentation as professional as the tutor can.
- Class work can easily cascade if less or inappropriate tasks are given.
- The coaching tutor has to listen if free-riders occur in teams; also pioneers of any innovation have to be awarded at any time.

[4] These courses partly have been shared with Edit Bányai, lecturer of PTE KTK, Pécs

Finally, I guess: a “case teacher” resembles an orchestra conductor or a basketball coach. Personal signals, communication and monitoring skills, and also a good humor is needed to keep the class in unity to achieve methodological aims. eBusiness solutions are all visible and “tangible” on the Web: go and touch them – students will learn, get experiences, and also enjoy!

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Some websites

Harvard Business School Cases:
http://harvardbusinessonline.hbsp.harvard.edu/b02/en/cases

Simulation And Gaming Association:
http://www.sagsaga.org/page17-420.html

Univ. of York
MIS Case Studies: http://wwwusers.cs.york.ac.uk/~kimble/teaching/mis

State University of Buffalo:
http://ublib.buffalo.edu/libraries/projects/cases/new.htm

University of Mississippi:
http://www.olemiss.edu/courses/pbl/index.html

Illionis Math and Science Academy
http://www.imsa.edu/team/cpbl/intro/index.html

Zeitschrift für Hochschuldidaktik
http://www.oeghd.or.at/zeitschrift/1997h1/index_e.html