

ESSENCE

NETWORKS AS THE BASIS FOR PROCESS-ORIENTED AND INTER-ORGANISATIONAL BUSINESS SYSTEMS INTEGRATION AND MANAGEMENT

RESEARCH PROGRAM

The “essence” of many organisations are processes that exist within an organisation, shared with other organisations, suppliers and customers, all refined and improved during long time and based on long experience. Buying a company today is often buying their experience and success elements captured in their business processes. The ESSENCE program will extend the latest developments in enterprise application and process integration technology in order to come up with methods and techniques necessary to enable efficient business process management, foundational before efficient methods and tools can be implemented and applied in organisations.

The program is a joint venture between five Swedish university departments: the Department of Computer and Systems Sciences at the Royal Institute of Technology (KTH/DSV), the Department of Numerical Analysis and Computer Science at the Royal Institute of Technology (KTH/NADA), the Department of Computer Science at Högskolan Skövde (HS), the Department of Information and Media Technology at Mid Sweden University (MH), and the Department of Computer Engineering at Mälardalen University (MdH). Its aim is to join the forces of these departments in an effort to further investigate and develop technology for network based process oriented business management. This technology will enable organisations to rapidly create/reuse/adapt flexible electronic business processes by facilitating the integration of actors and systems, to support the design of network based products and services, to visualise complex processes, and to monitor and optimise processes. The research program is related to on-going and finished projects at all sites concerning process-oriented systems integration (KTH/DSV and HS), enterprise modeling (KTH/DSV and HS), inter-organizational cooperation and integration, (KTH/DSV and MH), knowledge management and information retrieval (KTH/DSV, KTH/NADA, and HS), and case-based reasoning enabling capture, adaptation and reuse of processes (MdH). The program will result in the creation of a strong Nordic competence network in the area of Business Process Management with national and international workshops.

The aim of the ESSENCE program is to use and extend the latest developments in enterprise application integration technology research and further develop so-called process brokers and associated methodology in order to come up with methods, techniques, and prototype tools for:

a) Business process design and systems integration

A process broker is a kind of digital interpreter that enables fast and reliable communication between actors, systems, and applications independently of existing platforms and standards. By utilizing process broker technology, business processes are designed and implemented that integrate all actors, human as well as computer applications over the business process. Enterprise analysis and in particular process modelling and design are important activities in this context. Note that processes can include several organisations that use different models and standards for inter-organisational co-operation (Rosettanet, ebXML, BizTalk etc.) Thus, an important research question is the design of methods that support translations between different protocols and process standards. Two key techniques in this context are ontologies and conflict analysis. Ontologies are collections of terms, definitions and semantic relationships that can be used to discover relations between components of models. Conflict analysis aims at

identifying inconsistencies between models based on an analysis of their semantics. Furthermore, language technology can be used in the integration process to compare the semantic proximity of objects from different models to be integrated.

b) Business process monitoring and management

Process monitoring and management means to supervise, control and, when necessary, change particular enactments in business processes in real time, and to measure and improve their performance in the long run. As the enactment of a business process proceeds, a trace will be stored that contains all the information generated during the course of the process. The information will be time-stamped, and it will hence be possible to derive the time-span of various sub-activities. The trace will also be complemented by various measurements regarding the outcome of the various activities. Except time such measurements may be related to availability, productivity, cost, value created, responsiveness, profit, etc.

The collection of process traces will constitute a data warehouse from which information concerning business results in the small and in the large may be derived. The information may be presented such that it together with the process management abilities of a process broker constitute what may be referred to as a 'corporate control room' from which the enterprise may be monitored and controlled. The organization can be viewed as a vessel, which is steered towards its goals by designing and managing its business processes, and by monitoring the enactment of these processes. More specifically, the processes need to be controlled, changed, monitored for performance (throughput, time, capacity, bottlenecks), assessed and analysed as well as improved and redesigned.

c) Business process knowledge management

Users that participate in a business process need to understand not only their own activities but also the context of the process in which these activities take place. Furthermore, users need to understand their existing processes and relate them to "best-practice" in order to continuously improve the processes. Thus, there is a need to manage the knowledge embedded in processes, and an essential tool for this purpose is a process repository. The repository would be complemented by powerful indexing and search mechanisms and may be used e.g. during business process design and for training purposes.

As shown in Figure 1, the repository has three parts. Generic processes are abstract patterns that may be common for application domains and industry sectors. Specific processes are processes that are used in a particular organisation. Process enactment histories contain traces of process enactments. The process engine enacts the processes (1) and stores the outcome of the enactment in the repository (2). The process analyser measures and analyses enactment histories (7). The process designer creates new processes from generic models (5) and/or old models (4), using enactment history (6) or process analyser results (8) to improve on earlier versions and stores the new models in the repository (3) from where they may be enacted by the process engine. The process patterns editor builds new patterns (9) or modifies old ones (10) possibly based on enactment histories (11).

Process knowledge management will benefit from applying case-based reasoning methodology, an active and promising research area in artificial intelligence, based on a cognitive model of learning. New tasks are matched against previously solved tasks and their solutions and experience gained. The case-based cycle will identify reusable parts, adapt them (domain knowledge repository) to the current task and after revision add them to the case library (extending the experience captured in the process knowledge repository). This ensures that much knowledge and experience is retained, often lost when employees change work or position within organisation, the most valuable asset for many organisations. The research program will develop methods necessary to handle business processes in a case-based reasoning approach. Representation, methods, and techniques will be well integrated with the work carried out for

paragraphs a and b above, and may also be used in training of new staff, analysis (e.g. ISO 9000 compliance), and configuration management (version handling of processes, tracing to original requirements etc).

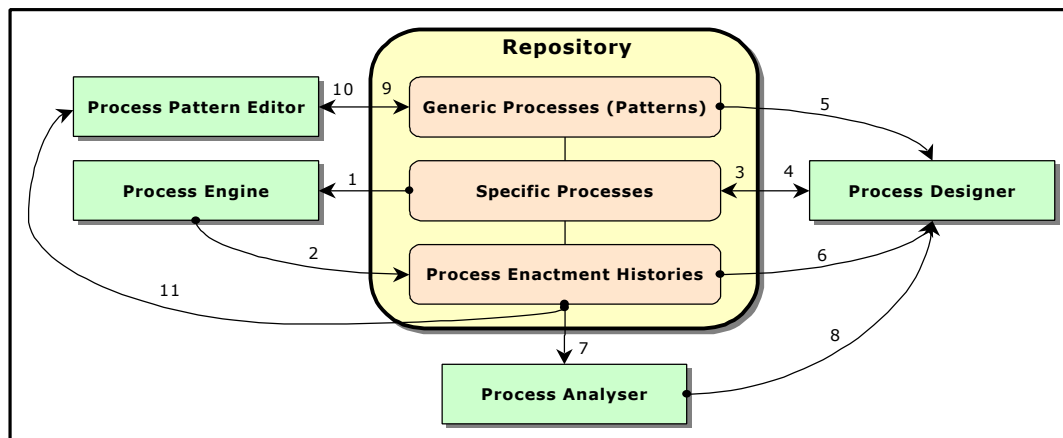


Figure 1. Process repository architecture

BUDGET

Budget per year:

KTH/DSV One PhD, 60%, 600 KSEK

KTH/NADA One PhD student, 80%, 600 KSEK

MH One PhD student, 80%, 600 KSEK

MdH One PhD student, 80%, 600 KSEK

HS One PhD, 60%, 600 KSEK

Total: 3000 KSEK/Year

These amounts include salaries, costs for supervision of PhD students, administrative overhead, and travel costs. The budget is given excluding VAT (högskolemomms).

The approach of the program will be a combination of theoretical investigations, construction of prototypes, and case studies. A number of projects will be defined within the program. All projects will be of a foundational nature, but some of them will also involve field experiments and will be carried out in co-operation with Swedish industry.

All projects will be carried out by two or more program partners. The program will initiate a series of national and international workshops and conferences in the area to create a strong research community.

STRATEGIC RELEVANCE

The results of the program will be relevant in several areas:

Products and services. New methodologies and tools that enable companies to rapidly and flexibly develop new network based products and services with an assured level of quality and efficiency. Their

development and distribution will become accessible to companies with a fraction of the cost and effort required in traditional ways.

Organisational forms. The results of the project will also contribute to turning sets of collaborating companies into so called dynamic value constellations, where the companies can co-operate in virtual organisations to create more value for customers than each one of them could achieve alone. These organisations will be able to react to changes rapidly, and at low cost. They will also be able to constantly reconfigure themselves to maintain excellence.

The organisations will be able to organise according to business processes, i.e. sequences of activities that create value for their customers. Concentrating on the customers' needs the organisations place their customers, and value adding activities for the customers, in focus.

Interoperability. Providing methodologies and tools for interoperability will allow companies to take advantage of each other's capacities. The possibility of interoperability between organisations will stimulate closer collaboration, planning, and execution of joint distributed business processes among the organisations and their suppliers and customers. Localisation of partners will become less important which enables co-operation between partners across regions and countries.

The research results will be valuable for solving problems concerning semantic interoperability between business process frameworks. This will be of strategic importance for the widespread adoption and effective use, in particular the provision of new services, of the possibilities of the next generation of the Internet - the so-called "semantic web".

BRIEF CVs OF KEY PERSONNEL

BENKT WANGLER, PROFESSOR

Professor Benkt Wangler has a PhD in Computer and Systems Sciences from Kungl Tekniska Högskolan, Stockholm. He holds the chair in Information Systems Engineering at the Department of Computer Science at the University of Skövde, Sweden and is also a professor of computer and systems science at Stockholm University. He was previously the leader of the Information Systems Laboratory at the Swedish Institute for Systems Development (SISU) for many years. Prior to this, he was a consultant analyst and lecturer to Sperry AB (now Unisys) in Sweden, in the areas of databases and systems development. Since 1989 Wangler has been heavily involved in several international and national projects. He has been actively participating in 7 EU research on information systems and databases. At present he is a leader of a NUTEK-sponsored research project, ProcessBroker, on process-oriented enterprise application integration. He has also been managing the Swedish part of the European ESPITI initiative in software process assessment and improvement. Wangler has also acted as a referee of proposals for the ESPRIT-4 LTR and ESSI programs.

Areas of interest focus around the use of IT for the supply of information in organisations and include information systems methodology, in particular requirements engineering, legacy systems migration, and enterprise applications integration; and database technology (including data warehousing and related technologies).

Wangler was the program chair of CAiSE 2000, the 12th Conference on Advanced Information Systems Engineering, and the organising chair of the 4th European-Japanese Symposium on Information Modelling and Knowledge Bases and has been a program committee member of numerous conferences in the areas of information systems and databases. He has also acted as a reviewer of contributions for several well-known scientific journals. Wangler is a member of ACM, IEEE Computer Society and the Swedish Society for Information Processing.

Högskolan Skövde has a strong, industry-related profile with its core competence mainly within

natural science and engineering and with an emphasis on IT. The Department of Computer Science has over the years built a strong environment both with regard to educational programmes and research. The department has eight active research groups in areas such as database technology, real time systems, AI, information systems engineering and several others. The proposed project will be carried out within the Information Systems Engineering group, several members of which have long experience of participation in national as well as international research projects. Some of the areas in which the group specializes are inter-organizational business process modelling and standardisation, analysis patterns, data warehousing and knowledge management.

HERCULES DALIANIS, ASSOCIATE PROFESSOR

Master of Science in Engineering, (Civilingenjörsexamen) KTH, 1983, Doctor of Engineering, PhD, (Teknologie Doktor), KTH 1996, Associate Professor, (Docent), Stockholm University 2001, Dalianis has 24 published paper in the area, he has also presented his research for an international audience. Dalianis is teaching, supervising, both undergraduate and graduate students and performing research in human language technology at NADA, KTH.

Dalianis has been working in the intersection between academia and industry for more than 15 years with translating the needs of the industry to concrete research and pushing the results back from academia to the industry and this specifically in the human language technology area.

Dalianis has been working at KTH, ISI/University of Southern California, SISU, IBM, Ellemtel, Ericsson and Cap Gemini as a project leader, consultant, seller, teacher and researcher within the area of systems development, requirements engineering and natural language processing. Specifically at Cap Programator (Cap Gemini) as Project leader of the ESPRIT-project P8145 KACTUS, modelling Knowledge About Complex Technical systems for multiple Use and project leader of the project VOLVEX (Validation Of Specifications by Natural Language Generation for VOLVO expressed in STEP/EXPRESS) supported by the Volvo Research Foundation, Volvo Educational Foundation and Dr Pehr G Gyllenhammar Research Foundation and several NUTEK supported project. Dalianis has also started a spin-off company Euroling AB, dealing with human language technology products.

NADA/KTH has since the beginning in 1990 carried out research and given courses in human language technology. The research group has also built different demonstrators as spell- and grammar checkers, text summarization and information retrieval tools. They have carried out different studies in human computer interaction and published and presented their results for an international audience.

LOVE EKENBERG, PROFESSOR

Love Ekenberg received his BSc in mathematics and his PhD in computer science from Stockholm University in 1988 and 1994, respectively. He became docent at Stockholm University in 1997. From 2001, he is full professor in Computer Science. He has published about 50 articles on risk and decision analyses, formal methods, and schema integration, and is member of a number of referee committees. Ekenberg has worked as leader and coordinator of major national and international IT projects and as senior researchers in these fields. For a couple of years, he has also supervised the use of formal methods in connection with security analyses at nuclear power and telecom companies in Sweden.

The natural science and technology faculty of Mid Sweden University has quite recently got the right to examine PhD students. It has a rapidly growing research environment and a strong competence both from theoretical and industry-related aspects. Furthermore, the IT field has become a prioritized area within the faculty. Dept. of Information Technology and Media (ITM) is a node in the National Graduate School of Teleinformatics. It is also a part of the recently launched Graduate School in Mathematics and Computing. Furthermore, it is strongly involved in a large-scale project in Mathematical Modelling and System Analysis financed by KK-Foundation and SCA. There are several research groups within a span covering various aspects such as telecommunication, database theory,

process verification, system engineering, risk management and artificial intelligence. ITM is also one of the largest Information Technology departments in Sweden with respect to students.

PETER FUNK, ASSOCIATE PROFESSOR

Dr Peter Funk is Associate Professor in the Department of Computer Engineering at Mälardalen University (employed since Jan. 1999) and heading the artificial intelligence group. He received his PhD (Doctor of Philosophy) in Information Technology at the University of Edinburgh, Faculty of Science and Engineering, Department of Artificial Intelligence, 1994-1998.

Peter Funk has extensive experience in applied research in industry and more than 9 years research for Ericsson in the area of applied AI techniques, requirements engineering and process/knowledge representation. He is the first to receive the Wallenberg grant for scientific research three times. Beside research activities and supervision of Ph.D. students he is currently involved in starting a new computer science masters program including an AI profile (autumn 2001), active in numerous workshop and program committees (e.g. ECAI, DEXA), member of the advisory board for Mälardalens Real Time Research Centre, MRTC. He started and headed a research project with Ericsson 1998-2001, funded by Ericsson, KK stiftelsen and MRTC (total funding ~5 Mkr). Peter is also deputy Member of the university faculty employment committee for academic staff. Other previous appointments are elected chairperson of the Union of Civil Engineers (330 members) at Ericsson/Ellemtel and seat at the Company Board of Directors representing the union, 1991-1992 and co-starter and organiser of the Human-Technology-Society network at Ericsson/Ellemtel 1988-1991. At the Technical Institute in Stockholm he was awarded a premium prize for general ability and excellence (1976). Peter masters Swedish, English and German fluently. His research focus is intelligent, adaptive and learning systems (Case-Based Reasoning), embedded AI techniques and agent technologies. Peter is active in national and international networks in the area of AI, CBR, knowledge management and process management.

Mälardalen Högskola as an international well known centre in real time systems research (MRTC), strong research in Software Engineering, Programming Languages and Artificial Intelligence. All strongly represented in education, with PhD students, with close collaboration among the four areas and with participation in national/international research communities/projects.

PAUL JOHANNESSON, PROFESSOR

Paul Johannesson received his BSc in Mathematics, and his PhD in Computer Science from Stockholm University in 1983 and 1993, respectively. He became docent in 1995. He is full professor in Information Systems at the Royal Institute of Technology. Johannesson has published work on federated information systems, translation between data models, languages for conceptual modelling, schema integration, the use of linguistic instruments in information systems, and analysis patterns in systems design. He is the co-author of a textbook on conceptual modelling, published by Prentice Hall. He has been a member and project leader of several national and international projects on requirements engineering, information and application integration, knowledge management, and the use of IT in teaching information systems design. Johannesson is and has been a member of several international program committees; among these are the ER conference and the CAiSE conference. Johannesson is head of the research laboratory SYSLAB. He is responsible for tracks on information systems education at KTH and Stockholm University.

The Department of Computer and Systems Sciences at KTH carries out research and education in the areas of information systems, security, software engineering, and interactive systems. The research group SYSLAB within DSV is since long well established in research in enterprise modelling and database technology as well as in software engineering. SYSLAB has been and is participating in many national as well as international projects on enterprise modelling, process integration, and knowledge management.