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Utility Aspects on Strategic IT-Integration Issues

by

Hans Ottosson, Rune Gustavsson and Jan Bosch

Department of
Computer Science and Business Administration
University of Karlskrona/Ronneby
S-372 25 Ronneby
Sweden

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UTILITY ASPECTS ON STRATEGIC IT-INTEGRATION ISSUES

Hans Ottosson
President
EnerSearch AB
Carl Gustavs vag 1
S-205 09 Malmo
Sweden

Rune Gustavsson
Professor
University of
Karlskrona/Ronneby
S-325 27 Ronneby
Sweden

Jan Bosch
Ass. professor
University of
Karlskrona/Ronneby
S-325 27 Ronneby
Sweden

ABSTRACT

The traditional industrial society is currently in a rapid transition towards a society where information and knowledge are prime assets. Information technologv is the main enabler for this social change. However, in addition to an enabler, information technologv also is an integrator. Traditionally, the different producers of products, utilities and services had their own infrastructure towards the consumer. In the future, the leve1 of interaction between the provider and customer will be so advanced, that no single producer, especially not the utility provider, can afford to construct the required infrastructure independently. Alternatively, multiple interested parties need to jointly develop a shared infrastructure that fulfils the combined requirements. Utility providers, operating in an increasingly global and dynamic market, can earn a competitive advantage by proactively experiment and install an infrastructure to provide additional functionality to the customer. Otherwise, the advantages of decreased production cost and increased customer satisfaction will be exploited by competitors. This paper discusses the efforts of EnerSearch, a subsidiary of Sydkraft and IBM, in exploiting information technologv in two major projects. The Integrated Distribution Automation & Management (IDAM) project aims at improving the management of the utility information needs, whereas the Information, Society, Energy, System (ISES) project is more general, with the intention to provide a platform for implementing and assessing new services, products and trading. The knowledge obtained in these ongoing projects alreadyproves to be highly valuable for determining future strategies in the utility market, the dwelopment of new products and services and the identification of appropriate co-operations with providers in other domains.

1.0 THE NEW INFORMATION SOCIETY

Our society is undergoing a rapid transition from a mainly industrial society to a society where information and knowledge are prime assets. Information technology (IT) is a factor that will have a great impact on our future every-day life. We all know how computers can assist us in writing letters, do our accounting, and serve as communication links to the outside world. We have got used to the fact that we can connect our computers to each other, and form networks by using ordinary telephone lines. We see no limitations in our possibilities on the new information highways. The technology as such seems not to be a limiting factor of the future possibilities. We already have adapted to the fact that the impact ofinformation technology by now is limited by lack of forceful applications to justify needed investments in infrastructures, and not only by available technology. We finnly believe that such applications can be found within the services of the future utilities. We also believe that the utilities should not develop particular or isolated solutions in their information networks. The boundary definition of a utility is likely to change in the future and possibly remain movable.

In short, the ingredients of the information society exist and are evolving at an ever increasing pace. The utilities should take advantage of that fact, make use of the benefits and influence the advancements.

The emerging impact of IT on our society in general also generates push-pull forces on how utilities should develop their future business processes and the corresponding information structures. The utilities should, in a proper way, integrate their information infrastructures with other information networks in order to provide new services to their customers and to enable new business possibilities.

In Sweden, as in many other countries, IT is part of national R&D programmes. The goal is to provide interactive access of information to citizens needed in different situations. Information highways integrate intratnets of communities, schools, universities, libraries, hospitals and other organisations. Already, business activities take place on the electronic markets.

All of those players are developing their own IT Strategies. It is essential that the utility industry became an active partner in the transition into this new world.

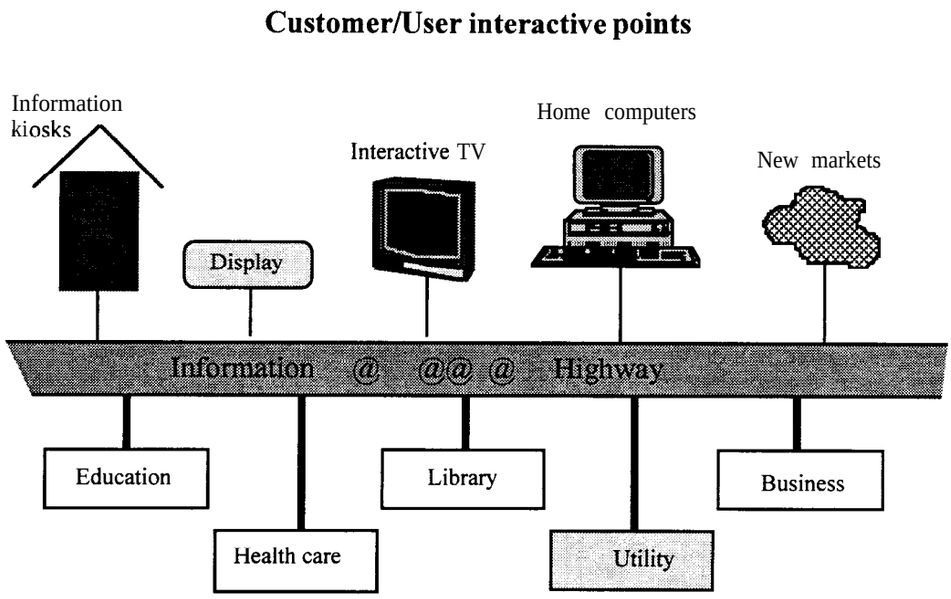

Figure 1: The future information society integrates all kinds of services to the users.

2.0 THE IMPACT OF IT ON THE ORGANISATIONAL STRUCTURE

The current era is a time of change, changes in technology, changes in organisation structures and changes in the markets of organisations. Organisations in the 21st century have a difficult time to live up to the changes of their environment. A number of these changes deal with the changing role of the customer, the customer is not an outsider of the Company but has become a part of the business activities. The business has to approach its customers in a completely different manner. Secondly, the market of organisations has been globalised, so that virtually the whole world is the market. This means that not on only the customers are part of the new market, but also more international competitors belong to this group. The last and very important change is the development in technology that has increased the analysis and supply ofinformation and the productivity within the companies. Also the changes in technology have played an important role in the globalisation of the market. With the help of new technology infrastructures, such as Internet and the World Wide Web, organisations are now able to reach a larger public, i.e. customers, suppliers, competitors, share-holders and others that could be interesting for the organisation.

All these changes in the environment of organisations have caused business to adjust their organisation structure in order to survive. There are several ways of changing the structure, such as decentralisation and mergers with other companies. However, recently there is a trend towards holistic organisational change instead of changes in small parts of the organisation. An increasing number of organisations is developing a structure that emphasises the business process instead of functional departments. The traditional structure of a functional decomposition (dividing the Company into departments where specific functions were petfornred) is suddenly exchanged fora more flexible and dynamic structure based on the

business processes. The new structure could be an organisation based on processes, like in business process re-engineering, or it could be an organisation that works with virtual, temporary projects and for these projects a special organisational form is used to support the project. An example of the above mentioned organisational forms could be a virtual organisation or a network organisation.

A virtual organisation can be defined in two ways:

It can be a temporary network of independent companies linked by IT to share skills, costs, and access to one another's markets [1]

It can be an organisation that is distributed geographically and whose work is co-ordinated through electronic communications [2]

The network organisation is:

An organisation where independent people and groups act as independent nodes, links across boundaries, to work together fora common purpose; it has multiple leaders, lots of voluntary links and interacting levels [3]

In both the virtual as well as in the network organisation, the communication and the main activities are supported by an information system; in particular, availability of information and communication between members in the organisation. The new organisational structures am developed in order to be flexible, dynamic, easy to change and less hierarchical so that the employees obtain more responsibility. The organisations change from being hierarchical and functional decomposed into a project or process oriented organisation with a less hierarchical structure. However, one could actually question whether the information system, the management, the work and the responsibilities have changed too, so that they can support the new organisational structure. Lately, more and more organisations realise that by changing one aspect in the organisation also other aspects have to be changed, however, many do not yet include the information system as one of these aspects.

One can state that the conventional information system (IS) are rather static and still hierarchically composed. As mentioned above, the information system should match the organisation. This means that it should have a similar structure, so that it is able to support the organisation.

3. 0 THE UTILITY HAS ITS OWN INFORMATION AND KNOWLEDGE NETWORK

In the previous sections, the ongoing changes in society and in organisational structures have been discussed. These changes also affect the domain of utilities, and utility providers need to pro-actively meet the expected changes. For many utility providers, the degree of competition is increasing constantly and, for many other providers, this will soon become a reality due to the removal of the monopoly structures that may have existed for many decades. Moving from a monopoly to an open utility market requires the provider to have a competitive advantage over its competitors. We are convinced that this competitive advantage will be achieved through the use of information technology. IT can be used in many ways to increase competitiveness. One example is the ability to offer advanced services to the customer, possibly even combined with products or services from different segments. Providers that are unable to offer this functionality will lose from the cost effectiveness as well as from the customer orientation perspective. Whereas these two dimensions used to be contradictory, information technology is able to combine the dimensions in a synergetic way. Thus, adapting to the changes in society is of strategic importance.

The utility represents its own information system, through the large number of customers and distributed microprocessors throughout the electrical grid. It is important for the utilities to form their own standards and methods, and to link relevant information to the society systems. A joint utility view would enhance this process. This would also rapidly support the development, production, and market of distributed components. Meters, sensors, and other units working on the utility communication infrastructure are urgently needed.

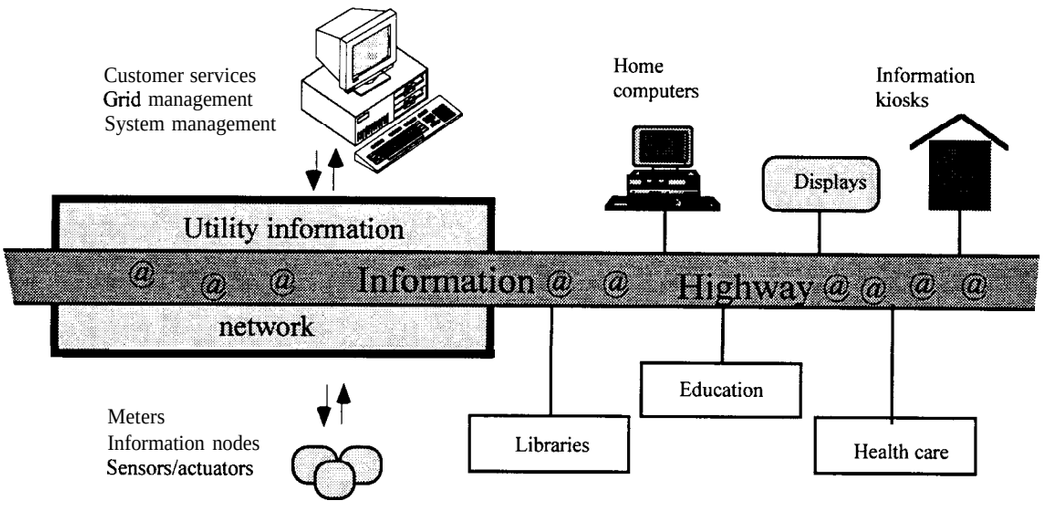

Figure 2: The integrated utility/society information system

The investments in the new utility infrastructures are considerable and can possible not be justified by singular services. Re-use and standards are necessities in such an endeavour. The system must support a multi-user interface for customer support, decision tools and different types of other services. It is important that the standards provide for interoperability, and that the system design is flexible in the choice of the physical communication networks.

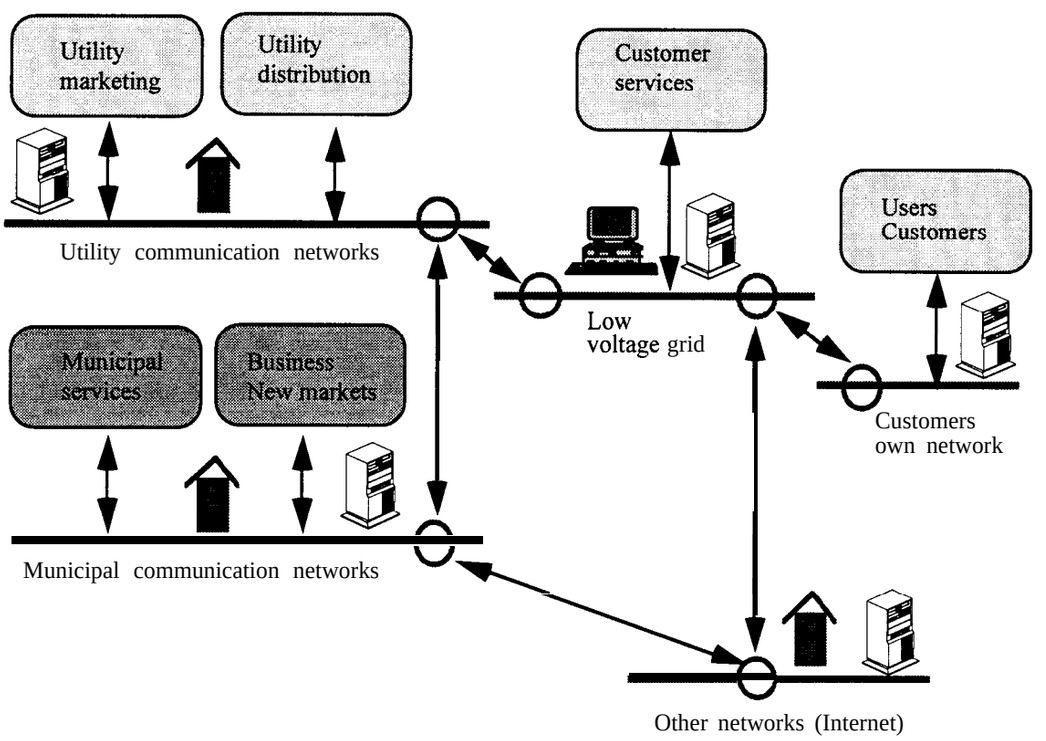

Figure 3:The need for integration and standards between the different networks.

The implementation and utilisation of infrastructures and services on enterprise networks, power nets, home nets, and Internet are considered as the main growth areas of future world wide IT. The low voltage grid is one of the future communication medias, on which a growing communication can be expected. The business areas Power Generation and Power Distribution together with Customer Services can be modelled as intelligent objects, or agents, which use different networks to communicate and negotiate services and prices of energy [4].

Development of at least de facto standards are urgently needed. We witness today market announcements of systems for specific applications: remote metering, distribution automation, customer information or any other "limited" purpose. But as was stressed earlier, cost effective investments in flexible and hence durable infrastructures demand that we define an overall architecture, which easily can adapt services such as those mentioned, but also new ones, to handle the utility needs 5 or 10 years from now.

5.0 IDAM - INTEGRATED DISTRIBUTION AUTOMATION AND MANAGEMENT

IBM and Sydkraft are co-operating, through the constitution of EnerSearch AB, in the development of an efficient and open utility information platform. The system should be seen as a decentralised infrastructure aiming at the management of utility information needs. A brief description of the system is given below:

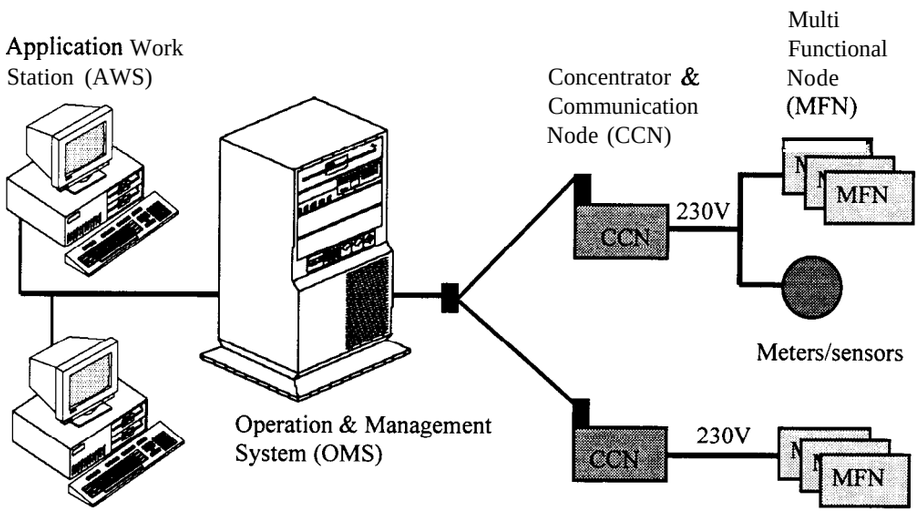

Figure 4: IDAM - a decentralised infrastructure for the integration of utility needs and customer services.

The Application Work Stations (AWS) are arranged as a multi user system. They serve as administrative tools to manage the IDAM system and the different applications attached to the system. The application software is developed in co-operation with the respective user to meet specific needs. Market applications, grid management, metering control and customer services are typical examples on AWS functions. The communication between the AWS and the OMS is based on any fast and reliable data network with sufficient capacity. A standard protocol is used.

The Operation & Management System (OMS) is a central computer with the responsibility for the overall system control and management. Some of the OMS functions are:

- system and network management
- access and security control
- meter management
- command interface
- application workstation interface
- global communication interface
- data gathering
- audit log

The OMS serves as the database and communication organiser. Quality control of both data and communication is carried out. Metered values are examined in a quality test function before stored. Scalability is important in the specification for the OMS Unit.

The Communication & Concentrator Node (CCN) represents the gateway to the locally distributed infrastructure. The CCN is equipped with an intermediate database to store metered values and other parameters related to any local application.

The CCN communicates with the OMS on any preferred media like ordinary phone lines, GSM digital technology or own cabling. In the other direction, the communication is based on LonWorks and the A-band Echelon transceiver. The use of the low voltage grid is of great advantage, utilising the existing infrastructure for communication.

The distributed system undemeath a CCN is built on open protocols to safeguard that different sensors and meters can be used. Again, standards are important for the manufacturers at this fast growing market of distributed components.

The Multi Functional Node (MFN) is one of several expected distributed components based on LonWorks. The node includes an A-band transceiver, an application microprocessor, I/O-ports, memory, a real-time-clock, serial interfaces and an expansion-card option for specific applications.

5.0 INFORMATION, SOCIETY, ENERGY, SYSTEM - THE "ISES" PROJECT

The ISES Project [5] provides a unique arena for implementing and assessing possibilities of new services, products and trade. ISES is based on the idea of utilities as spearheads into future use of information technology, to the advantage of the industry and its customers as well as to the society as a whole. The field test is performed at "Ronneby", a city within the Blekinge County in the south of Sweden.

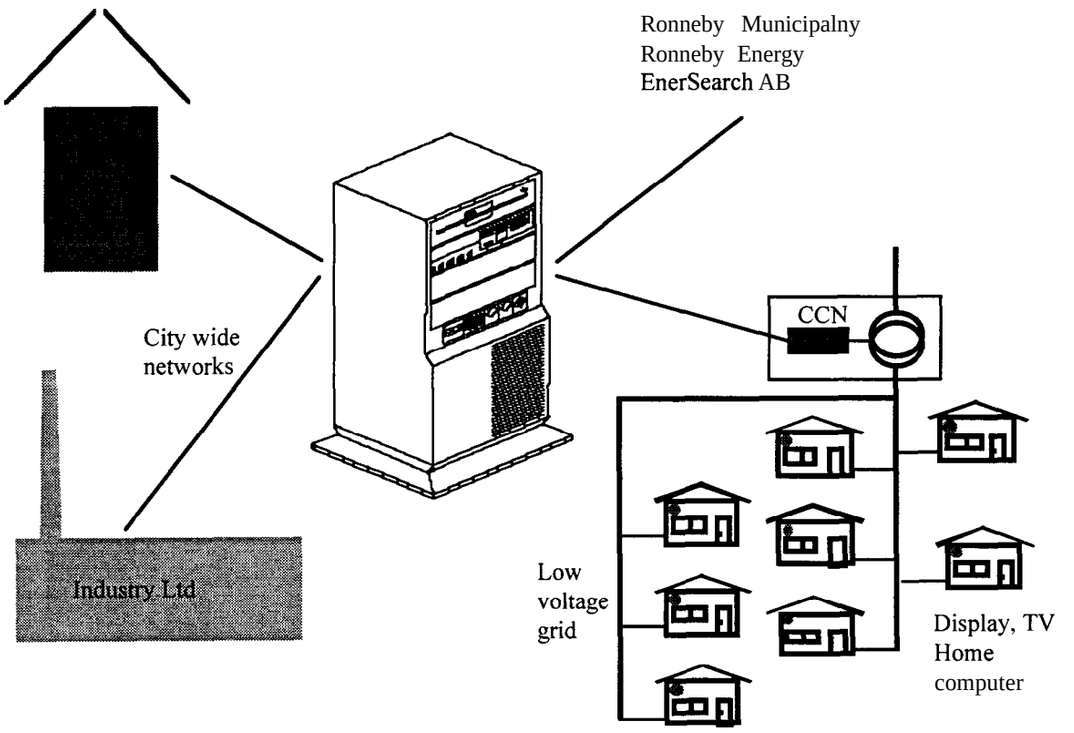

Figure 5: The ISES project enables and supports an integrated view of important existing and plantred information structures.

The ISES Project (1996 - 1998) undertakes research and development in 9 sub-projects:

Sub-project 1: New business strategies

Theme: Strategies for customer orientated interactive market communication, with focus on the development and empirical test of models for ideal market dialogues, linking together various relevant theories of strategy, marketing, information and decision-making.

Objective: Analysis of the significance in two-way market communication as the strategy for value-added utteraction between customers and suppliers.

Sub-Project 2: Information kiosks

Theme: Design, use and acceptance ofinformation kiosks, equipped with sound and video opporhmities.

Objective: Analysis on how municipalny information opportunities can utilize information kiosk technology. The kiosk will be located at a suitable place, preferably in a public building.

Sub-project 3: Databases and standardised interfaces in information systems

Theme: Studies on general functionalities, standardised electronic documents and databases. The project maps out the standards intended to apply for various actors within the new information infrastructure, and proposes co-ordination for common access to shared information.

Objective: Increased searchability and interpretation of information utilised in general information networks.

Sub-project 4: Virtual organisations

Theme: Virtual organisation models creating co-operation in organisations where the participants are distributed in geographical locations. The study take into account organisational models, methods of communication and interactive co-operation in complex organisations.

Objective: Methods of rationalising the organisation in distributed organisations utilising advanced information technology and object-oriented methods.

Sub-project 5: Simulation of the energy system

Theme: Computer simulation of energy systems for the analysis of cost minimisation over a selected period of time. Investments, depreciation and operating costs are taken into account. The energy system is simulated with respect to the system's purchasing and production opportunities and to market-oriented measures.

Objective: Technical and economic rationalisation in energy systems.

Sub-project 6: Computer control technology for energy systems

Theme: Analysis of control systems and communication on the low voltage grid for increased efficiency in connection with technical as well as market-oriented measures.

Objective: Installation and commissioning of a computerised control and monitoring system in the distribution network.

Sub-project 7: Communication on the low-voltage grid

Theme: Defming characteristical parameters related to the electrical low-voltage grid as a communication medium, e.g. noise levels, attenuation and transient phenomena.

Objective: Specialised knowledge on communication on the low-voltage network.

Sub-project 8 - Distributed load control

Theme: Development of methods for applied software-based agent technology within a secondary sub-station area for automated dynamic load control. The process may be compared to an "inquiry/offer/decision" method, where the measure should result in the desired reduction in demand ata minimum of cost and loss of comfort in the energy system.

Objective: Automated, distributed load control for increased utilisation of investments made in existing distribution networks.

ub-project 9: Distributed decision islands

Theme: Analysis of opportunities and beneficial effects in distributed, intelligent decision islands based on microcomputers in local networks. Previously developed agent-oriented technology will be reinforced and focused on decision-making processes for market applications and technical use.

Objective: Intentional selection of different types of messages from a common database in a secondary sub-station through communication on the low voltage grid.

8.0 CONCLUSION

Information and knowledge will be prime assets in the new society. IT is one of the main enabler in the process towards this change. The organisational strucmres will be more dynamic and flexible to meet the demands. The virtual network organisation will become a reality.

The utilities have their own information networks through the large number of customers and distributed nodes throughout the electrical grid. This infrastructure should be integrated with the needs of the society. In the future, the leve1 of utteraction between the provider and customer will be so advanced, that no single producer, especially not the utility providet-, can afford to construct the required infrastructure independently. Alternatively, multiple interested parties need to jointly develop a shared infrastructure that fulfils the combined requirements.

The IDAM system represents the development of an efficient and open utility information platform. The system should be seen as a decentralised infrastructure aiming at the management of utility information needs

The ISES Project provides a unique arena for implementing and assessing possibilities of new services, products and trade. ISES is based on the idea of utilities as spearheads into future use of information technology, to the advantage of the industry and its customers as well as to the society as a whole.

9.0 ACKNOWLEDGEMENTS

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9.0 BIOGRAPHIES

Hans Ottosson holds a degree in electrical engineering and a Ph.L (1985) in energy systems from Linkoping University, Sweden. Currently, he is the President of EnerSearch, a subsidiary of Sydkraft and IBM, and Director at Sydkraft, Corporate R&D. Sydkraft is one of the member companies of SwedPower. His research interests include the field of distributed microprocessor infrastructures used in large information systems. He was responsible for the introduction of load management in the South of Sweden (1986 - 1989). Mr Ottosson suggested a System Design for Load Management at the Abu Dhabi Electric Utility (1991) and have had special commissions on a programme for the Institutional Development of INE in Nicaragua (1992). E-mail: hans.ottosson@sydkraft.se

Rune Gustavsson is at present professor in computer science at the Swedish University of Karlskrona/Ronneby and the manager of the research centre SIKT at the same university. He has earlier been professor at the Universities of Uppsala and Lund. Before joining the university of Karlskrona/Ronneby he was research manager at the Swedish Institute of Computer Science (SICS). Gustavsson has been an acting partner in several international research projects and evaluation committees, and also served at several program committees of workshops and conferences. Gustavsson's main research interests are open systems, multi agent systems and knowledge management in organisations. E-mail: rune.gustavsson@sikt.hk-r.se

Jan Bosch received a M.Sc. in computer science (1991) from University of Twente, Netherlands, in and a Ph.D. in computer science (1995) from Lund University, Sweden. Currently, he is an assistant professor at the University of Karlskrona/Ronneby, Sweden. His research interests include extensible object-oriented language models, paradigm extensibility, object-oriented compilation techniques and object-oriented software architectures. E-mail: jan.bosch@ide.hk-r.se

ENERSEARCH AB

IBM Utility & Sydkraft

Research on distributed microprocessor infrastructures

Sponsors

ABB Network Partner
IT Blekinge
IBM Utility
PreussenElektra
Ronneby Municipality
Sydkraft

Business idea: Research results

Research platform

Karlskrona/Ronneby university
Lund university
Linköping university
The Danish university, Copenhagen

Ronneby Municipality
The County of Blekinge

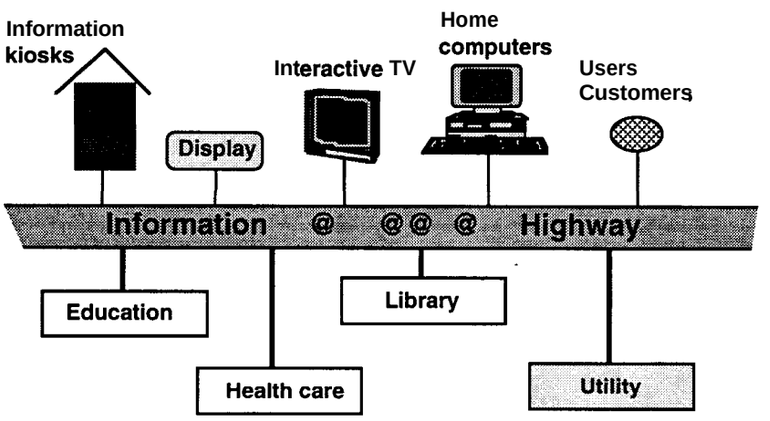
What impact will modern information technology have on the future society?

Helicopter view

Society functions
- customer communication / marketing
- information management
- "virtuell organizations"

Technical systems
- communication networks / standards
- energy system / grid utilization
- transports / logistics

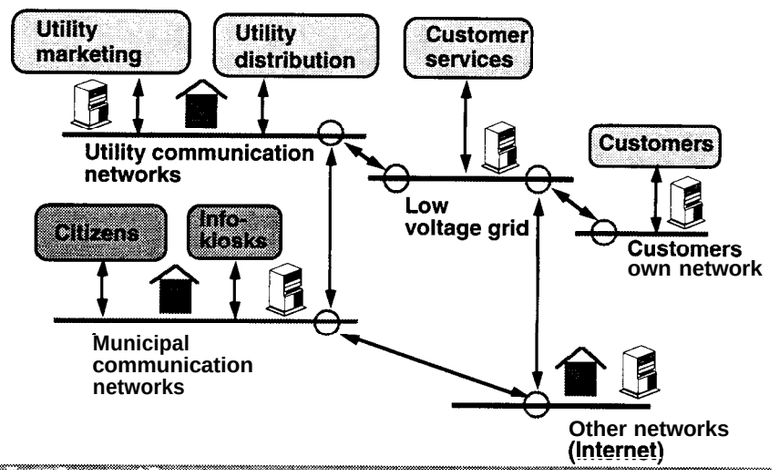
The new information societv



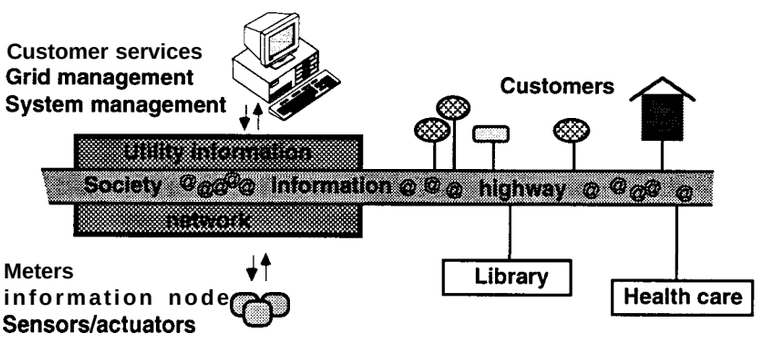
Communication technology Important strategic knowledge

Synergy needed in shared networks

Communication networks



Information management



Methods and standards to generate, store, present and re-use data are key areas

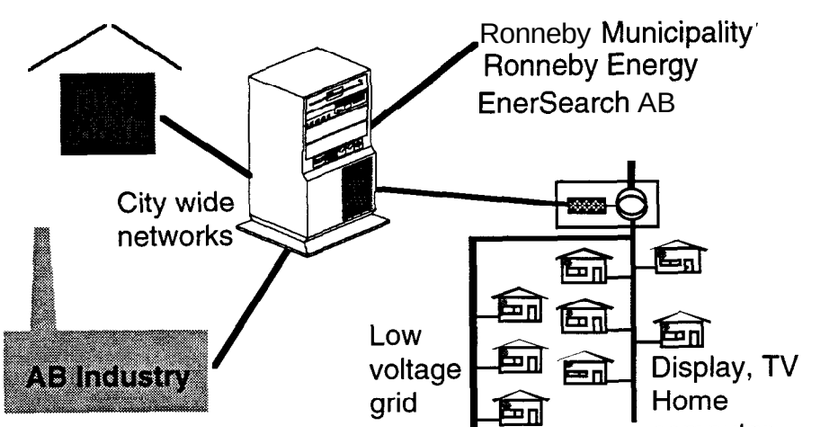
The "ISES" Project
Information/Society/Energy/System

Blekinge as a fullscale laboratory
- 1996 Ronneby city
- 1997 Blekinge county
- 1998 New functions, evaluation

Regional development
- new work oppurtunities

Co-operation industry / university

Pilot installation Ronneby



The "ISES" R&D Projects

1. New Business Strategies
   - value added functions by interactive communication

2. Information Kiosks
   - design, use and acceptance of information kiosks by the society

3. General Platforms in Communication Networks
   - standards and tools in distributed, networked databases

continue....

The "ISES" Project
continue....

4. Virtual Organisations
   - methods for eff icient work processes in distributed organisations

5. Energy System Simulation
   - evaluation from generation to end-user for the most cost eff icient solution.

6. Energy System Computer Technology
   - integrated distribution automation and management

continue....

The "ISES" Project
continue....

7. Power Line Communication Technology
   - characterization of the low voltage grid patameters

8. Distributed Load Management
   - increased utilization of the electrilcal distribution grid

9. Distributed Intelligent Software Agents
   - will distributed knowledge have an impact on future energy systems