Planet Internet
Challenges Facing Informatics

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Abstract

The Internet has during the past few years experienced an explosive growth. It is seen as a unifying socio-technical concept for the development of open and simple standards. As such it has proven to be a strong force in setting the agenda for the development and use of software. How can we explain this change, and what are the general issues? What impact do the resulting radical changes have on society and social institutions? How do they affect work, education, health care, legal and political institutions? How do they change the conditions of doing business and making a living, of building families and becoming a professional? The paper is unconventional in providing highlights from a book documenting the results from a longitudinal research network. The rationale is to raise a set of general issues and as such, in the format of a paper, enable a more strategic discussion about our discipline and the main challenges we in informatics are faced with.

From big calculator to global network

Since the computers were first invented, in the 1940s, their use has undergone a number of radical changes. First, the computer was a calculator built and operated by scientists in white coats. With the emergence of commercial mainframe computers in the 1960s, the computer became the central information processor for businesses. In the early 1980s the computer changed into becoming a personal productivity tool supporting the individual. But soon the personal computers sitting on people's desks were connected in local area networks, enabling sharing of resources and cooperation. The explosive adoption of Internet technologies during the 1990s has woven such local networks into a global network, making up the infrastructure of information society. The technology is now marketed as a communication medium, and the future looks bright for the computer playing the role of personal intelligent agent or assistant.

How can we explain these changes, and what are the general issues? What impact do these radical changes have on society and social institutions? How do they affect work, education, health care, legal and political institutions? How do they change the

conditions of doing business and making a living, of building families and becoming a professional?

To begin to answer these questions we take a look at the central concepts used to describe the use of the technology throughout it's life span. The scientists and their huge hand-made computers dealt with *data*, which they stored and manipulated. When the computer was taken out of the scientific and military context and brought into businesses, the focus shifted to that of *information*. Of course, there was still data on the tapes and punch cards, but the way the technology was understood was as an information processing technology supporting transactions. The data was made subject to interpretation and refinement. This view is to a large extent still the dominant perspective.

But the notion of information technology (IT) has grown into a more general notion of *communication* technology emphasizing that the technology is increasingly being used as a communication medium, and not only as an individual tool. Currently there is a strong interest in studying how we can understand the use of the technology in relation to *knowledge*, i.e., not only information as interpreted data, but information with meaning or values attached. What concept will be able to capture the use of computer technology in a world of global networks linking technology and people in ways we could hardly imagine less than five years ago? Perhaps the concept of *interaction* can serve as a focal point for analysing and designing the role of computers in such a world.

The digital collision

Looking beyond the computer on what is happening today in the arena of technology use, a relatively simple way of illustrating the technological challenges we are faced with is to describe the convergence of different technologies. Traditionally, the telephone and the telegraph supported conversation or messages transmitted by wire. Data were stored and manipulated by transaction processing systems such as the computer. Radio and TV provided broadcasts transmitted through the air. Many of the new technologies promoted can be viewed as mixtures of the computer with its processing power, the TV which enables broadcasting, and the telephone with the capability of peer-to-peer communication.

This convergence has led to computer-mediated interaction permeating more and more aspects of society. Interaction between computers, computer supported interaction between people and interaction between people and computers can all be viewed as instances of interaction. Some of the examples of this convergence of technologies are: electronic mail, voice mail, the cellular telephone interfacing with personal digital assistants, pagers, and pay-per-view television. Interoperability between technologies via gateways allows us, for example, to send faxes and SMS messages not only from telephones but also via the Internet, and to have e-mails read out from the telephone.

The fact that the isolated mainframe in the corporate basement has transformed into a node in a global information infrastructure combined with an increasingly global market for businesses has led to radical changes in the conditions for developing and using information technology. Information technology has become interaction technology. In the modern world of business, responsiveness is crucial, and with this comes a need for quick uptake of emerging technologies. In order to understand interaction, we must both study it from a theoretical perspective and in situ. The immense complexity involved in networks of human and computers interacting, can only be

understood and designed if we pay proper attention to both the deep theoretical aspects and to the contingency of human activities.

Technology is changing the world, but not always in the way we think and want it to. Not only are we experiencing a convergence of technologies. The world of technology use is a messy one. The use of technology is not all glitter and chrome, but can be very pragmatic and mundane. On the one hand, do not believe that the world of tomorrow will be swarming with intelligent agents, who will be highly visible and do everything for you. On the other hand, there is probably already now an agent in your new dishwasher, and it is written in Java!

New issues on the agenda

The radical changes in the way interaction technologies (computers, telephones, television) are used, lead to new challenges for how to describe them. The shift from the individual machine providing processing power, to a network of machines, implies that we need to understand networks in a more complex sense than simply as the technical connections between machines. We must look at the role of people and technology in the formation and reproduction of networks understood as institutionalised practices. The integration of separate networks also becomes an important issue. Organisations increasingly demand and technology increasingly allows people to conquer temporal and spatial boundaries, making the issue of mobility and the use of mobile information technology an important one.

As an example, the estimated 106 percent diffusion rate of cellular telephones in Finland by the year 2000 implies that for many young people this will be their first and only type of telephone (*Wired Magazine* 7:01). Also, the rapid growth of personal digital assistants (PDA's), handheld multi-purpose computers that increasingly merge with cellular telephones, has and will continue to have a profound effect on working life. As “everything is connected to everything,” the notion of the *system* as the most appropriate unit of technology analysis becomes increasingly uninteresting. The *system* concept implies order, overview, and control. However, in large networks of people and technology which over time has grown by an inner force more than as a result of a rational design process, the institutionalised practices and technical solutions can not be easily changed as a result of new design decisions. The guiding principles will have grown from local needs for interoperability, interaction, and standards. The resulting networks can more appropriately be viewed as infrastructures that have been shaped by cultivation, than as systems that have been designed.

The emergence of the Internet and the World Wide Web, which enable interaction, competition and resource sharing on a global scale, also implies that we need to view the development of technology in a different light. Increasingly, applications are developed and assembled by cloning existing applications, and by “gluing” together existing components. The notion of tinkering, or *bricolage*, describe these phenomena more appropriately than the notion of rational design. With the emphasis shifting from the technology being an individual productivity tool to being an interaction medium, we must change the way we understand the process of organisations adopting technology. It may very well be that the intended purpose of the technology and the suggested patterns of use gradually are replaced and redefined through the everyday use of the technology. The telephone is a good example of how such a change in use has taken place. The inventor, Graham Bell, intended the telephone to be used as an effective medium for

conveying short business messages. As it happened, the use of telephones drifted in all directions to becoming a backbone for both business and private communication. Indeed, as argued by Guice (1998):

> At various times and places, telephones have been considered worthless toys, a medium for musical concerts, and a kind of telegraph. (Guice, 1998, p. 207)

An abundance of readily available standard components means a high potential for inventing new technologies with a relatively small investment. On the other hand, the market for the developed product or service, will most often be global, and therefore imposing harsh demands on innovation and scalability.

Interaction technology is creating new markets. IT allows companies to forge stronger links with their customers, and to employ new business-to-business links. On the global scene of technology enabled business, attention can be a better unit of measurement than monthly revenue. There are several good examples from the World Wide Web. ICQ (www.icq.com) was bought by AOL and Hotmail (www.hotmail.com) by Microsoft, both for enormous amounts of money simply because of their customer base and technological innovations, despite of the fact that they had not generated any substantial revenue. Currently Netscape and Microsoft battle over the attention of the users, but not for immediate revenue. The software is given away for free because the companies hope to make the revenue in other areas.

What is Internet anyway?

One of the critical factors for the convergence of technologies, for the creation of a global interaction technology, is standardisation of platforms. In the past ten years there has been no stronger standardisation force than the Internet. It is Internet that has played the central role in the digital collision, and in the creation of a global information infrastructure. Being about Internet the book addresses more fundamental and principled issues than the immediate ones related to the diffusion and use of the various Internet services. We will discuss file transfer, discussion groups, electronic mail, chat rooms, and the World Wide Web, but our major task is to develop a theoretical perspective helping us understand the role of interaction technology in society, in our everyday life, in business and at work. It is the amazing diffusion of Internet that is transforming the world into a global electronic market. A discussion of the importance and social role of global information infrastructures naturally begins with a presentation of Internet. So, we will give a brief outline of the history of the Internet and a short introduction to the basic technical concepts.

The Internet plays an increasingly important role in both information systems practice and research. For a long time the Internet was called something else. In fact, the notion of the Internet as a single identified entity is a bit misleading. Internet is a network of networks, and a result of a series of mergers through deployment of gateways and adoption of common protocols. Internet is not only a technical network of networks but a much more complex socio-technical network of computer researchers, funding agencies and technology (Guice, 1998).

The Internet has evolved immensely from its birth in 1969 as the ARPANET (Advanced Research Projects Agency Net), an experimental network between contractors and computer science researcher working for the US Department of Defence. The revolutionary technical idea behind the network was to provide wide area network

connections via packet switching instead of dedicated communication channels. The decentralised method of distribution using the principle of least resistance enables packets to find their way even if part of the network is congested or out of service.

From the mid-1980s and until 1990 when ARPANET was decommissioned, it proved very successful as a world wide information infrastructure for faculty, staff and students at universities and research centres. In 1991 the American NSF (National Science Foundation) removed the restrictions against commercial use of the Internet. The release of the World Wide Web software developed by Tim Berners-Lee, the same year, is one of the main driving forces in this third period of the Internet. Now it is being used widely by large and small businesses, by private citizens, in schools and by consumers (Guir, 1998).

The explosive adoption pattern we have witnessed during the past decade can, however, also be attributed non-technical factors, such as the organisation of the standardisation process for Internet protocols. Several researchers have argued that the strength of the TCP/IP (Transmission Control Program/Internet Protocol) protocol, which is the basis for the Internet, and the service standards, such as, HTTP for World Wide Web servers, HTML (Hyper Text Markup Language) for documents and FTP (File Transfer Protocol) for file transfer, is that it is sufficiently advanced to do the job while at the same time being sufficiently simple to be successfully adopted widely.

The method for implementing standards is through Requests For Comments (RFC), where proponents of a certain standard or service, writes a technical report describing the innovation. This report is then published on the Internet and commented on by the community. In order for an innovation to be fully accepted as a standard, it must be implemented on several computer platforms and demonstrated to be stable. The Internet can be viewed as a result of user driven development in the sense that all the initial users were researchers and computer experts who had significant impact on the development of standards and services. The fact that a very powerful standard alternative to TCP/IP, OSI (Open Systems Interconnection), with powerful backing lost the battle is an important illustration of how information technology develops from user initiatives within rather than political decisions from outside.

From avant-garde to basic right to main player

It took radio 37 years to gain 50 million listeners world-wide. Television needed 15 years to gain 50 million viewers. The World Wide Web had 50 million surfers within 3 years (Observer Internet Supplement). Internet as a unifying concept for the development of open and simple standards has proven to be a strong force in setting the agenda for the development of commercial software.

Initially the Internet was a communication technology for the chosen few who could master the complex instructions and happened to be in the right place. Now, it seems ordinary people and politicians alike discuss access to the global network as a basic human right. The American Government is currently planning to equip every citizen with an electronic mail account.

A number of generally available services are made available on the Internet. There is a standard protocol for electronic mail supporting asynchronous communication, an Internet Relay Chat (IRC) service for synchronous interaction, news groups for focused broadcasting, the FTP protocol for exchanging files, and the World Wide Web for publishing electronic documents and for gluing together other services. These and

other services and standards are used for a large number of diverse purposes. The Internet is both a publicly available communication infrastructure and the backbone for closed proprietary intranets. There can be found static text documents as well as highly interactive services. The combination of the internal company intranet supporting the operations of the organisation and the external company internet facilitating customer contact has led to a new type of system, the extranet, which blurs the boundary between the company and its customers and suppliers. One of the best known examples is the US Federal Express (www.fedex.com), who provides its customers with direct access to the internal package tracking system in order to real time trace where the package is.

As with any technology, there are many different opinions about the Internet. The Internet has, if any, been a catalyst for polarising opinions. On the one hand, it has been hailed as the bastion of ultimate freedom. The open and democratic process in which the Internet has been created has been used as a metaphor for how people will and should behave when populating cyberspace. On the other hand, it has spurred intense debates about issues such as the negative effects of freely available information, about the influence of large multinational corporations, and not least about the availability of pornographic material.

Opening the Internet to commercial interests in the beginning of the 1990s led at the same time to a dramatic increase in the amount of available material of general interest. It did, however, also lead to increasing polarisation, with large organisations making heavy investments in order to establish a presence. Very little revenue so far has been generated directly from the Internet, excluding advertising revenue and companies buying shares in Internet related companies. With a global market, most consumers are not yet ready to pay directly for Internet services, when a relatively comparable one is available for free, or only for the price of providing your personal data.

The first many years of the Internet, the infrastructure was strictly devoted to academic and other non-profit activities. However, in 1993-94 commercial activity was allowed, and a mad race for cyber real-estate began. Many organisations have made money by registering names and selling them to companies who are looking for a prime location. In a sense you may say that size does not matter in cyberspace, yet: Imagine that you are a commercial gardener who grow fantastic carrots. You can then establish a website, www.carrots.com. Providing that you can manage to establish the necessary logistical system for providing customers with carrots, you can in principle be the biggest and most well-known carrot provider on the net. On the other hand, brand new companies and institutions are not the only ones populating the Internet. Old institutions have moved to the web and brand new ones grow up. Reuters and CNN are good examples of existing institutions that quickly established strongholds as news providers. The on-line bookstore Amazon (www.amazon.com), on the other hand, did not exist pre-web. In a world of very little structure and where the big players had not established themselves, it was relatively easy for new institutions to form. Yahoo (www.yahoo.com) is perhaps one of the best examples. Right now there is a race for world dominance among the big players, such as Netscape, Yahoo, Exite etc. They are all putting in bids for world dominance in terms of being the first place people go when they want to navigate the web. So you may say that size is everything in cyberspace when it comes to web portals. This competition mirrors the attempts of operating systems developers to gain world dominance and hence be the de facto standard. Many of the development efforts on the web can be viewed as attempts to turn the information infrastructure into a global operating system.

Information for freedom or control

Some argue that the Internet will save us all from all sorts of disasters, and generally transform humankind into peaceful co-existence on a truly democratic basis. Others argue that the increased possibilities for free markets across borders combined with increased possibilities for monitoring behaviour will lead to a nightmare society where ordinary people constantly are monitored and controlled, and where most people work for low wages. We believe that it is important to balance the discussion between Technology Utopia and Technology Phobia. Technology is neither bad, nor good, nor neutral.

In order to discuss the role of the Internet and the possible consequences of future developments, we need to balance two concerns. On the one hand, some people argue that technology is a train we can not stop or even change the course of. Some, on the other hand, argue that the actual technical properties of the technology does not matter because we as users of the technology can just choose to use it in a way which suits us. On the one extreme you believe that technology has a life of its own that can not be affected, on the other extreme you think that technology only matters to the extent that we let it matter. This discussion is a fundamental one within the philosophy of technology, and we have no ambition of resolving this issue here. We just want to make one observation.

In a world of interaction technology, it is of course inviting to view the relationship between people and technology in terms of interaction. People and technology are joined together in a network of interactors, some of which are human and organisational and some of which are technological. When analyzing the emergence of the Internet, it is, on the one hand, too simple to assume that there is one internal Internet logic driving the process and that it is impossible to affect the course of development from outside. On the other hand, we can view Internet as a powerful actor in the development of technology. If a system does not integrate with Internet, then it may risk losing its appeal. Here are some examples.

A number of applications, for example, Lotus Notes through Domino, and SAP R/4 offer Internet connectivity as main selling points. Whole corporations have reoriented their strategies as a result of the Internet phenomenon. IBM has re-launched itself as the e-commerce Internet company. Service providers such as America Online (AOL) and Prodigy were forced to provide gateways from their networks to the Internet. Microsoft initially also made strategic investments in the proprietary, closed, Microsoft Network. The company was subsequently forced to adopt an Internet strategy when it realised the power of the phenomenon and the fact that it could not be centrally controlled. Standard software packages become instantly more marketable if they provide Internet access. In most games, support for playing over wide area networks is a must. If the Internet can be viewed as an actor in the field of commercial software, what are some of the effects then for the Information Systems profession? Most of the themes we will discuss may have been interesting even before the emergence of a global information infrastructure, but the global information infrastructure, Internet, has made the themes even more relevant.

The Internet Project 1995 - 1999

The Internet project (http://internet.adb.gu.se) was conceived in 1994 on the initiative of Pål Sørgaard as a cooperative endeavor bringing together researchers at Oslo University

and Göteborg University. This was the year that Internet really became well known in Scandinavia. The Swedish prime minister Carl Bildt sent email messages to president Clinton and urged the Swedish nation to make the "IT-leap." The Internet project was motivated by a realization that Internet and the World Wide Web would quickly change the use of information technology so radically that we would have to reconsider the role of information technology in shaping work and life, as well as our own role in developing information technology use.

The Internet project quickly turned into an international research network, doing empirical studies of Internet use in combination with suggestions for technology development. Research became organized in autonomous activities in response to the original ambition of the project to give a rich overview of the main aspects of the use of Internet technology: electronic publishing and changes in the use of documents, mobile and ubiquitous personal communication, the growth of virtual worlds and a new informational infrastructure, new forms of cooperation in networking organizations, new professions, and substantial changes in our everyday lives.

The particular aims of the Internet project, within the general topic defined by its name, is defined by the interests of the network and has been changing. On a more general level, the ambition has been to contribute in four general ways: (a) developing theory of information technology use, (b) performing design oriented empirical studies of such use, (c) developing and testing applications, and (d) developing a new curriculum for informatics education.

Two theoretical approaches have dominated the research group (in addition to original, individual contributions by members of the network). On the one hand we all have our background in the Scandinavian approach to systems development, and the user-oriented, participatory, action-research, interventionist perspective of that approach, as spelled out in Dahlbom & Mathiassen (1993), in many ways sets the agenda for the project. On the other hand, we have all been struggling to better understand the role of technology in shaping society, the way people and technology constitute each other. The ideas of Bruno Latour have played an important role in our discussions, and actor-network theory has been used to analyze issues of standardization and flexibility in the development of Internet.

The Internet project is an interdisciplinary cooperation of researchers from computer science, information systems, and ethnology, combining technical development with empirical case studies and theoretical analysis. The different activities in the project are held together by a common approach to the study of the use of information technology. We are particularly interested in the role of Internet technology in advanced knowledge organizations, such as pharmaceutical research companies, public administrations, news providers, and hospitals. Much of the research has been design oriented case studies of Internet use in such organizations.

The project is funded by the Swedish Transport & Communications Research Board. The project leader is associate professor Kristin Braa of the University of Oslo.

Research methods

The research reported has its origin in the discipline that in the the US is called information systems (or management information systems). But one of the ambitions of the Internet project has been to break out of the research tradition of that discipline with its focus on methods of information systems development.

If we look at the development of computer technology use, it is easy to see that the discipline called information systems (IS) was born in, and for a long time defined by, the early use of computers as information systems. When personal computing and human-computer interaction was all the rage in the mid-1980s, the IS researcher went on thinking and talking in terms of systems development, extending the notion of information system to cover other forms of computer technology use, such as word processing, desktop publishing, and communication.

The pioneering programmers with knowledge about numerical methods, algorithms and data types, who had acquired competence in systems analysis, design and development, never really learned interface design, human-computer interaction, and user modelling. Instead, it was psychologists who in the 1980s entered the field, performing experiments and doing usability tests. The large systems development projects gave way for mass produced software, graphical user interfaces, and new ways of interacting with computers. But the information systems profession kept defending their mainframes and character screens all through the 1980s. It was really only when client-server networks were introduced towards the late 1980s that the information systems specialists finally accepted the personal computer.

When the Internet project was conceived in 1994, it was as a deliberate reaction against the conservatism of the information systems discipline. If we missed the personal computing stage, we wanted to make sure to be on board from the very beginning of the Internet era. We stopped worrying about information systems and turned our attention to information technology, to networks, Internet, and mobile computing. Rather than going on about "developing information systems" we began defining our discipline in terms of "using information technology," making sure to stress the design orientation of our research to distinguish it from traditional social science. And we began to think of such design oriented studies of information technology use as the heart of all of informatics.

Informatics is a broad and sprawling collection of knowledge items and research issues somehow related to computer technology. It ranges from mathematics and electronics to psychology and sociology. And yet, to the extent that you make computer technology the essence of the discipline, the heart of informatics will be the use of that technology. For what is technology if not artifacts designed for use? So, whatever the nature of your research, be it mathematical, electronic, or linguistic, if it belongs to informatics it is because in the end it contributes to improved use of information technology.

In the Internet project we perform design-oriented studies of information technology use. We examine the use of technology with the ambition to come up with new ideas for such use. Our research typically begins with ethnographic studies of human activities, such as work, education, health care, or entertainment, with a focus on actual and possible use of information technology. The aim of such studies is diagnostic, trying to identify possibilities for improvement both in technology, the way it is used, and the way the use is organized. On the basis of such studies, use suggestions are made, application prototypes are designed and developed, organizational change is initiated. This is the heart of our research, the idea generation phase. It can be followed by implementation and evaluation studies, testing the ideas, but such testing is of secondary interest only.

Thus, research in the Internet project is focused on creative idea generation. It is bordered on two sides by more traditional research approaches: the initial phase of ethnographic, descriptive studies and the final phase of positivistic hypothesis testing. It has to defend its more unorthodox creative orientation against these two, avoiding both

falling into the trap of endlessly careful work practice descriptions, or methodologically impressive testing of well known ideas with obvious outcome. With a research orientation that is tracking (leading?) the development of new technology, the Internet project is uninterested both in careful description and testing for its own sake, rather than as means to further idea generation. Why, unless you are a historian, describe in detail a work practice that will soon be replaced due to new technology? And why evaluate with great care an artifact that soon will be replaced by something very different in a very different organization of use? Both ethnography and positivism suffer from the natural science syndrome of taking the world for granted as it is. In informatics we are interested, not in nature, but in the artificial world and we are interested in improving its future, not documenting its past.

The scientific community is rightly conservative, and our view of research is radical. This makes it difficult for us to seem quite respectable as we stress the creative aspect of scientific work. So we often have to fall back on the two more respectable phases of our scientific method. We spend more time than we want on the ethnographic studies, and we may even accept to do applications evaluation. But we do it grudgingly. How come it can be so difficult to make creative work, the generation of ideas, seem scientifically respectable?

From a slightly different perspective, the scientific methods used in our research may not seem radical at all, resembling as they do the systems development methods of the old discipline information systems. In the typical waterfall method you analyze, design, implement, and test. And so do we. But this only goes to show that on a slightly more abstract level we carry on the tradition. But on a concrete level, the differences are substantial.

The field of information systems research does indeed provide a meeting place for the joint and in-context study of work, management, and technological issues. However, the multi-disciplinary nature of information system research can lead to researchers finding themselves caught in an uncomfortable space, falling between research traditions that have different notions of relevance and rigour (Keen 1991) and, as a consequence, different research methods.

The research is founded upon the belief that the primary laboratory for information system research is the organisation, where the development and use of technical artefacts can be studied in-context. The organisational laboratory provides researchers with a rich setting for investigating the work, management, and technology issues associated with information systems.

Issues in Informatics

The Internet is no longer an exclusive academic experiment; it is both big business and the life of a large population. We will in this section describe general challenges the IT community is facing. The fact that the Internet functions as an information infrastructure implies that issues outside those strictly related to the Internet must be taken into consideration. General issues related to, for example, increased networking, the relationships between standardisation and flexibility, and the increasing need for people to manage interaction, etc., all become much more important when a common interaction infrastructure

From paperwork to network

Much information in organisations is based on paper documents. Despite all the dreams of the paperless office, there are still a lot of paper in most offices. At the same time, the amount of electronic documents in offices grow rapidly as well. How can we more fundamentally understand the role of documents in work settings?

Documents—and what we can do with them—change when they become electronic. Use of documents in organisations has a powerful but often ignored history. Negotiating transitions to and from paper-based and digital forms imposes a very complex problem. Transforming paper documents into digital documents may create new services but may also reveal that much work relies on the very existence of paper documents. Such work practises are developed through conventions connected to production and use of documents over time. In order to exploit the potential of digital documents need to be standardised in some form. Aligning the document production process and the degree of document standardisation is a challenge. Well-known problems may here be intensified, such as making sure that those who do the work will not gain the benefit. Standardising documents will often involve a wide range of actors, both those who produce the documents, where the document it selves often play a role, those who deliver information and those who use the document in various ways. One of the fundamental contradictions in this domain is the one between standardisation on the one hand and flexibility on the other. The World Wide Web offers a good example of this contradiction. The fact that HTML has emerged as a standard means both restrictions for the individual text author, and infinite possibility for reaching an audience. If the author chooses to use a format that is less restrictive, and therefore more flexible, then the audience may be much smaller. Not everybody has access to Latex of even Microsoft Word.

The production of electronic documents can enforce a standard, making it more flexible to use and reuse the document at a later stage. On the other hand, it may in some situations be more feasible to allow for less standardisation of the documents in order to make it easier to produce them. This can, however, lead to problems later on because the documents in effect are unstructured. One of the challenges here is to resolve the contradiction by providing gateways allowing a certain degree of flexibility without enforcing too much standardisation.

From design to cultivation

In this section we widen the scope from use of documents to include the communication in organisations where documents are organised in company intranets. Internal organisational information and communication can be organised in more or less structured intranets which are internet facilities behind organisational firewalls. The forms and norms of communication in organisations are developed through socially shared genres. A genre of organisational communication is a typified communicative action invoked in response to recurrent situations. The business letter is a good example of a genre that has evolved out of businesses communicating with businesses by writing letters. The early business letters were styled as personal letters from one person to another. They subsequently evolved into letters that went straight to the point in business terms. Genre analysis is an approach to study communicative practise and the relationship between communication and organisation. Genre analysis can be applied to understand how the development and use of intranet evolve through cultivation rather than through

explicit design. This understanding may have implication for design of communication technology and its role in generating and shaping genres. Cultivation is a way of shaping technology that is fundamentally different from that of rational planning, engineering methods and construction of technology. Cultivation is a conservative belief in the power of natural systems to withstand our effort of design, either by disarming or ruining by breakdown. Cultivation is founded on the technical systems as organisms with a life of its own, meaning that technology can be an actor in it selves.

From product to service

Intranets are internal to organisations. Looking outwards, we need to investigate changes in the relationships between organisations and their customers. Increasingly this can be characterised more as a matter of providing services than of selling products.

One such example is the business of digital newspapers – a particular genre of web sites designed to convey news over the net. The newspaper has been a source of information and entertainment for centuries. The emergence of the web has spawned the discussion of whether printed news will decrease as people turn to the Internet. Although initial feared that digital media would mean the end of printed news, there is no evidence today that the digital media is influencing the sales curves of printed newspapers. Rather it seems as though digital news has developed into a genre of its own. The genre of digital newspapers has inherited many of the form and content characteristics of printed newspapers. The content structuring concept of sections used in digital newspaper is very similar to that of printed newspapers, but additional structuring concepts are introduced. Digital media affords different types of functions, the ability of users to invoke predefined actions that yields an output. Digital media also affords the representation of virtual spaces, locations where users can be present and possibly meet other users. The basic entity of an article is still the content carrying atom of digital newspapers as for printed newspapers. However, the computer screen is not comparable to print of paper in terms of real estate, much less data can be presented on a page in a digital newspaper. This has lead to the emergence of what we denote as composites – pages that only serves the purpose of presenting large number of articles in a limited space. Articles in digital media are, thus, presented multiple times to the user, in composites with other articles, as very short descriptions, and in separate pages that present articles in traditional ways.

From transaction to interaction

Service is all about interaction. The technology enables increasingly interaction among people and not only means of performing simple transactions. IT generally enables interaction among people. In a world of global competition, decreasing hierarchical control of the workforce and increasing possibilities for interaction is the name of the game as means of increasing organisational response to the customers. The impact of technological advances within communication and information technology can clearly not be exaggerated. Instant availability of communication through faxes, mobile telephones, electronic mail, pagers and video conferencing has meant that people working or doing business together can interact despite being temporally and spatially “dislocated”. This is all well and good, but if technology enables you to reach the rest of the World with the push of a button, then you might be available to the rest of the world with a touch of each of their buttons as well. The concept of *interaction overload* is introduced which characterises situations where the interaction that the individual needs

to engage in does not meet his or her co-operative preferences. The concept is a further development of the well-known concept of information overload characterising situations where the information presented to the individual exceeds his or her cognitive capacity.

From stationary to mobile work

The fact that interaction increasingly is disconnected from geographical and temporal constraints imply that the issue of mobility must be studied more carefully. Work—as well as life in general—is becoming increasingly mobile. A flexible and distributed organisation of work is increasingly widespread. In combination, customers and partners expect more, such as better service and improved fit. Thus, it is, in many aspects of working life, necessary to travel, visit and wander foreign sites to stay competitive. Mobile computing and cellular telephones are becoming prevalent. Many researchers contribute to the area by identifying and resolving the *technical constraints* of for example wireless networks and small displays. This will alleviate some shortcomings of this new technology. We believe, however, that innovation of *use* will become proportionately important. Dispersed and networking groups may benefit from the traditional group functions, such as co-ordination and sharing, without introducing too much bureaucracy and losing the essential advantages of networking. Networking is here used to describe work practices within which social networks are essential. Social networks are established, maintained and developed on an individual basis. Group working, on the other hand, is a group explicitly designed for a purpose. Its members have been assigned different roles, the interface towards the customer is more homogenous, co-ordination of work if typically more formalised, and so on. At a first glance, networking and group working seems to exclude each other; for instance, how could one possibly combine extensive use of personal networks with optimal group co-ordination?

From order to chaos

Wherever and whenever people work, they increasingly communicate and collaborate using information and interaction technology. The fact that more and more activities thus takes place in or are documented in Cyberspace implies that more and more activities leaves behind traces for later inspection and analysis. Some of these traces are left as an unintended by-product, such as the log containing user queries to an on-line database. Here, the fact that the use of a system easily can be logged means that the log containing the traces of user behaviour can inform the service provider about the usability of the system and the typical interests of the users. Web based services who offers web sites customised to the particular web browser logging onto the site, can, for example, save a log of the browsers. Some traces are intentionally designed with a purpose of their own, for example, the digital traces placed every day by consumers who have joined a loyalty scheme in their local supermarket. Consumers allow the shop to record their purchasing behaviour against receiving loyalty points. The shop, of course, primarily aims for loyal customers who will place their customs at the shop each week, but it is clearly also important for the shop to establish the buying behaviour of it's customers. Large national supermarket chains with hundreds of shops can, for example, use this data to optimise the logistics of producing and transporting goods, and to create profiles of customers for marketing purposes. Similarly, a service provider on the Web, will often require of it's customers to fill in a forms containing personal data. The symbiotic

relationship between the loyalty scheme member and the supermarket is, however, not the only use of traces. There is not necessarily always common interests between the party who leaves traces and the one analysing them. Itemised telephone bills can, for example, be used in criminal courts to prove guilt or innocence. Viewing World Wide Web as a huge body of ill-structured text that is the result of human activity, emphasises the fact that it is something which is already present, outside our control. Somebody else than us has left it there to be inspected, and they have not necessarily left it in any structured state. How can we understand and support the navigation of ill-structured textual traces of human activity? A conceptual model characterising Web navigation is suggested, it characterises navigation as consisting of four functional elements: declaration, search, exploration, and evaluation. The framework is used for characterising the process of surveying 83 Swedish Web sites, and also provides the concepts for analysing navigation support functionality available. Presentation of results from the Web survey illustrates how we can understand and study textual traces. Studying ill-structured textual traces involves significantly different challenges that the ones associated with data-mining structured databases.

From control to drifting

The themes described above all dealt with phenomena related to the use of emergent infrastructure technologies. In the following, we take a look at ways of more generally understanding the world of people and technology. We must be able to understand change in a world of increasingly interconnectivity. Is change planned and managed, or is it to some extent outside the scope of human control? Does the emergence of global infrastructures imply that changes are increasingly difficult or even impossible?

This first contribution wants us to abandon the traditional way of explaining how we make use of technologies in organisational life. It argues that we can not only look at this activity as a planned, monitored and controlled process. Indeed, it may slip and slide and create a life of its own. Work is situated, distributed and unpredictable. The planning, monitoring and control of the use of technology is complex. We can not assume that there are simple causal relationships between management action and member behaviour. One way of understanding and describing the way the use of information technology can change over time is the notion of drifting. This opposes the classical models and methods concerned with active control efforts that have effect. By drifting we mean a slight or significant shift of the role and function in concrete situations of usage, that the technology is called to play compared to the planned, pre-defined and assigned objectives and requirements – irrespective of who plans or define them. The drifting phenomenon also captures the *bricolage* or tinkering with technology and the sequence of ad hoc adjustments. Technology drifting is a widespread process. The various instances of drifting unveil a variety of learning processes taking place around the innovation and punctuating its internalisation within the organisation. Such processes may range from improvisation to radical reform but tend to occur in fragmented loose ways. Drifting seems to lay outside the control of various actors.

From systems to infrastructure

On the other hand, it would be very wrong to look at the use of IT as an entirely drifting affair. You are not alone! IT is not a stand-alone technology anymore, but closely integrated with practices, procedures, and the installed base of technology. Every time we

do something we have to take the installed base into consideration. Existing structures can both help and hinder you in getting where you want to be. They can help you integrate, and they can limit your possibilities for change. The scope for control over an infrastructure can be limited, and management have to live with a resource that they can govern only in part. The governance of infrastructure is a problem, not a given, since there can be multiple stakeholders with conflicting interests. The outcome is that the infrastructure can expand and grow in directions and to an extent that is largely outside the control of any individual stakeholder. Building large infrastructures takes time. All elements are connected. As time passes, new requirements appear which the infrastructure has to adapt to. A whole infrastructure cannot be changed instantly - the new has to be connected to the old. The new version must be designed in a way making the old and the new linked together and "interoperable" in one way or another. Hence, the old - the installed base - heavily influence how the new can be designed. Infrastructures develop through extending and improving the installed base. The focus on infrastructure as "installed base" implies that infrastructures are considered as always already existing, they are *never* developed from scratch. When "designing" a "new" infrastructure, it will always be integrated into and thereby extending others or it will replace one part of another infrastructure. This has been the case in the building of all transport infrastructures. Every single road - even the first one if it make sense to speak about a such - has been built in this way. When air traffic infrastructures have been built, they have been tightly interwoven with road and railway networks - one needed these other infrastructures to travel between airports and the travels' end points. Air traffic infrastructures can only be used for one part of a travel, and without infrastructures supporting the rest, isolated air traffic infrastructures would be useless. A large information infrastructure is not just hard to change. It might also be a powerful actor influencing its own future life - its extension and size as well as its form.

From infrastructure to networking

In this section we look closer at the notion of infrastructure and its role in our understanding of society, comparing and contrasting the society we are leaving, dominated by machine technology, with the society we are entering, built by information technology. We argue that the notion of infrastructure, obviously useful as it is in theorizing about industrial society, can be very misleading when used in theories about information society. In particular, we concentrate on, what we take to be, the four central ingredients in the notion of infrastructure: (a) the idea of infrastructure as a foundation underlying society, (b) the idea of infrastructure as a stable structure, (c) the idea of infrastructure as a common resource, and (d) the idea of infrastructure as a common standard.

Information technology is not the stable basis of information society. It is a flexible means of communication, by which social structures are formed, reformed, and dissolved, in a continuous process of networking. Information technology is characterized by its lightness rather than by its weight and inertia. It is relatively inexpensive so that we can afford to compete rather than share, and it is an adapter technology that invites us to experiment with several standards at the same time. Rather than forming a stable infrastructure for information and service production, information technology introduces a more flexible and lightweight, networking, society without infrastructure. We end by saying something about that society, about its networking, nomadic, organizations, and about everyday life in such a society.

Farmers and factory owners are people of substance, and processes and change are always secondary to substance in their conception of the world. The idea of infrastructure is a powerful example of substance thinking. A networking, nomadic society may perhaps be better described with verbs than with nouns. It is a networking society, not a network society. It is activities and actions rather than organisations and agents that make up that society.

From systems to actor-networks

On a very general level, we would argue for the need for new ways of characterising the integration of technology in everyday life. Understanding the world as hard and soft systems makes us focus on transactions. Looking at the world as networks of actants makes us focus on the complex interrelationships between technology and people. This section provides us with relatively simple concepts for investigating a complex world of people and technology. An approach that takes the role of artefacts seriously in the sense that almost every aspect of our society is permeated by technology. This, in turn, implies that the traditional distinction between people and technology will blur since it distracts us from the actual pragmatics of technology use. Within management and engineering literature, technology is primarily seen as something to be designed, i.e. being completely controlled by and a product of human activity. In other literatures, more focused on macro level processes, the usual story is how technology change the world, often portrayed as revolutions (the microprocessor revolution, the information revolution, etc.). In these stories technology is the master - or designer - and society it's material being "designed." These two opposing views correspond to social constructivism and technological determinism respectively. Most people would claim that both these extreme positions are wrong. The true picture is somewhere in between. Humans are shaping technology under some constraints at the same time as technology influence the development of society beyond what was intended by the designers without completely determining its path. Agreeing that extreme positions are wrong is certainly easier than finding a "middle position" carefully spelled out. Actor network theory is one such attempt. In actor-network theory, technological and social elements are considered tied together into networks, based on the assumption that technologies are always defined to work in an environment including non-technological elements - without which the technology would be meaningless and would not work either. In the same way, humans use non-human objects (technologies and other artefacts) in all our dealings in our worlds - our existence in the world is based upon the existence of these objects. Accordingly, neither humans nor technological artefacts should be considered as pure, isolated elements, but as heterogeneous networks. Elements in such a network are not initially defined as human, social or technological, they are referred to by a common term - actant. These assumptions do not deny any differences - or borders - between what is social and what is technological. However, these borders are seen as negotiated, not as given.

Cultivating Planet Internet

How can we affect the development of Internet technology? Some would argue that this is only possible if we are so powerful that we can engage in global competition with the largest and smartest players. Others claim that the best technology does not always win, and argue that everybody has a fair chance of changing the game if they are good at

reading it. Traditionally, technology disciplines in general and the computing profession in particular, has been design oriented. There has always been a strong focus on changing things, preferably to the better, but at least changing. Based on the arguments promoted above, it only makes limited sense to focus on design of technology alone. When each technological component must be seen as a component in a complex and distributed network, where human and technology actors together constitute a network, the design of the individual technical component only tells us part of the story. On the other hand, with a global market for ideas about how we can bring new technology into use, and with infrastructures in place where these ideas can be expressed in a powerful way for a very large community of users, there still is room for good ideas.

In order to frame the discussion about design, we suggest the notion of cultivating the use of information technology. This brings the relationship between all elements in the network to the fore. What are then the main issues related to cultivating Planet Internet?

What used to be requirement driven is now driven from standards, fashion, and opportunities. Independent of what is "good" and "needed" shit continues to happen in what sometimes seems to be an utterly unplanned fashion.

This discussion is an attempt to initiate a discussion of a reorientation of our field. Our aim is to address some of the challenges for the IS field created by the new integrating technology. The current situation can be regarded similar to the early days of computer technology when code and fix was the standard practice. We need to establish techniques and guidelines for building horizontal as opposed to vertical information systems. The main challenge our field will be faced with is to change our perspective sufficiently to understand the unique features, and still bring with us the wisdom from previous experiences.

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