



AMBIENT SWEDEN

Internet Foresight – How Sweden
will become a leading Internet
nation in 2015



THE ROYAL SWEDISH ACADEMY OF ENGINEERING SCIENCES (IVA)
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The project's steering committee consisted of the following individuals from IVA's network:

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We would like to thank everyone for their great commitment and the insightful experiences the participants have generously shared, as well as the valuable and important viewpoints that have resulted in the project's proposals. We offer special thanks to the heads of the three panels: Bo Boivie from HiQ for his work with the *User Panel*, Olle Viktorsson from Ericsson, *Infrastructure Panel*, and Henrik Nilsson from Bird & Bird, *Security and Legal Panel*. Eva Stattin, Communications Director and Ann-Margret Malmgren, Project Assistant, both with IVA, have worked extensively on the project. All of the project participants are listed in the appendix.

Finally, we would like to stress that all forward-looking analysis must contain a large measure of humility. Developments are rapid, especially in the area of technology, and it is not easy to predict the future. This should not, however, prevent us from trying. We hope that the project's proposals will be well received and further developed by the recipients of this report. Our ambition is that the proposals presented in this report will lead to the establishment of a programme – *Ambient Sweden* – which will help to realise the vision of Sweden as a successful Internet nation in 2015.

Stockholm, April 2008

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Summary

The Internet is playing an ever more important role in our lives. Today, private individuals, businesses and organisations are dependent on the Internet for numerous functions in both business and private life. The need for infrastructure and Internet services is rapidly growing. Among other things, the Internet offers a multitude of opportunities for companies and government agencies to expand and improve their offerings. A determined effort towards integrating information technology in society is also helping to reduce the impact on the climate by reducing the need for travel and rendering transportation more efficient. In many respects Sweden is already at the forefront of development. If Sweden is to maintain its position, it is vital that we as a nation play an active role in influencing development in the area. Issues concerning the future of the Internet affect many people and organisations. Developing proposals for steps to take so that Sweden can be a prominent Internet nation in 2015 has been the goal of the work presented in this report.

In IVA's *Internet Foresight* project around 50 experts have worked intensively with issues concerning the future of the Internet. They include individuals who have built up the Internet in Sweden, people from the private and public sectors who are knowledgeable in this area and individuals who are well-informed about research into the future of the Internet and Internet-based services. Three expert panels have addressed the issues from three different perspectives: the user perspective, infrastructure requirements and security and legal aspects. The work of the expert panels is presented in separate reports that can be ordered or downloaded from IVA's website: www.iva.se/internetframsyn

The prospects for Sweden to strengthen its position within the Internet field are good. According to the latest statistics from the Swedish Post and Telecom Agency (PTS), Internet access in Sweden

is among the highest in the world. In 2007 demand for mobile Internet grew significantly. Children and teenagers regard the "Web" as a natural and self-evident part of their everyday lives. But the older generations are also getting more and more from what the Internet has to offer.

Numerous players are focusing on securing a strong position in the market. On the commercial side, we see international corporations such as Intel, Google and Ericsson advancing their positions through acquisitions. Fresh statistics from the Institute for Advertising and Media Statistics (IRM) show that advertising on the Internet increased by 230 per cent from 2005 to 2007, from SEK 1.7 billion to SEK 4.1 billion. The value of Internet advertising is now almost equivalent to TV advertising. More and more organisations are choosing the Internet as a channel for marketing as well as information and communication.

In reports from the World Economic Forum we see that countries with a well-developed IT sector tend to have greater growth. Other factors are, of course, contributing to growth, but countries such as the US, South Korea and Sweden have enjoyed a long period of growth above the OECD average. One explanation is that they have a high percentage of IT-based companies, but also high IT use within the private and public sectors.

The development of the Internet has been fast and its emergence has not been accompanied by any real control measures. This has resulted in a number of negative consequences. We are all familiar with the existence of such phenomena as spam, child pornography, chat forums where people pose as someone else, bullying and illegal trade with medicine and drugs, as well as illegal file sharing. These crimes and behaviours themselves are not new, but the Internet has made it easy to be anonymous and to act in a lawless realm. For some, the Internet has become a separate virtual world where national and international regula-

tion and laws do not apply in the same way as in the physical world. Criminal and unethical behaviour on the Internet often goes unpunished, which is also part of the reason for its success and popularity. Doing nothing about these negative consequences could erode confidence in the Internet. Loss of confidence will result in users turning their back on the Internet and ceasing to use services that involve economic transactions and personal information. Lack of trust also means more manual work, instead of the simplification of administrative tasks that the Internet otherwise can offer. Efforts to promote trust in and ethical behaviour on the Internet are therefore an important concern for everyone in society.

For various reasons, Sweden should be and is capable of being involved in leading development in this field. The project has identified a number of areas that are crucial to development. Below are the project's proposed measures to ensure that Sweden will be a prominent Internet nation in 2015:

New opportunities for businesses and the public sector

By building further in areas where we are already strong, Sweden can, by 2015, be a leader in mobile Internet, be best at e-administration and green IT, and also be regarded as a pioneer within digital media distribution. This requires determined and targeted initiatives and investment.

Raise the level of trust in the Internet

This can be achieved by generally increasing awareness of the importance of information security among users, businesses and the public sector. Internet infrastructure needs to be robust, i.e. providing uninterrupted and high-quality service. Introducing a general and accepted national e-identification system is another measure that could increase the level of trust in the Internet.

A common service market

Internet users must be able to get the services they need independent of access and carrier networks. This is not the case today. Steps should therefore be

taken to make it possible to create common services such as e-mail addresses that follow the user and not the operator; communication services such as video conferencing or TV and music services that are not dependent on which operator a user is connected to.

Infrastructure for future Internet services

The capacity requirement for an average user is 100 Mbps – both via fixed and mobile connection. To meet this need we must have long-term and predictable regulation that does not present an obstacle for investment in the area by operators and other players. Nor should there be any inappropriate competition through tax financed expansion of broadband networks. A system involving buying services in a competitive environment should ensure that even individuals and businesses in areas where market players are not investing fully will also have access to broadband.

A business-friendly climate

The prospects for starting, expanding and operating businesses must be as good or better than in the countries with which we are competing. This involves everything from exploiting innovation to seed financing and having a simple set of rules. The rules need to support foreign citizens and people with the necessary skills with the desire to work and live in Sweden, enabling them to do so.

The distance between steps on the digital ladder will be reduced through increased competence

In the past we have talked about a digital gap between those within the information society and those on the outside. Now we see a digital ladder where new steps keep appearing – for all users. There are many different levels of digital competence, and the different levels (steps on the ladder) are not static, but are instead constantly changing as the technology is developed. In order for Sweden to take the lead as a prominent Internet nation in 2015, we need a conscious effort to help and inspire people to climb the digital ladder. This needs to be a joint effort of the public sector, schools, labour market players and citizens' organisations.

A flexible working life

In 2015 there will be a strong demand for a new order in the labour market. Distance work could be a success factor for Swedish industry and the public sector. New forms of communication are supporting regional development. Systems and applications that facilitate more personal contact from a distance via the Internet are necessary if Swedes are to climb the digital ladder. In order to attract competence, reduce the need for physical meetings, free up resources, reduce personal stress levels and help to reduce environmental impact, it is important to promote a more flexible working life using the Internet as a tool. The various parties in the labour market need to develop a new order for a flexible future working life.

Introduce computer studies and IT-based teaching in schools

We need to develop teaching methods for all subjects that make better use of the opportunities offered by IT and the Internet. Investment in this area should include resources for pedagogical research, teacher training in technology use and development of the appropriate tools. In this context, Swedish innovation companies could play an important role, both nationally and internationally. We would also like to see a new compulsory subject – computer studies – introduced into the school curriculum. Computer studies should cover technology, ethics and media scrutiny, all of which are important skills to possess in order to climb the digital ladder.

Research and innovation that places Sweden at the top

In Sweden we have teams of world class researchers as well as numerous researchers with the potential to become world-class experts. Maintaining and expanding this research front is essential if Sweden is to be a successful Internet nation. We propose the establishment of an "Internet of the Future" committee tasked, among other things, with producing the basis for a research budget. Internet foresight must help to ensure that Swedish industry is competitive and stimulate the creation of new enterprises.

International profiling

Swedish players need to continue to actively participate in international organisations that focus on Internet use and standardisation, particularly within mobile Internet, e-administration, green IT and digital media distribution. Swedish players must actively participate in important, tone-setting conferences. The fact that both Swedish and foreign companies have a positive view of being established in Sweden reinforces our position. In order to achieve coordination at the national level and to be in concordance at the international level, we propose the creation of a network. The main purpose of the network would be to work with initiatives that are structured, long-term and predictable.

With the initiatives and measures in the above-mentioned areas, we believe that Sweden can achieve its goal of being a leading Internet nation in 2015. To ensure that this happens, we would like to establish a programme – *Ambient Sweden* – to realise the proposals generated by *Internet Foresight*. The *Ambient Sweden* programme will drive the development and implementation of the proposals. IVA is an appropriate organisation to continue to promote these efforts and initiatives, which should be carried out in cooperation with a broad range of other players. The programme should be launched in the first half of 2008 as this could generate additional detailed materials to use during Sweden's chairmanship of the EU in autumn 2009.



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I. Ambient Sweden

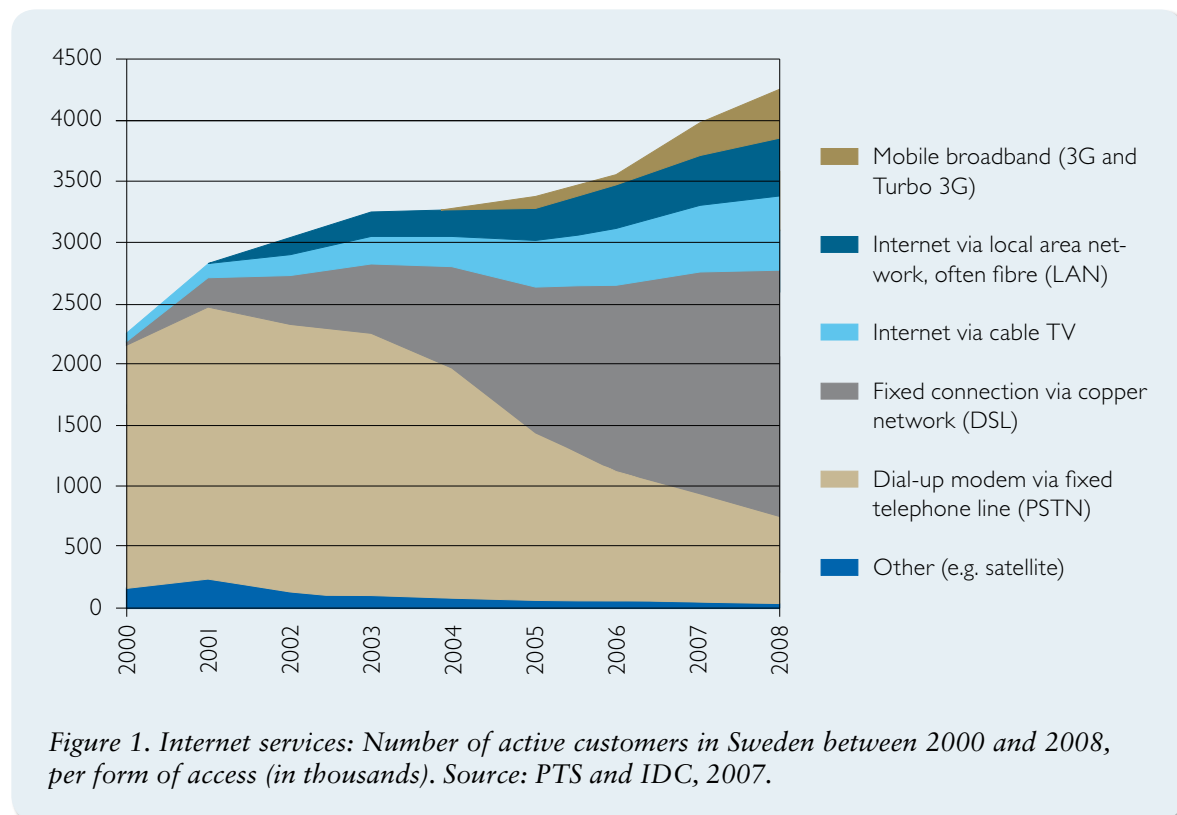
In the future there will be a greater demand for a “personal Internet” where every individual has access to the Internet in every situation, for all of the individual’s needs and with the requisite quality and security for universal trust in the system. To achieve a personal Internet, online services should be easy to access and use. The services should encourage greater Internet use and the spawning of new services and business opportunities. Services should be able to be accessed regardless of which service delivery network is used. To make this possible we need a common service market.

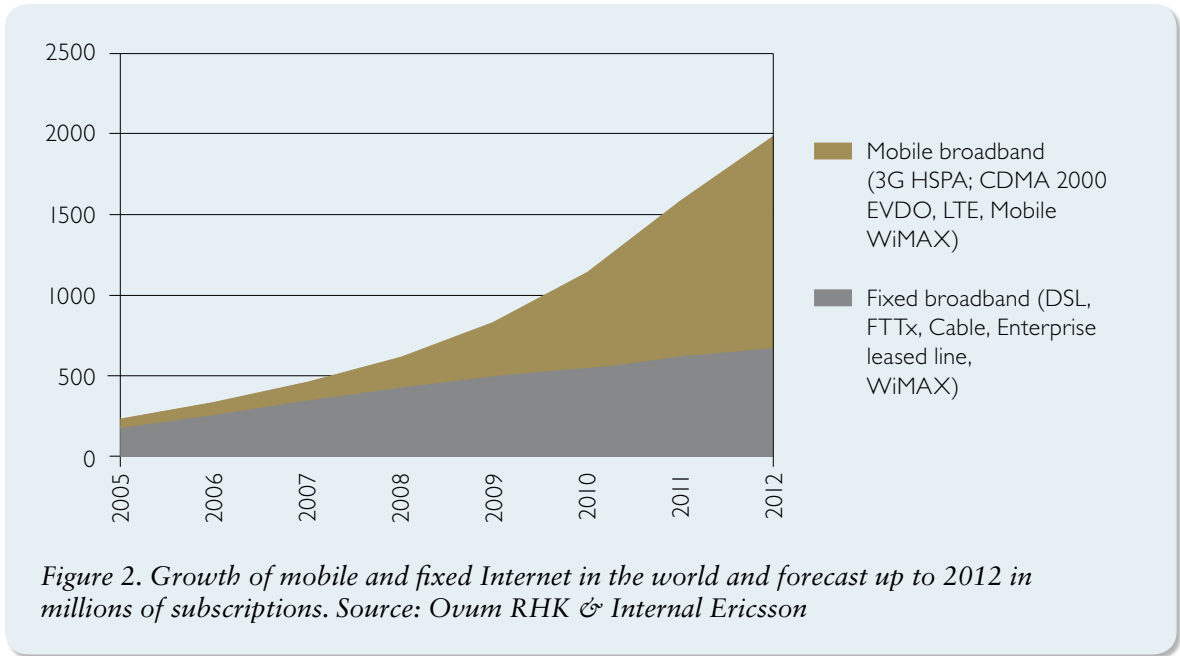
Sweden and the rest of the Nordic region have a unique opportunity to lead this development in

the EU. Within a decade we will see development equivalent to the development we have seen in telephony – from fixed to mobile – over the past 30 years. Mobile broadband took off in earnest in 2007

Today most Swedes have the basic requirements for fixed and/or wireless access technologies. According to PTS (Swedish Post and Telecom Agency), 9.1 million Swedes have access to broadband. Only 2,700 people today lack the basic requirements for broadband in Sweden. In the future it will be important to sustain this level of access.

This requires the expansion of fibre access, at





least in densely populated areas and suburbs in order to provide at least 100 Mbit/s. A mobile technology with a greater bandwidth is needed to reach similar speeds where there is no access to fibre connections.

As shown in figures 1 and 2, Sweden is in a strong position with the high level of Internet access in the country today. *Ambient Sweden* is the programme that will advance Sweden's position

more rapidly internationally. In this report we provide background and analysis on why Sweden needs to be a prominent Internet nation by 2015, and proposals for how to achieve this.

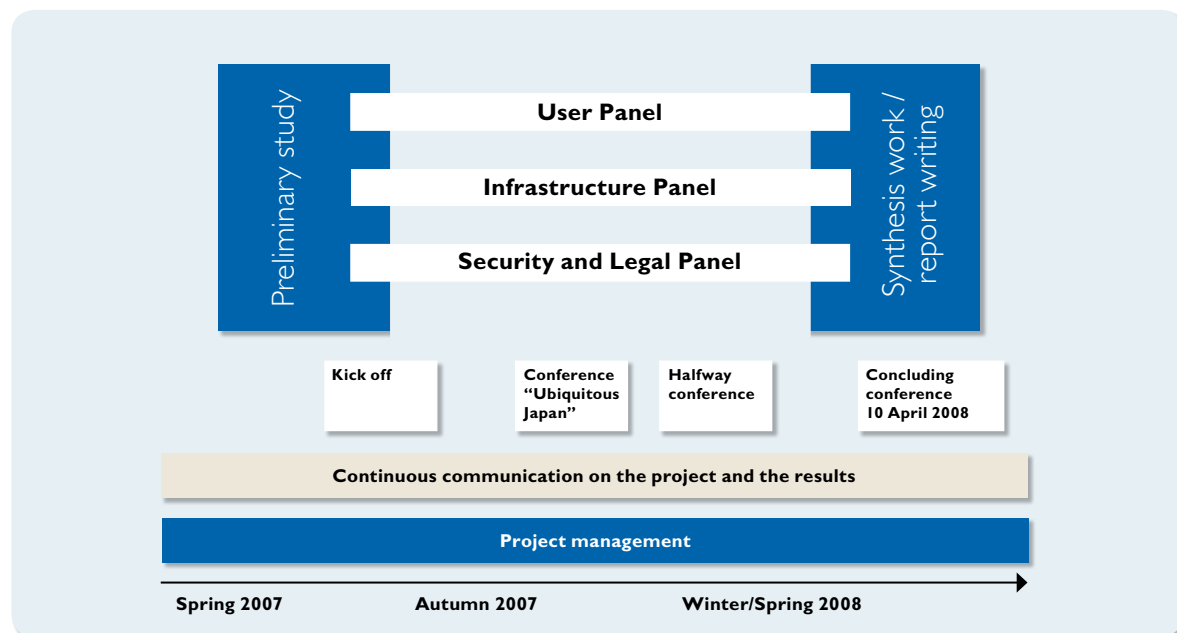
By implementing and actively following up the measures proposed in *Ambient Sweden* it will be possible to realise the vision of a "personal Internet," and Sweden will be a role model in the EU for others to follow.

2. Background, purpose and goals

What kind of Internet do we want? This was the title of a seminar arranged by IVA in autumn 2006. It generated a lot of interest and the discussions led to the conclusion that more work is needed at the national level in this area. To see if there were others who shared the sense of urgency and the need to highlight, in the form of a project, the crucial issues concerning the future of the Internet, IVA contacted most of the leading organisations within the field. The response was strong.

After securing commitment and financing

from central players, the project was named *Internet Foresight* and work began in spring 2007. The starting point of *Internet Foresight* was the in-depth preliminary study work carried out by three panels. Based on the current situation and the most recent research discoveries, the panels identified various options and, where necessary, proposed measures to make Sweden a successful Internet nation in 2015. Their assignment also involved proposing who would be responsible for implementing the measures.



The better Sweden is positioned within the three areas compared to the rest of the world, the more prominent it will be.

See also
www.iva.se/internetframsyn.

Advanced usage – usage aspect

High usage in companies, government agencies and among private individuals.

High user benefits. High level of integration in applications.

Access to broadband

Access to broadband everywhere via fibre, radio or copper networks.

Efficient and balanced market.

The nation's collective leadership

Leader in international organisations for usage.

Leader in international organisations for standardisation.

Research and product development resulting in successful businesses.

Definition of a prominent Internet nation

What does "prominent Internet nation" really mean? The diagram above shows three areas where Sweden needs to be as good or better than comparable nations, i.e. in Internet usage and access and the nation's collective leadership in the field.

There are two aspects to *usage*: To be prominent in this area, usage must be generally high in the private and public sectors and among private individuals. The benefits of Internet use must also be substantial, i.e. services that add value in the form of facilitated communication, increased service or greater efficiency. The user defines what "high user benefits" means.

By *access* to the Internet we mean that the Internet should be available everywhere with adequate capacity, security and quality. Here again, the user determines what is "adequate" and needs will vary from occasion to occasion and place to place. Also, access to the Internet should be delivered in an efficient market with no obstacles preventing investment in new capacity.

The nation's collective leadership means that Sweden needs to be "the gold standard" in international organisations for the way the Internet is organised, governed and developed – in terms of both user and technical issues (standardisation in particular). Also, Sweden needs to be engaged in world-class research and entrepreneurial activity.

3. Why should Sweden be a leading Internet nation?

Why is it important for Sweden to be a successful Internet nation? In the same way as the industrial revolution helped increase prosperity in the 20th century, information technology and the Internet are helping to improve competitiveness in the 21st century. Sweden is a good Internet nation today, but can be better – or more prominent. For every indicator for the prospects for industrialisation in the 1900s, there are similar indicators for positive development of the Internet in this century. And we should add that the Nordic region is driv-

ing development of mobile telephony. Thus, the prospects for being a prominent Internet nation in 2015 are better for Sweden than for other EU nations if we act wisely and in time, taking the right steps and making the right investments.

Constructive use of the Internet throughout a society will naturally support economic, democratic and climate-improving development. The Internet can be seen as a tool to get what we want, not a technology that sets limitations on our actions.

The Internet contributes to a nation's development in various ways:

Securing welfare through growth and increased international competitiveness

A high employment rate in advanced Internet-based products and services. Those employed help to increase competitiveness and growth in the following ways:

- High technology attracts significant investment
- Helping to improve the efficiency of work processes
- Well-educated employees are required
- Significant export income from products and services

A sustainable society through the use of modern Internet technology

By using the Internet, travel can be reduced thereby reducing the impact on the environment

- The number of people involved in distance working one or two days a week will increase with an Internet with higher capacity between the home and the workplace.
- The number of overseas business trips will decline when video conferences become increasingly similar to personal meetings.

- Technological developments are leading to less energy consumption for Internet infrastructure.

Effective industries and societal functions

- Logistics are becoming more efficient and increasingly important in international trade. Wal Mart, H&M and IKEA are good examples of companies with more efficient processes.
- In the health care sector people are requiring more care for their money. The Internet can help improve and simplify communication between the health care system and the care provider and between players in the care chain.
- Refined and intelligent machine-to-machine communication is becoming more efficient in industry.

A better quality of life through easily accessible Internet services

- Routine tasks carried out between private individuals, businesses and the authorities are being simplified and rendered more efficient.
- Greater freedom of choice through more exposure to different alternatives.
- Improved general communication between people who, for various reasons, cannot meet in person.

The Internet was commercialised in 1995, and in 2015 we will see a society where the vast majority of people are connected to it. Development in the area has been rapid, which means the Internet is a relatively new phenomenon that in many respects, like a new building, has not “settled down” yet. Many of the questions that *Internet Foresight* addresses bear witness to this. Such rapid development, both in terms of usage and technology, begs the question: Which inventions, products, processes will be launched over the next ten years? Can we predict this? Factors such as the need to reduce environmental impact, an ageing population, the desire for more effective and flexible work situations and the Internet as a tool for education, will all impact development. So far, development within media and entertainment has been explosive and it is likely that media and entertainment will continue to drive the economic development of the Internet for the next decade.

4. A vision of Sweden in 2015

A “personal Internet” opens up new opportunities for private individuals and the public and private sectors. When the Internet becomes a natural part of our lives we will have a society with access to the information people require and desire in every context where they may need it. Imagine if Sweden led the way by overcoming obstacles and showing the other EU nations that we have the strength and courage to position our country as an Internet pioneer in 2015.

IVA’s independent networks have carried out foresight projects in the past. *Technology Foresight* launched in 1999/2000 and *Energy Foresight* in 2000 are examples of major projects. Foresight means looking forward and attempting to predict important trends. The premise of the projects is to start with a scientific foundation and have a broad and firm footing in industry, academia and the public sector.

In IVA’s *Internet Foresight* project about 50 well-informed individuals worked intensively on issues concerning the future of the Internet. These were people who had built up the Internet in Sweden, experts from the business community and the public sector as well as individuals with a strong background in research on the future of the Internet and Internet-based services. Three expert panels worked with issues from three different perspectives: the user perspective, infrastructure requirements, and security and legal aspects. Each of the panels presented its work in a separate report that can be ordered or downloaded from IVA’s website: www.iva.se/internetframsyn.

The prospects for Sweden strengthening its position within the Internet are good. According to the latest statistics from the Swedish Post and Telecom Agency (PTS), access to the Internet in Sweden is among the highest in the world. In 2007 demand for mobile Internet grew significantly. For children and youth, the “Web” is an

entirely natural part of their everyday lives. But the older generations are also getting more from all that the Internet has to offer.

Numerous players are investing to secure a strong position in the market. On the commercial side, we are seeing international corporations such as Intel, Google and Ericsson advancing their positions through acquisitions. Fresh statistics from the Institute for Advertising and Media Statistics (IRM) show that Internet advertising grew by 230 per cent from 2005 to 2007 from SEK 1.7 to 4.1 million and is now almost as valuable as TV advertising. More and more people are choosing the Internet as a channel for marketing, information and communication.

A series of reports from World Economic Forum show that countries with a well-developed IT sector tend to have better growth. There are of course other factors contributing to this growth, but the US, South Korea and Sweden have enjoyed growth above the OECD average for a long time. One explanation is the high percentage of IT-based enterprises, another is high IT usage by businesses and government authorities.

The Internet has also helped improve transparency. When news is made available to everyone around the world within a matter of seconds, at the same time there is no longer a newspaper editor filtering it. Countries that have tough restrictions on the Internet such as China and Saudi Arabia are finding they cannot avoid using the information available on the Web. In the future the Internet will help spread democracy and promote a more open and tolerant world.

Internet development has been rapid and has grown with no real controls, which has had certain negative consequences. We are all familiar with spam, child pornography, chat forums where people pretend to be someone else, bullying, illegal selling of medicines and drugs and illegal file

sharing. These crimes and behaviours are not new, but the Internet has made it easy to be anonymous and act in a lawless realm.

For some the Internet has become a separate virtual world where national and international rules and laws do not apply in the same way as in the physical world. Criminal or unethical behaviour on the Internet often goes unpunished, which is one explanation for its success and popularity. Doing nothing to address the negative aspects may threaten trust in the Internet. If trust is gone, users will turn their backs on the Internet and stop using services involving financial transactions and personal information. Lack of trust also means more manual work, instead of the Internet simplifying administrative tasks. Working to maintain trust and ethical behaviour on the Internet is therefore an issue for all of society.

If Sweden does not invest now, we will not have the “personal Internet” that will be vital in shaping the nation’s development. We will have an Internet where we cannot influence and control development. We will be led into the future instead of being involved in impacting development. There are examples where Swedish players have used access to and familiarity with the Internet in a manner worthy of imitation. In the public sector, the Tax Agency is a role model, providing Internet services to make things easier for individuals and businesses, for example by improving the efficiency of tax filing. The Swedish Motor Vehicle Inspection Company also has a simple and popular service for Sweden’s car owners. Companies like IKEA and H&M have benefited by using the Internet to improve logistics efficiency. Internationally, Wal Mart is a shining example.

Who is driving development? We have already mentioned that the Internet has developed without any formal control, but it is actually the US that dominates the Internet, mainly through strong companies on the distribution side (e.g. Cisco) and on the service side (e.g. Google, Microsoft). However, we are now seeing a paradigm shift; instead of an Internet where large American corporations are delivering content, we are seeing the need for a “personal Internet” that needs to be available where people are. Nordic leadership in mobile communication may be crucial to this development. Demand for mobile broadband has increased sharply over the past year and is likely to continue to increase, especially since the technological development of

terminals and services that are better suited to mobile Internet is providing users with new solutions.

A strong IT sector and effective IT services are key if Sweden is to maintain a higher growth rate than other comparable countries. Without aggressive investment Sweden will not be as competitive. Again, we are seeing that countries investing long-term in creating opportunities for IT use among their citizens, businesses and authorities have a higher growth rate.

How will the Internet be used in the future? *Internet Foresight* has highlighted some areas where we are likely to see change.

By 2015 the teaching of core subjects in schools will be improved. The Web and podcasts will supplement traditional maths instruction in the curriculum. Most teachers will regard the Internet as a tool and many will recognise the obvious benefits of IT support-based teaching. In language instruction there will be interactive exercises using sound and images to better teach pronunciation and listening comprehension. The relationship between schools and parents will be improved as well as among teachers at their own and other schools. School children will be in contact with their class and their teachers online. In 2015 classroom teaching will be the foundation with an Internet that is trusted as a complement and instrument to improve education. Some students that have had difficulties with traditional classroom teaching will be helped by Internet-based instruction.

In 2015 Sweden will be a pioneer in digital media distribution. Sweden’s reputation as a haven for illegal file sharing will be history. Users will have access to the entire global supply of music, films and books and there will be an established and accepted system for compensating those holding the rights to their work. Web 3.0 and Mobile 2.0 will give many artists and authors the opportunity to present their creations to the world.

In 2015 investment in advancing Sweden’s position in mobile communication will have paid off. Popular services will work just as well via a mobile terminal as via a fibre connection at home. More and more services will be offered in a common service market, independent of Internet operator. A system for payment for services will have been in place for a long time. In 2015 there will be many popular mobile services based on position-

ing that encourages young people and adults to engage in physical activity. Much of the content in these services will be locally produced.

In 2015 healthcare will have been revolutionised using the Internet as a tool. Here too, more resources will go to patients and less to administration. There will be a “walk through” system providing a thorough physical exam in 15 minutes. This physical exam in combination with a web-based health portal will help to keep people fit by providing advice on diet and exercise. Some insurance companies will provide discounts for people who undergo regular “walk through” exams.

In 2015 there will be a lively discussion on personal integrity. More and more personal data will be available online, and the combination of this data with prevailing phenomena will make many people uncomfortable. Many people will, however, understand how data provided online is handled. A personal negotiator – a kind of virtual integrity ombudsman – will be a much appreciated service. The personal negotiator will help classify and keep track of a user’s online contacts. Everything will be possible, from being completely anonymous in certain circumstances to full transparency in others.

In 2015 there will be strong Internet security. A system of electronic identification will have been introduced within the EU. e-ID will be used in financial transactions, as well as, where appropriate, to reveal a person’s identity in social contexts. To protect individuals from online crime there will be a minimum security requirement with re-

spect to firewalls and virus protection, as well as standards for how users behave online. The Swedish Data Inspection Board will have a stronger enforcement role and will ensure that users, i.e. individuals, companies and government authorities, maintain the required security levels.

In 2015 Sweden will be experiencing strong growth. A contributing factor will be that more and more SMEs will be using IT to improve their competitiveness. New, successful ventures and established businesses will be better at using the Internet for both internal and external communication.

In 2015 the Internet will have helped reduce travel. There will be an efficient model and agreements between parties in the job market regulating distance work. More and more meetings will take place online in the form of audio or video conferences that feel like real meetings. Commuting to and from the office will be reduced and many air-polluting plane trips will have been replaced by high quality video conferences.

The *Ambient Sweden* programme will make the “personal Internet” – which by 2015 will be a natural part of people’s everyday lives – a reality, and this will happen in a way that utilises Sweden’s strengths and opportunities to make Sweden more competitive. Through *Ambient Sweden* negative phenomena such as spam, phishing and other undesirable behaviour will be dealt with effectively. In particular, Ambient Sweden will make Sweden a role model within the EU. This is where we want to be in 2015 and why the programme needs to get underway immediately.

Governing the Internet

Since 1998 ICANN (Internet Corporation for Assigned Names and Numbers) has been responsible for all names and numbers on the Internet.

Responsibility for domains has, however, been decentralised and in Sweden the Internet Infrastructure Foundation (II-stiftelsen) is responsible for allocating domain names.

IP addresses are allocated by Internet operators who in turn receive them from a regional Internet registry (RIR) associated with IANA (Internet Assigned Numbers Authority). IANA handles the operational

side of address allocation through agreements with the governing body, ICANN.

The Internet Society (ISOC) is a member organisation consisting of both companies and private individuals. ISOC is behind IETF (Internet Engineering Task Force) which develops standards for the Internet, as does IRTF (Internet Research Task Force) which conducts research in technology and new functionality.

The Internet cannot function without the physical infrastructure that is financed, built, operated, supervised and maintained by the network operators.



5. All eyes on the horizon and 2015

How will the Internet be used in 2015? We cannot know for sure? However, certain trends are so powerful that we can point to areas that must be dealt with sensibly in order to have a say in the development of Internet. In this section we will address areas where *Internet Foresight* sees a strong need for Sweden to have a unified national approach and implement powerful measures.

Trust and integrity

Both now and in the future it is important for people to be mature Internet users. This is true regardless of how the technology develops and what the existing security mechanisms are in the form, for example, of legislation, identification options and software etc. that help users make the right choices, protect their identity, safeguard their integrity, or simply avoid certain phenomena and content. Mature Internet users are responsible for their own actions, have a media-critical approach and respect for their own integrity and that of others. Integrity protection is based on trust in the technology as well as the content and communication on the Web. Trust can be good and bad. It is possible for users to place too much trust in the technology, its protective mechanisms and other people they meet on the Web. On the other hand, users may have too little confidence in who and what they encounter, which creates unnecessary limitations to Internet use.

Regardless of whether someone is using the Internet as a consumer or a producer, it is important to pay attention to both personal and legal/commercial integrity. A consumer's need for and access to protection may be very significantly different from that of a producer. There is often a mutual need for and interest in integrity protection and technical security when sending important documents or executing financial transactions. Often

people are not aware of this when communicating in social, digital meeting places such as Facebook or when surfing Google. What happens to my information and my images? How is personal information spread, altered, distorted or perhaps abused? Who owns my information and my images? How do I know the people I'm communicating with are who they say they are? What is needed here is a high level of awareness among both old and young generations. Irrespective of access to technical solutions for people to protect themselves, their identity and the information they want to share via the Web, they need to be aware and be media critical. This places a big responsibility on current and future Internet users.

Strengthen integrity for data made available online

The Internet is increasingly used as a source of information. Consequently, we are becoming increasingly dependent on being able to trust the information we find there to be "authentic." This means, for example, being sure that the information actually comes from the source given and that it was created at the time stated. Often we want to and should be able to trust the party confirming the data is "authentic" even if the party sending or publishing the data has a reason to be anonymous, we still want to be able to trust the content. A suitable comparison is when someone pays for something in a shop, we trust their money even though we don't know the person paying.

We need a simple method for "branding" data, even from ordinary users, to be sure the data actually comes from the right source and has not been tampered with along the way. Data in this context might be everything from e-mail, chat and blog entries to the publication of data on websites, the transfer of files or other formats that may emerge in future. Today many experienced users and organisations have access to methods to confirm their identity and that the data they are sending

has not been changed without this being noticed. It is not always easy for ordinary Internet users to understand these methods and to what extent they can be trusted. The majority of people accept the methods used by banks and government authorities, but many find it difficult to know what to do when a “normal” website suddenly says it has a “certificate.” In those situations we are often forced to trust something vague in order to use the service.

More and more ordinary users are becoming producers of data that is openly published or sent to other users. It is not just data from government authorities, companies and other organisations we want to be able to trust. Today we usually place our faith in the fact that we are communicating with a central system, e.g. a website we log on to, and we expect it to give us some form of guarantee when we use it to communicate with others. In the future we will increasingly communicate directly peer to peer (p2p) and we will want to feel secure in the forum where we will interact.

The foundation for building this trust is having a generally accepted e-identity supported by an ID document issued by a body we can trust. We should be able to use this e-identity in all contexts and in all equipment that users may need now and in the future. This is especially important in mobile applications, although this may be technically challenging. Today there are different identification methods: A great number of issuers can also verify everything from whether a sender’s e-mail address is correct to whether the right person has signed a document. But to what extent can we trust these issuers? If it goes as far as a dispute in court, what is the evidential value of such a document?

The Internet has given individuals and small companies the opportunity and freedom to access information and to communicate in a way that used to be reserved for government authorities and large organisations. Private individuals are now executing their own financial transactions (banking, stock trading, commercial etc.), which was not possible in the past.

A roadmap for development of e-identities has been produced by Verva at the request of the Swedish Government (Verva 2007). The roadmap contains activities that need to be implemented to spread the use of e-identities. The focus is on the public sector, but should be developed to cover society as a whole.

With a general e-identity that has evidential value in disputes, private individuals will be able to access services e.g. to:

- Certify that they created the data
- Certify that they created or transferred the data at a certain time
- Verify that they themselves or their data have certain characteristics

Such services give individual citizens a better chance of asserting their rights in disputes with “stronger parties” such as government authorities or other large organisations.

When users communicate with other people online there are situations when they only want to communicate with people who identify themselves. In some contexts I only want to receive information from people I already know. In other situations I, as a user, may want to be anonymous. Identification solutions should meet the user’s control needs – ranging from being fully identified to anonymous. The services offered also need to set balanced standards for how well identified I need to be as a user in order to use the service.

Available routines for increased information security

Information security at the appropriate level prevents the corruption of information and threats to personal integrity. SUSEC (Swedish University Information SECURITY Group) has produced an example of how information security work can be organised. It is mainly intended for IT units at universities, but also applies to other organisations. The IT security handbook was updated in 2007 and is available at <http://itsakhandbok.irt.kth.se/susec/>.

Working life in the future

Working life in 2015 will be characterised by great flexibility and constant learning. People will work in different ways depending on whether they are teenagers, young people with or without children, singles, parents with teenagers or who are empty nesters.

What will the new working life require?

A flexible working life for all age groups will be a generally accepted concept in 2015. Virtual teams, i.e. groups working on joint projects but at different locations around the world, will need new tools to support a new kind of management. A work day in 2015 will be characterised by many people being able to move, relatively unimpeded, between physical, virtual and video media-enabled spaces. This will mean new requirements for the working environment, design of support systems and job market rules.

Two new concepts will be key factors for working life in 2015: *time shift* and *location shift*, i.e. working independent of time and place.

A modernisation of the work culture using new technology and new standards will mean that people to a greater extent will work independent of work hours and work places. The work culture focus will be shifted from hours worked and presence at a workplace to an individual's productivity and collaboration capacity.

The intention is not to force people into distance work as we know it today, but instead to develop new methods and techniques that allow for better and more personal communication independent of time and space, and thereby increase productivity and reduce stress and environmental impact.

For the concepts of *time shift* and *location shift* to work optimally, we need a new work culture involving cooperation between the various parties in the labour market. It is time for "Taylor 2.0"! A century ago we had "Taylor 1.0" which improved work efficiency through routines and reduced individual freedom. In 2015 individuals who are constantly evolving and employers who value initiative and communication skills will be in demand. By demonstrating the flexibility and improved quality of life afforded by these new working methods, the necessary updating of employment conditions, contracts and laws will be perceived as both reasonable and desirable.

What do we have to gain in the future? Distance work will feel much more rewarding and will be a success factor for Swedish industry and the public sector. Web-based and video media communication can affect how metropolitan areas are developed and may also strengthen regional development in sparsely populated and rural areas, e.g. by making it easier for people in these areas to find skilled work. New forms of communication

are expanding regional job markets and people are able to live further from their workplace.

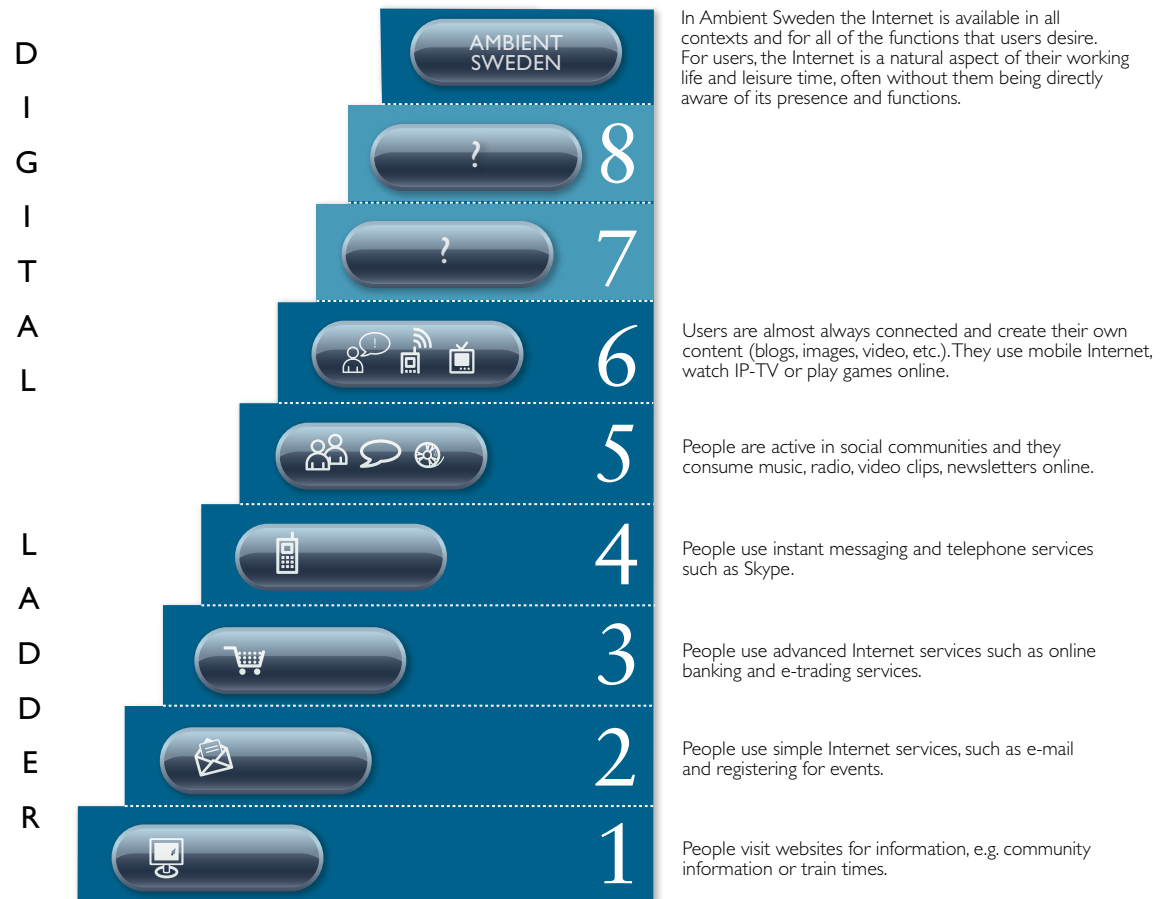
What will we lose by not acting? We will experience growing problems with technology stress, a drop in population in areas outside regional centres and deteriorating service for citizens.

The public sector should be a catalyst for this development by allowing services to be developed and implemented in a dialogue with the various parties in the labour market, working life researchers, organisation consultants and architects. One important issue is cooperation between government agencies (e.g. Swedish Post and Telecom Agency, National Board of Housing, Building and Planning and the National Rail Administration), since community planning issues have gone beyond physical conditions to include digital ones. This revolutionary effort opens the door for Sweden to stand out as a leader in developing a modern working life and influencing the EU to embark on joint projects in areas such as standardisation and open source development.

The digital ladder

In the media and the political debate we often hear the term *digital gap* used to describe the differences between those with access to and knowledge of digital technology and those without it. In certain contexts the gap is believed to be as significant and crucial as other gaps in society, such as class, or that corresponds to the gap between educated and uneducated people in the last century. This is because those with access to digital technology are also the ones who can make the system work for them; they are well-educated and are empowered by access to information and services. The gap is described both as a problem within Sweden as well as a difference between industrial and developing nations.

But the world is not usually black and white. There is an entire grey scale in the differences in access to digital technology, from no access to the Internet at all to taking advantage of the most complex opportunities the Internet has to offer. The risk in describing the problem as a gap is that we are directing the political powers towards an imaginary problem that can easily become a simplified binary problem around the question: "How can we bridge the gap?" If we instead try



to describe the problem in a more nuanced way, a different fix-it package will emerge.

We feel it is appropriate to use a different metaphor for the problem, i.e. *the digital ladder*. A multidimensional approach to the problem is warranted because the differences are not just related to education or financial resources. We need to understand that the rungs on the digital ladder relate to fundamental differences in society. It cannot merely be seen as an education issue. The differences i.e. spaces between the rungs are significantly smaller in Sweden than in many other countries, but the problem still remains, and we need to understand the differences if we are to create the conditions for all of Sweden to be a prominent Internet nation in 2015.

The dimensions of the ladder

Access to and use of digital technology depends on age, skills, financial circumstances, geographi-

cal location and cultural background. We define the rungs on the ladder according to the situation that people are in.

Here are some examples: Members of the older generation, retirees, are not usually involved in further education nor do they have any reason to learn about new technology. It is a myth that older people are hostile towards technology. But what you don't have, you don't miss. The reasons for embracing new technology may be unclear. What can you actually gain from embracing new technology? A consequence of this may be that the older generation does not have access to the cheaper alternatives that digital technology offers. For example, online banking is less expensive and train tickets are cheaper purchased online than over the phone.

People without access to computers or the Internet have to go to a library or Internet café. They can never decide what to install on their

own computers. Certain groups are excluded from the services that government authorities are only offering electronically, such as the municipal child day care queue, or services that are only offered in certain languages. In general they are shut out from many opportunities to exercise their democratic rights if they cannot (for language reasons) take part in various forums on the Internet.

If Sweden is to take the lead as a prominent Internet nation in 2015 we need a conscious and joint effort to inspire all citizens to climb the digital ladder. This needs to be done as a collaboration between the public sector, schools, labour market players and citizens organisations.

The Internet and the good life

The Internet undeniably brings new opportunities for many people, at home, at school and at work. In particular, it facilitates long-distance communication, which has positive effects both for human contact and the environment.

The Internet also allows ordinary people to become content producers, to make their voices heard in different forums and debate on their own terms.

The new Web

More and more services on the Internet are being embedded in Web formats or displayed in a browser, e.g. streaming audio and video, interactive games and learning tools. Mobile Web services are also rapidly advancing. A possible future scenario is that everything offered online will be packaged for access via tools with Web functionality, in our PCs, mobile phones, built into cars etc. Platform independent services will thus be easier to develop, which encourages innovation. But there are also signs to the contrary: digital gadgets with specific functionality, where the Internet's information resources and services are used by more and more programs and digital gadgets without us even noticing it – the Internet as invisible infrastructure.

We are already seeing signs that the traditional PC metaphor with programs that we install our-

selves is disappearing. Instead, the programs are on the Web accessed by a browser. An obvious example is word processing, spread sheets, e-mail, etc. which can be run in a browser instead of being installed on a computer.

Another effect of resources being on the Web is that users can access more computer capacity than their PC can provide. There is an interesting strategy here with mobile access to the Internet where network-based processing compensates for the mobile unit's shortcomings in terms of processing, data storage etc. We will soon see the Web not only as providing information and services, but as a full resource system ensuring we get access to what we need.

In recent years we have seen an interesting change in how the Web is perceived. During the Web's first fifteen years it was a framework for delivering information. "Content is King" was the motto – to be successful you need the best and most well-constructed information on your website.

In the first few years of this century new types of websites emerged, filled with content created by the users themselves. Early precursors were blogs where blog owners constantly added actual material which was then selected and presented with a personalised tone.

The Web's search engines still fill an extremely important function. Interesting complements have emerged, e.g. in the form of websites where users can highlight things they think others should be made aware of.

The driving forces for the Web's development have shifted from industrial players to the rank and file. It is not careful analysis and engineering developments that are driving the creation of new services. Instead the needs of individuals have been the seeds for new functionality. The service for "tagging" Web content originated from small tools to organise personal Web bookmarks or photo collections.

The flow of information on the Internet is huge and it has become difficult to follow up what may be interesting news in cyberspace. News channels – based on RSS technology – provide newsbill-like information about various types of news.

Social networking websites have been very successful. By linking up with certain people within a social website, people are building social networks in which they can interact and integrate with other users.



The conclusion of all this is that we are seeing how the user's Web and the user's Internet are increasingly being shaped by the users themselves with dynamic content and new forms of interaction. The development has only just begun and by highlighting some ways in which the Web has developed in recent years, we can understand what will be important in the future.

Green IT

Climate change and the need to reduce fossil fuel use are more or less established truths today. The debate is about the options we have to solve the problems. Which options and means do we have to improve the situation? High up on the agenda in both the public and private sectors today is how to improve energy efficiency and reduce travel.

IT in this context is not only an enabling technology for better, faster and more structured communication, production and action. IT is also enabling technology for dematerialisation in society, visualising and improving the efficiency of processes and transportation or perhaps even replacing them entirely. We can conduct our daily business, shopping and perhaps taking care of our health without necessarily moving. We can use innovative IT to ensure safety, security, predictability and planning within the framework of a sustainable society. The examples are both numerous and exciting.

We cannot ignore the fact that IT is to an extent a drain on society's resources. Statistics from the Swedish Energy Agency show that the use of PCs, copiers, computer rooms, servers etc. accounts for around 25 per cent of all energy consumption in our office environments. The statistics are similar in other countries.

By building visual environments we can monitor the environment and avoid flooding, control transportation and make it more efficient and plan construction to make the sustainable society a reality in the near future. We not only save energy and reduce carbon emissions, we also save money and increase security in various ways through mobile services, positioning and geographic IT. This is a development that we have so far only glimpsed at. The potential is almost endless. Traditionally, we have been a prominent nation in IT and telecoms. Now we have geographical IT (an

industry growing by 30 per cent a year) bringing new, innovative and cost-effective solutions for society, e.g. smarter transport and logistics solutions.

Digital media distribution

File sharing is controversial, but strictly from a user perspective, the possibility of sharing digital information is desirable for many. Most would certainly do it legally if there were sensible, reasonably priced business models.

Today's dominant solutions for digital music purchasing are not that effective because it is easy for a person to pass on a song he has purchased to a friend. We need solutions that make it possible to give music away, play a song a few times before paying for it etc.

Today's proposed solutions for the file sharing problem are about locking in the users and taking legal action against illegal file sharing. A holistic approach to digital media distribution is needed with solutions that do not lock in users and thereby tempt them to seek out illegal alternatives again.

Work on finding such solutions should include an interdisciplinary study of user behaviour, creating innovative business and payment models and investing resources in companies that create good solutions.

Games and entertainment

For many the Internet is mainly a source of experiences. We play games online, communicate with friends, play through social networks and services, watch TV and films, listen to music and take virtual trips. There are thousands of websites describing destinations, hotels and sights to see. But we not only consume what others provide, we also produce content and share it with others.

What we need from our politicians is a strong vision of what changes to society we are going to accomplish by not only looking at social structure as infrastructure for trains and good building standards, but also the side of life we call "the good life."

Media consumption behaviour among today's

youth is an indicator for the importance of the Internet. The young generation today is the first one since TV was invented to watch less TV than their parents. Instead they pick and choose from an online offering: they listen to the news at the same time as they play and chat with their friends.

Pervasive games, i.e. games played in urban contexts, integrated into everyday life, will grow into a new genre in the gaming world. These games may involve going to a certain place to find a treasure, or getting props like magic wands that send secret messages wirelessly and that add a dimension to the game.

Gaming consoles and mobile phones will have physical interfaces that will add another dimension to the experience – a physical one. This in turn means that we will not be fettered to our desk when we take virtual trips, play games or communicate on a social and emotional level with others. We will be able to express ourselves physically.

But the future is not only rosy. Pervasive technology will make us easy targets for those who want to make money by making us dependent on kicks and quick adventures. Parents and schools have a big responsibility to educate young people to be critical of media and sources.

Mobile 2.0

In 2007 we have seen how the Internet in mobile devices has reached not only early adopters but broad user groups as well. It has become easier to go online from mobile phones, more people have 3G subscriptions, many use electronic calendars and e-mail from their phones. Today a mobile device is an attractive platform that can be used by anyone who wants to create multimedia. We can take pictures, send video, write text and compose multimedia messages (MMS).

Mobile technology gives us access to entirely new ways of expressing ourselves.

Mobile phones “know” where they are – both geographically and by identifying which other units (mobile phones and other wireless communication units) are close by. The combination of multimedia functions in mobile phones and access to local context information means we can create tools to support local communities and exchange photos, share music, blog together or cre-

ate video on the spot at a sporting event.

But to do all this we need to think beyond how we see the Internet today. We need to think in terms of services that have both local and global context. We need to see all of the services we have on our computers and phones, e.g. a calendar, as things that accompany us through different networks and with access to different platforms (mobile phone, computer, someone else’s computer). We also need to solve the interaction problem for mobile phones (so-called baby interfaces – small screens, small buttons).

An interesting development that we believe will be a success by 2015 is experiences that are delivered in platforms other than computers, e.g. through mobile phones, gaming consoles or integrated – ambient – with the world. Just as for the internet, the strong drivers are from the entertainment side of life – games and social communication. Just as Web 2.0 has made it possible for users to create content and functionality, a Mobile 2.0 will emerge where position and other local data are used as part of the services. To take a simple example: photos we take can be tagged with the location where they were taken and which other mobile devices were there. The photos can then be left at the location so that others can see them when they pass by. People who were at the location can also look for photos of themselves online by searching for photos taken at locations where their mobile phone was present.

Infrastructure for future Internet services

Infrastructure is not only cables and fibre. The word infrastructure makes us think about systems of physical equipment or structures that are necessary for a society to function, such as roads, power grids, water and draining and networks transporting data. In this report we use the broad definition of the Internet: IP-based services and networks, both fixed and mobile. Access to the Internet with a certain quality and connection speed has in everyday terms been labelled broadband.

Internet access is “everywhere” – but at different speeds

The Swedish Post and Telecom Agency (PTS) has set goals aimed at having broadband infrastruc-

ture in place for all Swedish households, businesses and the public sector by 2010. The goal is broadband which at the access level can at least be upgraded to downstream transfer speeds of 2 Mbit/s. Fixed access with higher speeds are available everywhere today in cities, densely populated areas and in newly constructed buildings. In sparsely populated areas and some older suburban areas there is sporadic coverage with speeds over 10 Mbit/s. Here and there in these areas we find wireless, close-range access with similar speeds as fixed access. Data speeds for mobile access essentially depend on population density and vary between more than 10 Mbit/s in population centres to 0.2 Mbit/s (NMT) in sparsely populated areas.

Access to the Internet these days is often provided by wireless terminals. Both local hotspots and telephony networks are contributing to this development. Usage is already on the increase, for example, over 430,000 mobile broadband 3G cards for laptops were sold in Sweden in 2007 – a 380 per cent increase from 2006.

Infrastructure market situation

There is little competition and the rules are unclear in the infrastructure market for fixed access, which results in less willingness to invest. A discussion is under way on the best way to create long-term infrastructure competition. Is functional separation the right model for all access networks? If the same standards are introduced for all access media (fibre, cable etc.), will this impede investment?

Broadband subsidies have been aimed at expansion in sparsely populated areas and contracts for this expansion have gone to various players. Telia, Terra.com and the city network operators were the main recipients of this broadband subsidy. The idea was to expand broadband where the market has not been able to meet the demand, and thereby even out broadband penetration between sparse areas with high connection costs and population centres with low connection costs.

The emergence of city networks has probably been a good thing for Internet development in Sweden. Unfortunately, there are cases where competition problems have arisen due to lack of transparency in networks built with broadband subsidies (PTS 2007a), whether they are private or municipal networks. Today we have a large, heterogeneous infrastructure owned by many

small and large network owners. Variations can be found both within and between networks. A heterogeneous infrastructure may make it hard to deliver quality services to many users, but it may help to develop a local market. The problem is networks where there is competition at only one or a few levels in the value chain and where customers are locked into long contracts to access broadband infrastructure. To increase the use and value of the Internet to the desired extent, more diversity of services is what should be the general goal.

We can distinguish two types of business models: The open Internet based on “best effort,” where people mainly pay for access. Alongside this is the closed operator-controlled network that aims to provide a high quality of service (QoS) to handle more demanding services such as IP-TV. Closed networks and domains make it more difficult for the service market to flourish. One problem is how to achieve peering – i.e. coordinated traffic between operators – of infrastructure with QoS. Today there is little interest in this and no standard contracts or business models exist that could drive development.

Viewing the current infrastructure from a service perspective, we see there is no service-independent platform for future online services. Right now, simple IP based services can be provided online, for example, text-based services such as web applications or simple video services without guaranteed quality (Youtube). But VoIP (Voice-over-IP) and similar services do not work with guaranteed quality and functionality between users with different service providers and network operators. Click-to-call (automatic online calls) and co-surfing (e.g. for fast and direct online support for problems with website functionality) should be very useful for many government authorities to offer citizens who would receive interactive help filling out forms or discussing options (child day care placement, education, job offers) online. If the Internet is to be considered a fundamental service infrastructure, full interoperability is needed for the services.

Competition with significantly higher bit speeds is needed in the networks

Since the beginning of this century, when Sweden started investing in broadband, access to IT has become increasingly important for businesses, the public sector and individuals. According to



the PTS proposal in the 2007 broadband strategy, in order to ensure transparency in expanding networks based on different links in the value chain, PTS should, in consultation with the Swedish Competition Authority, the market's players and other affected government authorities, work to set reasonable and non-discriminatory terms. We see this proposal as a minimum and believe that competition is needed all the way out into the networks with significantly higher bit speeds if we are to ensure that as many people in Sweden as possible have competitive and attractive broadband services.

Efforts to make the Internet more robust are important

Both the physical and the logical infrastructure are constantly facing new threats. A function that is developed and implemented at a fast pace in the NTSG (Nationella TeleSamverkansgruppen – a forum to support the national infrastructure for electronic communications) under the project management of PTS is a system for shared situation perception when there are disruptions and interruptions in telecommunication and Internet traffic. The system could be under great strain, for example, in the event of a major power outage caused by a storm. To be able to convey reliable and current information on the situation to the affected parties and users, the system would be able to report on the status of the Internet and telephony area by area for the whole of Sweden.

It is vital for network owners to implement coordinated preventative measures. Today this is done within NTSG which is under PTS and which acts as a neutral forum for these types of measures. Traffic exchange between operators is an example of an area to look at in this context. One important aspect is stopping security problems in used protocol to raise confidence in the routing information that is spread from operator to operator over the entire Internet.

A new market takes shape

Internet use self-evident

If Sweden is to be an Internet nation to be reckoned with in 2015 the Swedish people, and the public and private sectors should be able to regard the Internet as something that is self-evident. The

knowledge-based economy will continue to develop, and demand for infrastructure for communication will continue to increase. For example, government services need to be more robust and accessible than they are today. Users need both the technology and skills to access and use these services. Government authorities and citizens are expected to be able to use the Internet for services and information in multiple contexts, which requires an expansion of what is now included in the concept of the “24 hour authority.”

Robust infrastructure with good coverage leads to a sustainable society

Robust infrastructure with good coverage of both fixed and mobile broadband is of utmost importance to achieve a sustainable society – especially from an environmental perspective. Robust infrastructure reduces the need for physical transportation, optimises logistics for physical transportation, makes companies and government authorities throughout the country more efficient and facilitates contacts between citizens, the authorities and businesses. Travel can increasingly be replaced by telecom and Internet services. Increased distance work and distance learning may help reduce energy consumption. But if these things are to become more widespread, we need both cooperation and competition between the various players in the market.

Our dependence on the Internet is increasing

Society's dependence on effective Internet infrastructure will be even greater in 2015. The Internet will, for many organisations and companies, have become a crucial resource, and disruptions could therefore have dire consequences. The Internet will also be an increasingly important source of information in the case of a crisis or catastrophic event. For individuals too, technological development has led to new services that are perceived as increasingly indispensable. Government agencies' Internet-based services that are available 24/7, like other social and commercial services, will require high accessibility. The Internet will have become an increasingly important channel for information, social services, social intercourse and increased efficiency. For Sweden's ageing population the Internet will be used in new ways and in application areas such as care and lifestyle adjusted services for new user groups. As

the Internet becomes more mobile, our dependence on it will increase further. A concrete example is mobile sensors in “near-body networks” that set off alarms in realtime if a person becomes ill. All this indicates that the need for and requirements of the infrastructure will be greater in 2015, particularly in the case of wireless applications.

Internet citizens – in a realm without physical borders

We are still not used to a place where we are not sure who is setting the rules and monitoring compliance – even if this place is virtual. It is also hard to regulate something with an international connection. Unclear jurisdictions, both from a criminal perspective and in terms of a forum for conflict resolution, make it more difficult to present evidence or prove a claim. Globalisation is continuing while international harmonisation of laws is still a problem. The laws are difficult to adapt to the constant and rapid technical development. International cooperation will increase. Sweden will need to adapt to foreign conventions, and will need to influence international issues when directives are reviewed. The problems that cannot be solved through legislation will require increased self-regulation from the market’s players. Information to users, for example, on operational security, quality and integrity protection, as well as increasing demand for availability and reliable information from government agencies will therefore be increasingly important.

Exorbitant costs for high quality access “everywhere”

Is “the same for everyone” a reasonable expectation? This is a question we often hear in economic and political debate. Regarding infrastructure, this question should be seen in the light of investment in relation to population density. Perhaps not everyone needs to watch TV on the Internet. The cost of having high-quality access “everywhere” is exorbitant. And what is even more troubling is that in order to have “the same for everyone,” we have to define a minimum level, which limits development of new services that require more than this minimal level. Future access will continue to vary in quality, but future applications will be able to handle this better than today.

Effective use of the spectrum critical for access to inexpensive wireless access

Offering flexible wireless access with high data speeds requires access to significantly more radio spectrum than is available today. Greater available broadband enables both cheaper and more energy efficient technical solutions for access. It is mainly in population centres where the rapid growth of mobile Internet access will soon lead to capacity problems (more spectrum is, however, no solution for the problem in sparsely populated areas). A change is already on the way in the form of new frequency ranges where the 3G successor, LTE (Long Term Evolution) can be used. But we need much more spectrum and new technology to drastically reduce costs and energy consumption for wireless high speed access (>10 Mbit/s). Spectrum use is low today, even in densely populated industrial nations. New technology with radio equipment that is flexible over large frequency areas will lead to more dynamic use of spectrum. Effective market mechanisms will be an incentive for spectrum licencees to share resources on a commercial basis that they do not need at the moment. The potential of such methods is great since more than half (in Sweden even more) of spectrum is fallow and waiting for sporadic, future use.

The technical problems (capacity problems) will be more storage-oriented

There are indications of a paradigm shift in the capacity problem from a connection paradigm to a storage paradigm. The new storage paradigm, which partially replaces the connection paradigm, is a result of the rapidly growing storage capacity in mobile devices etc. creating new links between access and services. The storage capacity in a user’s equipment such as a laptop, media player, mobile terminal will have increased dramatically by 2015 (>100 GB for flash memory, >1 Tb for small hard discs). This in turn will change behavioural patterns and mobile broadband use. Instead of constant connection and downloading in connection with consumption, many applications will download when given the opportunity and when bandwidth is essentially free. This will happen in combination with more updates and if necessary when there is less bandwidth. Memory synchronization will also take place via near field communication (NFC) with higher data speeds (more Gb/s). New media industry business models will

emerge when the industry goes from program tables that lock users into consuming at a certain time to “window displays” where users (or their electronic agents) at a certain location download the information they want for consumption later on. Since users want to download huge amounts of data (Gb) in a matter of seconds, storage caches are needed close to the user. The question for the future is to what extent “public” caches will be needed or if the home network will fill this function instead.

Services that are independent of access platforms are essential for a flourishing Swedish Internet service market

The Internet will be the carrier of a large portion of all media (TV, radio, video, newspapers) and communication (telephony, chat, e-mail) in society. Users will increasingly want to purchase their services regardless of who delivers the access service. Today many services are only available in a few networks, e.g. music services or IP-TV. By 2015 the service market will have developed so that the same service will from a purely technical point of view be available from many network owners. At the same time more and more different types of terminals will be able to connect to the Internet. With technical development and economies of scale as drivers, most services should technically be able to be accessed from several types of terminals. The user’s terminal must, however, meet the basic requirements, for a number of services etc. Government agencies and publicly funded networks are key players in this context and can set a good example.

Trusting the infrastructure is key

Trust and accessibility go hand in hand

For people to trust the Internet they need to have adequate access to it. Both service providers and users play a part in ensuring functionality and accessibility of different services. They can improve their skills through training and information so that they can make the appropriate demands. Business users can require that an SLA (Service Level Agreement) is signed. This also applies to government procurement, which can also be supported

by Verva’s guidelines and recommendations. Consumer needs should also be met by setting clear expectations and having uniform SLAs.

Traceability and identification (e-id) are key functions in crime prevention and protection

To raise confidence in the Internet, factors such as encryption, traceability and digital signatures are important. Traceability helps prevent criminal activity but drives up costs. Despite the increasing costs, work on e-identity has high commercial potential in several areas. The problem with a general personal electronic identity may be solved in 2015 if the authorities can decide on a standard.

The “war” will continue in 2015 – the spread to mobile terminals is unavoidable

When individuals and the society individuals live in become more and more dependent on IT in general and the Internet in particular, the risk of attacks increases. Criminals as well as more radical groups can attack society using technical means instead of the more traditional ones. These attacks are no longer carried out by individual hackers who want to test their abilities, but by more organised groups with extortion or terror attacks in mind. Even “unorganised” crime that has plagued users for some time, such as spam, viruses and spyware, will continue, as will the counteractions. This “warfare” will continue to be independent of which terminal is used for access; even personal mobile terminals will be exposed.

Competition is a driver for preparedness

Much of the responsibility for Internet infrastructure being robust rests with the Internet operators who, within the framework of what is commercially viable in a competitive market, take steps to protect their respective parts of the infrastructure against disruptive or damaging incidents. Competition motivates operators to be well prepared to fix problems that arise.

The need for transition to IPv6

Today’s Internet communication is built on IPv4 (Internet Protocol version 4) which will continue to dominate for several years. The next version is called IPv6 and will primarily provide a greater number of addresses. We have differing opinions on the need for transition to IPv6 before 2015.

These opinions reflect the discussions within academia and industry on future IP address requirements. Some feel that IPv4 addresses will soon run out. With an imminent shortage of IPv4 addresses, demand can be expected to increase. This may increase the price of IPv4 connections which may be an obstacle to development in Sweden and other countries. The other point of view is that it is possible that an IP address will be the unique identifier of things or people, which puts the need for IPv6 into question. Sweden therefore has a reason to wait and see, rather than drive development. According to this approach, IPv6 will not solve any actual problems that have not already been solved. In any case, it is important to highlight the fact that it is neither a question of an immediate nor a comprehensive transition to IPv6 where the new protocol replaces the old. Rather, it is about another protocol being introduced gradually alongside the existing one.

A common service market

Services that work independent of access are essential for a flourishing Swedish Internet service market

The Internet will be the carrier of a large portion of all media (TV, radio, video, newspapers) and communication (telephony, chat, e-mail) in society. Users will increasingly want to purchase their services regardless of who delivers the access service. Today many services are only available in a few networks, e.g. music services or IP-TV. By 2015 the service market will have developed so that the same service from a purely technical point of view will be available from many network owners. At the same time more and more different types of terminals will be able to connect to the Internet. With technical development and economies of scale as drivers, most services should technically be able to be accessed from several types of terminals. The user's terminal must, however, meet the basic requirements for a number of services etc. Government agencies and publicly funded networks are key players in this context and can set a good example.

The problem of today's fractured service market

Viewing the current infrastructure from a service perspective, we see there is no service-independent platform for future online services. Right now simple IP based services can be provided online, for example text-based services such as web applications or simple video services without guaranteed quality (Youtube). But VoIP (Voice-over-IP) and similar services do not work with guaranteed quality and functionality between users with different service providers and network operators. Click-to-call (automatic online calls) and co-surfing (e.g. for fast and direct online support for problems with website functionality) should be very useful for many government authorities to offer citizens who would receive interactive help filling out forms or discussing options (child day care placement, education, job offers) online. If the Internet is to be considered a fundamental service infrastructure, full interoperability is needed for the services.

The boundary between the Internet and the physical world is erased

In 2015 the embedded systems in the devices and technical equipment we have around us will be increasingly connected to the Internet. If the revolution of the first decade of this century is that more and more objects in our everyday lives, such as car keys, credit cards and packaging are fitted with cheap microprocessors, the second decade will connect these to the Internet. A whole new group of services, such as the positioning of tiny objects and micropayments, will emerge to accompany this development. If to this we add small inexpensive connected sensors, a series of location-specific services will take off, with applications that are particularly useful in the care sector. We are talking about volume services that do not require large amounts of data. These volume services will probably not cause capacity problems, although issues such as access, reliability and cost will continue to be bottlenecks. There are several strong candidates (U-Code and RFID) for identification of everything around us from food packaging to vehicle parts.

Business-friendly climate

Companies producing digital services belong to a growth industry. They provide new jobs, help make business more efficient and facilitate the use of e-services within the public sector. At the same time it is hard for small business to expand. To succeed globally a national base is needed as a starting point. We need action on the service market and more national players. Otherwise there is a risk that the service market will be dominated by international players.

What do we mean by “business-friendly climate”? In such a climate, innovations will emerge with professional support. Innovators who want to realise an idea by starting a business in some cases need a support structure to take the first step to become an entrepreneur. Seed capital is needed in the early phases so that innovators can test their ideas. The innovators need access to a constructive network of experienced industrialists. Such networks help the innovator build a support structure to govern and manage the enterprise before it becomes more robust.

Education – schools and learning are the foundation

In 2015 education in schools will look different and technology will be integrated into instruction. This makes sense because the Internet offers information, communication and creativity, which are also vital aspects of learning.

Information

The Internet is a gigantic textbook. In some subjects it may replace traditional textbooks. The Internet has been used as source of knowledge for a long time. It is like a growing, searchable, collective memory. Teachers usually use the Internet to find source texts they then pass on to students for analysis and revision. Copyright laws prevent a lot of information from being used.

It is becoming increasingly common for more and more Internet users, such as teachers and their pupils, to build their own knowledge base and make it available on the Web. According to *The Horizon Report 2008*, so-called collective intelligence, where everyone contributes content, will be one of the strongest trends in a few years. This

could involve a group of people creating teaching materials together, or information being changed dynamically.

Communication

All learning requires interactivity and communication. A teacher needs to be prepared to quickly adjust a teaching method to the students. How well does the Internet meet this need?

The World Internet Institute’s report *Swedes and the Internet Year 2007* states that e-mail, which is a relatively slow form of communication, is still the most common Internet activity. A full 98 per cent of active users who were asked, mainly older users, responded that e-mail was the function they used the most. Chat rooms, IP telephony and video conferences were not nearly as common. In schools the last-named method would enable communication in realtime and thereby also a faster adjustment to the students’ situation.

Many young people experience a sense of belonging through these communication channels and this can be useful in a learning situation. In mathematics to aid comprehension it is important to discuss the subject in different “languages:” verbal, formal or visual. But a slower form of communication may sometimes be beneficial, e.g. to have time to reflect on a situation. This could be in the form of a recorded discussion in a social sciences subject or a maths review session that students can subscribe to and see through an MP3 – so-called podmaths.

Creativity

Activities in schools where students are co-producers of online content, Web 2.0 and Mobile 2.0 will be used more in education in 2015. Students will be involved in creating videos, homepages and blogs, or constructing their own games.

Reflections on Internet use, e.g. playing games, should be included in social studies, addressing, for example, the issue of media criticism, how game providers can manipulate us, or an examination of the gaming industry and economic development.

Schools have a vital mission in developing individual consciousness and critical thinking. This is important for Internet use. We need mature and self-assured people using the technology in an ethical way, for example, not infringing upon others. In schools this can translate into bullying, but bullies today can be anonymous.

An outsider at school

Schools are different from other places in that what happens there subsequently has repercussions throughout society. This relates both to Internet technology and other important subjects where the Internet is used as a tool to achieve goals. According to the Swedish National Agency for Education, more than 10 per cent of children in compulsory school do not reach the required standard in the core subjects by the time they leave after the ninth grade. Widespread lack of knowledge in the core subjects of maths and Swedish has negative consequences for the individual and society. It is clear that schools need to reach more children. Internet technology can help.

Being an outsider also means not having access to information or being able to communicate with others effectively. It is therefore vital to improve the statistic of one in three Swedish citizens who are basically without an Internet connection. A situation where school children are without access to the Internet at school or at home will be unacceptable in 2015. Nor will it be acceptable for children, their parents or their teachers to lack the skills to use the technology in a practical way.

School children

Internet technology is useful in schools because children embrace it right from the start. New technology is “cool” and makes lessons more exciting because attractive gadgets such as MP3 players or PDAs are used.

Although many young people are seasoned technology and Internet users, there are those who are not. No one should have to feel like an outsider in society because they lack the skills to use technology. We therefore propose introducing a new subject, *Computer Studies*, in compulsory school education where children can explore the latest technology and learn about ethics and how to be media-critical.

The Internet also offers a broader range of learning styles to meet the needs of more school children. In 2015 the Internet will be a natural and integrated teaching tool for all subjects in all Swedish schools.

Children and teenagers with a foreign background sometimes become outsiders. They need to have contact with their native country and knowledge about their new country in order to be integrated into society.

The Internet opens up the world in a global perspective. School children with a foreign background are able to keep up with what is going on in their native country and keep in touch with old friends. International cooperation is made easier. There is also a market here where Sweden could develop Internet-based teacher training for other countries.

Teachers

Since 2015 will soon be here, it is time to create the necessary conditions in terms of equipment and staff for broader Internet use in schools. Earmarked investments are needed for this purpose.

Technical development puts new pressure on school faculty and staff. The role of the teacher should be reviewed in light of the accelerated Internet development. New professional categories are needed in all schools, e.g. IT educators.

Teachers should also be in the forefront in terms of IT skills in general and Internet skills in particular, both to use as educational tools and to teach their students about them. The knowledge teachers have today represents the average level within the population. Education degrees by 2015 should include an educational and subject-oriented IT course for all teachers. But that is not enough. Teachers should also be offered continuous training in the field.

Parents

Parental participation is a key factor for a child's success. We need to remember to involve the parents in the school's teaching network. Support programmes aimed at different parent categories can be linked to such a network; programmes, for example, focusing on translating portions of lessons aimed at multilingual children and their parents.

By 2015 every school child should have access to the Internet at home and in school. Here there is a largely untapped opportunity to use the Internet through a mobile phone. Mobile phone services will be developed further by 2015. In Sweden 93 per cent of people have a mobile phone, which is another argument for using the mobile phone as a platform.

Finally, we should mention that motivation is an essential aspect of learning. Japan's most recent technology venture contains, in addition to the technology strategy goals, a vision whereby 80 per cent of the population should be satisfied

and motivated to use the Internet. We measure up well in comparison. A full 83 per cent of Swedes are satisfied or very satisfied with the Internet, which should translate into great potential for development in schools and lifelong learning.

Research and innovation

Competence is needed in Sweden

In the complex infrastructure environment that is emerging as we approach 2015, it is vital for Sweden to remain at the forefront of technology research to benefit from and impact development. Swedish research, financed by both the private and public sectors has great potential to help improve infrastructure over the next decade. Much of the framework created by the Internet today and in the future is being created from the bottom up, i.e. with substantial decentralisation and without an overall plan or legislation.

The increasing complexity of the Internet means that only a few individuals understand the overall picture and no one has overall responsibility. The complexity is growing so fast that people cannot keep up in terms of having the relevant skills. The development of Internet security is not driven by a uniform underlying plan either, but in many respects by solutions such as patches and add-ons. The result is that both intentional and unintentional problems arise when users and legislators fall behind. The fact that only a few individuals have an overall grasp may lead to a situa-

tion where it is hard to identify and fix problems. These individuals will also become weak links in the system.

International profiling

Almost all Internet issues have an international connection. Several issues are being addressed within the EU to harmonise rules and attitudes within EU member nations. During their EU Presidencies, countries have periodically put forward proposals for joint initiatives within the Union, for example eEurope and i2010.

When Sweden takes over the Presidency in the second half of 2009, this could be an opportunity for a further European initiative within ICT.

Today there is a national order where different organisations take responsibility for different functions of the Internet. This is described by ISOC-SE in a report on the theme: *Who is doing what in Internet Sweden?* There are also some organisations and groups working together to create the conditions to act internationally.

Sweden has a long tradition of cooperation between organisations and the public and private sectors. This tradition will be developed to get the best possible effects from the Internet, both nationally and internationally. A new coordinated effort nationally within the areas described in this report for powerful international action would be valuable.



6. Proposals

The proposals below are based on the work described in detail in the following three reports:

Ambient Sweden – Internetframsyn ur ett användarperspektiv
Ambient Sweden – Internetframsyn ur ett infrastrukturperspektiv
Ambient Sweden – Internetframsyn ur ett säkerhets- och juridikperspektiv
All reports in Swedish with English summaries.

Exploit new opportunities for enterprise and the public sector



By building on strengths, Sweden will be a leader in 2015 in mobile Internet, set an example in e-administration and green IT and be seen as a pioneer in digital media distribution.

Mobile 2.0: Just as Web 2.0 has made it possible for users to create content and functionality, we will see a Mobile 2.0 emerge where position and other local data is used as an integrated part of the services. Sweden has a unique opportunity to be a pioneer through conscious efforts by the telecom industry. The Government can speed up the progress of Mobile 2.0 by providing research and development grants as well as being a customer and ordering the technology for its own activities. Swedish innovation companies and researchers can also help drive the market.

Mobile phones today are multimedia platforms that allow us to take pictures, shoot video, write text and send multimedia messages. Mobile phones also “know” where they are – both geographically as well as by identifying other units (mobile phones and other wireless communication devices) in the vicinity. The combination of multimedia functions in mobiles and access to local context information enables us to create tools that support local “communities” in exchanging photos, sharing music, blogging at a festival or creating video “on the fly” at a sporting event. The Mobile 2.0 tool has the potential to join people together locally.

Create a Mobile 2.0 landscape that allows Sweden to be a pioneer.

The telecom industry in Sweden should take the lead to exploit Sweden's position as a pioneer in the field and create a world-class Mobile 2.0 landscape. Researchers and innovation companies should also take an active part in this initiative.

e-administration: The public sector should take responsibility for society's information resources. If forest and rock were the raw materials that built industrial Sweden, digital information is the raw material that is building e-Sweden. There is a lot to accomplish within e-administration. Access to government services and public information for citizens should be transparent with a common point of entry. Swedish government authorities should be pioneers in attaining confidence-inspiring levels of information security.

Focus on the role of the authorities and information security within e-administration. Effective e-administration is a necessary step towards being a prominent Internet nation. Access to government authorities should be transparent with a common point of entry for all users. The authorities need to implement the 24-hour Web. Trust in the authorities' information security is crucial for the development of e-administration.

A special structure needs to be put in place for oversight of the information security work of government authorities.

Green IT: Sweden can be a leader in green IT showing how IT can be used to reduce climatic impact. Internet-based meetings to replace travel need to be more efficient both in terms of the Internet and terminal technology and from a work method perspective ensuring, for example, chairman support, shared documents or multi-party conferences. This may be a question of education and information about what the technology can offer. The big challenge is to change the meeting culture in society, so that the use of telecommunication and Internet-based services becomes an obvious option.

Let the Internet be a tool for sustainable development through increased investment in green IT. Ensure that the public sector makes better use of the alternatives to physical travel that the Internet offers. Ensure that new infrastructure contains higher societal sustainability standards.

Digital media distribution: The message from users about file sharing is clear: people want to be able to share music and film with each other. The digital media format is easy to use and modern and users want to share music and film with their friends. The vast majority would probably do this legally if sensible, reasonably priced business models existed. Sweden has up to now been a leading nation in developing digital media distribution technology. Sweden should exploit this to be a pioneer in finding an efficient overall solution for regulation, legislation, innovative business models and effective IT infrastructure. Such a solution could spread throughout the world. It requires, however, the cooperation of several agencies, companies, researchers and representatives from other public institutions and interest groups.

Create overall solutions for digital media distribution to make Sweden a pioneer in the field. We need initiatives for interdisciplinary studies of user behaviour to ensure we do not lock users into solutions that force them to resort to illegal options.



Increased trust in the Internet

Trust is achieved by increasing general knowledge on the importance of information security for users and the public and private sectors. Trust in the internet would increase by having a general and accepted e-identification solution. The internet also needs to be robust, i.e. free from interruptions and of high quality to meet video and TV needs without delays and interruptions. This proposal has four components.

Firstly, **a basic level of information security** must be accepted by users, providers, businesses and government agencies. This involves both an overall greater understanding among users of the risks of reckless internet use, and requiring higher standards of providers and product developers. Security measures must be actively integrated into the development of new services and functions.

Secondly, **the legislation must be adapted** over time to changes in society, involving developing or abolishing existing regulation. New phenomena are often regulated by law over time as circumstances require.

We propose that fundamental freedoms and rights as protection for personal integrity must be adequately protected in the electronic environment as well. An inventory and evaluation of existing constitutional legislation must be carried out based on the changed conditions in society. Societal changes have been so fast and radical as a result of IT technology in combination with the emergence of the Internet that a comprehensive overhaul of the collective civil and criminal legislation is called for. Combating IT crime should be

prioritised by raising the level of competence in the same way as has been done for environmental and economic crime.

Thirdly, we need to create the necessary conditions for a **widespread and generally accepted e-identity for all situations**. We need more ways for users to identify themselves online, including via mobile applications. We need solutions that allow users to choose how much of their identity they expose in order to use an online service. A simple method is needed to “brand” data from ordinary users as well so that we can be sure the data comes from the right source and that it has not been changed by anyone.

The Swedish Administrative Development Agency (Verva) has, at the request of the Government, produced a plan for e-identification (Verva 2007). The plan is mainly aimed at public administration and should therefore be expanded to cover other parts of society.

The Ministry of Enterprise, Energy and Communications should assign the relevant departments to drive the e-identification plan so that it covers the needs of the entire Swedish society. e-identification should be platform and terminal independent. A first step is for those providing e-identification to offer commercial solutions based on the WPKI Non-Profit Association's specifications (WPKI, 2007).

Fourthly, there is a need for a **general quality guide for Internet connections** in the form of “colour coding.” Today's consumers are offered Internet connections with uneven quality. It can often be difficult for an individual consumer to judge capacity needs and the quality of an Internet connection. Through a system of colour coding, consumers would be made aware of the quality required for the services they need.

Up to now the market has been unsuccessful with technology solutions and business models. A system of colour coding would provide guidance – if you want service X you need a “yellow” connection. In this way the Internet could become “service transparent;” it will be possible to easily deliver a service from one point to everyone on the Internet who wants it.

KTIB (Swedish Consumer Bureau for Telecom and Internet) will be assigned to establish the standards that should apply for various kinds of Internet connections taking into account different consumer needs. The standards should be formulated in consultation with PTS (Swedish Post and Telecom Agency), industry players and Internet research and consumer representatives.

A common and open service market



Internet users in the future need to be able to use services regardless of access and carrier network. Examples of common services are e-mail addresses that follow the user and not the operator, communication services such as video conferences, and TV and music services independent of operators. To initiate user-driven development towards a common service market, a number of steps need to be taken.

Services that are independent of access and carrier network. This proposal aims to stimulate development whereby Internet users can access services independent of access and carrier network.

Giving users the ability to keep their e-mail address when they switch network operator can be compared to number portability for mobile networks which is an option for mobile phone users.

The national and local government, in its role as a procurer of Internet access, can be a competent customer and, for example, proactively require fully redundant name servers and DNSSEC from Internet providers. The public sector should set a good example. Government authorities and publicly financed networks should meet the basic standards required to stimulate development and use of services on the Internet. Requiring govern-

ment authorities to meet these standards is an important factor in achieving this.

The proposal aims for all public services by 2015 to be open and accessible and independent of access and carrier network. The public sector must prioritise purchasing services that can be accessed by all. All Swedish online public services must be perceived as secure, robust and easy to access and use. The proposal is aimed at government authorities and network operators operating in Sweden. To choose services, we suggest cooperation between players, e.g. in the form of a sector council for Internet Sweden.

Establish a meeting place for players in the service market. This proposal aims at establishing an organised “meeting place” for all players in a maturing service market where services, platforms and networks can be developed, tested and prepared for commercialisation through industry agreements. This would help increase the variety of services and make the services more accessible to users. At this meeting place the parties could develop solutions for a robust service market on the Internet in Sweden, e.g. by testing different business models, products and technologies. Today there are several service providers and developers who are finding it hard to reach a larger audience because the necessary technology is lacking. For users with a basic level of Internet access this can be done using open interfaces for operator services. The proposal would help third-party service providers gain access to services such as user ID, payment and positioning without the need for a large investment. By lowering the threshold for players to contribute value creating solutions, more players are given the opportunity to enter the service market. This would lead to a maturing market where players can operate internationally as well. Internet players in Sweden are given more opportunities than today to create, without compulsion, common solutions and partnerships.

One option is to use existing test beds. It is important that the tests are designed based on the users’ circumstances regardless of networks and with all the relevant components. The test will make it easier for small businesses and help promote the growth of more dynamic ecosystems.

We propose that the threshold for introducing new Internet services be lowered significantly

for new Swedish players, especially for small and medium-sized businesses, so that they can reach a larger group of end customers. This will grow the service market. The users should feel that the Internet offers a significantly larger range of attractive Swedish services.

Work towards advanced traffic exchange between operators. This proposal’s overall aim is to allow users to choose advanced services from providers other than their existing network operator. Certain services, such as mobile operators’ music services and IP-TV over broadband, are currently only available from the particular operator. More and more of these services should also be available e.g. in open city networks and building networks. A likely development is that commercial network operators will become more interested in filling their networks with attractive services as the differences between operators’ access services diminish and the access market becomes saturated. Swedish operators may possibly also see the benefits of working with each other as this would strengthen their competitiveness in comparison to large multinational service companies such as Google and Yahoo. This would perhaps result in them offering to exchange services to make them available for each others’ access customers. Such a move would require cooperation, e.g. with respect to Quality of Service, including at the network level.

Concretely, this proposal aims to create incentives for Internet operators to collaborate on infrastructure and services. Successful solutions are based on combinations of technology and technical solutions. It is therefore important to demonstrate that there are business models and technology that work. Regulation of natural monopoly situations may be needed, including for access networks. Incentives are needed for collaboration on infrastructure and services. A concrete proposal is to develop standard contracts that operators can use for advanced traffic exchange.

Most Internet services will be network independent in 2015 because the services’ access network needs will be met by the various operators. The proposal is aimed at network operators operating in Sweden. The incentive structure for this type of national collaboration in a climate of global competition may require Government involvement.

Infrastructure for future Internet services



We believe that the infrastructure in Sweden in 2015 should be able to be described as follows:

- Open and in a competitive environment
- Reliable
- Secure
- Supporting a flourishing service offering

We see the need for user capacity of up to 100 Mbit/s – both fixed and mobile connections. The main driver is video and TV. The following conditions are required to realise this:

- Long-term and predictable regulation that stimulates investment
- Procurement in a competitive environment that ensures that individuals and businesses have access to broadband in areas where market players are not investing fully
- Secure access, functionality and quality of traffic between operators
- A modern spectrum policy

Also, inappropriate competition due to tax-financed expansion of broadband networks should not be allowed to occur. The future infrastructure

needs to be more resource-efficient and use less energy – an issue that must be solved internationally.

Sweden should also lead development towards a modern spectrum policy, encompassing technology and service neutrality, effective spectrum management and spectrum trading. This would help Sweden be an industrial leader in the area of dynamic/spectrum access, which facilitates cheap and energy-efficient wireless high-speed access. Sweden has strong potential to be a test bed for this.

This proposal has two parts: A modern spectrum market and a research investment, and it applies not only to commercial players, but also to government agencies such as PTS and VINNOVA.

Our aim is for openness and competition to be guiding principles in the 2015 infrastructure. The industry should also guarantee the accessibility, functionality and quality of traffic between operators.

Promote a business and entrepreneur friendly climate



The prospects for starting, expanding and operating a business must be better in Sweden than in our competitor nations. This applies to everything from exploiting innovation to seed financing and having simple regulatory frameworks. The regulations must allow Swedish and foreign citizens with families and the type of expertise that is in demand to work and live in Sweden. A business-friendly climate is vital for the entire private sector, but since the IT sector is over-represented

among start-ups, it is particularly important for Internet-related enterprise.

Companies producing digital services need help. They belong to a growth industry. They provide jobs, help improve efficiency, e.g. in the public sector where e-services are used. From this perspective, the market today is not working. If we do not act on the service market in Sweden, it will be taken over by international players. It is already dominated by a few big players.



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We need an innovation-friendly climate with professional support for innovators who want to start a business to realise their ideas. Seed capital is needed in the early phases, followed by venture capital. It is also essential to create ac-

cess to good networks of experienced industrialists to support the innovators, such as Connect and IVA's mentor program. VINNOVA has an important role in developing structures to test the viability of innovators' ideas.

From digital gap to digital ladder



In the past we talked about a digital gap between those in the information society and those outside. In the future we will see a digital ladder where each rung is important and which everyone can climb. There are various levels of digital competence and the different levels (rungs on the ladder) are not static but constantly changing as the technology develops. For Sweden to be a leading Internet nation in 2015, a conscious and joint effort is needed to help and inspire all citizens to climb the digital ladder. The public sector, schools,

various parties in the labour market and citizens' organisations need to work together to achieve this.

For Sweden to be a leading Internet nation in 2015 a conscious and joint effort is needed to help and inspire all citizens to climb the digital ladder. The public sector, schools, parties in the labour market and citizens' organisations need to work together to achieve this.

A flexible working life



In 2015 the expectations of the job market will be great, especially among young people. Distance work may be a success factor for Swedish industry and the public sector. New forms of communication will help regional development. Systems and applications that facilitate a more personal form of contact at a distance via the Internet are also necessary for Swedes to climb the digital ladder. To attract expertise, free up resources, manage personal stress levels and reduce the need for physical meetings and thereby also climatic impact, a more flexible working life needs to be developed using the Internet as a tool. The various parties in the labour market need to develop a new order for the working life of the future where 9 to 5 office jobs are not the norm.

Many Swedish government authorities have offices in different locations. They should lead the way, creating a plan of action and acting as catalysts for a work culture which, with the help of the Internet, promotes a flexible working life independent of time and place.

The Government should require the Swedish authorities to create action plans and act as catalysts for development that promotes a flexible working life independent of time and place. The Government Offices should have a department responsible for coordinating these efforts which should involve a dialogue between job market players, working life researchers, organisation consultants and architects.



Introduce IT-based teaching and computer studies in schools

Develop teaching methods for all subjects that make better use of IT and the Internet. An investment in this area should include resources for educational research, teacher training in technology use and the development of appropriate tools. Swedish innovation companies can play an important role, both nationally and internationally. We would also like to see a new compulsory subject – Computer Studies – introduced in schools. Computer Studies should include technology, ethics, information security and how to be media-critical, which are also skills needed to climb the digital ladder.

Swedish schools need to work on reaching more school children. A recent study shows that just over 10 per cent of Swedish compulsory school children are failing in the core subjects. The Internet could be an important tool in adding more learning styles. One prerequisite for using the Internet in school classes is to have sufficient IT personnel and technical equipment resources.

The Minister for Education should initiate an investment in education to help all subjects make better use of IT and the Internet, including resources for educational research, teacher training in technology use and the development of appropriate tools. Swedish innovation companies could play an important role, both nationally and internationally.

We would also like to see a new compulsory subject – Computer Studies – introduced in schools. Computer Studies should include technology, ethics, information security and how to be media-critical, which are also skills needed to climb the digital ladder.

Starting in the fourth grade, every child should have access to his/her personal online terminal at school.

All of Sweden's universities should set up an "Internet experiment workshop" where upper secondary level school children could participate.



Research and innovation that places Sweden at the top

The United States has led Internet development, both technically and economically. Europe and the Nordic region in particular have played the same role in telecommunication. Now that the number of mobile phone users is exceeding fixed users, it is vital to safeguard Europe's and Sweden's position and tradition in mobile communication.

In Sweden we have world-class research teams and more researchers with the potential to join them. Maintaining and expanding this research front is essential if Sweden is to be a leading Internet nation. But this will not happen by itself. To be successful, we need a national Internet re-

search initiative. Like in the EU, we need to create a national programme for Internet research that will make Sweden one of the leading nations in the EU. Industry and academia need to work together so that successful research can be converted into products and services. During its work the panel has highlighted several important research areas, including network architecture, system architecture, operation and maintenance, security, routing and distributed storage.

This proposal is aimed at Swedish ICT Research which is assigned the task of establishing an "Internet of the Future" sector council.

A structure for this already exists within Swedish ICT, e.g. through existing councils on motor vehicles and security. Now we need stakeholders – researchers, financiers and industry – at the initiative of Swedish ICT, to step up and take part in the sector council.

Before the end of 2008 an “Internet of the Future” sector council will be established and a strategic plan will be prepared as a basis for the 2009 research budget for the sector council. The goal will be that in 2015 there will be at least three Swedish world-class Internet research teams.

Research provides the prerequisites for ensuring the competitiveness of Swedish industry and encouraging new enterprise (start-ups).

Within the European research community the EIT (European Institute of Innovation and Technology) is expected to be an important player in the next few years. EIT will be organised in the form KIC – Knowledge and Innovation Centres – with different areas of focus.

Sweden should work hard to ensure that an ICT targeted KIC has one of its main hubs in Stockholm to ensure that we, from both an academic and industrial perspective, can continue to be at the frontline of international research into the Internet of the future.

International profiling



Swedish players must continue to be active in international organisations for Internet use and standardisation, particularly in the areas of mobile Internet, e-administration, green IT and digital media distribution. Swedish players should be active at important conferences. Swedish and foreign companies should have a positive view of setting up a business in Sweden. For national coordination and to act with unanimity internationally, we propose forming a network. The main purpose of the network is to work in a more structured, long-term and consistent way. Today’s efforts are good, but from time to time they have tended to involve ad hoc solutions.

The network should produce a description of the processes and activities that exist and are under way in Sweden, the EU and internationally within the area of the Internet. It should work on describing objectives, planning and resource allocation. Researches will be recruited to the network to describe the administration of the Internet and how this information is spread to the

users. One task will be to monitor important international conferences and work to ensure high quality Swedish participation.

Organisations such as the IT policy section of the Ministry of Enterprise, Energy and Communications, ISOC-SE, PTS, .SE, DFS and others that work with Internet issues should be part of the network. ISOC-SE (Swedish Chapter of the Internet Society) is an appropriate organisation to act as the convenor for the network.

We suggest forming a network of organisations that plan and work together for Sweden to address issues nationally and assess how and in what way to get involved internationally. This may involve coordination between public authorities, the private sector and organisations to achieve a specific result. The network should also propose an overall strategy for how Swedish players can act in the best way nationally, within the EU and internationally, and which geographical regions are of particular interest



Implement the proposals through Ambient Sweden

We suggest that the proposals prepared by *Internet Sweden* now be implemented through *Ambient Sweden*, a programme to start in 2008 that will focus on further development and implementation of the proposals that have been presented with the aim of making Sweden a prominent Internet nation by 2015. IVA is an appropriate or-

ganisation to coordinate this initiative through *Ambient Sweden*. IVA is also, through *Ambient Sweden*, willing to assist by providing the Ministry with background materials and arranging conferences during Sweden's EU Presidency in autumn 2009.

7. Appendix

Project participants

The following individuals have worked on Internet Foresight.

Steering committee

Jan Uddenfeldt, Ericsson, Chairman Internet Foresight, member of IVA's Division XII/Information technology
Peder Ramel, CEO, 3
Lars Stugemo, CEO, HiQ
Östen Mäkitalo, KTH, member of IVA's Division XII/Information technology
Staffan Truvé, CEO, SICS + Interactive Institute, member of IVA's Division XII/Information technology
Marianne Treschow, gd, PTS, member of IVA's Division VII/Basic and Interdisciplinary Engineering Sciences

User Panel

Bo Boivie, HiQ, Panel leader
Pernilla Rydmark, VINNOVA
Björn Scharin, PTS
Jan Flodin, ISOC-SE
Rolf Berndsson, DFS
Christer Marking, City of Stockholm
Charlie Gullström, KTH
Olle Olsson, W3C and SICS
Henrik Ahlén, Alfa Bravo AB
Kia Höök, Stockholm University and SICS
Anna Stenkvis, Tensta Gymnasium
EwaThorslund, Almega
Ola Knutsson, KTH, Editor

Infrastructure Panel

Olle Viktorsson, Ericsson, Panel leader
Göran R Olofsson, TeliaSonera
Andreas Cederborg, 3
Anders Bergfeldt, Multicom Security
Anders Rafting, PTS
Ulf Borbos, SSNf
Bengt Ahlgren, SICS
Jens Zander, KTH
Tove Madsen, Acreo

Eva Westberg, VINNOVA
Niklas Kviselius, Stockholm School of Economics

Security and Legal panel

Henrik Nilsson, Bird&Bird, Panel leader
Christina Jonsson, ISOC-SE
Helena Andersson, Stockholm University
Anna Hörnlund, PTS
David Mothander, 3
Wiggo Öberg, Verva
Magnus Bergström, The Swedish Data Inspection Board
Patrik Lidehäll, KTH
Nicklas Lundblad, Google
Per Oskarsson, the Swedish Emergency Management Agency
Katarina Renman-Claesson, IRI
Oscar Wenell, TDC Song
Benjamin Yousefi, Stockholm University, Editor

Project Management IVA

Staffan Eriksson, Project Director
Östen Frånberg, Project Manager
Eva Stattin, Communication Manager
Pelle Isaksson, Communication Assistant
Ann-Margret Malmgren, Project Assistant

Students from IHR and MarkIT from Stockholm University have also conducted studies and attitude surveys on behalf of Internet Foresight.

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The Internet is playing an increasingly important role in our lives. Today private individuals, companies and organisations depend on the Internet for a multitude of functions for both business and personal needs. The need for Internet infrastructure and services is growing rapidly. In many ways, Sweden is already at the forefront of this development. If Sweden is to maintain its position it is essential that we as a nation play an active role in influencing development in this area.

This report is a synthesis of the work carried out within the framework of IVA's Internet Foresight project. The project has focused on the goal of ensuring that Sweden is a leading Internet nation in 2015. Around fifty experts have worked intensely in three panels to analyse the current status, look into the future and formulate proposals for a course of action. The panels' analysis and proposals are presented in separate reports which can be ordered or downloaded on IVA's website: www.iva.se/internetframsyn.

In this report we explain why we believe it is important for Sweden to be a successful and leading Internet nation and we give our definition of means, measurers and actions for a "a prominent Internet nation". To ensure that development corresponds to the project's proposals, we have started a programme called Ambient Sweden. This programme will enable the proposals to be implemented.



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