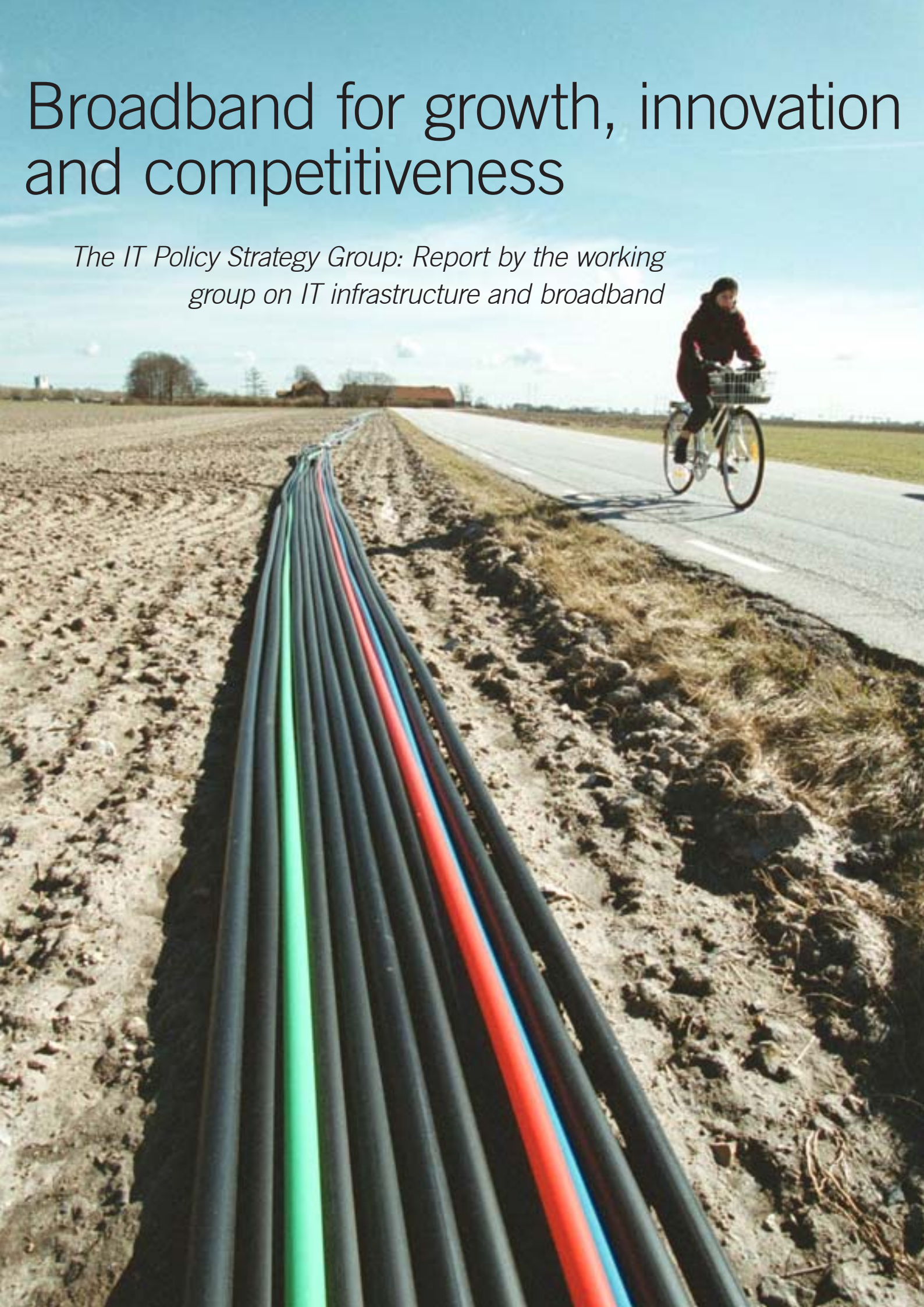
Broadband for growth, innovation and competitiveness

The IT Policy Strategy Group: Report by the working group on IT infrastructure and broadband



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1 Summary

In April 2004 the Government's IT Policy Strategy Group set up a working group on IT infrastructure and broadband. The primary task of the working group has been to support the Strategy Group by working, within the framework of a free market, for future-proof, accessible, competition-neutral, technology-neutral and coherent electronic communications networks, which are capable of meeting the challenges of the future. This report summarises our discussions and proposals.

The working group has produced the following vision for this area:

Sweden must be the country where an efficient and secure IT infrastructure provides the best conditions for enterprise, innovation and eServices, both public and private. IT must enable Swedish people to access the services they need, no matter where they are.

This imposes a number of demands on different actors – business and industry (operators, network-owners and other stakeholders) and the public sector (as legislators, regulators and purchasers, as well as network-owner and fund provider). By means of this vision we want to bring about both a growth-oriented climate and freedom of choice for the end-user, given the future scenario of globalisation and of Sweden as a meeting-place that is described in the final report by the Strategy Group.

Growth and innovation in the broadband sector require a number of interventions going far beyond IT policy. Among them are a changed attitude to public procurement; purchaser skills; new building standards to promote broadband installation during the renovation, extension and new construction of buildings; investment in research and education; etc. Sweden must become an attractive place in which to develop and test new services, as well as a meeting-place for expertise in the area. Here, IT infrastructure constitutes an important precondition for innovation in many areas. A sustainability perspective, with the infrastructure's potential in relation to flexible working forms, distance-working, etc., should also be included. In this regard, the working group proposes that a separate agenda should be established for this broader measure, which includes better opportunities to establish new business in Sweden.

From the perspective of the end-user we see primarily two problems. The first relates to the ability to take part in the IT society and hence bridging over the digital gaps. If Sweden is to become the most attractive place for innovations and enterprise in the IT area, the skills of the population must keep pace. The other concerns the difficulty for the end-user in comparing various broadband products, since information about them is not specified in a uniform manner.

All this entails a number of consequences and requirements for the IT infrastructure. One of the conclusions that we have drawn, like others before us, is that it is not efficient to build a physical IT infrastructure for one application only. It is important to build physical IT infrastructure for general use, in which the capacity of the network can be increased step-by-step, for example, by upgrading communications equipment without needing to construct additional networks. Likewise it is important that the technical conditions should exist for high capacity in both directions, both to and from the user. The central point for development and access to services, both public and private, is a favourable development of stable connections and links with the Internet. This requires consumer advice, demands on the suppliers and understanding for the roles of the various actors and their potential for stimulating development. For a consumer to have only one Internet service provider to choose from does not necessarily imply a limitation of competition and freedom of choice as regards services.

To achieve the vision we have set up the following general objectives for IT infrastructure:

The whole of Sweden should have an efficient and future-proof infrastructure for electronic communications with high transfer capacity in both directions, so as to enable good technical quality of transfer for multimedia services, in a functional, cost-effective and competitive market.

A number of measures need to be adopted to achieve this goal. An IT policy agenda must be developed within the general industrial policy. In addition, *continuing broadband subsidy, an investment in "broadband in the home", fibre-cabling, coordination of ducts, labelling of services, a predictable spectrum policy* and a number of other measures can take us a large part of the way. The most important thing is that the measures adopted should be characterised by their *long-term and foreseeable nature* – all with a view to creating a market, where there is sound competition, in which the end-user is in focus and where there are incentives for investments and innovation.

2 Introduction

The Government decided on 18 June 2003 to appoint an IT Policy Strategy Group. The Group's remit was to provide advice to the Government and to be a driving force in achieving the IT policy goal of an information society for all. An important task has been to work together with other actors in society to maintain Sweden's vanguard position in the IT area.

Questions within and adjacent to the IT infrastructure area have been an important focus area throughout the Strategy Group's mandate. In April 2004 a working group on IT infrastructure and broadband was set up, with about twenty members. During the two years the working group has been active, there have been twenty or so meetings at which a number of questions have been discussed. Agreement has been reached on a number of these issues, while on others there have been widely differing viewpoints.

In this report we summarise the discussions that have been held in the group and we also submit a number of proposals as to how we envisage taking this work further. We submit these proposals to the IT Policy Strategy Group.

The report is arranged as follows. Chapters 1 and 2 comprise the summary and introduction. Chapter 3 deals with the working group and its objectives, while Chapter 4 contains the conclusions and proposals on which the working group is in agreement. Chapter 5 is a description of the current situation on the basis of a number of different perspectives, while Chapter 6 takes up a number of other relevant problems that we see in the present situation, but where there is not complete agreement in the group about how they are to be solved. The annex is a complementary section describing all parts of the communications architecture.

The report reflects only the working group's proposals and discussions and has therefore not been processed within the Government Offices. The members of the working group have been chosen as individuals and not as representatives of their respective organisations. Therefore the report gives an account of the views of the individual participants and not necessarily those of their organisations.

Stockholm 23 October 2006

On behalf of the working group

Patrik Fältström, member of the IT Policy Strategy Group
Caroline Andersson, project leader at the IT Policy Strategy Group secretariat

3. The working group on IT infrastructure and broadband

3.1 The remit

In accordance with its job description, the primary task of the working group has been to support the Strategy Group by working, "within the framework of a free market, for future-proof, accessible, competition-neutral, technology-neutral and coherent electronic communications networks, which are capable of meeting the challenges of the future."

The working group's task has included submitting proposals for common goals and to stimulate the actors concerned to strive in the same direction, so that public efforts towards IT infrastructure are optimised. This task has also included identifying barriers and indicating priorities in efforts to promote future-proof, accessible, competition-neutral, technology-neutral and coherent electronic communications networks. In this task, the working group has taken advantage of previously acquired experience in the ongoing Government's broadband initiative, and the accumulated results of work on broadband issues presented by various actors.

The working group has aimed to find forms and methods in order to:

- aid in the formulation and clarification of concepts on IT infrastructure and Internet architecture, in order to facilitate cooperation and dialogue between network-owners, operators, and public and other actors;[1]
- formulate proposals for inclusion in the common set of goals and stimulate the actors concerned to strive in the same direction, so that public investment in IT infrastructure is optimised;
- identify barriers and indicate priorities in efforts to promote future-proof, accessible, competition-neutral, robust and technology-neutral, coherent electronic communications networks;
- create dialogue and cooperation between the actors concerned and encourage forms of cooperation that lead to results and stimulate the various market partners, both operators and users;
- help to increase understanding of the consequences of the current process of convergence in Internet technology; counter various forms of lock-in and lock-out effects in electronic communications.

An important part of the work has been to submit evidence in the form of target formulations and specific proposals for the IT Bill which the Government put forward in July 2005 (Government Bill 2004/05:175: From an IT policy for society to a policy for the IT society).

During 2005-2006 the working group tackled a number of issues that still constitute thresholds or barriers in the optimal functioning of IT infrastructure and in meeting the needs of society, both collectively and individually. Examples of such issues are the labelling of services, the future of the copper network, e-ID and the review of the Electronic Communications Act. The working group has been chaired by Patrik Fältström, a member of the IT Policy Strategy Group and Internet specialist at Cisco, and coordinated by Caroline Andersson, Project Leader at the IT Policy Strategy Group secretariat.

A list of those who were members of the working group during the whole or parts of its mandate period is given below. It is important to note that they were selected as individuals and not as representatives of particular organisations. That means that the descriptions, proposals and all else emerging from the report are not necessarily supported by their respective organisations. The aim has therefore not been to achieve consensus in the Group, but rather to promote constructive discussions that can assist in the work on IT policy. Those whose names are given in italics left the working group before completion of this final report.

Patrik Fältström, The IT Policy Strategy Group/Cisco
Caroline Andersson, Secretariat of the IT Policy Strategy Group
Maria Häll, Secretariat of the IT Policy Strategy Group
Ministry of Industry, Employment and Communications
Ministry of Education, Research and Culture
Jonas Birgersson, Labs2
Björn Björk, Swedish Association of Local Authorities & Regions
Markus Boberg, Consiglio
Ulf Borbos, Swedish Urban Network Association
Peter Dahlström, Länssamverkan Bredband
Anne-Marie Eklund-Löwinder, Internet Infrastructure Foundation
Roland Eklund, TeliaSonera
Jörgen Eriksson, Packetfront
Linus Fredriksson, Radio and TV Authority
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Jonny Nilsson, National Post And Telecom Agency
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Anders Rafting, National Post And Telecom Agency
Johan Rådman, Swedish Consumer Agency
Rene Summer, Ericsson
Ola Svensson, Formerly of the Swedish Consumer Agency
Hans Tjernström, Teleste
Maria Ulfvensjö, Swedish Competition Authority
Nils Weidstam, SOS Alarm
Anna Wibom, National Post And Telecom Agency
Fredrik von Essen, IT-Företagen

[1] See Annex 2: The communications architecture.

4. Conclusions

The working group agreed on a number of conclusions relating to the vision, targets and proposals for measures, which we report below.

4.1 Vision and goals

In the IT Bill (2004/05:175) the Riksdag (Swedish Parliament) laid down the following IT goals in this area:

An efficient and reliable physical infrastructure with high transmission capability must be accessible nationwide, inter alia to give people access to interactive public eServices.

The working group has examined this goal but has come to the conclusion that in order to offer one of the world's most attractive IT infrastructures we would need to aim significantly higher. We have therefore produced the following vision:

Sweden must be the country where an efficient and secure IT infrastructure provides the best conditions for enterprise, innovation and eServices, both public and private. IT must enable the population of Sweden to access the services they need, no matter where they are.

This imposes a number of demands on different actors – both the business sector (operators, network-owners and other stakeholders) and the public sector (as legislators, regulators and purchasers, and also as a network-owner and fund provider). By means of this vision we hope to bring about both a growth-oriented climate for IT-intensive business and freedom of choice for the end-user.

Growth and innovation in the broadband area require a number of initiatives going far beyond IT policy. At issue are a revised attitude to public procurement; purchaser skills; new building standards to encourage broadband installation during the renovation, extension and new construction of buildings; investment in research and education; and so on. Sweden must become an attractive place in which to develop and test new services, as well as a meeting-place for expertise in the area. Here, IT infrastructure constitutes an important precondition for innovation in many areas. A sustainability perspective, with the infrastructure's potential in relation to flexible working forms, distance-working, etc., should also be included.

From the perspective of the end-user we see primarily two problems. The first relates to the ability to take part in the IT society and hence bridging over the digital gaps. If Sweden is to become the most attractive place for innovations and enterprise in the IT area, we need both spearhead skills in the IT area and a high standard of awareness among the general public. The other concerns the difficulty for the end-user in comparing various broadband products, since information about them is not specified in a uniform manner.

To achieve the vision, we have set up the following general objectives for IT infrastructure:

The whole of Sweden should have an effective, robust, and future-proof infrastructure for electronic communications with high transfer capacity in both directions, so as to enable good technical quality of transfer for multimedia services, in a functional, cost-effective and competitive market.

In our interpretation, the overall goal entails the following consequences:

- An IT policy agenda must be developed within the general industrial policy.
- Consumers must be able to make conscious choices between the services on offer and obtain the services they want. The price of services must reflect the quality chosen.
- Those providing services must be able to offer their Internet-based content services to the target groups they themselves define without the Internet Service Provider or Internet operator erecting market or technical barriers to accessibility.
- Competition must work well at all levels in the value chain, both at the national level and the regional and local levels.
- In its roles as purchaser, procurer and user of services, the public sector must set a good example, stimulate high quality and aid growth and innovation.
- Interactive public eServices must be accessible to people and enterprises in all parts of the country.
- Sweden's infrastructure for electronic communications must be robust and have good capacity to withstand attack, interference and interruption.
- Regulation and legislation, as well as skills and knowledge among the responsible agencies, must support the above goals.
- Within the industry, there should be active cooperation groups/organisations for various types of initiatives and agreements within the sector, and so on. IT-Företagen, the Swedish Urban Network Association, the National Telecommunications Cooperative Group and the Swedish Internet Operators' Forum, etc., are all possible examples.

We summarise below the proposals on which we have been able to reach agreement in the working group, in order to strive towards the vision and achieve the overall goal.

4.2 Proposals from the working group

4.2.1 Passive IT infrastructure

The passive infrastructure, in particular fibre optic cables, masts and cable trunking, will be usable for many years and hence will take a long time to depreciate in value. Active equipment constantly changes. Different technologies are replaced, developed and depreciate very quickly. We have therefore opted to focus on the passive infrastructure that, because of its nature, is very important to the development of an information society for all. The passive infrastructure must be accessible to market actors and have good national coverage. The working group is in agreement that there are a number of competition problems and challenges at the passive infrastructure level (i.e. equipment not powered by electricity). Some of these problems should be solved by means of clearer guidelines and incentives to cooperation with a view to achieving better exploitation of the passive IT infrastructure and hence stimulating competition in those parts of the infrastructure that are more changeable. This includes the idea of e.g. coordination in the laying of certain conduits and that cable is laid down when road excavations are being carried out for other purposes. It is desirable for this to be solved by means of sector agreements in which a central authority and/or local initiatives could take the lead.

It is also important to have an active attitude to deployment of fibre cable. When excavations are being carried out for other reasons, the opportunity to lay fibre cables should be taken, with the encouragement, where appropriate, of both central and local authorities. It is important to remember that no commercial actor will lay down fibre cable without a customer. The excavation costs must for example be coordinated among different actors, and that requires an established financing model. The Government should encourage the negotiation of suitable models. Such measures reduce the public disruption caused by repeated excavations, as well as increasing the possibility of more rapid and robust broadband expansion outside built-up areas, and contribute to more rapid general extension of broadband throughout the country. Initiatives in this area also fall under the proposals below 4.2.2-4.2.7.

Proposal: **Cables and conduits should be coordinated, including the allocation of costs, the goal being at least that empty conduit should be created when excavation must in any case be carried out. The Government should take an initiative to bring about the negotiation of such agreements.**

4.2.2 Predictability and a long-term approach

The broadband market, including the building and development of IT infrastructure, is relatively young. Regulation, investment, ownership and public sector roles must all be inspired by predictability and a long-term approach. Obscurities and uncertainties discourage market actors and end-users alike, in particular as regards readiness to invest. That in turn has a decisive effect on most other IT policy areas that in various ways are dependent on a functioning IT infrastructure. Sector agreements can be a better route than regulation and a natural step before resorting to regulation, provided of course that the provisions of competition law are observed.

The Government's standpoint has long been that this development must be market-driven. In addition to the commercial level there can, nevertheless, be a need for measures by society. The operators currently have certain (minor) obligations under the Electronic Communications Act, but there are no public measures, i.e. investments financed out of general taxation to provide for the needs of society or basic requirements. The working group therefore advocates a political discussion on this subject.

Proposal: **Regulations, interventions, ownership and the roles of the public sector must be characterised by predictability and a long-term approach, as well as adopting a holistic perspective over all policy areas. Government initiatives should primarily complement sector initiatives and agreements, stimulate demand and have clear, monitorable goals.**

4.2.3 Security, robustness and confidence

A developed IT society, in which both communications and functions of importance to society are increasingly carried out by electronic means, requires a robust infrastructure for these purposes. Security, robustness and confidence are basic preconditions if electronic communications are to work well. Coordination of certain functions between different actors is the key to progress in this, for example within areas such as the documentation of physical networks that enable electronic communication, including electric power supply, and so on. Cooperation between network owners in electricity supply and electronic communications is currently led by the National Post and Telecom Agency and Svenska Kraftnät (the Swedish national electrical grid) (as well as by the county administration boards) but should be further encouraged or formalised on the basis of government initiatives.

The public sector in the shape of, for example, Verva (the Swedish Administrative Development Agency) must further act as an expert purchaser. By buying and demanding from the market goods and flexible functions and solutions it is possible in many cases to influence the market to a much greater degree than through regulation. In addition, work on the specification of basic functions, with a focus on IT infrastructure and the Internet, needs to be pursued and developed.

Proposal: **In consultation, the industry should set down game rules for cooperation between the country's dominant network owners. Central agencies should initiate and support such a development.**

The market should be encouraged to increase cooperation among the owners of physical infrastructures for electronic communications and electricity supply, etc. A review of documentation rules should be performed, with the aim of creating uniformity and increasing precision and quality in the work. Electricity supply focusing on reserve power supply should be studied in particular.

Greater cooperation among electricity supply and electronic communications network owners is currently being promoted by the National Post and Telecom Agency and Svenska Kraftnät (the Swedish national electrical grid) but should be further encouraged or formalised by means of central government initiatives.

Purchasers and especially Verva, which represents the public sector, should ensure clear requirements are formulated. In addition, continue to develop specifications of basic functions focusing on IT infrastructure and the Internet.

4.2.4 Distribution and access networks

As regards distribution networks and access networks, there is probably still a need for financial support in sparsely populated districts, as well as for more rapid development of future-proof distribution networks (that is to say, fibre-based networks reaching to 250 metres from the household/property/client) that are also capable of meeting the needs of tomorrow. The working group therefore considers that the existing financial support for broadband should be retained but that certain clarifications and adaptations should be made to the present system. It is also important to consider broadband construction from a regional perspective, against the background of the EU Structural Funds.

The Group also consider that the development of broadband connection – a "home broadband subsidy" that builds on the national home-computer scheme – should be instituted. The support should also be extended to new groups that are not in receipt of a salary (students, the unemployed, pensioners and others).

Another important area is the allocation of frequencies, particularly in the higher frequency bands. Allocation of frequencies should stimulate new products and services as well as the development and extension of those already existing. In addition to normal licensed bands, there will be a need for both unlicensed frequency bands (such as 2.4GHz), as well as higher frequencies with lower effects for the access network, that is to say, the final 250 metres. The WIMAX and 3G technologies will also meet an important need, but they do not mean that an extension of the fibre network is unnecessary, rather the contrary. There are major opportunities with radio access to offer broadband services, both in areas that today have other available access, and also in areas that have absolutely no other broadband access. However, current radio technology has insufficient capacity for traditional TV and video services, as well as other eServices that require very high bandwidth. Generally speaking, increased bandwidth requirements will also be necessary throughout the country for radio-based solutions, particularly in areas where radio access is the only access possibility. In areas where other available access forms exist, radio solutions will also be important, primarily for mobile use in the current situation. Our ability in future to link up on demand will depend on a well-developed fibre structure, in combination with different radio solutions (and other access forms). That requires fibre access to masts/aerials for various radio solutions (including closed systems such as Rakel/TETRA) which also puts demands on the passive infrastructure.

Frequency allocation for radio access must pay regard to the ITU recommendations and promote possibilities for effective broadband coverage, so that we do not allocate the upper sections of the frequency band to the wrong purposes.

Proposal: **The broadband subsidy should be retained to stimulate a continuation of network roll-out, both as regards the subsidy for the distribution network and in the form of a tax subsidy to households for connection costs.**

A new "home broadband subsidy" should be introduced with a view to including the monthly subscription costs of broadband connection. It should also apply to all groups in receipt of salary or corresponding income.

Frequency allocation should stimulate new products and services as well as as network roll-out and the development of existing networks.

4.2.5 The fibre network coverage

In the current situation, there is no clear overall picture of the exact geographical coverage of the fibre optic network in Sweden, especially not the distribution networks within municipalities. Nor is there any clear picture of how accessible the networks are, that is to say whether different actors can buy "Dark Fibre" products, transfer or the like. The reason why it is important to establish the coverage of the available and future-proof distribution networks (i.e. the possibility to buy, for example, "Dark Fibre" service) is that access is a precondition for developing effective broadband with high transfer capacity and arbitrary access technology. In the great majority of cases the fibre optic networks constitute the backhaul and distribution networks for other access forms, such as WLAN, xDSL, as well as in future new radio technologies with shorter range and higher capacity.

To stimulate the development of new access forms and at the same time contribute to the development of the fibre optic distribution networks, we propose the establishment of a system to make it possible to develop information about the coverage of the fibre optic distribution networks. This can be compared to the information needed to obtain an overview of municipal water and wastewater systems. This information should serve as a guide to operators and other actors who want to establish themselves with different access technologies in various areas. In addition there should be established plans for how this surface coverage can be expanded, as well as what goals should be set up, such as for example that the fibre optic distribution network should reach out to a maximum of 250 metres from the households/property/customer (for example terminate in the electricity meter box) where subsequently market actors offer different access solutions.

Proposal: **A system should be set up to enable an overview to be obtained of the coverage of the fibre network, i.e. of areas where Dark Fibre products or similar are available, to serve as a guide for operators and other actors wishing to establish themselves in particular areas.**

In addition, plans should be drawn up for this expanding surface coverage, including the formulation of goals.

4.2.6 Services and products

The service and products area embraces issues about competition (lock-in/lock-out) and about consumer information. It remains important that all service providers should keep the end-user in focus. Similar importance is attached to clear requirements from purchasers (purchaser skills) and to a clear description of the products available.

The working group is in agreement that the market as a whole suffers if service providers are locked out. The role of central government in this should be to produce a definition of openness, which can subsequently be adapted to the market and followed up by measures. In this too the industry has an important role as regards the production of rules for communications operators.

As for consumers, they must have information about products and their applications, including the services obtainable or, conversely, not obtainable. The important thing is that end-users have sufficient information to be able to compare and choose. The National Post and Telecom Agency is already working actively on the production of comparative quality information for consumers. This information will be available in early 2007.

One method of doing this is to encourage the labelling of broadband products and services with various quality declarations and quality standards. This work should also include specifications for labelling various IP services, such as standard agreements for a basic Internet service for the consumer market. This type of labelling of the various eServices could consist of different symbols for how much bandwidth, etc., a service requires to function according to certain quality requirements. Corresponding labelling should subsequently be available for different broadband products (Internet inter-connections, connecting to the Internet). It would mean that a customer would not need to know about broadband speeds, throughput or other technical specifications.

By comparing the labelling of the eServices they use with that of a various broadband products (broadband connections) on the market, the customer can be guided in making the correct choice. An easy way to achieve this would be colour-coding of the services, to enable them to be matched with the broadband connections bearing the same colour. That would make it possible to stimulate development and increase understanding for the need for qualitative Internet connections.

Proposal: **Within the framework of the Inquiry on access to IT infrastructure, the Government should introduce the concept of transparency and accessibility, and also examine how that can be applied on the market and followed up with measures.**

The industry should initiate cooperation for the production of game rules for communications operators.

The Telephone Advice Bureau, in consultation with the industry, the National Post and Telecom Agency, the Swedish

Consumer Agency, Verva and others, should produce a proposal for labelling broadband products and services with different quality and quality standards for the consumer market, as well as a specification for labelling different IP services and standard agreements for a basic Internet service.

The industry should cooperate in ensuring that there are clear product descriptions.

4.2.7 The activities of central government/ the public sector (as owners)

Both the Government and local authorities have important roles as regards IT infrastructure in their capacity as owners and should regard ownership as an opportunity to implement their policy. In the view of the working group, they should coordinate their ownership interests with other measures, in the framework of looking at this sector as whole. The public sector should also set a good example in its ownership roles. In general all public sector decisions should also take into account technology and service convergence and technology neutrality.

Another important public sector role is to act as an informed purchaser and user. To facilitate this Verva should continue its work on the specification of basic functions, focusing particularly on the IT infrastructure and Internet area for improved quality and robustness.

There is a further important public sector role as regards general supervision of the market. It should be associated with a higher priority by the courts in speeding up the appeals procedure. Central government should actively work to ensure that the problems currently to be seen in relation to the copper network do not arise in the new infrastructures already existing and now emerging (fibre networks).

Proposal: **Introduce a holistic approach, within the framework of which public ownership is coordinated and central government sets a good example in its ownership role.**

Central government should actively work to ensure that the problems currently to be seen in relation to the copper network do not arise in the new infrastructures already existing and now emerging (fibre networks).

5. Description of the current situation

This section describes the working group's view of the present situation within Swedish IT policy, what has happened in this area within the EU, and the state of affairs in Sweden at the county and municipal authority level as well as in the industry as a whole.

5.1 Development of Swedish IT policy

In July 2005 the Government presented its Bill "From IT policy for society to a policy for the IT society" 2004/2005:175.[2] It was the third IT Bill since the first was put forward in 1995. The second, known as the Broadband Bill, came in 2005. The new Bill entails a change in attitude – instead of focusing solely on the IT infrastructure, it now regards it as an important underlying precondition for services, use and benefit. The Bill also entails a further development in the attitude to IT policy, which must now become a integral part of all policy areas that cooperate and fulfil their functions as regards achieving the objective of a sustainable information society for all. New IT tools and technology solutions are in constant development in society. Many traditional environments are being digitalised and new services being developed and increasingly used, both by individual citizens and in the private and public sectors. That is especially important for those with disabilities, who derive great benefit from the opportunities afforded by IT development.

In the IT Bill, the Government has proposed three sub-goals for IT policy:

- IT must contribute to improved quality of life and to the improvement and simplification of everyday life for people and enterprises.
- IT must be used to promote sustainable growth.
- An efficient and secure physical infrastructure with high transmission capability must be accessible in all parts of the country, inter alia to give people access to interactive public eServices.

The political objective means that the IT infrastructure must be well developed and open, i.e. available to all, in order to encourage competition and diversity, which in turn are important for the development of both infrastructure and services. Central government's interventions in certain areas have been intended to give support for this goal in those cases where the market has not functioned. In current political discussions on IT infrastructure, we often hear concepts such as transparency, attainability, mobility, competition and freedom of choice. Confidence and security are also areas where a number of interventions have been made. The public sector has a general responsibility to ensure the rule of law and to contribute to confidence and security in general, and that applies also as regards the digital environments. The public sector's role as an informed buyer and end-user, various types of regulation, financing and information, advice and dialogue are all important tools to achieve this.

The working group have noted that there are still a number of areas within the electronic communications area where competition has not functioned optimally. The National Post and Telecom Agency, the Swedish Competition Authority and the Swedish Consumer Agency all have a central role in illuminating and dealing with these barriers to competition. In addition, a number of inquiries and surveys have been set in motion by the government, for example as regards the National Post and Telecom Agency's supervision of appeals and an inquiry about 112/SOS Alarm emergency service. In the IT Bill, the Government has also given notice of an inquiry as regards accessibility to networks. Furthermore, at the beginning of 2007 the National Post and Telecom Agency will submit proposals for a broadband strategy for 2010 to the Government. In addition, the entire governmental broadband initiative for the years 2000-2006 will shortly be evaluated.

5.2 Development within the EU

Within the EU also the focus has been broadened in order to embrace to a greater extent services, use and benefit. After having worked for a number of years with the eEurope action programme, it has now been decided to take the next step with i2010. In Europe the general objective is to ensure competition between enterprises within the EU. A High Level Group has also been set up, consisting of one representative from each Member State. Examples of questions discussed are digital gaps ("e-Inclusion"), public eServices (efficiency, access, and quality), broadband roll-out, etc. As regards IT infrastructure, proposals have been made in the strategy for further measures within the area of e-Inclusion, "Bridging the broadband gap".

Moreover, a survey is currently in progress about the regulation of electronic communication, in which the Member States are discussing the areas in which competition still does not operate to the full. An interesting question is how long we should retain sector-specific regulation before it is time to return to regulation under more general competition law.

Another important question relates to the attitude to broadband from the regional policy aspect. In the national strategy for regional development presented by the Government at the end of June 2005, proposals were made as regards the

[2] Riksdagen (the Swedish Parliament) adopted the IT Bill on 25th of January 2006.

allocation of almost SEK 13 billion to various interventions, among which the information society, including broadband, is a priority area.

5.3 10 years – a glance in the rear-view mirror

What has happened in the IT area during the 10 years that have passed since the first IT Bill? The answer is "a great deal" and today there is a completely new situation as compared with 10 years ago, as regards the discussion of matters of IT strategy. The truths of yesterday have to a large extent already been played out and current problems require new methods of approach. Today, for example, IT policy is more deeply anchored at the political level in municipalities and counties than it was only five years ago. Here are some general reflections about the changes:

- The use of IT, and functions in today's IT systems such as e-mail, word processing, economic systems etc., were already to be found in the IT system 20 years ago. Primitive user network interfaces meant that only a few "specialists" could handle the systems. The development of graphical user interfaces (MacOS, Windows) has meant that IT use today has spread throughout all social, professional and stakeholder groups the world over and that various services have become easier to use and spread in both traditional and new activities.
- The Internet has existed as a global phenomenon since the 1980s but was long considered to be of doubtful value. Today the Internet is a function of great importance to society that has changed the conditions for both private individuals and for private and public business throughout large parts of the world.
- In Sweden a number of new actors within the area of electronic communications, for example urban networks, have been established during the past 10 year period. Many have contributed to developing the market for electronic communications by establishing generally accessible, competition-neutral local broadband networks and putting them at the disposal of operators and service providers. However, that does not apply universally. Around the country today there remain areas where for various reasons there is still inadequate availability, access, and quality.
- In Sweden in 2000 the price for 1 Mbps line capacity (transit) was SEK 1 200 per month, whereas today the price is approximately SEK 200 per month. In addition, this product is much more widely available. This change has been brought about primarily by strong technology development, market growth and increased competition, and not by government support alone.

5.4 The development of this industry

5.4.1 The Annual Report by the National Post and Telecom Agency

The National Post and Telecom Agency issues an annual report about the Swedish telecommunications market. It contains general information about the total number of subscriptions to telephone services (land lines and mobile) and Internet access. The latest issue, relating to the first half of 2006, reported the following information as regards Internet access:

- In January 2006 there were approximately 2.5 million broadband access connections in Sweden that had already been delivered or were ready for delivery (including ADSL).[3] In other words, more than half the households in Sweden could immediately connect to a broadband network. This is an increase of 40 percent in comparison with the same month in 2005.
- More than 1.7 million households today have a broadband subscription.
- There are nevertheless major geographical differences in access to broadband. Places with fewer than 250 inhabitants have significantly worse access to broadband networks than larger places.
- Connections of at least 2 Mbps now constitute more than half of all subscriptions, as compared with 40 per cent in 2005.

The trend of development, according to the report, is still towards a continuation of a strong increase in ADSL connections at the expense of dial-up connections. To obtain a complete picture of developments in the industry, information on the following would be desirable:

- Development in various geographical areas.
- Development in different parts of the value chain – not simply access to and competition for broadband, but also the corresponding figures as regards services.

In the absence of reliable data, it is necessary when assessing policy to refer to what market actors themselves say, as well as to other more informal reports and channels. The actors have strong economic interests and are in addition characterised by a strong faith in the idea that their particular infrastructure and corresponding products are better/more

[3] Excluding 3G and radio.

topical than those of others. It is therefore in principle impossible to achieve a completely objective picture of developments in the industry.

5.4.2 Different actors

The following is an attempt to describe development in the industry from the perspective of different infrastructure representatives and to illuminate the problems that have been discussed in the working group:

- The ASDL perspective: TeliaSonera dominates the market and, according to the company itself, it is in a position to provide an ADSL connection to 93 per cent of the population. In addition to TeliaSonera, other major actors with origins in the telephony market (Bredbandsbolaget has a special role) are also strongly backing ASDL in the more densely populated areas. The access form which its competitors use is LLUB, Local Loop Unbundling, through which the operators obtain access direct to copper cables in the telephone exchanges. In the major built-up areas, space in the telephone exchanges is running out, and the operators are looking for agreements to extend them. Market actors believe that an upgraded variant of ASDL could prove a powerful, competitive access form for many years to come and could have a particular part to play in sparsely populated areas, even if in many cases it has to be replaced by another system because the copper network is poor in quality and too distant. There is also an increased need to obtain 'bit stream access' in order to stimulate competition and increased access and sales of broadband access through DSL. This is the object of a current lengthy lawsuit that in itself may be detrimental to both development and predictability.
- "The fibre-exclusive urban network" perspective: the advocates of this perspective believe that they are disadvantaged by the operator-neutral networks (urban networks) in those instances where the urban networks do not make Dark Fibre available exclusively as a product, claiming that such networks have competitive advantages, among other reasons because they are publicly owned or paid for out of public funds and therefore difficult for private actors to compete against.
- The urban network/communications operators' perspective: The municipal urban networks originate in the fibre-based municipal internal networks that were established during the 1990s. Under the national broadband initiative during the first few years of the 2000s, the networks received a development subsidy to enable them to include households and enterprises, that is to say activities outside the local authorities own organisation. The cost to public funds was, in that context, very modest (approx. SEK 5.2 bn) compared with the investments that had already been made, but the subsidy proved to be a catalyst for the local authorities' continued investments in networks.

The basic idea behind the urban networks is to constitute a competitive alternative to the copper network and/or the operator-specific fibre networks. It is still not clear how many organisations or private clients have access to them, because cataloguing and measuring the broadband system is mainly done at a very general level, but they are broadly estimated to be about 15-20 per cent of broadband subscribers. The urban networks have over a period of 5 years developed into an alternative broadband operator in many places and have also helped to create competition that has given local and regional services providers the possibility to reach out with their services, a fact that has also been reflected in the prices of broadband services.

It must be emphasised that the municipal networks are as a rule procured in competition through an open tender procedure and financed on a market basis with borrowed capital that must be repaid, that is to say, they are not subsidised by general taxation. These schemes vary from one local authority to another. A common pattern is that a municipal company, usually an electricity company, owns the network, and that the operation of the network is transferred to external partners through what are known as communications operators services or that Internet operators lease fibre connections. There are currently a number of business models that have developed around these business relations. The important basic questions are who owns the end-user, who makes the client connections available and how the payment flows between network owners, operators and service providers are shaped. In what way the various models stimulate the market or not, or whether the urban networks act on a market basis, are questions about which opinions are divided. The urban networks nevertheless articulate an ambition to make the Internet accessible to operators and service providers on equal terms, in everyday speech known as 'operator-neutral/open networks'. It is important to clarify whether private actors on the market have been disadvantaged by the operator-neutral networks (urban networks), whether the urban networks have competitive advantages because they are publicly owned, or whether the differences in opinion are based on a number of misunderstandings.

- The cable-TV network perspective: The cable-TV network, with Com Hem as the leading actor, covers approximately half of the households in the country. Cable-TV is normally delivered via coaxial cable in the property, where it is upgraded to provide two-way communication and higher transfer speeds. Com Hem, for example, currently delivers broadband at up to 8 Mbit/s but experiments are in progress with significantly higher speeds. The cable-TV operators vigorously deny that their technology is transient. The operators are nevertheless naturally limited to their current customer-base of cable-TV subscribers and their investments primarily go to upgrading existing networks rather than to establishing new ones.
- "Mobile Broadband": all mobile operators currently offer broadband services based on their 3G networks. They currently offer up to 384 kbit/s and automatically have the same coverage as 3G networks. The operators supply 3G cards to the growing market segment with laptop computers. These offers are becoming more and more an ADSL alternative.
- Wireless networks: many different actors today offer 'hot spots' in public places. Wireless solutions are also becoming more common in homes and workplaces (WLAN).
- Other networks: satellites and PLC (Power Line Communication, in which the electricity supply network is used): these networks are currently aimed at limited circles of customers who have special conditions or requirements.

The services available to the consumer on demand always include Internet access at varying transfer speeds. Over and above that, the range of services on offer varies greatly as regards both the packages and content. Most of the major actors offer, in addition to Internet access, 'triple play' packages, in which Internet access, telephone and TV are supplied in the same package. Other services on offer to varying extents are e-mail, chat and web hosting.

A trend in Europe that is now also spreading to Sweden is the consolidation of national telephone companies, with those like TeliaSonera, Telenor and TDCSong becoming dominant actors. In the longer term, in combination with different packaging, this brings a risk of reduced competition.

The trend (and need) is to stop investment in copper networks and instead to invest in new fibre networks at the access level, and so to ensure future capacity requirements. There is an inherent risk that the consumer can no longer freely choose the services desired, since the fibre network is currently not governed by the same access regulation as the copper network. However, if the principle of open networks is maintained, there are nevertheless good pre-conditions for effective competition and opportunities for innovation as regards new services.

5.4.3 Local and global eServices

The eServices on offer today vary as regards accessibility. We have therefore opted to distinguish between local and global eServices. Global services are available on the Internet, irrespective of which Internet operator the client is connected to. Local services are offered to those clients who are connected to the local network. These services are accessible only to those customers who are linked to a local IP network, through which there may not necessarily be an Internet connection. Nor is the service accessible to the customer, if s/he is outside the local network. One might call the above services IP-based services (locally accessible on the local IP net) or Internet-based services (available globally over the Internet).

It is important for customers to be informed about and understand the differences between these various services, and in particular for it to clear whether the services wanted are accessible independently of the Internet operator, i.e. that they are mobile (when, where and by whatever means) and hence generally available, or only accessible from the local network. It is equally important for it to be apparent whether an Internet access is completely transparent or whether there are limitations on what (Internet-based) services are available.

5.4.4 Accessibility and Internet traffic patterns

When we study the development of Internet traffic in Sweden we see that it very largely remains within the country. We use eServices, search for, download and send information within Sweden, with the result that traffic exchanged between Swedish operators is increasing substantially, as compared with Internet traffic that goes to foreign Internet operators. We also see the same tendencies in other countries. That may be for cultural and linguistic reasons, as well as because file-sharing programs, e.g. for updating operative systems and software etc., find sources close to the customers.

Irrespective of the reason for this development, it also means that traffic exchanges and communication between the

Swedish Internet operators is working well. That is not the case everywhere in the world. This development also suggests that the greater part of the eServices that will be developed will be accessible independently of the Internet operator. That is important especially for the public eServices that must reach the population throughout the country.

5.5 The future?

The appearance on the scene of IT has meant major changes both for industry and for the public sector and especially for the individual. What has happened in recent years, however, is that the Internet has become our most important information carrier and that the Internet Protocol has turned upside down our traditional way of looking at electronic communications.

What will the business models of the future look like? How are providers of electronic transport, content and services to receive payment and compensation for their production costs for material that some of them have hitherto offered to customers, free of charge? What are we prepared to pay for? How much of the household budget should be spent on an Internet access that is necessary for public eServices? What will be on offer free of charge? What will the future broadband landscape look like? What services will we use? What public eServices will exist? What demands does this make for transfer, quality and robustness, etc? Will we be able to receive the services we want, irrespective of time and place? In our view the principal point is that the IT infrastructure itself should place no limits on the development of services, freedom of choice and accessibility and not put obstacles in the way of new and/or more advanced services with higher requirements. That is particularly important for those networks which researchers use (SUNET) [the Swedish University Network].

There must continually be consultations, cooperation, exercises, investment in critical infrastructure, and so forth, as regards crisis management for IT infrastructure. When crises arise it is already too late to invent solutions to the problems. How is this cooperation to be encouraged? In a market exposed to competition we have different contractual circumstances, but crisis situations require cooperation far above the normal.

Purchaser skills – if buyers insist on high quality connections it helps to develop robust high quality networks.

In future the major alternatives to broadband connections will be connections via fibre infrastructure and fibre connections in nearby connection points, for example electricity junction boxes, instead of the current situation in which there are copper networks for telephony (ADSL) and connections in telephone exchanges. The easiest way to acquire new customers is to connect them when erecting new building or making property extensions/conversions. It is much more difficult to get to customers to change their broadband supplier. It is therefore important to catalogue and remedy the problems currently affecting the access network, and to forestall problems with the new fibre infrastructures being rolled out. Calculations show that almost all new extensions of the fibre networks, providing opportunities to acquire new customers, will be completed by the end of the calendar year 2007.

Another important future aspect is the infrastructure seen from an ecologically sustainability perspective. IT gives wholly new opportunities to reduce the environmental impact from passenger transport and the associated carbon dioxide emissions, by exploiting virtual meetings and flexible forms of work. This is described in greater detail in the report produced by the Strategy Group's working group on IT and the environment ("An ecologically sustainable information society in 2020") to be found at http://www.regeringen.se/sb/d/2495.

6. Questions that arose during the Group's work

Discussion in the working group has centred on a number of main points. The objective has at no time been to reach agreement on all questions, but rather to demonstrate the problems and challenges that exist, as well as to try to find a common appraisal of the goals. Below are presented a selection of the most important areas discussed by the group.

6.1 What is broadband?

The expression broadband is much used, in many contexts. It is often used to mean "IT infrastructure with high capacity", but it can also be a synonym for an "always on" Internet connection with relatively high capacity (for example, as compared with a modem connection). According to our information, however, there are on the market solutions in which a broadband connection does not necessarily automatically mean a connection to the Internet. The broadband connection in these cases gives an 'always on' connection to a 'local' network, with the possibility of choosing among a number of Internet connections (Internet operators). In the majority of cases, however, the broadband connection is synonymous with an 'always on' Internet connection. In the current situation there is no reason to attempt a further definition of the word "broadband", but on other hand it is appropriate to distinguish between the different concepts of existing broadband connections, and the way in which these various services differ from one another. We understand that it is difficult for the end-user to compare various broadband products, since information about them is not specified in a uniform way. That makes it difficult for the customer (consumer or service provider) to choose between different providers and services. It also makes it difficult for broadband providers to describe services that have different quality standards and to justify price differences as compared with competing providers.

From a user-perspective it is important to distinguish between IP access and Internet access:

- IP access means that the customer can only communicate with certain addresses which also have IP access within the same local network ("local network" can be limited either geographically or by the network topology).
- Internet access means that the customer can communicate with all destinations on the Internet, in particular, anyone who has Internet access can communicate with all others who have Internet access.

In the same way a distinction can be made between IP-based services and Internet-based services:

- Internet-based service is one that itself has an Internet access (connected to the Internet) and enables the customer to access the service from anywhere at all on the Internet. A customer of such a service can access the service no matter where on the Internet (according to network topology) the customer has obtained access to the Internet.
- IP service uses IP but is not generally accessible via the Internet (e.g. a local service)

One of the most important points is to distinguish between IP access and Internet access, and to distinguish between IP-based service and Internet-based service. It is necessary to distinguish between these different access forms and services when we speak of mobile services, i.e. those accessible when, where and however the customer wishes. In this it is important that the access forms and services are correctly defined in such a way that the customers know what they are getting when they enter into a contract and how the services can be invoked and used. The creation of knowledge and customer skills on these concepts and services is an important driving force in bringing about quality services at market prices. Before making a purchase customers buying services must therefore already be informed whether they are Internet-based or IP based, i.e. how accessible the services will be.

It is particularly important that the public eServices, which must be accessible to everybody everywhere, both procure good quality Internet access and can be accessed from all destinations, i.e. they must be typical Internet-based services.

6.2 What is open network?

In discussions on competition and convergence one often meets the concepts open network and transparency. In the USA the discussion is of "network neutrality", which is a slightly different question concerned only with the effort to achieve service accessibility, without market or financial barriers. Transparency as it is discussed in Europe means equal accessibility at all levels in the value chain on non-discriminatory terms, and the requirements are based on those that are fundamental to functioning competition and on the desire for innovation within Europe, a Europe which is defined as a common market.

An understanding of this discussion requires an insight into the fact the architecture of the Internet is stratified primarily in three layers: services, IP and physical infrastructure (or transfer). For a more detailed description of the communications architecture, see Annex 1.

How far the requirements for transparency should extend varies. In the view of the working group it is particularly important that customers should not be shut out of Internet-based services or global key services (see above). Depending on the degree of infrastructure competition there is nonetheless reason to consider how great should be the transparency required at different levels: the fewer the prerequisites for competing infrastructures, the greater the reason to try to bring about transparency at different levels.

The working group has defined transparency as follows:

- Customers must be able to access services according to choice from different service providers, irrespective of the Internet or IP operator and without market or technological barriers. *In this a distinction must be made between IP-based and Internet-based services. IP-based services are a local service accessible only within a local network via an IP or Internet provider, whereas an Internet-based service can be accessed throughout the Internet. The choice whether the service is to be accessible throughout the Internet or only locally is made by the service provider. The difference between two competing service providers must be apparent to the customer intending to purchase these services. See Chapter 5.1*
- Customers must be able to choose between different Internet or IP operators independently of the transfer and physical infrastructure. In some places, however, that will not be possible on a market basis, for example in sparsely populated areas. Where it is not possible to offer freedom of choice as regards IP and/or Internet provider it is important that, instead, there is openness as regards the possibility of choosing different services.
- Service providers must be able to offer their services to freely chosen target groups independently of the IP or Internet provider and not be prevented by market, financial or technological lock-out situations. *This is the closest discussion in Europe comes to the concept of Network Neutrality which is used in the USA for those cases where an IP or Internet provider gives preference to certain service providers, or locks out their competitors. The question in the USA is whether regulation is necessary to forbid this kind of preferential treatment. We consider that regulation is not needed today, but that standards and requirements for efficient and equal competition may lead to a need for supervision in future. The supervision must however be cautious so that it still permits the product bundling that is desirable for the customer. To begin with any supervision as regards the customer's ability to change service provider must be a technology neutral application of already existing regulations about e.g. changing telephone operating company and number portability (where it is applicable) in the VoIP service (also called Internet telephony).*
- Operators (IP, Internet or transmission operators) can on like terms rent physical infrastructure (including necessary subsidiary services) independently of the owner. *That means that if the owner of physical infrastructure also provides an IP service these two businesses must be separated and reported in such a way that his own IP service is not given preferential treatment as compared with competing IP providers.*

6.3 Competition – at what level?

As regards services and products within the IT and telecommunications markets, breaking the infrastructure monopoly faces policy with a partly new dimension of competition. The monopolies and oligopolies that characterise the infrastructure market have many times taken their example from the state-owned monopolies (Televerket, Kommundata, et al.). Since they are established on the market and own the infrastructure, these actors can, by locking in customers and locking out competitors (who have no infrastructure), consolidate and deepen their commercial grip on the market, often with the result that competition is distorted or even eliminated altogether. As a regulator and in many cases owner, central government has an important part to play in ensuring that sound competition exists.

Linked to questions about competition, the working group has among other things discussed the following questions:

- Where is the line to be drawn between monopoly and competition?
- Is this demarcation different in different parts of the country, depending on the situation of the market and competition?
- How is (are) the monopolist(s) to be controlled?
- If what has previously been a monopoly is exposed to competition (or is to be exposed to competition), how is this to be managed?
- How is the creation of new monopolies to be avoided?
- If what has been exposed to competition (or should be exposed to competition) has become a de facto monopoly, how is that be managed?
- The importance of having a clear set of rules in order not to inhibit necessary investments in infrastructure.
- The importance of having clear recommendations so

that the public sector (central government, local authorities, county councils and other authorities) acts correctly and competently, irrespective of whether as a buyer, a user or an owner.

6.3.1 Is parallel roll-out of IT infrastructure good or bad?

The EU has been positive to 'parallel roll-out' of IT infrastructure. Infrastructure competition, in which different network owners compete with one another in offering services to end-users, has the advantage that it creates a competitive pressure throughout the value chain. Infrastructure competition also requires less regulation, since the same needs do not arise as with competition in services to ensure that competitors can obtain access to the infrastructure on non-discriminatory terms higher up in the value chain. At the same time there is awareness that in many respects it is not economically defensible to have parallel infrastructures. The balance between infrastructure competition and service competition may need to be very different in the different parts of a country like Sweden, much of which, as compared with the rest of Europe, is sparsely populated. In certain sparsely populated and geographically remote parts there will in all probability be no infrastructure competition at all. In other parts the end-user can nowadays already choose between three or four different infrastructures.

The majority probably think that it is natural and logical that ducts should be shared between competing actors. Ducts therefore does not have to be compulsorily exposed to competition. Probably the best solution for all parties is for excavations to be carried out only once, with competition-neutral ways of obtaining payment from competitors.

One level above ducts there is the cabling, e.g. fibre cable. In a number of areas a neutral party has laid out a sufficient quantity of fibre so that several different actors who lease fibre can share the same cabling.

We can correspondingly discuss, layer by layer, where in the infrastructure model (see Annex 1) it is more acceptable to have monopoly-like situations and where there is a requirement for competition. The working group notes that, the higher in the structure model we get, the greater the prerequisites for competition. To that may be added geographical factors – the more densely an area is built up, with many customers, the stronger the arguments for establishing parallel, internally competing, infrastructures. In this respect Sweden has been among the leading countries by virtue of the many different infrastructures to be found in the densely populated areas.

Irrespective of where the line is drawn it is desirable that the actors who operate on one level in the value chain, where they have a monopoly, should maintain neutrality. The customer of such an actor must feel confident that there are equal conditions of competition, i.e. that the price will be set by the market, that it is cheaper and better to lease from this neutral party than to establish an infrastructure of one's own, that the supervisory authority has predictable means to deal with new actors on the market, and so on.

We found that it was precisely the dividing line between monopoly and competition, and the actions and effects of the various actors in different market situations, which were the central questions for IT policy. They influence not only the development of IT infrastructure but also the development of services, competition and innovation as well as the ability of consumers (private persons, enterprises, the public sector, etc) to access the services they desire, independent of time and place.

6.3.2 Lock-in and lock-out

Within the foreseeable future, IP will be the dominant technology in use as the basis for electronic communications. Recently there have, however, arisen services that can only be accessed by customers of a specific broadband provider. It can also happen that a given broadband provider locks out certain service providers, who as a result cannot be accessed by the consumer.

It is emphasised in many contexts that the IT infrastructure must be open to all operators at reasonable prices. That is good because it benefits the consumers, i.e. the users. Unfortunately, it does not appear obvious that this transparency must apply to the whole IT infrastructure, i.e. all the way to the consumer. Transparency is often understood to apply only to national networks and urban networks. Those who lead the debate do not always think about the fact that Internet's function reaches all the way to, respectively, the personal computer or the server, from one end to the other.

The present business models do not work, among other reasons because of the combination of the facts that, firstly, it is regarded as too expensive for the operator to connect a single household, and, secondly, households have been spoiled by low prices for connection and more or less free access to services. The operator then sells local services to cross-subsidise the connection, which leads to lock-in (of the customer)/lock-out (of other service providers or of customers who may not access the service unless they are broad-

band subscribers).

The networks we have today have been built or controlled by one provider or operator, both within and between the houses where the users are. The focus must be on enabling consumers to enjoy freedom of choice and access services and service providers independently of the network or Internet operator. Neither ownership nor contractual provisions must be allowed to prevent competition. Such a solution provides the conditions for competition, to the benefit of the consumer, between different service providers, while enlarging the consumer's freedom of choice. At the same time, there must be an incentive to invest in networks. In a phase in which new infrastructure is being built, with an increased choice for customers, it is natural that the service content is designed to enable those who build it to recoup their outlay. Over time, however, demands from users for increased coordination between different networks – including increased accessibility of different services – will grow, among other reasons in order to achieve a broader spread of more advanced IP-based services, for example health services.[4]

The justification for opposing lock-in is primarily to counter the negative effects of vertical integration such as those described in Annex 1. It must nevertheless be emphasised that the commercial bundling of services is not always necessarily negative – provided the consumer is given good information about what the services permit, he has the means to decide which service is the best for his particular needs. That is especially important as regards the use of public eServices. It is even more important to have freedom of choice and for a consumer to know for sure whether the service can be accessed from different places or not. If a consumer buys a service (for booking the laundry room, hiring a film, etc.) he or she needs to know whether it can be accessed, irrespective of whether s/he is at work or at home. Or whether the service is accessible, using either a 3G telephone or a hot-spot for wireless communication through a laptop computer. If the customer knows this, he or she can compare services with his or her own needs, at the same time as it creates the possibility for service providers to differentiate their products in relation to one another, as regards price, accessibility, quality and so on.

6.3.3 Different market situations and transparency

Market situations and competition conditions are different in different parts of Sweden. These different conditions can lead to different solutions and hence to different business models. Despite these differences in market situations, it remains equally important that the IT infrastructure is open.

The common goal must then be to give the end-user freedom of choice among different service providers, independently of fibre, transfer and IP providers. Another goal is that there must be no barrier to modification of market conditions and the competitive situation. Supervision must be adaptive and based on transparency from the perspective both of the consumer and of the operator/provider.

That means that monopoly situations (non-transparency) even in minor areas e.g. residential properties, housing areas, urban networks, and so on, disfavour the end-user and should if possible be avoided.

If a network is open to competition in services, a monopoly situation in the access network itself can nevertheless be to some extent positive for the customer. One example may be that it is overall cheaper with one IP provider in a block of flats rather than several, even though that IP provider becomes at least de facto a monopolist. Transparency is not an objective to be achieved in its own right, and should therefore not be pursued to ridiculous lengths. Nonetheless, at the service level competition must always be required and the customer's freedom of choice must be defended.

Nor can one require networks always to be built in the same way, throughout Sweden. It must nevertheless be possible for the customer to be able to choose a service provider. It can happen that an IP provider has a monopoly in one area, but that is acceptable so long as the customer can still choose a number of different service providers. It is probably not economically defensible today to require competition among IP providers in all parts of Sweden but, purely hypothetically, additional IP providers could one day enter the market even in the less densely populated areas, and therefore one should ensure that network design and architecture place no barriers in the path of such a development.

Is it possible to achieve open networks in accordance with the picture we describe? In a country so sparsely populated as Sweden it is rather expensive to link up every individual household with fibre. That is also why the access network is the major problem – the customer has considerable capacity, as does the "core" (the operator's backhaul), but the "entry slip-roads" are missing, so there is still rather little traffic in between. For an operator to be prepared to connect households there must be a sufficient number of them in the same area. An operator in a given geographical area moreover needs as many business and administrative clients as possible, since as a rule they are the big users who buy con-

[4] See the visionary program of IT-Företagen "SverigeITopp 2020", page 10.

siderable bandwidth, while households as it were hitch a lift with them. The operators moreover prefer households to remain customers for a reasonable period, since otherwise the business is not profitable for them. The consumer price for a connection to e.g. the Internet is also quite low, which naturally creates both temptations and needs for the operator to try to earn money on something else, such as services and content. That in turn creates a situation in which operators are tempted to lock customers into their networks, as a result of which they have only limited interest in effective cooperation with other operators, at the same time as it strengthens their desire to go higher up the value chain.

Communications operators could possibly prove an interesting intermediary. Since they are (or should be) neutral in relation to the Internet operators they can assemble a large group of Internet users whom they can in a cost-effective way put in contact with Internet operators. In that way the communications operators can bring about what the market cannot achieve in the present situation – a major group of connected users who share the same infrastructure. However, it is important from the point of view of the Internet operators that all traffic from these customers transits equipment that they themselves control, or that the corresponding functions can be delivered by the communications operator. That is because of the possibility of introducing new (supplementary) services (firewalls, volume debiting, and so on) but also questions of responsibility (storing traffic data etc.) so that Internet Service Providers can differentiate their services from one another and not merely compete on the basis of price. Eventually this could mean that different individuals in one and the same household might be able to use different Internet operators. Suppose, for example, parents who are distance-working – they may well prefer not to share an Internet operator with teenage children who are playing games.

In the best of worlds, competition and cooperation ought to operate horizontally at each of the various levels. It appears, however, that the horizontally structured market is not sufficiently mature and developed. A possible explanation is that those operating at the respective levels have inherited other ways of working. It is probable that organisations with quite different performance/cost relations must be developed if we are to have an effective, possibly monopolist, infrastructure, effective competition at the IP level where that is possible, and at the same time completely free competition at the service levels. Here we can see the communications operator as a kind of test market.

Central to development and access to services, public as well as private, is nevertheless a favourable development of stable links and connections to the Internet. In this are required both consumer advice, norms for the providers, and an understanding of the roles of the different actors in stimulating development. Different technical solutions and business models can have their value, depending on market conditions, geography and other factors. What is important, though, in all cases is that customers should have high quality access to the Internet (according to their needs and preference) to be able to invoke the services they want. If one looks at development in general, the communications operator may be compared with a local Internet operator (with limited/local coverage) who offers his customers freedom to choose a transit operator, i.e. the route out to the rest of the Internet.

6.3.4 Effective public eServices - a comparison with the USA

The key question in the USA is whether an ISP may give preference to a specific IP-based service. In reality it means that one can only choose a service provider that the ISP itself has chosen, and that regulation may be required to avoid this distortion of competition. If we compare this with a public eService, in which the VoIP function is included, is there then a risk that it will be filtered out?

Within the EU we already have good competition and probably it is too soon to legislate on this matter. The reason is that we must be able to permit commercial bundling. It must not however entail technological or business lock-in or lock-out (see Annex 1). For that reason, in Sweden we speak of "the definition of Internet connection", so that a consumer who has bought broadband or an Internet connection must be able to make certain demands. Services that can be accessed via this broadband connection must be able to compete with local services on equal terms.

Another important question is what information the customer is given on purchase. If the customer is informed about what he obtains, then he can himself determine the product's quality.

The most important factor is good quality Internet service, so that public eServices can become a reality, with complete accessibility irrespective of time and place. That means that global services will predominate and that these will be able to reach large groups of customers, and probably also be cheaper than local services. Probably in time it will not be necessary to distinguish between local and global services, since the global services reach out to a major group of custo-

mers (equivalent to the market).

6.4 Robust networks – a national strategy

A developed IT society, in which both communications and functions of importance to society are increasingly carried out by electronic means, requires a robust infrastructure for these purposes. In accordance with the IT Bill an effective and secure physical IT infrastructure with high transfer capacity must be available in all parts of the country. A robust network should be designed by the Internet operator to be able to cope with two simultaneous faults (interruption of fibre/transmission or active equipment), while still carrying all the traffic sent and received by customers. Furthermore, either Dark Fibre must already be available as a product or the operator must be able to obtain permission to lay fibre of his own. In addition, of course, services are required; to enable the infrastructure to function, e.g. power supply.

Various factors constitute an incentive to create robustness in electronic communications. The operators invest to increase robustness primarily in order to meet commercial demands from their customers. In addition to the commercial level, central government may need to invest where commercial interests do not meet the needs of society. Such an investment can sometimes be undertaken wholly by central government and sometimes the costs are shared between the state and operator, depending on commercial interests. In many cases, central government and the public sector, as expert purchasers of electronic communications, could also set a good example and sometimes be precisely the major commercial customer that operators have in many parts of the country. Requirements could be laid down for competent and expert public procurement procedures in connection with the re-location or establishment of public authorities.

In a competitive market there will in all probability always be need for central government to take special measures to increase robustness, in order to ensure the desired accessibility over the longer term. The idea that the market will spontaneously take measures to meet society's requirements places too much reliance on the willingness of privately-owned operators, sometimes beyond the national frontiers, to finance robustness over and above their own commercial needs.

The conditions for actors on the market are regulated via the National Post and Telecom Agency. The purpose is to create, through competition, the conditions in which everyone in Sweden has access to effective, good value and secure communications services. As well as its regulatory function, the National Post and Telecom Agency also has the major task, in combination with the operators, of increasing the robustness of the networks.

Over and above work already in progress it is possible to improve robustness in electronic communications still further by taking additional measures. Such measures can increase the possibilities for a more rapid and more robust broadband expansion outside the densely populated areas. They can also help to bring about a more rapid roll-out of broadband more generally in the country.

Work on crisis management and recovery can be made more efficient and conducted more cost-effectively. A study is needed, to establish how technical infrastructure, as regards cables and exchanges for electronic communication, ought to be mapped so that, whenever required, it is a quick and simple task to produce a situation report. Both commercial confidence and national security considerations must be taken into account during the study.

It is a vital national interest to record the shape of the national infrastructure. The road network, the railway network, the electricity network, the district-heating network and the gas-supply network are all well-documented in Sweden today. Yet there are gaps in the documentation of the infrastructure for electronic communication. Certain operators have kept good records of their own infrastructure. Other operators need to develop their records. The supervisory authority and other agencies that may need to have access to such information currently have problems in obtaining an overall view of the technical infrastructure for electronic communications. There exists no general picture of the infrastructure for electronic communications in Sweden today.

The lack of information results in an uncertain basis for decision and increased costs in the physical planning in general and the planning of new infrastructure for electronic communications in particular. Every year these deficiencies result in unnecessarily heavy direct and indirect costs related to cables that have accidentally been dug up. Despite this incomplete information networks are currently being extended in a number of places in the country. The gaps in the information can result in difficulties and delays in this work, with major public disruption and increased costs for subscribers.

When the physical infrastructure for electronic communications was primarily managed by the state-owned Televerket, the Government had a good overview of its shape. Today there are limited opportunities to obtain information

about the physical infrastructure of electronic communications in Sweden. If the present development is permitted to continue Sweden as a nation will very soon have lost insight into how the electronic communications networks are physically constructed. If they should be seriously damaged, or in a crisis situation, when networks may need to be linked together, decision-makers may be surprised by the lack of physical capacity in certain parts of the country.

6.5 The role of central government and other parts of the public sector

By virtue of the broadband investment that has been made the Government and the municipalities have taken an active part in these matters. The working group has discussed what roles the public sector might conceivably have:

- Fund provider/guarantor as regards the funding of new construction or extension.
- Supervision when the market fails to function.
- Major and competent purchasers that can specify requirements in the course of public procurement.
- Official enquiries, analysis, information, coordination, debate etc.

Regulation and other intervention by the public sector should be long-term and predictable, in order not to inhibit the market's readiness to invest. The market wants predictable intervention from the public sector (regulation, support etc), so that reasonable investment models and business plans can be drawn up, irrespective of the form and content of regulation.

The public sector in the shape of, for example, Verva (the Swedish Administrative Development Agency) must further act as a competent purchaser. By buying and demanding from the market goods and flexible functions and solutions it is possible in many cases to influence the market to a much greater degree than through regulation. It is, nonetheless, important that the tougher requirements that are thereby imposed should be accompanied by an increased allocation of funds for purchasing, since tougher requirements lead to higher prices.

It is also important that the various interventions proposed should be coordinated. Today the capital for research and development, as well as for pilot programmes, comes from a number of different quarters, e.g. Vinnova, the EU and FMV (the Defence Materiel Administration), at the same time as inquiries and plans about the future are also conducted by most organisations (e.g. the National Post and Telecom Agency, Verva, the Defence Materiel Administration, KBM (the Swedish Emergency Management Agency), the Swedish Armed Forces. If Sweden is to be competitive we need increased coordination of resources. At the same time it must be accepted that certain interventions can prove failures, because if there are not occasional failures, the interventions made are insufficient. Support for R and D should be accompanied by a greater degree of follow-up, so that applications and approvals become simpler, while follow-up with the aid of measurable targets must provide answers to whether the promised result has been achieved or not. An important part in this includes that the ability of public sector, as purchaser, both to order non-existent products in order to carry out R&D and also to buy the first (expensive) examples of new products.

Currently the major part of the Swedish infrastructure is owned directly or indirectly by the public sector through e.g. government ownership of Telia, Teracom, National Rail Administration, Svenska Kraftnät (the national electricity grid) and local authority ownership of various municipal network-owners such as Stokab in Stockholm. It is at present difficult for the market to understand what role the public sector considers these companies should have.

Access to infrastructure is largely a regional policy matter. It ought to be possible for the price for access to the fibre network to be set as low as possible and for it not to depend on where in Sweden one lives or works. It is precisely that which makes the fibre network a regional policy infrastructure question, as a generally available common good in the economic sense. Without this attitude one must instead accept that access to broadband will vary in different parts of the country for the foreseeable future, precisely like access to public water supplies and mains drainage. A fibre network has a long write-off period and the required return on the investment roughly corresponds to the movement in GDP. Unfortunately, the market aims to make investments in fibre profitable in the short term and, as a result, they must be integrated with services (c.f. telephony, the price of which is set according to the extent to which it is used and its capacity), or sold to users who can themselves profit from added value, in order to enable those investing in fibre rapidly to recoup their money. A better model would be to write off the investment over a long period, so that the rental costs can be kept low. Theoretically, a fibre cable can be used for 25 years or more, and the trunking that carries it many times longer still. With such long write-off periods, the requirement for rapid repayment disappears and with it the need for cross-

subsidies from services.

It is the gains to the national economy and the secondary effects that are of interest from the perspective of society. Priority areas such as healthcare, schools and social services can be organised more cost-effectively with a higher standard of service and better quality. New enterprise in new areas becomes possible. Independence of time and space puts a premium on areas far from "the centre". That creates the conditions for competition in services, including technological development, throughout Sweden.

6.6 The users as the drivers of development

If the sector producing IT accounts for only 5 per cent of the value-added and employment in the economy it means that the sectors of the economy using IT account for the lion's share of the added value and employment. The wholly decisive factor in the development of productivity (growth) in Sweden then becomes the degree to which IT is extended to, absorbed, used and developed in business and industry, as also by organisations and the public administration.

As regards public eServices, IT is in a class of its own as the most important driving force in the achievement of objectives such as improved quality and efficiency. The central agencies' efficiency improvements in systems for handling transactions are dependent on the use of IT. In many municipalities it is the public sector that is clearly predominant and the major individual activity and hence the largest client of the Internet operators. Healthcare establishments, schools and municipal administrations represent a significant user need for electronic communications between their different constituent parts and to the citizens. In addition it is the public administration, more than the business world, which is under a duty to make available services of like quality, accessible to all inhabitants. For that reason the question of access to IT is probably of greater importance in the public administration than in any other sector, and a fundamental tool in the improvement of efficiency in the public sector in general. The provision to households of access to IT infrastructure with high transfer capacity can also be a means to prevent the emergence of digital gaps, promote integration in society, etc.

If there existed a general infrastructure supporting all conceivable objectives, it should also be possible to adapt it to individual use, with a high degree of individualisation and at a low cost (since the same infrastructure can be 're-used' for many purposes).

New areas of use arise almost daily, and many previous inquiries point to a need for, and the desirability of, information and services that can be communicated via IP-based networks in various areas and sectors of society. In many cases these applications are at present unknown, but history shows that access to IP-based high-capacity networks creates the possibility of innovation and new services in the form of Podcast, Skype, RSS and BitTorrent, requiring varying traffic patterns. Innovators will always design their services in accordance with the capacity they obtain, and they drive infrastructure ahead of them. The common IT infrastructure needs to carry the collected needs of many different organisations and private individuals for electronic communication, including in such cases as where a number of people in the same household or a single place of work simultaneously use different services on the Internet.

6.7 The possibilities and weaknesses of technology

Formerly one communication network was built for each application. The fixed telephone network and the land-based TV network are examples of this. On the basis of IP technology different services can be distributed via the same physical IT infrastructure (physical networks). The application employed is governed by what communication protocol (set of rules) is used by the communicating parties.

An IP-based infrastructure for electronic communications can thus constitute the basis both for existing and new applications. Existing ones are for example e-mail, Web and file transfers. The more recent applications relate among other things to the transfer of text, sound (e.g. speech in the form of telephony, music) and images (e.g. still pictures, moving pictures) of high technical quality. It can be foreseen that new applications will be developed, in which the requirements for capacity and (low) network delay, as well as traffic patterns, are still unknown. It is therefore important to be sure that the physical IT infrastructure not only has the prerequisites for carrying known applications but as far as possible is also ready to handle future applications using IP-technology. Conversely, history has shown that if there are connections with good transfer quality, services have appeared on the market to exploit them. Skype is an example of a service that has emerged because more and more users are permanently connected to the Internet. Moreover, Skype is an example of a program designed to function for users, given the products now available on the market. We will see many applications similar to Skype in the future.

A conclusion that can be drawn is that the physical IT infrastructure cannot be laid down for one application. Another conclusion is that it is important to lay down a general physical IT infrastructure where the network's capacity can be increased stage by stage through e.g. the upgrading of communications equipment, without the need to build further networks. Likewise, that there are technological conditions for high capacity both to and from the user. With the use of IP-technology different services can thus be distributed over the same physical IT infrastructure (physical networks). IP-technology is also independent of what type of physical media (network) is used for the transfer. Those parts in which different media are exploited lie in the first instance closest to the user (the access network).

A further conclusion is that there will remain a great requirement for quality and security of operation as regards services and physical IT infrastructure. The planning and laying down of a physical IT infrastructure must thus be directed to the long term.

The physical infrastructure must be technology neutral. Whoever provides the IP transport service will choose the technology, and that choice depends entirely on (a) what transfer is available, (b) geographical problems and (c) the number of potential clients. An operator wants nonetheless to have as few systems as possible to maintain in its own infrastructure, so for an end-user there will not in practice always be competition. Apart from the major cities, where we see a certain competition, and Telia's copper network on which there will perhaps always be competition, a customer in practice has the possibility of access to only one or two types of transfer. These are probably used by different operators. The consumer choices are thus between e.g. operator A, over a copper network, and operator B, via radio.

Annex 1: The different actors in the electronic communications sector

In the discussion about IT infrastructure and various services it is important to keep track of the different actors and the nature of the value chain. Below we describe the whole chain of actors, their different roles and responsibilities, from those who own a physical network to service providers and the users of eServices.

The communications architecture

All use of electronic services and electronic communications builds on communications architecture. It can be considered as a value chain with different levels. Each level has different actors with different roles. There are differences in the mutual relations among the various actors and the service providers. In the majority of cases they have no links with each other at all, but in certain cases there are contractual relationships, e.g. on the leasing of cabling or transfer capacity. Different actors also have different technological solutions and different types of technological equipment that in the majority of cases, only they themselves have responsibility for, and control over. In certain cases, one and the same actor has responsibility for several levels in the value chain and that can lead to what is known as vertical integration.

Vertical integration

Vertical integration means dependencies, technological or contractual, between different levels in the value chain. One actor exists and acts at different levels in the value chain, which can have both positive and negative consequences for competition in a given area.

Vertical integration can mean that one actor has the ability to ensure quality right out to the end-user, plus that control of both networks and services can bring with it an increased readiness to invest. However, one consequence can also be that, by controlling the different levels, the actor reduces

The different levels of IT infrastructure

Application level

User's equipment, services, information

IP level (Internet)

Network services offered to the user by the Internet operator

Transfer level

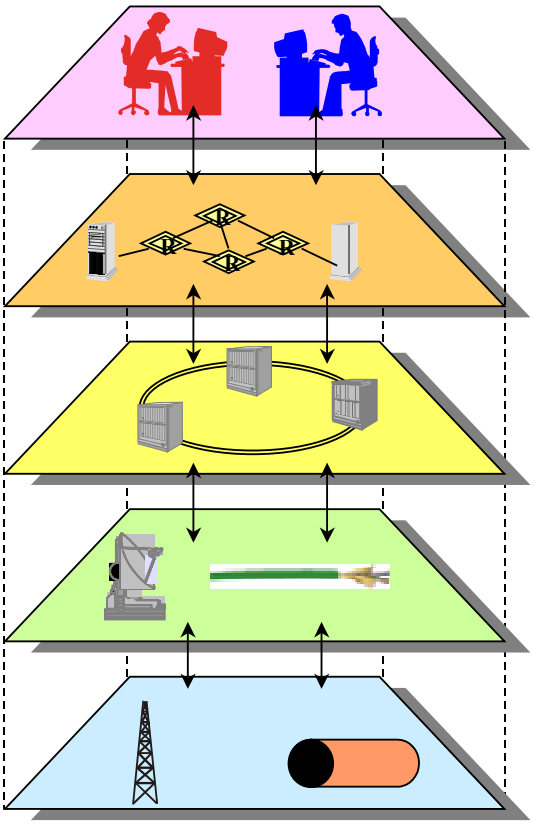
Several logistic connections for data and telecommunication

Cable level

Cabling (e.g. optical fibre, copper wire) and antennae

Trunking level

Piping to house cabling and masts for antennae



the freedom of choice for the end-user. Vertical integration can also make it difficult, above all for new actors, to enter the market, which also results in reduced freedom of choice. Here one must distinguish between commercial packaging and technological and pricing barriers, in which the latter have more serious effects in inhibiting competition. Within IT policy effective competition is an important parameter for the positive development of eServices. The ability to access public eServices independently of network and Internet connection is, moreover, decisive for the IT society. The Electronic Communications Act is a tool for effective competition on specific markets, e.g. the copper network.

It is important to distinguish between commercial packaging (e.g. in which telephony and TV can be included in a single broadband subscription), where the user has freedom of choice among corresponding services from quite different service providers, and cases in which technical equipment/solutions or other limitations hinder the customer's ability to choose other providers of corresponding services. The users can be locked in (limited freedom of choice), and alternative service providers be locked out (or unable to compete because of price-squeezing effects or technological limitations). The degrees and effects of vertical integration are complicated matters in which everything from freedom of choice, competition, mobility, flexibility and finance must be discussed.

The application levels

This level in the value chain is divided into (at least) two different part-levels. There is both the level of the technical protocols that are used to transfer electronic services and there is also the level of the services themselves. At these levels too are found all the services that are accessible via the Internet and include in practice an infinite number of services available over the whole world such as e-mail, IP-telephony, Web, TV, radio, games, chat and databases. This level also includes all services that can be accessed via mobile telephones, e.g. WAP services. However, these are currently usually tied to mobile operators, which creates a vertical lock-in.

The IP telephony service Skype is an example of an Internet-based telephony service where the transfer is that which is normally used for Web services and hence does not have the same solution as other IP-telephony or traditional telephony.

Every service provider has different technical solutions and technical equipment for the various services. Neither network owners, transfer providers nor Internet operators (at the lower levels in the value chain) have any possibility of insight or control over what happens at these levels.

The active equipment level

This level consists of two part-levels, both electronic equipment where data and telecommunication (transfer) is established on physical cables or antennae, and equipment for the establishment of IP communication (e.g. Internet). In certain cases there is no transfer level, since the Internet operators (see below) lease cable (e.g. optical fibre connections or copper cabling) direct from network owners. In other cases, for e.g. traditional telephony or mobile telephony, these are established direct at the transfer level and without an IP level. However, that happens less and less commonly, since traditional telephony, like mobile telephony uses the IP level to transport telephone conversations between telephone exchanges.

The transfer level consists of electronic equipment in which logical connections are established for data- and telecommunication with a mass of different competing standards. Actors and providers at this level lease cable from network owners and establish data- and telecommunication, transfer. These actors subsequently lease out communications capacity, transfer, to various operators who wish to link together various objects/customers for e.g. telephony, mobile telephony or for IP communication (Internet, Internet operators).

Transfer providers have no control over (cannot see) what their customers (the operators) use the network capacity for and what type of traffic is established or what technical equipment is used. In certain cases the transfer providers refine their own transfer networks and themselves become e.g. Internet operators or telephony operators. This is a further example where vertical integration can arise.

Actors at the IP level are called Internet Service Providers or Internet operators and use one common technical standard (IP). In certain cases at this level there are communications operators who establish local IP networks with connections to one or more Internet operators. Internet operators or communications operators lease capacity, transfer, from the transfer provider or lease cable direct from the network owner. The Internet operator connects the customers (the public, property owners, schools, enterprises, service providers, hospitals etc.) to the Internet. In this way, the customers access without restriction from the Internet operator the infinite quantity of services and information

that is to be found on the Internet. All service providers are in other words themselves connected to the Internet via an Internet operator somewhere in the world and are hence also customers. In some cases, the Internet operator runs his own Internet-based services e.g. e-mail, IP telephony, IP-TV etc. that he offers his customers. That is also an example of vertical integration.

The passive infrastructure level

At the base of this value chain lies the passive infrastructure. The passive infrastructure consists of two part-levels, the conduit/duct level and the cable level, without electronic equipment or communication.

The conduit level consists of pipes and conduits in the ground where different cables may be laid in tunnels, hung on posts or buried in the ground, and also of masts on which antennae for radio transmission and reception can be mounted.

The actors who own conduits either lease space in it to actors who want to lay cables or erect antennae, or they lay their own cabling and antennae in their own conduits or masts.[5]

The cable level consists of cabling, e.g. copper cables and optical fibre cables, and also of antennae that can be mounted on masts, on the roofs of houses, and so on. The actors who own cabling are called network-owners. In Sweden we have many network owners in the shape of e.g. TeliaSonera and other private network owners, Svenska Kraftnät, municipal and private urban networks, regional network owners and property owners (owners of networks in properties). The network owner's role is to lease out cabling to actors who wish to establish electronic communications between different places. The network owner can have no control over, or responsibility for, what communication is established, what technical equipment is used or what the communication itself is used for. Certain network owners nevertheless establish their own communication with their own technical equipment on their cables. Here there can arise vertical integration that can disadvantage effective competition. An example of vertical integration is TeliaSonera's provision of services to the end-user over the copper-based access network that broadly speaking accesses all households throughout Sweden. With a view to encouraging competition both at the service level and at the infrastructure level the legislator/authority attempts to place TeliaSonera under an obligation to make their cabling available to other actors parallel with their own establishment of communication via these cables.

[5]See "När en räcker - mastdelning för miljön" [When one is enough - sharing masts for the environment], Official Government Reports (SOU) 2005:97.