

# A Completely Connected Sweden by 2025 – a Broadband Strategy





## Preface

The government's vision is a *completely connected Sweden*.

A political vision is necessary, not for a technologically driven development, but for a society that takes advantage of the opportunities of technology. If politics can be a guide to the *why* and the *what*, research and technology can provide the *how*.

Access to broadband is rapidly becoming a prerequisite for being able to benefit from basic social services and for participating completely in society. That development is already advanced. In the future, some of our social services will be carried by the digital infrastructure. For example, it is likely for a large part of health care to be done remotely. The digitalization will also be able to contribute to a global improvement in efficiency of the public sector and to an improved social service and quality of life for the citizens. But in order for everyone to be able to benefit from the social services in an egalitarian way, and in order for prosperous businesses to be able to develop in all parts of the country and in order for the public sector to be able to render their service more efficient, everyone needs to have high-capacity internet access.

Increased globalization, digitalization, urbanization and climate change are all connected to or affected by the connected society. It is important to achieve a Sweden that sticks together and where there are opportunities for living and working in the entire country. In order for new businesses and new jobs to be created, Sweden needs to create a world class competence and infrastructure.

Broadband connection creates opportunities for smart solutions that help facilitating peoples' everyday life, their common creativity, the development of business ideas, regardless of location and thereby for occupation and growth, without wearing on the environment. In the government's strategy Smart Industry, broad and accelerated digitalization is a fundamental theme, as well as in the cooperation programs initiated by the government, especially those concerning smart cities. In order for strategies and programs to be practicable, the broadband infrastructure is an instrument of great importance. Studies show that digitalization help create an increasingly sustainable society; we gain quality improvements and cost savings as well as a decreased strain on the environment and good opportunity for a socially collected society. At the same time, it is important for businesses and individuals in all of Sweden to benefit from the opportunities of the digitalization.

In Sweden, several companies using digital business models have already been founded and attained an estimated value of over a billion dollars, so called Unicorns (in 2016 equivalent to approximately 9 billion SEK). There is also support for the view suggesting that broadband penetration has a positive effect on the GNP growth. Collectively this contributes to the government's goal for Sweden to have the lowest unemployment rate in Europe by the year 2020.

The government is now moving to adapt the infrastructure to the digital era by formulating a broadband strategy concerning access to broadband both in and outside the home and the workplace, for everyone. The government is parallelly developing a strategy for the digitalization in order to support industry, commerce and societal development.

The government's ambitions concerning coverage in the entire country are highly set and in order to work according to a long-term perspective the entire country needs an active broadband policy. By way of the broadband policy, the government would like to inspire all operators to a continuously fast broadband expansion and especially to see an improvement for users who find themselves outside densely populated areas and small populated areas, in order for Sweden to be completely connected.

In order for the vision to be realized, both public and private efforts are required. The government will therefore work to maintain the positive development in fast broadband expansion. In the new strategy, the starting point is a market-driven development, completed by public efforts.

It is with great joy that the government presents a broadband strategy containing goals that for the first time includes all of Sweden.



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## Summary

The government of Sweden hereby establishes a broadband policy in order to face people's need for high-speed broadband and reliable high-quality mobile services. The vision of the government is an entirely connected Sweden, thus creating opportunities for living and working, as well as inspiring growth and innovative production.

In the short term, the goals will be broadened to include broadband access for 95 percent of all households and businesses at a minimum capacity of 100 mbit/s, already by the year 2020.

In the long term, the government considers it necessary to create goals in two specific areas; *access to high-speed broadband in all of Sweden* and *access to reliable and high-quality mobile services* – where the leitmotif is “utilization without experienced limitations”. All of Sweden includes areas where people and things usually find themselves. The objective of these goals is that 98 percent of the population should have access to broadband at a minimum capacity of 1 Gbit/s at home, as well as in the workplace, the remaining 1,9 percent at a minimum capacity of 100 mbit/s, and 0,1 percent at a minimum capacity of 30 mbit/s, no later than the year 2025. The goals also include everyone's access to reliable and high-quality mobile services, where they usually find themselves, no later than the year 2023.

The present broadband strategy was decided upon in 2009 and contains goals targeting the year 2020. The government now adjusts these goals, targeting broadband access for 90 percent of all households and businesses at a minimum capacity of 100 mbit/s, and is working to reach further. In addition to this, goals have been established on EU-level targeting internet access for everyone in Europe at a capacity exceeding 30 mbit/s, and paying access in 50 percent of all households at no less than 100 mbit/s, no later than the year 2020. In a message transmitted on the 14th of September 2016, the European Commission suggested new goals concerning connectivity in 2025. The ambition of the government is that the goals in their strategy correspond to those of the European Union.

Since 2009, the development in broadband expansion, as well as in broadband utilization, has increased at an exceedingly quick pace. According to the survey conducted by The Swedish Post and Telecom Authority for the year 2015, less than 130 households and businesses are today lacking some kind of broadband at their permanent address. Concerning high-speed broadband, the access differs from densely populated areas and small populated areas to sparsely populated areas where the access is scarcer.

The implementation of this policy requires new activity in several areas. Clarity is needed regarding the operators on the broadband market, the positions they hold in relation to each other, and how the broadband expansion might be affected by the specific nature of these relations. The expansion needs to be made more flexible and facilitated in several ways in order to create a solid foundation for increased cost-efficiency.

Opportunities need to be created in order for the expansion to reach more people and things where these can be found. The government has identified three strategic areas that are paramount to the successful achievement of the goals set up for the years 2020 – 2025:

- roles and rules on the broadband market
- cost-efficient expansion of the broadband infrastructure
- infrastructure and services for everyone

The focal point has to be people's need for broadband access, whether they live in densely populated areas, small populated areas, scarcely populated areas, rural areas, or in areas situated between those already mentioned. The foundation is a market driven expansion conducted in harmony with the responsibilities of the public sector, such as access to public services and the long-term sustainability of growth and enterprise. The role of the public sector, as well as that of the private sector is stressed in the strategy. Private investments must not be prevented and forced out, whilst the responsibility for access and utilization of digital services must be taken into account. A well balanced principle of caution should therefore prevail. In some of Sweden's rural and sparsely populated areas, there are challenges concerning the profitability of broadband investments, which demand administrative efforts as well as public investment. An example of administrative efforts is support for broadband expansion in areas lacking conditions for commercial expansion. Another example is the possibility for a fiber association in just and reasonable terms to gain access to piping in compliance with the law (2016:534) concerning proceedings for the expansion of broadband infrastructure. It is also of great importance that the expansion is met with demand and a will for payment.

## 1. Vision, goals and strategic areas

In this section, the vision, the target and the strategic areas are presented. In section 2, the strategic areas are presented in detail, together with the activities linked to each area, and in section 3 how the strategy will be developed further. Finally, in section 4, a shorter presentation is given with the purpose of clarifying the background for the activities suggested in section 2.

### Vision

The government's vision for a *completely connected Sweden* is that the broadband infrastructure should correspond to the users' need for connectivity. In practice, neither fixed nor wireless broadband should be a limitation for utilization, supply or development of digital services. A similar situation would be the consummation of electricity, where there is a limitation to the amount of electricity that can be delivered to a facility, but where the basic capacity for domestic use is sufficiently elevated and reliable for the user not to experience any limitation. In the same way, the user should feel reassured that the connection works for the broadband services used. This contributes to a democratic and egalitarian society of equals that is equipped for the future. This is necessary for the digitalization to be able to reach its full potential.

### Goals

In order to realize the vision of a completely connected Sweden, increased access to broadband is required. The strategy therefore contains goals concerning access to high-speed broadband and to reliable high-quality mobile services. A condition for reaching these goals is a continuously accelerated expansion and communication between different technologies. The government suggests activities in areas concerning interaction between the market and the state, how the expansion could be more cost-efficient, as well as how it could reach further and a greater number of people. The goals of the broadband strategy are:

*In the year 2020, 95 percent of all households and businesses should have access to broadband at a minimum capacity of 100 Mbit/s*

The objective is broadened already for the year 2020, by which 95 percent of all households and businesses should have access to broadband at a minimum capacity of 100 mbit/s. This means a broadening of the objective suggested in the Broadband strategy for Sweden, decided upon in 2009. However, the trend shows, as was presented in the 2009 strategy, an increasing demand for high transfer speed.

The goals presented in the Digital Agenda for Europe continue to serve as a target for the broadband expansion until 2020 and is a basis for the government's goals posterior to the year 2020. In short, this means that everyone should have access to a connection at a capacity exceeding 30 mbit/s, and paying access in 50 percent of all households at no less than 100 mbit/s, no later than the year 2020. In a message transmitted on the 14th of September 2016, the EU-commission suggested new goals concerning connectivity in 2025. The ambition of the government is that the goals in their strategy should correspond to those of the European Union.

*By the year 2023, all of Sweden should have access to reliable high-quality mobile services*

- *where people usually find themselves*
- *situational adaptation*
- *coverage for practical use*

Sweden should at the highest possible degree have access to reliable and high-quality mobile services. This means that it in the areas where people usually find themselves, should be possible to use the desired mobile services, adapted to the situation. In the basic scenario, this is parallel to coverage for practical use, i.e. to be able to use services, applications and other functions, outside the household or the office, for example on the bus, in the car, or while walking, by way of a wireless connection. The same scenario is also valid for connected things. The connection needs to

be sufficiently stable and of such a quality that the users do not experience any limitations in their situationally adapted use. A reliable connection can be used without interruption and at a sufficient capacity. An expression meaning the area where the user's application or similar service is working as expected is coverage for practical use. The goals concern areas where people and things usually find themselves since the areas missing coverage via cellular masts today are found exclusively in desolate places such as unpopulated mountainous areas. In these areas, satellites could be a solution, posterior to 2020.

The goal should be to respond to the demand for broadband people are likely to have outside their home and their workplace. The goal supplements those for high-speed broadband at home and in the workplace.

*By the year 2025, all of Sweden should have access to high-speed broadband*

- 98 percent of all households and businesses should have access to 1 Gbit/s
- 1,9 percent of all households and businesses should have access to 100 Mbit/s
- 0,1 percent of all households and businesses should have access to 30 Mbit/s

All of Sweden should have access to high-speed broadband. This means access to high-speed broadband at home and at work at a sufficiently high capacity for the user not to experience any limitations within the services requested by them.

The goal concerning 1 gbit/s includes generally all users and connected things. The great majority of households and businesses should have an access allowing for a capacity of 1 gbit/s and a smaller part of the households and businesses, 2 percent, at lower capacities. For these 1,9 percent, the goal is broadband access at a minimum capacity of 100 mbit/s, and the remaining 0,1 percent at a minimum of 30 mbit/s, by the year 2025. In a few number of cases, it concerns social services as established in the act (2003:389) relating to electronic communications. The goal for high-speed broadband by the year 2025 only concerns connection to fixed points or at a fixed location, i.e. utilization at home or in the workplace. Utilization outside the home or the workplace, for

example while moving from the home to the workplace, is not included in this objective, but by those regarding reliable and high-quality mobile services by the year 2023.

The goal is neutral in relation to technology, which means that the connection can be provided by fixed or wireless technology. Fiber and cable television today provide communications at a capacity of 1 gbit/s. In the long term, also different kinds of wireless solutions will be able to provide that kind of communication. Given the geographical aspects of Sweden, and the repartition of its population, a completely connected Sweden requires a combination of different technologies – fixed and wireless. In some cases, the question whether the coverage is missing or defective, is one of definitional nature. A number of factors affect the cellular signal's capacity to reach its destination, for example geographical location, the structure of a house or a car, the choice of terminal and operator.

The objective should be everyone's connectivity, an objective that depends on the existence of a reasonable offer. The objective means that the household or the business has access to fiber or an equivalent in its immediate proximity, in order to be able to buy a connection. An actual connection requires demand, the will of the individual, as well as an opportunity for investment.

## Strategic Areas

### Roles and rules

In order to accelerate the expansion, the roles and rules for the operators on the broadband market need to be clarified.

### Cost-efficient expansion

In order to lower the demands for access to the broadband market, plans, terms and incentives need to be clear.

### Infrastructure and services for everyone

In order to reach further and more people, obstacles to the cooperation between technologies and activities should be eliminated.

## 2. Strategic Areas and Activities

### Roles and rules

In order to accelerate the expansion, the roles and rules for the operators on the broadband market need to be clarified.

The basis is a market-driven expansion in harmony with the need in the public sector for long-term sustainable access to important infrastructure. This means a continuous market-driven expansion, completed by public efforts. In most cases this issue can be solved by allowing for competition before different activities, for example by procurement. With procurement comes a possibility to make demands. The aspiration is a market in harmony with society's need for a sufficient coverage by a robust infrastructure, in order to be able to provide social services and maintain a sustainable growth. When the government now raises their level of ambition and widens their broadband objectives to include all citizens, it is vital that the operators on the market maintain their investments and are given incentives and opportunities to do this. Simultaneously, it is important that the public sector contributes with efforts destined to facilitate the expansion when geographical distances and lower population density lead to higher costs.

The market and the public sector have an important role to play in order to provide access to high-speed broadband to all of Sweden, in the most effective way possible. It is therefore important that private investments are not obstructed or excluded, while the responsibility of the public sector for the citizens' access to and use of digital services also need to be considered. This means that a well-balanced principle of caution must prevail regarding the question whether public operators should invest in broadband infrastructure in order to satisfy a need or not. To satisfy this need, the public sector is able to make demands that will be fulfilled via procurements.

There is a need to emphasize the repartition of roles and responsibilities between different operators, concerning broadband expansion and the importance of authorities and individuals, in order to better match supply and demand. It is a complex area including a great number of different operators with an equally great impact on and importance for the broadband expansion. To some extent, the relations between these operators are indistinct and ineffective. Who will do what, in order to attain a market climate where neither consumers, nor businesses, experience limitations to their use due to the broadband connection, at home, at work or in between the two?

Everyone who is an operator on the broadband market has important tasks and it is important to consider the opportunities that follow an influence on the market, but also the responsibilities. The government wishes that an incentive is created for continuous investments on the market by clarifying the ways in which the operators should act in relation to one another. In some parts of Sweden's countryside and sparsely populated areas, there are challenges concerning the potential profitability of broadband investment which demand administrative efforts as well as public investment. An example of administrative efforts is support for broadband expansion where possibilities for commercial investment are missing. Another example is the opportunity for a fiber-association in just and reasonable terms to gain access to piping in compliance with the law (2016:534) concerning proceedings for the expansion of broadband infrastructure.

According to the follow-up of the government's broadband strategy conducted by the Swedish Post and Telecom Authority, the market operators' investments in fixed and mobile broadband infrastructure reached 12.5 billion SEK in 2015, of which 9 billion concerned investments in fixed broadband infrastructure. The municipal city networks invest exclusively in fixed broadband infrastructure and in 2015 their investments amounted to approximately 2.3 billion of the total investments.

In the OECD report "Development of High-Speed Networks and the Role of Municipal Networks" it is established that a combination of private and public investments is necessary for an efficient expansion of the broadband infrastructure. The OECD study shows that city networks will play an important role in the development of broadband infrastructure in order to meet the rising demand. According to the report, there are also signs that the existence of a city network inspires private operators to invest in fixed broadband infrastructure, thus creating competition in these areas. According to the study, others say that the city networks in some cases compete with the operators in the private sector or create a local monopoly, thus inhibiting private initiatives.

In the last few years, the local markets have become increasingly attractive to investment. This is a positive development and the government would like to stress the importance of a broadband infrastructure that is open to everyone, under the same terms and conditions. An open broadband infrastructure, at an active as well as at a passive level, i.e. concerning fiber cables and equipment for transferring information (for further information on the chain of value of the

broadband market, see the chapter entitled “Background”), inspires competition of services, development of services and innovation. It is therefore important where the different operators position themselves in the chain of value. Considerable investments are required for the deployment of the physical infrastructure, whereas it is less expensive to add the active equipment and to deliver services to the final client. This means that the competition is tougher higher up in the chain of value. Public operators should therefore act on the lower levels of the chain of value and parallel infrastructures should not be obstructed, where these are possible. A model for vertical separation, i.e. not simultaneously offering services for final clients and providing infrastructure and services at a wholesale level, could offer an opportunity for public operators to act in harmony with the providers of services in order to increase the selection of services for the final clients. Procurements can be conducted on different levels and in different domains of services. A positive development in the domain of electronic communications and in particular new fixed and mobile broadband services is characterized by increased demand, competition and investment.

The broadband infrastructure should be a key question for the concerned public operators on governmental, regional and municipal level. A change needs to be put in motion in order for the broadband infrastructure to be considered as a topic of importance to the social planning. It is also of great importance to consider the market’s exposure to competition, which means that parallel options should not be obstructed, for example by hindering parallel private property networks within municipal property companies or in the permit application process preceding the deployment of broadband. For further information see the chapter concerning cost-efficient expansion of broadband.

The *government* has a responsibility for optimizing the use of their broadband infrastructure. The report “The Government’s Broadband Infrastructure as a Resource” (SOU 2016:1), contains several suggestions on how the organization of the government’s broadband infrastructure might be conducted, and on how the supply of publically owned fiber and piping should be increased and made available for broadband constructors. This concerns creating opportunities for the over-capacity of the governmental broadband infrastructure to be made accessible to the market. It is also of importance that the regional broadband coordinators at an early stage are provided with information concerning the planned changes and developments in order to facilitate co-deployment between broadband infrastructure and other infrastructure.

When broadband is considered in *regional* strategies or plans, it is favorable that the need for development of as well fixed as wireless broadband is described. High-speed broadband is in many cases a requirement for being able to run and develop for example agrarian and industrial enterprises, e-commerce or other services such as tourism, transportation, artisanship, etc. in rural and sparsely populated areas. Consequently, regional strategies could have a positive impact on municipal strategies, plans and implementation in the area. The government will carefully follow the development, through the work conducted by the broadband coordinators, and when needed by revising how cooperation on the regional level could be strengthened and how the role of respective operator could be clarified.

The government is responsible for formulating national strategic goals for the broadband expansion, even though the municipalities without any doubt have important roles to play in order to achieve these goals. The government therefore wishes to reach a point of agreement with the municipalities on which of their tasks are the most urgent in contributing to a continuously fast expansion of broadband at a local level. In some cases, the municipalities may differentiate between what they need for their own municipal administration and what might be needed for other parts of the municipality. The government stresses the role of The Swedish Association of Local Authorities and Regions, which is to guide the municipalities in the broadband expansion in a way that is competitively neutral and defined by transparency concerning permits and charges, including access to property with the appropriate rights and remuneration, continuously aided by guidelines emanating from relevant authorities.

The increasing dependency in society on digital services makes higher demands for robustness and reliability. This means that the infrastructure should be robust enough to stand for strain and to be of such a quality that it is operational and accessible even at moments of interference. The basis for the government is that robustness and security primarily should be provided by the *market operators*. Supporting the task are clear guidelines for the construction of robust fiber infrastructure, “Robust Fiber”, which have been drawn up by the operators of the business under the direction of the Swedish Post and Telecom Authority. Furthermore, the directives of the Swedish Post and Telecom Authority concerning demands for reliability should ensure that the operators on the market conduct a sustainable and continuous work for reliability. The purpose is that infrastructures and services should reach a basic level of reliability. In order to achieve a robust broadband infrastructure, it is also important to ensure a legally righteous treatment of the issues concerning access to property. This is

also an important factor in relation to the long-term sustainability of the networks.

The government considers it to be of great importance that the operators on the market actively work for a raised level of quality, among other things, issues concerning network security and formulate minimum levels for specific functions corresponding to the requirements for security and robustness for societally vital digital services. To have support for IPv6 (Internet protocol version 6), for digital services such as websites, domain name-servers and email-servers, is one of the factors considered important for a business in order to maintain and improve their ability to communicate with other via the internet, especially for businesses with clients abroad. The government, the regions and the municipalities are important users as well as buyers of networks and services and can actively contribute to the construction and maintenance of covering, robust and reliable networks, through demands made at a possible procurement. Networks need to be equipped in order to be prepared at moments of great strain. Networks also need to be able to serve as back-up for the social networks presumed by a public undertaking.

A better dialogue between private and municipal operators is needed, partly to reduce the transactional costs for a broadband expansion, and partly to increase comprehension for what is considered as disturbing the market in relation to the necessity of high-speed broadband access to the citizens of the municipality. A dialogue is also needed between private and municipal operators in order to avoid procedures inhibiting the possibility of infrastructural competition. The dialogue should be conducted on their own initiative or via the areas for cooperation already existing.

In cases where municipal housing companies deploy new infrastructure for broadband, it is important that the possibility of using existing parallel infrastructures, such as networks for cable-tv, are not obstructed, presuming that there are not particular reasons for doing this. Thereby it is possible to implement a suitable and balanced principle of caution, where public investments do not risk excluding private ones. The dialogue mentioned above would include the possible ways in which the operators could cooperate in terms of permits, on one hand transparency from the municipalities concerning costs for restoration, and on the other transparency from the commercial operators concerning the extension of the infrastructure. It would also include the ways in which consumers in all areas of the municipality could gain access to a connection at a reasonable rate as well as demands for a minimum quality of the networks. Furthermore, the dialogue could increase the

comprehension for the ways in which the municipalities regard their responsibility in relation to an improved health and medical care, education or supply in general of services of interest to the public good and how everyone should be able to profit from these services. It could also facilitate more cost-efficient digital communications and promote economic and social growth. This involves collectively formulating a description of reality as well as discussing the modalities of a desired situation and how such a situation should be achieved.

The government would also like to stress the importance of the consumers' demand and will for payment. The demand of the final client and their will for payment, are very important forces in order to attract investments in the broadband expansion.

#### *Activities*

By proposing the following activities, the government would like to inspire constructive action from all operators who are in position to affect the broadband expansion in a positive fashion.

Activities in order reach the goals for an accelerated expansion:

- The government's work with Bredbandsforum continues
- Clarity and simpler rules as leimotif when overhauling Euro directives
- Mission to direct city networks and to provide broadband
- Mission to develop the work with broadband coordinators
- Information concerning the benefits of broadband investment

#### Increased Cooperation through Continuous Work for Bredbandsforum

Bredbandsforum has been given the task of facilitating cooperation between operators in society, targeting an effective expansion of the broadband infrastructure. The forum also has the mission of organizing encounters between companies, authorities and other organizations in order to collectively identify obstacles and finding solutions facilitating broadband access all over Sweden.

In the budget proposition (prop. 2016/17:1, expense area 22), the government announced that their work with Bredbandsforum will continue.

## Clearer and Simpler Rules at EU-Level – overhaul of the Euro directives for electronic communications

On the 14<sup>th</sup> of September 2016, the EU-commission presented suggestions for legal acts containing new and revised rules for the domain of electronic communications. The telecom regulations of the future will, for example need to be adapted to the fixed copper infrastructure in Sweden is being replaced by fiber, provided by a number of different operators. Sweden is actively contributing to the commission's overhaul of the framework and is working constructively to reach the best possible result in the negotiations. The general Swedish goal of the negotiations is the overhaul is that the domestic market should be supported in such a way that the positive development of the Swedish domain of electronic communications is preserved at enables Sweden remain in the vanguard. During the last few years, the investments in Sweden have been relatively elevated, compared to other countries in the OECD.

As a part of the work concerning the overhaul of the EU-framework for electronic communications, the government is acting to develop a perspective for the end user where regulation should be technologically neutral, flexible and not too detailed in order to be able to follow the rapidity of technological development. The rules should be clear and simple. The expansion of the broadband infrastructure need to be promoted and competition as well as profit in relation to risk need to be ensured. The basis should be that competition is a means to inspire new investment.

## Increased Access to All Municipal Infrastructure on Equal Terms

The municipalities' broadband infrastructure is an important asset. Clearer rules or guidelines need to be considered in order to clarify the fact that municipal broadband infrastructure is provided on non-discriminatory terms and satisfies the existing demand from the operators for network access. To be able to use the infrastructure of others, access to the land is also required. The access needs to be ensured in a legally secure and sustainable way.

The intention of the government is to give to the Swedish Post and Telecom Authority a mission to conduct a survey in order to map and analyze certain issues concerning the direction of city networks, providing and expanding broadband infrastructure as well as linked prerequisites for competition. The mission includes, among other things, to investigate whether it would be appropriate to make an exception from the localization principle of the Municipalities Act (1991:900).

Within the framework of the mission, it is also necessary to investigate a refinement of the city network-model, a model for vertical separation, where the supply of networks and services at a wholesale level and sales of services to end users in these networks are separated. Consequently, the mission does not englobe solely the physical infrastructure, such as piping and fiber, but the entire chain of value. The mission will also include existing opportunities, such as municipal associations. The Swedish Post and Telecom Authority should, when carrying out the mission, profit from the existing knowledge found at the Swedish Competition Authority, and to consult with that authority.

#### Developed Work with Broadband Coordinators and a mission to Bredbandsforum to Support Municipalities

Together with an evaluation of the broadband coordinators, is an occasion to further investigate whether there is a need for further expansion of the organization, which potentially might mean expanding the organization to municipalities where there is need.

The government intends to give to Bredbandsforum a mission to provide guidance to the municipalities, following the evaluations of the broadband coordinators, on how to achieve an expansion of the broadband infrastructure in an effective, coordinated and competitively neutral way. In relation to this work, the government would like to see cooperation with the Swedish Association of Local Authorities and Regions.

#### Increase in Demand and Will for Payment among Users for Continuous Investments in High-Speed Broadband

It is important that consumers and companies invest in broadband access of sufficient capacity in order to be able to benefit from the advantages of the digitalization. The digitalization is a great force for change, when considering basic societal functions, in contact with the public sector as well as education, work, service, amusement and culture. A description of the potential future use of digital services and of how daily life could be facilitated, contributes to explaining and motivating the investment that is needed.

The government intends to give to the Swedish Post and Telecom Authority a mission to analyze, describe and spread knowledge on what quality improvements, cost savings and other concrete gain the use of broadband services might have for users in all areas of the country.

## Cost-Efficient Expansion

In order to lower the demands for entry to the broadband market, plans, terms and incentives need to be clear.

A starting point for the government's strategy is that the broadband expansion needs to be facilitated in several ways. A great gain can be made if the time-lapse from the initiation of the expansion to the moment when the permits are issued, actual construction is carried out and work of restoration is completed, can be shortened. Transparency and predictability concerning terms and conditions are key-words. It is also of importance that the time for management is reasonable and that the methods for deployment are effective. Clear rules are needed for the investment decisions of the commercial operators. For example, the process for constructing a cell tower is long, relatively complicated and includes many different operators without synchronized processes.

The regulations decided upon by the directives of the European Parliament and Council 2014/61/EU, on the 15<sup>th</sup> of May 2014, concerning lowered costs for the expansion of high-speed networks for electronic communications, aim to lower the costs for deploying broadband infrastructure both fixed and wireless. The obstacles that remain and which might affect the decisions to invest are among other things the municipal processes when giving out permits and how the terms and conditions for these permits are formulated, for example concerning the demand for restorational work after digging on municipal land.

The municipalities can be of help by clarifying what requirements there are and what charges are demanded when deploying broadband on municipal land as well as collectively creating transparency of for example the basis for calculating restoration costs that is used. A briefing on how the charges that are taken out affect the possibility of implementing the broadband expansion would make a valuable contribution to the dialogue concerning roles and rules already mentioned. Transparency concerning the commercial operators' infrastructure extension is another of those examples.

Aggregated demand drives the expansion. There might be a positive effect to compiling the potential for demand for mobile coverage in areas in their entirety. This might include demand for mobile coverage in between municipalities as well as describing a municipality's internal

need for wireless infrastructure together with the need for wireless infrastructure that habitants, businesses and other people moving in the area might have. A comprehensive image might bring to the commercial operators' attention other investment possibilities that otherwise might not have been taken into account. Governmental authorities also have need for an analysis of the need and demand for digital services and thereby demand for both fixed and wireless infrastructure, as a step in their work for a digitalization of the public sector.

### *Activities*

By the following activities, the government would like to lower the demands for entry to the market and see to it that the expansion of broadband infrastructure becomes faster, more dynamic and cost-efficient.

Activities in order to reach goals for lowered demands for entry:

- a mission for accelerated processes when deploying broadband
- guidance towards wireless broadband in social planning
- an evaluation of to what extent the need for broadband is satisfied by planning and constructing, together with an analysis of the need for guidance
- development of a model for calculating benefits
- authorities in position to affect the broadband expansion – analysis of the need for clarification

### Simpler and Faster Permit Processes for Broadband Deployment

The current permit processes are found to be complicated and time-consuming, which might affect the will to invest and the expansional pace in a negative way. With reference to the act for measures concerning the broadband expansion, the parliament and the government have taken measures to solve these problems. On the issue of trial of permits concerning the expansion of broadband infrastructure according to the Road Act (1972:948) and the law of wiring (1973:1144), a time-limit of four months was set on the 1<sup>st</sup> of July 2016. The report *The Government's Broadband Infrastructure as a Resource (SOU 2016:1)* contains suggestions for the government to give the Swedish Transport Administration a mission, partly to clarify what is required of an application for deployment of piping or wiring for broadband in areas adjacent to the road to be able to be processed, and partly to process those kinds of applications within one month after a complete application has been submitted.

It is the government's intention to give to the Swedish Post and Telecom Authority a mission to analyze in which ways other processes can be rendered more efficient as well as to guide county councils and municipalities in the permit process. This might also include the permit process for power companies. It is crucial that also the permit processes for power companies is working in a flexible way, since power supply is a prerequisite for the deployment of broadband.

#### More Wireless Broadband in Regional and Local Strategies as well as in Social Planning

It would be favourable for the regional and local broadband strategies to include ambitions and targets for wireless broadband. It is important to consider fixed and mobile technologies as completing one another in order to reach full coverage. This concerns for example planning the for cell tower locations and thereby faster and more efficient permit processes.

The government has the intention to give to the Swedish Post and Telecom Authority a mission to provide guidance to regional and local operators on how fixed and mobile technologies can complete one another in order to reach the designated goals. In order for the support for raised competence to be as effective as possible, it is important that both the Swedish Post and Telecom Authority and the regional broadband coordinators establish a good dialogue with the representatives chosen by the municipalities and county councils.

#### Faster Processes? – Follow-up and evaluation of the practical application of rules and regulations

The act for planning and construction (2010:900) sets the framework for the municipal responsibility for planning and includes both an obligation to include broadband infrastructure in general and detailed plans as well as a possibility to reserve land for the given purpose within the framework of the detailed plan. In the 2017 budget proposition (prop. 2016/17:1), a continuous effort for a raised level of competence is announced in order to create a uniform and effective application of the act for planning and construction. The government commissioned the National Board of Housing, Building and Planning to implement such an effort.

The intention of the government is to give to the Swedish Post and Telecom Authority a mission to conduct a primary exploratory survey containing a description of present-day conditions concerning how the need for electronic communications infrastructure can be satisfied while planning and constructing. In addition to the description, an assessment is needed of what challenges might be connected to the application of the legal act in the given area, of how the realization of the expansion practically works and of what guidance and other efforts that could be necessary in order to create opportunities for an improved application. Within the framework of the survey, the Swedish Post and Telecom Authority will consult with the National Board of Housing, Building and Planning, Land Survey and the Swedish Association of Local Authorities and Regions.

#### Increased Knowledge of Calculation of Benefits and Effects of Investment in Broadband Infrastructure

The societal transformation brought on by the digitalization demands a new way of regarding investments in electronic communications infrastructure. A long-term perspective is necessary to value the potential benefits of services using electronic communications could bring to a municipality for example. Also non-monetary benefits, such as efforts creating security and opportunities for a democratic societal dialogue, might be necessary to involve in the context. There is a need for calculations of benefits based on a situation where several different activities collectively could benefit from and handle the costs of an investment in broadband infrastructure.

The intention of the government is to give the Swedish Post and Telecom Authority a mission to create a model for calculating benefits based on a situation where several different activities collectively could benefit from and handle the costs of an investment in broadband infrastructure, especially in municipalities. The model for calculation then could be used by other operators. Within the framework of the mission, the Swedish Post and Telecom Authority should consult with the Swedish Agency for Growth Policy Analysis.

#### Specification of Missions Capable of Facilitating the Broadband Expansion

A number of authorities, for example the National Agency for Public Procurement, the National Board of Housing, Building and Planning, the County Councils, Land Survey, the Swedish Board of Agriculture

and the Swedish Agency for Economic and Regional Growth already have tasks related to the broadband expansion.

The National Agency for Public Procurement could play a key role in providing support by guidance and education for municipalities and others who want to procure broadband infrastructure.

Land Survey plays an important role in verifying that access to land destined for broadband expansion can be gained in a sustainable and legally secure way. The National Board of Housing, Building and Planning has a guidance plan dating from 2010 regarding electronic communications, clarifying how the municipalities' practical work with the act for planning and construction could be conducted and what should be included. The regional councils have a task to supervise the municipalities' application of the act and to give them guidance and support in the process. The regional councils also process support for broadband infrastructure within the framework of the Program for Rural Development. The Swedish Board of Agriculture is the administrating authority of the Program for Rural Development and thereby responsible for the implementation of the support contained within the program, among other things support for broadband infrastructure to the end-client. The Swedish Agency for Economic and Regional Growth is the administrating authority for, among other things, the three northern regional funding programs where efforts targeting the expansion of the broadband infrastructure is carried out by the creation of networks connecting several towns.

The government has an important task in coordinating governmental activities and see to it that the areas of responsibility are neatly defined. It is also important that the responsibility for an effective broadband expansion is stressed when formulating instructions and letters of regulation for authorities, since it entails the governments active work for a global perspective, increased efficiency and coordination.

The government intends to investigate whether further clarification is needed of the missions destined for authorities capable of affecting the broadband expansion.

## Infrastructure and Services for Everyone

In order to reach further and more people, obstacles to the cooperation between technologies and activities should be eliminated.

One of the pillars of the government's strategy is that the broadband expansion must reach further and more people in the entire country, including rural and sparsely populated areas. The broadband connection required in a certain situation can be fixed or wireless. In some parts of Sweden and in some situations, wireless broadband technologies (including aerial fiber based on a radio connection from one point to another) or satellite solutions are the most suitable, while fixed technologies are to be preferred in other situations. This means that a continuous expansion of cellular networks and other wireless networks is crucial to the access to broadband.

The image provides a schematic description of what the market might resemble regarding broadband connection to a fixed point (broadband via copper is not included in the illustration, neither has the extension of the individual technologies been taken into account). The image also illustrates the fact that different technologies are optimal for satisfying the need for broadband in different parts of the country.



The global mobile data traffic is expected to increase considerably in the years to come. The trend is driven by increasingly powerful mobile units, faster mobile networks and the internet of things. A changing labour market makes new demands for mobility and access to broadband. Companies are digitalized at a higher rate, which makes higher demands for the connectivity of the employees, not only at work but also at home, while commuting, travelling and while in meetings.

The coverage for mobile broadband services in Sweden has expanded at a fast pace, primarily as a result of the 4G-expansion in surface-covering frequency bands. There is also development of broadband technologies in the satellite domain. When mobile traffic is increasing, extensive infrastructure for fiber is also needed in order to maximize the usage of the valuable and limited radio spectrum.

A changed user pattern and new advanced areas of usage can be matched by a fast technological development and allocation of new frequency bands. It is relevant to focus on enhanced capacity and coverage in order to increase access to mobile services. Capacity can be enhanced in several ways, for example by concentrating the frequency of base stations or by adding new frequency bands, thereby potentially delivering higher data capacity and transmission speed.

According to the Swedish Post and Telecom Authority, the combined capacity of the Swedish mobile networks is expected to double from 2015 to 2020. Especially the mobile networks at 700, 800 and 900 MHz play an important role in providing access to high-speed wireless broadband connections. These frequencies have properties which provide good surface coverage and good capacity. Radio frequencies are also a prerequisite for a number of radio-based services, especially for operators in public order, security, health and defence. Enhanced capacity and coverage are two decisive factors for the possibility to reach the suggested goals.

An active and target oriented management of the radio spectrum is also decisive for the development of 5G-technology. According to a message transmitted on the 14<sup>th</sup> of September 2016 by the European Commission, it is important to facilitate the development of 5G. 5G is considered a revolutionary technology which enables wireless broadband services at Gigabit capacity, thereby creating opportunities for new kinds of application as well as innovative business models in areas like transport, health, energy and media. The European Commission suggests that all densely populated areas and all larger roads used for

transport by land should have continuous 5G-coverage and that a number of cities in respective countries should be chosen to be prepared for 5G by the year 2020.

There are areas where mobility is of great importance but where the present-day coverage is insufficient. For example, this might be rural and sparsely populated areas in connection with areas where people live and where some industries are located. The public actors in public order, security, health and defence are important users in such areas. The operators' expansion of the 4G and 5G, as well as existing and future demands for coverage in large frequency bands entail a continuously improved mobile coverage. Active management of the radio frequencies is consequently important in order to reach the government's goals for the possibility to use reliable and high-quality mobile services where people usually find themselves. Among other things, the government considers the formulation of the Swedish Post and Telecom Authority for the requirements for coverage in frequency permissions to be an important instrument in facing the increasing demand for wireless broadband connections. This is also valid for analyzing which areas might be considered as normal places of residence.

A fast development in the digital field of different societal sectors could result in entirely new kinds of services with importance to society and its citizens. An increasing number of tv-services are distributed via broadband, especially via a fixed broadband connection. In the long term, the issue of accessibility to the basic selection of tv-services should be updated and be included as a parameter when assessing what a broadband connection should be able to be used for.

#### *Activities*

By the following activities, the government would like to ensure that broadband connections and services reach as many people as possible.

Activities for reaching goals for more broadband for everyone :

- government funding for broadband expansion
- analysis of effective use of government funds for expansion
- mission for the future need for frequencies
- effectuation of an analysis of the surrounding world
- analysis of the level of functional access to the internet

Government Funding for Broadband Expansion

In the years to come, there will be need for government funding in order to expand the broadband infrastructure in areas where conditions for commercial expansion are missing. In areas where population density is lower and where the geographical distance between villages, communities and households is larger, the cost for investment per household increases considerably in relation to densely populated areas, which renders profitability more difficult to achieve. Further completing efforts using government funding will therefore be needed in order to implement expansion of high-speed broadband in the more sparsely populated areas of the country.

As it has been announced in the 2017 budget proposition (prop. 2016/17:1 expense area 22), the government intends to increase funding by 850 million SEK for the broadband expansion targeting areas where conditions for commercial expansion is missing, for the period 2017-2020. Furthermore, the government has decided to redistribute 150 million SEK to broadband expansion within the framework of the European Agricultural Fund for Regional Development (EAFRD). This means that the existing support for broadband expansion within the framework of the EAFRD is increased from 3.25 billion SEK to 4.25 billion SEK. Previously, the government has also enabled investments of 1.2 billion SEK through efforts made for the three northern regional programs of the European Regional Development Fund (ERDF). The investments within the framework of the EAFRD and the ERDF will complete and reinforce one another.

#### Overhaul of the Design of Governmentally Funded Efforts for an Effective Expansion

Government funds for broadband expansion are today allocated in form of governmental support, mainly by way of the EAFRD, but also via the ERDF in the northern parts of the country. These programs extend until the year 2020. The allocation of support is based on the demand on local and regional levels, generating requests for support via the programs. The applied model has generated very good expansion in rural areas, but following the expansion of the infrastructure and the fact that the future unconnected areas are even more sparsely populated and dispersed, the current design needs to be revised.

The government intends to ensure that government funds are continuously used in an effective way with regard to the goals and priorities of the IT-policies.

#### The Future Need for Frequencies – Socially Vital Services

Radio frequencies are a limited resource with great socio-economical value. The starting point is that the utilization of frequencies should be conducted in an effective way. The increased utilization, the increased need for data capacity and demands for better geographical coverage is demanding for the infrastructure and makes it particularly urgent that the radio frequencies are used in an effective and dynamic way that benefits the common interest. The Swedish Post and Telecom Authority has the task of planning for frequency utilization as well as allotting frequencies and deciding upon permits with reference to the electronic communications act and with consideration to the existing need for frequencies of different kinds of radio utilizations.

The government intends to analyze the frequency utilization of socially vital services in the long term. Given the increasing convergence between different networks and the future development of different kinds of technology using radio waves, including the fact that frequencies are a limited resource, the government sees the importance of analyzing how these socially vital services in the long term (10-30 years) could best work within the frequency plan, while the radio utilization simultaneously is using the frequency space.

#### Increased Knowledge on New Technology for Broadband Using an Analysis of the Surrounding World

Collecting and diffusing information on the inner potential of the broadband expansion from a societal point of view is of importance and is connected to the calculation of benefits described in the section on cost-efficient expansion. Technological development is continuous and there must be preparedness and understanding for the fact that the conditions are constantly changing.

The government intends to give to Bredbandsforum an assignment to recurrently summon groups formed in an ad-hoc manner (thematically adapted). These groups shall have the assignment to shed light on the industrial development using an analysis of the surrounding world. Important themes are for example, when considering 5G-technology,

results from research on technology which help to solve the issue of fast and cost-efficient broadband to all of Sweden as well as the societal effects of broadband expansion.

#### A More Suitable and Socially Englobing Service

Societally englobing services is the minimum supply of services, for example that telephony and functional access to the internet at a certain quality should be accessible for all users with reasonable terms and conditions at a reasonable price. For the time being, this means that an access point to the internet should be designed in such a way that the end-user demanding it can receive it at a minimum capacity of 1 Mbit/s.

In the work of overhauling the Euro directives concerning electronic communications, the government intends to work for technologically neutral solutions by regulations. Broadband and functional access to the internet coincide as notions more and more frequently when digital services of today demand an increasingly fast broadband connection in order to function.

The government intends to give to the Swedish Post and Telecom Authority a mission to revise the level of functional access to the internet.

## Overview of New Activities

Roles and Rules	Cost-Efficient Expansion	Infrastructure and Services for Everyone
Continuous work for Bredbandsforum	Mission for faster processes when deploying broadband	Government funding for broadband expansion
Clarity and simpler rules as leitmotif when overhauling Euro directives	Guidance towards wireless broadband in social planning	Analysis of effective use of government funding for expansion
Mission to direct city networks and to provide broadband	Evaluation of to what extent the need for broadband is satisfied when planning and constructing, together with an analysis of the need for guidance	Investigation of the future need for frequencies
Mission to develop the work with broadband coordinators	Development of a model for calculating benefits	Effectuation of an analysis of the development of the broadband market
Information on the benefits of broadband investment	The authorities' effect on the broadband expansion – analysis of the need for clarification	Analysis of the functional access to the internet

## Overview of Present-Day Activities

Roles and Rules	Cost-Efficient Expansion	Infrastructure and Services for Everyone
Handling of the report The Government's Broadband Infrastructure as a Resource (SOU 2016:1)	The Act (2016:534) on measures to be taken for the expansion of the broadband infrastructure	Spectrum management
Digital Single Market Telecom Single Market Overhaul of regulations	Broadband coordinators	Broadband support via the EAFRD and the ERDF
The next generation's decision concerning important market influence	Broadband school – Swedish Post and Telecom Authority's mission to educate public operators	A collected digitalization policy, formulation of a strategy for digitalization
Bredbandsforum		Work for reliable and robust electronic communications
Work concerning the management of the internet		

### 3. Management of the Strategy, Follow-Up and Evaluation

By an amendment to the regulation (2007:951) containing instructions to the Swedish Post and Telecom Authority, this authority should be accorded an active responsibility for the strategy, for example to see to that it is followed up but also to analyze and evaluate the strategy's goals and activities. The purpose of giving to the Swedish Post and Telecom Authority the overseeing responsibility, even though other authorities keep their respective areas of responsibility, is to have a collected image of the efforts' effectivity in order to reach the goals set up by the government.

The government intends to give to the Swedish Post and Telecom Authority a mission to continuously:

- to analyze the development in relation to established goals
- to display the opportunities brought on by a well-expanded infrastructure
- to communicate the broadband strategy and its content
- to hold an organizing position in relation to the work contributed with by other authorities according to their respective missions.

The government intends to give to the Swedish Post and Telecom Authority a mission to follow up the goals of the strategy:

The goal for All of Sweden to have access to high-speed broadband is followed up:

- by analyzing how many households and workplaces that have access to fiber in the immediate proximity (so called homes passed)
- by analyzing how many households and workplaces have access to broadband, and that in a short period of time and without special costs could order an internet subscription to a fixed place of residence or a fixed workplace.

It is up to the individual user to decide whether to connect to a broadband network or not, and this is the reason for the goals to be followed up by an analysis of the possibility to connect to broadband, i.e. how many households and workplaces that have access to fiber in their immediate proximity and not whether the users actually are connected or not. Therefore, the achievement of the goals is not dependent on whether the residential owners choose to invest in a broadband connection or not.

The goal for All of Sweden to have access to reliable and high-quality mobile services is followed up:

- by surveys in accordance with the indicators developed for a yearly follow up of the increase in capacity and surface coverage
- by verification and update of the assumptions concerning expansion of capacity in different frequency bands
- by verification and update of the assumptions concerning surface coverage.

#### **4. Background: Broadband and the Broadband Market**

In the Broadband Strategy for Sweden, launched in 2009, the following goals were presented:

- In the year 2020, 90 percent of all households and businesses should have access to broadband at a minimum capacity of 100 Mbit/s
- All households and businesses should have good opportunities to use electronic social services and service via broadband.

A central starting point of the strategy is that the development should be market-driven. The government should not control the market and the technological development, but try to create opportunities and to eliminate obstacles to the development. The Swedish Post and Telecom Authority, responsible for following up the goals, makes the assessment that the goals of the broadband strategy will be reached. In 2015, the access to broadband at a minimum capacity of 100 Mbit/s reached 67 percent.

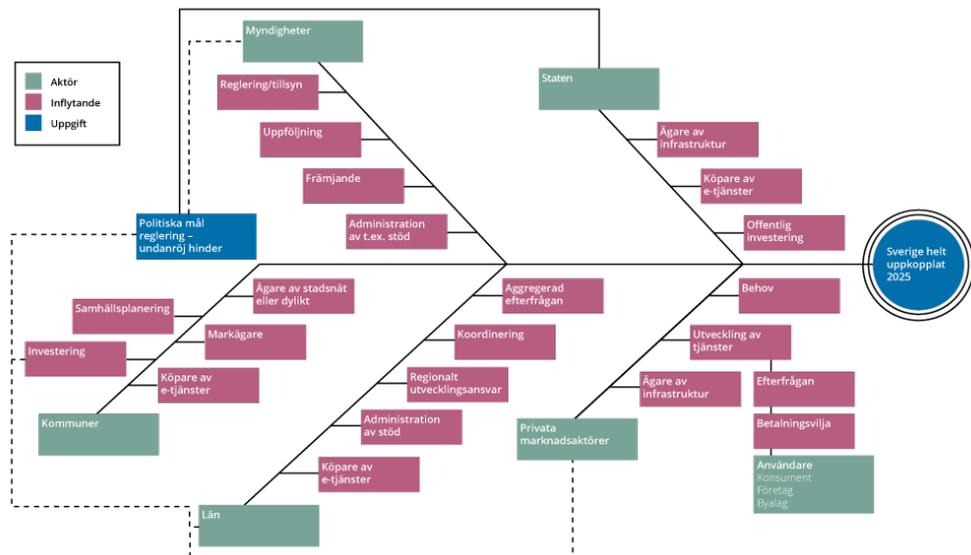
In 2010, the European Commission launched A Digital Agenda for Europe. Among other things, it contains the goal that everyone in Europe should have access to internet capacities exceeding 30 Mbit/s and that 50 percent or more of the European households should be paying for internet connections exceeding 100 Mbit/s, no later than the year 2020.

In October of 2015, approximately 87 percent of all households and businesses in Sweden had access to broadband at a minimum capacity of 30 Mbit/s. Furthermore, it is clear that approximately 40 percent of those eligible had bought an internet access of 100 Mbit/s by October of 2015.

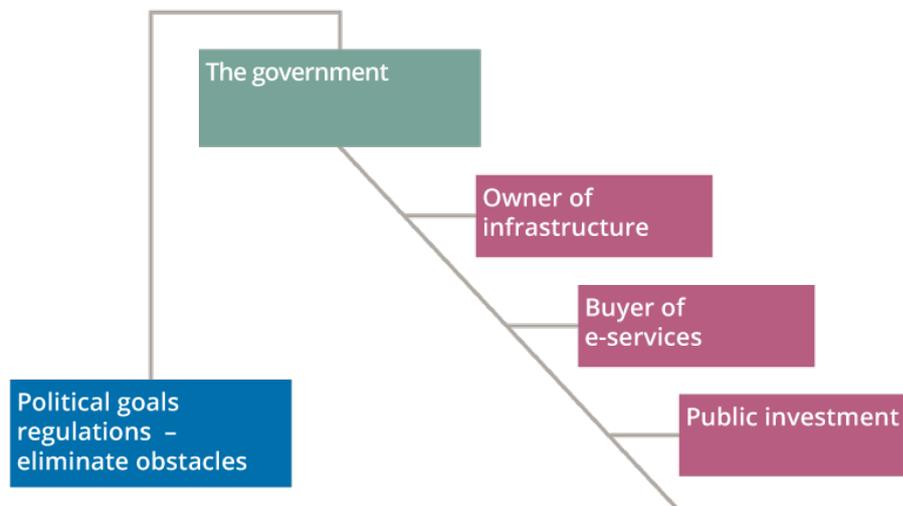
The government's ambitions regarding country-wide coverage are highly set and in order to work according to a long-term perspective, an active broadband policy is required for the entire country. The government therefore announced in their budget proposition (prop. 2016/17:1, expense area 22) a new broadband strategy.

#### **Operators on the Broadband Market**

In Sweden, the responsibility for the broadband expansion is shared by several different operators on national, regional and local levels.

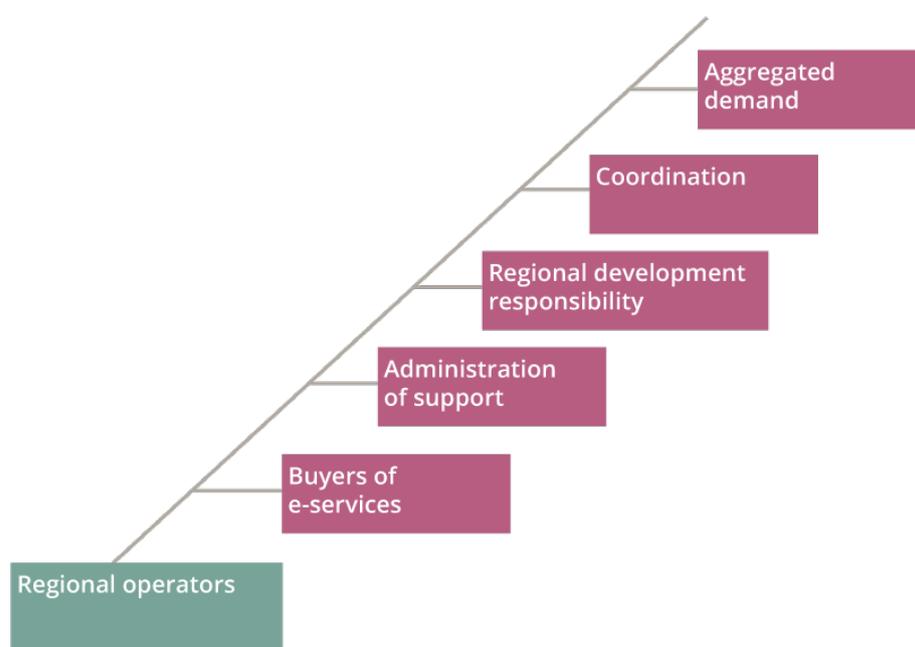


The role of the *government* is to create opportunities for the market operators by formulating political goals and eliminating obstacles to the development and, in a way that does not inappropriately bias competition, use the public infrastuctures in order to benefit the expansion and to direct public efforts where commercial investment is not likely to occur.

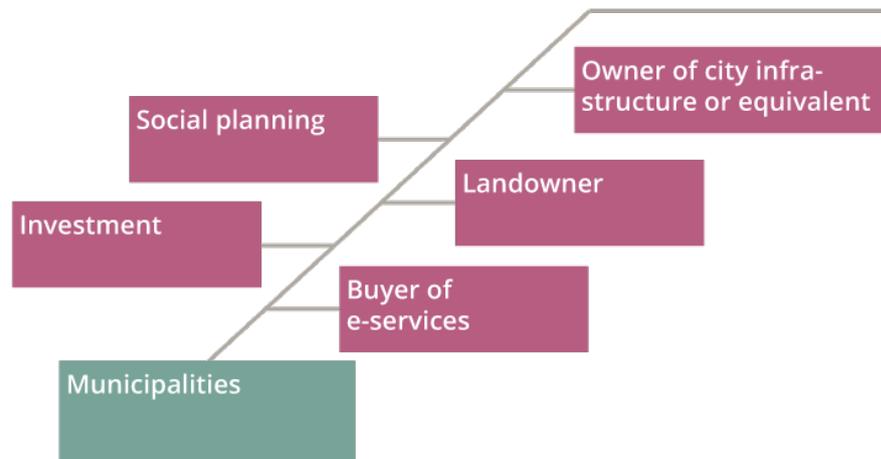


Several kinds of public operators on the *regional level* also have an impact on the broadband expansion: regional councils, county councils and cooperational associations. In every region, one of these operators has the regional responsibility for development. Among other things, this includes the strategic and operative work in sustainable regional growth, where investment in and promotion of broadband might be included.

The regional councils have the task of working for the achievement of the broadband goals as well as managing broadband support within the framework of the Rural Development Program. The operators with responsibility for regional development have accepted the government's offer to appoint regional broadband coordinators. These coordinators will receive support from the national secretariat of Bredbandsforum. In 2016, they have also completed the broadband school of the Swedish Post and Telecom Authority, which is an education in broadband for public operators. The broadband coordinators play an important role in transferring knowledge and in stimulating the municipalities' interest as well as in creating cooperation between operators and levels. In some regions, there are regional market operators, for example in the Västerbotten and Norrbotten regions.



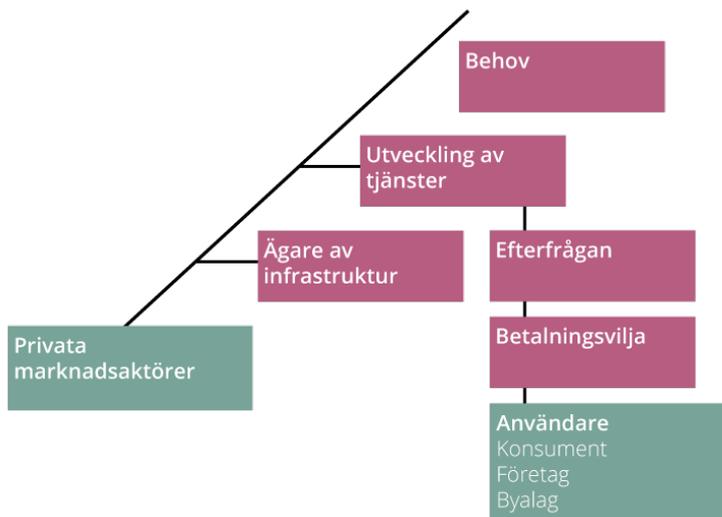
*The municipalities* play several roles as market operator, land owner and in issuing permits. In addition to this, they invest in infrastructure and are users of digital services. The implication of the municipalities in the role as owner of broadband infrastructure/market operator is to a great extent based on voluntariness. A great number of municipalities have chosen to deploy and to own broadband infrastructure within a city network. The form of organization varies depending on whether the operation is conducted in public management or a publically owned company.



The *municipal operators* need to adapt to certain municipal legalities, including when they act as market operators. According to these, the municipalities themselves are allowed to handle matters of public interest connected to their area or their members. Furthermore, the municipalities are only allowed to pursue a business venture if it is done without any purpose of gain and with the purpose of supplying the members of the municipality or county with establishments or services with interest to the public good. If the municipalities are to engage in an activity that is traditionally considered to be part of the private economy, exceptionally important reasons need to exist. Other limitations to where and how activities are allowed to be carried out are the principle of localization (the needs that are to be satisfied by the municipality need to be located in its area), the principle of cost (the charges need to correspond to the costs), the principle of equality as well as the possibility to provide support to an individual or to an individual businesses. Also other regulations such as those for public procurement and governmental support are applicable. There are guiding principles for municipal efforts in the broadband field on issues concerning for example competition, that have been formulated by the Swedish Post and Telecom Authority and the Swedish Competition Authority.

The actions of the *private market operators* are directed by the demands for profit made by their owners. An investment is generally made if it is judged to generate a sufficient yield, which is defined by the financial goals set up by the companies. Among the decisive factors when investing, horizon of investment, capital cost, risk assessment and consumer's demand, can be found. The higher the experienced obstacles

and insecurities of the investment are, the lower the probability of an effectuated investment is.



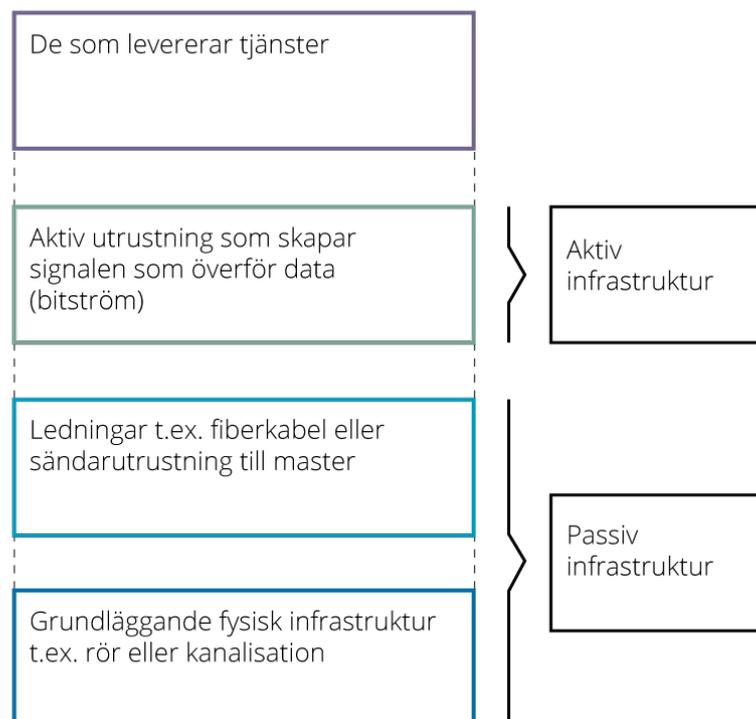
The already high expectations of the *consumers* for the capacity and coverage of the communication services are increasing and statistics show that there is no longer any considerable difference between genders in computer utilization. The consumers' demand and will for payment are important factors when considering market investments. In the present-day situation, the consumers contribute a part of the investments in fixed infrastructure by way of connection charges. There are great differences in what is considered standard price and a great discrepancy between the highest price and the lowest. The price is affected by factors such as demand for yield, what land work and equipment is included, time-lapse of contract, area and municipality, operator and pricing model.

Regarding the wireless infrastructure, the expectations for coverage are high. In some cases, it is a question of definitions of whether coverage is missing or is insufficient. A user does not usually reflect on what might cause the service to stop functioning, but will interpret it as a problem of network coverage. Furthermore, a user can experience an insufficient coverage as a result of the chosen operator's network not providing coverage in the area in question.

In many cases, *fiber associations* are formed in order to expand the broadband using support in areas where commercial expansion is not planned.

### The Broadband Market's Chain of Value

The broadband market can be described partly in terms of a chain of value, and partly in terms of a hierarchic network structure. In order to deliver broadband services to the final client, a requirement is that the operator either owns or rents infrastructure and active equipment for transmission and communication. The hierarchic network structure can be described in terms of foundation networks, inter-local networks and access networks. This concerns which technology is used, the dimensions of the network, the level of strain on the networks and what equipment is used by consumers and operators at the extremities of the networks. The image illustrates the broadband market's chain of value.



### Regulations of Competition on the Broadband Market

Within the domain of electronic communications, there are extensive EU-regulations with the purpose of creating a common, inner market for those kinds of services. The basis of the EU-regulations is that supply and demand primarily should lead to an expansion operated by the market operators. However, there is allocated room for governmental intervention in order to achieve a favorable development from a general standpoint, in cases where commercial conditions are missing. The EU-regulations concerning competition do not take into account security aspects.

High-capacity broadband connections have been identified as being of strategic importance to the European Union in order to achieve the established goals for a smart and sustainable growth as well as for innovation and for social and territorial unity. The strategy of the European Commission for a digital inner market, Digital Single Market, DSM, which was presented on May 6<sup>th</sup> 2015, includes a thorough overhaul of the EU-framework for electronic communications. Within the the framework of that overhaul, the Commission presented on September 14<sup>th</sup> 2016 their suggestions for legal acts concerning all parts of the framework, including regulations of access and competition, the radio spectrum management, the regulations for consumer rights and societally englobing services.

The European Commission also presented the message Connectivity for a Competative Digital Inner Market – towards a European gigabit-society. The message has to be viewed as an umbrella message for the entire overhaul of the framework for electronic communications. Among other things, there are suggestions for strategic goals concerning connectivity, which the member states are urged to approve. The strategic goals concern gigabit-connectivity for vital social functions, 5G-coverage in densely populated areas and by roads for transport on land, as well as access to 100 Mbit/s (possible to upgrade to gigabit-capacity) for all households in Europe.

Government support which also includes regional and municipal support to the expansion of broadband networks is basically not allowed. Exceptions can be allowed by the European Commission if the support is deemed consistent with the inner market. Exceptions can be allowed if the support does not cause an inappropriate bias of commerce and competition, and under the condition that a number of terms have been fulfilled.

## **Utilization and Demand**

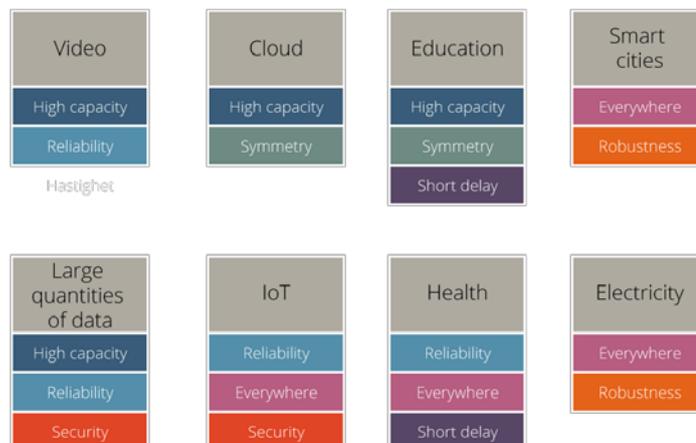
### *The possibilities of digitalization, demand and user benefits*

I believe there is a global market for maybe five computers, is Thomas Watson, former president of the board at IBM, supposed to have said. The statement, dating from the mid-1940's shows how difficult it is to speculate on future development in general, and especially on digital development.

Today, less than one percent of things that could be connected to the internet are connected. The industry predicts the development to be exponential. By the year 2020, between 22 and 50 billion products, or five things per smartphone user, are expected to be connected to the internet. Electronic communications will be a basic resource in all kinds of domains, when more and more products are communicating. People and connected things will therefore be able to generate large amounts of data. Besides, this does not only concern connected things but also connected institutions, authorities, automatized transportation systems, airports and ports.

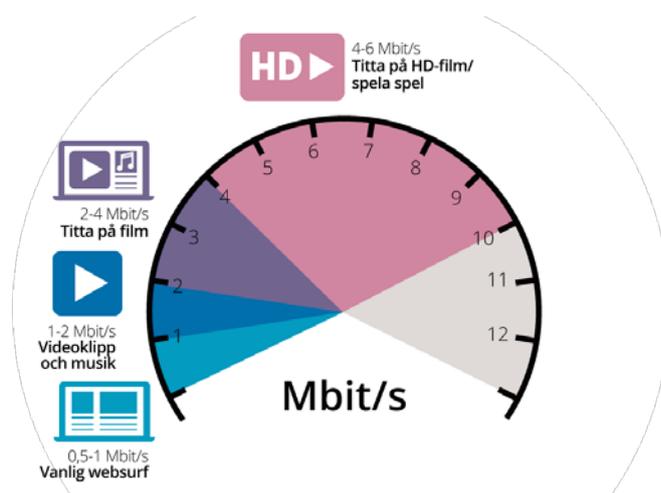
The demand when it comes to digital services and applications will also undoubtedly continue to increase at a high pace. New services, applications and terminals are expected to grow, which will make further demands for the future networks and for creative solutions. An example of this is broadband for lampposts and electrical cabinets, that via wireless technologies facilitate utilization of services and applications. It is clear that in order to face the demand, reliable high-capacity infrastructure to a reasonable price and to transparent terms and conditions is needed. The law for electronic communications requires operators to provide information on the quality of the services.

The following image shows areas likely to expand and what basic conditions each area needs from the infrastructure. Demands for symmetry, i.e. the same capacity for uploading and downloading will for example be of great importance for services that require interaction, for example safety alarms, video communication in health care or participation in real-time long-distance education containing interactivit



Concerning reliable broadband connections, the demand comes from a number of different parties. Citizens want to benefit from services that facilitate their every-day life. The public sector or businesses develop and launch different services for the citizens – that they are expected to use. This is both in order to face a need that is both large and diverse but also to inspire demand. Many services can today in a quick and simple manner only be executed electronically. For example, there are municipalities offering electronic home-help services and where broadband access facilitates a transition to digital services and thereby considerable savings. Furthermore, the need for safe and reliable broadband services for societally vital activity.

The following image shows an example of which broadband capacity is required for a specific service.



Källa: Ofcom (tillsynmyndighet för telekom i Storbritannien)

### *Conditions for societally englobing services*

A prerequisite of the digitalization of society is the digital infrastructure. Gaps emerge between those who have good access to digital services and those who have less access to digital services, for example in areas with insufficient access to high-speed broadband.

Societally englobing services mean the minimum supply of services, for example telephony and functional access to the internet at a given quality, that should be accessible for all users at a reasonable price. This in accordance with the law for electronic communications. The regulation is completed with a direction in the regulation (2003:396) for electronic communications, which states that the connection should be

designed in such a way that the end-user is able to receive data at a minimum capacity of 1 Mbit/s.

The work to ensure the access to societally englobing services consists of a continuous analysis of the market in order to ascertain whether a market failure is imminent or not. The Swedish Post and Telecom Authority procures telephony for households and businesses that have had but no longer have fixed telephony. The procurement is conducted in accordance with a governmental mission.

#### *Robust and reliable connection*

Available services are also a question of robustness. Providers of communication networks and communication services are required to ensure that the activity, for example providing broadband, fulfills basic requirements for security. Governmental grants also contribute to measures such as the operators' main wiring being built into caverns, or efforts targeting power supply, backup electricity, redundancy and quality. Societally important organizations including public order, security, health and defence all have particularly high demands for robustness.

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