Viestintävirasto
Kommunikationsverket
Finnish Communications
Regulatory Authority

REPORT

Communications Markets and Technologies in 2010

www.ficora.fi

Finnish Communications Regulatory Authority
P.O. Box 313
FI-00181 Helsinki, Finland
Itämerenkatu 3 A
Helsinki, Finland
Telephone +358 9 69 661
Fax +358 9 6966 410

Viestintävirasto
Kommunikationsverket
Finnish Communications
Regulatory Authority

Table of Contents

INTRODUCTION

Finland is strongly engaged in the development and support of the information society. The aim is to increase competitiveness and productivity, social and regional equality, as well as citizens' well-being and quality of life by means of information and communications technologies throughout society. A further aim is to maintain Finland's position as one of the leading countries in generating and exploiting ICT.

The communications markets and the entire field of telecommunications are going through a dynamic change. The traditional communications networks are being replaced by IP-based solutions, and fast telecommunications connections and wireless technology in particular are becoming more common. However, the introduction of new technology is not essential but the change in the way society works is. The information society is moving towards a ubiquitous world where communications services are constantly present in people's everyday life regardless of time and place.

New technology can be extensively applied in the whole society. Networks transmit communications not only between people, but also between machines and equipment to an ever greater extent. Integrated information systems are being used in products and processes, and the intelligence of terminal equipment is increasing. Public and private sector organisations are creating virtual services on the web. For users, technological development provides seamless mobility and network-neutral communications and content services. Due to convergence, services available to consumers are versatile, interactive and greatly personified.

Fast and safe communications networks capable of carrying the necessary traffic are crucial to a ubiquitous society. Fast communication connections provided by fixed and wireless networks and enhanced network coverage in various regions enable more accessible network services, encourage the progress of new working and business methods and promote regional development and equality. Vital factors for the development of the information society include the improved environment of electronic business, as well as versatile, enhanced and reliable communications services.

This vision, Communications Markets and Technologies in 2010, describes FICORA's view of how the communications markets and services will be developed until 2010. The sections deal with network technologies, the electronic communications infrastructure, communications markets, communications services, and information security.

COMMUNICATIONS NETWORK TECHNOLOGIES

The greatest technical change since the digitalisation of telecommunications networks is the ongoing transformation to Internet Protocol (IP) based network and service infrastructure. The traditional service-specific circuit-switched transfer networks are being replaced by packet-switched IP-based multi-service networks which are able to transmit voice and data services as well as radio and television broadcasts.

Backbone networks

A fixed optical backbone network forms the basis for services. This backbone network comprises backbone routers, transmission links and edge routers, which connect access networks implemented by various technologies to the backbone network. The backbone network transmits information between access networks as quickly and reliably as possible. The backbone network's physical level is implemented by means of optical Wavelength Division Multiplex (WDM) techniques.

The optical cable network covers all the most important population centres. The basic transfer rate of the backbone network's individual channels is 10 Gbit/s, and for the most loaded connections it can be as much as 40 Gbit/s. Backbone routers based on optical connections are being introduced. The quality of connections in backbone networks is guaranteed by Multi Protocol Label Switching (MPLS) which is used for traffic engineering.

Radio links are used for backbone network connections when the required capacity is small (< 1 Gbit/s). Radio links can be used at the edge of the optical cable network for programme transmission in mass communications networks and for mobile network base station connections. Radio links are also used to ensure optical cable connections.

Access networks

Fixed access networks

Local loops are still implemented by means of traditional copper pairs in fixed access networks. Optical cables are being brought nearer to the end customer – firstly, optical cables are principally brought to a curb or house MDF, but in the future they will also be brought directly to a socket in people's homes.

Data transmission rates provided to subscribers in densely populated areas can be as high as 10 to 100 Mbit/s, although the rates are lower in sparsely populated areas. The difference between urban and rural areas increases. The majority of Internet connections are based on xDSL solutions. Cable data services increase competition at the local level.

Wireless access networks

Wireless Local Access Networks (WLANs), which are exempt from radio licensing, are being commonly introduced as access networks. The main technologies for wireless access networks are WLAN (Wi-Fi, Wireless Fidelity) and WiMAX (Worldwide Interoperability for Microwave Access). WLAN is mostly used in homes and in offices and urban areas (hotspots). WiMAX is becoming more common in the same areas as WLAN, but the technology is also used to implement backbone connections for access networks and subscriber lines over long distances.

Wireless networks are used as the principal method of implementing Internet connections only in sparsely populated areas as they are not capable of providing large amounts of users with economically feasible data transfer rates that, for example, video-on-demand requires.

Mobile and mass communications networks

The status of GSM networks remains strong in spite of competing technologies. The data transfer capacity of GSM networks can be significantly improved by an EDGE update. In addition, nationwide GSM networks are also supplemented by third generation Universal Mobile Telecommunications Systems – the UMTS networks. Mobile services are also provided through other wireless networks by means of Unlicensed Mobile Access (UMA) and WLAN-interworking technologies.

Both traditional circuit-switched connections (GSM switching centres) and packet-switched connections (GPRS nodes) are still being provided in mobile networks. Mobile operators are changing over to a service architecture complying with IP multimedia subsystem (IMS) and the role of the circuit-switched network is gradually diminishing. A mobile network operating in the 450 MHz frequency band and intended for data transmission improves the provision of Internet communications especially in sparsely populated areas and in the archipelago.

The digital switchover of the Finnish television network will take place in 2007. The video signal will be distributed not only to traditional television receivers but also to mobile-like terminal equipment. The distribution of television programmes in broadband networks is becoming more common, particularly in areas where a cable television network service is not provided. The distribution of High Definition TV broadcasts will commence through the terrestrial network, but an increase in the number of broadcasts is foreseen only after 2010. Due to a lack of capacity in the terrestrial network, the majority of HDTV broadcasts will be transmitted via cable or satellite. Established practices are expected to be introduced regarding HDTV video coding standards, display resolution, interfaces that protect copyrights, and technology used in digital video discs by 2010.

Other wireless networks and radio equipment

New technologies are enabling more advanced short range devices and networks where the typical operating distance is less than 10 metres. Short range networks and devices are being increasingly used both in industry and in personal communication (mobile phones, digital cameras, portable computers, home electronics and ancillary devices). In industry, cable networks with high installation and maintenance costs are being replaced by low-cost wireless sensor networks. A wireless, simple, self-organising low-electric power device (Low-Rate Wireless Personal Area Network, LR-WPAN) can also be used in other applications. Another new technology, Radio Frequency Identification (RFID), enables many new logistic applications for industrial, commercial and transport purposes, the use of which will increase extensively by 2010.

Ultra Wide Band (UWB) is a spread spectrum broadband technology with high-speed data transmission enabling a high transmission capacity of more than 100 Mb/s over short distances (from a few metres to tens of metres). UWB normally occupies a bandwidth of more than 500 MHz. In addition to its high transmission rate, UWB's advantage is that the connection distance is not restricted to line of sight as is the case when using infra-red. By 2010, UWB will be introduced within industry, and the traffic and service sectors for self-controlled networks and for Personal Area Networks (PAN) that do not require centralised management. Separate base stations are not required, which is why the networks can also be used in areas where no other networks have been built (temporary use, difficult distances).

Service and service management architectures

The most important feature of an IP-based network is that the network and the services are separate from each other. This enables the development and provision of services regardless of the network technology used. Standardised interfaces and application frameworks also become more common at the application level. Standardised interfaces at a higher level ease the work of application developers and enable more seamless interoperability between the applications. This means that platform neutrality and neutrality in the operating systems will increase in application software. The fact that the network and services are separate, however, decreases the possibility of using all the features of the lower protocol layers in the development of services.

Both Internet-based and NGN-based (Next Generation Networks) solutions will be introduced in service production, distribution and management. Solutions which combine the features of both models will also be adopted. In addition, traditional circuit-switched solutions, especially the GSM network, will be used side-by-side with the IP-based service architectures. In all models, Session Initiation Protocol (SIP), will establish its position as the control protocol for multimedia services provided in networks. SIP enables integration of video, voice and data services and it is also used in non-real-time applications.

Both the Internet and NGN models support the production of integrated voice, video and data services. The biggest difference between these models concerns their different quality guarantees. The NGN model guarantees the required quality of service (bandwidth, end-to-end delay, and jitter). In the Internet model, the quality of service is mainly based on best effort thinking where the network does not guarantee the service quality experienced by the user. However, the quality of service can also be very good also in the Internet model.

Services in the Internet model are implemented at the network level by means of the public Internet. Services are provided by two methods: in a peer-to-peer network method the service control is decentralised in users' terminal equipment; in a server method the servers in a network take care of most of the service control. Service providers using the Internet model may provide their services throughout the world to anyone who has an Internet connection.

Guaranteeing service quality in the NGN model requires extra resources from the network as well as a large amount of various management mechanisms. The essentially related information security, strong identification and versatile service management and charging possibilities increase the complexity of the NGN service architecture. Because of the complexity and expense of the NGN model compared with the Internet model, only the biggest players are adopting it.

In principle, the NGN model offers open interfaces to service providers, but in practice there are restrictions regarding the use of network features. The NGN service architecture is based on a new IP multimedia subsystem (IMS) specified for mobile networks. IMS was originally developed for the provision of multimedia services only in UMTS/GPRS networks, but it became access network independent when 3GPP Release 6 was released. In terms of the application software, it is no longer an issue whether the application is used via a wireless or wired access network.

INFRASTRUCTURE RESOURCES NECESSARY FOR ELECTRONIC COMMUNICATIONS

Radio frequencies

Increase in demand and measures required by the increase

The technological development and enhanced applications used in radio equipment and networks will mean a growth in demand for radio frequencies and the amount of radio equipment, which will in turn increase the provision of wireless services. Frequency planning for new radio systems will be more demanding than before because there is a lack of available frequencies. There will be a need for coordinated frequency bands for various radio systems, and the frequency ranges will be used more efficiently. Part of the present frequency use must be transferred to higher frequencies within technical and economic limits.

National decisions related to spectrum policy are only made in rare individual cases. Spectrum decisions must be either European-wide or global so that users of radio equipment can get the greatest possible benefit from their equipment. The ongoing European harmonisation of the use of frequencies and the common market area for radio equipment make the adoption of new systems easier, improve the availability of equipment and reduce prices. In addition to this harmonisation, there are also efforts to make more efficient use of the spectrum capacity with technology-neutral frequency decisions and more flexible administrative procedures related to the adoption of frequencies. The aim is to adopt more collective frequency bands which do not require a licence from the regulatory authority.

Required measures needed to secure the availability of frequencies include development of the frequency planning methods and more investment in planning work. Detection methods must be developed in order to deal with interference problems to ensure availability of interference-free frequencies.

The greatest need for additional frequencies with regard to both licensed frequencies and frequencies that are exempt from licensing stems from the growth in the number of wireless access networks, short range devices, and UWB equipment and services. Assigning new frequency bands is problematic because there is a lack of available frequency bands that are technically and economically feasible, and because moving the current usage to other frequencies over a short period of time is either expensive or requires long transitional periods of usually more than ten years.

Administrative procedures

In autumn 2005, the European Commission published a Communication on a market-based approach to spectrum management. The Communication contains a plan according to which spectrum trading should be allowed in all EU countries by the end of this decade. Frequencies would still be assigned for a fixed term. In cases where usage requires a license, it would still be possible to attach relevant conditions to guarantee the availability of a sufficient amount of interference-free frequencies. The assignment of frequencies for a specific purpose would, however, primarily be abolished. Spectrum trading, which is a key issue in the Communication, requires several clarifications and restrictions. However, the aim of increasing flexibility in frequency decisions and increasing the number of licence-exempt frequencies complies with FICORA's aims regarding the availability of frequencies.

Mobile networks, wireless access networks and television distribution networks

The 2.5 GHz extension bands for IMT 2000 will be adopted during this decade. Frequency solutions for networks beyond IMT 2000 will be made at the ITU World Radiocommunication Conference in 2007, so that the new bands which currently accommodate other radio networks, can be made available before the expected adoption date in around 2015. The necessary number of frequencies, most likely more than 100 MHz, will be unravelled at the beginning of 2006. New frequencies for mobile communications between 3 to 5 GHz are being sought.

Protection against interference cannot be guaranteed for users of WLAN frequencies that are exempt from radio licensing. The quality and speed of transmissions may suffer especially in the heavily loaded 2.4 GHz frequency band. Multiple frequency bands have been reserved in the 5 GHz band for global WLAN usage, compared to 2.5 GHz. This will guarantee the capacity for many years to come. In order to utilise the 5 GHz frequency bands it must, however, be possible for sufficiently affordable equipment to be available for the bands.

Service providers are attempting to achieve the same frequency resource for WiMAX applications as has been allocated for the IMT 2000 extension in the 2.5 GHz bands. In any case, the European harmonisation work is attempting to allocate frequencies for WiMAX applications of between 3 and 6 GHz.

The reorganisation of television frequency bands for digital distribution will be carried out at the ITU Regional Radiocommunication Conference in 2006 (RRC-06). The aim is also to combine the blocks reserved for digital radio with other digital television and radio operations. Finland's aim is to get a total of nine multiplexes for fixed, mobile or portable reception. Two of these multiplexes can also be used with mobile equipment. In total, nine multiplexes could transmit 50 television channels currently distributed by analogue techniques. On the other hand, one HDTV channel uses the capacity of an entire multiplex by means of current techniques. In the future more efficient HDTV coding will be possible and thereby the frequency efficiency will also increase.

In order for Finland to get the use of nine multiplexes, requires the television network needs of neighbouring countries, especially Russia and Sweden, to be adapted to the Finnish frequency plan. Russian military aviation significantly restricts the spectrum capacity available in Finland. Only after RRC-06 will it be possible to estimate whether or not the band used for the distribution of analogue television will provide frequencies for other purposes, mainly mobile networks.

Radio links and satellites

The use of radio links will concentrate on higher frequency bands. It will be possible to build cost-efficient connections up to 50 kilometres in length for frequency bands below 10 GHz. Above 10 GHz, radio links are concentrated in 15 GHz, 18 GHz and 23 GHz frequency bands, where they are mainly used for mobile network base station connections. These frequency bands are fully occupied in certain geographic areas. Additional frequencies may be assigned for base station connections over 25 GHz. WiMAX may to some extent replace normal radio link technology. However, frequencies allocated to radio links will remain in use as the total use increases.

The provision of positioning applications and services based on radio navigation satellites (such as Galileo and GPS) will increase exponentially, but this will not require additional frequencies. The use of other satellite based systems and applications will increase gradually, and the current supply of frequencies is sufficient.

Aeronautical service

Aviation traffic and the aeroplane industry have undergone rapid growth and additional frequencies are needed, which will be discussed at the 2007 World Radiocommunication Conference to secure future development. The reservation of frequencies for a new application – Unmanned Aerial Vehicles (UAV) – will also be discussed. At first, UAV will mainly be used for military applications, but the idea is to broaden its use for civil purposes, too. The candidate bands suggested by the aeronautical community partly conflict with candidate bands for systems beyond IMT-2000, and also with frequencies needed for military defence.

Private mobile radio, telecommand and telemetry

The frequency bands 160 MHz and 450 MHz have traditionally been used for private mobile radio but this usage has been or is being transferred to new networks, such as the emergency services network (TETRA) and GSM-R for the railways. The released capacity cannot, however, be entirely used for new systems. The old radio networks used by the authorities will still be used for a long time, at least in the fire and rescue services. In addition, the 160 MHz and 450 MHz bands were introduced in Finland in the 60s and 70s in a different way to the current European plan (for example, the transmission frequency for base stations and mobile stations differs from European recommendation). This considerably restricts the efficient use of frequencies, especially in areas where the use must be agreed upon with Estonia and Russia. The current bands are, however, sufficient for the use of private mobile radio systems.

Short range devices and UWB

New short range wireless applications and wireless networks have an ongoing demand for frequencies. Harmonised frequency bands are exempt from radio licensing, unless there is a specific reason to make a case-specific frequency plan. FICORA must be able to recognise future frequency needs in time and be prepared to reserve a sufficient amount of frequencies for these networks.

UWB technology uses the same frequencies as the rest of the radio service, on the basis that it does not cause interference to other systems or require them to be protected against interference. Even though UWB technology operates according to these principles, the introduction is still faced with many partly unsolved technical problems. In Europe, the UWB industry aims to adopt the 3-6 GHz band using the same technical conditions as in the U.S.A. The European answer, however, seeks to maintain a more permanent frequency solution, thus securing the operation of other services. The first European frequency decisions are scheduled for 2006. The UWB radar and sensor applications are being used already to some extent and they therefore require appropriate administrative procedures as soon as possible.

Frequency needs for military use

The frequency bands used for military purposes in Finland are mainly concentrated in frequencies that have been harmonised for military use elsewhere in Europe. The defence forces have traditionally been able to operate freely in the bands allocated to them. Due to the growth of frequency needs for the civilian services, however, an increasing amount of frequencies must be shared, as was the case in the 5 GHz WLAN solution. In some cases military use must be transferred to other frequency bands. Radio technology used for military purposes is expanding, thus increasing the demand for frequencies. Combining the frequency needs of civilian and military purposes requires more resources for the increasingly demanding nature of frequency planning.

Numbering and addressing

The numbers currently used in telephone networks will still be important in steering communications for a long time, even though other address applications are being introduced alongside numbers. Telephone services provided by IP technology set new challenges for the efficient use of numbering and require further international coordination. As IP networks become a unifying element for all communications networks and network addresses, prefixes and codes will be a crucial infrastructure resource. There is a growing demand for IPv4 addresses as the use of IP-based applications and IP terminal equipment increases. A lack of IPv4 addresses and problems related to network address translation increase operators' willingness to adopt IPv6.

Increased IP-based communications and interoperability with PSTN/ISDN services also requires integration of the various numbering and address systems. Therefore, FICORA maintains a national ENUM service which is necessary for integrating numbering and address systems. How widely ENUM will be adopted depends on customers' needs and willingness as well as on the development of international standards and solutions.

COMMUNICATIONS MARKETS

Market players

The changeover to an IP-based network and service infrastructure essentially affects both the communications services provided and their use. Most communication services can be implemented independently of networks with IP technology and the Internet, and customers may buy communications services elsewhere as well as from their network operator. These changes substantially affect the operating conditions of business enterprises in the sector and the value chains and the structure of communications markets.

Competition in the communications sector is still fairly new, and telecommunications operators who previously held a monopoly have, despite the opening up of competition, been able to defend their position by vertically integrating networks and services. As the use of IP-based services becomes more general, the provision of services is becoming more horizontal, and it is no longer self-evident whether the operator who owns a network is also an important provider of communications services. Network operators may rapidly turn into providers of transmission capacity with their only task being to transmit voice and data services as efficiently as possible.

As a result of the changes in the market, telecommunications operators are likely to try and rationalise their activities to gain scale advantages by extending their networks. Consequently, Europe-wide structural arrangements and other European or worldwide cooperation between communications operators will become more common. It is also to be expected that the ownership arrangements of companies established in Finland will continue. In future, electronic communications networks will most probably be managed by ever larger companies and corporations operating in several countries. The new players in network businesses that have entered the market in the recent years, may, given the increasingly competitive situation, retire from the market or become subject to a corporate acquisition. However, it is also possible that new network operators providing wireless local loops, for instance, will enter the market, and the number of networks available will not necessarily decrease to any great extent.

Some of the companies may respond to the technological development by intensifying vertical integration of networks, services and content. It is possible that the structural evolution of the sector will generate groups of communications companies that are in command of traditional telecommunications networks, wireless networks and television and radio networks and provide both communications and content services. In spite of the centralisation and internationalisation of the sector, versatile national media will retain its strong position.

The transitional market phase will attract totally new service providers that are independent of telecommunications operators, such as software suppliers or equipment manufacturers. The entry into the market of new service providers will be fairly easy, although only few newcomers are likely to become important players, as the ability to provide services profitably is subject to gaining advantages of scale. Some of the new service providers in the Finnish market also operate abroad, since the Internet enables the provision of services worldwide. It is probable that in future services will be provided by a few global companies complemented by some smaller companies specialised in only a few services.

Due to the limited radio frequencies, mass communication by radiocommunication is subject to a licence. This restricts the number of the people involved and puts them in a different position compared with those involved in adjacent distribution channels, such as cable television networks and IPTV networks. The "must carry" legislation and copyright legislation are of utmost importance regarding the position of those involved in adjacent distribution channels.

Development of the competitive situation

As a result of changes in the use of communications services, the operational models and earnings logic of companies in the communications sector may differ greatly from traditional operator models. For instance, the importance of telephone services charged by time and their share of the total turnover of companies in the sector will reduce. New pricing practices will be introduced in the market, particularly the provision of voice services at a fixed monthly rate or as a part of fixed-price broadband services. It is also possible to change over, at least partially, from the traditional terminal compensation practice to the "sender keeps all" model. Charging may be based, for instance, on the transmission capacity available, the service standard of the selected connection or subscription to content services.

As networks and services become diverged, it is to be expected that competition in services will also diverge from network competition. Services competing with traditional telecommunications services will be provided via the Internet at lower prices than before. The business operations of some service providers are not necessarily based on the profit gained from communications services at all, in which case the service could possibly even be provided to users totally free of charge. New service providers will not only have an impact on the operating conditions of operators using fixed networks, but services (such as VoIP) will also be provided through the Internet to mobile subscribers.

However, network operators will also seek to maintain their position as important service providers. In addition to their own services, network operators will probably try to obtain their share of income from the services produced by others on the grounds that the services are accessed via their networks. In this situation, the negotiating power of different players will be decisive with regard to the income distribution model to be used in providing services. In addition, traditional operators may seek to offer their products in attractive packages, thus helping them to maintain their position as providers of communications services. The search for cost-efficiency may also lead to general "self-service", which means that customers will be more and more frequently advised to manage their communications services themselves via the Internet.

Many of the traditional sub-markets of communications are reaching or have already reached a phase of maturity, which again demands better cost-efficiency than before from market players. This will encourage operators to introduce new IP-based network technologies that are cheaper than the present circuit-switched technique. Networks are being built and developed using the most up-to-date technology and by integrating access networks to each other. The construction of new networks always requires substantial investment, and the construction of parallel fixed access networks in a sparsely populated country like Finland, particularly in rural areas, is not economically viable. The technical development of networks may diverge regionally, in which case the competitive conditions in different parts of the country may also greatly differ from each other.

Wire connections will still maintain their position as the primary access network for several years. Even though new competing alternatives for fixed-access copper wire networks will appear, the traditional copper network will continue to be the bottle-neck restricting competition in the market. The maintenance of a copper network is relatively cheap and the new xDSL technologies enable the implementation of increasingly faster broadband connections over the networks. Copper networks are being replaced by wireless connections mainly in sparsely populated areas where subscriber connections are too long or expensive to install broadband.

Voice and data services can be provided over wireless networks, and cable television networks in addition to fixed networks. These networks will become ever more important in the provision of communications services in future. In addition to the copper network, service providers will be interested in offering their services to end-users over optical cable networks, cable television networks and wireless access networks, which may raise questions concerning the relinquishing of access rights.

As a result of the transfer to IP-based services, the number of interconnected services and service providers will increase, making interconnection arrangements and agreements more complicated. The number of standards and different models used in the implementation of communications networks and services will also increase and the network and service applications will become more heterogeneous. Along with new network and service technologies, there will be an increasing need for new technical interconnection specifications and mechanisms, and service providers must act in close cooperation to ensure the best possible results.

The total demand for communications services is continuing to grow. This will also have a positive effect on the turnover and profitability of established operators, even though the savings obtained by using IP technology allows a reduction in the price of communications services. Strict competition in the provision of communications services is expected to continue, but price competition in particular may exclude some players from the market. Long-term restriction of competition by established operators is limited by the threat of new entrants to the market and better possibilities for users to independently choose their service provider. A precondition of successful market entry by small companies is that large companies must not be allowed to bundle their services as packages and tie customers to them, thus preventing customers from buying some of their communications services from competing operators.

The separation of networks and services and their transfer over to a multi-channel system will also increase competition in electronic media. The traditional roles of service providers and content producers will blur, since the same services may be provided by IP-based networks through many different access networks. On the one hand, successful producers of electronic media content will diversify their range of services to cover communications services as well, and on the other, traditional telecommunications operators will also compete for broadcasting rights. Similarly, hardware and software manufacturers may seek to extend their provision of services to include communications and content services.

The increase in the provision of services by electronic media and the changes in the traditional ways of using them will provide national players in the sector with new challenges. The competition for advertisers will increase among the new channels and the different groups of media. The sponsoring of television programmes and product placement will become more important, since new methods of financing are needed, in addition to traditional television advertising. However, the digitalisation of television may even improve the competitiveness of national players and provide them with new business opportunities. The collection of copyright fees for each distribution channel will reduce the players' opportunities for exploiting new distribution channels.

COMMUNICATIONS SERVICES

Networking society

In 2010, Finland will have nationwide, secure, high-capacity data transmission networks enabling access to a diversified range of services. These networks will be partly based on fixed networks and partly on wireless solutions. The use of broadband services will become more common both at home and in business, and the data transfer rates of the connections will increase.

Broadband connections are a prerequisite for the development of electronic commerce and services. Electronic banking services and payment are already well-established. Acquiring products and services via the Internet will become more and more common in households. Many services in society will be transferred to an electronic format with the advent of broadband connections and evolving systems of electronic payment and identification. In addition to the traditional method of electronic identification, a method of identification will also be integrated into the SIM cards of mobile communications operators, i.e. mobile certification.

This new technology will be extensively applied throughout society. However, the actual change process towards a ubiquitous society and next generation methods of communication is being made possible by the applications and services being developed by software manufacturers. In addition to communication between human beings, communication between machines and equipment will also be transmitted via networks. Wireless data transmission applications in health care, industrial processes, controlling transport engineering and logistics, for instance, will increase along with the development of equipment and network technology. New applications will enable a reduction in production costs, rationalisation of operations and the provision of services that have not previously been available in a wireless form.

Communications services and their use

The habits associated with the use of communications services are mainly affected by the increase in mobility and the changeover to multiple channels. Services are implemented independently of networks and are provided in parallel through different networks. Customers may access communications services through different networks according to their current situation and needs. The terminal devices are versatile and function in ways that allow the user to change over from one network to another without interrupting the service. Smooth mobility in the use of communications services is especially important.

The methods of communication will also change. The number of subscriptions to fixed networks continues to decrease, while telephone services change over to mobile networks or VoIP telephone services provided through broadband connections. The circuit-switched telephone service in mobile networks (GSM) will maintain its position in the provision of telephone services longer than in fixed networks, but even here it will gradually be replaced by VoIP telephone services provided over a mobile broadband.

In future, speech will only be another application among many others. Instead of speech or alongside to it, communications with text and picture will become increasingly prevalent. Access to services provided via the Internet will become easier and their use will increase as a result of wireless local loops becoming more common and the development of terminal equipment for mobile communications. The set-ups and service menus necessary for the use of services are incorporated in the terminal equipment so that no special expertise is required for their use.

Electronic mail has already become a very important form of communication that has partly replaced the letter on paper and the telephone. Correspondingly, the GSM short message service has, alongside GSM voice services, become part of personal communication. E-mail and short message services are complemented by totally new forms of communication that involve the exploitation of information on presence, positioning and availability. In the long run, GSM short messages are likely to be partly replaced by more versatile instant messaging, mobile e-mail and multi-media message services.

Various real-time services in text format concerning presence services, instant messaging and group communication, will be part of young people's everyday personal communication. Picture, voice and data transmission will be part of instant messaging services. In the case of presence services, users may handle their communications better using the sender's or their own terminal device, for instance. Directory services and search services will improve availability. There is an abundance of services based on network positioning and new services for satellite positioning are also being developed.

The content and properties of communications services are to a great extent determined by consumer behaviour. There are many versatile and thoroughly developed services available. Solutions based on both the public Internet and the NGN model that ensure the quality of service and a combination of the two are used in the production, distribution and administration of services. Speech, data and television services and related additional services are offered to consumers as ready-made packages.

Terminal equipment will develop into a versatile and intelligent personal means of communication tailor-made to meet users' needs. The new terminal devices will be able to transmit speech, e-mail, instant messages and any other new forms of communication. Terminal devices can be adapted to their actual use environment according to the needs and habits of the user. New communications services will also be used in living rooms to a greater extent. The advent of high-definition television will enable home entertainment centres to provide the same services as computers and other terminal equipment.

There is a risk that with the development of the information society the divide between the generations will deepen. Younger generations will adopt new ways of communication and easily learn how to use different terminal devices. Older generations may find it difficult to keep up with this development, therefore, the implementation of services able to meet the requirements of all users will be highlighted.

Content services and versatile electronic media

The increased use of fast data transfer connections also advances the provision of content services. Customers are offered a wide array and new value-added services. The difference between traditional target communication and mass communication services will decrease. On one hand, with digitalisation mass communication will become more interactive, and on the other, the importance of entertainment services in target communication will be emphasised.

Digital distribution will be implemented as the only method of broadcasting television programmes in 2007. A major proportion of households will be using digital receivers well in advance of the termination of analogue broadcasting in 2007. On the other hand, other ways of receiving television programmes are becoming more general. There is an increasing number of users who receive TV programmes through their broadband connection or even via a mobile TV.

Content services will become more important and choices for consumers will improve. The provision of content services is multi-channel, i.e. the consumer can receive the same content services through competing channels. The increasing number of channels will also enable the provision of programmes to smaller groups than before. The sponsoring of television programmes and product placement will become more general, as new technology will enable traditional advertising breaks to be bypassed.

Digitalisation also means that new technologies will be exploited, in particular in commercial televisions. Pay TV services will increase and services will be available that enable TV programmes to be watched at a fixed time.

TV programmes will also include interactive elements more than before. However, the digitalisation and the interactivity involved will allow the provision of new, targeted entertainment and content services within traditional mass communication networks, too.

The use of media and entertainment regardless of time and place will increase greatly. Entertainment services, such as games, films, music and television programmes will form a big proportion of the services provided via the Internet. Services can be accessed via several different types of terminal equipment, and the use of personal mobile phones as a distribution channel for entertainment services, in particular, will become more general. Content may also be downloaded onto recording terminal devices for later use. For instance, films or music that have been paid for will be distributed as files via the Internet.

Copyright problems constitute a challenge for the development of content services. Producers of media content seek to protect their products by complicated technical arrangements and to restrict distribution channels to ensure protection against illegal copying.

INFORMATION SECURITY

Information security means the administration of information, information systems and services with regard to their confidentiality, integrity and availability. Despite the changes in society, the aim and definition of information security remain the same, but the phenomena in the information security sector are changing. The functioning of societies is more and more dependent on data systems and the faultless operation of electronic communications networks and services. Information security is essential to ensure the functionality of services. New information security threats will appear alongside the rapid technological development and diffusion of IP-based solutions. A high level of functionality is essential for information and communications systems particularly to safeguard important functions in society, i.e. the critical infrastructure. The protection of consumers against security threats will also become a greater challenge, since security breaches are aimed at the weakest link. In a changing society, the implementation of information security will be a global challenge.

Changes in technology

The use of Internet protocol and wireless access networks in communications services are particular challenges to the implementation of information security. Changes in technology are rapid and the volume of software used continues to increase. The planning and testing of security solutions takes time, and poor quality services with a low level of security may be introduced quickly in the market as a result of fast product development. The risk of programming mistakes also increases with the increasing amount and complexity of software. Consequently, security problems also increase and become more complicated.

The standardisation of services based on the Internet protocol is being achieved rapidly thanks to unofficial standardisation fora, and the number of solutions in compliance with the standards is increasing. As a result of standardisation, information security can be taken into account at the early stage of planning services better than before. Traditional devices connected to networks, such as work-stations, servers and network equipment, are becoming safer, as security technology, such as the control of software integrity and firewall programmes, have been incorporated into their design. In addition, threats are restricted by more secure software default settings. Information security is also better considered in the planning of software. On the other hand, mistakes are also made in planning and development work and it is hard to forecast future threats. The increase in harmonised products and services that conform to the standards and the general availability of popular software components may also increase the risk of threats. However, the overall impact of product development and standardisation contribute to the advancement of security.

The problems of information security are primarily focused on extensively used technologies and software. This phenomenon will continue and is related to the aim of achieving high efficiency and volume in information security breaches. The development of open source software continues and the use of open source systems is simultaneously expanding. The open source method, where the development and assessment of software is public, enables the development of more secure software. In practice, the greatest benefit comes from spreading risks with the increasing number of programmes and manufacturers. The increasing use of open source software will lead to an increase in the range of services and software used by them, which will diminish the risk of extensive threats from materialising.

Functionality of the critical infrastructure

Similar technological solutions are mainly used in communications that are essential to the functioning of society as are used in other communications networks and services. The functionality of communications and availability of services in all circumstances are vital to the operation of critical infrastructure. To ensure functionality, the actors involved in the critical infrastructure work in partnership with business and the authorities across operational borders. Cooperation enables a more rapid response to disturbances.

The information technology solutions used in critical infrastructure are often based on generally used software and equipment due to economic reasons. The telecommunications of the infrastructure systems are simultaneously implemented through public telecommunications networks. Consequently, the actors involved are exposed to the same vulnerabilities and general threats as end-users, for instance. In developing information security, up-to-date information on vulnerabilities must be distributed properly to contribute to the functionality of critical infrastructure services. Due to the rapid development of threats, vulnerabilities are often exploited before the publication of patch files. In order to restrict their harmful effects on organisations, these vulnerabilities must be analysed. The capability and methods of analysing vulnerabilities constitute important tools in planning and implementing alternative protection measures.

With the increasing threats, some entities, particularly in sectors where high functionality is required, have gone from using generally used software to tailor-made fault-tolerant industrial solutions. The growing concern regarding implementing information security will also force many players to reconsider the use of isolated information systems and networks. A changeover to totally closed systems is, however, not cost-effective in all cases, as there is a need for networking and mobility.

In closed systems, there is also a risk that information security solutions are based on an imagined isolation from open networks. The fact that the lack of information security is a known fact can be regarded as an "advantage" of open environments and the Internet. In this instance the implementation of information security is based on separate security solutions, such as user identification or the encryption of telecommunications.

The continuity of operations is crucial in the operation of critical infrastructure. Most of the resources are used for backup and recovery arrangements, as the recovery of systems is of utmost importance. In addition to recovery arrangements, actors involved in critical infrastructure invest in the confidentiality of information and the use of encryption methods. The pursuit of economic benefit related to security breaches means that there is a risk of trade and business secrets being disclosed especially of the critical infrastructure players. In addition to ensuring the continuity of operations and prevention of industrial espionage, critical infrastructure players must also prepare for the threats posed by terrorism.

Position of consumers and the role of players

The consumer cannot control the changing environment of information technology, or the threats to information security. It is also difficult for consumers to perceive the different aspects related to the protection of their own data and communication, i.e. the sender information which is delivered to a second party, the provider of communications or content services. General information on security threats is important in order for consumers to be able to protect themselves against security threats through their own actions.

Consumers' everyday life in the technological environment is made ever more complicated by information security measures. The daily functions and equipment of consumers such as set-top boxes, home theatres, mobile phones and house engineering are connected to IP networks. It is difficult for the consumer to control the threats produced by this new technology and increased electronic communications. Extensive know-how on information security in this expanding sector cannot be required of consumers, but awareness of the importance of security and preparation against threats must be improved.

Operators and other service providers play a key role in the prevention and solution of information security problems. The prevention of security problems requires new security services and measures from operators. The operators are developing information security services as an integrated part of their actual communications services. Operators provide tailor-made easy service packages, possibly limited in different ways, the quality and information security of which operators can best ensure simultaneously for different customer groups. For instance, efficient solutions for identification could considerably reduce the misuse of services. Smart card solutions based on certifications are also becoming more general. The illegal use of services can be prevented by efficient identification solutions, which thus increase the citizens' confidence in electronic communications.

The fragmentation of the sector is setting new challenges. It is more and more difficult to master information security in data processing and communications as a result of the divergence of networks and services and the increase in mobility of communications services. Service providers of small add-on services are not necessarily able to take full responsibility for information security.

Information security breaches

Security breaches are made more and more frequently by professionals and the most vulnerable points of networks and services are exploited. Instead of gaining a reputation as a hacker, these professionals make these breaches in order to gain economic benefit, for instance by blackmailing business enterprises or stealing valuable information. Because of the economic motive, it is usually the weakest link that is targeted with the smallest possible input and maximum efficiency. Consequently, the largest breaches are aimed at consumers and generally used software.

Information security breaches have already become a serious issue. In information security crime, the emphasis is on the search for methods to gain financial benefit. This involves criminals and skilled experts. Due to this professionalism, it does not take long for a discovered software vulnerability to be exploited. The prevention of threats is particularly difficult, if they are directed at a specific goal, as the target is not even necessarily aware of the attack. The speed and imperceptibility of attacks also make it difficult for producers of security software to respond to the increasing threats. Alongside professional network criminals, amateurs may also seek to benefit at the consumers' expense, as the opportunities for exploiting vulnerabilities and the use of hacking software increase.