Broadband Status in Finland

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Introduction

This report summarises the current status of broadband in Finland. The case study is aimed at locating the types of information that could be gathered to assess the EU broadband situation, and to develop solid empirical foundations for creating broadband deployment scenarios.

Broadband Access

According to the Finnish Ministry of Transport and Communications, the number of broadband connections was 500,000 in January 2004. This exceeds previous forecasts. About 85 percent of the households were within the reach of broadband services, and 21 percent of households subscribed to broadband in January 2004.[1] The number of broadband connections almost doubled in 2003, and the growth increased in the second half of the year.

In September 2003, Finland had the fifth highest number of broadband connections per capita in the EU, after Denmark, Belgium, Netherlands, and Sweden. In the last third of the year, the number of broadband connections per inhabitants grew about three times faster in Finland than in the U.K.[2]

[1] http://www.laajakaistainfo.fi/laajakaista_tanaan/index.php. Earlier estimates stated that there would be about 400,000 connections and about 15 percent of households would be connected by the end of 2003. The recent data from the Ministry of Transport and Communication and service provider annual and SEC reports shows that the growth speed has increased since the mid-2003.

[2] From 6.9 to 9.6 percent per inhabitants. The U.K. broadband connections grew from 4.4 at the end of September 2003, calculated from ECTA broadband scorecard, to 5.3 percent, calculated from Ofcom January 2004 Internet and Broadband Update.

At the end of the year, the broadband penetration reached almost ten connections per hundred inhabitants. In September 2003, only Korea, Canada, Iceland, Denmark, Belgium and the Netherlands had reached this level. The leading EU countries, Denmark and Belgium, seem to be about 6 months ahead in the penetration curve, and the next ones, the Netherlands and Sweden about 3 months. Behind these countries, Finland now seems to be close to the U.S. penetration rates.

The growth of different broadband technologies can be seen in Figure 1, which also shows the total number of access lines to households. The decrease in the household access lines is largely caused by the increasing use of mobile phones. Already 36 percent of households used only mobile phones in February 2004. About 16 percent of mobile phone users were able to use internet or WAP services through their mobile phones. There were 87 mobile subscriptions per 100 inhabitants in Finland at the end of 2002. In November 2003 approximately 3.6 million Finns or 92 percent of those aged 15-74 had a personal mobile phone. Almost 74 percent of the Finnish population in that age group sends text messages weekly.[3] According to the operators, the standard analogue subscriber lines are also increasingly being replaced by DSL lines that are used to carry Voice over Broadband.

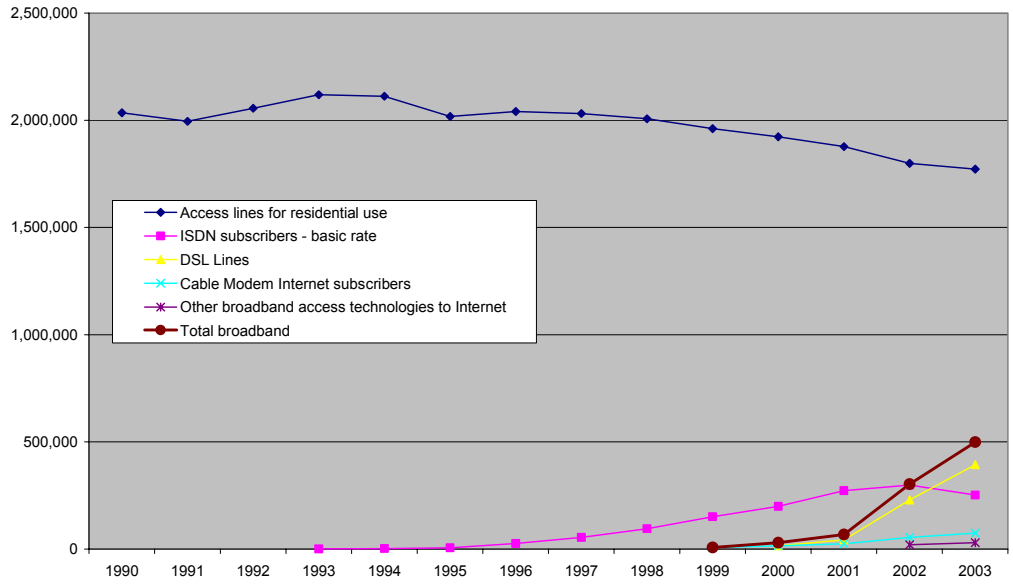

Figure 1. Broadband growth in Finland.[4]

From Figure 1 it is clear that DSL technologies have been driving broadband growth. They have also substituted basic-rate ISDN and leased lines. The growth has been very rapid, as commercially DLS became available in Finland only in year 2000.

[3] Data provided by Juha Nurmela, Statistics Finland.

[4] Based on data from OECD, ECTA, Finnish Ministry of Transport and Communications, and year 2003 annual results of broadband providers. The OECD year 2002 estimate for "other" is adjusted (from 68,000 to 20,000) as it is apparently too high. According to the Ministry of Transport and Communications, the share of FTTH/LAN, PLC, and satellite was about 6.5 percent in 2003. The broadband numbers do not include leased line connections.

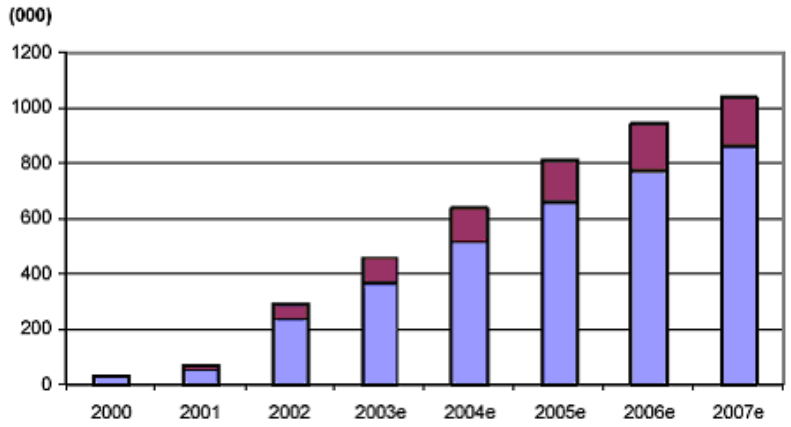

Figure 2. Estimated broadband connection growth (households and firms). IDC / OECD 2003.

Due to the rapid growth in 2003, the existing estimates for future broadband penetration appear to be conservative. The IDC estimates published in 2003 are shown in Figure 2. The estimates for household penetration are shown in Figure 3. It seems that the estimate for 2004 was reached already in February 2004.

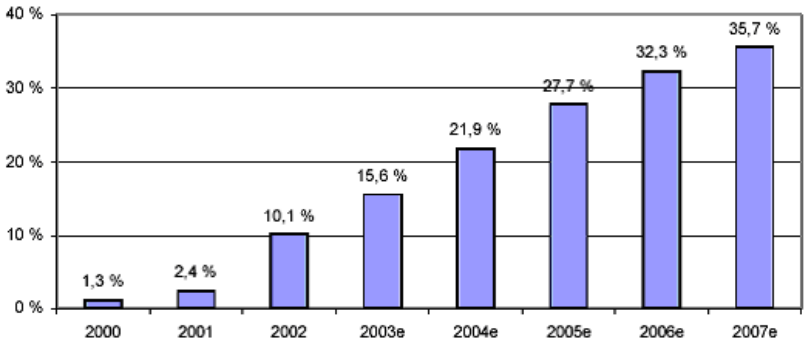

Figure 3. Finnish households with broadband access. IDC / OECD 2003.

According to IDC[5] and ECTA[6] estimates, cable modems represented about one fifth of broadband connections in Finland in 2003. The total number of connections, however, seems to be too low in the ECTA estimates, which may mean that the relative share of cable is exaggerated. The ECTA DSL scorecard, for example, shows only 1000 broadband connections that are not DSL or cable connections in Finland at the end of September 2003. This is clearly too low, at least if end users are counted. According to FICORA[7], there were a couple of thousand WLAN subscribers and 600 PLC subscribers in Finland at the end of 2003, and there were also more than 4000 FTTC/Ethernet connections in one local network in Espoo. IDC, on the other hand,

[5] IDC 2003: European Broadband Access Services Market Analysis, 2002-2007.
[6] ECTA 2003: DSL scorecard, end of September 2003.
[7] Finnish Communications Regulatory Authority 2004: Päätösluonnos huomattavasta markkinavoimasta tukkutason laajakaistapalvelujen markkinoilla, 127/934/2004, 19.2.2004. http://www.ficora.fi/suomi/document/M12_Keikyan_Puhelinosuuskunta_KK1.pdf

seems to have too low household penetration numbers, and Informa gives a 18 percent ratio of cable to DSL, implying perhaps 14 percent cable modem share. The share of cable modems therefore appears to be somewhere between 15-20 percent of total broadband connections at the end of 2003. There were also at least two satellite broadband providers, although their relative share remains low, partly because marketing and installation services for satellite broadband equipment have started only recently.

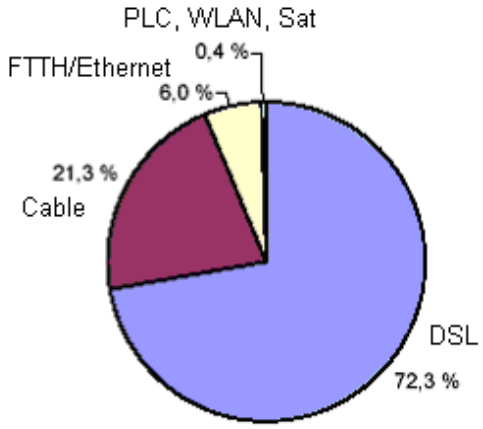

Figure 4. Household broadband access by technology in Finland. IDC 2003.

The diffusion speed of broadband is potentially limited by the capabilities of the basic telecommunications infrastructure. In Finland this does not seem to be a major issue, as the country has an advanced digital telecommunications infrastructure. For example, Finland has been among the first countries to digitalise its telecommunications networks, as can be seen in Figure 5.

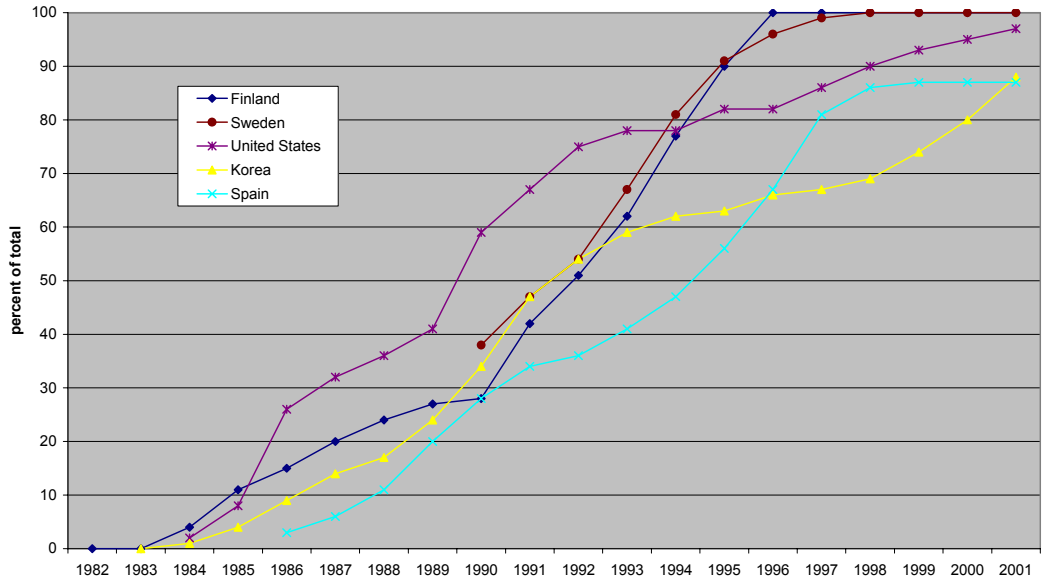

Figure 5. Percent of digital access lines.[8]

There were more than 250,000 digital TV receivers and set-top boxes in the Finnish households in February 2004, or 11 percent of all households. During the next six months 15 percent of households were planning to purchase digiTV set-top boxes.[9] The Finnish Government made a decision in March 2004 that television broadcasting will move to digital broadcasting by the end of August 2007. This will make DVB-T a potential distribution channel for wireless datacasting, and increase the availability of broadband services through interactive TV and mobile devices.

Broadband Prices

According to ITU, a typical monthly broadband subscription cost in July 2003 was 2.93 percent of average income in Finland.[10] This was the tenth highest in the EU, after UK, Belgium, Germany, Denmark, Sweden, Austria, Netherlands, France and Luxembourg.[11]

[8] OECD, Telecommunications Database 2003.
[9] Statistics Finland, 2004: Tilastouutisia 3.3. 2004, Kuluttajabarometri: Digiboksi yli 250 000 taloudessa helmikuussa.
[10] Birth of Broadband, ITU Internet Reports, 2003. ITU uses the most common or the most price efficient offering and does not include connection costs.
[11] There seems to be very little correlation between current broadband penetration and subscription prices in the EU. Ireland, UK, Luxembourg, Germany, and Greece appear to be outliers in penetration vs. subscriber cost graphs.

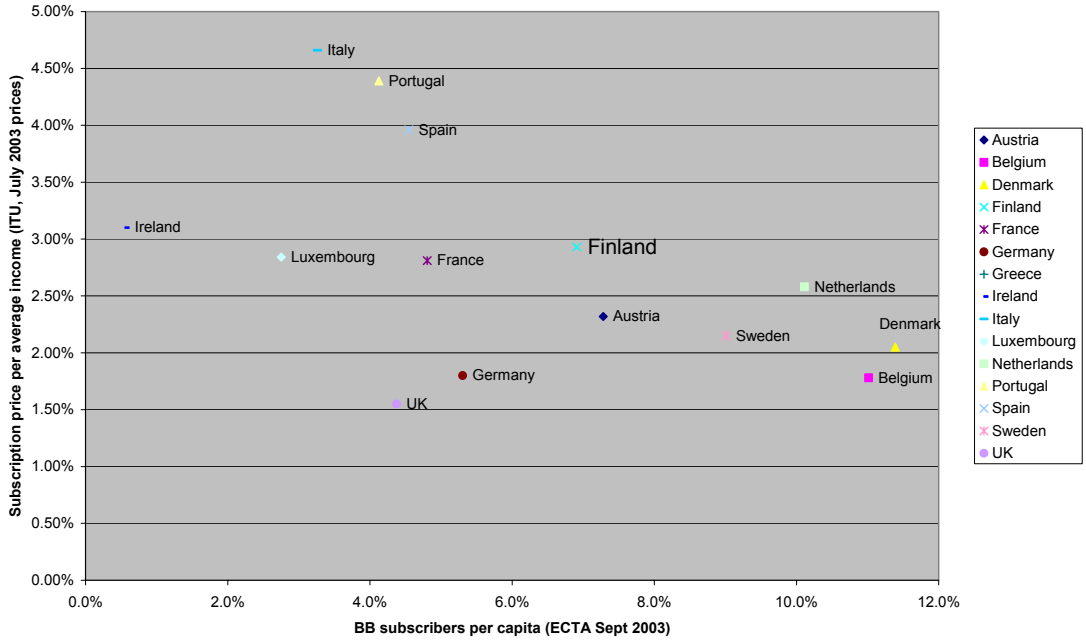

Figure 6. Relative subscription prices and the number of subscribers in some EU countries.

There does not seem to be any clear correlation between prices and the rate of growth of broadband penetration. This indicates that there are strong structural factors influencing broadband diffusion.

More generally, observing subscriber growth in different countries, it seems that broadband diffusion has been much more rapid that other network technologies. One possible reason for this is that broadband seems to substitute earlier technologies and its deployment can rely on user skills and usage patterns that have developed using narrow-band and LAN networks. This removes a major bottleneck from the diffusion process.[12] In the Finnish case it appears to be possible to define some key factors that increase broadband diffusion rates over other network technologies. A specifically interesting question for further study is what factors increased broadband penetration growth rates in Finland during 2003. In general, Finland has had relatively high subscriber costs, both when measured from the total income, and when adjusted with purchase power parities. It has also very rapidly increased its broadband penetration from relatively low levels in the last few years.

Some examples of different types of broadband offers are shown in Table 1. The cheapest cable modem prices were 32 € per month and the cheapest 256 kbps ADSL was 38 € per month in October 2003. It seems that the rapid price decreases seen in the recent years have been slowing down. The operators have frequently had special offers where, for example, the service connection costs have been lowered. In March 2004 the price for 256/256 kbps ADSL provided by Elisa was 39 € and the connection cost had been reduced to 78 €. The 512/512 kbps ADSL monthly fee remained at 49 €, but connection cost had been reduced by 49 €. The relative subscription fees for

[12] Cf. Yang et al. 2003: Diffusion of Broadband Mobile Services in Korea: The Role of Standards and Its Impact on Diffusion of Complex Technology System, http://weatherhead.cwru.edu/pervasive/Paper/UBE%202003%20-%20Yoo.pdf

256 kbps and 2 Mbps ADSL among EU countries is shown in Table 2 and Table 3, using the Finnish service basket as a reference point. Finland had about twice as high subscription fees than U.K. in 256 kbps ADSL and about four times higher fees in 2 Mbps ADSL than Belgium. In general, the price differences become considerable across EU when higher speed connections are compared.

Table 1. Some broadband service offers in Finland, October 2003.[13]

Operator	Type	Speed	Connection cost	Monthly fee, €
Sonera	ADSL	512/512 kbit/s	129	48
Sonera	Cable	~750/256 kbit/s	49	49
Elisa	ADSL	512/512 kbit/s	126	49
Elisa	Cable	512/128 kbit/s	50	46
Finnet	ADSL	256/256	127.89	44.26
	ADSL	512	129.42	50.91
	ADSL	1Mb	124.92	70.73
	ADSL	2Mb	127.20	109.33
HTV Welho	Cable	525/200	50	49
Saunalahti	ADSL	512/512 kbit/s	160	46
Jyväsviestintä KaNetti	Cable	700/200 kbit/s	49	48
PäijätVisio	Cable	500/100 kbit/s	80	49.90
Vattidata	PLC	1Mb/256 kbit/s	70	49
Turku Energia	PLC	~750/? kbit/s	50	46
RS-Solutions	WLAN	512/512 kbit/s	0	42
Wireless Solutions Finland	WLAN	512/512 kbit/s	0	42.05
TiscaliSat	Satellite	400/- kbit/s	49.90	39.90

Table 2. ADSL subscription fees for 256 kbps, index, FI=100.[14]

Country	Monthly fee	Operators	Price (Finland =100)
UK	28,55	1	57,8
Netherlands	30,21	6	61,1
Sweden	33,27	1	67,3
Italy	36,95	1	74,7
Luxemburg	39,00	2	78,9
Denmark	45,81	2	92,7
Spain	47,82	5	96,7
Finland	49,43	15	**100,0**
Greece	52,54	2	106,3
Portugal	65,00	1	131,5

[13] Source: "Kansallinen laajakaistastrategia" (The National Finnish Broadband Strategy). Publications of the Finnish Ministry of Transport and Communications, 50/2003, December 2003.
[14] Source: "EU-maiden ADSL- ja kaapelimodeemiyhteyksien kuluttajahinnat" (ADSL and cable modem subscriber prices in the EU countries), Publications of the Finnish Ministry of Transport and Communications, 49/2003, October 2003.

Table 3. ADSL subscription fees for 2Mbps, index FI =100.[15]

Country	Monthly fee	Operators	Price (Finland =100)
Belgium[16]	26,07	5	23,9
Sweden	52,85	1	48,5
Austria	59,00	1	54,2
Germany	60,84	1	55,9
UK	63,75	1	58,5
Italy	104,03	2	95,5
Denmark	105,16	4	96,5
Netherlands	105,16	4	96,5
Finland	108,92	22	**100,0**
Spain	174,27	3	160,0
Greece	300,00	1	275,4

Broadband Competition

Finnish telecommunications operations were opened up for competition in the early 1990s. The GSM networks and data transfer were opened up to competition in 1990, and full-fledged competition in local, trunk and international telecommunications began in 1994. Today, setting up telecommunications services generally only requires notification to the Ministry of Transport and Communications, with only the construction of mobile phone networks requiring a government license.[17]

The three biggest operators had relatively similar market shares (18-27 %) in year 2003, and there are no dominant players. The Finnish telecom market, however, is rather unique in Europe in that historically there has not been a single national telecom operator. There exists a large number of typically small regional operators that dominate their local markets both for cable TV and fixed line telephony. These operators often have 80-90 percent market share in their regions. The regional operators also often own the regional cable networks. The large number of regional operators has created problems in access to the local loop, both because of monopolistic pricing and because of varying terms of access in the different regions that has made country-wide services difficult to roll-out.

Table 4. Market shares of the biggest broadband providers in 2002.[18]

Operator	%
TeliaSonera	32.5
Elisa	27.2
Finnet	17.1
HTV Welho	11.3
Others	11.9

[15] Source: "EU-maiden ADSL- ja kaapelimodeemiyhteyksien kuluttajahinnat, lokakuu 2003" (ASDL and cable modem subscriber prices in the EU countries). Publications of the Finnish Ministry of Transport and Communications, 49/2003, October 2003.
[16] The price for Belgium is calculated from 3-4 Mbps service offerings.
[17] Ministry of Finance: Product and capital market reforms in Finland. November 2001. http://europa.eu.int/comm/economy_finance/epc/documents/sf02_en.pdf.
[18] Source: IDC 2003.

The Finnish Competition Authority has actively intervened in the broadband market. During the first half of 2003, the FCA investigated over 40 local operators. Prior to the start of the FCA's project, almost all the local telecom companies collected such high broadband access charges that the entry of competing operators into the retail market was virtually impossible. When the average broadband access charge exceeded the average 50€ consumer price by 15 percent, outside ISPs could in no way provide the service commercially.

The telecom companies have also asked from ISP operators a wholesale price that has been several times as high as that asked by the company itself from consumers and other retail customers. Additionally, some telecom operators have totally refused to lease broadband service connections to competing operators.[19] Also the Finnish Ministry of Transport and Communications has put considerable pressure on telecom operators to improve competition in the broadband area. The access and retail prices have rapidly decreased.

The Finnish Competition Authority has told in December 2003 that it is planning to sue those operators that still use their monopoly positions to limit competitor access to local loop.

The development of broadband services also crucially depends on the investments that service providers make. This is obviously limited by the revenues that operators get from their operations. In general, public telecommunication operators have decreased their investments as a ratio of their total revenues since the 1980s. This can be seen from Figure 7. The investments in Figure 7 do not include 3G spectrum license fees that were about 93.5 billion in 2000 in OECD countries.[20] The Finnish Government did not auction spectrum, but Finnish telecom operators paid considerable sums for licenses in Germany and Italy.

[19] Finnish Competition Authority, press release, 27 June 2003, http://www.kilpailuvirasto.fi/cgi-bin/english.cgi?luku=news-archive&sivu=news/n-2003-06-27
[20] OECD Communications Outlook 2003, p. 18.

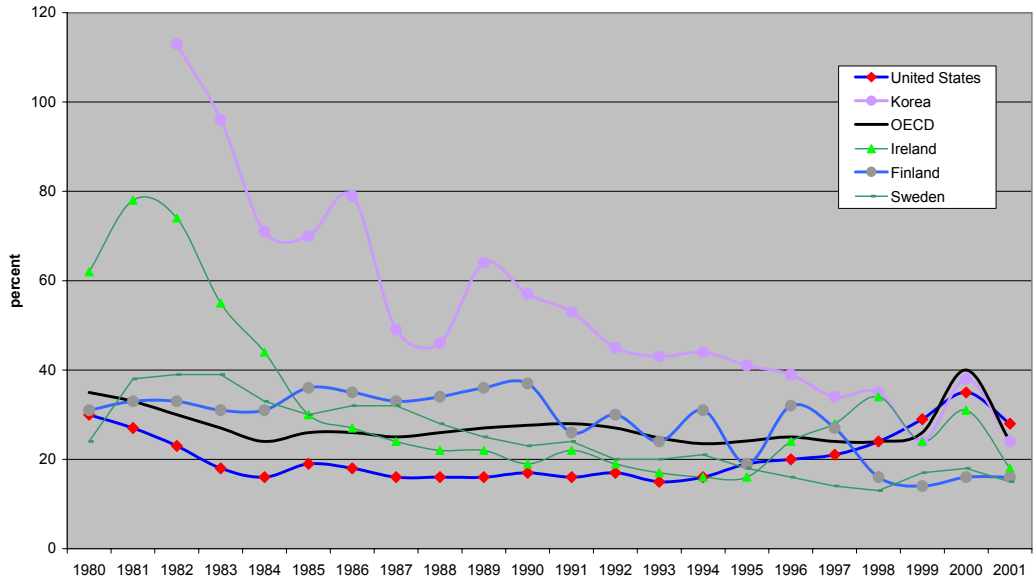

Figure 7. Total PTO investment per revenue in some countries.[21]

The investments made by the Finnish public telecommunication operators have been around 100 USD per inhabitant during the last decade, without 3G license fees. Since 1997, the revenue per inhabitant has been over the OECD average, reaching 800 USD in 2001. Finnish PTOs have typically invested less per inhabitant than OECD average but more than, for example, Korea.

Use of Broadband

Broadband use has rapidly expanded in the recent years, and there are few detailed studies on its actual use in Finland. Often the consumer benefits of broadband are described as potential benefits, such as improved speed of downloading large files, capability for interactive video, and efficient teleworking. In practice, the current major broadband benefits seem to be its "always on" characteristic, its usually predictable flat-rate pricing, and the fact that normal phone calls are available while the Internet is being used. Compared with traditional dial-up, the improvement of connection setup time is a considerable change, and broadband connections facilitate efficient use of networked resources and communication. On the other hand, when broadband connections are always on, their security risks have also become of major concern.

For specific user groups, such as active users of peer-to-peer music and video sharing systems, high-speed connections represent a considerable improvement over narrow-band connections, and make the peer-to-peer server architecture possible in the first place. Much of the current peer-to-peer network traffic, however, is created by the unclear situation with copyright enforcement on the net. Similarly, most of the email traffic today is created by spam and, indeed, many broadband-connected computers

[21] Source: OECD Telecommunications Database 2003.

are today used to send spam mail by breaching their security. As the legal status of spam and digital rights management systems becomes clarified, the need for broadband may be somewhat reduced. According to the Pew Internet & American Life project, the percentage of online Americans downloading music files on the Internet dropped by half between April and November 2003, when RIAA began filing suits against those suspected of copyright infringement. Peer-to-peer traffic represented one fifth to half of the total network traffic in the mid-2003.[22] Efficient enforcement and digital rights management systems could, therefore, considerably diminish network traffic in the short term.

The Finns are among the most active Internet users within the EU. 61 percent of Finns in the 15-74 age group had their own email addresses in October 2003 and 63 percent of email address owners used their email daily.[23] In February 2004, however, only 59 percent of households had PCs.[24] The relatively high percentage of Internet users compared with the households with PCs results from the fact that larger households typically have PCs and almost all households with PCs are connected to the Internet, as well as from the fact that some people get access to the Internet at their workplaces and using public access points.

People who acquired broadband connection in 2003 increased their Internet use considerably. On average, the weekly use of Internet increased 4 hours. The increase was most striking in sparsely populated areas, where men increased their weekly use by 6 hours and women by 2.5 hours on average. Increase by people aged under 40 averaged 1.5 hours more than that of people aged over 40. Broadband users also seem to be relatively well aware of the security problems associated with broadband. About 70 percent of household with broadband have a firewall in their home PC and about 60 percent have virus protection for incoming email.[25]

[22] Hadenius, P. (2004): Relieving peer-to-peer pressure. Technology Review, February 25, 2004. http://www.technologyreview.com/articles/wo_hadenius022504.asp. Sandvine has recently claimed that up to 80 percent of residential Internet traffic can now be peer-to-peer traffic generated by KaZaA, eDonkey, and WinMX (http://www.sandvine.com/news/pr_detail.asp?ID=40).
[23] Data from Juha Nurmela, Statistics Finland, March 2004.
[24] Statistics Finland, 2004: Tilastouutisia 3.3. 2004, Kuluttajabarometri: Digiboksi yli 250 000 taloudessa helmikuussa.
[25] Data from Juha Nurmela, Statistics Finland, March 2004.

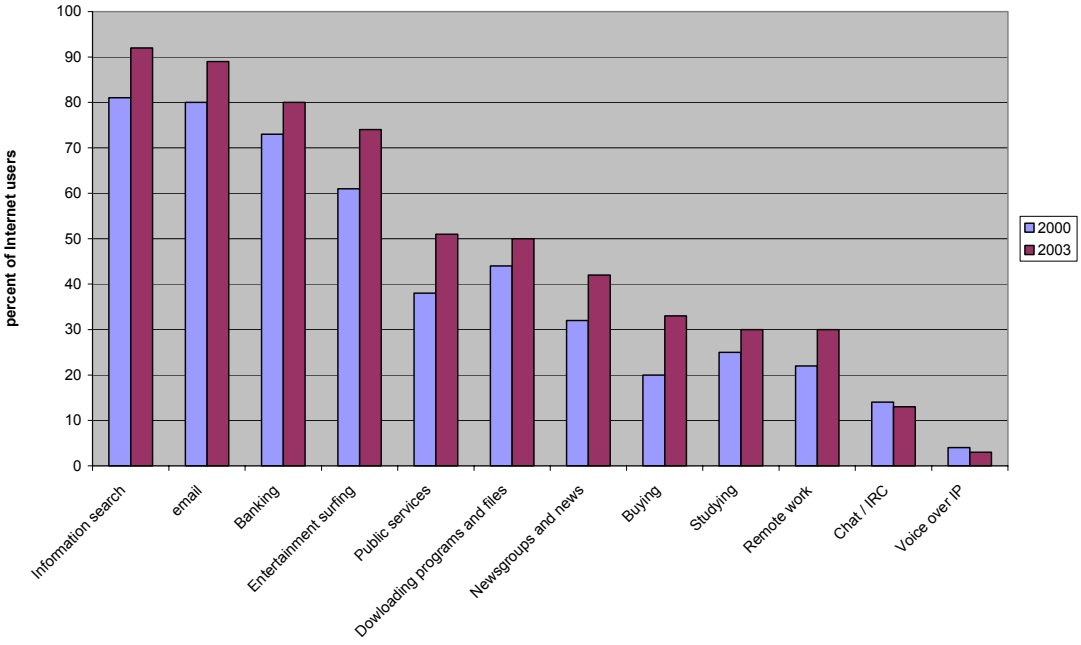

Figure 8. Internet use in the Tampere region, Finland.[26]

Personal email, information retrieval, net surfing, and e-banking are the most common uses of the Internet in Finland. The popularity of different services is shown in Figure 9.

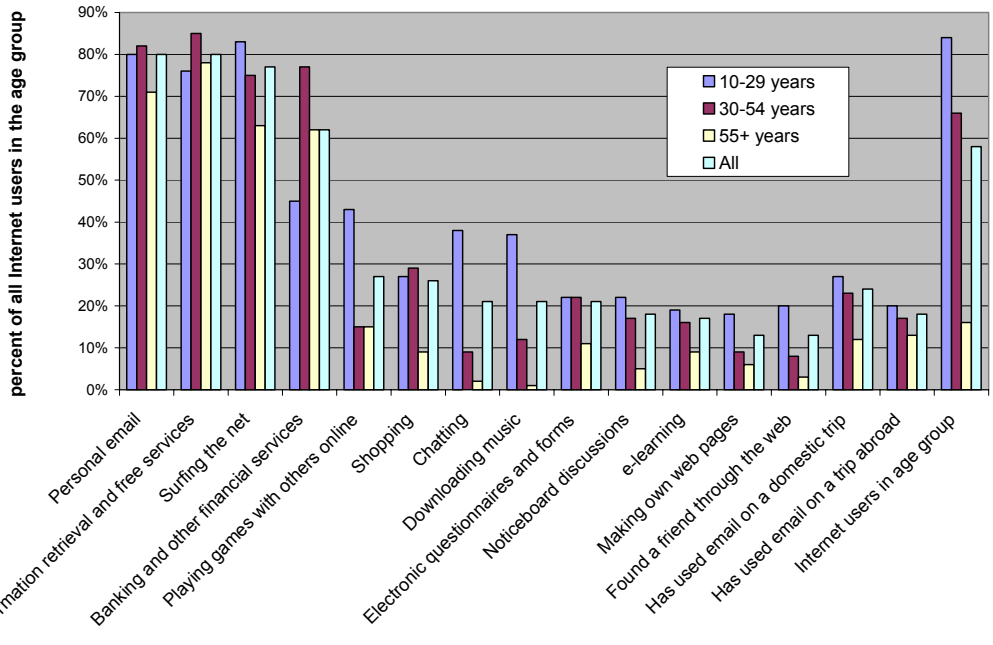

Figure 9. Use of Internet applications in different age groups at the end of 2002.[27]

[26] Data from eTampere / Infocity 2003 survey conducted in October 2003 by Taloustutkimus Oy.
[27] Nurmela Juha & Ylitalo Marko (2003): The Evolution of the Information Society. How Information Society skills and attitudes have changed in Finland 1996 - 2002. Reviews 2003/4, Statistics Finland, Table 6.5.

Some recent studies have focused on the use of the Internet among the elderly population of over 50 years of age. In this demographic group, the use of the Internet appears to be limited by relatively high perceived costs when compared with expected benefits, difficult non-ergonomic working positions, difficulties in using the mouse and keyboard, and representation of content in ways that require good eyesight. Potentially, broadband could be used to transmit multimedia content that could adapt to different user needs, for example, by switching from text to audio according to user preferences.

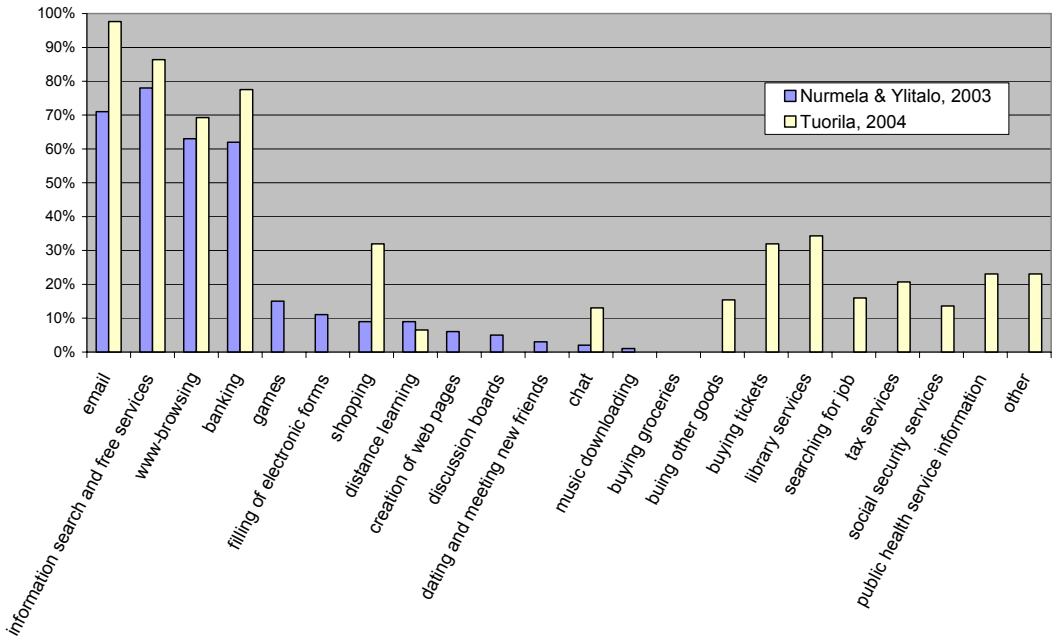

Figure 10. Uses of the Internet in the 50+ age group in Finland.[28]

The Finnish Ministry of Transport and Communications has launched a research program in 2002 that focuses on the use and user perceptions of broadband. In a survey conducted in May 2002, 21 percent of Finns without broadband access felt that they would need one. The perceived need for broadband in some consumer groups is shown in Figure 11. In general, the various studies show that both the use and perceived benefits of broadband increase with higher household income, higher levels of education, and household size. Low incomes, low levels of education, unemployment, lack of children under 18 years in the household, and age of over 44 years decrease both the use and perceived benefits of broadband.[29]

[28] Tuorila, H., 2004: Yli 50-vuotiaat Internet-palvelujen käyttäjinä (People over 50 as users of the Internet), National Consumer Research Centre, Publications 2/2004. Nurmela Juha & Ylitalo Marko (2003): The Evolution of the Information Society. How Information Society skills and attitudes have changed in Finland 1996 - 2002. Reviews 2003/4, Statistics Finland.

[29] Koivumäki, M. & H. Soronen, 2003: Laajakaistapalvelujen käyttötarpeet: Internetiä käyttämättömät lähikuvassa (User needs for broadband services: close shot of non-users of internet). Publications of the Ministry of Transport and Communications, 27/2003, May 2003.

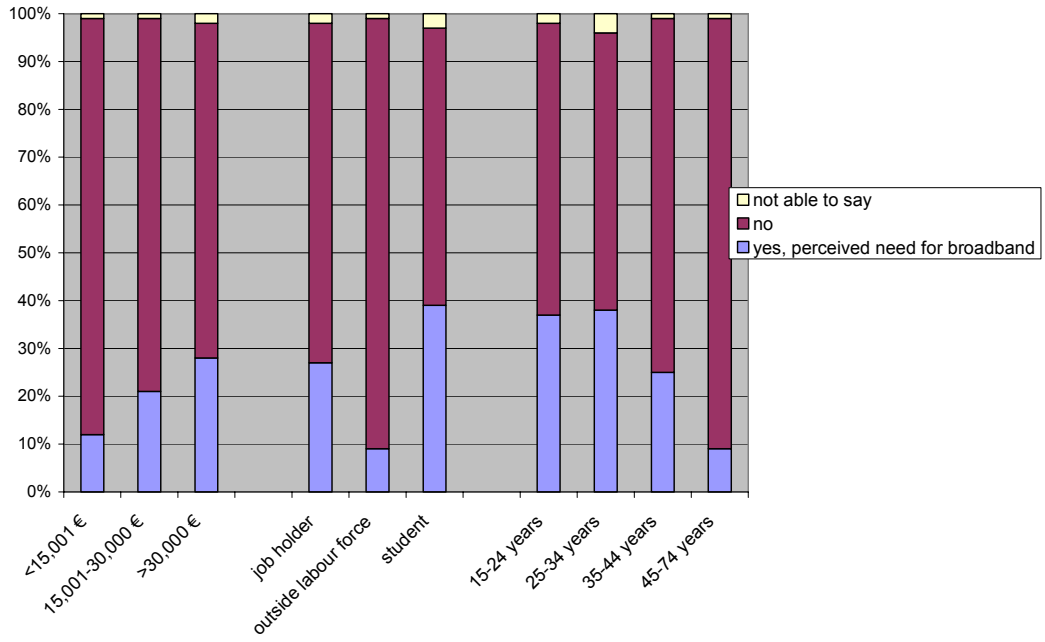

Figure 11. Perceived need for broadband in some demographic categories, May 2002.[30]

It is possible that the gains from broadband would be similar to those in other countries, however. Experts have argued that applications of particular importance for broadband diffusion include IP telephony, video, audio, gaming, online photos, teleworking, e-commerce, and local content.[31] Oftel residential survey, conducted in August 2003, has separately studied where the current broadband users see the main benefits of broadband. These are depicted in Figure 12.

[30] Koivumäki, M. 2002: Laajakaistapalvelut käyttäjän näkökulmasta: väestöryhmäkartoitus ja kuluttajien tarpeet (Broadband services from user's viewpoint: mapping of demographic groups and consumers needs), Publications of the Ministry of Transport and Communications, 28/2002, September 2002.
[31] Reynolds, T. 2003: Promoting Broadband.

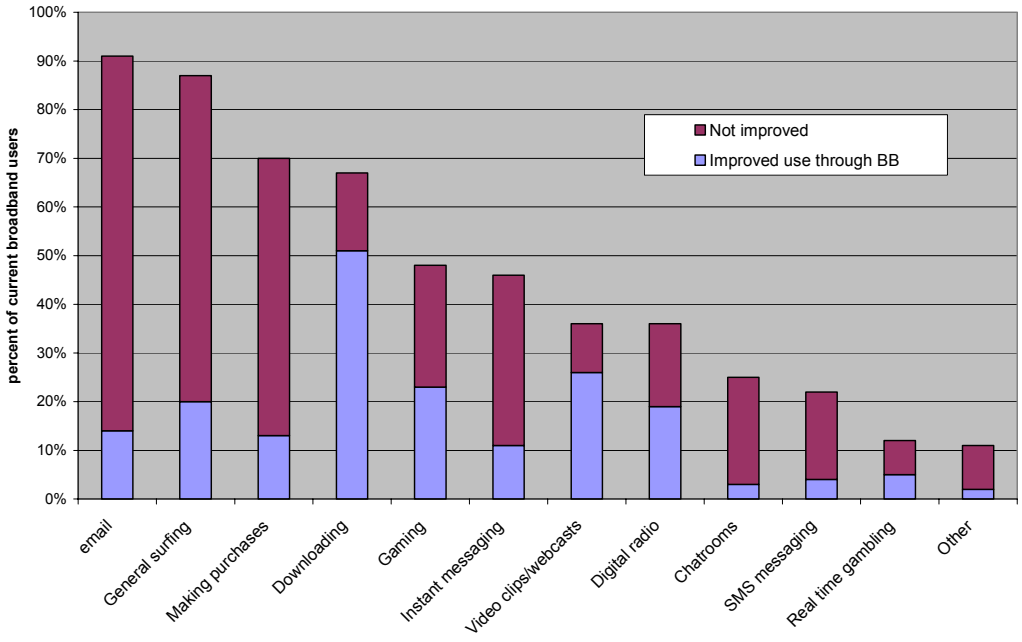

Figure 12. Benefits of broadband perceived by U.K. broadband users, August 2003.[32]

Business use

Many medium sized and large companies have been connected to the Internet using leased lines. At the end of 2001, Finland had about 60 leased lines per 100 000 inhabitants, the fifth highest in EU after Denmark, Sweden, Luxembourg and the Netherlands. In the spring 2003, 94 percent of all businesses that employed more than five persons used the Internet, and 99 percent of firms with 20-49 employees had Internet connections. In business services and wholesale trade the number reached 99 percent, whereas in construction and car sales it was around 85 percent. 58 percent of all firms with more than five employees had their own web site. Broadband was used by over half of all firms.[33] The connection types used by firms can be seen in Figure 13.

[32] Oftel, Consumers' use of Internet, Oftel residential survey, Q14 August 2003, 27 October 2003.
[33] Statistics Finland: Internet ja sähköinen kauppa yrityksissä 2003 (Internet and electronic commerce in business firms 2003).

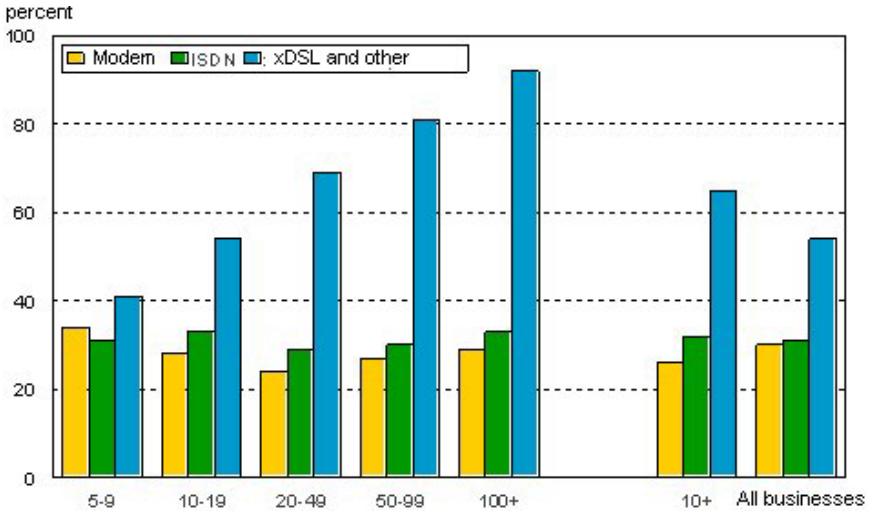

Figure 13. Internet connection types in Finnish firms, spring 2003.[34]

Policy Initiatives

The Finnish government published a resolution on the national broadband strategy at the end of January 2004. It states that:

> High-speed telecommunications with nationwide coverage are essential for achievement of the Government's objectives. A high-quality, efficient communications infrastructure will improve productivity and promote economic growth in all sectors. It will also advance the development of new forms of work and business, thereby improving the ability of companies to compete. Furthermore, good telecommunications infrastructure will facilitate improvements in the quality and availability of public services, providing a useful tool for developing these services, especially in sparsely populated areas. Comprehensive provision of high-speed telecommunications is also vital in ensuring regional equality.
>
> The broadband market is still in its infancy. While it is dominated by broadband services offered via the fixed telephone network and cable television networks, new broadband technologies have begun to enter the market.
>
> Broadband services are also being offered via the electricity grid and wireless local networks, and satellite broadband services were introduced in Finland in 2003. Third generation broadband mobile services are already available in several European countries and will soon appear on the Finnish market. In addition, subscriber connections are now also being offered via fibre-optic cables.[35]

The strategy is:

- to promote competition within and between all communications networks,
- to promote the provision of electronic services and content,
- to stimulate demand for broadband services,

[34] Source: Statistics Finland: Internet ja sähköinen kauppa yrityksissä 2003.
[35] http://www.laajakaistainfo.fi/english/index.php

- to continue and develop special support measures in those areas in which there is insufficient demand for the commercial supply of broadband facilities.

The accompanying strategy targets include having 1 million broadband connections in Finland by the end of 2005, including all access technologies; affordable high-speed access for everyone, with comprehensive geographical coverage. The goal is also that Finland will be a European leader in the availability and use of high-speed telecommunications.

The strategy notes that the appropriate connection methods depend on regional factors and the level of demand. The measures and initiatives included in the strategy are designed to be technology neutral to guarantee the parallel development of alternative technologies and effective competition. The strategy explicitly discusses cable networks, DVB-T, UMTS, FTTH, FTTC/Ethernet, WLAN, PLC, xDSL, and satellite.

The broadband strategy is closely linked to the Finnish information society policy programme. The current programme was adopted by the government in September 2003, and it continues the previous government information society programmes and strategies. The programme is coordinated by the Prime Minister. The information society, as a means to promote welfare, sustainable development, transparency, accountability, democracy, good governance and societal and economic development, has been a central theme in the Finnish government programs since the mid-1990s. According to the current minister of Transport and Communication, Leena Luhtanen:

> The challenge is to harness the ICT tools in such a manner that the potential their utilisation provides, can be exploited in the most effective way. Technology alone, without effective means to utilise it, only promotes productivity and stimulates growth in one, though important field, namely technology production.
>
> It is important to remember that the starting point and basis for all the development in the pursuit of a modern information society are, in fact, the needs of our citizens. Successful solutions and services are built on an understanding of people's requirements.[36]

Minister Luhtanen also noted that recent research in Finland has shown that up to 77 percent of the Finnish households did not feel that they needed broadband services:

> These figures emphasise the fact that although the infrastructure is important, we must now concentrate on making the broadband more attractive for the customers by actively enhancing content production and the development of related services. This is an example that well illustrates the fact, how important it is to cater for the needs of the citizens, if we wish to succeed.[37]

There have been several initiatives to extend the discussion on the challenges and priorities of the information society beyond traditional policy circles and to engage the citizens in the policy definition. The current online forum "Knowledge society –

[36] Leena Luhtanen (2004) Information society models and the new everyday life. Article of the month, eFinland, 1 Jan 2004. http://e.finland.fi/netcomm/news/showarticle.asp?intNWSAID=19717
[37] ibid.

society of the future?" was launched in 17.2.2004 and ends 29.2.2004. Comments and contributions from the citizens will be used to focus the information society programme and the inputs from the discussion will be fed back to the group of ministers and to the Finnish Information Society Council.

There also exist several regional information society strategies and initiatives that try to promote broadband use. These include initiatives at the Turku[38], Tampere[39], and Oulu[40] regions. In general, the Finnish initiatives emphasize convergence and multiplatform solutions where services and applications can be accessed using fixed and mobile terminals.

Open policy issues

Open and emerging policy issues include regional coverage and universal service provision. The current policy emphasizes the role of regional authorities and commercial actors in service development, as well as technology neutrality. To increase regional availability, the Finnish Competitive Authority and the Finnish Communications Regulatory Authority have actively pursued local loop unbundling and competition in broadband wholesale market.

The regulation of Voice of Broadband is becoming an increasingly visible topic as many consumers will potentially switch to broadband based telephony services, where, for example, emergency service access may require new approaches. The diffusion of powerline broadband (PLC) was also delayed as measurement revealed that PLC technology creates electromagnetic interference levels that exceed accepted limits. The newer PLC technologies, however, seem to avoid most of these problems.

FUNET backbone

The Finnish universities and research centers are connected by the FUNET network. This is the original Internet backbone in Finland. It has some 80 user organisations and 300 000 users. Funet is managed by the Finnish Center for Scientific Computing (CSC). It has recently installed routers that are capable of 10 gigabit rates within Finland. The main backbone service provider is currently TeliaSonera. The customer organisations are typically connected using black fibre, Ethernet, or Gigabit Ethernet. Funet makes international connections through Nordunet with 10 Gbps and 2.5 Gbps, and the connections to commercial service providers through Ficix[41], via 1 Gbps connections.

[38] http://www.turku.fi/tietoyhteiskunta/Ihminen_turku_engl.pdf
[39] http://www.etampere.fi/office/en/
[40] http://www.oulu.ouka.fi/smartoulu/english/paasivu.htm
[41] Finnish Communication and Internet Exchange: http://www.ficix.fi

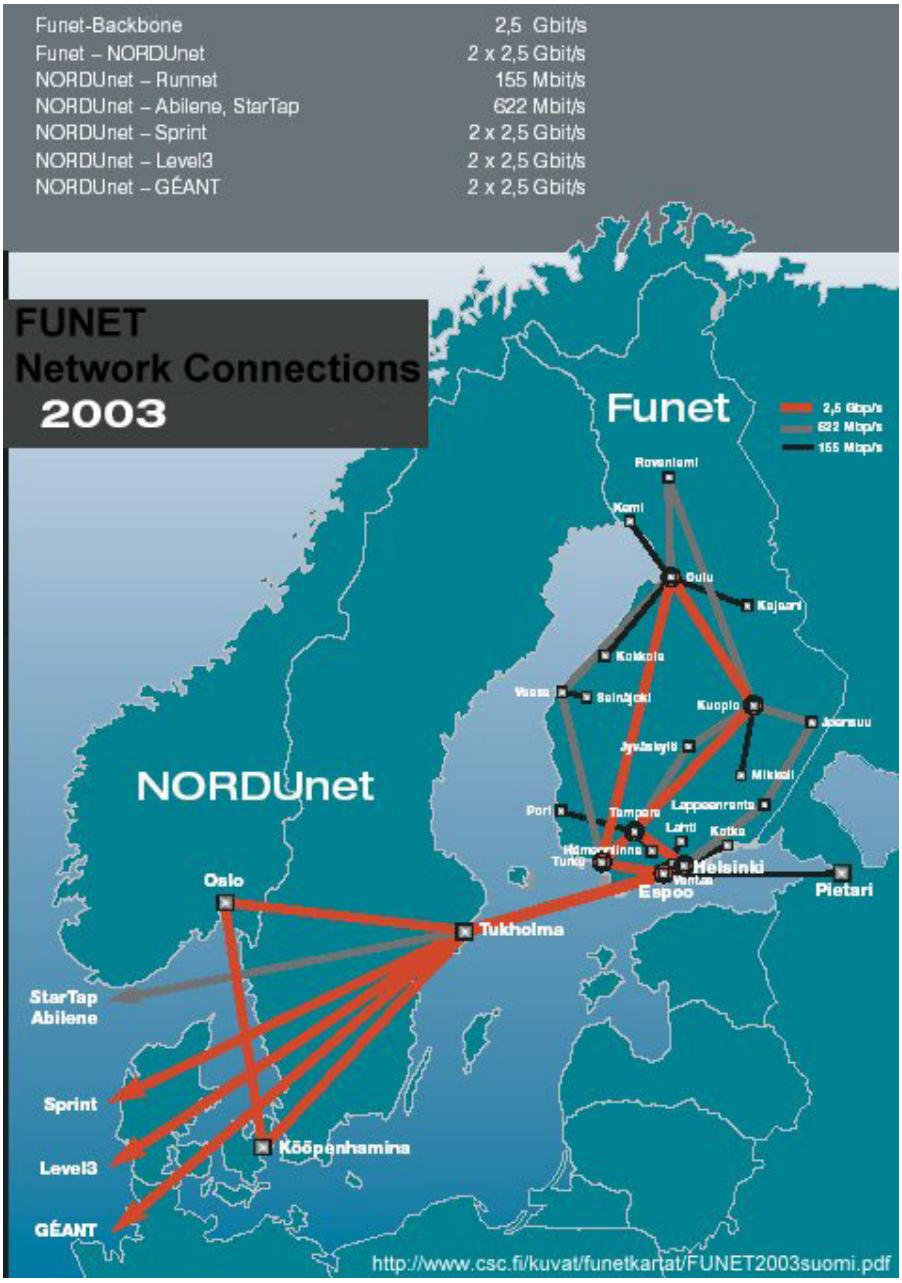

Figure 14. FUNET Internet backbone.

Broadband Rollout Scenarios

Infrastructure cost estimates

The Finnish Ministry of Transport and Communications has conducted a study on technical and financial viability of broadband in Finland.[42] The study analyses

[42] Laajakaista kaikille ? Tekniset ja taloudelliset edellytykset Suomessa (Broadband for everyone? Technical and financial viability in Finland), Publications of the Ministry of Transport and Communications, 41/00.
http://www.mintc.fi/www/sivut/dokumentit/julkaisu/julkaisusarja/2000/rapt41a.pdf

information society services and their data transmission requirements, the status of backbone, regional and access networks, and surveys the main bottlenecks and challenges for broadband roll out, as seen by potential service providers. The study also analyses existing technologies that could be used to roll-out broadband services in Finland, and calculates costs for various alternative approaches.

According to the study, 95 percent of the Finnish population was living within a less than a few kilometers from optical fiber in year 2000. Although in some rural counties up to half of the exchanges and concentrators did not have optical fiber links, more than 90 percent of the population also in these counties were within the access. Most of the households and businesses were less than 2 km from exchanges or concentrators. More recently, these figures have been updated, showing that 448 counties, or 95 percent of all Finnish counties, were connected to fiber. This represented 99 percent of the population. Over 50 percent of the counties had more than one fiber network provider. In 2002 fiber was connected to about 5200 concentrators, representing 85 percent of all concentrators and 98 percent of population.[43]

Table 5. Optic fiber in backbone and regional networks, Finland, year 2000,

	Total	In counties with fiber access	Within regional fiber networks
Counties	460	430 / 95 %	
Population	5.1 M	5.1 M / 99 %	4.8 milj. / 95 % *)
Switches and concentrators	5 900	5 800 / 99 %	4700 / 80 %
Phone lines	2.8 M	2.8 M / 99 %	2.65 M / 95 %

The study notes that already the existing access network has so much capacity that if it would be fully used, international connections would become a major bottleneck. The reason is that the operators have to pay relatively high prices for international connections and therefore they only provide limited capacity. The study also refers to tests that showed that a 128 kbps ISDN was clearly faster than most megabit-connections when used for international web surfing.

The study estimates that only about 2000 km fiber cable would be needed to cover all the counties that still remained without fiber connections in year 2000, corresponding to an investment of approximately 15 million euros.[44] When fiber would be extended also to the smallest concentrators, 10,000 km new cable would be needed, corresponding to roughly 170 million euros. Assuming that optical fiber would be

[43] Pentti, J., Sassi, J. & M. Kääriäinen 2003: Ruotsin ja Suomen laajakaistayhteyksien kattavuus (Broadband coverage in Sweden and Finland). Publications of the Ministry of Transport and Communications, 21/2003, April 2003.

[44] At the same time, some interviewed operators intended to make backbone investments of about 50 million euros during the next four years.

extended to all 200,000 businesses and 2.3 million households, the cost could be 3,300 million euros.[45]

In studying the alternative roll-out scenarios, it is of course important to note that the different countries have quite different geographic constraints. For example, whereas the Netherlands has about 470 inhabitants per sq.km. (when only land is counted), and Belgium about 337, Sweden has about 20 and Finland only about 15 inhabitants per sq.km.[46]

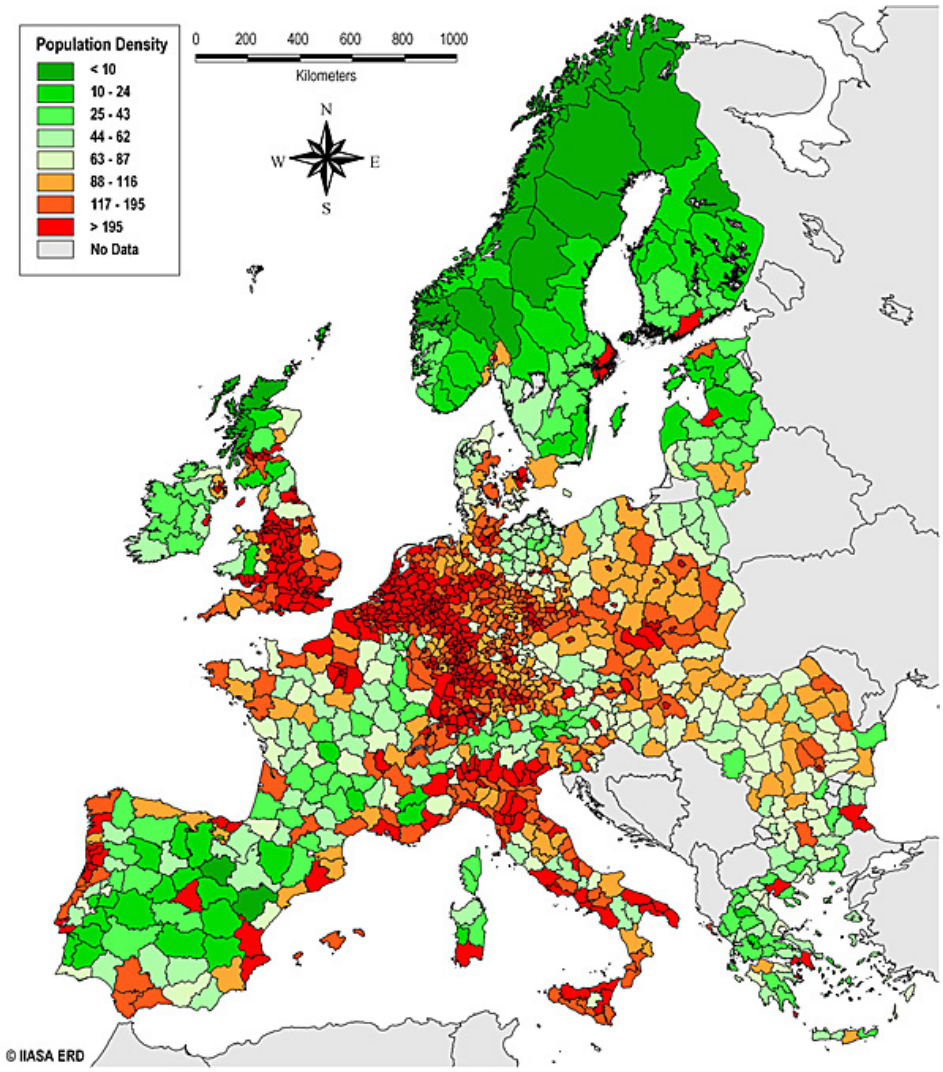

Figure 15. Europe's population density.[47]

Actors

The main actors in the diffusion of broadband are business users, consumers, network operators, content providers and equipment manufacturers.

[45] The last calculation assumes that the material and installation costs for optical fibre are similar to copper (about 100 euros per connection), and that the terminal equipment and other active components are about 700 euros.

[46] Singapore has 6,430 inhabitants per sq.km, and South Korea 491, roughly the same population density as the Netherlands.

[47] Source: http://www.iiasa.ac.at/Research/ERD/DB/mapdb/map_9.htm

Also the various ministries, including Ministry of Transport and Communications, Ministry of Education, Ministry of the Interior, and Ministry of Trade and Industry have important roles, as they develop and fund initiatives for broadband infrastructure and services, and also act as service providers themselves. The current Finnish Information Society Programme is coordinated by the Prime Minister and the program management is located at the Prime Minister's Office. An important rationale for this arrangement has been the belief that efficient implementation of Information Society initiatives requires collaboration across the Ministries, and coordination at the highest policy levels.

The Ministry of Transport and Communications has set up a project to follow the implementation of the Finnish broadband strategy, and an associated web-site that acts as a portal for broadband information.[48] The national regulatory agency FICORA and the Finnish Competition Authority have important roles in monitoring and enforcing competition and standards.

Current traffic patterns

The amount of traffic through the Finnish Internet exchange FICIX is available trough the FICIX web site http://stats.lanwan.fi/ficix. This covers the traffic only partially, as there exists direct peering arrangements among the network operators, and as the academic networks are connected to the rest of the world through NORDUNET. Finland has one of the four Internet root servers that are located outside the US. The Internet traffic has roughly tripled annually in Finland during the last decade. There is currently no data available about the share of different protocols in the Finnish internet backbones.

Ongoing and planned broadband pilots

A IPDC (IP datacast) DVB-T pilot was announced in December 2003 that will recruit about 500 pilot users in the Helsinki region. TeliaSonera Finland and Radiolinja provide mobile access for protected TV-like services to the end-users. Broadcast firms MTV Oy, Nelonen (Channel Four Finland) and The Finnish Broadcasting Company will produce the content available for the pilot users. Digita will operate the IPDC service system and network. In this role it will manage the services and broadcast them on-air. Nokia will provide the IPDC specific equipment such as the terminals, which enable the devices to receive the broadcast signal. Technical IPDC tests have been going on since September 2002, providing up to 12 Mbps to mobile terminals.[49]

Nokia is also actively involved with DVB-X that tries to adapt DVB-T to small mobile devices. According to Nokia, DVB-T is well suited for broadcasts that can be received at users moving at speeds of up to 170 km/h, but DVB-X may be needed for battery operated devices.[50] More interestingly, Nokia seems to be investing in WiMAX 802.16 wireless broadband. WiMAX could rapidly become important for

[48] http://www.laajakaistainfo.fi
[49] IP Datacast Forum (2002): IP Datacast test network launched in Helsinki. http://ipdc-forum.org/news/press-release-2.htm
[50] Henriksson, J. DVB-X. DVB Scene 05, March 2003. http://www.dvb.org/documents/newsletters/DVB-SCENE-05.pdf

broadband access, in particular if Intel will integrate it in its chipsets, as it has promised.[51] The first chipsets are expected before the end of 2004. WiMAX has the potential to become a core component in 4G wireless broadband networks. Currently the technology providers claim that WiFi, 3G, and WiMAX will complement each other.

[51] Fortt, J. Intel's widespread wireless vision. Mercury News, Jan. 27, 2004. http://www.mercurynews.com/mld/mercurynews/business/7806352.htm