Future of the wireless Internet

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May 28, 2003

Abstract

The mobile Internet is gaining features, but the market is still small and developing. This paper offers a brief view of the current situation and some of the near future's wireless technologies. It also speculates on what the consumers want from the wireless services, and who will be able to fulfill these needs.

1 Introduction

The Internet is slowly coming to a wireless space. Mobile devices are gaining more features, and at the same time the networks are evolving and offering ever higher transfer rates.

At the same time people are beginning to use wired broadband connections which allows richer content than before. Even though the mobile devices are lagging behind the desktop computers, people are beginning to expect the same services via wireless connection.

This development will lead to the GSM operators offering faster connections, both using the new mobile network technologies such as EDGE or UMTS, and wireless local area network technologies. As the GSM operators begin offering more complete access services, the Internet service providers (ISPs) will have to focus on providing content services, independent of the access provider.

2 Situation today

2.1 Mobile networks

There are currently four actual GSM networks in Finland. These networks are owned by Radiolinja Origo Oy, Sonera Corporation, Suomen 2G Oy and the local operator in Åland, Ålands Mobiltelefon Ab [1].

In addition to these four operators, there are several operators that use the other companies' networks as their physical medium. Although they offer some price advantages, these operators are typically much smaller than the ones using their own network.

A consumer has lots of options available. After one has chosen an operator, there are still several kinds of services available. Sonera, Radiolinja and DNA Finland (the service operator using the Suomen 2G Oy network) offer nine basic subscriptions. In addition there are several additional services and/or billing models that one can choose [2] [3] [4].

One of the basic principles in Finnish telecommunications is that the consumer should know, how much the call will cost. However, this abundance of choices has made it awkward to track the actual cost - especially since the cost is decided on several facts such as the time of day and the network the call receiver is in. The minute fee varies from less than ten cents per minute to over 30 cents per minute.

Some operators have tried to fight this complexity with simplified billing schemes. For example, Radiolinja has a subscription called "Aina" that uses a fixed minute price. DNA goes even further with its Maraton subscription, in which the subscription uses a fixed, monthly fee.

2.2 Internet access at home

Finland is claimed to be one of the front-runners in data and telecommunications. Nevertheless, most of the Internet users are still using a conventional modem access.

According to the Ministry of Transport and Communications, almost 60% of Finnish homes own a computer, and over 50% has an Internet access. Over half of these are using modem access. Different kinds of broadband services are becoming common fast, however: in spring of 2002 there were about 100 000 broadband subscriptions in Finland, in January 2003 the number was 270 000 [5].

The biggest Internet service provider (ISP) in Finland is Sonera [6]. The information is a bit old, but it shows, that three biggest ISP's have about 60% of the market.

The broadband connection costs about 50 euros per month. There is a stark contrast between this and the modem connections, which often cost only the price of a modem connection. Free ISP's had about 20% portion of the market in 2001, and it is estimated, that it has gone up since.

2.3 Internet access at work

I found no real data about the ISP market shares in corporate space. However, it can be estimated that the trend is the same as in private user space.

In corporate space there is a possibility for more consolidated services. For example, Sonera is offering communications products that combine fixed phone lines, mobile phones, data communications and services.

2.4 Internet on the road

The concept of Internet on the road is two-fold. On the one side is the actual mobile Internet - possibility of using Internet wherever you are. On the other side is the more

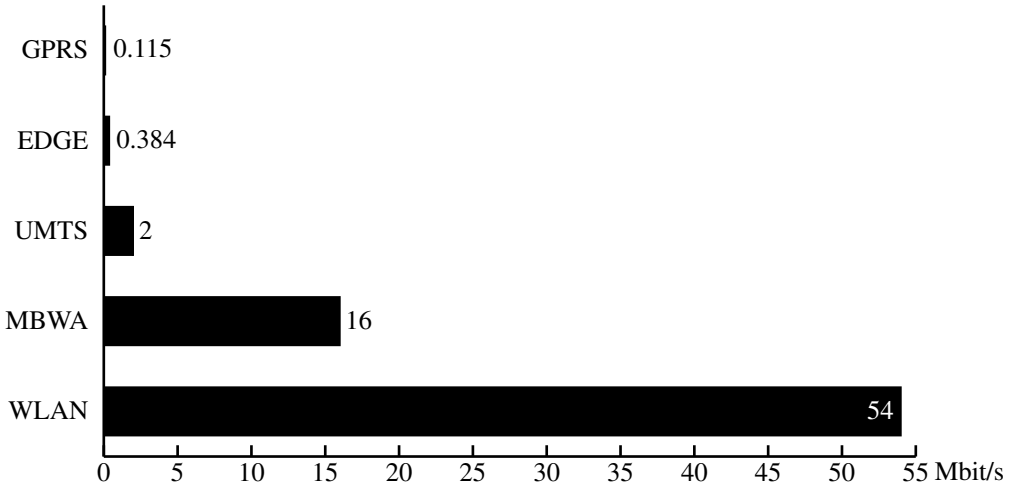

Figure 1: Speed comparison of the future wireless technologies

limited possibility of using the Internet out of office - for example, during a trip or while visiting a customer.

In practice, the mobile Internet is achieved through the mobile phone networks. All the networks in Finland support general packet radio service (GPRS), which offers packet switched data communications in mobile network.

Wireless connections are one of the ways of the Internet out of office. Some hotels, air ports, cafés and even private corporations offer a WLAN possibility. Some work by paying to the café or hotel owner, some offer the possibility of using a more permanent contract. Examples of the latter are Telia HomeRun (which also allows Sonera wGate users) [7], and on a world-wide scale T-Mobile on Starbucks coffee shops [8].

3 Future techniques

3.1 EDGE

The technology of choice for today's mobile networks is GPRS. It is an extension of the GSM specification that allows data transfer speeds of up to 115 kilobits per second. There is, however, a need for faster connection. One possible answer is EDGE.

EDGE stands for Enhanced Data rates for Global Evolution, and it is another extension of the current GSM technology. It uses a more advanced modulation technique that allows more bits encoded into a single channel. If one mobile device uses all eight time slots in the local cell, the maximum speed is 384 kilobits per second [9].

The EDGE architecture is designed to make use of the existing technology. It allows an easy way to upgrade the mobile network to higher data transfer rates: the base stations need upgrades, but the core network requires no adaptations. This makes it a tempting technology to upgrade to, while waiting for the 3G dream to come true.

Even though EDGE is slower than third generation networks, it can be used as a medium for 3G services, so it has been described as a sort of "3G Lite". In fact, some mobile operators have added the EDGE to their 3G portfolio; it seems to be easier to change the definition of 3G and upgrade the available network rather than build a new one from ground up.

3.2 UMTS

The GPRS and EDGE technologies are usually referred as 2.5G - the advanced second generation of mobile networks. At the moment the digital nirvana of mobile phoning is 3G; UMTS, IMT2000, WCDMA, whatever you want to call it.

The third generation promises more speed and more available capacity in the network. Universal mobile telephone system (UMTS) offers data speeds of up to two megabits per second, and the code division multiple access (CDMA) technology allows more users per network cell.

The downside is that 3G needs its own network. It uses a new frequency band, so the air interface has to be updated. In addition, even though 3G coexists with the GSM networks, substantial parts of the core network has to be updated [10]. It has been suggested, that 3G networks will not be available in the countryside - it makes no sense to build a new network in areas of low usage.

In addition to the costs of building the network, there is the cost of 3G licences. Several European mobile operators have made heavy losses because of the licence auctions - so far there are no 3G users, so there is no income, just expenses.

So far, Finland has no third generation networks open for public. However, there are some in Europe - for example, Hutchison 3G opened its "3" network in Great Britain in the beginning of March 2003 [11].

3.3 WLAN

The wireless local area networks (WLAN) are growing fast in popularity. The current standard is IEEE 802.11b, which allows speeds up to 11 megabits per second. However, the current wired local area networks work at speeds of 100 megabits per second, so there is a definite speed gap between wireless and wired medias. The future offers several alternative technologies to narrow that gap.

The IEEE is developing two different standards to allow higher speeds in wireless networks. One is 802.11a [12], and the other is 802.11g [13]. In addition, there is a European standard, HiperLAN/2 [14]. All of these offer speeds of up to 54 megabits per second, but there are definite technical and economical differences.

The 802.11a is probably the most ready for market. It is an approved standard, and there are already lots of equipment for the 802.11a networks. There has, however, been some problems with the standard coming to Europe: the 802.11a uses 5 GHz frequency, which has been partly subject to licensing. In addition, Europe has a bit stricter regulations than

in the United States, which is why the IEEE is developing an extension called 802.11h that can be used in Europe also.

The 802.11g standard is still in proposal state. The main difference between 802.11a and 802.11g is that the 802.11g is promised to be compatible with the current 802.11b standard. 802.11g uses the same 2.4 GHz frequency as the 802.11b standard, and the old devices should be able to connect with the new, 802.11g base stations - and vice versa. Unfortunately, 802.11g also has some of the limitations of the 802.11b, such as inefficiency in high density networks.

The HiperLAN/2 is a standard developed by European Telecommunications Standards Institute (ETSI). It differs quite radically from the IEEE standards. For example, it uses a time division multiple access (TDMA) where as the 802.11 standards use carrier sense multiple access with collision avoidance (CSMA/CA). The maximum throughput of HiperLAN/2 is estimated to be 42 megabits per second, much higher than the 802.11a estimated throughput of 18 megabits per second [15].

Even though it seems that the HiperLAN/2 is more advanced than its 802.11 counterparts, it seems that the Europe is also adopting the 802.11a (or 802.11h) standard. The 802.11a is already available, and the 802.11g will be compatible with the old networks. HiperLAN/2 is neither.

3.4 MBWA

In addition to the mobile networks and wireless LANs, there is some development on defining a combination of both. The IEEE 802.20 working group is defining a standard called Mobile Broadband Wireless Access (MBWA) [16].

The MBWA definition is targeted to the needs between the mobile cellular networks and the local wireless networks. It should be able to cover metropolitan areas, and allow mobile device movement of up to 250 kilometers per hour, and it will allow global mobility.

The MBWA is designed to use a licensed frequency of 3.5 GHz, and it will allow user data rated of up to 16 megabits per second. It will be purely IP based, and in that sense mostly used for data applications.

The 802.20 standard is, however, still in the drawing board. The project timeline promises that the actual MBWA standard should be ready in December of 2004.

4 Future trends

4.1 More mobility

One of the current trends - that we can estimate to continue in the future - is the advance of mobility. People are using more and more electronic devices, and they want to be able to access the network with them.

Even though there has been a definite downturn in IT investments, portable computers has

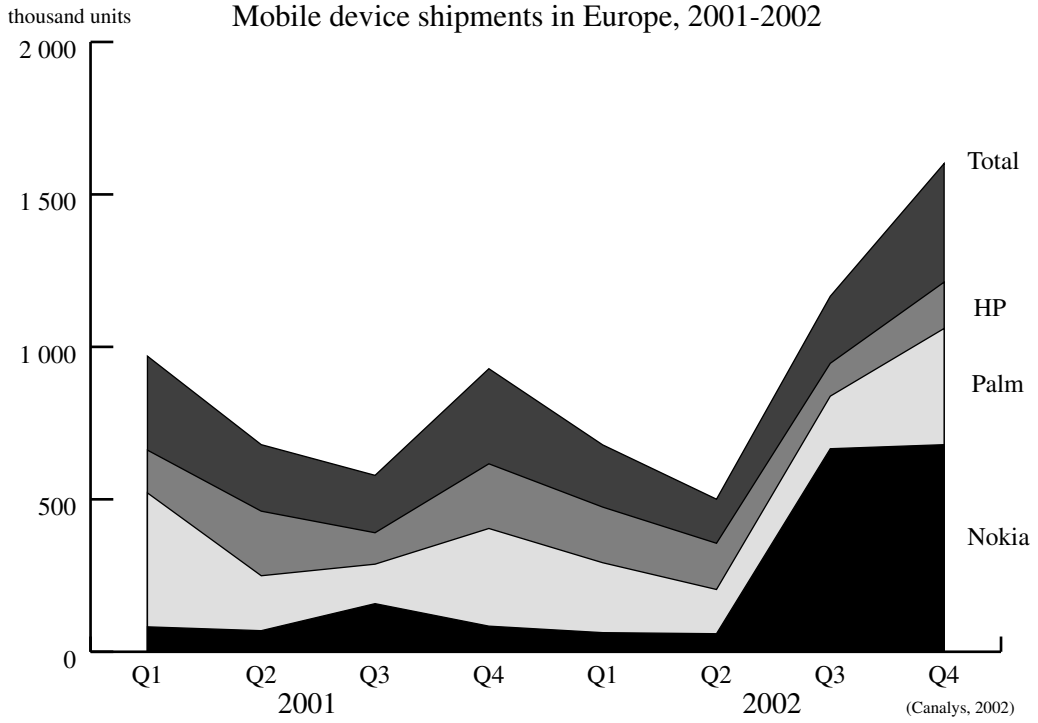

Figure 2: Portable device market has grown fast since the announcement of smartphones such as Nokia 7650. [18]

been one of the markets that keep on growing. This has hold true for several years now, and there is no reason why this development would end - or even slow down. Portable computers offer most of the features of the current desktop computers in a sleek package and almost comparable price.

As the mobile network connection becomes more common, it breeds also new services that take advantage of it. There will also be new ways of taking advantage of the mobile connection. For example, Personal Mobile Gateway by IXI uses a single connection module that offers network connection for different kinds of devices via Bluetooth [17].

4.2 Constant access

Even as the computers are becoming smaller, in the other end of the scale the mobile phones are gaining more and more features. There is a growing market for smartphones and other portable devices (see Figure 2). This market also promotes the use of mobile networks and constant Internet access.

These devices are suitable mostly for viewing data. They usually have a restricted interface: a small keyboard or a stylus driven interface with character recognition. However, they are excellent utilities for reviewing data from some other source, such as the Internet. A typical use case could be the e-mail.

Smartphones, such as Nokia Communicator 9210 or Sony-Ericsson P800, are already

showing the benefits of a computer-like mobile device with a constant access to the Internet. As more people get used to using the Internet, and the portable devices become more common, the need for mobile Internet services gets even stronger.

4.3 Need for speed

In addition to constant access, there is also a need for getting faster connections. We have seen this development for some time now: the textual gopher service was replaced by WWW, which allowed pictures. Now we are slowly moving towards even more multimedia; for example, Macromedia claims that 98% of the WWW users are able to view Flash content, such as animations [19].

This development towards richer content can also be seen in mobile space. The GSM phones started with speech and text messages, then they got wireless application protocol (WAP). The GPRS made it possible to develop multimedia messaging (MMS). Now some phones even include a built-in camera and allow short videos [20].

There is a constant race between the network technologies and the services. As the networks get faster, the services begin to use more bandwidth.

4.4 Simplicity

To make a service popular, it has to be simple enough. The rationale for this is evident - the simpler a service is to use, the more it has potential users.

Mobile phones are popular, and the basic services are easy to use; most people know how to dial a number or send a short message. Sound Partners, for example, predict that the Short Messaging Services (SMS) will keep on growing worldwide until at least 2006 [21].

However, more advanced services are still waiting for the breakthrough. The WAP was supposed to be a platform for new services, but according to a study by Ministry of Traffic and Communications, it has not made a dent to the success of the SMS [22].

There might not be enough users for more specialized services, or they might not be practical in current networks. However, as the data rate goes up and the mobile devices evolve, it becomes easier to build more accessible, interactive services.

5 Access separates from services

5.1 Network needs roaming

It seems that there will be several network architectures in the future. Even though the telecom operators are developing and marketing 3G, it is not a "one size fits all" solution.

As far as the mobile, cellular networks go, it seems that the 3G will be confined to densely populated areas. In the countryside the operators will probably keep on using the GSM network, because it provides enough capacity for most uses.

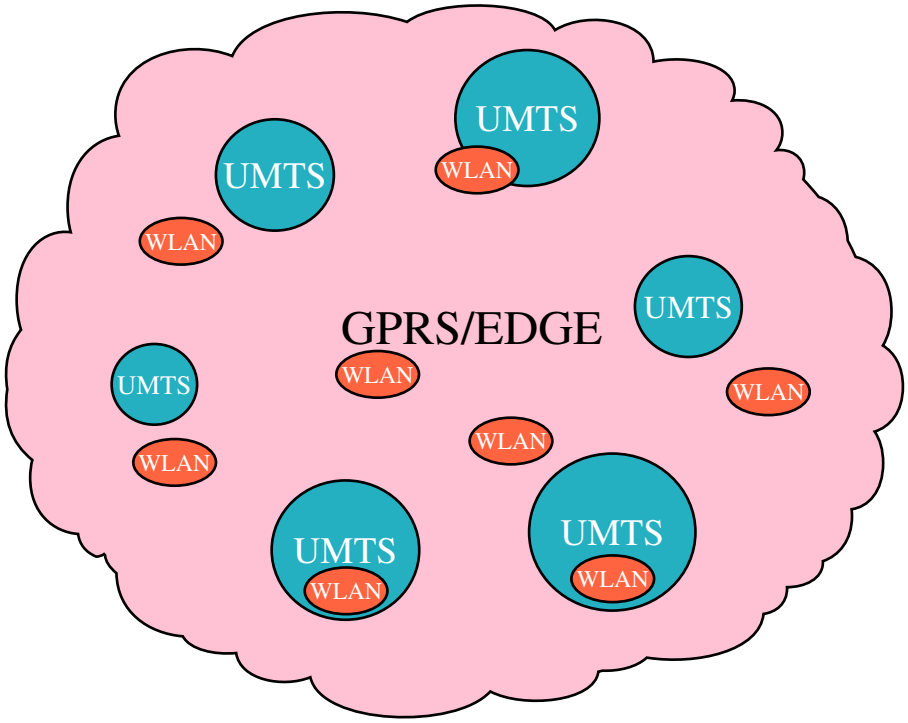

Figure 3: Several network technologies bring the need for inter-technology roaming

It also seems that for now the promises of speed leave unfulfilled. International Telecommunications Union (ITU) defines 3G as, among other things, a network able to offer data transfer speed of at least 144 kilobits per second and two megabits maximum [23]. In practice the first networks in United States promise maximum speeds of 144 kilobits per second, and fail to deliver even that [24].

This means that in addition to 3G there will be a demand for both lower speed but wider area networks, and also higher speed networks. To make this scheme successful, the operators must allow people to roam from one network media to another seamlessly.

5.1.1 One for all

Even today there are several networks working together - in mobile space there are 900 MHz and 1800 MHz versions of the GSM network. Most of the mobile phones are able to use both of these networks, and change the network as necessary.

There is no real reason, why this could not happen in the future as well. Different network technologies can work quite well together: for example, the Nokia D211 data card offers both GPRS and WLAN connectivity in one expansion card for a computer [25]. At least in data communications one possible way of handling the mobility might be Mobile IPv6 [26].

However, the inter-operator roaming between networks has traditionally been used mostly to give mobile networks coverage abroad. Are the operators willing, or even able, to co-

operate? Although the WLAN does not necessarily need the roaming ability, it might enhance the services, if one could always use the fastest network connection available.

It seems that the GSM operators have an edge here. The GSM/GPRS network has the widest coverage of the wireless network technologies, and it will be so for some time. That makes it a logical backbone for the co-operating networks.

There is also the question of customers. Nowadays one may have several communications service providers: one for a fixed telephone line, one as an ISP, one as a mobile operator. The GSM operators already have over four million subscribers in Finland. The customer might even be willing to pay a bit more for the service, if it makes his life simpler. As stated in Sec. 2.3, operators already offer this sort of bundles in corporate space.

According to a telecommunications consultancy Analysys, in Europe the fixed and mobile operators will also be the dominant force in WLAN hot spots [27]. For now, though, the hot spots in Finland are few, and it seems there is no possibility of roaming.

5.1.2 The will and the way

The GSM operator may be the logical choice for maintaining the WLAN hot spots or possibly the future MBWA network. However, there are some political concerns that might slow the development down.

The most obvious reason for reluctance is the 3G networking. GSM operators have invested huge amounts of money to build a new cellular network, and the faster WLAN might slow the user acceptance of the new network. On the other hand, big Finnish GSM operators, such as Sonera and Radiolinja, see the WLAN as a possible complementary technology on the side of the actual mobile networks [28].

It remains to be seen if the operators are willing to build their own WLAN networks. Another possibility would be co-operation with ISPs or other, more focused operators - although the same corporations that own the GSM operators also operate as an ISP.

Whoever builds the actual networks, it seems that the customer relationship for the access will be with the GSM operator.

5.2 Connection needs content

Even if the network technology is top notch, it has no use if there are no services that take advantage of it.

The count of ISPs has gone down during the last few years [5], and this development may well continue. If the GSM operators are willing to provide the access to the network, it is possible, that ISPs are left with providing the services.

The network and services are already divided into different companies, even though there are close ties between them - for example, DNA Finland Oy is just one of the service operators in the networks owned by Suomen 2G Oy. Both of these companies are owned by the Finnet group.

The development of new technology opens up new possibilities for the services. This might also open up the networks for all kinds of operators. The Ministry of transport and communications has explored the possibility of the ISPs offering services in mobile phone networks, and it seems there is willingness of co-operation on both sides of the fence [28].

5.2.1 End of the free

So far, the Internet has offered lots of services for free. At some point this has to change: the companies want to get some revenue out of their efforts, and the Internet will not work on voluntary efforts alone.

This change is already visible. Even though there are free e-mail services, such as the Hotmail (`http://www.hotmail.com/`) or Yahoo (`http://www.yahoo.com/`), the basic service is limited, and to get rid of the limitations you have to pay. For example, Hotmail offers only two megabytes of free storage space, after which it starts deleting the messages. Some of the free services have gone out of business altogether - take Iobox (`http://www.iobox.com/`) for an example.

The network allows richer and richer content, and this also wakes up the content providers - be it movies or music, media corporations want their share. This might open up possibilities for the ISPs or other service providers: the corporations creating the content may not be the most apt for customizing it for the mobile use or Internet. One example of this kind of business is the Wireless Entertainment Services Finland Ltd. (`http://www.wes.fi/`).

It is certainly possible, that the GSM operators, or the companies in close contact with them, will keep on offering the basic services, and that there will be a number of smaller companies focusing on more customized services.

6 Conclusion

Currently, there is a trend of upgrading the Internet connections from slow modem links to speedier broadband connections. One reason for this is the better usability of the faster transfer rates, and there are also some financial advantages, such as a fixed fee.

At the same time, mobile devices are becoming smarter and more common. As people get used to fast Internet access on their desktops, they will start demanding something similar for the mobile devices.

There are several technologies that will be used in the near future for providing a fast wireless access. Some of these technologies are meant primarily for mobile phones, others are designed for data use. As there is a need for both content and connection, these technologies are of interest to both the GSM operators and ISPs.

During the next few years, the wireless market will, in my opinion, arrange itself into two different roles. On the one side there are the access providers that offer the actual connection. On the other side are the service providers that make use of the possibilities the network offers for content.

The GSM operators have an edge in providing the access: they already have a network that covers large areas, and they have over four million customers in Finland alone.

On the other hand, it seems that the ISPs are faster to pick up the market trends - in contrast to the bigger and slower moving telecom operators. This might make them suitable for providing services to more focused user groups. However, the number of ISPs has gone down during the past few years, and this change of role will probably reduce the count even more.

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