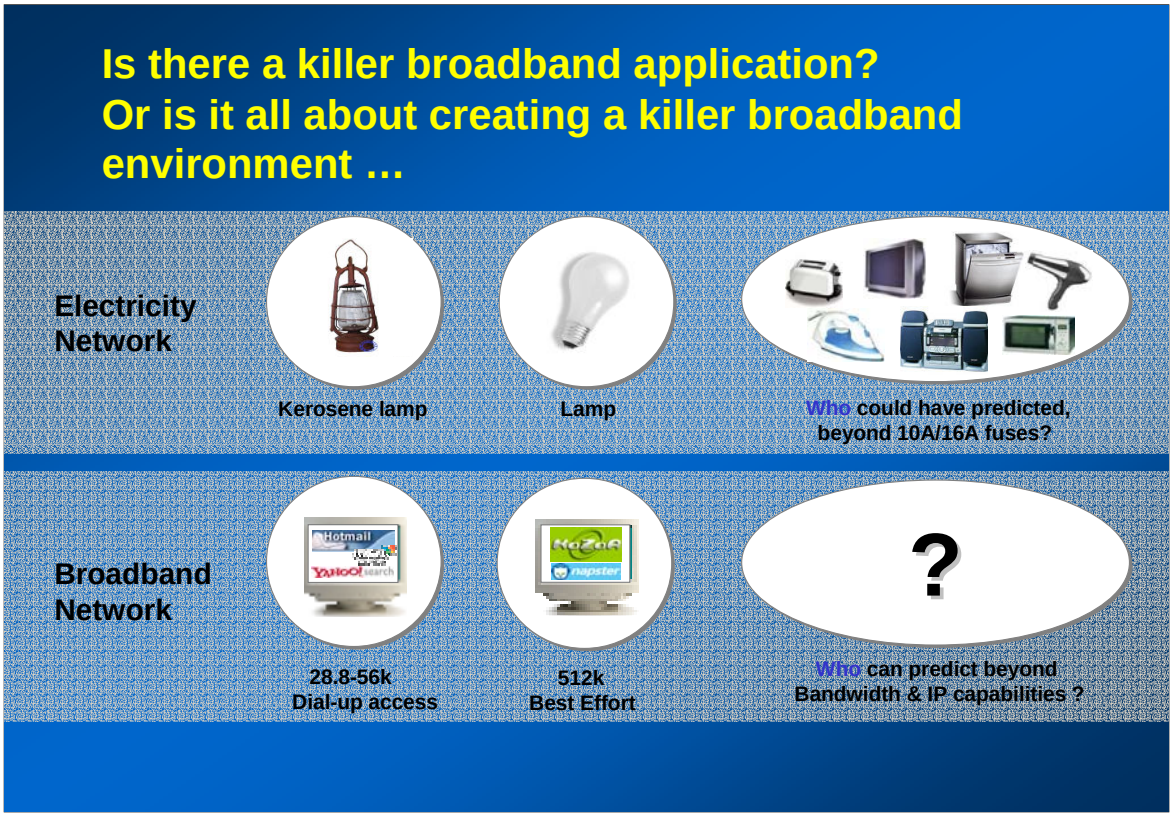
Mr. Toru Nagasaka, Session Chairman

Our second speaker this morning is Mr. Stig Persson from Ericsson. He is general manager of Broadband Access and Broadband Service in Business Unit System. He also has been leading the broadband technologies. Mr. Persson will present to us an overview of broadband applications including devices and services designed for home networks, such as multi-service gateways and interactive television. He will also introduce access technologies to the residential market and broadband technologies inside individual homes. Mr. Persson please be so kind to start your presentation.

Mr. Stig Persson

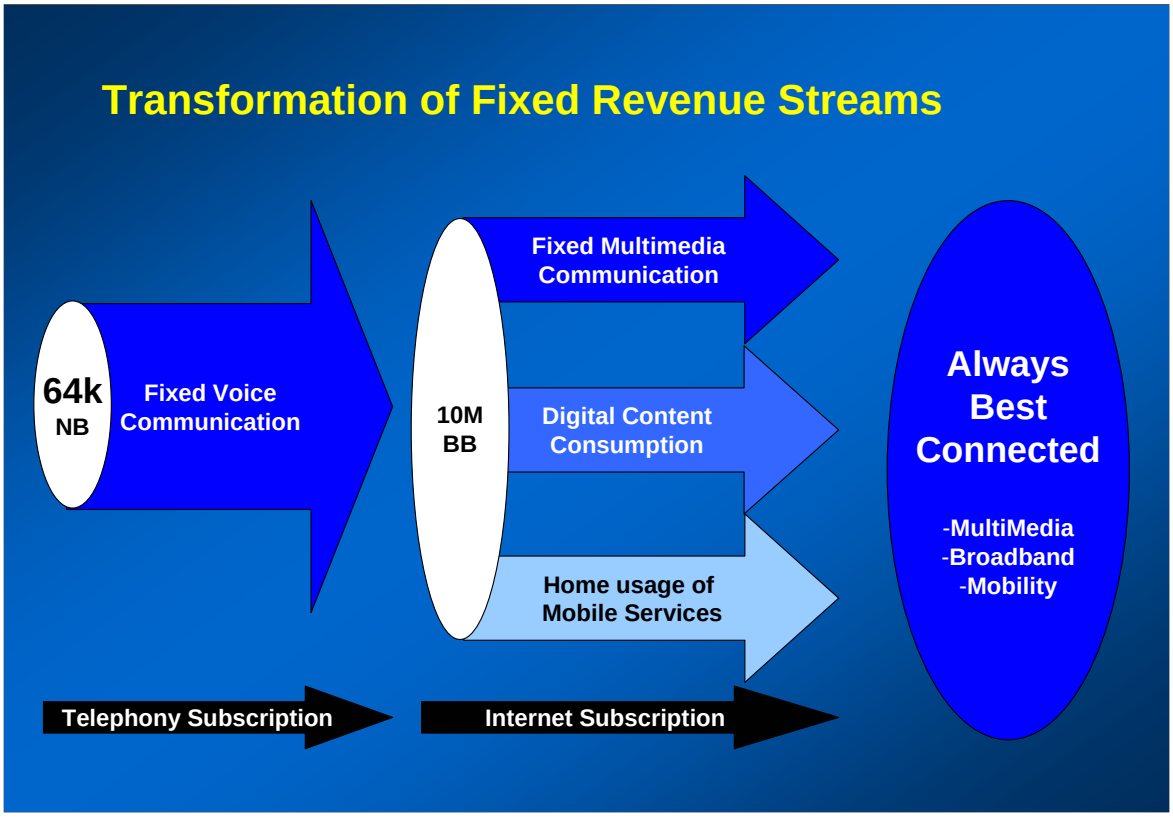
Good morning.

I am going to present Ericsson's view on the future when it comes to broadband. We see a future both for the fixed and for the wireless. In the next 10 years there will be an evolution you never have thought about 4 or 5 years ago.



If you take this slide and think about what happened 130 years ago when the electric lamp was invented. In those days you did not have any clear view of the future of electricity. The starting application in the electric network was the lamp. It was used as a tool to have a better environment in your home or at your business. After that we have witnessed a lot of new appliances and industries to utilize the electricity network.

We can take the same similarities and look, what happened in broadband networks and in the internet, which was invented in 1972 with a first connection between Santa Barbara and San Francisco. Then 6 to 8 years ago we started to introduce internet with a dial-up access covering speeds up to 56 kbit/s. In the future, we expect to see the speed to go up much higher and new industries will enter this arena. The picture and TV will become the important applications.

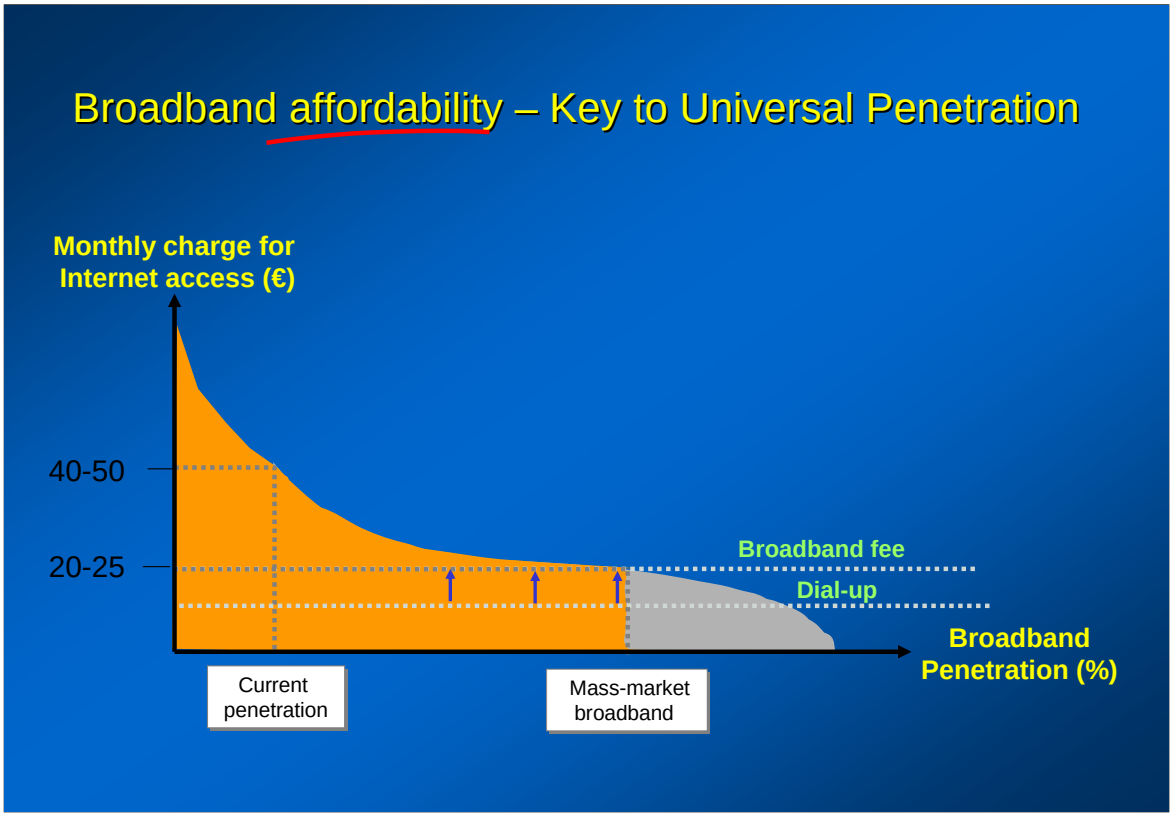


The telephony network was invented back in 1876 by Alexander Graham Bell. So it has been with us for almost 140 years. Now we can see that internet is going to take over the telecommunication network rapidly. There is demand for higher speed in the network. For the next couple of years we can expect a speed with a minimum of 10 Mbit/s for each subscriber. There will be a split between two or three different types of communication services.

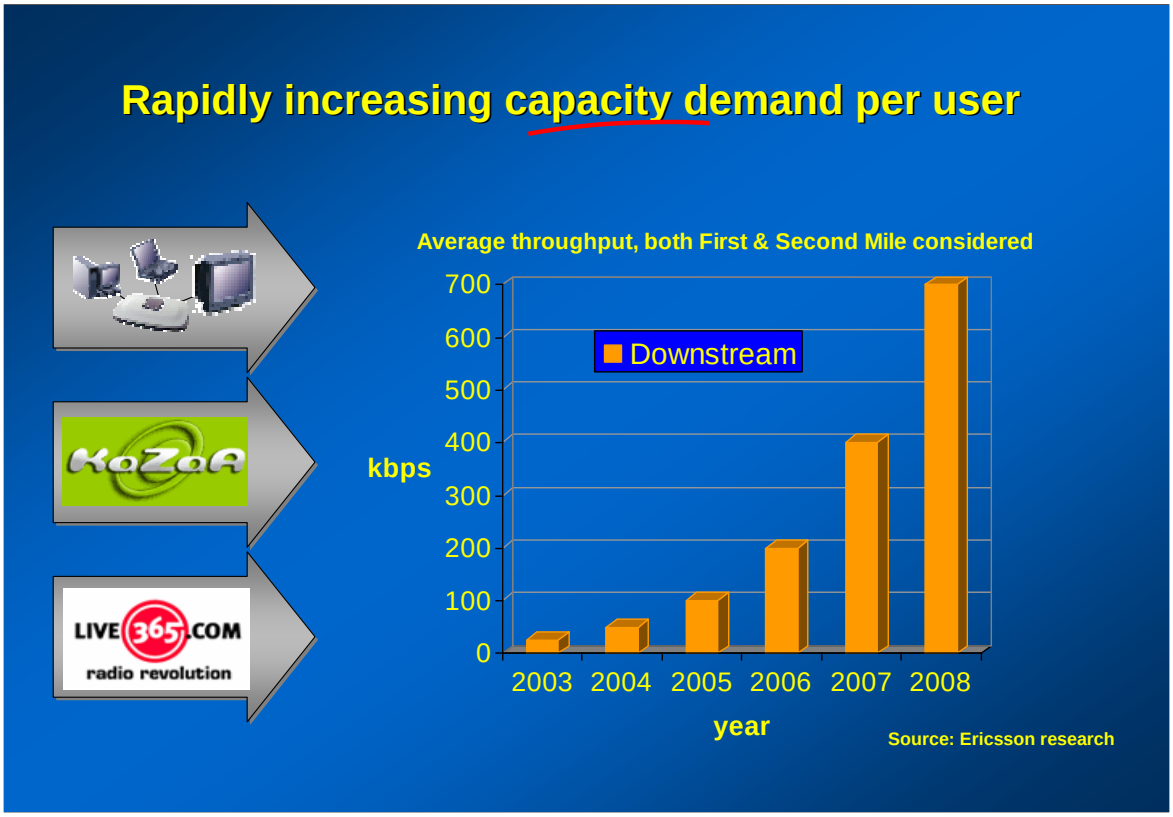
Digital content: That is where today's TV normal in most of the houses in the world will evolve to another TV. Another change will occur with the regular telephone which will become more media rich. You will see more functions like video telephony. There will also be a lot of new appliances or devices in the network.

The important thing in the future is to have a network where you can always be best connected with all your devices. Therefore broadband will take a major part in this scenario together with the evolution of mobility. Today we use the mobile networks mainly for voice, but in the future it will be used for all the services the fixed broadband networks are used today.

We can expect in the next 10 years or so to have a connected home. The important point in that connected home will be some type of intelligent device. Today we call it the residential gateway, which you can see in the middle of the picture. That box, a kind of communication center or hub, will be connected to various devices, such as a video recorder, a TV or a media center to store your data and pictures. You may even expect in your future home a wireless base station as a connection to the mobile wireless network.



Here you can see that up to now broadband has been really expensive. But based on the competition the price will quickly go down from €50, which has been the common price for a 512 kbit/s connection in Europe. As you could hear in the presentation from NTT, even the fiber access is down to €30. In the next 3 to 4 years you can expect, that under the changing market conditions the cable industry wants to expand their business. They want to introduce Voice-over-IP (VoIP) services and to compete with the traditional incumbents like BT, France Telecom and RBOCs like SBC and BellSouth, which have controlled this market for 140 years. The only way for them to survive is to start to compete in a very good way.



We can expect in a very short time frame from now until 2008 for the fixed network, broadband and distribution of digital TV will be the killer application. From that point you have to deploy fiber further out to be in the fiber deep pocket access architecture. So when it comes to your industry, in the short term you can see good signs and the “light in the tunnel”.

One of the basic drivers for this is a rapidly increased number of power users in each household. There will also be introduced a number of new applications. In the middle you can see an application called Kazar, which is a P-to-P connection. Today there are a lot of P-to-P connections in the fixed broadband networks. In Sweden the broadband users are downloading around 30,000 movies each night in an illegal way. That is a huge application, which requires a lot of bandwidth.

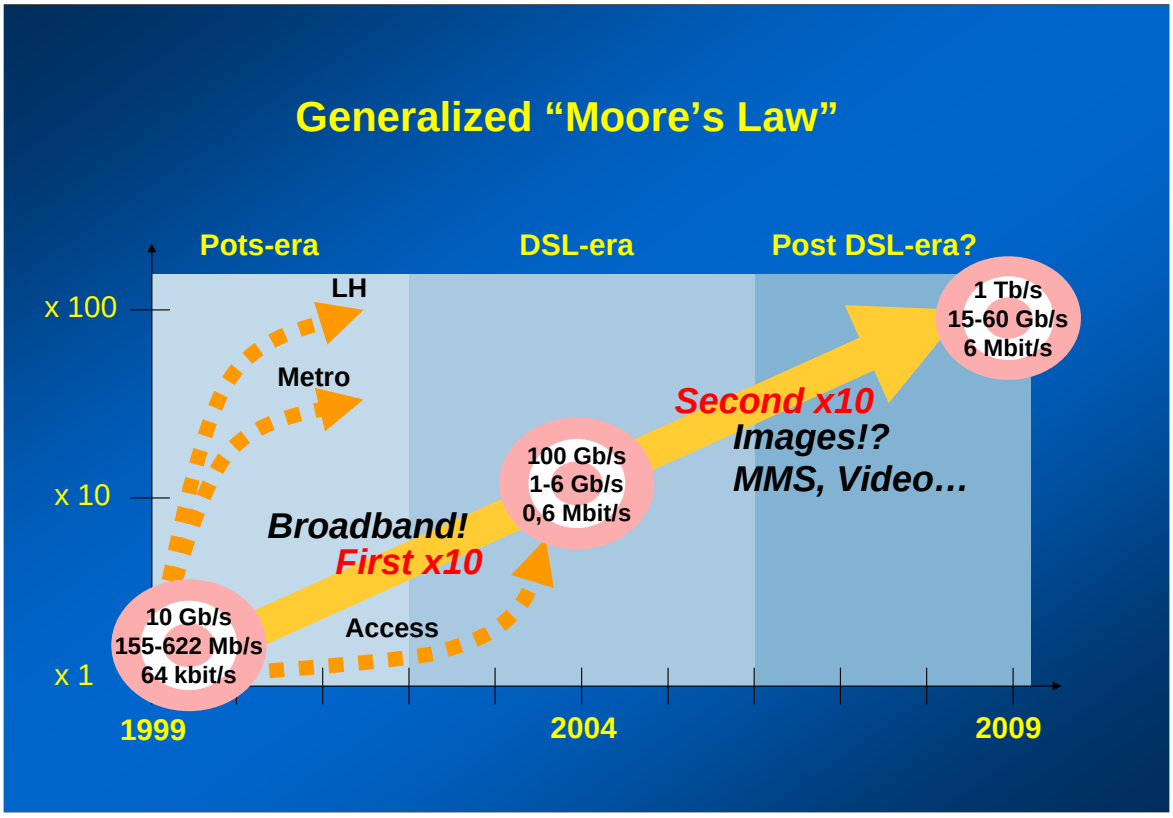
TV and radio distribution is going to be an even more important application in the network.

The US market will become deregulated already in 2006, when it comes to voice. When this happens then the cable TV players will start to sell VoIP services. SBC, Verizon, Quest and BellSouth, the 4 big RBOCs, have to build the appropriate architecture, so they can start to distribute digital TV. Even in that case starting late in 2005 to 2007 they will offer bandwidth around 20 to 25 Mbit/s per customer. So they can distribute 1 HDTV channel and 2 or 3 traditional TV channels over the copper or fiber architecture.

Broadcast Application Overview

- **Low Speed Streaming – MPEG-3**
  - Broadcast radio (128-192 kbps)
  - Financial News, e.g. Reuters
- **Medium Speed Streaming – MPEG-4**
  - Distance learning (384 kbps)
  - PC-TV (1024kbps)
- **High Bandwidth Streaming – MPEG-2**
  - Broadcast TV (4-5.5 Mbps)
  - NVOD (3.5-4.5 Mbps)

Here you can see some types of broadband applications. The killer now here is that we really are going to have traditional TV distribution applications. But it is also coming to new high definition TV. The bandwidth requirement for this service is 270 Mbit/s, with appropriate coding mechanisms this can be lowered to 20 or even10 Mbit/s. This leads to much more bandwidth in the access than what we have experienced recently.



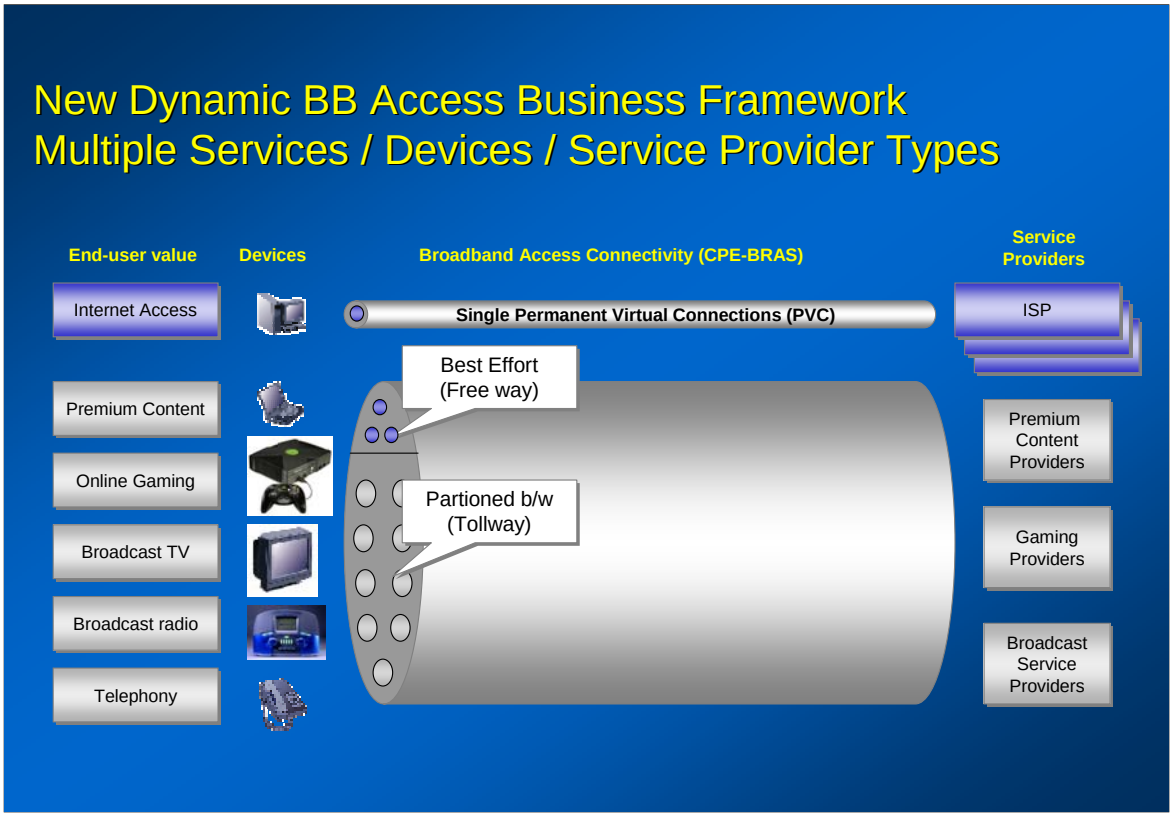
Here is what you have to expect when you plan your future in your business. After the internet bubble burst in 2000, at that time it was common to have 10 Gbit/s in the transport network and 155 or 620 Mbit/s in the metro network. In the access network the speed was 64 kbit/s. We see and plan now for the future transport network 1 Tbit/s, in the metro network 15 to 60 Gbit/s and in the access network 6 to 8 Mbit/s for each customer.

Why is that? You can expect that the digital TV is going to change the environment rapidly in comparison to the situation today. Images are another reason. When we start to introduce images in the wireless network we will need much more bandwidth than today. Image and video will be the killer applications for you, which will drive your business in the next 10 years.

Multi-Service Gateways – base for Home Networks

- **High Performance DSL**
  - ADSL2, ADSL2+, EFM-VDSL
- **Integrated Home Networking**
  - 4*Ethernet 10/100BASE-T
  - 802.11 b/g (optional)
- **IP Multi-Service enabled**
  - Multiple PVCs
  - Upstream Shaping, DHCP
  - Routed and Bridged options
- **Secure protection of CPN**
  - Built in Firewall
- **Remote Provisioning Support**
  - Light weight protocol, e.g. DHCP 121
  - DSLF TR-062 and its evolution

There will be multi-service gateways. That box in the middle has to be supported by different types of technology. I think it will be wireless in the home, but it will also be fiber to the point.



You can see a clear trend for the future, where we need a better network. High speed internet access is the service to look for. But for the players in this business to have a chance, they must have an access network system, so they can start to sell both best effort free way services and tollway services. If you want to distribute digital TV, then you need to have functions so you can bill an account for TV service. In the same way, if you want to introduce popular game services you need to have a very fast network and also the possibility to assure that each user has the right functions such as low latency.

Digital TV Situation – Opportunity

- **Unique Value Proposition**
  - Increased Channel Offering – niche channels / personal package
  - All TV sets supported – personal viewing
  - Time-shifted TV/Radio – no Hollywood fees for operators
  - On Demand Services – Archived material
- **Analog Satellite TV replacement**
  - Eliminate satellite dish in MTU areas
  - Get rid of dish and limited programming
- **End of life for analog terrestrial**
  - Digital Terrestrial limited to 50 channels
- **Satellite dishes forbidden in certain markets**

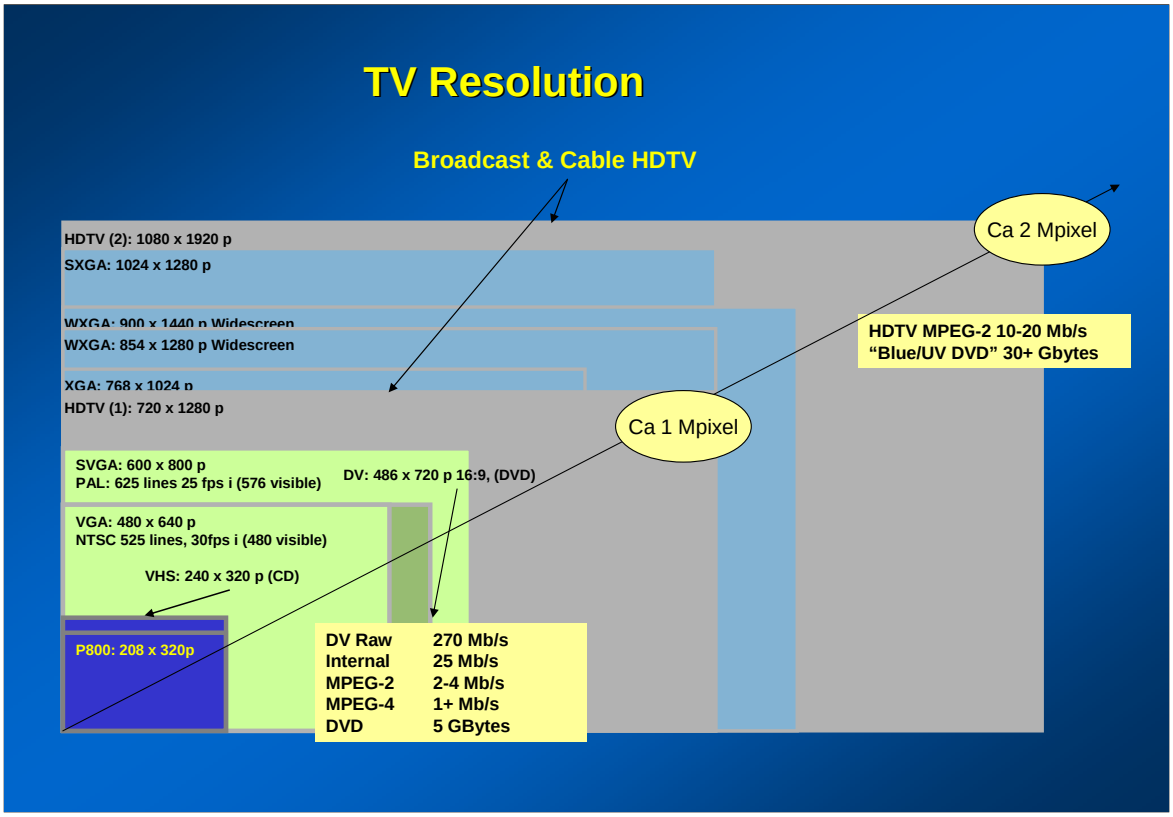
Broadcast Situation – Base for advanced offerings

- Broadcast required as Basic Service in any Video offering
- Premium Sports TV shifting to PPV (Football, Hockey)
- Satellite distribution remains MPEG-2 in the near term
- Bandwidth performance
  - 4Mbps PAL today moving towards 3-3.5Mbps
  - MPEG-4 technically possible but not mainstream for TV Broadcast
- Hybrid Set-top-boxes might evolve
  - Digital terrestrial (Basic Channels) & IP (Premium channels on iTV)
- Internet Radio Broadcasting with CD quality

On a 100 Mbit/s network you can begin to distribute new types of applications such as TV and media rich applications, including DVD movie and music distribution. It is inexpensive and there are huge opportunities for new applications.

Here I show you some ideas we in R&D at Ericsson expect from a wireless network in the next 10 years.

First, I want to point out what will happen with the mobile hand set of the expected 2 billion users. The handsets will be quite cheap, so that they can be sold in the emerging markets, for example in China and India. Asia will be in the driving seat when it comes to wireless network evolution, both in terms of users and deployment.


TV Resolution
Broadcast & Cable HDTV
HDTV (2): 1080 x 1920 p
SXGA: 1024 x 1280 p
WXGA: 900 x 1440 p Widescreen
WXGA: 854 x 1280 p Widescreen
XGA: 768 x 1024 p
HDTV (1): 720 x 1280 p
SVGA: 600 x 800 p
PAL: 625 lines 25 fps i (576 visible)
DV: 486 x 720 p 16:9, (DVD)
VGA: 480 x 640 p
NTSC 525 lines, 30fps i (480 visible)
VHS: 240 x 320 p (CD)
P800: 208 x 320p
Ca 2 Mpixel
HDTV MPEG-2 10-20 Mb/s
"Blue/UV DVD" 30+ Gbytes
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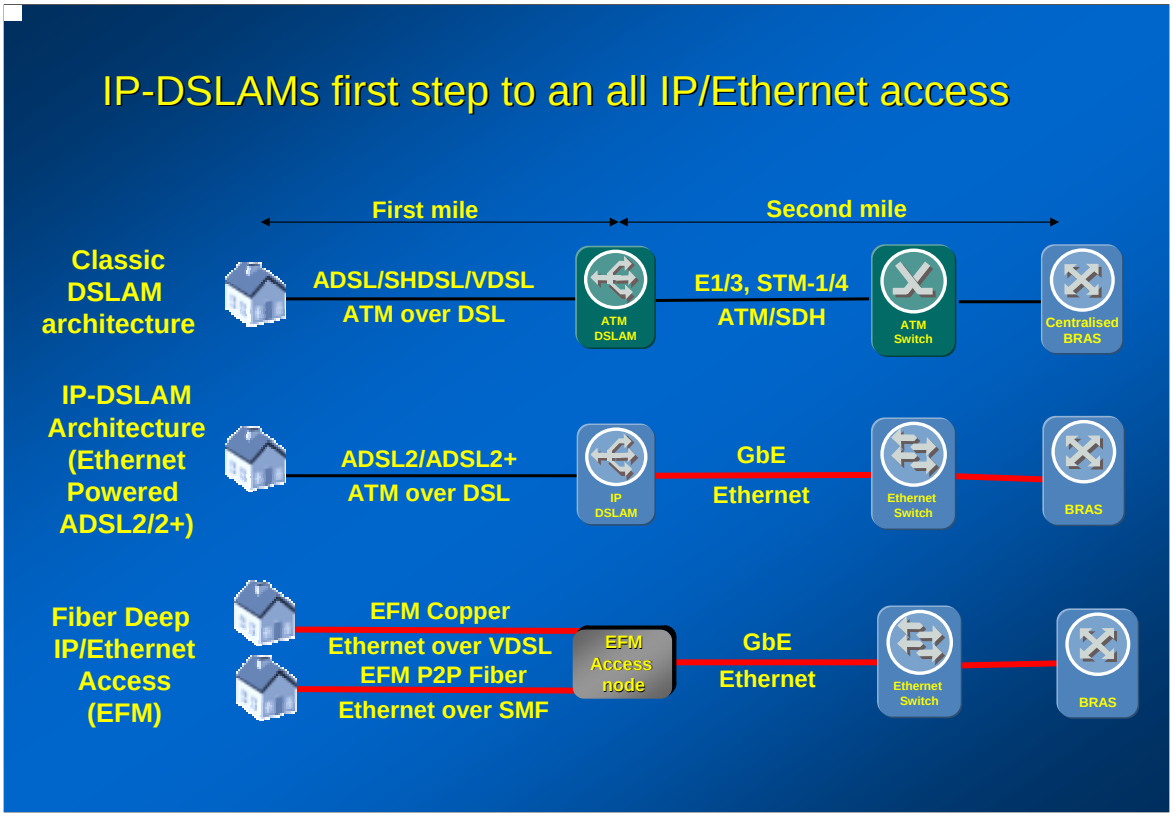
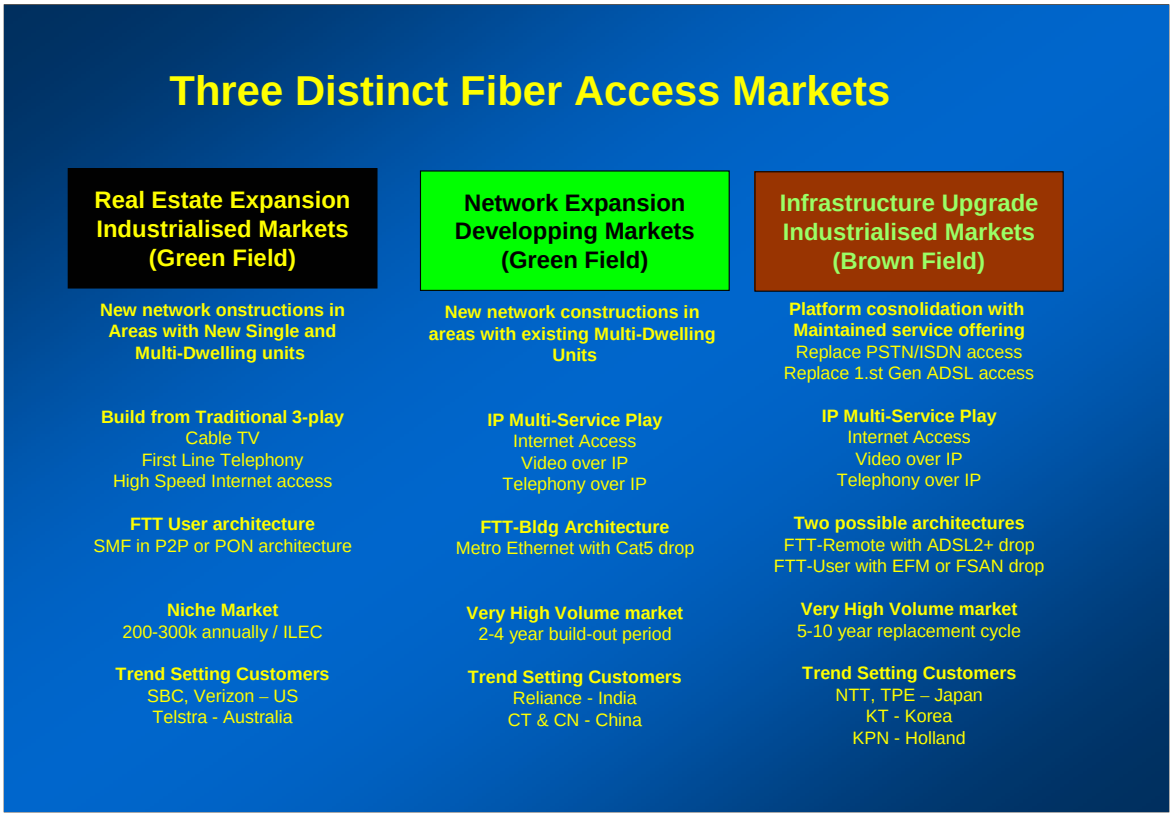
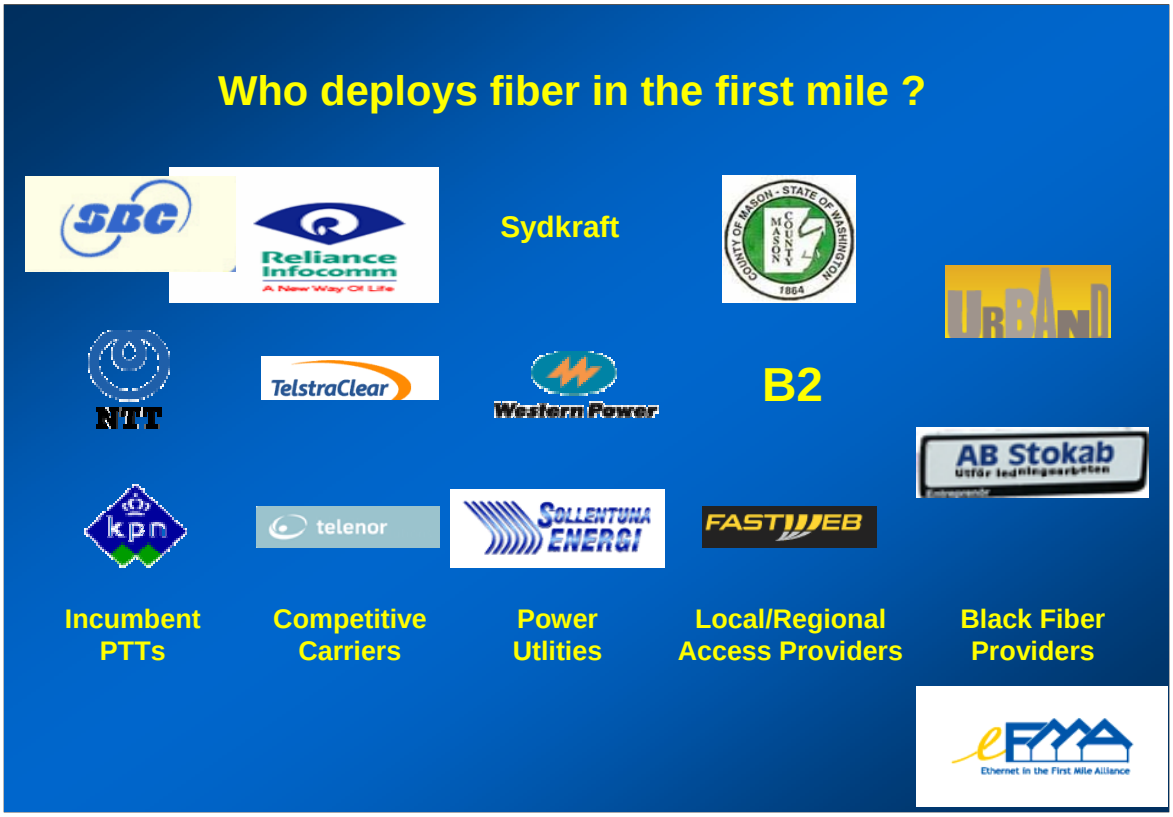
MPEG-4 1+ Mb/s
DVD 5 GBytes



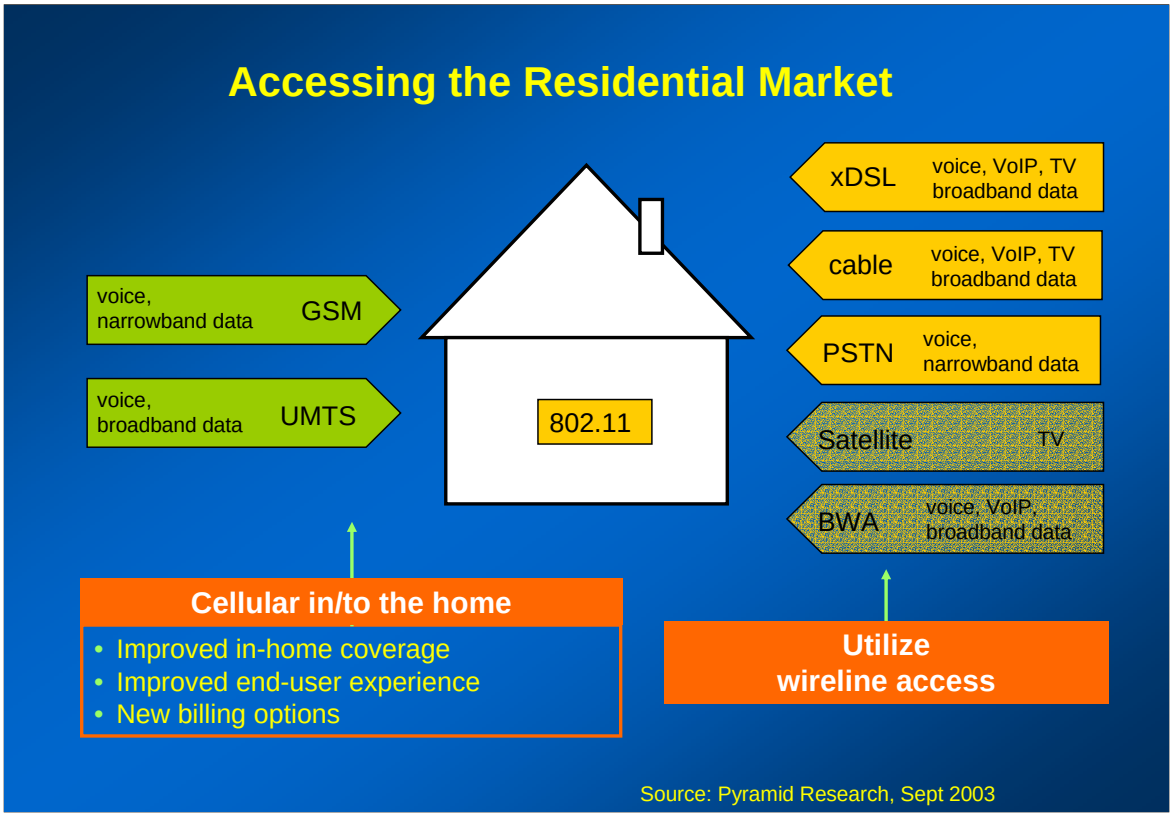
So far during the last 6 to 7 years it has been DSL technology which has been deployed to expand the capacity in the copper network. It was also ATM to be used between the first mile point and the second. During the last 1½ years there is a very clear trend to go to ADSL plus and Gbit Ethernet to reduce the number of bottlenecks in the network. In anticipation of digital TV we expect that there will be Gbit Ethernet over fiber to some kind of new access node. That will be coming quickly.



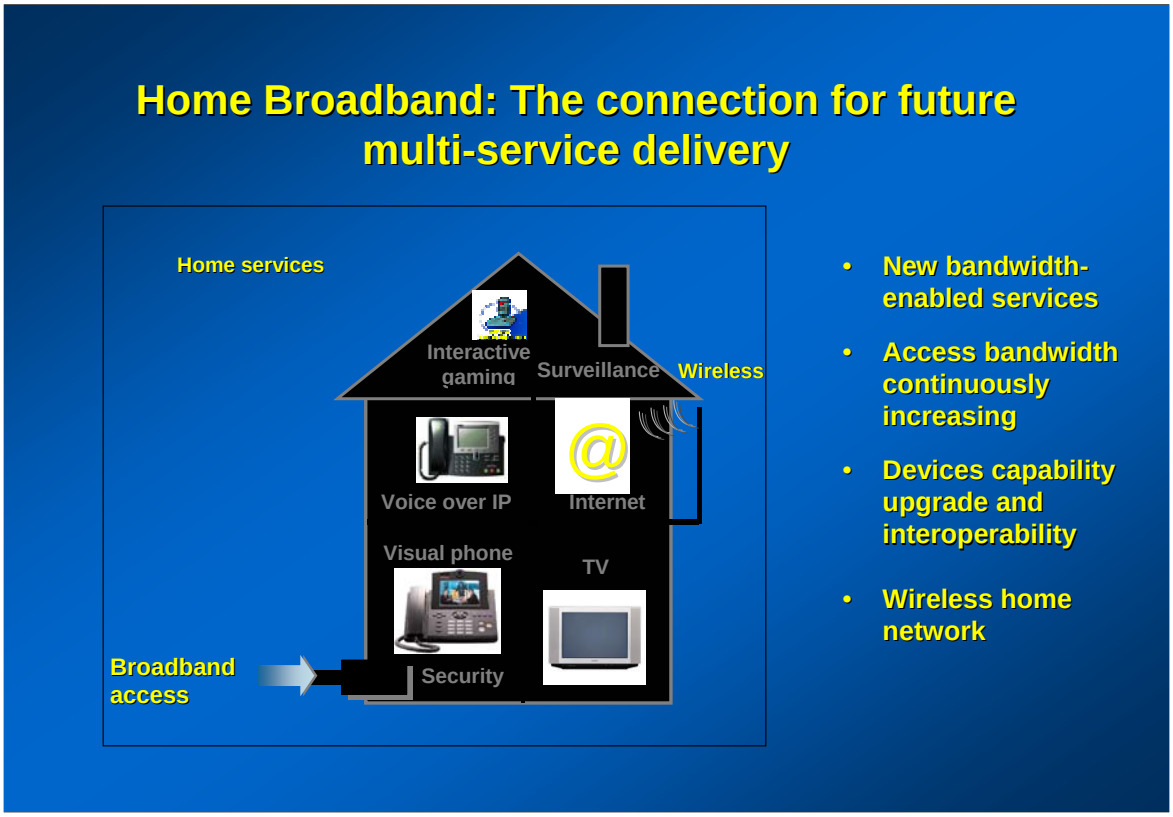
If you look into a house today, there are many possibilities to feed a house with communications services. You can use traditional copper networks. You can also use satellite networks and broadband wireless access solutions, high speed radio access solutions. There are a number of possibilities to sell services. Competition is the only way to drive this market in a cost efficient way.



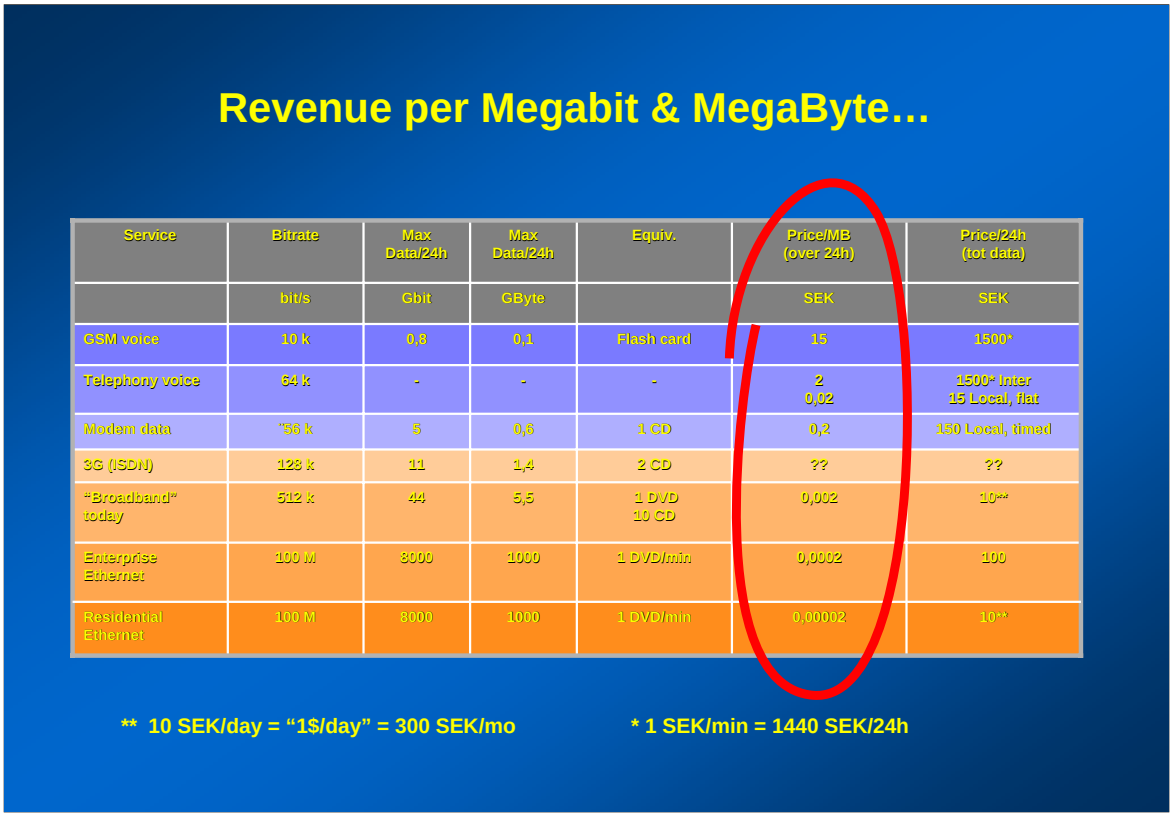
Comparing the situation in 1996 to that in the year 2000 when the first internet way was introduced, you see that now there are better chances because there is more competition than before.



Looking back over the last 130 years, there were mainly fixed telephony networks today covering 1.3 billion users. This can be compared with the situation in 1981, when the first analogue mobile telephone service was introduced, and in 1991 when the first digital wireless system was introduced. It took that wireless network 10 years to pass the first billion users.



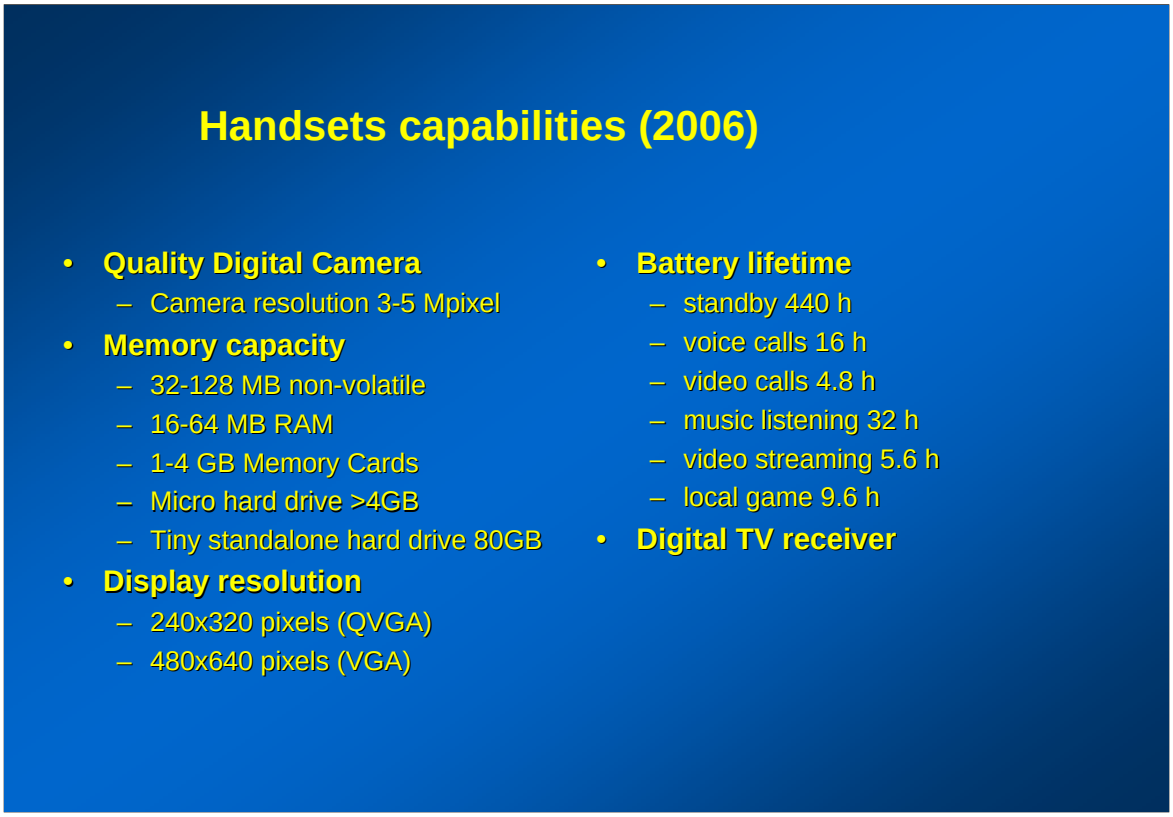
We expect to reach 2 billion wireless users in late 2006 and the third billion users to be reached in 2011. That means that over time the fixed telephone users will become mobile users.



So providers of fixed telephone services must look for other applications to be provided over their networks.

Looking back to 1932 and the Dick Tracy comic strips and his high-tech watch, we see it being realized soon. We expect a huge development in handsets, their design and style.

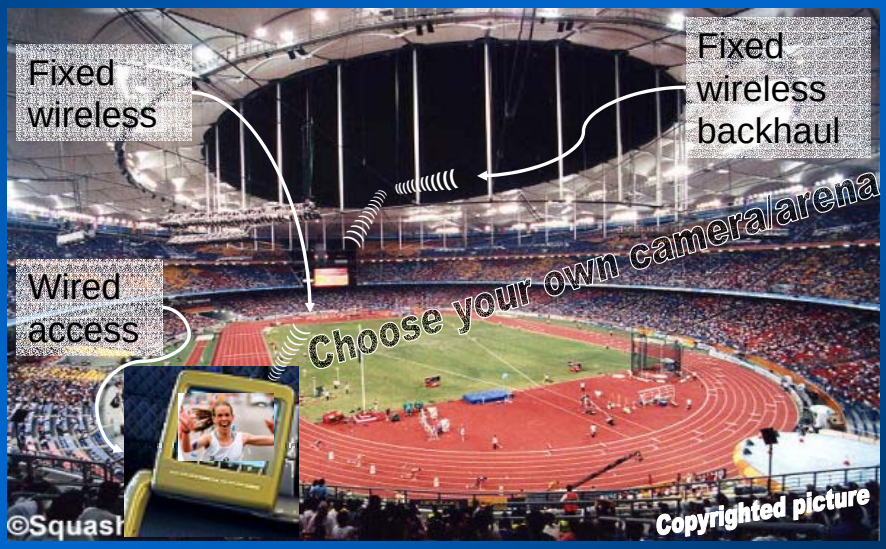
Today 150 million new handsets and 170 million new TV sets are distributed every year. Compare this to what is happening in the wireless industry where there are 600 million wireless handsets added every year. We expect that use will follow one of two major tracks. One will be to use them as a traditional mobile telephone and the other to use them as a personal digital assistant (PDA). You can expect more use to display text and video on electronic devices and to do it faster with more functions.



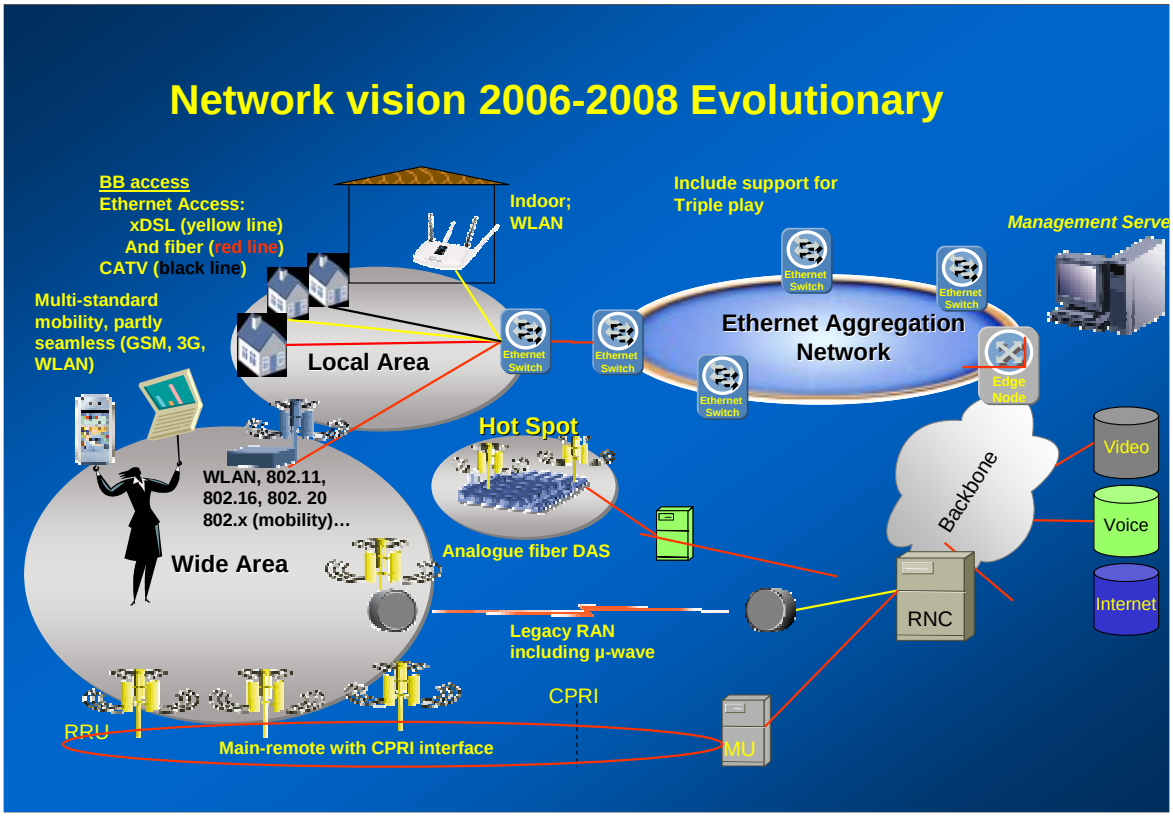
Let us look at how a handset should be designed for 2006 and what type of network will be needed for wireless transmission. Several factors will need to be considered. For videos and camera clips you need camera functions. The mobile handset camera in 2006 will have about 5 Mpixels in a small unit. Comparing this to cameras on the market today, you will find that the good cameras recently have 5 Mpixels. There are 60 million digital cameras in use today in mobile handsets.

Memory capacity on micro hard drives for the future handsets will have to be in the range of 4 Gbit. Resolution will be similar to that of a PC. Of course batteries will have to be further evolved. Digital TV receivers which are already in use in Japan and will be built into the mobile handsets.

Leisure – using interactive broadband access



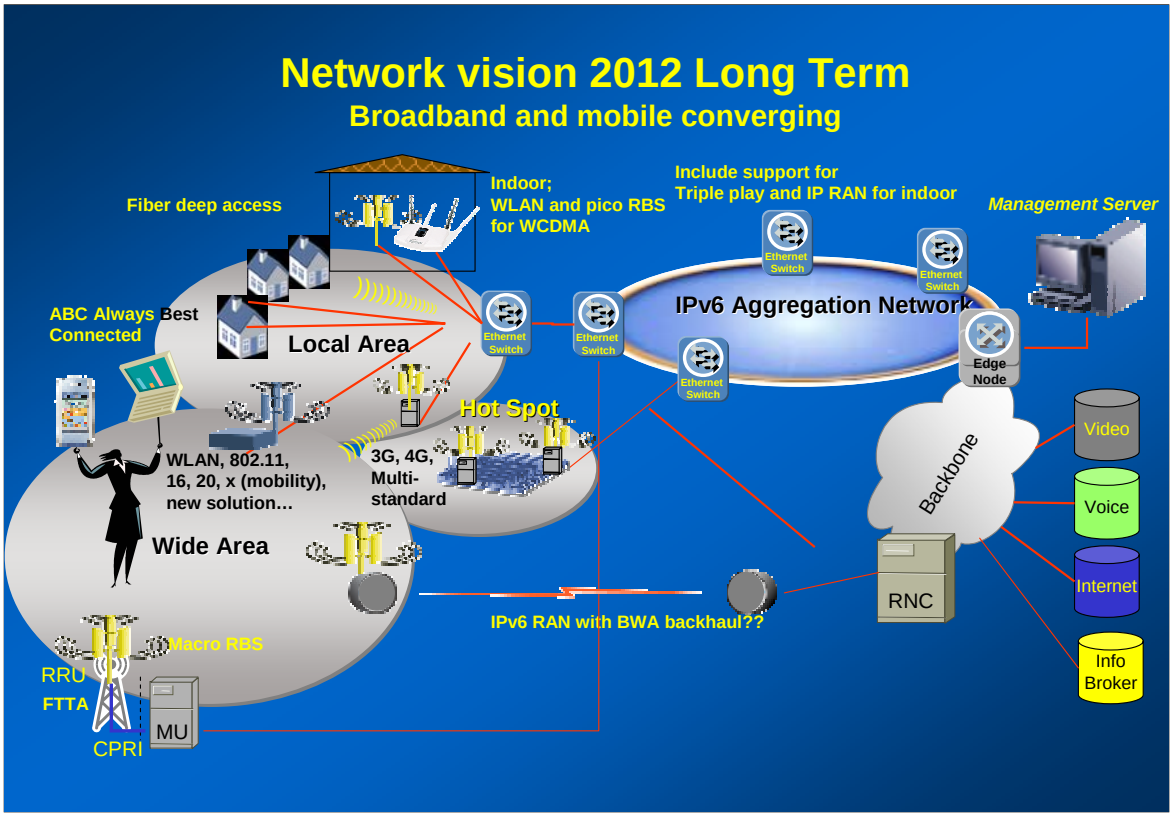
We see that the fixed wireless and the fixed wired access will be merged in the future. This could be an Olympic stadium as in Athens or in Beijing 2008. You would be able to access personalized information either via your fixed access menu or distributed over the wireless network. So you could subscribe for services, to look at athletes from the US or to follow some other special interest.



So, as you can see in this slide, we expect that there will be wireless in the household, but there will be many alternatives to traditional copper cable TV and fiber and many opportunities on the wireless side too.

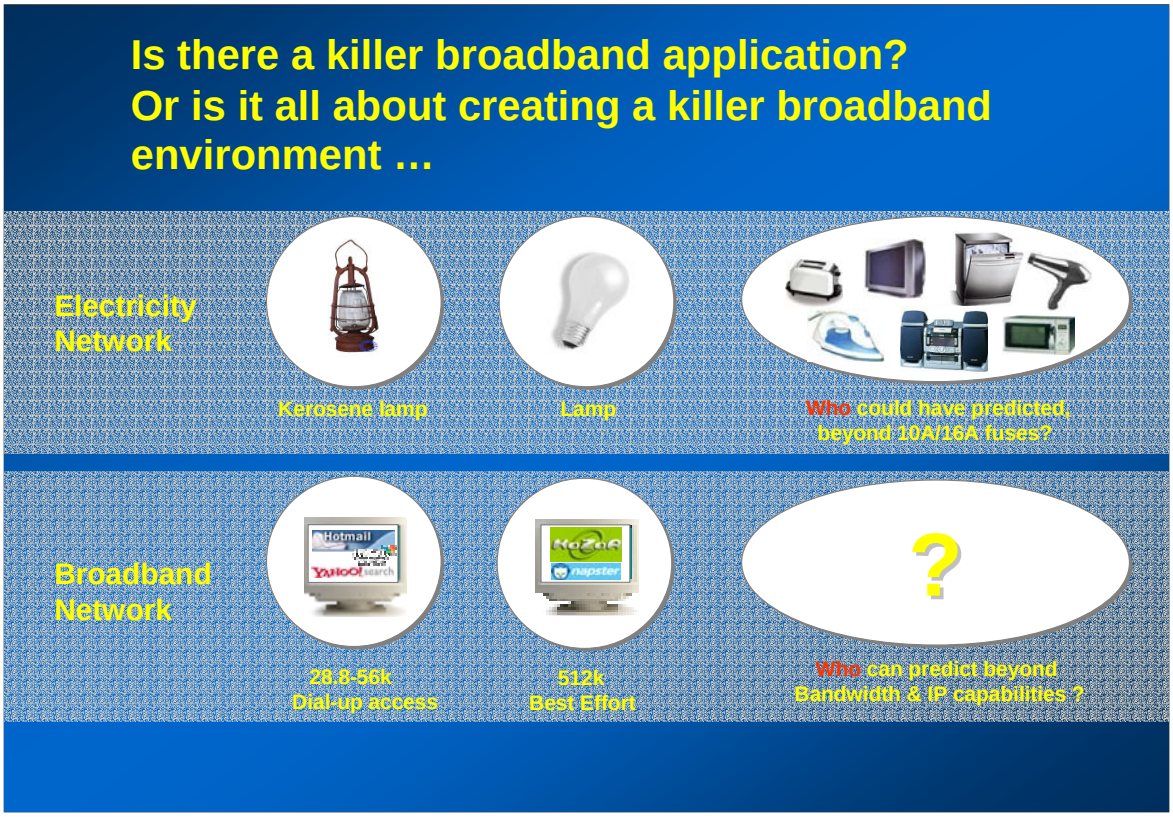
In the short term there will be a demand for more bandwidth in the network. There will therefore be more Ethernet and fiber used in the network in the next 4 or 5 years.

With respect to the radio development, today we have radio base stations for the traditional wireless network which are fed by traditional radio links. Soon there will be so much capacity to each radio base station, so we are expecting to feed the radio base station via fiber. If fiber technology comes down in price, we will be able to build other types of radio networks with even more fiber applications.



In the fourth generation wireless network, we expect that we will be able to distribute 1 Gbit to each mobile user and to distribute 100 Mbit to a user in a car travelling at 300 km/h. If this is to happen, we must deploy much more fiber and begin to develop new ideas (see the bottom of this slide) with antennas fed directly by fiber so you avoid the loss from electro-optic conversion.

You might have heard rumors that there will be radio base stations every 200 m in the fourth generation network. This future network will be much more distributed than today. It will be a fiber network even though it is a wireless network, because you will need to use fiber in order to distribute the information.



We are beginning to see the “light at the end of the tunnel” after 3 or 4 terrible years. My feeling is that you in the fiber optic business will have very good business during the next 10 years, based on the evolution we see in fixed and wireless networks.

Thank you very much.