

Trends in Communications ***-An Environment Overview***

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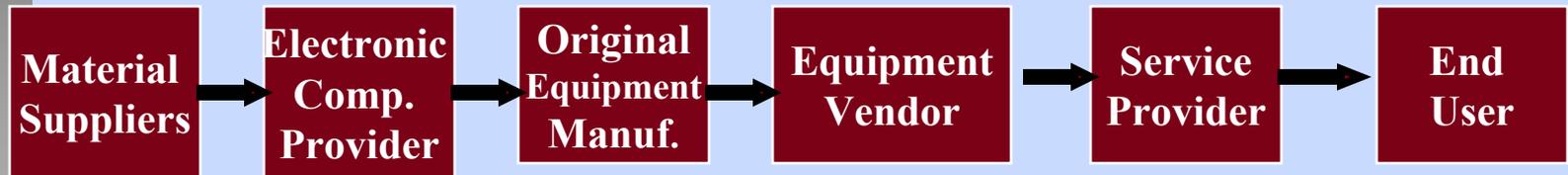
President IEEE Communications Society (2002-2003)

President IEEE Canada (2000-2001)

So what will we talk about?

- What is the telecom environment?
- Telecom
 - “ancient” history till today
- Wireless
- Internet
 - “ancient” history till today
- Broadband
- And where are things going?

Value Chain and Main Categories of Players in Telecom Industry



Electronic component Provider:

- Intel
- Qualcomm
- Broadcom

Original Equipment Manufacturer:

- Flextronics
- Celestica

Equipment Vendor:

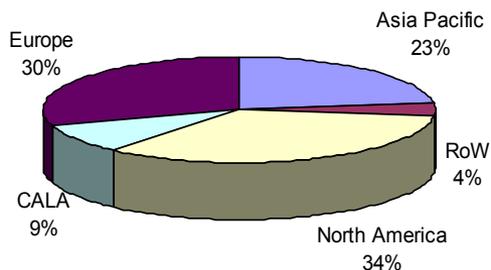
- Nokia
- Cisco
- Alcatel
- Ericsson
- Motorola
- Nortel
- Lucent
- Siemens
- NEC

Service Provider:

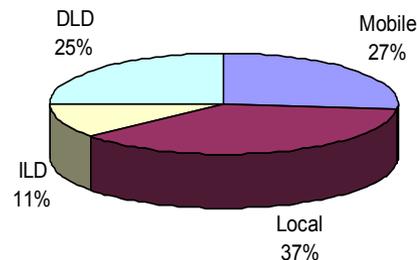
- Bell Canada
- China Unicom
- Verizon
- SBC
- NTTDoCoMo
- Deutsche Telekom
- Vodafone

Global Telecom Market

2000 Market Size of US \$880B



2000 Market Share by Services



2000 Global Telecom Market Share Breakdown:

	Local Services	DLD	ILD	Mobile Services
Global Market Size (US\$B)	308	205	91	227
North America	35%	42%	31%	28%
Asia Pacific	21%	19%	18%	30%
Europe	29%	25%	32%	31%
CALA	12%	10%	11%	8%
RoW	3%	4%	8%	3%

Global Telecom Market: Since 2000



“We built it, and they didn’t come”

Telecommunications Equipment Manufacturers

- Orders for communications equipment
 - peaked at about \$13.3 billion in June 2000
 - Declined steadily to about \$3.6 billion in September 2001.
- Industry operation dropped from 87% to 55% of capacity in 2001
- Sales revenues for telecom equipment declined in 2001 by nearly 28% from the prior year
- Revenues fell further in 2002
- Profits were down in 2001, and remained weak in 2002

- Headcount in top 10 companies was 1/2 that 10 years ago

By 2003

- Telecom Service Industry was a Trillion Dollar Industry – 1,300 billion at end of 2002
- With IT included this was 2.200 Trillion
- Overall this industry represented 3% of GDP
- Americas 43%, EMEA 34% and Asia Pacific 24%
 - Telecom industry was still a large and very viable industry

2004 Update

- US unemployment in computing at 5.2% in 2003, as compared to 2% in years in last decade – as compared to 6% rate in all jobs, compared to an earlier 4%
- Causes: outsourcing, automation and business strategy
- Companies using the investments they made in the 90's rather than researching, developing and deploying new technologies
- Total focus on cost cutting
- 80% of CEO's surveyed in 2004 said they would shift focus to new growth projects

Source: International Herald
Tribune, March 10, 2004

2005 Update – Something had to change

The telecom industry has always embraced change, as indicated by:

- The move from operator connection to direct dial
- The move from analogue to digital transmission
- The rapid rise of the Internet

With the advantage of hindsight, we can view these changes as natural evolutions (not that it seemed so at the time).

2005 Update (cont'd)

But...

What we are seeing today is a revolution - a true transformation.

Since the autumn of 2005, we have seen the definition of what is telecom and who plays in this market change beyond recognition.

Impact of Disruptive Technologies

- Clayton Christensen writes about disruption in *The Innovator's Dilemma*
- Technologies that totally disrupt the current balance – Automobiles, airplanes, digital pictures, personal computers
- Do we have disruption today?
- How do incumbents fare?

September 2005

- eBay (the online auction company) bought Skype
- Google (the Internet portal) announced plans to provide WiFi service in the San Francisco area
- Sprint Nextel now offers Rhapsody (a radio service) to its mobile customers
- Skype reached an agreement to offer services with German mobile operator e-Plus
- and Cingular announced plans to offer Yahoo! Instant Messaging over mobile

November 2005

- Four major US cable operators (Comcast, Time Warner, Cox Communications and Advance/Newhouse Communications) formed a joint venture with Sprint Nextel to address the convergence of video entertainment, wireline and wireless data and communications services
- SBC (the US regional operator) completed the purchase of AT&T (the US long-distance, global service provider, and iconic telecoms brand); and
- Vodafone broadcast the Holland versus Italy soccer game live to mobile handsets.

Line Loss Hits Telcos Hard

- A **three percent loss in the number of traditional residential phone customers** served caused an **overall 2.2% loss in revenue** among incumbent telephone companies in the third quarter of 2005
- There were 12.2 million traditional residential telephone lines at the end of the third quarter of 2005, down 3% from the same period in 2004
- "This was the largest year-over-year drop since the end of 2001 when the erosion of this market began.
- The **entry of a few cable television companies** into the local telephony market largely explains the acceleration of the downward movement in 2005
- Operating **profits plunged 31.4% to \$900 million**, compared to \$1.3 billion in the previous quarter.
- The market for business lines has remained stable

Reference: March 07, 2006 (cartt.ca)

Line Loss Hits Telcos Hard (cont'd)

- Wireless attracted more than 500,000 new customers between June and September of 2004
- Total number of wireless subscribers more than 16 million at the end of third quarter 2005, up 12.4% from the third quarter of 2004
- Operating revenues climbed to \$2.9 billion, up 16% from the third quarter of 2004
- Operating profits rose 15.7% to \$868.9 million

What were Long-Distance Resellers facing in 2005?

- Research firm Yankee Group says price compression and cannibalization by VoIP services will yield a negative 8.5 percent compound annual growth rate this year for the traditional wholesale voice services market
- “The segment is in its sunset phase, the analyst firm notes, although it will provide solid revenue for the next three or four years. “
- What's a rebiller to do in such a breathtakingly transformational era?
- First thing's first: Take care of the existing business.
- People that have large customer bases need to focus on having a better way to buy the long-distance, not necessarily on how to sell more things."

Assessing The Year Ahead (2006) In Telecom

- The primary theme for next year is that existing trends intensify and gain momentum
- Real-time collaboration goes mainstream
- Job titles such as "SVP of Collaborative Services" are starting to crop up
- Voice commoditizes - Carriers have been girding for years for their core services to crater - all signs say 2006 is the year it happens.
- Nontraditional voice players emerge as a major force. E.g. Microsoft's stated direction is to incorporate voice into its conferencing and collaboration services. Google's getting into the network business (via wireless infrastructure, see prediction below) and eBay bought Skype. Voice providers are increasingly something other than the traditional telcos.
- Convergence keeps going strong – VoIP continues to escalate in consumer and enterprise acceptance
- The wireless revolution continues

Reference: Network World, 01/09/06

What does all of this mean?

- The list of telecoms service providers now comprises **traditional telcos, software companies, a range of new service providers, portals and media companies** in addition to the established cable-TV companies.
- This amounts to a step-function increase in the number of competitors in this already crowded marketplace.
- So the number of providers has expanded, but so has the **definition of what a telco actually does**

Cellular Growth in the US

Yes, there was still some good news:

- ~141M subscribers as of Dec 2002
- 10% Y/Y growth in subscriptions
- 36% Y/Y growth in minutes
- 20.8% Y/Y growth in capital investment
- Forecast data revenues was for ~\$1B in 2003
- Cell phones, PDA's and PC all on growth curve

Source: CTIA Wireless Industry Survey,
Mar 2003

2003 Update in Wireless Telephony

- Total Service Revenues rose nearly 13 percent by mid 2003.
- Data Service Revenues were up 70 percent to \$700 million in the first six months of 2003
- Minutes of Use were up 30 percent -- over 380 billion for the first half of 2003.
- Monthly SMS Traffic rose over 31 percent
- Digital Subscriberhip reached 92 percent -- The number of digital subscribers topped 128.3 million
- Wireless Investment rose over 13 percent
- Total Wireless Subscriberhip went up 10 percent

Ref: CTIA

Cellular Local Number Portability

- **FCC Mandate in 2003 for LNP between US Cellcos**
- **US Cellular service commoditized-**

Few differentiators:

- Price
- Bundled cell phone
- Technology transparent to users

Retention factors today:

- Contract termination penalty
- Need to change phone # when changing carriers

Impact on Cellular carriers: Increased Churn Rate

25-30%



50-55%

Wireless Number Portability rules in Canada (2005 -2007)

- Currently, Local Number Portability is available to customers of wireless service companies in Canada that have undertaken to comply with the requirements to become Competitive Local Exchange Carriers (CLEC's).
- In the February 2005 federal budget, the government identified wireless number portability as a priority item. Also, in April 2005, the Canadian Wireless Telecommunications Association (CWTA) announced that Canada's wireless carriers have agreed to implement number portability in Canada and have begun the planning efforts required to achieve this result.
- **December 2005 - CRTC decision requiring all Canadian wireless telephone companies to implement wireless number portability (WNP) by March 14, 2007, in most of Canada.**
- By March 14, 2007 Bell Mobility, Rogers Wireless and the mobility division of TELUS Communications Inc. will be required to provide WNP to their customers in British Columbia, Alberta, Ontario and Québec. This means that customers in any of these provinces will be able to switch to any service provider in that province (wireline or wireless) and keep their phone number.
- Throughout Canada, all wireless carriers will, by the same date, be required to release a phone number to another carrier (port-out customers) and by no later than September 12, 2007, to accept a phone number from another carrier (port-in customers).

Reference: CRTC website

Easing the burden

- New area codes were much in demand due mainly to the rapid increases in cellular numbers, plus other applications such as home alarms
- According to the US area code assignments, 108 new area codes were added during the last 4 years of the 1990's; only 11 added from mid-2003-2007
- Creation of 551, 862 and 848 codes in New Jersey created 23 million numbers – less than 2% have been assigned to customers

- Why?
- Regulatory changes helped reduce the number of wasted numbers
 - Local Number Portability
 - 2001 ruling allowed companies to get numbers in blocks of 1000 rather than 10,000
- End of the telecom boom caused many small telecom startups to leave the industry, freeing the area codes assigned to them
- People not using pagers as they once did

Associated Press Jan 22, 2007

Wireless Possibilities

- Many technologies have been developed for different specialized applications
 - 3G
 - WiFi
 - Ultrawideband
 - Bluetooth
 - WiMAX
 - ZigBee
 -

Broadband Wireless in the U.S.

320 US cities planning ubiquitous broadband wireless

■ Initial municipal applications

- public safety, automated utility meter reading and inspection services
- help the public deal with inclement weather eg. track of "breadcrumbs" on the city Web site to show which streets have been plowed. Similarly, children could watch the progress of school buses from the warmth of their homes and emerge no sooner than necessary.
- High-speed mobile access to streamlining building inspection services. Philadelphia CIO Dianah Neff reckons it can save her city about two hours per day, per inspector, which will clear permits faster.
- Or, telemetry systems for controlling and monitoring pump houses, water towers and electrical substations, more flexible and cost-effective platform for prisoner-release programs that utilize ankle-bracelet monitoring.

Wi-Fi is Driving Rapid Change

- WiFi is a commoditized wireless technology, allowing users to create Wireless Local Area Networks (WLANS) with high speed internet service eg, it's what people expect as the basic capability
- Analysts predicted 700 million users and a nearly U.S. \$3 billion worldwide market by 2007
- Municipal networks being designed for ubiquitous regional coverage: Notably Philadelphia, San Francisco, and New Orleans
- These statements have been basic statements since at least 2004 – and still apply in 2007

IEEE 802.11 “WiFi” LAN

Properties



The **WiFi Alliance** is an organization of vendors and users, that provides interoperability standards and testing to equipment compliant with IEEE 802.11 standards

Properties

- **Power: 100 mW max**
- **Configuration: Hierarchical or Ad-Hoc**
- **Spectrum: 2.4 and 5.8 GHz Unlicensed bands**
- **Channel BW: 20 MHz (Overlapping)**
- **Two modulation technologies are available:**
 - **CDMA: 802.11b @ 2.4 GHz**
 - **OFDM: 802.11a @ 5.8 GHz, 802.11g @ 2.4 GHz**
- **CSMA/CA LAN Protocol**
 - **(Carrier Sensing Multiple Access/Collision Avoidance)**
- **Security via station authentication**
- **Data rates up to 11 MB (b), 54 Mb (a and g)**
 - **Actual data rates are usually much lower**
- **Maximum range ~100M with clear LOS in LAN configuration**
 - **Some specialized point-point applications up to 20 km.**

WiMAX: Standardized BWA for Urban and Rural Applications

- WiMax is as fast as traditional broadband but potentially less expensive; relatively easy to create
- Well suited to rural areas: no need for wired “last mile”
 - Considerable success with point-to-point microwave systems from Redline (Canadian product, Rainy River – long hops, short towers)
 - Numerous trials of Fixed WiMAX 802.16 (2004) systems under way world wide
- Large deployments of NextNet “pre-Mobile WiMAX” systems by Clearwire in the US, Canada, Mexico and Europe, can transition to 802.16e
- Mobile WiMAX, IEEE 802.16 (2005) systems will define “4G” in North America:
 - Sprint/NEXTEL decision to adopt Motorola and Samsung WiMAX in 2.5 GHz band settles the 10-year question of the next generation technology in North America

IEEE 802.16 “WiMAX” WAN

Properties



The **WiMAX Forum** is an organization of vendors and users, that will provide interoperability standards and testing to WAN equipment compliant with IEEE 802.16a/d/e standards. WiMAX is described as **“WiFi on steroids”**.

Properties

- **Power:** Varies with band. Profiles from 100 Mw up to 2W
- **Configuration:** P-P and P-MP Cellular
- **Spectrum:** Initially 3.5 GHz licensed and 5.8 GHz unlicensed bands, 2.5 GHz added with Mobile WiMAX
- **Radio interface:** OFDM, using 256 tones for 802.16 (2004), OFDMA 256-2048 tones for 802.16 (2005)
- **Access Protocols:**
 - TDD and FDD variants
 - Downstream: TDM (Broadcast)
 - Upstream: TDMA with access contention
- **Security via station authentication and encryption**
- **Data rates variable with channel bandwidth 3.5 MHz in 3.5 GHz band, 20 MHz in 5.8 GHz band**
 - Actual realizable data rates are $\sim 2\text{b/Hz}$
- **Maximum range $\sim 2\text{Km}$ for indoor Non-LOS cellular service at 3.5 GHz**

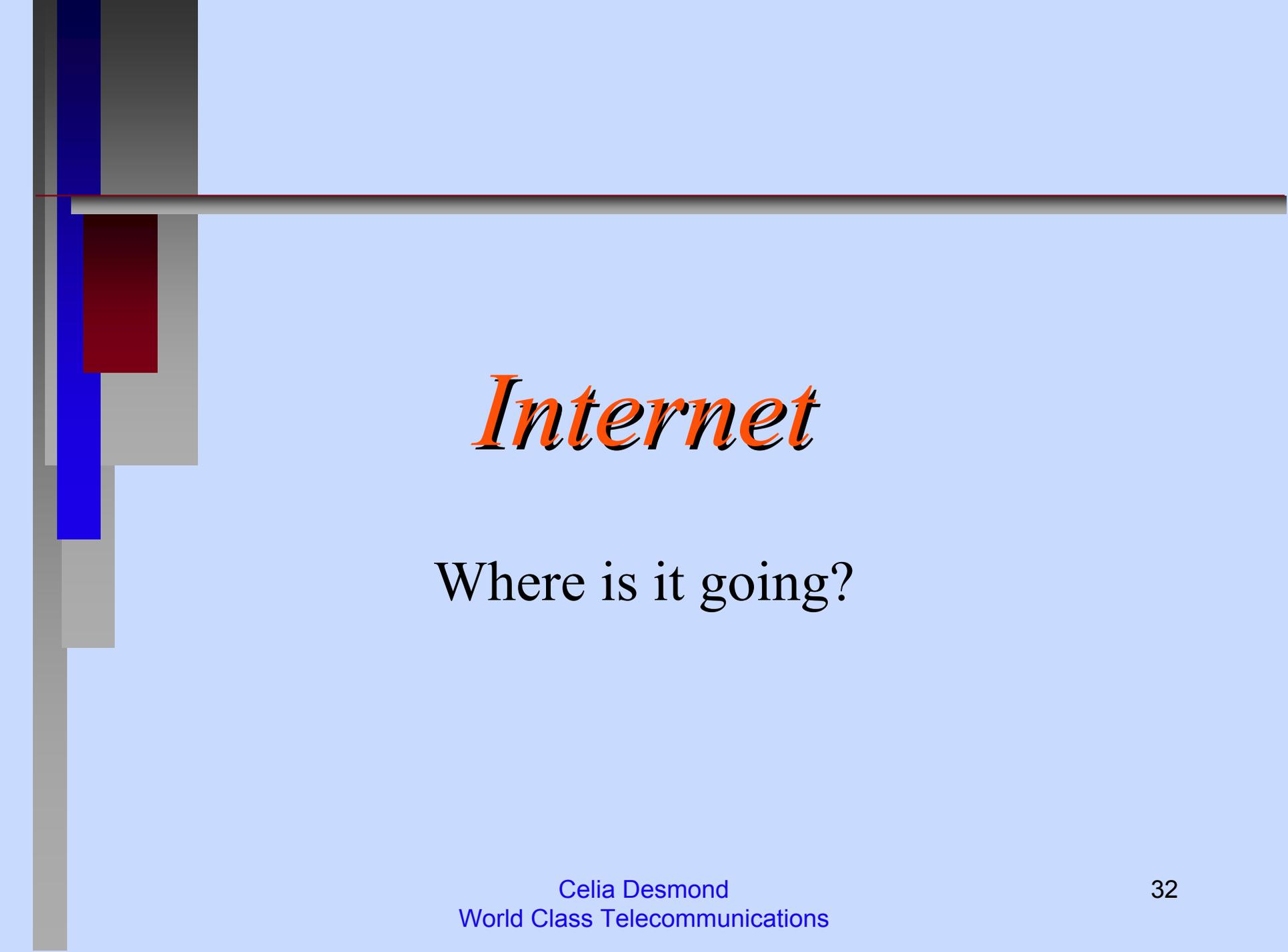
Comparison of Wireless Data Technologies

Technology	3G Cellular	WiMAX™ (802.16d/e)	Wi-Fi™ (802.11b/g)	ZigBee™ (802.15.4)	Bluetooth™ (802.15.1)
Typical Application	Wide Area Voice & Data	Wide Area Data	Data/Voice LAN	Control & Telemetry	Cable Replacement
Battery Life (days)	1-7	N/A	N/A	100 - 1,000+	1 - 7
Bandwidth (KB/s)	100-2000	1K-40K (backhaul) 100-5K (P-MP)	1K-11K (b) 1k-54k (g)	20 - 250	720
Typical Range (m)	1,000+	≤30K (backhaul) 1K-5K (P-MP)	1 - 100	1 - 100+	1 - 10+
Key Attributes	Coverage, Cost, Quality	Throughput, Coverage	Cost, Speed, Flexibility	Cost, Low Power, Flexibility	Cost, Simplicity

Update on China

- China is **preparing to invest billions of dollars** over the next several years on a massive **upgrade of its cellular-phone system**
- This is fueling intense competition among global telecommunications-equipment vendors.
- Beijing probably will **start awarding licenses for so-called third-generation, or 3G, networks** in the next six months or so
- The upgrade will create what is likely to become the world's biggest 3G wireless network.
- **In 2005, China added nearly 59 million new wireless subscriptions**, more than the entire population of Italy.
- China's adoption of 3G will bring cutting-edge wireless technology to a market that already boasts more mobile phone users than any other -- **398.8 million subscriptions at the end of January**, far more than the population of the U.S

Feb 27, 2006 Wall Street Journal

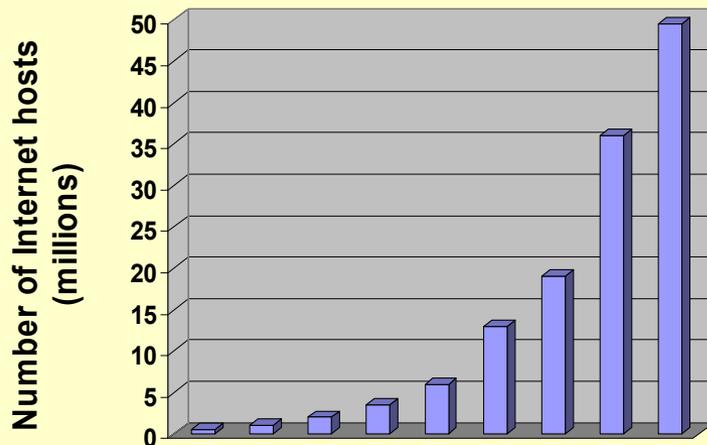


Internet

Where is it going?

The Growth of Internet

**Growth in the Number of Internet Hosts
(1991-1999)**



(Source: Microsoft)

Internet 2000

- **Over 300 million users online Worldwide**
- **Internet Users (3Q'2000):**
 - North America - 147.48 M*
 - Europe - 91.82 M*
 - Asia/Pacific Region - 75.5 M*
 - Latin America - 13.19 M*
 - Africa - 2.77 M*
 - Middle East - 1.9 M*
- **Growth estimated over 500,000 new users per month**
- **Business is the fastest growth area**

Canada's Internet penetration

	2000	2001	2002	2003	2004	2005
Internet access from home	40%	48%	52%	58%	62%	68%
High-speed access from home	7%	10%	12%	22%	35%	40%

The New Generation Network – is very different

Internet Vs. Internet 2

- low bandwidth
- best effort
 - ◆ IP plus TCP or UDP
- Static applications
 - ◆ e-mail
 - ◆ file transfer
 - ◆ browsing
- high bandwidth
- quality of service
 - ◆ Using protocols such as MPLS
- Real time applications
 - ◆ interactive client server
 - ◆ teleconferencing
 - ◆ telepresence
 - ◆ virtual environments
 - ◆ **collaboratories**

Internet Services

Many varied service types are available, and proliferation continues

- E-Commerce
- Voice over IP
- Networked games
- E-Learning
- E-Government
- E-news
- Web browsing
- And so on.... Many, many very new concepts are taking hold

Electronic Commerce

- Growth of E-commerce



Predicted Growth of E-commerce was in multiple billions

E-commerce services are proliferating, using many different service models

Growth is solid, but did not meet the initial steep predications

Internet Services Predictions

IP Telephony

- Predicted to rise from \$314 million (U.S.) in 2000 to \$4.02 billion (U.S.) in 2007
- IDC forecasted that “**Web Talk**” revenues would reach US\$16.5 B by 2004 with 135 billion minutes of traffic
 - ◆ But this didn’t happen
 - ◆ IP Voice services are really taking off in 2006 via both traditional and non-traditional providers
 - ◆ Traditional telcos started to deploy these capabilities in earnest in 2005

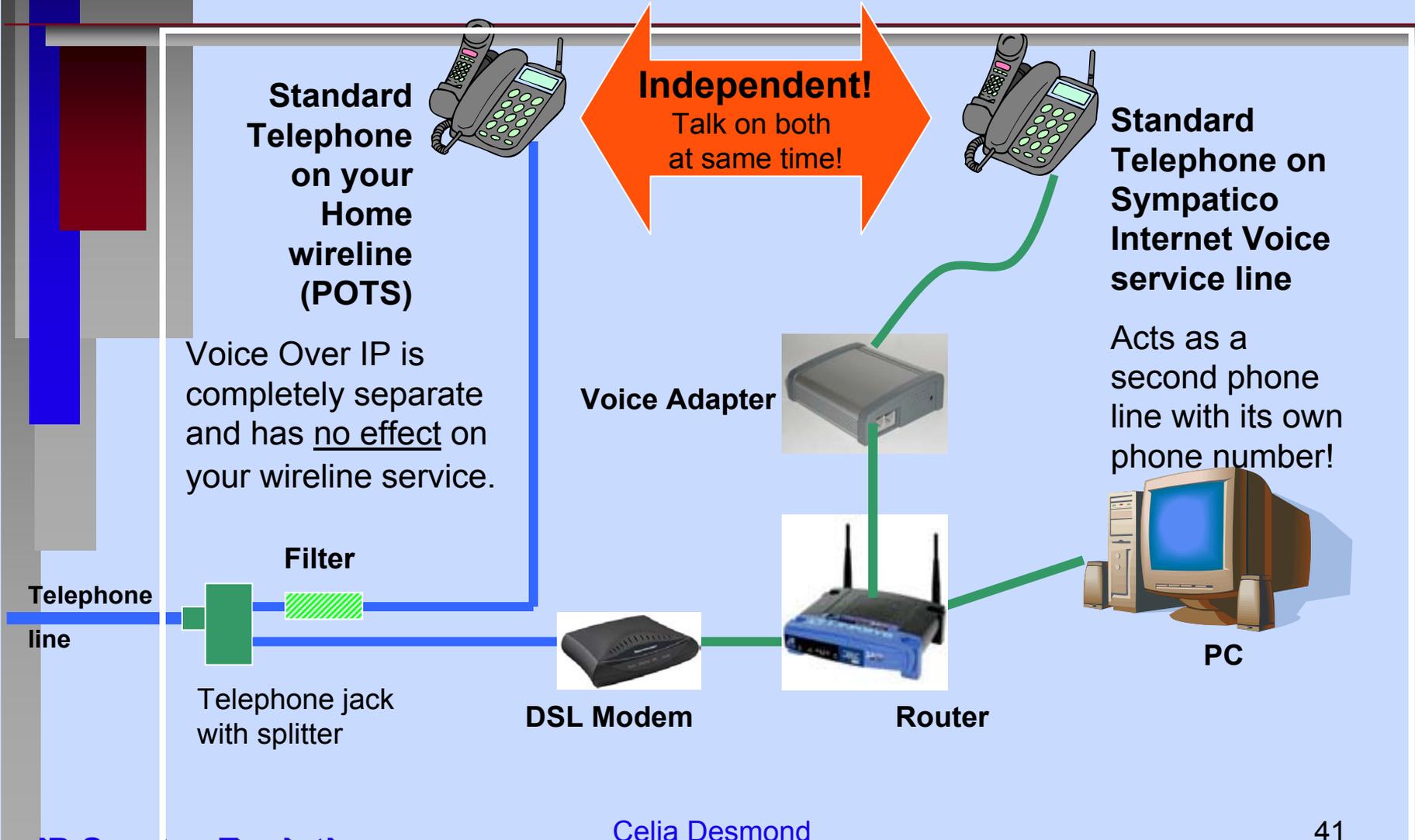
Race for VOIP service

- VOIP is here in 2005&2006
- Numbers rapidly increasing as all players make good on offers of triple play
- Telcos banking on single network based on IP, with MPLS or other such protocols to bring the service differentiation and quality
- Multimedia was just around the corner

VoIP Market Segments

- Toll bypass
 - Mature market
 - Incumbent competitive with new entrants
- Enterprise
 - New and incumbent providers competing
- Residential
 - Growth possibilities
- Bell Canada, Telus, Sprint offering VoIP in Canada as of 2005
- Services such as Skype are everywhere

One typical VoIP Configuration



Skype Pushing To Win Small-Business Users

- Skype, which was purchased by eBay in 2005, already boasted 75 million users in 2006
- It charges cheap rates for a variety of other services such as Internet-based calls to non-Skype users' mobile phones.
- Skype lets Internet users of its software make free calls through their computers to other Skype users.
- New Web site dedicated to small companies at [HYPERLINK www.skype.biz](http://www.skype.biz)
- New hardware, and improvements to a program that lets companies manage their employees' pre-paid Skype accounts.

Update on Canada – Cable Voice – predictions in 2006

Cable Voice Will Grow Much Faster Than IPTV

- Cable companies to capture in excess of 40% of all voice access lines by year-end 2010
- In just one year, **Rogers is already the third largest residential telephone company**
- **ILECs stand to shed in the range of 10% of their access lines per year over the period.**
- **Non-facilities VOIP** services (such as Vonage and Skype) have little traction overall in the Canadian market
- High-Speed Internet services "are expected to remain the bright light of penetration and revenue growth"
- **High-Speed Internet** access services will be subscribed to by more than **80% of Canadian households in 2010**
- Revenues are forecasted to grow by close to 60% over the same period

Update on Canada – Telco TV – predictions in 2006

- Telco TV is estimated to capture an overall market share of 15% of the subscription TV market by 2010
- Cablecos are expected to see a decline in their subscription TV connections as telcos capture market share
- Canadian residential market is headed towards an effective near duopoly structure between the incumbent telcos and cablecos

What is Skype now?

- Peer-to-peer VoIP provider Skype, which has more than 171 million users and is owned by eBay Inc., recognizes the need to go beyond the call. For example, Skype already has expanded into commerce services. Skype subscribers now can send money through the service provider's Send Money capability, enabled by PayPal. Skype CEO and founder Niklas Zennström introduced the feature at VON, noting that many Skype users have friends and family "on the other side of the planet." Send Money is an ideal service for them, he said. "It takes communications one step further by adding transactions and sending money," he added.
- Zennström also discussed Skype Prime at VON. Skype Prime lets users sell their services - anything from IT support to foreign language tutoring - to one another.
- Meanwhile, Skype Find is a search engine of sorts aimed at local business listings, with an integrated click-to-call VoIP option.
- And because there are so many Skype users today, more application developers are interested in targeting them. That's why the company recently launched Skype Extras, an ecosystem for third-party developers. More than 7 million Extras already have been downloaded.

Kelly M. Teal - <http://www.xchangemag.com/articles/07junfeat07.html> May 30, 2007

New Services - Facebook

- Competition for My Space (105 million visited MySpace in April, 38.8 million visited Facebook)
- Launched new platform to allow others to build on-line services to operate within Facebook web site
 - Post 30 second music clips
 - Play full length songs on their portfolio
- Helped Facebook grow from 24 million users to 27 million
- Offered in June 2007 more than 800 new services, up from 100 in May
- Services include:
 - Slide Inc – highlight top friends (recently had 6.3 million users)
 - RockYou Inc horoscope service (3.5 million users)
 - Flash Sudoku
 - Stress Meter – lets users chart their stress levels
- These services allow Facebook to gain info about their clients, and to sell ads
- They expect a profit of \$30M on revenue of \$150M in 2007, mostly from ads
- Additional new services are being considered
- When iLike launched a music provision service on the Facebook platform, they attracted hundreds of thousands of users and Facebook had thousands of users within days. They are attracting record labels and artists They plan to spend \$200K on a marketing campaign to remain in the lead.
- iLike already gets more revenue from Facebook than from iLike.com though ads and commissions for selling songs and concert tickets via Facebook
- Some difficulty for the third party service providers to be able to keep up with the changes

What is IEEE doing?

- IEEE is active in many of the new spaces
- IEEE Island in Second Life should be ready by the end of the summer 2007
 - Will have a visitors center
 - Activity locations
 - Maybe some technical tutorials to offer
- Space is free, but you pay to do anything with it
- Over 7 million people are already there
- Many companies already there (IBM, Toyota)

Telcos need to use Web 2.0

- Applications need to be developed too quickly to allow telcos to build everything themselves
- Mash-ups will be needed
- Mashups are browser-based applications that draw content from multiple sources on the Web, and they're often created by third-party developers that are given the chance to tinker with applications. Mashups are the key to the speed at which Web 2.0 moves, because you've got so many developers trying out new ideas. Telcos should embrace the concept if they want to keep up, Chappell argues.
- The services realm is getting hijacked by non-telcos like Google (Nasdaq: GOOG - message board) and Yahoo Inc. (Nasdaq: YHOO - message board) -- often called "over-the-top" providers -- that are beating telcos to the punch when it comes to creating hip new services.

JUNE 01, 2007 Light Reading

Opportunities for IT Companies

- Anyone can become a service provider
 - Peer-to-peer applications leverage the excess storage and processing of computers
 - High bandwidth access is becoming prevalent

Issues for Customers

- Dumb network with smart edges means complexity for end user
- Possible security issues with info in edge devices
- Multiple consumer/provider relationships not best for business customers

The problem with technology

- Remember when a phone had a dial on the front with numbers, a TV had a volume knob and a dial with channels on it, and a record player had two controls: volume and speed?
- Now:
- * I have six remote controls on the TV room table, with more buttons than a 747.
- * My deskphone has 25 buttons on it with four icons I don't even know and one called "R."
- * My PocketPC PDA/phone keeps it secret that Bluetooth headset mode is disabled.
- * There are five ways to connect a DVD player to a sound system but my sound system only has the four I don't need.
- * I need to navigate a menu just to watch a movie.
- * And my car needs a firmware upgrade.

July 11, 2007, By Rob England (Datamation)

What people want

- I want to pick the phone up, dial a number and talk to someone. When I'm done I will hang up. I want to turn on one device (or turn on all the devices at once) to watch Sky, DVD or video.
- I want to change channels, play/stop/rewind/forward/eject, adjust volume, and mute from one remote. (The mute button is the only valuable advance in user interface in fifty years of consumer technology.) The remote should park in a socket on the front of the box and recharge while it's there. I'm not going back into the TV room until the manufacturers get it together.
- I want "dial tone" functionality for all the devices in my life, meaning they're always on, and they work by engaging them physically, e.g., pick up the hand-piece or open the door or stick a disc in. I don't want all this other stuff. Do you?
- I'm not alone. A survey of 15,000 mobile phone users in 37 countries shows that "too many functions I did not use" is the number one device problem in all regions of the world. Of course manufacturers are not entirely to blame. As consumers we are naïve and childish, seduced by spec sheets and blinking lights. There are alternatives out there, if you can find them, such as Kyocera's A101k phone.

Value Propositions - Broadband Services

- Mobile services, local loop unbundling and VOIP causing decline in fixed market everywhere
- New subscriptions are mainly broadband
- Companies must offer new value propositions to maintain or gain market share
- Some examples (2004):
 - PCCW now offering TV in Hong Kong, aiming for broadband data
With over 30 channels of TV, they attracted 100,000 customers within 2 months
 - SK Telecom on Korea generated revenue via new services such as chat, ring tones, games

Reference: Infocom 2004 - Dr. Liang Wu, PCCW

Broadband vs Dialup

- **% of broadband subscribers exceeded dialup:**
 - In Canada, in 2003
 - In US, in 2004
- **Broadband Penetration, new subscriptions, 2004***
 - S Korea 97%
 - Canada 84%
 - Hong Kong 72%
 - Japan 52%
 - USA 38%
 - Australia 21%
 - New Zealand 16%

* Ovum

It's a Broadband World After All

- Worldwide, broadband penetration among Internet users grew by 24% in 2004.
- 62% use broadband as their primary Internet connection
- The fastest broadband adoption rates were found in France, Urban Brazil and the U.K., growing by 59%, 50%, and 45% respectively.
- However, the report found the world is still divided into haves and have nots.
- Dial-up regions include urban Russia, India, Mexico, and Brazil and the European regions of France and the U.K.
- Nearly 6 in 10 U.S. users access the Internet through a high-speed connection.

"The Face of the Web" survey by Ipsos-Insight.

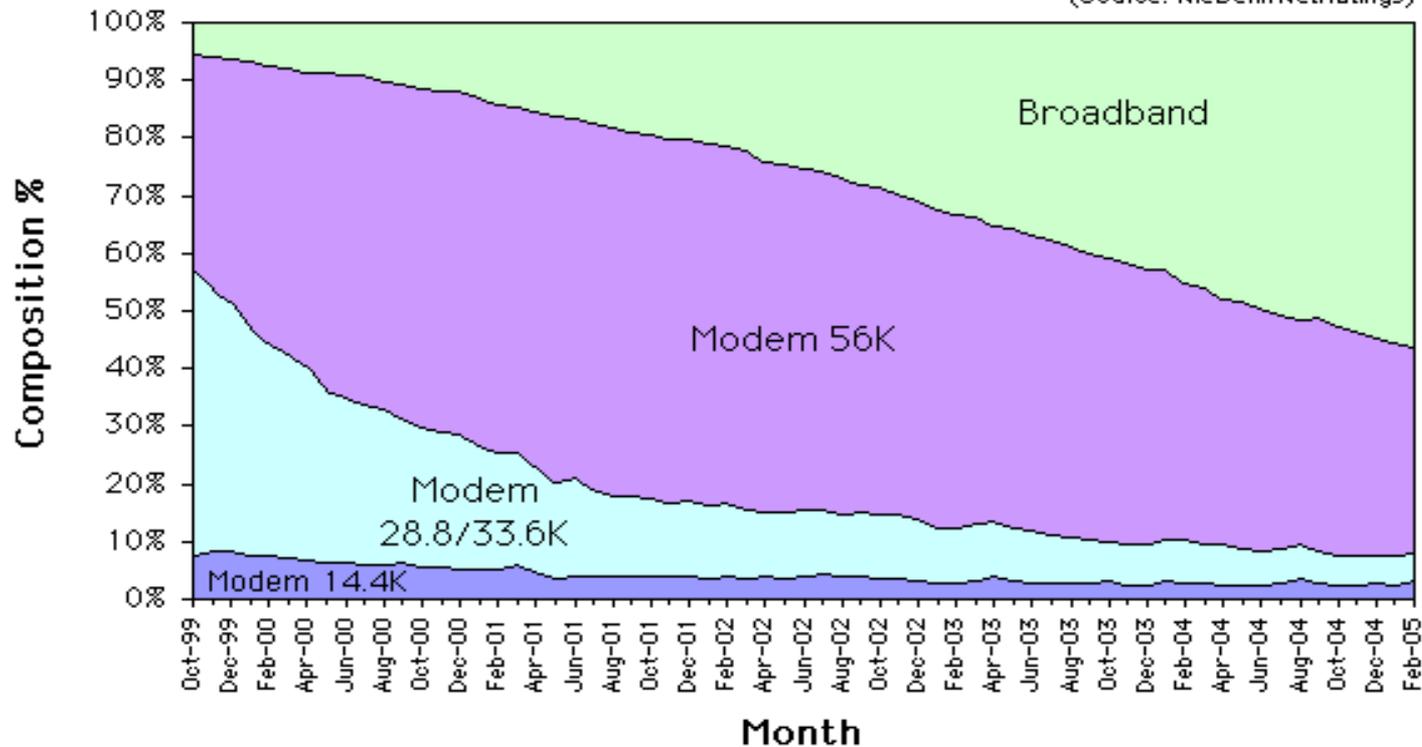
Celia Desmond

IEEE Communications Society

Web Connection Speed Trends - Home Users (US)

Web Connection Speed Trends - Home (US)

(Source: Nielsen//NetRatings)

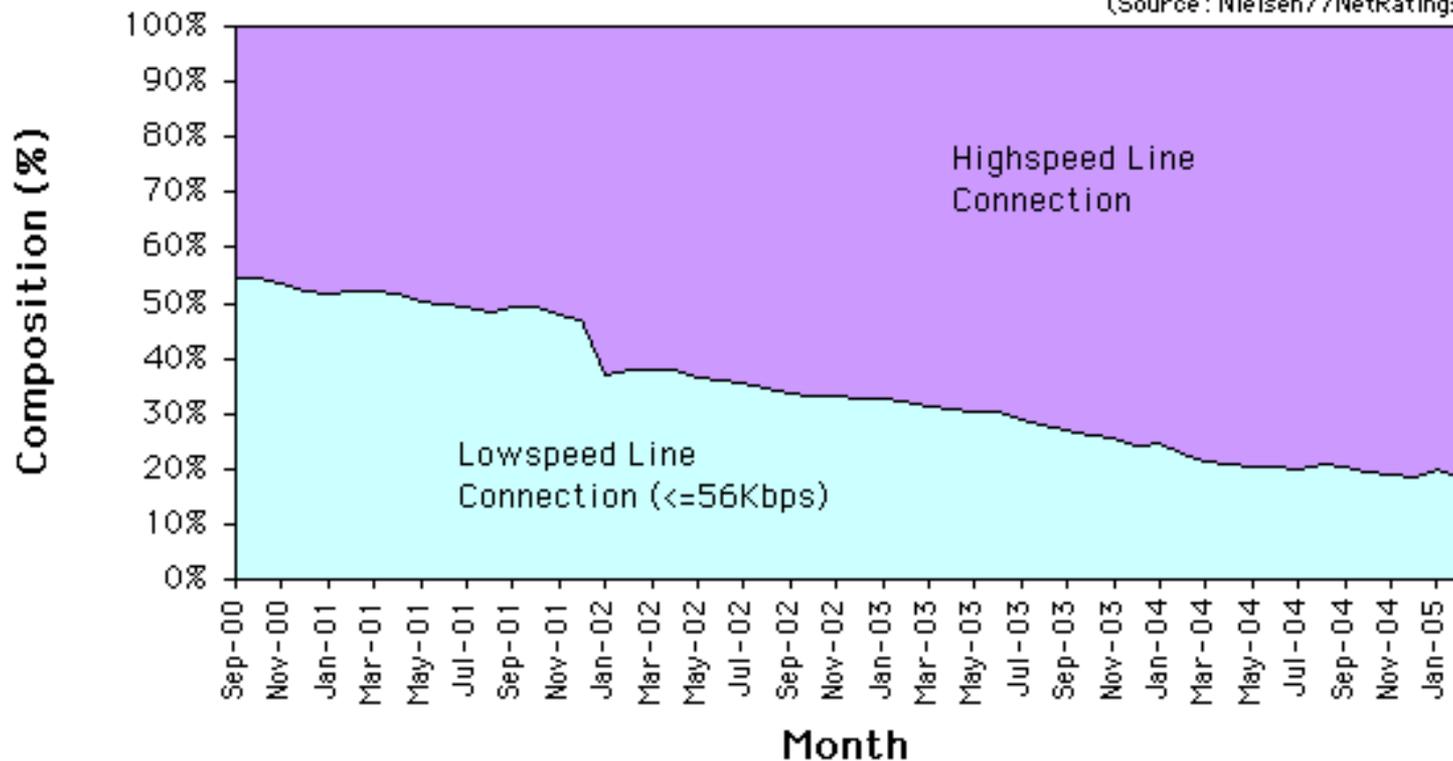


- This chart and the info to follow, derived from Nielsen//NetRatings data, show trends in connection speeds to the Internet for United States users.

Web Connection Speed Trends - Work Users (US)

Web Connection Speed Trends - Work (US)

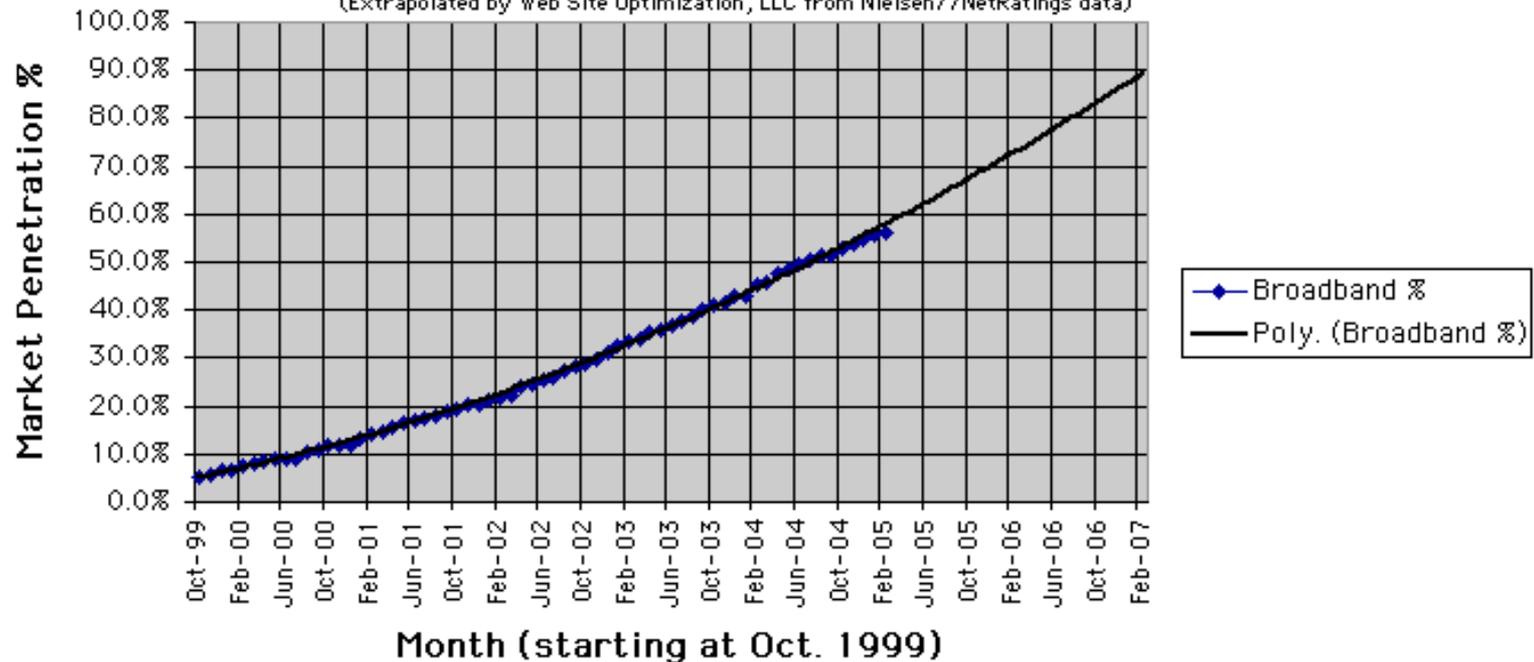
(Source: Nielsen//NetRatings)



Broadband Connection Speed Trend - Home Users (US)

Broadband Growth Trend – US Home Users

(Extrapolated by Web Site Optimization, LLC from Nielsen//NetRatings data)





The Big Picture

Top Companies

1997

Alcatel

Lucent

Motorola

Ericsson

Nortel

2002

Motorola

Nokia

Ericsson

Alcatel

Cisco

Competition

-the technology perspective

■ Transport

- T1, PRI, T3, Optical (SONET, SDH, DWDM), Microwave, and Satellite...

■ Access

- ISDN, DSL, Cable Modem, Broadband Fixed Access, Wireless access, and Satellite...

■ Switching

- Frame Relay, ATM, IP Routing, MPLS, and Gigabit Ethernet...

■ Mobile

- GSM, TDMA, CDMA, GPRS, 1xEVDO, WCDMA, and CDMA2000, HSDPA...

Network Evolution

- **To survive, networks must be**
 - ◆ Evolvable
 - ◆ Scalable
 - ◆ Flexible
 - ◆ Have open standards
 - ◆ Be easy to maintain and operate
 - ◆ Be open to rapid service development
 - ◆ Be priced competitively
 - ◆ Support multiple services

What's a telco now?

- Until now, a telco provided to its customers - PSTN and private circuits i.e. 'calls and lines'.
- No longer!
- BT's Q2 2006 results, included two inconspicuous but remarkable facts:
 - BT now earns more from networked IT services than it does from calls (£1.822 billion 2006 versus £1.513 billion in H1 2005)
 - BT now earns more from broadband than it does from private circuits (£664 million versus £616 million in H1 2005).
 - To call BT a phone company that offers calls and lines is simply no longer an accurate epithet.

Company structures changing

- Rogers Communications Inc is laying off significant numbers of staff in reaction to a change in strategy
- Instead of selling to largest corporate customers they plan to target small to medium sized businesses
- BT is reinventing itself as an IT services company, now that they have shifted from narrowband to broadband
- Want to move from hardware-based company to software based services
- Creating two new groups (moving in 20,000 existing employees) to create new IT products and reduce reliance on acquisitions to gain new services
 - BT Design – design and development of new services
 - BT Operate – deployment and operation of new services
- Suffered some failures in telecom:
 - BT Fusion fixed-mobile convergence product attracted only 40,000 users over 15 months
 - BT Movio – mobile TV standard using Digital Audio Broadcasting (DAB) failed – probably wrong standard for Europe
 - BT Vision – IP TV offering free TV channels with the option of video-on-demand (competitors dominate the 12M customers already) attracted only 2400 customers in 4 months

Financial Post June 22, 2007
Global Insight April 25, 2007

AT&T Offering Service Outside Telco Traditional Bounds

- AT&T will offer a new internet based IPTV system, U-verse to 18 million homes in 13 states
- They plan to spend \$6.5 billion between 2004 and 2008, \$1.4 billion more than they anticipated initially
- Increased costs are related to the cost of adding servers, plus a premium they will pay to ensure vendors will supply when equipment is needed

Wall Street Journal, May 7, 2007

Top Five Technologies in 2007

- Ruby on Rails
 - Open source project initially a PM tool for Web development companies
 - Useful for constructing database-backed web applications
 - Offers tutorials for creating applications quickly
- NAND Drives
 - Solid state drive (SSD) which is faster, quieter, uses less power than notebook hard disk drives (HDD)
 - Flash memory technology that excels at reading, writing, erasing from flash memory
 - Reports of results up to 100 times faster than conventional hard drives
 - Still very costly

Computerworld March 1, 2007

Top Five continued

- Ultra-Wideband
 - Operates at close to 500 MBPS in 3.1 to 10.6 GHz range
 - Low power consumption
 - Better than Bluetooth (2.1 MBPS) for applications such as video, audio-rich or large files – operates over a wider spectrum of radio frequencies
 - Uses: Connect mobile computer or PDA to digital projector; play digital video from a camcorder onto HDTV; transmit info from a PC to a printer, scanner, etc
- Hosted Hardware (Or Grid Computing)
 - Lease a huge server on demand by tapping into a of supercomputing power
 - Aimed at mid-sized to small businesses
 - Allows large users to lease the downcycles of their servers to smaller users
- Advanced CPU Architectures
 - New processors will have increased performance and battery life

What is the impact of these?

Computerworld March 1, 2007

New Trends in Telecommunications

- Convergence of telecommunications, computation and entertainment, leading to innovative new services

Bandwidth expansion

- The great rates war

- Migration of intelligence

- Globalization

- IP changing the architecture on incumbent telco networks

- Create need for both technical skills and personal management skills

- Emerging role of consumer electronics

- Sony announced new line of television and appliances with WiFi

- Intel supports WiFi in domestic environment

- Centrino and various chip for enabling WiFi on appliances

- Trend toward non-hierarchical networks, wireless routers, hot spot

- Software radio

In conclusion

- New services must offer value to end user
- Services more content centric
- Intelligence moving to the edge
- Peer to peer services
- Packet switching replacing circuit switching
- Rapid technology and network architecture changes
- Customer service and customer understanding are key