

Wireless Broadband Deployment & Other Latest Technology Trends

13th ITU Sub-regional Meeting,
Yangon, Myanmar

Presented by: Laina Raveendran Greene
ITU consultant
laina@getit.org
www.getit.org

4-6th October 2006 , GetIT, Inc

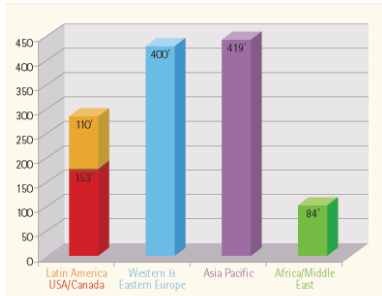
Agenda

Part 1- Technology Trends
- wireless alphabet soup
-other related technologies

Part 2- Policy and Regulatory Trends
-putting issues in perspective
-other related issues

ITU sub-regional meeting, Myanmar,
4-6 October 2006

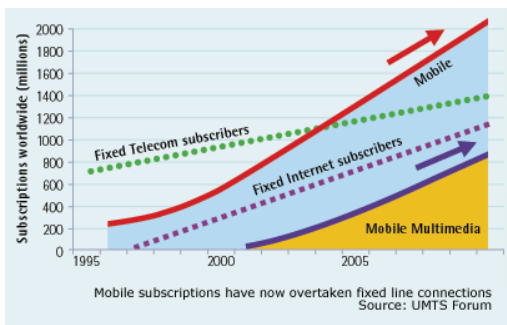
Part 1: Technology Trends-



Region	Subscriptions (millions)
Latin America USA/Canada	110
Western & Eastern Europe	400
Asia Pacific	419
Africa/Middle East	84

World mobile subscriptions by region (end 2002)
Source: UMTS Forum


Part 1: Technology Trends-



Mobile subscriptions have now overtaken fixed line connections
Source: UMTS Forum

Part 1: Technology Trends

Are you feeling confused???




- Number soup- 1G, 2G, 2.5G, 3G, 3.5G, 4G, 802.11, 802.16.....
- Alphabet soup- AMPS, TDMA, GSM, CDMA, wCDMA, CDMA 2000, Wi-Fi, Wi-Max.....

Part 1: Technology Trends-

This session objective is to:

- simplify
- gather data
- formulate framework



Part 1: Technology Trends- a) Simplify-Definitions

Wireless vs mobile vs portable
(infrastructure is not wired) vs fast mover vs walking pace

Part 1: Technology Trends- a) Simplify-Definitions

Broadband vs Narrowband

Different people have different definitions- Very fast? Better than what exists today?
Converged networks? IP Based? Faster than dial-up?

Part 1: Technology Trends- a) Simplify-Definitions

WHAT IS BROADBAND?

Recommendation I.113 of the ITU Standardization Sector defines broadband as a
"transmission capacity that is faster than primary rate Integrated Services Digital Network (ISDN) at 1.5 or 2.0 Megabits per second (Mbps)".

TRAI has defined a broadband service as
"An always-on data connection that is able to support various interactive services, and has the capability of a minimum download speed of 256 Kbps."

.....others define it as higher than dial-up speeds

Speeds & Capabilities

Application	Minimum	Ideal
E-mail / Basic Web Browsing	10	100
Video Conferencing	100	1,000
E-Learning	100	1,000
Telemedicine	100	1,000

Data Rates: 1, 10, 100, 1,000, 10,000 Kilobits per second

Access Technologies: 2G, Satellite, 2.5-3G, Dial Up, Cable Modem/DSL, Fiber

Legend: MINIMUM (blue), IDEAL (yellow)

Part 1: Technology Trends- a) Simplify-Number soup

- 1G: 9.6 kbps analogue (voice)
- 2G: 14.4 kbps digital (voice and short text)
- 2.5G: upto 48kbps packetized & digital (voice, data, email, web browsing)
- 3G: upto 144 kbps to 2Mbps(theoretically) digital & broadband (voice, data, video, MMS)
- 3.5G: 3.56 Mbps to 14.4 Mbps digital & broadband (voice, data, video and interconnectivity)
- 4G: 10Mbps to 1Gbps digital, broadband and IP network (voice, data, video, interconnectivity, lower costs)


Part 1: Technology Trends- a) Simplify-Alphabet soup

- 1G: AMPS, FDMA, TACS
- 2G: D-AMPS, TDMA, GSM, CDMA, PDC, PH5, PCS
- 2.5G: GPRS, EDGE
- 3G: IMT 2000, CDMA 2000 (EvDO), (EGPRS) EDGE, UMTS, FOMA, TD-SCDMA
- 3.5G: HSDPA, HSUPA
- 4G: WI-FI, WI-MAX, WI-BRO.....

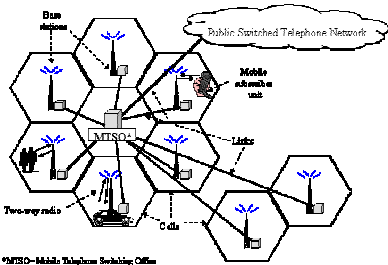
Part 1: Technology Trends-

This session objective is to:

- a) simplify
- b) gather data
- c) formulate framework

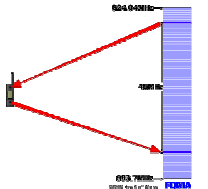


Part 1: Technology Trends- b) Data-cellular



*MTSO - Mobile Telephone Switching Office
ITU

Part 1: Technology Trends- b) Data-FDMA & OFDMA



Frequency Division Multiple Access or FDMA is an access technology that is used by radio systems to share the radio spectrum. The terminology "multiple access" implies the sharing of the resource amongst users, and the "frequency division" describes how the sharing is done: by allocating users with different carrier frequencies of the radio spectrum.


Orthogonal Frequency Division Multiple Access (OFDMA) is a multiple access scheme for OFDM systems. It works by assigning a subset of subcarriers to individual users.

© Team Nokia

Part 1: Technology Trends- b) Data-TDMA

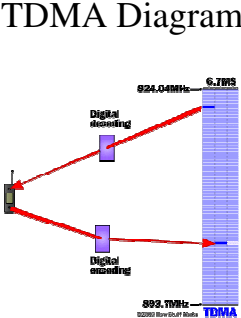
Time Division Multiplex Access

- Time is broken up into time slots, i.e., small, equal-length intervals.
- Each user is assigned one slot per frame. This slot assignment stays fixed as long as the user communicates with the base station (e.g., length of the phone conversation).



LUCIS Summer Workshop, 2004

TDMA Diagram



Nokia

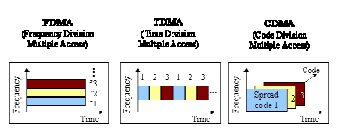
Part 1: Technology Trends- b) Data-CDMA

Packet based wireless access technology
)

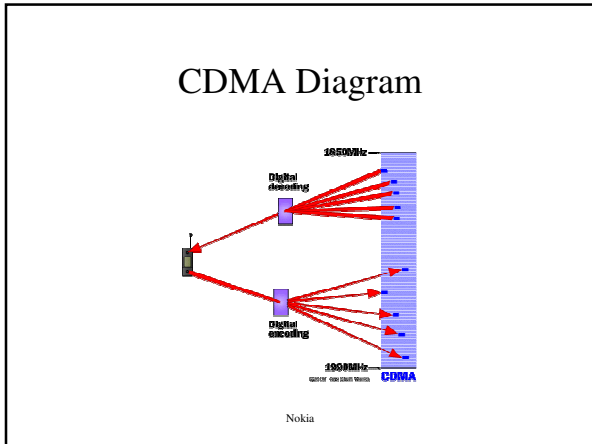
Increases capacity through efficient use of spectrum

Permits many radios to share the same frequency channels

At the same time



ITU



Part 1: Technology Trends- b) Data-CDMA

Cocktail party analogy:
people talk to each other at the same time and thus "interfere" with other. To keep this interference in control, we require that all parties must:

- talk at the same volume level; no one partier shouts above anybody else.
- use a different language to communicate in.

The caveat in this analogy is that if you speak in one language, it is assumed that only your desired listener can understand this language.

LUCIS Summer Workshop

Part 1: Technology Trends- b) Data-GSM

GSM: Global System for Mobile Communications. A TDMA-based digital communication standard, which has been widely deployed in Europe and around the world in the 900 MHz band.

Part 1: Technology Trends- b) Data-PCS, PCN, PHS, PDS

PCS: Personal Communications Services. In Canada and the United States PCS spectrum has been allocated for use by public systems at the 2.0 GHz frequency range.

PHS - a phone standard Developed in Japan. Between A cellphone and cordless

Cellular vs. PCS

- "digital cellular", paging, caller ID and email
- PCS has smaller cells and larger number of antennas.

	Cellular	PCS
Frequency	824MHz-894 MHz	1850 MHz-1990 MHz
Channel spacing	30 KHz	200 KHz
Time slots	3	8

Nokia

Part 1: Technology Trends- a) Simplify-Alphabet soup

- 1G *AMPS, FDMA, TACS*
- 2G *D-AMPS, TDMA, GSM, CDMA, PDC, PHS, PCS*
- 2.5G *GPRS, EDGE*
- 3G *IMT 2000, CDMA 2000 (EvDO), (EGPRS) EDGE, UMTS, FOMA, TD-SCDMA*
- 3.5G *HSDPA, HSUPA*
- 4G *WI-FI, WI-MAX, WI-BRO.....*

Part 1: Technology Trends- b) Data-GPRS

GPRS- General Packet Radio Services



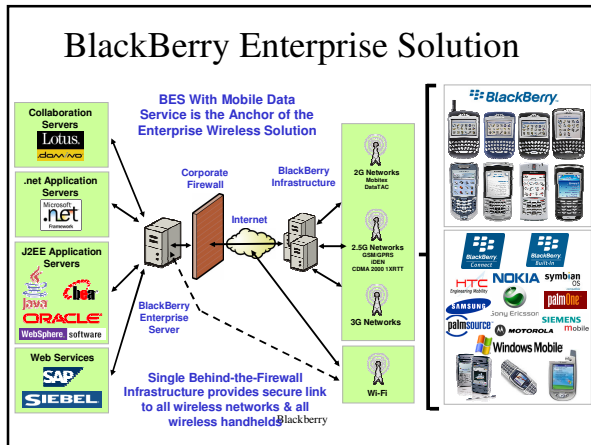
A mobile data service available to users of GSM Mobile phones. It provides moderate-speed data transfers By using unused TDMA channels in the GSM network.




Part 1: Technology Trends- b) Data-EDGE

EDGE- Enhanced Data for GSM Evolution

This technology works in TDMA and GSM networks. EDGE Can offer Internet connectivity and high speed data applications Such as video services and other multimedia benefits upto 384 kbps.



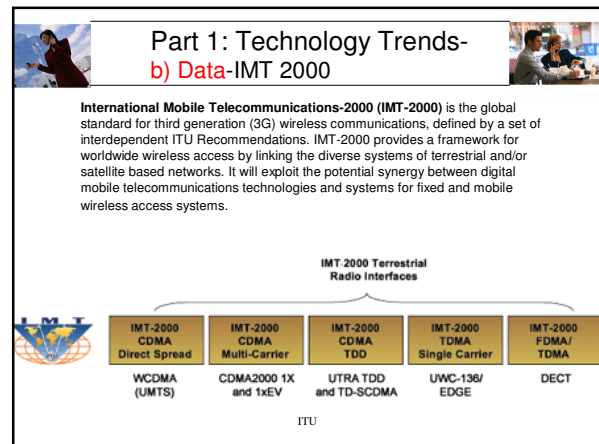
Part 1: Technology Trends- a) Simplify-Alphabet soup



- 1G *AMPS, FDMA, TACS*
- 2G *D-AMPS, TDMA, GSM, CDMA, PDC, PHS, PCS*
- 2.5G *GPRS, EDGE*
- 3G *IMT 2000, CDMA 2000 (EvDo), (EGPRS) EDGE, UMTS, FOMA, TD-SCDMA*
- 3.5G *HSDPA, HSUPA*
- 4G *WI-FI, WI-MAX, WI-BRO.....*

Part 1: Technology Trends- b) Data-UMTS

Another name for UMTS (Universal Mobile Telecommunications System). It is based on CDMA and was envisioned for the next generation of GSM. European standard designed for use of data transmission of 144kbps in vehicles, 384 kbps pedestrian and 2Mbps indoor user. 3G/UMTS employs a 5 MHz channel carrier width to deliver significantly higher data rates and increased capacity, offers optimum use of radio resources, especially for operators who have been granted large, contiguous blocks of spectrum - typically ranging from 2x10 MHz up to 2x20 MHz - to reduce the cost of deploying 3G networks

**Part 1: Technology Trends-
b) Data-TD-SCDMA**



Developed by China. Spectrum efficiency to many more users within a geographical area, and is appropriate for densely populated regions. 5 times better than GSM.




**Part 1: Technology Trends-
b) Data-CDMA 2000 standards**


The CDMA2000 standards CDMA2000 1x, CDMA2000 1xEV-DO, and CDMA2000 1xEV-DV are approved radio interfaces for the ITU's IMT-2000 standard and a direct successor to CDMA, IS-95 (cdmaOne). CDMA2000 is standardized by 3GPP2. CDMA2000 is a registered trademark of the Telecommunications Industry Association (TIA-USA) in the United States, not a generic term like CDMA.

•1x Evolution-Data Optimized, abbreviated as **EV-DO** or **1xEV-DO** and often **EVDO** is a wireless radio broadcast standard. Adopted by CDMA providers e.g. in Japan, Korea, US, Mexico, etc. It is standardized by 3GPP2, as part of the CDMA family of standards.

**Part 1: Technology Trends-
a) Simplify-Alphabet soup**

- 1G *AMPS, FDMA, TACS*
- 2G *D-AMPS, TDMA, GSM, CDMA, PDC, PH5, PCS*
- 2.5G *GPRS, EDGE*
- 3G *IMT 2000, CDMA 2000 (EvDO), (EGPRS) EDGE, UMTS, FOMA, TD-SCDMA*
- 3.5G *HSDPA, HSUPA*
- 4G *WI-FI, WI-MAX, WI-BRO.....*



**Part 1: Technology Trends-
b) Data-Related technologies**

HSDPA- High Speed Downlink Packet Access based on WCDMA. Developed by 3rd Generation Partnership Project (3GPP)


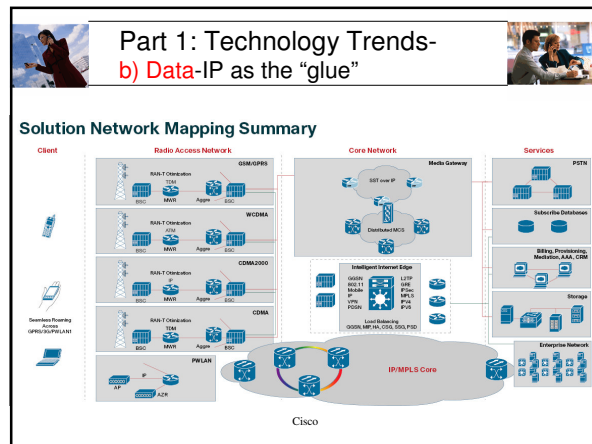
HSUPA High Speed Uplink Packet Access





**Part 1: Technology Trends-
a) Simplify-Alphabet soup**

- 1G *AMPS, FDMA, TACS*
- 2G *D-AMPS, TDMA, GSM, CDMA, PDC, PH5, PCS*
- 2.5G *GPRS, EDGE*
- 3G *IMT 2000, CDMA 2000, (EGPRS) EDGE, UMTS (WCDMA), FOMA, TD-SCDMA*
- 3.5G *HSDPA, EvDO, HSUPA*
- 4G *WI-FI, WI-MAX, WI-BRO.....*

November 2005, Trends "IMS Will Transform Telecom"

IMS Introduces A Standard Architecture For

The diagram illustrates the IMS (IP Multimedia Subsystem) architecture, which is divided into three layers:

- Services layer:** Contains Applications and Content. It provides video clips and a tool to add voiceovers.
- Control layer:** Contains Media gateways and Session control. It uses presence to find Mary on a network.
- Access layer:** Contains Wireless and Wireline. It handles the physical transmission of data.

Example scenarios:

- Janice sends a *Desperate Housewives* voice-annotated video clip with her singing "Happy Birthday" to Mary.
- Mary receives Janice's voice-annotated video clip on her mobile phone.

Note: Many additional applications like locator games, active phone book, and IPTV will be available.

Forrester

Part 1: Technology Trends- b) Data-IP backbone

IP Backhaul Case Study: Live Busy Hour GSM Efficiency Gain Results

The graph shows E1 Utilization over a 39-second period. The 'Before Optimization' line shows high utilization, while the 'After Optimization' line shows significantly lower utilization. Key metrics include:

- 100% Idle Bandwidth Recovered
- 70% Bandwidth Recovered
- 50% Active Bandwidth Recovered

Legend: Blue line = Avg E1 TMD Util; Red line = Avg Util After Opt; Yellow line = Inst Util After Opt; Green line = Inst Util Before Opt; Black line = Avg Util Before Opt.

Cisco

Part 1: Technology Trends- b) Data-IP backbone

HSDPA Offload to Ethernet Backhaul: IP Broadband RAN Transport

The diagram shows a network architecture for HSDPA offload to Ethernet backhaul. It includes a Cell-Site with BTS and Node-B, connected to a BSC and RNC. The network is connected to a Mobile Operator Network PLMN. Key components include:

- Optimized GSM and UMTS RAN Backhaul: Abis + Luo Over IP
- GSM/GPRS/EDGE path
- UMTS Voice and Signaling path
- Broadband IP Backhaul
- Wimax, DSL, Metro-E, Microwave (Ethernet over SD-WAN)

Cisco

Part 1: Technology Trends- b) Data-IP access/network devices

WLAN

802.11 is a family of specifications for wireless local area networks (WLANs) developed by a working group of the Institute of Electrical and Electronics Engineers (IEEE).

There are four specifications of current interest: 802.11, 802.11a, 802.11b, and 802.11g. All four use the Ethernet protocol and CSMA/CA (carrier sense multiple access with collision avoidance) for path sharing. The most recently approved standard, 802.11g, offers wireless transmission over relatively short distances at up to 54 megabits per second (Mbps) compared with the 11 megabits per second of the 802.11b standard. Like 802.11b, 802.11g operates in the 2.4 GHz range and is thus compatible with it.

802.11a/b/g (Wi-Fi)

802.11a	802.11b	802.11g
5 GHz	2.4 GHz	2.4 GHz
54 Mbps	11 Mbps	54 Mbps
Less interference, more bandwidth	Best over-all coverage range	Faster than 802.11b and better range than 802.11a
Not as widely implemented, shorter range	Not as fast as other technologies	Less range than 802.11b

- 802.11n – 100Mbps, still in draft

www.virchowkrause.com

Part 1: Technology Trends- b) Data-Wi-Max

Assumptions	Frequency: 3.5 GHz Bandwidth: 3.5 MHz Per 60° sector	Full featured		Standard	
		From	To	From	To
LOS		30	50	10	16
NLOS (Erect-Flat)		4	9	1	2
Indoor self-install CPE		1	2	0.3	0.5
Maximum throughput per sector (Mbps)	Downlink	11.3	8	11.3	8
	Uplink	11.3	8	11.3	8
Maximum throughput per CPE at cell edge (Mbps)	Downlink	11.3	2.8	11.3	2.8
	Uplink	0.7	0.175*	11.3	2.8
Maximum number of subscribers		More		Less	

IEEE 802.16 Standard

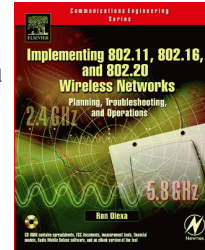
	802.16	802.16a/HiperMAN	802.16e
Completed	December 2001	January 2003 (802.16a)	Estimate mid '04
Spectrum	10 - 66 GHz	< 11 GHz	< 6 GHz
Channel Conditions	Line of Sight Only	Non Line of Sight	Non Line of Sight
Bit Rate	32 - 134 Mbps in 28MHz channel bandwidth	Up to 75 Mbps in 20MHz channel bandwidth	Up to 15 Mbps in 5MHz channel bandwidth
Modulation	QPSK, 16QAM and 64QAM	OFDM 256 sub-carriers QPSK, 16QAM, 64QAM	Same as 802.16a
Mobility	Fixed	Fixed, Portable	Nomadic Mobility
Channel Bandwidths	20, 25 and 28 MHz	Scalable 1.5 to 20 MHz	Same as 802.16a with UL sub-channels
Typical Cell Radius	2-5 km	7 to 10 km Max range 50 km	2-5 km

Part 1: Technology Trends- b) Data-802.20 and on

IEEE 802.20-

Discussion reopened
In IEEE in Sept'06

Is this a captured
Standard?

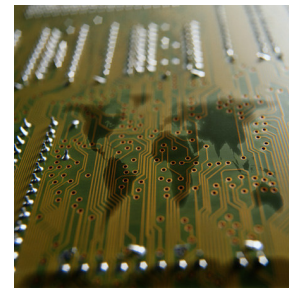


Part 1: Technology Trends- b) Data-Wi-Bro

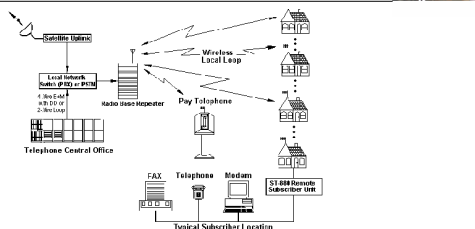
Developed in Korea. In Feb 2002, the Korean government Allocated 100Mhz of spectrum in the 2.3Ghz band and in Late 2004 WiBro Phase 1 was standardised by the TTA (Telecommunications Technology Association) of Korea



Part 1: Technology Trends- -Related technologies

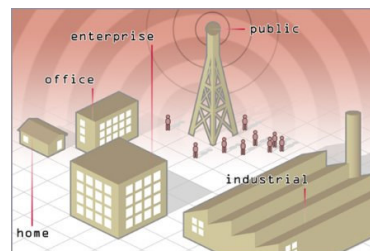


Part 1: Technology Trends- b) Data-WLL



WLL Wireless local loop (WLL) describes a technique where wireless communications are used as the final "last mile" link between the person holding the telephone (or sitting at the computer terminal) and the start of the telephone pole or other wired service. There are a number of technologies that can be used to provide this link, including CDMA, TDMA, GSM, UMTS 3G, PHS, PAS, DECT, and LMDS to name a few.

Part 1: Technology Trends- b) Data-DECT



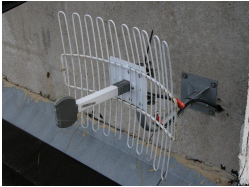
Linksys DECT
VOIP phone

(Source: DECT Forum)
**DECT wireless technology targets
homes, businesses, industry, and public
areas**

(DECT) DECT or Digital Enhanced (formerly European) Cordless Telecommunications is an ETSI standard for digital portable phones, commonly used for domestic or corporate purposes. DECT can also be used for wireless data transfers.

Part 1: Technology Trends-
b) Data-MMDS


MMDS operates at lower frequencies, in the 2 GHz licensed frequency bands. MMDS has wider coverage than LMDS, up to 35 miles, but has lower throughput rates.



Part 1: Technology Trends-
b) Data-LMDS

<http://www.wcai.com/lmlds.htm>

LMDS is a Local Multipoint Distribution Service, a broadband wireless point-to-multipoint communication system operating above 20 GHz - used to provide digital two-way voice, data, Internet, and video services. Average distance between LMDS transmitters is approximately one mile apart.



Part 1: Technology Trends-
b) Data-DVB-H

DVB-H (Digital Video Broadcasting-Handheld)
Used by mobile operators to multicast digital television signals to mobile handsets. DVB-H technology adapts the DVB system for transmission of digital television to handheld, battery-powered receivers.




Part 1: Technology Trends-
b) Data-FLO

FLO (Forward Link Only) is a multicast technology that was designed to increase the capacity and reduce the cost of delivering video, audio and other content To large numbers of user simultaneously. FLO is complementary to cellular networks using CDMA 2000, EV-DO, or WCDMA. Intended to be an alternative to DVB-H.



Part 1: Technology Trends-
b) Data-Bluetooth

- Bluetooth is the codename for a technology specification for small form factor, low-cost, short range radio links between mobile PCs, mobile phones and other portable devices. The Bluetooth Special Interest Group is an industry group consisting of leaders in the telecommunications and computing industries that are driving development of the technology and bringing it to market.
- http://www.digianswer.com/tech_list.asp

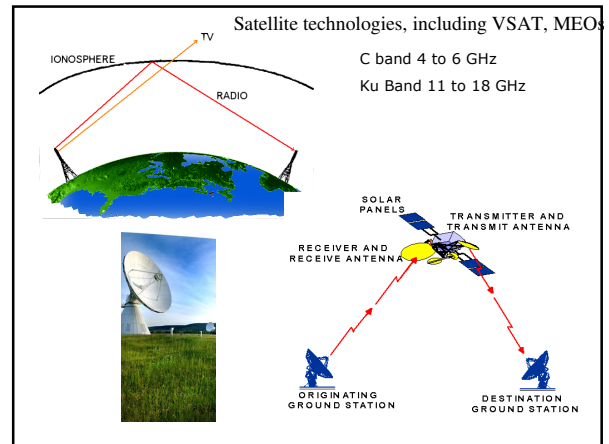
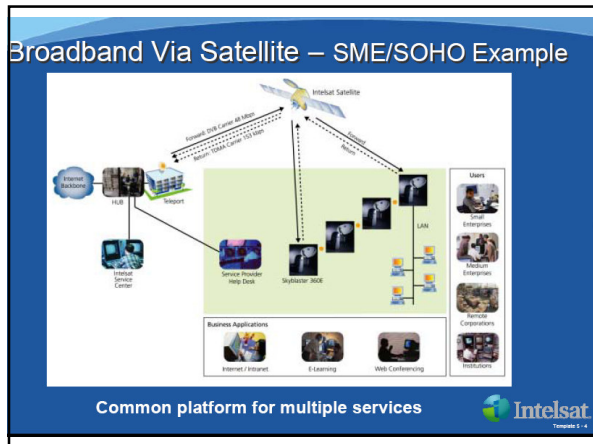


Part 1: Technology Trends-
b) Data-RFID

- RFID and other wireless sensors are at early stages of development and have limitless potential for business and home use.
- Some current uses: tracking supplies and inventory, tracking baggage on airlines, monitoring livestock.
- Policy issues discussed at Department of Commerce's April 2004 Forum
 - Need for different types of spectrum
 - Need for harmonization of standards globally
 - Privacy concerns about information stored through RFID.



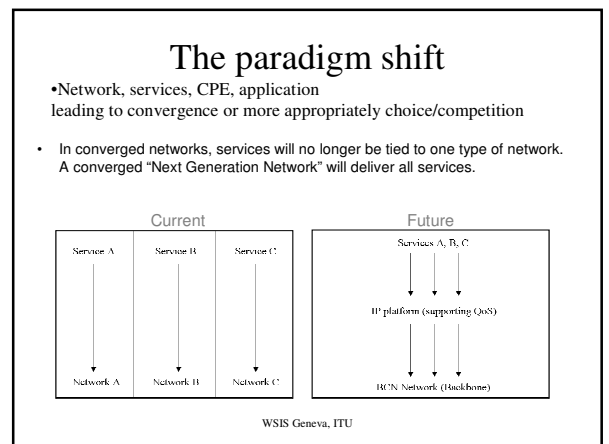
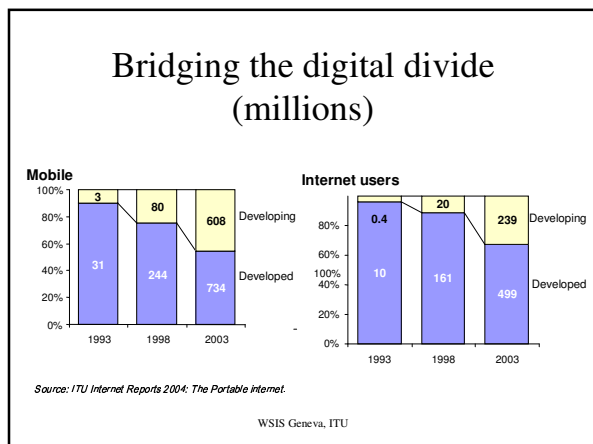
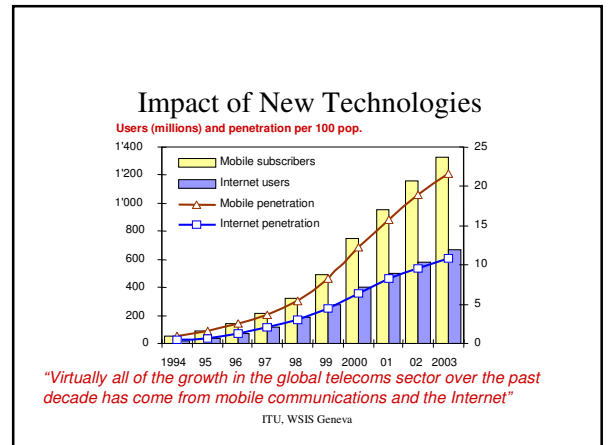
NTIA



Part 1: Technology Trends-

This session objective is to:

- simplify
- gather data
- formulate framework



Part 1: Technology Trends-

c) Framework -principles


What is your goal?
Use this to assess current and future technologies..

- connectivity
- affordability and usability
- bandwidth
- mobility
- interconnectivity

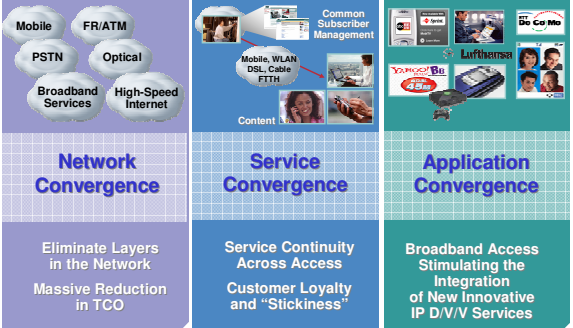
Are you trying to achieve

- Pt to pt
- pt to multipt
- multipt to multipt

Beware of walled garden promises in technology



Trend: Convergence



Network Convergence

Eliminate Layers in the Network
Massive Reduction in TCO

Service Convergence

Service Continuity Across Access
Customer Loyalty and "Stickiness"

Application Convergence


Broadband Access Stimulating the Integration of New Innovative IP D/V/V Services

© Cisco

Part 1: Technology Trends-


This session objective was to:

- simplify
- gather data
- formulate framework



End of Part 1: Technology Trends

Cleared some confusions?



- Any questions?.....