

# World Information and Communications Development Trends

Ministry of Information and Communications (MIC)  
Hanoi, Viet Nam

27 August 2007

Robert Shaw

Head, ICT Applications and Cybersecurity Division  
ITU Telecommunication Development Sector  
International Telecommunication Union

# Agenda

- Introduction to ITU
- Networks in Transition: the Impact of New Technologies
- From Fixed to Mobile
- On the Internet
- What Comes Next?
- Next Generation Networks: Convergence between Fixed, Mobile and IP networks
- What Rules Will Apply to Next Generation Networks?
- Summary

# Introduction to ITU

- International organization where governments and private sector coordinate global telecom networks and services
- Founded in 1865, it is oldest specialized agency of the UN system
- 191 Member States, 780 Sector Members & Sector Associates
- Headquarters Geneva, 11 regional offices, 760 staff / 80 nationalities

# ITU Mission & More

- Maintain and extend international cooperation in telecommunications
- Technical and policy assistance to developing countries
- To harmonize actions of Member States and promote cooperation between Member States and Sector Members
- Instigator and manager of the **World Summit on the Information Society (WSIS) held in two phases**
- ITU has been named as one of the **world's ten most enduring institutions** by US university scholars
  - Defined as an institution that has changed and grown in unswerving success and relevance — yet remained true through time to its founding principles

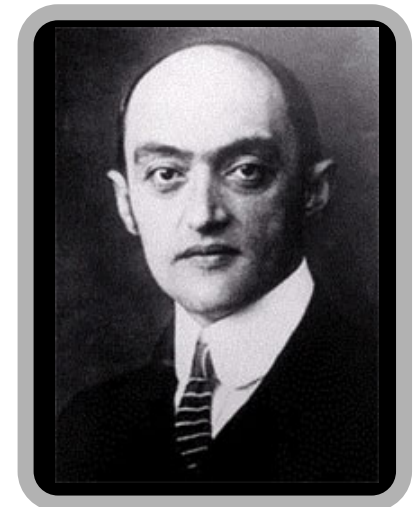




# Networks in Transition

# The Impact of New Communications Technologies

- Technology-driven industries like the communications sector have historically been characterized by steady growth punctuated by “giant leaps” forward, usually when “new” technology is introduced
- “Technology is not kind. It does not wait. It does not say please. It slams into existing systems. Often destroying them, while creating new ones”
  - Joseph Alois Schumpeter (1937)



# Has happened a number of times

- 1840's: telegraph
- 1870's: telephone
- 1890's: radio telegraphy or "wireless"
- 1920's: radio broadcasting
- 1950's: television broadcasting
- 1960's: geostationary satellite communications
- 1970's: computer communications
- 1980's: optical communications
- 1990's: Internet and mobile
- 2000's: ?

1865: ITU Created

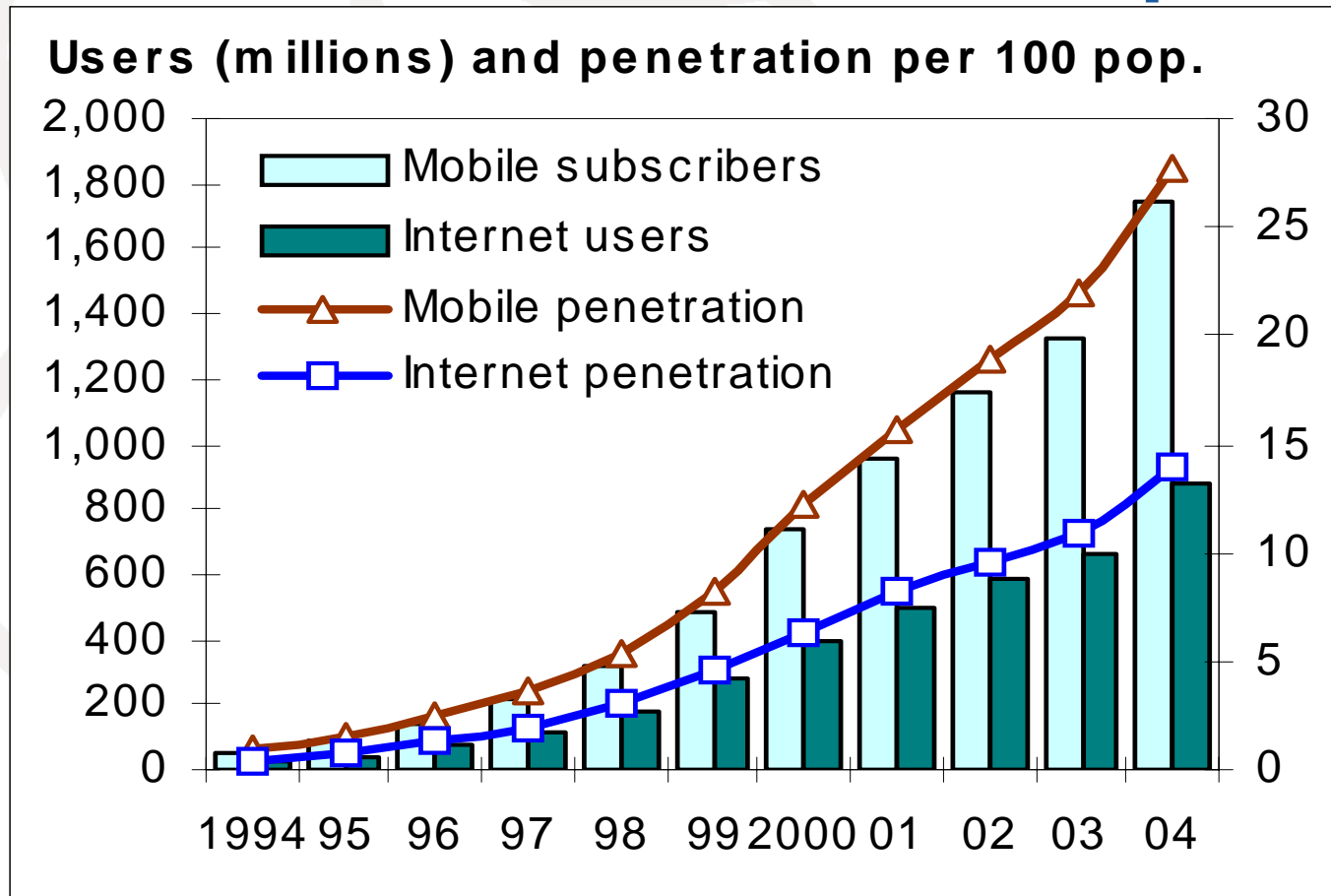
# Impact of New Technologies

- In the last part of the twentieth century, the almost simultaneous arrival of two major innovations — **mobile technology** and the **Internet** — not only changed the face of communications, but also gave impetus to economic growth

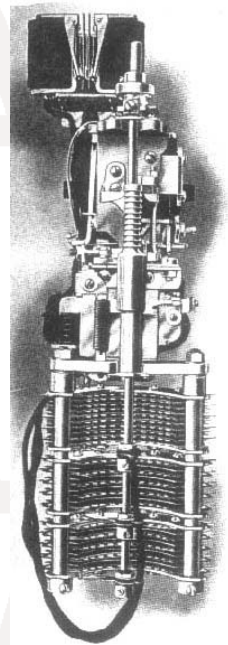




# Mobile and Internet: Twins Born Two Years Apart



# From Fixed to Mobile



## The First Mobile?

- 1910: Lars Magnus Ericsson and his wife Hilda regularly used the first car phone

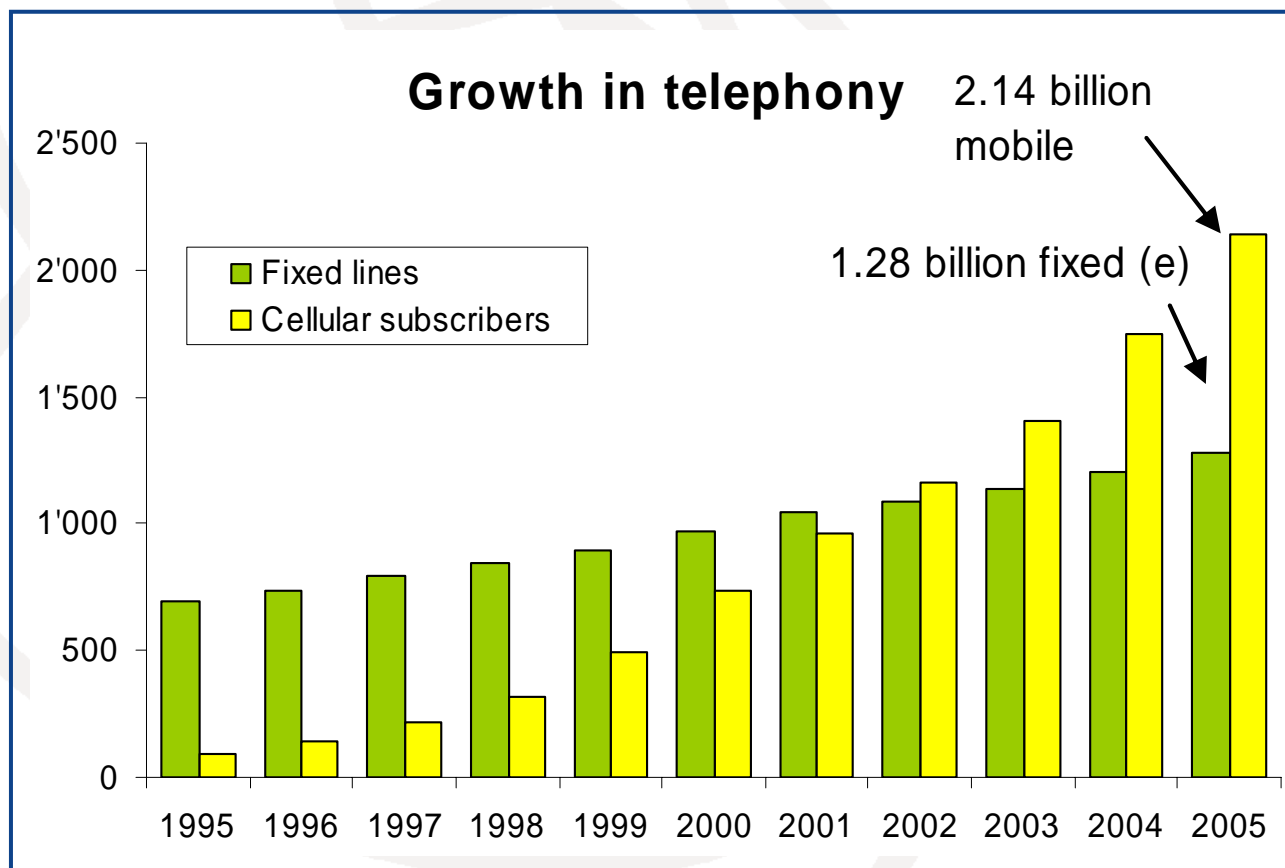


# 1924: The First Mobile Radio Telephone



Source: <http://www.bell-labs.com/technology/wireless/earlyservice.html>

# Growth in Telephony: Mobile Overtakes Fixed



Source: ITU

# Mobile: the Dominant End-User Platform

- Economies of scale
  - 2 billion and growing
- Wide Appeal
  - young, old, male, female, rich, poor...
- Size and portability
  - Smaller than laptop, low power requirements
  - Growing in functionality/sophistication
- Emotional Attachment
  - many can't leave home without it
- Fashion and identity
  - Accessory, personal diary, status symbol
- Physical proximity
  - At day, at night, standing still, on the move



# Mobile in Developing Countries



- Developing countries have seen the greatest impact of mobile communications for access to basic telecommunication services
- Cellular networks can be built faster than fixed-lines networks and can cover geographically challenging areas
- Mobile services have served to boost competition
- Prepaid has opened access to mobile for those who would otherwise not qualify for telephone subscription plans

# 15 Leaders in Mobile





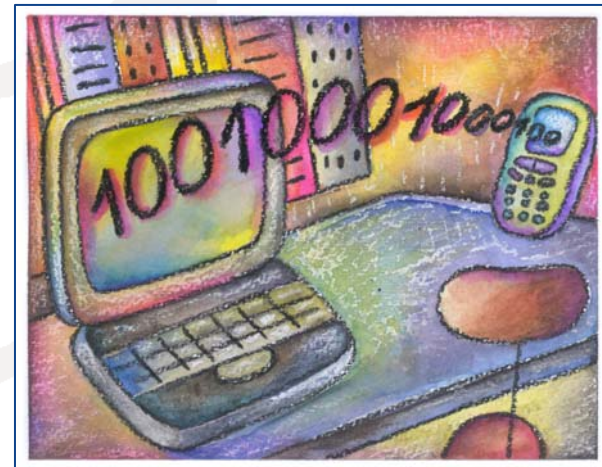
# W-CDMA vs. CDMA2000

- ITU refers to family of 3G technologies as **IMT-2000**
- 269.5 million IMT-2000 users at end of 2005
  - 225.1 million CDMA2000 + 44.4 million W-CDMA
- CDMA2000 has lead on W-CDMA
  - CDMA 2000 was more natural transition from 2G cdmaOne
  - GSM to W-CDMA was substantial upgrade
  - Another inhibitor was high license fees for 3G in Europe
- Although ITU includes CDMA2000 in the IMT-2000 family, it is perhaps more appropriate to compare W-CDMA with faster CDMA2000 1x EV-DO



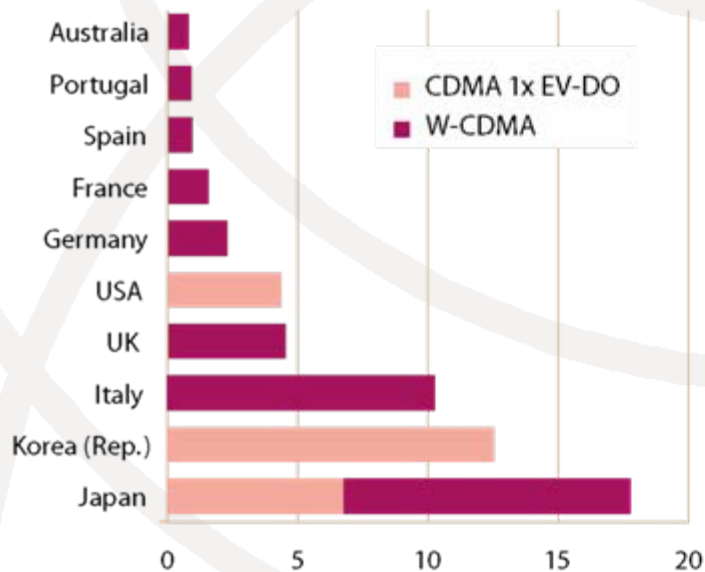
# HSDPA: Enhancing 3G for W-CDMA networks

- HSDPA: High-Speed Downlink Packet Access offering smooth cost-efficient upgrade to existing W-CDMA networks
- W-CDMA enables streaming video, broadband Internet access and video conferencing, but...
  - HSDPA offers peak downlink data rates of up to 14 Mbps - dramatically more than the 384 kbps that is typical of today's 3G and highest data rate of any available mobile WAN technology
- According to survey by Global mobile Suppliers Association (GSA), 94 HSDPA networks are planned, in deployment or commercially launched in 47 countries

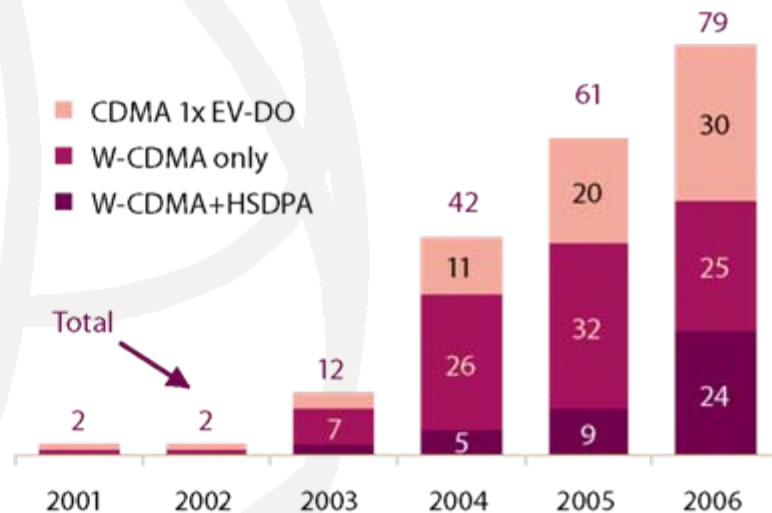


# Expansion of 3G Mobile and Mobile Broadband

Top ten 3G mobile markets, 2005



Number of economies with mobile broadband technologies, 2001-2006



Source: ITU/UNCTAD/KADO Digital Opportunity Platform and ITU Internet Report 2006: digital.life.

# On the Internet



# Data Communication Paradigms



- In early data networking days, there was assumption that the telephony model of reserving dedicated circuits was also right model for data communication
- However:
  - Data can't flow until path set up
  - Call fails if path cannot be established
  - Required bandwidth must be reserved
  - Efficiency decreases as path setup time increases or bandwidth increases
  - Requires all components along the path to be highly reliable

# Enter Paul Baran and Don Davies

- While working at RAND on a scheme for U.S. telecommunications infrastructure to survive a "first strike," Baran outlined distributed network architecture
- Baran's work was similar to research performed independently by Donald Davies in UK (the term 'packet switching' comes from Davies)
- Baran's work appeared in RAND Memorandum "**On Distributed Communications**" published in 1964
- Suggested a non-telephony communication paradigm with distributed architecture
- This was considered to be **crazy** in 1964



# "On Distributed Communications", 1964

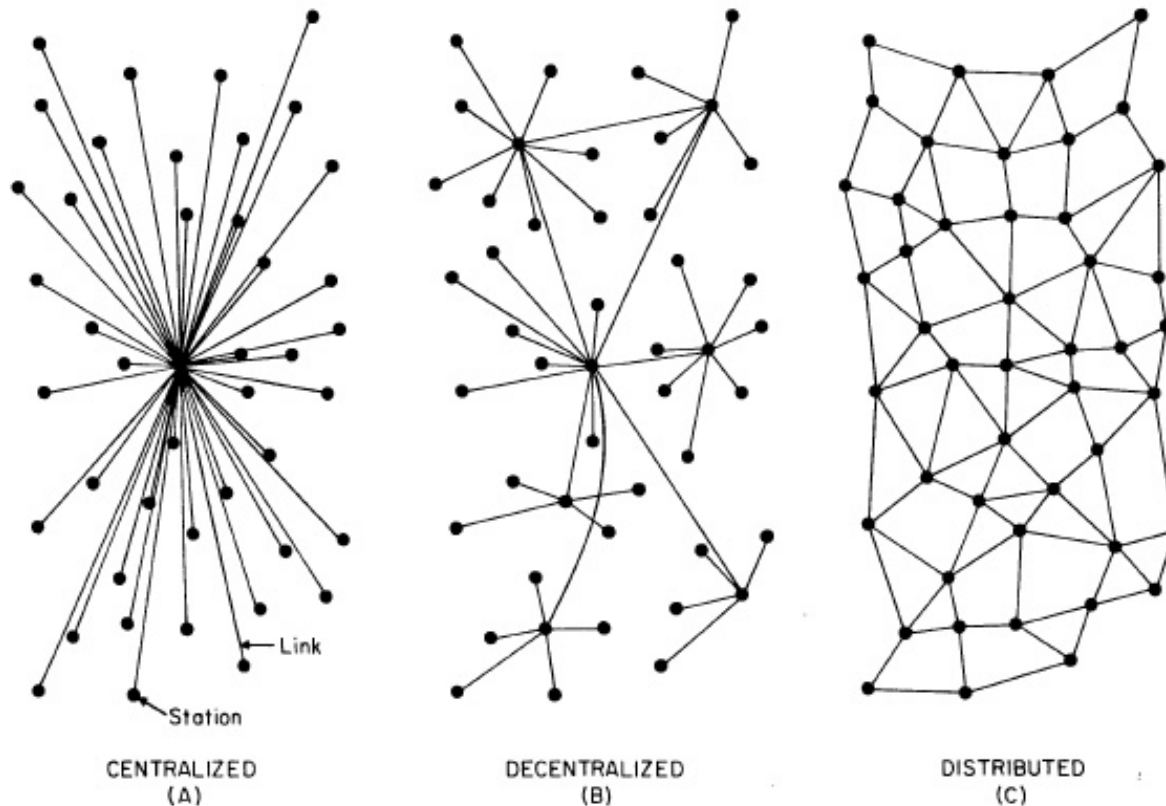
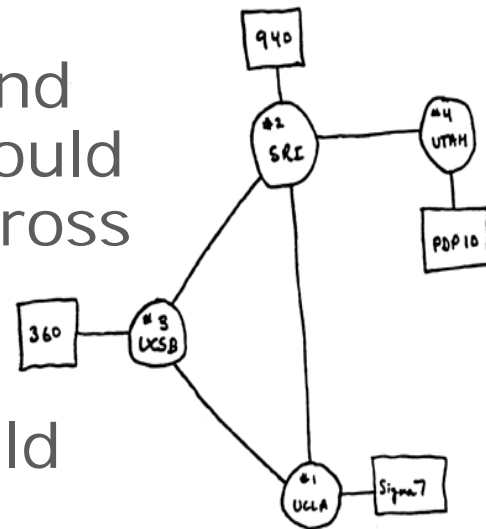


FIG. 1 – Centralized, Decentralized and Distributed Networks

# Enter Bob Kahn and Vint Cerf

- Everybody wants their own packet switched network (and there were many different types...)
- Vint Cerf and Bob Kahn realized a **common encapsulation format** and **common addressing structure** would mean there could be 'transitivity' across multiple networks
- Wrote specifications in 1974 and demonstrated in 1977 that they could 'concatenate' multiple networks to "internetwork"
- This protocol becomes **'TCP/IP'**





# TCP/IP becomes dominant data networking paradigm



- Focuses on end points rather than connectivity paths
- Data sent in chunks with each chunk having name of final destination
- Reliability increases exponentially as system scales up
- Distributed routing supports any topology and tends to spread load and avoid hierarchy's hot spots
- Adaptive routing lets system heal itself and hook up initially
- Took around 10 years for people to realize that this was an efficient network
- With invention of WWW in 1989, the Internet reaches a new audience

# Internet History after the Web

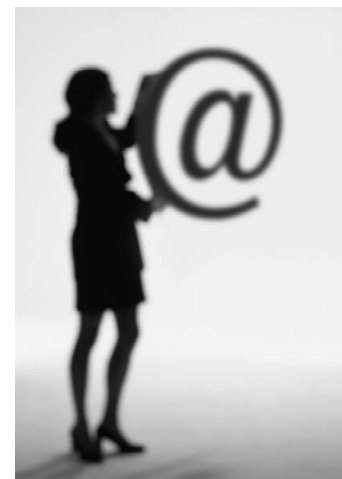
## 1990's

- Growth throughout OECD countries
- Begun "privatisation" of backbone
- Primarily a channel for Web and email
- Wide disparity in connectivity
- "Dot.com" mania rules
- Some thought Internet was suitable platform to subsume all existing networks & services
- Cocktail of over-investment, hyper-competition and technological change lead to telecoms & Internet recession



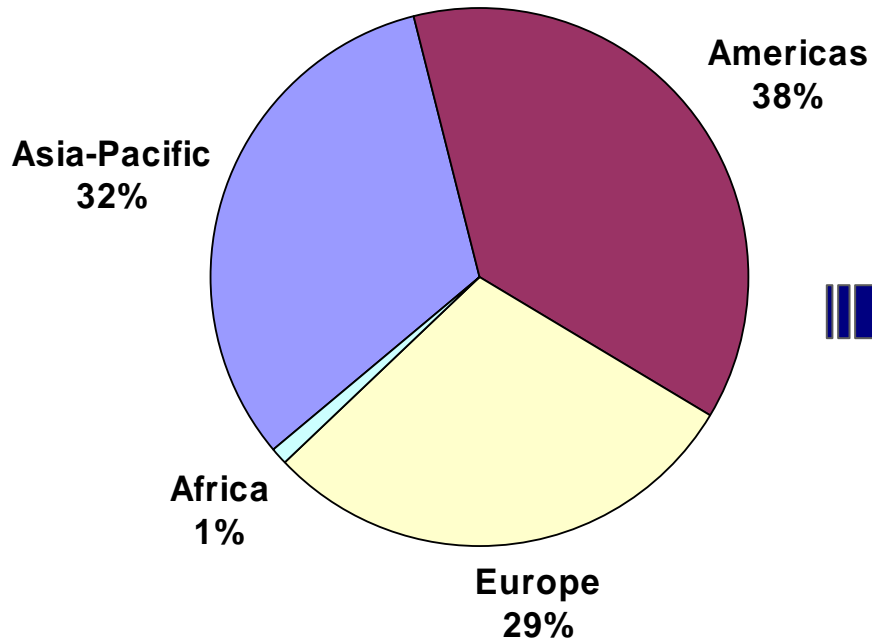
# Internet 2007

- Communications epicentre has shifted from North America and Western Europe to Asia-Pacific
- Majority of Internet and mobile users in Asia-Pacific and nowhere to grow but up
- China has overtaken the United States as the world's largest market for fixed-lines, mobile and soon broadband
- Continued innovation:
  - Blogs, Wikis, XML, Ajax, Grids, Mesh, SOAP, Web services, Skype, RSS, Torrents, Podcasts, Web 2.0, mashups, geo-location services
- P2P data traffic exceeds web traffic by a factor of 10
  - massive growth of video
  - voice just another application

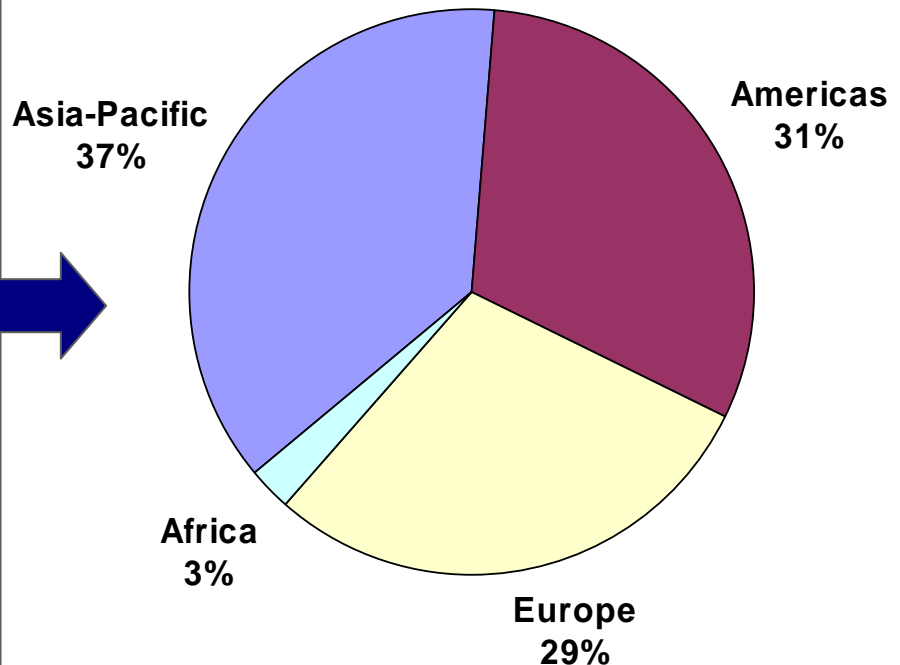


# Shift in Demographics: Internet Users by Region 2001-2004

**2001: Number of Internet Users by Region**  
Estimated 500 Million Users

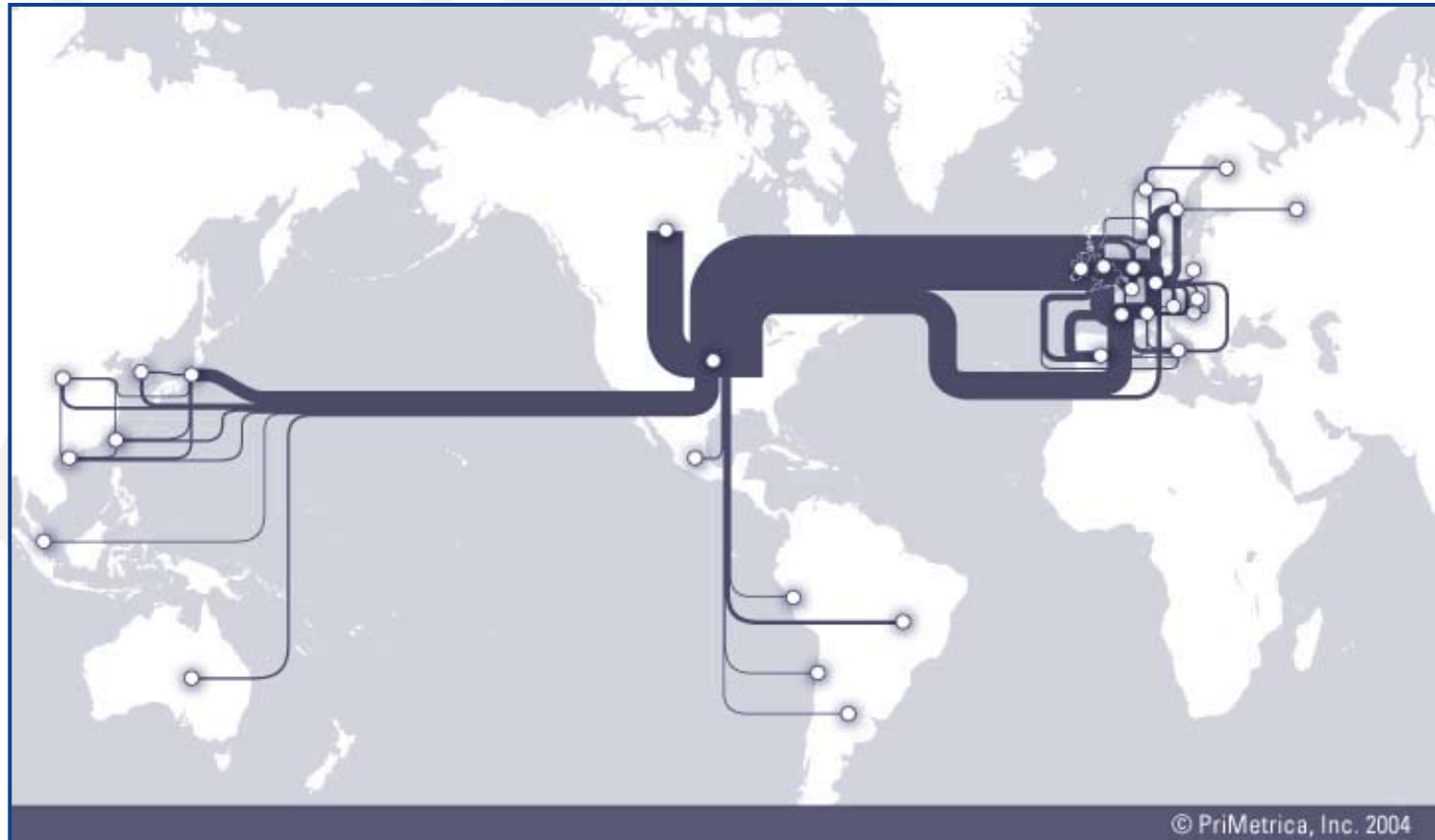


**2004: Distribution of Internet Users by Region**  
Estimated 875 Million Users



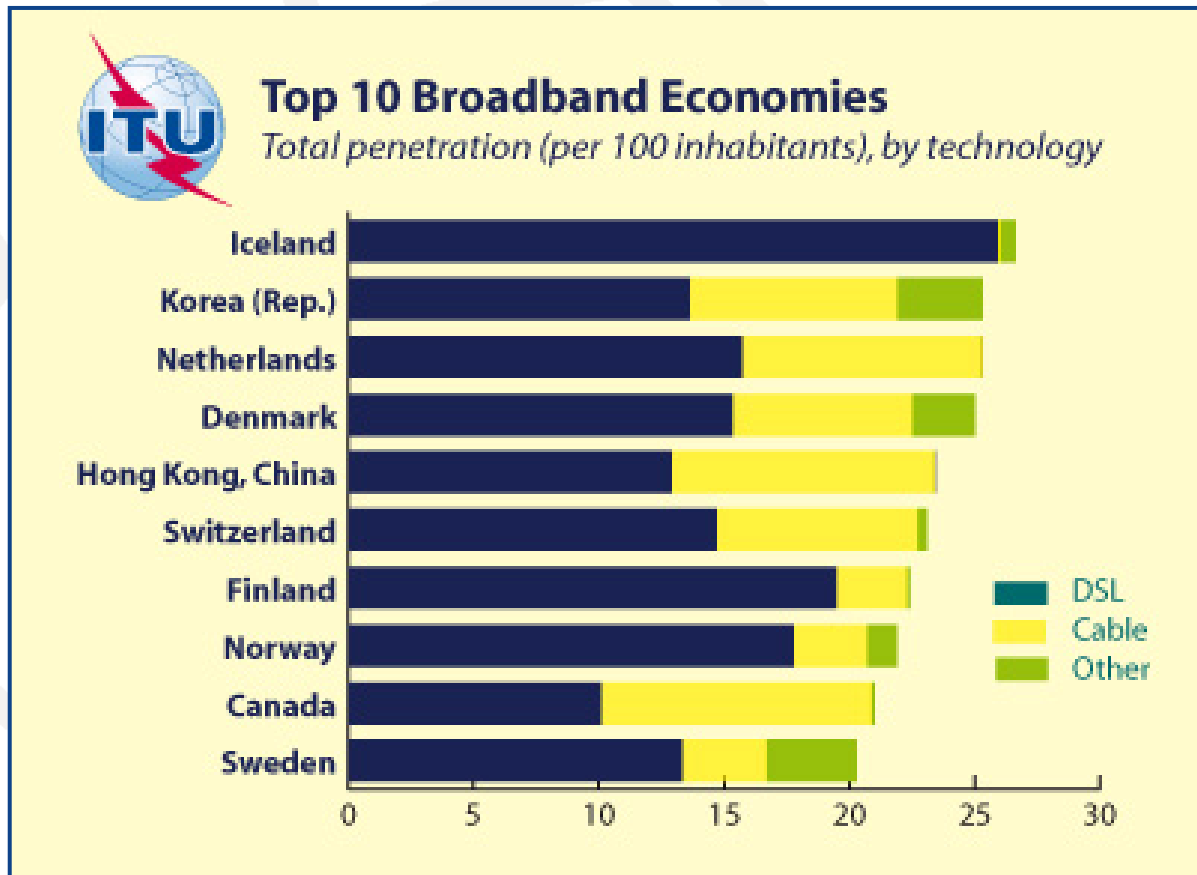
Asia-Pacific has overtaken Americas as largest percentage of regional Internet users with much more potential for growth...

# Great Disparities in Connectivity



# Top Broadband Economies

(January 2006)



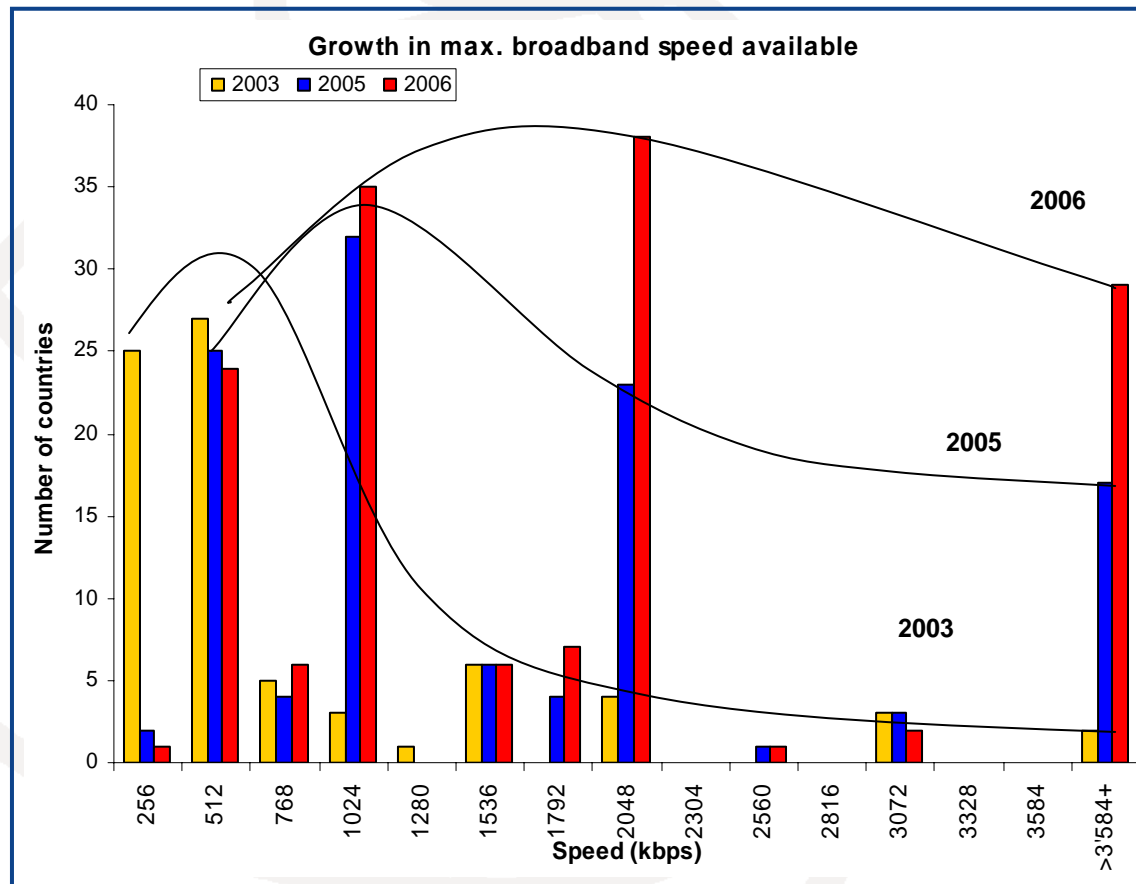
# Top Broadband Markets

Economy	Total fixed broadband subscribers (000s) 2005	Penetration (per 100 inhabitants) 2005	As a % of Internet subscribers	Price (in USD per 100 kbit/s) 2006
1. United States	50'237.1	16.9	73.9	\$0.49
2. China	37'504.0	2.9	51.2	\$1.47
3. Japan	22'374.9	17.5	66	\$0.06
4. Korea (Rep.)	12'190.7	25.2	100	\$0.08
5. Germany	10'687.0	12.9	53.4	\$0.52
6. United Kingdom	9'864.0	16.5	63.1	\$0.63
7. France	9'449.0	15.6	71.3	\$0.37
8. Italy	6'780.0	11.7	38.5	\$0.31
9. Canada	6'429.0	19.9	80.4	\$1.08
10. Spain	4'994.3	11.7	90	\$4.89
11. Taiwan, China	4'340.9	19	54.1	\$0.18
12. Netherlands	4'100.0	25.2	58.6	\$0.14
13. Brazil	4'385.1	2.4	26.5	\$1.20
14. Mexico	1'876.3	1.8	47.7	\$6.24
15. Australia	2'102.8	10.4	35.2	\$3.41
16. Belgium	2'004.9	19.4	91.7	\$1.22
17. Sweden	1'931.0	21.4	58.5	\$0.24
18. Switzerland	1'631.8	21.9	62.7	\$1.57
19. Hong Kong, China	1'659.1	23.6	63.0	\$0.83
20. Turkey	2'253.1	2.2	70.6	\$9.85
<b>WORLD</b>	<b>216'708.6</b>	<b>3.4</b>	<b>56.2</b>	<b>\$76.01</b>

Note: "Fixed Broadband" is considered any dedicated connection to the Internet of 256 kbit/s or faster.

Source: ITU/UNCTAD Digital Opportunity Platform and ITU World Telecommunication Indicators Database.

# Broadband is getting faster





# Broadband is getting cheaper

<i>Economy</i>	<i>Company</i>	<i>Speed kbit/s</i>	<i>Price per month US\$</i>	<i>US\$ per 100 kbit/s</i>	<i>Change 2005-06</i>
Japan	Yahoo BB	51'200	36.00	0.07	-12.5%
Korea (Rep.)	Hanaro	51'200	40.59	0.08	--
Netherlands	Internet Access Ned.	20'480	27.97	0.14	-81.3%
Taiwan, China	Chunghwa	12'288	22.67	0.18	--
Sweden	Bredbandsbolaget	24'576	56.08	0.23	-6.5%
Singapore	StarHub	30'720	73.17	0.24	-85.0%
Italy	Libero	12'288	37.23	0.30	-73.8%
Finland	Elisa	24'576	85.64	0.36	-51.4%
France	Free	10'240	37.29	0.36	-90.1%
United States	Comcast	4'096	20.00	0.49	--
Germany	Freenet.de	6'016	30.95	0.52	--
United Kingdom	Pipex	8'128	50.89	0.63	-53.6%
Hong Kong, China	Netvigator	6'144	51.17	0.83	-0.1%
Portugal	Sapo	8'128	75.82	0.93	-0.8%
Canada	Bell	4'096	41.26	1.01	-3.93%
<b>Average</b>		<b>18'278</b>	<b>44.33</b>	<b>0.43</b>	<b>-45.5%</b>
<b>Best practice (top 20%)</b>		<b>40'960</b>	<b>27.59</b>	<b>0.10</b>	<b>-46.9%</b>

# Birth of Triple Play

Table 1. Triple-play pricing with unlimited PSTN calling plans, September 2005

Company	Type	Country	Price USD (PPP)	Price USD	Down (kbit/s)	Bit Cap (MB)	TV Chan
Free Telecom	ADSL	France	32.50	36.72	20 000		93
Casema	Cable	Netherlands	48.43	53.75	10 000		42
Versatel	ADSL	Netherlands	60.62	67.28	20 000		1
Kabel Deutschland	Cable	Germany	68.77	78.40	6 200		38
Cablecom	Cable	Switzerland	71.83	102.72	2 000		87
TeliaSonera	ADSL	Sweden	75.00	92.25	24 000		23
Dansk Bredbånd	FTTB	Denmark	78.87	112.78	10 000		30
France Telecom	ADSL	France	78.98	89.25	8 000		34
Lyse	Fibre	Norway	80.86	120.48	4 000		23
Mstar	Fibre	USA	90.26	90.26	15 000		24
Smart Telecom	Fibre	Ireland	91.38	122.44	2 000		70
Noos	Cable	France	91.89	103.83	10 000		100
Telenor	ADSL	Norway	98.54	146.83	4 000		25
TDC	ADSL	Denmark	100.68	143.97	4 096		18
Telewest	Cable	UK	106.50	119.28	1 000		100
Belgacom	ADSL	Belgium	113.54	124.89	4 000	30 000	42
SBC	ADSL	USA	124.97	124.97	3 000		60
Homechoice	ADSL	UK	129.89	145.47	8 000		55
Cogeco	Cable	Canada	144.05	151.25	10 000	30 000	88
Comcast	Cable	USA	149.79	149.79	6 000		70

Source: <http://www.oecd.org/dataoecd/47/32/36546318.pdf>

## But Many Problems Preventing Internet to Scale to Robust Public Infrastructure

- authentication
- security
- spam
- dumb network
- governance
- measurement
- patch management
- "normal accidents"
- scalable configuration management
- robust scalability of routing system
- compromise of e2e principle
- growth trends in traffic and user expectations
- time management and prioritization of tasks
- intellectual property and digital rights
- interdomain qos/emergency services
- inter-provider vendor/business coordination



Source: Top Problems of the Internet, K.C. Claffy at <http://www.caida.org/publications/presentations/2005/topproblemsnet/topproblemsnet.pdf>

# Clean Slate Approach?

- “It's time for a clean-slate approach”
  - MIT's David D. Clark
- “If fails to fail often enough so it looks like it works”
  - Mike O'Dell
- “The Internet is Broken”, David Talbot, Technology Review, Dec 2005/Jan 2006 in three parts: [Part 1](#), [Part 2](#), [Part 3](#)
- E2E architecture means intelligence at edges
  - **securing the edge becomes each user's problem**
- Too much reliance of economies and society on fragile and insecure infrastructure



# What Comes Next?

# Dangers in Predicting the Future

- Napoleon: “**History is the version of past events that people have decided to agree upon.**”
- When we look back over history in advancements in electronic communication networks, we tend to forget about the **highs and the lows**, the **boom-bust cycles** and the **failed predictions about likely usage**

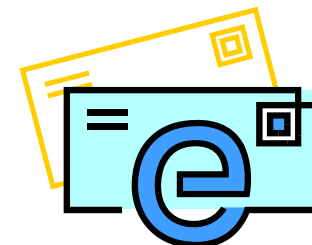
# We Often Get It Wrong: Telephone

- “For the first 30 years of the telephone, promoters struggled to identify the **killer application** that would promote its wide adoption by home owners and businesses. ...
- Telephone promoters in the early years touted the telephone as new service to broadcast news, concerts, church services, weather reports, etc... **The concept that someone would buy the telephone to chat was simply inconceivable at that time.**”
  - C. Fischer, America Calling



# We Often Get It Wrong: Email

- “The popularity of email was not foreseen by the ARPANET's planners. Roberts had not included electronic mail in the original blueprint for the network. In fact, in 1967 he had called the ability to send messages between users **“not an important motivation for a network of scientific computers”** . . .
  - J. Abbate, *Inventing the Internet*





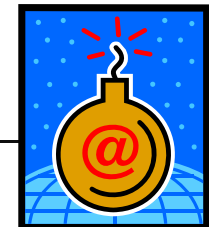
# We Often Get It Wrong: Messaging

- Few believed that **sending text messages from one mobile user to another** would be a useful function
- Korea: mid-2005 – 90 million text messages sent each day...
- In 2005:
  - United Kingdom: 29 billion
  - China: 300 billion!

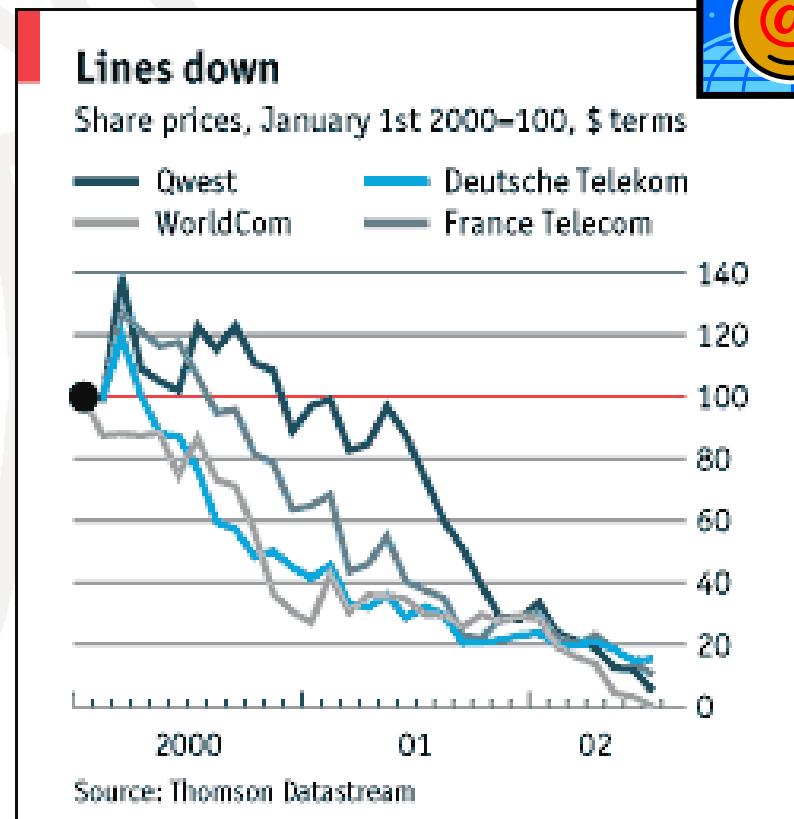
Connect  
without  
talking



# We Often Get It Wrong: Dot.Com Crash



- Trillions of US Dollars lost in shareholder value
- Leading companies in heavy debt or bankruptcy
- Hundreds of thousands of jobs lost



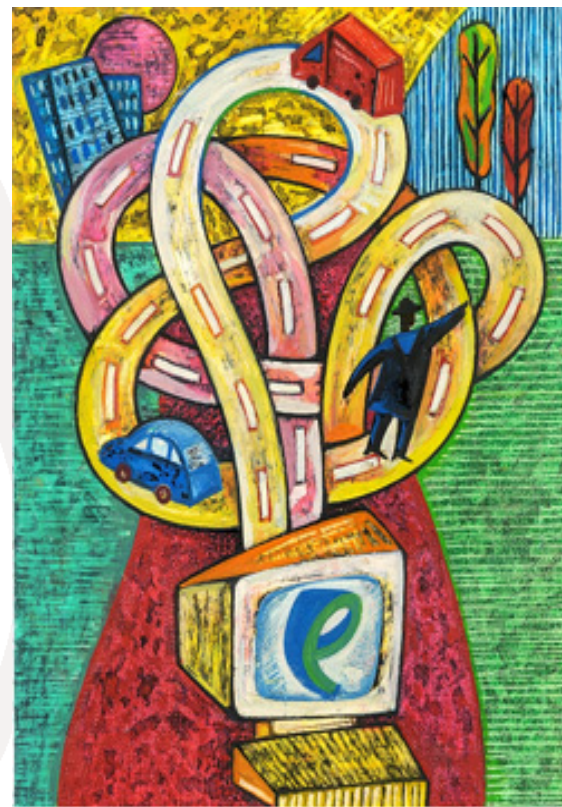
# Looking Beyond TCP/IP

- Like the phone system before it, TCP/IP solved the problems it set out to solve so well, it's hard to conceive of alternative
- When TCP/IP was invented there were few machines and many users per machine
- Today there are many machines per user with vast amounts of data that needs to be synchronized and shared



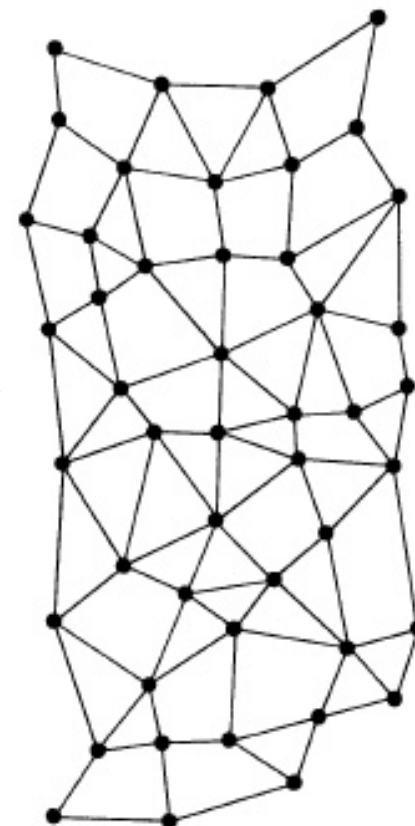
# Why Look Beyond TCP/IP?

- The 'raison-d'être' of both the telephone network and TCP/IP is to allow two end points (machines) to have a 'conversation'
- But the overwhelming use of the Internet is for a machine to acquire named chunks of data (web pages, email, video)



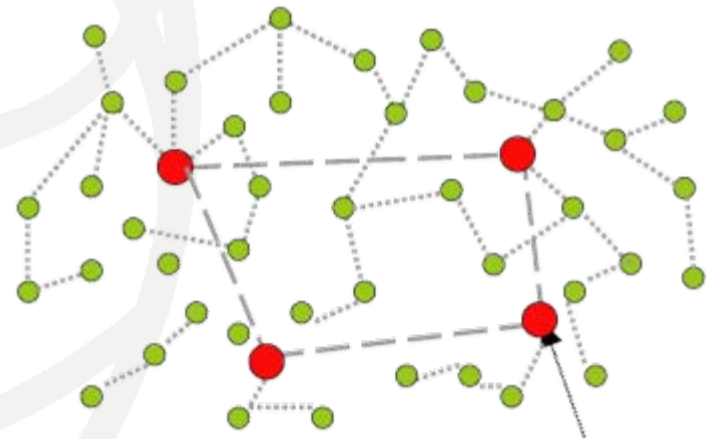
# Rethinking Network Architectures

- A new data-centric rather than connectivity-centric architecture is likely to emerge
  - Connectivity/Content is fully 'meshed'
  - I want this named object and I don't care where it comes from...whether the device next to me or across the world
  - Why move around chunks of data if it's already local or closer to me?
  - Meshed data-centric architecture can be argued to be just another instantiation of Baran and Davies' original ideas



# Waiting for the Overlay?

- Just as the Internet was an overlay on the telephone network, a new data-centric architecture could be overlaid on the Internet
  - Some first attempts: BitTorrent, Akami CDN, Sonos Mesh, Limelight, Apple Rendez-Vous
- End game: ubiquitous, pervasive, grid, mesh, wireless networks
  - anywhere, anytime, anything
  - All nodes also become part of routing infrastructure





# Next Generation Networks: Convergence between Fixed, Mobile and IP networks

# First Transition

- Growth of Internet and other IP-based networks and requirements for bandwidth and capacity has driven rapid innovation in telecommunication access and transport networks:
  - leveraging copper wire “last-mile” networks through digital subscriber line (“DSL”) technologies
  - re-architecting of cable networks to support IP services
  - advances in optical networking technologies (e.g. GPON)
  - advances in wireless technologies (Wi-Fi, WiMax)



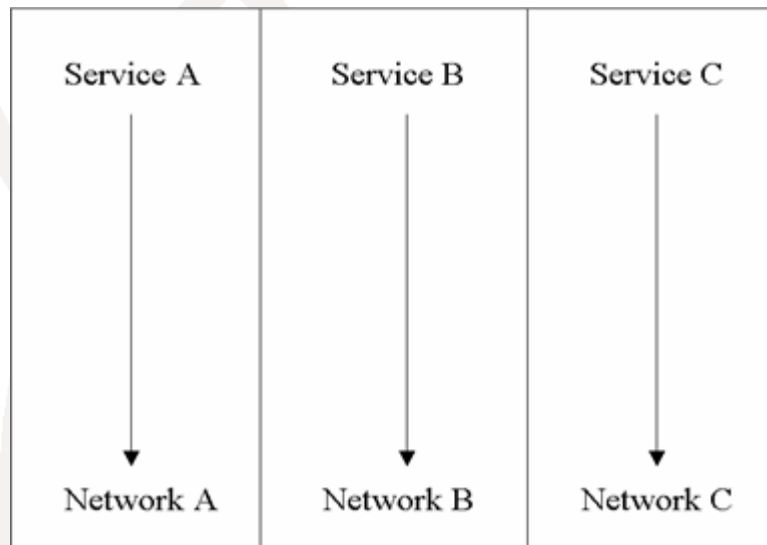
## Second Transition

- Complete integration & interoperability of IP-based and PSTN network services and applications
  - Major impact on strategies for build-out of national communications infrastructures
  - Shift from PSTN build-out to broadband-based “converged” IP NGN platform
  - Fixed-mobile convergence

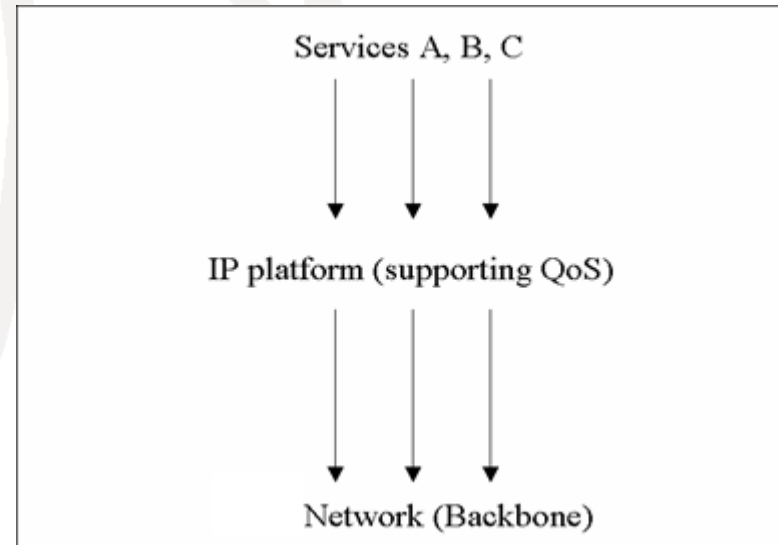
# The paradigm shift

- In converged networks, services are no longer tied to specific networks. A converged **Next Generation Network** can deliver all services

Current



Future



# What are NGNs?

- Faced with separate infrastructures for voice and data businesses, convergence and growing competition, almost all telecoms providers and equipment manufacturers are making substantial investments in IP-Enabled Next Generation Networks (NGNs).
- IP-based NGNs represent the “marriage” of the Public Switched Telephone Network (PSTN) with the world of the Internet
  - an extensive area of standardization within ITU
- In the coming years, IP-enabled NGNs will be deployed by numerous service providers around globe



## ITU-T Definition of NGN (Y.2001)

- Next Generation Network (NGN): a packet-based network able to provide telecommunication services and able to make use of multiple broadband, QoS-enabled transport technologies and in which service-related functions are independent from underlying transport-related technologies.
- It enables unfettered access for users to networks and to competing service providers and/or services of their choice.
- It supports generalized mobility which will allow consistent and ubiquitous provision of services to users.



# NGN Core & Access Networks

- **NGN access:** “the deployment of fibre into the local loop, either to the incumbent’s street cabinet ... or the deployment of fibre all the way to customer premises (typically apartment blocks rather than individual houses).
- **NGN core:** “the replacement of legacy transmission and switching equipment by IP technology in the core, or backbone, network. This involves changing telephony switches and installing routers and Voice over IP equipment.”

Source: ECTA

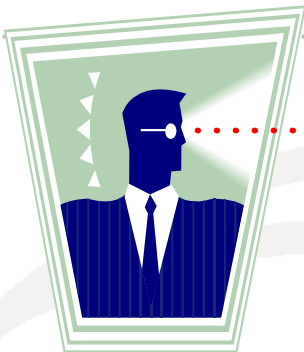
# Intelligent Infrastructures

- NGN core and access network infrastructures will be supplemented with an intelligent infrastructure or a business layer for IP networks capable of providing QoS, reliability and security assurances for multiple service scenarios across service providers
- With growing security problems, this will be separate from the transport layer (out-of-band) (like for mobile)
- Basis for identity, authentication, DRM, access to resources and intercarrier/service compensation mechanisms...
- Trusted federation initiatives emerging:
  - e.g., IPSphere Forum ([www.ipsphereforum.org](http://www.ipsphereforum.org))

# Migration to NGNs

- **2009 / British Telecom:** BT aims to move majority of its subscriber base to “broadband dial tone” by 2009. Aims for annualized cost savings of £1bn pa from 21st century network Capex in medium term likely to be below current £3bn pa level once network migration completed.
- **2012 / Deutsche Telekom:** Company has completed an NGN overlay backbone network, voice/data integration to be driven by customer demand, company has suggested by 2012. Core network already IP-MPLS, carriers traffic for both fixed and mobile business.
- **2009 / KPN:** Company is in “first phase” of move to an IP everywhere environment for corporate customers. KPN aims to move to an all IP core backbone by 2007, with Ethernet in the access network by 2009. ATM and SDH to be phased out of network by 2010, completing move to IP. Cost savings targeted at 150 M Euro pa from 2005, rising to 2000 m EURO pa from 2008. Headcount to fall by equivalent of 8000 by 2009. Network transformation programme means capex at 1-2 bn Euro pa from 2006 onwards.

Source: CSFB, 2005



## But NGN Visions Differ

- PSTN on steroids? Internet on steroids?
- To fix the Internet security mess?
- Monetize the Internet? Emulate mobile players?
- Revenge of the telcos? Walled gardens?
- Attempt to move “up the value chain” into audiovisual content services
  - from “dumb pipe” provider into “content”
  - e.g., much of current US telecom legislation revision activity was about carriers getting video franchises



# Moving into Content: a Wise Strategy?

- What is Content?
  - From the Latin “Contentum” meaning “that which is contained”
- Popular use: material prepared/ packaged by professionals to be disseminated to large numbers of consumers such as movies, videos/DVDs, books, newspapers, sports events



# Content Characteristics

- Until now, typically distributed by mass distribution or broadcast systems;
  - Often packaged around geographical boundaries (e.g., DVD zones, iTunes)
  - Typically bound by national/regional licensing regimes
  - Often timed release in different geographical markets
  - Culturally embedded



# Contrast Content with Point-to-Point Communications

- e.g., fixed, mobile, VoIP
- email
- chat (IRC, Yahoo, AOL, Skype)
- mobile text messaging
- Content and point-to-point can be complementary
  - e.g. voting on the Eurovision song contest, Pop Idol, X-Factor

# Running the Numbers



## ■ Content:

- US Hollywood box office revenues (2003):
  - ~ US\$ 11 billion
  - with home rentals perhaps 3 x that (~ US\$ 35 billion?)
- Global music industry revenues ~ US\$ 35 billion

## ■ Telecoms:

- US only telecom revenues (2003):
  - US\$ 348.0 billion!
- Global text messaging revenues for 2005:
  - ~ US\$ 75 billion

“Triple Play Will Not Save Declining Margins, But Telcos Still Have to Do It”

Guy Zibi, Pyramid Research, August 2007

# But it's Not Just the Numbers

- The Internet has demonstrated the possibilities of producing value driven by large, varied and un-coordinated audiences
- Much of the cultural production that characterizes this new environment is driven by non-economic motives:
  - Takes place outside of market processes (e.g., Blogs, Wikipedia, Open Source, Flickr, Myspace, Cyworld)
  - Where does the altruistic 'robust ethic of open sharing' come from?
  - See [Yochai Benkler's "The Wealth of Networks"](#)
  - Suggests discourse rooted in market-based economic analysis is unequal to task



# What Rules Will Apply to Next Generation Networks?

# IP-enabled NGNs Means Wave Of Challenges For National Policy Makers And Regulators

- Technologies and architecture of IP-enabled NGNs are fundamentally different from PSTN
- This means new services, network topologies, associated costs and commercial models
- It is also likely to lead to development of new and different kinds of IP-based **interconnection arrangements** that are service-based, time-based, capacity-based or even IPR rights-based (e.g., for audiovisual content crossing IPR border regimes)

# Regulatory forbearance?



- Incumbent carriers state commercial models for IP-enabled NGNs are at an early and evolutionary phase and it is too early to discuss open access or wholesale mandated interconnection regimes
- Also argued that IP-enabled NGNs, particularly the deployment of high-speed access networks (e.g. FTTx, VDSL), require massive investments and that national regulatory moratoria for incumbents are appropriate
- Capital markets appear to agree...



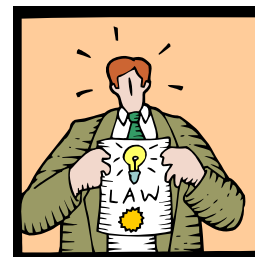
# Negative Sentiment Towards NGN Access Network Investments in Europe

- “[A]lthough we expect some fibre build, particularly...for VDSL in European countries with cable competition, we still see the regulatory backdrop as unsupportive of a sustained increase in capital intensity.”  
Merrill Lynch, June 2006 (cited in Telecom Markets, 13 June 2006)
- “The dominance of free cash flow yield (FCFY) valuation measures in Europe is testament to the fear and suspicion with which the market regards investment in capex. The focus on FCFY has sent company management teams a clear message – spend as little as possible on network...”  
HSBC Global Research, Telecoms and Media. April 2006. “Net Neutrality”
- “We...see little incentive from a regulatory perspective for incumbents in Europe to pursue FTTP [Fibre to the Premises].”  
Credit Suisse First Boston. July 2005.

*Source: Brian Williamson, Director, Indepen*

## Others Say Not So Fast...

- Competitive providers argue the opposite, saying that regulators need to ask whether, in the absence of wholesale economic regulation, will market dynamics be sufficient to ensure a competitive environment?
- They are worried that without immediate attention by regulators to NGNs, carriers will rapidly vertically integrate services and that bottlenecks will emerge, particularly for delivery of audiovisual content...
- But is it just the traditional carriers that we need to be worried about?



# What About These Players?

- Mega-internet service providers like Google, MSN, eBay and Yahoo
  - strong brands, deep pockets
  - entering audiovisual content business
    - Most Internet traffic will be video in a few years
  - entering voice markets and some infrastructure provisioning



# And Who Pays for Investments in Infrastructure?



- “The Internet can't be free in that sense, because we and the cable companies have made an investment and for a Google or Yahoo! or Vonage or anybody to expect to use these pipes [for] free is nuts!”

– Ed Whitacre, former CEO of AT&T

## Doubtful That Policy Makers And Regulators Understand What Interconnection Means In A Multi-service NGN Environment

- What should happen when worlds collide?
- Extensive economics literature exists about interconnection in the traditional PSTN world
- An emerging literature deals with interconnection in the world of IP-based networks like the internet
  - e.g., economics of peering, transit, private IXPs
- Very different interconnection arrangements prevail in these two worlds.
  - Different technology
  - Different regulatory history
  - Different industry structure

## No Signal?

- “NTT’s CEO and CTO have raised the alarm and are calling for the world’s operators to start work on new interconnection models today, before NGNs are in place...”
- NTT’s CEO Norio Wada has “called for a new interconnect framework that will extend national NGNs into a secure and fully managed global IP network”
- Both technical standards and commercial agreements are needed...
  - “No signal”, Total Telecom Magazine, September 2006

## Back to Basics?

- Why do we regulate?
  - Manage limited resources (spectrum, numbers)
  - Market failures: Market power
  - Market failures: Desirable capabilities that would not be deployed without intervention
- But policy makers and regulators have a changing role in building “information economies”
- Fundamental underpinning layer of networked economies and information societies
  - so is it promoting competition “über alles”, or
  - is it promoting the development of national infrastructure industries (e.g., like power, water, sewage, transport)?
  - A number of Asian countries see national broadband networks as **key element of global competitiveness**

# Distinguishing Types of Regulation

## ■ **Symmetric**, examples:

- Universal service and access
- Consumer emergency calls (E112/E911)
- Consumer protection and privacy (e.g. SPAM, SPIM)
- Quality of services
- Legal intercept
- Authenticated caller or sender identification
- Data protection and privacy issues

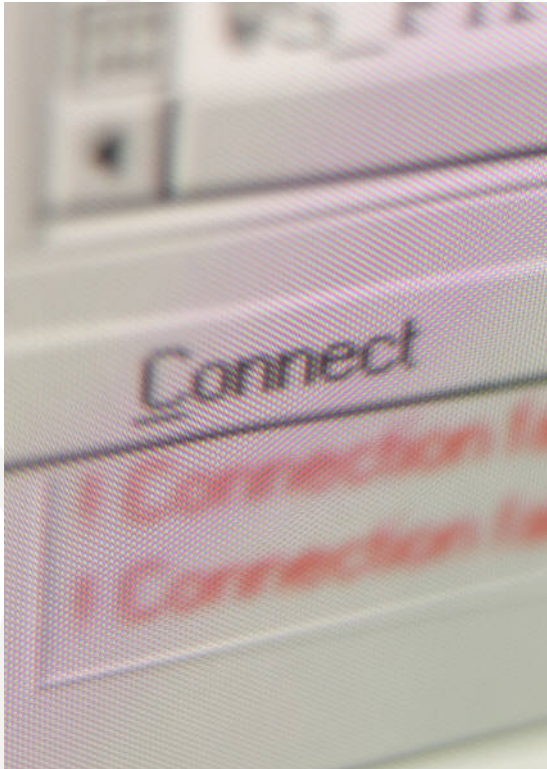
Subject of many national policy and regulatory proceedings for IP-based networks

## ■ **Asymmetric**

- e.g., open access, wholesale economic regulation
- clear that one size does not fit all across different economies because of different starting conditions
  - is there facilities-based infrastructure competition?



# Market Power & Interconnection



- Migrations to NGN will not eliminate **Significant Market Power (SMP)** concerns
- Where service providers possess SMP, they have ability and incentive to exploit it to detriment of consumers
- In absence of regulation, **interconnection** often serves as locus of exploitation of SMP
- Market power associated with last mile bottlenecks **will continue to be significant regulatory concern** for foreseeable future

# Example: Network Neutrality

- Current U.S. “network neutrality” debate reflects concerns about SMP of internet providers
  - Lack of competition in broadband internet access?
- Can be argued that network neutrality debate is just shifting open access debate to a higher network layer
  - the internet was never neutral to all applications
  - see first paper on **Network Neutrality** by Tim Wu
  - Is network neutrality a US-only debate?
    - Why do we not care whether the world’s triple play leader (free.fr) is “network neutral”?

## Lines of Defense?

- Trying to address market inefficiencies in NGN interconnection arrangements through *ex ante* regulation is likely to be extremely difficult
  - not enough understanding of new services, network topologies, associated costs or commercial models
  - costs aren't sunk as in case of PSTN unbundling
- First line of defense for policy makers/regulators might be focus on competitiveness in underlying access and transport markets for consumer broadband internet access and high capacity transit

## And What About Content?



- Convergence is setting two very different regulatory cultures on a **rapid collision course**: the highly-interventionist regulatory culture of broadcasting and less interventionist culture of telecommunications (at least with regard to content)
- Particularly sensitive topic as the regulation of audiovisual content industries is **culturally embedded** and tied to national regulatory regimes consistent with **societal, cultural and religious values**
- For example, in Europe under examination in the **Audiovisual Media Services Directive**

# Content Regulatory Issues

- What about?
  - advertising
  - public broadcasting
  - licensing
  - quality
  - content diversity
  - child and youth protection
  - support for national content quotas
  - decency and protection from abusive uses and community standards?

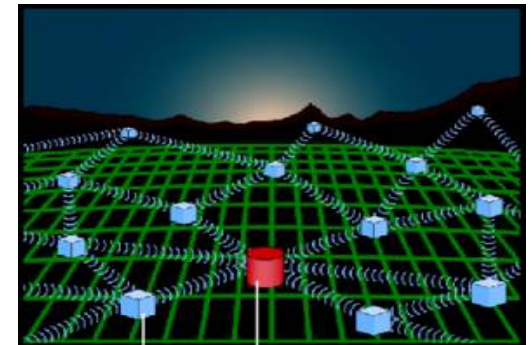




# Summary

# Big Picture Trends

- Mobile overtakes fixed (2002)
- Growth in mobile, wireless networks & mobile data services
- Birth of Broadband
  - >250 million global broadband subscribers in about 6 years
- Convergence of IP-based networks with telephone, mobile and TV networks
  - “N-play” converged offerings
- End game: ubiquitous, pervasive, grid, mesh, wireless networks
- What will be the next Internet overlay?



## Big Picture Trends cont'd

- Converged networks will make services available across a range of devices
- NGN role and visions unclear
- Days when legislation and regulation could assume distinct services running over distinct technologies and networks are disappearing fast
- Economic models for interconnection regime in converged PSTN/IP networks unclear
- Convergence is setting two very different regulatory cultures on a **rapid collision course**: highly-interventionist regulatory culture of broadcasting and less interventionist culture of telecommunications





# Links

- ITU Telecommunication Development Sector
  - <http://www.itu.int/itu-d/>
- ITU-D ICT Applications and Cybersecurity Division
  - <http://www.itu.int/itu-d/cyb/>
- ITU-D Regulatory and Market Environment Division
  - <http://www.itu.int/ITU-D/treg/>
  - Best Practice Guidelines for Next-Generation Networks (NGNs) Migration
    - <http://www.itu.int/ITU-D/treg/Events/Seminars/GSR/GSR07/consultation.html>



# International Telecommunication Union

Helping the World Communicate