Voice over
Internet Protocol

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IP telephony

- Considerable costs savings
- Vastly increased affordability for customers
- Removes the cost of distance
- Operators are already making the savings
- They are passed on to customers only where there is effective competition
- Many operators are trying to create barriers to VoIP, sometimes aided by government

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International telephony

- Many governments have removed the bottlenecks
  - which has increased competition
  - which has caused sharp reductions in prices
  - except for calls to mobile networks with Calling Party Pays (CPP)
- In developed countries:
  - incumbent operators have responded to the challenge of cheap VoIP with a bundle:
    - "all you can eat" national tariffs that conceal per minute rates
    - now some international flat-rate offers
    - DSL plus "telephony" (plus video, etc.)
    - but excluding fixed-to-mobile calls
  - enormous benefits from economies of scale
  - some operators offer in-bound numbers in other cities and countries

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Consumer information

- (Potential) customers need:
  - information about services
  - protection from abuses
- Operators need to make clear what they offer, especially the quality of service
- Customers should have a choice amongst:
  - many operators
  - many offers and bundles

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Number portability

- A pre-requisite for competition
- Necessary to reduce customer switching costs
- Many VoIP operators are interested in portability for the monthly subscription
- Customers want to keep a number that is valuable to them
- Simplest policy is reciprocity, if a customer can bring a number, then they can also take it away again

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Access to emergency services

- A major debate in many countries
- Much of it by fixed incumbents trying to block VoIP
- Two genuine issues:
  - access to the service in the absence of electric power
  - uncertainty about location of callers
- However, the same problems arise with:
  - cordless phones
  - cellular phones

United States of America

- Mobile operators have offered flat-rate plans
- Vonage (unlimited calls within USA and Canada):
  - works with broadband connection
  - area codes available in most states
  - US$ 24.99 per month residential
  - US$ 49.99 per month small business
- Broadvoice:
  - Unlimited world US$ 24.95 per month (35 countries, to fixed not mobile)
  - also offers numbers for/in the United Kingdom
- The end of the long distance operators:
  - AT&T acquired by SBC
  - MCI acquired by Verizon

VoIP is an application

- Simple download of software
- Instant messaging (ICQ, Yahoo, etc)
- Skype:
  - is not a service
  - already reached 5,25,000 concurrent users
  - conference calls
  - shows on-line status of "buddies"
  - can be embedded in a PDA
  - SkypeOut gateway to the PSTN
  - SkypeIn gateway from the PSTN
- Games consoles with voice (and Wi-Fi):
  - Nintendo DS
  - Sony PSP

Skype charges (per minute)

- €0.017 (approximately US $ 0.021 or £ 0.012) per minute
- Argentina Australia, Austria, Belgium, Canada, Chile, China, Denmark, Estonia, France, Germany, Greece, Hong Kong, Ireland, Italy, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Russia, Singapore, South Korea, Spain, Sweden, Switzerland, Taiwan (Taipei), United Kingdom, United States
- Calls to mobile phones are more expensive (except North America and China)

Egypt	€0.172
Eritrea	€0.355
Djibouti	€0.346
Ethiopia	€0.428
Somalia	€0.645
Kenya	€0.229
Uganda	€0.140
Tanzania	€0.285
South Africa	€0.063
Viet Nam	€0.307
Cambodia	€0.269
Laos	€0.109
Thailand	€0.106
Malaysia	€0.023

http://www.skype.com/

A call from Japan to the USA
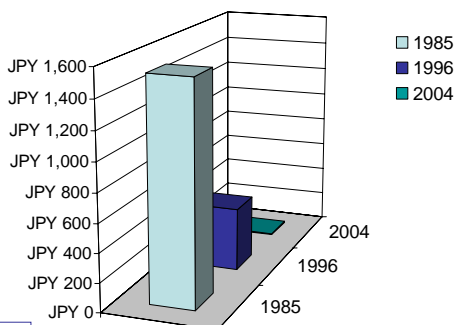
ETB 1 = JPY 12

Hong Kong, SAR

- The Office of the Telecommunications Authority (OFTA) opened up the supply of IP Telephony in June 2005
- It created a framework to facilitate the deployment of IP technology:
  - innovative services
  - adequate protection to consumers
- Class 1 services are required to meet the licensing conditions applicable to fixed network operators
- Class 2 services are only required to meet minimal licensing conditions in order not to inhibit technological deployment

http://www.ofta.gov.hk/en/tas/ftn/tas20050620.pdf
http://www.ofta.gov.hk/en/tas/ftn/tas20050620a.pdf

Philippines

- The National Telecommunications Commission declared VoIP a value-added service (VAS)
- Deputy Commissioner Jorge Sarmiento "The issue is not whether VoIP is a tele-communications or value-added service. The issue is whether VoIP is a service not ordinarily provided for local exchange and inter-exchange operators and overseas carriers"
- Manuel Pangilinan, Chairman of Philippine Long Distance Telephone Co.: "If PLDT were to stay on its legacy business and continue offering voice as a primary service, I think we would be dead pretty soon."

http://www.ntc.gov.ph/whatsnew/Draft%20Rules%20on%20VoIP.pdf
http://www.ntc.gov.ph/whatsnew/NTC%20Memo%20on%20VoIP.pdf

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VoIP in Africa

VoIP is an important technology that has the potential to transform telephony in Africa. Entry of IP telephony service providers whether legal or illegal in domestic markets has facilitated the acceleration of pace of market liberalisation and the introduction of competition in the long-distance and international service markets.

The general approach evidenced in Africa of prohibition is at best, short sighted, and at worst, a serious threat to innovation, eventual competition and overall consumer welfare.

Tracy Cohen and Russell Southwood
CTO report, funded by UK DfID

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Wireless VoIP

Nokia E-Series handsets
- Wi-Fi when in:
  - corporate offices worldwide
  - home
- SIP client
- otherwise GSM
- Being combined with iPASS, a global Wi-Fi supplier

France Iliad "free.fr"
- Any Wi-Fi hotspot with "freebox":
  - your home
  - your neighbours
  - people in the next street, village or town
- Free calls to fixed networks in France and 14 countries

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Mino

MiΠO
ONE WORLD, CONNECTED

- Three clients:
  - Java
  - WAP
  - web (incl. PC)
- Mobile traffic carried over GPRS, EDGE, cdma2000 or UMTS
- Also over the Internet

- 2.2¢ to:
  - Argentina
  - Australia
  - Austria
  - Belgium
  - Brazil
  - Canada
  - etc.
- 7.3 ¢ to:
  - American Samoa
  - Andorra
  - Armenia
  - Bahamas
  - Bangladesh
  - Benin
  - etc.

http://www.minowireless.com/mino/

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IP-VPN

- Regulation in most countries is:
  - antiquated
  - silent on IP, MPLS, etc.
- Thus very unclear what is (not) permitted
- Corporate users want to ensure:
  - dial-in access from fixed and mobile networks
  - IP access from DSL, cable modem, etc.
  - break-out to PSTN and the Internet
  - binding Service Level Agreements
  - MPLS interconnection

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Security

- VoIP Security Alliance (VoIPSA)
- Spearheaded by 3Com but including:
  - Manufacturers
  - Operators
  - consultants
- Rather than waiting for a high-profile attack on VoIP to occur, they are collaborating to create a culture of security

http://www.voipsa.org/

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Challenges for fixed carriers

- Low (economic) barriers to entry
- New carriers with lower cost structures
- Loss of traditional revenues
- Perceptions of the financial markets:
  - they do not like declining revenues
- Additionally, in developing countries:
  - lack of resources, skills and capital
  - "grey market" eroding their profit margins
  - bundling with broadband and video is not obviously financially significant

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Challenges for security

- Emergency services:
  - access to
  - provision of location information
- Personal/corporate security
  - denial of service attacks
  - viruses, worms, trojans and other malware
  - SPIT - SPam over Internet Telephony
- Law enforcement authorities:
  - provision for wire tapping
  - data preservation
  - data retention

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Challenges for policy makers

- Declining cost of basic telephony
- Increasing range and richness of services and applications
- Blurring of traditional distinctions:
  - how is VoIP different from CPS?
- Change undermines:
  - mechanisms to fund universal service
  - the regulatory regime
  - the established operators
  - fixed opinions

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Challenges for regulators

- Definition:
  - one service or many?
  - how to distinguish types?
- Assignment of telephone numbers:
  - geographic and/or non-geographic
  - "nomadic"
  - secondary numbers (other city, ex-patriates)
- Quality of service:
  - defining
  - measuring
  - publishing and enforcing
- Anti-competitive effects of bundling
- Access for the disabled to VoIP

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Next Generation Networks

- a Next Generation Network is a packet-based network able to provide telecommunication services, 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 offers unrestricted access by users to different service providers
- it supports generalised mobility which will allow consistent and ubiquitous provision of services to users

http://www.itu.int/ITU-T/studygroups/com13/index.asp

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Generations

- Useful for historical explanations
- Successive "generations" of:
  - computers
  - semi-conductors
  - cellular wireless technologies:
    - analogue
    - digital
    - digital with IP capability
- Extensively (mis-)used in advertising

But we are not all using the same generation today

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OECD policy analysis

"It could be very tricky for policy makers and regulators to strike a balance between allowing nascent markets to develop without interference and ensuring that competition is able to develop in those new markets. However, they can play an important role in removing barriers to the effective deployment of NGN while encouraging the development of NGN."

http://www.oecd.org/dataoecd/58/11/34696726.pdf

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Adoption & diffusion

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- Incumbent operators:
  - cost savings (OPEX and CAPEX)
  - new services and revenues
  - politico-regulatory advantage
- Enterprises:
  - return on investment
  - added-value and increased functionality
- Consumers:
  - life-style choices
  - exciting devices and services

- Barriers:
  - insufficient competition
  - lack of clarity in the benefits
  - excessive pricing

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UK - NGN exercise

- Driven by BT and its 21st century network (21CN)
- Massive OFCOM consultation:
  - two rounds of documents and comments
- In parallel with and related to the developments in "equivalence"
- Too abstract for customer assessment
- Unclear what are the:
  - benefits
  - threats

http://www.ofcom.org.uk/consult/condocs/ngn/
http://www.ofcom.org.uk/consult/condocs/nxgnfc/

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Interconnection

- Well established rules for:
  - conventional networks
  - IP networks
- How do NGNs interconnect?
  - price
  - quality of service
  - interworking
  - location

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Interoperability

- Will the service you want be available on the networks to which you have access?
- Will the devices and networks interwork?
- How will the network be selected:
  - the cheapest? (for the user or the provider?)
  - the best quality
- What happens if you have no billing relationship?
- Will all services be available on all networks?

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The question of liability

- Multiplicity of:
  - networks, devices and sensors
  - network operators and service providers
  - third parties (aggregators, portals, etc.)
- We need to be clear about:
  - who controls and manages the service?
  - who ensures security to minimise misuse?
- Ultimately, if something goes wrong:
  - who pays the penalty?
  - who goes to gaol?

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Access

- Where are the bottlenecks?
- What are the remedies?
- What are the equivalents of:
  - Carrier Pre-Selection (CPS)
  - Local Loop Unbundling (LLU)
  - Number Portability (NP)
- Will they take as long to sort out as in the past?
  - deny
  - delay
  - degrade

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Control points

- Telating to network capabilities:
  - Network Address Translators and firewalls
  - routing tables
  - Quality of Service capabilities and interconnect
  - network coverage
  - termination capabilities
- Related to accessing services and content:
  - unnecessary software and service bundles
  - "walled gardens"
  - tunnelling
  - filtering mechanisms and digital rights
  - end-user devices
  - content
- Relating to user information:
  - authentication, single log-on and user profile management
  - customer billing information
  - access to customer information systems
  - resolution of names and numbers through customer identity systems
  - functions for determining location

http://www.cullen-international.com/documents/cullen/cipublic/studies/ngnfinal.pdf

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AT&T

"They don't have any fiber out there. They
don't have any wires. They don't have
anything ... they use my lines for free --
and that's bull. For a Google or a Yahoo!
or a Vonage or anybody to expect to use
these pipes for free is nuts!"

Edward Whitacre, CEO

He seems to forget that the *customer* is paying rent for broadband
access in order to reach Google, Yahoo! and Vonage.

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More than one network

- Fixed broadband:
  - corporate
  - residential
- Wireless broadband networks:
  - Wi-Fi
  - WiMAX
- Cellular voice and data networks
- Digital broadcast networks
  (DAB, DMB, DVB, terrestrial and satellite)
- (Re-)distribution (Wi-Fi and UWB):
  - office and residential
  - Personal Area Networks (PANs)
  - car networks

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An Internet of things

- The next step, beyond today's Internet, is to
  connect inanimate objects to networks
- Networks and networked devices become
  omnipresent
- Electronic tags (e.g. RFID) and sensors extend
  the communication and monitoring potential of
  the "network of networks"

http://www.itu.int/osg/spu/publications/internetofthings/

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A definition from Japan

"As is the Internet, the ubiquitous network is a
single integrated ICT paradigm that covers a
full range of key elements from network
infrastructure, digital equipment with
communications capabilities and digital
platforms (infrastructure environment) to
solutions, and represents the environment for
ICT utilization."

Teruyasu MURAKAMI

http://www.nri.co.jp/english/opinion/papers/2004/pdf/np200479.pdf

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Ubiquitous network society

- NGN plus RFID/sensors
- Preferred model in North-East Asia
- Any time, any place, any network, any device
- Operators owning all types of infrastructure:
  - wired
  - cellular
  - wireless
  - this reduces interconnection & access disputes

http://www.stanford-jc.or.jp/research-project/scti/summary/materials/200404261-imagawa.pdf

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Radio Frequency Identification (RFID)

- Communication:
  - person to object
  - machine to object
- Passive or active tags
- Open or encrypted tags
- Requires assignment of spectrum
- Privacy concerns:
  - US Department of State passports
  - Gillette Mach 3 razors

http://europa.eu.int/comm/justice_home/fsj/privacy/docs/wpdocs/2005/wp111_en.pdf

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Quality of service

- No consensus on approach:
  - over-provision?
  - MPLS?
  - Diffserv?
  - something else?
- How do you map QoS classes between networks?

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Conclusions

- Voice telephony is now almost free
- Revenues come from
  - new types of traffic
  - new types of service
- One network will not suffice!
- NGN creates complex problems of:
  - access
  - interconnection
  - interoperability
- There is no clarity about the value of NGN to customers

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Issues

- How do you err on the side of least damage?
- What should public policy promote?
  - competition?
  - investment?
  - infrastructure?
  - technologies?
    (3G cellular wireless, WiMAX, Fibre To The X (FTTx), NGN, etc)
- Is the ubiquitous network society model applicable away from Japan and Korea?

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