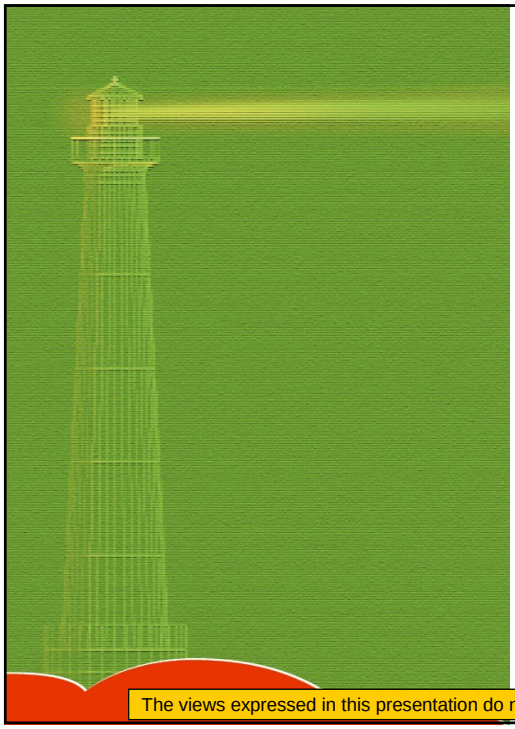
7th Global Symposium for Regulators (Dubai, 2007)

The Road to Next Generation Networks (NGN): Can regulators promote investment and achieve open access?

Presentations



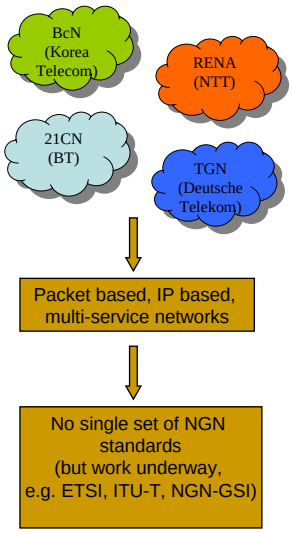
Next-Generation Networks (NGN) Regulatory Overview

Dr.Tracy Cohen
Councillor, ICASA

The views expressed in this presentation do not necessarily represent the views of ICASA.

Defining NGNs

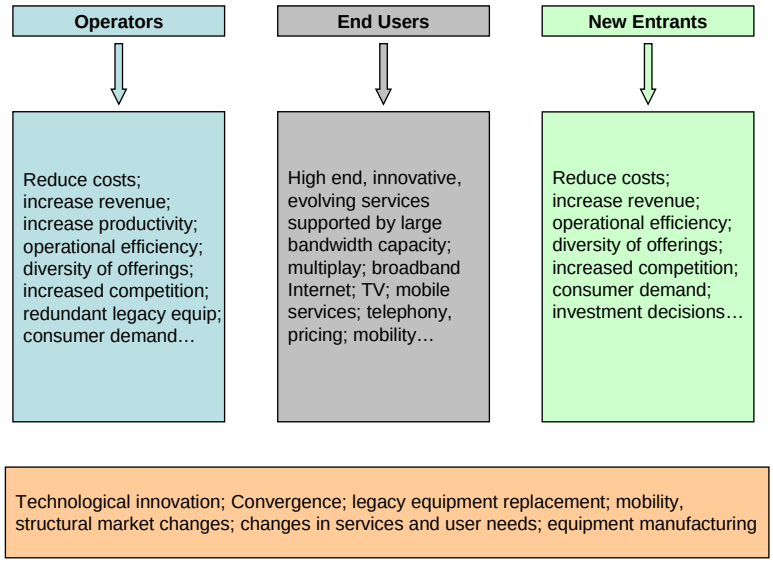
- Broadband networks that use IP and allow integrated data, voice and video
  (VoIP, IPTV,VoD)
- Core and access NGN
- Migration (OECD)
  - 2012 – fixed; 2020 – mobile
- Technology choices and services not linked
- Unfettered, ubiquitous access
- Very fast access to an end-to-end IP based network



Extracting Essentials

- Possible co-existence of regulatory approaches for PSTN and IP-based networks
- What regulatory approach?
  - New? Legacy? Hybrid model?
- An opportunity to review (and where necessary) remedy the regulatory framework
- New technology, old regulatory challenges
- NGN development linked to national broadband policy
- NGNs in developing and developed countries
  - Affordability and access
  - Degree of competition
  - Pace and manner of reform

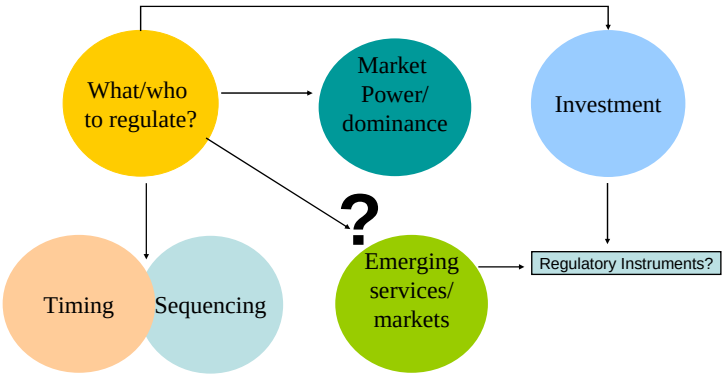
NGN Drivers



NGN Challenges

Operators	End Users	New Entrants
Integrity and cost of equipment; ROI concerns for existing investments; Uncertainty - technology specifics; take-up; demand; managing competition from the Internet and new entrants; QoS; regulatory risk	Consumer issues; Interoperability; Quality of service (QoS); access and affordability: Supply; privacy; security	Degree/intensity of competition between layers; integrity and cost of equipment; uncertainty; market dominance; take-up; demand; walled gardens; managing competition from incumbents; QoS; costs of compliance; regulatory risk

Regulatory Approach



Implementation

- No framework for NGNs
- Current principles aimed at circuit switched space
- Different country contexts will inform
- Clear rules required
- Recognise convergence
- Balanced and proportional regulation

- Competition
- Interconnection
- Universal service and access
- Standards and interoperability
- Licensing
- Numbering
- Spectrum assignment
- Consumer protection

CONSULTATION
e.g. "NGN co" - UK
"NGN eCo"- India

Recommendations

- Start thinking about processes and consult widely
- Facilitate competition and growth in services
- Encourage competitive market based outcomes
- Monitor market power in new services/markets
- Traditional PSTN approach is futile
- Technology and service agnostic approach, unified licencing
- Pursue universal service goals efficiently
- Educate consumers and ensure participation
- Maintain PSTN operation and legacy PSTN until full migration
- Create reasonable certainty for the sector
- Explore co and self-regulation options
- Balance roles of regulator and market
- Plan, time and sequence reform optimally

SHUKRAN

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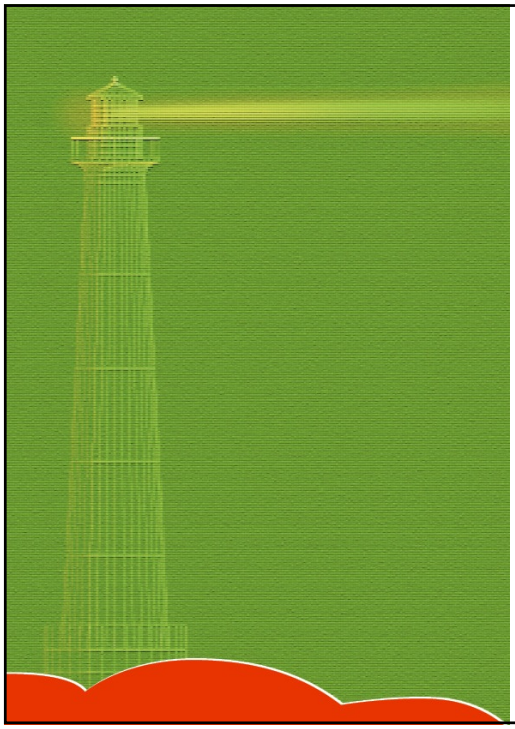


Dubai UAE 7th GSR 5-7 February 2007
Global Symposium for Regulators

NGN: TECHNOLOGY CHANGES FAREWELL TO CIRCUIT SWITCHING- HOW SOON?

Prof. Jens Arnbak
TU Delft

THE CLASSIC NATIONAL PHONE NET: AN (UN)ECONOMIC CASE.... ?

NETWORK INVESTMENTS:

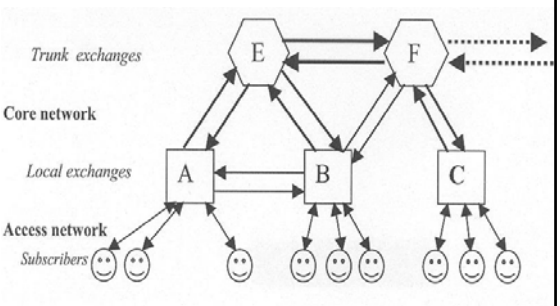
TRUNK LEVEL

- Trunk exchanges ~10%
- Multiplexed cables ~ 7%
- Test equipment ~ 7%
- Radio & SATCOM relays ~ 4%

LOCAL LEVEL

- Local exchanges ~ 22%
- Subscriber access lines ~ 49%

~1100 € per subscriber!



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REVENUE SHIFT IN FIXED NETWORKS

- In final years of Europe's national monopolies (1994-1997), the average daily use per subscriber line remained very low:
  - ~ **12 minutes national**
  - ~ **0.5 minute international** (incl. business users!)
- Rebalancing to cost-oriented phone tariffs (mandated by EU) was completed first by the Netherlands (1998):
  - Incumbent (KPN) ***subscription fee raised*** by 27%
  - Incumbent ***domestic minute rate reduced*** by 27%
- Low-user scheme ***(BelBudget)*** introduced by NL in 1998:
  - 700,000 subscribers (10%) were expected to join, but...
  - Only 70,000 opted in (i.e. about 1%!)

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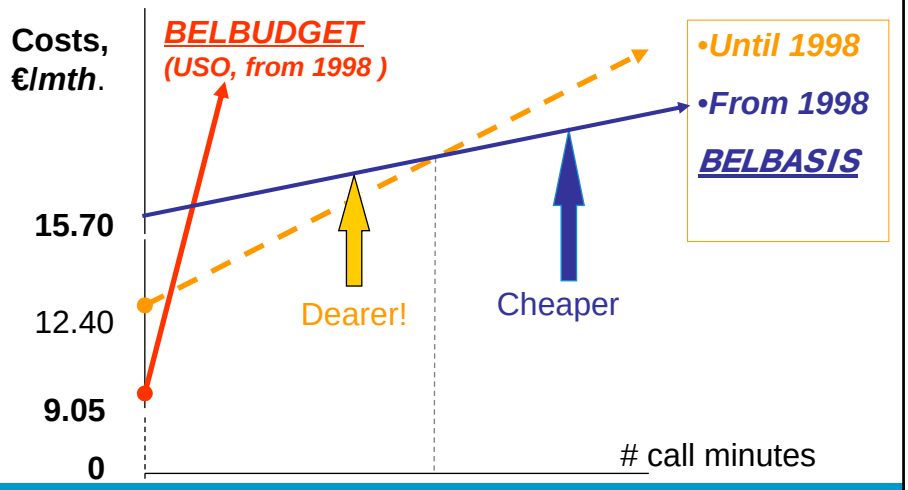
MAKING INCUMBENT'S TARIFFS COST-ORIENTED (KPN TARIFF RE-BALANCING, 1998)



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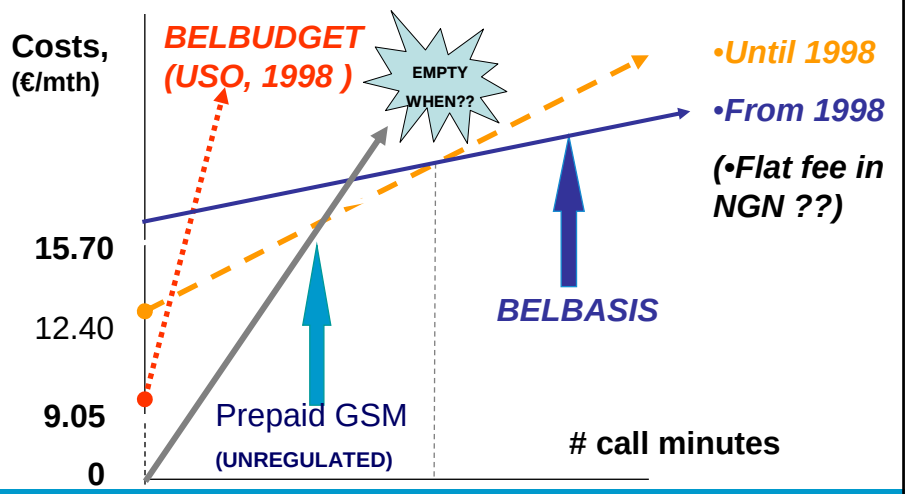
BUT: TARIFF REBALANCING MITIGATED BY *COMPETITIVE* (PREPAID) MOBILE OFFERS!



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INCUMBENTS' TRAFFIC CHANGES

2004, RELATIVE TO 2003 (Source: OVUM)

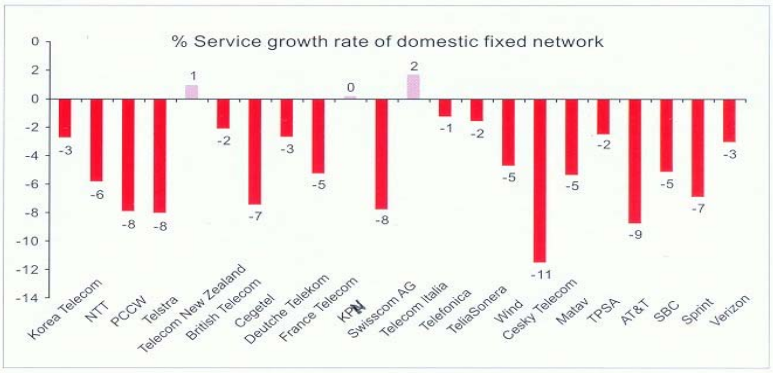

Figure 1 Service growth rate of global fixed network operators

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Effect on incumbents, by end 2001

(Source: McKinsey Quarterly, 2003)

Dominant National operator	NATIONAL CALLS (LONG-DISTANCE)		INTERNATIONAL CALLS	
	Market share loss	Price reduction (@ 3 min.)	Market share loss	Price reduction (@ 3 min.)
Denmark *(TDC)*	38 %	58 %	51 %	76 %
Germany *(DT)*	41 %	61 %	49 %	83 %
Holland *(KPN)*	30 %	39 %	50 %	90 %
Sweden *(Telia)*	31 %	85 %	57 %	89 %
UK *(BT)*	47 %	49 %	68 %	62 %

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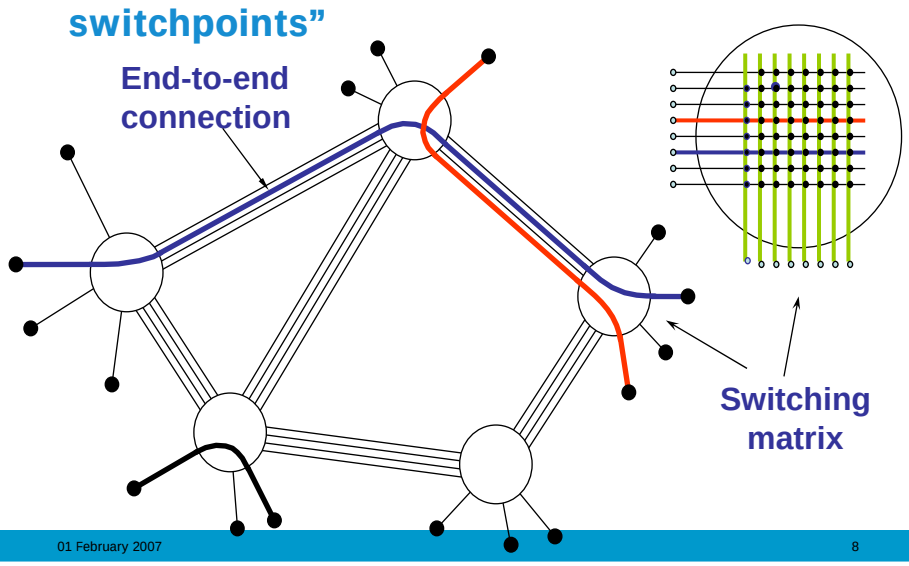
Circuit Switching: "Railway with switchpoints"



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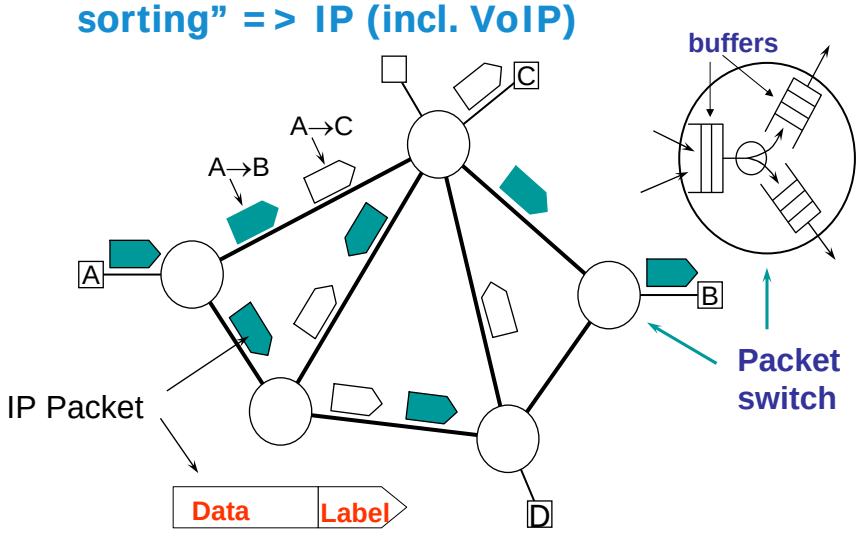
Packet Switching & Routing: “Post-office sorting” => IP (incl. VoIP)



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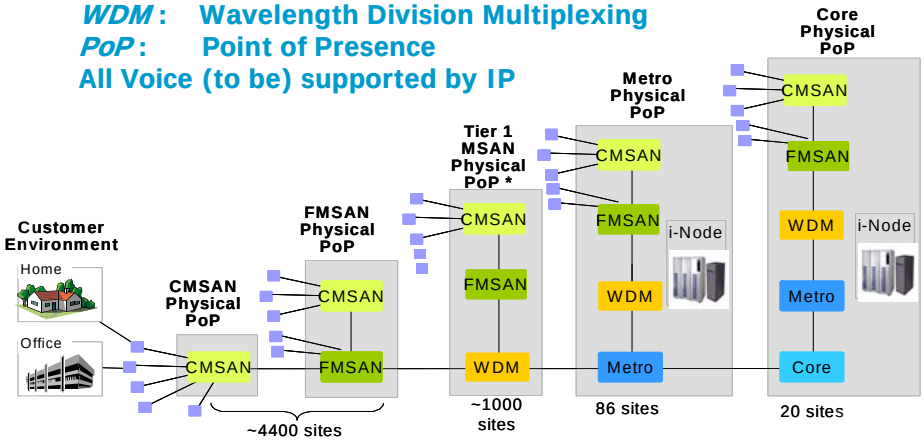
BT’s *NGN* : Functional Nodes

CMSAN : Copper Multi-Service Access Node
FMSAN : Fibre Multi-Service Access Node
WDM : Wavelength Division Multiplexing
PoP : Point of Presence
All Voice (to be) supported by IP



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NGN : KEY DEVELOPMENT DIRECTIONS

- **NGNs** should support *any* IP-based ICT-application
- **NG Core networks** should have simple structure (***"lasagna instead of spaghetti"***) to provide
  - supply & support of a **WIDER** range of services,
  - saving of costs and maintenance time in the longer run
- **NG Access networks** should provide bandwidth on (economic) demand; regulatory intervention may still be required for legacy access bottlenecks, which
  - can seldom be replicated in an economic way => a case for continuing local-loop unbundling?
  - may, however, be bypassed by broadband wireless access (e.g., ***WiMax***)

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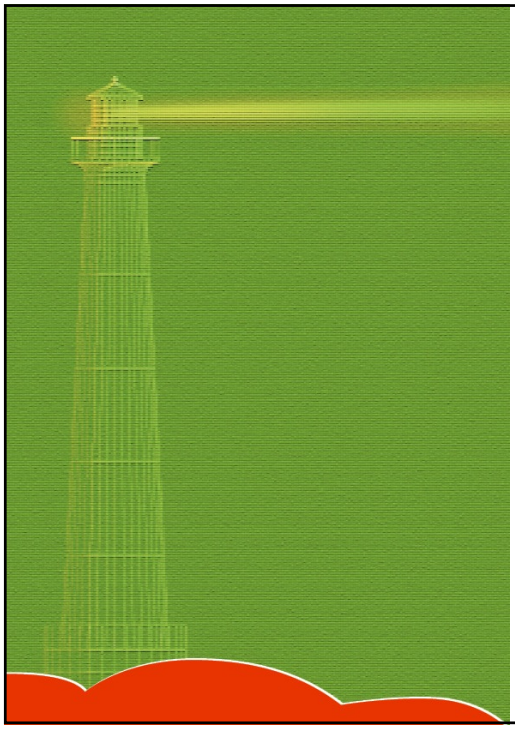


Fixed Mobile Convergence

Ewan Sutherland

Introduction

- Introduction
- Terminological vagueness
- Classes of convergence
- Multinational corporations
- Consumers
- Social networking
- Conclusions

Concatenation of vagueness

- Fixed:
  - not always entirely fixed
  - DECT, call-forwarding, nomadic VoIP, etc.
- Mobile:
  - often wrongly equated with wireless cellular
  - many users are not so very mobile
  - there are non-cellular alternatives
- Convergence:
  - often confused with substitution

Classes of convergence

- Packets (everything carried by IP)
- Devices (everything in one device)
- Services (access from many devices to the same applications, programmes and search engines)
- Invoices (everything on the same bill)
- Companies (everything owned by one group)
- Globalisation (everything available everywhere)
- Legislation (everything under the same rules)

Corporate networks

- Fixed networks are the infrastructure of globalization
  - underpinning outsourcing
- Moving to IP-VPNs running MPLS to prioritize:
  - voice and video conferencing
  - access to enterprise application software
  - electronic mail and messaging
- A highly competitive global market:
  - limited presence in Africa and Central Asia
- Cellular mobile is quite distinct:
  - almost entirely national offers
  - voice with some messaging
  - very little use for enterprise application software
- Corporate mobility is achieved by
  - Wi-Fi hot-spots, fixed broadband and dial-up

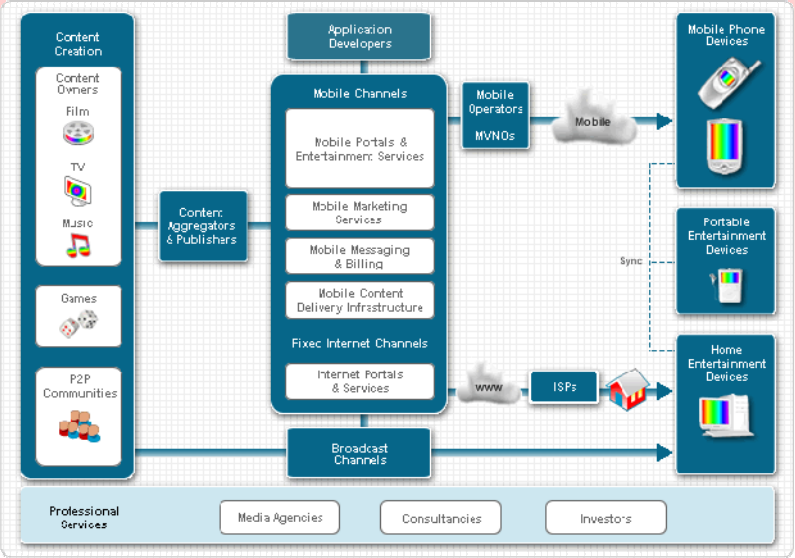
Consumer markets

- Fast Moving Consumer Goods (FMCG):
  - reliance on brands and fashion
  - new designs every few days
- Selection is often for non-cellular features:
  - cameras to upload clips to the fixed Internet
  - banking services
- Bundling into multi-play:
  - triple play
  - quadruple play
- Networking being added to non-telephones:
  - domestic appliances
  - cars (telematics)
- Advertisers like the idea of a personal device

Sony: Cybershot, Walkman, Playstation

	Mylo	*PSP3*	*Vaio UX*	*W700i*
GSM	N	N	-	Y
GPRS	N	N	-	Y
UMTS	N	N	-	N
Wi-Fi	Y	Y	Y	N
Bluetooth	N	N	Y	Y
VoIP	Y	Y	Y	N
IM	Y	Y	Y	N
Video	MP3/4	UMD	DVD	MP3
Camera (MP)	N	N	-	2
Storage (MB)	1.0	4.0	1.0 + 40	0.5 to 2.0
Weight (g)	150	280	545	99

Channels to market?



Source: Mobile Entertainment Forum.

Leverage

- The biggest policy challenge lies in avoiding leverage of market power between markets:
  - from fixed to mobile and mobile to fixed
  - from voice to television
  - from content to broadcasting/distribution
- These are not traditional telecommunications issues, but controlled with competition law tools
- The other problem is of concentration of market power in spectrum ownership

Conclusions

- FMC is not “fixed”, it changes
- Corporate markets are separate
- Consumer markets are unstable, as they respond to a very wide range of new offers
- Revenues are increasingly from non-voice services

Thank you

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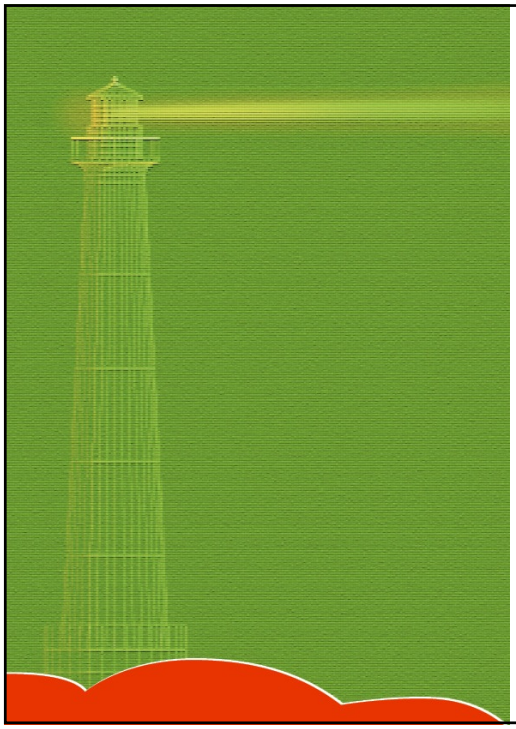


Interconnection of IP-Based NGNs

J. Scott Marcus
Senior Consultant
Wik Consult

Interconnection of IP-Based NGNs

- Many operators, especially incumbents, look to migrate to NGNs.
  - Enhance economies of scope and scale.
  - Accelerate time-to-market for new IP-based services.
- NGN represents a marriage of PSTN and Internet.
  - Different technology.
  - Different culture.
  - Substantially different regulatory traditions.
- What should happen when these disparate worlds collide?

Interconnection of IP-Based NGNs

- PSTN – regulated arrangements.
  - Regulation to address market power.
  - Termination fees in the absence of regulation will tend to be very high, for both large and small operators.
  - Lack of interconnection implies a connectivity breakdown.
- Internet – “Coasian” private arrangements in most cases.
  - Peering: two providers exchange traffic only for their respective customers, often with no explicit charges.
  - Sharing of facilities costs for interconnection may be unequal.
  - In most countries, no regulation of peering.
  - Lack of interconnection usually does not imply a loss of connectivity, but may have implications for costs.

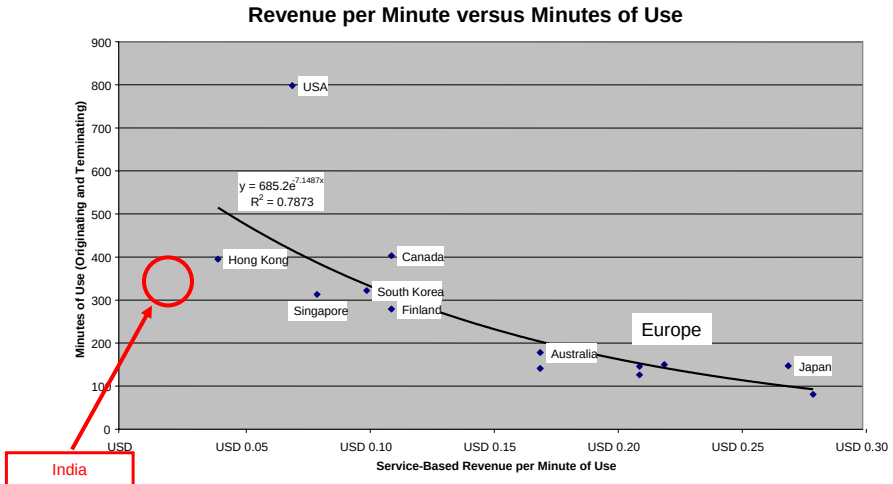
Interconnection of IP-Based NGNs

- The migration to IP-based NGNs breaks the strong historical linkage between the *service* and the *network*, thus enabling the emergence of independent service providers.
- Implications for regulation in support of competitive entry:
  - NGN introduces new forms of competition.
  - Does not necessarily eliminate traditional market power.
  - May enable the emergence of new competitive bottlenecks.
- Traditional interconnection arrangements represent an attempt to use wholesale payments (between network operators) to correct for imbalanced retail payments (between service providers). To the extent that the network and service providers are different firms, this system will break down for a variety of technical and practical reasons. Moreover, the reason for existence of current arrangements must be called into question.

Wholesale and retail arrangements

- Wholesale arrangements
  - Calling Party's Network Pays (CPNP): termination fee to the operators that completes the call.
  - Bill and Keep: private arrangements, no regulatory obligation to pay a termination fee.
- Retail arrangements
  - Calling Party Pays (CPP): the recipient pays nothing.
  - Receiving Party Pays (RPP): rarely used, not interesting.
  - Flat rate: prevalent in Bill and Keep countries, and Internet.
- Flat rate retail arrangements are attractive going forward.
  - Better reflect costs in an industry with high sunk costs.
  - Consumers greatly prefer flat rate.

Wholesale and retail arrangements



Source FCC, *Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services, 11th Report*, September 2006, Table 12, based on *Interactive Global Wireless Matrix 4Q05*, Merrill Lynch, Telecom Services Research

Wholesale and retail arrangements

- CPNP with high mobile termination rates tends to lead to:
  - Subsidies for mobile adoption, and thus rapid penetration.
  - High retail prices.
  - Exclusion of calls with high termination from flat rate plans.
  - Low usage.
- Rapid penetration is beneficial; the other aspects are harmful.
- There is no economic rationale for CPNP in an NGN world.
- What role for the regulator?
  - Regulators need not regulate retail arrangements except to the extent necessary to address market power distortions.
  - Nonetheless, the implications of wholesale regulation for retail behavior are entirely relevant to the regulator.

Implications for developed countries

- If deployment of mobile and fixed services are substantially complete, there is no advantage in continuing to promote CPNP.
  - Stimulating adoption when penetration approaches or exceeds 100% provides no genuine benefit to consumers.
  - CPNP tends to lead to high retail charges, and to low use.
  - Cross-subsidies from fixed to mobile distort the development of the market, and may inhibit the evolution of the fixed network.
- The migration time from PSTN to NGN represents an opportunity to consider migration from CPNP to Bill and Keep.
  - Conventional CPNP is probably unsustainable anyway.
  - Bill and Keep is sustainable and economically rational.
  - If a change is needed anyway, probably best to migrate directly to the preferred end state.

Implications for developing countries

- For most developing countries, migration to NGN is years in the future.
- CPNP fosters faster penetration of mobile services, which is generally a positive development.
- Internationally, settlement arrangements generate net subsidies in favor of developing countries.
- Immediate abandonment of CPNP arrangements might be premature.
- Maintaining CPNP, but with substantially lower termination rates (ideally less than 0.02 USD) may provide an appropriate balance between stimulating mobile penetration and encouraging use of services.
- Low termination rates pave the way to later migration to Bill and Keep.

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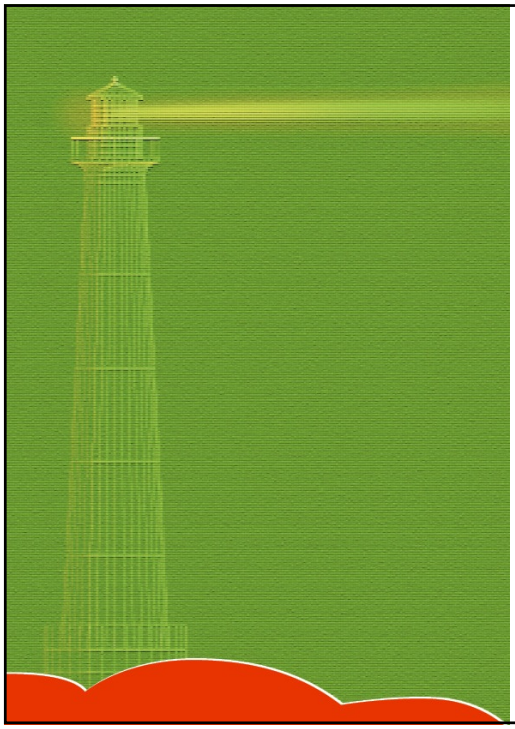

NGN Enabling Environment

Janet Hernandez
Senior Vice-President
Telecommunications Management Group, Inc.

Why are Wireline Providers Deploying NGNs?

- Cost efficiencies derived from a single all IP-based network vis-à-vis traditional networks
- Consumer demand: the "need for speed"
- Competition from facilities-based providers:
  - Cable providers
  - Power utilities
  - Municipality projects
  - Alternative service providers

How Should Regulators Enable the Migration Towards NGNs?

- Regulators will need to strike the right balance between promoting competition on one side and efficient investment and innovation on the other
- Regulatory certainty is crucial for this transition
- Should NGNs be regulated under existing frameworks: *ex ante* obligations on dominant providers?
- Will this deter investment?
  - NGN deployment in the UK *v.* Australia
- Do NGNs give rise to new/emerging markets? Should NGNs be free from legacy regulation?
  - Permanent forbearance: U.S. and Hong Kong, China
  - Regulatory holidays: Germany

Is the Regulatory Framework Ready for NGN?

Checklist of Issues for Regulators to Consider Regarding NGN

1) Does the regulatory framework present any market entry barriers?
2) Does the current licensing framework facilitate different services over different platforms (i.e., technology neutrality)?
3) How are VoIP and other IP-based services regulated?
4) What are the regulatory policies for these new technologies and services with regard to numbering, spectrum, interconnection, universal service, and rights of ways and shared deployment?
5) Does the regulatory framework promote diversification of access networks?
6) Are institutional and structural changes of the regulatory authority required to address an NGN environment?
7) Does the regulatory framework encourage and facilitate public (municipal) initiatives?

Modifications to Regulatory Frameworks

Market Barriers

- Introducing regulatory changes to **eliminate or modify restrictions** that impede operators from entering other markets

Licensing

- Shifting to **more flexible licensing regimes** with broader category of licenses (e.g., Malaysia, Uganda) in some countries and to **unified licensing** system in others (Argentina, Peru, EU, Morocco, India (proposed))
- Adhering to **technology neutrality** in licensing
- **Simplifying** licensing processes (shift from individual license and class licenses to notifications, registrations and/or deregulation)

VoIP Regulation

- Numerous jurisdictions are introducing **VoIP-specific regulation**

Modifications to Regulatory Frameworks

Interconnection

- **Symmetrical interconnection** approach
- Considering whether to **extend ad hoc interconnection** to network infrastructure via direct access or resale (local loop unbundling and bitstream)
- **Capacity-based** interconnection

Numbering

- Assignment of **numbering resources to new technology** services providers (*e.g.*, VoIP)
- **Inter-modal portability** between different services (fixed-to-mobile and vice versa)
- **ENUM** initiative

Rights of Way and Shared Deployment

- Facilitating use of **public/municipal infrastructure** (ducts, poles, etc.) or **public property** (federal land)
- Promoting **shared NGN deployment** to reduce costs

Modifications to Regulatory Frameworks

Universal Service

- Modifying the **scope** (from voice to data service and broadband services, where it is required by the market)
- Modifying **sources of funding** (to include IP-based services, such as broadband and VoIP)

Spectrum

- Introducing **flexible spectrum** use (technology neutrality, trading, in-band migration);
- Following technological developments **regarding IMT-2000 and beyond IMT-2000 systems** (WRC-07)

Institutional Change

- Governments are merging broadcasting and telecommunications responsibilities into **one entity**

Involve Stakeholders in the Transition to NGNs

- Awareness raising campaigns are currently seen as a prime course of action for regulators (e.g., TRAI of India)
- NGN deployment involves complex issues and decision (technical, commercial, etc.) that service providers are better equipped to address than regulators
- Industry consultations are an essential part of regulator's decision-making process, allowing them to establish more robust guiding principles for the transition to NGNs (e.g.,. Ofcom/UK and OPTA/Netherlands)
- The use of industry bodies/self regulation is a valuable tool to determine the way forward within the boundaries of the regulator's guiding principles (e.g., NGNuk initiative)

Conclusions

- Migration to NGNs is a further step on the road to convergence in the ICT sector
- Regulators must strike the right balance between promoting competition in the market and not deterring efficient investment and innovation
- Regulatory certainty is a fundamental requirement to transition to an NGN world and frameworks should be flexible in order to allow for the provision of multiple services over a single network
- Specific reforms to legacy frameworks are necessary to enable all-IP based networks and services
- Awareness raising, and industry participation (via consultation and industry bodies) is of outmost importance for a smooth transition to NGNs

Thank You

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ENSURING TELECOMMUNICATIONS SUCCESS AROUND THE WORLD

Telecommunications Management Group, Inc.

Quality of Service and Consumer Protection in an NGN World

Rosalind Stevens-Strohmann
Consumer Policy Manager
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Ofcom
OFFICE OF COMMUNICATIONS

Consumer Policy – Balancing consumer protection with consumer empowerment

- Deployment of NGN provides new opportunities to increase consumer choice but raises new challenges for QoS and consumer protection
- Challenge for regulators is to:-
  - **Empower consumers** by equipping them with the skills and information they need to get the best deal they can.
  - **Protect consumers** against various kinds of harm eg SPIT, fraud and identity theft, mis-use of personal information, etc.

Regulatory approaches to QoS

Enforcement approach

NRA defines QoS parameters, sets standards, actively monitors and enforces

For example:
Waiting list for main lines
% of faults cleared by next working day
% of failed calls
Number of main line faults
% of operator service calls answered in 15 seconds
Number of complaints per 1000 bills
Customer satisfaction rate

(ITU indicators)

Encouragement approach - NRA relies on competition and publicity to help consumers make informed choices and switch providers.

www.topcomm.org.uk
www.topnetuk.org

In reality most regulators use a mixture of both

Industry provision of comparable QoS for consumers

www.topcomm.org.uk

www.topnetuk.org

QoS aspects to be addressed as NGN is deployed

- Service disruption during migration from PSTN to NGN
- Management of end to end voice quality of service
- Access to emergency services and emergency call location
- Number portability
- Feasibility of alternative text relay services
- Differentiation of QoS
- Network integrity
- Network security

Consumer dimension to net neutrality and QoS

- Potential shift from “best efforts” approach to prioritisation of traffic.
- How willing is the consumer to pay differential amounts for different levels of QoS
  - For higher bandwidth services?
  - QoS guarantees?
  - Higher caps to usage?
  - Tailored made, managed services?,
- Differentiation may be more efficient – consumers only pay for QoS levels that are relevant to them
- Does ability to differentiate promote the innovation of new products and services?
- How do you protect consumers against potential for providers to downgrade some services (eg “free” broadband) to unacceptably low levels?

Reducing barriers to switching

- ***Consumers need information that is:***
  - Accurate, comparable, easy to understand
  - About nature, price and quality of service
  - Complete and accurate about transfer process
  - Clear about the impact of switching on current services

There must be no artificial barriers to consumer empowerment

- Migration process must not discourage consumers from switching eg unpredictable, unreliable
- Consumers must be protected against dishonest sales and marketing activity

Consumer protection and cyber security

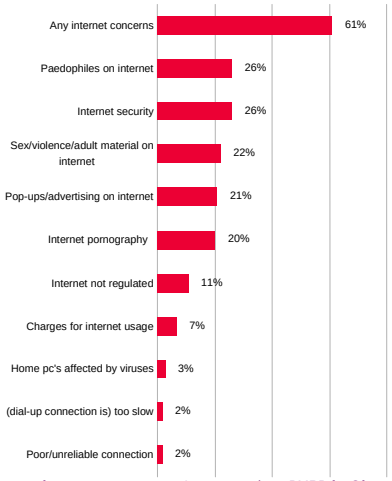
NGN increases potential for higher speeds of connectivity to Internet

Internet likely to play a greater role in citizens/consumers' lives

New opportunities and new potential for harm

Traditional regulatory structures unlikely to be effective

Industry led approach likely to be more successful



Source: Ad hoc survey of consumer concerns re Internet services, BMRB for Ofcom, August 2006

International initiatives to combat cyber crime

Privacy

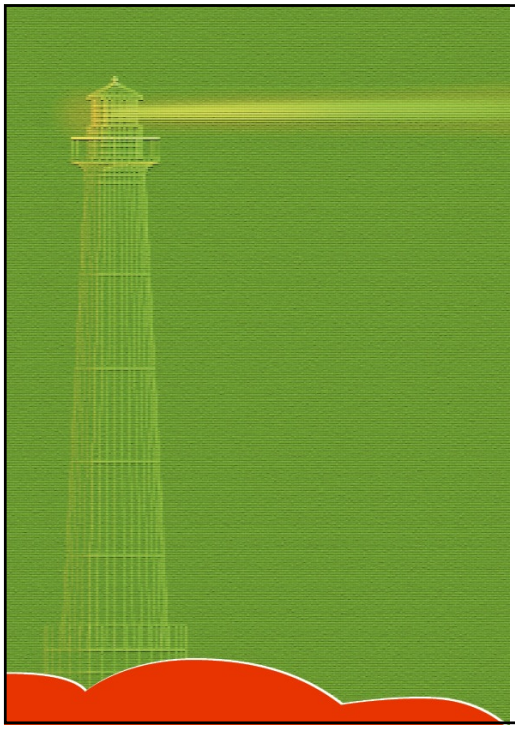
- EU Directives for the protection of personal data
- 1981 Council of Europe Convention for the Protection of Individuals with regard to automatic processing of personal data –
- OECD guidelines and Working Party on Information Security and Privacy
- APEC Privacy Framework

Inappropriate content and consumer protection

- UN Optional Protocol to the Convention on the Rights of the Child on the Sale of Children, Child Prostitution and Child Pornography
- 2001 European Convention on Cybercrime

Online advertising

- EU Television without Frontiers Directive/ European Advertising Standards Alliance



Next Generation Networks (NGN) and Universal Access

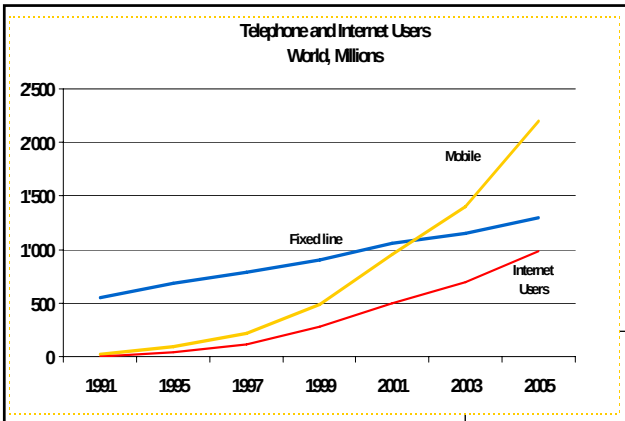
Susan Schorr
ITU BDT
Regulatory Reform Unit

Helping the world communicate

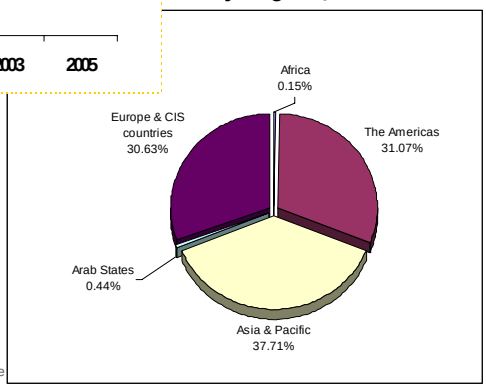
Universal Access Issues Today—or using all tools

- How should the scope of universal access be defined?
- NGN means infrastructure is decoupled from services. What should universal access funding support?
- Should broadband be included in a universal access definition?
- Where funding is required, how should universal access funds be collected and distributed?
- How should needs be identified - top down or bottom up?
- What role do not-for-profit organizations play?

2



Broadband subscribers by region, 2005



Source: ITU World Telecommunication Indicators Database

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International Telecommunication Union

The road to NGN

- Replacement of legacy PSTN equipment with IP-based equipment in the core
- Separation of transport and services
- NGN technological innovations already transforming the way universal access provided – VoIP, Wi-Fi, BWA

4

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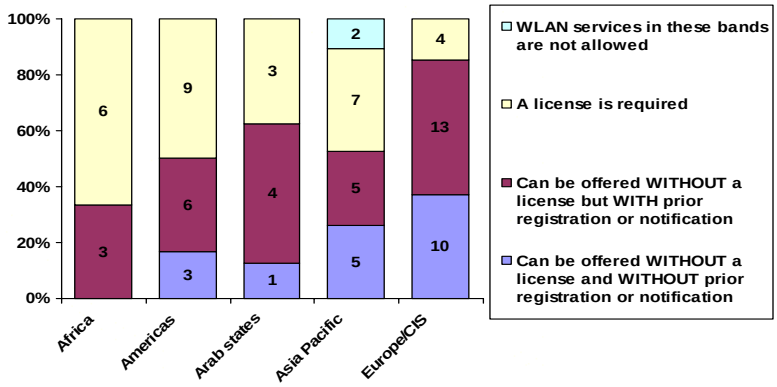
Treatment of PUBLIC provision of wireless local area network services in the 2.4GHz band, World, 2005



Source: ITU World Telecommunication Regulatory Database

5

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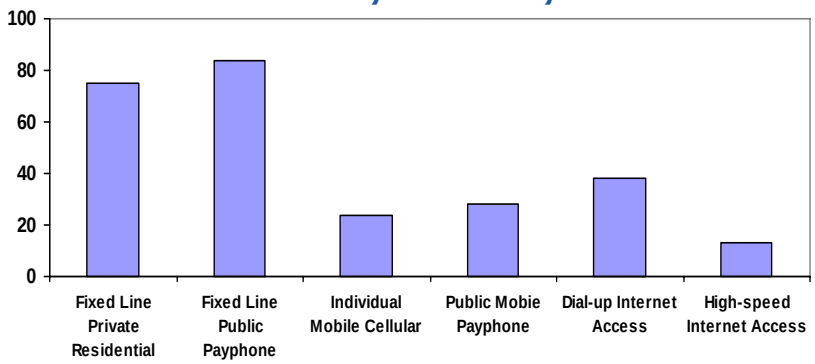
Service included in universal access and/or services definition, World, 2005



Source: ITU World Telecommunication Regulatory Database

Note: 99 countries reported a universal access definition; 27 reported no definition

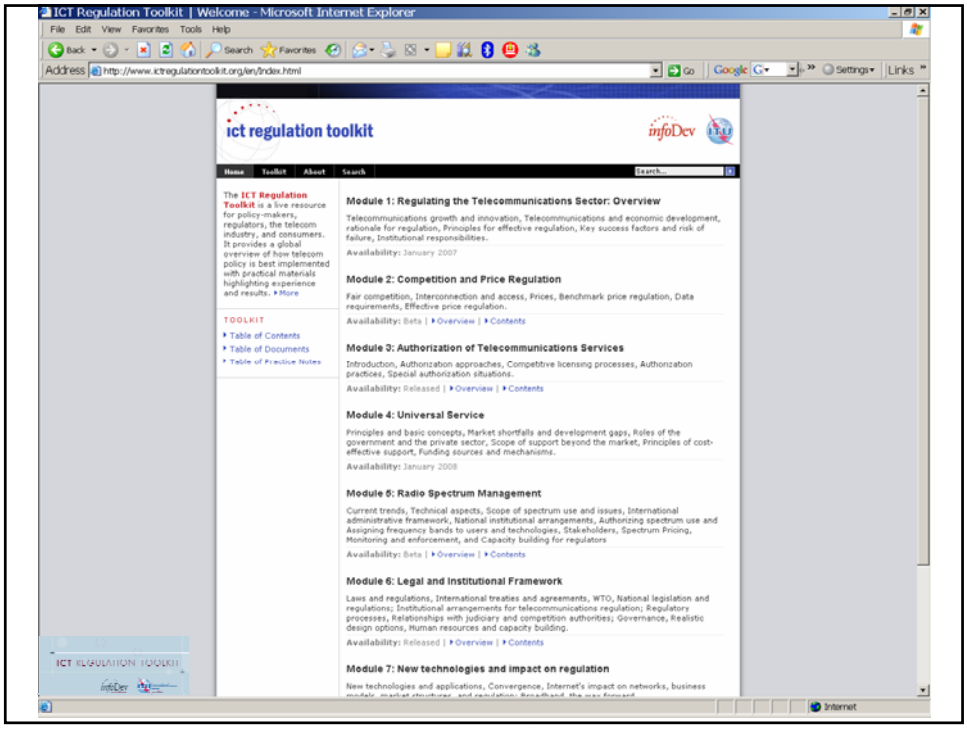
6

Universal Access Funding and Disbursement

- Eroding revenues from international and long distance calls coupled with decline of accounting rate system and rise of VoIP
- Universal access funds based on operator revenue, levies on end users, license and spectrum fees, general taxation
- Who is supported? End users, Incumbents, Small operators, NGOs and Not for Profits
- Top-down or bottom up approach?
- Micro-finance

Conclusion: NGN as a Catalyst for Change

- Migration to NGN offers opportunities and challenges for Universal Access
- Greater reliance on sector reform
- Government funding collected and disbursed in innovative ways
- Leverage technological developments, new actors, innovative financing (micro-credit)
- Ensure backbones deployed



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Universal Access Module

- The Key role that regulatory reform plays in promoting universal access/service
  - Fostering a competitive market to address the "market efficiency gap"
  - Addressing the true access gap: government financial intervention to achieve universal access
  - The role of the government as a facilitator, how in some cases it can do so without providing financial support, e.g., to bring a broad range of actors together to develop national broadband internet backbones or establish national and regional Internet Exchange Points (IXPs).
- Universal service / access policies in the context of increasing deployment of broadband and Internet; including to schools, rural areas, health facilities, youth, women, indigenous people and disabled users.
- Universal service / access mechanisms in the context of changing interconnection modalities associated with next-generation networks.
- The provision of emergency services in both traditional telecommunications and IP/NGN environments.
- The design of targeted subsidies; risks and management models for universal service / access funds.
- Examples and case studies of operator-specific strategies for planning universal access projects
- The roles of public and private sectors, and NGOs, including for example initiatives for local open access networks for communities and municipalities.

10

International Interconnection, NGN and ICT Development

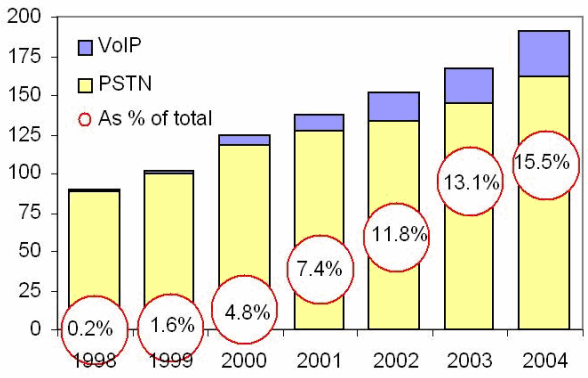
Eric Lie

Trends in International PSTN Interconnection

- **The Accounting Rate System**
  - Half-circuit model
  - Not necessarily cost based
- **Decline of the AR System**
  - Market liberalization and competition
  - Regulatory intervention
    - E.g. FCC 1997 Benchmarks Order
  - Growth of VoIP
  - Migration to NGN?

Trends in International PSTN Interconnection

International Voice Traffic
in billions of minutes



Trends in International Internet Interconnection

- **Charging Arrangements**
  - Peering and Transit
  - International VoIP Interconnection
- **New charging models?**
  - Better than “best efforts”?
  - Differentiated charging?
  - International end-to-end quality of service and security guarantees
  - Global “net neutrality”?

Trends in International Internet Interconnection

- **Market Overview**
  - A US-centric internet
  - Increasing competition and capacity
- **Regulation and Reform**
  - National competition policy
  - International cooperation
    - ITU – Recommendation D.50
    - APEC
    - WSIS - WGIG

International Interconnection and ICT Development

- **Mitigating the impact of declining settlement revenues**
  - Sector liberalization and reform
  - Domestic market growth
  - International Reform Efforts
    - ITU-T Study Group 3
  - Targeted development assistance

International Interconnection and ICT Development

- **Reducing the cost of international internet connectivity**
  - **Expanding international internet infrastructure**
    - E.g. FLAG NGN, EASsy, etc.
  - **Sector reform**
    - Liberalization of international facilities and open access
    - Domestic sector reform – licensing, spectrum management, interconnection (unbundling, leased lines, etc.) …
  - **Facilitating traffic aggregation and exchange**
    - Establishing IXPs

Thank you

http://www.itu.int/ITU-D/treg

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