Networks in Action: Overview of ENUM

FORUM ON TELECOMMUNICATION REGULATION IN AFRICA
Kampala, Uganda
3-5 November 2004

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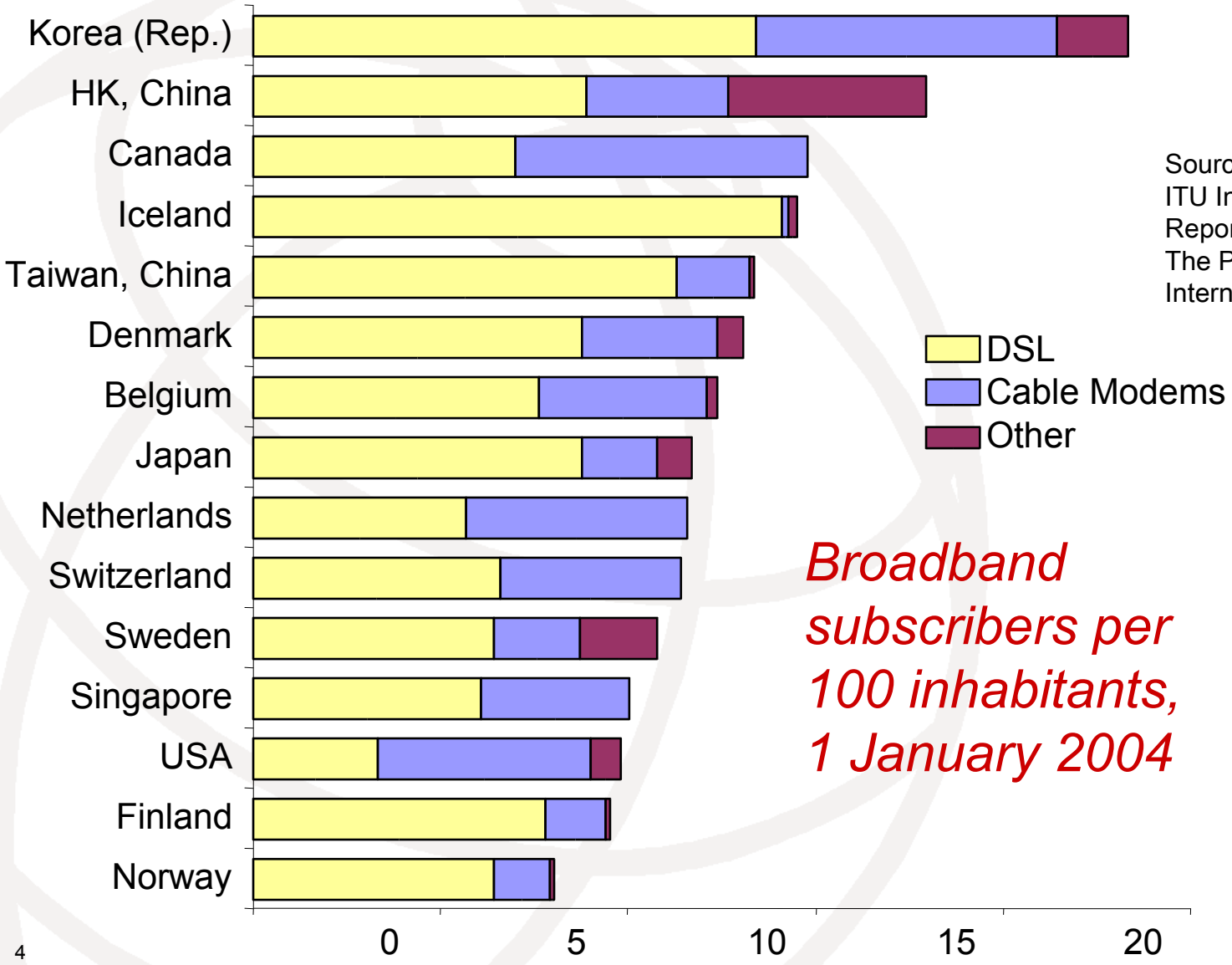
Agenda

- Networks in Action: Waves of Convergence
- Network Technology Paradigm Shift
- Next Generation Networks
- Emerging Regulatory Imperatives
- Case Study: VoIP
- Case Study: ENUM
- What problem is it trying to solve?
- Why is ENUM important for regulators?
- Current Status

Networks in Action: First Wave

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

Fixed-line broadband: Top 15



Source:
ITU Internet Reports 2004: The Portable Internet.

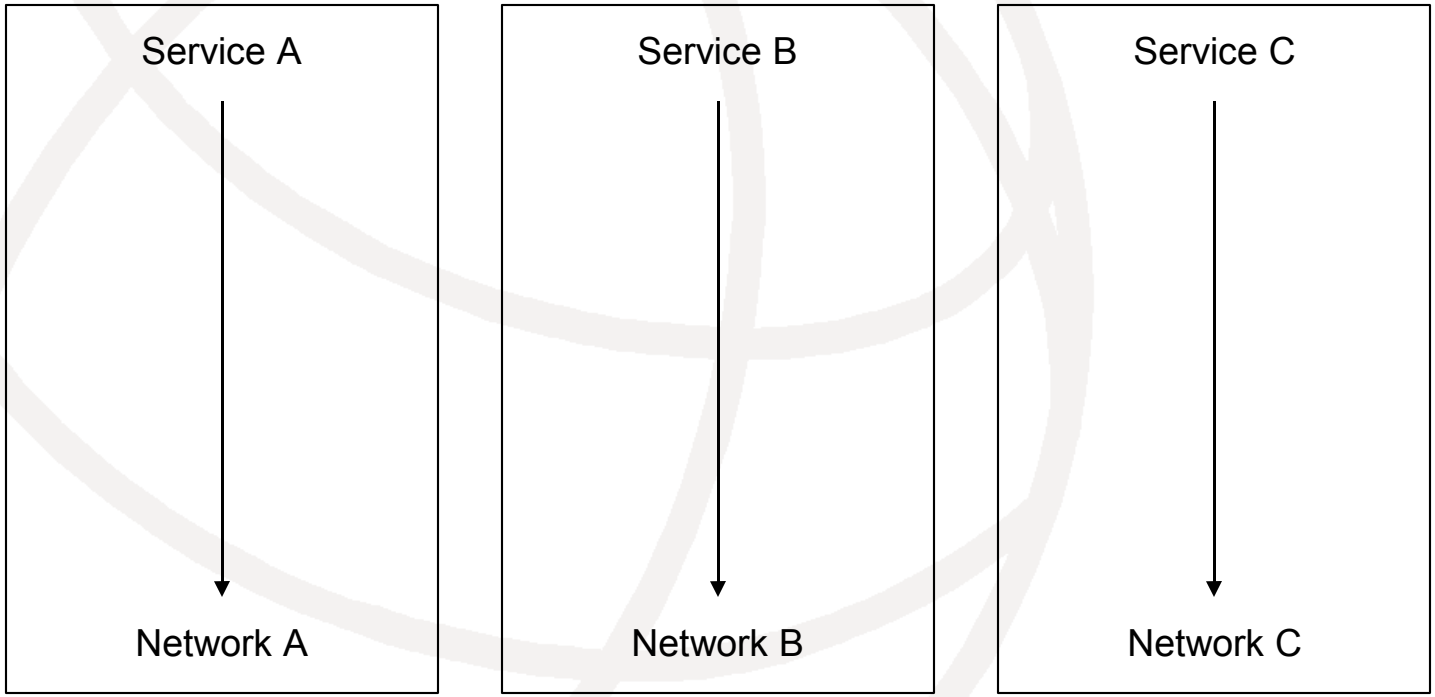
Broadband subscribers per 100 inhabitants, 1 January 2004

Networks in Action: Second Wave

- Ongoing trend towards integration & interoperability of IP-based and PSTN network services and applications
- Emergence of differentiated Quality of Service (“QoS”) IP-based services
- Managed end-to-end performance needed for new applications requiring real-time traffic (e.g., video, voice)
- New network management, QoS, traffic engineering, pricing & accounting models

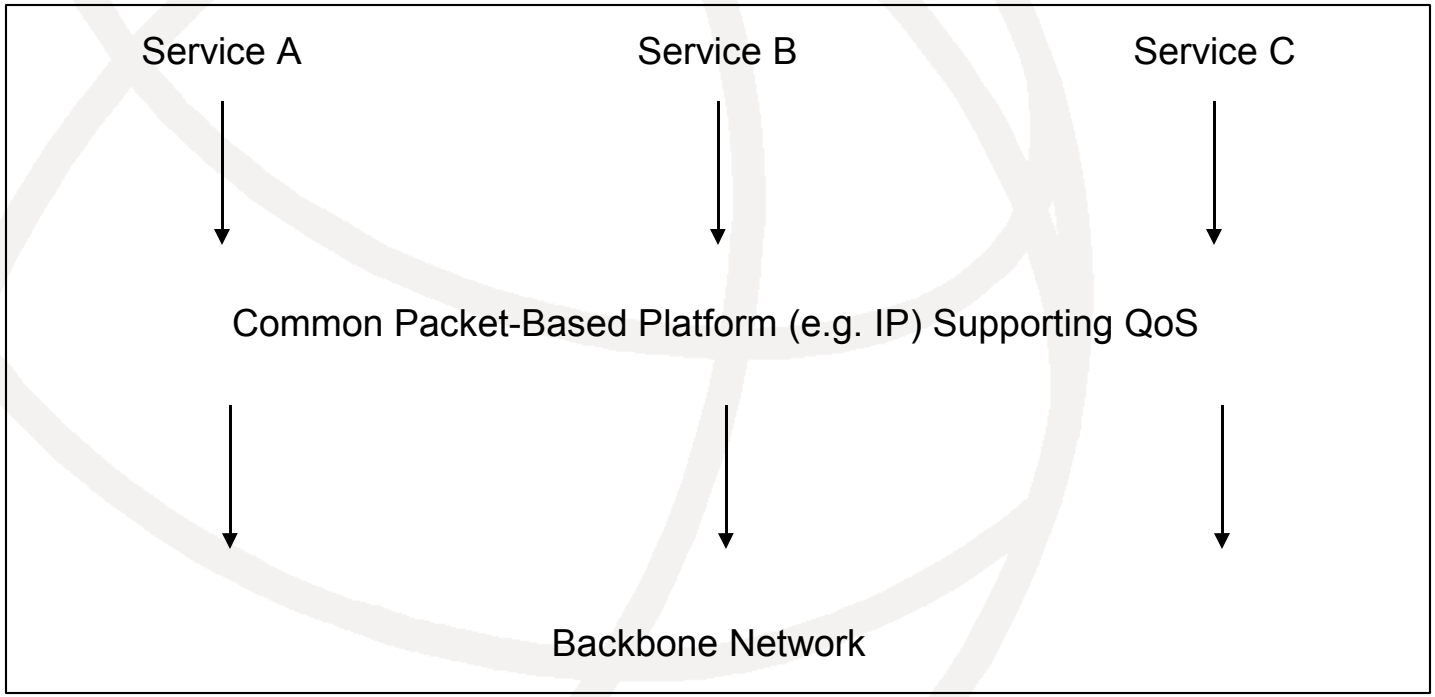
Network Technology Paradigm Shift

- Current scenario: services tied to specific technologies and networks

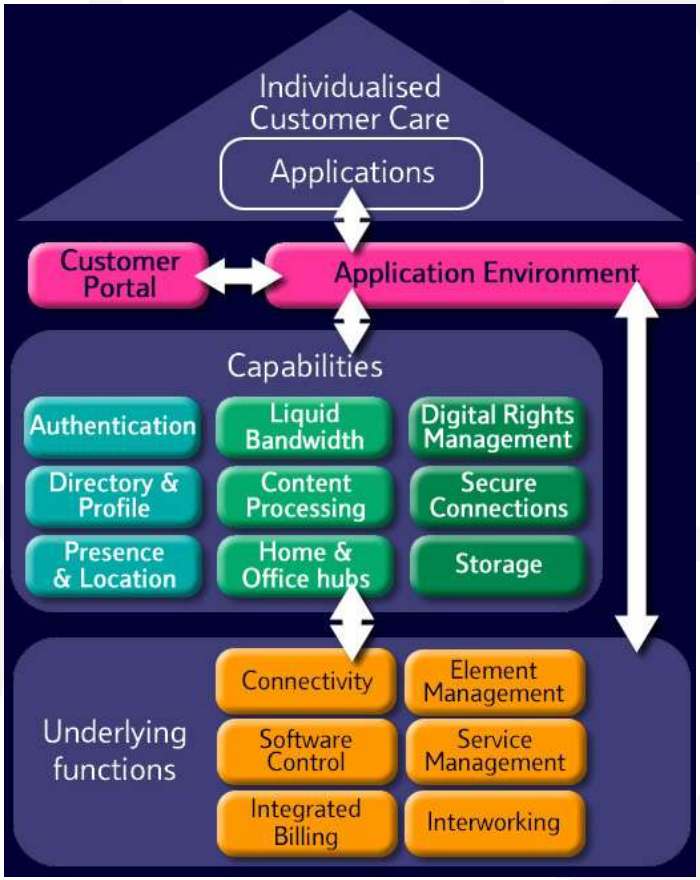


Network Technology Paradigm Shift

- Future scenario: shift from multiple service specific networks to multi-service NGN



Next Generation Networks



- Evolution of current PSTN, mobile, wireless and IP-based networks to unified **Next Generation Networks** providing both Internet and carrier-grade telecommunication network and service offerings with QoS

Source: Mick Reeve, BT

ITU-T Definition of NGN (Feb 2004)

- "A **Next Generation Network (NGN)** is a packet-based network able to provide services including 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 offers unrestricted access by users to different service providers. It supports generalized mobility which will allow consistent and ubiquitous provision of services to users."

Next Generation Networks

- Requires substantial:
  - standards work and resource investment by operators and equipment manufacturers
  - significant policy and regulatory review
- ITU under reorganization around NGN technical and regulatory frameworks
  - Recent WTSA-04 focus on NGN
  - Area of intensive standardization by operators and equipment manufacturers in ITU-T
- Transition to Next Wave: Phase Three - Ubiquitous & Pervasive Networks
  - anybody, anytime, anywhere

Emerging Regulatory Imperatives

- The days when legislation and regulation could assume distinct services running over distinct technologies and networks are disappearing fast
- Co-existence and continued intersection of NGN and Internet in terms of technological and regulatory developments should be foreseen

Emerging Regulatory Imperatives

- Growing concerns about public interest and national critical network infrastructure (CNI) vulnerabilities (e.g. widespread fraud, spam, phishing, security flaws, cybercrime, zombie armies, spyware)
- Transition of Internet to public infrastructure and services will continue to invoke further government and intergovernmental mandates and oversight

“List of 13” Public Interest and National Security Mandates

- public safety (E911) needs
- disability assistance
- law enforcement support
- competition (Computer III/number portability/1996 Act requirements)
- fraud prevention
- reliability and reporting obligations
- restoration after failures
- call prioritization during emergencies
- privacy and data protection
- consumer protection against unwanted intrusions
- universal service and other contributory obligations
- intercarrier compensation
- nondiscriminatory regulatory treatment

Source: Tony Rutkowski, Verisign

Case Study:
Rapid Growth of VoIP

User dreams can be regulator's nightmares

Switzerland

USA

- USA phone number (number exhaust?)
- Rings in Switzerland
- Flat-rate monthly price ($20-$35) to and from the US
- Cheaper to call next door in CH from the US number than CH phone
- Requires broadband in CH and functions as fixed line

This is only the beginning

- Currently
  - Broadband allows access to other voice markets using VoIP
  - Users can avoid fixed-line and mobile carriers to make voice calls around the world
- Future
  - Indications that voice bundled in palette of multimedia services
  - Regulators need to rethink universal service requirements on voice carriers - possible move towards universal “ICT” service?

Chinese saying: “Fallen leaves return to the root”*

- While VoIP has long been an issue for developing economies
  - where it was mostly about price arbitrage
  - topic of ITU World Telecommunication Policy Forum 2001
- It has now also become a major issue for developed economies
  - Threatens US multi-billion dollar intercarrier compensation scheme, extensive cross-subsidies, universal service funds, etc.
  - tipping point for urgent revision of regulatory frameworks

* English equivalent: “The chicken has come home to roost”

Headline: “Battle Brews Over Rules for Phones on Internet”

- USA: “Fierce battle is emerging among rival companies and between federal and state regulators over the shape of the new government regulations and control of the service, which has the potential to be the most significant development in telecommunications since the breakup of the AT&T monopoly 20 years ago.”
  - *New York Times, July 28 2004*

A few European VoIP Regulatory Proceedings

- CEPT: http://www.ero.dk/voip
- European Commission: http://europa.eu.int/information_society/topics/ecomm/doc/useful_inform

- DE – RegTP: http://www.regtp.de/imperia/md/content/en/voiceoverip/2.pdf
- ES – CMT: http://www.cmt.es/cmt/centro_info/c_publica/pdf/cp_VoIP.pdf
- http://www.cmt.es/cmt/centro_info/c_publica/pdf/Consultation_VoIP.pdf
- IE – ComReg: http://www.comreg.ie/whats_new/default.asp?ctype=5&nid=101674
- UK – OFCOM: http://www.ofcom.org.uk/ind_groups/ind_groups/telecommunications/vo

Case Study: ENUM

ENUM as a Case Study

- ENUM is a good case study of how complex the technological and regulatory intersection of the Internet and PSTN can be…
- This is against backdrop of wider debate as to what will be the predominant global addressing scheme?
  - Telephone Numbers (billions in place, language neutral…)
    - +41 22 730 5338
  - Internet style addresses (Uniform Resource Indicators = URIs)
    - mailto:robert.shaw@itu.int, sip:robert.shaw@itu.int

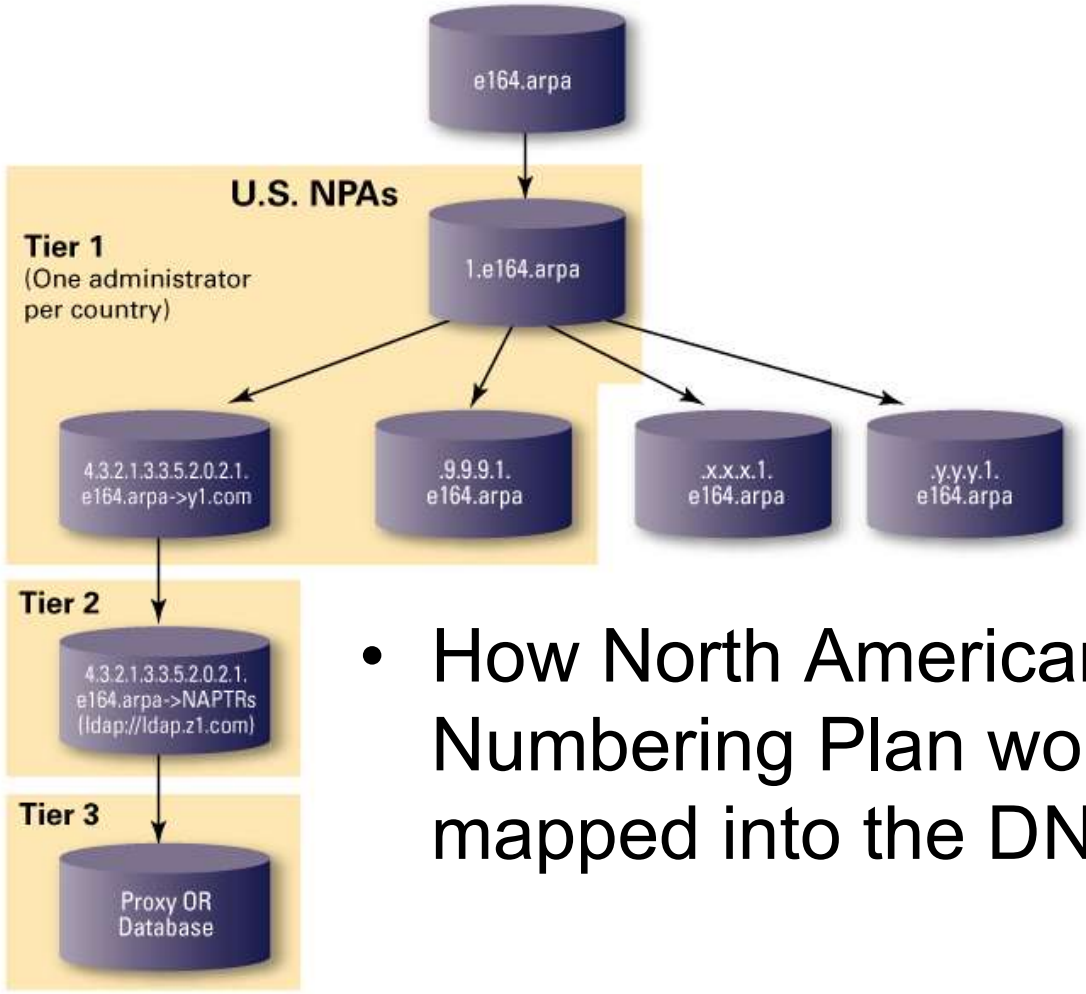
Issues of Convergence

- Problems of addressing calls that pass from one network service to another:
  - Now widely possible to originate calls from IP address-based networks to other networks
  - But uncommon to terminate calls from other networks to IP address-based networks
  - To access a subscriber on an IP address-based network, some sort of global addressing scheme across PSTN and IP address-based networks needed
- ENUM is one (of many possible) solution(s)…

What is ENUM?

- A protocol defined by IETF in RFC 3761
- Originally conceptualized as database in the public Domain Name System to find specific services (URIs) associated with E.164 numbers to be managed by ‘end-users’
- Rooted in a specific public part of the DNS (currently e164.arpa)

Example: ENUM Tiers for +1



- How North American Numbering Plan would be mapped into the DNS

Why is this topic so important to regulators?

- Mapping of telephone numbers onto Internet
- Could allow conventional telephones to call IP terminals (PCs)
- Another option is to assign numbering resources to IP terminals (e.g, Japan, Korea)
- Should telephone numbers used in this way be subject to government oversight and regulation?
- Who should exercise control over telephone numbers used in this way?

Complexities

- In telecommunication numbering, regulatory tradition with government involvement (e.g. number portability, consumer protection)
- In the Internet, management of naming and addressing often left to “industry self-regulation”
- National numbering/regulatory authorities required to be involved to some extent in coordinating overall responsibility for ENUM for their portion of E.164 resources

Roles and Responsibilities

- Most ENUM service and administrative decisions are national issues under purview of ITU Member States, since most E.164 resources are utilized nationally
- ITU has defined interim procedures for trials
- ITU ensures that Member States specifically opt-in for their E.164 country code resources to be placed in the DNS

ITU Past Activities

- Preparation and circulation of tutorial papers
- ITU-T SG 2 Supplement on issues that need to be addressed by national and international authorities
- ITU-T SG 2 Meetings from 2001
- Discussion with IETF and RIPE NCC on roles and responsibilities

ITU Responsibilities

- Define and implement administrative procedures that coordinate delegations of E.164 numbering resources into the agreed DNS name servers
  - Draft Recommendation E.A-ENUM is being prepared by Study Group 2 for approval

Recommendations for National Consideration Issues

- Consultation process
- National deployment Issues
  - How do you authenticate the identity of the subscriber for ENUM services?
  - Who are ENUM Registrars and what are they responsible for?
  - How do you validate ENUM data for potential users (Add - Modify – Delete) NAPTR list of services and preferences?
  - How is data provisioned in the country code name servers?
  - Portability of services/data across providers
  - Competition issues

Is there a rush?

- To date, both industry and national administrations have taken considerable amounts of time to work through numerous complex issues that need to be addressed
- Some frustration at slow progress
- Why the delay?

What the critics say…

- No clear business case for ENUM
- Wrong technology and routing solution for wrong problem…
- Why? Large installed based of telephone numbers (billions) which users & service providers understand…
- Complexity of telephone numbers increasingly hidden in modern devices
- Only for ‘techies’ – few consumers would “opt-in” even if available
- Growing general Internet security and privacy concerns
- Carriers will never expose their number resources and customers to public vulnerabilities

ENUM Mutating into "Carrier/Operator ENUM"?

- Carriers could use ENUM 'technology' to find within their network
  - VoIP servers hosting their subscribers
  - Interworking servers (e.g. SIP/H.323)
  - egress border elements to other IP-based networks
  - egress gateways to PSTN-based networks
- This ENUM database could also
  - interwork with existing IN (NP) databases
  - be provisioned from same core administrative database
  - in any private or public DNS root
- Could also be across carriers/operators
- Solutions may not necessarily use ENUM technology (DNS) or protocols so 'ENUM' might be misnomer

Source: Thanks to Richard Stastny, Austria

ENUM: Some Barriers

- Laudable goal but many difficult business and policy issues
- Public DNS based solution requiring ‘opt-in’ very unlikely as global authoritative source for IP routing information for phone numbers
- But ‘opt-out’ (automatic provisioning of all numbers by operators/service providers) only likely in non-public databases
- PSTN/NGN telephone number routing schemes to continue for foreseeable future
- Impact of growing assignment of national number resources to IP terminals?
  - although not exact substitute

ENUM: Some Barriers

- Number of alternative solutions appearing (e.g. proprietary, peer-to-peer like Dundi, unclear impact…)
- Yet in NGN, there remains requirement to associate different naming, numbering, addressing and routing (NNAR) information across supported platforms
- Will other solutions emerge as part of work on NGN/IP-enabled signalling and directory issues?

ITU Future ENUM Activities

- Cooperate with IAB/IETF to make final choice of TLD (currently e164.arpa), registry, requirements for registry operations
- Continue interim administration
- Determine ITU-T Recommendation E.A-ENUM, May 2005?

Current Status

- Some References
  - http://www.itu.int/ITU-T/inr/enum/
  - http://www.itu.int/ITU-T/worksem/enum/
  - http://www.itu.int/osg/spu/newslog/categories/enum
- Interim procedures:
  - http://www.itu.int/ITU-T/inr/enum/procedures.html
- Over 25 approved delegations:
  - http://www.itu.int/itudoc/itu-t/enum/enum-app.html

Current Status

- Dissemination of experiences
  - http://www.itu.int/ITU-T/inr/enum/trials.html
- Also see ITU handout here on a number of country experiences
  - NB: Poland's offer to provide ENUM and Number Portability software solutions free of charge to developing countries

Thank you

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