An ENUM Tutorial

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Agenda

- What is ENUM and the market is serves?
- How does it work?
- Why is it important ?
- Where is it going …

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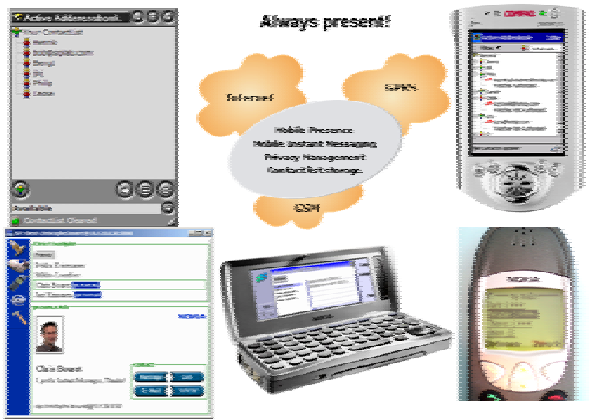
Why are telephone numbers important for VoIP routing?

- **Never underestimate the value of naming and addressing in networks.**
- **Would we have telecom competition if there was no number portability?**
- **People, *and service providers*, know how to use telephone numbers**
- **Billions of telephony devices only use numeric key pads**
- **Telephone Numbers and URI's can and will be used interchangeably**
  - **tel:+15714345400**
  - **sip:operator@neustar.biz**
  - **sip:sales@landsend.com**
- **SIP and PSTN domains MUST be transparently interoperable to ensure universal reach**
- **For the foreseeable future SIP calls will have to be routed by both naming schemes**



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Why are URI's important ..

- URI's = Uniform Resource Indicator – The naming and addressing scheme for Internet services
- URIs represent a generic naming scheme to describe IP service points
  - Generic format of
    service:service-specific-address
    Example: SIP:name@domain.foo
    Example: mailto:name@domain.foo
- A URI in IP context is ultimately resolvable to
  transport protocol (TCP/UDP) selection
  IP address
  Port address
  Address selector within the application session

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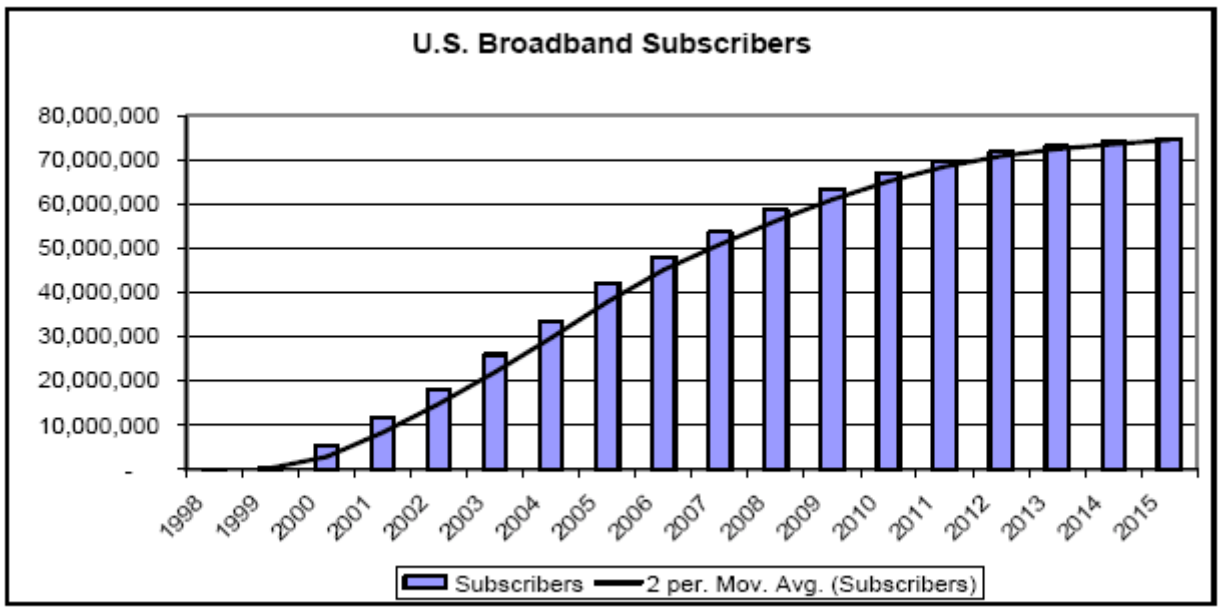
Industry Imperatives supporting ENUM

- ENUM Represents the Ultimate in Number Portability
  - Select not just service provider
  - Select method of call transport
- **New services cannot work if "dumbed down" to the PSTN to cross SP boundaries (e.g. video)**
- **Need to bundle service offerings and access**
  - Provide users to access services on-demand and without geographical limitations
  - Non-traditional relationships maybe required
  - Need to target new markets and access mediums (e.g., fixed, WiFi/WiMAX, cellular)

ENUM driven by BB adoption

- Jupiter reports 46M US households (40%) will have always on BB by 2008
- Strategy analytics reports 33.5 M BB households by end of 2004

U.S. Broadband Subscriber Forecast Will Follow Classic S-Curve



Source: CIBC World Markets Corp.

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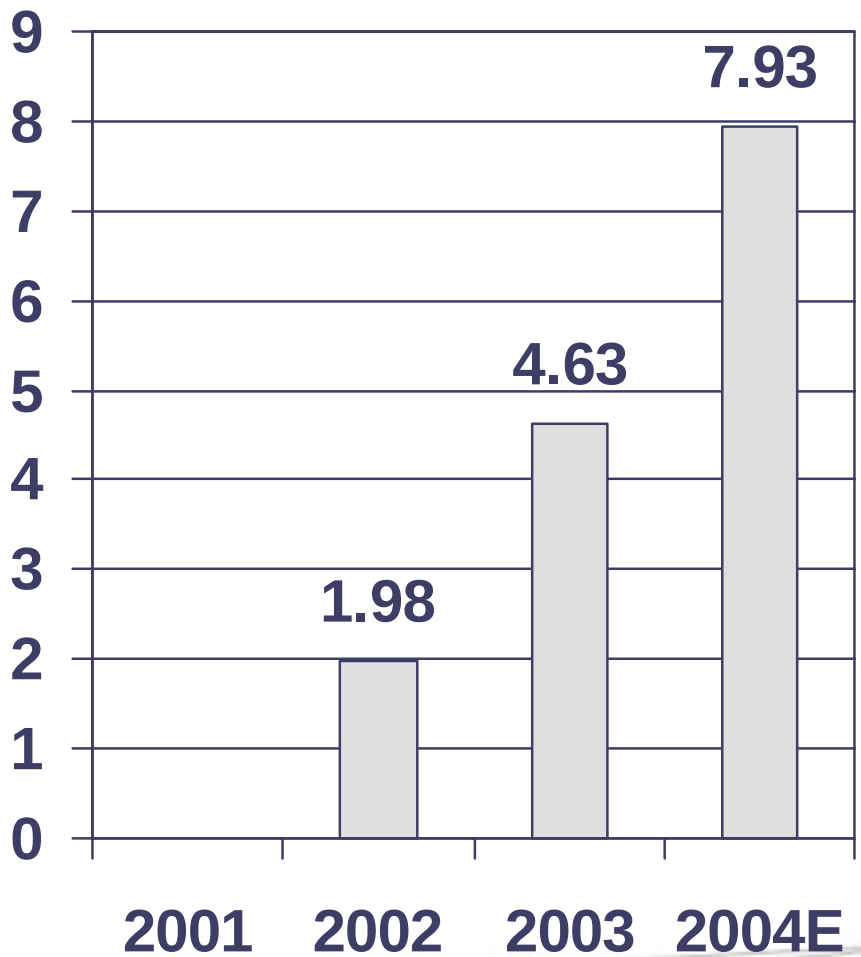
Enterprise VoIP adoption even stronger



The real battle ground is the enterprise

2004 IS IP-PBX lines crosses TDM PBX line station shipments

Market Realities : The Opportunity Cost Lost

- Based on current US Access charges ($0.01) VoIP providers are losing perhaps ¼ 1/5 revenue to incumbents.
  - 500 Min X .01 = $5.00 on $24.94 per month
    - “A penny saved is a penny earned per share”
- Default PSTN routing is not economically sustainable
- ATT spends 9B on access charges
  - “A billion here a billion there..it starts to add up to real money.”

VONAGE
THE BROADBAND PHONE COMPANY®

sipgate

The Real Arbitrage

- Traditional Telecom exchanges are based on Reciprocal Compensation
  - Extremely high accounting costs result of per transaction costs
  - 40% of toll charges in US are related to Recp Comp / Billing OSS related issues
- The Internet is based on Transit and Peering models
  - Users Pay for Transit
    - “Move my bits please.”
  - Networks Peer Traffic
    - “Ill move your bits if you’ll move mine”
  - Non-Transaction based – Bit Traffic Flows are aggregated.
  - Very Low accounting costs

Oh BTW .. Its about SIP

- Internet Engineering Task Force (IETF) protocol
  - It is the Session Initiation Protocol
  - Integration of Voice-Text-Video “sessions”
- Inventors: M. Handley, H. Schulzrinne, E. Schooler, and J. Rosenberg
- Became “Proposed Standard” and RFC 2543 in March 1999 in MMUSIC WG.
- Separate SIP WG established in September 1999.
- 3 other SIP WG’s SIPPING (applications), SIMPLE (presence and instant messaging) and XCON (conferencing).
- RFC2543bis-09 I-D became RFC 3261 in June 2002 .
  - Entire spec rewritten for clarity, but some new features
  - Mostly backwards compatible with RFC 2543

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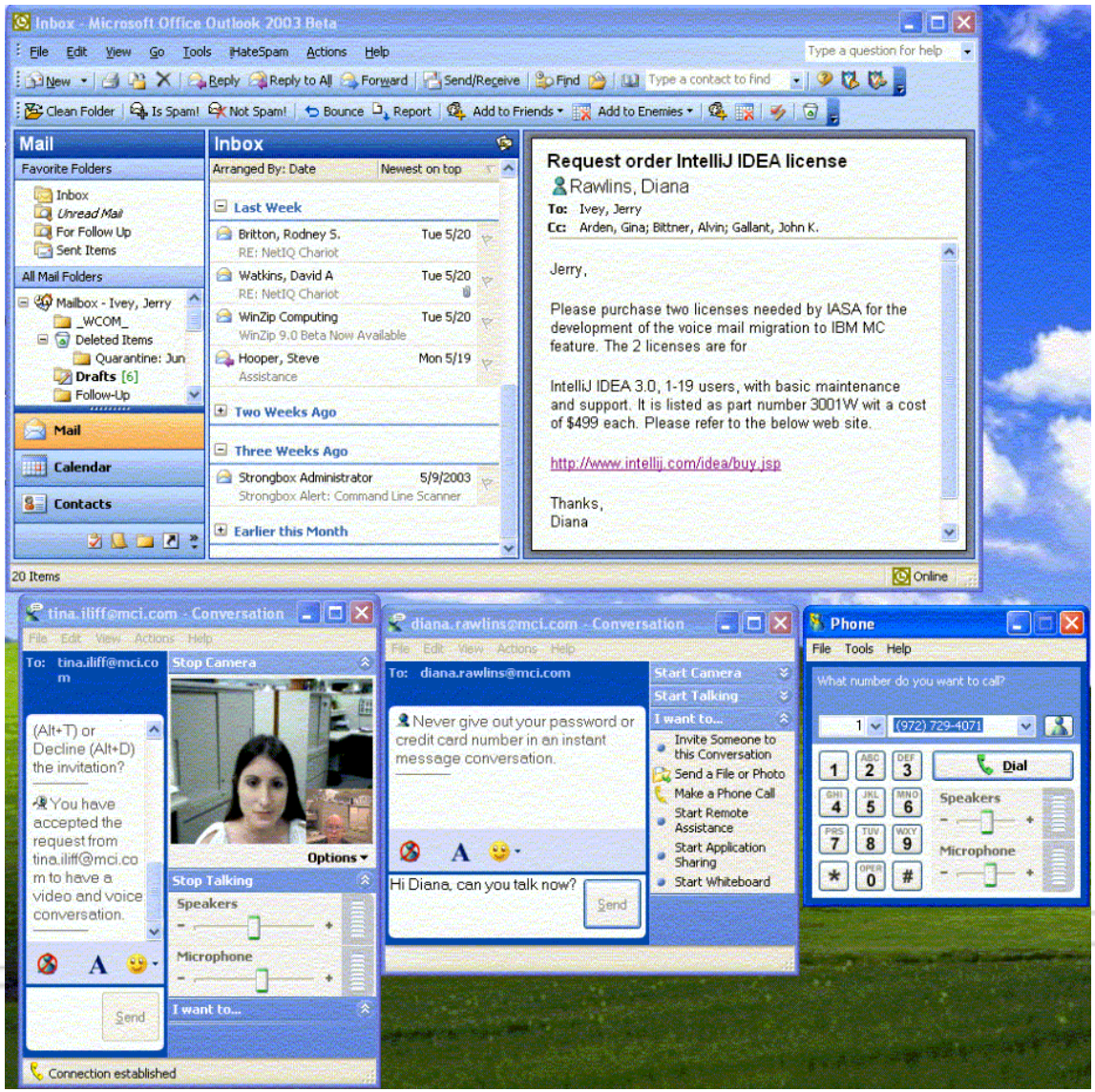
Its not just about Voice..

- Integrated
  - Voice
  - Video
  - Text messaging
  - and especially Presence



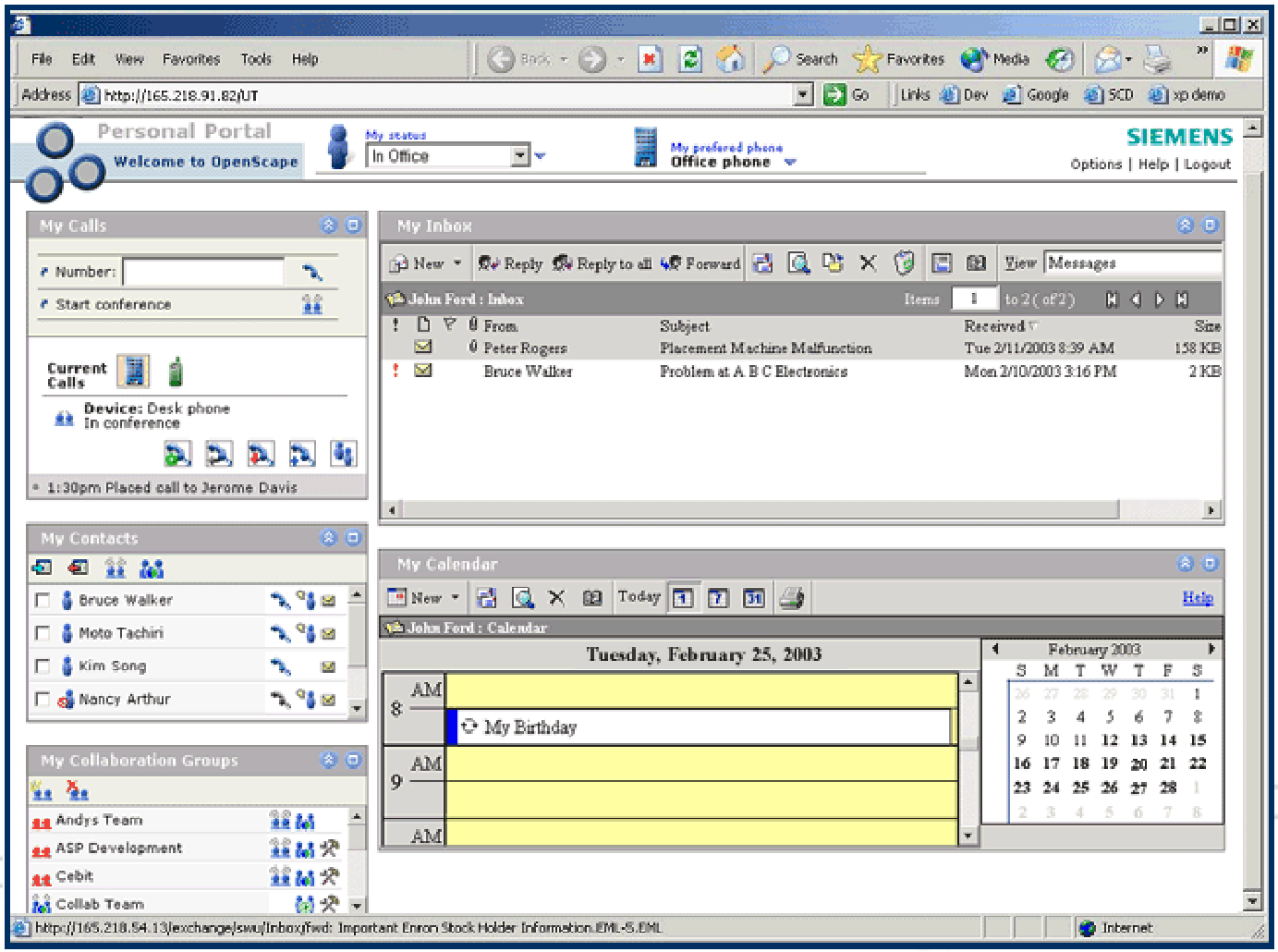
Microsoft Office 2002

its about Real Time Multimedia Sessions..

Siemens OpenScape

Calendar Exchange

View Presence on line potentially keyed to TN

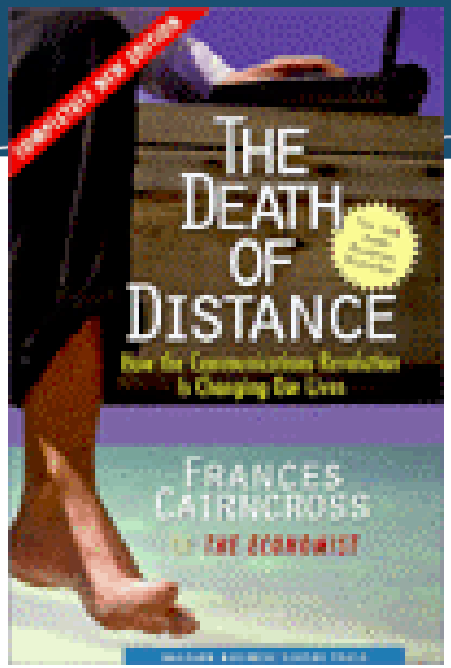


Its about new Service Provider Service Creation

- User Control vs Operator Control

ENUM IETF RFC 3761

- ENUM perfectly matches phone numbers to internet domain names
- Considered a key enabler for Convergence
  - Whatever that is..
- The potential for using TN's to address multiple applications other than voice
  - Mobility and Presence
  - Video
- Creates service interoperability across domain boundaries
- ENUM accelerates the shift from location to individual based communications addressing



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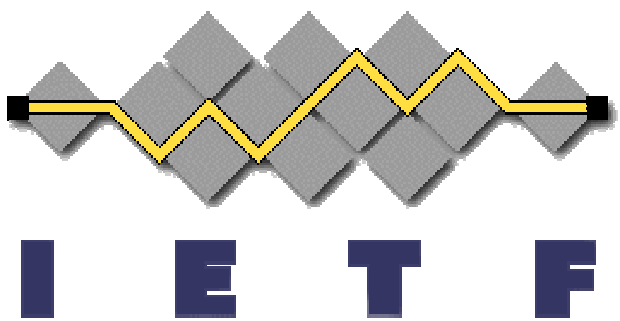
What is the IETF ?

- Internet Engineering Task Force
- Oversees the standards process for Internet protocols and technologies
- Industry driven standards body
- No membership whatsoever
- Personal participation, anyone can participate
- Work is done using mailing lists
- Rough consensus and running code (no voting)

http://www.ietf.org/overview.html



What is the IETF ?

- Work is done in Working Groups (i.e. ENUM WG)
  - WG has a charter, statement of activity, schedule and milestones and a mailing list
  - WGs can be instantiated and closed (by IESG)
- Working Groups exist within an Area (currently 8 areas, i.e. ENUM WG is part of Transport Area)
  - An area is managed by an Area Director
- Area Directors are members of the IESG (Internet Engineering Steering Group)
- The IESG and IAB (Internet Architecture Board) is chartered by the Internet Society

IETF ENUM WG

- Home page:
  - http://www.ietf.org/html.charters/enum-charter.html
- RFC 3761 is the update of RFC 2916: main differences are
  - ENUM is now a DDDS application
  - enumservice field has changed E2U+foo
  - enumservices have to be registered with IANA
    - RFC 3762 for H.323
    - RFC 3764 for SIP
    - Definitions for HTTP, FTP, TEL MAIL due shortly
  - DNS security mentioned
  - Clarifications on text

ENUM is a DDDS Application

- Dynamic Delegation Discovery System, RFC 3401 through RFC 3405
- RFC 3401 is the base document, but you have to read at least RFC 3401 through RFC 3404 to understand DDDS
- RFC 3402 specifies the Algorithm of DDDS
- RFC 3403 specifies the NAPTR Resource Record

(Very short) ENUM History

- 1999 - IETF ENUM WG formed
- Sept. 2000 – IETF ENUM WG – RFC2916
- 2001 – Various Workshops (ITU-T, Europe, US, Asia, …)
- 2002 – ITU -T Interim Procedures (IAB, RIPE-NCC)
  - ITU -T generic TLD Investigation
  - ETSI TS 102 051 "ENUM Administration in Europe"
- 2003 – ETSI TS 102 172 "Minimum Requirements for Interoperability of European ENUM Trials"
  - IETF new ENUM revision, IANA registered enumservices
  - ITU-T final procedures ENUM domain
  - ETSI ENUM Workshop (Feb 2004) and Plugtest (2004)
- 2004 – IETF New RFC
  - Enumservices registration
  - 1st Commerciallztion Austria – Romania
- 2005 – US Trials ?? APEET Coordination

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How Does ENUM [RFC 2916] Work?

- For a normal VoIP, a client or user agent on the network takes a fully qualified E.164 telephone number from the application and create a DNS lookup into a single highly defined and structured domain [e164.arpa].
- The search for resources on the internet associated with + 1 202 533-1234 becomes a Fully Qualified Domain Name (FQDN) - DNS look up to: 4.3.2.1.3.3.5.2.0.2.1.e164.arpa

- Goal : Phone Number IN … Service URL OUT !

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ENUM in a nutshell RFC 3761

- take E.164 phone number

+1 571 434 5651

- turn it into a FQDN

1.5.6.5.4.3.4.7.5.1.e164.arpa.

- ask the DNS
- return list of URI's

sip:richard.shockey@neustar.biz

To Understand ENUM you must understand the DNS

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Step 1 Explanation

- Each digit in the FQDN can become a definable and distributed “zone” in DNS terms

1.5.6.5.4.3.4.7.5.1.e164.arpa.

- Delegation can (but doesn’t have to) happen at every digit, including at last digit
- Zones such as country codes, area codes or primary delegated blocks of numbers can be delegated as well as individual numbers
- DNS defines authoritative name servers (NS records) for NAPTR/service resource records

- Delegation model completely matches that of the E.164 number plan

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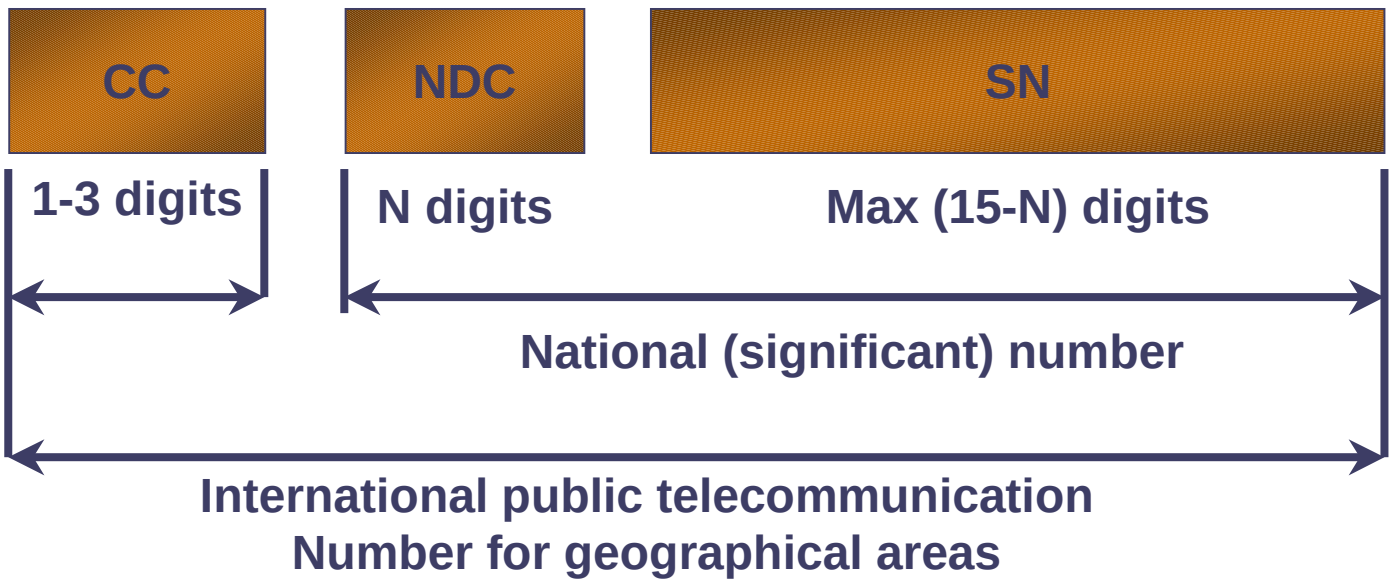
Structure of ITU E.164 Number

- Structure very suitable for delegation in DNS



CC – Country Code
NDC – National Destination Code
SN – Subscriber Number

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The Response from the DNS

Input:

$ORIGIN. 1.5.6.5.4.3.4.1.7.5.1.e164.arpa

Output: All NAPTR RR will be returned to resolver

In this response the preferred contact method is SIP

	ord	pr	fl	service	regexp replacement
IN NAPTR	100	10	"u"	“E2U+sip"	"!^.*$!sip:15714345651@carrier.net!" .
IN NAPTR	100	15	"u“	“E2U+VPIM"	"!^.*$!vpimserver1.carrier.net!" .
IN NAPTR	100	20	"u“	“E2U+ifax"	"!^.*$!mailto:faxmachine4@neustar.biz!" .

- Based on service requirements defined by the enumservice field, translate replacement field into URL and execute as required

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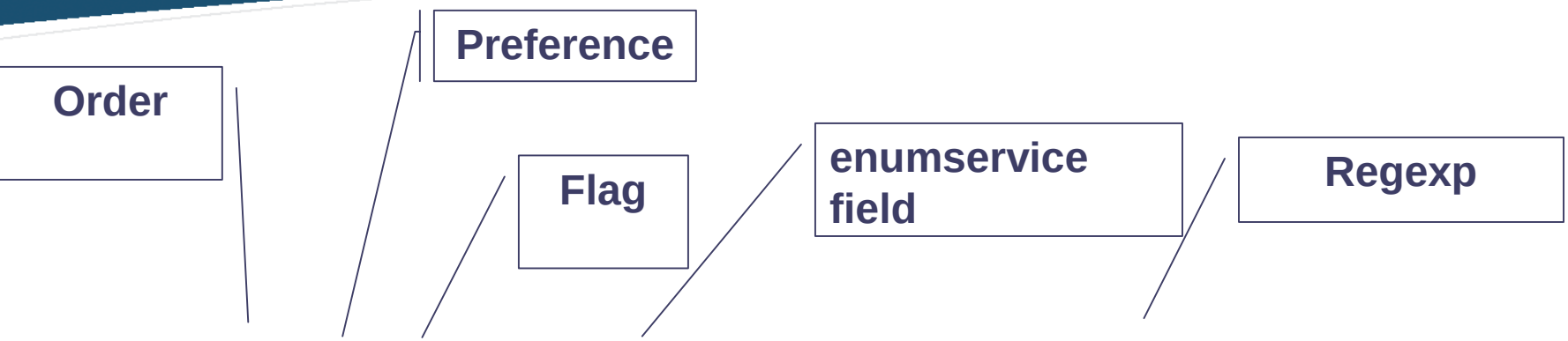
NAPTR Record Structure




```
IN NAPTR 10  10 “u” “E2U+fax”     “!^.*$!mailto:me@domain.foo!”
IN NAPTR 10  10 "u" “E2U+SIP      "!^.*$!sip:+12025332800@network.com" .
```

- Order field indicates order of rules in DDDS current ENUM practice is to set order to common value (10) .
- Preference indicates service selection.
- U Flag – Terminal lookup resulting in URI
- enumservice field: Specifies protocol to use to communicate with the E2U service defined in RFC3761 (SIP = RFC 2543) (mailto =SMTP)

IETF IESG maintains enumservice registration field oversight in IANA Registry

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Simple ENUM/SIP Call Flow SIP RFC 3261

ENUM Global Directory (DNS) Equates +1-202-555-1234 to sip:mark@carrier.net to enable Voice over IP using SIP

2. Calling party proxy UAC queries DNS for location of end point

DNS-Server

3. DNS returns NAPTR record containing SIP URL to Calling Party UA

Response
sip:name@domain.com

Query
4.3.2.1.5.5.5.2.0.2.1.e164.arpa?

1. The caller simply dials the person's normal telephone number

Dial
+1-202-555-1234

Sip Proxy

Sip
Sip:name@domain.com

Sip Proxy

"Call Setup"

4. Calling party UA connects the call

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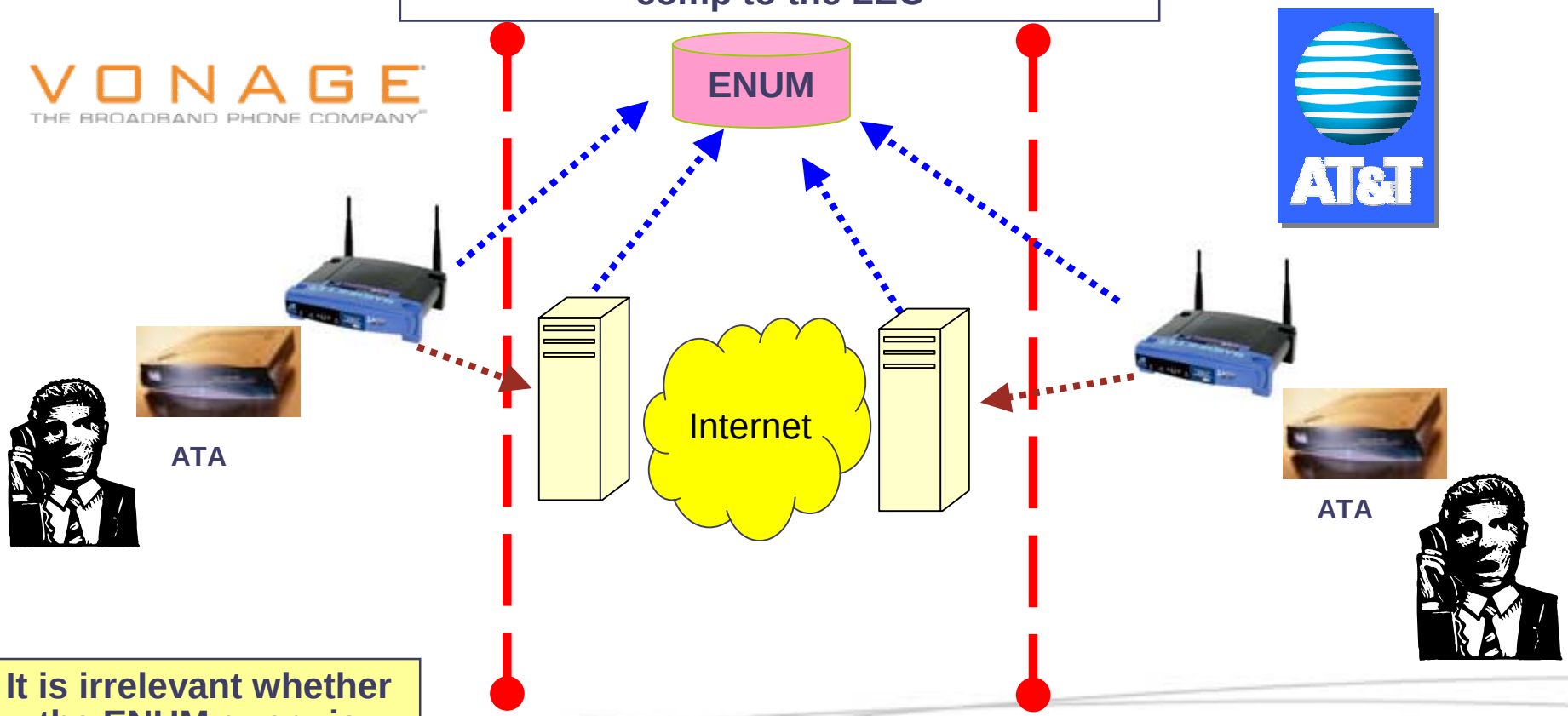
Classic ENUM - Residential

VoIP providers have a huge economic incentive to peer their traffic to avoid comp to the LEC



It is irrelevant whether the ENUM query is done at the edge of the Customer Prem or the network SIP proxy.

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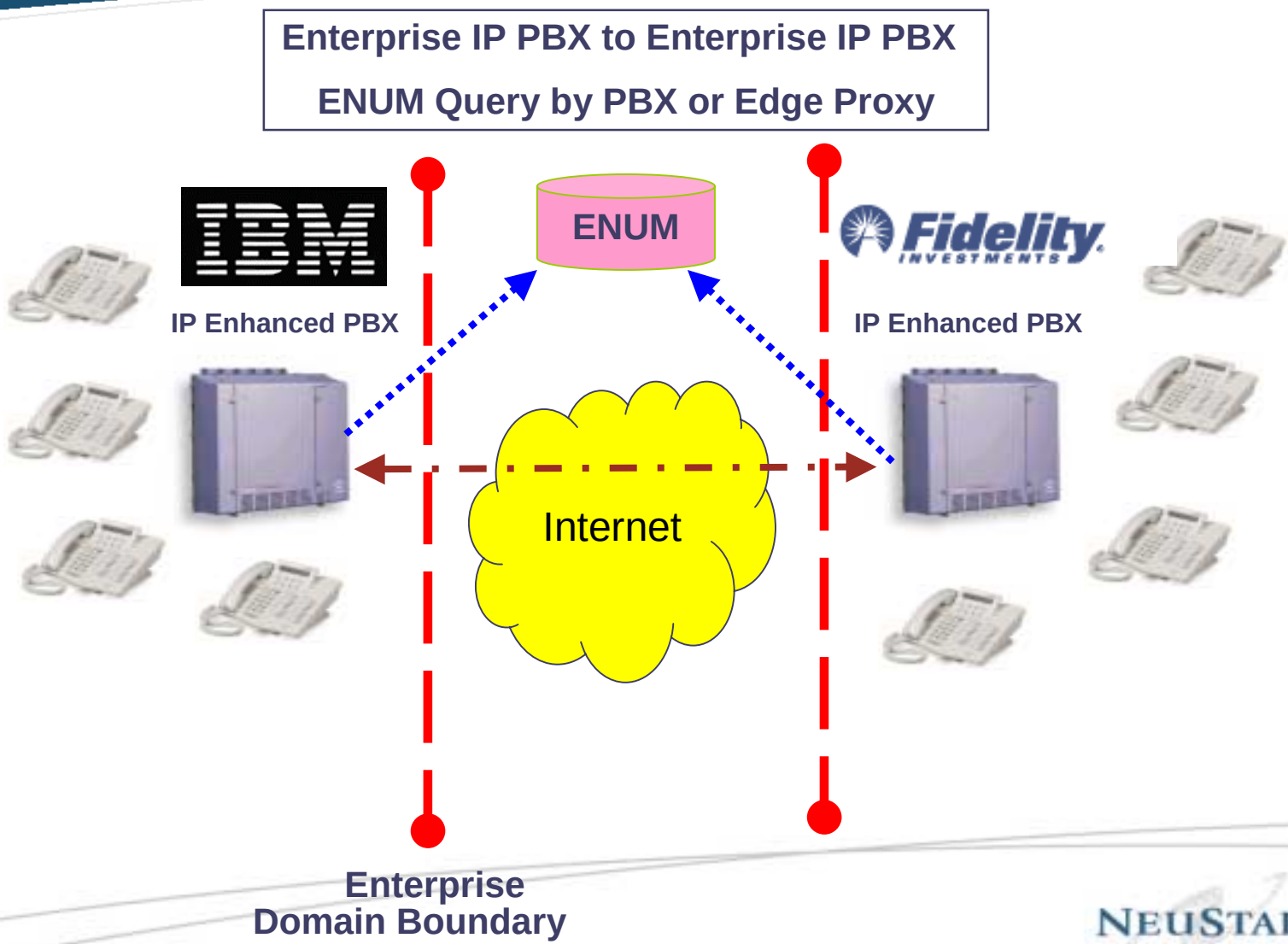
ENUM Enterprise Architecture Model



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Basic DNS Terms

Nameservers constitute the server half of the architecture. The zone managers provide nameservers for their zones.

Clients called **resolvers** query the nameservers for information about the zone. Web browsers and email servers have resolvers built-in for this purpose.

DNS queries are **recursive**. The nameserver always responds to the resolver as opposed to forwarding the resolver's query to the next level.

The **SOA** (start of authority) record is an administrative record which identifies the authoritative nameservers for a particular zone, as well as, other administrative information. There is only one SOA record in any zone file.

The **NS** (nameserver) record is a delegation record that identifies the authoritative nameservers for the domain names within the zone. The NS record will include another domain name that the resolver must query for more DNS information.

The **A** (name-to-address) record is a delegation record that maps a domain name to an IP address.

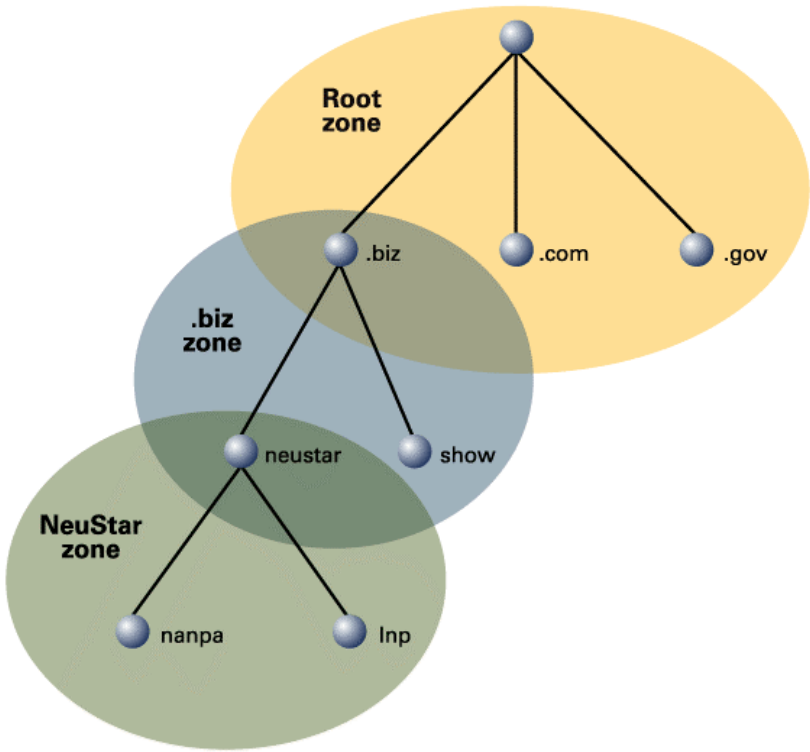
How does the DNS work?

The DNS is a distributed database.

Individual **zones** can be locally controlled.
In the example provided ICANN manages the Root zone, NeuStar has been contracted by ICANN to manage the .biz zone, and NeuStar as the registrant of neustar.biz manages that zone.

All of the zones at the top level are managed by an entity called a **registry**. For example NeuStar is the registry for .biz and VeriSign is the registry for .com.

Each node in the DNS hierarchy is designated by a **domain name**.
In the example provided the node identified as neustar has the domain name neustar.biz.
The node identified as nanpa has the domain name nanpa.neustar.biz.



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How does the DNS work?

Even though each zone can be locally controlled the data is available across the entire network through a **client-server architecture**.

Nameservers constitute the server half of the architecture. The zone managers provide nameservers for their zones.

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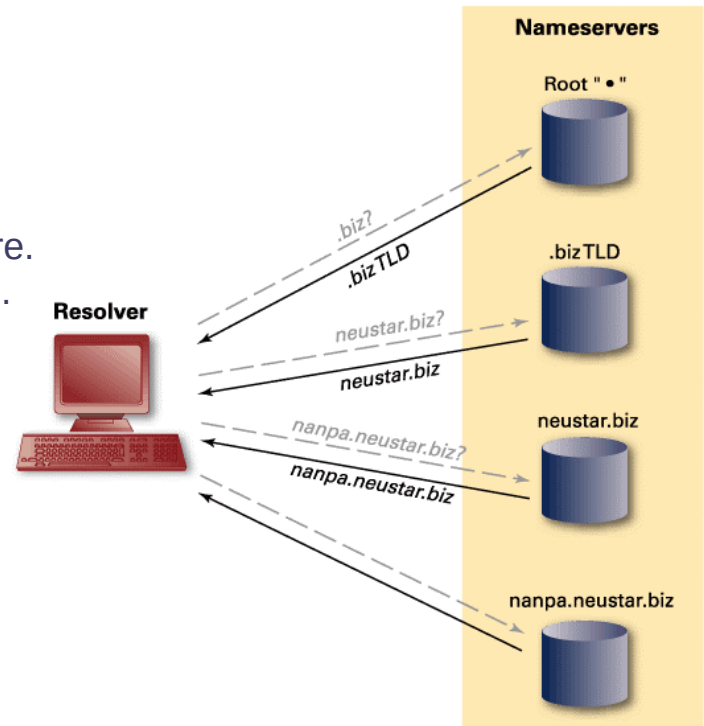

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How does the DNS work?

- **Domain name registries**
  - Registries are responsible for managing top level domains (zone). This concept is also applied to other levels within the DNS such as co.uk, and fed.us, but is required at the top level.
  - ENUM works the same way with each nation-state maintaining control of the various zones below e164.arpa

  - Registries typically have the following responsibilities:
    - Maintain **authoritative database** for the zone
    - Provide a **Whois**
    - Provide a **registrar interface**
    - Update and publish the **zone file**
    - Operate the **nameservers**

  - **Registrars** act as an interface between the **registrants**, i.e., the consumers that register domain names, and the registry. They are the retail channel for domain names.

- **ENUM Registrars and the policies and procedures they follow are nation state issues.**

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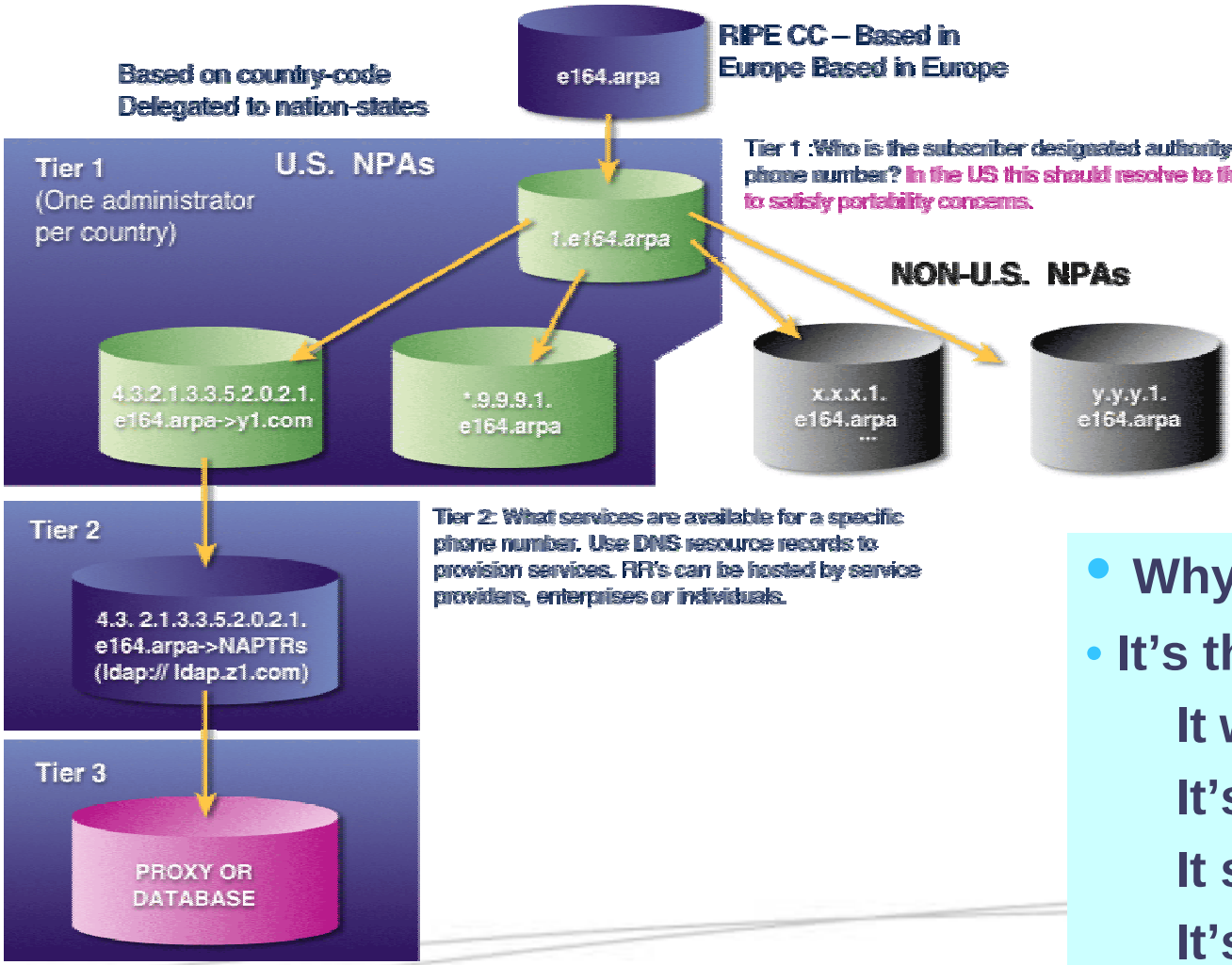
What is the e164.arpa domain?

- e164.arpa is a second level domain that was designated by RFC 3761 specifically for providing global ENUM service.

- The Internet Architecture Board (IAB) is responsible for the technical operation of the e164.arpa domain in cooperation with the International Telecommunications Union (ITU).
  - The IAB has outsourced the registry operations to RIPE-NCC in Amsterdam
  - RIPE-NCC is the RIR for Europe
  - RIPE runs the “technical operations” for the domain
- Telephone number country codes will be delegated from this domain upon approval by the ITU.
  - For example, country code +44 (United Kingdom) will become the domain 4.4.e164.arpa

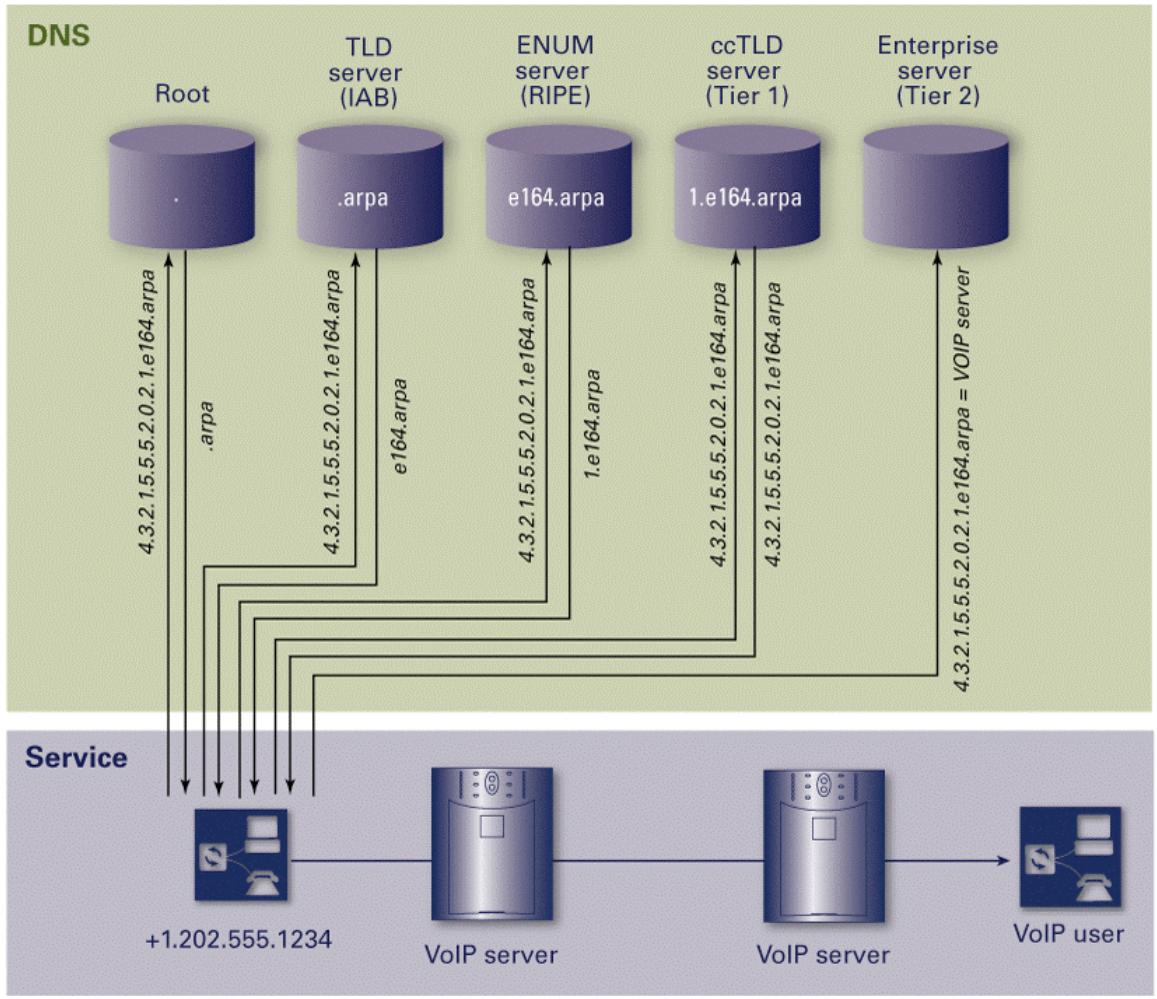
ENUM DNS Hierarchy



- Why DNS ?
- It's there
  - It works…
  - It's global…
  - It scales…
  - It's open…

What is the process that represents an E.164 TN as an Internet address?

- The VoIP user on the bottom left dials +1 202-555-1212 to call the VoIP user on the bottom right.
- The user's resolver creates an ENUM domain name from the TN and queries the DNS.
- The DNS will return the Internet address (VoIP server) of the VoIP user.
- A "call" is established between the two VoIP users.
- The Internet address is hosted in the **Tier 2** service provider's DNS servers.
- The Tier 2 service provider will register the ENUM domain name with the Tier 1 registry.
- The **Tier 1 registry** manages the ENUM domain names within a country code.
- The Tier 1 points the resolver to the Tier 2 to retrieve the Internet address.



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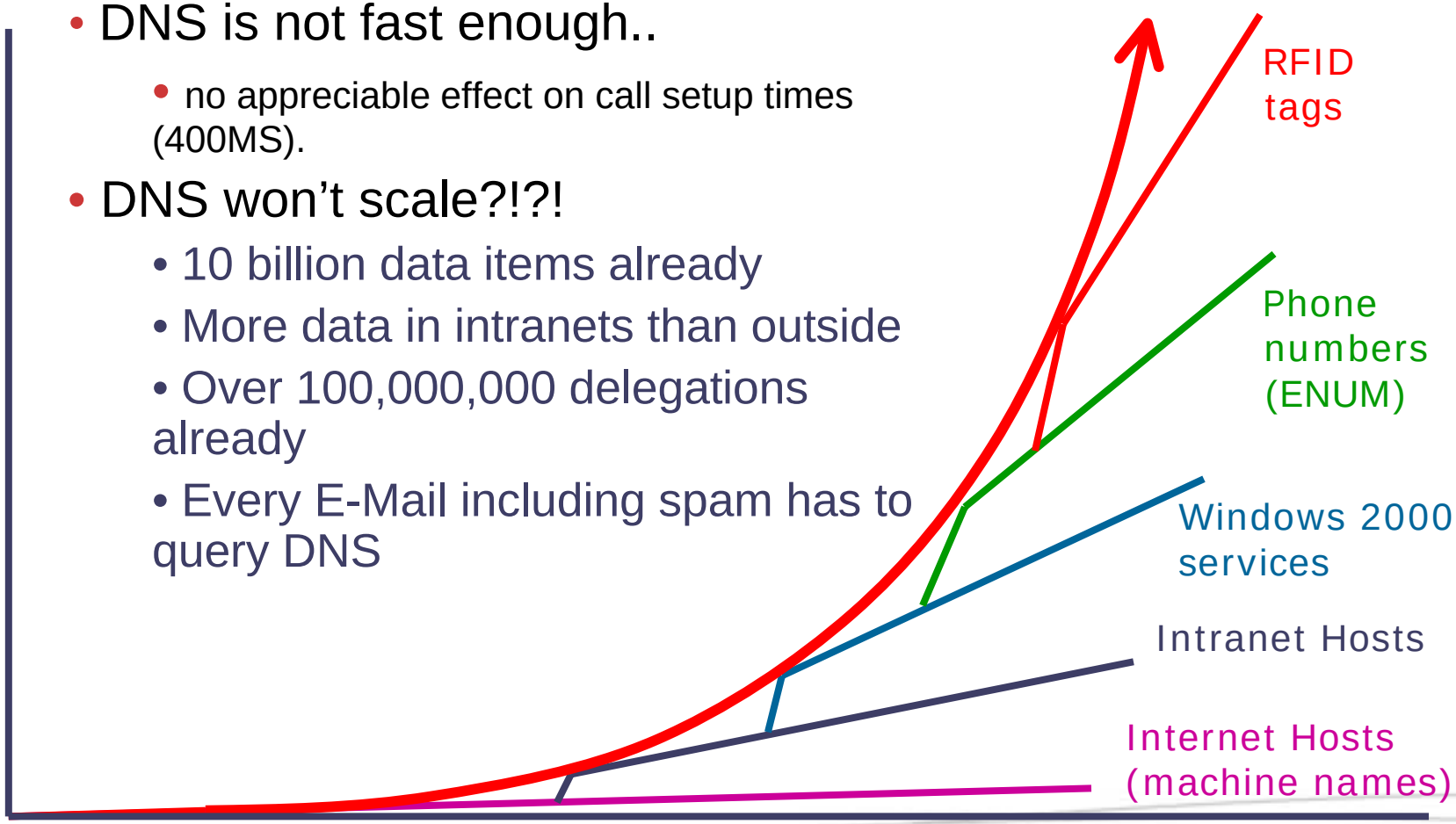
ENUM Urban Legends

- DNS is not fast enough..
  - no appreciable effect on call setup times (400MS).
- DNS won't scale?!?!
  - 10 billion data items already
  - More data in intranets than outside
  - Over 100,000,000 delegations already
  - Every E-Mail including spam has to query DNS



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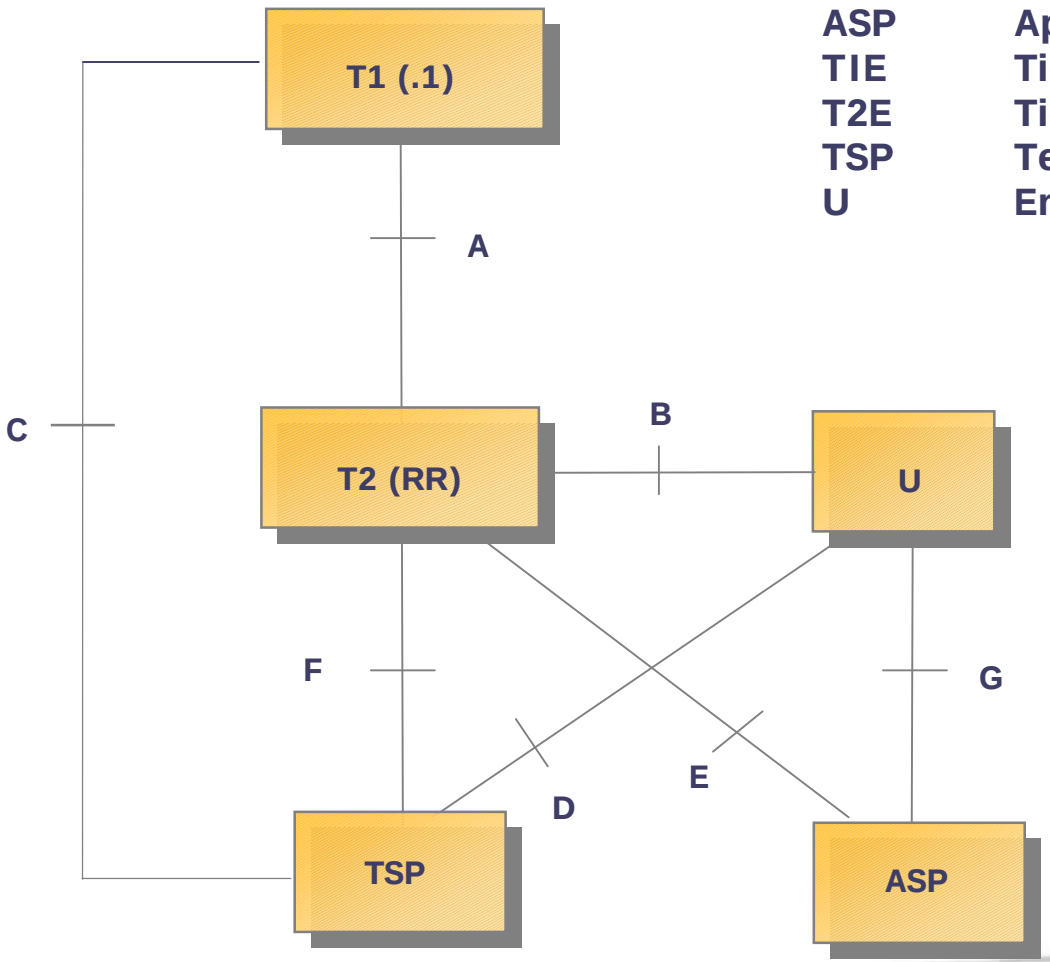
Reference Model for ENUM Admin Process



Functional Elements Legend

ASP	Application Service Provider
TIE	Tier 1 Entity
T2E	Tier 2 Entity
TSP	Telephony Service Provider
U	End User

Transactions between entities will require new trusted and secure ecommerce protocols.

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ENUM Administrative Policy Considerations

- **How do I register my Phone Number?**
- Nation State Issue
  - .. Registration Model much like Domain Names…

- **Competition is not about Tier1, its about Tier 2**
  - Who holds the NAPTR records and why….
    - What is the role of the Incumbent Carrier?

- **Who are the privacy considerations for ENUM?**
  - In North America and Europe primarily Opt-IN
    - What is the role of the Incumbent Carrier?

- **“Keep your eyes on the prize!”**
  - New Services and Innovation in Communications
  - New Competition among Service Providers
  - Lower Costs to Business and Consumers

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New Concept : Private/Carrier/Infrastructure ENUM

- Private ENUM is generally regarded as one or more technologies (including DNS) that permit service providers to exchange phone number to URI data in a *private secure manner*.
- Service providers are looking for NGN signaling infrastructures.
- Private ENUM is to be assumed as authoritative for all endpoints service providers choose to exchange data for. There is no need to OPT-OUT.
- The technology by which this data is accessed is currently not fixed
  - PULL Model; DNS, SIP, LDAP
  - PUSH Model; NPAC/LSMS, CD-ROM, FTP
- Private and Public ENUM are Orthogonal to each other, they serve different markets for different reasons.

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Private/Carrier/Infrastructure ENUM

- There are multiple options on how Service Providers can create systems query for TN to URI data.

- PULL Model; DNS, SIP, LDAP – All call query from central database.
  - Use the Technology of 3761 in another domain aka e164.sip.net secured with VPN
  - Use SIP itself as a query response mechanism. Send INVITE return a 302 MOVE with the SIP URI.
    - Use Digest Authentication for Security.
  - LDAP ?

- Carriers may have different needs based on their unique architecture.

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Private/Carrier/Infrastructure ENUM

- PUSH Model; Number Portability Databases, CD-ROM, FTP. Push the database into SP network. Each SP maintains full copy of all records
  - This is how the current telephone network works. The North American IN routing table is a union of the LERG and the NPAC fully distributed in carrier network or accessed on a per dip basis through 3rd parties.

  - Conclusion: What is important is the the exchange of data between Service providers not the underlying technology of how the database is queried.

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An Private ENUM Alternative: RFC 3261 aka SIP

SIP Redirect ENUM Like Query-Response Method

```
INVITE sip:+19725552222@b.example.com SIP/2.0
Via: SIP/2.0/UDP client.a.example.com:5060;branch=z9hG4bK74bf9
Max-Forwards: 70
From: <sip:+13145551111@a.example.com>;tag=9fxced76sl
To: <sip:+19725552222@b.redirect.com>
Call-ID: <2xTb9vxSit55XU7p8@a.example.com>
Contact:<sip:+ 19725552222@b.example.com>

SIP/2.0 302 MOVED TEMPORARILY
Via: SIP/2.0/UDP network.location.foo:5060;branch=z9hG4bK74bf9
Max-Forwards: 70
From: <sip:+13145551111@a.example.com>;tag=9fxced76sl>
To: <sip:+19725552222@b.redirect.com>
Call-ID: <2xTb9vxSit55XU7p8@a.example.com >
Contact: <sip:user.name@serviceprovider.com:5060>
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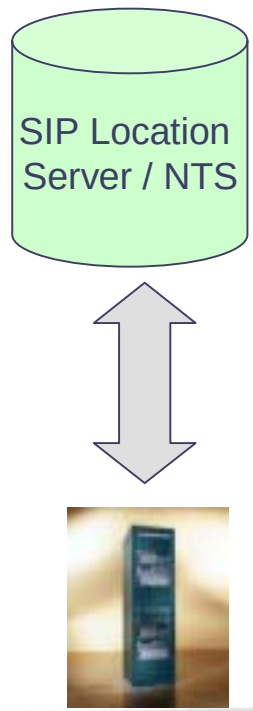

Note change in Contact Data – LNP and other SS7 data can be added.

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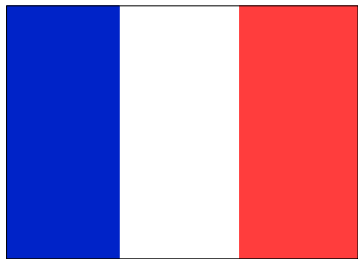
Private ENUM uses : Global Enterprise VoIP Dial Plan

- ENUM *could* unite global private VoIP dialing plans across existing VPN and Intranet Links on diverse vendor Platforms
- ENUM unites them through common administration and access plan

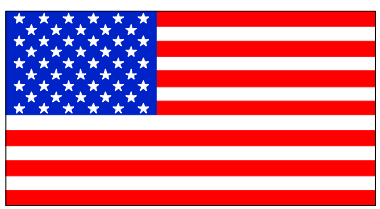


IBM

MITEL

IBM

SIEMENS



ENUM Public or Internal

IBM

IBM

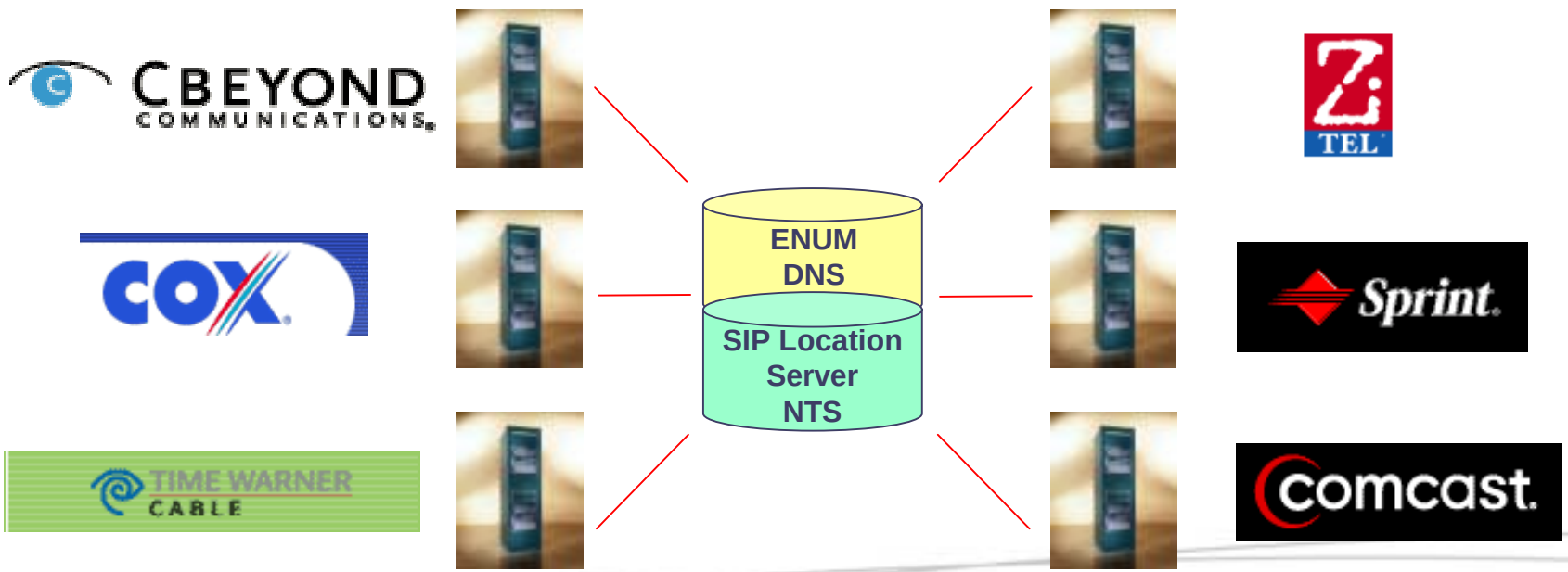
Cisco Systems

NORTEL NETWORKS

BUSINESS WITHOUT BOUNDARIES

Private ENUM : SP “Federation”: Optimal Service Routing

- SP’s *could* optimize VoIP session termination strategies by routing directly from one SP to another
- Essentially “Friends and Family” routing plans within the “federation”



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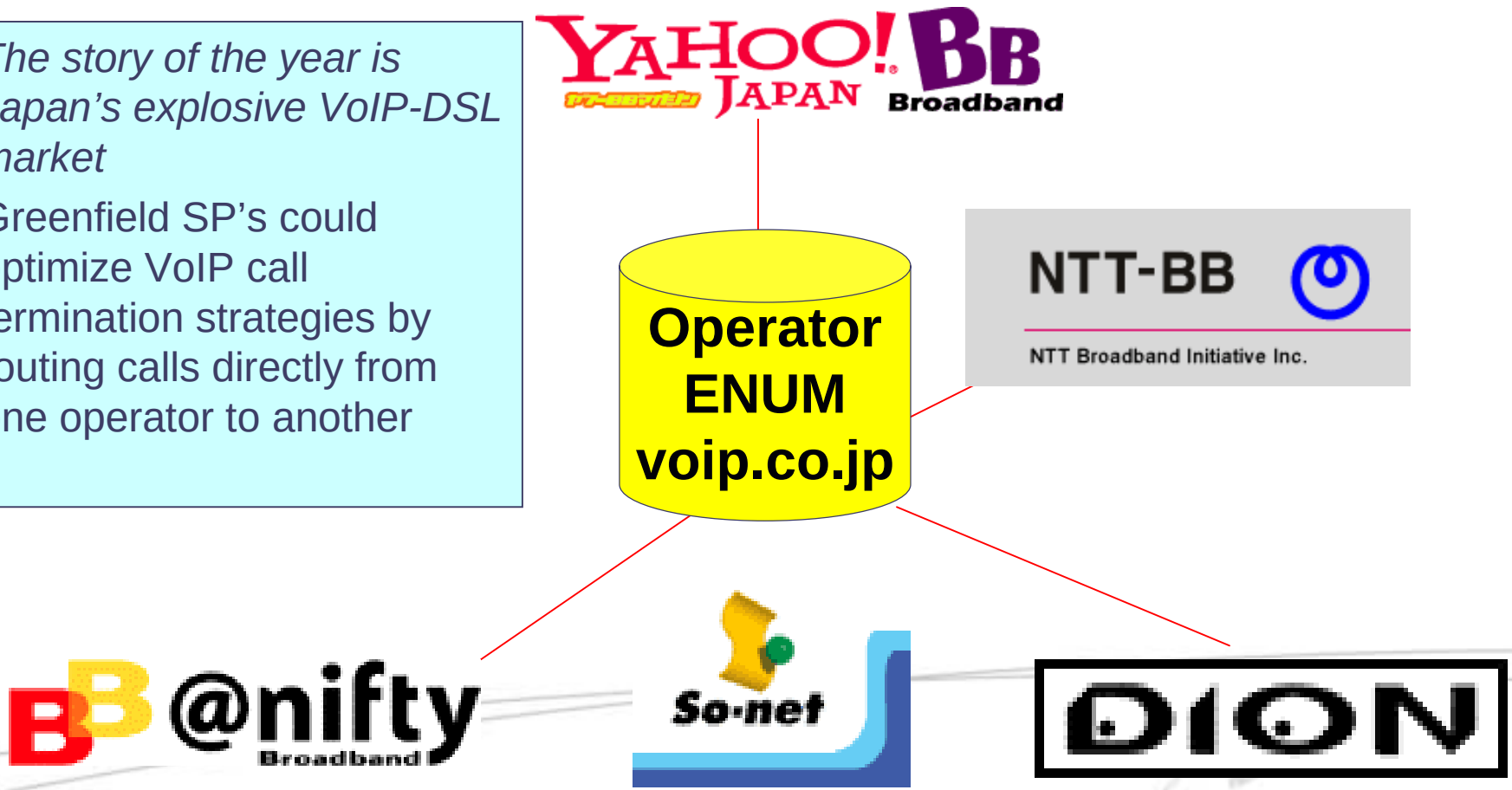
Private ENUM : NGN Japanese VOIP Operators

- *The story of the year is Japan's explosive VoIP-DSL market*
- Greenfield SP's could optimize VoIP call termination strategies by routing calls directly from one operator to another



Private ENUM: Wireless Operators MMS Routing

- November 23, 2003 Wireless Number Portability in the US was implemented.
  - WNP breaks TN routing
  - A phone number is not routable, a LRN is
  - How do you get a picture from one phone to another when the only data you have you have is a phone number?
  - SS7 not capable of dealing with large binary objects

Operator ENUM E164.mms.us

verizon wireless
We never stop working for you.SM

AT&T Wireless

Sprint.

··T··Mobile·

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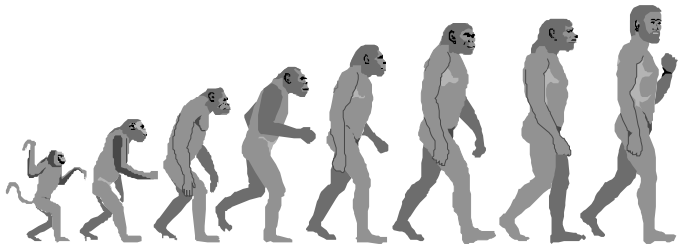
DNS - SIP Redirect Technology as an alternative SS7



- ENUM/DNS/SIP and can provide a more sophisticated, less expensive and easier to deploy Number Translation Services for service providers.
  - The natural evolution of NextGen telephony signaling systems
    - **SCP costs 1 Million Dollars + PRI's + per dip charges**
    - **DNS Box 25 K maximum BIND9**
- SS7 signaling is complicated, expensive and disruptive in an all IP architecture
  - Number Portability- Geographic number to routing number mapping (NP dip)
    - –http://search.ietf.org/internet-drafts/draft-yu-tel-url-02.txt

✓ Public and Private ENUM systems can and will co-exist.

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ENUM Administrative Policy Considerations

A major political hot potato.

Nation States have always managed Phone Numbers.

- TIER 1 National Service Provider is essentially a TLD operator.
- TIER 1 Maintains only NS records of authority
- TIER 2 Maintains NAPTR records
- TIER 2 could be anyone
  - Service provider
  - Enterprise
  - Individual
- How do I register my Phone Number?
- TBD .. Registration Model much like Domain Name.
- Who has the right to register a number in ENUM
- Individual or Service provider
  - What is the role of the service provider
- Competition is not about Tier 1, its about Tier 2
  - Who holds the NAPTR records and why….
    - What is the role of the Incumbent Carrier?

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The ENUM OSI Model

10) Religious : We don't want to go there

9) Political : YOU ARE HERE !

8) Economic : Show me the money!

7) Application : Provides different services to the applications

6) Presentation : This layer formats data to be sent across a network

5) Session : This layer establishes connections between applications

4) Transport : Provides end to end communication control

3) Network : Routes the information in the network

2) Data Link : Provides error control between adjacent nodes

1) Physical : Connects the entity to the transmission media

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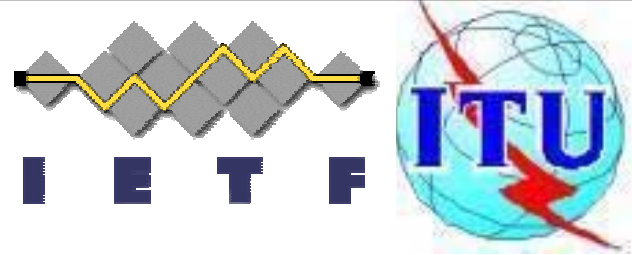
The IAB – ITU Agreements



- Core Principal – Nation-State control of the national portions of the e164.arpa tree
  - Maintain the authority and integrality of the E.164 plan
  - Build trust and consensus among all participants in the system
- [RFC3026] Blaine, R. "Liaison to IETF/ISOC on ENUM" RFC 3026, January 2001
- [RFC 3245] Klensin, J. Editor "The History and Context of Telephone Number Mapping (ENUM) Operational Decisions: Informational Documents Contributed to ITU-T Study Group 2 (SG2)", RFC 3245, March 2000
- Interim Procedures for the delegation of E.164 Shared Country Codes for Networks and Groups of Countries
  - http://www.itu.int/ITU-T/inr/enum/procedures.html
    http://www.itu.int/ITU-T/inr/enum/procedures-02.html
- ITU ENUM Pages : http://www.itu.int/osg/spu/enum/

Public ENUM Status - What about the US?

US ENUM LLC has formed
2005 trials and deployment coming

US DOMESTIC POLICY

- United States Government reiterates its support for RFC 3761 and endorses moving forward with ENUM based on the concept of a Industry Managed LLC

- United States ENUM Forum - http://www.enum-forum.org
  - Participants include MCI, ATT, Sprint, SBC, Verizon, NeuStar, Cox , C&W, Cisco, Telcordia

- Canada too .. http://www.enumorg.ca

- Similar forums all over Asia-Pac and Europe

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Estimated CC1 ENUM LLC Timeline
October 20, 2004

Estimated Date	Proposed Event
November 17-18, 2004	Annual Membership Meeting – Austin, TX (Host SBC)
December 7, 2004	Potential Formation Meeting - Dallas TX • LLC Technical Advisory subcommittee for CC1 Tier 1 RFP
December 8-9. 2004	Monthly Membership Meeting – Dallas TX (MCI)
January 12-13, 2005	Monthly Membership Meeting – Phoenix AZ (GoDaddy)
April xx, 2005	LLC releases CC1 ENUM Tier 1 RFP to governments
June xx, 2005	RFP released to bidders
July xx, 2005	Bidder Conference - RFP clarifying questions to LLC
August, 2005	RFP Responses Due
September, 2005	LLC Bidders Conferences
October 2005	LLC selects Tier 1 vendor
October 2005	**CC1 Tier 1 Vendor Contract Signed**
January 1, 2006	**Tier One Operational**

This information is subject to change due to the needs of the CC1 ENUM LLC

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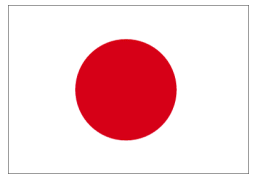
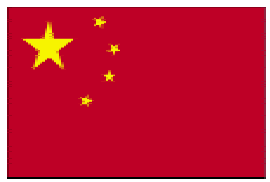
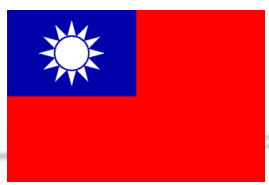
ENUM Global Status – 23 Active Delegations

- **Austria is first nation to have commercial ENUM services**
  - http://www.enum.nic.at
- **UK OFFCOM in major VoIP Consultations**
- **Japan, Korea, China Taiwan and Singapore teaming up for ENUM cooperation**
  - **http://www.apenum.org/**
- **Australia** Just announced trials..
  - http://www.aca.gov.au/telcomm/telephone_numbering/enum_nsg2/eoi.htm
- **ITU ENUM web pages**
  - http://www.itu.int/osg/spu/enum/index.html







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ENUM Delegations

Delegations in e164.arpa (partial)

- 246 Diego Garcia
- 247 Acscension Island
- 31 Netherlands
- 33 France
- 353 Ireland
- 358 Finland
- 36 Hungary
- 374 Armenia
- 40 Romania
- 41 Switzerland
- 420 Czech Republic
- 421 Slovakia
- 423 Liechtenstein
- 43 Austria
- 44 UK
- 46 Sweden
- 48 Poland
- 49 Germany

- 55 Brazil
- 86 China
- 246 Diego Garcia
- 247 Ascension
- 290 Saint Helena
- 971 UAE
- 87810 VISIONng UPT

additional Asian countries (Korea, Japan, ...) soon to come

http://www.itu.int/itudoc/itu-t/enum/enum-app.html

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Large Scale IPC Trial at43

- Large Scale Trial on IP Communications using ENUM
- University of Vienna ~100.000 Students
  - re-use of existing student account credentials via RADIUS
  - iptel.org SIP Express Router as SIP proxy with call routing, ENUM processing, PSTN interworking
  - some functions based on Asterisk open-source IP-PBX:
    - voice-mail, conference bridge, IVR,
  - PSTN Connection: CISCO 5300 PSTN/ISDN Gateway with PRA
  - Various Soft- and Hard-phones, WiFi-Phones, ...
  - IP Connection to other universities, communities and "IP-PBX"
  - Applications: Crash test for VoIP, Chat, IM, Presence, **SMS, use of SIM-Cards**...
- IP calls free, PSTN->IP calls by caller; IP->PSTN with call-by-call accounting
- Naming, Numbering and Addressing with ENUM
  - Base: sip:<student-id>@sip.univie.ac.at
  - Austrian number for private networks: +43 59966 nnnnnn
  - global UPT number: +87810 2843 nnnnnn

```
ORIGIN  6.6.9.9.5.3.4.e164.arpa.
*       NAPTR   100 10 "u" "E2U+sip" "!^¥¥+4359966(.*)$!sip:¥¥1@sip.univie.ac.at!" .
```

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ENUM at KR-NIC and JP- NIC

- APEET - **http://www.apenum.org**
- http://www.enum.or.kr/en/
- http://etjp.jp/english/

EPP in use in Poland

- EPP parameters for 8.4.e164.arpa Registry
- http://www.ietf.org/internet-drafts/draft-bartosiewicz-enum-48tld-01.txt

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Privacy and Security issue

- **http://www.shockey.us/enum/draft-ietf-enum-privacy-security-01.txt**

- What is ENUM really ?
  - Calling party control –
    - Global Directory Service – The big white pages in the sky?
    - List all available URI for all possible services ?
      - Do you want your email address in the DNS?
        - » Maybe if you are a Real Estate Agent?
  - Called Party control - IMHO the answer
    - Minimal Routing Data Base
    - SIP AOR only
    - Let SIP do the dirty work

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IETF ENUM current Activities

- Provisioning protocols the ENUM system
  - Tier 1 Tier 2 interactions
  - EPP- 164 (SOAP ?)
  - XML object based on IETF PROVREG WG
    - Used by Domain Name Registrars
  - E.164 Number Mapping for the Extensible Provisioning Protocol
    - http://www.ietf.org/internet-drafts/draft-ietf-enum-epp-e164-08.txt
- WHOIS ?
  - Strong technical reasons for wanting a WHOIS like service here
    - DNS Technical Contact
  - An ENUM Registry Type for the Internet Registry Information Service
    - http://www.ietf.org/internet-drafts/draft-ietf-enum-iris-ereg-00.txt

ENUM WG Ongoing issues

- What about DNSSEC
  - Its not ready yet. Period.
- ENUM dip indicator ..
  - Network elements can determine if a ENUM query has been done
  - http://www.ietf.org/internet-drafts/draft-ietf-iptel-tel-enumdi-00.txt
- ENUM Void parameter.
  - Is the number valid but not active?
  - http://www.ietf.org/internet-drafts/draft-ietf-enum-void-00.txt

Is a WHOIS IRIS necessary for ENUM

- Central Database of information about Telephone Numbers.
- Technical information about who is running the DNS infrastructure for a TN.
  - Goes to the stability and security issue.
- Requirements of Law Enforcement Administrations
  - They are there they have legitimate needs IRIS could help

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IRIS

- Developed in IETF to replace WHOIS
  - XML based in use at both .COM and .NET
- http://iris.verisignlabs.com/blojsom/blog/iris/
- Text based protocol designed to allow registries of Internet resources
  - to express query and result types specific to their needs
  - Authentication – the process used to verify the identity of a user
  - Authorization – the access policies applied to a user based on authentication
- Encompasses the following
  - a decentralized system using DNS hierarchies where possible for location
  - built upon standard Internet building blocks
  - does not impose any informational trees or matrices
  - may be used with multiple application transports, including BEEP

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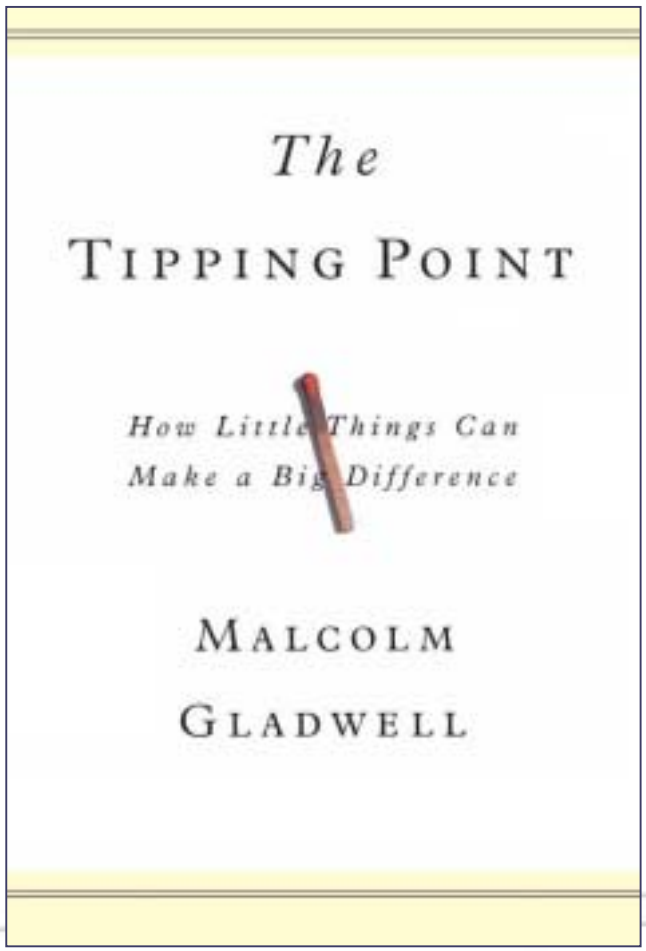
Effects on the Existing Intelligent Network

Market survey research indicates that 30% of all consumers may switch to VoIP in 3 years.

At what Percentage of VoIP deployment must all calls “dip” into ENUM for Routing?



NeuStar

- ENUM’s success is directly dependent on Metcalfe's Law.
  - *The usefulness, or utility, of a network equals the square of the number of users*

Contact, not Content, is King

Douglas Rushkoff

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