An IETF view of ENUM

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Who is the IETF?

- Internet Engineering Task Force
- The organization that oversees the standards process for Internet protocols and technologies
- Industry-based standards body with broad participation from vendors, operators and researchers
- We make standards that work – how you work them is up to you!
The Structure of the IETF

Overview of the IETF

The Internet Engineering Task Force (IETF) is a large open international community of network designers, operators, vendors, and researchers concerned with the evolution of the Internet architecture and the smooth operation of the Internet. It is open to any interested individual.

The actual technical work of the IETF is done in its working groups, which are organized by topic into several areas (e.g., routing, transport, security, etc.). Much of the work is handled via mailing lists. The IETF holds meetings three times per year.

The IETF working groups are grouped into areas, and managed by Area Directors, or ADs. The ADs are members of the Internet Engineering Steering Group (IESG). Providing architectural oversight is the Internet Architecture Board (IAB). The IAB also adjudicates appeals when someone complains that the IESG has failed. The IAB and IESG are chartered by the Internet Society (ISOC) for these purposes. The General Area Director also serves as the chair of the IESG and of the IETF, and is an ex-officio member of the IAB.

The Internet Assigned Numbers Authority (IANA) is the central coordinator for the assignment of unique parameter values for Internet protocols. The IANA is chartered by the Internet Society (ISOC) to act as the clearinghouse to assign and coordinate the use of numerous Internet protocol parameters.

First-time attendees might find it helpful to read *The Tao of the IETF*. This was published as RFC 3150.
Huh? - Let's see that again!
We do not believe in Kings, Presidents and Voting. We believe in rough consensus and running code

Dave Clark, MIT, Former IAB member

The IETF has a focus on developing standards where interoperability testing of conformant implementations of the standard, and use of the technology in production contexts form an integral part of the standards process.
How Does the IETF Work?

- Proposed work items are aired at a BOF session
  - Gather interest and support
- A work program is chartered by the IESG
  - Working Group Charter
    - WG Chair(s) and Area Director
    - Working Group statement of activity
    - Schedule of milestones
  - Periodic IESG review and recharter as necessary
Internet Drafts

- [http://www.ietf.org/1id-abstracts.html](http://www.ietf.org/1id-abstracts.html)
- Individual submissions
  - draft-<person>-<header>
- Working Group Documents
  - draft-ietf-<working group>-<header>
  - Working Group documents denote some level of ‘buy-in’ from the community of interest
IETF Documents

- RFCs
  - Informational
  - Best Current Practice
  - Standards Track
    - Proposed (good idea, clearly written, Working Group approved, peer reviewed)
    - Draft (interoperability tested, sound idea)
    - Full (many people are / were using this technology)
    - Historic (no longer that useful)
ENUM is a working group with the IETF Transport Area

**Telephone Number Mapping (enum)**

*Last Modified: 2003-03-16*

**Chair(s):**

Patrick Felton <patrick@csiro.au>,
Richard Shockey <rik@hockey@newton.bitc>

**Transport Area Director(s):**

Scott Bradner <sbradn@harvard.edu>,
Allison Mankin <mankin@princeton.edu>

**Transport Area Advisor:**

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**Mailing Lists:**

General Discussion: enum@ietf.org
To Subscribe: enum-request@ietf.org
In-Body Subscribe
Archives: http://www.ietf.org/ietf-mail-archive/enum/

**Description of Working Group:**
ENUM (cont)

Description of Working Group:

This working group has defined a DNS-based architecture and protocol (RFC 2916) by which E.164 numbers, as defined in ITU Recommendation E.164, can be expressed as a Fully Qualified Domain Name in a specific Internet Infrastructure domain defined for this purpose (e164.arpa). The result of the ENUM query is a series of DNS NAPTR resource records (RFC 2915) which can be used to contact an resource (e.g., URI) associated with that number.

The Working Group proposes to advance RFC 2916 from Proposed Standard to Draft Standard.

Background:

E.164 numbers are globally unique, language independent identifiers for resources on Public Telecommunication Networks that can support many different services and protocols. E.164 numbers are used to identify ordinary phones, fax machines, pagers, data machines, email clients, voice terminals, or the hearing impaired, etc.

A prospective caller may wish to discover which services and protocols are supported by the terminal named by a given telephone number. The caller may also require more information than just the telephone number to communicate with the terminal.

The holder of an E.164 number or device may wish to control what URLs are associated with that number.

Working Group Revised Goals and Scope:

1. The working group will update RFC 2916 to reference the DDNS system (revision of RFC 2035) and advance RFC 2916 to Draft Standard.

2. The working group will examine and document various aspects of ENUM administrative and/or operational procedures and international issues to be considered include privacy and security considerations in storing ENUM related data as well as validation and authentication of data, including DKIM NAPTR records in the DNS. The working group will coordinate activities in these areas with the DNSSD and PROVEX Working Groups where appropriate.

3. The Working Group will continue to maintain appropriate contact and liaison with standards bodies and groups, specifically IETF, in order to provide technical or educational information as needed, such as the appropriate use of DNS. The Working Group will encourage the exchange of technical information within the existing global ENUM community as well as documentation or practical experience with implementations or administration of RFC 2916.
ENUM (cont)

Goals and Milestones:

- **Done** Initial draft of ENUM Requirements
- **Done** Initial draft of ENUM Protocol
- **Done** Revised draft of ENUM Protocol
- **Done** Submit ENUM Protocol document to IESG for publication as Proposed
- APR 08 Review and update RFC 2678 appropriate to DDOS (revision of 2015)
- JUN 08 ENUM service registrations for SP and T.38
- AUG 08 Document appropriate ENUM Security and Privacy issues (Informational)
- NOV 08 Document appropriate ENUM Registration and Provisioning Procedures (Informational)

Internet-Drafts:

- ENUM-ID (draft-ietf-enum-enum-id-00.txt) (430 bytes)
- ENUM-ID (draft-ietf-enum-enum-id-01.txt) (430 bytes)

Request For Comments:

- ENUM number and DNS (RFC 2678) (1615 bytes)
- New Four-Portability in the Global Switched Telephone Network (GSTN): An Overview (RFC 3682) (785 bytes)

IETF Secretariat - Please send questions, comments, and/or suggestions to ietf-web@ietf.org

Return to working group directory.

Return to IETF home page.
Why ENUM?

Because tpc.int did not work!
- tpc.int (c 1992) mapped E.164 numbers to A records (IP addresses) to emulate fax delivery
- Each new service required a new E.164 -> IP address mapping
- Did not scale to multiple services using a single mapping

ENUM is part of a broader IETF approach of splitting out the components of VOIP / PSTN interaction into discrete efforts and addressing each component as a discrete technology standardization effort

ENUM is not an end in itself
The Good Bits of ENUM

- **E164.arpa**
  - Single mapping that is service independent
  - Each mapping can be associated with a collection of URIs
  - The mapping may be statically configured or dynamically generated (or both)
  - Each end point of the DNS hierarchy populates the entry with desired service entries
  - Each application selects compatible service entries from the set
  - ENUM is independent of directory, call control, routing and transport considerations
  - It’s just a mapping from the E.164 domain into multiple URI service domains
The DNS is an issue in all this......

- DNS is insecure
  - TSIG, DNSSEC, PKI, etc may help, but when and how much?
- DNS is variably timed
- DNS is generally not well maintained
- DNS is generally not well synchronized
- There is no “DNS says ‘no’”, only an indistinct timeout
- Putting regular expressions in the DNS is an fascinating complication
- But we have nothing better in terms of a very large distributed database to poke towards this problem space

Remember:

- The DNS is a lousy kitchen sink. We have seen many proposals to “just put in in the DNS”. Be very concerned whenever you hear this!
ENUM is NOT everything

In particular, ENUM is NOT:

- a directory
- a search service
- a transport service
- a voice encoding method
- a rendezvous protocol

All ENUM is a distributed partial mapping from E.164 addresses into a set of service points identified via a URI labelling
Most IETF work these days assumes a ‘reference architecture’

ENUM’s core reference architecture is VOIP-to-VOIP
The single gateway model is simple:

- A PSTN / IP gateway maintains a mapping between IP and E.164 addresses

1. Call "12345678"
2. PSTN routes the call to 12345678 to the VOIP gateway
3. Gateway maps E.164 address "12345678" to IP 10.0.0.10
4. Gateway initiates a SIP session with 10.0.0.10
Use PSTN / VOIP Gateways

- Each Gateway maps a set of telephone numbers to a set of served IP service addresses
- Each Gateway knows only about locally served devices
- Gateway-to-Gateway calls need to be explicitly configured in each gateway to use IP or some private connection, or use the default of the PSTN
- The PSTN currently is the glue that allows the VOIP islands to interconnect with each other
The multi-Gateway VOIP World

VOIP Islands

- E.164 numbers are only routable over the PSTN
- Enterprise or carrier VOIP dialling plans cannot be remotely accessed by other VOIP network segments
The Core ENUM Problem

How can a VOIP gateway find out dynamically:
- If a telephone number is reachable as an Internet device?
- And if so, what’s its Internet service address?
1. How do network elements (gateways, SIP servers etc) find services on the Internet if you only have a telephone (E.164) number?
Problem statements for ENUM (2)

2. How can subscribers define their preferences for nominating particular services and servers to respond to incoming communication requests?
The ENUM Objective

_allow any IP device to establish whether an E.164 telephone address is reachable as an Internet-described Service_

- And ... what the preferred Service Point actually is
- And if its an Internet-reachable Service Point... what IP address, protocol address, port address and application address should be used to contact the preferred Service Point
The PSTN is a multi-service platform

To emulate this in IP, IP services associated with a single E.164 may be provided on a collection of different IP service points

An ENUM DNS request should return the entire set of service points and the associated service.
Why URIs?

- URIs represent a generic naming scheme to describe IP service points
  - Generic format of
    service:service-specific-address

- A URI in IP context is ultimately resolvable to transport protocol (TCP/UDP) selection
  - IP address
  - Port address
  - Address selector within the application session
Telephone numbers are well accepted identifiers within their realm of application.

Any collection of service URIs can be linked against an ENUM entry:
- mail, www, irc, sms, …
E.164 as a common address substrate?

tel:+61 2 62486165
mailto:gih@telstra.net
tel:+61 2 12345678
sip:gih@sip.telstra.net

Use this number for any service
+61 2 12345678
Issues where the IETF has an active interest...

- Who should manage the e164.arpa zone?
- Should there be one root for a single ENUM database or multiple databases for different functions, number ranges, area codes or even numbers?
- How to secure the DNS to ensure that ENUM answers are valid, timely and authoritative
Practical Issues

Issues where the IETF has a limited (if any) role to play in ENUM

- How to protect the privacy of the ENUM database?
- How to verify changes to the ENUM database?
- Should telephone number holders ‘opt-in’ or ‘opt-out’ of the system?
- Portability and ownership of a phone number?
  - Can I cancel all phone services and keep my phone number?
- Compliance with legislative framework
  - What is a “public telephone call” from a strict regulatory perspective?
- Is there a valid need for yet another public identity space?