

ENUM

successes – failures - alternatives

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ENUM – ecosystem components



- The „Protocol“
 - Core protocol
 - Enumservice definition
 - IETF WG
- ENUM „Flavours“
 - User ENUM
 - Infrastructure ENUM
 - Private ENUM

ENUM – ecosystem components II



- User ENUM:
 - The „e164.arpa“ administration
 - Globally (RIPE’s „root“ role)
 - ITU „interim procedures“
 - Locally (+43, ..)
 - Interaction with Regulators
 - The community
 - Local interaction
 - ENUMfederation

„Core“ Protocol + IETF WG



- RFC2916 (2000) -> RFC3761 (2004) -> RFC6116 (2004)
- Stable, deployed
 - (but still „proposed standard“)
 - Late (interesting!) alternative of the „URI RRTYPE“.
- IETF WG closed in May 2011

✓ SUCCESS!

Enumservice Registration



- IANA registry defined in
 - RFC2916 – not!
 - RFC3761 – IESG approval, RFC publication
 - RFC6117/8 – Specification Required (eases registration independent of WG existence)
- Currenty 40 services (type/subtype) registered

TODO: most popular services?

✓ SUCCESS!

User ENUM – Implementation

(Registries part)



- Registration of ENUM-Records in publicly available DNS, under control of the End User
 - e164.arpa administration: RIPE „root“, ITU „interim procedures“
 - ✓ SUCCESS! (besides some lame delegations)
 - *.e164.arpa administration: Implementation of registry in accordance with local regulators
 - ✓ SUCCESS!
 - ENUM Validation: Complex and resource intensive process
 - FAILURE (too complex in the „user control“ scenario)

User ENUM – industry uptake



- Some very eager early adoptors
 - Mostly small VoIP operators
 - Zero large Telcos (User empowerment, „free calls“ just scary to them)
 - Critical mass never reached
 - Left early adoptors frustrated
 - „Eager Operator“ report: ENUM „call rate“ below 1%, „ENUM minutes“ by magnitudes more expensive
 - „It’s not about free calls, it’s about new services“
 - Never happened – „Skype just works fine for me“
 - Minutes are cheap anyway – fixed -> mobile
- FAILURE

Current uptake

- <http://crawler.enum.at>
 - 900k numbers globally (800k in Taiwan??)



enum.at ENUM crawler

searching e164.arpn for NAPTR sets





This is a DNS-based crawler which crawls through e164.arpn, the top level domain designated for ENUM. Specifically, it looks for NAPTR resource records sets, and tries to discover the whole "golden" ENUM tree

Status: 906239 ENUM numbers (containing 1743082 NAPTR records). Crawling speed: 101 numbers in the last minute.

What is the ENUM crawler?

The ENUM crawler uses certain properties of the e164.arpn namespace to discover all numbers for which ENUM entries (NAPTRs) exist. A full crawling round takes a little longer than a week, currently, so that new numbers should appear after approximately that delay. However, certain nameserver implementations might prevent the crawler to discover all enum-enabled numbers.

top country codes

#	country name	E.164	ENUMs
1.)	 Taiwan, Province of China	+886	801513
2.)	 Poland	+48	25010
3.)	 Austria	+43	21127
4.)	 Germany	+49	16284
5.)	 Sweden	+46	15652
6.)	 Norway	+47	14482
7.)	 Korea, Republic of	+82	9403
8.)	 Slovakia	+421	884
9.)	 Romania	+40	726
10.)	 Czech Republic	+420	465
11.)	 United Kingdom	+44	300
12.)	 Australia	+61	128
13.)	 Netherlands	+31	117
14.)	 Lithuania	+370	97
15.)	 Japan	+81	33
16.)	 Qatar	+974	2
17.)	 Brazil	+55	2
18.)	 Jordan	+962	2
19.)	 Greece	+30	2

recently discovered

[+43 15332030](#) (2 hours ago, 1 NAPTR)
[+886 09861011326](#) (7 hours ago, 2 NAPTRs)
[+886 09861011320](#) (7 hours ago, 2 NAPTRs)
[+886 09861011323](#) (7 hours ago, 2 NAPTRs)
[+886 09861011325](#) (7 hours ago, 2 NAPTRs)
[+886 09861011321](#) (7 hours ago, 2 NAPTRs)
[+886 09861011329](#) (7 hours ago, 2 NAPTRs)
[+886 09861011327](#) (7 hours ago, 2 NAPTRs)
[+886 09861011324](#) (7 hours ago, 2 NAPTRs)
[+886 09861011322](#) (7 hours ago, 2 NAPTRs)

Infrastructure ENUM



- Operator-controlled entries in the public DNS
- Response to „user control is bad, we still want to use ENUM for the peering case“
 - Once in operation, they went silent
 - Zero uptake in +43
 - Any uptake elsewhere
- FAILURE – why?
 - Those willing already had user ENUM in place
 - Operators don't want to expose their data, market share, infrastructure
 - Chicken/Egg problem in VoIP-peering – ENUM solves only the „discovery“ problem

So, where's the success?

it's invisible.

It's not on the internet.

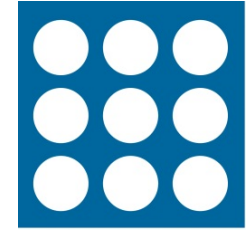
It's „private ENUM“

Private ENUM



- The use of ENUM-Technology in private environments
 - Accessible from within an operators network only
 - Or within a group of operators
 - Or in form of a „VoIP peering point“
- Massive uptake in most VoIP operator networks
- ✓ **SUCCESS!**

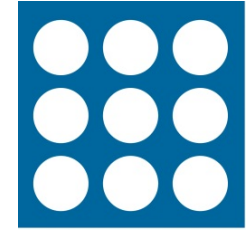
Private ENUM use cases



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- Peering Scenario: Find peer organisation for a certain number
- Local Number Portability queries
- Caller Name queries
- Internal routing queries
- Selecting an outbound „trunk“ from within a network
- ENUM is still the prime (only?) standardized E.164 -> identifier lookup protocol

Private ENUM success reasons



- Implemented in almost any vendor's VoIP switch (even in some IMS equipment..)
- DNS is well understood, scales extremely well, and supports high query loads
- Private ENUM does not expose data „outside“
- Allows use of „non-standard“ Enumservices
 - And even „hacks“ in the DNS, like client-specific answers

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Alternatives – User ENUM



- For individuals:
 - Skype, mobile phone, Instant Messaging
 - Phone numbers are not *that* important anymore (Smartphones)
 - And calls are cheap – normal phones *are* and alternative
 - ENUM requires information to be public – hinders „service discovery“ and „business card“ cases
 - P2Psip?

Alternatives – User ENUM



- For enterprises:
 - Vendor-specific „PBX interconnect“
 - Least Cost Routing – calls are cheap

- ViPR – <http://tools.ietf.org/wg/vipr>
 - „Built-in“ validation (via PSTN)
 - „Build-in“ discovery of numbers (DHT)
 - „New services“ rather than „free calls“ (sounds familiar ;)

Alternatives – Infrastructure ENUM



- Bilateral agreements, employing private ENUM (if at all)
- Managed „VoIP Peering Fabrics“
- <http://tools.ietf.org/wg/drinks>
 - Provisioning protocol for VoIP peering data
 - Doesn't require the „output“ to be (i/p)-ENUM
 - But supports NAPTRs

Conclusion



- User-ENUM: Too complex, financially unattractive, overtaken by other services
- Infrastructure-ENUM: embraced only by smaller operators, scary to larger ones, solves only part of the problem (discovery)
- Private ENUM: Success – at least makes use of the protocol and the services registration, but does not require the administrative infrastructure of e164.arpa...