Telephone Numbers in the DNS (ENUM)

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with material from Olav Kolkman
Please contact me...

QuickTime™ and a TIFF (Uncompressed) decompressor are needed to see this picture.
The problem

- Humans can and want to communicate using numerous services
  - Some of those services are IP based
  - Others are PSTN based
  - There is convergence towards IP based communication

- About 2 Billion people in the world use numeric keypads for communication

- We’d like a mechanism that ties these two worlds
The Solution

• Use e.164 addresses with an service discovery model from the IP world
  (Results in trivial business cards)

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ENUM in a nutshell

- take phone number
  
  +46 8 685 9131

- turn into domain name
  
  1.3.1.9.5.8.6.8.6.4.e164.arpa.

- ask the DNS
  
  mailto:paf@cisco.com

- return list of URI’s
  
  sip:paf@cisco.com
  jid:paf@cisco.com
A use case
voip2voip

SIP Server

DNS Server

Query:
1.3.1.9.5.8.6.6.4.e164.arpa

Response:
sip:paf@cisco.com

voip call:
+46 8 685 9131

SIP negotiation and call setup

VOIP call

Sip Server

SIP Server
voip2pstin

Query:
1.3.1.9.5.8.6.6.4.e164.arpa

Response:
sip:202220650@gateway.example

voip call:
+46 8 685 9131

SIP negotiation and call setup

SIP Server

DNS Server

VOIP/PSTN Gateway

switched

VOIP
E.164 addresses

- E.164 are the numbers used for international public telecommunication number plans
- ITU-T standard
- Different categories:
  - Geographic area
  - Global Services
  - Networks

<table>
<thead>
<tr>
<th>Geographic Area</th>
<th>Country code</th>
<th>National Destination Code (optional)</th>
<th>Subscriber Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>International public telecommunication number for geographic areas (maximum 15 digits)</td>
<td>+46</td>
<td>8</td>
<td>6859131</td>
</tr>
</tbody>
</table>

- cc=1-3 digits
- National (significant) number
- Maximum 15-cc digits
E.164 and NAPTR

- Take the number:
  - +31-20-2220650

- Remove all non-digits except the leading +
  - +31202220650 (this is the number on which the regular expression is to act, discriminates ‘public enum’)

- Remove the + and reverse the order of the digits
  - 05602220213

- Put each digit in its own domain and hang below e164.arpa
  - 0.5.6.0.2.2.2.0.2.1.3.e164.arpa.
Examples

$origin 0.5.6.0.2.2.2.0.2.1.3.e164.arpa.
IN NAPTR 10 10 "u" "E2U+voice:sip" ( "!^.*$!sip:olaf@nlnetlabs.nl!" . )
IN NAPTR 10 10 "u" "E2U+email:mailto" ( "!^.*$!mailto:olaf@nlnetlabs.nl!" . )
IN NAPTR 10 20 "u" "E2U+voice:tel" ( "!^(.*)$!tel:\1!" . )

Signals application that there is a preference for SIP instead of PSTN
Slowly moving up a few layers

Source: ISC, where you can buy this shirt
Delegation and Administration

• E.164 space is ‘owned’ by ITU-T
• Administrative responsibility for content is left to the member states
• e164.arpa. zone is maintained by RIPE NCC
  – Delegation from RIPE to whom?
  – Who is requesting this delegation?
• Do we use registry/registrar mechanisms for all DNS roles?
• Who is running the services?
Administration Model...

RIPE NCC

ITU-T TSB

Admin

Verification agency

Delegation on CC level

Service operator

DNS operator

DNS operator

Holder of E.164

ENUM registrar

Delegation on Customer level
But ENUM for infrastructure

- Convergence of telcos to ENUM
- Infrastructure information in the public DNS
  - Publish routing information
- ENUM was always intended for the public
  - 0.5.6.0.2.2.2.0(…) NAPTR <point to SIP service for user>
  - 0.5.6.0.2.2.2.0(…) NAPTR <point to SIP service for infrastructure>
- Two owners of the same record in the same zone
Economics

Query:
1.3.1.9.5.8.6.6.4.e164.arpa

Response:
sip:202220650@gateway.example

SIP negotiation and call setup

SIP Server

DNS Server

VOIP

VOIP/PSTN Gateway

SIP negotiation and call setup

switched

voip call: +46 8 685 9131
VOIP Economics are radically different from classic telecom model.
Payments

• PSTN
  – Fixed fee
  – Termination fee (per minute charge) that follows the call
• Email
  – Payment for IP
  – Payment for both incoming and outgoing
• VoIP
  – Payment for IP
  – Payment for both incoming and outgoing
• New business models for VoIP compared with PSTN
  – Internet is “bill and keep”
  – No termination fees for VoIP?
Back to technology Services

- E2U+H323
- E2U+SIP
- E2U+ifax:mailto
- E2U+pres
- E2U+web:http
- E2U+web:https
- E2U+ft:ftp
- E2U+email:mailto
- E2U+fax:tel
- E2U+sms:tel
- E2U+sms:mailto
- E2U+ems:tel
- E2U+ems:mailto
- E2U+mms:tel
- E2U+mms:mailto
- E2U+vpim:mailto
- E2U+vpim:ldap
- E2U+voice:tel

And we are still counting
Administrational mess and protocol problems

- Different ASPs for services, but only one delegation
  - Do you want your mms:mailto record to be maintained by your cell phone operator?
- There could be a lot of data in an RRSet
  - 512bytes limit set by DNS easily exceeded
  - With DNSSEC one ads an extra blob of data
- EDNS0 support seems to be a necessity
ENUM Next Generation
Current idea

$ORIGIN 3.8.0.0.6.9.2.3.6.1.4.4.e164.arpa.
  NAPTR 10 100 "u" "E2U+sip" "!*\$!sip:info@example.com!" .
  NAPTR 10 101 "u" "E2U+h323" "!*\$!h323:info@example.com!" .
  NAPTR 10 102 "u" "E2U+msg" "!*\$!mailto:info@example.com!" .

$ORIGIN 3.8.0.0.6.9.2.3.6.1.4.4.e164.arpa.
  _sip._e2u    URI 10 10 "sip:info@example.com"
  _sip._e2u    URI 10 10 "sip:info@example2.net"
  _h323._e2u   URI 10 10 "h323:info@example.com"
  _msg._e2u    URI 10 10 "mailto:info@example.com"

Slide courtesy: Patrik Fältsröm
More delegation structure

arpa.

e164.arpa.

4.4.e164.arpa.

3.8.0.0.6.9.2.3.6.1.4.4.e164.arpa.

NAPTR 10 100 "u" "E2U+sip" "!^.*$!sip:info@example.com"
NAPTR 10 101 "u" "E2U+h323" "!^.*$!h323:info@example2.net"
NAPTR 10 102 "u" "E2U+msg" "!^.*$!mailto:info@example.net"

_URI 10 10 "sip:info@example.com"
_URI 10 10 "sip:info@example2.net"
ENUM Next generation

• Today, query for NAPTR and get back every URI “connected” to the domain
• Should we separate between
  – What services exists for this domain?
  – What URI should I use for this service?
• Will this at the same time make delegation possible of separate URI specifications to different organisations?
• Backward compatibility?
Conclusion

• ENUM is an open standard for tying services to globally unique identifiers that people have been using for over 100 years
• Working with the technology opens regulatory and economic challenges
• ENUM is evolving, current players are early players
QUESTIONS?