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E.164 number and DNS
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Abstract

This document discusses the use of DNS for storage of E.164 numbers. More specifically, how DNS can be used for identifying available services connected to one E.164 number. Routing of the actual connection using the service selected using these methods is not discussed.

Discussion on this Internet-Draft is to be held on the mailing list ietf-e164-dns@imc.org, which is hosted by the Internet Mail Consortium. To subscribe, send an email to ietf-e164-dns-request@imc.org, with the text "subscribe" as the only word in the body of the mail. There is an archive of the mailing list at [<http://www.imc.org/ietf-e164-dns/>](http://www.imc.org/ietf-e164-dns/).

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1. Introduction

The NAPTR[1] records in DNS[3] can be used for looking up what services are available for a specific domainname. This technology is used for finding what services exists given an E.164 number.

1.1 Terminology

"Must" or "Shall" - Software that does not behave in the manner that this document says it must is not conformant to this document.

"Should" - Software that does not follow the behavior that this document says it should may still be conformant, but is probably broken in some fundamental way.

"May" - Implementations may or may not provide the described behavior, while still remaining conformant to this document.

2. E.164 numbers and DNS

The domain "e164.int." is being populated in order to provide the infrastructure in DNS for storage of E.164 numbers. In order to facilitate distributed operations, this domain is divided into subdomains. Holders of E.164 numbers which want to be listed in DNS should contact the appropriate zone administrator in order to be listed, by examining the SOA resource record associated with the zone, just like in normal DNS operations.

To find the DNS names for a specific E.164 number, the following procedure is to be followed:

1. See that the E.164 number is written in its full form, including the countrycode IDDD. Example: +46-8-56264000.
2. Remove all characters part from the digits. Example: 46856264000
3. Put dots (".") between each digit. Example:
4.6.8.5.6.2.6.4.0.0.0
4. Change the order of the digits. Example: 0.0.0.4.6.2.6.5.8.6.4
5. Append the domain "e164.int" to the end. Example:
0.0.0.4.6.2.6.5.8.6.4.e164.int

3. Identifying available services

For a record in DNS, the NAPTR record is used for identifying available ways of contacting a specific node identified by that name. Specifically it can be used for knowing what services exists for a specific domainname, including phone numbers by the use of the e164.int domain as described above.

The identification is using the NAPTR resource record defined for use in the URN resolution process, but it can be generalized in a way that suits the needs specified in this document.

3.1 The NAPTR record

The key fields in the NAPTR RR are order, preference, service, flags, regexp, and replacement. For a detailed description, see:

- o The order field specifies the order in which records MUST be processed when multiple NAPTR records are returned in response to a single query.
- o The preference field specifies the order in which records SHOULD be processed when multiple NAPTR records have the same value of "order".
- o The service field specifies the resolution protocol and resolution service(s) that will be available if the rewrite specified by the regexp or replacement fields is applied.
- o The flags field contains modifiers that affect what happens in the next DNS lookup, typically for optimizing the process.
- o The regexp field is one of two fields used for the rewrite rules, and is the core concept of the NAPTR record.
- o The replacement field is the other field that may be used for the rewrite rule.

Note that the client applies all the substitutions and performs all lookups, they are not performed in the DNS servers. Note also that it is the belief that regexps should rarely be used. The replacement field seems adequate for the vast majority of situations.

3.1.1 Specific use of some fields in the NAPTR record

The flags can be "s" or "a" for the next step in the resolution process described in this document. "s" flag means that the next lookup should be for SRV records, and "a" that the result of the rewrite is a URI. Other flags are the "u" and the "p" flags.

The service supported for a call must be N2R.

3.1.2 Example of use

```
tele2.se.  
;;      ord pr fl  service      re replacement  
IN NAPTR 100 10 "a" "sip+N2R"      "" "sip:information@tele2.se"  
IN NAPTR 102 10 "a" "smtp+N2R"      "" "mailto:information@tele2.se"
```

This describes that the domain tele2.se is preferable contacted via the SIP protocol, secondly via SMTP (for VPIM voicemail over SMTP for example).

In both cases, the next step in the resolution process is to use the resolution mechanism for each of the protocols, (SIP and SMTP) to know what node to contact for each.

3.1.3 When the virtual address is a phone number

When the target address is a phone number, it is first translated into a RR name in the e164.int domain according to the method described above.

Example:

```
2.8.0.4.6.2.6.5.8.6.4.e164.int.  
IN NAPTR 10 10 "a" "sip+N2R"      "" "sip:paf@swip.net".  
IN NAPTR 102 10 "s" "potscall+N2R" "" _potscall._tcp.paf.swip.net.  
IN NAPTR 102 10 "a" "smtp+N2R"      "" "mailto:paf@swip.net".
```

Note that the preferred method is to use the SIP protocol, but the result of the rewrite of the NAPTR record is a URI (the "a" flag in the NAPTR record). In the case of the protocol SIP, the URI might be a SIP URI, which is resolved as described in [RFC 2543](#)[4].

The rest of the resolution of the routing is done as described above.

3.1.4 The potscall protocol name

The potscall protocol name is just a placeholder so one knows that the protocol to use is plain old telephony. Because the protocol is not run on top of IP, the address to use when addressing the endnode has to be a phone number. This address is given back when looking up the SRV record for the _potscall._tcp service in the given domain.

Example:

```
_potscall._tcp.paf.swip.net.
```



```
IN SRV 10 10 2.8.0.4.6.2.6.5.8.6.4.e164.int.  
IN SRV 20 10 0.0.0.4.6.2.6.5.8.6.4.e164.int.
```

4. IANA Considerations

IANA is to allocate the protocol name "potscall" as a placeholder for a protocol name in the SRV record type. No portnumber have to be allocated for this protocol name.

5. Security Considerations

As this system is built on top of DNS, one can not be sure that the information one get back from DNS is more secure than any DNS query. To solve that, the use of DNSSEC for securing and verifying zones is to be recommended.

The caching in DNS can make the propagation time for a change take the same amount of time as the time to live for the NAPTR and SRV records in the zone that is changed. The TTL should because of that be kept to a minimum. The use of this in an environment where IP-addresses are for hire (i.e. DHCP) must therefore be done very carefully.

6. Acknowledgement

I thank the people at Ericsson, especially Bjorn Larsson, for support and ideas, and especially the group which implemented this scheme in their lab to see that it worked. I also thank the people of ITU-T SG2, Working Party 1/2 (Numbering, Routing, Global Mobility and Service Definition) for comments, and Leif Sunnegardh at Tele2 for information about how SS7 really works.

References

- [1] Mealling, M and R Daniel, "The Naming Authority Pointer (NAPTR) DNS Resource Record", Internet-Draft [draft-ietf-urn-naptr-rr-03.txt](#), June 1998.
- [2] Gulbrandsen, A and R Daniel, "A DNS RR for specifying the location of services (DNS SRV)", Internet-Draft [draft-ietf-urn-naptr-rr-03.txt](#), June 1998.
- [3] Mockapetris, P, "Domain names - Implementation and Specification", [RFC 1035](#), November 1987.
- [4] Handley, M, Schulzrinne, H, Schooler, E and J Rosenberg, "SIP: Session Initiation Protocol", [RFC 2543](#), March 1999.

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[Appendix A](#). Example SIP

Caller (A) uses a phone, connected to the PSTN network, on number +46-8-7525252.

Callee (B) is buying a service by provider X, which is telephony over the Internet via the use of SIP.

Callee want to get reached on the message number +46-76-11223344, which is in this example supposed to be directed to the correct SIP URI.

On the buissness card, the callee have printed the number +46-76-11223344 (and probably the SIP URI "sip:foobar@x.example.net").

Caller reads the buissness card, lifts the handle, and punches the number +46-76-11223344.

The SCP looks up the NAPTR record in DNS for 4.4.3.3.2.2.1.1.6.7.6.4.e164.int. The DNS server for Number Inc. has the following information in its DNS:

```
4.4.3.3.2.2.1.1.6.7.6.4.e164.int. IN SOA ....  
IN NS ....  
IN NAPTR 100 10 "a" "sip+N2R" ""sip:foobar@x.example.net".
```

This shows to the switch that the only way B can be contacted is via the SIP protocol, using the URI "sip:foobar@x.example.net".

The resolution of the SIP URI, using SRV records etc, is described in [appendix D of RFC 2543](#).

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