

Central Numbering Database; DNS Implementation

Note : This standard is intended to allow fulfilment of changes to General Condition 18 which were announced by Ofcom via the November 2007 Statement entitled "Telephone number portability for consumers switching suppliers - Concluding Statement" and subsequently set aside by the Competition Appeal Tribunal (Case 1094/3/3/08). At the time of publishing, Ofcom is reviewing the regulation in this area so readers are cautioned that changes to this standard may prove necessary. Network Interoperability Consultative Committee,

Network Interoperability Consultative Committee,
Ofcom,
2a Southwark Bridge Road,
London,
SE1 9HA.

**© 2008 Ofcom copyright
NOTICE OF COPYRIGHT AND LIABILITY**

Copyright

All right, title and interest in this document are owned by Ofcom and/or the contributors to the document unless otherwise indicated (where copyright be owned or shared with a third party). Such title and interest is protected by United Kingdom copyright laws and international treaty provisions.

The contents of the document are believed to be accurate at the time of publishing, but no representation or warranty is given as to their accuracy, completeness or correctness. You may freely download, copy, store or distribute this document provided it is not modified in any way and it includes this copyright and liability statement.

You may not modify the contents of this document. You may produce a derived copyright work based on this document provided that you clearly indicate that it was created by yourself and that it was derived from this document and provided further that you ensure that any risk of confusion with this document is avoided.

Liability

Whilst every care has been taken in the preparation and publication of this document, NICC, nor any committee acting on behalf of NICC, nor any member of any of those committees, nor the companies they represent, nor any person contributing to the contents of this document (together the “Generators”) accepts liability for any loss, which may arise from reliance on the information contained in this document or any errors or omissions, typographical or otherwise in the contents.

Nothing in this document constitutes advice. Nor does the transmission, downloading or sending of this document create any contractual relationship. In particular no licence is granted under any intellectual property right (including trade and service mark rights) save for the above licence to copy, store and distribute this document and to produce derived copyright works.

The liability and responsibility for implementations based on this document rests with the implementer, and not with any of the Generators. If you implement any of the contents of this document, you agree to indemnify and hold harmless the Generators in any jurisdiction against any claims and legal proceedings alleging that the use of the contents by you or on your behalf infringes any legal right of any of the Generators or any third party.

None of the Generators accepts any liability whatsoever for any direct, indirect or consequential loss or damage arising in any way from any use of or reliance on the contents of this document for any purpose.

If you have any comments concerning the accuracy of the contents of this document, please write to:

The Technical Secretary,
Network Interoperability Consultative Committee,
Ofcom,
2a Southwark Bridge Road,
London SE1 9HA.

Contents

Intellectual Property Rights	4
Foreword	4
1 Scope	5
2 References	5
2.1 Normative references	5
3 Definitions and abbreviations.....	6
3.1 Definitions	6
3.2 Abbreviations	6
4 Record Mapping	7
4.1 Zone Data	7
4.2 NAPTR Resource Records	7
5 Information Flows	8
5.1 Real Time Retrieval Function - Reference Point D ₃	8
5.2 Change Notification Function - Reference Point D ₁	8
5.3 Bulk Retrieval Function - Reference Point D ₂	9
5.3.1 Full Section Transfers.....	9
5.3.2 Incremental Transfers	9
History	10

Intellectual Property Rights

Pursuant to the NICC IPR Policy, no investigation, including IPR searches, has been carried out by NICC. No guarantee can be given as to the existence of other IPRs which are, or may be, or may become, essential to the present document.

Foreword

This NICC Document (ND) has been produced by NICC TSG NNA.

1 Scope

The present document specifies the reference implementation for the use of DNS to access the Central Numbering Database.

This specification describes the mapping of record formats between DNS Resource Records and the URIs used in the Central Numbering Database, and the DNS protocol methods corresponding to the required Information Flows.

2 References

For the particular version of a document applicable to this release see [ND1610](#) [11].

2.1 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

- [1] NICC ND 1631: “NGN; PSTN/ISDN Service Interconnect; Architecture for usage of Common Numbering Database”
- [2] IETF RFC 1034: “Domain Names – Concepts and Facilities”
- [3] IETF RFC 1035: “Domain Names – Implementation and Specification”
- [4] IETF RFC 1995: “Incremental Zone Transfer in DNS”
- [5] IETF RFC 1996: "DNS NOTIFY: A Mechanism for Prompt Notification of Zone Changes"
- [6] IETF RFC 2308: “Negative Caching of DNS Queries (DNS NCACHE)”
- [7] IETF RFC 2931: “DNS Request and Transaction Signatures (SIG(0)s)”
- [8] IETF RFC 3403: “Dynamic Delegation Discovery System (DDDS) Part Three: The Domain Name System (DNS) Database”
- [9] IETF RFC 3645: “Secret Key Transaction Authentication for DNS (TSIG)”
- [10] IETF RFC 3761: “The E.164 to Uniform Resource Identifiers (URI) Dynamic Delegation Discovery System (DDDS) Application (ENUM)”
- [11] NICC ND 1610: “Multi-Service Interconnect of UK Next Generation Networks”

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

Checkpoint Reference : an encoded date-time that represents a version of a Section of the Central numbering database. Each change to a Section (or set of changes that are taken together) results in a new checkpoint reference.

Section : A portion of the Central Numbering Database that can be downloaded independently of the remainder of it.

Zone : Authoritative information is organized into units called ZONEs, and these zones can be automatically distributed to the name servers which provide redundant service for the data in a zone.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

DNS	the Domain Name System, as described in [2] and [3]
SOA	Start Of Authority [2]
RR	Resource Record [2]

4 Record Mapping

The DNS access protocol for access to the Central Numbering Database **shall** be ENUM-like, that is, it conforms to [10] (other than in the choice of base domain) and the DNS database will return NAPTR Resource Records as defined here.

4.1 Zone Data

Each Section **shall** be maintained as a separate Zone.

The Checkpoint Reference **shall** be implemented using the “Serial Number” field contained within the SOA RR for each Zone.

The Serial Number field **may** contain an unsigned 32-bit integer representing the number of seconds elapsed since a defined start date.

The “Minimum” field of the SOA RR (see [6]) **shall** have a value no greater than Timer T₄ (see Clause 10 of [1]). This field controls negative-caching (i.e. caching the fact that no record exists) and should be set so as to ensure that the introduction of a new record is propagated at least as quickly as a change to an existing record.

Values for the “Refresh”, “Retry” and “Expiry” fields of the SOA RR will be chosen as appropriate and according to best practise for the operation of DNS servers based on the size and volatility of the Zone Data.

4.2 NAPTR Resource Records

Each telephone number in the database will require two records of each form for which it has data (that is, there will be 0, 2, or 4 records for each number). Each intermediate level in the numbering scheme will require one SEND-N form record.

The NAPTR RRs returned from the database shall be the functional equivalent of the following:

```
$ORIGIN 4.3.2.1.4.4.cdb.uktel.org.uk.
;; PSTN form records
0.9.8.7.6.5 IN NAPTR 1000 1000 "u" "E2U+pstn:tel" "!^.*$!tel:URI!" .
*.0.9.8.7.6.5 IN NAPTR 1000 1000 "u" "E2U+pstn:tel" "!^.*$!tel:URI!" .
;; IMS form records
0.9.8.7.6.5 IN NAPTR 1000 1000 "u" "E2U+pstn:sip" "!^.*$!sip:URI!" .
*.0.9.8.7.6.5 IN NAPTR 1000 1000 "u" "E2U+pstn:sip" "!^.*$!sip:URI!" .
;; SEND-N form records
8.7.6.5 IN NAPTR 1000 1000 "u" "E2U+pstndata:send-n" "!^.*$!pstndata:URI!" .
```

That is:

- The searched domain shall be generated using the rules of [10] section 2.4, except that step 4 shall use the base domain `cdb.uktel.org.uk`.
- For telephone numbers, one record shall be an exact match for the telephone number, while the other shall be a wildcard catching all longer queries (corresponding to over dialling).
- For intermediate levels, the record shall be an exact match for the prefix sequence.
- For dead-end levels, the record shall be a wildcard catching all queries beginning with that sequence or an exact match, depending on the record contents.

- The *order* and *preference* fields **shall** have the value 1000.
- The *flags* field **shall** have the value “u” (case insensitive), indicating that this record generates the final URI. The DDS loop mechanism **shall not** be used.
- The *service* field **shall** have the value “E2U+pstn:sip” for the IMS form records, “E2U+pstn:tel” for the PSTN form records and “E2U+pstndata:send-n” for the SEND-N form records.
- The *regexp* field **shall** generate a URI of the form specified in Annex A of [1]. It should use the exclamation mark (“!”) for the delimiter and a pattern that matches the entire string (“^.*\$”) unless there is an explicit reason to do otherwise; users of the database **shall not** assume that either of these apply.
- The *replacement* field **shall** be empty in accordance with [8].

5 Information Flows

The Transaction Identity **shall** be implemented using the ID field of the DNS protocol message (see [3], Section 4.1.1).

Each response from the Central Numbering Database **shall** be authoritative and flagged as such by having the “Authoritative Answer” (AA) bit set in the response header.

For the purposes of error checking, except where specified otherwise, all DNS protocol messages **shall** be cryptographically signed with TSIG [9] or SIG0 [7].

It should be noted that DNS message sizes **may** exceed the limits allowable for UDP messages and therefore CPs **shall** ensure that their networks also support TCP communications for DNS messages to and from the Central Numbering Database.

5.1 Real Time Retrieval Function - Reference Point D₃

To perform this function the CP **shall** issue a standard DNS request for NAPTR Resource Records as per clause 4.2 and the Central Numbering Database **shall** respond accordingly.

The D₃ “time to live” response value shall map directly to the DNS TTL value returned in the NAPTR Resource Records.

For performance reasons the DNS protocol request and response messages for this function **shall not** be cryptographically signed.

5.2 Change Notification Function - Reference Point D₁

On any change of data within a Section the Checkpoint Reference for that Section **shall** be updated and the Central Numbering Database **shall** send a DNS NOTIFY [5] message to each of the CP DNS servers that are subscribed to that Section.

The NOTIFY message **shall** contain the name of the DNS Zone to which it applies. The RDATA field of the NOTIFY message **shall** contain the new SOA record, which in turn contains the current Checkpoint Reference.

The CP DNS server **shall** send back a “NOTIFY” response message to confirm that it has received the Change Notification from the Central Numbering Database to allow the Central Numbering Database to remove the CP DNS server from its retransmit queue. (See [5] Section 3.3).

5.3 Bulk Retrieval Function - Reference Point D₂

5.3.1 Full Section Transfers

A CP **may** request a copy of the full zone data for a Section at any time by sending a DNS AXFR [2] request to the Central Numbering Database.

The Central Numbering Database **shall** respond to the AXFR request by returning a full copy of the most recent version of that zone in standard AXFR response format.

The SOA RR contained in the AXFR response **shall** contain the current Checkpoint Reference which the CP **shall** use for future Incremental Transfers.

Each CP who wishes to maintain a local copy of a Section **shall** first perform a Full Section Transfer to obtain the initial zone data. Additionally a CP **may** perform a Full Section Transfer at any time (e.g. in order to recover from a corrupted database).

5.3.2 Incremental Transfers

In response to a NOTIFY message a CP DNS server **shall** send a DNS IXFR [4] request to the Central Numbering Database.

This request **shall** contain the last Checkpoint Reference known to the CP DNS server.

The Central Numbering Database **shall** then respond with an IXFR response containing all of the changes between the specified Checkpoint Reference and the most recent version of the Zone. No other changes **shall** be included.

The IXFR response **shall** contain an SOA RR containing the latest Checkpoint Reference.

As specified in [4], if the Central Numbering Database is unable to perform an Incremental Transfer (perhaps because the CP supplied Checkpoint Reference is too old) then the response from the Central Numbering Database shall contain the same data as if a Full Load had been requested.

History

Document history		
<Version>	<Date>	<Milestone>
1.1.1	2008-04-11	Initial issue
1.1.2	2008-10-20	Updated to align with IETF Send-N draft (-02)