

Network Working Group
Request for Comments: 3596
Obsoletes: 3152, 1886
Category: Standards Track

S. Thomson
Cisco
C. Huitema
Microsoft
V. Ksinant
6WIND
M. Souissi
AFNIC
October 2003

DNS Extensions to Support IP Version 6

Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

Copyright Notice

Copyright (C) The Internet Society (2003). All Rights Reserved.

Abstract

This document defines the changes that need to be made to the Domain Name System (DNS) to support hosts running IP version 6 (IPv6). The changes include a resource record type to store an IPv6 address, a domain to support lookups based on an IPv6 address, and updated definitions of existing query types that return Internet addresses as part of additional section processing. The extensions are designed to be compatible with existing applications and, in particular, DNS implementations themselves.

Table of Contents

1. Introduction	2
2. New resource record definition and domain.	2
2.1. AAAA record type	3
2.2. AAAA data format	3
2.3. AAAA query	3
2.4. Textual format of AAAA records	3
2.5. IP6.ARPA domain.	3
3. Modifications to existing query types.	4
4. Security Considerations.	4
5. IANA Considerations.	4

6. Intellectual Property Statement.	4
Acknowledgments.	5
Appendix A: Changes from RFC 1886.	6
Normative References	6
Informative References	6
Authors' Addresses	7
Full Copyright Statement	8

1. Introduction

Current support for the storage of Internet addresses in the Domain Name System (DNS) [1,2] cannot easily be extended to support IPv6 addresses [3] since applications assume that address queries return 32-bit IPv4 addresses only.

To support the storage of IPv6 addresses in the DNS, this document defines the following extensions:

- o A resource record type is defined to map a domain name to an IPv6 address.
- o A domain is defined to support lookups based on address.
- o Existing queries that perform additional section processing to locate IPv4 addresses are redefined to perform additional section processing on both IPv4 and IPv6 addresses.

The changes are designed to be compatible with existing software. The existing support for IPv4 addresses is retained. Transition issues related to the co-existence of both IPv4 and IPv6 addresses in the DNS are discussed in [4].

The IP protocol version used for querying resource records is independent of the protocol version of the resource records; e.g., IPv4 transport can be used to query IPv6 records and vice versa.

This document combines RFC 1886 [5] and changes to RFC 1886 made by RFC 3152 [6], obsoleting both. Changes mainly consist in replacing the IP6.INT domain by IP6.ARPA as defined in RFC 3152.

2. New resource record definition and domain

A record type is defined to store a host's IPv6 address. A host that has more than one IPv6 address must have more than one such record.

2.1 AAAA record type

The AAAA resource record type is a record specific to the Internet class that stores a single IPv6 address.

The IANA assigned value of the type is 28 (decimal).

2.2 AAAA data format

A 128 bit IPv6 address is encoded in the data portion of an AAAA resource record in network byte order (high-order byte first).

2.3 AAAA query

An AAAA query for a specified domain name in the Internet class returns all associated AAAA resource records in the answer section of a response.

A type AAAA query does not trigger additional section processing.

2.4 Textual format of AAAA records

The textual representation of the data portion of the AAAA resource record used in a master database file is the textual representation of an IPv6 address as defined in [3].

2.5 IP6.ARPA Domain

A special domain is defined to look up a record given an IPv6 address. The intent of this domain is to provide a way of mapping an IPv6 address to a host name, although it may be used for other purposes as well. The domain is rooted at IP6.ARPA.

An IPv6 address is represented as a name in the IP6.ARPA domain by a sequence of nibbles separated by dots with the suffix ".IP6.ARPA". The sequence of nibbles is encoded in reverse order, i.e., the low-order nibble is encoded first, followed by the next low-order nibble and so on. Each nibble is represented by a hexadecimal digit. For example, the reverse lookup domain name corresponding to the address

```
4321:0:1:2:3:4:567:89ab
```

would be

```
b.a.9.8.7.6.5.0.4.0.0.0.3.0.0.0.2.0.0.0.1.0.0.0.0.0.0.0.1.2.3.4.IP6.  
ARPA.
```

3. Modifications to existing query types

All existing query types that perform type A additional section processing, i.e., name server (NS), location of services (SRV) and mail exchange (MX) query types, must be redefined to perform both type A and type AAAA additional section processing. These definitions mean that a name server must add any relevant IPv4 addresses and any relevant IPv6 addresses available locally to the additional section of a response when processing any one of the above queries.

4. Security Considerations

Any information obtained from the DNS must be regarded as unsafe unless techniques specified in [7] or [8] are used. The definitions of the AAAA record type and of the IP6.ARPA domain do not change the model for use of these techniques.

So, this specification is not believed to cause any new security problems, nor to solve any existing ones.

5. IANA Considerations

There are no IANA assignments to be performed.

6. Intellectual Property Statement

The IETF takes no position regarding the validity or scope of any intellectual property or other rights that might be claimed to pertain to the implementation or use of the technology described in this document or the extent to which any license under such rights might or might not be available; neither does it represent that it has made any effort to identify any such rights. Information on the IETF's procedures with respect to rights in standards-track and standards-related documentation can be found in BCP-11. Copies of claims of rights made available for publication and any assurances of licenses to be made available, or the result of an attempt made to obtain a general license or permission for the use of such proprietary rights by implementors or users of this specification can be obtained from the IETF Secretariat.

The IETF invites any interested party to bring to its attention any copyrights, patents or patent applications, or other proprietary rights which may cover technology that may be required to practice this standard. Please address the information to the IETF Executive Director.

Acknowledgments

Vladimir Ksinant and Mohsen Souissi would like to thank Sebastien Barbin (IRISA), Luc Beloeil (France Telecom R&D), Jean-Mickael Guerin (6WIND), Vincent Levigneron (AFNIC), Alain Ritoux (6WIND), Frederic Roudaut (IRISA) and G6 group for their help during the RFC 1886 Interop tests sessions.

Many thanks to Alain Durand and Olafur Gudmundsson for their support.

Appendix A: Changes from RFC 1886

The following changes were made from RFC 1886 "DNS Extensions to support IP version 6":

- Replaced the "IP6.INT" domain by "IP6.ARPA".
- Mentioned SRV query types in section 3 "MODIFICATIONS TO EXISTING QUERY TYPES"
- Added security considerations.
- Updated references :
 - * From RFC 1884 to RFC 3513 (IP Version 6 Addressing Architecture).
 - * From "work in progress" to RFC 2893 (Transition Mechanisms for IPv6 Hosts and Routers).
 - * Added reference to RFC 1886, RFC 3152, RFC 2535 and RFC 2845.
- Updated document abstract
- Added table of contents
- Added full copyright statement
- Added IANA considerations section
- Added Intellectual Property Statement

Normative References

- [1] Mockapetris, P., "Domain Names - Concepts and Facilities", STD 13, RFC 1034, November 1987.
- [2] Mockapetris, P., "Domain Names - Implementation and Specification", STD 13, RFC 1035, November 1987.
- [3] Hinden, R. and S. Deering, "Internet Protocol Version 6 (IPv6) Addressing Architecture", RFC 3513, April 2003.

Informative References

- [4] Gilligan, R. and E. Nordmark, "Transition Mechanisms for IPv6 Hosts and Routers", RFC 2893, August 2000.
- [5] Thomson, S. and C. Huitema, "DNS Extensions to support IP version 6", RFC 1886, December 1995.
- [6] Bush, R., "Delegation of IP6.ARPA", BCP 49, RFC 3152, August 2001.
- [7] Eastlake, D., "Domain Name System Security Extensions", RFC 2535, March 1999

- [8] Vixie, P., Gudmundsson, O., Eastlake, D. and B. Wellington,
"Secret Key Transaction Authentication for DNS (TSIG)", RFC
2845, May 2000.

Authors' Addresses

Susan Thomson
Cisco Systems
499 Thornall Street, 8th floor
Edison, NJ 08837

Phone: +1 732-635-3086
EMail: sethomso@cisco.com

Christian Huitema
Microsoft Corporation
One Microsoft Way
Redmond, WA 98052-6399

EMail: huitema@microsoft.com

Vladimir Ksinant
6WIND S.A.
Immeuble Central Gare - Bat.C
1, place Charles de Gaulle
78180, Montigny-Le-Bretonneux - France

Phone: +33 1 39 30 92 36
EMail: vladimir.ksinant@6wind.com

Mohsen Souissi
AFNIC
Immeuble International
2, rue Stephenson,
78181, Saint-Quentin en Yvelines Cedex - France

Phone: +33 1 39 30 83 40
EMail: Mohsen.Souissi@nic.fr

Full Copyright Statement

Copyright (C) The Internet Society (2003). All Rights Reserved.

This document and translations of it may be copied and furnished to others, and derivative works that comment on or otherwise explain it or assist in its implementation may be prepared, copied, published and distributed, in whole or in part, without restriction of any kind, provided that the above copyright notice and this paragraph are included on all such copies and derivative works. However, this document itself may not be modified in any way, such as by removing the copyright notice or references to the Internet Society or other Internet organizations, except as needed for the purpose of developing Internet standards in which case the procedures for copyrights defined in the Internet Standards process must be followed, or as required to translate it into languages other than English.

The limited permissions granted above are perpetual and will not be revoked by the Internet Society or its successors or assignees.

This document and the information contained herein is provided on an "AS IS" basis and THE INTERNET SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Acknowledgement

Funding for the RFC Editor function is currently provided by the Internet Society.

