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Results from Interoperability Tests of DHCPv6 Implementations  
draft-ietf-dhc-dhcpv6-interop-01.txt

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#### Abstract

This document publishes issues with the DHCPv6 protocols specifications, based on the results of interoperability testing among several implementations.

#### Introduction

The DHCPv6 specification [[1](#)] has been accepted as a Proposed Standard, and several related specifications have been published and will soon be submitted to the IESG for review. Several implementations of DHCPv6 have been completed, and these implementations have been tested for interoperability.

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The purpose of this document is to provide a published record of the issues discovered through interoperability testing, for review and discussion by the appropriate IETF working groups.

A course of action to correct problems with the DHCPv6 specifications is proposed for many of the listed issues. These changes will be made to the DHCPv6 specification prior to its publication as an RFC.

The remainder of this documents lists specific issues, along with a summary of any discussion of the issue that has already occurred through e-mail and a proposed course of action to correct the issue.

Throughout this document, unless otherwise qualified, section references and numbers refer to [draft-ietf-dhc-dhcpv6-28](#).

1. Response of servers to Renew and Rebind messages, sections [18.2.3](#) and [18.2.4](#)

Issue: Sections [18.2.3](#) and [18.2.4](#) have exactly the same sentence:

If the server cannot find a client entry for the IA the server returns the IA containing no addresses with a Status Code option set to NoBinding in the Reply message.

however, the semantics of "the server cannot find a client entry" is slightly different between the case of Renew and the case of Rebind.

Discussion: A Renew message is sent to a specific server, which originally assigned the addresses in the IA. If the server now does not have a record of the IA, it can authoritatively respond with a NoBinding Status Code.

However, a Rebind message may be sent to more than one DHCP server, and the servers that did not originally assign the addresses in the IA may legitimately not have any record of the IA. Therefore, in response to a Rebind message, the server should only respond if it can determine that the addresses are somehow invalid, and not respond if it simply has no record of the IA.

Resolution: Leave the sentence in [section 18.2.3](#) unchanged. Replace the sentence in [section 18.2.4](#) with the following text:

If the server cannot find a client entry for the IA and the server determines that the addresses in the IA are not appropriate for the link to which the client's interface is attached according to the server's explicit configuration information, the server MAY send a Reply message to the client

containing the client's IA, with the lifetimes for the addresses in the IA set to zero. This Reply constitutes an explicit notification to the client that the addresses in the IA are no longer valid. In this situation, if the server does not send a Reply message it silently discards the Rebind message.

## [2.](#) Correctness of T1 and T2 parameters

Issue: What should a client or server do if it receives an IA\_NA in a message where  $T1 > T2 > 0$ ?

Discussion: A client should ignore the IA\_NA with the invalid T1 and T2 values. A server should ignore the invalid T1 and T2 values and process the IA\_NA as though the client did not set those values.

Resolution: Add the following paragraphs at the end of [section 22.4](#), "Identity Association for Non-temporary Addresses Option":

If a server receives an IA\_NA with T1 greater than T2, and both T1 and T2 are greater than 0, the server ignores the invalid values of T1 and T2 and processes the IA\_NA as though the client had set T1 and T2 to 0.

If a client receives an IA\_NA with T1 greater than T2, and both T1 and T2 are greater than 0, the client discards the IA\_NA option and processes the remainder of the message as though the server had not included the invalid IA\_NA option.

## [3.](#) Receipt of a Request message for an existing binding

Issue: What should a server do when it receives a Request message

that contains an IA for which the server already has a binding associating the IA with the requesting client (this can happen if the first Reply from a client is lost and the client resends the Request message)?

Discussion: The server either updates the parameters and sends a new Reply or sends a cached copy of the previous Reply.

Resolution: Add the following paragraph at the end of [section 18.2.1](#):

If the server finds that the client has included an IA in the Request message for which the server already has binding that associates the IA with the client, the client has resent a

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Request message for which it did not receive a Reply message. The server either resends a previously cached Reply message or sends a new Reply message.

#### [4.](#) Client response to receipt of Reply with IA containing Status Code of NoAddrsAvail

Issue: [Section 18.1.8](#) describes the client's behavior:

When the client receives a NoAddrsAvail status from the server in response to a Request, the client can either try another server (perhaps restarting the DHCP server discovery process) or use the Information-Request to obtain configuration parameters only.

What does the client do if it receives more than one IA, and some IAs have been assigned addresses, while other IAs have been returned with status NoAddrsAvail?

Discussion: The client should examine and process each IA individually.

Resolution: Replace the text in question with:

The client examines the status code in each IA individually. If the status code is NoAddrsAvail, the client has received no usable addresses in the IA and may choose to try obtaining

addresses for the IA from another server. The client uses addresses and other information from any IAs that do not contain a Status Code option with the NoAddrAvail code. If the client receives no addresses in any of the IAs, it may either try another server (perhaps restarting the DHCP server discovery process) or use the Information-request message to obtain other configuration information only.

5. Client processing of an IA option that does not include all addresses sent by the client

Issue: [Section 18.1.3](#) says:

The client includes an IA option with all addresses currently assigned to the IA in its Renew message.

and [Section 18.2.3](#) has corresponding sentence:

If the server finds that any of the addresses are not

appropriate to the link to which the client is attached, the server returns the address to the client with lifetimes of 0.

If the server finds the addresses in the IA for the client then the server sends back the IA to the client with new lifetimes and T1/T2 times. The server may choose to change the list of addresses and the lifetimes of addresses in IAs that are returned to the client. That is,:

- \* the client sends all addresses for an IA to be renewed.
- \* (if the binding is still valid) the server returns all the addresses for the IA with 0 or larger lifetimes.

What does the client do if an address it sent to the server is not included in the IA in the Reply message from the server?

Discussion: The client leaves addresses in its IA, leaving the lifetimes on those addresses unchanged. The client then discards the addresses when their lifetimes expire.

Resolution: Add the following item to the bullet list in [section 18.1.8](#):

- Leave unchanged any information about addresses the client has recorded in the IA but that were not included in the IA from the server

Add the following text to the end of the last paragraph of [section 10](#):

Additionally, when the valid lifetime for an address in an IA expires, the client MUST remove the address from the IA.

## 6. Receipt of Reply with Rapid Commit option after sending Request

Issue: [Section 17.1.4](#) says:

If it does not receive such a Reply message and does receive a valid Advertise message, the client processes the Advertise message as described in [section 17.1.3](#).

What should the client do if it receives a Reply message for a Solicit message with a Rapid Commit option after SOL\_TIMEOUT has expired and the client has sent a Request message? Should the client ignore or accept it? In the latter case, what happens if the client has already sent a Request message (for which it will

receive a different Reply message)?

Discussion: The client can either discard the Reply message or process the Reply message and discard any subsequent Reply messages received in response to the Request message.

Resolution: Add the following text to the end of [section 17.1.4](#):

If the client subsequently receives a valid Reply message that includes a Rapid Commit option, it either:

- processes the Reply message as described in [section 18.1.8](#), and discards any Reply messages received in response to the Request message

processes any Reply messages received in response to the Request message and discards the Reply message that includes the Rapid Commit option

7. Inconsistent or incorrect text in [section 15](#)

Issue: Text in [section 15](#) is inconsistent, ambiguous and incorrect.

Discussion: For example, in [section 15.6](#):

Servers MUST discard any received Renew message that meets any of the following conditions:

- + the message MUST include a Server Identifier option
- + the contents of the Server Identifier option MUST match the server's identifier
- + ...

However, there is a wording problem. The first sentence should read:

Servers MUST discard any received Renew message that fails to meet any of the following conditions:

Resolution: Review and reword appropriate text in [section 15](#) for consistency and correctness.

8. Typographic error regarding MRC in [section 18.1.6](#)

Issue: In the following line of [Section 18.1.6](#):

MRC REL\_MAX\_MRC

should be:

Resolution: Correct typo in [section 18.1.6](#).

9. Inconsistent lifetimes for an address

Issue: What should a client or server do if the preferred lifetime is larger than the valid lifetime for an IA address option in a reply message (to request/renew, etc)? Similarly, suppose either T1 or T2 is larger than the shortest preferred lifetime in the IA?

Discussion: A client discards any addresses for which the preferred lifetime is larger than the valid lifetime. It is acceptable for T1 or T2 to be larger than a preferred or valid lifetime when the server does not expect to extend the lifetime of that address in the future. A server ignores any invalid or inconsistent lifetimes or values for T1 and T2 and processes the IA as though the client had not set those invalid or inconsistent values.

In a related matter, the text in [section 22.4](#) that gives recommended values for T1 and T2 should be clarified to indicate that T1 and T2 should be based on shortest lifetime of any address that the server intends to extend in the future.

Resolution: Add the following paragraph before the next-to-last paragraph of [section 22.6](#) (bottom of page 65 in [draft-ietf-dhc-dhcpv6-28.txt](#)):

A client discards any addresses for which the preferred lifetime is greater than the valid lifetime. A server ignores the lifetimes set by the client if the preferred lifetime is greater than the valid lifetime and ignores the values for T1 and T2 set by the client if those values are greater than the preferred lifetime.

Change the second sentence of the last paragraph of [section 22.4](#) to:

Recommended values for T1 and T2 are .5 and .8 times the

shortest preferred lifetime of the addresses in the IA that the server is willing to extend, respectively.

## 10. "Infinity" as a time value

Issue: Should DHCPv6 have a notion of "infinity" as lifetimes and T1/T2 values? In [RFC2461](#) [2], 0xffffffff is taken to mean "infinity". If DHCPv6 intends to be consistent with that meaning, there should be an explicit definition somewhere in the specification.

Discussion: DHCPv6 should treat 0xffffffff as "infinity" in the case of time values. In [section 22.4](#), the recommendations for values of T1 and T2 need to be clarified for the case when the lifetimes of the addresses in an IA are 0xffffffff.

Resolution: Add [section 5.6](#):

### 5.6 Representation of time values and "Infinity" as a time value

All time values for lifetimes, T1 and T2 are unsigned integers. The value 0xffffffff is taken to mean "infinity" when used as a lifetime (as in [RFC2461](#) [17]) or a value for T1 or T2.

Add the following sentence after the sentence in the last paragraph of [section 22.4](#) that begins "Recommended values...":

If the "shortest" preferred lifetime is 0xffffffff ("infinity"), the recommended T1 and T2 values are also 0xffffffff.

Add the following paragraph at the end of [section 22.4](#):

Care should be taken in setting T1 or T2 to 0xffffffff ("infinity"). A client will never attempt to extend the lifetimes of any addresses in an IA with T1 set to 0xffffffff. A client will never attempt to use a Rebind message to locate a different server to extend the lifetimes of any addresses in an IA with T2 set to 0xffffffff.

Add the following paragraph before the next-to-last paragraph of [section 22.6](#) (bottom of page 65 in [draft-ietf-dhc-dhcpv6-28.txt](#), after the paragraph added in [Section 9](#) of this document):

Care should be taken in setting the valid lifetime of an address to 0xffffffff ("infinity"), which amounts to a permanent assignment of an address to a client.

11. Client behavior in response to receipt of Reply message with StatusCode set to NoBinding

Issue: In [section 18.1.8](#), it's not clear if the client should continue to send Renew/Rebind messages as well as send a Request message in response to a Reply with a Status Code set to NoBinding.

Discussion: For each IA in the original Renew/Rebind, the client should:

- \* send a Request if the StatusCode in the IA is NoBinding
- \* send a Renew/Rebind if the IA is not in the Reply
- \* accept the response if the IA is in the Reply and there is no status code

Resolution: Change the text in the corresponding (third-to-last) paragraph in [section 18.1.8](#) to read:

When the client receives a Reply message in response to a Renew or Rebind message, the client examines each IA independently. For each IA in the original Renew or Rebind message, the client:

- + sends a Request message if the StatusCode in the IA is NoBinding (and does not send any additional Renew/Rebind messages)
- + sends a Renew/Rebind if the IA is not in the Reply message
- + otherwise accepts the information in the IA

12. Maximum value for Elapsed Time option

Issue: The value carried in the Elapsed Time option is an unsigned,

16 bit integer with a resolution of 1/100 of a second. The maximum time that can be represented in this format is roughly 11 minutes. What happens if the client's elapsed time exceeds the maximum value that can be represented in the Elapsed Time option?

Discussion: The value 0xffff should be used to represent any elapsed time value greater than the maximum time that can be represented in the Elapsed Time option.

Resolution: Add the following sentence to the end of [section 22.9](#):

The elapsed time value is an unsigned, 16 bit integer. The client uses the value 0xffff to represent any elapsed time values greater than the largest time value that can be represented in the Elapsed Time option.

### [13](#). Appearance of Elapsed Time option in DHCP messages

Issue: The table in [Appendix A](#) shows (incorrectly) that the Elapsed Time option may appear in Advertise and Reply messages.

Discussion: A server should not include an Elapsed Time option in Advertise and Reply messages.

Resolution: Edit the table in [Appendix A](#).

### [14](#). Acknowledgments

Thanks to Tatuya Jinmei for identifying many of these issues and for contributing to the discussion and resolution of the issues. This document was reviewed and discussed by Jim Bound, Ralph Droms, Tatuya Jinmei, Ted Lemon, Ole Troan, Bernie Volz and Jun Xie.

### References

- [1] Droms, R., Bound, J., Volz, B., Lemon, T., Perkins, C. and M. Carney, "Dynamic Host Configuration Protocol for IPv6 (DHCPv6)", [draft-ietf-dhc-dhcpv6-28](#) (work in progress), November 2002.

- [2] Narten, T., Nordmark, E. and W. Simpson, "Neighbor Discovery for IP Version 6 (IPv6)", [RFC 2461](#), December 1998.

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