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DNS Configuration options for Dynamic Host Configuration Protocol for IPv6 (DHCPv6)

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Abstract

This document describes Dynamic Host Configuration Protocol for IPv6 (DHCPv6) options for passing a list of available DNS recursive name servers and a domain search list to a client.

1. Introduction

This document describes two options for passing configuration information related to Domain Name Service (DNS) (RFC 1034 [6] and RFC 1035 [1]) in DHCPv6 (RFC 3315 [2]).

2. Terminology

The key words MUST, MUST NOT, REQUIRED, SHALL, SHALL NOT, SHOULD, SHOULD NOT, RECOMMENDED, MAY, and OPTIONAL in this document are to be interpreted as described in BCP 14, RFC 2119 [3].

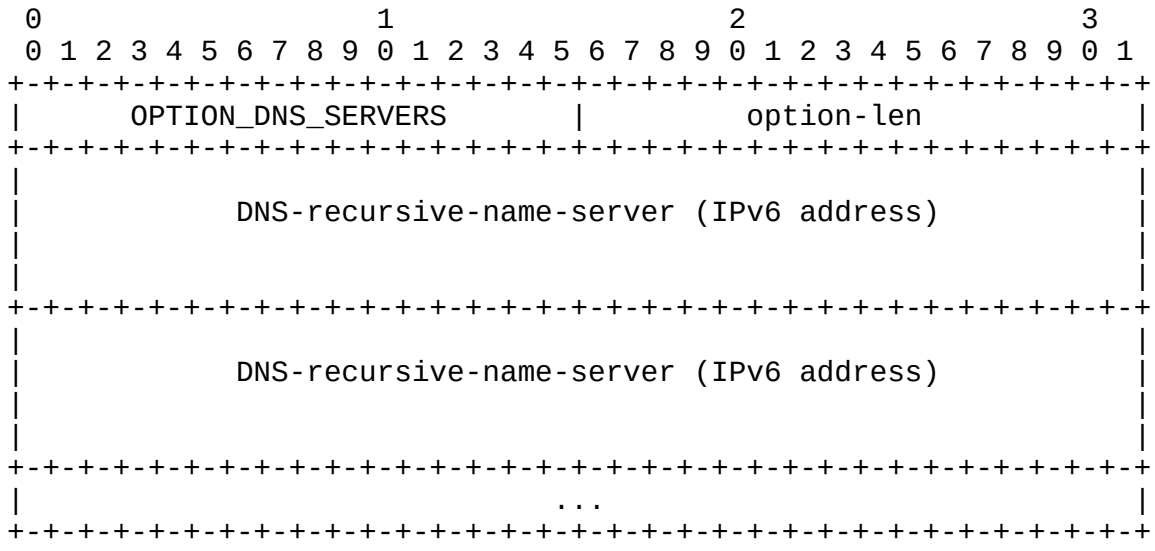
Throughout this document, unless otherwise specified, the acronym DHCP refers to DHCP for IPv6 (DHCPv6) as specified in RFC 3315.

This document uses terminology specific to IPv6 and DHCP as defined in section "Terminology" of RFC 3315.

3. DNS Recursive Name Server option

The DNS Recursive Name Server option provides a list of one or more IPv6 addresses of DNS recursive name servers to which a client's DNS resolver MAY send DNS queries [1]. The DNS servers are listed in the order of preference for use by the client resolver.

The format of the DNS Recursive Name Server option is:



option-code: OPTION_DNS_SERVERS (23)

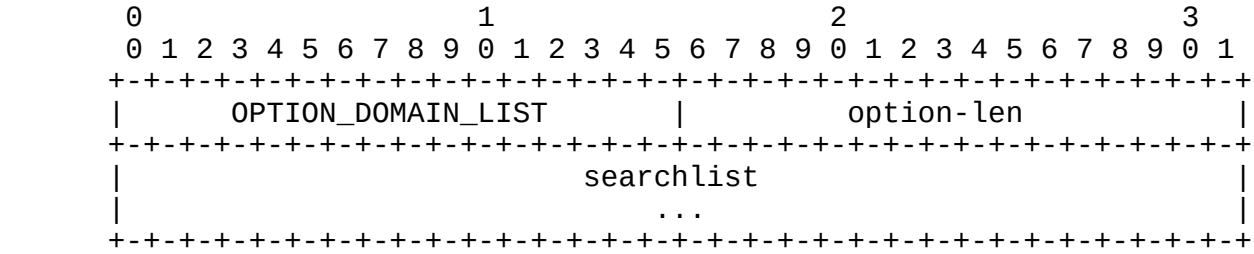
option-len: Length of the list of DNS recursive name servers in octets; must be a multiple of 16

DNS-recursive-name-server: IPv6 address of DNS recursive name server

4. Domain Search List option

The Domain Search List option specifies the domain search list the client is to use when resolving hostnames with DNS. This option does not apply to other name resolution mechanisms.

The format of the Domain Search List option is:



option-code: OPTION_DOMAIN_LIST (24)

option-len: Length of the 'searchlist' field in octets

searchlist: The specification of the list of domain names in the Domain Search List

The list of domain names in the 'searchlist' MUST be encoded as specified in section "Representation and use of domain names" of RFC 3315.

5. Appearance of these options

The DNS Recursive Name Server option MUST NOT appear in any other than the following messages: Solicit, Advertise, Request, Renew, Rebind, Information-Request, and Reply.

The Domain Search List option MUST NOT appear in any other than the following messages: Solicit, Advertise, Request, Renew, Rebind, Information-Request, and Reply.

6. Security Considerations

The DNS Recursive Name Server option may be used by an intruder DHCP server to cause DHCP clients to send DNS queries to an intruder DNS recursive name server. The results of these misdirected DNS queries may be used to spoof DNS names.

To avoid attacks through the DNS Recursive Name Server option, the DHCP client SHOULD require DHCP authentication (see section "Authentication of DHCP messages" in RFC 3315) before installing a list of DNS recursive name servers obtained through authenticated DHCP.

The Domain Search List option may be used by an intruder DHCP server to cause DHCP clients to search through invalid domains for incompletely specified domain names. The results of these

misdirected searches may be used to spoof DNS names. Note that support for DNSSEC [4] will not avert this attack, because the resource records in the invalid domains may be legitimately signed.

The degree to which a host is vulnerable to attack via an invalid domain search option is determined in part by DNS resolver behavior. RFC1535 [7] contains a discussion of security weaknesses related to implicit as well as explicit domain searchlists, and provides recommendations relating to resolver searchlist processing. Section 6 of RFC1536 [5] also addresses this vulnerability, and recommends that resolvers:

1. Use searchlists only when explicitly specified; no implicit searchlists should be used.

2. Resolve a name that contains any dots by first trying it as an FQDN and if that fails, with the names in the searchlist appended.

3. Resolve a name containing no dots by appending with the searchlist right away, but once again, no implicit searchlists should be used.

In order to minimize potential vulnerabilities it is recommended that:

1. Hosts implementing the domain search option SHOULD also implement the searchlist recommendations of RFC1536, section 6.

2. Where DNS parameters such as the domain searchlist or DNS servers have been manually configured, these parameters SHOULD NOT be overridden by DHCP.

3. A host SHOULD require the use of DHCP authentication (see section "Authentication of DHCP messages" in RFC 3315) prior to accepting a domain search option.

7. IANA Considerations

IANA has assigned an option code to the DNS Recursive Name Server option (23) and to the Domain Search List option (24) from the DHCP option code space defined in section "IANA Considerations" of RFC 3315.

8. Acknowledgements

This option was originally part of the DHCPv6 specification, written by Jim Bound, Mike Carney, Charlie Perkins, Ted Lemon, Bernie Volz and Ralph Droms.

The analysis of the potential attack through the domain search list is taken from the specification of the DHCPv4 Domain Search option, RFC3397 [8].

Thanks to Rob Austein, Alain Durand, Peter Koch, Tony Lindstrom and Pekka Savola for their contributions to this document.

9. References

9.1. Normative References

[1] Mockapetris, P., "Domain names - implementation and specification", STD 13, RFC 1035, November 1987.

[2] Bound, J., Carney, M., Perkins, C., Lemon, T., Volz, B. and R. Droms (ed.), "Dynamic Host Configuration Protocol for IPv6 (DHCPv6)", RFC 3315, May 2003.

[3] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

[4] Eastlake, D., "Domain Name System Security Extensions", RFC 2535, March 1999.

[5] Kumar, A., Postel, J., Neuman, C., Danzig, P. and S. Miller, "Common DNS Implementation Errors and Suggested Fixes", RFC 1536, October 1993.

9.2. Informative References

[6] Mockapetris, P., "Domain names - concepts and facilities", STD 13, RFC 1034, November 1987.

[7] Gavron, E., "A Security Problem and Proposed Correction With Widely Deployed DNS Software", RFC 1535, October 1993.

[8] Aboba, B. and S. Cheshire, "Dynamic Host Configuration Protocol (DHCP) Domain Search Option", RFC 3397, November 2002.

Intellectual Property Statement

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