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Distributing Address Selection Policy using DHCPv6
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Abstract

RFC 3484 defines default address selection mechanisms for IPv6 that allow nodes to select appropriate address when faced with multiple source and/or destination addresses to choose between. The RFC 3484 allowed for the future definition of methods to administratively configure the address selection policy information. This document defines a new DHCPv6 option for such configuration, allowing a site administrator to distribute address selection policy overriding the default address selection policy table, and thus control the address selection behavior of nodes in their site.

Status of this Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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1. Introduction

RFC 3484 [RFC3484] describes default algorithms for selecting an address when a node has multiple destination and/or source addresses to choose from by using an address selection policy. In Section 2 of RFC 3484, it is suggested that the default policy table may be administratively configured to suit the specific needs of a site. This specification defines a new DHCPv6 option for such configuration.

Some problems have been identified with the default RFC 3484 address selection policy [RFC5220]. It is unlikely that any default policy will suit all scenarios, and thus mechanisms to control the source address selection policy will be necessary. Requirements for those mechanisms are described in [RFC5221], while solutions are discussed in [I-D.ietf-6man-addr-select-sol] and [I-D.ietf-6man-addr-select-considerations]. Those documents have helped shape the improvements in the default address selection algorithm [I-D.ietf-6man-rfc3484-revise] as well as the DHCPv6 option defined in this specification.

1.1. Conventions Used in This Document

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 [RFC2119].

1.2. Terminology

This document uses the terminology defined in [RFC2460] and the DHCPv6 specification defined in [RFC3315]

2. Address Selection Policy option

The Address Selection Policy option provides the policy table for address selection rules as described in RFC 3484 and in [I-D.ietf-6man-rfc3484-revise].

Each end node is expected to configure its policy table, as described in RFC 3484, using the Address Selection Policy option as described in the section below on processing the option.

Multiple Address Selection Policy options MAY appear in a DHCPv6 message. They constitute a single policy table.

The format of the Address Selection Policy option is given below.

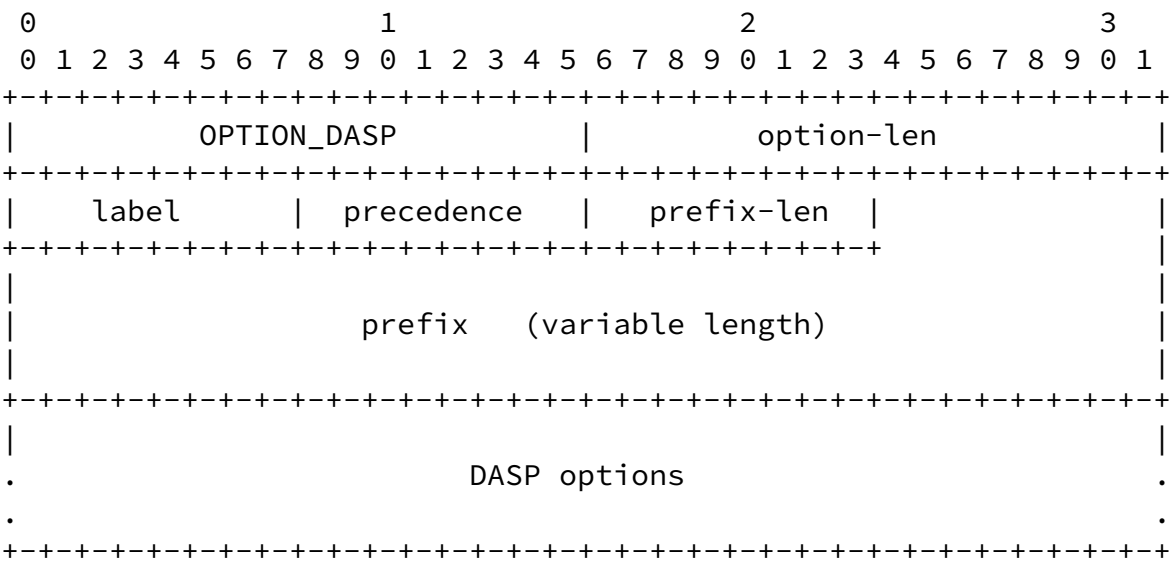


Figure 1: Address Selection Policy option format

option-code: OPTION_DASP (TBD).

option-len: The total length of the label field, precedence field, prefix-len field, prefix field, and DASP options field in octets.

label: An 8-bit unsigned integer; this value is used to make a combination of source address prefixes and destination address prefixes.

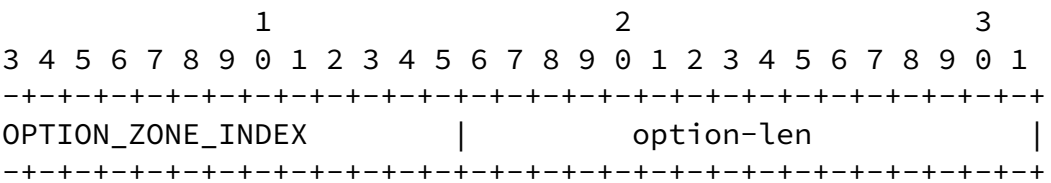
precedence: An 8-bit unsigned integer; this value is used for sorting destination addresses.

prefix-len: An 8-bit unsigned integer; the number of leading bits in the prefix that are valid. The value ranges from 0 to 128.

prefix: A variable-length field containing an IP address or the prefix of an IP address. An IPv4-mapped address [RFC4291] must be used to represent an IPv4 address as a prefix value. The Prefix should be truncated on the byte boundary. So the length of this field should be between 0 and 16 bytes.

DASP options: Options specific to this particular Address Selection Policy option. This includes, but not limited to, zero or one PREFIX_ZONE option that specify the zone index of the prefix in this option.

The format of the Zone Index option is given below.



```
|                          zone-index                           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 2: Zone Index option format

option-code: OPTION_ZONE_INDEX (TBD).

option-len: 4.

zone-index: The zone-index field is an 32-bit unsigned integer, and used to specify the zone for scoped addresses. The zone-index is defined in RFC 3493 [RFC3493] as 'scope ID'.

3. Appearance of the Address Selection Policy option

The Address Selection Policy option MUST NOT appear in any messages

other than the following ones: Solicit, Advertise, Request, Renew, Rebind, Reconfigure, Information-Request, and Reply.

4. Processing the Address Selection Policy option

This section describes how to process received Address Selection Policy options at the DHCPv6 client.

When a host receives a DHCPv6 message that includes multiple Address Selection Policy options, they MUST be treated as a single policy table.

This option's concept is to serve as a hint for a node about how to behave in the network. So, basically, it should be up to the node's administrator how to make use of or even ignore the received policy information.

4.1. Handling of the local policy table

RFC 3484 defines the default policy table. Also, a user is usually able to configure the policy table to satisfy his requirement.

The client node SHOULD provide the following choices:

a) It receives distributed policy table, and replaces the existing policy tables with that.
b) It preserves the default policy table, or manually configured policy.

4.2. Handling of the stale policy table

When the information from the DHCP server goes stale, the policy received form the DHCP server should be removed and the default policy should be restored.

The received information can be considered stale in several cases, such as, when the interface goes down, the DHCP server does not respond for a certain amount of time, and the Information Refresh Time is expired.

4.3. Processing multiple received policy tables

The policy table is node-global information by its nature. So, the node cannot use multiple received policy tables at the same time. In other words, once the received policy from one source is merged with another source, the policy is more or less changed. The policy table is defined as a whole, so the slightest addition/deletion from the

policy table brings a change in semantics of the policy.

It also should be noted that, when a node is single-homed and has only one upstream line, adopting a received policy table does not degrade the security level.

Under the above assumptions, we specify how to handle multiple received policy tables below.

A node MAY use OPTION_DASP in any of the following two cases:

1: The address selection option is delivered across the only secure, trusted channel.
2: The address selection option delivery is not secured, but the node is single-homed.

In other cases the node MUST NOT use OPTION_DASP unless the node is specifically configured to do so.

5. Implementation Considerations

- The value 'label' is passed as an unsigned integer, but there is no special meaning for the value, that is whether it is a large or small number. It is used to select a preferred source address prefix corresponding to a destination address prefix by matching the same label value within the DHCP message. DHCPv6 clients need to convert this label to a representation specified by each implementation (e.g., string).

- Currently, the label and precedence values are defined as 8-bit unsigned integers. In almost all cases, this value will be enough.

- The maximum number of address selection rules that may be conveyed in one DHCPv6 message depends on the prefix length of each rule and the maximum DHCPv6 message size defined in RFC 3315. It is possible to carry over 3,000 rules in one DHCPv6 message (maximum UDP message size). However, it should not be expected that DHCP clients, servers and relay agents can handle UDP fragmentation. So, the number of the options and the total size of the options should be taken care of.

- Since the number of selection rules could be large, an administrator configuring the policy to be distributed should consider the resulting DHCPv6 message size.

6. Security Considerations

A rogue DHCPv6 server could issue bogus address selection policies to a client. This might lead to incorrect address selection by the client, and the affected packets might be blocked at an outgoing ISP because of ingress filtering. Alternatively, an IPv6 transition mechanism might be preferred over native IPv6, even if it is available. To guard against such attacks, a legitimate DHCPv6 server

should be communicated through a secure, trusted channel, such as a channel protected by IPsec, SEND and DHCP authentication, as described in section 21 of RFC 3315,

Another threat is about privacy concern. As in the security consideration section of RFC 3484, at least a part of, the address selection policy stored in a host can be leaked by a packet from a remote host. This issue will not be degraded regardless of the introduction of this option, or regardless of whether the host is multihomed or not.

7. IANA Considerations

IANA is requested to assign option codes to OPTION_DASP from the option-code space as defined in section "DHCPv6 Options" of RFC 3315.

8. References

8.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

[RFC3315] Droms, R., Bound, J., Volz, B., Lemon, T., Perkins, C., and M. Carney, "Dynamic Host Configuration Protocol for IPv6 (DHCPv6)", RFC 3315, July 2003.

[RFC3484] Draves, R., "Default Address Selection for Internet Protocol version 6 (IPv6)", RFC 3484, February 2003.

8.2. Informative References

[I-D.ietf-6man-addr-select-considerations]
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[RFC2460] Deering, S. and R. Hinden, "Internet Protocol, Version 6 (IPv6) Specification", RFC 2460, December 1998.

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[RFC4941] Narten, T., Draves, R., and S. Krishnan, "Privacy Extensions for Stateless Address Autoconfiguration in IPv6", RFC 4941, September 2007.

[RFC5220] Matsumoto, A., Fujisaki, T., Hiromi, R., and K. Kanayama, "Problem Statement for Default Address Selection in Multi-Prefix Environments: Operational Issues of RFC 3484 Default Rules", RFC 5220, July 2008.

[RFC5221] Matsumoto, A., Fujisaki, T., Hiromi, R., and K. Kanayama, "Requirements for Address Selection Mechanisms", RFC 5221, July 2008.

Appendix A. Past Discussion

- The 'zone index' value is used to specify a particular zone for scoped addresses. This can be used effectively to control address selection in the site scope (e.g., to tell a node to use a specified source address corresponding to a site-scoped multicast address). However, in some cases such as a link-local scope address, the value specifying one zone is only meaningful locally within that node. There might be some cases where the administrator knows which clients are on the network and wants specific interfaces to be used though. However, in general case, it is hard to use this value.

- Since we got a comment that some implementations use 32-bit integers for zone index value, we extended the bit length of the 'zone index' field. However, as described above, there might be few cases to specify 'zone index' in policy distribution, we defined this field as optional, controlled by a flag.

- There may be some demands to control the use of special address types such as the temporary addresses described in RFC4941 [RFC4941], address assigned by DHCPv6 and so on. (e.g., informing not to use a temporary address when it communicate within the an organization's network). It is possible to indicate the type of addresses using reserved field value.

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