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Usage of Host Generating Interface Identifier in DHCPv6
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Abstract

This document describes a procedure for configuring a host's IPv6 address which prefix is allocated from a DHCPv6 server while it's interface identifier is independently generated by the host. The method is applicable to Cryptographically Generated Addresses (CGA).

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

[RFC3315] describes the operation of address assignment by a DHCP server. A client uses a Solicit message to discover DHCP servers configured to assign addresses. A server sends an Advertise message in response to announce the availability of the server to the client. The client then uses a Request message to request addresses. The server then returns addresses in a Reply message. The operation assumes that the server is responsible for the assignment of an integral address which include prefix and interface identifier parts as described in [RFC4291].

[RFC3633] defines Prefix Delegation options providing a mechanism for automated delegation of IPv6 prefixes using the DHCPv6. This mechanism is intended for delegating a long-lived prefix from a delegating router to a requesting router. The practice of separating prefix assignment from interface identifier assignment is only used for routers not hosts.

[RFC3972] describes a method for binding a public signature key to an IPv6 address in the Secure Neighbor Discovery (SEND) protocol [RFC3971]. The basic idea is to generate the interface identifier (i.e., the rightmost 64 bits) of the IPv6 address by computing a cryptographic hash of the public key. That is, the host decides its interface identifier. As for the prefix part of the CGA, it is probably got through Router Advertisement message defined in [RFC4861], or through DHCPv6 operations defined in this document.

[I-D.ietf-csi-dhcpv6-cga-ps] describes potential issues in the interaction between DHCPv6 and CGA. A usage of DHCPv6 for generating CGA is proposed in the document to facilitate separation of prefix and interface identifier assignment. A host’s IPv6 address prefix is allocated from a DHCPv6 server while interface identifier is independently generated by the host.

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 [RFC2119].

The terminology in this document is based on the definitions in [RFC3315], in addition to the ones specified in this section

derivative prefix: A prefix is derived from another prefix. For example, a /64 prefix is derived from a /48 prefix, that is, the /64 prefix has the same leftmost 48 bits with the /48 prefix.

authorized prefix: A specific router is given a specific set of subnet prefixes to advertise; other routers have an authorization to advertise other subnet prefixes. In [RFC3971],Certification Path Advertisement message is used to convey authorized prefixes.

3. Address Auto-configuration in SEND

Router Advertisements in [RFC4861] allow routers to inform hosts how to perform Address Auto-configuration. For example, routers can specify whether hosts should use DHCPv6 and/or stateless address configuration. In Router Advertisement message, M and O bits are used for indication of address auto-configuration mode.

Whatever address auto-configuration mode a host uses, the following two parts are necessary for the host to formulate it's IPv6 address:

- A prefix part. In [RFC3971], Certification Path Solicitation and Certification Path Advertisement messages are designed for verifying routers being authorized to act as routers. Certification Path Advertisement message can also be used to verify that routers are authorized to advertise a certain set of subnet prefixes. In stateless auto-configuration mode, the prefixes in Router Advertisement message should be a subset of authorized prefixes, or derivative prefixes from authorized prefixes. In the stateful auto-configuration mode, Section 4 illustrates a procedure for prefix allocation from a DHCPv6 server.
- An interface identifier. The basic idea of [RFC3972] is to generate the interface identifier (i.e., the rightmost 64 bits) of the IPv6 address by computing a cryptographic hash of a public key of a host. The host is responsible for interface identifier generation.

4. DHCPv6 Operation

Figure 1 shows the operation of separating prefix assignment and interface identifier generation.

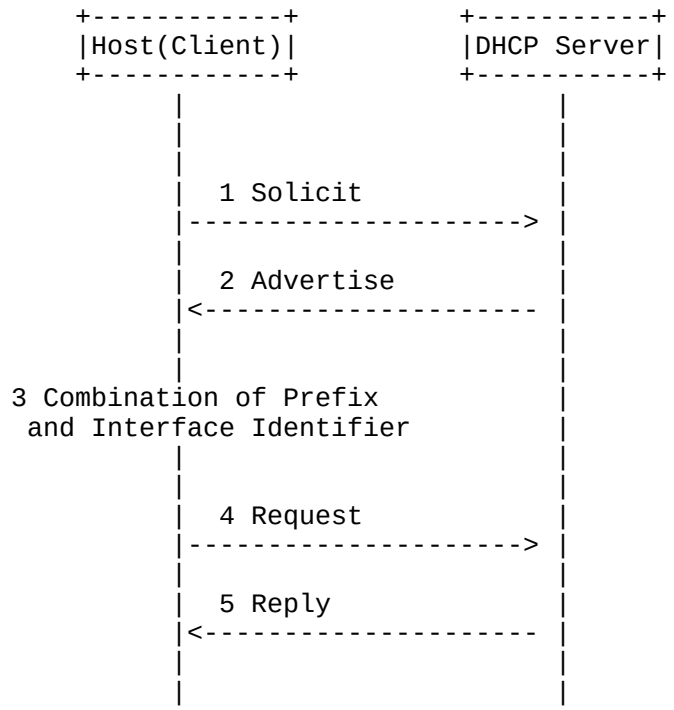


Figure 1: DHCPv6 Operation

1. A host uses a Solicit message to discover DHCP servers configured to assign prefixes for the host. Identity Association for Prefix Delegation Option (IA_PD) is defined in [RFC3633] for prefix delegation between a requesting router and delegating router. Referring to the definition, we design Identity Association for Prefix Assignment Option (IA-PA) in Section 5.1 for prefix assignment from a DHCPv6 server to a host. The host uses hints for prefix assignment preference. The hints are authorized prefixes advertised by an authorized router through Certification Path Advertisement defined in [RFC3971].
2. Based on the hints, the DHCP server assigns one or more prefixes to the host. The assigned prefixes SHOULD be a subset of the authorized prefixes or derivative prefixes of the authorized prefixes. Identity Association for Prefix Assignment Option in Section 5.1 is used for conveying the assigned prefixes. If there is not a proper prefix available, a status-code is returned to the host and the procedure is terminated.
3. The host generates an interface identifier and formulates a combined IPv6 address by concatenating the assigned prefix and the self-generated interface identifier. There are many ways to

generate interface identifier. [RFC3972] defines a method to generate the interface identifier by computing a cryptographic hash of a public key of the host.

4. The host sends a Request message for confirming usage of the combined address. An IA Address option described in Section 5.3 SHOULD be included to convey the combined address.
5. The DHCP server SHOULD verify the uniqueness of the combined IP address, and send Reply with IA Address option to grant the usage of the combined address. Otherwise, a status code is included to deny the usage of the combined address.

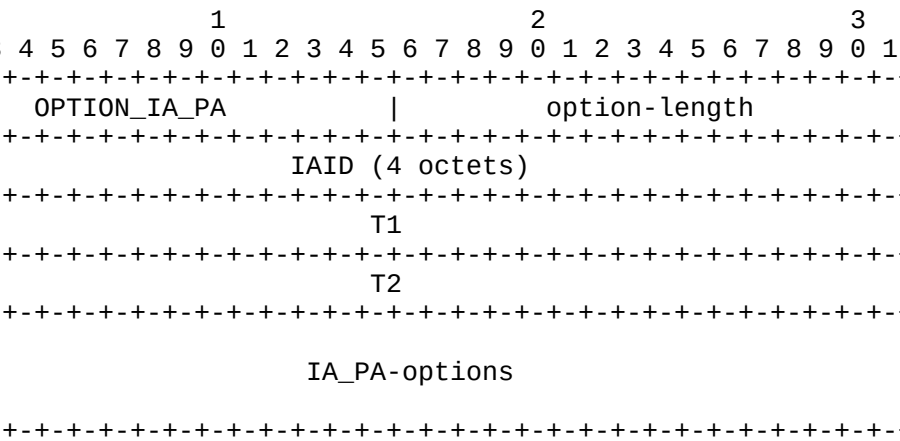
5. DHCPv6 Options

In this section, one new option is defined, Identity Association for Prefix Assignment Option . At the same time, we extend the usage of existing options, IA_PD Prefix and IA Address option.

5.1. Identity Association for Prefix Assignment Option

The IA_PA option is used to carry a prefix assignment identity association, the parameters associated with the IA_PA and the prefixes associated with it.

The format of the IA_PA option is:



option-code: OPTION_IA_PA (TBA1)

option-length: 12 + length of IA_PA-options field.

IAID: The unique identifier for this IA_PA; the IAID must be unique among the identifiers for all of this host's IA_PAs.

T1: The time at which the host should contact the DHCPv6 server from which the prefixes in the IA_PA were obtained to extend the lifetimes of the prefixes assigned to the IA_PA; T1 is a time duration relative to the current time expressed in units of seconds.

T2: The time at which the host should contact any available DHCPv6 server to extend the lifetimes of the prefixes assigned to the IA_PA; T2 is a time duration relative to the current time expressed in units of seconds.

IA_PA-options: Options associated with this IA_PA.

The details of the fields are similar to the IA_PD option description in [RFC3633]. The difference is here a DHCP server and a host involved, while a delegating router and requesting router involved in [RFC3633].

5.2. IA_PD Prefix option

IA_PD Prefix option in [RFC3633] is reused here. Originally the option is used for conveying prefix information between a delegating router and a requesting router. Here the IA_PD Prefix option is used to specify IPv6 address prefixes associated with an IA_PA in Section 5.1. The IA_PD Prefix option must be encapsulated in the IA_PA-options field of an IA_PA option.

5.3. IA Address Option

The IA Address option in [RFC3315] is reused here. It must be encapsulated in the Options field of an IA_NA or IA_TA option. IA_NA and IA_TA are also described in [RFC3315].

A host sends a DHCPv6 message with an IA Address option to a DHCPv6 server for validating the usage of an address in the option.

6. Applicability

In point-to-point link model, DHCPv6 operation with host generating interface identifier described in this document may be used. [RFC4968] provides different IPv6 link models that are suitable for 802.16 based networks and a point-to-point link model is recommended. Also, 3GPP and 3GPP2 have earlier adopted the point-to-point link model based on the recommendations in [RFC3314]. In this model, one prefix can only be assigned to one interface of a host (mobile station) and different hosts (mobile stations) can’t share a prefix. The unique prefix can be used to identify the host. It is not necessary for a DHCP server to generate an interface identifier for the host. The host may generates it’s interface identifier as described in [RFC4941]. An interface identifier could even be generated via random number generation.

7. IANA consideration

This document defines a new DHCPv6 [RFC3315] option, which must be assigned Option Type values within the option numbering space for DHCPv6 messages:

The OPTION_IA_PA Option (TBA1), described in Section 5.1.

8. Security Considerations

Security considerations in DHCPv6 are described in [RFC3315].

To guard against attacks through prefix assignment and address confirmation, a host and a DHCPv6 server SHOULD use DHCP authentication as described in section "Authentication of DHCP messages" of [RFC3315].

9. Acknowledgements

10. References

10.1. Normative References

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10.2. Informative references

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[RFC3314] Wasserman, M., "Recommendations for IPv6 in Third Generation Partnership Project (3GPP) Standards",

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