Network Working Group
Internet-Draft
Intended status: Standards Track
Expires: October 27, 2011

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April 25, 2011

Prefix Assignment in DHCPv6
draft-xia-dhc-host-gen-id-04.txt

Abstract

This document describes a procedure for configuring hosts' IPv6 address which the prefix is assigned from a DHCPv6 server through DHCPv6 protocol while the interface identifiers are independently generated by the hosts. The method is applicable to Cryptographically Generated Addresses (CGA), and other host-generated IPv6 addresses.

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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This Internet-Draft will expire on October 27, 2011.

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1. Introduction

[RFC3315] describes the operation of address assignment by a DHCPv6 server. A client uses a Solicit message to discover DHCPv6 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. The 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.

There are also other host-generated IPv6 addresses. Modified EUI-64 interface identifier [EUI-64] is typically generated by hosts. The DHCPv6 operations defined in this document also supports such address methods.

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

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. 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 the stateless auto-configuration address 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 address mode, prefix assignment from a DHCPv6 server is not currently support.
- An interface identifier. Modified EUI-64 interface identifier [EUI-64] is a widely-used host generated interface identifier. It generates interface identifier from the host MAC address. The interface identifier of [RFC3972] is generated by computing a cryptographic hash of a public key of a host. The host is responsible for interface identifier generation.

In the ND-managed environment, RA is used to assign the prefix.

So far, there is no mechanism to support the scenario that prefixes are managed by a DHCPv6 server. The DHCPv6 operation defined in this document enables the DHCPv6 server to assign a prefix, rather than a integral address, to the host, so that the host can obtain an IPv6 address by combining the prefix with its own generated interface identifier. It actually enables the auto address configuration

through DHCPv6.

4. DHCPv6 Operation

Figure 1 shows the operation of separating prefix assignment and interface identifier generation in the DHCPv6.

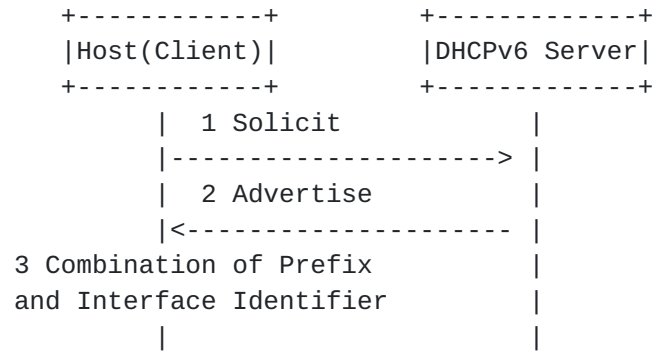


Figure 1: DHCPv6 Operation

1. A host uses a Solicit message to discover DHCPv6 servers that have been 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, a new Identity Association for Prefix Assignment (IA-PA) option is defined in Section 5.1 to enable the prefix assignment from a DHCPv6 server to a host.
2. The DHCPv6 server assigns one or more prefixes to the host in Advertise messages or in the Reply messages to the prefix requests from the hosts. 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. When receiving multiple prefixes, the host may use pre-configured hints for prefix assignment preference. The hints are authorized prefixes advertised by an authorized router through Certification Path Advertisement defined in [RFC3971].
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. Modified EUI-64 interface identifier [EUI-64] is generated based on the host MAC address.

After the host generates an IPv6 address using the above procedure, the host may send a Request message to the DHCPv6 server in order to confirm the usage of the new address. The confirmation procedure may be completed together with the address registration procedure. However, the confirmation procedure is out of scope.

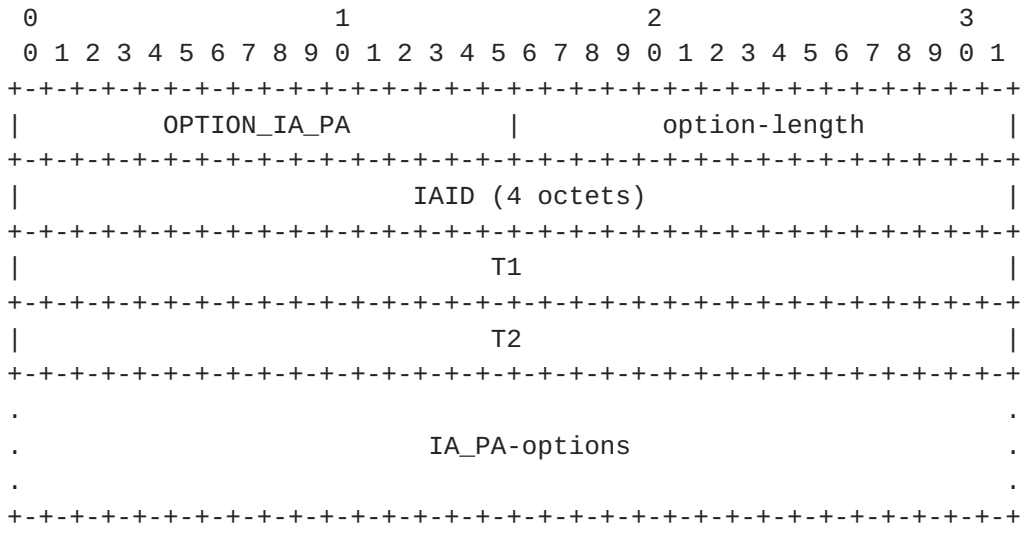
5. DHCPv6 IA_PA Option

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 DHCPv6 server and a host involved, while a delegating router and requesting router involved in [RFC3633].

5.2. IA_PA Prefix Option

OPTION_IAPREFIX (26) "IA_PD Prefix Option" defined in Section 10 of [RFC3633] is reused.

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.

6. Applicability

In point-to-point link model, DHCPv6 operation with host-generated 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 DHCPv6 server to generate an interface identifier for the host. The host may generate its 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, a host and a DHCPv6 server SHOULD use DHCPv6 authentication as described in Section 21, "Authentication of DHCP messages" of [RFC3315] or Secure DHCPv6 [I-D.ietf-dhc-secure-dhcpv6] .

9. Acknowledgements

The authors would like to thanks Suresh Krishnan and other members of DHC WG for their valuable comments.

10. References

10.1. Normative References

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10.2. Informative references

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