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Definition of the UUID-Based DHCPv6 Unique Identifier (DUID-UUID)

Abstract

This document defines a new DHCPv6 Unique Identifier (DUID) type called DUID-UUID. DUID-UUIDs are derived from the already-standardized Universally Unique IDentifier (UUID) format. DUID-UUID makes it possible for devices to use UUIDs to identify themselves to DHC servers and vice versa. UUIDs are globally unique and readily available on many systems, making them convenient identifiers to leverage within DHCP.

Status of This Memo

This is an Internet Standards Track document.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on Internet Standards is available in Section 2 of RFC 5741.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at http://www.rfc-editor.org/info/rfc6355.

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1. Introduction

DHCP Unique Identifiers (DUIDs) are used in DHCPv6 to identify clients and servers. This document defines a new DHCP Unique Identifier (DUID) type that embeds a Universally Unique IDentifier (UUID) [RFC4122]. UUIDs are already in widespread use and serve as an existing identifier that could be leveraged by DHCPv6. For example, x86-based systems ship with an embedded UUID in firmware that is readily available to the software running on the device.

Although DUIDs are new to DHCPv6, identifying clients in DHCP via a UUID is not. DHCPv4 [RFC2132] defines a Client Machine Identifier Option (option 97) that embeds a UUID (aka a Globally Unique Identifier (GUID)) [RFC4578]. This document extends that capability to DHCPv6.

Terminology specific to IPv6 and DHCPv6 is used as defined in the "Terminology" sections of [RFC3315].

2. Background

In DHCPv6, clients identify themselves to servers via DHCP Unique Identifiers (DUIDs) [RFC3315]. DUIDs are identifiers that DHCP servers treat as opaque objects with no internal structure. DUIDs are intended to be globally unique, with no two devices using the same DUID. Three DUIDs types have been defined previously:

DUID-LLT - the Link-Layer address of one of the device’s network interfaces, concatenated with a timestamp

DUID-EN - an Enterprise Number plus additional information specific to the enterprise

DUID-LL - the Link-Layer address of one of the device’s network interfaces

DUIDs are intended to remain constant over time, so that they can be used as permanent identifiers for a device. In the case of DUID-LLTs, they are intended to be generated once, stored in stable storage, and reused from that point forward.

One issue that has arisen concerns devices that employ multi-step network boot loading. An initial step (typically run out of firmware) loads a small image that, in turn, loads a second image and so forth until the actual target system is loaded. Each step in the booting process may invoke DHCP. In some operational environments, it is important that each step in the sequence use the same DUID, so that the server knows it is getting requests from the same device and can return the proper configuration information (including the pointer to the correct image to load).

Unfortunately, none of the previously defined DUIDs are ideal for multi-step network booting. The DUID-LLT and DUID-LL identifiers that a given device may use are not guaranteed to remain constant across each booting step. Even if the different stages used DUID-LL or DUID-LLT, on devices with multiple interfaces, there is no way to guarantee that the same interface (and hence DUID) will be selected. Finally, in the case of DUID-LLT, even if the same interface is chosen, it can be difficult to ensure that each stage uses the same timestamp value. While a DUID-EN could be defined and used, such usage is proprietary by definition.

This document defines a new DUID type, based on the Universally Unique IDentifier (UUID) [RFC4122]. UUIDs are already used in practice and serve as an existing identifier that could be leveraged by DHCP. In some environments, a UUID-based DUID is preferable to the other existing DUID types.

It should be noted that use of a DUID-UUID will not, by itself, solve all the network boot problems described in this document. Given the availability of a suitable DUID-UUID, implementations will still need to take steps to ensure that all boot stages use the same DUID-UUID as appropriate. Given that DHCP has already defined multiple DUID types, the question of which of several DUIDs to select from already exists, and defining a new DUID type does not, by itself, help. It is believed, however, that network boot services can be configured to use a DUID-UUID and that other software can do so as well. Ensuring this happens in general is beyond the scope of this document.

3. UUID Considerations

Although many UUIDs are in use today, not all UUIDs meet DHCP's requirements (see Section 9 of [RFC3315]). DHCP UUIDs should be persistent across system restarts, system reconfiguration events,

system software and operating system upgrades or reinstallation as well as be easily available to any part of the boot process that requires access to the DHCP UUID. For example, UUIDs used in Microsoft's Component Object Module (COM), and for labeling partitions in filesystems, are likely not appropriate as they may not be accessible to firmware boot loaders and can change over time.

Implementations of this specification using DUID-UUID must select a UUID that is persistent across system restart and reconfiguration events and that is available to all DHCP protocol agents that may need to identify themselves. For instance, a UUID that is part of the system firmware, or managed by the system firmware, satisfies this requirement.

4. DUID-UUID Format

The DUID-UUID is carried within Client Identifier or Server Identifier options. It has the following format:

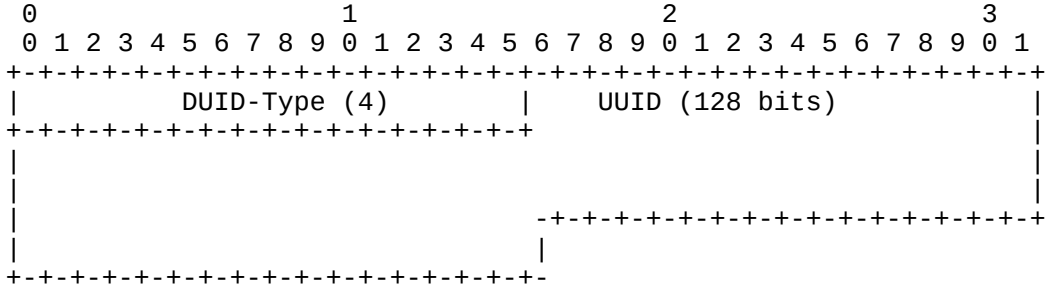

Figure 1: DUID-UUID Format

DUID-Type - DUID-UUID (4) - (16 bits)

UUID - An [RFC4122] UUID (128 bits)

5. Acknowledgements

This document was inspired by a discussion on the DHC mailing list in November 2009 on the topic of netboot for IPv6. Specifically, some scenarios were described where it was difficult to do something in DHCPv6 that had worked well in DHCPv4.

We would like to thank the following individuals in particular for their specific comments and suggestions on this document: Thomas Huth, Andre Kostur, Stephen Jacob, Suresh Krishnan, Ted Lemon, Bernie Volz, and Vincent Zimmer.

6. IANA Considerations

IANA has assigned the value 4 for use by the DHCPv6 DUID-UUID type.

7. Security Considerations

DHCP traffic between a client and server is sent in the clear. An eavesdropper residing on the path between the client and server could see DHCP traffic and obtain the UUID for a particular machine. This may raise some privacy issues but is not a new issue brought on by the use of the DUID type defined in this document.

8. References

8.1. Normative References

[RFC2132] Alexander, S. and R. Droms, "DHCP Options and BOOTP Vendor Extensions", RFC 2132, 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.

[RFC4122] Leach, P., Mealling, M., and R. Salz, "A Universally Unique IDentifier (UUID) URN Namespace", RFC 4122, July 2005.

8.2. Informative Reference

[RFC4578] Johnston, M. and S. Venaas, "Dynamic Host Configuration Protocol (DHCP) Options for the Intel Preboot eXecution Environment (PXE)", RFC 4578, November 2006.

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