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DHCPv6 Remote Boot Options
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Abstract

This document describes a means by which to support network boot of a bare-metal platform utilizing a pre-boot execution environment, such as the Unified Extensible Firmware Interface [UEFI22]. The problem being addressed is that the PXE [PXE21] and UEFI Specifications [UEFI22] only describe how to ascertain boot configuration options using DHCPv4 [RFC2131], not for DHCPv6 [RFC3315]. Similarly, iSCSI boot [RFC4173] does not specify how to discover boot device information in an DHCPv6 environment. This document will describe

how to ascertain this boot information in an IPv6 environment utilizing options in the DHCPv6 hand-off [RFC3315].

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1. Introduction

Many hosts today have the ability to boot an Operating System image (or "boot file") that is located on a server in the network. To do so, the host must begin with some functionality just sufficient to be able to get on the network and retrieve the boot file. As indicated in Figure 1, it is desirable to obtain from DHCP the information needed to locate the boot file, so that by the time the host is able to communicate on the network, it can immediately begin downloading the boot file.

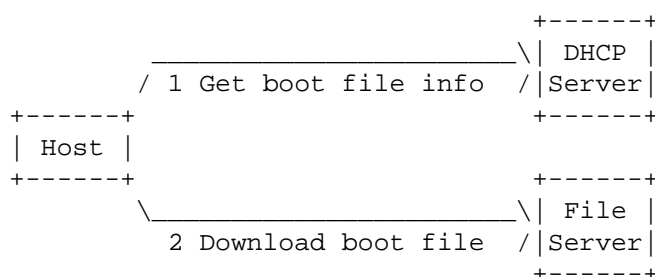


Figure 1: Network Boot Sequence

Two methods for downloading a boot file are specified today.

- o iSCSI: [RFC2132] specifies a DHCPv4 option for retrieving boot file information and [RFC4173] specifies how to download the boot file.
- o TFTP: [RFC2132] and [RFC4578] specify DHCPv4 options for retrieving boot file information and [RFC1350] specifies how to download the boot file.

The problem with both is that while the methods for downloading the boot files can work over either IPv4 or IPv6, the boot file info can only be obtained over DHCPv4. As a result, they do not support a network that only provides IPv6, nor do they support IPv6-only devices. To address this gap, this document specifies DHCPv6 options that provide parity with the DHCPv4 options.

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].

2. DHCPv6 Options

2.1. Root Path Option

The Root Path option specifies the path-name that contains the client's root disk. The path is formatted as a character string consisting of characters from the NVT ASCII character set.

This option provides parity with the Root Path Option defined for DHCPv4 in [RFC2132] section 3.19.

```

      0               1               2               3
      0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          OPTION_ROOT_PATH          |          option-len          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
.                                     .
.          root-disk-pathname (variable length)          .
.                                     .
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

option-code OPTION_ROOT_PATH (TBD1).

option-len Length of Root Path Name in octets.

root-disk-pathname See below

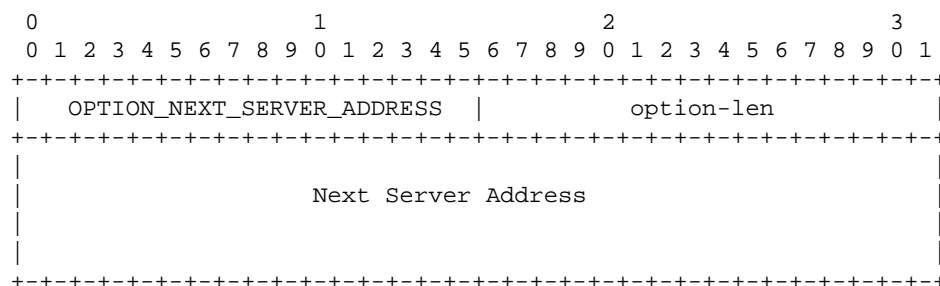
This NULL-terminated ASCII string is the URL (conforming to [RFC2396]) to a boot file. This string starts with the protocol which is used for downloading. Separated by '://', the hostname or IPv6 address of the server hosting the boot file (see also the note below), the path, file name and query parts of the URL follow. For iSCSI, the format of the URL is specified in [RFC4173] section 5.

2.2. Next Server Address Option

This option conveys the address of the server to use in the next step of the client's bootstrap process. A DHCP server may return its own address in this option, if the server is prepared to supply the next bootstrap service (e.g., delivery of an operating system executable image).

This option provides parity with the siaddr field in DHCPv4.

The format of the option is:



option-code OPTION_NEXT_SERVER_ADDRESS (TBD3).

option-len 16

Next Server Address The IPv6 address or IPv4-mapped address of the next server

2.3. Boot File Size Option

This option specifies the length in 512-octet blocks of the default boot image for the client. The file length is specified as a 32-bit integer.

This option provides parity with the Boot File Size Option defined for DHCPv4 in [\[RFC2132\] section 3.15](#).

The format of the option is:

```

      0               1               2               3
    0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|   OPTION_BOOT_FILE_SIZE   |   option-len   |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|       File Size          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

option-code OPTION_BOOT_FILE_SIZE (TBD4).

option-len 4

File Size The length in 512-octet blocks of the boot image for the client.

2.4. Client System Architecture Type Option

This option provides parity with the Client System Architecture Type Option defined for DHCPv4 in [\[RFC4578\] section 2.1](#).

The format of the option is:

```

      0               1               2               3
    0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|   OPTION_CLIENT_ARCH_TYPE   |   option-len   |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
.
.   Processor Architecture Type (variable length)   .
.
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

option-code OPTION_CLIENT_ARCH_TYPE (TBD5).

option-len See below.

Processor Architecture Type A list of one or more architecture types, as specified in [\[RFC4578\] section 2.1](#).

2.5. Client Network Interface Identifier Option

The Client Network Interface Identifier option is sent by a DHCP client to a DHCP server to provide information about its level of Universal Network Device Interface (UNDI) support.

This option provides parity with the Client Network Interface Identifier Option defined for DHCPv4 in [\[RFC4578\] section 2.2](#).

The format of the option is:

```

      0                               1                               2                               3
      0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-----+-----+-----+-----+-----+-----+-----+-----+
|                   OPTION_NII                   | option-len |
+-----+-----+-----+-----+-----+-----+-----+-----+
|   Type   |   Major   |   Minor   |
+-----+-----+-----+-----+-----+-----+-----+

```

option-code OPTION_NII (TBD6).

option-len 3

Type As specified in [\[RFC4578\] section 2.2](#).

Major As specified in [\[RFC4578\] section 2.2](#).

Minor As specified in [\[RFC4578\] section 2.2](#).

2.6. iSNS Option

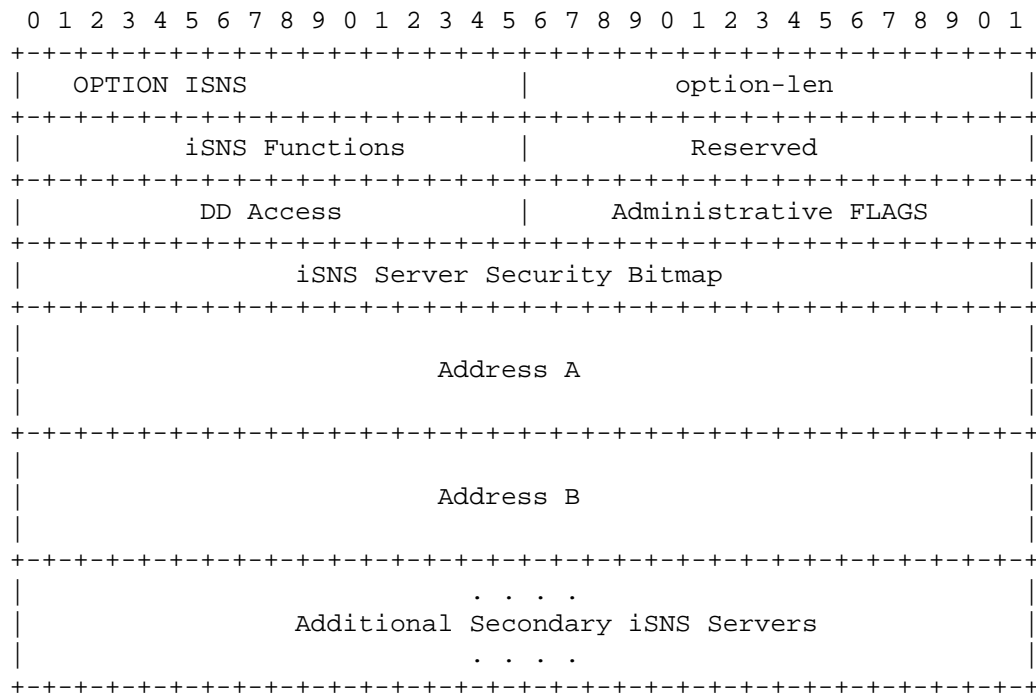
As specified in [\[RFC4173\] section 6](#), iSCSI boot requires either iSNS or SLP support.

This option provides parity with the iSNS Option defined for DHCPv4 in [\[RFC4174\] section 2](#).

```

      0                               1                               2                               3

```

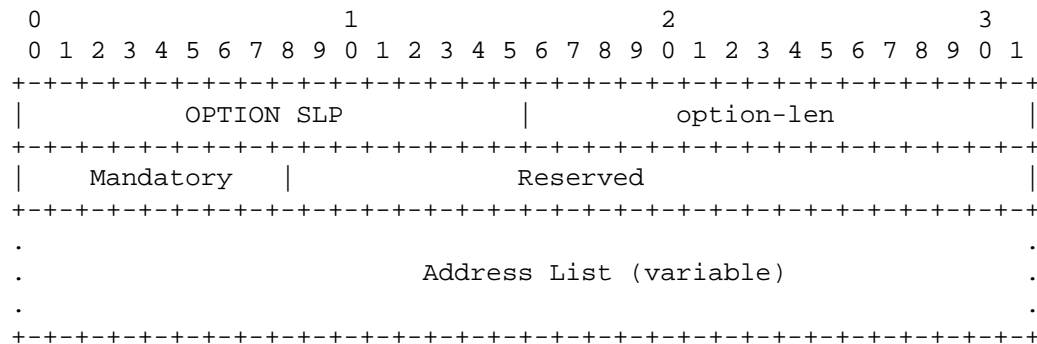


option-code	OPTION_ISNS (TBD7)
option-len	2
iSNS Functions	As specified in [RFC4174] section 2 .
Reserved	MUST be set to zero
DD Access	As specified in [RFC4174] section 2 .
Administrative FLAGS	As specified in [RFC4174] section 2 .
iSNS Server Security Bitmap	As specified in [RFC4174] section 2 .
Address A	As specified in [RFC4174] section 2 , except that it contains an IPv6 address.
Address B	As specified in [RFC4174] section 2 , except that it contains an IPv6 address.
Additional Secondary iSNS Servers	As specified in [RFC4174] section 2 , except that it contains IPv6 addresses.

2.7. SLP Directory Agent Option

As specified in [\[RFC4173\] section 6](#), iSCSI boot requires either iSNS or SLP support.

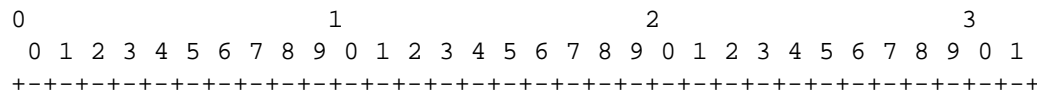
This option provides parity with the SLP Directory Agent Option defined for DHCPv4 in [\[RFC2610\] section 3](#).



2.8. SLP Service Scope Option

As specified in [\[RFC4173\] section 6](#), iSCSI boot requires either iSNS or SLP support.

This option provides parity with the SLP Directory Agent Option defined for DHCPv4 in [\[RFC2610\] section 4](#).



OPTION SLP SERVICE	option-len
Mandatory	Scope List (variable)

option-code OPTION_SLP_SERVICE (TBD8)

option-len 2

Scope List As specified in [\[RFC2610\] section 4](#)

3. Security Considerations

If an adversary manages to modify the response from a DHCP server or insert its own response, a host could be led to contact a rogue file server, resulting in an attacker being able to run arbitrary code on the host. Consequently, a practical way to verify loaded boot images is to make sure that each host verifies the boot file to be executed using a mechanism of their choice.

In addition, some options contain information about a client's system architecture and may be of use to potential attackers.

See the security considerations in [\[RFC3315\]](#), [\[RFC4173\]](#), and [\[RFC4578\]](#) for more discussion. This document introduces no new concerns beyond the ones covered therein for IPv4.

4. IANA Considerations

This document introduces a new IANA registry for processor architecture types. The name of this registry shall be "Processor Architecture Type". Registry entries consist of a 16-bit integer recorded in decimal format, and a descriptive name. The initial values of this registry can be found in [\[RFC4578\] section 2.1](#).

The assignment policy for values shall be Expert Review, and any requests for values must supply the descriptive name for the processor architecture type.

5. Acknowledgments

The authors would like to thank Ruth Li, Dong Wei, Kathryn Hampton, Phil Dorah, Richard Chan, and Fiona Jensen for discussions that led to this document.

6. References

6.1. Normative References

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- [RFC4578] Johnston, M. and Venaas, S. "Dynamic Host Configuration Protocol (DHCP) Options for the Intel Preboot eXecution Environment (PXE)", [RFC 4578](#), November 2006.
- [UEFI22] Unified Extensible Firmware Interface Specification, Version 2.2, September 2008, <http://www.uefi.org>

6.2. Informative References

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