

Superseded

CableLabs® Specifications

CableLabs' DHCP Options Registry

CL-SP-CANN-DHCP-Reg-I02-080306

ISSUED

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1 SCOPE

This specification defines the CableLabs DHCP Registry. It describes the CableLabs-specific DHCP option codes for DHCPv4 and DHCPv6 including the DHCPv6 Vendor-specific Information Options for CableLabs.

The scope of this version of this specification includes:

- DHCPv4 protocol fields authoritatively assigned by CableLabs that are mandated for product implementation in eDOCSIS, DOCSIS, CableHome, PacketCable, and OpenCable specifications.
- DHCPv6 protocol fields authoritatively assigned by CableLabs that are mandated for product implementation in DOCSIS specifications and in other specifications under development for PacketCable.

The CableLabs DHCPv6 options are carried in the DHCPv6 Vendor-specific Information option (option code OPTION_VENDOR_OPTS, Section 22.17 of [RFC 3315]). The enterprise number for Cable Television Laboratories, Inc. to be used in the DHCPv6 Vendor-specific option, is 4491.

The actual product requirements related to the implementation of these DHCP options can be found in the CableLabs Project specifications.

1.1 Requirement Terminology

Throughout this document, the words that are used to define the significance of particular requirements are capitalized. These words are:

"MUST"	This word means that the item is an absolute requirement of this specification.
"MUST NOT"	This phrase means that the item is an absolute prohibition of this specification.
"SHOULD"	This word means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood and the case carefully weighed before choosing a different course.
"SHOULD NOT"	This phrase means that there may exist valid reasons in particular circumstances when the listed behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.
"MAY"	This word means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example; another vendor may omit the same item.

2 REFERENCES

2.1 Normative References

This specification establishes a protocol registry; it does not contain any normative references.

2.2 Informative References

This specification uses the following informative references.

- [ANSI/SCTE 22-1] ANSI/SCTE 22-1, Data-Over-Cable Service Interface Specification, DOCSIS 1.0 Part 1: Radio Frequency Interface (RFI), 2002.
- [ANSI/SCTE 23-1] ANSI/SCTE 23-1, Data-Over-Cable Systems, Radio Frequency Interface Specification 1.1.
- [CANN] CableLabs' Assigned Names and Numbers Specification, CL-SP-CANN-I02-080306, March 6, 2008, Cable Television Laboratories, Inc.
- [CH 1.0] CableHome 1.0 Specification, CH-SP-CH1.0-C01-060728, July 28, 2006, Cable Television Laboratories, Inc.
- [CH 1.1] CableHome 1.1 Specification, CH-SP-CH1.1-C01-060728, July 28, 2006, Cable Television Laboratories, Inc.
- [eDOCSIS] Data-Over-Cable Service Interface Specifications, eDOCSIS Specification, CM-SP-eDOCSIS-I14-080215, February 15, 2008, Cable Television Laboratories, Inc.
- [eRouter] Data-Over-Cable Service Interface Specifications, IPv4 and IPv6 eRouter Specification, I03-070518, May 18, 2007, Cable Television Laboratories, Inc.
- [EUE-PROV] PacketCable 2.0, E-UE Provisioning Framework Specification, PKT-SP-EUE-PROV-I01-071106, November 6, 2007, Cable Television Laboratories, Inc.
- [MIB-CLABDEF] CableLabs Definition MIB Specification, CL-SP-MIB-CLABDEF-I07-080306, March 6, 2008, Cable Television Laboratories, Inc.
- [MULPIv3.0] Media Access Control and Upper Layer Protocols Interface (MULPI) Specification, CM-SP-MULPIv3.0-I07-080215, February 15, 2008, Cable Television Laboratories, Inc.
- [OC-HOST 2.0] OpenCable Host Device 2.0 Core Functional Requirements, OC-SP-HOST2.0-CFR-C01-071113, November 13, 2007, Cable Television Laboratories, Inc.
- [PROV] PacketCable MTA Device Provisioning Specification, PKT-SP-PROV-C01-071129, November 29, 2007, Cable Television Laboratories, Inc.
- [PROV 1.5] PacketCable 1.5 MTA Device Provisioning Specification, PKT-SP-PROV1.5-I03-070412, April 12, 2007, Cable Television Laboratories, Inc.
- [RFC 868] IETF RFC 868/STD0026, Time Protocol, May 1983.
- [RFC 1035] IETF RFC 1035, Domain Names – Implementation and Specification, November 1987.
- [RFC 2131] IETF RFC 2131, Dynamic Host Configuration Protocol, March 1997.
- [RFC 2132] IETF RFC 2132, DHCP Options and BOOTP Vendor Extensions, March 1997.
- [RFC 3046] IETF RFC 3046, DHCP Relay Agent Information Option, January 2001.
- [RFC 3256] IETF RFC 3256, The DOCSIS (Data-Over-Cable Service Interface Specifications) Device Class DHCP (Dynamic Host Configuration Protocol) Relay Agent Information Sub-option, April 2002.
- [RFC 3315] IETF RFC 3315, Dynamic Host Configuration Protocol for IPv6 (DHCPv6), July 2003.
- [RFC 3495] IETF RFC 3495, Dynamic Host Configuration Protocol (DHCP) Option for CableLabs Client Configuration, March 2003.

[RFC 3594]	PacketCable Security Ticket Control Sub-Option for the DHCP CableLabs Client Configuration (CCC) Option, September 2003.
[RFC 3634]	IETF RFC 3634, Key Distribution Center (KDC) Server Address Sub-option for the Dynamic Host Configuration Protocol (DHCP) CableLabs Client Configuration (CCC) Option, December 2003.
[RFC 3925]	IETF RFC 3925, Vendor-Identifying Vendor Options for Dynamic Host Configuration Protocol version 4 (DHCPv4), October 2004.
[RFC 3993]	IETF RFC 3993, Subscriber-ID Suboption for the Dynamic Host Configuration Protocol (DHCP) Relay Agent Option, March 2005.
[RFC 4014]	IETF RFC 4014, Remote Authentication Dial-In User Service (RADIUS) Attributes Suboption for the Dynamic Host Configuration Protocol (DHCP) Relay Agent Information Option, February 2005.
[RFC 4243]	IETF RFC 4243, Vendor-Specific Information Suboption for the Dynamic Host Configuration Protocol (DHCP) Relay Agent Option, December 2005.
[RFC 4361]	IETF RFC 4361, Node-specific Client Identifiers for Dynamic Host Configuration Protocol Version Four (DHCPv4), February 2006.
[RFC 4580]	Dynamic Host Configuration Protocol for IPv6 (DHCPv6) Relay Agent Subscriber-ID Option, June 2006.
[RFIv2.0]	Radio Frequency Interface Specification, CM-SP-RFIv2.0-I11-060602, June 2, 2006, Cable Television Laboratories, Inc.

2.3 Reference Acquisition

- Cable Television Laboratories, Inc., 858 Coal Creek Circle, Louisville, CO 80027, Phone +1-303-661-9100; Fax +1-303-661-9199; [http:// www.cablelabs.com](http://www.cablelabs.com).
- Internet Engineering Task Force (IETF) Secretariat, 46000 Center Oak Plaza, Sterling, VA 20166, Phone +1-571-434-3500, Fax +1-571-434-3535, <http://www.ietf.org>.
- Internet Assigned Numbers Authority (IANA), <http://www.iana.org>.

3 ABBREVIATIONS

This document uses the following abbreviations and acronyms.

DHCP	Dynamic Host Configuration Protocol
eCM	Embedded Cable Modem
eSAFE	Embedded Service/Application Functional Entity
OUI	Organization Unique Identifier
TSP	Telephony Service Provider

4 DHCPV4 PROTOCOL FIELD VALUES

4.1 CableLabs Values for DHCPv4 Option 43

Several CableLabs specifications mandate implementation of DHCPv4 option 43 by the DHCP client function of consumer premise equipment devices, to convey to the cable operator's provisioning system information about the product that can be used to make device and service configuration decisions during the provisioning process.

The DHCPv4 Option 43 sub-options registered by this specification for all CableLabs projects for DHCPv4 are listed in Table 1. Also see DHCPv4 Option 43 Syntax Requirements in [eDOCSIS].

Table 1 - CableLabs DHCPv4 Option 43 Sub-options

DHCP Option 43	Value	Description	Reference
Sub-option 1		The request sub-option vector is a list of sub-options (within option 43) to be returned to client by the server upon reply to the request. None defined.	
Sub-option 2	<Device Type>	Device type of the component making the DHCP request. For a DOCSIS cable modem: "ECM"= embedded Cable Modem (as specified by DOCSIS 1.0, 1.1, or 2.0 Base Specifications) For a PacketCable E-MTA: "EMTA" = embedded Multimedia Telephone Adapter (as specifications in PacketCable 1.0 and 1.5 MTA Device Provisioning Specifications) For CableHome PS: "EPS" = Embedded Portal Services or "SPS" = Stand-alone Portal Services For an OpenCable Host: "ESTB" For an OpenCable CableCARD: "CARD" For an eRouter: "EROUTER"	DOCSIS 1.1/2.0/3.0* PacketCable 1.0/1.5 CableHome 1.0/1.1 OpenCable Host 2.0 CableCARD 2.0 eRouter
Sub-option 3	"ECM: <eSAFE ₁ ;eSAFE ₂ ... SAFE _n >"	Colon-separated list of eCM and eSAFE(s) contained in the complete eDOCSIS device. First on the list MUST be "ECM" for eCM. <eSAFE _x > can be "EMTA", "EPS", "ESTB" or "EROUTER" corresponding to embedded MTA, embedded Portal Service Element, and embedded STB, respectively. For example: "ECM:EMTA" = A PacketCable Embedded MTA "ECM:EPS" = A CableHome Embedded Portal Services Element "ECM:ESTB" = An Embedded STB "ECM:EMTA:EPS" = An Embedded MTA and Embedded Portal Services Element "ECM:ESTB:CARD" – Indicates that a Cable Card is making a request via the eCM's DOCSIS return channel "ECM:EROUTER" = An embedded Router for DOCSIS	DOCSIS 1.1/2.0/3.0* PacketCable 1.0/1.5 CableHome 1.0/1.1 OpenCable Host 2.0 CableCARD 2.0 eRouter

DHCP Option 43	Value	Description	Reference
Sub-option 4	"<device serial number>"	Device serial number as in the MIB object docsDevSerialNumber, e.g., "123456" For OpenCable CableCARD, the serial number of the card. If Serial Number is not available, then other unique identifier (other than MAC Address) may be utilized.	DOCSIS 1.1/2.0/3.0* PacketCable 1.0/1.5 CableHome 1.0/1.1 OpenCable Host 2.0 CableCARD 2.0
Sub-option 5	"<Hardware version>"	Hardware version number. Identical to value as reported in the <Hardware version> field in the MIB object sysDescr. e.g., "v.3.2.1"	DOCSIS 1.1/2.0/3.0* PacketCable 1.0/1.5 CableHome 1.0/1.1 OpenCable Host 2.0 CableCARD 2.0
Sub-option 6	"<Software version>"	Software version number. Identical to value as reported in the <Software version> field in the MIB object sysDescr. e.g., "v.1.0.2"	DOCSIS 1.1/2.0/3.0* PacketCable 1.0/1.5 CableHome 1.0/1.1 OpenCable Host 2.0 CableCARD 2.0
Sub-option 7	"<Boot ROM version>"	Boot ROM version. Identical to value as reported in the <Boot ROM version> field in the MIB object sysDescr. e.g., "Bv4.5.6"	DOCSIS 1.1/2.0/3.0* PacketCable 1.0/1.5 CableHome 1.0/1.1 OpenCable Host 2.0 CableCARD 2.0
Sub-option 8	"<OUI>"	A 6-octet, hexadecimal-encoded, vendor-specific Organization Unique Identifier (OUI)	DOCSIS 1.1/2.0/3.0* PacketCable 1.0/1.5 CableHome 1.0/1.1 OpenCable Host 2.0 CableCARD 2.0
Sub-option 9	"<Model number>"	Device model number. Identical to value as reported in the <Model number> field in the MIB object sysDescr. e.g., "T3000"	DOCSIS 1.1/2.0/3.0* PacketCable 1.0/1.5 CableHome 1.0/1.1 OpenCable Host 2.0 CableCARD 2.0

DHCP Option 43	Value	Description	Reference
Sub-option 10	"<Vendor name>"	Vendor name or ID. Identical to value as reported in the <Vendor name> field in the MIB object sysDescr. e.g., "XYZ Corp" Not used for OpenCable CableCARD. Sub-option 51 is used instead.	DOCSIS 1.1/2.0/3.0* PacketCable 1.0/1.5 CableHome 1.0/1.1 OpenCable Host 2.0
Sub-options 11 to 127 Reserved for CableLabs			
<i>Sub-options 11..14</i>		<i>CableHome</i>	
Sub-option 11	PS WAN-Man (0x01) PS WAN-Data (0x02)	Identifies that an address is being requested in the CableHome Portal Services WAN Management realm. Identifies that an address is being requested in the CableHome Portal Services WAN-Data realm	CableHome 1.0/1.1
Sub-option 12	"<CM/PS System Description >"	CM/PS System Description from sysDescr	CableHome 1.0/1.1
Sub-option 13	"<CM/PS Firmware Rev >"	CM/PS Firmware Revision from docsDevSwCurrentVers	CableHome 1.0/1.1
Sub-option 14	"<Firewall Policy File Version>"	Firewall Policy File Version from cabhSec2FirewallPolicyCurrentVersion	CableHome 1.0/1.1
Sub-option 15		Unassigned	
<i>Sub-options 16..17</i>		<i>OpenCable</i>	
Sub-option 16	<Device TPID>	OpenCable DCAS Host Transport Processor Identifier	OpenCable DCAS™ specification
Sub-option 17	<Device SMID>	OpenCable DCAS Host Secure Micro Identifier	OpenCable DCAS™ specification
Sub-options 18..30		Unassigned	
<i>Sub-options 31..32</i>		<i>PacketCable</i>	
Sub-option 31	<MTA MAC Address>	Sub-option 31 contains the PacketCable MTA MAC Address encoded as a 6-byte octet string.	PacketCable 1.0/1.5
Sub-option 32	<MTA correlation ID>	Sub-option 32 contains the PacketCable Provisioning correlation ID encoded as a 4-byte integer in network order	PacketCable 1.0/1.5
Sub-options 33..50		Unassigned	

DHCP Option 43	Value	Description	Reference
<i>Sub-options 51..54</i>		<i>OpenCable</i>	
Sub-option 51	<Vendor name>	Name of the OpenCable CableCARD vendor	CableCARD 2.0
Sub-option 52	<Card capability>	Card capability using the encoding format per DOCSIS specification. Since there is no standard/required capability identification, Conditional Access vendor must provide documentation on the supported capability.	CableCARD 2.0
Sub-option 53	<Vendor device identification>	Conditional Access Vendor specific device identification	CableCARD 2.0
Sub-option 54	<CARD Identification>	64 bit CARD_ID as specified in the Card X.509 certificate	CableCARD 2.0
Sub-options 55..127		Unassigned	
Sub-options 128..254		Reserved for Vendors	
*Required only for cable modems in eDOCSIS devices.			

4.2 CableLabs Values for DHCPv4 Option 60 Vendor Client Identifier

The DHCP option code 60 contains a string identifying capabilities of the DHCPv4 client and associated CPE (eCM, or eSAFEs like eMTA, ePS, etc.).

The DHCP Option 60 values registered by this specification for all CableLabs projects for DHCPv4 are listed in Table 2.

Table 2 - CableLabs DHCPv4 Option 60 Values

Specification	Product or Function	ASCII Coded Option 60 String	Reference
DOCSIS 1.0	Cable Modem	The CM MAY include the string "docsis 1.0" in this field.	[ANSI/SCTE 22-1]
DOCSIS 1.1	Cable Modem	docsis1.1:xxxxxx, where xxxxxx is the ASCII representation of the hexadecimal encoding of the Modem Capabilities.	[ANSI/SCTE 23-1]
DOCSIS 2.0	Cable Modem	docsis2.0:xxxxxx, where xxxxxx is the ASCII representation of the hexadecimal encoding of the Modem Capabilities.	[RFIv2.0]
DOCSIS 3.0	Cable Modem	docsis3.0:	[MULPIv3.0]
CableHome 1.0	Portal Services	CableHome1.0	[CH 1.0]
CableHome 1.1	Portal Services	CableHome1.1	[CH 1.1]
OpenCable Host 2.0	OpenCable Host	OpenCable2.0:xxxxxx, where xxxxxx is the ASCII representation of the hexadecimal encoding of the device capabilities.	[OC-HOST 2.0]
PacketCable 1.0	Embedded MTA	pkctc1.0:xxxxxx, where xxxxxx is the ASCII representation of the hexadecimal encoding of the device capabilities.	[PROV]

Specification	Product or Function	ASCII Coded Option 60 String	Reference
PacketCable 1.5	Embedded MTA	pktc1.5:xxxxxx, where xxxxxx is the ASCII representation of the hexadecimal encoding of the device capabilities.	[PROV 1.5]
PacketCable 2.0	Embedded UE	pktc2.0:xxxxxx, where xxxxxx is the ASCII representation of the hexadecimal encoding of the device capabilities.	[EUE-PROV]

4.3 DHCPv4 Vendor Identifying Vendor Specific Options for DOCSIS 3.0

This section defines CableLabs DHCPv4 options, which are carried in the DHCPv4 Vendor-Identifying Vendor Specific options [RFC 3925], and CableLabs DHCPv4 relay agent options, which are carried in the DHCPv4 Vendor Specific Information relay agent sub-option [RFC 4243]. The enterprise number for Cable Television Laboratories, Inc, to be used in these DHCPv4 sub-options is 4491.

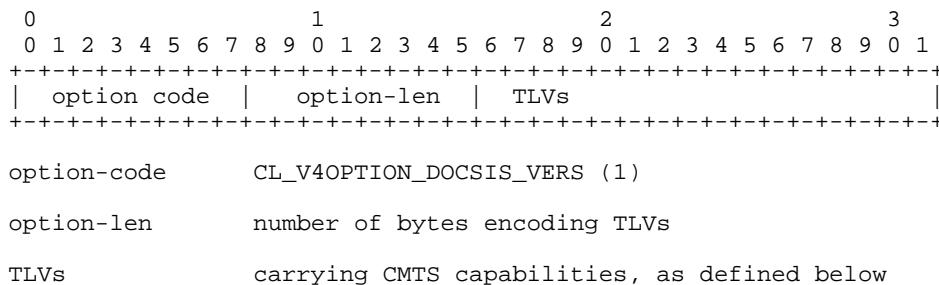
4.3.1 DOCSIS Vendor Identifying Vendor Specific Relay Agent Options

All the options covered in this section are carried in the CableLabs DHCPv4 Relay agent option.

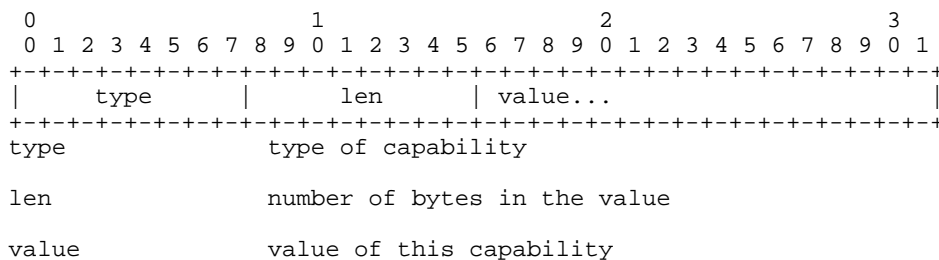
4.3.1.1 The DHCPv4 Relay Agent CMTS capabilities option

This DHCPv4 Relay Agent Option is used by the CMTS to transmit (or advertise) specific capabilities of the CMTS. Additional CMTS capabilities may be added to indicate additional CMTS capabilities that should help the provisioning server make more informed configuration decisions.

The DHCPv4 Relay Agent DOCSIS Version relay agent option is a DOCSIS DHCP Vendor Identifying option carries the DOCSIS version of the CMTS in which the relay agent is implemented. This option has the following format.



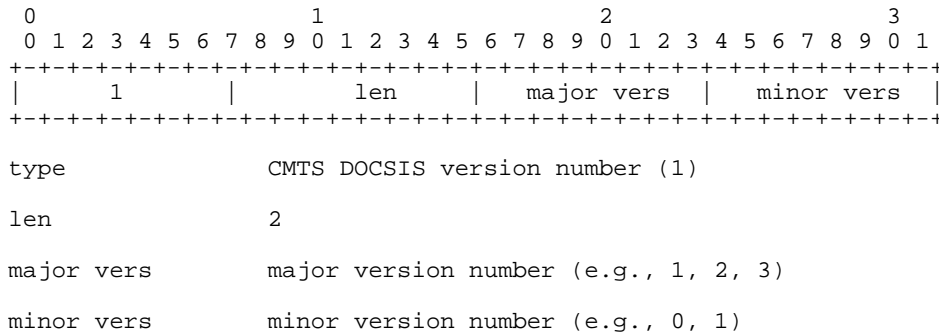
The type and length field for each TLV are each carried in one octet and the value field is variable length:



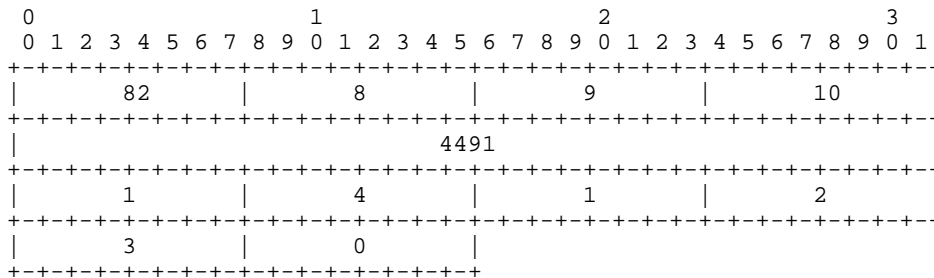
The following TLVs are defined in this specification.

4.3.1.1.1 CMTS DOCSIS Version Number

This TLV carries the DOCSIS version that the CMTS is compatible with. The 'major vers' and 'minor vers' are combined to form the DOCSIS version number. The format of this TLV is:



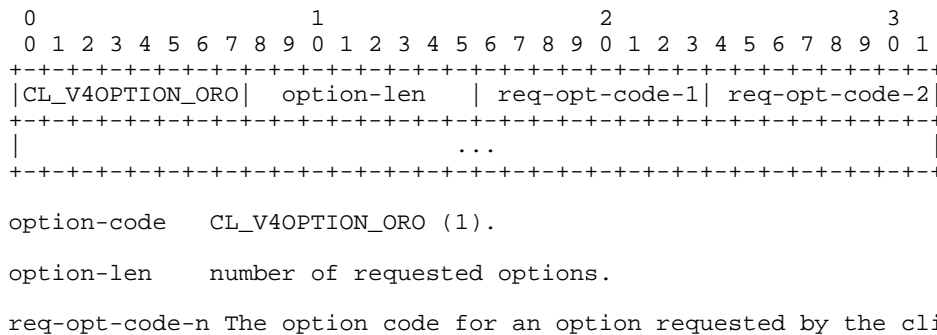
The DOCSIS version option is carried in the CMTS Capabilities option of a Relay Agent option, as shown in the following diagram:



4.3.2 The DHCPv4 Option Request Option

This option is used to identify the options requested by the client from the server. The option is similar to the DHCPv4 Parameter Request List (option code 55, [RFC 2132]). The option code for this option is 1 and the format of the remainder of the option is identical to that of the DHCPv4 Parameter Request List option: a length field followed by a list of 8-bit values, which are the option codes for the DHCPv4 CableLabs Vendor-specific Information options requested by the client.

The format of the Option Request option is:



4.3.3 The DHCPv4 TFTP Servers Option

The DHCPv4 TFTP Servers option carries a list of IPv4 addresses of TFTP servers to be used by the CM. The option has the following format:

```

      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 code | option-len | IPv4 address of TFTP server 1 |
+-----+-----+-----+-----+-----+-----+-----+-----+
| address of server 1 (cont.) | IPv4 address of TFTP server 2 |
+-----+-----+-----+-----+-----+-----+-----+-----+
| address of server 2 (cont.) |                               ...
+-----+-----+-----+-----+-----+-----+-----+-----+
.                               ...                               | IPv4 address of TFTP server n |
+-----+-----+-----+-----+-----+-----+-----+-----+
| address of server n (cont.) |                               ...
+-----+-----+-----+-----+-----+-----+-----+-----+

```

option-code CL_V4OPTION_TFTP_SERVERS (2)

option-len number of bytes for TFTP server IPv4 addresses (4*n for
n servers)

IPv4 addresses of TFTP servers

4.3.4 The DHCPv4 eRouter Container Option

The eRouter container option specifies a method by which an operator may pass on multiple DHCPv4 options to all clients that are provisioned by the DOCSIS eRouter. When an eRouter receives the container option from the server it will attach the set of options obtained within this option and pass them on to all of its clients which are the stand-alone CPE devices.

The Container option has the following format:

```

      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-code | option-len | TLV-encoded-ops ... |
+-----+-----+-----+-----+-----+-----+-----+-----+
|                               ...                               |
+-----+-----+-----+-----+-----+-----+-----+-----+

```

option-code CL_V4EROUTER_CONTAINER_OPTION (3)

option-len n (n = number of bytes in the TLV encoded options)

TLV-encoded-options A set of one or more TLV encoded options

4.3.5 The DHCPv4 PacketCable MIB Environment Indicator Option

The DHCPv4 MIB environment container option specifies a method by which an operator may indicate the default MIB environment to be utilized by PacketCable MTAs for provisioning and management.

The container option has the following format:

```

      0                               1                               2
      0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3
+-----+-----+-----+-----+-----+-----+-----+
| option-code | option-len | env-indicator |
+-----+-----+-----+-----+-----+-----+

```

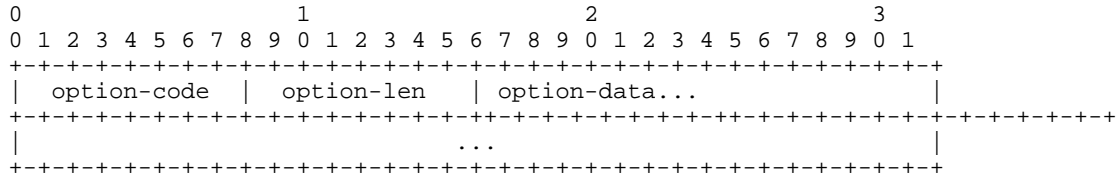
option-code CL_V4_PACKETCABLE_MIB_ENV_OPTION (4)

```
option-len          1
env-indicator      0x01 (CableLabs), 0x02 (IETF), 0x03 (EuroCableLabs)
```

4.3.6 Modem Capabilities Encoding for DHCPv4

This encoding is only applicable for DOCSIS 3.0 and newer versions of Cable Modems. This sub-option encodes the Modem Capabilities Encoding for transmission in a DHCPv4 message. This option contains the TLV5 as specified in the “Modem Capabilities Encoding” sub-section of [MULPIv3.0], encoded in hexadecimal.

The format of the Modem Capabilities Encoding option is:



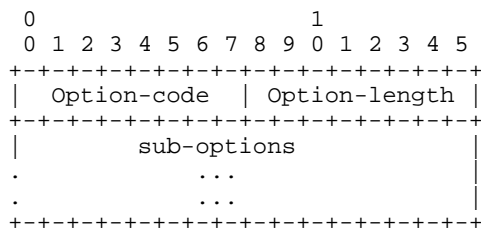
```
option-code    CL_V4OPTION_MODEM_CAPABILITIES (5)
option-len     number of octets carrying TLV5 data.
option-data    TLV5 data. e.g., The hexadecimal encoding for the first
                two sub-TLVs
                (concatenation and DOCSIS Version) of a DOCSIS 3.0 modem
                would be: 0x05 0xnn 0x01 0x01 0x01 0x02 0x01 0x03. This
                example shows only two sub-TLVs, for the sake of simplicity.
```

4.4 CableLabs Specific DHCPv4 Options for Cable Modems with embedded PacketCable devices

This section specifies CableLabs-specific DHCPv4 options for Cable Modems operating in IPv4 mode, to relay DHCPv6 Server information, and IP addressing mode preference, to embedded PacketCable devices that support IPv6 or dual-stack operation. They are carried in the DHCPv4 vendor-specific option [RFC 3925]. The enterprise number for Cable Television Laboratories, Inc. to be used in the DHCPv4 vendor-specific option is 4491.

4.4.1 DHCPv4 CableLabs Client Configuration Option for DHCPv6 Server Addresses

This DHCP Option is transmitted to Cable Modems operating in IPv4 mode, to be relayed to embedded PacketCable devices that support operation in IPv6 mode. This allows such embedded PacketCable devices to identify the DHCPv6 servers from which they can obtain IP parameters such as IP address. This option has the following format.



```
option-code    (1 octet)          : CL_V4OPTION_CCCV6 (123)
option-length  (1 octet)          : length of the contents in octets.
Sub-options    (Max of 254 octets) : sub-options as specified later in this section
```

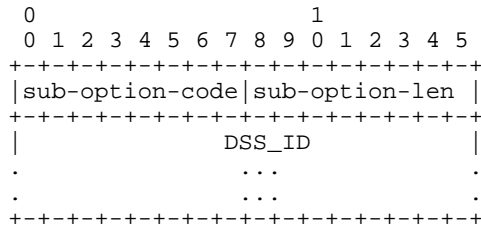
The format and meaning of each sub-option is defined in Table 3 below.

Table 3 - DHCPv4 CableLabs Client Configuration Option for DHCPv6 Server Addresses

Sub-option Code	Description	Comments
1	Primary DHCPv6 Server Selector ID	Primary DSS_ID; see below.
2	Secondary DHCPv6 Server Selector ID	Secondary DSS_ID; see below.

Sub-options 1 and 2 contain the primary and secondary DHCPv6 Server Selector IDs (DSS_IDs). A DSS_ID is an abstract opaque value that identifies valid DHCPv6 servers from which an embedded PacketCable device can accept its DHCPv6 parameters. Sub-option 1 identifies the Primary DSS_ID and sub-option 2 identifies the Secondary DSS_ID. The length of the DSS ID is limited to 32 bytes. The representation requirements for the DSS_ID are outside the scope of this document; specifications using this option are expected to specify any applicable requirements.

Each of the sub-options (1 and 2) will adhere to the following format:



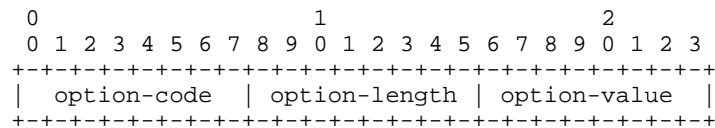
```

sub-option-code   (1 octet)   : value of '1' for sub-option; value of '2' for
                               sub-option 2
sub-option-len    (1 octet)   : the length of the contained DSS_ID (less than
                               or equal to 32)
DSS_ID            (<= 32 octets): contains the DSS_ID encoded as a set of up
                               to 32 bytes.
    
```

4.4.2 DHCPv4 CableLabs IP addressing mode preference DHCP Option

This DHCP Option is provided to Cable Modems in IPv4 mode when they are provided with DHCPv4 server addresses (using DHCP option 122) and DHCPv6 DSS_IDs (using CL_V4OPTIONCCC_V6) to be relayed to embedded PacketCable devices that support dual-stack operations. It indicates a preference for the desired mode of operation, i.e., IPv4 or IPv6.

This option has the following format:



```

option-code   (1 octet) : CL_V4OPTION_IP_PREF (124)
option-length (1 octet) : 1
option-value  (1 octet) : 1 - indicates IPv4, 2 - indicates IPv6.
    
```

5 DHCPV6 PROTOCOL FIELD VALUES

The Dynamic Host Configuration Protocol for IPv6 (DHCPv6) is defined in [RFC 3315] and [RFC 4361].

5.1 Values for the CableLabs Project codes

CableLabs Project Codes listed in Table 4 MUST be used as applicable for the 3-bit value of the CableLabs project code in the DHCPv6 option header field. This table defines the values of the 'code' field in the CableLabs sub-option code header field.

Please refer to the CableLabs Assigned Names and Numbers specifications [CANN] for the format of the DHCPv6 CableLabs Vendor-specific Information Option.

Table 4 - CableLabs Project Codes for DHCPv6 Options

CableLabs Project*	Code
Common	0
DOCSIS	1
PacketCable	2
OpenCable	3
CableHome	4

*Except for "Common," this table is aligned with the OID assignments for the associated CableLabs projects defined under clabProject in [MIB-CLABDEF]. CableLabs common MIB modules are defined under a different branch (clabCommonMibs) in [MIB-CLABDEF].

5.2 DHCPv6 CableLabs Vendor Specific Information Option - Common Sub-Options

Table 5 below lists and defines DHCPv6 sub-options that may be common to multiple CableLabs projects:

Table 5 - DHCPv6 CableLabs Vendor-specific Information Option Shared by CableLabs Projects

Type (Decimal value of the Type field is derived by concatenating the 3-bit CableLabs Project Code 000, the 3-bit reserved field 000 and the 10-bit sub-option type)	Value	Description	Source Spec for DHCP IPv4 equivalent
CableLabs sub-option type (Least Significant 10 bits in binary)	Type (Decimal)		
0000000001	1	Multiple 16 bit option id's	CL_OPTION_ORO [eDOCSIS]
0000000010	2	"ECM", "EPS", "EMTA", "ESTB", or "EROUTER"	CL_OPTION_DEVICE_TYPE [eDOCSIS]

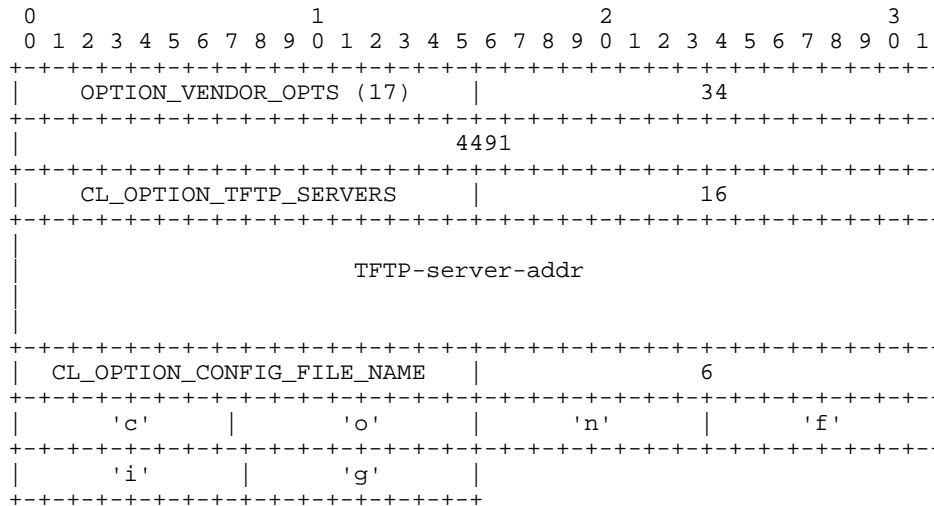
Type (Decimal value of the Type field is derived by concatenating the 3-bit CableLabs Project Code 000, the 3-bit reserved field 000 and the 10-bit sub-option type)		Value	Description	Source Spec for DHCP IPv4 equivalent
CableLabs sub-option type (Least Significant 10 bits in binary)	Type (Decimal)			
000000011	3	"ECM: <eSAFE1:eSAFE2 ... SAFEn>"	<p>CL_OPTION_EMBEDDED_COMPONENTS_LIST</p> <p>Colon-separated list of eCM and eSAFE(s) contained in the complete eDOCSIS device.</p> <p>First on the list MUST be "ECM" for eCM. <eSAFEx> can be "EMTA", "EPS", or "ESTB" corresponding to embedded MTA, embedded Portal Service Element, and embedded STB, respectively.</p> <p>For example:</p> <p>"ECM:EMTA" = A PacketCable/Embedded MTA</p> <p>"ECM:EPS" = A CableHome/Embedded Portal Services Element</p> <p>"ECM:ESTB" = An Embedded STB</p> <p>"ECM:EMTA:EPS" = An Embedded MTA and Embedded Portal Services Element</p> <p>"ECM:EROUTER" = An eRouter</p> <p>"ECM:EMTA:EROUTER" = An Embedded MTA and an eRouter</p>	[eDOCSIS]
000000100	4	"<device serial number>"	<p>CL_OPTION_DEVICE_SERIAL_NUMBER</p> <p>Device serial number as in the MIB object docsDevSerialNumber</p> <p>e.g., "123456"</p>	[eDOCSIS]
000000101	5	"<Hardware version>"	<p>CL_OPTION_HARDWARE_VERSION_NUMBER</p> <p>Hardware version number. Identical to value as reported in the <Hardware version> field in the MIB object sysDescr.</p> <p>e.g., "v.3.2.1"</p>	[eDOCSIS]
000000110	6	"<Software version>"	<p>CL_OPTION_SOFTWARE_VERSION_NUMBER</p> <p>Software version number. Identical to value as reported in the <Software version> field in the MIB object sysDescr.</p> <p>e.g., "v.1.0.2"</p>	[eDOCSIS]

Type (Decimal value of the Type field is derived by concatenating the 3-bit CableLabs Project Code 000, the 3-bit reserved field 000 and the 10-bit sub-option type)		Value	Description	Source Spec for DHCP IPv4 equivalent
CableLabs sub-option type (Least Significant 10 bits in binary)	Type (Decimal)			
0000000111	7	"<Boot ROM version>"	CL_OPTION_BOOT_ROM_VERSION Boot ROM version. Identical to value as reported in the <Boot ROM version> field in the MIB object sysDescr. e.g., "Bv4.5.6"	[eDOCSIS]
0000001000	8	"<Vendor OUI>"	CL_OPTION_VENDOR_OUI A 6-octet NVT ASCII string, containing hexadecimal-encoded, vendor-specific Organization Unique Identifier (OUI) that may match the OUI in the eCM's MAC address.	[eDOCSIS]
0000001001	9	"<Model number>"	CL_OPTION_MODEL_NUMBER Device model number. Identical to value as reported in the <Model number> field in MIB object sysDescr. e.g., "T3000"	[eDOCSIS]
0000001010	10	"<Vendor name>"	CL_OPTION_VENDOR_NAME Vendor name or ID. Identical to value as reported in the <Vendor name> field in the MIB object sysDescr. e.g., "XYZ Corp"	[eDOCSIS]
0000001011 – 0000011111	11-31		Reserved for CableLabs.	[MULPIv3.0]
0000100000	32	Multiple 16 octet IPv6 addresses	CL_OPTION_TFTP_SERVERS TFTP Server Addresses option	[MULPIv3.0]
0000100001	33	"<Config File Name>"	CL_OPTION_CONFIG_FILE_NAME Configuration File Name option	[MULPIv3.0]
0000100010	34	Multiple 16 octet IPv6 addresses	CL_OPTION_SYSLOG_SERVERS Syslog Server Addresses option	[MULPIv3.0]
0000100011	35	Multiple octets	CL_OPTION_MODEM_CAPABILITIES	[MULPIv3.0]

Type (Decimal value of the Type field is derived by concatenating the 3-bit CableLabs Project Code 000, the 3-bit reserved field 000 and the 10-bit sub-option type)		Value	Description	Source Spec for DHCP IPv4 equivalent
CableLabs sub-option type (Least Significant 10 bits in binary)	Type (Decimal)			
0000100100	36	6 octet MAC address	CL_OPTION_DEVICE_ID Device Identifier option	[MULPIv3.0]
0000100101	37	Multiple 16 octet IPv6 addresses	OPTION_RFC868_SERVERS	[MULPIv3.0]
0000100110	38	32 bit signed integer	CL_OPTION_TIME_OFFSET	[MULPIv3.0]
0000100111	39	1 – for IPv4 preference 2 – for IPv6 preference	CL_OPTION_IP_PREF	[EUE-PROV]

DHCPv6 defines a Vendor-specific Information Option (see the option code OPTION_VENDOR_OPTS in Section 22.17 of [RFC 3315]). The format is defined in the CableLabs Assigned Names and Numbers specifications [CANN].

As an example, the TFTP Servers and Configuration File Name options would be carried as shown in the following diagram:



The values of CL_OPTION_TFTP_SERVERS and CL_OPTION_CONFIG_FILE_NAME are defined below.

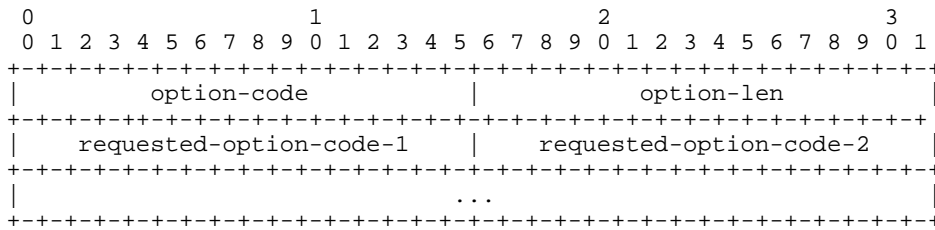
The following sub-sections individually describe each of the option sub-types from Table 5 above.

5.2.1 Option Request Option

This option is used to identify the options requested by the client from the server. The option is similar to the DHCPv6 Option Request option (option code OPTION_ORO, Section 22.7 of [RFC 3315]).

The sub-option type for this option is 1 and the format of the remainder of the option is identical to that of the DHCPv6 Option Request option: a length field followed by a list of 16-bit values, which are the option codes for the CableLabs Vendor-specific Information options requested by the client.

The format of the Option Request option is:



option-code CL_OPTION_ORO (1)

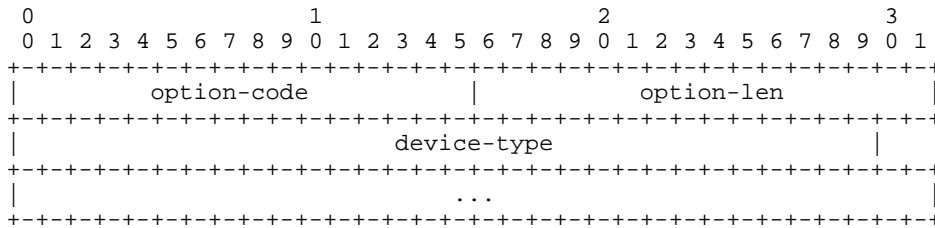
option-len 2 * number of requested options in bytes.

requested-option-code-n The option code for an option requested by the client.

5.2.2 Device Type Option

This option is used to identify the device type of the component making the DHCPv6 request.

The format of the Device Type option is:



option-code CL_OPTION_DEVICE_TYPE (2)

option-len length of device-type field in bytes.

device-type The device type as NVT ASCII text MUST NOT be null terminated.

"ECM" for embedded Cable Modem (as specified by DOCSIS 1.0, 1.1, 2.0

or 3.0 Base Specifications)

"EPS" for CableHome embedded Portal Services Element

"EMTA" for PacketCable embedded Multimedia Terminal Adapter

"EDVA" for PacketCable embedded Digital Voice Adapter

"ESTB" for an embedded Set-Top Box

"EROUTER" for an embedded DOCSIS Router

5.2.3 List of Embedded Components in eDOCSIS Device Option

This option contains the colon-separated list of eCM and eSAFE(s) contained in the complete eDOCSIS device.

The format of the Embedded Components List 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-code          |          option-len          |
+-----+-----+-----+-----+-----+-----+-----+-----+
|                               |                               |
|                               |                               |
|                               |                               |
+-----+-----+-----+-----+-----+-----+-----+-----+

```

option code: CL_OPTION_EMBEDDED_COMPONENTS_LIST(3)
option length: n (for string of length n)

embedded-components-list: The list of embedded components separated by colons NVT ASCII text MUST NOT be null terminated:

- "ECM" for embedded Cable Modem (as specified by DOCSIS 1.0, 1.1, 2.0 or 3.0 Base Specifications) - must be first
- "EPS" for CableHome embedded Portal Services Element
- "EMTA" for PacketCable embedded Multimedia Terminal Adapter
- "ESTB" for PacketCable embedded Set Top Box
- "EROUTER" for eRouter

e.g., if the eDOCSIS device is an E-MTA with an integrated eCM and an eMTA, this object must contain the value 'ECM:EMTA' (without the single quotes)

5.2.4 Device Serial Number Option

This option contains the device serial number as in the MIB object docsDevSerialNumber.

The format of the Device Serial Number 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-code          |          option-len          |
+-----+-----+-----+-----+-----+-----+-----+-----+
|                               |                               |
|                               |                               |
|                               |                               |
+-----+-----+-----+-----+-----+-----+-----+-----+

```

option code: CL_OPTION_DEVICE_SERIAL_NUMBER (4)

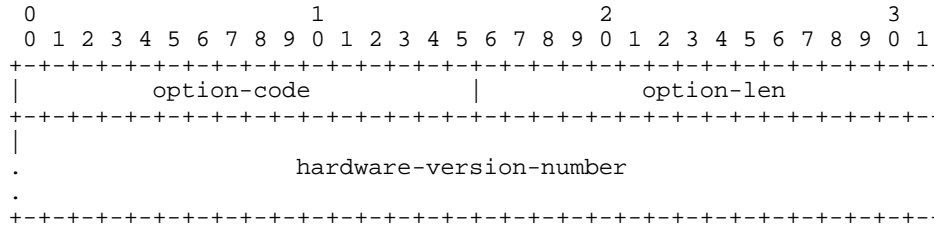
option length: n (for string of length n)

device-serial-number: The device serial number string as NVT ASCII text MUST NOT be null terminated.

5.2.5 Hardware Version Number Option

This option contains the hardware version number as reported in the <Hardware version> field in the MIB object sysDescr.

The format of the Hardware Version Number option is:



option code: CL_OPTION_HARDWARE_VERSION_NUMBER(5)

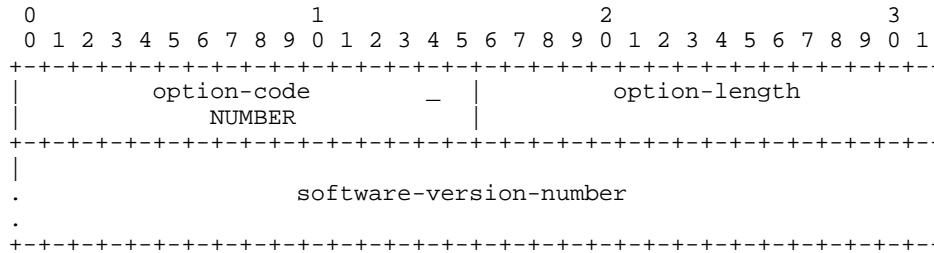
option length: n (for string of length n)

hardware-version-number: The hardware version number string NVT ASCII text MUST NOT be null terminated.

5.2.6 Software Version Number Option

This option contains the software version number as reported in the <Software version> field in the MIB object sysDescr.

The format of the Software Version Number option is:



option code: CL_OPTION_SOFTWARE_VERSION_NUMBER(6)

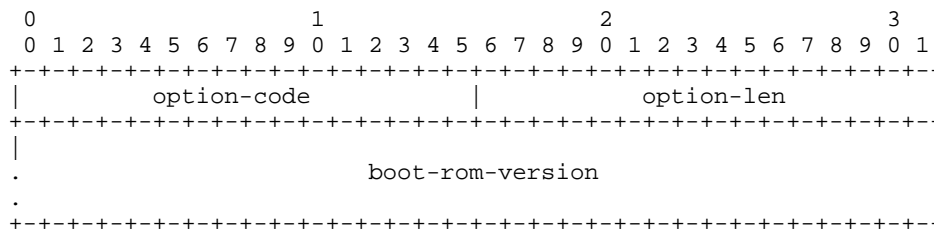
option length: n (for string of length n)

software-version-number: The software version number string as NVT ASCII text MUST NOT be null terminated.

5.2.7 Boot Rom Version Option

This option contains the boot rom version as reported in the <Boot ROM version> field in the MIB object sysDescr.

The format of the Boot Rom Version option is:

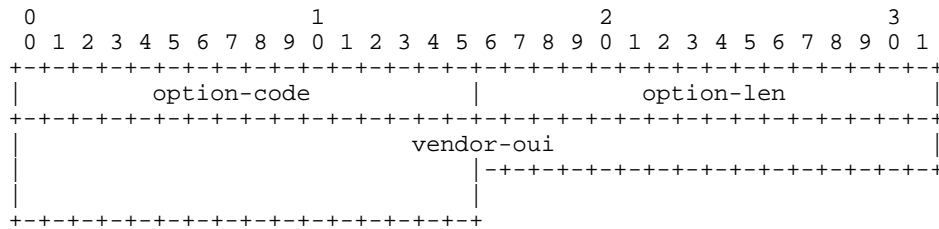


```
option code:      CL_OPTION_BOOT_ROM_VERSION(7)
option length:    n (for string of length n)
boot-rom-version: The boot rom version string as NVT ASCII text
                  MUST NOT be null terminated.
```

5.2.8 Vendor-specific Organization Unique Identifier Option

This option contains the 6-octet hexadecimal-encoded, vendor-specific Organization Unique Identifier (OUI) that may match the OUI in the eCM's MAC address.

The format of the Vendor OUI option is:

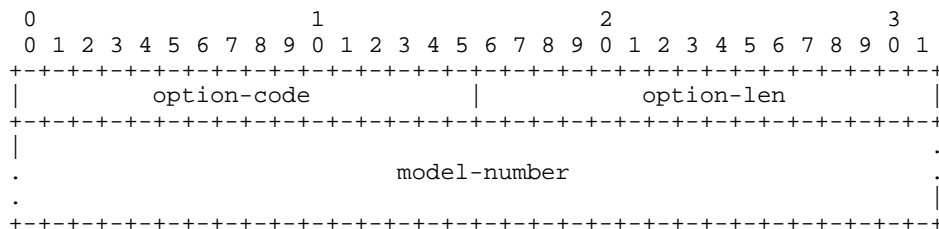


```
option code:      CL_OPTION_VENDOR_OUI(8)
option length:    6
vendor-oui:      The 6-octet NVT ASCII string containing the hexadecimal-
                  encoded, vendor-specific Organization Unique Identifier
                  (OUI). This string is not null terminated.
```

5.2.9 Model Number Option

This option contains the device model number as reported in the <Model number> field in the MIB object sysDescr.

The format of the Model Number option is:

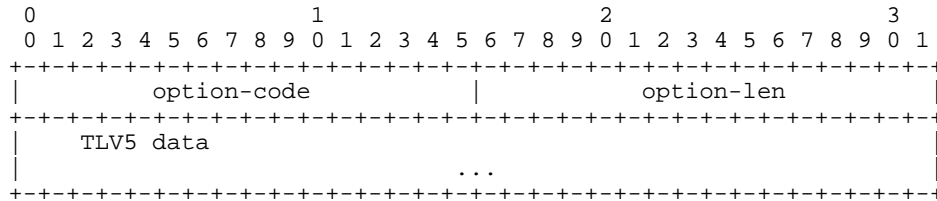


```
option code:      CL_OPTION_MODEL_NUMBER(9)
option length:    n (for string of length n)
model-number:    The model number string as NVT ASCII text MUST NOT
                  be null terminated.
```


5.2.14 TLV5 Encoding

This sub-option encodes the Modem Capabilities Encoding information for transmission in a DHCPv6 message. The sub-option code is CL_OPTION_MODEM_CAPABILITES. This option contains the TLV5 as specified in the “Modem Capabilities Encoding” sub-section of [MULPIv3.0], encoded in hexadecimal.

The format of the Modem Capabilities Encoding option is:



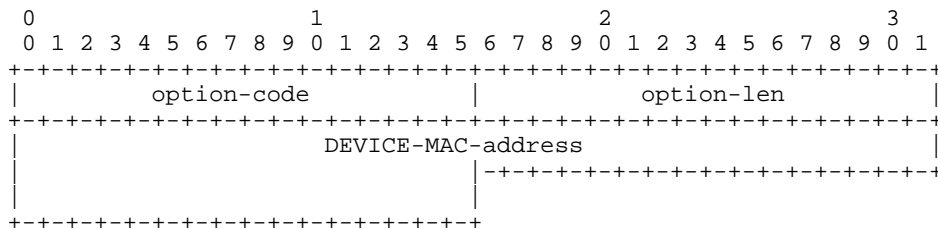
option-code CL_OPTION_MODEM_CAPABILITIES (35)

option-len number of octets carrying TLV5 data.

option-data TLV5 data. e.g., The hexadecimal encoding for the first two sub-TLVs (concatenation and DOCSIS Version) of a DOCSIS 3.0 modem would be: 0x05 0xnn 0x01 0x01 0x01 0x02 0x01 0x03. This example shows only two sub-TLVs, for the sake of simplicity.

5.2.15 Device Identifier Option

For DOCSIS 3.0 CMs, the option contains the identifier of the CM device. In DOCSIS 3.0, a CM's device identifier is its MAC address. (Note: As the DOCSIS CM's hardware address can only be an Ethernet address, there is no need for hardware type and length.)



option-code CL_OPTION_DEVICE_ID (36)

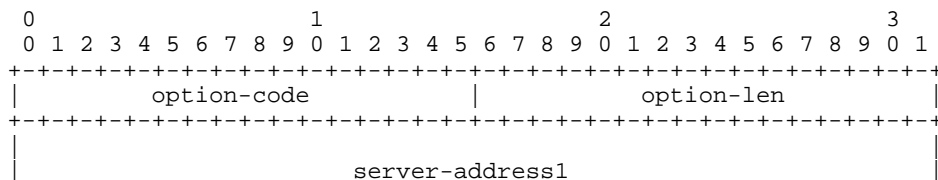
option-len MUST be 6.

DEVICE-MAC-address the MAC address of the device.

5.2.16 The IPv6 Address of a Time Protocol Server

The Time Protocol Servers option defines a list of Time Protocol servers available to the DHCPv6 client [RFC 868]. The IPv6 address of each server is included in the option. The addresses SHOULD be listed in order of preference.

The Time Protocol Servers option has the following format:



5.2.18 DHCPv6 CableLabs IP Addressing Mode Preference DHCP Option

This DHCP Option is provided to Cable Modems in IPv6 mode when they are provided with DHCPv4 server addresses (using CL_OPTION_CCC) and DHCPv6 DSS_IDs (using CL_OPTIONCCC_V6) to be relayed to embedded PacketCable devices that support dual-stack operations. It indicates a preference for the desired mode of operation, i.e., IPv4 or IPv6.

This option has the following format:

```

      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-code       | option-length     |                   |
  +-----+-----+-----+-----+-----+-----+-----+-----+
  | option-value     |                   |                   |
  +-----+-----+-----+-----+-----+-----+-----+-----+

```

```

option-code   (2 octets) : CL_OPTION_IP_PREF (39)
option-length (2 octets) : 1
option-value  (1 octet)  : 1 - indicates IPv4, 2 - indicates IPv6.

```

5.3 DHCPv6 CableLabs Vendor-specific Information Option: DOCSIS Sub-options

DHCPv6 options used by DOCSIS 3.0 devices that are carried in the DHCPv6 Vendor-specific Information option (option code OPTION_VENDOR_OPTS, [RFC 3315]).

The DHCPv6 Vendor-specific Information option, as well as any other DHCPv6 options, are used for carrying IPv6 addresses and related information.

This section lists the DOCSIS specific DHCP sub-options carried in the DHCPv6 Vendor-specific Information option.

5.3.1 Relay Agent Options

In DHCPv6, options may be carried in the Relay-forward and Relay-reply messages to carry information between the DHCPv6 relay agent and the DHCPv6 server. These options are equivalent to the sub-options of the DHCPv4 Relay Agent Information option. This section explains or defines several options that may be sent between DHCPv6 relay agents and DHCPv6 servers.

5.3.1.1 DHCPv6 Options Defined Elsewhere

The DHCPv6 Interface-ID option [RFC 3315] is equivalent to the DHCPv4 Relay Agent Information option Agent Circuit-id Sub-option [RFC 3046].

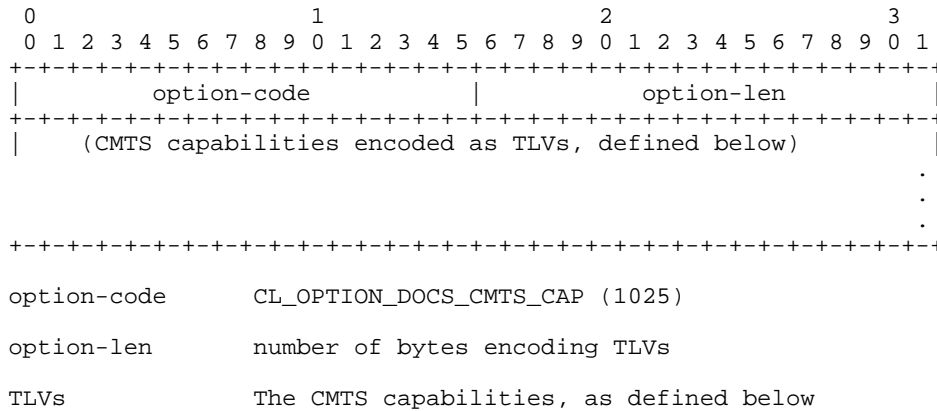
The DHCPv6 Relay Agent Subscriber-ID Option [RFC 4580] is equivalent to the DHCPv4 Subscriber-ID Sub-option [RFC 3993].

The DHCPv6 Relay Agent RADIUS Attribute Option [RFC 4580] is equivalent to the DHCPv4 RADIUS Attributes Sub-option [RFC 4014].

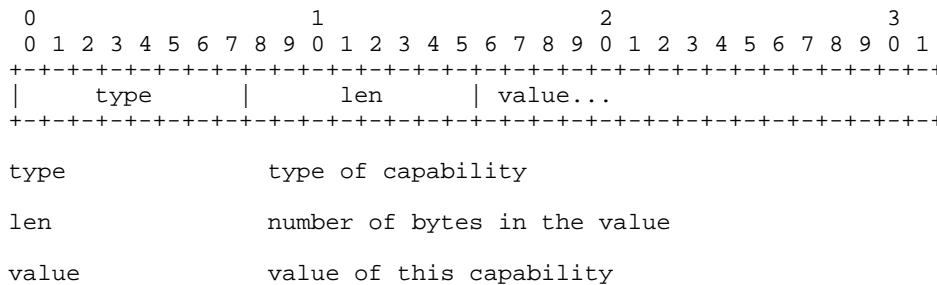
The DOCSIS Device Class option will be defined as a DHCPv6 Vendor-Specific Information option by PacketCable and/or CableHome.

5.3.1.2 DHCPv6 Relay Agent CMTS Capabilities Option

The DHCPv6 Relay Agent CMTS capabilities option carries the capabilities of the CMTS in which the relay agent is implemented. This option has the following format.



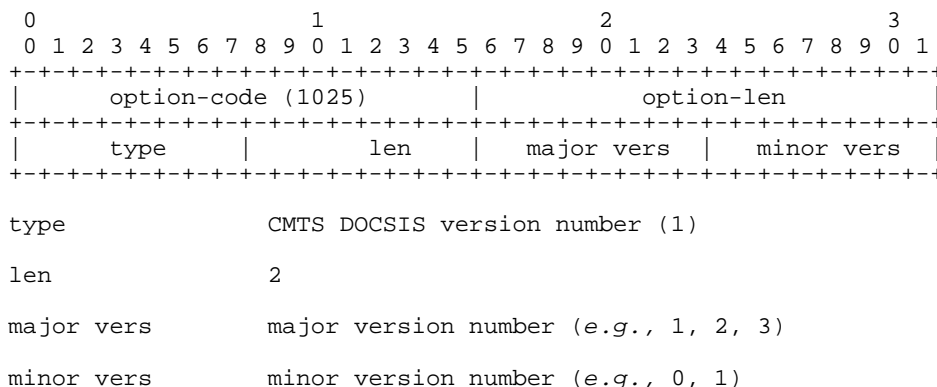
The type and length field for each TLV are each carried in one octet and the value field is variable length:



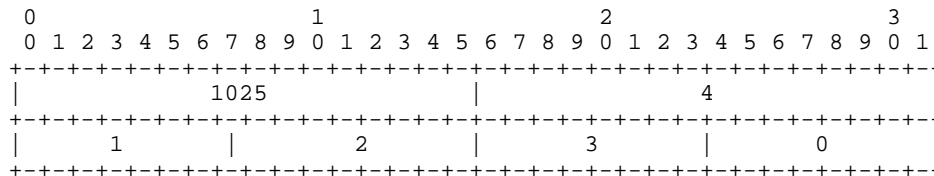
The following TLVs are defined in this specification.

5.3.1.2.1 CMTS DOCSIS Version Number

This TLV carries the DOCSIS version that the CMTS is compatible with. The 'major vers' and 'minor vers' are combined to form the DOCSIS version number. The format of this TLV, shown in the context of the containing sub-option, is:



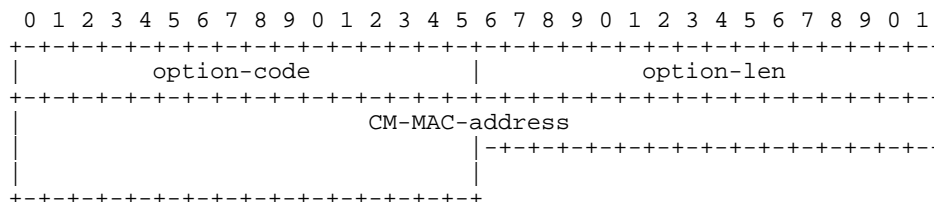
A DHCPv6 relay agent implemented on a CMTS that is compatible with the DOCSIS 3.0 specification would send the following CMTS Capabilities option to the DHCPv6 server:



5.3.1.3 DOCSIS Relay Agent CM MAC Address Option

The DHCPv6 Relay Agent CM MAC address option carries the MAC address of the CM through which a DHCPv6 message was received. If the DHCPv6 message was sent by the CM, this option will carry the MAC address of the CM. If the DHCPv6 message was sent by a CPE and forwarded through a CM, this option will carry the MAC address of the forwarding CM. (Note: As the DOCSIS CM's hardware address can only be an Ethernet address, there is no need for hardware type and length.)

The format of this option is:



- option-code CL_CM_MAC_ADDR (1026)
- option-len MUST be 6 bytes.
- CM-MAC-address The MAC address of the CM.

Table 6 - DOCSIS Sub-options of DHCPv6 CableLabs Vendor-specific Information Option

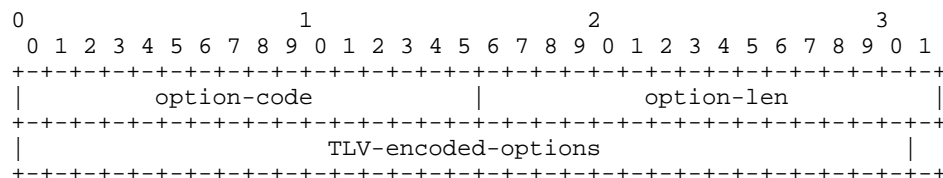
CableLabs Project Code for DOCSIS	CableLabs sub-option type	Value	Description
001	1025		DHCPv6 Relay Agent CMTS Capabilities Option
		4	CMTS DOCSIS Version Number
001	1026		DOCSIS Relay Agent CM MAC address option

5.3.2 eRouter Container Option

The eRouter container option specifies a method by which an operator may pass on multiple DHCPv6 options to all clients that are provisioned by the DOCSIS eRouter. When an eRouter receives the container option from the server it will attach the set of options obtained within this option and pass them on to all of its clients which are the stand-alone CPE devices.

While the eRouter container is a sub-option of the DHCPv6 Vendor-specific Information option (option code OPTION_VENDOR_OPTS, [RFC 3315]), the TLV-encoded-options transmitted in the eRouter container are standard DHCPv6 options drawn from the option space defined in [RFC 3315]), though not limited to options defined only in that document. Thus, the CableLabs Vendor-specific option using the CableLabs enterprise number defines a sub-option space which includes this sub-option, the eRouter container. But the eRouter container does not define a further sub-option space, but instead contains options drawn from the option space defined by [RFC 3315].

The Container option has the following format:



option-code CL_EROUTER_CONTAINER_OPTION (1027)

option-len n (n = number of bytes in the TLV encoded options)

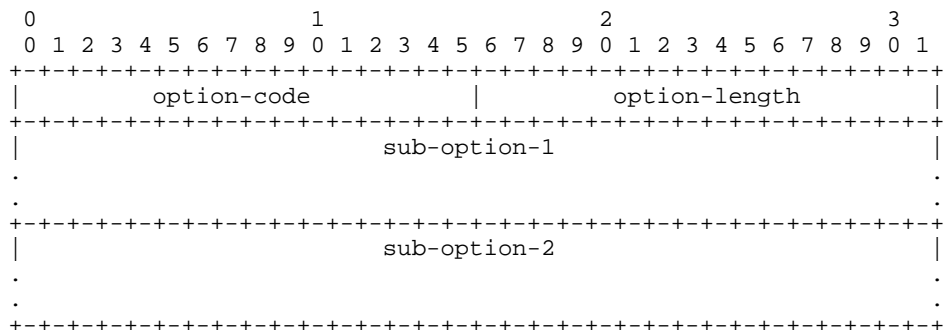
TLV-encoded-options A set of one or more TLV encoded options

5.4 DHCPv6 CableLabs Vendor-specific Information Option: PacketCable Sub-options

This section defines CableLabs DHCPv6 options for PacketCable compliant devices. These options are carried in the DHCPv6 vendor-specific information option (OPTION_VENDOR_OPTS, [RFC 3315]). The enterprise number for Cable Television Laboratories, Inc. to be used in OPTION_VENDOR_OPTS is 4491.

5.4.1 DHCPv4 CableLabs Client Configuration for PacketCable

This DHCP Option is transmitted to Cable Modems operating in IPv6 mode, to be relayed to embedded PacketCable devices that support operation in IPv4 mode. This allows such embedded PacketCable devices to identify the DHCPv4 servers from which they can obtain IP parameters such as IP address. This option has the following format:



option code: CL_OPTION_CCC (2170)
 (2170, or 0x087A is the result of adding the 000 'reserved sequence'
 and the PacketCable Project code 010 (binary) to the sub-
 option code 122 (decimal))

option-length: n

Table 7 lists the sub-options of the CL_OPTION_CCC DHCPv6 option. The sub-options are encoded as standard DHCPv6 options as specified in [RFC 3315]: using 16-bits for the sub-option-code, and 16-bits for the sub-option-length. It is to be noted that reference to [RFC 3495] in Table 7 relates to the data content of the respective sub-options, and not to the encoding of option-code or option-length.

The sub-options are indicated in Table 7.

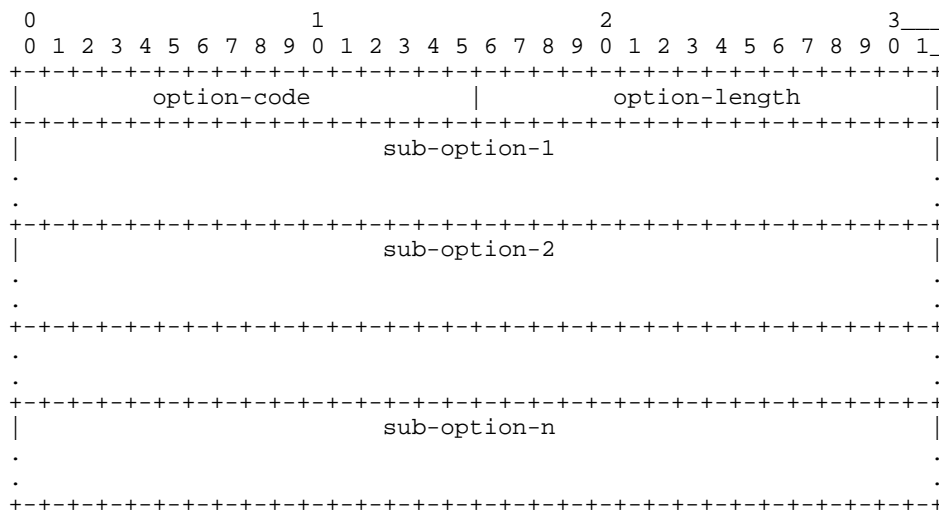
Table 7 - PacketCable Sub-options of DHCPv6 CableLabs Vendor-specific Information Option

Sub-option Code	Description	Source Spec for DHCP IPv4 equivalent
1	Primary DHCPv4 Server IP address	Sub-option data encoded as specified in [RFC 3495], option 122.1
2	Secondary DHCPv4 Server IP address	Sub-option data encoded as specified in [RFC 3495], option 122.2

5.4.2 DHCPv6 CableLabs Client Configuration Option for PacketCable

This DHCP option (CL_OPTION_CCCV6) is used by the PacketCable compliant devices to communicate the IPv6 Related information for the purposes of their configuration during the IP address acquisition phase. Sub-options 1 and 2 are transmitted to Cable Modems requesting IPv6 configuration via DHCPv6, and embedded with PacketCable devices. The remaining sub-options are transmitted to the embedded PacketCable device requesting IPv6 configuration via DHCPv6.

The format of the DHCPv6 CableLabs Client Configuration Option for IPv6 addressing is as follows:



option-code (2 octets): CL_OPTION_CCCV6 (2171)
 (2171, or 0x087B is the result of adding the 000 'reserved sequence' and the PacketCable Project code 010 (binary) to the sub-option code 123 (decimal))

option-length (2 octets): number of bytes of following sub-option data
 sub-options (n octets): encoded as specified in Table 8

The sub-options of CL_OPTION_CCCV6 are encoded as standard DHCPv6 options ([RFC 3315]): using 16-bits for the sub-option-code, and 16-bits for the sub-option-length. The format and meaning of each sub-option is as follows, where references to [RFC 3495], [RFC 3594], and to Section 4.4.1 of this document relate to the data content of the respective sub-options, and not to the encoding of option-code or option-length.

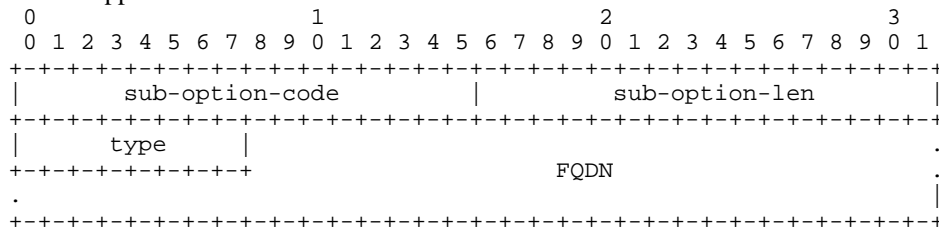
Table 8 - PacketCable Sub-options of CL_OPTION_CCCV6

CableLabs Sub-Option Type	Description	Comments
01	Primary DHCPv6 Server Selector ID	Sub-option data contains primary DSS_ID. Refer to Section 4.4.1 of this document for DSS_ID information.
02	Secondary DHCPv6 Server Selector ID	Sub-option data contains secondary DSS_ID. Refer to Section 4.4.1 of this document for DSS_ID information.
03	Service Provider's Provisioning Server Address.	See below for encoding details.
04	Service Provider's AS-REQ/AS-REP Backoff and Retry	Sub-option data encoded per [RFC 3495], sub-option 4.
05	Service Provider's AP-REQ/AP-REP Backoff and Retry	Sub-option data encoded per [RFC 3495], sub-option 5.
06	Service Provider's Kerberos Realm Name	Sub-option data encoded per [RFC 3495], sub-option 6.
07	Service Provider's Ticket Granting Server Utilization	Sub-option data encoded per [RFC 3495], sub-option 7.
08	Service Provider's Provisioning Timer Value	Sub-option data encoded per [RFC 3495], sub-option 8.
09	Security Ticket Control	Sub-option data encoded per [RFC 3594].

Sub-option 3 of CL_OPTION_CCCV6 carries the Service Provider's Provisioning Server Address or FQDN. This sub-option format is based on sub-option 3 of option 122 [RFC 3495], extended for IPv6. The general form of this sub-option is defined here; however, the content of the sub-option is subject to limitations of the particular CableLabs project (e.g., PacketCable [EUE-PROV] restricts the content to FQDN only.)

The content of sub-option 3, the Service Provider's Provisioning Server Address, can be configured as either an IPv6 address or as an FQDN. The encoding of sub-option 3 will adhere to one of two formats, indicated by a single "type" octet which follows the sub-option length field.

1. FQDN. The type octet is set to 0 (zero) to indicate an FQDN type encoding. The type octet is followed by the encoded FQDN. The FQDN MUST be encoded per [RFC 1035], Section 3.1. Note that a terminating 0 (a zero-length label) is required. Also note that name compression, as described in [RFC 1035], section 4.1.4, MUST NOT be applied.

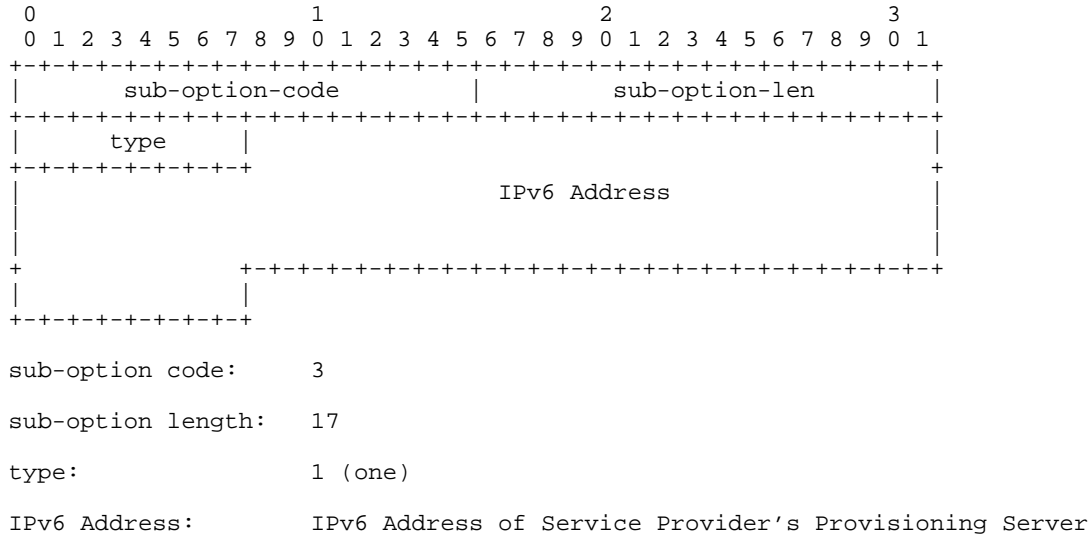


```

sub-option code:      3
sub-option length:   n (for FQDN of length n)
type:                0 (zero)
FQDN:                Fully Qualified Domain Name of Service Provider's
                    Provisioning Server

```

2. IPv6 Address. The sub-option length is 17. The type octet is set to 1 (one) to indicate an IPv6 address type encoding. The type octet is followed by 16 octets of IPv6 address. The IPv6 address MUST be encoded as 16 binary octets in network byte-order.



5.5 DHCPv6 CableLabs Vendor Class Option Values

The DHCPv6 Vendor Class Option (16, [RFC 3315]) contains an enterprise identifier and a series of vendor-specific length/value pairs. CableLabs uses this to identify the device with respect to CableLabs project. The enterprise number for Cable Television Laboratories, Inc., to be used in the Vendor Class Option is 4491. As required by the DHCPv6 specification, the vendor-class-data is formatted as a 2-octet length and a data value. In CableLabs use, the value is formatted as a string of ASCII characters (with no NUL terminator). While the Vendor Class Option allows for multiple values in each vendor-specific instance, CableLabs devices provide only a single identifying value, corresponding to a single project, unless otherwise indicated by a CableLabs specification.

The DHCPv6 Vendor Class Option values registered by this specification for all CableLabs projects for DHCPv6 are listed in Table 9.

Table 9 - CableLabs DHCPv6 Vendor Class Values

Specification	Product or Function	ASCII Coded Vendor Class Value	Reference
DOCSIS 3.0	Cable Modem	docsis3.0	[MULPIv3.0]
PacketCable 2.0	Embedded UE	pktc2.0	[EUE-PROV]

Appendix I Standard DHCP Options Used by CableLabs DHCPv4 Clients (Informative)

Table 10 lists DHCP options that a CableLabs DHCPv4 client uses in current specifications. Refer to the CableLabs Specification references for normative requirements and any additional details.

Table 10 - DHCP Options Used by CableLabs DHCPv4 Clients

DHCP Option Number	Description	Normative Reference	CableLabs Specifications	Comments
0	Pad	[RFC 2131]	CableHome 1.1 OpenCable Host 2.0 CableCARD 2.0	
1	Subnet Mask	[RFC 2132]	DOCSIS 1.1/2.0/3.0 CableHome 1.1 PacketCable 1.0/1.5 OpenCable Host 2.0 CableCARD 2.0	non-critical for DOCSIS
2	Time Offset	[RFC 2132]	DOCSIS 1.1/2.0/3.0 CableHome 1.1	non-critical for DOCSIS
3	Router Option	[RFC 2132]	DOCSIS 1.1/2.0/3.0 CableHome 1.1 PacketCable 1.0/1.5 OpenCable Host 2.0 CableCARD 2.0	non-critical for DOCSIS
4	Time Server Option	[RFC 2132]	DOCSIS 1.1/2.0/3.0 CableHome 1.1	non-critical for DOCSIS
6	Domain Name Server	[RFC 2132]	PacketCable 1.0/1.5 OpenCable Host 2.0	
7	Log Server Option	[RFC 2132]	DOCSIS 1.1/2.0/3.0 CableHome 1.1 PacketCable 1.0/1.5	non-critical for DOCSIS
12	Host Name	[RFC 2132]	CableHome 1.1 PacketCable 1.0/1.5	
15	Domain Name	[RFC 2132]	CableHome 1.1 PacketCable 1.0/1.5 OpenCable Host 2.0	
23	Default Time-to-Live	[RFC 2132]	CableHome 1.1 OpenCable Host 2.0 CableCARD 2.0	
26	Interface MTU	[RFC 2132]	CableHome 1.1	
43	Vendor Specific Information	[RFC 2132]	DOCSIS 1.1/2.0/3.0 CableHome 1.1 PacketCable 1.0/1.5 OpenCable Host 2.0 CableCARD 2.0	Included in the DHCP DISCOVER and DHCP REQUEST messages sent by the DHCP Client in the CPE device to the DHCP server. Refer to Table 1.
50	Requested IP Address	[RFC 2132]	DOCSIS 1.1/2.0/3.0 CableHome 1.1 OpenCable Host 2.0 CableCARD 2.0	Included in DHCP DISCOVER and DHCP REQUEST messages sent by the DHCP client to the DHCP server.

DHCP Option Number	Description	Normative Reference	CableLabs Specifications	Comments
51	IP address lease time	[RFC 2132]	DOCSIS 1.1/2.0/3.0 CableHome 1.1 OpenCable Host 2.0 CableCARD 2.0	
54	Server Identifier	[RFC 2132]	CableHome 1.1 OpenCable Host 2.0 CableCARD 2.0	
55	Parameter Request List	[RFC 2132]	DOCSIS 1.1/2.0/3.0 CableHome 1.1 PacketCable 1.0/1.5 OpenCable Host 2.0 CableCARD 2.0	Included in DHCP DISCOVER and DHCP REQUEST messages sent by the DHCP client to the DHCP server.
60	Vendor Class Identifier	[RFC 2132]	DOCSIS 1.1/2.0/3.0 CableHome 1.1 PacketCable 1.0/1.5 OpenCable Host 2.0 CableCARD 2.0	Included in DHCP DISCOVER and DHCP REQUEST messages sent by the DHCP client to the DHCP server. Refer to Table 2.
61	Client Identifier	[RFC 2132]	DOCSIS 1.1/2.0/3.0 CableHome 1.1	Included in DHCP DISCOVER and DHCP REQUEST messages sent by the DHCP client to the DHCP server.
67	Configuration File Option	[RFC 2132]	DOCSIS 1.1/2.0/3.0	Also called the 'Bootfile name'
68	DHCP relay agent information option	[RFC 3046]	DOCSIS 2.0/3.0	Option for specific agent-supplied sub-options
Sub-options				
1	Agent Circuit ID Sub-option	[RFC 3046]	DOCSIS 2.0/3.0	
2	Agent Remote ID Sub-option	[RFC 3046]	DOCSIS 2.0/3.0	
4	DOCSIS Device Class sub-option	[RFC 3256]	DOCSIS 2.0/3.0	
122	CableLabs Client Configuration	[RFC 3495]	CableHome 1.1 PacketCable 1.0/1.5	For CableHome, presence of this information in the DHCP ACK message from the DHCP server configures the PS to operate in SNMP Provisioning Mode.
Sub-options				
1	Telephony Service Provider's Primary DHCPv4 server Address	[RFC 3495]	PacketCable 1.0/1.5	Required by PacketCable specifications for the cable modem only.
2	Telephony Service Provider's Secondary DHCPv4 server address	[RFC 3495]	PacketCable 1.0/1.5	Optional for the cable modem in PacketCable specifications
3	Telephony Service Provider's SNMP Manager Address	[RFC 3495]	CableHome 1.1 PacketCable 1.0/1.5	
4	AS-REQ/REP Exchange Backoff and Retry for SNMPv3 Key Management	[RFC 3495]	PacketCable 1.0/1.5	Optional

DHCP Option Number	Description	Normative Reference	CableLabs Specifications	Comments
5	AP-REQ/REP Kerberized Provisioning Backoff and Retry	[RFC 3495]	PacketCable 1.0/1.5	Optional
6	Kerberos Realm of SNMP Entity	[RFC 3495]	CableHome 1.1 PacketCable 1.0/1.5	
7	Ticket Granting Server Usage	[RFC 3495]	PacketCable 1.0/1.5	Optional
8	Provisioning Timer	[RFC 3495]	PacketCable 1.0/1.5	Optional
9	Security Ticket Invalidation	[RFC 3495]	PacketCable 1.0/1.5	Optional
10	Kerberos Server IP Address	[RFC 3634]	CableHome 1.1	

Appendix II Acknowledgements

On behalf of CableLabs and its participating member companies, we would like to extend our thanks to all vendor participants who contributed to the development of the protocol fields registered in this specification. Key contributors to this document are recognized individually in each of the CableLabs project-specific specifications.

CableLabs Standards Department

Appendix III Revision History (Informative)

III.1 Engineering Changes for CM-SP-CL-SP-CANN-DHCP-Reg-I02-080306

The following engineering changes are incorporated into CM-SP-CL-SP-CANN-DHCP-Reg-I02-080306:

ECN	Date Accepted	Summary
CANN-DHCP-Reg-N-07.0027-3	3/19/2007	Addition of PacketCable MIB module indicator
CANN-DHCP-Reg-N-07.0030-2	8/29/2007	Changes to I01
CANN-DHCP-Reg-N-07.0031-3	10/31/2007	CableLabs Specific DHCP Options for PacketCable
CANN-DHCP-Reg-N-07.0035-4	2/20/2008	Corrections to other CANN-DHCP ECNs