CableLabs® Specifications

CableLabs' DHCP Options Registry

CL-SP-CANN-DHCP-Reg-I14-170111

ISSUED

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Document Status Sheet

Document Control Number:	CL-SP-CANN-DHCP-Reg-I14-170111			
Document Title:	CableLabs' DHCP Options Registry			
Revision History:	I01 – Released 01/19/07 I02 – Released 03/06/08 I03 – Released 08/11/09 I04 – Released 06/11/10 I05 – Released 10/08/10 I06 – Released 02/10/11 I07 – Released 06/23/11 I08 – Released 11/17/11 I09 – Released 08/09/12 I10 – Released 08/08/13 I11 – Released 05/15/15 I12 – Released 12/10/15 I13 – Released 03/17/16 I14 – Released 01/11/17			
Date:	January 11, 2017			
Status:	~~Work in Progress~~	~~Draft~~	**Issued**	~~Closed~~
Distribution Restrictions:	~~Author Only~~	~~CL/Member~~	~~CL/ Member/ Vendor~~	**Public**

Key to Document Status Codes:

Work in Progress	An incomplete document, designed to guide discussion and generate feedback that may include several alternative requirements for consideration.
Draft	A document in specification format considered largely complete, but lacking review by Members and vendors. Drafts are susceptible to substantial change during the review process.
Issued	A generally public document that has undergone Member and Technology Supplier review, cross-vendor interoperability, and is for Certification testing if applicable. Issued Specifications are subject to the Engineering Change Process.
Closed	A static document, reviewed, tested, validated, and closed to further engineering change requests to the specification through CableLabs.

Trademarks

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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, 2012, Data-Over-Cable Service Interface Specification, DOCSIS 1.0 Part 1: Radio Frequency Interface (RFI).

[ANSI/SCTE 23-1] ANSI/SCTE 23-1, 2010, DOCSIS 1.1, Part 1: Radio Frequency Interface.

[CANN] CableLabs' Assigned Names and Numbers Specification, CL-SP-CANN-I15-170111, January 11, 2017, 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.

[DEMARC1.0] DPoE Demarcation Device Specification, DPoE-SP-DEMARCv1.0-C01-160830, August 30, 2016, Cable Television Laboratories, Inc.

[eDOCSIS] Data-Over-Cable Service Interface Specifications, eDOCSIS Specification, CM-SP-eDOCSIS-I28-150305, March 5, 2015, Cable Television Laboratories, Inc.

[eRouter] Data-Over-Cable Service Interface Specifications, IPv4 and IPv6 eRouter Specification, CM-SP-eRouter-I19-160923, September 23, 2016, Cable Television Laboratories, Inc.

[EUE-PROV] PacketCable 2.0, E-UE Provisioning Framework Specification, PKT-SP-EUE-PROV-C01-140314, March 14, 2014, Cable Television Laboratories, Inc.

[MIB-CLABDEF] CableLabs Definition MIB Specification, CL-SP-MIB-CLABDEF-I12-160325, March 25, 2016, Cable Television Laboratories, Inc.

[MULPIv3.0] MAC and Upper Layer Protocols Interface Specification, CM-SP-MULPIv3.0-I30-170111, January 11, 2017, Cable Television Laboratories, Inc.

[MULPIv3.1] MAC and Upper Layer Protocols Interface Specification, CM-SP-MULPIv3.1-I10-170111, January 11, 2017, Cable Television Laboratories, Inc.

[OC-HOST 2.0] OpenCable Host Device 2.0 Core Functional Requirements, OC-SP-HOST2.0-CFR-C02-080328, March 28, 2008, 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-I04-090624, June 24, 2009, Cable Television Laboratories, Inc.

[R-PHY] Data-Over-Cable Service Interface Specifications, DCA-MHAv2, Remote PHY Specification, CM-SP-R-PHY-I06-170111, January 11, 2017, Cable Television Laboratories, Inc.

[RFC 868] IETF RFC 868/STD0026, Time Protocol, May 1983.

[RFC 1035] IETF RFC 1035/STD0013, 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] IETF RFC 3495, 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 3986] IETF RFC 3986, Uniform Resource Identifier (URI): Generic Syntax, January 2005.

[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] IETF RFC 3495, Dynamic Host Configuration Protocol for IPv6 (DHCPv6) Relay Agent Subscriber-ID Option, June 2006.

[RFIv2.0] Data-Over-Cable Service Specifications, Radio Frequency Interface Specification, CM-SP-RFIv2.0-C02-090422, April 22, 2009, Cable Television Laboratories, Inc.

[sRouter] Standalone Router Specification, CL-SP-sRouter-I02-170111, January 11, 2017, Cable Television Laboratories, Inc.

[Wi-Fi-GW] Wi-Fi Requirements for Cable Modem Gateways, WR-SP-WiFi-GW-I05-150515, May 15, 2015, 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.
- Internet Engineering Task Force (IETF) Secretariat, 48377 Fremont Blvd., Suite 117, Fremont, California 94538, USA, Phone: +1-510-492-4080, Fax: +1-510-492-4001, http://www.ietf.org.
- Internet Assigned Numbers Authority (IANA), http://www.iana.org.

3 ABBREVIATIONS

This document uses the following abbreviations and acronyms.

ASCII	American Standard Code for Information Interchange
CER	Customer Edge Router
DHCP	Dynamic Host Configuration Protocol
eCM	Embedded Cable Modem
eSAFE	Embedded Service/Application Functional Entity
NVT	Network Virtual Terminal
OUI	Organization Unique Identifier
PS	Portal Services
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.

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, 2.0, 3.0, or 3.1 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" For an eDVA: "EDVA" For a Demarcation Device: "DEMARC" as specified by DEMARC 1.0 For a RemotePHY Device: “RPD” as specified by [R-PHY]	DOCSIS 1.1/2.0/3.0/3.1* PacketCable 1.0/1.5/2.0 CableHome 1.0/1.1 OpenCable Host 2.0 CableCARD 2.0 eRouter eDVA DEMARC 1.0
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", "ETEA" or "EROUTER" corresponding to embedded MTA, embedded Portal Service Element, embedded STB, embedded TDM Emulation Adapter, and embedded Router, 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 "ECM:EDVA" = An embedded PacketCable Digital Voice Adapter "ECM:ESG" = An Embedded SMA Gateway "ECM:ETEA" = An Embedded TEA	DOCSIS 1.1/2.0/3.0/3.1* PacketCable 1.0/1.5/2.0 CableHome 1.0/1.1 OpenCable Host 2.0 CableCARD 2.0 eRouter

DHCP Option 43	Value	Description	Reference
		Vendors are allowed to add vendor-specific devices to the end of the list that are not eDOCSIS eSAFEs. Such devices will be included with a prefix "v" in same colon-separate format. For example: To include an eCM, an eMTA and a vendor device named "VendorXEmbeddedDevice", Sub-Option 3 would contain: "ECM:EMTA:vVendorXEmbeddedDevice" To include an eCM, an eSTB and a vendor device named "VendorYEmbeddedDevice" Sub-Option 3 would contain: "ECM:ESTB:vVendorYEmbeddedDevice"	
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 1.1/2.0/3.0/3.1* 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 1.1/2.0/3.0/3.1* 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 1.1/2.0/3.0/3.1* 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 1.1/2.0/3.0/3.1* PacketCable 1.0/1.5 CableHome 1.0/1.1 OpenCable Host 2.0 CableCARD 2.0
Sub-option 8	"<OUI>"	The 6-octet, NVT ASCII string containing the hexadecimal-encoded, vendor-specific Organization Unique Identifier (OUI). This string is not null terminated.	DOCSIS 1.1/2.0/3.0/3.1* 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 1.1/2.0/3.0/3.1* PacketCable 1.0/1.5 CableHome 1.0/1.1 OpenCable Host 2.0 CableCARD 2.0
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 1.1/2.0/3.0/3.1* PacketCable 1.0/1.5 CableHome 1.0/1.1 OpenCable Host 2.0

DHCP Option 43	Value	Description	Reference
Sub-options 11 to 127		**Reserved for CableLabs**	
Sub-options 11..14		*CableHome*	
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-options 15		*Config File Encapsulation Feature*	
Sub-option 15	"<eSAFE1:eSAFE2 … SAFEn>"	Colon-separated list of eSAFEs contained in an eDOCSIS device that supports eCM Config File Encapsulation. The list could contain "EMTA", "EDVA", "EPS", "ESTB", "ETEA", "EROUTER", or "ESG". The requirements for support of eCM Config File Encapsulation by each eSAFE type (and hence the requirements for the contents of this sub-option), can be found in the relevant eSAFE specification. If no eSAFE supports eCM Config File Encapsulation, then the eCM MUST either not populate this sub-option or set the sub-option length to zero. For example: "ESTB" = An Embedded STB with eCM eSAFE config file TLV support "" (or absence of sub-option 15) = no eSAFE supports the eCM eSAFE config file TLV	
Sub-options 16..17		*OpenCable*	
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-option 18	"<VideoSecurityElement>"	Video Security Type Only present if the device contains an eSTB. This sub-option takes one of the following values: "CARD" corresponds to an eSTB with a CableCARD Device as its security element. "SM" corresponds to an eSTB with a Secure Microprocessor as its security element. "EMBED" corresponds to an embedded security eSTB.	
Sub-options 19..30		Unassigned	
Sub-options 31..32		*PacketCable*	
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
Sub-options 51..54		*OpenCable*	
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..60		Unassigned	
Sub-options 61..70		*Remote PHY*	
61	<CCAP-Cores>	Address of all CCAP-Cores RPD attempts to connect to. The first entry in the list is principal Core.	[R-PHY]
Sub-options 62..70		Unassigned	
Sub-options 71..127		Unassigned	
Sub-options 128..254		**Reserved for Vendors**	
*Required only for cable modems in eDOCSIS devices.			

4.1.1 DHCPv4 Option 43 Examples (Informative)

4.1.1.1 DOCSIS Cable Modem with Embedded PacketCable 1.0 MTA Example

Table 2 shows the syntax for DHCP Option 43 for the eCM in an E-MTA.

Table 2 - Example eDOCSIS Device: E-MTA

DHCP DISCOVER Options	Value	Description
eCM DHCP DISCOVER		
eCM Option 43 sub-option 1	N/A (omitted because the list is empty)	List of sub-options (within option 43) to be returned by server
eCM Option 43 sub-option 2	"ECM"	Embedded cable modem
eCM Option 43 sub-option 3	"ECM:EMTA"	ECM followed by a list of embedded components (eSAFEs)
eCM Option 43 sub-option 4	"123456"	Device serial number as in MIB object docsDevSerialNumber
eCM Option 43 sub-option 5	"V1.2.3"	Hardware version number as in <Hardware version> field in MIB object sysDescr
eCM Option 43 sub-option 6	"V3.2.1"	Software version number as in <Software version> field in MIB object sysDescr
eCM Option 43 sub-option 7	"Boot 4.5.6"	Boot ROM version number as in <Boot ROM version> field in MIB object sysDescr
eCM Option 43 sub-option 8	"0204DF"	6-octet OUI as Vendor ID
eCM Option 43 sub-option 9	"Xman200"	Device model number as in <Model number> field in MIB object sysDescr
eCM Option 43 sub-option 10	"XYZ Broadband"	Vendor name as in <Vendor name> field in MIB object sysDescr

4.1.1.2 DOCSIS Cable Modem with Embedded CableHome 1.1 PS Example

Table 3 shows the syntax for DHCP Options 43 for the eCM in a CableHome 1.1 E-PS device.

Table 3 - Example eDOCSIS Device: DOCSIS 1.1 CableHome/E-PS

DHCP DISCOVER Options	Value	Description
eCM DHCP DISCOVER		
eCM Option 43 sub-option 1	N/A (omitted because the list is empty)	List of sub-options (within option 43) to be returned by server
eCM Option 43 sub-option 2	"ECM"	Embedded cable modem
eCM Option 43 sub-option 3	"ECM:EPS"	ECM followed by a list of embedded components (eSAFEs)
eCM Option 43 sub-option 4	"123456"	Device serial number as in MIB object docsDevSerialNumber
eCM Option 43 sub-option 5	"V1.2.3"	Hardware version number as in <Hardware version> field in MIB object sysDescr
eCM Option 43 sub-option 6	"V3.2.1"	Software version number as in <Software version> field in MIB object sysDescr
eCM Option 43 sub-option 7	"Boot 4.5.6"	Boot ROM version number as in <Boot ROM version> field in MIB object sysDescr
eCM Option 43 sub-option 8	"0204DF"	6-octet OUI as Vendor ID
eCM Option 43 sub-option 9	"Xman200"	Device model number as in <Model number> field in MIB object sysDescr
eCM Option 43 sub-option 10	"XYZ Broadband"	Vendor name as in <Vendor name> field in MIB object sysDescr

4.1.1.3 DOCSIS Cable Modem with Embedded STB Example

Table 4 illustrates the syntax for DHCP Options 43 for the eCM with an embedded STB.

Table 4 - Example eDOCSIS Device: DOCSIS 1.1 Embedded STB

DHCP DISCOVER & REQUEST Options	Options Value	Description
eCM DHCP DISCOVER & REQUEST		
eCM Option 43 sub-option 1	N/A (omitted because the list is empty)	List of sub-options (within option 43) to be returned by server
eCM Option 43 sub-option 2	"ECM"	Device type of the entity making the DHCP request. For DOCSIS, this is: "ECM "= embedded Cable Modem (as specified by DOCSIS 1.0, 1.1, or 2.0 Base Specifications)
eCM Option 43 sub-option 3	"ECM:ESTB"	Colon-separated list of eCM and eSAFE(s) contained in the device. First on the list MUST be "ECM". "ECM" = embedded CM "ESTB" = embedded STB
eCM Option 43 sub-option 4	e.g., "123456"	Device serial number from MIB object docsDevSerialNumber
eCM Option 43 sub-option 5	e.g., "V1.2.3"	Hardware version number from <Hardware version> field in MIB object sysDescr
eCM Option 43 sub-option 6	e.g., "V3.2.1"	Software version number from <Software version> field in MIB object sysDescr
eCM Option 43 sub-option 7	"Boot 4.5.6"	Boot ROM version number from <Boot ROM version> field in MIB object sysDescr
eCM Option 43 sub-option 8	"0204DF"	A 6-octet, hexadecimally-encoded, vendor-specific Organization Unique Identifier (OUI) that may match the OUI in the eCM's MAC address
eCM Option 43 sub-option 9	"Xman200"	Device model number from <Model number> field in MIB object sysDescr
eCM Option 43 sub-option 10	"XYZ Broadband"	Vendor name as in <Vendor name> field in MIB object sysDescr

DHCP DISCOVER & REQUEST Options	Options Value	Description
eCM DHCP DISCOVER & REQUEST		
eCM Option 43 sub-option 15	"ESTB"	eSTB supports eCM eSAFE Config file TLVs
eCM Option 43 sub-option 18	"EMBED"	This device contains an embedded security eSTB

4.1.1.4 DOCSIS Cable Modem with Embedded PacketCable MTA and CableHome PS

Table 5 shows the syntax for DHCP Option 43 for the eCM in an eDOCSIS device that contains the following embedded components: a DOCSIS 2.0 eCM, a PacketCable 1.0 eMTA, and a CableHome 1.1 ePS.

Table 5 - Example eDOCSIS Device Containing DOCSIS 2.0 eCM, eMTA and ePS

DHCP DISCOVER Options	Value	Description
eCM DHCP DISCOVER		
eCM Option 43 sub-option 1	N/A (omitted because the list is empty)	List of sub-options (within option 43) to be returned by server
eCM Option 43 sub-option 2	"ECM"	Embedded cable modem
eCM Option 43 sub-option 3	"ECM:EMTA:EPS"	ECM followed by a list of embedded components (eSAFEs)
eCM Option 43 sub-option 4	"123456"	Device serial number as in MIB object docsDevSerialNumber
eCM Option 43 sub-option 5	"V1.2.3"	Hardware version number as in <Hardware version> field in MIB object sysDescr
eCM Option 43 sub-option 6	"V3.2.1"	Software version number as in <Software version> field in MIB object sysDescr
eCM Option 43 sub-option 7	"Boot 4.5.6"	Boot ROM version number as in <Boot ROM version> field in MIB object sysDescr
eCM Option 43 sub-option 8	"0204DF"	6-octet OUI as Vendor ID
eCM Option 43 sub-option 9	"Xman200"	Device model number as in <Model number> field in MIB object sysDescr
eCM Option 43 sub-option 10	"XYZ Broadband"	Vendor name as in <Vendor name> field in MIB object sysDescr

4.1.1.5 DOCSIS Cable Modem with Embedded TEA

Table 6 shows the syntax for DHCP Option 43 for the eCM with an embedded TEA.

Table 6 - Example eDOCSIS Device: DOCSIS 1.1 TEA

DHCP DISCOVER Options	Value	Description
eCM DHCP DISCOVER		
eCM Option 43 sub-option 1	N/A (omitted because the list is empty)	List of sub-options (within option 43) to be returned by server
eCM Option 43 sub-option 2	"ECM"	Embedded cable modem
eCM Option 43 sub-option 3	"ECM:ETEA"	ECM followed by a list of embedded components (eSAFEs)
eCM Option 43 sub-option 4	"123456"	Device serial number as in MIB object docsDevSerialNumber
eCM Option 43 sub-option 5	"V1.2.3"	Hardware version number as in <Hardware version> field in MIB object sysDescr
eCM Option 43 sub-option 6	"V3.2.1"	Software version number as in <Software version> field in MIB object sysDescr
eCM Option 43 sub-option 7	"Boot 4.5.6"	Boot ROM version number as in <Boot ROM version> field in MIB object sysDescr
eCM Option 43 sub-option 8	"0204DF"	6-octet OUI as Vendor ID
eCM Option 43 sub-option 9	"Xman200"	Device model number as in <Model number> field in MIB object sysDescr

DHCP DISCOVER Options	Value	Description
eCM DHCP DISCOVER		
eCM Option 43 sub-option 10	"XYZ Broadband"	Vendor name as in <Vendor name> field in MIB object sysDescr

4.1.1.6 DOCSIS Cable Modem with Embedded Router

Table 7 shows the syntax for DHCP Option 43 for the eCM with an embedded router.

Table 7 - DOCSIS Cable Modem with Embedded Router

DHCP DISCOVER Options	Value	Description
eCM DHCP DISCOVER		
eCM Option 43 sub-option 1	N/A (omitted because the list is empty)	List of sub-options (within option 43) to be returned by server
eCM Option 43 sub-option 2	"ECM"	Embedded cable modem
eCM Option 43 sub-option 3	"ECM:EROUTER"	ECM followed by a list of embedded components (eSAFEs)
eCM Option 43 sub-option 4	"123456"	Device serial number as in MIB object docsDevSerialNumber
eCM Option 43 sub-option 5	"V1.2.3"	Hardware version number as in <Hardware version> field in MIB object sysDescr
eCM Option 43 sub-option 6	"V3.2.1"	Software version number as in <Software version> field in MIB object sysDescr
eCM Option 43 sub-option 7	"Boot 4.5.6"	Boot ROM version number as in <Boot ROM version> field in MIB object sysDescr
eCM Option 43 sub-option 8	"0204DF"	6-octet OUI as Vendor ID
eCM Option 43 sub-option 9	"Xman200"	Device model number as in <Model number> field in MIB object sysDescr
eCM Option 43 sub-option 10	"XYZ Broadband"	Vendor name as in <Vendor name> field in MIB object sysDescr
eCM Option 43 sub-option 15	"EROUTER"	eRouter supports eCM eSAFE Config file TLVs

4.1.1.7 DOCSIS Cable Modem with Embedded PacketCable 2.0 E-DVA Example

Table 8 shows the syntax for DHCP Option 43 for the eCM in an E-DVA.

Table 8 - Example eDOCSIS Device: E-DVA

DHCP DISCOVER Options	Value	Description
eCM DHCP DISCOVER		
eCM Option 43 sub-option 1	N/A (omitted because the list is empty)	List of sub-options (within option 43) to be returned by server
eCM Option 43 sub-option 2	"ECM"	Embedded cable modem
eCM Option 43 sub-option 3	"ECM:EDVA"	ECM followed by a list of embedded components (eSAFEs)
eCM Option 43 sub-option 4	"123456"	Device serial number as in MIB object docsDevSerialNumber
eCM Option 43 sub-option 5	"V1.2.3"	Hardware version number as in <Hardware version> field in MIB object sysDescr
eCM Option 43 sub-option 6	"V3.2.1"	Software version number as in <Software version> field in MIB object sysDescr
eCM Option 43 sub-option 7	"Boot 4.5.6"	Boot ROM version number as in <Boot ROM version> field in MIB object sysDescr
eCM Option 43 sub-option 8	"0204DF"	6-octet OUI as Vendor ID
eCM Option 43 sub-option 9	"Xman200"	Device model number as in <Model number> field in MIB object sysDescr
eCM Option 43 sub-option 10	"XYZ Broadband"	Vendor name as in <Vendor name> field in MIB object sysDescr

4.1.1.8 DOCSIS Cable Modem with Embedded PacketCable SMA Gateway Example

Table 9 shows the syntax for DHCP Option 43 for the eCM in an E-SG.

Table 9 - Example eDOCSIS Device: E-SG

DHCP DISCOVER Options	Value	Description
eCM DHCP DISCOVER		
eCM Option 43 sub-option 1	N/A (omitted because the list is empty)	List of sub-options (within option 43) to be returned by server
eCM Option 43 sub-option 2	"ECM"	Embedded cable modem
eCM Option 43 sub-option 3	"ECM:ESG"	ECM followed by a list of embedded components (eSAFEs)
eCM Option 43 sub-option 4	"123456"	Device serial number as in MIB object docsDevSerialNumber
eCM Option 43 sub-option 5	"V1.2.3"	Hardware version number as in <Hardware version> field in MIB object sysDescr.
eCM Option 43 sub-option 6	"V3.2.1"	Software version number as in <Software version> field in MIB object sysDescr
eCM Option 43 sub-option 7	"Boot 4.5.6"	Boot ROM version number as in <Boot ROM version> field in MIB object sysDescr
eCM Option 43 sub-option 8	"0204DF"	6-octet OUI as Vendor ID
eCM Option 43 sub-option 9	"Xman200"	Device model number as in <Model number> field in MIB object sysDescr
eCM Option 43 sub-option 10	"XYZ Broadband"	Vendor name as in <Vendor name> field in MIB object sysDescr

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 10.

Table 10 - 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:xxxxxxx, where xxxxxxx is the ASCII representation of the hexadecimal encoding of the Modem Capabilities.	[ANSI/SCTE 23-1]
DOCSIS 2.0	Cable Modem	docsis2.0:xxxxxxx, where xxxxxxx is the ASCII representation of the hexadecimal encoding of the Modem Capabilities.	[RFIv2.0]
DOCSIS 3.0	Cable Modem	docsis3.0:	[MULPIv3.0]
DOCSIS 3.1	Cable Modem	docsis3.1:	[MULPIv3.1]
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:xxxxxxx, where xxxxxxx is the ASCII representation of the hexadecimal encoding of the device capabilities.	[OC-HOST 2.0]
PacketCable 1.0	Embedded MTA	pktc1.0:xxxxxx, where xxxxxxx is the ASCII representation of the hexadecimal encoding of the device capabilities.	[PROV]
PacketCable 1.5	Embedded MTA	pktc1.5:xxxxxx, where xxxxxxx is the ASCII representation of the hexadecimal encoding of the device capabilities.	[PROV 1.5]
PacketCable 2.0	Embedded UE	pktc2.0:xxxxxx, where xxxxxxx is the ASCII representation of the hexadecimal encoding of the device capabilities.	[EUE-PROV]
DEMARC 1.0	DEMARC	DEMARC 1.0	[DEMARC1.0]

Specification	Product or Function	ASCII Coded Option 60 String	Reference
sRouter 1.0	Standalone Router	SROUTER1.0	[sRouter]

4.3 DHCPv4 Vendor Identifying Vendor-Specific Relay Agent Options

This section defines CableLabs DHCPv4 options, which are carried in the 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.

All the options covered in this section are carried in the CableLabs DHCPv4 Relay agent option. (Option 82-9-4491-x)

4.3.1 The DHCPv4 Relay Agent CMTS capabilities option

This section defines CableLabs DHCPv4 Relay sub options, which can be carried in the DHCPv4 Vendor-Specific Information Relay Agent sub-option [RFC 3046], [RFC 4243].

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

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     type      |      len      | value...                      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

type              type of capability

len               number of bytes in the value

value             value of this capability
```

The following TLVs are defined in this specification.

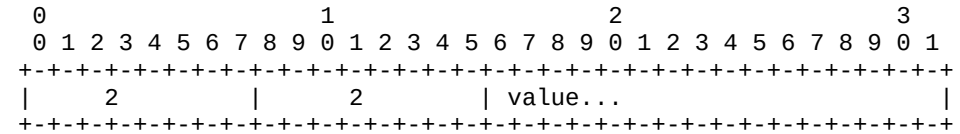
4.3.1.1 CMTS DOCSIS Version Number

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:

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|      1        |        len     |   major vers  |   minor vers  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

type              CMTS DOCSIS version number (1)

len               2

major vers        major version number (e.g., 1, 2, 3)

minor vers        minor version number (e.g., 0, 1)
```

4.3.1.2 DPoE System Version Number

This TLV carries the DPoE System Version Number that the device is compatible with. The 'major vers' and 'minor vers' are combined to form the DPoE version number. The format of this TLV is:



type DPoE System version number (2)

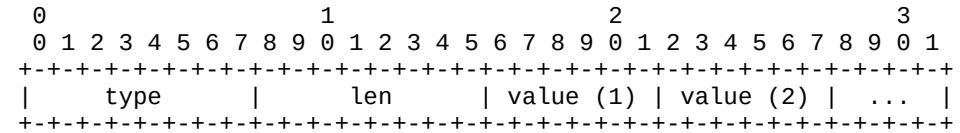
len 2

major vers major version number (e.g., 1, 2, 3)

minor vers minor version number (e.g., 0, 1)

4.3.1.3 DPoE System DHCPv4 PBB service option

If PBB is configured on the DPoE System, this TLV carries the DPoE System DHCPv4 PBB service option. The length (len) is the number of bytes for the PBB backbone addresses assigned to the DPoE System, equal to 6×n for n backbone address. The format of this TLV is as follows:



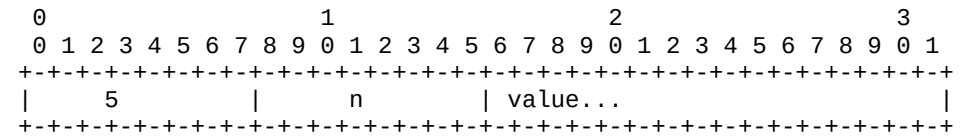
Type DPoE System DHCPv4 PBB service option (4)

len 6×n (for n backbone addresses)

value (n) backbone (BB) MAC Address (48 bit IEEE 802 MAC address)

4.3.1.4 CMTS CM Service Class

This TLV carries the Service Class name or the QoS Profile Name provisioned to the CM. It can be utilized by the provisioning server to determine the available profile for the user. Using this sub-option, the MSO can relay the provisioned service class or QOS profile names as defined on the CMTS to the DHCP server which in turn will combine this information with other parameters such as DHCPv4 option 60 and 43 to assign an appropriate address.



type Service Class or QoS Profile Name (5)

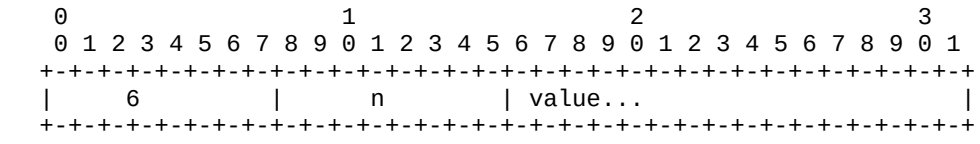
len n (for string of length n)

value Colon delimited list of service class names or qos

profile names (max len 254)

4.3.1.5 CMTS MSO Defined Text

This TLV carries the MSO defined text provisioned for an interface. It can be utilized by the provisioning server to determine the profile for the user.



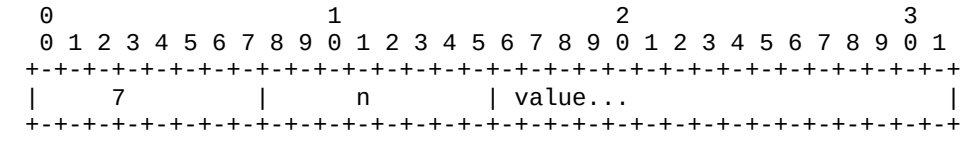
type MSO Defined Text (6)

len n (for string of length n)

value MSO defined Text (max len 254)

4.3.1.6 Secure File Transfer URI

This TLV carries the Secure File Transfer URI option that is communicated to the CPE. The Secure File Transfer URI Option provides a Uniform Resource Identifier (URI) to the location where a target configuration file is stored, together with the indication of the preferred secure file transfer mechanism that the CPE device is requested to use, to retrieve the said file. The format of this TLV is:



type Secure File Transfer URI (7)

len n (for string of length n)

value URI (max len 254)

The URI is constructed with the standard form as defined in [RFC 3986].

4.4 DHCPv4 CableLabs Vendor-Specific Information Option - Common Sub-Options

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

All the options covered in this section are carried in the CableLabs Vendor specific option. (Option 124-4491-x, Option 125-4491-x)

DHCPv4 defines an Option Request Option (see option code CL_V4OPTION_ORO in Section 4.4.1) which is used by the client to inform the server about options the client wants the server to send to the client.

The clients (e.g., eCM, eRouter) MUST include the following options within the CL_V4OPTION_ORO(1) list of options, so that the DHCPv4 Server can infer that vendor-specific ORO options are contained within the option request option.

Table 11 below lists and defines DHCPv4 sub-options that may be common to multiple CableLabs projects:

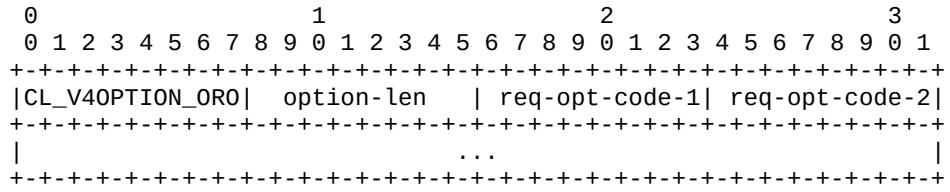
Table 11 - DHCPv4 CableLabs Vendor-Specific Information Option Shared by CableLabs Projects

Type		Value	Description	Source Spec for DHCP IPv4
CableLabs sub-option type (Least Significant 10 bits in binary)	**Type (Decimal)***			
0000000001	1	The number of requested options plus the option codes requested by the client	CL_V4OPTION_ORO	[MULPIv3.0] [MULPIv3.1]
0000000010	2	IPv4 addresses of TFTP servers	CL_V4OPTION_TFTP_SERVERS	[MULPIv3.0] [MULPIv3.1]
0000000011	3	A set of one or more TLV encoded options	CL_V4EROUTER_CONTAINER_OPTION	[eRouter]
0000000100	4	eMTA MIBs supported; 0x01 – CableLabs 0x02 – IETF 0x03 - EuroCableLabs	CL_V4_PACKETCABLE_MIB_ENV_OPTION	[EUE-PROV]
0000000101	5	TLV5 modem capabilities data	CL_V4OPTION_MODEM_CAPABILITIES	[MULPIv3.0] [MULPIv3.1]
0000000110	6	IPv4 address or FQDN	CL_V4OPTION_ACS_SERVER	[Wi-Fi-GW]
0000000111	7	IPv4 address or FQDN	CL_V4OPTION_RADIUS_SERVER	[Wi-Fi-GW]
01111011	123		CL_V4OPTION_CCCV6	[EUE-PROV]
01111100	124		CL_V4OPTION_IP_PREF	[EUE-PROV]
* (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.)				

4.4.1 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:



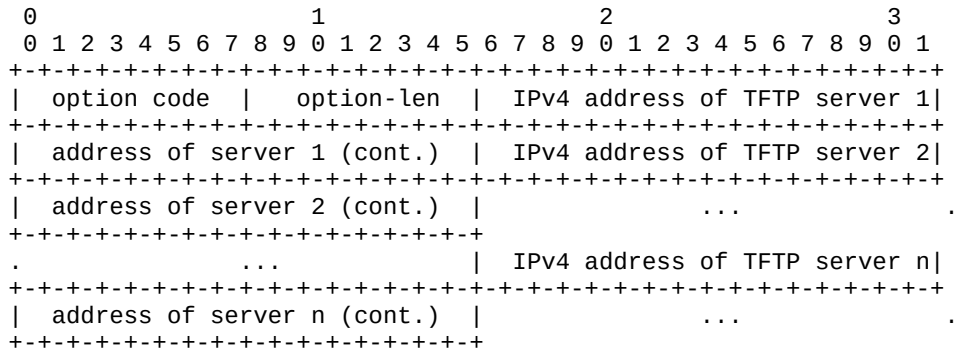
option-code CL_V4OPTION_ORO (1).

option-len number of requested options.

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

4.4.2 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:



option-code CL_V4OPTION_TFTP_SERVERS (2)

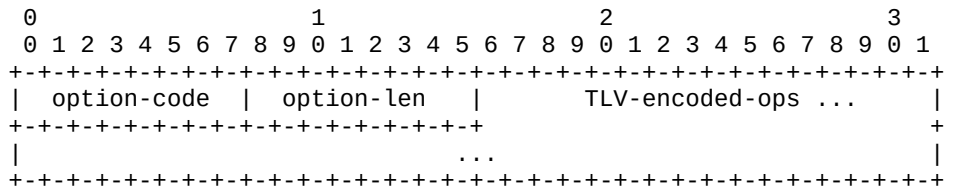
option-len number of bytes for TFTP server IPv4 addresses (4*n for n servers)

IPv4 addresses of TFTP servers

4.4.3 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:



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

4.4.4 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)
```

4.4.5 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:

```
  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-data...                |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-++-+-+-+-+-+-+-+-++-+-+-+-+-+-+
 |                               ...                             |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

 option-code   CL_V4OPTION_MODEM_CAPABILITIES (5)

 option-len    number of octets carrying TLV5 data.

 option-data   TLV5 data.
```

The hexadecimal encoding for this TLV along with 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.

4.4.6 CableLabs Specific DHCPv4 Options for Stand-alone Access Points

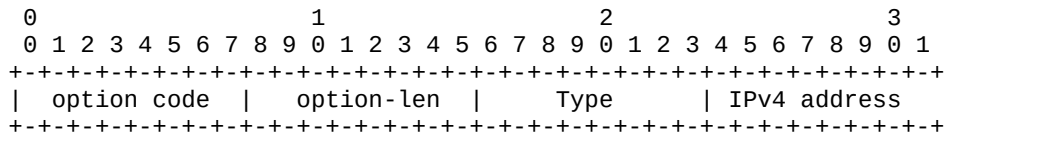
This section specifies CableLabs-specific DHCPv4 options for a Stand-alone Access Point (AP) operating in IPv4 mode. Options defined in this section provide additional configuration information, which may be requested by a Stand-alone AP or Wi-Fi Gateway.

4.4.6.1 Access Point ACS IPv4 Server Address

This DHCP Option is requested by Access Points that are not pre-configured with an ACS IPv4 address, and that require use of DHCP to obtain their ACS Server information. This option may be encoded as either an IPv4 address or an FQDN.

When encoded as an IPv4 address, the following conventions must be followed.

The length octet MUST be followed by a single octet that indicates the specific address type that follows. This type octet MUST be set to 1 to indicate an IPv4 address. The type octet MUST be followed by 4 octets of the IPv4 address:



```
 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  |     Type      | IPv4 address
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

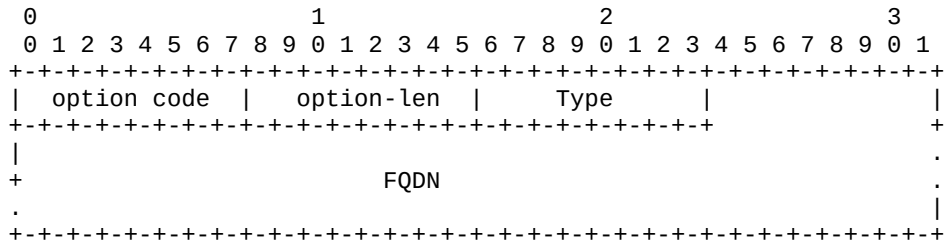
option-code CL_V4OPTION_ACS_SERVER (6)

option-len number of bytes for ACS server IPv4 address (4 bytes)

IPv4 address of ACS server

When encoded as an FQDN, the following conventions must be followed.

The length octet MUST be followed by a single octet that indicates the specific address type that follows. This type octet MUST be set to 0 to indicate an FQDN. The type octet MUST be followed by the encoded FQDN:



```
 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  |     Type      |               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+               +
|                                                               .
+                         FQDN                                  .
.                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

option-code CL_V4OPTION_ACS_SERVER (6)

option-len number of bytes for ACS server FQDN

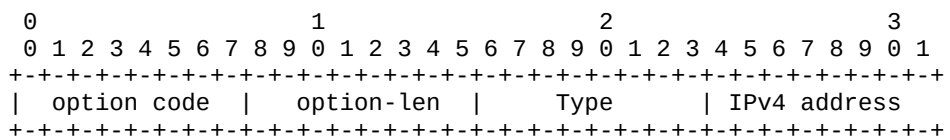
FQDN of ACS server

4.4.6.2 Access Point RADIUS IPv4 Server Address

This DHCP Option is requested by Access Points that are not pre-configured with a RADIUS server IPv4 address, and that require use of DHCP to obtain their RADIUS server information. This option may be encoded as either an IPv4 address or an FQDN.

When encoded as an IPv4 address, the following conventions must be followed.

The length octet MUST be followed by a single octet that indicates the specific address type that follows. This type octet MUST be set to 1 to indicate an IPv4 address. The type octet MUST be followed by 4 octets of the IPv4 address:



```
 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  |     Type      | IPv4 address
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

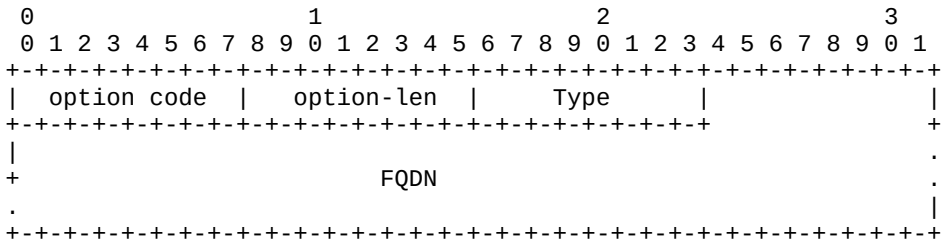
option-code CL_V4OPTION_RADIUS_SERVER (7)

option-len number of bytes for RADIUS server IPv4 address (4 bytes)

IPv4 address of RADIUS server

When encoded as an FQDN, the following conventions must be followed.

The length octet MUST be followed by a single octet that indicates the specific address type that follows. This type octet MUST be set to 0 to indicate an FQDN. The type octet MUST be followed by the encoded FQDN:



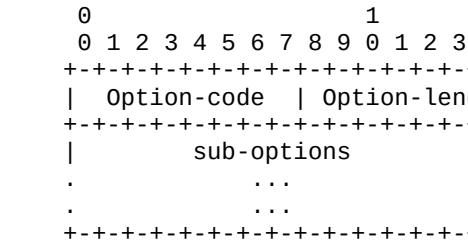

```
option-code      CL_V4OPTION_RADIUS_SERVER (7)

option-len       number of bytes for RADIUS server FQDN

FQDN of RADIUS server
```

4.4.7 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.

4.4.7.1 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
```

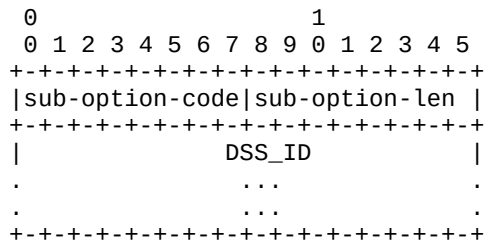
The format and meaning of each sub-option is defined in Table 12 below.

Table 12 - 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:

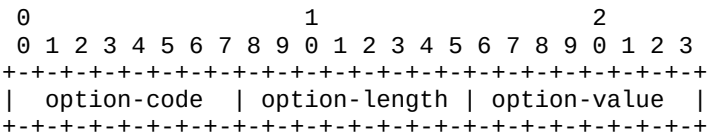



```
sub-option-code   (1 octet)     : value of '1' for sub-option; value of '2' for
                                  sub-option 2

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.
```

4.4.7.2 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, and dual stack operation.

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 – indicates IPv4 for provisioning, and also
                               acquire IPv6.
                           6 – indicates IPv6 for provisioning, and also
                               acquire IPv4.
```

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 13 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 13 - CableLabs Project Codes for DHCPv6 Options

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

Table Note:

*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

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 Specification [CANN].

DHCPv6 also defines an Option Request Option (see option code OPTION_ORO in section 22.7 of [RFC 3315], which is used by the client to inform the server about options the client wants the server to send to the client.

The clients (e.g., eDVA, eCM) MUST include OPTION_VENDOR_OPTS (17) within the ORO(6) list of options, so that the DHCPv6 Server can infer that vendor-specific ORO options (e.g., CL_OPTION_ORO) are contained within OPTION_VENDOR_OPTS.

Table 14 below lists and defines DHCPv6 sub-options that may be common to multiple CableLabs projects:

Table 14 - DHCPv6 CableLabs Vendor-specific Information Option Shared by CableLabs Projects

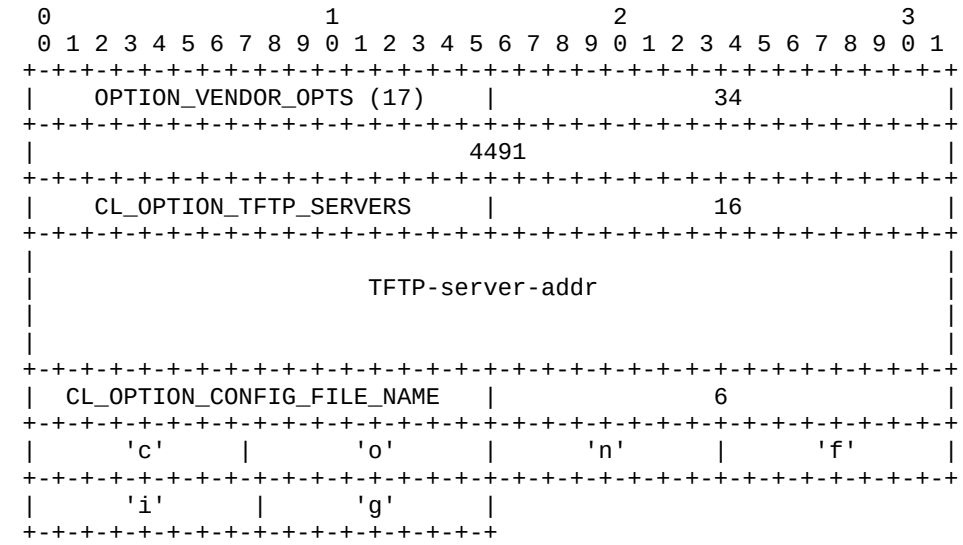
Type		Value	Description	Source Spec for DHCP IPv4 equivalent
CableLabs sub-option type (Least Significant 10 bits in binary)	**Type** (Decimal)			
0000000001	1	Multiple 16 bit option id's	CL_OPTION_ORO	[eDOCSIS]
0000000010	2	"ECM", "EPS", "EMTA", "ESTB", or "EROUTER"	CL_OPTION_DEVICE_TYPE	[eDOCSIS]

Type		Value	Description	Source Spec for DHCP IPv4 equivalent
CableLabs sub-option type (Least Significant 10 bits in binary)	**Type** (Decimal)			
0000000011	3	"ECM: < eSAFE1:eSAFE2 … SAFEn>"	CL_OPTION_EMBEDDED_COMPONENTS_LIST Colon-separated list of eCM and eSAFE(s) contained in the complete eDOCSIS device. 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. 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:EROUTER" = An eRouter "ECM:EMTA:EROUTER" = An Embedded MTA and an eRouter	[eDOCSIS]
0000000100	4	"<device serial number>"	CL_OPTION_DEVICE_SERIAL_NUMBER Device serial number as in the MIB object docsDevSerialNumber e.g., "123456"	[eDOCSIS]
0000000101	5	"<Hardware version>"	CL_OPTION_HARDWARE_VERSION_NUMBER Hardware version number. Identical to value as reported in the <Hardware version> field in the MIB object sysDescr. e.g., "v.3.2.1"	[eDOCSIS]
0000000110	6	"<Software version>"	CL_OPTION_SOFTWARE_VERSION_NUMBER Software version number. Identical to value as reported in the <Software version> field in the MIB object sysDescr. e.g., "v.1.0.2"	[eDOCSIS]
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] [MULPIv3.1]
0000100000	32	Multiple 16 octet IPv6 addresses	CL_OPTION_TFTP_SERVERS TFTP Server Addresses option	[MULPIv3.0] [MULPIv3.1]

Type		Value	Description	Source Spec for DHCP IPv4 equivalent
CableLabs sub-option type (Least Significant 10 bits in binary)	**Type** (Decimal)			
0000100001	33	"<Config File Name>"	CL_OPTION_CONFIG_FILE_NAME Configuration File Name option	[MULPIv3.0] [MULPIv3.1]
0000100010	34	Multiple 16 octet IPv6 addresses	CL_OPTION_SYSLOG_SERVERS Syslog Server Addresses option	[MULPIv3.0] [MULPIv3.1]
0000100011	35	Multiple octets	CL_OPTION_MODEM_CAPABILITIES	[MULPIv3.0] [MULPIv3.1]
0000100100	36	6 octet MAC address	CL_OPTION_DEVICE_ID Device Identifier option	[MULPIv3.0] [MULPIv3.1]
0000100101	37	Multiple 16 octet IPv6 addresses	OPTION_RFC868_SERVERS	[MULPIv3.0] [MULPIv3.1]
0000100110	38	32 bit signed integer	CL_OPTION_TIME_OFFSET	[MULPIv3.0] [MULPIv3.1]
0000100111	39	1 – for IPv4 preference 2 – for IPv6 preference	CL_OPTION_IP_PREF	[EUE-PROV]
0000101000	40	IPv6 address or FQDN	CL_V6OPTION_ACS_SERVER	[Wi-Fi-GW]
0000101001	41	IPv6 address or FQDN	CL_V6_OPTION_RADIUS_SERVER	[Wi-Fi-GW]
0000101010	42	IPv6 address or 128 zeros	CL_V6_OPTION_CER-ID	[eRouter]
0000111101	61	<CCAP-Cores>	CL_V6_CCAP_CORES Address of all CCAP-Cores RPD attempts to connect to. The first entry in the list is principal Core.	[R-PHY]

* (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.)

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.

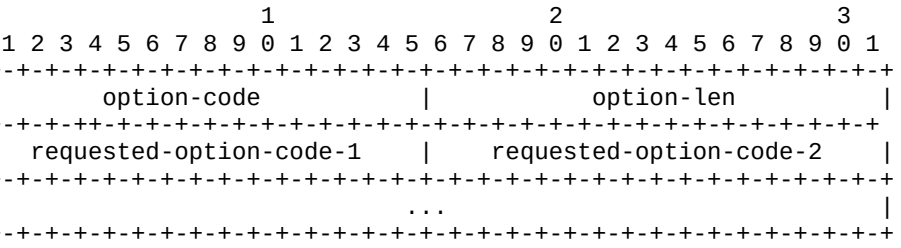
The following sub-sections individually describe each of the option sub-types from Table 14 above.

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)

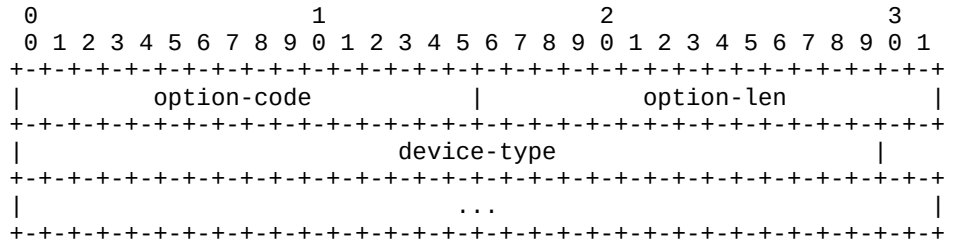
option-len 2 * number of requested options in bytes.

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

5.2.2 Device Type Option

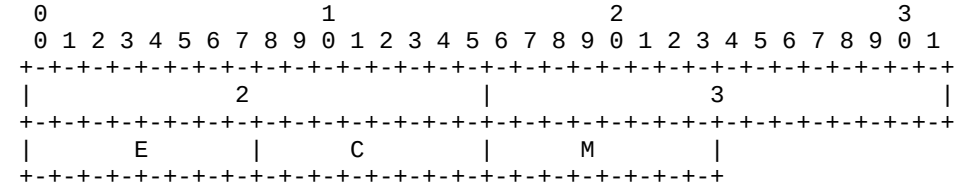
This option is used to identify the device type of the component making the DHCPv6 request.

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, 3.0
    or 3.1 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
   "SROUTER" for a Standalone Router
```

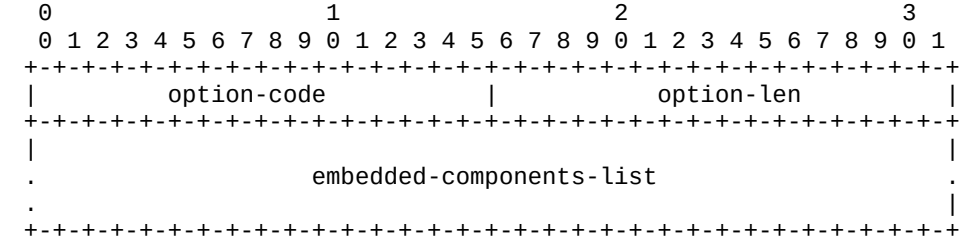
Example: To indicate to the provisioning system that the DHCP client is implemented on an embedded cable modem, Option code 2 contains the string ECM as shown below.



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.

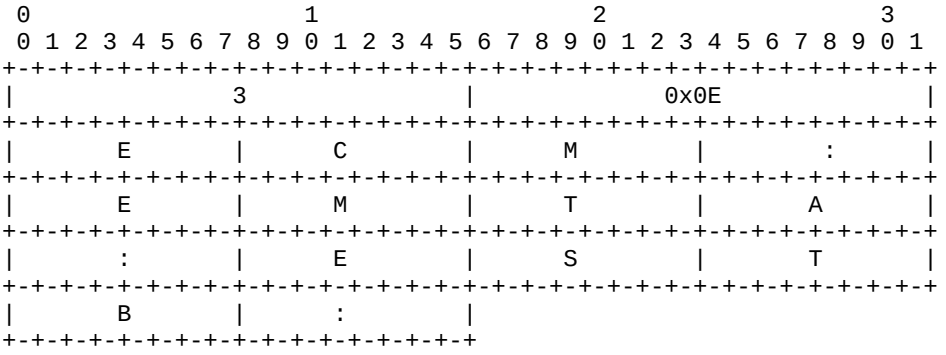
The format of the Embedded Components List option is:




```
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, 3.0
      or 3.1 Base Specifications) – must be first
     "EPS" for CableHome embedded Portal Services Element
     "EMTA" for PacketCable embedded Multimedia Terminal Adapter
     "EDVA" for PacketCable embedded Digital Voice 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)
```

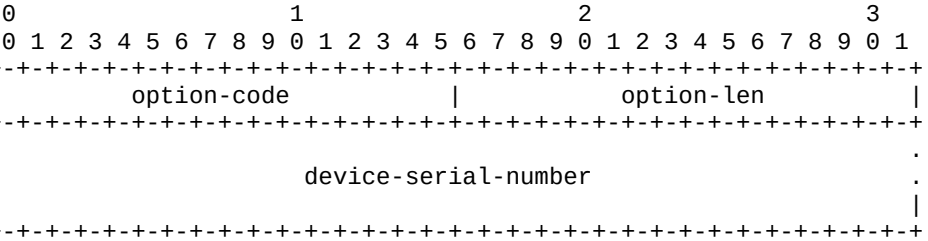
An example of the List of Implemented eSAFEs for a hypothetical product implementing an eCM, eMTA, and eSTB follows:



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:

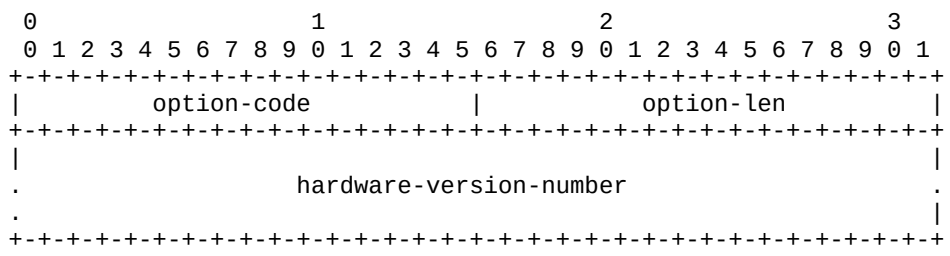



```
option code:         CL_OPTION_DEVICE_SERIAL_NUMBER (4)

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)

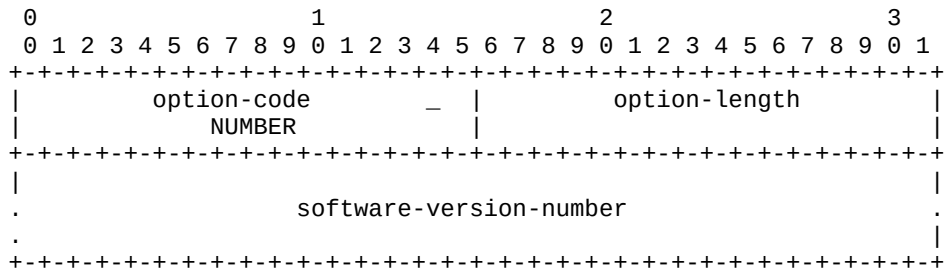
option length: n (for string of length n)

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)

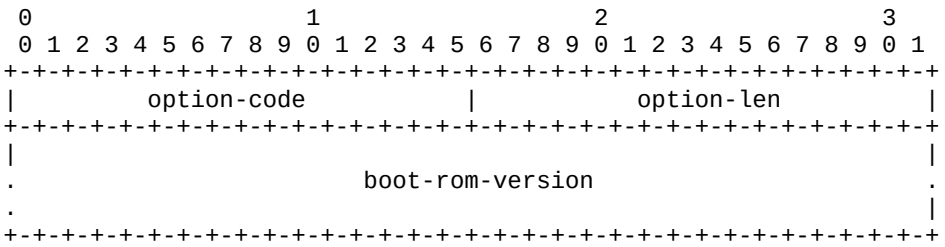
option length: n (for string of length n)

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:

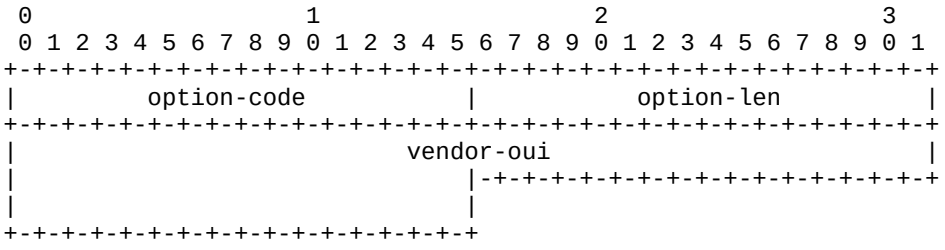



```
option code:         CL_OPTION_BOOT_ROM_VERSION(7)

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:

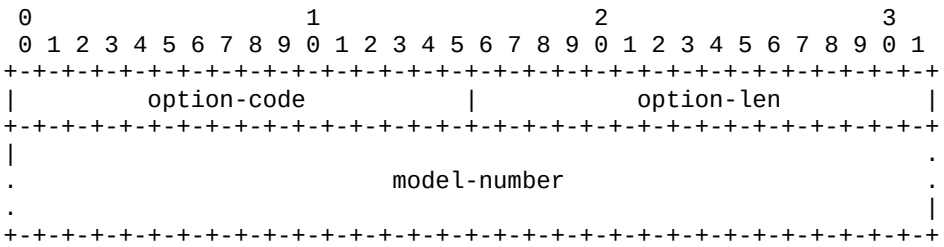



```
option code:         CL_OPTION_VENDOR_OUI(8)

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:



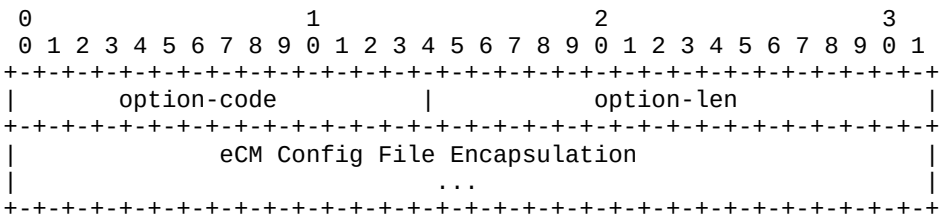
option code: CL_OPTION_MODEL_NUMBER(9)

option length: n (for string of length n)

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

5.2.10 eCM Config File Encapsulation

The eCM Config File Encapsulation option indicates the list of eSAFE devices that supports this feature.



option code: CL_OPTION_ECM CFG ENCAPS(15)

option length: n (for string of length n)

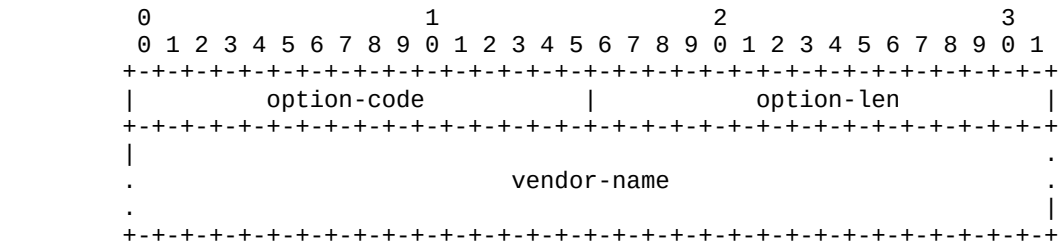
eCM Config File Encapsulation: "<eSAFE1:eSAFE2 …SAFEn>"

This is a colon-separated list of eSAFEs contained in the eDOCSIS device that supports eCM Config File Encapsulation. This list follows the same syntax as defined for the DHCPv4 Option 43 Sub-option 15 Encoding, in Section 4.1.

5.2.11 Vendor Name Option

This option contains the vendor name or ID as reported in the <Vendor name> field in the MIB object sysDescr.

The format of the Vendor Name option is:



option code: CL_OPTION_VENDOR_NAME(10)

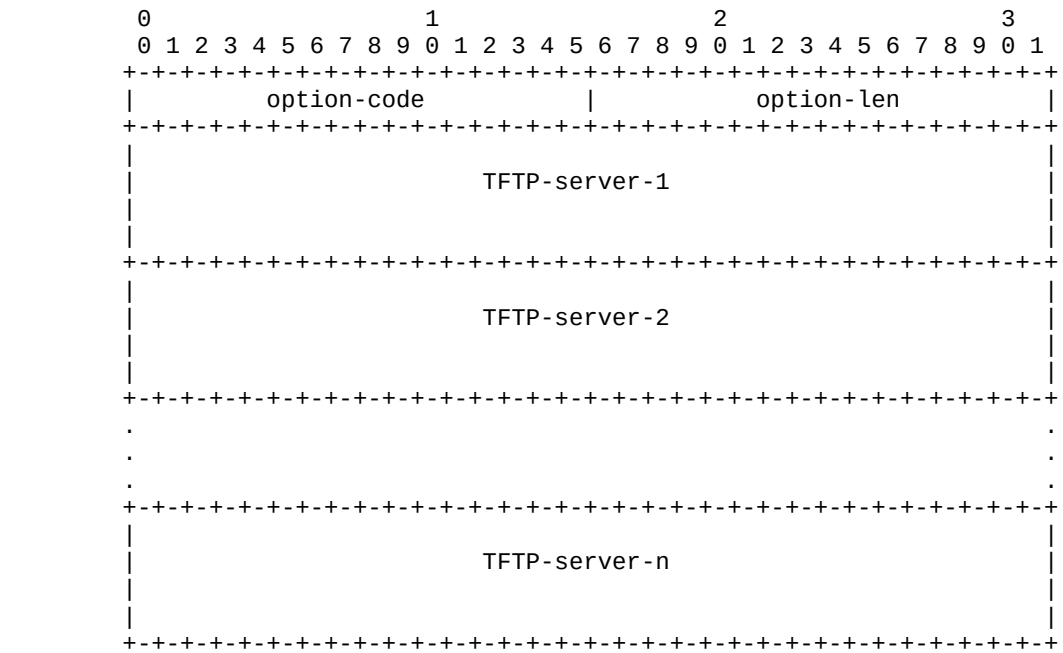
option length: n (for string of length n)

vendor-name: The vendor name string NVT ASCII text MUST NOT be null terminated.

5.2.12 TFTP Server Addresses Option

The TFTP Server Addresses option contains the IPv6 addresses of the TFTP servers from which the client obtains its configuration file. The TFTP server addresses are listed in order of preference, and the client MUST attempt to obtain its configuration file from the TFTP servers in the order in which they appear in the option.

The format of the TFTP Server Addresses option is:



option code: CL_OPTION_TFTP_SERVERS(32)

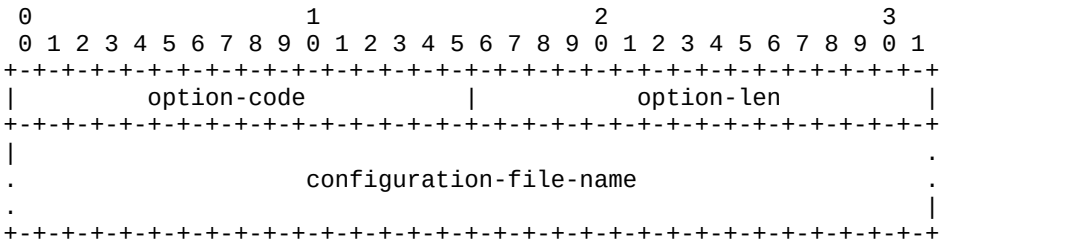
option length: 16*n (for n servers in the option) in bytes

TFTP-server: The IPv6 address of a TFTP server

5.2.13 Configuration File Name Option

This option contains the name of the configuration file for the client. The client MUST use this name to specify the configuration file to be obtained from a TFTP server.

The format of the Configuration File Name option is:



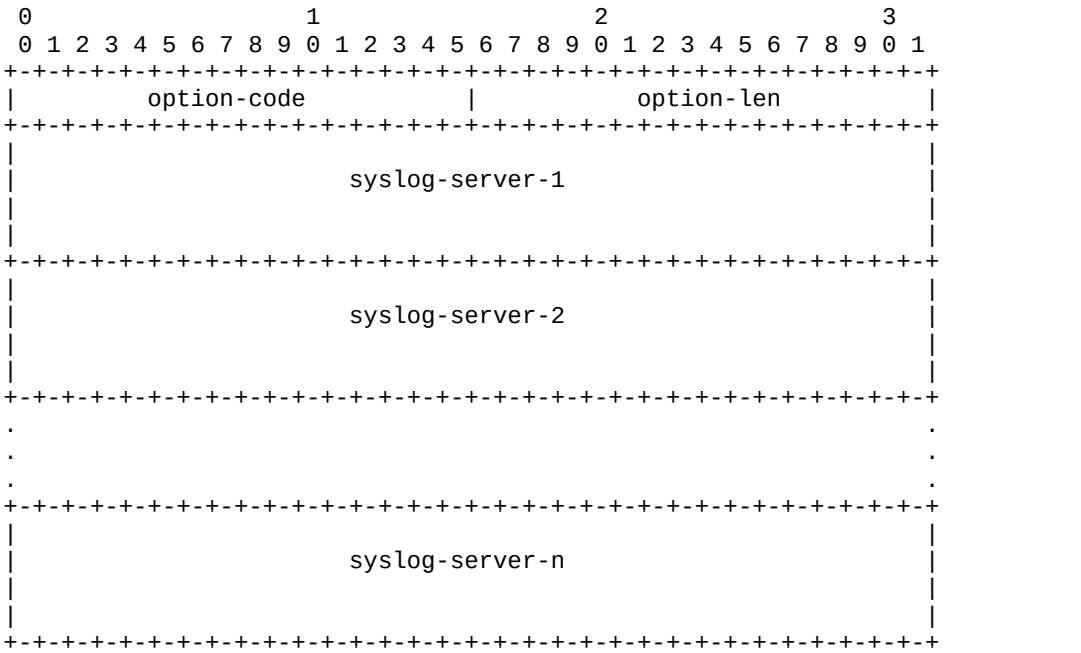

```
option code:         CL_OPTION_CONFIG_FILE_NAME(33)

option length:       n (for file name of length n)

configuration-file-name: The name of the configuration file for the client
```

The file name MUST consist of octets of NVT ASCII text, and MUST NOT be null-terminated. The file name MUST consist of octets of NVT ASCII text, and MUST NOT be null-terminated.

5.2.14 Syslog Server Addresses Option

The Syslog Server Addresses option contains the IPv6 addresses of the syslog protocol servers that the client uses for syslog messages. The syslog server addresses are listed in order of preference, and the client MUST attempt to use the syslog servers in the order in which they appear in the option.

The format of the Syslog Server Addresses option is:

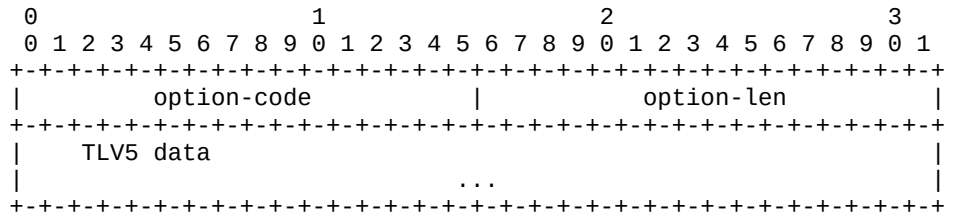


```
option code:         CL_OPTION_SYSLOG_SERVERS(34)

option length:       16*n (for n servers in the option)

syslog-server:       The IPv6 address of a syslog server
```

5.2.15 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], [MULPIv3.1], encoded in hexadecimal.

The format of the Modem Capabilities Encoding option is:

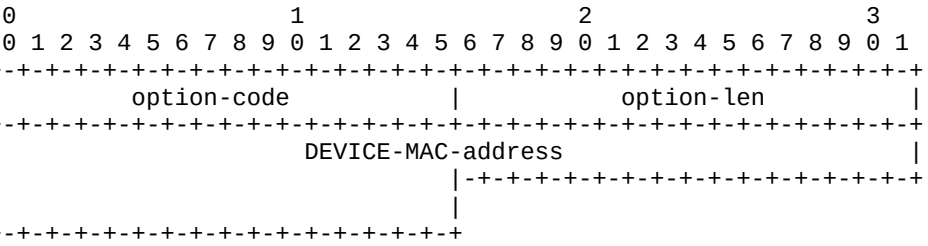



```
option-code   CL_OPTION_MODEM_CAPABILITIES (35)

option-len    number of octets carrying TLV5 data.

option-data   TLV5 data.
```

The hexadecimal encoding for this TLV along with the first two sub-TLVs (concatenation and DOCSIS Version) of a DOCSIS 3.0 modem would be: 0x35 0xnn 0x01 0x01 0x01 0x02 0x01 0x03. This example shows only two sub-TLVs, for the sake of simplicity.

5.2.16 Device Identifier Option

For DOCSIS 3.0 and DOCSIS 3.1 CMs, the option contains the identifier of the CM device. In DOCSIS 3.0 and DOCSIS 3.1, 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.)

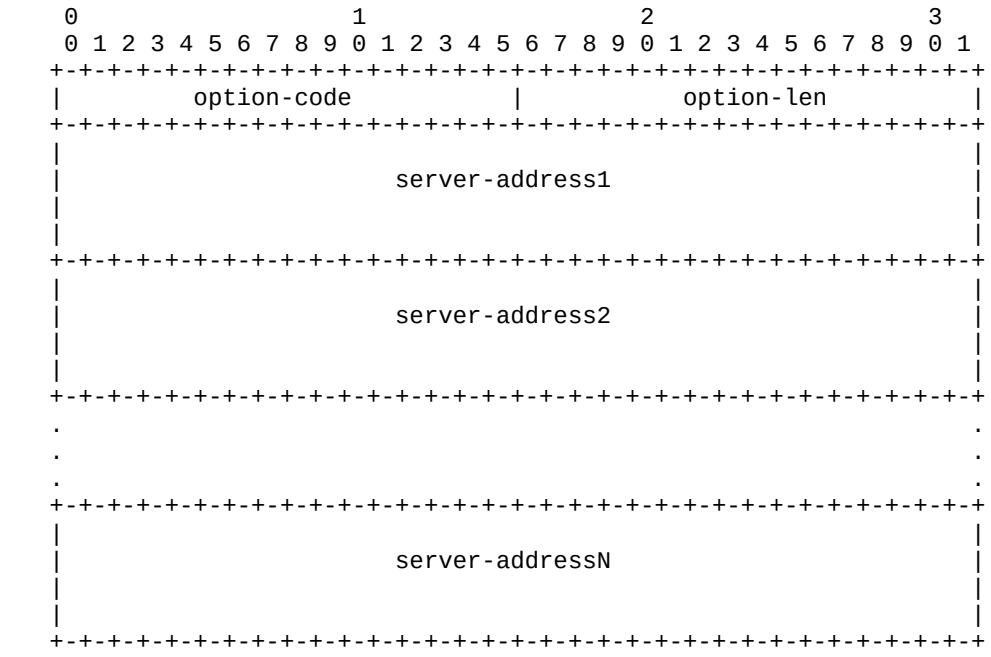



```
option-code                CL_OPTION_DEVICE_ID (36)

option-len                 MUST be 6.

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

5.2.17 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:

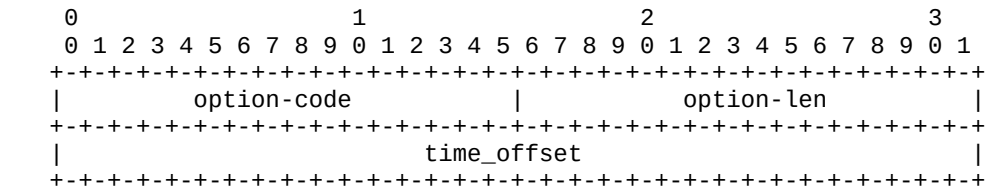



```
option-code         OPTION_RFC868_SERVERS (37)

option-len          16 * N in bytes.

server-address1-N   The IPv6 addresses of the Time Protocol servers.
```

5.2.18 Time Offset Option

The Time Offset option specifies the offset in seconds from Coordinated Universal Time (UTC) that the client should use to determine its local time. The offset is expressed as a two's complement 32-bit integer. A positive offset indicates a location east of the zero meridian and a negative offset indicates a location west of the zero meridian. It is recommended that this option be used only when the concept of local time based on a 24-hour day is known to be meaningful.

The Time Offset option has the following format:

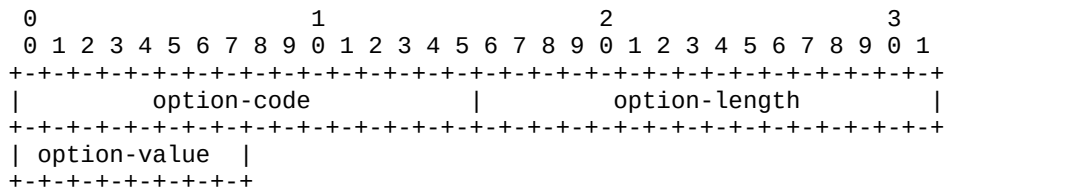



```
option-code         CL_OPTION_TIME_OFFSET (38)

option-len          4.

server-address1-N   Offset in seconds from UTC.
```

5.2.19 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, and dual stack operation.

This option has the following format:



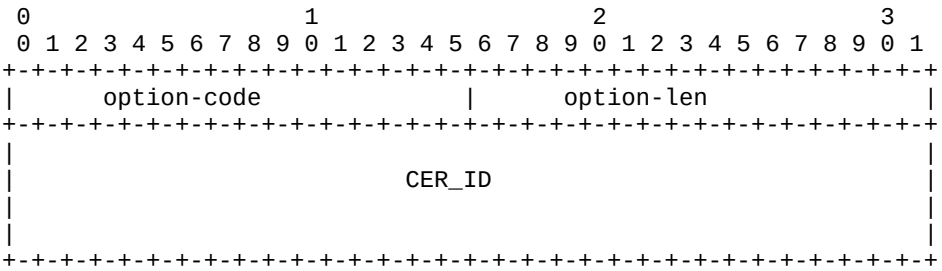

```
option-code    (2 octets) : CL_OPTION_IP_PREF (39)

option-length  (2 octets) : 1

option-value   (1 octet)  : 1 – indicates IPv4, 2 – indicates IPv6.

                            5 – indicates IPv4 for provisioning, and also
                                acquire IPv6.
                            6 – indicates IPv6 for provisioning, and also
                                acquire IPv4.
```

5.2.20 CER-ID Option

This option is used to identify the router(s) on the edge of the customer network, facing the operator's network, and acting as the demarcation point between them.

The sub-option type for this option is 42 and the CER-ID field is a 128-bit string that is usually set to an IPv6 interface address that is reachable on the customer LAN. Alternatively, 128 consecutive zeros in the CER-ID field explicitly indicate that the device sending this option is NOT the Customer Edge Router (CER).

The format of the Option Request option is




```
    option-code        OPTION_CER_ID   (42)
    option-length      n (for string of length n)
    CER_ID value       CER IPv6 LAN address, 128 zeros or null.
```

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

DHCPv6 options used by DOCSIS 3.0 or DOCSIS 3.1 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].

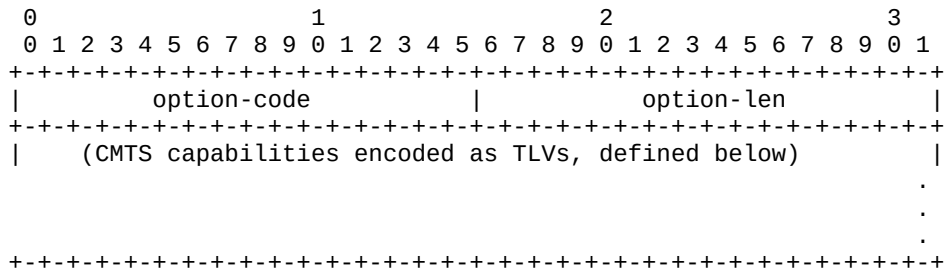
The DHCPv6 Relay Agent Subscriber-ID Option [RFC 4580] is equivalent to the DHCPv4 Subscriber-ID Sub-option [RFC 3993].

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.

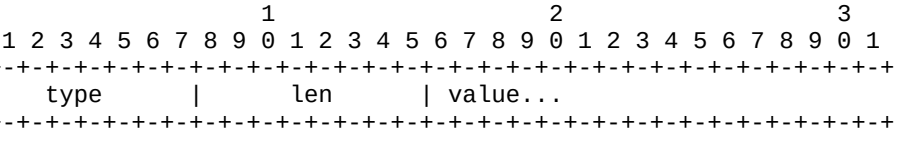


option-code CL_OPTION_DOCS_CMTS_CAP (1025)

option-len number of bytes encoding TLVs

TLVs The CMTS capabilities, as defined below

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



type type of capability

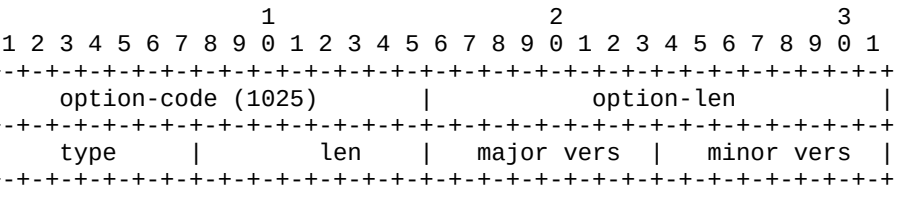
len number of bytes in the value

value value of this capability

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:



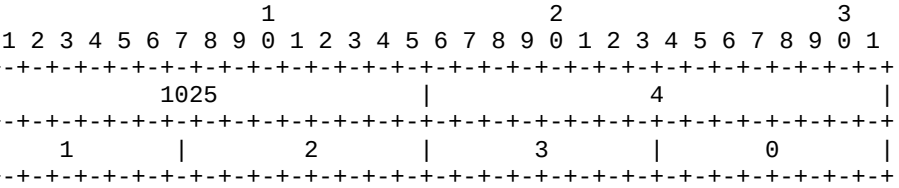
type CMTS DOCSIS version number (1)

len 2

major vers major version number (e.g., 1, 2, 3)

minor vers minor version number (e.g., 0, 1)

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:



5.3.1.2.2 DPoE System Version Number[1]

This TLV carries the DPoE System Version Number with which the device is compatible. The 'major vers' and 'minor vers' are combined to form the DPoE version number. The format of this TLV is:

[1] Added per CANN-DHCP-Reg-15.0140-3 on 2/10/16 by KB; moved from Section 5.2 per CANN-DHCP-Reg-16.0153-1 on 11/11/16 by KB.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     2         |      2        | value...                      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

type                DPoE System version number (2)

len                 2

major vers            major version number (e.g., 1, 2, 3)

minor vers            minor version number (e.g., 0, 1)
```

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:

```
 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          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        CM-MAC-address                         |
|                               |-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

  option-code    CL_CM_MAC_ADDR (1026)

  option-len     MUST be 6 bytes.

  CM-MAC-address The MAC address of the CM.
```

Table 15 - 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	

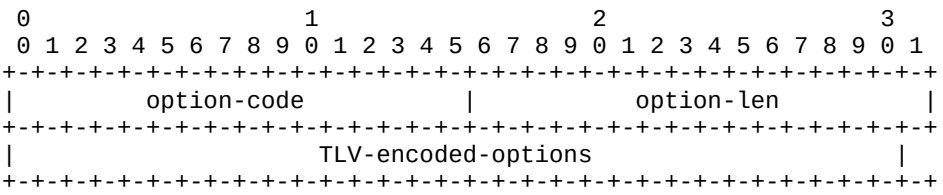
5.3.2 eRouter Container Option

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:



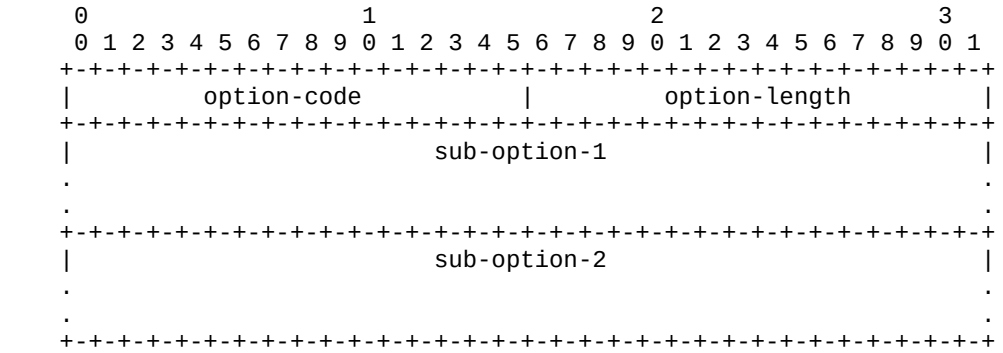

```
   option-code             CL_EROUTER_CONTAINER_OPTION (1027)

   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 16 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 16 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 16.

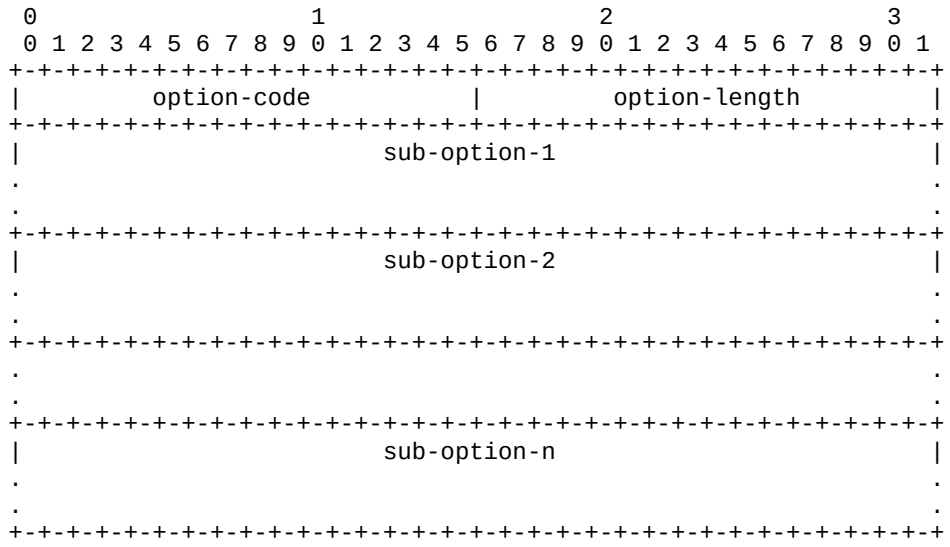
Table 16 - PacketCable Sub-options of DHCPv6 CableLabs Vendor-specific Information Option

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   as per section 5.4
```

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 4.4.7.1 of this document relate to the data content of the respective sub-options, and not to the encoding of option-code or option-length.

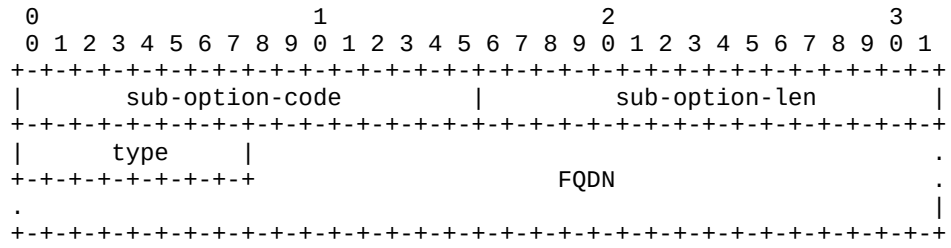
Table 17 - PacketCable Sub-options of CL_OPTION_CCCV6

CableLabs Sub-Option Type	Description	Comments
01	Primary DHCPv6 Server Selector ID	Sub-option data containing primary DSS_ID as defined in Section 4.4.7.1 and encoded as per [RFC 3315].
02	Secondary DHCPv6 Server Selector ID	Sub-option data containing secondary DSS_ID as defined in Section 4.4.7.1 and encoded as per[RFC 3315].
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 as defined per [RFC 3495] (sub-option 4) and encoded as defined per [RFC 3315].
05	Service Provider's AP-REQ/AP-REP Backoff and Retry	Sub-option data as defined per [RFC 3495] (sub-option 5) and encoded as per [RFC 3315].
06	Service Provider's Kerberos Realm Name	Sub-option data as defined per [RFC 3495] (sub-option 6) and encoded as per [RFC 3315].
07	Service Provider's Ticket Granting Server Utilization	Sub-option data as defined per [RFC 3495] (sub-option 7) and encoded as per [RFC 3315].
08	Service Provider's Provisioning Timer Value	Sub-option data as defined per [RFC 3495] (sub-option 8) and encoded as per [RFC 3315].
09	Security Ticket Control	Sub-option data as defined per [RFC 3495] (sub-option 9) and encoded as per [RFC 3315].

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.)

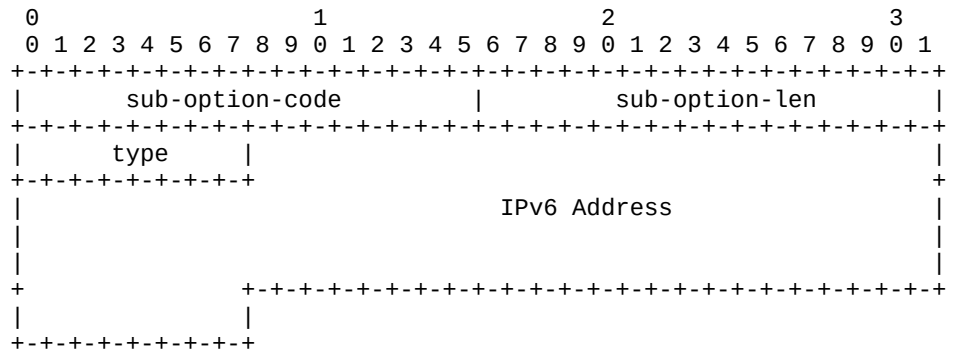
The content of sub-option 3, the Service Provider's Provisioning Server Address, can be configured as either an IPv6 address or as an FQDN. The encoding of sub-option 3 will adhere to one of two formats, indicated by a single "type" octet which follows the sub-option length field.

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.



sub-option code: 3

sub-option length: 17

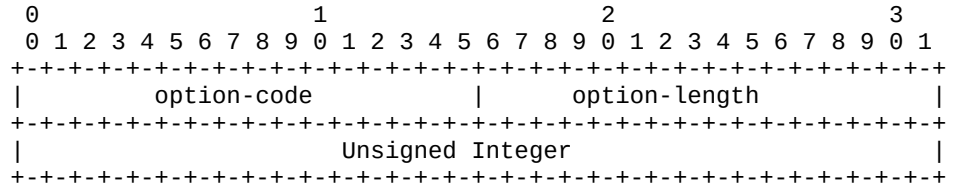
type: 1 (one)

IPv6 Address: IPv6 Address of Service Provider's Provisioning Server

5.4.3 DHCPv6 CableLabs Correlation ID Option for PacketCable

The DHCPv6 option (CL_OPTION_CORRELATION_ID) is used by PacketCable-compliant devices operating in DHCPv6 mode. The contained value (correlation ID) is randomly generated by the PacketCable eSAFE component after a soft reset or a hard reboot. This value is then consistently communicated by the eUE during the provisioning process and any associated MIB object(s). This allows for the correlation of related events within a given provisioning attempt.

The Correlation ID option has the following format:



option-code CL_OPTION_CORRELATION_ID (2172)

option-len 4

Value Unsigned Integer

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 18.

Table 18 - CableLabs DHCPv6 Vendor Class Values

Specification	Product or Function	ASCII Coded Vendor Class Value	Reference
DOCSIS 3.0	Cable Modem	docsis3.0	[MULPIv3.0]
DOCSIS 3.1	Cable Modem	docsis3.1	[MULPIv3.1]
PacketCable 2.0	Embedded UE	pktc2.0	[EUE-PROV]

5.6 CableLabs Specific DHCPv6 Options for Stand-alone Access Points

This section specifies CableLabs-specific DHCPv6 options for a Stand-alone Access Point (AP) operating in IPv6 mode. Options defined in this section provide additional configuration information, which may be requested by a standalone AP or Wi-Fi Gateway.

5.6.1 Access Point ACS IPv6 Server Address

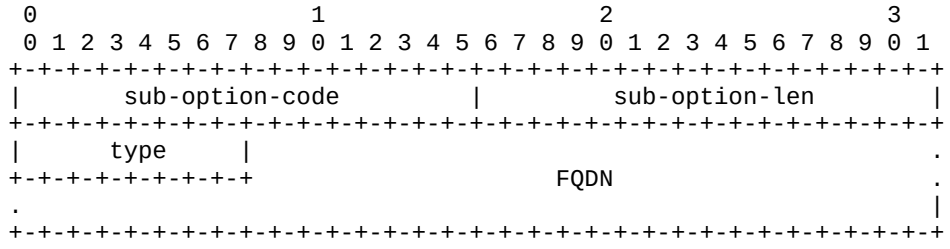
This DHCP Option is requested by Access Points that are not pre-configured with an ACS IPv6 address, and that require use of DHCP to obtain their ACS Server information. This option may be encoded as either an IPv6 address or an FQDN.

When encoded as an IPv6 address, the following conventions must be followed.

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.

When encoded as an FQDN, the following conventions must be followed.

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.



option-code: CL_V6OPTION_ACS_SERVER (40)

option-length: n (for FQDN of length n)

type: 0

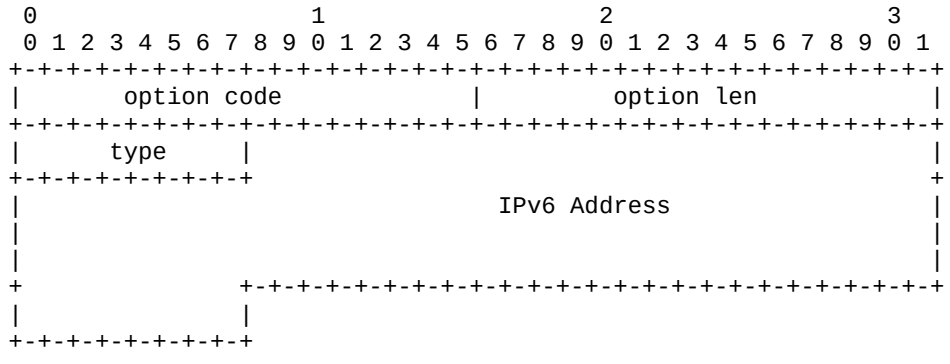
FQDN: Fully Qualified Domain Name of ACS Server

5.6.2 Access Point RADIUS IPv6 Server Address

This DHCP Option is requested by Access Points that are not pre-configured with a RADIUS server IPv6 address, and that require use of DHCP to obtain their RADIUS server information. This option may be encoded as either an IPv6 address or an FQDN.

When encoded as an IPv6 address, the following conventions must be followed.

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.



option-code: CL_V6OPTION_RADIUS_SERVER (41)

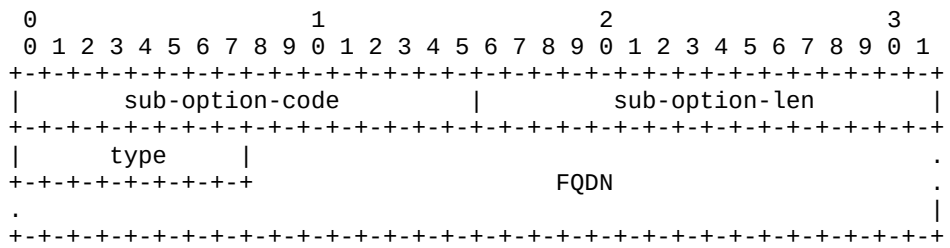
option-length: 17

type: 1

IPv6 Address: IPv6 Address of RADIUS Server

When encoded as an FQDN, the following conventions must be followed.

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.



option-code: CL_V6OPTION_RADIUS_SERVER (41)

option-length: n (for FQDN of length n)

type: 0

FQDN: Fully Qualified Domain Name of RADIUS Server

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

Table 19 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 19 - 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 1.1/2.0/3.0/3.1 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 1.1/2.0/3.0/3.1 CableHome 1.1	non-critical for DOCSIS
3	Router Option	[RFC 2132]	DOCSIS 1.1/2.0/3.0/3.1 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 1.1/2.0/3.0/3.1 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 1.1/2.0/3.0/3.1 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 1.1/2.0/3.0/3.1 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 1.1/2.0/3.0/3.1 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.
51	IP address lease time	[RFC 2132]	DOCSIS 1.1/2.0/3.0/3.1 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	

DHCP Option Number	Description	Normative Reference	CableLabs Specifications	Comments
55	Parameter Request List	[RFC 2132]	DOCSIS 1.1/2.0/3.0/3.1 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 1.1/2.0/3.0/3.1 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 10.
61	Client Identifier	[RFC 2132]	DOCSIS 1.1/2.0/3.0/3.1 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 1.1/2.0/3.0/3.1	Also called the 'Bootfile name'
82	DHCP relay agent information option	[RFC 3046]	DOCSIS 2.0/3.0/3.1	Option for specific agent-supplied sub-options
Sub-options				
1	Agent Circuit ID Sub-option	[RFC 3046]	DOCSIS 2.0/3.0/3.1	
2	Agent Remote ID Sub-option	[RFC 3046]	DOCSIS 2.0/3.0/3.1	
4	DOCSIS Device Class sub-option	[RFC 3256]	DOCSIS 2.0/3.0/3.1	
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
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 Specifications Management Team

Appendix III Revision History (Informative)

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

The following engineering changes are incorporated into 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

III.2 Engineering Changes for CL-SP-CANN-DHCP-Reg-I03-090811

The following engineering changes are incorporated into CL-SP-CANN-DHCP-Reg-I03-090811:

ECN	Date Accepted	Summary
CANN-DHCP-Reg-N-09.0040-3	4/1/2009	Added reference to eDVA
CANN-DHCP-Reg-N-09.0041-2	5/20/2009	Option 82 length
CANN-DHCP-Reg-N-09.0043-2	7/15/2009	CANN DHCP Registry

III.3 Engineering Changes for CL-SP-CANN-DHCP-Reg-I04-100611

The following engineering changes are incorporated into CL-SP-CANN-DHCP-Reg-I04-100611:

ECN	Date Accepted	Summary
CANN-DHCP-Reg-N-10.0050-1	5/5/2010	DHCP text alignment between eDOCSIS & CANN
CANN-DHCP-Reg-N-10.0051-2	5/5/2010	DHCP Relay Agent Sub-options in support of IPv4 Exhaustion

III.4 Engineering Changes for CL-SP-CANN-DHCP-Reg-I05-101008

The following engineering changes are incorporated into CL-SP-CANN-DHCP-Reg-I05-101008:

ECN	Date Accepted	Summary
CANN-DHCP-Reg-N-10.0084-2	9/1/2010	D-3.0 Modem Capability encoding
CANN-DHCP-Reg-N-10.0085-1	9/1/2010	DHCP OPTION_VENDOR_OPTS (17) in ORO(6)

III.5 Engineering Change for CL-SP-CANN-DHCP-Reg-I06-110210

The following engineering change is incorporated into CL-SP-CANN-DHCP-Reg-I06-110210:

ECN	Date Accepted	Summary
CANN-DHCP-Reg-N-10.0086-2	01/05/2010	eUE correlation ID addition to CANN

III.6 Engineering Change for CL-SP-CANN-DHCP-Reg-I07-110623

The following engineering change is incorporated into CL-SP-CANN-DHCP-Reg-I07-110623:

ECN	Date Accepted	Summary
CANN-DHCP-Reg-N-11.0094-1	05/11/2011	Cablelabs DHCP Relay Information Option: Service Class Name and Qos Profile Name Clarification

III.7 Engineering Change for CL-SP-CANN-DHCP-Reg-I08-111117

The following engineering change is incorporated into CL-SP-CANN-DHCP-Reg-I08-111117:

ECN	Date Accepted	Summary
CANN-DHCP-Reg-N-11.0096-1	07/20/2011	Enhancements to IP addressing mode preference DHCP option

III.8 Engineering Change for CL-SP-CANN-DHCP-Reg-I09-120809

The following engineering change is incorporated into CL-SP-CANN-DHCP-Reg-I09-120809:

ECN	Date Accepted	Summary
CANN-DHCP-Reg-N-12.0107-1	3/4/12	Adding support for new DHCP relay agent option for DPoE DEMARC

III.9 Engineering Change for CL-SP-CANN-DHCP-Reg-I10-130808

The following engineering change is incorporated into CL-SP-CANN-DHCP-Reg-I10-130808:

ECN	Date Accepted	Summary	Author
CANN-DHCP-Reg-N-13.0116-2	6/5/13	Add DEMARC 1.0 and PBB Correction	Johnson

III.10 Engineering Changes for CL-SP-CANN-DHCP-Reg-I11-150515

The following engineering changes are incorporated into CL-SP-CANN-DHCP-Reg-I11-150515:

ECN	Date Accepted	Summary	Author
CANN-DHCP-Reg-N-15.0129-1	4/15/2015	Define new CableLabs DHCP options to support standalone AP provisioning	Berg
CANN-DHCP-Reg-N-15.0130-2	4/15/2015	Add New CANN DHCP options to summary tables	Berg

III.11 Engineering Changes for CL-SP-CANN-DHCP-Reg-I12-151210

The following engineering changes are incorporated into CL-SP-CANN-DHCP-Reg-I12-151210:

ECN	Date Accepted	Summary	Author
CANN-DHCP-Reg-N-15.0134-3	10/7/2015	Options update for D3.1 and RemotePHY and general cleanup.	Sundaresan
CANN-DHCP-Reg-N-15.0135-1	11/4/2015	CER-ID Option Encoding	Kloberdans

III.12 Engineering Change for CL-SP-CANN-DHCP-Reg-I13-160317

The following engineering change is incorporated into CL-SP-CANN-DHCP-Reg-I13-160317:

ECN	Date Accepted	Summary	Author
CANN-DHCP-Reg-N-15.0140-3	2/10/2016	DHCPv6 ORO options for DPoE System Number	Erichsen

III.13 Engineering Change for CL-SP-CANN-DHCP-Reg-I14-170111

The following engineering change is incorporated into CL-SP-CANN-DHCP-Reg-I14-170111:

ECN	Date Accepted	Summary	Author
CANN-DHCP-Reg-N-16.0146-1	4/27/2016	Add SROUTER Device Type	Burroughs
CANN-DHCP-Reg-N-16.0153-1	8/11/2016	Correct DPoE System version DHCPv6 Relay Agent Capabilities Section	Burroughs