CableLabs® Specifications

CableLabs' DHCP Options Registry

CL-SP-CANN-DHCP-Reg-I01-070119

ISSUED

Document Status Sheet

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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 stable document, which has undergone rigorous member and vendor review and is suitable for product design and development, cross-vendor interoperability, and for certification testing.
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, Data-Over-Cable Service Interface Specification, DOCSIS 1.0 Part 1: Radio Frequency Interface (RFI), 2002.
[ANSI/SCTE 23-1]	ANSI/SCTE 23-1, Data-Over-Cable Systems, Radio Frequency Interface Specification 1.1.
[CANN]	CableLabs' Assigned Names and Numbers Specification, CL-SP-CANN-I01-070119, January 19, 2007, Cable Television Laboratories, Inc.
[CH 1.0]	CableHome 1.0 Specification, CH-SP-CH1.0-C01-060728, July 28, 2006, Cable Television Laboratories, Inc.
[CH 1.1]	CableHome 1.1 Specification, CH-SP-CH1.1-C01-060728, July 28, 2006, Cable Television Laboratories, Inc.
[eDOCSIS]	Data-Over-Cable Service Interface Specifications, eDOCSIS Specification, CM-SP-eDOCSIS-I10-061222, December 22, 2006, Cable Television Laboratories, Inc.
[eRouter]	Data-Over-Cable Service Interface Specifications, IPv4 and IPv6 eRouter Specification, I01-061207, December 7, 2006, Cable Television Laboratories, Inc.
[MIB-CLABDEF]	CableLabs Definition MIB Specification, CL-SP-MIB-CLABDEF-I06-070119, January 19, 2007, Cable Television Laboratories, Inc.
[MULPIv3.0]	Media Access Control and Upper Layer Protocols Interface (MULPI) Specification, CM-SP-MULPIv3.0-I02-061222, December 22, 2006, Cable Television Laboratories, Inc.
[OC-HOST 2.0]	OpenCable Host Device 2.0 Core Functional Requirements, OC-SP-HOST2.0-CFR-I12-070105, January 5, 2007, Cable Television Laboratories, Inc.
[PROV]	PacketCable MTA Device Provisioning Specification, PKT-SP-PROV-I11-050812, August 12, 2005, Cable Television Laboratories, Inc.
[PROV 1.5]	PacketCable 1.5 MTA Device Provisioning Specification, PKT-SP-PROV1.5-I02-050812, August 12, 2005, Cable Television Laboratories, Inc.
[RFC 868]	IETF RFC 868/STD0026, Time Protocol, May 1983.
[RFC 2131]	IETF RFC 2131, Dynamic Host Configuration Protocol, March 1997.
[RFC 2132]	IETF RFC 2132, DHCP Options and BOOTP Vendor Extensions, March 1997.
[RFC 3046]	IETF RFC 3046, DHCP Relay Agent Information Option, January 2001.
[RFC 3256]	IETF RFC 3256, The DOCSIS (Data-Over-Cable Service Interface Specifications) Device Class DHCP (Dynamic Host Configuration Protocol) Relay Agent Information Sub-option, April 2002.
[RFC 3315]	IETF RFC 3315, Dynamic Host Configuration Protocol for IPv6 (DHCPv6), July 2003.
[RFC 3495]	IETF RFC 3495, Dynamic Host Configuration Protocol (DHCP) Option for CableLabs Client Configuration, March 2003.
[RFC 3594]	PacketCable Security Ticket Control Sub-Option for the DHCP CableLabs Client Configuration (CCC) Option, September 2003.

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

2.3 Reference Acquisition

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

3 ABBREVIATIONS

This document uses the following abbreviations and acronyms.

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

4 DHCPV4 PROTOCOL FIELD VALUES

4.1 CableLabs Values for DHCPv4 Option 43

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

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

Table 1 - CableLabs DHCPv4 Option 43 Sub-options

DHCP Option 43	Value	Description	Reference
Sub-option 1		The request sub-option vector is a list of sub-options (within option 43) to be returned to client by the server upon reply to the request. None defined.	
Sub-option 2	<Device Type>	Device type of the component making the DHCP request. For a DOCSIS cable modem: "ECM"= embedded Cable Modem (as specified by DOCSIS 1.0, 1.1, or 2.0 Base Specifications) For a PacketCable E-MTA: "EMTA" = embedded Multimedia Telephone Adapter (as specifications in PacketCable 1.0 and 1.5 MTA Device Provisioning Specifications) For CableHome PS: "EPS" = Embedded Portal Services or "SPS" = Stand-alone Portal Services For an OpenCable Host: "ESTB" For an OpenCable CableCARD: "CARD" For an eRouter: "EROUTER"	DOCSIS 1.1/2.0/3.0* PacketCable 1.0/1.5 CableHome 1.0/1.1 OpenCable Host 2.0 CableCARD 2.0 eRouter
Sub-option 3	"ECM: < $eSAFE_1$:$eSAFE_2$ … $SAFE_n$>"	Colon-separated list of eCM and eSAFE(s) contained in the complete eDOCSIS device. First on the list MUST be "ECM" for eCM. <$eSAFE_x$> can be "EMTA", "EPS", "ESTB" or "EROUTER" corresponding to embedded MTA, embedded Portal Service Element, and embedded STB, respectively. For example: "ECM:EMTA" = A PacketCable Embedded MTA "ECM:EPS" = A CableHome Embedded Portal Services Element "ECM:ESTB" = An Embedded STB "ECM:EMTA:EPS" = An Embedded MTA and Embedded Portal Services Element "ECM:ESTB:CARD" – Indicates that a Cable Card is making a request via the eCM's DOCSIS return channel "ECM:EROUTER" = An embedded Router for DOCSIS	DOCSIS 1.1/2.0/3.0* PacketCable 1.0/1.5 CableHome 1.0/1.1 OpenCable Host 2.0 CableCARD 2.0 eRouter

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

DHCP Option 43	Value	Description	Reference
Sub-option 10	"<Vendor name>"	Vendor name or ID. Identical to value as reported in the <Vendor name> field in the MIB object sysDescr. e.g., "XYZ Corp" Not used for OpenCable CableCARD. Sub-option 51 is used instead.	DOCSIS 1.1/2.0/3.0* PacketCable 1.0/1.5 CableHome 1.0/1.1 OpenCable Host 2.0
Sub-options 11 to 127		**Reserved for CableLabs**	
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-option 15		Unassigned	
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-options 18..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..127		Unassigned	
Sub-options 128..254		**Reserved for Vendors**	
*Required only for cable modems in eDOCSIS devices.			

4.2 CableLabs Values for DHCPv4 Option 60 Vendor Client Identifier

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

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

Table 2 - CableLabs DHCPv4 Option 60 Values

Specification	Product or Function	ASCII Coded Option 60 String	Reference
DOCSIS 1.0	Cable Modem	The CM MAY include the string "docsis 1.0" in this field.	[ANSI/SCTE 22-1]
DOCSIS 1.1	Cable Modem	docsis1.1: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:xxxxxxx, where xxxxxxx is the ASCII representation of the hexadecimal encoding of the Modem Capabilities.	[MULPIv3.0]
CableHome 1.0	Portal Services	CableHome1.0	[CH 1.0]
CableHome 1.1	Portal Services	CableHome1.1	[CH 1.1]
OpenCable Host 2.0	OpenCable Host	OpenCable2.0: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]

Specification	Product or Function	ASCII Coded Option 60 String	Reference
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]

4.3 DHCPv4 Vendor Identifying Vendor Specific Options for DOCSIS 3.0

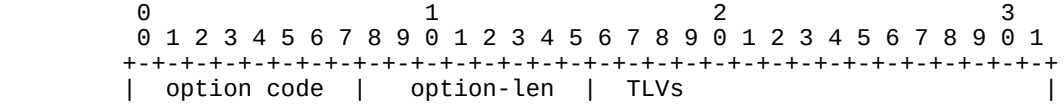
4.3.1 DOCSIS Vendor Identifying Vendor Specific relay agent options

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

4.3.1.1 The DHCPv4 Relay Agent CMTS capabilities option

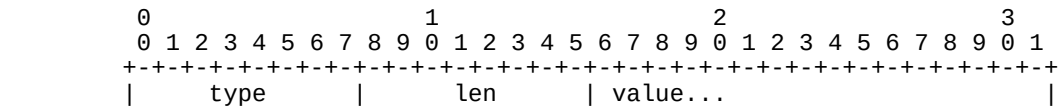
This DHCPv4 Relay Agent Option is used by the CMTS to transmit (or advertise) specific capabilities of the CMTS. Additional CMTS capabilities may be added to indicate additional CMTS capabilities that should help the provisioning server make more informed configuration decisions.

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




```
option-code      CL_V4OPTION_DOCSIS_VERS (1)

option-len       number of bytes encoding TLVs

TLVs             carrying 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:

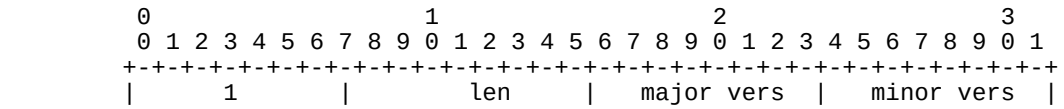



```
type             type of capability

len              number of bytes in the value

value            value of this capability
```

The following TLVs are defined in this specification.

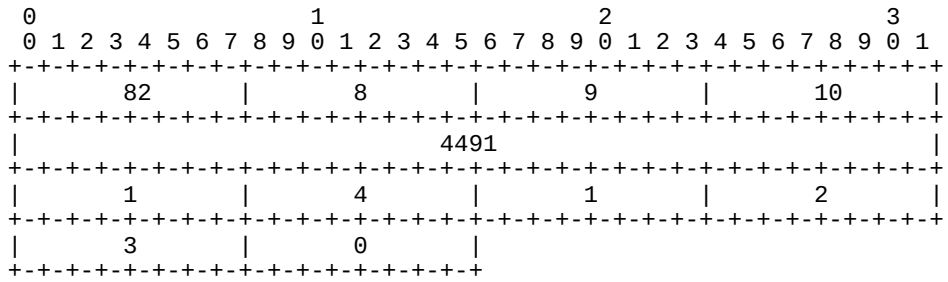
4.3.1.1.1 CMTS DOCSIS Version Number

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



```
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)
```

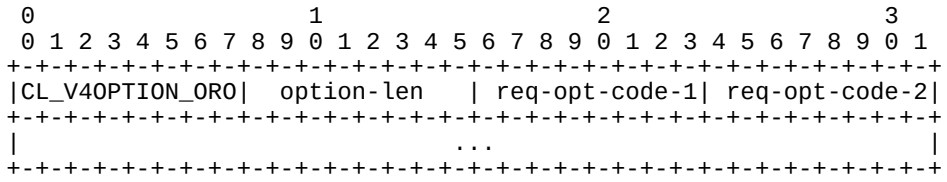
The DOCSIS version option is carried in the CMTS Capabilities option of a Relay Agent option, as shown in the following diagram:



4.3.2 The DHCPv4 Option Request option

This option is used to identify the options requested by the client from the server. The option is similar to the DHCPv4 Parameter Request List (option code 55, [RFC 2132]. The option code for this option is 1 and the format of the remainder of the option is identical to that of the DHCPv4 Parameter Request List option: a length field followed by a list of 16-bit values, which are the option codes for the DHCPv4 CableLabs Vendor-specific Information options requested by the client.

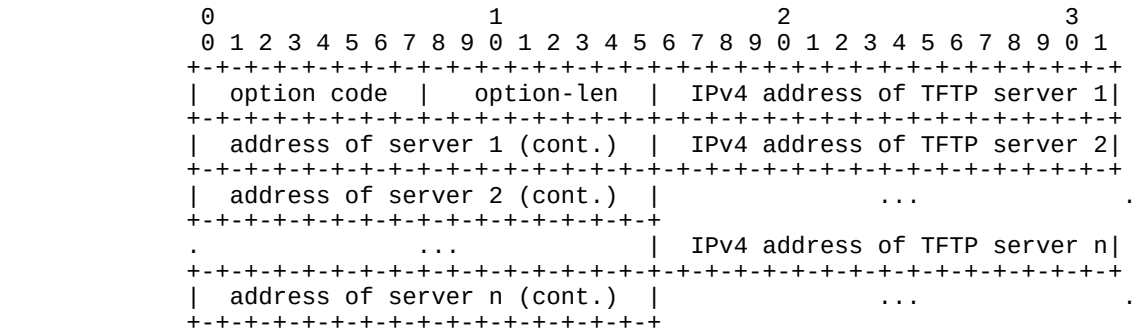
The format of the Option Request option is:




```
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.
```

4.3.3 The DHCPv4 TFTP Servers option

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



option-code CL_V4OPTION_TFTP_SERVERS (2)

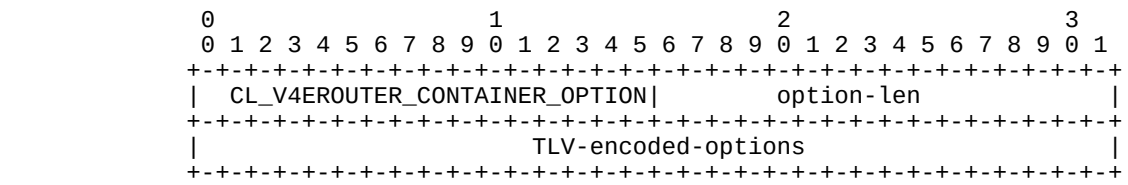
option-len number of bytes for TFTP server IPv4 addresses (4*n for n servers)

IPv4 addresses of TFTP servers

4.3.4 The DHCPv4 eRouter container option

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

The Container option has the following format:



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

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 3 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.

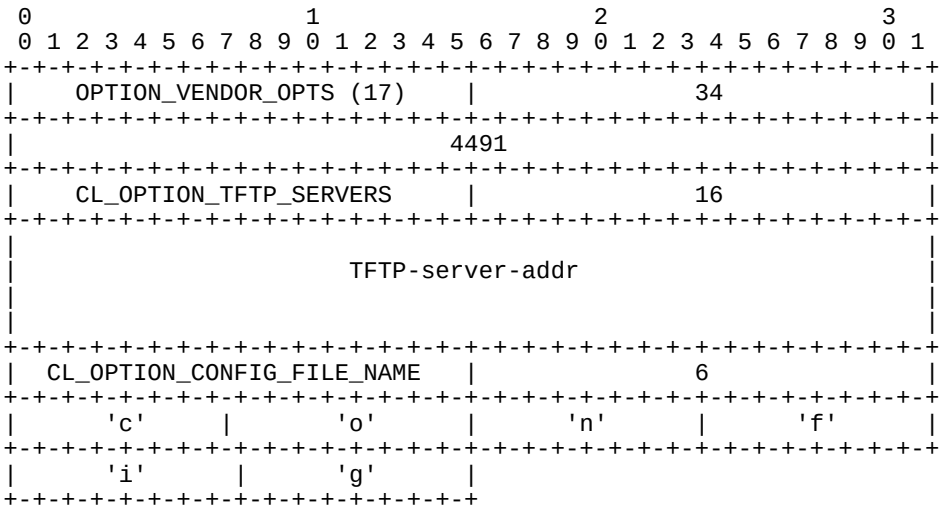
Table 3 - CableLabs Project Codes for DHCPv6 Options

CableLabs Project*	Code
Common	0
DOCSIS	1
PacketCable	2
OpenCable	3
CableHome	4
* Except for "Common", this table is aligned with the OID assignments for the associated CableLabs projects defined under clabProject in [MIB-CLABDEF]. CableLabs common MIB modules are defined under a different branch (clabCommonMibs) in [MIB-CLABDEF].	

5.2 Common DHCPv6 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 specifications [CANN].

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



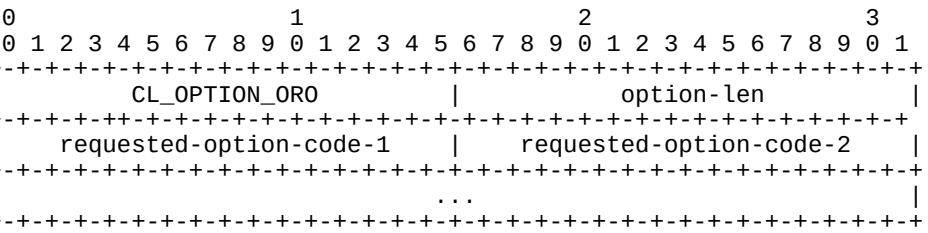
The values of CL_OPTION_TFTP_SERVERS and CL_OPTION_CONFIG_FILE_NAME are defined below.

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:

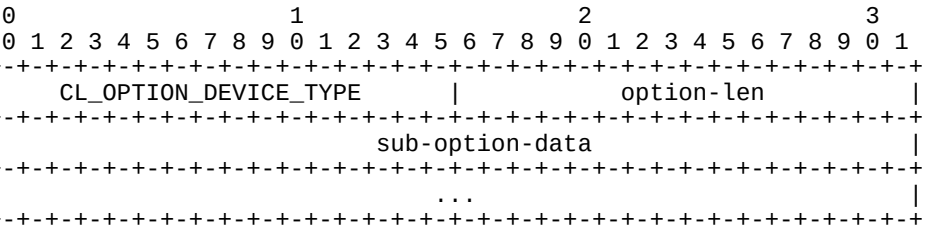



```
option-code   CL_OPTION_ORO.

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

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

The format of the Option Request option is:




```
option-code         CL_OPTION_DEVICE_TYPE.

option-len          4 + length of sub-option-data field in bytes.

sub-option-data     The device type:
   "ECM" for embedded Cable Modem (as specified by DOCSIS 1.0, 1.1, 2.0
    or 3.0 Base Specifications)
   "EPS" for CableHome embedded Portal Services Element
   "EMTA" for PacketCable embedded Multimedia Terminal Adapter
   "ESTB" for an embedded Set-Top Box
   "EROUTER" for an embedded DOCSIS Router
```

5.2.3 List of embedded components in eDOCSIS device

CL_OPTION_EMBEDDED_COMPONENTS_LIST

5.2.4 Device Serial Number

CL_OPTION_DEVICE_SERIAL_NUMBER

5.2.5 Hardware Version Number

CL_OPTION_HARDWARE_VERSION_NUMBER

5.2.6 Software Version Number

CL_OPTION_SOFTWARE_VERSION_NUMBER

5.2.7 Boot Rom Version

CL_OPTION_BOOT_ROM_VERSION

5.2.8 Vendor-specific Organization Unique Identifier

CL_OPTION_VENDOR_OUI

5.2.9 Model Number

CL_OPTION_MODEL_NUMBER

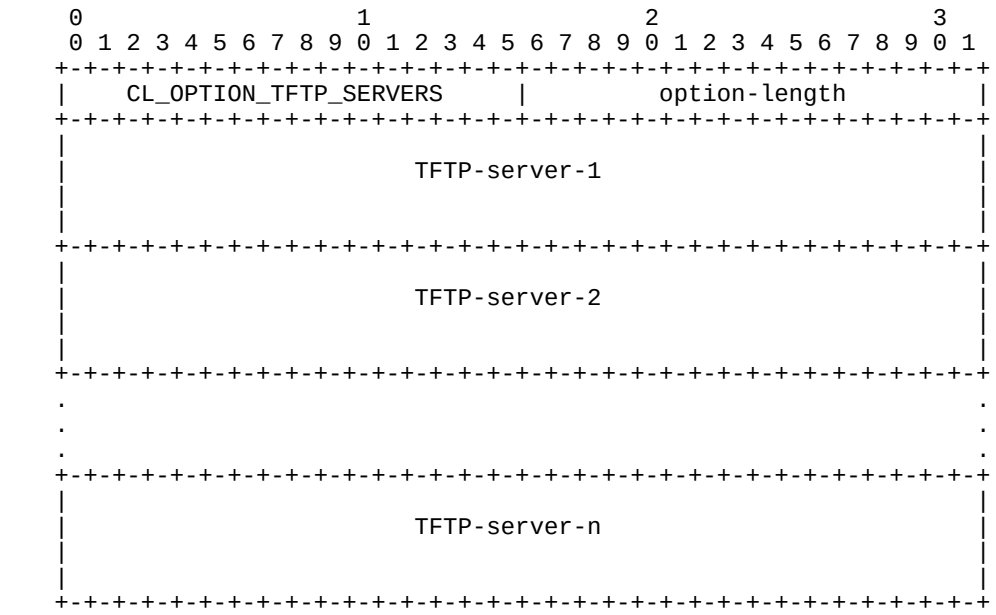
5.2.10 Vendor Name

CL_OPTION_VENDOR_NAME

5.2.11 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:

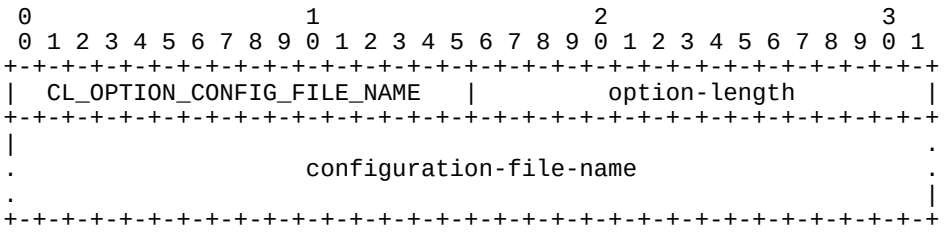


```
option code:         CL_OPTION_TFTP_SERVERS

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

TFTP-server:         IPv6 address of TFTP server
```

5.2.12 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:



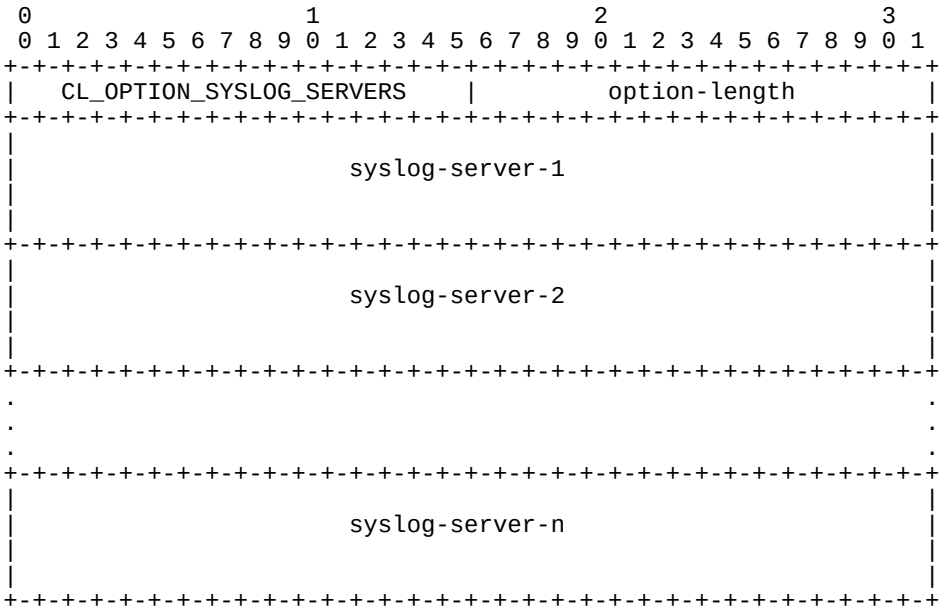

```
option code:         CL_OPTION_CONFIG_FILE_NAME

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

configuration-file-name: 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.

5.2.13 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:

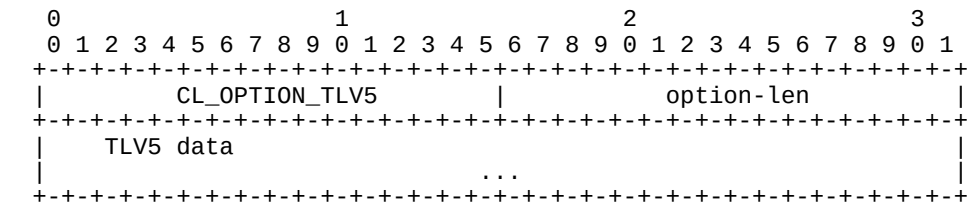


```
option code:         CL_OPTION_SYSLOG_SERVERS

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

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

5.2.14 TLV5 Encoding

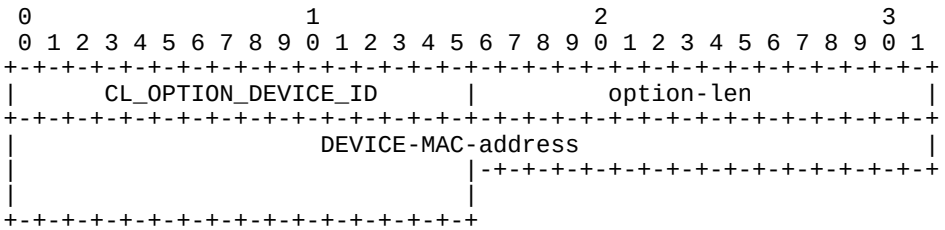
This sub-option encodes TLV5 information for transmission in a DHCPv6 message. The sub-option code is CL_OPTION_TLV5. All TLV5 information carried in the TLV5 Encoding option is encoded as specified in the "Modem Capabilities Encoding" subsection of the "Common Radio Frequency Interface Encodings" Annex in [MULPIv3.0] , and then carried as the data in the CL_OPTION_TLV5 sub-option.

The format of the TLV5 Encoding option is:




```
option-code   CL_OPTION_TLV5

option-len    number of octets carrying TLV5 data.

TLV5 data     TLV5 data.
```

5.2.15 Device Identifier option



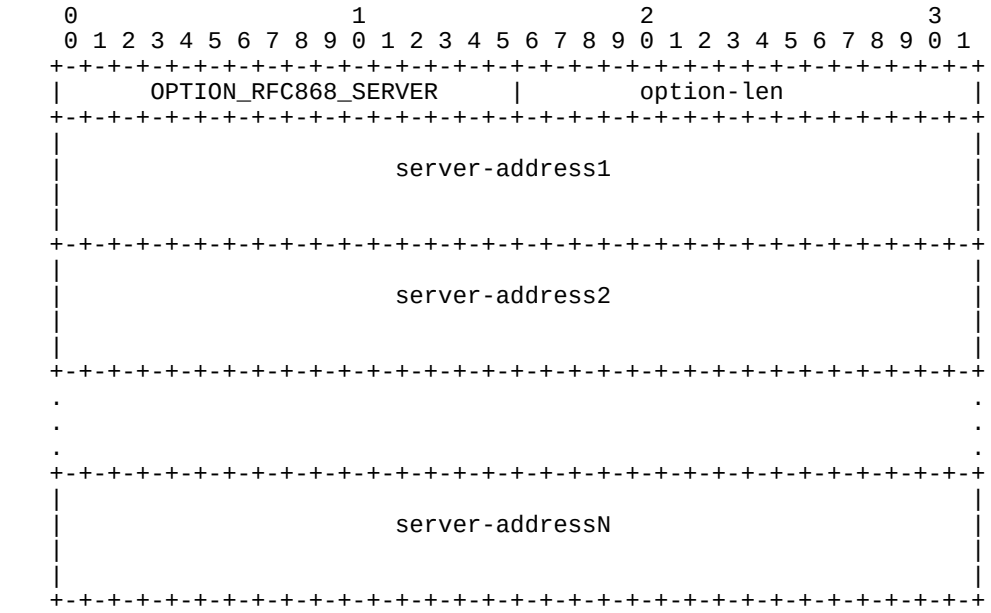

```
option-code                CL_OPTION_DEVICE_ID

option-len                 MUST be 6.

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

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

5.2.16 Format of the Time Protocol Servers option

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:

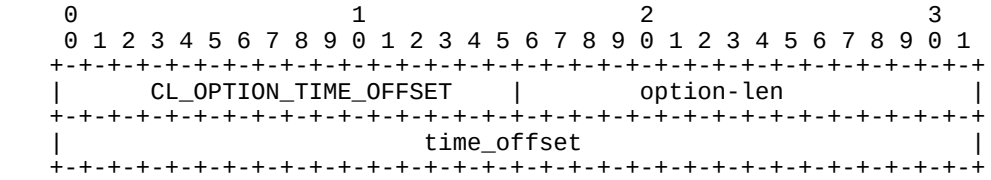


option-code	OPTION_RFC868_SERVERS
option-len	16 * N in bytes.
server-address1-N	The IPv6 addresses of the Time Protocol servers.

5.2.17 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
option-len	4.
server-address1-N	Offset in seconds from UTC.

5.3 DHCPv6 CableLabs Vendor-specific Information Option: COMMON sub-options

Table 4 lists and defines DHCPv6 sub-options that may be common to multiple projects:

Table 4 - DHCPv6 CableLabs Vendor-specific Information Option Shared by CableLabs Projects

CableLabs Project Code	CableLabs sub-option type	Value	Description	Source Spec for DHCP IPv4 equivalent
000	1		CL_OPTION_ORO	[eDOCSIS]
000	2	"ECM", "EPS", "EMTA", or "ESTB"	CL_OPTION_DEVICE_TYPE	[eDOCSIS]
000	3	"ECM: < $eSAFE_1$:$eSAFE_2$ … $SAFE_n$>"	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	[eDOCSIS]
000	4	"<device serial number>"	CL_OPTION_DEVICE_SERIAL_NUMBER Device serial number as in the MIB object docsDevSerialNumber e.g., "123456"	[eDOCSIS]
000	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]
000	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]
000	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]

CableLabs Project Code	CableLabs sub-option type	Value	Description	Source Spec for DHCP IPv4 equivalent
000	8	"<OUI>"	CL_OPTION_VENDOR_OUI A 6-octet, hexadecimal-encoded, vendor-specific Organization Unique Identifier (OUI) that may match the OUI in the eCM's MAC address.	[eDOCSIS]
000	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]
000	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]
000	11 to 31		Reserved for CableLabs.	[eDOCSIS]
000	32		CL_OPTION_TFTP_SERVERS TFTP Server Addresses option	[MULPIv3.0]
000	33		CL_OPTION_CONFIG_FILE_NAME Configuration File Name option	[MULPIv3.0]
000	34		CL_OPTION_SYSLOG_SERVERS Syslog Server Addresses option	[MULPIv3.0]
000	35		CL_OPTION_TLV5	[MULPIv3.0]
000	36	"<MAC_address>"	CL_OPTION_DEVICE_ID Device Identifier option	[MULPIv3.0]
000	37		OPTION_RFC868_SERVER	[MULPIv3.0]
000	38		CL_OPTION_TIME_OFFSET	[MULPIv3.0]

5.4 DHCPv6 CableLabs Vendor-specific Information Option: DOCSIS sub-options

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

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

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

5.4.1 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.

5.4.1.1 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].

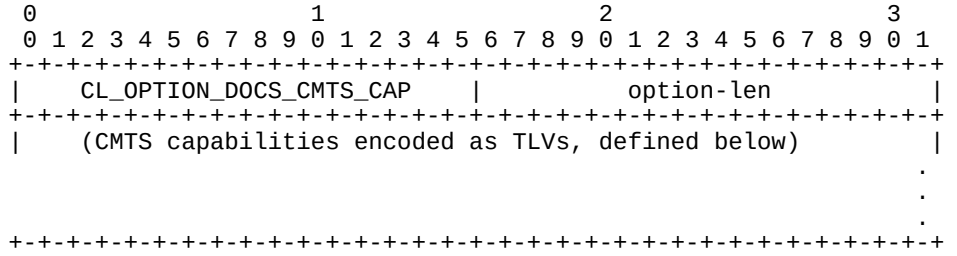
The DHCPv6 Relay Agent Subscriber-ID Option [RFC 4580] is equivalent to the DHCPv4 Subscriber-ID Sub-option [RFC 3993].

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.

5.4.1.2 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.

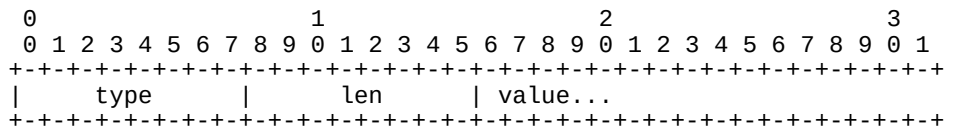


option-code CL_OPTION_DOCS_CMTS_CAP

option-len number of bytes encoding TLVs

TLVs carrying 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

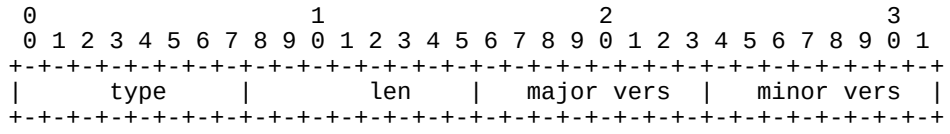
len number of bytes in the value

value value of this capability

The following TLVs are defined in this specification.

5.4.1.2.1 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 is:



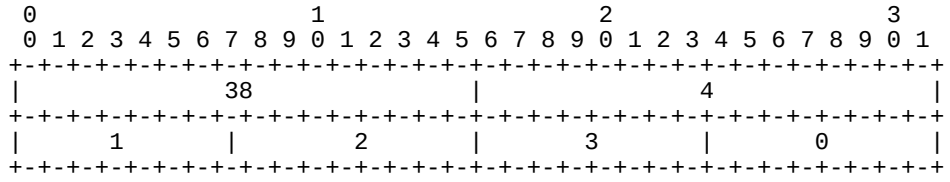
type CMTS DOCSIS version number (1)

len 2

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

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

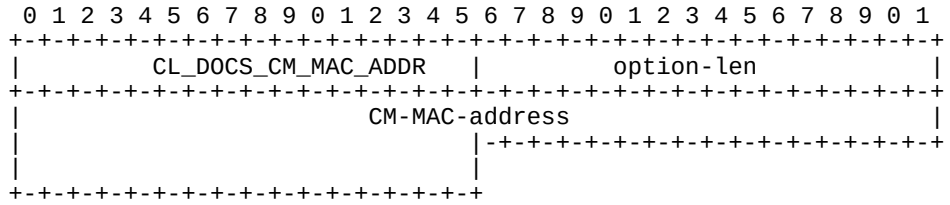
A DHCPv6 relay agent implemented on a CMTS that is compatible with the DOCSIS 3.0 specification would send the following CMTS Capabilities option to the DHCPv6 server:



5.4.1.2.2 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.

The format of this option is:



option-code CL_CM_MAC_ADDR (39)

option-len The option-len MUST be 6 bytes.

CM-MAC-address MAC address of CM.

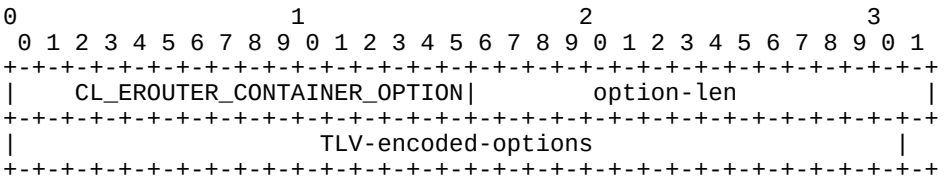
Table 5 - DOCSIS sub-options of DHCPv6 CableLabs Vendor-specific Information Option

CableLabs Project Code for DOCSIS	CableLabs sub-option type	Value	Description	
001	01		DHCPv6 Relay Agent CMTS Capabilities Option	
			1	CMTS DOCSIS Version Number
001	02		DOCSIS Relay Agent CM MAC address option	

5.4.2 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.

The Container option has the following format:



option-code	CL_EROUTER_CONTAINER_OPTION
option-len	n (n = number of bytes in the TLV encoded options)
TLV-encoded-options	A set of one or more TLV encoded options

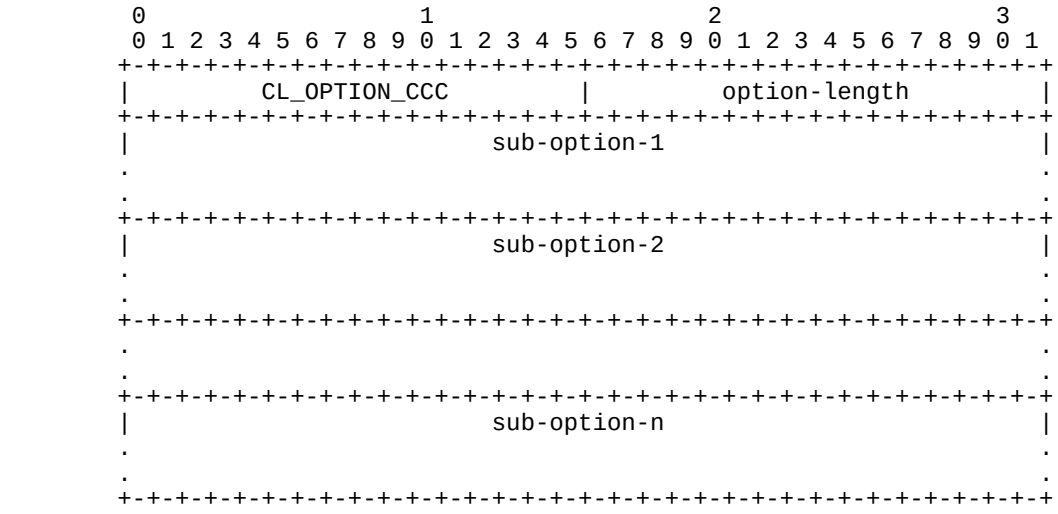
5.5 DHCPv6 CableLabs Vendor-specific Information Option: PacketCable sub-options

The CableLabs Client Configuration options for PacketCable 1.5 Telephony Service Providers (TSPs) are defined in [RFC 3495] and [RFC 3594].

5.5.1 CableLabs Client Configuration

The CableLabs client configuration option carries information that is used to configure a PacketCable Multimedia Terminal Adapter (MTA). This option carries one or more sub-options, which are defined below.

The format of the CableLabs client configuration option is:



option code:	CL_OPTION_CCC
option length:	n

Definition of the sub-options carried in this option is deferred to the PacketCable and/or CableHome specifications.

Table 6 - PacketCable sub-options of DHCPv6 CableLabs Vendor-specific Information Option

CableLabs Project Code for PacketCable	CableLabs sub-option type	Value	Description	Source Spec for DHCP IPv4 equivalent
010	01		TSP's Primary DHCPv4 Server Address	[RFC 3495], option 122.1
010	02		TSP's Secondary DHCPv4 Server Address	[RFC 3495], option 122.2
010	03		TSP's Provisioning Server Address	[RFC 3495], option 122.3 & [PROV 1.5], section 8.1.2
010	04		TSP's AS-REQ/AS-REP Backoff and Retry	[RFC 3495], option 122.4
010	05		TSP's AP-REQ/AP-REP Backoff and Retry	[RFC 3495], option 122.5
010	06		TSP's Kerberos Realm Name	[RFC 3495], option 122.6
010	07		TSP's Ticket Granting Server Utilization	[RFC 3495] option 122.7
010	08		TSP's Provisioning Timer Value	[RFC 3495], option 122.8
010	09		Security Ticket Control	[RFC 3594], option 122.9

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

Table 7 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 7 - DHCP Options Used by CableLabs DHCPv4 Clients

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

DHCP Option Number	Description	Normative Reference	CableLabs Specifications	Comments
50	Requested IP Address	[RFC 2132]	DOCSIS 1.1/2.0/3.0 CableHome 1.1 OpenCable Host 2.0 CableCARD 2.0	Included in DHCP DISCOVER and DHCP REQUEST messages sent by the DHCP client to the DHCP server.
51	IP address lease time	[RFC 2132]	DOCSIS 1.1/2.0/3.0 CableHome 1.1 OpenCable Host 2.0 CableCARD 2.0	
54	Server Identifier	[RFC 2132]	CableHome 1.1 OpenCable Host 2.0 CableCARD 2.0	
55	Parameter Request List	[RFC 2132]	DOCSIS 1.1/2.0/3.0 CableHome 1.1 PacketCable 1.0/1.5 OpenCable Host 2.0 CableCARD 2.0	Included in DHCP DISCOVER and DHCP REQUEST messages sent by the DHCP client to the DHCP server.
60	Vendor Class Identifier	[RFC 2132]	DOCSIS 1.1/2.0/3.0 CableHome 1.1 PacketCable 1.0/1.5 OpenCable Host 2.0 CableCARD 2.0	Included in DHCP DISCOVER and DHCP REQUEST messages sent by the DHCP client to the DHCP server. Refer to Table 2.
61	Client Identifier	[RFC 2132]	DOCSIS 1.1/2.0/3.0 CableHome 1.1	Included in DHCP DISCOVER and DHCP REQUEST messages sent by the DHCP client to the DHCP server.
67	Configuration File Option	[RFC 2132]	DOCSIS 1.1/2.0/3.0	Also called the ‘Bootfile name'
68 Sub-options	DHCP relay agent information option	[RFC 3046]	DOCSIS 2.0/3.0	Option for specific agent-supplied sub-options
1	Agent Circuit ID Sub-option	[RFC 3046]	DOCSIS 2.0/3.0	
2	Agent Remote ID Sub-option	[RFC 3046]	DOCSIS 2.0/3.0	
4	DOCSIS Device Class sub-option	[RFC 3256]	DOCSIS 2.0/3.0	

DHCP Option Number	Description	Normative Reference	CableLabs Specifications	Comments
122 Sub-options	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.
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 Standards Department