

Data-Over-Cable Service Interface Specifications DOCSIS 3.0

Operations Support System Interface Specification

CM-SP-OSSiv3.0-I23-140403

ISSUED

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1 SCOPE

1.1 Introduction and Purpose

This specification is part of the DOCSIS[®] family of specifications developed by Cable Television Laboratories (CableLabs). In particular, this specification is part of a series of specifications that define the third generation of high-speed data-over-cable systems. This specification was developed for the benefit of the cable industry, and includes contributions by operators and vendors from North America, Europe, and other regions.

1.2 Background

1.2.1 Broadband Access Network

A coaxial-based broadband access network is assumed. This may take the form of either an all-coax or hybrid-fiber/coax (HFC) network. The generic term "cable network" is used here to cover all cases.

A cable network uses a tree-and-branch architecture with analog transmission. The key functional characteristics assumed in this document are the following:

- Two-way transmission.
- A maximum optical/electrical spacing between the CMTS and the most distant CM of 100 miles in each direction, although typical maximum separation may be 10-15 miles.
- A maximum differential optical/electrical spacing between the CMTS and the closest and most distant modems of 100 miles in each direction, although this would typically be limited to 15 miles.

At a propagation velocity in fiber of approximately 1.5 ns/ft., 100 miles of fiber in each direction results in a round-trip delay of approximately 1.6 ms.

1.2.2 Network and System Architecture

1.2.2.1 The DOCSIS Network

The elements that participate in the provisioning of DOCSIS services are shown in Figure 1-1.

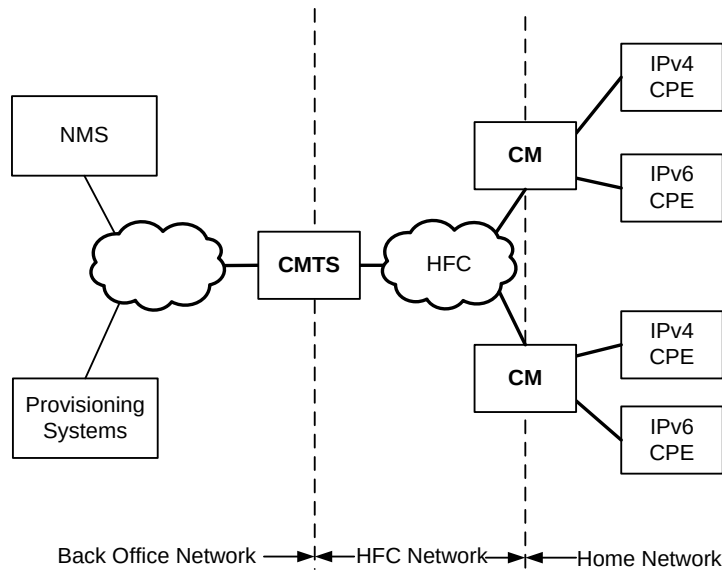


Figure 1-1 - The DOCSIS Network

The CM connects to the operator's HFC network and to a home network, bridging packets between them. Many CPEs devices can connect to the CMs' LAN interfaces. CPE devices can be embedded with the CM in a single device, or they can be separate standalone devices (as shown in Figure 1-1). CPE devices may use IPv4, IPv6 or both forms of IP addressing. Examples of typical CPE devices are home routers, set-top devices, and personal computers.

The CMTS connects the operator's back office and core network with the HFC network. Its main function is to forward packets between these two domains, and optionally to forward packets between upstream and downstream channels on the HFC network. The CMTS performs this forwarding with any combination of link-layer (bridging) and network-layer (routing) semantics.¹

Various applications are used to provide back office configuration and other support to the devices on the DOCSIS network. These applications use IPv4 and/or IPv6 as appropriate to the particular operator's deployment. The following applications include:

- Provisioning Systems²
 - The DHCP servers provide the CM with initial configuration information, including the device IP address(es), when the CM boots.
 - The Configuration File server is used to download configuration files to CMs when they boot. Configuration files are in binary format and permit the configuration of the CM's parameters.
 - The Software Download server is used to download software upgrades to the CM.
 - The Time Protocol server provides Time Protocol clients, typically CMs, with the current time of day.
 - Certificate Revocation server provides certificate status.

¹ Revised per OSSlv3.0-N-12-1058-3 on 7/24/12 by JS.

² Section modified per OSSlv3.0-N-07.0581 on 1/29/08 by KN.

- Network Management System (NMS)
 - The SNMP Manager allows the operator to configure and monitor SNMP Agents, typically the CM and the CMTS.
 - The syslog server collects messages pertaining to the operation of devices.
 - The IPDR Collector server allows the operator to collect bulk statistics in an efficient manner

1.2.3 Service Goals

As cable operators have widely deployed high-speed data services on cable television systems, the demand for bandwidth has increased. Additionally, networks have scaled to such a degree that IPv4 address constraints are becoming a burden on network operations. To this end, CableLabs' member companies have decided to add new features to the DOCSIS® specification for the purpose of increasing channel capacity, enhancing network security, expanding addressability of network elements, and deploying new service offerings.

The DOCSIS system allows transparent bi-directional transfer of Internet Protocol (IP) traffic, between the cable system head-end and customer locations, over an all-coaxial or hybrid-fiber/coax (HFC) cable network. This is shown in simplified form in Figure 1-2.

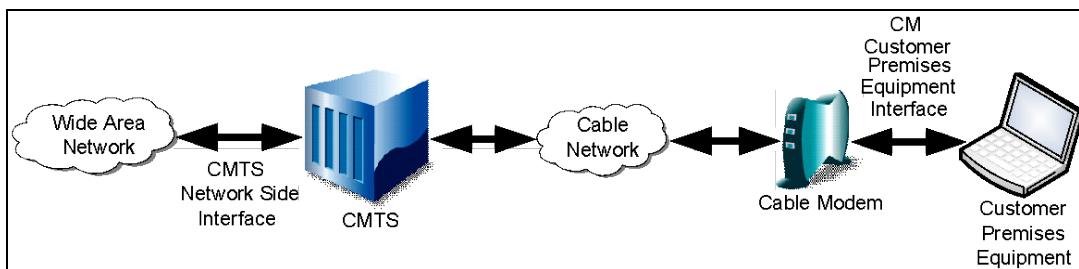


Figure 1-2 - Transparent IP Traffic through the Data-Over-Cable System

1.2.4 Statement of Compatibility³

This specification defines the DOCSIS 3.0 interface. Prior generations of DOCSIS were commonly referred to as DOCSIS 1.0, 1.1, and 2.0. DOCSIS 3.0 is backward-compatible with equipment built to the previous specifications with the optional exception for handling DOCSIS 1.0 CMs. DOCSIS 3.0-compliant CMs interoperate seamlessly with DOCSIS 2.0, DOCSIS 1.1, and DOCSIS 1.0 CMTSs. DOCSIS 3.0-compliant CMTSs seamlessly support DOCSIS 2.0, DOCSIS 1.1, and may optionally support DOCSIS 1.0 CMs (refer to Annex G of [MULPI]).

³ Revised per OSSiv3.0-N-12-1040-3 on 7/24/12 by JS.

1.2.5 Reference Architecture

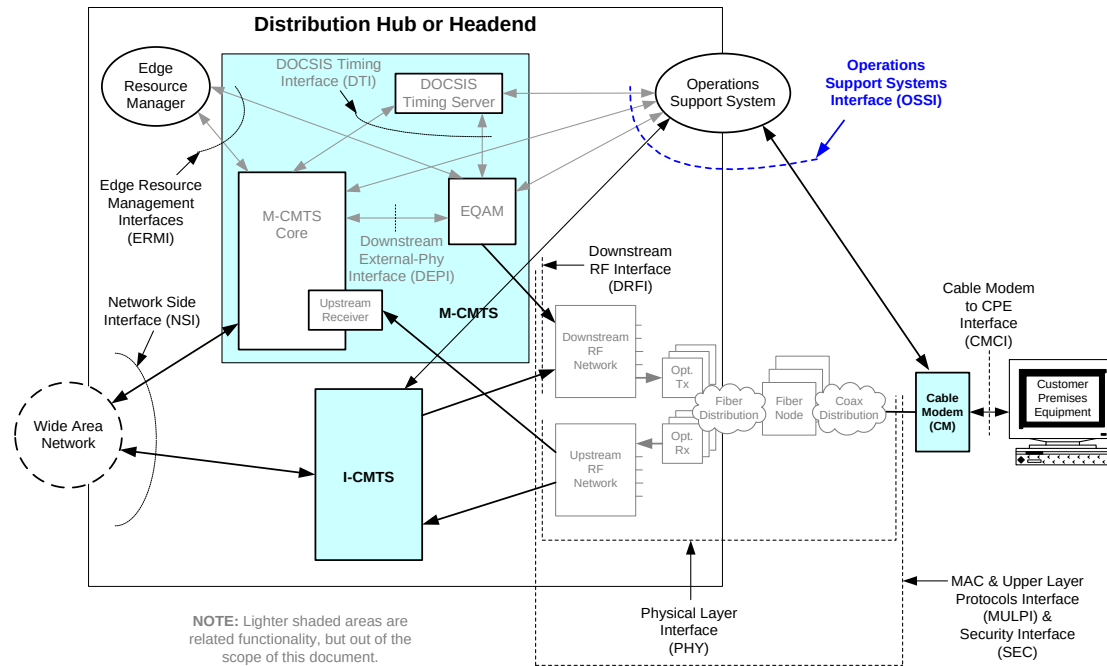


Figure 1-3 - Data-over-Cable Reference Architecture

The reference architecture for data-over-cable services and interfaces is shown in Figure 1-3.

1.2.6 DOCSIS 3.0 Documents

A list of the specifications in the DOCSIS 3.0 series is provided in Table 1-1. For further information, please refer to <http://www.cablemodem.com>.

Table 1-1 - DOCSIS 3.0 Series of Specifications⁴

Designation	Title
CM-SP-PHYv3.0	Physical Layer Specification
CM-SP-MULPIv3.0	Media Access Control and Upper Layer Protocols Interface Specification
CM-SP-OSSiv3.0	Operations Support System Interface Specification
CM-SP-SECv3.0	Security Specification
CM-SP-CMCIv3.0	Cable Modem CPE Interface Specification

This specification is defining the interface for the Operations Support Systems Interface (OSSI).

Related DOCSIS specifications are listed in Table 1-2.

⁴ Revised per OSSiv3.0-N-08.0700-4 on 1/7/09 by JS.

Table 1-2 - DOCSIS 3.0 Related Specifications⁵

Designation	Title
CM-SP-eDOCSIS	eDOCSIS™ Specification
CM-SP-DRFI	Downstream Radio Frequency Interface Specification
CM-SP-DTI	DOCSIS Timing Interface Specification
CM-SP-DEPI	Downstream External PHY Interface Specification
CM-SP-DSG	DOCSIS Set-Top Gateway Interface Specification
CM-SP-ERMI	Edge Resource Manager Interface Specification
CM-SP-M-OSSI	M-CMTS Operations Support System Interface Specification
CM-SP-L2VPN	Layer 2 Virtual Private Networks Specification
CM-SP-TEI	TDM Emulation Interface Specification

1.3 Requirements

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.

This document defines many features and parameters, and a valid range for each parameter is usually specified. Equipment (CM and CMTS) requirements are always explicitly stated. Equipment must comply with all mandatory (MUST and MUST NOT) requirements to be considered compliant with this specification. Support of non-mandatory features and parameter values is optional.

1.4 Conventions

In this specification the following convention applies any time a bit field is displayed in a figure. The bit field should be interpreted by reading the figure from left to right, then from top to bottom, with the MSB being the first bit so read and the LSB being the last bit so read.

MIB syntax and XML Schema syntax is represented by this code sample font.

Note: Notices and/or Warnings are identified by this style font and label.

⁵ Revised per OSSIV3.0-N-08.0700-4 on 1/7/09 by JS.

1.5 Organization of Document

Section 1 provides an overview of the DOCSIS 3.0 series of specifications including the DOCSIS reference architecture and statement of compatibility.

Section 2 includes a list of normative and informative references used within this specification.

Section 3 defines the terms used throughout this specification.

Section 4 defines the acronyms used throughout this specification.

Section 5 provides a technical overview and lists the DOCSIS 3.0 key features for the functional area of this specification.

Section 6 defines requirements for the OSSI SNMP and IPDR management protocols.

Section 7 defines the requirements for the OSSI management objects including SNMP MIBs and IPDR Service Definitions.

Section 8 defines the OSSI requirements for the PHY, MAC and Network Layers.

Section 9 defines the OSSI requirements for the Cable Modem to CPE Interface (CMCI).

Section 10 defines the OSSI requirements for the Cable Model device including LED operations.

1.5.1 Annexes⁶ (Normative)

Annex A includes a detailed list of MIB object requirements for the CM and CMTS.

Annex B defines the IPDR Service Definition and associated schema for Subscriber Account Management.

Annex C defines the IPDR Service Definition auxiliary schemas.

Annex D includes a detailed list of DOCSIS events and the associated formats.

Annex E defines the MGMD-STD-MIB requirements for DOCSIS 3.0 MGMD devices.

Annex F defines protocol filtering requirements.

Annex G defines the object model for the DOCSIS 3.0 Diagnostic Log feature.

Annex H defines the requirements for DOCS-IFEXT2-MIB.

Annex I defines the object model for the DOCSIS 3.0 Load Balancing requirements.

Annex J defines the object model for the DOCSIS 3.0 Enhanced Signal Quality Monitoring feature.

Annex K defines the DOCSIS 3.0 data type definitions.

Annex L defines the object model for the DOCSIS 3.0 Security requirements.

Annex M defines the object model for the DOCSIS 3.0 IP Multicast requirements.

Annex N defines the object model for the CM registration and upstream status requirements.

Annex O defines the object model for the MAC requirements.

Annex P defines the object model for the Subscriber Management requirements.

Annex Q defines the DOCSIS 3.0 MIB modules.

Annex R defines the DOCSIS 3.0 IPDR Service Definition schemas.

1.5.2 Appendices (Informative)

Appendix I identifies business process scenarios for Subscriber Account Management.

⁶ Revised per OSSlv3.0-N-07.0481-2 by ab on 7/17/07.

Appendix II provides a summary of Cable Modem authentication and code file authentication including areas of responsibility.

Appendix III includes example IPDR Instance Documents.

Appendix IV includes a list of IPDR/SP message encoding examples.

Appendix V identifies signal quality monitoring use cases for use as operational guideline examples.

Appendix VI provides an overview of the Object Model Notation using UML.

Appendix VII includes an RCC/RCP object diagram and corresponding XML Schema and Instance Documents.

Appendix VIII includes recommendations regarding CMTS exporter configuration.

Appendix IX includes acknowledgements and contains a list of contributors.

Appendix X includes engineering change revision history.