# Data-Over-Cable Service Interface Specifications

# DOCSIS® 3.0 Management Features Differences Technical Report

# CM-TR-MGMTv3.0-DIFF-V01-071228

**Released**

**Notice**

# Abstract

This technical report describes the management requirements differences between DOCSIS 2.0 and DOCSIS 3.0. The DOCSIS 3.0 specifications brings two major features to the cable High-Speed Service: Channel Bonding and IPv6 for Cable Modems management. From the management side, this represents an important change to the management interfaces as well. The intended audience of this document are cable operators and implementers of management systems who want to understand the high level differences of the management interfaces of DOCSIS 3.0 compared to DOCSIS 2.0.

# Document Status Sheet

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|---|---|---|---|---|
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## Trademarks

# Contents

# 1 MANAGEMENT OF DOCSIS 3.0 FEATURES OVERVIEW

## 1.1 Introduction

This document provides a summary of the management information defined to support the features in DOCSIS 3.0. The objective of this document is to provide a quick reference to the major differences in DOCSIS 3.0 management information compared with Pre-3.0 definitions. The DOCSIS 3.0 management requirements are defined in [OSSIv3.0]. By Pre-3.0 this document refers to the management requirements for DOCSIS 2.0 which are defined in [OSSIv2.0]. The document is divided into three areas:

- Changes in DOCSIS 3.0 SNMP MIB definitions relative to Pre 3.0
- SNMP MIB definitions introduced to support new DOCSIS 3.0 features
- IPDR Service Definitions for DOCSIS 3.0 compared to pre DOCSIS 3.0

The last two areas above are organized according to DOCSIS 3.0 functional categories each one containing one or more features.

## 1.2 OSSI Specification Structure Changes

The reader will notice that the [OSSIv3.0] specification document structure is different to previous versions of the documents (i.e., [OSSIv2.0] in two aspects:

- The [OSSIv3.0] requirements are organized using the classical Management functions (FCAPS): Fault, Configuration, Accounting, Performance, and Security.
- The [OSSIv3.0] management information is defined using conceptual Object Models that are protocol neutral. The models are then represented with appropriate syntax depending on the management interface being specified: For example, SNMP MIB Modules and IPDR Service Definitions. This approach provides two benefits, first, introduces an abstraction model of the requirement independent of the Network element (NE) management interface, and second, facilitates the re-use of the object models for new management protocols and interfaces in the future. Note that the [OSSIv3.0] specification only provides object models for the new DOCSIS 3.0 features. Existing SNMP MIB modules requirements are not re-defined as object models – only a few abstractions are used, e.g., to link 3.0 requirements with existing objects in SNMP MIB modules.

## 1.3 Object Model vs. Protocol Specific Representation

Traditionally, the OSSI specifications have been SNMP centric. Therefore, to effectively compare DOCSIS pre-3.0 management requirements (e.g., SNMP MIB objects) with DOCSIS 3.0 management requirements this document references specific SNMP MIB modules and MIB objects, in addition to the general references to the [OSSIv3.0] object models are introduced. For IPDR service Definitions IPDR Service Definitions the schema notation is used for comparing the overlapping areas of both [OSSIv3.0] and [OSSIv2.0]. The readers are encouraged to look at the object models Annexes of [OSSIv3.0] for further details.

## 1.4 Management Requirements DOCSIS 3.0 versus 2.0 - Snapshot

The table below shows an approximate number of mandatory managed objects for DOCSIS 3.0 compared to DOCSIS 2.0. The increases are primarily associated with support for IPv6, Channel Bonding, Multicast and HFC topology.

| Managed objects (OIDs) | DOCSIS 2.0 | DOCSIS 3.0 | % increase |
|---|---|---|---|
| Defined SNMP MIB objects | 1385 | 2130 | |
| Mandatory CM MIB objects | 682 | 840 | 23% |
| Mandatory CMTS MIB objects | 755 | 1407 | 86% |

IPDR Service Definitions are expanded beyond the SAMIS Service Definition in [OSSIv2.0] to improve the performance and efficiency of data collection from the 3.0 CMTS.

| IPDR Schema Definitions | DOCSIS 2.0 | DOCSIS 3.0 |
|---|---|---|
| Mandatory CMTS IPDR schemas | 1 | 10 |

Approximately 15% of the DOCSIS 2.0 mandatory SNMP MIB objects are currently retrieved on a regular basis, primarily for:

- Interface information:
  - RFI MIB: docsIfSignalQualityTable, docsIfDownstreamChannelTable, docsIfUpstreamChannelTable; docsIfCmtsModulationTable
  - IF MIB: ifTable, ifXTable,
- CM registration status:
  - RFI MIB: docsIfCmStatusTable, docsIfCmtsCmStatusTable
- Software and provisioning information:
  - Cable Device MIB: docsDevSoftware;
  - SNMPv2 MIB: sysDescr.

While with pre-3.0 DOCSIS devices the key management functions used were status monitoring and performance of cable modem on single upstream and downstream, channels, in DOCSIS 3.0 the monitoring and performance functions are expanded to support channel bonding and the configuration aspects of the CMTS HFC topology and channel bonding.

# 2 REFERENCES

All references are subject to revision. Therefore, readers of this document should use the most recent editions of the documents listed below,.

## 2.1 Normative References

This technical report does not use any normative references.

## 2.2 Informative References

This technical report uses the following informative references.


[DEPI] Downstream External-PHY Interface, CM-SP-DEPI-I05-070223, February 23, 2007, Cable Television Laboratories, Inc.

[DRFI] DOCSIS Downstream Radio Frequency Interface, CM-SP-DRFI-I05-070223, February 23, 2007, Cable Television Laboratories, Inc

[eDOCSIS] DOCSIS eDOCSIS™ Specification, CM-SP-eDOCSIS-I13-070803, August 3, 2007, Cable Television Laboratories, Inc.

[ID MGMD] IETF Internet Draft, J. Chesterfield, Multicast Group Membership Discovery MIB, draft-ietf-magma-mgmd-mib-08, March 2006. Refer to http://tools.ietf.org/html/draft-ietf-magma-mgmd-mib-08.

[IPDR/SP] IPDR/SP Protocol Specification, Version 2.1, IPDR.org, November 2004.

[M-OSSI] DOCSIS M-CMTS Operations Support System Interface Specification, CM-SP-M-OSSI-I07-071206, December 6, 2007, Cable Television Laboratories, Inc.

[MULPI] DOCSIS MAC and Upper Layer Protocols Interface Specification v3.0, CM-SP-MULPIv3.0-I06-071206, December 6, 2007, Cable Television Laboratories, Inc.

[OSSIv1.1] Data-Over-Cable Service Interface Specifications, Operations Support System Interface Specification, CM-SP-OSSIv1.1-C01-050907, September 7, 2005, Cable Television Laboratories, Inc.

[OSSIv2.0] Data-Over-Cable Service Interface Specifications, Operations Support System Interface Specification, CM-SP-OSSIv2.0-I10-070803, August 3, 2007, Cable Television Laboratories, Inc.

[OSSIv3.0] Data-Over-Cable Service Interface Specifications, Operations Support System Interface Specification, CM-SP-OSSIv3.0-I05-071206, December 6, 2007, Cable Television Laboratories, Inc.

[PHY] DOCSIS Physical Layer Specification v3.0, CM-SP-PHYv3.0-I05-070803, August 3, 2007, Cable Television Laboratories, Inc.

[RFC 1493] IETF RFC 1493, E. Decker, Definitions of Managed Objects for Bridges, July 1993.

[RFC 2011] IETF RFC 2011, K. McCloghrie, Ed., SNMPv2 Management Information Base for the Internet Protocol using SMIv2, November 1996.

[RFC 2013] IETF RFC 2013, K. McCloghrie, Ed., SNMPv2 Management Information Base for the User Datagram Protocol using SMIv2, November 1996.

[RFC 2669] IETF RFC 2669, M. St. Johns, Ed., DOCSIS Cable Device MIB Cable Device Management Information Base for DOCSIS compliant Cable Modems and Cable Modem Termination Systems, August 1999.

[RFC 2790] IETF RFC 2790, Waldbusser, P. Grillo, Host Resources MIB, March 2000.

[RFC 2863] IETF RFC 2863, K. McCloghrie and F. Kastenholz, The Interfaces Group MIB, June 2000.

[RFC 2933] IETF RFC 2933, K. McCloghrie, D. Farinacci, D. Thaler, Internet Group Management Protocol MIB, October 2000

[RFC 3418] IETF RFC 3418, R. Presuhn, Ed., Management Information Base (MIB) for the Simple Network Management Protocol (SNMP), December 2002.

[RFC 3433] IETF RFC 3433, A. Bierman, D. Romascanu, K.C. Norseth, Entity Sensor Management Information Base, December 2002.

[RFC 4001] IETF RFC 4001, M. Daniele et, al., Textual Conventions for Internet Network Addresses, February 2005.

[RFC 4022] IETF RFC 4022, R. Raghunarayan, Ed., Management Information Base for the Transmission Control Protocol (TCP), March 2005.

[RFC 4113] IETF RFC 4113, B. Fenner and J. Flick, Management Information Base for the User Datagram Protocol (UDP), June 2005.

[RFC 4131] IETF RFC 4131, S. Green et al., Management Information Base for Data Over Cable Service Interface Specification (DOCSIS) Cable Modems and Cable Modem Termination Systems for Baseline Privacy Plus, September 2005.

[RFC 4133] IETF RFC 4133, A. Bierman, K. and McCloghrie, Entity MIB, August 2005.

[RFC 4323] IETF RFC 4323, M. Patrick, and W. Murwin, Data Over Cable System Interface Specification Quality of Service Management Information Base (DOCSIS-QoS MIB), January 2006.

[RFC 4188] IETF RFC 4188, K. Norseth, Ed. and E. Bell, Ed., Definitions of Managed Objects for Bridges, September 2005.

[RFC 4292] IETF RFC 4292, B. Haberman, IP Forwarding Table MIB, April 2006.

[RFC 4293] IETF RFC 4293, S. Routhier, Ed., Management Information Base for the Internet Protocol (IP), April 2006.

[RFC 4546] IETF RFC 4546, D. Raftus and E. Cardona, Radio Frequency (RF) Interface Management Information Base for DOCSIS 2.0 Compliant RF Interfaces, June 2006.

[RFC 4547] IETF RFC 4547, A. Ahmad and G. Nakanishi, Event Notification Management Information Base for DOCSIS Compliant Cable Modems and Cable Modem Termination Systems, June 2006.

[RFC 4639] IETF RFC 4639, R. Woundy and K. Marez, Cable Device Management Information Base for Data-Over-Cable Service Interface Specification (DOCSIS) Compliant Cable Modems and Cable Modem Termination Systems, December 2006.

[SEC] DOCSIS Security Specification v3.0, CM-SP-SECv3.0-I06-071206, December 6, 2007, Cable Television Laboratories, Inc.

# 3 MIB MODULES CHANGES

This section includes a summary of functional areas which are traditionally defined as managed objects in SNMP MIB modules.

## 3.1 Existing MIB Modules Changes

### 3.1.1 DOCSIS MIB Modules

| Configuration & Status Monitoring & Performance | | |
|---|---|---|
| **Functional Area** | **MIB Module Description** | |
| Cable Device | New IETF RFC MIB module preserves the existing IANA OID root, primarily IPv6 support updates<br>OSSIv3.0 takes precedence over the Cable Device MIB RFC on:<br>• IP filtering and legacy IPv4 support of NmAccess Required for backward compatibility rather than deprecated<br>• Not to require compliance to DIFFSERV-MIB [eDOCSIS] | |
| **MIB MODULE** | **Pre-3.0** | **3.0** |
| Name | DOCS-CABLE-DEVICE-MIB [RFC 2669] | DOCS-CABLE-DEVICE-MIB [RFC 4639] |
| Rooting OID | mib-2.69 | mib-2.69 |
| Comments: | | |
| | | |

| Configuration & Status Monitoring & Performance | | |
|---|---|---|
| **Functional Area** | **MIB Module Description** | |
| RFI | New RFIv2 MIB RFC, preserves the existing IANA OID root<br>DOCSIS 3.0 Channel Bonding and CMTS Topology are defined in DOCS-IF3-MIB [OSSIv3.0] | |
| **MIB MODULE** | **Pre-3.0** | **3.0** |
| Name | DOCS-IF-MIB (ID-05) See [OSSIv2.0] | DOCS-IF-MIB [RFC 4639] |
| Rooting OID | Transmission.127 | Transmission.127 |
| Name | - | DOCS-IF3-MIB Annex Q.6 [OSSIv3.0]<br>Object Model: Annex J; Annex N; Annex O [OSSIv3.0] |
| Rooting OID | | clabProjDocsis.20 |
| Name | - | DOCS-TOPO-MIB Annex Q.8 -CMTS only -<br>Object Model: Annex O [OSSIv3.0] |
| Rooting OID | | clabCommonMibs.2 |
| Comments: | | |
| | | |

| Configuration & Status Monitoring & Performance | | |
|---|---|---|
| **Functional Area** | **MIB Module Description** | |
| BPI+ | New IANA OID root;<br>Changes to DOCSIS 2.0<br>• AES Encryption algorithm support<br>• DOCSIS 3.0 deprecates Multicast CM Authorization management from BPI+ MIB (see Category: DOCSIS Authentication, Authorization and Encryption) | |
| **MIB MODULE** | **Pre-3.0** | **3.0** |
| Name | DOCS-BPI2-MIB (ID-05) | DOCS-IETF-BPI2-MIB [RFC 4131] |
| Rooting OID | docsIfMib.6 | mib-2.126 |
| Comments: | | |
| | | |

| Configuration & Status Monitoring & Performance | | |
|---|---|---|
| **Functional Area** | **MIB Module Description** | |
| QOS | New CableLabs OID root;<br>Merges 2.0 requirements and 3.0 requirements:<br>• CM Upstream Filtering (Upstream Drop classifiers – UDCs)<br>• 3.0 Channel Bonding (1) | |
| **MIB MODULE** | **Pre-3.0** | **3.0** |
| Name | DOCS-QOS-MIB<br>[OSSIv1.1]: ID-04<br>[OSSIv2.0]: Annex J | DOCS-QOS3-MIB [OSSIv3.0] Annex Q.7<br>Object Model: [OSSIv3.0] Annex O.2.8, O.2.9 |
| Rooting OID | docsIfMib.7 | clabProjDocsis.16 |
| Comments: | | |
| (1) OSSIv3.0 does not require IETF [RFC 4323] (DOCS-IETF-QOS-MIB) because:<br>• Main difference between DOCSIS 2.0 requirements DOCS-QOS-MIB (I04 updated by ECRs) and DOCS-IETF-QOS-MIB was the InetAddress [RFC 4001] types for support of IPv4/IPv6 classifiers.<br>• The segmentation of QOS MIB objects from 2.0 plus Channel bonding, IPv6 & PCMM QOS extensions were inefficient as separated MIB Modules<br>• The DOCS-QOS3-MIB takes DOCS-QOS-MIB OID structure under a CableLabs enterprise number and adds the [MULPI] channel bonding and DBC messaging. | | |

| Configuration & Status Monitoring & Performance | | |
|---|---|---|
| **Functional Area** | **MIB Module Description** | |
| Subscriber Management | New CableLabs OID root;<br>Normalizes DOCSIS 2.0 Sub Mgmt Filters and UDCs management:<br>• Similar to Classifier structure<br>• Enables configuring UDCs in the CMTS during CM registration<br>IPv6 Prefix considerations:<br>• Rather than management of individual IP addresses for CPEs it defines CPE IP Prefixes learning and Controls for MAX CPE IP Prefixes (1) | |
| **MIB MODULE** | **Pre-3.0** | **3.0** |
| Name | DOCS-SUBMGT-MIB (ID-02) | DOCS-SUBMGT3-MIB ([OSSIv3.0] Annex Q.2)<br>Object Model: Annex P |
| Rooting OID | experimental.83.4 | clabProjDocsis.10 |
| Comments: | | |
| (1) A unicast CPE IP can still be represented as IP/Prefix, where the Prefix has all bits set to 1 | | |

| Configuration & Status Monitoring & Performance | | |
|---|---|---|
| **Functional Area** | **MIB Module Description** | |
| Load Balancing | New MIB Module for DOCSIS 3.0;<br>Support for Load Balancing Groups based on Service Groups and Fiber Node Topology:<br>• General Load Balancing Groups are by default MD-CM-SGs<br>• Restricted Load Balancing Groups can be configured using the legacy Load Balancing Group ID TLV or the DOCSIS 3.0 defined Service Type ID TLV [MULPI]<br>• Change Over operations over multiple Channels<br>• Load Balancing across MAC Domains is vendor specific. | |
| **MIB MODULE** | **2.0** | **3.0** |
| Name | DOCS-LOADBAL-MIB Annex I [OSSIv2.0] | DOCS-LOADBAL3-MIB Annex Q.9 [OSSIv3.0]<br>Object Model: Annex I [OSSIv3.0] |
| Rooting OID | clabProjDocsis.2 | clabProjDocsis.22 |
| Comments: | | |
| | | |

| Status Reporting | | |
|---|---|---|
| **Functional Area** | MIB Module Description | |
| DOCSIS Event Notifications | New IETF [RFC 4547] Some notifications have issues to be resolved such as:<br>• IPv6 support in notification varbinds,<br>• Deprecated DOCSIS 2.0 notification varbinds due to Channel Bonding | |
| **MIB MODULE** | **Pre-3.0** | **3.0** |
| Name | DOCS-CABLE-DEVICE-TRAP-MIB<br>[OSSIv1.1]: Annex M same as<br>[OSSIv2.0]: Annex H | DOCS-IETF-CABLE-DEVICE-NOTIFICATION-MIB [RFC 4547] |
| Rooting OID | docsDev.10 | mib-2.132 |
| Comments: | | |
| The requirements for DOCSIS notifications are work in progress. The event types are being normalized to resolve the issues with varbinds resulting in deprecating [RFC 4546]. | | |

### 3.1.2 General IETF MIB Modules

| Configuration & Status Monitoring & Performance | | |
|---|---|---|
| **Functional Area** | **MIB Module Description** | |
| IP | OSSIv3.0 requires new IPv4 and IPv6 ready IETF MIBs<br>IETF defines the use of INETADDRESS-MIB types [RFC 4001] to represent support of IPv4 and IPv6 in MIB Modules (uses tuple InetAddressType, InetAddress, and other types for IP version, Prefix Length, etc). | |
| **MIB Modules** | | |
| **Functional Area** | **Pre-3.0** | **3.0** |
| Name | IP-MIB [RFC 2011] | IP-MIB [RFC 4293] |
| Rooting OID | mib-2.48 | mib-2.48 |
| Name | UDP-MIB [RFC 2013] | UDP-MIB [RFC 4113] |
| Rooting OID | mib-2.50 | mib-2.50 |
| Name | - | TCP-MIB [RFC 4022]<br>-CMTS only- |
| Rooting OID | | mib-2.49 |
| Name | IGMP-STD-MIB [RFC 2933]<br>- CM, CMTS - | IGMP-STD-MIB [RFC 2933]<br>- CM only (1) |
| Rooting OID | mib-2.85 | mib-2.85 |
| Name | - | MGMD-STD-MIB [ID MGMD]<br>- CMTS only - |
| Rooting OID | | OID TBD (2) |
| Comments: | | |

| |
|---|
| (1) In 3.0 Support of IGMP-STD-MIB is only required for CMs to report Pre-3.0 DOCSIS Multicast (MDF disabled) and IGMP passive/active proxy requirements (See [OSSIv3.0], [MULPI]) |
| (2) Still IETF Internet Draft; therefore, IANA has not assigned OID for rooting this MIB Module - Requirements is not expected to be validated prior to that time. |

| **Configuration & Status Monitoring & Performance** | | |
|---|---|---|
| **Functional Area** | **MIB Module Description** | |
| BRIDGE | Updated [RFC 1493] from SMIv1 to SMIv2 and minor extensions to synch with 802.1 (e.g., addendum, Rapid Spanning Tree) | |
| **MIB Module** | **Pre-3.0** | **3.0** |
| Name | BRIDGE-MIB [RFC 1493] | BRIDGE-MIB [RFC 4188] |
| Rooting OID | mib-2.17 | mib-2.17 |
| Comments: | | |
| | | |

## 3.2 New MIB Modules

### 3.2.1 DOCSIS MIB Modules

| **Configuration & Status Monitoring & Performance** | |
|---|---|
| Functional Area | MIB Module Description |
| Security | New MIB Module for DOCSIS 3.0<br>DOCSIS Security extensions for CPE Access |
| **MIB Module** | |
| Name | DOCS-SEC-MIB Annex Q.3 [OSSIv3.0]<br>-CMTS only -<br>Object Model: Annex L [OSSIv3.0] |
| Rooting OID | clabProjDocsis.11 |
| Comments: | |
| | |

| **Status Monitoring** | |
|---|---|
| Functional Area | MIB Module Description |
| Diagnostic Log | New MIB Module for DOCSIS 3.0<br>Log of CM link instabilities:<br>CM flaps<br>Ranging errors |

| MIB Module | |
|---|---|
| Name | DOCS-DIAG-MIB Annex Q.1 [OSSIv3.0]<br>-CMTS only -<br>Object Model: Annex G [OSSIv3.0] |
| Rooting OID | clabProjDocsis.9 |
| Comments: | |

| Configuration & Status Monitoring | |
|---|---|
| **Functional Area** | **MIB Module Description** |
| Downstream RFI | New MIB Module for DOCSIS 3.0 and M-CMTS Architecture Management [M-OSSI]<br>DOCSIS DRFI extensions |
| **MIB Module** | |
| Name | DOCS-DRF-MIB Annex E [M-OSSI] (1)<br>-CMTS only- |
| Rooting OID | clabProjDocsis.23 |
| Comments: | |
| (1) The original DOCS-IF-M-CMTS-MIB was split via ECN into two MIB modules: the original MIB module maintained the DEPI requirements for M-CMTS [M-OSSI], [DEPI] and the DOCS-DRF-MIB module took the Downstream RF requirements such as capabilities, Dependencies and Channel Block [M-OSSI], [DRFI]. | |

### 3.2.2 General IETF MIB Modules

| Status Monitoring & Performance | |
|---|---|
| **Functional Area** | **MIB Module Description** |
| Host Resources | IETF standard for Host Systems management |
| **MIB Module** | |
| Name | HOST-RESOURCES-MIB [RFC 2790]<br>-CMTS only- (1) |
| Rooting OID | mib-2.25 |
| Comments: | |
| (1) Per [OSSIv3.0] there is a pending item action to define reduced compliance requirements for the CMTS. | |

| Configuration | |
|---|---|
| **Functional Area** | **MIB Module Description** |
| Entity MIB | IETF standard for configuring logical and physical components of a device |
| **MIB Module** | |
| Name | ENTITY-MIB [RFC 4133]<br>-CMTS only- (1) |

| | |
|---|---|
| Rooting OID | mib-2.47 |
| Name | ENTITY-SENSOR-MIB [RFC 3433]<br>-CMTS only - |
| Rooting OID | mib-2.99 |
| Comments: | |
| (1) Per [OSSIv3.0] there is a pending item action to define reduced compliance requirements for the CMTS. | |

# 4 DOCSIS 3.0 CHANGES FOR PRE 3.0 SNMP OBJECTS

This section includes general management information of DOCSIS Pre-3.0 features that were changed or enhanced in DOCSIS 3.0. The equivalence between the MIB modules and objects defined in pre 3.0 and 3.0 is discussed in this section.

## 4.1 Category: Secure Software Download

### 4.1.1 Feature: IPv6 SSD support

| Secure Software Download | |
|---|---|
| Description | SNMP initiated Software Download uses now an IP version neutral SNMP MIB object for the file server where the image file resides |
| Device | CM |
| Requirement | MUST |
| NM Functions | Configuration |
| References | [OSSIv3.0] Secure Software Download section<br>[SEC] Secure Software Download section |

| CM MIB Objects | | |
|---|---|---|
| | **Pre-3.0** | **3.0** |
| MIB Module Name | DOCS-CABLE-DEVICE-MIB [RFC 2669] | DOCS-CABLE-DEVICE-MIB [RFC 4639] |
| Object Name | docsDevSwServer (1) | docsDevSwServerAddressType,<br>docsDevSwServerAddress<br>docsDevSwServerTransportProtocol (2) |
| Object Name | docsDevSwFilename<br>docsDevSwAdminStatus<br>docsDevSwOperStatus<br>docsDevSwCurrentVers | docsDevSwFilename<br>docsDevSwAdminStatus<br>docsDevSwOperStatus<br>docsDevSwCurrentVers |
| | | |
| MIB Module Name | SNMPv2-MIB [RFC 3418] | SNMPv2-MIB [RFC 3418] |
| Object Name | sysDescr | sysDescr |
| Comments: | | |
| (1) Deprecated in favor of an IP version neutral SNMP MIB object<br>(2) The SNMP MIB object docsDevSwServerTransportProtocol provides a switch between TFTP and HTTP protocols for SSD. | | |
| Links: | | |
| For SSD validation of successful Software download the manager can additionally verify the following:<br>Feature: CM Operational Status<br>DOCSIS Event Notifications | | |

## 4.2 Category: IP Filtering

### 4.2.1 Feature: CM Pre-3.0 Filtering and Upstream Drop Classifiers

| CM IP Filtering | |
|---|---|
| Description | LLC Filtering Support:<br>- Same for Pre-3.0 and 3.0<br>- Mandatory for CM, optional for CMTS;<br>IP Filtering for 3.0 support:<br>- Legacy IPv4 filters (minimum of 64 Filtering rules)<br>- Mandatory for CM, optional for CMTS<br>Upstream Drop Classifiers (UDCs)<br>- Min 64 Filtering rules<br>- No CM Downstream filters<br>- IPv4 and IPv6<br>- TLV 60 (UCD TLV)<br>- Similar to Upstream Classifiers for QOS, without Service Flows references/Ids<br>- Applicable during registration and DSC operations<br>- No SNMP read/write operations<br>- UDCs are reported as Classifiers with SF ID = 0<br>- IP Filters and UDCs do not coexist<br>- During Registration the CMTS commands the CM to use UDCs or legacy IP filtering.<br>- UDCs from the config file, or<br>- Optionally from CMTS configuration based on UDC Group ID(s) |
| Device | CM |
| Requirement | MUST |
| NM Functions | Configuration |
| References | [MULPI] Annex C, Upstream Packet Classification Encoding section, Classifiers section<br>[OSSIv3.0] Annex F |
| Links: | |
| Feature: CMTS Pre-3.0 IPv4 SubMgt Filters & IPv6 SubMgt Filters | |

| CM MIB Objects | | |
|---|---|---|
| | **Pre-3.0** | **3.0** |
| MIB Module Name | DOCS-CABLE-DEVICE-MIB | DOCS-CABLE-DEVICE-MIB |
| Object Name | docsDevFilterLLCUnmatchedAction<br>docsDevFilterLLCTable | docsDevFilterLLCUnmatchedAction<br>docsDevFilterLLCTable |
| Object Name | docsDevFilterIpDefault<br>docsDevFilterIpTable<br>docsDevFilterPolicyTable (1)<br>docsDevFilterTosTable (1) | docsDevFilterIpDefault<br>docsDevFilterIpTable |
| **docsDevFilterIpTable** | | |
| MIB Module Name | | DOCS-QOS3-MIB |
| Object Name | | docsQosPktClassTable (2) |
| Comments: | | |
| (1) deprecated MIB objects in DOCSIS 3.0<br>(2) UDC instances reference Service Flow Id = 0 | | |
| Links: | | |
| | | |

| CMTS MIB Objects | | |
|---|---|---|
| | **Pre-3.0** | **3.0** |
| MIB Module Name | - | DOCS-SUBMGT3-MIB |
| Object Name | - | docsIf3MdCfgCmUdcEnabled (1)<br>docsIf3MdCfSendUdcRulesEnabled (1)<br>docsSubMgt3GrpUdcGroupIds (1)<br>docsSubMgt3GrpUdcSentInRegRsp (1) |
| Object Name | - | docsSubMgt3FilterGrpTable (1) |
| Comments: | | |
| The CMTS optionally supports the signaling of UDC rules to the CM during registration. (see Annex P [OSSIv3.0]) | | |
| Links: | | |
| | | |

### 4.2.2 Feature: CMTS Pre-3.0 IPv4 SubMgt Filters & IPv6 SubMgt Filters

Note: DOCS-CABLE-DEVICE-MIB IP Filtering and LLC Filtering are optional for CMTS. Instead CMTS supports Subscriber Management Filtering and vendor specific IP Access list.

| Subscriber Management Filtering | |
|---|---|
| Description | CMTS policy based IP US/DS IP Filtering |
| Device | CMTS |
| Requirement | MUST |
| NM Functions | Configuration & Status Monitoring |
| References | [OSSIv3.0] Annex P<br>[OSSIv3.0] Annex Q.2 |
| Links: | |
| | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | |
| | **1.1/2.0** | **3.0** |
| MIB Module Name | DOCS-SUBMGT-MIB | DOCS-SUBMGT3-MIB |
| Object Name | docsSubMgtObjects (1)<br>docsSubMgtCpeControlTable<br>docsSubMgtCpeIpTable<br>docsSubMgtCmFilterTable<br>docsSubMgtPktFilterTable<br>docsSubMgtTcpUdpFilterTable (6) | docsSubMgt3Base<br>docsSubMgt3CpeCtrlTable (2)<br>docsSubMgt3CpeIpTable (3)<br>docsSubMgt3GrpTable<br>docsSubMgt3FilterGrpTable (4,5)<br>- |
| Comments: | | |
| (1) Refers to Global default policies, and Filter groups MIB objects<br>(2) See Feature: Source Address Verify –SAV- & Allow upstream IPv6 traffic from CMs only for operator provided IPv6 prefixes<br>(3) CMTS learns CPE IPv4 and IPv6 Prefixes - See Feature: Source Address Verify –SAV<br>(4) Filter table structure follows the attribute definitions from QOS packet classification<br>(5) LLC filter criteria is only used for UDC CMTS initiated configuration not for CMTS filtering of CM/CPE traffic by Subscriber Management Filters<br>(6) 3.0 analogous classification parameters are included in docsSubMgt3FilterGrpTable. | | |
| Links: | | |
| Feature: CM Pre-3.0 Filtering and Upstream Drop Classifiers | | |

## 4.3 Category: NMS

### 4.3.1 Feature: Enhanced Signal Quality Monitoring Interface Measurements Extensions

| Enhanced Signal Quality Monitoring | |
|---|---|
| Description | Provides additional PHY measurements and values for management of the Physical layer. |
| Device | CM & CMTS |
| Requirement | MUST |
| NM Functions | Performance |
| References | [OSSIv3.0] Appendix V Signal Quality Use Cases (Informative) |

| CM & CMTS MIB Objects | | |
|---|---|---|
| | **Pre-3.0** | **3.0** |
| MIB Module Name | DOCS-IF-MIB | DOCS-IF-MIB |
| Object Name | docsIfSignalQualityTable | docsIfSignalQualityTable (1) |
| | | |
| MIB Module Name | | DOCS-IF3-MIB |
| Object Name | | docsIf3SignalQualityExtTable (2) |
| Comments: | | |
| (1) The SNMP MIB object docsIfSigQSignalNoise is deprecated and replaced by the attributes in docsIf3SignalQualityExtTable object<br>(2) Includes Received MER statistics. | | |
| Links: | | |
| | | |

| CMTS MIB Objects | | |
|---|---|---|
| | **Pre-3.0** | **3.0** |
| MIB Module Name | DOCS-IF-MIB | DOCS-IF3-MIB |
| Object Name | | docsIf3CmtsSignalQualityExtTable (1) |
| Object Name | docsIfCmtsCmStatusTable (2) | docsIf3CmtsCmUsStatusTable (3) |
| | | |
| MIB Module Name | DOCS-IFEXT2-MIB | DOCS-IFEXT2-MIB |
| Object Name | docsIfExt2CmtsCmMscStatusTable (4)<br>docsIfExt2CmtsUpChannelMscTable (5) | docsIfExt2CmtsCmMscStatusTable (4)<br>docsIfExt2CmtsUpChannelMscTable (5) |
| Comments: | | |
| (1) Provides Carrier to Noise and Interference ratio (CNIR) and Expected Receive Signal Power<br>(2) Rx Power, MicroReflections, Equalization Data, CodeWords, FEC counters for CM upstream, channel<br>(3) Rx Power, MicroReflections, Equalization Data, CodeWords, FEC counters per upstream channel in the Transmit Channel Set (TCS) – Available also as an IPDR service Definition<br>(4) Optional (See [OSSIv3.0] Requirements for DOCSIS RF MIB [RFC 4546] section for considerations on docsIfCmtsCmStatusIndex for DOCSIS 3.0<br>(5) Optional (See [OSSIv3.0]) | | |
| Links: | | |
| DOCSIS IPDR Service Definitions | | |

## 4.4 Category: Pre-3.0 DOCSIS RFI

### 4.4.1 Feature: DOCSIS RF Interfaces Management

| DOCSIS RF Interfaces Management | |
|---|---|
| Description | Management of MAC Domain, Downstream, Upstream and Logical Upstream channels |
| Device | CM & CMTS |
| Requirement | MUST |
| NM Functions | Configuration & Status Monitoring & Performance |
| References | [OSSIv3.0] Annex A.2 |
| Links: | |
| | |

| CM & CMTS | | |
|---|---|---|
| **MIB Module** | | |
| | **2.0** | **3.0** |
| MIB Module Name | IF-MIB | IF-MIB |
| Object Names | ifTable<br>ifXTable<br>IfStackTable | ifTable<br>ifXTable<br>ifStackTable |
| | | |
| MIB Module Name | DOCS-IF-MIB | DOCS-IF-MIB |
| Object Names | docsIfDownstreamChannelTable<br>docsIfUpstreamChannelTable | docsIfDownstreamChannelTable (1)<br>docsIfUpstreamChannelTable |
| Comments: | | |
| (1) Includes docsIfDownChannelStorageType introduced by IETF revision of DOCS-IF-MIB [RFC 4546] | | |
| Links: | | |
| Feature: MAC Domain Level Parameters configuration – MDD, and CM-STATUS Messaging Enable/Disable | | |

| CM | | |
|---|---|---|
| **MIB Module** | | |
| | **2.0** | **3.0** |
| MIB Module Name | DOCS-IF-EXT2-MIB | DOCS-IF-EXT2-MIB |
| Object Names | docsIfExt2CmMscStatusTable | docsIfExt2CmMscStatusTable |
| Comments: | | |
| | | |
| Links: | | |
| | | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | |
| | **2.0** | **3.0** |
| MIB Module Name | DOCS-IF-MIB | DOCS-IF-MIB |
| Object Names | docsIfCmtsModulationTable | docsIfCmtsModulationTable (1) |
| Object Names | docsIfCmtsChannelUtilizationInterval<br>docsIfCmtsChannelUtilizationTable<br>docsIfCmtsDownChannelCounterTable<br>docsIfCmtsUpChannelCounterTable (2) | docsIfCmtsChannelUtilizationInterval<br>docsIfCmtsChannelUtilizationTable<br>docsIfCmtsDownChannelCounterTable<br>docsIfCmtsUpChannelCounterTable |
| | | |
| MIB Module Name | DOCS-IF-EXT2-MIB | DOCS-IF-EXT2-MIB |
| Object Names | docsIfExt2CmtsMscGlobalEnable<br>docsIfExt2CmtsUpChannelMscTable (3)<br>docsIfExt2CmtsUpChannelTable (3) | docsIfExt2CmtsMscGlobalEnable<br>docsIfExt2CmtsUpChannelMscTable (3)<br>docsIfExt2CmtsUpChannelTable (3) |
| Comments: | | |
| (1) docsIfCmtsModStorageType introduced by IETF revision of DOCS-IF-MIB [RFC 4546], and not part of the DOCSIS 2.0 requirements<br>(2) Early versions of DOCSIS 2.0 does not list some attributes of this table as mandatory<br>(3) optional | | |
| Links: | | |
| | | |

## 4.5 Category: MAC Domain Configuration

### 4.5.1 Feature: MAC Domain Level Parameters configuration & Configurable Association of Upstream Channels to Downstream Channels

| MAC Domain Configuration | |
|---|---|
| Description | MAC Domain configuration information |
| Device | CMTS |
| Requirement | MUST |
| NM Functions | Configuration |
| References | [OSSIv3.0] Annex O<br>[RFC 4546] |
| Links: | |
| | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | |
| | **2.0** | **3.0** |
| MIB Module Name | IF-MIB | IF-MIB |
| Object Names | ifStackTable | ifStackTable |
| | | |
| MIB Module Name | DOCS-IF-MIB | DOCS-IF-MIB |
| Object Names | docsIfCmtsMacTable (1) | docsIfCmtsMacTable (1) |
| | | |
| MIB Module Name | | DOCS-IF3-MIB |
| Object Name | | docsIf3MdCfgTable (1,2,3)<br>docsIf3MdChCfgTable (4)<br>docsIf3MdUsToDsChMappingTable (4) |
| Comments: | | |
| (1) MAC Domain level configuration parameters<br>(2) Channel IDs (DOCS-IF-MIB docsIfDownChannelId and docsIfUpChannelId) are configured at the MD-Channel association level (docsIf3MdChCfgTable) instead of on a per channel basis.<br>(3) J.83 Annex (docsIfDownChannelAnnex) is configured at the MAC Domain level (docsIf3MdCfgTable)<br>(4) Configurable association of US/DS channels to a Mac Domain | | |
| Links: | | |
| | | |

## 4.6 Category: Pre-3.0 and 3.0 CM Status

### 4.6.1 Feature: CM Operational Status

| CM Status Information | |
|---|---|
| Description | Provides state and Link state of each CM to the CMTS: MAC Address, IP, Topology information, US performance Metrics |
| Device | CM & CMTS |
| Requirement | MUST |
| NM Functions | Configuration & Status Monitoring & Performance |
| References | Annex N [OSSIv3.0] |
| Links: | |
| | |

| CM | | |
|---|---|---|
| **MIB Module** | | |
| | **1.x/2.0** | **3.0** |
| MIB Module Name | DOCS-IF-MIB | DOCS-IF3-MIB |
| Object Names | docsIfCmStatusTable | docsIf3CmStatusTable<br>docsIf3CmStatusUsTable (1) |
| Object Names | docsIfCmMacTable<br>docsIfDocsisBaseCapability | docsIfCmMacTable<br>docsIfDocsisBaseCapability<br>docsIf3CmCapabilities (2) |
| | | |
| MIB Module Name | DOCS-CABLE-DEVICE-MIB | DOCS-CABLE-DEVICE-MIB |
| Object Name | docsDevServerBootState | docsIf3CmStatusValue (3) |
| Object Name | docsDevRole<br>docsDevDateTime<br>docsDevResetNow<br>docsDevSerialNumber<br>docsDevSTPControl- | docsDevRole<br>docsDevDateTime<br>docsDevResetNow<br>docsDevSerialNumber<br>docsDevSTPControl<br>docsDevMaxCpe |
| Object Name | docsDevServerDhcp<br><br>docsDevServerTime<br><br>docsDevServerTftp | docsDevServerDhcpAddressType<br>docsDevServerDhcpAddress<br>docsDevServerTimeAddressType<br>docsDevServerTimeAddress<br>docsDevServerConfigTftpAddressType<br>docsDevServerConfigTftpAddress |
| Comments: | | |
| (1) There is one instance of docsIf3CmStatusUsTable for each channel of the CM TCS<br>(2) Enhanced CM capabilities reporting (TLV-5 in REG-REQ, REG-RSP)<br>(3) The object docsIf3CmStatusValue from docsIf3CmStatusTable now includes the state values of docsDevServerBootState which is now deprecated | | |
| Links: | | |
| | | |

Note: the SNMP MIB objects from DOCS-CABLE-DEVICE MIB listed in the CM table above are supported (mandatory or optional) by the CMTS as well, however, Typically the CMTS does not follow similar bootstrap process like the CM and support of those objects is not relevant and not listed in this table as a CMTS requirement – See [OSSIv3.0] Annex A for detailed CMTS compliance requirements.

| CMTS | | |
|---|---|---|
| **MIB Module** | | |
| | **2.0** | **3.0** |
| MIB Module Name | DOCS-IF-MIB | DOCS-IF-MIB |
| Object Names | docsIfCmtsStatusTable | docsIfCmtsStatusTable |
| Object Names | docsIfCmtsMacToCmTable | docsIfCmtsMacToCmTable |
| | | |
| MIB Module Name | DOCS-IF-MIB | DOCS-IF3-MIB |
| Object Name | docsIfCmtsCmStatusTable | docsIf3CmtsCmRegStatusTable (1)<br>docsIf3CmtsCmUsStatusTable (1,2) |
| Comments: | | |
| (1) The CMTS CM registration status and US Status are also available as IPDR service Definitions<br>(2) There is one instance of docsIf3CmtsCmUsStatusTable for each channel of the CM TCS – Provides per channel in the TCS Mute state, Ranging status and Timing offset information. | | |
| Links: | | |
| DOCSIS IPDR Service Definitions<br>Feature: Enhanced Signal Quality Monitoring Interface Measurements Extensions | | |

## 4.7 Category: DOCSIS Queuing Services

### 4.7.1 Feature: DOCSIS Services Configuration, DSID Assignment and Attribute-Based Service Flow Assignment

| CoS, QoS Service Configuration | |
|---|---|
| Description | Information related to DOCSIS COS and QOS Service configuration. DOCSIS 3.0 expands the QOS framework to support upstream and downstream channel bonding service flows and QOS for downstream multicast |
| Device | CM & CMTS |
| Requirement | MUST |
| NM Functions | Configuration |
| References | [OSSIv3.0] Annex O<br>[OSSIv3.0] Annex Q.6<br>[OSSIv3.0] Annex Q.7 |
| Links: | |
| Feature: QoS Support for Multicast sessions | |

| CM & CMTS | | |
|---|---|---|
| **MIB Module** | | |
| | **1.x/2.0** | **3.0** |
| MIB Module Name | DOCS-IF-MIB | DOCS-IF-MIB |
| Object Names | docsIfQosProfileTable (1,2) | docsIfQosProfileTable (1,2) |
| | | |
| MIB Module Name | DOCS-QOS-MIB | DOCS-QOS3-MIB |
| Object Name | docsQosPktClassTable<br>docsQosParamSetTable<br>docsQosServiceFlowTable<br>docsQosPHSTable<br>- | docsQosPktClassTable (3)<br>docsQosParamSetTable (4,5)<br>docsQosServiceFlowTable (6)<br>docsQosPHSTable<br>docsQosServiceFlowSidClusterTable (7) |
| Comments: | | |
| (1) CMTS optional<br>(2) Introduced docsIfQosProfStorageType by IETF revision of DOCS-IF-MIB [RFC 4546]<br>(3) Includes IPv6 & CMIM extensions includes US/DS Bonding QoS Parameters<br>(4) Different Index order allows the retrieval of the 'active' Service Flow QoS Param Set in one third of the time (ifIndex,docsQosParamSetType,docsQosParamSetServiceFlowId) instead of ifIndex, docsQosParamSetServiceFlowId, docsQosParamSetType) [OSSIv2.0]<br>(5) Includes Interface Channel Set, DSID Information, partial service indication<br>(6) Upstream Sid Cluster service Flow information | | |
| Links: | | |
| | | |

| CM | | |
|---|---|---|
| **MIB Module** | | |
| | **1.x/2.0** | **3.0** |
| MIB Module Name | DOCS-QOS-MIB | DOCS-QOS3-MIB |
| Object Name | -<br>- | docsQos3CmDsidTable (1)<br>docsQos3CmDsidClientTable (2) |
| Comments: | | |
| (1) DSID information<br>(2) DSID CPE client replication information | | |
| Links: | | |
| | | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | |
| | **1.x/2.0** | **3.0** |
| MIB Module Name | DOCS-IF-MIB | DOCS-IF-MIB |
| Object Names | docsIfCmtsQosProfilePermissions | docsIfCmtsQosProfilePermissions |
| | | |
| MIB Module Name | DOCS-QOS-MIB | DOCS-QOS3-MIB |
| Object Name | docsQosServiceClassTable<br>docsQosCmtsMacToSrvFlowTable<br>docsQosServiceClassPolicyTable (2)<br>-<br>-<br>-<br>-<br>-<br>- | docsQosServiceClassTable (1)<br>docsQosCmtsMacToSrvFlowTable<br>-<br>docsQosServiceFlowSidClusterTable (3)<br>docsQosGrpServiceFlowTable (4)<br>docsQosGrpPktClassTable (5)<br>docsQos3CmtsDsidTable (6)<br>docsQos3CmtsDebugDsidTable (7)<br>docsQos3CmtsDebugDsidStatsTable (8) |
| Comments: | | |
| (1) Includes US/DS Bonding QoS Parameters<br>(2) Optional in 1.x/2.0, Deprecated in 3.0<br>(3) Upstream Sid Cluster service Flow information<br>(4) Service Flow extension for Multicast<br>(5) Classifier extension for Multicast<br>(6) DSID information<br>(7) DSID debugging control<br>(8) DSID debugging statistics | | |
| Links: | | |
| | | |

### 4.7.2 Feature: DOCSIS Services Monitoring Status and Performance

| DOCSIS CoS, DOCSIS QoS Service Status & Performance | |
|---|---|
| Description | Information related to DOCSIS COS and DOCSIS Service Status and statistics. DOCSIS 3.0 expands the Service Flow framework to multicast and upstream and downstream channel bonding |
| Device | CM & CMTS |
| Requirement | MUST |
| NM Functions | Monitoring Status & Performance |
| References | [OSSIv3.0] Annex O<br>[OSSIv3.0] Annex Q.6<br>[OSSIv3.0] Annex Q.7 |
| Links: | |
| Feature: QoS Support for Multicast sessions | |

| CM | | |
|---|---|---|
| MIB Module | | |
| | 1.x/2.0 | 3.0 |
| MIB Module Name | DOCS-IF-MIB | DOCS-IF3-MIB |
| Object Names | docsIfCmServiceTable (1) | docsIfCmServiceTable (1)<br>docsQosCmServiceUsStatsTable (2) |
| Comments:<br>(1) docsIfCmServiceTable is only instantiated when the CM is in DOCSIS CoS mode<br>(2) docsQosCmServiceUsStatsTable is instantiated when the CM is in DOCSIS QoS mode | | |
| Links: | | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | |
| | **1.x/2.0** | **3.0** |
| MIB Module Name | DOCS-IF-MIB | DOCS-IF3-MIB |
| Object Names | docsIfCmtsServiceTable | docsIfCmtsServiceTable (1) |
| | | |
| MIB Module Name | DOCS-QOS-MIB | DOCS-QOS3-MIB |
| Object Name | docsQosServiceFlowStatsTable<br>docsQosUpstreamStatsTable<br>docsQosDynamicServiceStatsTable<br>docsQosServiceFlowLogTable<br>-<br>- | docsQosServiceFlowStatsTable<br>docsQosUpstreamStatsTable (2)<br>docsQosDynamicServiceStatsTable (3)<br>docsQosServiceFlowLogTable<br>docsQosUpChCounterExtTable (4)<br>docsQos3ServiceFlowCcfStatsTable (5) |
| Comments: | | |
| (1) In 3.0 only Pre-registration SIDs and SIDs corresponding to 1.0 CoS Mode are reported – In 1.1/2.0 CMTSs pre-registration, 1.0 CoS and 1.1 QoS SIDs are reported.<br>(2) Per SID reports for non CCF Service Flows<br>(3) Includes DBC messages and transaction counters per MAC Domain<br>(4) Per Upstream interface reports on total/missed fragments for CCF service Flows<br>(5) CCF Service Flows statistics | | |
| Links: | | |
| | | |

## 4.8 Category: DOCSIS Authentication, Authorization and Encryption

### 4.8.1 Category: AES (44)

| AES | |
|---|---|
| Description | BPI+ AES Encryption |
| Device | CM & CMTS |
| Requirement | MUST |
| NM Functions | Configuration & Status Monitoring |
| References | [RFC 4131]Cryptographic-Suite section [SEC] |
| Links: | |
| | |

| CM | | |
|---|---|---|
| **MIB Module** | | |
| | **1.1/2.0** | **3.0** |
| MIB Module Name | DOCS-BPI2-MIB | DOCS-IETF-BPI2-MIB |
| Object Names | docsBpi2CmTEKDataEncryptAlg<br>docsBpi2CmCryptoSuiteDataEncryptAlg | docsIetfBpi2CmTEKDataEncryptAlg (1)<br>docsIetfBpi2CmCryptoSuiteDataEncryptAlg (1) |
| Comments: | | |
| (1) To report AES encryption the enumeration values of the SNMP MIB objects are extended with 'aes128CbcMode' | | |
| Links: | | |
| | | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | |
| | **1.1/2.0** | **3.0** |
| MIB Module Name | DOCS-BPI2-MIB | DOCS-IETF-BPI2-MIB |
| Object Name | docsBpi2CmtsTEKDataEncryptAlg<br>docsBpi2CmtsIpMulticastDataEncryptAlg | docsIetfBpi2CmtsTEKDataEncryptAlg (1)<br>docsIetfBpi2CmtsIpMulticastDataEncryptAlg (1) |
| Comments: | | |
| (1) To report AES encryption the enumeration values of the SNMP MIB objects are extended with 'aes128CbcMode' | | |
| Links: | | |
| | | |

### 4.8.2 Category: Pre-3.0 BPI+ Multicast Authorization

| BPI+ Multicast Authorization | |
|---|---|
| Description | CMTS Configuration of CM Multicast authorization<br>Pre-3.0 CMs:<br>- Per CM configuration of (*,G) allowed with corresponding SAID<br>- SAIDs for multicast (*,G) are preconfigured and SAID Reqs, Replies, Rejects and error codes are reported<br>DOCSIS 3.0 CMTS, all CMs<br>- CM Authorization by the CMTS is based on Multicast Session Static Rules (S,G) or Profiles (list of (S,G)s).<br>- CM signals during registrations the Static rules and/or profiles for Multicast authorization received from the config file<br>Pre-3.0 CMs always require Encrypted Multicast<br>- However, The CMTS does not require to allow SAIDs for Multicast configuration;<br>- Pre-3.0 systems report ( *,G) statistics There is no way to express (S,G) statistics |
| Device | CMTS |
| Requirement | MUST |
| NM Functions | Configuration & Status Monitoring & Performance |
| References | [OSSIv3.0] Multicast authorization Object Model<br>[MULPI] IP Multicast Join Authorization section. |
| Links: | |
| Feature: Multicast Authorization | |

| CMTS | | |
|---|---|---|
| MIB Module | | |
| | 1.x/2.0 | 3.0 |
| MIB Module Name | DOCS-BPI2-MIB | DOCS-MCAST-AUTH-MIB |
| Object Name | docsBpi2CmtsMulticastAuthTable (1)<br>docsBpi2CmtsIpMulticastMapTable | - (2)<br>docsBpi2CmtsIpMulticastMapTable (3) |
| Comments: | | |
| (1) Deprecated<br>(2) See Feature Multicast Authorization in the next section<br>(3) CMTS need not provide read-create access for SAIDs as in DOCSIS 2.0 | | |
| Links: | | |
| Feature: Multicast Authorization | | |

# 5 NEW FEATURES (SNMP MIB OBJECTS)

## 5.1 Category: DS Channel Bonding

### 5.1.1 Feature: Static RCC assignment per MD-DS-SG

| Static RCC assignment per MD-DS-SG | |
|---|---|
| Description | The CMTS assigns the CM RCC based on the CMTS configuration of RCCs and RCP-IDs. |
| Device | CM & CMTS |
| Requirement | MUST |
| NM Functions | Configuration & Status Monitoring |
| References | [MULPI] Cable Modem Physical Receive Channel Configuration section. |
| Links: | |
| | |

| CM & CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-IF3-MIB | |
| Object Names | docsIf3RccStatusTable | For CM:<br>docsIf3RccStatusRccStatusId = 1 (always) |
| | docsIf3RxModuleStatusTable | |
| Links: | | |
| | | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-IF3-MIB | |
| Object Names | docsIf3RccCfgTable | |
| | docsIf3RxChCfgTable | |
| | docsIf3RxModuleCfgTable | |
| | docsIf3CmtsCmRegStatusTable | Provides per CM:<br>• RCS<br>• TCS,<br>• RCP-ID,<br>• MD-CM-SG-ID |
| Links: | | |
| Category: Pre-3.0 and 3.0 CM Status<br>Feature: Calculation of Service Groups (MD-*-SG), Downstream Freqs for Ambiguity Resolution, and Per-CM Cable Plant Topology Resolution | | |

### 5.1.2 Feature: Static downstream bonding group assignment

| Static downstream bonding group assignment | |
|---|---|
| Description | The CMTS assigns the CM bonding groups based on the operator configured channel sets or individual DS channels. |
| Device | CM & CMTS |
| Requirement | MUST |
| NM Functions | Configuration & Status Monitoring |
| References | [MULPI] Downstream Channel Bonding section<br>[OSSIv3.0] Annex O<br>[OSSIv3.0] Annex Q.6<br>[OSSIv3.0] Annex Q.7 |
| Links: | |
| | |

| CM | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-IF3-MIB | |
| Object Names | docsQos3CmDsidTable | |
| | docsQos3CmDsidStatsTable | |
| | docsQos3CmDsidClientTable | |
| | | |
| Links: | | |
| | | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-IF3-MIB | |
| Object Names | docsIf3BondingGrpCfgTable | docsIf3BondingGrpCfgDir = 'downstream' |
| | docsIf3DsBondingGrpStatusTable | docsIf3DsBondingGrpStatusCfgId <> 0; Value 0 indicates CMTS dynamic configuration (not required) |
| | docsIf3DsChSetTable | |
| | docsIf3MdCfgMultRxChModeEnabled | |
| MIB Module Name | DOCS-QOS3-MIB | |
| Object Names | docsQosParamSetRequiredAttrMask | |
| | docsQosParamSetForbiddenAttrMask | |

| CMTS | | |
|---|---|---|
| | docsQosParamSetPeakTrafficRate | |
| | docsQosParamSetDsResequencing | |
| | docsQosServiceClassRequiredAttrMask | |
| | docsQosServiceClassForbiddenAttrMask | |
| | docsQosServiceClassPeakTrafficRate | |
| | docsQosServiceClasDsResequencing | |
| | docsQosServiceFlowParamSetTypeStatus | |
| | docsQosServiceFlowChSetId | |
| | docsQosServiceFlowAttrAssignSuccess | |
| | docsQosServiceFlowDsid | |
| | docsQosCmtsDsidTable | |
| | docsQosCmtsDebugDsidTable | |
| | docsQosCmtsDebugDsidStatsTable | |
| Links: | | |
| Feature: MAC Domain Level Parameters configuration & Configurable Association of Upstream Channels to Downstream Channels | | |

### 5.1.3 Feature: DBC Messaging

| DBC Messaging | |
|---|---|
| Description | DOCSIS 3.0 provides statistics and events of CM and CMTS DBC messages |
| Device | CM & CMTS |
| Requirement | MUST |
| NM Functions | Configuration & Status Monitoring |
| References | [MULPI] Dynamic Bonding Change (DBC)<br>[OSSIv3.0] Annex O<br>[OSSIv3.0] Annex Q.7<br>[OSSIv3.0] Annex D |
| Links: | |
| Feature: Static downstream bonding group assignment | |

| CM & CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-QOS3-MIB | |
| Object Names | docsQosDbcReqs | |
| | docsQosDbcRsps | |
| | docsQosDbcAcks | |
| | docsQosDbcSuccesses | |
| | docsQosDbcFails | |
| | docsQosDbcPartial | |
| Links: | | |
| | | |

## 5.2 Category: Multiple Transmit Channel Mode

### 5.2.1 Feature: Upstream Channel Bonding

| Upstream Channel Bonding | |
|---|---|
| Description | The CMTS assigns the CM bonding groups to Channel Sets or individual US channels based on QoS policies |
| Device | CM and CMTS |
| Requirement | MUST |
| NM Functions | Configuration & Status Monitoring |
| References | [MULPI] Upstream Channel Bonding section<br>[OSSIv3.0] Annex O<br>[OSSIv3.0] Annex Q.6<br>[OSSIv3.0] Annex Q.7 |
| Links: | |
| Feature: DOCSIS Services Configuration, DSID Assignment and Attribute-Based Service Flow Assignment<br>Feature: DOCSIS Services Monitoring Status and Performance | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-IF3-MIB | |
| Object Names | docsIf3BondingGrpCfgTable | For upstream entries:docsIf3BondingGrpCfgDir = 'upstream' |
| | docsIf3UsBondingGrpStatusTable | |
| | docsIf3UsChSetTable | |
| | docsIf3MdCfgMultTxChModeEnabled | |
| Links: | | |
| Feature: MAC Domain Level Parameters configuration & Configurable Association of Upstream Channels to Downstream Channels | | |

| CM & CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-QOS3-MIB | |
| Object Names | docsQosParamSetRequiredAttrMask | |
| | docsQosParamSetForbiddenAttrMask | |
| Object Names | docsQosServiceClassRequiredAttrMask | |
| | docsQosServiceClassForbiddenAttrMask | |
| Object Names | docsQosServiceFlowParamSetTypeStatus | |
| | docsQosServiceFlowChSetId | |
| | docsQosServiceFlowAttrAssignSuccess | |
| | docsQosServiceFlowDsid | Value zero for upstream service flows |
| Links: | | |
| Feature: MAC Domain Level Parameters configuration & Configurable Association of Upstream Channels to Downstream Channels | | |

### 5.2.2 Feature: Continuous Concatenation & Fragmentation, Queue Depth Requesting, Multiple Request Outstanding, and Multiple Upstream SID Clusters

| Upstream Channel Bonding | |
|---|---|
| Description | The CMTS assigns the CM bonding groups to Channel Sets or individual US channels based on the QoS policies |
| Device | CM and CMTS |
| Requirement | MUST |
| NM Functions | Configuration & Status Monitoring |
| References | [MULPI] Upstream Channel Bonding section<br>[OSSIv3.0] Annex O<br>[OSSIv3.0] Annex Q.6<br>[OSSIv3.0] Annex Q.7 |
| Links: | |
| Feature: DOCSIS Services Configuration, DSID Assignment and Attribute-Based Service Flow Assignment<br>Feature: DOCSIS Services Monitoring Status and Performance | |

| CM & CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-QOS3-MIB | |
| Object Names | docsQosParamSetMultiplierContentionReqWindow | |
| | docsQosParamSetMultiplierBytesReq | |
| | docsQosParamSetMaxReqPerSidCluster | |
| | docsQosParamSetMaxOutstandingBytesPerSidCluster | |
| | docsQosParamSetMaxTotBytesReqPerSidCluster | |
| | docsQosParamSetMaxTimeInSidCluster | |
| Object Names | docsQosServiceClassMultiplierContentionReqWindow | |
| | docsQosServiceClassMultiplierBytesReq | |
| | docsQosServiceClassMaxReqPerSidCluster | |
| | docsQosServiceClassMaxOutstandingBytesPerSidCluster | |
| | docsQosServiceClassMaxTotBytesReqPerSidCluster | |
| | docsQosServiceClassMaxTimeInSidCluster | |
| Object Names | docsQosServiceFlowSidClusterTable | |
| | docsQosCcfSfStatsTable | |
| Links: | | |
| Feature: MAC Domain Level Parameters configuration & Configurable Association of Upstream Channels to Downstream Channels | | |

## 5.3 Category: IPv6

### 5.3.1 Feature: Basic IPv6 forwarding with static routes

| IPv6 forwarding | |
|---|---|
| Description | CMTS IPv6 routing functions Note that a CMTS May do transparent-bridging, IPv4/IPv6 routing or a combination of both. |
| Device | CMTS |
| Requirement | MUST |
| NM Functions | Configuration & Status Monitoring |
| References | [MULPI] CMTS Forwarding Rules section |
| Links: | |
| | |

| CM & CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | IP-MIB [RFC 4293] | |
| Object Names | ipForwarding | |
| | ipv6IpForwarding | |
| | ipv4InterfaceTableLastChange | |
| | ipv4InterfaceTable | |
| | ipv6InterfaceTableLastChange | |
| | ipv6InterfaceTable | |
| | ipSystemStatsTable | Optional for CM and CMTS |
| | icmpStatsTable | |
| Links: | | |
| | | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | IP-FORWARD-MIB [RFC 4292] | |
| Object Names | | Standard for IP routers but not part of DOCSIS Management requirements |
| | | |
| | | |
| | | |
| | | |
| | | |
| MIB Module Name | IP-MIB [RFC 4293] | |
| Object Names | ipIfStatsTable | |
| | ipAddressPrefixTable | |
| | ipAddressSpinLock | |
| | ipAddressTable | |
| | ipNetToPhysicalTable | Note: only eCMs ([eDOCSIS]) are required to support ipNetToPhysicalTable |
| | ipDefaultRouterTable | |
| | ipv6RouterAdvertGroup | |
| | ipv6RouterAdvertSpinLock | |
| | ipv6RouterAdvertTable | |
| Links: | | |
| | | |

### 5.3.2 Feature: IP Provisioning Configuration

| MDD msg to CM sets IP version | |
|---|---|
| Description | Configures the MAC Domain MDD IP provisioning information |
| Device | CMTS |
| Requirement | MUST |
| NM Functions | Configuration & Status Monitoring |
| References | [MULPI] Establishing IP Connectivity section<br>[OSSIv3.0] Annex O |
| Links: | |
| Category: Pre-3.0 & 3.0 CM Status | |

| CMTS | | |
|---|---|---|
| MIB Module | | Comments |
| MIB Module Name | DOCS-IF3-MIB | |
| Object Names | docsIf3MdCfgIpProvMode | |
| Links: | | |

### 5.3.3 Feature: CM registers in IPv4 or IPv6

| CM registers in IPv4 or IPv6 | |
|---|---|
| Description | Report of CM IP Addresses |
| Device | CMTS |
| Requirement | MUST |
| NM Functions | Configuration & Status Monitoring |
| References | [OSSIv3.0] Annex O |
| Links: | |
| Feature: CM Operational Status<br>Feature: IP Provisioning Configuration | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | | |
| Object Names | docsIf3CmtsCmRegStatusIPv6Addr | |
| | docsIf3CmtsCmRegStatusIPv6LinkLocal | |
| | docsIf3CmtsCmRegStatusIPv4Addr | |
| | docsIf3CmtsCmRegStatusValue | |
| Links: | | |
| | | |

### 5.3.4 Feature: Provide response to ND messages from CM

| Provide response to ND messages from CM | |
|---|---|
| Description | The CMTS forward or proxy ND messages on behalf of CMs and CPEs. ND request and response messages are counted by CM and CMTS |
| Device | CM & CMTS |
| Requirement | MUST |
| NM Functions | Performance |
| References | [MULPI] IPv6 forwarding considerations section<br>[OSSIv3.0]The ICMP Group section |
| Links: | |
| | |

| CM & CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | IP-MIB | |
| Object Names | icmpMsgStatsTable | Basic requirements: Statistics for ND messages, which correspond to the icmpMsgStatsType (ICMP message Types):<br>133 Router Solicitation<br>134 Router Advertisement<br>135 Neighbor Solicitation<br>136 Neighbor Advertisement |
| Links: | | |
| | | |

### 5.3.5 Feature: Support for IPv6 CPE traffic

| Support for IPv6 CPE traffic | |
|---|---|
| Description | Support for IPv6 CPE traffic forwarding. IPv6 CPE traffic is subject to QOS, CM IP Filtering (UCDs) and CMTS IP Filtering (SubMgt Filters) |
| Device | CM & CMTS |
| Requirement | MUST |
| NM Functions | Configuration & Performance |
| References | CMTS Forwarding Rules MULPIv3.0 section<br>[OSSIv3.0] Requirements for Internet Protocol MIB section |
| Links: | |
| Feature: CM Pre-3.0 Filtering and Upstream Drop Classifiers<br>Feature: CMTS Pre-3.0 IPv4 SubMgt Filters & IPv6 SubMgt Filters<br>Feature: DOCSIS Services Configuration, DSID Assignment and Attribute-Based Service Flow Assignment<br>Feature: DOCSIS Services Monitoring Status and Performance | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-SUBMGT3-MIB | |
| Object Names | docsSubMgt3CpeIpTable | |
| MIB Module Name | IP-MIB | |
| Object Names | ipSystemStatsTable | |
| | ipIfStatsTable | |
| Links: | | |
| Category: IPDR Service Definition DOCSIS-CPE-TYPE | | |

### 5.3.6 Feature: Dn IPv6 SF classifiers

| Dn IPv6 SF classifiers | |
|---|---|
| Description | Ipv6 Packet classification for Downstream Service Flows |
| Device | CMTS |
| Requirement | MUST |
| NM Functions | Configuration & Status Monitoring |
| References | [MULPI]Classifiers section<br>[OSSIv3.0] Annex O<br>[OSSIv3.0] Annex Q.7 |
| Links: | |
| Category: DOCSIS Queuing Services | |

| CM & CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-QOS3-MIB | |
| Object Names | docsQosPktClassInetAddressType | Value = 'ipv6'<br>CM enforcement of Downstream Service Flows and Classifiers is optional |
| | docsQosPktClassExtFlowLabel | |
| Links: | | |
| | | |

### 5.3.7 Feature: Source Address Verify –SAV- & Allow upstream IPv6 traffic from CMs only for operator provided IPv6 prefixes

| CPE IPs and Prefixes Enforcement | |
|---|---|
| Description | Prevents IP spoofing of CMs and CPEs behind CMs.<br>Note: the CM provides an IP anti-spoofing mechanism defined in DOCS-CABLE-DEVICE-MIB that prevents IP spoofing by configuring docsDevCpeEnroll, docsDevCpeIpMax and docsDevCpeInetTable. However, this feature is optional and proved being not scalable, nor secure. |
| Device | CMTS |
| Requirement | MUST |
| NM Functions | Configuration & Status Monitoring |
| References | Source Address Verification section [SEC]<br>[OSSIv3.0] Annex L<br>[OSSIv3.0] Annex Q.3<br>[OSSIv3.0] Annex P<br>[OSSIv3.0] Annex Q.2<br>[OSSIv3.0] Annex O<br>[OSSIv3.0] Annex Q.6 |
| Links: | |
| | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-IF3-MIB | |
| Object Names | docsIf3MdCfgSrcAddrVerifEnabled | |
| MIB Module Name | DOCS-SEC3-MIB | |
| Object Names | docsSecCmtsSavControl | |
| | docsSecSavCmAuthTable | |
| | docsSecSavCfgListTable | |
| | docsSecSavStaticListTable | |
| | docsSecCmtsCmSavStatsTable | |
| MIB Module Name | DOCS-SUBMGT3-MIB | |
| Object Names | docsSubMgt3CpeCtrlTable | Extends the DOCSIS 2.0 MAX CPE IP to limit the number of IPv6 Prefixes |
| Links: | | |
| | | |

## 5.4 Multicast

### 5.4.1 Feature: Support for MDF Disabled mode, including support for legacy modems

| MDF Disabled mode | |
|---|---|
| Description | Controls the configuration of Multicast DSID Forwarding |
| Device | CMTS |
| Requirement | MAY |
| NM Functions | Configuration |
| References | [MULPI] Annex G Multicast DSID-based Forwarding (MDF) Modes section |
| Links: | |
| | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-:IF3-MIB | |
| Object Names | docsIf3MdCfgMcastDsidFwdEnabled | |
| Links: | | |
| | | |

### 5.4.2 Feature: IGMPv2 (ASM for IPv4), IGMPv3 (SSM for IPv4) and MLDv2 (SSM for IPv6)

| Multicast Support | |
|---|---|
| Description | Multicast support of IGMPv3 and IGMPv3 |
| Device | CM & CMTS |
| Requirement | MUST |
| NM Functions | Configuration |
| References | [MULPI] Annex G Multicast DSID-based Forwarding (MDF) Modes section<br>[OSSIv3.0] Annex E |
| Links: | |
| | |

| CM | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | IGMP-STD-MIB | |
| Object Names | IgmpInterfaceTable | Only for MDF disabled |
| | igmpCacheTable | Only for MDF disabled |
| Links: | | |
| | | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | MGMD-STD-MIB | |
| Object Names | mgmdRouterInterfaceTable | Per MAC Domain where IP Multicast traffic is forwarded.<br>Per NSI interface where multicast is supported |
| | mgmdRouterCacheTable | Per MAC Domain where IP Multicast traffic is forwarded.<br>Per NSI interface where multicast is supported |
| Links: | | |
| | | |

### 5.4.3 Feature: Multicast for IPv6 Provisioning of CMs (includes eSAFEs)

| Multicast for IPv6 Provisioning of CMs | |
|---|---|
| Description | Provides Pre and Post Registration DSIDs for IPv6 Provisioning |
| Device | CMTS and CM |
| Requirement | MUST |
| NM Functions | Configuration & Status Monitoring & Performance |
| References | [MULPI] Labeling Multicast Packets with DSIDs section |
| Links: | |
| | |

| CM & CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | IP-MIB | |
| Object Names | icmpMsgStatsTable | |
| Links: | | |
| | | |

| CM | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-QOS3-MIB | |
| Object Names | docsQos3CmDsidTable | |
| | docsQos3CmDsidClientTable | |
| | docsQos3CmDsidStatsTable | |
| Links: | | |
| | | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-MCAST-MIB | |
| Object Names | docsMcastCmtsReplSessTable | IPv6 Provisioning DSIDs uses indicates docsMcastCmtsReplSessServiceFlowId = 0 Multicast replication |
| Links: | | |

### 5.4.4 Feature: QoS Support for Multicast sessions

| QoS Support for Multicast sessions | |
|---|---|
| Description | Provides configuration policies to assign QOS to downstream Multicast sessions |
| Device | CMTS |
| Requirement | MUST |
| NM Functions | Configuration & Status Monitoring |
| References | [MULPI] Multicast Forwarding section<br>[OSSIv3.0] Annex M<br>[OSSIv3.0] Annex Q.4 |
| Links: | |
| Feature: DOCSIS Services Configuration, DSID Assignment and Attribute-Based Service Flow Assignment<br>Feature: DOCSIS Services Monitoring Status and Performance | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-QOS3-MIB | |
| Object Names | docsMcastCmtsGrpCfgTable | Control of per-(S,G) the QOS replication handling |
| | docsMcastCmtsGrpQosCfgTable | |
| | docsMcastCmtsReplSessTable | Per-replication parameters references |
| | docsQosGrpServiceFlowTable | |
| | docsQosGrpPktClassTable | |
| | | |
| Links: | | |
| | | |

### 5.4.5 Feature: D3.0 Dynamic Multicast Encryption

| Multicast Encryption | |
|---|---|
| Description | BPI+ Encryption for Multicast |
| Device | CMTS |
| Requirement | MUST |
| NM Functions | Configuration |
| References | [MULPI] Multicast Forwarding section<br>[OSSIv3.0] Annex M<br>[OSSIv3.0] Annex Q.4 |
| Links: | |
| | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-QOS3-MIB | |
| Object Names | docsMcastCmtsGrpCfgTable | Control of per-(S,G) the encryption replication handling (via docsMcastCmtsGrpCfgEncryptConfigId) |
| | docsMcastCmtsGrpEncryptCfgTable | Rule that includes the Encryption Algorithm to use |
| | docsMcastCmtsReplSessTable | Includes Encryption References to parameters |
| Links: | | |
| | | |

### 5.4.6 Feature: Multicast Authorization

| Multicast Authorization | |
|---|---|
| Description | Authorization of Join-based Multicast Requests |
| Device | CMTS |
| Requirement | MUST |
| NM Functions | Configuration & Status Monitoring |
| References | [MULPI] Multicast Forwarding section<br>[OSSIv3.0] Annex M<br>[OSSIv3.0] Annex Q.5 |
| Links: | |
| | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-QOS3-MIB | |
| Object Names | docsMcastAuthCtrl | |
| | docsMcastAuthCmtsCmStatusTable | |
| | docsMcastAuthProfileSessRuleTable | |
| | docsMcastAuthStaticSessRuleTable | |
| | docsMcastAuthProfilesTable | |
| Links: | | |
| | | |

### 5.4.7 Feature: DSID-indexed PHS for Multicast

| DSID-indexed PHS for Multicast | |
|---|---|
| Description | DSID-Indexed Packet Header Suppression (PHS) for Multicast Sessions |
| Device | CMTS |
| Requirement | SHOULD |
| NM Functions | Configuration |
| References | [MULPI] Multicast Forwarding section<br>[OSSIv3.0] Annex M<br>[OSSIv3.0] Annex Q.4 |
| Links: | |
| | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-QOS3-MIB | |
| Object Names | docsMcastCmtsGrpCfgTable | Control of per-(S,G) the PHS replication handling (via docsMcastCmtsGrpCfgPhsConfigId) |
| | docsMcastCmtsGrpPhsCfgTable | Includes PHS-Indexed rule to apply to the Multicast replication |
| Links: | | |
| | | |

## 5.5 Category: Topology/Infrastructure

### 5.5.1 Feature: Configurable assignment of channels to fiber nodes

| Configurable assignment of channels to fiber nodes | |
|---|---|
| Description | CMTS mapping of US/DS Channels to fiber nodes |
| Device | CMTS |
| Requirement | MUST |
| NM Functions | Configuration |
| References | [MULPI] Relationship to the Physical HFC Plant Topology section<br>[OSSIv3.0] Annex O<br>[OSSIv3.0] Annex Q.8 |
| Links: | |
| | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | CLAB-TOPO-MIB | |
| Object Names | clabTopoFiberNodeCfgTable | |
| | clabTopoChFnCfgTable | |
| Links: | | |
| | | |

### 5.5.2 Feature: Calculation of Service Groups (MD-*-SG), Downstream Freqs for Ambiguity Resolution, and Per-CM Cable Plant Topology Resolution

| Calculation of Service Groups (MD-*-SG) | |
|---|---|
| Description | CMTS determination of Mac Domain Cm Service Groups during the topology resolution process |
| Device | CMTS |
| Requirement | MUST |
| NM Functions | Configuration |
| References | [MULPI] Cable Modem Service Group (CM-SG) section<br>[OSSIv3.0] Annex O<br>[OSSIv3.0] Annex Q.6 |
| Links: | |
| Feature: Configurable assignment of channels to fiber nodes (FiberNodeCfg, ChFnCfg) | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-IF3-MIB | |
| Object Names | docsIf3MdNodeStatusTable | |
| | docsIf3MdDsSgStatusTable | |
| | docsIf3MdUsSgStatusTable | |
| | docsIf3MdChCfgTable | |
| Object Names | docsIf3CmtsCmRegStatusRcsId | |
| | docsIf3CmtsCmRegStatusTcsId | |
| Links: | | |
| | | |

### 5.5.3 Feature: MAC Domain Level Parameters configuration – MDD, and CM-STATUS Messaging Enable/Disable

| MDD and CM-STATUS messaging Configuration | |
|---|---|
| Description | Configuration of the MDD and CM-STATUS enable/disable |
| Device | CMTS |
| Requirement | MUST |
| NM Functions | Configuration |
| References | [MULPI] MAC Domain Descriptor (MDD) section<br>[MULPI] Status Report (CM-STATUS) section<br>[OSSIv3.0] Annex O<br>[OSSIv3.0] Annex Q.6 |
| Links: | |
| Feature: MAC Domain Level Parameters configuration – MDD, and CM-STATUS Messaging Enable/Disable | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-IF3-MIB | |
| Object Names | docsIf3MdCfgMddInterval | |
| | docsIf3MdCfgCmStatusEvCtlEnabled | |
| Links: | | |
| | | |

### 5.5.4 Feature: DCC-based load balancing for CMs in Legacy Mode, and DBC load balancing of D3.0 CMs

| Load Balancing | |
|---|---|
| Description | DOCSIS defined Load Balancing for pre-3.0 (DCC based ) and 3.0 CMs (DBC based) |
| Device | CMTS |
| Requirement | MUST |
| NM Functions | Configuration and Status Monitoring |
| References | [MULPI] Autonomous Load Balancing<br>[OSSIv3.0] Annex I |
| Links: | |
| | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-LOADBAL3-MIB | |
| Object Names | docsLoadbal3System | Global Load Balancing Enable & Disable operation |
| | docsLoadbal3ChgOverGroup | Change Over operations for single and multiple channel |
| | docsLoadbal3ChgOverStatusTable | Status of change Over operations (similar to DOCSIS 2.0) |
| | docsLoadbal3CmtsCmParamsTable | CM provisioned Load Balancing parameters (similar to DOCSIS 2.0) |
| | docsLoadbal3GeneralGrpDefaults | Defaults Load Balancing parameters for Load Balancing Groups |
| | docsLoadbal3GeneralGrpCfgTable | Current General LBG Status (MD-CM-Sg) (*) |
| | docsLoadbal3GrpCfgTable | Restricted LBG configuration(*) |
| | docsLoadbal3GrpStatusTable | General and Restricted LBG status information (*) |
| | docsLoadbal3RestrictCmCfgTable | CMTS configured CM Assignment to Restricted LBGs – Similar to DOCSIS 2.0 plus Service Type ID assignment |
| | docsLoadbal3PolicyTable | Autonomous Load Balancing Policies (same as DOCSIS 2.0) |
| | docsLoadbal3BasicRuleTable | Defined Load Balancing Basic Policy (same as DOCSIS 2.0) |
| | | (*) Replaces the operation of DOCSIS 2.0 docsLoadBalGrpTable and docsLoadBalChannelTable – DOCSIS 3.0 has no granular control of channel pairs (docsLoadBalChnPairsTable) as in DOCSIS 2.0 |
| Links: | | |
| | | |

### 5.5.5 Feature: CM-CTRL Messaging

| CM-CTRL Messaging | |
|---|---|
| Description | Operator controlled delivery of CM-CTRL messages to a given CM<br>The CM-CTRL messages provides mechanisms to temporarily Mute upstream channels, CM re-initialization, data forwarding disabling and CM-STATUS messaging enabling |
| Device | CMTS |
| Requirement | MUST |
| NM Functions | Configuration and Status Monitoring |
| References | [MULPI] CM Control Request (CM-CTRL-REQ) and CM Control Response (CM-CTRL-RSP) sections<br>[OSSIv3.0] Annex N<br>[OSSIv3.0] Annex Q.6 |
| Links: | |
| | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-IF3-MIB | |
| Object Names | docsIf3CmtsCmCtrlCmd | There is no standard defined mechanism to enable particular CM-STATUS messages |
| Links: | | |
| | | |

## 5.6 Category: Security

### 5.6.1 Feature: Certificate Revocation Lists (CRLs), and Online Certificate Status Protocol (OCSP)

| Certificate Revocation Lists (CRLs) and Online Certificate Status Protocol (OCSP) | |
|---|---|
| Description | Configuration mechanisms to verify the validity of CM certificates during registration. |
| Device | CMTS |
| Requirement | MUST |
| NM Functions | Configuration |
| References | [SEC] Certificate Revocation section<br>[OSSIv3.0] Annex L<br>[OSSIv3.0] Annex Q.3 |
| Links: | |
| | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-SEC-MIB | |
| Object Names | docsSecCmtsCertRevocationList | |
| | docsSecCmtsOnlineCertStatusProtocol | |
| | docsSecCmtsCertificateCertRevocationMethod | |
| Links: | | |
| | | |

### 5.6.2 Feature: TFTP Proxy, TFTP Options, and Config File Name/Content Learning

| TFTP Configuration File Security | |
|---|---|
| Description | CMTS TFTP proxy for CM config files with validation of TFTP requests (name and file content) |
| Device | CMTS |
| Requirement | MUST |
| NM Functions | Configuration |
| References | [SEC] TFTP Configuration File Security section<br>[OSSIv3.0] Annex L<br>[OSSIv3.0] Annex Q.3<br>[OSSIv3.0] Annex O<br>[OSSIv3.0] Annex Q.6 |
| Links: | |
| | |

| CMTS | | |
|---|---|---|
| MIB Module | | Comments |
| MIB Module Name | DOCS-SEC-MIB | |
| Object Names | docsSecCmtsServerCfgTftpOptions | |
| | docsSecCmtsServerCfgConfigFileLearningEnable | |
| MIB Module Name | DOCS-IF3-MIB | |
| Object Names | docsIf3MdCfgTftpProxyEnabled | |
| Links: | | |
| | | |

### 5.6.3 Feature: Early Authentication and Encryption (EAE)

| Early Authentication and Encryption (EAE) | |
|---|---|
| Description | Configuration of the Early Authentication and Encryption (EAE) enforcement |
| Device | CMTS |
| Requirement | MUST |
| NM Functions | Configuration |
| References | [SEC] EAE Enforcement section<br>[OSSIv3.0] Annex L<br>[OSSIv3.0] Annex Q.3<br>[OSSIv3.0] Annex O<br>[OSSIv3.0] Annex Q.6 |
| Links: | |
| | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-IF3-MIB | |
| Object Names | docsIf3MdCfgEarlyAuthEncrCtrl | |
| MIB Module Name | DOCS-SEC-MIB | |
| Object Names | docsSecCmtsEncryptEncryptAlgPriority | |
| | docsSecCmtsCmEaeExclusionTable | |
| Links: | | |
| | | |

### 5.6.4 Feature: Address Resolution Count

| Address Resolution count | |
|---|---|
| Description | Monitors the Per CM Address Resolutions requests |
| Device | CMTS |
| Requirement | MUST |
| NM Functions | Performance |
| References | [SEC] Address Resolution Security Considerations section<br>[OSSIv3.0] Annex N<br>[OSSIv3.0] Annex Q.6 |
| Links: | |
| Category: Pre-3.0 and 3.0 CM Status | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-IF3-MIB | |
| Object Names | docsIf3CmtsCmRegStatusAddrResolutionReqs | |
| Links: | | |
| | | |

## 5.7 Category: PHY and DRFI

### 5.7.1 Feature: Up SCDMA Selectable Active Codes (Mode 1 & Mode 2)

| Up SCDMA Selectable Active Codes (Mode 1) | |
|---|---|
| Description | SCDMA modes for Active Code Selection |
| Device | CM & CMTS |
| Requirement | MUST |
| NM Functions | Configuration |
| References | [PHY]<br>[OSSIv3.0] Annex N<br>[OSSIv3.0] Anne Q.6 |
| Links: | |
| | |

| CMTS | | |
|---|---|---|
| MIB Module | | Comments |
| MIB Module Name | | |
| Object Names | docsIf3UsChnExtSacCodeHoppingSelectionMode<br>docsIf3UsChnExtScdmaSelectionStringActiveCode | |
| | | |
| Links: | | |
| | | |

## 5.8 Category: NMS

### 5.8.1 Feature: Diagnostic Log

| Diagnostic Log | |
|---|---|
| Description | CMTS log of CM instabilities such as constant ranging and registration |
| Device | CMTS |
| Requirement | MUST |
| NM Functions | Status Monitoring |
| References | [OSSIv3.0] Annex G<br>[OSSIv3.0] Annex Q.1 |
| Links: | |
| | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-DIAG-MIB | |
| Object Names | docsDiagLogGlobal | |
| | docsDiagLogTriggersCfg | |
| | docsDiagLogTable<br>docsDiagLogDetailTable | |
| | docsDiagLogSizeHighThrshldReached | |
| | docsDiagLogSizeLowThrshldReached | |
| Links: | | |
| | | |

### 5.8.2 Feature: Enhanced Signal Quality Monitoring –Spectrum Analysis Measurements

| Spectrum Analysis Measurements | |
|---|---|
| Description | RF signal Information used for RF Quality monitoring |
| Device | CMTS |
| Requirement | MUST |
| NM Functions | Status Monitoring |
| References | [OSSIv3.0] Annex J<br>[OSSIv3.0] Appendix V |
| Links: | |
| Feature: Enhanced Signal Quality Monitoring Interface Measurements Extensions | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | DOCS-IF3-MIB | |
| Object Names | docsIf3CmtsSpectrumAnalysisMeasTable | |
| | | |
| Links: | | |
| DOCSIS IPDR Service Definitions | | |

### 5.8.3 Feature: Subset of Entity MIB and HOST Resource MIB

| Subset of Entity MIB and HOST Resource MIB | |
|---|---|
| Description | Provides management information about configuration and performance of the CMTS for service assurance, planning and remote operation |
| Device | CMTS |
| Requirement | SHOULD |
| NM Functions | Configuration & Status Monitoring & Performance |
| References | [OSSIv3.0] Requirements for Entity MIB [RFC 4133] section<br>[OSSIv3.0] Requirements for Entity Sensor MIB [RFC 3433] section<br>[OSSIv3.0] Requirements for Host Resources MIB [RFC 2790] |
| Links: | |
| | |

| CMTS | | |
|---|---|---|
| **MIB Module** | | **Comments** |
| MIB Module Name | ENTITY-MIB | |
| Object Names | | TBD detail list of requirements |
| MIB Module Name | ENTITY-SENSOR-MIB | |
| Object Names | entPhySensorTable | Required Temperature sensor only |
| MIB Module Name | HOST-RESOURCES-MIB | TBD detail list of requirements |
| Object Names | | |
| | | |
| Links: | | |
| | | |

# 6 IPDR SCHEMAS

## 6.1 DOCSIS IPDR Service Definitions

DOCSIS 3.0 defines a series of IPDR Service Definitions to enable the CMTS to report data using the IPDR Streaming protocol [IPDR/SP] in a reliable and scalable way. Below is the list of the DOCSIS 3.0 defined service definitions.

| Service Definition | Description |
|---|---|
| DOCSIS-SAMIS-TYPE-1 | SAMIS - Flat model like DOCSIS 2.0 |
| DOCSIS-SAMIS-TYPE-2 | SAMIS optimized (only service flows stats) |
| DOCSIS-CMTS-CM-US-STATS-TYPE | CMTS CM Upstream Statistics |
| DOCSIS-CMTS-CM-REG-STATUS-TYPE | CMTS CM Registration Information |
| DOCSIS-CMTS-TOPOLOGY-TYPE | CMTS Topology Configuration |
| DOCSIS-SPECTRUM-MEASUREMENT-TYPE | CMTS Spectrum amplitude Measurement |
| DOCSIS-CPE-TYPE | CPE Topology (CPE IP, MAC, FQDN) |
| DOCSIS-DIAG-LOG-TYPE | Diagnostic Log (All CMs) |
| DOCSIS-DIAG-LOG-EVENT-TYPE | Single Flap events in real time |
| DOCSIS-DIAG-LOG-DETAIL-TYPE | Diagnostic Log (All CMs) detailed triggers |

## 6.2 SAMIS-TYPE-1 vs. SAMIS-TYPE-2

There are two types of differences on how DOCSIS 2.0 and DOCSIS 3.0 IPDR Service definitions are specified

- The first and most obvious difference is that DOCSIS3.0 expands IPDR Service definitions beyond SAMIS as the table above details
- The DOCSIS 3.0 IPDR service definitions are closer to the OSSIv3.0 object models as the way to describe the elements: The IPDR-TYPE extension references elements (the object's attributes) that are defined in 'Auxiliary XML schemas', allowing the re-use of element definitions among several IPDR service Definitions.

The reference model for IPDR service definitions based on auxiliary schemas is described in the two SAMIS Service Definitions types: SAMIS-TYPE-1 and SAMIS-TYPE-2

SAMIS-TYPE 1 is similar to the SAMIS DOCSIS 2.0 IPDR Service Definition, which consists of CM Service Flow statistics at regular intervals (interim record type) and a closing record (stop record type) when the service flow is deleted.

SAMIS-TYPE-1 supports bonding representation for bonded service flows but maintain similar structure as SAMIS for DOCSIS 2.0 to guarantee a smooth transition from 2.0 to 3.0 OSS/BSS applications.

However, SAMIS-TYPE-1 by design includes redundant information per record as the CM reports more than one service flow, such as CM configuration information, CMTS identification, HFC topology and CPE information.

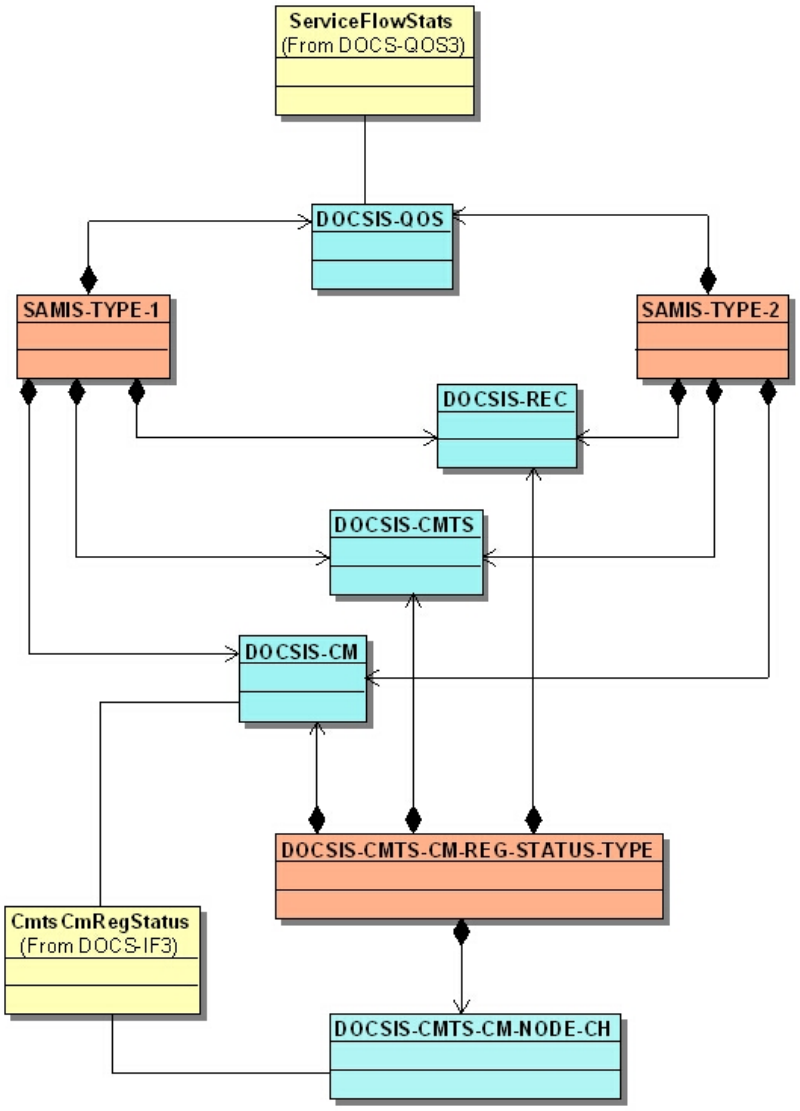
With the usage of Auxiliary XML Schemas to model the object attributes to be exposed as IPDR Service Definitions, there are opportunities for optimization of the content of the records streamed by the CMTS. In particular SAMIS-TYPE-2 is closer to Service Flow statistics only records while CM, CMTS information and topology information is streamed separately at the rates new updates or additional information is required by the collection systems. – All this data is expected to be normalized and correlated by the OSS applications with evident optimization on data exporting, storage and processing.

The figure below represents an object diagram of the SAMIS-TYPE-1 and SAMIS-TYPE-2 data elements. The Service Definition DOCSIS-CMTS-CM-REG-STATUS-TYPE and DOCSIS-CPE-TYPE are also included in the figure to add clarity to the SAMIS-TYPE-1 and 2 interpretations.

Each of this service definitions (in orange) are the composition (UML black diamond association lines ) of Auxiliary XML schemas (light blue), which are by themselves, associations to the CMTS OSSI object model (Yellow) those auxiliary schemas represent.

The main difference between SAMIS-TYPE-1 and SAMIS-TYPE-2 is that SAMIS-TYPE-2 contains less CM/CMTS information elements (from the auxiliary schemas) than SAMIS-TYPE-1. In addition the DOCSIS-CMTS-CM-REG-STATUS-TYPE Service Definition contains some of the elements from SAMIS-TYPE-1 not in SAMIS-TYPE-2 These elements correspond to changes in CM registration information that occurs at a different rate than the events reported at the service flow level.

Note also that DOCSIS-CPE-TYPE covers the function of the DOCSIS 2.0 SAMIS CPE info list that in 3.0 is streamed as a separate Service Definition as Service flows are not mapped to CPEs behind the CM necessarily.




***Figure***

The Table below compares the element information list of DOCSIS-SAMIS-TYPE-1 and DOCSIS-SAMIS-TYPE-2. The Blue classes in the diagram above represents the auxiliary XML schemas that the IPDR Service Definitions (Orange classes) use to reference the Service Definition elements. The yellow classes indicates the Object Model from where the auxiliary XML schemas are derived.

| DOCSIS-SAMIS-TYPE-1 | DOCSIS-SAMIS-TYPE-2 |
|---|---|
| DOCSIS-CMTS:CmtsHostName | DOCSIS-CMTS:CmtsHostName |
| DOCSIS-CMTS:CmtsSysUpTime | DOCSIS-CMTS:CmtsSysUpTime |
| DOCSIS-CMTS:CmtsIpv4Addr | |
| DOCSIS-CMTS:CmtsIpv6Addr | |
| DOCSIS-CMTS:CmtsMdIfName | DOCSIS-CMTS:CmtsMdIfName |
| DOCSIS-CMTS:CmtsMdIfIndex | DOCSIS-CMTS:CmtsMdIfIndex |
| DOCSIS-CM:CmMacAddr | DOCSIS-CM:CmMacAddr |
| DOCSIS-CM:CmIpv4Addr | |
| DOCSIS-CM:CmIpv6Addr | |
| DOCSIS-CM:CmIpv6LinkLocalAddr | |
| DOCSIS-CM:CmServiceType | |
| DOCSIS-CM:CmRegStatusValue | |
| DOCSIS-CM:CmLastRegTime | |
| DOCSIS-REC:RecType | DOCSIS-REC:RecType |
| DOCSIS-REC:RecCreationTime | DOCSIS-REC:RecCreationTime |
| DOCSIS-QOS:ServiceFlowChSet | DOCSIS-QOS:ServiceFlowChSet |
| DOCSIS-QOS:ServiceType | DOCSIS-QOS:ServiceType |
| DOCSIS-QOS:ServiceDsMulticast | DOCSIS-QOS:ServiceDsMulticast |
| DOCSIS-QOS:ServiceIdentifier | DOCSIS-QOS:ServiceIdentifier |
| DOCSIS-QOS:ServiceGateId | DOCSIS-QOS:ServiceGateId |
| DOCSIS-QOS:ServiceClassName | DOCSIS-QOS:ServiceClassName |
| DOCSIS-QOS:ServiceDirection | DOCSIS-QOS:ServiceDirection |
| DOCSIS-QOS:ServiceOctetsPassed | DOCSIS-QOS:ServiceOctetsPassed |
| DOCSIS-QOS:ServicePktsPassed | DOCSIS-QOS:ServicePktsPassed |
| DOCSIS-QOS:ServiceSlaDropPkts | DOCSIS-QOS:ServiceSlaDropPkts |
| DOCSIS-QOS:ServiceSlaDelayPkts | DOCSIS-QOS:ServiceSlaDelayPkts |
| DOCSIS-QOS:ServiceTimeCreated | DOCSIS-QOS:ServiceTimeCreated |
| DOCSIS-QOS:ServiceTimeActive | DOCSIS-QOS:ServiceTimeActive |