



SNMP MIBs

This appendix provides an overview of the SNMP feature of the Cisco VQE Server (VQE-S) and VQE Tools server. This chapter contains the following topics:

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SNMP Overview

The *Simple Network Management Protocol* (SNMP) is an application-layer protocol that provides a standardized framework and a common language for monitoring and managing devices in a network.

The SNMP framework has three parts:

- **SNMP manager**—System to control and monitor the activities of network hosts that use SNMP. The most common managing system is called a *Network Management System* (NMS). A variety of network management applications are available for use with SNMP (for example, Net-SNMP).
- **SNMP agent**—Software component in a managed device that maintains the data for the device and reports the data, as needed, to managing systems. The agent and Management Information Base (MIB) reside on the network hosts rather than on the NMS.
- **MIB**—Database of the objects that can be managed on a device. The managed objects or MIB objects can be read or set to provide information on the network devices and interfaces, and are organized hierarchically. The MIB consists of collections of MIB objects identified by object identifiers.

MIB Objects

MIB objects comprise of one or more object instances, which are essentially variables. The Cisco implementation of SNMP uses the definitions of MIB II variables described in RFC 1213.

MIBs can contain two types of MIB objects:

- **Scalar objects**—Define a single object instance (for example, `cvqsNumberOfChannels` in the `CISCO-VQES-MIB`).
- **Columnar objects**—Define multiple related objects such as zero, one, or more instances at any point in time that are grouped together in MIB tables (for example, `cvqsChannelTable` in the `CISCO-VQES-MIB` defines the status of each channel).

System MIB variables are accessible through SNMP as follows:

- Accessing a MIB variable—Function is initiated by the SNMP agent in response to a request from the NMS. The agent retrieves the value of the requested MIB variable and responds to the NMS with that value.
- Setting a MIB variable—Function is initiated by the SNMP agent in response to a message from the NMS. The SNMP agent changes the value of the MIB variable to the value requested by the NMS. SNMP SETs are not supported on the VQE-S or VQE Tools server.

SNMP Notifications

An SNMP agent can notify the SNMP manager when important system events occur, such as when an interface card starts or stops running. SNMP notifications are sent as either one of the following:

- Traps—Unreliable messages, which do not require receipt acknowledgment from the SNMP manager.
- Informs—Reliable messages, which are stored in memory until the SNMP manager issues a response.

Object Identifiers

An object identifier (OID) uniquely identifies a MIB object on a managed network device. The OID identifies the MIB object location in the MIB hierarchy, and provides a means of accessing the MIB object in a network of managed devices:

- Standard RFC MIB OIDs are assigned by the Internet Assigned Numbers Authority (IANA)
- Enterprise MIB OIDs are assigned by Cisco Assigned Numbers Authority (CANA).

Each number in the OID corresponds to a level of the MIB hierarchy. For example, the OID 1.3.6.1.4.1.9.9.xyz represents the .xyz with the location in the MIB hierarchy as follows:

1.3.6.1.4.1.9.9.942

iso(1).org(3).dod(6).internet(1).private(4).enterprises(1).cisco(9).ciscoMgt(9).nn-MIB

Note that the numbers in parentheses are included to help show correspondence to the MIB hierarchy. You can uniquely identify a MIB object, such as ifNumber in the IF-MIB, by its object name (iso.org.dod.internet.mgmt.mib-2.interfaces.ifNumber) or by its OID (1.3.6.1.2.1.2.1). In actual use, OIDs are represented as numerical values only.

For listings of OIDs assigned to MIB objects for all Cisco MIBs, see the link:

<ftp://ftp.cisco.com/pub/mibs/oid>

VQE MIB Support

The VQE-S and the VQE Tools server provide a standard set of built-in MIBs for managing a Linux platform, as well as enterprise-specific MIBs for monitoring VQE services. The MIBs cover GETs and a limited number of TRAPS. Only SNMP version 2 (SNMPv2) is supported on both the VQE-S and the VQE Tools server.

**Note**

Configuration of the standard Linux MIBs, the Cisco System Messages (Syslog) MIB, or the VQE-specific Mibs using SNMP is disabled.

Net-SNMP

The VQE-S and the VQE Tools server use Net-SNMP, a third-party product, for its tools and libraries that support SNMP. Net-SNMP offers an extensible agent, an SNMP library, tools to request or set information from SNMP agents, and tools to generate and handle SNMP traps.

**Note**

For information on configuring and using Net-SNMP, see the Net-SNMP website:
<http://www.net-snmp.com/docs/>

In the VQE implementation, the SNMP agent consists of a master agent and three or more subagents. The master agent is implemented by means of Net-SNMP. An Intel subagent is used to support the Linux MIBs, while Cisco subagents support the VQE-specific MIBs and the syslog MIB. The master agent communicates directly with the NMS by means of SNMP, and directly with the subagents by means of the AgentX protocol. Each subagent has its own MIB file and OID.

Figure B-1 Subagent Architecture

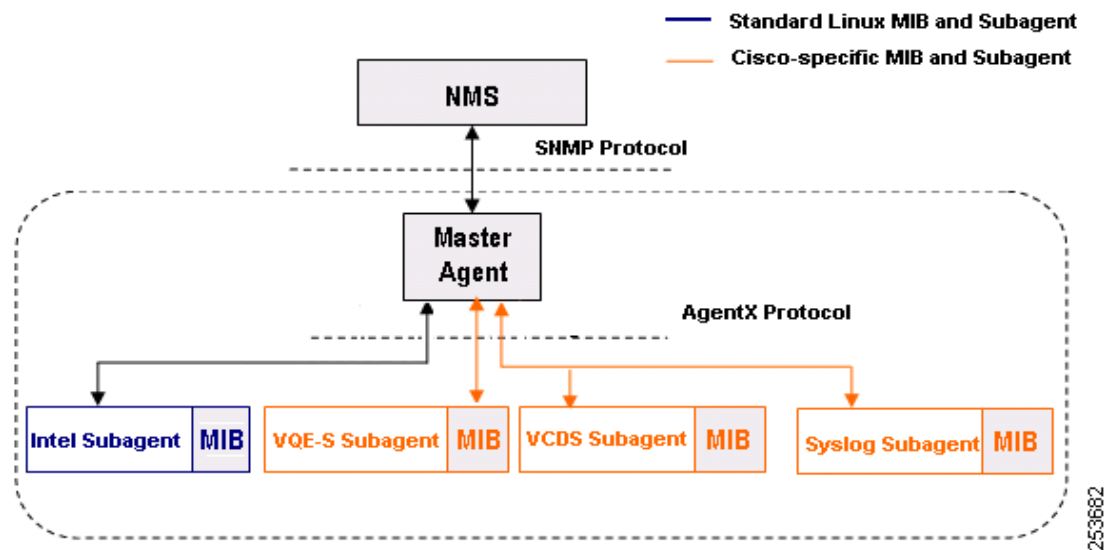


Figure B-1 shows the SNMP agent architecture. When a subagent initializes, it registers with the master agent, and informs the master agent of the range of OIDs for which it has responsibility. When a request for information is received from the NMS, the master agent sends a request to the subagent that is responsible for the OIDs defined in the request. The subagent processes the request and sends the information to the master agent, which forwards the information to the network manager.

On VQE-S and the VQE Tools server, the Intel subagent provides non-VQE system information, and the Syslog subagent provides information on system messages. On the VQE-S, the VQE-S subagent provides VQE-S-specific information. On the VQE Tools Server, the VQE Configuration Deployment Server (VCDS) subagent provides information specific to the VCDS.

**Note**

The Net-SNMP master agent service (snmpd) must be installed and be running for the subagent service to run.

Standard Linux MIBs

Net-SNMP provides a set of standard built-in MIBs for Linux platforms. The built-in MIBs cover GETs and TRAPs for some areas of the Linux distribution, such as interface status and statistics, SNMP protocol-related counters, and host resources.

The sysDescr and sysObjectID objects in the SNMPv2-MIB identify a VQE system. The following values can be used to identify a CDE hosting a VQE-S or a VCPT:

- SNMPv2-MIB::sysDescr.0 = STRING: "Cisco VQE (Video Quality Experience) offers service providers a set of technologies and products associated with the delivery of IPTV video services."
- SNMPv2-MIB::sysObjectID.0 = OID: SNMPv2-SMI::enterprises.9.1.942

**Note**

Table B-1 lists the standard MIBs that are supported on the CDEs that host a VQE-S and a VCPT. For information on the supported MIBs, see the MIB area of the Net-SNMP website:
<http://www.net-snmp.com/docs/mibs/>

Table B-1 *MIBs for CDEs That Host the VQE-S and the VCPT*

MIB/Table	Description
SNMPv2-MIB/system	System contact, location, and so on.
SNMPv2-MIB/snmp	SNMP protocol-related counters, including cold/warm start and authentication failure traps
SNMP-NOTIFICATION-MIB/snmpNotifyTable	Used to configure TRAP listeners
IF-MIB	Interface status and statistics
RMON/etherStatsTable	Statistics for each Ethernet interface
RMON/alarmTable	Stores configuration entries that each define a variable, polling period, and threshold parameters
RMON/eventTable	Controls the generation and notification of events from this device
HOST-RESOURCE-MIB (except hrPrinterTable)	System, memory, storage, device, processor, network, disc, partition, FS, and software version information about Linux host
INTEL-SERVER-BASEBOARD5	Supports the Intel Server Baseboard SNMP subagent for monitoring baseboard components, providing SNMP access to GET information for baseboard components, SET sensor thresholds and support events through the NOTIFICATION-TYPE construct. See: http://people.redhat.com/peterm/IPMI/sw/basebrd5.mib

Syslog MIB

The MIB CISCO-SYSLOG-MIB provides the means to gather system messages generated by the VQE-S or VQE Tools server. The VQE-S and the VQE Tools server can be configured so that these system messages are logged locally as well as being sent to a remote syslog server. With this MIB, system messages can also be received by means of SNMP. This MIB provides SNMP notifications only.

**Note**

An SNMP GET operation returns a zero value, and configuration of this MIB via an SNMP interface is disabled.

The MIB file is located in the /usr/share/snmp/mibs/ directory, and is available for download on Cisco.com from the following URL:

<ftp://ftp.cisco.com/pub/mibs/v2/CISCO-SYSLOG-MIB.my>

The CISCO-SYSLOG-CAPABILITY MIB file describes the capabilities of the CISCO-SYSLOG-MIB for the VQE-S and VQE Tools platforms. The MIB file is located in the /usr/share/snmp/mibs/ directory, and is available for download on Cisco.com from the following URL:

<ftp://ftp.cisco.com/pub/mibs/v2/CISCO-SYSLOG-CAPABILITY.my>

VQE-Specific MIBs

A VQE-specific MIB, CISCO-VQES-MIB, is integrated with the VQE-S. This MIB reports the status of the channels, Rapid Channel Changes (RCC), Unicast Retransmissions, and VQE-S capacity. A VQE-specific MIB, CISCO-VQE-TOOLS-MIB, is integrated with the VQE Tools server. This MIB reports the status of the VCDS.

The MIB files are located in the /usr/share/snmp/mibs/ directory, and are available for download on Cisco.com from:

<ftp://ftp-sj.cisco.com/pub/mibs/v2/CISCO-VQES-MIB.my>

<ftp://ftp-sj.cisco.com/pub/mibs/v2/CISCO-VQE-TOOLS-MIB.my>

CISCO-VQES-MIB

The MIB CISCO-VQES-MIB defines the managed objects that describe some of the VQE-S components. The MIB CISCO-VQES-MIB reports summary status information for several VQE-S components, including channel line ups, channels, Unicast Retransmission, and RCCs.

Table B-2 lists the types of summary information provided per component.

Table B-2 Information Provided by CISCO-VQES-MIB by Component

Components	Summary Information
Channel line up	• Total number of channels in the lineup. • Total number of active channels in the channel line up. • Time and day when the channel line up was last updated.
Channel	• Name of each channel in the channel line up. • State of each channel in the channel line up—A channel may be active, inactive, or inoperative. • Number of receivers on each channel in the line up. • Multicast IP address and port number of each channel in the line up. • Channel up trap. • Channel down trap.
Unicast Retransmission	• Total number of requests for error repair (generic NACK RTCP messages) received. • Total number of Generic NACK RTCP messages received that were invalid. • Total number of individual RTP packets requested for retransmission. • Total number of individual RTP packets requested and sent for retransmission.
RCC	• Total number of requests for RCC received. • Total number of requests for RCC received and accepted. • Total number of requests for RCC received but not accepted.
VQE-S Capacity	• Number of currently active RTCP receivers. • Number of received RTCP packets (ER requests, RCC requests or Receiver Reports) rejected by the VQE-S due to active RTCP receivers in the VQE-S reaching their limit of accepting RTCP requests. • Number of received ER requests rejected by the VQE-S due to the VQE-S reaching its limit of accepting ER requests. • Number of received RCC requests rejected by the VQE-S due to VQE-S reaching its limit of accepting RCC requests.

The MIB CISCO-VQES-MIB contains fifteen scalar objects, one columnar object, and two traps. The tree structure of the CISCO-VQES-MIB is as follows:

```

+---ciscoVqeSMIB(942)
|
+---ciscoVqeSMIBNotifs(0)
|
|   +---cvqsChannelUp(1)
|   +---cvqsChannelDown(2)
|
+---ciscoVqeSMIBObjects(1)
|
|   +---cvqsControlInfo(1)
|   |
|   |   +--- -RW- EnumVal    cvqsNotificationsEnable(1)
|   |   |
|   |   |   Textual Convention: TruthValue
|   |   |   Values: true(1), false(2)
|   |
|   +---cvqsChannelInfo(2)
|   |
|   |   +--- -R-- Gauge      cvqsNumberOfChannels(1)
|   |   +--- -R-- Gauge      cvqsActiveChannels(2)
|   |   +--- -R-- String      cvqsLastUpdatedTime(3)
|   |   |
|   |   |   Textual Convention: DateAndTime
|   |   |   Size: 8 | 11
|   |
|   +---cvqsChannelTable(4)
|   |
|   |   +---cvqsChannelTableEntry(1)
|   |   |
|   |   |   Index: cvqsChannelIndex
|   |   |
|   |   |   +--- ---- Unsigned  cvqsChannelIndex(1)
|   |   |   |
|   |   |   |   Range: 1..2147483647
|   |   |   +--- -R-- EnumVal    cvqsChannelMulticastIPType(2)
|   |   |   |
|   |   |   |   Textual Convention: InetAddressType
|   |   |   |   Values: unknown(0), ipv4(1), ipv6(2), ipv4z(3), ipv6z(4), dns(16)
|   |   |   +--- -R-- String      cvqsChannelMulticastIPAddr(3)
|   |   |   |
|   |   |   |   Textual Convention: InetAddress
|   |   |   |   Size: 0..255
|   |   |   +--- -R-- Unsigned  cvqsChannelMulticastPort(4)
|   |   |   |
|   |   |   |   Textual Convention: InetPortNumber
|   |   |   |   Range: 0..65535
|   |   |   +--- -R-- EnumVal    cvqsChannelStatus(5)
|   |   |   |
|   |   |   |   Values: active(1), inactive(2), inoperative(3)
|   |   |   +--- -R-- Gauge      cvqsChannelMemberPopulation(6)
|   |
|   +---cvqsErrorRepair(3)
|   |
|   |   +--- -R-- Counter64  cvqsTotalReceivedERMmsgs(1)
|   |   +--- -R-- Counter64  cvqsTotalReceivedInvalidERMmsgs(2)
|   |   +--- -R-- Counter64  cvqsTotalReceivedERPkts(3)
|   |   +--- -R-- Counter64  cvqsTotalSentERPkts(4)
|   |
|   +---cvqsRCC(4)
|   |
|   |   +--- -R-- Counter64  cvqsTotalReceivedRCCs(1)
|   |   +--- -R-- Counter64  cvqsTotalAcceptedRCCs(2)
|   |   +--- -R-- Counter64  cvqsTotalRefusedRCCs(3)
|   |
|   +---cvqsCapacity(5)
|   |
|   |   +--- -R-- Gauge      cvqsTotalRTCPReceivers(1)
|   |   +--- -R-- Counter64  cvqsRejectedRTPCs(2)
|   |   +--- -R-- Counter64  cvqsRejectedERs(3)

```

```

|         +-- -R-- Counter64 cvqsRejectedRCCs(4)
|
+--ciscoVqeSMIBConform(2)
|
|   +--cvqsMIBCompliances(1)
|   |
|   |   +--cvqsMIBCompliance(1)
|   |
|   +--cvqsMIBGroups(2)
|   |
|   |   +--ciscoVqeSControlGroup(1)
|   |   +--ciscoVqeSChannelGroup(2)
|   |   +--ciscoVqeSERGroup(3)
|   |   +--ciscoVqeSRCCGroup(4)
|   |   +--ciscoVqeSCapacityGroup(5)
|   |
|   +--ciscoVqeSNotifGroup(6)

```

CISCO-VQE-TOOLS-MIB

The CISCO-VQE-TOOLS-MIB is integrated with the VQE Tools server. It defines the managed objects and notifications that describe the VCDS component responsible for channel delivery. The data reported includes the following:

- Number of open connections
- Number of requests received
- Number of responses sent
- Number of requests per second.

The MIB CISCO-VQE-TOOLS-MIB contains four scalar objects. The tree structure of the CISCO-VQE-TOOLS-MIB is as follows:

```

+--ciscoVQEToolsMIB(969)
|
|   +--ciscoVqeToolsMIBNotifs(0)
|   |
|   +--ciscoVQEToolsMIBObjects(1)
|   |
|   |   +--vcdsInfo(1)
|   |   |
|   |   |   +-- -R-- Unsigned   numberOfSessions(1)
|   |   |   +-- -R-- Gauge     cvqtNumberOfSessions(1)
|   |   |   +-- -R-- Counter64 requestsReceivedTotal(2)
|   |   |   |   Textual Convention: Unsigned64
|   |   |   +-- -R-- Counter64 cvqtTotalReceivedRequests(2)
|   |   |   +-- -R-- Counter64 responsesSentTotal(3)
|   |   |   |   Textual Convention: Unsigned64
|   |   |   +-- -R-- Counter64 cvqtTotalSentResponses(3)
|   |   |   +-- -R-- Unsigned   requestsPerSecond(4)
|   |   |   +-- -R-- Gauge     cvqtRequestRate(4)
|   |   +--cvqtVcdsInfo(1)
|   |
|   +--ciscoVqeToolsMIBObjects(1)
|   |
|   +--ciscoVQEToolsMIBConformance(2)
|   |
|   |   +--ciscoVQEToolsMIBCompliances(1)
|   |   |
|   |   |   +--cvqtMIBReadOnlyCompliance(1)

```

```
| |
| | +--cvqtMIBCompliances(1)
| | |
| | +--ciscoVQETOOLSMIBGroups(2)
| | |
| | | +--ciscoVqeToolsVcdsGroup(1)
| | |
| | +--cvqtMIBGroups(2)
| |
+--ciscoVqeToolsMIBConform(2)
```

Compiling VQE-Specific MIBs

If you plan to integrate the VQE-S or the VQE Tools server with an SNMP-based management application, then you must also compile the MIBs for that platform. For example, if you are running HP OpenView on a UNIX operating system, you must compile VQE-S or VQE Tools server MIBs with the HP OpenView Network Management System (NMS). For instructions, see the NMS documentation.

