In-Band Management

Catalyst 2100 can be managed in-band through any SNMP-compatible workstation or through Telnet. This chapter describes how to use the pre-compiled MIBs supplied on the Catalyst 2100 diskettes. Catalyst 2100 supports standard SNMP MIB II objects as well as SNMP extensions designed to maximize Catalyst 2100's manageability and configurability.

The complete set of Catalyst 2100 MIB objects and other SNMP-based management techniques are described in a separate manual, *Catalyst 2000 MIB Reference Manual*, available on request from Cisco Systems.

Using Telnet

You can use any Telnet TCP/IP package to invoke the management console. Catalyst 2100 supports up to seven simultaneous Telnet sessions. See the "Out-of-Band Management" chapter for details on using the Catalyst 2100 management console.

Supported Network Management Platforms

This section describes how to configure the following platforms for Catalyst 2100 in-band management:

- SunNet Manager

- Novell NMS

- HP OpenView SNMP Management Platform

Note Before beginning, Catalyst 2100 must be configured for SNMP management. To do this, you must assign an IP address to Catalyst 2100 using the IP Configuration Menu, described in the section "IP Configuration" in the "Out-of-Band Management" chapter. You can also use the Bootstrap protocol (BOOTP) described in the section "Configuring Catalyst 2100 for SNMP Management with BOOTP" below.

Configuring Catalyst 2100 for SNMP Management with BOOTP

Catalyst 2100 must be configured with an IP address before it can make available any in-band management. You can assign an individual address to each Catalyst 2100, or you can use the BOOTP protocol to maintain a centralized database of such addresses.

A host machine with a BOOTP server program is needed to use BOOTP. A database containing a list of physical MAC addresses and corresponding IP addresses must be set up on this host. Other information such as the corresponding subnet masks, default gateway addresses and host names, can also be stored in the database but are optional. The Catalyst 2100 must be able to access the BOOTP server through one of its ports.

After a system reset, Catalyst 2100 looks into its Non-Volatile Random Access Memory (NVRAM) for a configured IP address, and if they exist, a default gateway address and IP subnet mask.

If an IP address has not been configured, Catalyst 2100 transmits a BOOTP broadcast request to all of its ports having a physical connection, requesting a mapping for its physical MAC address. A valid response will include the IP address, which is mandatory, along with the subnet mask, the default gateway and the host name, which are all optional.

The reception of a valid BOOTP response immediately activates the rest of the system's protocol suite, without requiring a system reset. The information is also saved in the NVRAM so the next reset will not have to redeploy BOOTP.

As long as its IP address remains undiscovered, Catalyst 2100 will resend BOOTP requests for up to 30 minutes.

For more information about using BOOTP, refer to the BOOTP server documentation.

Standard MIBs and MIB Extensions

The following tables list the MIB objects from the following MIBs:

- Catalyst 2100 enterprise-specific MIB

- Bridge MIB (RFC 1493)

- RS-232 MIB (RFC 1317)

Catalyst 2100 Enterprise-Specific MIB

Table 6-1   Catalyst MIB

Action	Associated MIB Objects
View Self-Test Results	`sysInfoPOSTResult` `sysInfoPOSTPortFailedPostMap`

View System Information	`sysInfoFwdEngineRevision`
	`sysInfoBoardRevision`
	`sysInfoTotalNumberOfPorts`
	`sysInfoNumberOfSwitchPorts`
	`sysInfoNumberOfInstalledModules`
	`sysInfoNumberofSwitchPorts`
	`sysInfoNumberOfSharedPorts`
	`sysInfoAddrCapacity`
	`sysInfoRestrictedStaticAddrCapacity`

View/Configure RS-232 Port for an Attached Modem	`netMgmtModemInitString`
	`netMgmtModemAutoAnswer`
	`netMgmtModemDialString`
	`netMgmtModemDialDelay`

View/Configure Logon Security	`netMgmtConsolePasswordThresh`
	`netMgmtConsoleSilentTime`
	`netMgmtConsoleInactTime`

View/Configure Switching Mode	`sysConfigSwitchingMode` `sysConfigMulticastStoreAndForward`

View/Configure Port Monitoring Mode	`sysConfigMonitor`
	`sysConfigMonitorPort`
	`sysConfigHigherProtocolMonitor`
	`swPortMonitoring`

Action	Associated MIB Objects
View/Configure Virtual LAN Information	`vlanMaxSupported` `vlanAllowMembershipOverlap`

View/Configure Virtual LAN membership	`vlanIndex`
	 `vlanName`
	 `vlanMemberPorts`
	 `vlanMemberIndex`
	 `vlanMemberPortIndex`
	 `vlanMemberPortOfVlan`

View/Configure Address Security	`swPortAddressingSecurity`
	 `swPortAddressTableSize`
	 `swPortSecuredAddressViolations`
	 `sysConfigAddressViolationAlert`
	 `sysConfigAddressViolationAction`

View/Configure Performance Information	`sysInfoBuffersUsed`
	 `sysInfoMaxBuffers`
	 `sysInfoUtilDisplay`
	 `swPortTxQueueFullDiscards`
	 `swPortRxNoBufferDiscards`
	 `bandwidthUsageCurrent`
	 `bandwidthUsageMaxPeakEntries`
	 `bandwidthUsagePeakInterval`
	 `bandwidthUsagePeakRestart`
	 `bandwidthUsageCurrentPeakEntry`
	 `bandwidthUsagePeakIndex`
	 `bandwidthUsageStartTime`
	 `bandwidthUsagePeak`
	 `bandwidthUsagePeakTime`

View/Configure Port Characteristics	`swPortIndex`
	 `swPortName`
	 `swPortMediaCapability`
	 `swPortControllerRevision`
	 `swPortMtu`
	 `swPortSpeed`
	 `swPortConnectorType`
	 `sysConfigPort25Connector`
	 `swPortFullDuplex`

Action	Associated MIB Objects
View/Configure Port Address Status	swPortNumberOfLearnedAddresses swPortNumberOfStaticAddresses swPortEraseAddresses swPortFloodUnregisteredMulticasts swPortFloodUnknownUnicasts
View Port Receive Statistics	swPortRxStatIndex swPortRxTotalOctets swPortRxTotalOctetsWraps swPortRxTotalFrames swPortRxUnicastFrames swPortRxUnicastlOctets swPortRxUnicastOctetsWraps swPortRxBroadcastFrames swPortRxBroadcastOctets swPortRxBroadcastOctetsWraps swPortRxMulticastFrames swPortRxMulticastOctets swPortRxMulticastOctetsWraps swPortRxForwardedFrames swPortRxFilteredFrames swPortRxNoBufferDiscards swPortRxFCSErrors swPortRxAlignmentErrors swPortRxFrameTooLongs swPortRxRunts
View/Configure Port Status	swPortStatus swPortAdminStatus swPortLastStatus swPortStatusChanges swPortLinkbeatStatus swPortLinkbeatLosses swPortJabberStatus swPortJabbers

Action	Associated MIB Objects

View Port Transmit Statistics	`swPortTxStatIndex`
	`swPortTxTotalOctets`
	`swPortTxTotalOctetsWraps`
	`swPortTxTotalFrames`
	`swPortTxUnicastFrames`
	`swPortTxUnicastlOctets`
	`swPortTxUnicastOctetsWraps`
	`swPortTxBroadcastFrames`
	`swPortTxBroadcastOctets`
	`swPortTxBroadcastOctetsWraps`
	`swPortTxMulticastFrames`
	`swPortTxMulticastOctets`
	`swPortTxMulticastOctetsWraps`
	`swPortTxDeferrals`
	`swPortTxSingleCollisions`
	`swPortTxMultipleCollisions`
	`swPortTxLateCollisions`

View/Configure Collision Histograms	`swPortTxCollIndex`
	`swPortTxCollCount`
	`swPortTxCollFrequencies`

View/Configure Spanning-Tree Protocol	`sysConfigEnableSTP`

View/Configure for In-Band Management	`netMgmtIpAddress`
	`netMgmtDefaultGateway`
	`netMgmtIpSubnetMask`
	`vlanIpAddress`
	`vlanIpSubnetMask`

View/Configure Set Clients	`netMgmtSetClientIndex`
	`netMgmtSetClientAddr`
	`netMgmtSetClientStatus`

View/Configure Trap Clients and Traps	`netMgmtTrapClientIndex`
	`netMgmtTrapClientAddr`
	`netMgmtTrapClientComm`
	`netMgmtTrapClientStatus`
	`netMgmtEnableLinkTraps`
	`netMgmtEnableAuthenTraps`
	`logonIntruder`
	`topologyChange`
	`switchDiagnostic`
	`newRoot`

Action	Associated MIB Objects

View/Configure Firmware Upgrades	`upgradeFirmwareSource`
	`upgradeEPROMRevision`
	`upgradeFlashSize`
	`upgradeFlashBankStatus`
	`upgradeTFTPServerAddress`
	`upgradeTFTPLoadFilename`
	`upgradeTFTPInitiate`
	`upgradeAutoExecute`
	`upgradeTFTPAccept`

Reset System	`sysConfigReset` `sysConfigDefaultReset`
Clear Port Statistics	`sysConfigClearPortStats` `swPortClearStatistics`

Bridge MIB (RFC 1493)

Table 6-2   Bridge MIB

Action	Associated MIB Objects

View Spanning-Tree Protocol status	`dot1dStpTimeSinceTopologyChange`
	`dot1dStpTopChanges`
	`dot1dStpDesignatedRoot`
	`dot1dStpMaxAge`
	`dot1dStpHelloTime`
	`dot1dStpHoldTime`
	`dot1dStpFowardDelay`
	`dot1dStpProtocolSpecification`
	`dot1dStpRootCost`
	`dot1dStpRootPort`

View/Configure Spanning-Tree Protocol parameters when this bridge is acting as root	`dot1dBridgeHelloTime`
	`dot1dBridgeMaxAge`
	`dot1dBridgeForwardDelay`

View/Configure Spanning-Tree Protocol parameters	`dot1dStpPriority`

View/Configure Per Port Spanning-Tree Protocol status	`dot1dStpPortPriority`
	`dot1dStpPortState`
	`dot1dStpPortEnable`
	`dot1dStpPortPathCost`
	`dot1dStpPortDesignatedRoot`
	`dot1dStpPortDesignatedCost`
	`dot1dStpPortDesignatedBridge`
	`dot1dStpPortDesignatedPort`
	`dot1dStpPortForwardTransitions`

View/Configure Address Aging parameters	`dot1dTpLearnedEntryDiscards` `dot1dTpAgingTime`

View/Configure the forwarding database of the bridge	`dot1dTpFdbAddress`
	`dot1dTpFdbPort`
	`dot1dTpFdbStatus`

View/Configure the static address table	`dot1dStaticAddress`
	`dot1dStaticReceivePort`
	`dot1dStaticAllowedToGoTo`
	`dot1dStaticStatus`

RS-232 MIB (RFC1317)

Table 6-3   RS-232 MIB Objects

Action	Associated MIB Objects

View RS-232 Port Input/Output Signals	`rs232InSigPortIndex`
	`rs232InSigName`
	`rs232InSigState`
	`rs232InSigChanges`
	`rs232OutSigPortIndex`
	`rs232OutSigName`
	`rs232OutSigState`
	`rs232OutSigChanges`

View/Configure RS-232 Port Characteristics	`rs232Number`
	`rs232PortIndex`
	`rs232PortType`
	`rs232PortInSigNumber`
	`rs232PortOutSigNumber`
	`rs232PortInSpeed`
	`rs232PortOutSpeed`

View/Configure RS-232 Async Port Characteristics	`rs232AsyncPortIndex`
	`rs232AsyncPortBits`
	`rs232AsyncPortStopBits`
	`rs232AsyncPortParity`
	`rs232AsyncPortAutobaud`

View RS-232 Async Port Statistics	`rs232AsyncPortParityErrs`
	`rs232AsyncPortFramingErrs`
	`rs232AsyncPortOverrunErrs`

MIB Installation in a Novell NMS Environment

This section describes how to load and integrate the Catalyst 2100 MIB extensions into Novell's NetWare Management System (NMS). These files are located with the NMS profiles on the Catalyst 2100 DOS-formatted diskette included with the Catalyst 2100. The diskette contains the following MIB files:

cat2000.mib Catalyst 2100 MIB extensions written in the ASN.1 language.

rfc1317.mib Definitions of managed objects for RS-232-like devices as defined in RFC-1317. Also written in ASN.1.

rfc1493.mib Definitions of managed objects for 802.1d bridge devices. Also written in ASN.1.

The files with **.prf** are NMS profiles. They are described in the section "Using the Supplied NMS Profiles" in this chapter and can be integrated into Novell NMS after performing step 2 in the following procedure. These instructions are specific to Novell NMS version 2.0 and 2.1. For other versions or for additional information, consult your Novell NMS documentation.

1 Copy the MIB files. Using the DOS copy command, transfer the cat2000.mib, rfc1493.mib and rfc1317.mib files to the current NMS directory. For a standard NMS installation, this directory is usually \nms\snmpmibs\current.

2 From the NMS main window, select the **Tools>SNMP MIB Compiler** command. Confirm this action by clicking **OK** to compile all current MIB definitions. For the compilation to succeed, any existing browser windows must first be closed.

3 Select the **Tools>SNMP MIB Browser** command from the NMS main window to view and set the Catalyst 2100 MIB objects.

4 Click **Add** to invoke the Profile Editor for creating a new profile. The names of all the available Catalyst 2100 scalar and table objects should now be listed in the Group Attribute Choices box of the Profile Editor window.

5 Choose the objects or tables to be added to the new Profile's Attribute Selection box as appropriate.

6 Enter a name and a description for the Profile, a community string and a display attribute as needed.

7 Click **Save** to store the named Profile to disk.

8 Enable Catalyst 2100 enterprise-specific traps: to activate or de-activate the ability to receive and process any type of traps at the NMS station, the **Fault>Alarm Disposition** command must be used. Refer to the *NMS User's Guide* for detailed information.

With a properly configured Catalyst 2100 on' an accessible local network, you are now ready to browse and set the Catalyst 2100 objects that are included in this Profile.

Using the Supplied NMS Profiles

The Catalyst 2100 diskette contains a number of NMS Profiles that have been set up with Catalyst 2100 MIB objects. These files are provided for convenience and can be used without change. Steps 1 and 2 listed above must be completed before these profiles can be used.

Copy the files *.PRF to the directory \nms\snmpmibs\profiles for a standard NMS installation. The supplied NMS profiles are as follows:

fs2sysin.prf sysInfo group

fs2syscf.prf sysConfig group

fs2port.prf swPort table

fs2rstat.prf swPortRxStatTable

fs2tstat.prf swPortTxStatTable

fs2upg.prf upgrade group

fs2netma.prf netMgmt group

fs2setcl.prf netMgmtSetClientTable

fs2trpcl.prf netMgmtTrapClientTable

fs2bwtab.prf bandwidthUsagePeakTable

fs2vlan.prf vlan group

fs2vltab.prf vlanTable

fs2vlmem.prf vlanMemberTable

fs2bandw.prf bandwidthUsage group

1dstatic.prf dot1dStaticTable

1dbase.prf dot1dBase

1dbasepo.prf dot1dBasePortTable

1dstp.prf dot1dStp group

1dstppor.prf dot1dStpPortTable

1dtp.prf dot1dTp group

1dtpport.prf dot1dTpPortTable

1dtpfdb.prf dot1dTpFdbTable

MIB Installation in a SunNet Manager Environment

This section describes how to load, integrate and use the Catalyst 2100 MIB extensions with SunNet Manager. These files are archived in TAR format on the UNIX TAR diskette included with Catalyst 2100. Along with the precompiled schema files, the diskette contains the following MIB files:

cat2000.mib Catalyst 2100 MIB extensions written in the ASN.1 language.

rfc1317.mib Definitions of managed objects for RS-232-like devices as defined in RFC-1317. Also written in ASN.1.

rfc1493.mib Definitions of managed objects for 802.1d bridge devices. Also written in ASN.1.

The schema files can be immediately integrated into SunNet Manager without requiring additional compilation, following the instructions below.

These instructions are specific to SunNet Manager versions 2.1 and 2.2. For other versions or for additional information, consult your SunNet Manager documentation.

1 Insert the Catalyst 2100 UNIX TAR diskette into the floppy drive of the SunNet Manager workstation.

2 Use TAR to extract the MIB files.

SunNet Manager is typically installed in the default directory /opt/SUNWconn/snm or in the directory designated by the environment variable $SNMHOME. Using the **UNIX TAR** command, extract all files on the Catalyst 2100 UNIX diskette into the directory $SNMHOME/agents on the SunNet Manager workstation as follows:

```
cd $SNMHOME/agents
tar xvf /dev/fd0
```

On some UNIX platforms, the name of the floppy device may be different. On SunOS 5.3, it may be necessary to stop the Volume Manager before the TAR diskette can be read. Become the root user and type the following:

```
/etc/init.d/volmgt stop
cd $SNMHOME/agents
tar xvf /dev/rdiskette
/etc/init.d/volmgt start
```

The following schemas are also included on the diskette:

cat2000.mib.schema

cat2000.mib.oid

cat2000.mib.traps

rfc1317.mib.schema

rfc1317.mib.oid

rfc1493.mib.schema

rfc1493.mib.oid

rfc1493.mib.traps

3   Set up the SunNet Manager SNMP target configuration file.

Locate the keyword **na.snmp.hostfile** in the file /etc/snm.conf. This keyword points to the file the SNMP proxy agent and SNMP trap proxy use to obtain target-specific information. In this file, add an entry for each target Catalyst 2100 to be managed. The following are the relevant schema file names to be specified:

— cat2000.mib.schema

— cat2000.mib.traps

— rfc1317.mib.schema

— rfc1493.mib.traps

Refer to the SunNet Manager reference documentation for detailed specification of the file named by the keyword **na.snmp.hostfile**.

4   Integrate Catalyst 2100 MIB files into SunNet Manager.

If the SunNet Manager application has not been started, start it now.

— Select the **File>Load>Management Database** command from the menu.

— Select the **cat2000.mib.schema** item and then **Load**.

— Select the **rfc1317.mib.schema** item and then **Load**.

— Select the **rfc1493.mib.schema** item and then **Load**.

The SunNet Manager will now understand the Catalyst 2100 Enterprise Specific MIB and trap schemas, the RFC-1317 MIB schema and the RFC-1493 MIB and trap schemas.

5   Manage Catalyst 2100 via the SunNet Manager Discover Tool.

Use the SunNet Manager Discover tool to locate and map Catalyst 2100. Once Catalyst 2100 is discovered and added as an icon to the network map, set up the icon properties to process the Catalyst 2100 schema, RFC-1317 schema and RFC-1493 schema. These schemas will be displayed with the names CATALYST-2000-MIB, BRIDGE-MIB and RFC1317-MIB, respectively, on the icon properties window.

— Click on the boxes to the left of CATALYST-2000-MIB, BRIDGE-MIB and RFC1317-MIB to enable management using these schemas.

— Type **localhost** on the proxy line to use the local SNMP proxy agent.

Catalyst 2100 is now manageable using the various facilities provided by SunNet Manager. These include the Quick Dump, Data Report, Event Report and Set Request facilities.

MIB Installation for HP OpenView SNMP Management Platform

This section describes how to load, integrate and use the Catalyst 2100 MIB extensions with the HP OpenView SNMP Management Platform. The MIB extension files are archived in TAR format on the UNIX TAR diskette that is included with the Catalyst 2100.

The diskette contains the following MIB files:

> **cat2000.mib** Catalyst 2100 MIB extensions written in the ASN.1 language.

> **rfc1317.mib** Definitions of managed objects for RS-232-like devices as defined in RFC-1317. Also written in ASN.1.

> **rfc1493.mib** Definitions of managed objects for 802.1d bridge devices. Also written in ASN.1.

These instructions are specific to version 3.31 of the HP OpenView SNMP Platform for SunOS 4.1.x or 5.x. For other versions or additional information, consult your applicable HP OpenView documentation.

1 Insert the Catalyst 2100 Unix TAR diskette into the floppy drive of the HP OpenView workstation.

2 Use TAR to extract the MIB files.

HP OpenView MIB files are typically installed in the default directory /usr/OV/snmp_mibs. Using the UNIX TAR command, extract all files on the Catalyst 2100 UNIX diskette into this directory on the HP OpenView workstation:

```
cd /usr/OV/snmp_mibs
tar xvf /dev/fd0
```

On some UNIX platforms, the name of the floppy device may be different. On SunOS 5.3, it may be necessary to stop the Volume Manager before the TAR diskette can be read. Become the root user and type the following:

```
/etc/init.d/volmgt stop
cd /usr/OV/snmp_mibs
tar xvf /dev/rdiskette
/etc/init.d/volmgt start
```

3 Integrate Catalyst 2100 MIB files into HP OpenView.

If the HP OpenView SNMP Platform application has not been started, start it now.

— Select the **Options>Load/Unload MIBs: SNMP** command from the menu.

— Select **Load**.

— Select **/usr/OV/snmp_mibs/cat2000.mib** and click **OK**.

— Select **Load**.

— Select **/usr/OV/snmp_mibs/rfc1317.mib** and click **OK**.

— Select **Load**.

— Select the **/usr/OV/snmp_mibs/rfc1493.mib** and click **OK**.

The HP OpenView SNMP Platform will now understand the Catalyst 2100 Enterprise Specific MIB, the RFC-1493 MIB and the RFC-1317 MIB.

4 Manage Catalyst 2100 via the MIB Browser.

Catalyst 2100 can now be managed using the HP OpenView MIB Browser. From the OpenView menu, select **Monitor>MIB Values:Browse MIB:SNMP**. A MIB Browser window will pop up where MIB objects can be viewed and set for any SNMP ready device.

Trap Clients and Traps

A trap client is a management workstation configured to receive and process traps. Catalyst 2100 supports up to four trap clients with separate community strings. At least one trap client must be defined before any traps are generated. See the section "Network Management (SNMP) Configuration" in the "Out-of-Band Management" chapter for instructions on defining trap clients with the Catalyst 2100 management console. See the section "Standard MIBs and MIB Extensions" in this chapter for the MIB objects to use.

Catalyst 2100 can generate the following traps:

warmStart Generated when the Catalyst 2100 is reset, or after the completion of a firmware upgrade where the new firmware is immediately selected for execution. This could be performed in-band or out-of-band with the management console.

coldStart Generated upon a power-on reset.

linkDown This trap is produced whenever a port changes to a suspended or disabled state due to spanning-tree blocking of a redundant path, secure address violation, loss of linkbeat, jabber error, or by management intervention. The trap frame carries the index value of the port.

linkUp This trap is generated when a port changes status from disabled or suspended to enabled.

authenticationFailure Generated when Catalyst 2100 receives an SNMP message that is not accompanied by a valid community string.

newRoot Catalyst 2100 sends this bridge-standard trap when it becomes the new root of the spanning tree.

topologyChange From the Bridge MIB, this trap is sent by Catalyst 2100 when any of its ports changes from the learning to the forwarding state, or from the forwarding state to the blocking state.

logonIntruder An enterprise-specific trap produced whenever the management console receives repeated logon failures due to invalid passwords. You can define the number of invalid passwords permitted before this trap is produced.

switchDiagnostic Catalyst 2100 generates this enterprise-specific trap when it does not pass all of the POST tests. Some POST failures are fatal and could prevent the generation of this trap.