



# Component Outage On-Line (COOL) Measurement for the Cisco 12000 Series Router

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This document describes the Cisco IOS Component Outage On-Line (COOL) Measurement feature, which provides an autonomous real-time outage monitoring and measurement within an individual networking device. COOL measurement allows network operators to monitor networking device component outages and collect raw outage data through the CISCO-OUTAGE-MONITOR-MIB. The management information base (MIB)-monitored components include hardware, software, local interfaces, and remote interfaces at next-hop network devices.

## Feature History for the Component Outage On-Line Measurement Feature

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### Feature History

Release	Modification
12.0(31)S3	This feature was introduced in this release.

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## Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at <http://www.cisco.com/go/fn>. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

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## Prerequisites for COOL Measurement

The following hardware and software components are minimum requirements on the networking device to support the COOL Measurement feature functionality:

- CISCO-OUTAGE-MONITOR-MIB, IF-MIB, and ENTITY-MIB
- Advanced Technology Attachment (ATA) Flash memory on the Route Processor (RP).
- On redundant processor systems, ATA Flash memory on both RPs.

## Restrictions for COOL Measurement

- Restrictions for on-line insertion or removal (OIR) devices:
  - If the physical entity (LC) object and the interface objects on the same LC are configured for COOL measurement monitoring, the physical entity (LC) OIR (removal) causes the interface objects removal on the LC from the COOL monitoring configuration.
  - For the Field Replaceable Unit (FRU) object (physical entity), it could be possible to pull off the LC or RP and insert into different slot, which is already configured by other physical entity object. To resolve the conflict, the existing physical entity object will be removed from the cool monitoring configuration.
- To minimize any performance impact caused by the COOL measurements, do not configure more than 2000 local or remote measurement objects.
- The event history table size is configurable up to 5000 events. When the maximum number of entries has been reached in the table, the oldest entry in the table is removed.
- During the router crash, there is no chance for the router to send a router device down message to the network management system (NMS). Also, in the event of an RP failure, or down event, there is not enough information to determine the reason for the failure. The logical object's down events are captured during the failed object restart process.
- If COOL software detects a different COOL version due to a Cisco IOS software upgrade or downgrade by reading the persistent file in Flash memory, the system will disable COOL measurement.
- To downgrade an image older than 12.0(31)S3, disable COOL measurement manually before the router reload. See the [“Disabling COOL Measurement” section on page 24](#) for more information.
- For COOL measurement, the gigabit interface converter (GBIC) and small form pluggable (SFP) objects are considered as interface objects (not FRU physical entity objects), and OIR for these objects will be tracked as an interface DOWN and UP event.
- If the RP physical entity object failure causes the entire system to crash, the outage will be captured by the Router Device Object not by the RP physical entity object.

## About COOL Measurement

To configure COOL measurement, you should understand the following topics:

- [COOL Measurement Overview, page 3](#)
- [Outage Measurement, page 4](#)
- [Outage Management, page 7](#)

## COOL Measurement Overview

Measuring system and component outages for a network device is typically carried out in various ways by a network management system (NMS) located somewhere on the network. With COOL measurement, the network devices themselves perform outage monitoring, simple event filtering, event notification, and storing of outage data within the networking device for NMS or other network management tools to poll.

COOL measurement allows network operators to monitor networking device component outages and collect raw outage data through the CISCO-OUTAGE-MONITOR-MIB. The MIB-monitored components include hardware, software, local interfaces, and remote interfaces at next-hop network devices, and logical devices. The collected raw outage data assists the NMS in several ways:

- Determining the source of failure events in real time.
- Deriving component Mean Time Between Failure (MTBF) and Mean Time To Repair (MTTR) values and, in turn, the networking device system availability.
- Allowing service providers to monitor Service Level Agreements (SLAs) in terms of traffic outage with their customers.

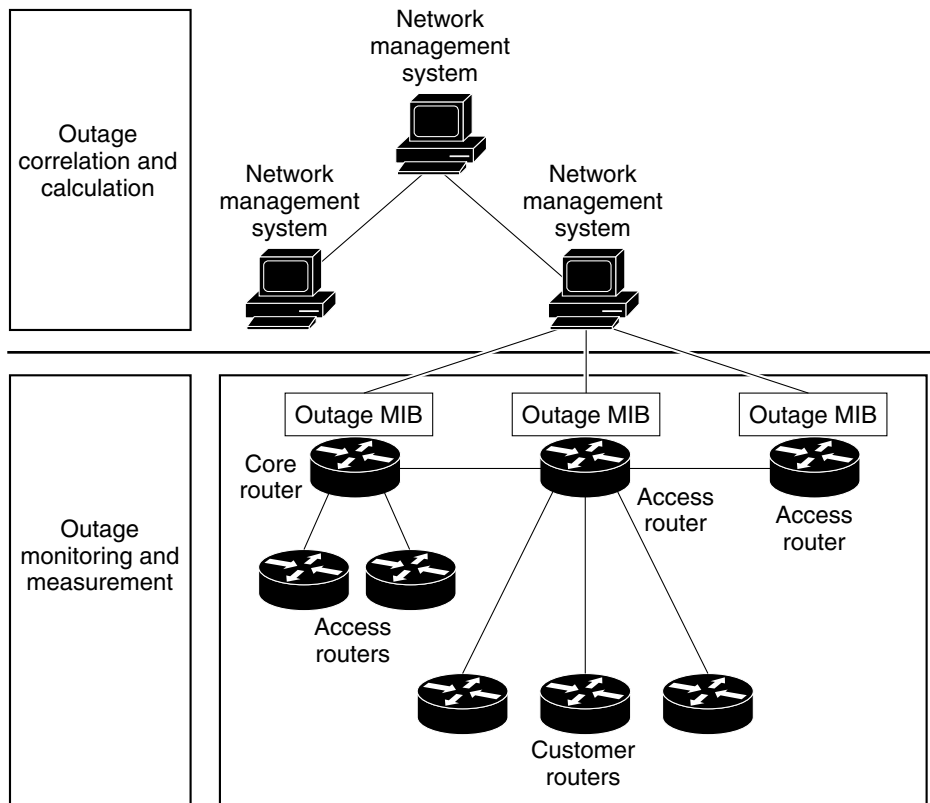
Compared to other outage monitoring tools, COOL measurement has the following benefits:

- **Monitoring**—COOL measurement allows the monitoring of networking devices in real-time and helps in determining the source of failure events.
- **Accuracy**—COOL measurement performs outage measurement from within a networking device, as opposed to external polling from an NMS. Internal measurement can pinpoint the source of failure events and downtime for such events as link failure and RP failure.
- **Data persistency**—COOL measurement stores the outage data in persistent storage on the networking device for NMS or other network management tools to access. This avoids certain data loss due to unreliable network transport, link outage, link congestion, or a device crash itself.
- **Efficiency**—COOL measurement performs event filtering operations close to the event sources, which reduces the processing overhead incurred by network and system resources at the upper layer of an NMS.

[Figure 1](#) illustrates networking device-based measurements in networks with one or more NMS. Outage monitoring is divided into two functions:

- **Outage monitoring and measurement**—Performed by COOL measurement in the individual networking devices.
- **Outage correlation and calculation**—Performed by one or more NMS or NMS-associated tools. Outage correlation and calculation are outside the scope of the COOL measurement function.

Figure 1 Outage Monitoring and Measurement Using COOL



Through the SNMP manager and MIB objects, the NMS collects the outage data in two ways:

- Event notification from the networking devices
- Data access to the networking devices

With the event notification mechanism, the NMS receives outage data upon each occurrence of an outage event. With the data access mechanism, the NMS “reads” the outage data stored in the networking devices periodically or on demand. In other words, the outage data is “pushed” by the networking devices to the NMS or “pulled” by the NMS from the networking devices.

To enable the NMS to manage COOL measurement on the networking device, a control channel (Telnet session, for example) must be established between the NMS and the networking device. The control channel is managed by command line interface (CLI) commands. Standard protocols such as FTP may be used for downloading the COOL measurement configuration information from the NMS to the networking device.

## Outage Measurement

The COOL Measurement feature has a number of functional elements:

- [Outage Model, page 5](#)
- [Outage Measurement Metrics, page 6](#)
- [Outage Event Characterization, page 7](#)

Each of these elements is described in the following sections.

## Outage Model

The target of COOL outage measurement is an object, which is a generalized term for physical and logical networking device components. COOL measurement provides outage measurements for defined types of networking objects:

- Physical objects
- Interface objects
- Remote objects
- Software objects
- Logical objects

Associated with the objects monitored by the COOL Measurement feature are failure modes. Figure 2 shows a sample edge network environment with each type of the monitored objects.

Figure 2 Objects Monitored for COOL Measurement

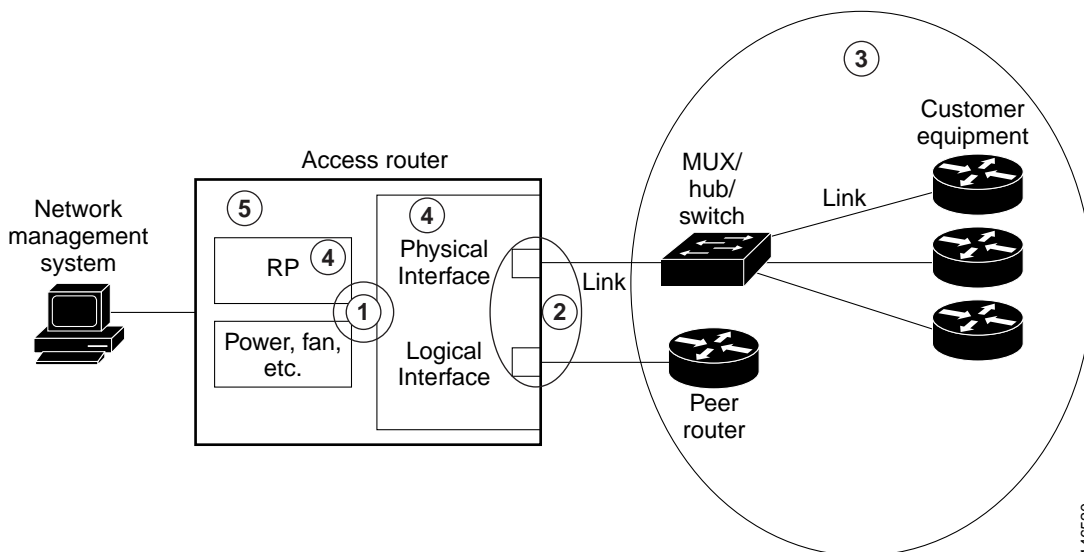


Table 1 lists the failure modes for each type of monitored object.:

Table 1 COOL Monitored Objects and Failure Modes

Type	Objects Monitored	Failure Modes
1	Physical Objects (ENT)	Failure of physical entities, also known as Field Replaceable Units (FRUs), include the route processors (active or standby), line cards, alarm cards, shared port adapters (SPAs), power supplies, fan, and fabric cards. The physical entity objects are defined in ENTITY-MIB.
2	Interface Objects (INT)	Failure of physical interfaces, sub-interfaces, or channelized interfaces associated with the ports of the networking device. Failures also can be due to interface hardware, software, or loss of signal, or administrative shutdown. Interface objects are defined by the IF-MIB.

**Table 1** COOL Monitored Objects and Failure Modes

Type	Objects Monitored	Failure Modes
3	Remote Objects	Failure of layer 3 interfaces of the next-hop networking device (customer equipment or peer networking device) or the link in-between.
4	Software Objects (PRS)	Failure of a software process for an operating system with restartable processes. This object type is reserved for future use.
5	Logical Objects (LNT)	Failure of logical entities such as the entire networking device, RP software, LC software, RP CPU, and LC CPU. Router Device, MIN-IOS-SW and MAX-IOS-SW are default logical objects used to measure the upper- and lower-bound of Cisco IOS software caused outages, respectively.

## Outage Measurement Metrics

COOL measurement tracks a number of metrics on a per object basis:

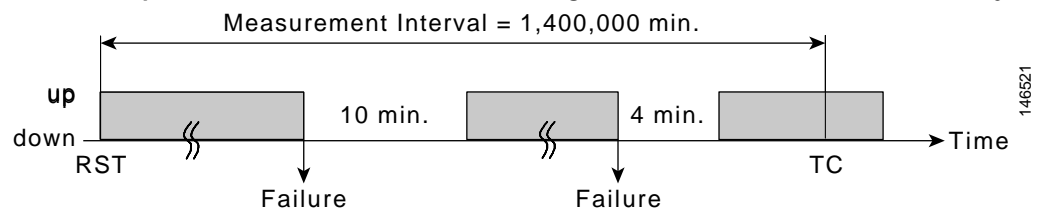
- Accumulated Outage Time (AOT) since measurement started
- Number of Accumulated Failures (NAF) since measurement started
- Recording Start Time (RST)

AOT is the time (in seconds) for a given measurement interval. NAF is the number of failures for a given measurement interval. RST is the time that the object was first added to the monitoring. The current time (TC) is also used in the calculation.

For a failure event, the corresponding object's NAF is increased by 1. For a recovery event, the outage time is calculated and added to the corresponding object's AOT.

Consider the example shown in [Figure 3](#). For object *i*, the AOT and NAF are measured. From these measurements, the NMS can calculate MTTR and MTBF values for the object.

- The measurement interval =  $TC - RST = 1,400,000$  minutes
- $AOT = 14$  minutes
- $NAF = 2$
- $Availability = 1 - AOT / (TC - RST) = 1 - 14 / 1,400,000 = 99.999\%$
- $MTTR = AOT / NAF = 14 / 2 = 7$  minutes
- $MTBF = (TC - RST) / NAF = 1,400,000 / 2 = 700,000$  minutes. = 11,667 hours

**Figure 3** Sample MTTR and MTBF Calculation Using AOT and NAF Measurements for Object *i*

## Outage Event Characterization

At any given time, each object that is monitored by COOL management exists in one of the two states, UP or DOWN. Before the COOL object manager changes the state of any object, it evaluates several outage characteristics:

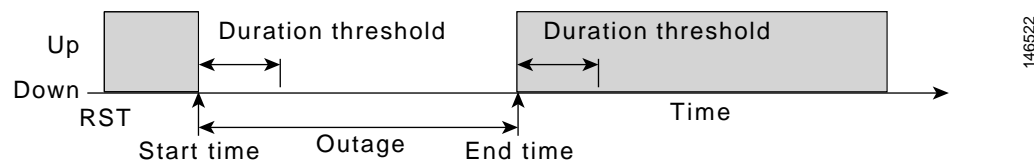
- Duration threshold—minimum interval before a state change will occur and is configured by the network administrator.
- Start time—time when the outage is first detected.
- End time—time when the outage ends.

When COOL measurement detects an object failure (outage) or recovery, the outage manager records the event start time. When the outage has ended, the end time is also recorded. If the outage time exceeds a specified duration threshold, the state is changed from UP to DOWN in the event history table for that object. If the period between the outage event start and stop time exceeds the duration interval, the state of the object is changed. If an outage ends before the duration threshold, it is not considered as an outage.

Similarly, when an object recovers, the recovery time is recorded. If an object that is in the process of recovering from an outage experiences another outage before the timer duration threshold, it is not considered as a recovery, and the state is not changed from DOWN to UP. If the recovery exceeds the duration, the state is changed to UP in the event history table for that object.

Figure 4 illustrates how the outage event detection and recovery time is determined.

**Figure 4** Outage Event Detection and Recovery Timing



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## Outage Management

Managing COOL measurement has a number of components:

- [Outage Event Detection and Calculation, page 7](#)
- [Outage Monitor MIB, page 8](#)
- [Persistent and Redundant Data Storage, page 10](#)
- [Outage Parameter Configuration, page 11](#)

The outage manager detects and collects outage-related events.

## Outage Event Detection and Calculation

The COOL manager detects outage events on a per-object basis. All object outage information includes the Accumulated Outage Time (AOT) since measurement started and the Number of Accumulated Failures (NAF) since measurement Record Start Time (RST). This enables the calculation of object Mean Time To Repair (MTTR), Mean Time Between Failure (MTBF), and availability.

The event detection for specific object types (physical, interface, remote, or logical) is discussed in the following sections.

## Physical Objects

The physical object state changes to **DOWN** when the object is physically removed, or a software or hardware failure of the physical object exceeds the duration threshold. The physical object state changes to **UP** when the same physical object is inserted into any slot of the router, or the software or hardware failure is fixed. The **DOWN** state duration is captured as **AOT** and the **DOWN** state event increases **NAF** by one.

## Interface Objects

The interface object state is changed to **DOWN** when the interface IDB detects down status due to a software or hardware interface object failure or peer interface failure that exceeds the duration threshold. The interface object state is changed to **UP** when the software or hardware failure of the interface object recovers or the peer interface recovers. The **DOWN** state duration is captured as **AOT** and the **DOWN** state event increases **NAF** by one. When a sub interface object is removed by the configuration (IDB is gone), that interface object will be removed from the COOL measurement configuration.

## Remote Objects

The remote object state is changed to **DOWN** when the periodic ICMP ping to the object fails 100 percent. The remote object state is changed to **UP** when the periodic ICMP ping to the object is successful. The number of remote devices and frequency of ICMP messages configured on the networking device is based on individual site requirements and should be determined with consideration for overall networking device performance—the more remote devices monitored, the more processing that is required by the networking device. When the remote object is configured the state is **INIT** before the first ICMP ping result is available.

## Logical Object Outage

A logical object consists of the router device and the Cisco IOS software on the route processor.

The router device outage can be calculated during the system restart by retrieving the last system up time and subtracting it from the current system time. The last system up time is kept by periodically updating the system time into the time stamp file on the persistent storage.

The IOS software failure on the route processor (RP) can be calculated by using a “crash reason” file, which records the crash reason during the RP crash. Since a software outage may be attributed to different causes, and if the specific cause is not clear, the COOL measurement feature categorizes the software outage by “worst case” and “best case”:

- Best Case Software Outage (MIN-**IOS-SW**)—includes only the exception error code of the event that appears to be the main cause of software outage.
- Worst Case Software Outage (MAX-**IOS-SW**)—includes all the error codes that contributed either fully or partially to software outage.

The IOS software object can be further categorized into the predefined **MIN-**IOS-SW**-Outage** object and **MAX-**IOS-SW**-Outage** object per RP.

## Outage Monitor MIB

The **CISCO-OUTAGE-MONITOR** MIB provides the ability to use the Simple Network Management Protocol (SNMP) to monitor in real time the hardware and software outage information for a networking device and connections with neighbor devices.

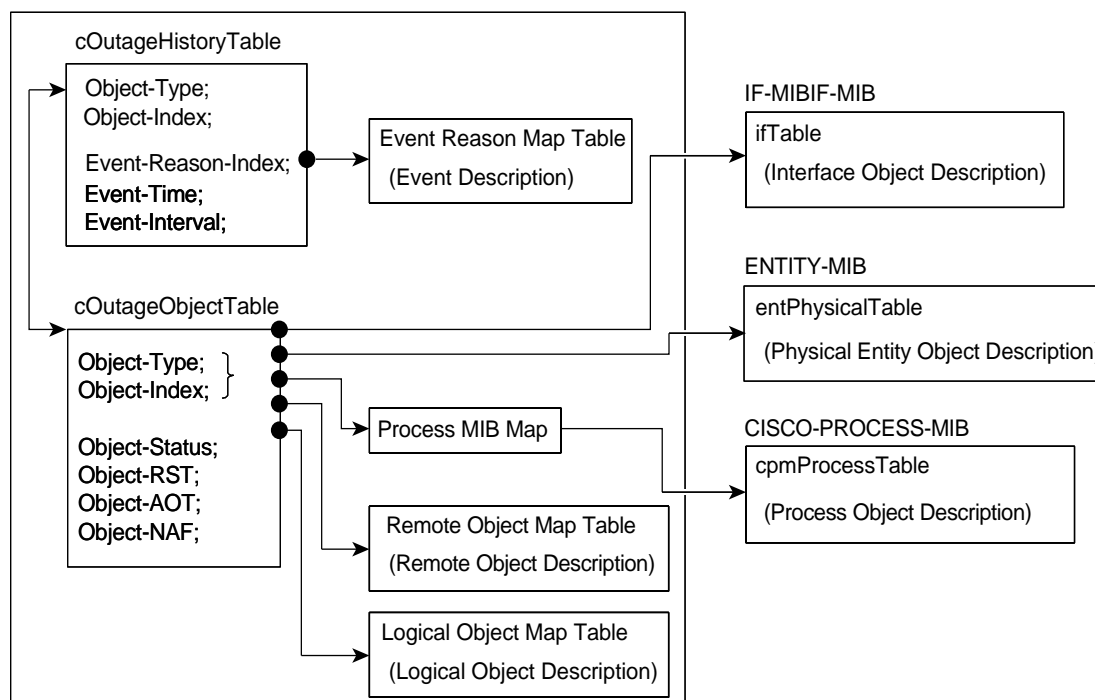
This MIB describes, stores, and reports outage-related information generated by individual hardware and software components comprising a networking device.

The MIB consists of an outage event notification and six information tables as follows:

- Outage Event Notification—Notifies the NMS of outage-related events generated from the networking device. The notification data are the same as the entry in Outage Event History Table.
- Outage Event History Table—Maintains a history of outage-related events generated from the networking device.
- Outage Object Table—Maintains outage information for all the objects being monitored.
- Outage Event Reason Map Table—Maintains the event reason and description information corresponding to the event index entry in the outage history table.
- Process MIB Map Table—Maintains an index of the software process object type and provides mapping to two table indexes (CPUtotalIndex and cpmProcessPID) in the CISCO-PROCESS-MIB. (Not supported in this release.)
- Remote Object Map Table—Maintains remote device descriptions corresponding to the remote object type index.
- Logical Object Map Table—Maintains logical device descriptions corresponding to the logical object type index.

Figure 5 illustrates the relationship of the CISCO-OUTAGE-MONITOR MIB information table with the IF-MIB, ENTITY-MIB, and CISCO-PROCESS-MIB.

Figure 5 CISCO-OUTAGE-MONITOR MIB Information Table Relationships



The COOL Measurement feature maintains outage information in two tables:

- [Outage Object Tables](#)
- [Outage Event History Table](#)

## Outage Object Tables

This table maintains entries for all the objects being monitored. Objects are added to the object table through COOL measurement command line interface. An entry in the table is updated following the detection of a state change for the object. Entries are removed only when the COOL measurement is disabled or the configuration is reset through the command line interface. The object table data includes the following information for each entry:

- Object Table Index—the object index identifies a specific index of the monitored object based upon the object type
- Object State—the current state of the object (UP or DOWN)
- Recording Start Time (RST)—specifies the date and time of the object to start outage recording. The recording time starts when the object is added to the table.
- Object AOT—accumulated Outage Time of the object since the initiation of the outage measurement process.
- Object NAF—number of accumulated failures of the object since the initiation of the outage measurement process.

## Outage Event History Table

This table maintains a history of outage-related events generated by the networking device for each object monitored by COOL measurement. An event occurs any time a monitored object changes state from UP to Down or Down to UP. Entries are dynamically added into the table when outage-related events occur. The event table data includes the following information:

- Object Type—one of the object tables such as interface, physical entity, sw process, and remote object.
- Object Table Index—index to the outage object table entry of a given object type.
- Event Type Index—index to the event type map table entry which contains the event type (UP or DOWN) and the event description (event category code and reason).
- Event Time—time of the event.
- Event Interval—time interval from the previous event to the current event.

## Persistent and Redundant Data Storage

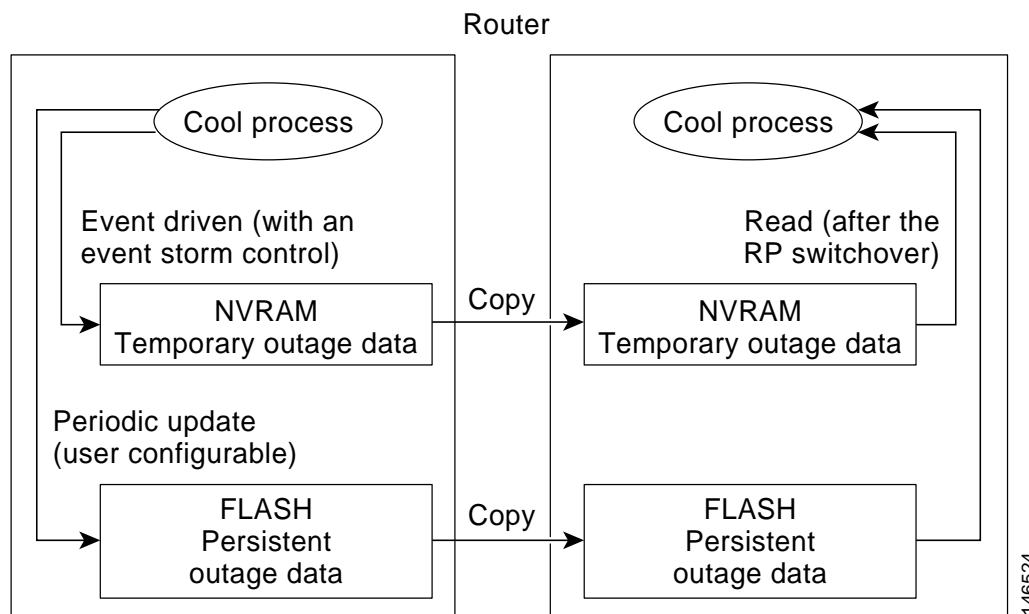
The COOL Measurement feature supports persistent data storage. It consists of two levels of data storage. It keeps the event driven outage data temporarily in the NVRAM and periodically updates the outage data changes to the Flash disk (persistent storage). The data persistency makes it possible to retain outage information against unreliable network transport, link outage, link congestion, and networking device failures over the measurement period.

Administrators can configure the periodic flash storage update interval using the “Flash file update timer” and can control the event driven update using the “event storm period timer” as well as the “event storm count” parameters based on site dependencies and requirements.

The COOL Measurement feature also provides a method of redundant data storage. If the networking device supports redundant processors, the outage data is saved into persistent storage on both processors. Data redundancy makes it possible to retain outage information following RP switch overs or single-point-of-storage failures over the measurement period. It also makes it possible to retain the networking device crash information even if one of the processors containing the outage data is physically replaced.

Figure 6 illustrates the COOL Measurement data persistency and redundancy.

Figure 6 COOL Measurement Data Persistency and Redundancy



## Outage Parameter Configuration

The COOL Measurement feature provides a command line interface for adding objects, configuring measurement parameters, displaying the monitoring status, and checking the availability and outage data for each object being monitored. For more information about outage monitor configuration, see the [“How to Configure COOL Measurement”](#) section on page 12. For COOL measurement commands, see the [“Command Reference”](#) section on page 33.

The COOL Measurement feature provides a number of configurable parameters and settings to customize outage monitoring. Table 2 provides a summary of these parameters.

Table 2 Outage Monitoring Configuration Parameters

Parameter	Unit	Default	Min	Max
Event history table size	entry	500	1	5000
Flash file update timer	minute	15	10	60
Duration threshold timer	second	8	1	180
Timestamp file update timer	second	30	1	100
Event storm period timer	second	1	1	5
Event storm count	number	5	1	5

### Event History Table Size

The event history table entry size can be configured. Changes to the history table size have the following effects:

- If the new table size is bigger than the previous table size, the new table keeps all the existing event history entries.
- If the new size is less than the previous table size and the table entry is bigger than the new size, the older event history entries will be dropped.
- If the new event table is too big to allocate memory (failed during the resize process), it will lose the previous event history entry.
- The new event history table size shall be stored into the persistent file right after the configuration.

#### Flash File Update Timer

The flash file update timer provides a configurable interval at which outage information is written from memory to a Flash disk file (persistent storage).

#### Duration Threshold Timer

This timer provides a configurable interval for the duration threshold of an outage or recovery event. A shorter duration may result in more events being reported as outages, when in fact the objects are recovering within an acceptable time.

#### Time Stamp File Update Timer

The time stamp file update timer provides a configurable interval at which the COOL measurement manager writes the system time to Flash disk to record the last system up time. The system outage can be calculated during the system restart by retrieving the last system up time and subtracting it from the current system time. The time-stamp period is configurable to ensure that the outage measurement gap is within the outage resolution requirement for MTBF based on site requirements.

#### Event Storm Period Timer

An event storm occurs when the number of outage events exceeds a specified event threshold in a specified time period. This event storm period timer sets that duration.

#### Event Storm Count

An event storm occurs when the number of outage events exceeds a specified event threshold in a specified time period. The event storm count sets that threshold value.

## How to Configure COOL Measurement

This section contains the procedures for configuring COOL measurement on the networking devices using the CLI. Each procedure is identified as either required or optional.

- [Enabling COOL Measurement, page 13](#) (required)
- [Adding an Interface Object to be Monitored, page 14](#) (optional)
- [Adding a Physical Entity Object to be Monitored, page 16](#) (optional)
- [Adding a Remote Device Object to be Monitored, page 18](#) (optional)
- [Configuring COOL Parameters, page 20](#) (optional)
- [Configuring SNMP COOL Measurement Notifications, page 23](#) (required)
- [Disabling COOL Measurement, page 24](#) (optional)

## Enabling COOL Measurement

To activate the COOL measurement process, perform the steps in this section. Enabling the COOL Measurement feature provides measurement of the Router-Device, MIN-IOS-SW, and MAX-IOS-SW objects by default.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **cool run**
4. **end**
5. **show cool object-table**
6. **show running-config / include cool**

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<code>enable</code>  <b>Example:</b> Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"><li>• Enter your password if prompted.</li></ul>
Step 2	<code>configure terminal</code>  <b>Example:</b> Router# configure terminal	Enters global configuration mode.
Step 3	<code>cool run</code>  <b>Example:</b> Router(config)# cool run	Enables COOL measurement.
Step 4	<code>end</code>  <b>Example:</b> Router(config)# end	(Optional) Exits to privileged EXEC mode.
Step 5	<code>show cool object-table [object-type]</code>  <b>Example:</b> Router# show cool object-table	(Optional) Displays monitored objects and their status. For <i>object-type</i> , select the object being monitored: physical device (1), interface (2), process (3), remote object (4), or logical entity (5). If no object is entered, the object table will display entries for all object types.
Step 6	<code>show running-config   include cool</code>  <b>Example:</b> Router# show running-config   include cool	(Optional) Displays COOL measurement-related Cisco IOS configuration information.

## Examples

To verify that the COOL Measurement feature is running, use the **show cool object-table** command. The **cool run** command initially enables three types of logical entity objects: Router-Device, minimum Cisco IOS software, and maximum Cisco IOS software. In this example, the networking device has redundant processors with a minimum and maximum entity object for the processor in slot 8 and in slot 9.

```
Router(config)# cool run
Router(config)# end
Router# show cool object-table
**** COOL Object Table ****

Type Index Status AOT          NAF LAST-Change-Time      Object-Name
-----
LNT  1      UP      0          0   Nov 03 2005 17:50:46 Router-Device
LNT  2      UP      0          0   Nov 03 2005 17:50:46 MIN-IOS-SW9
LNT  3      UP      0          0   Nov 03 2005 17:50:46 MAX-IOS-SW9
LNT  4      UP      0          0   Nov 03 2005 17:50:46 MIN-IOS-SW8
LNT  5      UP      0          0   Nov 03 2005 17:50:46 MAX-IOS-SW8

router# show running-config | include cool
cool run
cool parameters
```

## What to Do Next

Add additional interface, FRU entity, and remote device objects for monitoring by the COOL measurement process.

## Adding an Interface Object to be Monitored

To add an interface object to be monitored by the COOL measurement process running on the networking device, perform the following steps:

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **cool interface** *interface-name*
4. **end**
5. **show cool object-table**
6. **show running-config | include cool**

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<code>enable</code>  <b>Example:</b> Router> enable	Enables privileged EXEC mode.  • Enter your password if prompted.
Step 2	<code>configure terminal</code>  <b>Example:</b> Router# configure terminal	Enters global configuration mode.
Step 3	<code>cool interface interface-name</code>  <b>Example:</b> Router(config)# cool interface Ethernet5/1/0	Adds an interface to be monitored for COOL measurement.  In this example, interface Ethernet5/1/0 has been added for monitoring.
Step 4	<code>end</code>  <b>Example:</b> Router(config)# end	(Optional) Exits to privileged EXEC mode.
Step 5	<code>show cool object-table [object-type]</code>  <b>Example:</b> Router# show cool object-table	(Optional) Displays the objects to be monitored.  For <i>object-type</i> , select the object being monitored: physical device (1), interface (2), process (3), remote object (4), or logical entity (5). If no object is entered, the object table will display entries for all object types.
Step 6	<code>show running-config   include cool</code>  <b>Example:</b> Router# show running-config   include cool	(Optional) Displays COOL measurement-related Cisco IOS configuration information.

## Examples

In the following example, the interface object name is added to the list of monitored objects by the COOL measurement process. Additionally, the entry is added to the configuration file for the networking device.

```
Router# config terminal
Router(config)# cool interface ethernet 0
Router# show cool object-table
**** COOL Object Table ****
```

Type	Index	Status	AOT	NAF	LAST-Change-Time	Object-Name
LNT	1	UP	0	0	Nov 03 2005 17:54:53	Router-Device
LNT	2	UP	0	0	Nov 03 2005 17:54:53	MIN-IOS-SW9
LNT	3	UP	0	0	Nov 03 2005 17:54:53	MAX-IOS-SW9
LNT	4	UP	0	0	Nov 03 2005 17:54:53	MIN-IOS-SW8
LNT	5	UP	0	0	Nov 03 2005 17:54:53	MAX-IOS-SW8
INF	2	UP	0	0	Nov 03 2005 17:55:13	Ethernet0

```
Router# show running-config | include cool
cool run
cool interface Ethernet0
cool parameters
```

## Adding a Physical Entity Object to be Monitored

To add field replaceable unit (FRU) objects to the list of objects monitored for COOL measurement, perform the following steps:

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **cool physical-FRU-slot** *fru-slot-number* [**bay** *subslot*]
4. **end**
5. **show cool object-table**
6. **show running-config | include cool**

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>enable</b>  <b>Example:</b> Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"><li>• Enter your password if prompted.</li></ul>
Step 2	<b>configure terminal</b>  <b>Example:</b> Router# configure terminal	Enters global configuration mode.
Step 3	<b>cool physical-FRU-slot</b> <i>fru-slot-number</i> <b>bay</b> <i>subslot</i>  <b>Example:</b> Router(config)# cool physical-FRU-slot 7 bay 0	Adds a FRU entity for COOL measurement.  In this example, the FRU entity in slot 7, bay 0 is added.
Step 4	<b>end</b>  <b>Example:</b> Router(config)# end	(Optional) Exits to privileged EXEC mode.

	Command or Action	Purpose
Step 5	<code>show cool object-table [object-type] detail</code>  <b>Example:</b> Router# show cool object-table	(Optional) Display objects to be monitored.  For <i>object-type</i> , select the object being monitored: physical device (1), interface (2), process (3), remote object (4), or logical entity (5). If no object is entered, the object table will display entries for all object types.
Step 6	<code>show running-config   include cool</code>  <b>Example:</b> Router# show running-config   include cool	(Optional) Displays COOL measurement-related Cisco IOS configuration information.

## Examples

In this example, the physical object in slot 7 is added to list of objects monitored for COOL measurement. If the configuration is successful, the objects appear in the object table and in the configuration file for the networking device.

```
Router#config terminal
Router(config)#cool physical-FRU-slot 7
Router#show cool object-table
**** COOL Object Table ****

Type Index Status AOT          NAF LAST-Change-Time  Object-Name
-----
LNT 1     UP      0           0   Nov 03 2005 17:54:53 Router-Device
LNT 2     UP      0           0   Nov 03 2005 17:54:53 MIN-IOS-SW9
LNT 3     UP      0           0   Nov 03 2005 17:54:53 MAX-IOS-SW9
LNT 4     UP      0           0   Nov 03 2005 17:54:53 MIN-IOS-SW8
LNT 5     UP      0           0   Nov 03 2005 17:54:53 MAX-IOS-SW8
ENT 37    UP      0           0   Nov 03 2005 17:57:50 slot 7

Router#show running-config | include cool
cool run
cool physical-FRU-slot 7
cool parameters
```

In this example, the shared port adapter (SPA) device in slot 1, bay 0 is added list of objects monitored by the COOL measurement process. If the configuration is successful, the objects appear in the object table and in the configuration file for the networking device.

```
Router#config terminal
Router(config)#cool physical-FRU-slot 1 bay 0
Router#sh cool object-table
**** COOL Object Table ****

Type Index Status AOT          NAF LAST-Change-Time  Object-Name
-----
LNT 1     UP      0           0   Nov 03 2005 17:54:53 Router-Device
LNT 2     UP      0           0   Nov 03 2005 17:54:53 MIN-IOS-SW9
LNT 3     UP      0           0   Nov 03 2005 17:54:53 MAX-IOS-SW9
LNT 4     UP      0           0   Nov 03 2005 17:54:53 MIN-IOS-SW8
LNT 5     UP      0           0   Nov 03 2005 17:54:53 MAX-IOS-SW8
ENT 37    UP      0           0   Nov 03 2005 17:57:50 slot 7
ENT 69    UP      0           0   Nov 03 2005 17:59:41 module 1/0

Router#show running-config | include cool
cool run
cool physical-FRU-slot 1 bay 0
```

```
cool physical-FRU-slot 7
cool parameters
```

## Adding a Remote Device Object to be Monitored

To add a remote networking device object to be monitored for COOL measurement, perform the following steps:

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **cool remote-device** *entry-index remote-ip-address name seconds repeat [local-ip-address mode]*
4. **end**
5. **show cool object-table**
6. **show running-config | include cool**

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<code>enable</code>  <b>Example:</b> Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
Step 2	<code>configure terminal</code>  <b>Example:</b> Router# configure terminal	Enters global configuration mode.

	Command or Action	Purpose
Step 3	<pre>cool remote-device entry-index remote-ip-address name seconds repeat [local-ip-address mode]</pre> <p><b>Example:</b> Router(config)# cool remote-device 1 10.4.4.1 CPE1 30 5</p>	<p>Adds a remote device to be monitored.</p> <p>(Required) The <i>entry-index</i> argument specifies a unique index for each monitored device. Enter a value in the range 1 to 2000.</p> <p>(Required) The <i>remote-ip-address</i> is the destination IP address of the remote device.</p> <p>(Required) The <i>name</i> is the remote networking device name.</p> <p>(Required) The <i>seconds</i> represents the frequency, in seconds, that status messages are sent to the remote device. Enter a value in the range 30 to 6000 seconds.</p> <p><b>Note</b> The more remote devices that you have configured for outage monitoring, the greater the chance that it will impact the performance of the device running the COOL process.</p> <p>(Required) The <i>repeat</i> argument specifies the number of times the networking device attempts to send status message to the remote device before declaring the device down. Enter a value in the range 1 to 10.</p> <p>(Optional) The <i>local-ip-address</i> specifies a source IP address on the device running the COOL measurement process. Otherwise, the system will choose the best source IP address based upon the destination IP address.</p> <p>(Optional) The <i>mode</i> argument is always 1.</p>
Step 4	<pre>end</pre> <p><b>Example:</b> Router(config)# end</p>	<p>(Optional) Exits to privileged EXEC mode.</p>
Step 5	<pre>show cool object-table [object-type]</pre> <p><b>Example:</b> Router# show cool object-table</p>	<p>(Optional) Displays objects monitored by COOL.</p> <p>For <i>object-type</i>, select the object being monitored: physical device (1), interface (2), process (3), remote object (4), or logical entity (5). If no object is entered, the object table will display entries for all object types.</p>
Step 6	<pre>show running-config   include cool</pre> <p><b>Example:</b> Router# show running-config   include cool</p>	<p>(Optional) Displays COOL measurement-related Cisco IOS configuration information.</p>

## Example

In this example, the remote device “rm-test” is added to the list of objects monitored under COOL measurement. The status message configuration is set to 60 seconds and the repeat value is set to 5.

```
Router#config terminal
Router(config)#cool remote-device 2 10.10.10.10 rm-test 60 5
Router#show cool object-table
```

```
**** COOL Object Table ****
```

Type	Index	Status	AOT	NAF	LAST-Change-Time	Object-Name
LNT	1	UP	0	0	Nov 03 2005 17:54:53	Router-Device
LNT	2	UP	0	0	Nov 03 2005 17:54:53	MIN-IOS-SW9
LNT	3	UP	0	0	Nov 03 2005 17:54:53	MAX-IOS-SW9
LNT	4	UP	0	0	Nov 03 2005 17:54:53	MIN-IOS-SW8
LNT	5	UP	0	0	Nov 03 2005 17:54:53	MAX-IOS-SW8
RMT	2	INIT	0	0	Nov 03 2005 18:23:53	rm-test

```
Router# show running-config | include cool
cool run
cool remote-device 2 10.10.10.10 rm-test 60 5
cool parameters
```

## Configuring COOL Parameters



### Note

Configuring COOL measurement parameters is presented here as one task; however, it is not required that you configure these parameters at the same time or in any particular sequence.

To update the COOL parameter settings, perform the following steps:

### SUMMARY STEPS

1. **enable**
2. **show running-config**
3. **show cool parameters**
4. **configure terminal**
5. **cool parameter**
6. **size event-table**
7. **timer timestamp-file**
8. **timer flash-file**
9. **timer duration**
10. **timer event-storm**
11. **count event-storm**
12. **end**
13. **show cool parameters**

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<code>enable</code>  <b>Example:</b> Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>Enter your password if prompted.</li> </ul>
Step 2	<code>show running-config</code>  <b>Example:</b> Router# show running-config	Displays the current COOL configuration settings for review.
Step 3	<code>show cool parameters</code>  <b>Example:</b> Router# show cool parameters	(Optional) Displays the current COOL parameter settings for review.
Step 4	<code>configure terminal</code>  <b>Example:</b> Router# configure terminal	Enters global configuration mode.
Step 5	<code>cool parameter</code>  <b>Example:</b> Router(config)# cool parameter	Enters COOL parameter configuration mode.
Step 6	<code>size event-table number</code>  <b>Example:</b> Router(config-cool-pars)# size event-table 3000	(Optional) Sets the event table size. The default size is 500 entries. Enter a value in the range 1 to 5000 entries.  This examples sets the size of the event table to 3000 entries.
Step 7	<code>timer timestamp-file seconds</code>  <b>Example:</b> Router(config-cool-pars)# timer timestamp-file 10	(Optional) Sets the timestamp interval in seconds. The default value is 30 seconds. The range is 1 to 100 seconds.  This examples set the timestamp interval to 10 seconds.
Step 8	<code>timer flash-file seconds</code>  <b>Example:</b> Router(config-cool-pars)# timer flash-file 10	(Optional) Sets the flashfile timestamp interval in minutes. The default timer value is 15 minutes. The timer setting can range from 10 to 60 minutes.  This examples set the flash file timestamp interval to 10 minutes.

	Command or Action	Purpose
Step 9	<p><code>timer duration seconds</code></p> <p><b>Example:</b>  Router(config-cool-pars)# timer duration 10</p>	<p>(Optional) Sets the duration threshold interval in seconds. The default value is 8 seconds. Enter a value in the range 1 to 180 seconds.</p> <p>This examples set the timer duration threshold to 10 seconds.</p>
Step 10	<p><code>timer event-storm seconds</code></p> <p><b>Example:</b>  Router(config-cool-pars)# timer timestamp-file 2</p>	<p>(Optional) Sets the event-storm timer interval in seconds. The default value is 1 second. Enter a value in the range of 1 to 5 seconds.</p> <p>This examples set the time period for which the system checks for event storms to 2 seconds.</p>
Step 11	<p><code>count event-storm number</code></p> <p><b>Example:</b>  Router(config-cool-pars)# timer count event-storm 10</p>	<p>(Optional) Sets the number of events that must be detected within the event-storm timer interval before an event-storm is detected. The default value is 5 events. Enter a value in the range of 1 to 100 events.</p> <p>This example sets the event-storm count to 10.</p>
Step 12	<p><code>end</code></p> <p><b>Example:</b>  Router(config-cool-pars)# end  Router#</p>	<p>Ends all configuration modes and returns to EXEC mode.</p>
Step 13	<p><code>show cool parameters</code></p> <p><b>Example:</b>  Router# show running-config</p>	<p>(Optional) Displays the updated COOL parameter settings for review.</p>

## Examples

In this example, the event table size value is decreased from 500 to 200 entries. All other parameters remain at their default settings.

```
Router#show cool parameters
Time Stamp Period: Configured (30 seconds) Default (30 seconds)
Flash Update Period: Configured (15 minutes) Default (15 minutes)
Duration Threshold: Configured (8 seconds) Default (8 seconds)
Event Storm Count Number: Configured (5 times) Default (5 times)
Event Storm Check Period: Configured (1 seconds) Default (1 seconds)
Max Event History Table Size: Configured (500 entries) Default (500 entries)
```

```
Router#config terminal
Router(config)#cool parameters
Router(config-cool-pars)#
Router(config-cool-pars)#size event-table 200
Router(config-cool-pars)#exit
```

```
Router#show cool parameters
Time Stamp Period: Configured (30 seconds) Default (30 seconds)
```

```
Flash Update Period: Configured (15 minutes) Default (15 minutes)
Duration Threshold: Configured (8 seconds) Default (8 seconds)
Event Storm Count Number: Configured (5 times) Default (5 times)
Event Storm Check Period: Configured (1 seconds) Default (1 seconds)
Max Event History Table Size: Configured (200 entries) Default (500 entries)
```

```
Router#show running-config | include cool
```

```
cool run
!
cool parameters
  size event-table 200
```

## Configuring SNMP COOL Measurement Notifications

To configure and activate COOL measurement to send SNMP trap notifications to the NMS and to enable polling from the NMS, perform the following steps:

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **snmp-server enable traps outage**
4. **snmp-server host** *host-address* [**traps** | **informs**] [**version** {**1** | **2c** | **3** [**auth** | **noauth** | **priv**]}] *community-string* [**udp-port** *port*] [*notification-type*] [**outage**]
5. **end**

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>enable</b>  <b>Example:</b> Router> enable	Enables privileged EXEC mode.  • Enter your password if prompted.
Step 2	<b>configure terminal</b>  <b>Example:</b> Router# configure terminal	Enters global configuration mode.
Step 3	<b>snmp-server enable traps outage</b>  <b>Example:</b> Router(config)# snmp-server enable traps outage	Enables COOL measurement event traps.

	Command or Action	Purpose
Step 4	<pre>snmp-server host host-address [traps   informs] [version {1   2c   3 [auth   noauth   priv]}] community-string [udp-port port] [notification-type] [outage]</pre> <p><b>Example:</b> Router(config)# snmp-server host myhost.cisco.com public outage</p>	Configures a host address to forward the COOL measurement SNMP trap events.
Step 5	<pre>end</pre> <p><b>Example:</b> Router(config)# end</p>	(Optional) Exits to privileged EXEC mode.

## What to Do Next

Configure and activate COOL measurement.

## Disabling COOL Measurement

Disabling COOL measurement removes all COOL configuration and local outage measurement data. To disable COOL measurement on the networking device, perform the following steps:

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **no cool run**
4. **end**

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<pre>enable</pre> <p><b>Example:</b> Router&gt; enable</p>	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
Step 2	<pre>configure terminal</pre> <p><b>Example:</b> Router# configure terminal</p>	Enters global configuration mode.

	Command or Action	Purpose
Step 3	<code>no cool run</code>  <b>Example:</b> Router(config)# <code>no cool run</code>	Disables COOL measurement and removes local outage measurement data along with all configuration information.
Step 4	<code>end</code>  <b>Example:</b> Router(config)# <code>end</code>	(Optional) Exits to privileged EXEC mode.

## Example

The **no cool run** command disables the COOL measurement, deletes configuration settings, and removes local outage measurement data. To verify that the COOL Measurement feature is disabled, use the **show cool object-table** and **show running-config** commands.

```
Router# config terminal
Router(config)# no cool run

Router# show cool
cool has not been enabled

config ---> cool run

Router# show running-config | include cool
Router#
```

## Outage Measurement Examples

This section provides the following COOL measurement examples:

- [Network Device Outage Measurement: Example, page 25](#)
- [Cisco IOS Software Outage Measurement: Example, page 26](#)
- [Line Card Outage Measurement: Example, page 27](#)
- [Interface Outage Measurement: Example, page 29](#)
- [Remote Device Outage Measurement: Example, page 30](#)



### Note

The examples in this section illustrate the AOT and NAF measurements on the networking device running the COOL measurement process. The examples do not show MTTR and MTBF calculations, which are completed by the NMS using the COOL measurement data.

## Network Device Outage Measurement: Example

This example illustrates the accumulated outage time (AOT) and number of accumulated failures (NAF) changes for a network device outage due to a reload operation, power outage, or networking device hardware failure in the redundant route processor configuration.

The following initial object table information shows that there is no AOT or NAF information:

```
Router# show cool
No entry is available !

**** COOL Object Table ****

Type Index Status AOT          NAF LAST-Change-Time      Object-Name
LNT  1      UP      0          0   Nov 03 2005 18:43:56 Router-Device
LNT  2      UP      0          0   Nov 03 2005 18:43:56 MIN-IOS-SW8
LNT  3      UP      0          0   Nov 03 2005 18:43:56 MAX-IOS-SW8
LNT  4      UP      0          0   Nov 03 2005 18:43:56 MIN-IOS-SW9
LNT  5      UP      0          0   Nov 03 2005 18:43:56 MAX-IOS-SW9
```

Following a “reload” of the entire router, the AOT and NAF information is updated and a DOWN and UP event notification is sent to account for the downtime. In this example, the event history table shows that the network device went DOWN just 33 seconds after COOL measurement was enabled. The event table also shows that the device DOWN for 233 seconds before it returned to the UP state. The object table provides the update AOT and NAF information.

```
Router#show cool event-table
**** COOL Event Table ****

Index Type Obj-ID  Event Interval  Event-Time      Object-Name
1      LNT  1      DOWN  33          Nov 03 2005 18:44:29 Router-Device
2      LNT  1      UP    233        Nov 03 2005 18:48:22 Router-Device
```

```
Router#show cool object-table
**** COOL Object Table ****

Type Index Status AOT          NAF LAST-Change-Time      Object-Name
LNT  1      UP    233         1   Nov 03 2005 18:48:22 Router-Device
LNT  2      UP    0           0   Nov 03 2005 18:43:56 MIN-IOS-SW8
LNT  3      UP    0           0   Nov 03 2005 18:43:56 MAX-IOS-SW8
LNT  4      UP    0           0   Nov 03 2005 18:43:56 MIN-IOS-SW9
LNT  5      UP    0           0   Nov 03 2005 18:43:56 MAX-IOS-SW9
```

## Cisco IOS Software Outage Measurement: Example

This examples illustrates the AOT and NAF changes for a Cisco IOS software outage on a networking device supporting redundant processors. The MIN-IOS-SW9 and MAX-IOS-SW9 are logical software entities and represent the active processor in the networking device. The MIN-IOS-SW8 and MAX-IOS-SW8 are logical software entities that represent the standby processor in the networking device.



### Note

The MIN-IOS-SW object represents a known range of software functions in the networking device. Changes only to the MIN-IOS-SW values in the table reflect a software-only outage. The MAX-IOS-SW object represents a broad range of functions in the networking device, and changes to the MAX-IOS-SW values in the table may or may not represent a software-only outage.

In this example, the standby RP in slot 8 crashed due to a bus error, which may not be due to a purely software problem. A look at the event outage table prior to the RP crash shows only historical event information related to prior events on the networking device.

```
Router# show cool
**** COOL Event Table ****
```

```

Index Type Obj-ID Event Interval Event-Time Object-Name
1 LNT 1 DOWN 33 Nov 03 2005 18:44:29 Router-Device
2 LNT 1 UP 233 Nov 03 2005 18:48:22 Router-Device
**** COOL Object Table ****

```

```

Type Index Status AOT NAF LAST-Change-Time Object-Name
LNT 1 UP 233 1 Nov 03 2005 18:48:22 Router-Device
LNT 2 UP 0 0 Nov 03 2005 18:43:56 MIN-IOS-SW8
LNT 3 UP 0 0 Nov 03 2005 18:43:56 MAX-IOS-SW8
LNT 4 UP 0 0 Nov 03 2005 18:43:56 MIN-IOS-SW9
LNT 5 UP 0 0 Nov 03 2005 18:43:56 MAX-IOS-SW9

```

Following the RP outage in slot 8, the AOT and NAF information is updated to account for the downtime. In this example, the outage information is updated for MAX-IOS-SW8, which indicates a possible software and hardware problem. The event history table shows that the RP state was DOWN 530 seconds after COOL measurement was enabled. The event table also shows that the device was DOWN for 216 seconds before it returned to the UP state. The object table provides the updated AOT and increments NAF information.

```

Router#show cool event-table
**** COOL Event Table ****

```

```

Index Type Obj-ID Event Interval Event-Time Object-Name
1 LNT 1 DOWN 33 Nov 03 2005 18:44:29 Router-Device
2 LNT 1 UP 233 Nov 03 2005 18:48:22 Router-Device
3 LNT 3 DOWN 530 Nov 03 2005 18:52:46 MAX-IOS-SW8
4 LNT 3 UP 216 Nov 03 2005 18:56:22 MAX-IOS-SW8

```

```

Router#show cool object-table
**** COOL Object Table ****

```

```

Type Index Status AOT NAF LAST-Change-Time Object-Name
LNT 1 UP 233 1 Nov 03 2005 18:48:22 Router-Device
LNT 2 UP 0 0 Nov 03 2005 18:43:56 MIN-IOS-SW8
LNT 3 UP 216 1 Nov 03 2005 18:56:22 MAX-IOS-SW8
LNT 4 UP 0 0 Nov 03 2005 18:43:56 MIN-IOS-SW9
LNT 5 UP 0 0 Nov 03 2005 18:43:56 MAX-IOS-SW9

```

## Line Card Outage Measurement: Example

This example illustrates the measurements (AOT and NAF) recorded for a physical entity (line card) outage:

```
!
```

```
!Review the AOT and NAF values in the COOL object table.
```

```
Router# show cool object-table
No entry is available !
```

```
**** COOL Object Table ****
```

```

Type Index Status AOT NAF LAST-Change-Time Object-Name
LNT 1 UP 0 0 Nov 03 2005 18:38:06 Router-Device
LNT 2 UP 0 0 Nov 03 2005 18:38:06 MIN-IOS-SW8
LNT 3 UP 0 0 Nov 03 2005 18:38:06 MAX-IOS-SW8
LNT 4 UP 0 0 Nov 03 2005 18:38:06 MIN-IOS-SW9

```

```
LNT 5      UP      0          0   Nov 03 2005 18:38:06 MAX-IOS-SW9
ENT 40     UP      0          0   Nov 03 2005 18:39:49 slot 7
```

!Notice that slot 7 is a physical entity with no current outage info.

!Reload slot 7 to trigger an outage event for the sake of this example.

```
Router#hw-module slot 7 reload
```

!Review the values in the COOL event history table. Observe the history for slot 7. Note !that the line card went down 53 seconds after enabling COOL measurement.

```
Router#show cool event-table
**** COOL Event Table ****
```

Index	Type	Obj-ID	Event	Interval	Event-Time	Object-Name
1	ENT	40	DOWN	53	Nov 03 2005 18:40:42	slot 7

!Review the contents of the COOL object table again. Here, AOT is 17 seconds, but this is !just a snap-shot of the down time and the outage time is continuing to increase.

```
Router#show cool object-table
```

```
**** COOL Object Table ****
```

Type	Index	Status	AOT	NAF	LAST-Change-Time	Object-Name
LNT	1	UP	0	0	Nov 03 2005 18:38:06	Router-Device
LNT	2	UP	0	0	Nov 03 2005 18:38:06	MIN-IOS-SW8
LNT	3	UP	0	0	Nov 03 2005 18:38:06	MAX-IOS-SW8
LNT	4	UP	0	0	Nov 03 2005 18:38:06	MIN-IOS-SW9
LNT	5	UP	0	0	Nov 03 2005 18:38:06	MAX-IOS-SW9
ENT	40	DOWN	17	1	Nov 03 2005 18:40:42	slot 7

!Display the COOL event and object tables again. This time the event table information !shows that the line card in slot 7 is back up after 129 seconds. The AOT and NAF !information is updated in the COOL object table for slot 7.

```
Router#show cool event-table
**** COOL Event Table ****
```

Index	Type	Obj-ID	Event	Interval	Event-Time	Object-Name
1	ENT	40	DOWN	53	Nov 03 2005 18:40:42	slot 7
2	ENT	40	UP	129	Nov 03 2005 18:42:51	slot 7

```
**** COOL Object Table ****
```

```
Router# show cool object-table
```

Type	Index	Status	AOT	NAF	LAST-Change-Time	Object-Name
LNT	1	UP	0	0	Nov 03 2005 18:38:06	Router-Device
LNT	2	UP	0	0	Nov 03 2005 18:38:06	MIN-IOS-SW8
LNT	3	UP	0	0	Nov 03 2005 18:38:06	MAX-IOS-SW8
LNT	4	UP	0	0	Nov 03 2005 18:38:06	MIN-IOS-SW9
LNT	5	UP	0	0	Nov 03 2005 18:38:06	MAX-IOS-SW9
ENT	40	UP	129	1	Nov 03 2005 18:42:51	slot 7

## Interface Outage Measurement: Example

This examples illustrates the AOT and NAF measurements for an interface outage.

```
! Configure the interface.
Router#config terminal
Router(config)#cool interface ethernet 0
! Display the COOL object table to verify the entry in the table.
Router#show cool object-table
**** COOL Object Table ****

Type Index Status AOT          NAF LAST-Change-Time      Object-Name
-----
LNT  1      UP      0            0   Nov 15 2005 06:47:58 Router-Device
LNT  2      UP      0            0   Nov 15 2005 06:47:58 MIN-IOS-SW8
LNT  3      UP      0            0   Nov 15 2005 06:47:58 MAX-IOS-SW8
LNT  4      UP      0            0   Nov 15 2005 06:47:58 MIN-IOS-SW9
LNT  5      UP      0            0   Nov 15 2005 06:47:58 MAX-IOS-SW9
INF  2      UP      0            0   Nov 15 2005 06:48:09 Ethernet0
```

```
! Display the running configuration.
Router#show running-config | include cool
cool run
cool interface Ethernet0
cool parameters
```

```
! Cause a failure on the interface
Router#config terminal
Router(config)#interface ethernet 0
Router(config-if)#shutdown
! Display the COOL event and object tables to view the event.
Router#show cool
**** COOL Event Table ****
```

```
Index Type Obj-ID  Event Interval  Event-Time      Object-Name
-----
1     INF  2      DOWN  60           Nov 15 2005 06:49:09 Ethernet0
```

```
**** COOL Object Table ****

Type Index Status AOT          NAF LAST-Change-Time      Object-Name
-----
LNT  1      UP      0            0   Nov 15 2005 06:47:58 Router-Device
LNT  2      UP      0            0   Nov 15 2005 06:47:58 MIN-IOS-SW8
LNT  3      UP      0            0   Nov 15 2005 06:47:58 MAX-IOS-SW8
LNT  4      UP      0            0   Nov 15 2005 06:47:58 MIN-IOS-SW9
LNT  5      UP      0            0   Nov 15 2005 06:47:58 MAX-IOS-SW9
INF  2      DOWN  116         1   Nov 15 2005 06:49:09 Ethernet0
```

! Restart the interface and display the COOL event and object tables again to view the event.

```
Router#config terminal
Router(config)#interface Ethernet 0
Router(config-if)#no shutdown
```

```
Router#show cool
**** COOL Event Table ****

Index Type Obj-ID  Event Interval  Event-Time      Object-Name
-----
1     INF  2      DOWN  60           Nov 15 2005 06:49:09 Ethernet0
```

```

2      INF 2      UP 112      Nov 15 2005 06:51:01 Ethernet0
**** COOL Object Table ****

Type Index Status AOT      NAF LAST-Change-Time      Object-Name
LNT 1      UP    0      0      Nov 15 2005 06:47:58 Router-Device
LNT 2      UP    0      0      Nov 15 2005 06:47:58 MIN-IOS-SW8
LNT 3      UP    0      0      Nov 15 2005 06:47:58 MAX-IOS-SW8
LNT 4      UP    0      0      Nov 15 2005 06:47:58 MIN-IOS-SW9
LNT 5      UP    0      0      Nov 15 2005 06:47:58 MAX-IOS-SW9
INF 2      UP    112    1      Nov 15 2005 06:51:01 Ethernet0

```

## Remote Device Outage Measurement: Example

This examples illustrates the AOT and NAF measurements for a remote device outage:

```

! Configure a remote object.
! The remote object status is initially INIT status, since the object status is not
! confirmed yet. After the status verification, the object status will be changed to UP or
! DOWN.

```

```

Router#config terminal
Router(config)#cool remote-device 2 128.107.165.42 remote-obj1 50 5

```

```

Router#show cool
No entry is available !

```

```

**** COOL Object Table ****

```

```

Type Index Status AOT      NAF LAST-Change-Time      Object-Name
LNT 1      UP    0      0      Nov 15 2005 06:53:40 Router-Device
LNT 2      UP    0      0      Nov 15 2005 06:53:40 MIN-IOS-SW8
LNT 3      UP    0      0      Nov 15 2005 06:53:40 MAX-IOS-SW8
LNT 4      UP    0      0      Nov 15 2005 06:53:40 MIN-IOS-SW9
LNT 5      UP    0      0      Nov 15 2005 06:53:40 MAX-IOS-SW9
RMT 2      INIT  0      0      Nov 15 2005 06:55:33 remote-obj1

```

```

Router#show cool
No entry is available !

```

```

**** COOL Object Table ****

```

```

Type Index Status AOT      NAF LAST-Change-Time      Object-Name
LNT 1      UP    0      0      Nov 15 2005 06:53:40 Router-Device
LNT 2      UP    0      0      Nov 15 2005 06:53:40 MIN-IOS-SW8
LNT 3      UP    0      0      Nov 15 2005 06:53:40 MAX-IOS-SW8
LNT 4      UP    0      0      Nov 15 2005 06:53:40 MIN-IOS-SW9
LNT 5      UP    0      0      Nov 15 2005 06:53:40 MAX-IOS-SW9
RMT 2      UP    0      0      Nov 15 2005 06:55:33 remote-obj1

```

```

! The remote object becomes down.

```

```

Router#show cool
**** COOL Event Table ****

```

```

Index Type Obj-ID  Event Interval  Event-Time      Object-Name
1      RMT 2      DOWN 463      Nov 15 2005 07:03:16 remote-obj1
**** COOL Object Table ****

```

```

Type Index Status AOT          NAF LAST-Change-Time      Object-Name
LNT  1      UP      0          0   Nov 15 2005 06:53:40 Router-Device
LNT  2      UP      0          0   Nov 15 2005 06:53:40 MIN-IOS-SW8
LNT  3      UP      0          0   Nov 15 2005 06:53:40 MAX-IOS-SW8
LNT  4      UP      0          0   Nov 15 2005 06:53:40 MIN-IOS-SW9
LNT  5      UP      0          0   Nov 15 2005 06:53:40 MAX-IOS-SW9
RMT  2      DOWN   3          1   Nov 15 2005 07:03:16 remote-obj1

```

! After the remote object is UP, view the COOL event and object table to see the event.

```

Router#show cool
**** COOL Event Table ****

```

```

Index Type Obj-ID  Event Interval  Event-Time      Object-Name
1      RMT  2      DOWN  463           Nov 15 2005 07:03:16 remote-obj1
2      RMT  2      UP    53            Nov 15 2005 07:04:09 remote-obj1
**** COOL Object Table ****

```

```

Type Index Status AOT          NAF LAST-Change-Time      Object-Name
LNT  1      UP      0          0   Nov 15 2005 06:53:40 Router-Device
LNT  2      UP      0          0   Nov 15 2005 06:53:40 MIN-IOS-SW8
LNT  3      UP      0          0   Nov 15 2005 06:53:40 MAX-IOS-SW8
LNT  4      UP      0          0   Nov 15 2005 06:53:40 MIN-IOS-SW9
LNT  5      UP      0          0   Nov 15 2005 06:53:40 MAX-IOS-SW9
RMT  2      UP      53         1   Nov 15 2005 07:04:09 remote-obj1

```

## Additional References

For additional information related to the COOL Measurement feature, refer to the following references:

## Related Documents

Related Topic	Document Title
Configuring SNMP support	<i>Configuration Fundamentals Configuration Guide</i> , Part 3, Release 12.0
Cisco IOS commands	Cisco IOS Release 12.0 command reference publications

## Standards

Standards <sup>1</sup>	Title
ATIS Technical Requirements	<i>Recording Outages in Packet Network Elements</i> , Document Number T1.TRQ.11-2004

1. Not all supported standards are listed.

## MIBs

MIBs <sup>1</sup>	MIBs Link
<ul style="list-style-type: none"> <li>CISCO-OUTAGE-MONITOR-MIB</li> <li>IF-MIB</li> <li>ENTITY-MIB</li> </ul>	<p>To obtain lists of supported MIBs by platform and Cisco IOS release, and to download MIB modules, go to the Cisco MIB website on Cisco.com at the following URL:</p> <p><a href="http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml">http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml</a></p>

1. Not all supported MIBs are listed.

To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:

<http://tools.cisco.com/ITDIT/MIBS/servlet/index>

If Cisco MIB Locator does not support the MIB information that you need, you can also obtain a list of supported MIBs and download MIBs from the Cisco MIBs page at the following URL:

<http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml>

To access Cisco MIB Locator, you must have an account on Cisco.com. If you have forgotten or lost your account information, send a blank e-mail to [cco-locksmith@cisco.com](mailto:cco-locksmith@cisco.com). An automatic check will verify that your e-mail address is registered with Cisco.com. If the check is successful, account details with a new random password will be e-mailed to you. Qualified users can establish an account on Cisco.com by following the directions found at this URL:

<http://www.cisco.com/register>

## RFCs

RFCs <sup>1</sup>	Title
None	—

1. Not all supported RFCs are listed.

## Technical Assistance

Description	Link
<p>Technical Assistance Center (TAC) home page, containing 30,000 pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.</p>	<p><a href="http://www.cisco.com/public/support/tac/home.shtml">http://www.cisco.com/public/support/tac/home.shtml</a></p>

# Command Reference

This section documents new and modified commands. All other commands used with this feature are documented in the Cisco IOS Release 12.0 command reference publications.

## New Commands

- **clear cool event-table**
- **clear cool persist-files**
- **cool if-filter**
- **cool interface**
- **cool parameter**
- **cool physical-fru-slot**
- **cool remote-device**
- **cool run**
- **count event-storm**
- **show cool event-table**
- **show cool object-table**
- **show cool parameters**
- **size event-table**
- **timer event-storm**
- **timer duration**
- **timer flash-file**
- **timer timestamp-file**

## Modified Commands

- **snmp-server enable traps outage**
- **snmp-server host**

# clear cool event-table

To clear and then reset the outage event history table, use the **clear cool event-table** command in privileged EXEC mode or user EXEC mode.

## clear cool event-table

**Syntax Description** This command has no arguments or keywords.

**Command Modes** Privileged EXEC  
User EXEC

Command History	Release	Modification
	12.0(31)S3	This command was introduced in this release.

**Examples** The following example shows the contents of the COOL measurement event table before and after clearing it:

```
Router# show cool event-table

RP-Slot8#sh cool event-table
**** COOL Event Table ****

Index Type Obj-ID Event Interval Event-Time Object-Name
-----
1 ENT 45 DOWN 42 Sep 19 2005 23:59:07 slot 1
2 ENT 45 UP 140 Sep 20 2005 00:01:27 slot 1
3 INF 4 DOWN 29591 Sep 20 2005 08:05:56 GigabitEthernet7/0

Router# clear cool event-table

Router# show cool event-table
no entry is available !
```

Related Commands	Command	Description
	<b>show cool event-table</b>	Displays the outage event history.

# clear cool persist-files

To clear and reset any persistent files before enabling component outage on-line (COOL) measurement, use the **clear cool persist-files** command in privileged EXEC mode or user EXEC mode.

## clear cool persist-files

**Syntax Description** This command has no arguments or keywords.

**Command Modes** Privileged EXEC  
User EXEC

Command History	Release	Modification
	12.0(31)S3	This command was introduced in this release.

**Usage Guidelines** Outage data is stored in Advanced Technology Attachment (ATA) Flash memory in the networking device. Saving outage data allows it to persist after a component or device failure, system crash, or fail-over. The persistent data is useful in calculating outage information after the device is running normally again.

**Examples** The following example shows the files in disk0: on the networking device, including the persistent outage data file. The clear cool persist-files command deletes the file from disk0:.

```
Router# dir disk0:
```

```
Directory of disk0:/
```

```
  1  -rw-          342   Aug 04 2005 15:30:16  outage_data_persist_file
  2  -rw-        34657   Aug 23 2000 03:06:16  router1-config
  3  -rw-        34865   Aug 23 2000 03:06:34  router2-config
```

```
Router# clear cool persist-files
```

```
Router# dir disk0:
```

```
Directory of disk0:/
```

```
  2  -rw-        34657   Aug 23 2000 03:06:16  router1-config
  3  -rw-        34865   Aug 23 2000 03:06:34  router2-config
```

# cool if-filter

To configure an interface for filtering the event notification send, use the **cool if-filter** command in global configuration mode. To disable the filtering of the event notification send, use the **no** form of this command.

**cool if-filter** *interface*

**no cool if-filter** *interface*

<b>Syntax Description</b>	<i>interface</i>	Interface from which the COOL measurement trap originates. The argument includes the interface type and number in platform-specific syntax (for example, <i>type/slot/port</i> ).
---------------------------	------------------	---

<b>Defaults</b>	No interface is configured for filtering from the COOL event notification.
-----------------	--

<b>Command Modes</b>	Global configuration
----------------------	----------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	12.0(31)S3	This command was introduced in this release.

<b>Usage Guidelines</b>	A key benefit of using interface event notification filtering is the ability to reduce the overhead of event notification messages, especially in case of the event storm. Use the <b>show cool object-table detail</b> command to display the interface objects and filtering flag.
-------------------------	--

<b>Examples</b>	The following example shows how to configure the filtering for an Ethernet 5/1/0 notification:
-----------------	--

```
cool if-filter Ethernet 5/1/0
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>show cool object-table</b>	Displays a list of objects monitored for COOL measurement.

# cool interface

To specify an interface for component outage on-line (COOL) measurement, use the **cool interface** command in global configuration mode. To disable COOL monitoring for an interface, use the **no** form of this command.

**cool interface** *interface*

**no cool interface** *interface*

<b>Syntax Description</b>	<i>interface</i>	Interface from which the COOL measurement trap originates. The argument includes the interface type and number in platform-specific syntax (for example, <i>type/slot/port</i> ).
---------------------------	------------------	---

<b>Defaults</b>	No interface is specified to be monitored for COOL measurement.
-----------------	---

<b>Command Modes</b>	Global configuration
----------------------	----------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	12.0(31)S3	This command was introduced in this release.

<b>Usage Guidelines</b>	Use this command to monitor events from a particular interface.
-------------------------	---



**Note**

The COOL Measurement feature can monitor up to 2,000 objects. Each interface or field replaceable unit is counted as one object.

Use the **show cool object-table** command to display a list of monitored objects.

<b>Examples</b>	The following example shows how to enable COOL measurement on Ethernet interface 5/1/0: <pre>cool interface Ethernet5/1/0</pre>
-----------------	--

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>show cool object-table</b>	Displays a list of objects monitored for COOL measurement.

# cool parameter

To enter component object online (COOL) parameter configuration mode, use the **cool parameter** command in global configuration mode.

## cool parameter

**Syntax Description** This command has no arguments or keywords.

**Defaults** Cool parameter values are assigned as default values. No COOL parameter configuration is made for the default value.

**Command Modes** Global configuration

Command History	Release	Modification
	12.0(31)S3	This command was introduced in this release.

**Usage Guidelines** The COOL parameters define the characteristics of COOL management. To view the COOL parameters, enter the **show cool parameters** command.

**Examples** The following example shows how to enter COOL parameter configuration mode:

```
Router(config)# cool parameter
Router(config-cool-pars)#
```

Related Commands	Command	Description
	<b>show cool parameters</b>	Displays the Component Object Online (COOL) management parameters.

# cool physical-fru-slot

To add an entity for monitoring using component outage on-line (COOL) measurement, use the **cool physical-fru-slot** command in global configuration mode. To stop monitoring a specific FRU entity, use the **no** form of this command.

**cool physical-fru-slot** *fru-slot-number* [**bay** *subslot-number*]

**no cool physical-fru-slot** *fru-slot-number* [**bay** *subslot-number*]

Syntax Description		
	<i>fru-slot-number</i>	Indicates the physical slot number in the networking device.
	<i>subslot-number</i>	Indicates the sub slot number in the slot.

**Defaults** No physical entities are monitored for COOL measurement.

**Command Modes** Global configuration

Command History	Release	Modification
	12.0(31)S3	This command was introduced in this release.

**Usage Guidelines** By entering the slot number, you specify the physical device located in that slot.

**Examples** The following example shows how to add the physical object located in slot 9 for monitoring under COOL measurement:

```
cool physical-FRU-slot 9
```

The following example shows how to add a shared port adapter (SPA) device in bay 0 of slot 1 to the list of objects monitored under COOL measurement.

```
cool physical-FRU-slot 1 bay 0
```

## cool remote-device

To add a remote networking device for component outage on-line (COOL) measurement monitoring, use the **cool remote-device** command in global configuration mode. To disable monitoring of a remote device, use the **no** form of this command.

**cool remote-device** *entry-index remote-ip-address name seconds repeat [local-ip-address mode]*

**no cool remote-device** *entry-index remote-ip-address name seconds repeat [local-ip-address mode]*

### Syntax Description

<i>entry-index</i>	Unique index number representing a monitored device. Enter a value in the range 1 to 2000.
<i>remote-ip-address</i>	IP address of the interface on the remote device being monitored.
<i>name</i>	Name of the remote networking device.
<i>seconds</i>	Interval in seconds for sending <b>ping</b> messages to the remote networking device. Enter a value in the range 30 to 6000.
<i>repeat</i>	Number of <b>ping</b> repeat requests. Enter a number from 1 to 10.
<i>local-ip-address</i>	IP address of the networking device generating the ping messages. Otherwise, the system will choose the best source IP address based upon the destination IP address.
<i>mode</i>	(Optional) The only available mode is ping. The default mode is ping.

### Defaults

The default mode is ping.

### Command Modes

Global configuration

### Command History

Release	Modification
12.0(31)S3	This command was introduced in this release.

### Usage Guidelines

Remote networking devices can be monitored for outages.

### Examples

The following example shows the addition of a remote device named CPE1. This device has index number 1 and is configured to generate one ping message every 30 seconds.

```
cool remote-device 1 10.4.4.1 CPE1 30 5
```

### Related Commands

Command	Description
<b>show cool object-table</b>	Displays a list of objects monitored for COOL measurement.

# cool run

To enable component outage on-line (COOL) measurement, use the **cool run** command in global configuration mode. To disable COOL measurements, use the **no** form of this command.

**cool run**

**no cool run**

**Syntax Description** This command has no arguments or keywords.

**Defaults** COOL measurement is disabled.

Enabling COOL measurement automatically enables three logical event measurements: Router-Device, minimum Cisco IOS software, and maximum Cisco IOS software.

**Command Modes** Global configuration

Command History	Release	Modification
	12.0(31)S3	This command was introduced in this release.

**Examples** The following example shows how to start COOL measurement functions on the networking device:

```
cool run
```

Related Commands	Command	Description
	<b>snmp-server enable traps outage</b>	Enables sending COOL SNMP notifications.
	<b>snmp-server host</b>	Specifies the recipient of an SNMP notification operation.

## count event-storm

To set the threshold counter for event storms in objects monitored by component outage on-line (COOL) measurement, use the **count event-storm** command in cool parameter configuration mode. To remove the entry, use the **no** form of this command.

**count event-storm** *number*

**no count event-storm** {*number*}

<b>Syntax Description</b>	<i>number</i>	Indicates the event-storm threshold value. The default value is 5 events. The range is 1 to 100.
---------------------------	---------------	--

<b>Defaults</b>	The default event-storm count is 5.
-----------------	-------------------------------------

<b>Command Modes</b>	COOL parameter configuration
----------------------	------------------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	12.0(31)S3	This command was introduced in this release.

<b>Usage Guidelines</b>	When the COOL measurement monitor detects an object failure, the event storm counter is incremented. If the number of failures for an object exceeds the event storm counter threshold for the period determined by the <b>timer event-storm</b> command, an event storm is detected. At that time, the COOL measurement manager stops writing event information to event tables in memory on the networking device until the event count becomes less than the threshold. This prevents event storm information from overloading the event tables in system memory and Flash (persistent) memory.
-------------------------	--

<b>Examples</b>	The following example shows how to set the event-storm threshold counter to 10:
-----------------	---

```
count event-storm 10
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>show cool parameters</b>	Displays a list component object online (COOL) measurement parameters and their settings.
	<b>timer event-storm</b>	Sets the time interval used by component outage on-line (COOL) measurement to detect event storms caused by multiple object failures.

## show cool event-table

To display the outage event history for objects monitored by component object online (COOL) measurement, use the **show cool event-table** command in privileged EXEC mode or user EXEC mode.

**show cool event-table** [*number-of-events*]

<b>Syntax Description</b>	<i>number-of-events</i>	(Optional) Displays a specified number of recent events. The argument may be any number up to 500.
---------------------------	-------------------------	--

<b>Command Modes</b>	Privileged EXEC User EXEC
----------------------	------------------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	12.0(31)S3	This command was introduced in this release.

<b>Usage Guidelines</b>	The outage event table provides the outage information for each monitored object.
-------------------------	---

**Examples** The following example shows the output of the **show cool event-table** command:

```
Router# show cool event-table

RP-Slot8#sh cool event-table
**** COOL Event Table ****

Index Type Obj-ID Event Interval Event-Time Object-Name
1 ENT 45 DOWN 42 Sep 19 2005 23:59:07 slot 1
2 ENT 45 UP 140 Sep 20 2005 00:01:27 slot 1
3 INF 4 DOWN 29591 Sep 20 2005 08:05:56 GigabitEthernet7/0
```

The following examples shows only type 1 (physical) entities in the COOL measurement event table:

```
Router# show cool event-table 1
**** COOL Event Table ****

Index Type Obj-ID Event Interval Event-Time Object-Name
1 ENT 45 DOWN 42 Sep 19 2005 23:59:07 slot 1
2 ENT 45 UP 140 Sep 20 2005 00:01:27 slot 1
```

Table 3 describes the fields shown in the display.

**Table 3** *show cool event-table Field Descriptions*

Field	Description
Index	The number assigned to track each object monitored. This number is assigned automatically at the time the object is configured for monitoring. If the object is a physical-object type, the index number represents index in the ENTITY-MIB.
Type	The type of object being monitored: interface (INT or 1), physical-entity (ENT or 2), process object (PRS or 3), remote object (RMT or 4), logical entity (LNT or 5).
Object-Name	Name of the monitored device.
Event	The failure reason for the object being monitored.
Event-time	The time of the event.
Interval	Outage interval in seconds for the monitored object.
Object-Name	The name of the object being monitored.

#### Related Commands

Command	Description
<b>clear cool event-table</b>	Clears and resets the outage event history table.

# show cool object-table

To display monitored objects and their status, use the **show cool object-table** command in privileged EXEC mode or user EXEC mode.

## **show cool object-table** [*object-type*] **detail**

<b>Syntax Description</b>	<i>object-type</i>	(Optional) Object being monitored: interface (1), physical-object (2), process (3), remote object (4), logical object (5).
---------------------------	--------------------	--

<b>Command Modes</b>	Privileged EXEC User EXEC
----------------------	------------------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	12.0(31)S3	This command was introduced in this release.

<b>Usage Guidelines</b>	Use the cool object table to display a list of monitor objects, object index number, and outage information.
-------------------------	--

**Examples** The following is sample output from the **show cool object-table** command:

```
Router#show cool object

**** COOL Object Table ****
Type Index Status AOT          NAF LAST-Change-Time      Object-Name
LNT  1      UP      0          0   Sep 19 2005 23:52:31 Router-Device
LNT  2      UP      0          0   Sep 19 2005 23:52:31 MIN-IOS-SW8
LNT  3      UP      0          0   Sep 19 2005 23:52:31 MAX-IOS-SW8
LNT  4      UP      0          0   Sep 19 2005 23:52:31 MIN-IOS-SW9
LNT  5      UP      0          0   Sep 19 2005 23:52:31 MAX-IOS-SW9
INF  4      DOWN   106        1   Sep 20 2005 08:05:56 GigabitEthernet7/0
INF  5      DOWN  29685      1   Sep 19 2005 23:52:58 GigabitEthernet7/1
ENT  45     UP      140        1   Sep 20 2005 00:01:27 slot 1 ot 9
```

The following is sample output showing detailed information on type 1 (physical) entities:

```
Router#sh cool obj 1 detail
**** COOL Detailed Object Table ****
-----
Object Type: ENT
Object Index: 45
Object Status: UP
Object Start Time: Sep 19 2005 23:58:25
Object Last Change Time: Sep 20 2005 00:01:27
Object Name: slot 1
Serial Name: SAD072104KM
AOT: 140
NAF: 1
```

```
show cool object-table
```

```
Slot Number: 1
Table Status: Active
-----
```

Table 4 describes the fields shown in the displays.

**Table 4** *show cool object-table Field Descriptions*

Field	Description
Object Type or Type	The type of object being monitored: interface (INT or 1), physical-entity (ENT or 2), process objects (PRS or 3), remote objects (RMT or 4), logical entity (LNT or 5).
Object Index or Index	The number assigned to track each object monitored. This number is assigned automatically at the time the object is configured for monitoring. If the object is a physical-object type, the index number represents index in the ENTITY-MIB.
Object Status or Status	Status of the object being monitored: up (1) and down (2).
Object Start Time	The time that the object was first detected by COOL measurement.
Object Last Change Time or Last-Change-Time	Last object status change time.
AOT	Accumulated outage time in seconds.
NAF	Number of accumulated failures.
Object-Name	The item being monitored.
Flag	COOL interface filtering enabled (1) or disabled (0).
Slot Number	The slot number of the physical object.
Table Status	Reserved or Active. For the physical entity object, if the object is configured and removed by OIR (no Serial Number), the object becomes Reserved. When the object is inserted, it becomes Active.

# show cool parameters

To display component object online (COOL) measurement parameters, use the **show cool parameters** command in privileged EXEC mode or user EXEC mode.

## show cool parameters

**Syntax Description** This command has no keywords or arguments.

**Command Modes** Privileged EXEC  
User EXEC

Command History	Release	Modification
	12.0(31)S3	This command was introduced in this release.

**Usage Guidelines** Use the **show cool parameters** command to display the default and currently configured COOL measurement parameters.

**Examples** The following is sample output from the **show cool parameters** command:

```
Router# show cool parameters

Time Stamp Period: Configured (30 seconds) Default (30 seconds)
Flash Update Period: Configured (15 minutes) Default (15 minutes)
Duration Threshold: Configured (8 seconds) Default (8 seconds)
Event Storm Count Number: Configured (5 times) Default (5 times)
Event Storm Check Period: Configured (1 second) Default (1 second)
Max Event History Table Size: Configured (500 entries) Default (500 entries)
```

[Table 4](#) describes the fields shown in the display.

**Table 5** *show cool parameter Field Descriptions*

Field	Description
Time Stamp Period	The time interval for updating the Component Object Online (COOL) management timestamp file.
Flash Update Period	The number assigned to track each object monitored. This number is assigned automatically at the time the object is configured for monitoring. If the object is a physical-object type, the index number represents index in the ENTITY-MIB.
Duration Threshold	The minimum time before an object can change state after an outage or recovery is detected.
Event Storm Count Number	Last object status change time.

**Table 5** *show cool parameter Field Descriptions (continued)*

<b>Field</b>	<b>Description</b>
Event Storm Check Period	Accumulated outage time in seconds for objects monitored for COOL measurement.
Max Event History Table Size	The maximum number of events that are stored for objects monitored for COOL measurement.

## size event-table

To set the size of the event table that is maintained for objects being monitored by component outage on-line (COOL) measurement, use the **size event-table** command in cool parameter configuration mode. To remove a table size configuration entry, use the **no** form of this command.

**size event-table** *number*

**no size event-table** *number*

<b>Syntax Description</b>	<i>number</i>	Specifies the number of objects that are monitored for COOL measurement. The default size of the event table is 500 entries. The range is 1 to 5000 entries.
---------------------------	---------------	--

<b>Defaults</b>	The default setting is 500 entries.
-----------------	-------------------------------------

<b>Command Modes</b>	COOL parameter configuration
----------------------	------------------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	12.0(31)S3	This command was introduced in this release.

<b>Usage Guidelines</b>	<p>The COOL event history table size can be configured for 1 to 5000 entries. The default size is 500. An event occurs any time a monitored object changes state from UP to Down or Down to UP. Changes to the history table size have the follow effects:</p> <ul style="list-style-type: none"> <li>• If the new table size is bigger than the previous table size, the new table keeps all the existing event history entries.</li> <li>• If the new size is less than the previous table size and the table entry is bigger than the new size, the older event history entries will be dropped.</li> <li>• If the new event table is too big to allocate memory (failed during the resize process), it will lose the previous event history entry.</li> <li>• The new event history table size shall be stored into the persistent file right after the configuration.</li> </ul>
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<b>Examples</b>	The following example shows how to change the size of the event table to 2000:
-----------------	--

```
size event-table 2000
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>show cool parameters</b>	Displays a list component object online (COOL) measurement parameters and their settings.

## snmp-server enable traps outage

To enable the sending of component object on-line (COOL) measurement Simple Network Management Protocol (SNMP) notifications, use the **snmp-server enable traps outage** command in global configuration mode. To disable sending COOL SNMP notifications, use the **no** form of this command.

**snmp-server enable traps outage**

**no snmp-server enable traps outage**

**Syntax Description** This command has no arguments or keywords.

**Defaults** Disabled.

**Command Modes** Global configuration.

Command History	Release	Modification
	12.0(31)S3	This command was introduced in this release.

**Examples** The following example shows how to enable sending of COOL SNMP notifications to an SNMP server:

```
snmp-server enable traps outage
```

Related Commands	Command	Description
	<b>cool run</b>	Enables COOL measurement.
	<b>snmp-server host</b>	Specifies the recipient of an SNMP notification operation.

## snmp-server host

To specify the recipient of a Simple Network Management Protocol (SNMP) notification operation, use the **snmp-server host** global configuration command. To remove the specified host, use the **no** form of this command.

```
snmp-server host host-address [traps | informs] [version {1 | 2c | 3 [auth | noauth | priv]}]
community-string [udp-port port] [notification-type] [outage]
```

```
no snmp-server host host [traps | informs]
```

Syntax	Description
<i>host-address</i>	Name or Internet address of the host (the targeted recipient).
<b>traps</b>	(Optional) Sends SNMP traps to this host. This is the default.
<b>informs</b>	(Optional) Sends SNMP informs to this host.
<b>version</b>	(Optional) Version of the SNMP used to send the traps. Version 3 is the most secure model, because it allows packet encryption with the <b>priv</b> keyword. If you use the <b>version</b> keyword, one of the following must be specified: <ul style="list-style-type: none"> <li>• <b>1</b>—SNMPv1. This option is not available with informs.</li> <li>• <b>2c</b>—SNMPv2C.</li> <li>• <b>3</b>—SNMPv3. The following three optional keywords can follow the <b>version 3</b> keyword: <ul style="list-style-type: none"> <li>– <b>auth</b> (Optional). Enables Message Digest 5 (MD5) and Secure Hash Algorithm (SHA) packet authentication.</li> <li>– <b>noauth</b> (Default). The noAuthNoPriv security level. This is the default if the [<b>auth</b>   <b>noauth</b>   <b>priv</b>] keyword choice is not specified.</li> <li>– <b>priv</b> (Optional). Enables Data Encryption Standard (DES) packet encryption (also called “privacy”).</li> </ul> </li> </ul>
<i>community-string</i>	Password-like community string sent with the notification operation. Though you can set this string using the <b>snmp-server host</b> command by itself, we recommend you define this string using the <b>snmp-server community</b> command prior to using the <b>snmp-server host</b> command.
<b>udp-port</b> <i>port</i>	(Optional) User Datagram Protocol (UDP) port of the host to use. The default is 162.
<b>outage</b>	(Optional) Enables the host to receive component object online (COOL) measurement information as SNMP traps.

---

<i>notification-type</i>	<p>(Optional) Type of notification to be sent to the host. If no type is specified, all notifications are sent. The notification type can be one or more of the following keywords:</p> <ul style="list-style-type: none"> <li>• <b>bgp</b>—Sends Border Gateway Protocol (BGP) state change notifications.</li> <li>• <b>calltracker</b>—Sends Call Tracker call-start/call-end notifications.</li> <li>• <b>config</b>—Sends configuration notifications.</li> <li>• <b>dspu</b>—Sends downstream physical unit (DSPU) notifications.</li> <li>• <b>entity</b>—Sends Entity MIB modification notifications.</li> <li>• <b>envmon</b>—Sends Cisco enterprise-specific environmental monitor notifications when an environmental threshold is exceeded.</li> <li>• <b>frame-relay</b>—Sends Frame Relay notifications.</li> <li>• <b>hsrp</b>—Sends Hot Standby Routing Protocol (HSRP) notifications.</li> <li>• <b>isdn</b>—Sends Integrated Services Digital Network (ISDN) notifications.</li> <li>• <b>llc2</b>—Sends Logical Link Control, type 2 (LLC2) notifications.</li> <li>• <b>repeater</b>—Sends standard repeater (hub) notifications.</li> <li>• <b>rsrb</b>—Sends remote source-route bridging (RSRB) notifications.</li> <li>• <b>rsvp</b>—Sends Resource Reservation Protocol (RSVP) notifications.</li> <li>• <b>rtr</b>—Sends SA Agent (RTR) notifications.</li> <li>• <b>sdlc</b>—Sends Synchronous Data Link Control (SDLC) notifications.</li> <li>• <b>sdllc</b>—Sends SDLLC notifications.</li> <li>• <b>snmp</b>—Sends any enabled RFC 1157 SNMP linkUp, linkDown, authenticationFailure, warmStart, and coldStart notifications.</li> <li>• <b>stun</b>—Sends serial tunnel (STUN) notifications.</li> <li>• <b>syslog</b>—Sends error message notifications (Cisco Syslog MIB). Specify the level of messages to be sent with the <b>logging history level</b> command.</li> <li>• <b>tty</b>—Sends Cisco enterprise-specific notifications when a Transmission Control Protocol (TCP) connection closes.</li> <li>• <b>voice</b>—Sends SNMP poor quality of voice traps, when used with the <b>snmp enable peer-trap poor gov</b> command.</li> <li>• <b>x25</b>—Sends X.25 event notifications.</li> </ul>
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## Defaults

This command is disabled by default. No notifications are sent.

If you enter this command with no keywords, the default is to send all trap types to the host. No informs will be sent to this host.

If no **version** keyword is present, the default is version 1. The **no snmp-server host** command with no keywords will disable traps, but not informs, to the host. In order to disable informs, use the **no snmp-server host informs** command.

**Note**

If the *community-string* is not defined using the **snmp-server community** command prior to using this command, the default form of the **snmp-server community** command will automatically be inserted into the configuration. The password (*community-string*) used for this automatic configuration of the **snmp-server community** will be the same as specified in the **snmp-server host** command. This is the default behavior for Cisco IOS Release 12.0(3) and later.

**Command Modes**

Global configuration

**Command History**

Release	Modification
10.0	This command was introduced.
12.0(3)T	The following keywords were added: <ul style="list-style-type: none"> <li>• <b>version 3 [auth   noauth   priv]</b></li> <li>• <b>hsrp</b></li> </ul>
11.3(1) MA, 12.0(3)T	The <b>voice</b> notification-type keyword was added.
12.1(3)T	The <b>calltracker</b> notification-type keyword was added for the Cisco AS5300 and AS5800 platforms.
12.0(31)S3	The <b>outage</b> keyword was added.

**Usage Guidelines**

SNMP notifications can be sent as traps or inform requests. Traps are unreliable because the receiver does not send acknowledgments when it receives traps. The sender cannot determine if the traps were received. However, an SNMP entity that receives an inform request acknowledges the message with an SNMP response. If the sender never receives the response, the inform request can be sent again. Thus, informs are more likely to reach their intended destination.

However, informs consume more resources in the agent and in the network. Unlike a trap, which is discarded as soon as it is sent, an inform request must be held in memory until a response is received or the request times out. Also, traps are sent only once, while an inform may be retried several times. The retries increase traffic and contribute to a higher overhead on the network.

If you do not enter an **snmp-server host** command, no notifications are sent. In order to configure the networking device to send SNMP notifications, you must enter at least one **snmp-server host** command. If you enter the command with no keywords, all trap types are enabled for the host.

In order to enable multiple hosts, you must issue a separate **snmp-server host** command for each host. You can specify multiple notification types in the command for each host.

When multiple **snmp-server host** commands are given for the same host and kind of notification (trap or inform), each succeeding command overwrites the previous command. Only the last **snmp-server host** command will be in effect. For example, if you enter an **snmp-server host inform** command for a host and then enter another **snmp-server host inform** command for the same host, the second command will replace the first.

The **snmp-server host** command is used in conjunction with the **snmp-server enable** command. Use the **snmp-server enable** command to specify which SNMP notifications are sent globally. For a host to receive most notifications, at least one **snmp-server enable** command and the **snmp-server host** command for that host must be enabled.

However, some notification types cannot be controlled with the **snmp-server enable** command. For example, some notification types are always enabled. Other notification types are enabled by a different command. For example, the linkUpDown notifications are controlled by the **snmp trap link-status** command. These notification types do not require an **snmp-server enable** command.

A notification-type option's availability depends on the networking device type and Cisco IOS software features supported on the networking device. For example, the **envmon** notification-type is available only if the environmental monitor is part of the system. To see what notification types are available on your system, use the command `help?` at the end of the **snmp-server host** command.

## Examples

If you want to configure a unique SNMP community string for traps, but you want to prevent SNMP polling access with this string, the configuration should include an access list. In the following example, the community string is named `comaccess` and the access list is numbered 10:

```
Router(config)# snmp-server community comaccess ro 10
Router(config)# snmp-server host 172.20.2.160 comaccess
Router(config)# access-list 10 deny any
```

The following example sends RFC 1157 SNMP traps to the host specified by the name `myhost.cisco.com`. Other traps are enabled, but only SNMP traps are sent because only **snmp** is specified in the **snmp-server host** command. The community string is defined as `comaccess`.

```
Router(config)# snmp-server enable traps
Router(config)# snmp-server host myhost.cisco.com comaccess snmp
```

The following example sends the SNMP and Cisco environmental monitor enterprise-specific traps to address 172.30.2.160:

```
Router(config)# snmp-server enable traps snmp
Router(config)# snmp-server enable traps envmon
Router(config)# snmp-server host 172.30.2.160 public snmp envmon
```

The following example enables the networking device to send all traps to the host `myhost.cisco.com` using the community string `public`:

```
Router(config)# snmp-server enable traps
Router(config)# snmp-server host myhost.cisco.com public
```

The following example will not send traps to any host. The BGP traps are enabled for all hosts, but only the ISDN traps are enabled to be sent to a host.

```
Router(config)# snmp-server enable traps bgp
Router(config)# snmp-server host bob public isdn
```

The following example enables the networking device to send all inform requests to the host `myhost.cisco.com` using the community string `public`:

```
Router(config)# snmp-server enable traps
Router(config)# snmp-server host myhost.cisco.com informs version 2c public
```

The following example sends HSRP MIB informs to the host specified by the name `myhost.cisco.com`. The community string is defined as `public`.

```
Router(config)# snmp-server enable traps hsrp
Router(config)# snmp-server host myhost.cisco.com informs version 2c public hsrp
```

The following example enables the host `myhost.cisco.com` to receive component object on-line (COOL) measurement information as SNMP traps. The community string is defined as `public`.

```
Router(config)# snmp-server host myhost.cisco.com public outage
```

---

**Related Commands**

<b>Command</b>	<b>Description</b>
<b>snmp-server enable peer-trap poor qov</b>	Enables poor quality of voice notifications for applicable calls associated with a specific voice dial peer.
<b>snmp-server enable traps</b>	Enables SNMP notifications (traps and informs).
<b>snmp-server enable traps outage</b>	Enables sending of COOL SNMP notifications.
<b>snmp-server informs</b>	Specifies inform request options.
<b>snmp-server trap-source</b>	Specifies the interface (and hence the corresponding IP address) that an SNMP trap should originate from.
<b>snmp-server trap-timeout</b>	Defines how often to try resending trap messages on the retransmission queue.

## timer event-storm

To set the time interval used by component outage on-line (COOL) measurement to detect event storms caused by multiple object failures, use the **timer event-storm** command in cool parameter configuration mode. To remove a the specific time interval, use the **no** form of this command.

**timer event-storm** *seconds*

**no timer event-storm** *seconds*

<b>Syntax Description</b>	<i>seconds</i>	Specifies the time interval used by the COOL measurement monitor to detect an event storm. The default interval is 1 second. The range is 1 to 5 seconds.
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<b>Defaults</b>	The default setting is one second.
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<b>Command Modes</b>	COOL parameter configuration
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<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	12.0(31)S3	This command was introduced in this release.

<b>Usage Guidelines</b>	When the COOL measurement monitor detects an object failure, an event storm counter is incremented. If the number of object failures exceeds the event storm counter threshold as determined by the <b>count event-storm</b> command for the period determined by the <b>timer event-storm</b> command, an event storm is detected. The COOL monitor continues to check for event storms at the configured interval. The COOL measurement manager stops writing event information to event tables in memory until the event count becomes less than the threshold for the configured interval. This prevents event storm information from overloading the event tables in system memory and Flash (persistent) memory.
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<b>Examples</b>	The following example shows how to configure the event storm detection interval to 2 seconds:
-----------------	---

```
timer event-storm 2
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>show cool parameters</b>	Displays a list component object online (COOL) measurement parameters and their settings.
	<b>count event-storm</b>	Sets the threshold counter for failures of objects monitored by component outage on-line (COOL) measurement.

## timer flash-file

To set the time interval for writing component outage on-line (COOL) measurement event information from memory to Flash memory, use the **timer flash-file** command in cool parameter configuration mode. To remove a timer configuration entry, use the **no** form of this command.

**timer flash-file** *minutes*

**no timer flash-file** *minutes*

<b>Syntax Description</b>	<i>seconds</i>	Specifies the time interval for writing COOL event information from memory to Flash memory. The default interval is 15 minutes. The range is 10 to 60 minutes.
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<b>Defaults</b>	The default setting is 15 minutes.
-----------------	------------------------------------

<b>Command Modes</b>	COOL parameter configuration
----------------------	------------------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	12.0(31)S3	This command was introduced in this release.

**Usage Guidelines**

COOL measurement supports two levels of data storage. It keeps the event driven outage data temporarily in the memory and periodically updates the entire outage data table and object table to the Flash disk (persistent storage) at an interval specified by the **timer flash-file** command. A flash disk is generally larger than memory (NVRAM), but Flash memory has a limitation on the number of read/write operations. NVRAM storage is relatively small compared with Flash memory, but there is no read/write limitation.

To further limit write operations to the Flash disk, data is written to Flash memory only if new events are detected in outage or object tables.

Administrators can use these parameters to adjust COOL measurement and storage parameters to match site dependencies and requirements.

**Examples**

The following example shows how to change the interval for writing event information to Flash disk to 10 minutes:

```
timer flash-file 10
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>show cool parameters</b>	Displays a list component object online (COOL) measurement parameters and their settings.

## timer duration

To set the minimum time when an object that is being monitor by component outage on-line (COOL) measurement can change state after an outage or recovery is detected, use the **timer duration** command in cool parameter configuration mode. To remove a timer configuration entry, use the **no** form of this command.

**timer duration** *seconds*

**no timer duration** *seconds*

<b>Syntax Description</b>	<i>seconds</i>	Specifies the minimum time period after an object failure or recovery is detected when an object can change state from UP to DOWN, or DOWN to UP. The default duration setting is 8 seconds. The range is 1 to 180 seconds.
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<b>Defaults</b>	The default setting is 8 seconds.
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<b>Command Modes</b>	COOL parameter configuration
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<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	12.0(31)S3	This command was introduced in this release.

<b>Usage Guidelines</b>	At any give time, each object that is monitored by COOL management exists in one of the two states, UP or DOWN. When the COOL management monitor detects an object failure (outage) or recovery, the event start time is recorded. When the outage has ended, the end time is also recorded; however, the objects state is not changed until the timer duration interval (start time to end time) has passed. For example, if an outage is less than the duration threshold, it is not considered as an outage, but if the outage time exceeds the duration threshold, the state is changed from UP to DOWN.
-------------------------	--

Similarly, when an object recovers, the recovery time is recorded. If that object experiences an outage before the timer duration threshold has passed, it is not considered as a recovery, and the state is not changed from DOWN to UP. If the recovery exceeds the timer duration, the state is deemed UP.

Administrators can use these parameters to adjust COOL measurement to match site dependencies and requirements for calculating mean time between failure (MTBF) or repair (MTTR) values.

<b>Examples</b>	The following example shows how to set the timer duration to 10 minutes.
-----------------	--

```
timer duration 10
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>show cool parameters</b>	Displays a list component object online (COOL) measurement parameters and their settings.

# timer timestamp-file

To set the time interval for updating the Component Object Online (COOL) management timestamp file, use the **timer timestamp-file** command in cool parameter configuration mode. To remove the timer timestamp-file configuration, use the **no** form of this command.

**timer timestamp-file** {seconds}

**no timer timestamp-file** {seconds}

<b>Syntax Description</b>	<i>seconds</i>	Indicates the interval at which the system updates timestamp file in Flash memory (persistent storage). The default interval is 30 seconds. The interval range is 1 to 100 seconds.
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<b>Defaults</b>	The default timer setting is 30 seconds.
-----------------	--

<b>Command Modes</b>	COOL parameter configuration
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<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	12.0(31)S3	This command was introduced in this release.

<b>Usage Guidelines</b>	At intervals configured by the <b>timer timestamp-file</b> command, the COOL measurement manager writes the system time to Flash memory to record the last system up time. During the system restart, COOL reads the timestamp file and calculates the system outage by retrieving the last system up time and subtracting it from the current system time. The time-stamp period is configurable to ensure that the outage measurement gap is within the outage resolution requirement for meantime-between-failure (MTBF) based on site requirements.
-------------------------	---

<b>Examples</b>	The following example shows how to set the time stamp interval to 60 seconds:
-----------------	---

```
timer timestamp-file 60
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>show cool parameters</b>	Displays a summary of Component Object Online (COOL) management configured and default parameter settings.

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