



# Implementing System Logging

This module describes the tasks you need to implement logging services on the router.

The Cisco IOS XR Software provides basic logging services. Logging services provide a means to gather logging information for monitoring and troubleshooting, to select the type of logging information captured, and to specify the destinations of captured system logging (syslog) messages.

## Feature History for Implementing System Logging

Release	Modification
Release 6.1.2	Platform Automated Monitoring (PAM) tool was introduced for all Cisco IOS XR 64-bit platforms.

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# Implementing System Logging

System Logging (Syslog) is the standard application used for sending system log messages. Log messages indicates the health of the device and point to any encountered problems or simplify notification messages according to the severity level. The IOS XR router sends its syslog messages to a syslog process. By default, syslog messages will be sent to the console terminal. But, syslog messages can be send to destinations other than the console such as the logging buffer, syslog servers, and terminal lines.

## Syslog Message Format

By default, the general format of syslog messages generated by the syslog process on the Cisco IOS XR software is as follows:

```
node-id : timestamp : process-name [pid] : % message category -group -severity -message  
-code : message-text
```

The following table describes the general format of syslog messages on Cisco IOS XR software.

**Table 1: Format of Syslog Messages**

Field	Description
node-id	Node from which the syslog message originated.

Field	Description
timestamp	Time stamp in the month day HH:MM:SS format, indicating when the message was generated.  <b>Note</b> The time-stamp format can be modified using the <b>service timestamps</b> command.
process-name	Process that generated the syslog message.
size	Process ID (pid) of the process that generated the syslog message.
[ pid ]	Message category, group name, severity, and message code associated with the syslog message.
message-text	Text string describing the syslog message.

### Syslog Message Severity Levels

In the case of logging destinations such as console terminal, syslog servers and terminal lines, you can limit the number of messages sent to a logging destination by specifying the severity level of syslog messages. However, for the logging buffer destination, syslog messages of all severity will be sent to it irrespective of the specified severity level. In this case, the severity level only limits the syslog messages displayed in the output of the command **show logging**, at or below specified value. The following table lists the severity level keywords that can be supplied for the severity argument and the corresponding UNIX syslog definitions in order from the most severe level to the least severe level.

*Table 2: Syslog Message Severity Levels*

Severity Keyword	Level	Description
emergencies	0	System unusable
alert	1	Immediate action needed
critical	2	Critical conditions
errors	3	Error conditions
warnings	4	Warning conditions
notifications	5	Normal but significant condition
informational	6	Informational messages only
debugging	7	Debugging messages

## Prerequisites for Configuring System Logging

These prerequisites are required to configure the logging of system messages in your network operating center (NOC):

- You must be in a user group associated with a task group that includes the proper task IDs. The command reference guides include the task IDs required for each command. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.
- You must have connectivity with syslog servers to configure syslog server hosts as the recipients for syslog messages.

## Configuring System Logging

Perform the tasks in this section for configuring system logging as required.

### Configuring Logging to the Logging Buffer

Syslog messages can be sent to multiple destinations including an internal circular buffer known as logging buffer. You can send syslog messages to the logging buffer using the **logging buffered** command.

#### Configuration Example

This example shows the configuration for sending syslog messages to the logging buffer. The size of the logging buffer is configured as 3000000 bytes. The default value for the size of the logging buffer is 2097152 bytes.

```
RP/0/RP0/CPU0:Router# configure
RP/0/RP0/CPU0:Router(config)# logging buffered 3000000
RP/0/RP0/CPU0:Router(config)# commit
```

### Configuring Logging to a Remote Server

Syslog messages can be sent to destinations other than the console, such as logging buffer, syslog servers, snmp servers and terminal lines. You can send syslog messages to an external syslog server by specifying the ip address or hostname of the syslog server using the **logging** command. Also you can configure the syslog facility in which syslog messages are sent by using the **logging facility** command.

The following table list the features supported by Cisco IOS XR Software to help managing syslog messages sent to syslog servers.

**Table 3: Features for Managing Syslog Messages**

Features	Description
UNIX system log facility	Facility is the identifier used by UNIX to describe the application or process that submitted the log message. You can configure the syslog facility in which syslog messages are sent by using the <b>logging facility</b> command.

Features	Description
Hostname prefix logging	Cisco IOS XR Software supports hostname prefix logging. When enabled, hostname prefix logging appends a hostname prefix to syslog messages being sent from the router to syslog servers. You can use hostname prefixes to sort the messages being sent to a given syslog server from different networking devices. Use the <b>logging hostname</b> command to append a hostname prefix to syslog messages sent to syslog servers
Syslog source address logging	By default, a syslog message sent to a syslog server contains the IP address of the interface it uses to leave the router. Use the <b>logging source-interface</b> command to set all syslog messages to contain the same IP address, regardless of which interface the syslog message uses to exit the router.

### Configuration Example for Logging to Syslog Server

This example shows the configuration for sending syslog messages to an external syslog server. The ip address 209.165.201.1 is configured as the syslog server.

```
Router# configure
Router(config)# logging 209.165.201.1 vrf default
Router(config)# logging facility kern (optional)
Router(config)# logging hostnameprefix 203.0.113.1 (optional)
Router(config)# logging source-interface HundredGigE 0/0/1/0 (optional)
Router(config)# commit
```

### Configuration Example for Logging to SNMP Server

This example shows the configuration for sending syslog messages to an SNMP server. The logging trap command is used to limit the logging of messages sent to the snmp servers based on severity.

```
Router# configure
Router(config)# snmp-server traps syslog
Router(config)# logging trap warnings
Router(config)# commit
```

For more information on SNMP server configurations, see the *Configuring Simple Network Management Protocol* chapter in the *System Management Configuration Guide for Cisco NCS 540 Series Routers*

### Related Topics

- [Configuring Logging to the Logging Buffer, on page 3](#)
- [Configuring Logging to Terminal Lines, on page 4](#)

## Configuring Logging to Terminal Lines

By default syslog messages will be sent to the console terminal. But, syslog messages can also be sent to terminal lines other than the console. You can send syslog messages to the logging buffer using the **logging monitor** command.

### Configuration Example

This example shows the configuration for sending syslog messages to terminal lines other than console. In this example, severity level is configured as critical. The terminal monitor command is configured to display syslog messages during a terminal session. The default severity level is debugging.

```
RP/0/RP0/CPU0:Router# configure
RP/0/RP0/CPU0:Router(config)# logging monitor critical
RP/0/RP0/CPU0:Router(config)# commit
RP/0/RP0/CPU0:Router# terminal monitor
```

## Modifying Logging to Console Terminal

By default syslog messages will be sent to the console terminal. You can modify the logging of syslog messages to the console terminal

### Configuration Example

This example shows how to modify the logging of syslog messages to the console terminal.

```
RP/0/RP0/CPU0:Router# configure
RP/0/RP0/CPU0:Router(config)# logging console alerts
RP/0/RP0/CPU0:Router(config)# commit
```

## Modifying Time Stamp Format

By default, time stamps are enabled for syslog messages. Time stamp is generated in the month day HH:MM:SS format indicating when the message was generated.

### Configuration Example

This example shows how to modify the time-stamp for syslog and debugging messages.

```
RP/0/RP0/CPU0:Router# configure
RP/0/RP0/CPU0:Router(config)# service timestamps log datetime localtime msec or service
timestamps log uptime
RP/0/RP0/CPU0:Router(config)# service timestamps debug datetime msec show-timezone or service
timestamps debug uptime
RP/0/RP0/CPU0:Router(config)# commit
```

## Suppressing Duplicate Syslog Messages

Suppressing duplicate messages, especially in a large network, can reduce message clutter and simplify the task of interpreting the log. The duplicate message suppression feature substantially reduces the number of duplicate event messages in both the logging history and the syslog file.

### Configuration Example

This example shows how to suppress the consecutive logging of duplicate syslog messages.

```
RP/0/RP0/CPU0:Router# configure
RP/0/RP0/CPU0:Router(config)# logging suppress duplicates
RP/0/RP0/CPU0:Router(config)# commit
```

## Archiving System Logging Messages to a Local Storage Device

Syslog messages can also be saved to an archive on a local storage device, such as the hard disk or a flash disk. Messages can be saved based on severity level, and you can specify attributes such as the size of the

archive, how often messages are added (daily or weekly), and how many total weeks of messages the archive will hold. You can create a logging archive and specify how the logging messages will be collected and stored by using the **logging archive** command.

The following table lists the commands used to specify the archive attributes once you are in the logging archive submode.

**Table 4: Commands Used to Set Syslog Archive Attributes**

Features	Description
<b>archive-length</b> weeks	Specifies the maximum number of weeks that the archive logs are maintained in the archive. Any logs older than this number are automatically removed from the archive.
<b>archive-size</b> size	Specifies the maximum total size of the syslog archives on a storage device. If the size is exceeded then the oldest file in the archive is deleted to make space for new logs.
<b>device</b> {disk0   disk1   harddisk}	Specifies the local storage device where syslogs are archived. By default, the logs are created under the directory device/ <b>var/log</b> . If the device is not configured, then all other logging archive configurations are rejected. We recommend that syslogs be archived to the harddisk because it has more capacity than flash disks.
<b>file-size</b> size	Specifies the maximum file size (in megabytes) that a single log file in the archive can grow to. Once this limit is reached, a new file is automatically created with an increasing serial number.
<b>frequency</b> {daily   weekly}	Specifies if logs are collected on a daily or weekly basis.
<b>severity</b> severity	Specifies the minimum severity of log messages to archive. All syslog messages greater than or equal to this configured level are archived while those lesser than this are filtered out.

### Configuration Example

This example shows how to save syslog messages to an archive on a local storage device.

```
Router#conf t
Router(config)#logging archive
Router(config-logging-arch)#device disk1
Router(config-logging-arch)#frequency weekly
Router(config-logging-arch)#severity warnings
Router(config-logging-arch)#archive-length 6
Router(config-logging-arch)#archive-size 50
Router(config-logging-arch)#file-size 10
Router(config-logging-arch)#commit
```

## Platform Automated Monitoring

Platform Automated Monitoring (PAM) is a system monitoring tool integrated into Cisco IOS XR software image to monitor the following issues:

- process crashes
- memory leaks
- CPU hogs
- tracebacks
- disk usage

PAM is enabled by default. When the PAM tool detects any of these system issues, it collects the required data to troubleshoot the issue, and generates a syslog message stating the issue. The auto-collected troubleshooting information is then stored as a separate file in `hddisk:/cisco_support/` or in `/misc/disk1/cisco_support/` directory.

### PAM Events

When PAM detects a process crash, traceback, potential memory leak, CPU hog, a full file system, , it automatically collects logs and saves these logs (along with the core file in applicable cases) as a `.tgz` file in `hddisk:/cisco_support/` or in `/misc/disk1/cisco_support/` directory. PAM also generates a syslog message with severity level as warning, mentioning the respective issue.

The format of the `.tgz` file is: `PAM-<platform>-<PAM event>-<node-name>-<PAM process>-<YYYYMMDD>-<checksum>.tgz`. For example, `PAM--crash-xr_0_RP0_CPU0-ipv4_rib-2016Aug16-210405.tgz` is the file collected when PAM detects a process crash.

Because PAM assumes that core files are saved to the default archive folder (`hddisk:/` or `/misc/disk1/`), you must not modify the location of core archive (by configuring exception filepath) or remove the core files generated after PAM detects an event. Else, PAM does not detect the process crash. Also, once reported, the PAM does not report the same issue for the same process in the same node again.

For the list of commands used while collecting logs, refer [Files Collected by PAM Tool, on page 10](#).

The sections below describe the main PAM events:

#### Crash Monitoring

The PAM monitors process crash for all nodes, in real time. This is a sample syslog generated when the PAM detects a process crash:

```
RP/0/RP0/CPU0:Aug 16 21:04:06.442 : logger[69324]: %OS-SYSLOG-4-LOG_WARNING : PAM detected
  crash for ipv4_rib on 0_RP0_CPU0.
All necessary files for debug have been collected and saved at
0/RP0/CPU0 : hddisk:/cisco_support/PAM--crash-xr_0_RP0_CPU0-ipv4_rib-2016Aug16-210405.tgz
```

Please copy tgz file out of the router and send to Cisco support. This tgz file will be removed after 14 days.)

### Traceback Monitoring

The PAM monitors tracebacks for all nodes, in real time. This is a sample syslog generated when the PAM detects a traceback:

```
RP/0/RP0/CPU0:Aug 16 21:42:42.320 : logger[66139]: %OS-SYSLOG-4-LOG_WARNING : PAM detected
  traceback for ipv4_rib on 0_RP0_CPU0.
All necessary files for debug have been collected and saved at
0/RP0/CPU0 :
harddisk:/cisco_support/PAM--traceback-xr_0_RP0_CPU0-ipv4_rib-2016Aug16-214242.tgz
Please copy tgz file out of the router and send to Cisco support. This tgz file will be
removed after 14 days.)
```

### Memory Usage Monitoring

The PAM monitors the process memory usage for all nodes. The PAM detects potential memory leaks by monitoring the memory usage trend and by applying a proprietary algorithm to the collected data. By default, it collects top output on all nodes periodically at an interval of 30 minutes.

This is a sample syslog generated when the PAM detects a potential memory leak:

```
RP/0/RP0/CPU0:Aug 17 05:13:32.684 : logger[67772]: %OS-SYSLOG-4-LOG_WARNING : PAM detected
  significant memory increase
  (from 13.00MB at 2016/Aug/16/20:42:41 to 28.00MB at 2016/Aug/17/04:12:55) for
  pam_memory_leaker on 0_RP0_CPU0.
All necessary files for debug have been collected and saved at
0/RP0/CPU0 :
harddisk:/cisco_support/PAM--memory_leak-xr_0_RP0_CPU0-pam_memory_leaker-2016Aug17-051332.tgz

(Please copy tgz file out of the router and send to Cisco support. This tgz file will be
removed after 14 days.)
```

### CPU Monitoring

The PAM monitors CPU usage on all nodes periodically at an interval of 30 minutes. The PAM reports a CPU hog in either of these scenarios:

- When a process constantly consumes high CPU (that is, more than the threshold of 90 percentage)
- When high CPU usage lasts for more than 60 minutes

This is a sample syslog generated when the PAM detects a CPU hog:

```
RP/0/RP0/CPU0:Aug 16 00:56:00.819 : logger[68245]: %OS-SYSLOG-4-LOG_WARNING : PAM detected
  CPU hog for cpu_hogger on 0_RP0_CPU0.
All necessary files for debug have been collected and saved at 0/RP0/CPU0 :
harddisk:/cisco_support/PAM--cpu_hog-xr_0_RP0_CPU0-cpu_hogger-2016Aug16-005600.tgz
(Please copy tgz file out of the router and send to Cisco support. This tgz file will be
removed after 14 days.)
RP/0/RP0/CPU0:Jun 21 15:33:54.517 : logger[69042]: %OS-SYSLOG-1-LOG_ALERT : PAM detected
  ifmgr is hogging CPU on 0_RP0_CPU0!
```

### File System Monitoring

The PAM monitors disk usage on all nodes periodically at an interval of 30 minutes. This is a sample syslog generated when the PAM detects that a file system is full:



```
RP/0/RP0/CPU0:Jun 20 13:59:04.986 : logger[66125]: %OS-SYSLOG-4-LOG_WARNING : PAM detected
/misc/config is full on 0_1_CPU0
(please clean up to avoid any fault caused by this). All necessary files for debug have
been collected and saved at
0/RP0/CPU0 : harddisk:/cisco_support/PAM--disk_usage-xr_0_1_CPU0-2016Jun20-135904.tgz
(Please copy tgz file out of the router and send to Cisco support. This tgz file will be
removed after 14 days.)
```

## Disable and Re-enable PAM

The PAM tool consists of three monitoring processes—`monitor_cpu.pl`, `monitor_crash.pl`, and `monitor_show_show_logging.pl`.

Before disabling or re-enabling the PAM, use these options to check if the PAM is installed in the router:

- From Cisco IOS XR Command Line Interface:

```
Router# show processes pam_manager location all
Tue Jun 14 17:58:42.791 UTC
node:      node0_RP0_CPU0
           Job Id: 317
           PID: 14070
           Executable path: /opt/cisco/XR/packages/iosxr-infra.rp-6.1.1.17I/bin/pam_manager

           Instance #: 1
           Version ID: 00.00.0000
           Respawn: ON
           Respawn count: 4
           Last started: Mon Jun 13 23:08:43 2016
           Process state: Run
           Package state: Normal
           core: MAINMEM
           Max. core: 0
           Level: 999
           Placement: None
           startup_path:
/opt/cisco/XR/packages/iosxr-infra.rp-6.1.1.17I/startup/pam_manager.startup
           Ready: 0.166s
           Process cpu time: 0.200 user, 0.310 kernel, 0.510 total
JID  TID  Stack  pri  state  NAME  rt_pri
317  14070  0K  20  Sleeping  pam_manager  0
317  14071  0K  20  Sleeping  lwm_debug_threa  0
317  14076  0K  20  Sleeping  pam_manager  0
317  14077  0K  20  Sleeping  lwm_service_thr  0
317  14078  0K  20  Sleeping  qsm_service_thr  0
317  14080  0K  20  Sleeping  pam_manager  0
```

- From router shell prompt:

```
Router# run ps auxw|egrep perl

root    12559  0.0  0.0  57836 17992 ?        S    Apr24   0:00 /usr/bin/perl
/pkg/opt/cisco/pam//pam_plugin.pl
```

### Disable PAM

To disable PAM agent systemwide, execute the following command from XR EXEC mode:

```
Router# disable-pam
```




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**Note** The Cisco NCS 540 Series Routers are fixed routers with only 1 RP. The **process shutdown pam\_manager location all** command is *not* supported on the Cisco NCS 540 Series Routers.

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### Re-enable PAM

To re-enable PAM agent systemwide, execute the following command from XR EXEC mode:

```
Router# enable-pam
```




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**Note** The Cisco NCS 540 Series Routers are fixed routers with only 1 RP. The **process start pam\_manager location all** command is *not* supported on the Cisco NCS 540 Series Routers.

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## Data Archiving in PAM

At any given point of time, PAM does not occupy more than 200 MB of harddisk: space. If more than 200 MB is needed, then PAM archives old files and rotates the logs automatically.

The PAM collects CPU or memory usage (using **top -b -n1** command) periodically at an interval of 30 minutes. The files are saved under `harddisk:/cisco_support/` directory with the filename as `<node name>.log` (for example, `harddisk:/cisco_support/xr-0_RP0_CPU0.log`). When the file size exceeds the limit of 15MB, the file is archived (compressed) into `.tgz` file, and then rotated for a maximum of two counts (that is, it retains only two `.tgz` files). The maximum rotation count of `.tgz` files is three. Also, the old file (ASCII data) is archived and rotated if a node is reloaded. For example, `xr-0_RP0_CPU0.log` is archived if RP0 is reloaded.

You must not manually delete the core file generated by the PAM. The core file is named as `<process name>_pid.by_user.<yyyymmdd>-<hhmmss>.<node>.<checksum>.core.gz`.

## Files Collected by PAM Tool

The table below lists the various PAM events and the respective commands and files collected by the PAM for each event.

You can attach the respective `.tgz` file when you raise a service request (SR) with Cisco Technical Support.

Event Name	Commands and Files Collected by PAM
Process crash	<ul style="list-style-type: none"> <li>• <b>show install active</b></li> <li>• <b>show platform</b></li> <li>• <b>show version</b></li> <li>• core (gz) file</li> <li>• core.txt file</li> </ul>

Event Name	Commands and Files Collected by PAM
Process traceback	<ul style="list-style-type: none"> <li>• <b>show dll pid</b></li> <li>• <b>show install active</b></li> <li>• <b>show logging</b></li> <li>• <b>show platform</b></li> <li>• <b>show version</b></li> </ul>
Memory leak	<ul style="list-style-type: none"> <li>• <b>show install active</b></li> <li>• <b>show platform</b></li> <li>• <b>show version</b></li> <li>• core (gz) file</li> <li>• dumpcore running</li> <li>• continuous memory usage snapshots</li> </ul>
Show logging event	<ul style="list-style-type: none"> <li>• <b>show install active</b></li> <li>• <b>show logging</b></li> <li>• <b>show platform</b></li> <li>• <b>show version</b></li> <li>• core (gz) file</li> <li>• core.txt file</li> </ul>
CPU hog	<ul style="list-style-type: none"> <li>• <b>follow process</b></li> <li>• <b>pstack</b></li> <li>• <b>show dll pid</b></li> <li>• <b>show install active</b></li> <li>• <b>show platform</b></li> <li>• <b>show version</b></li> <li>• <b>top -H</b></li> <li>• core (gz) file</li> <li>• CPU usage snapshots</li> </ul>

Event Name	Commands and Files Collected by PAM
Disk usage	<ul style="list-style-type: none"><li>• <b>show install active</b></li><li>• <b>show platform</b></li><li>• <b>show version</b></li><li>• console log</li><li>• core (gz) file</li><li>• Disk usage snapshots</li></ul>