



# SAA Application Performance Monitor

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## Feature History

Release	Modification
11.2	The Response Time Reporter feature was introduced.
12.0(5)T	The Response Time Reporter feature was replaced by the Cisco Service Assurance Agent (SAA) feature.
12.2(2)T	The SAA Application Performance Monitor feature is introduced.

This document describes the Cisco Service Assurance Agent (SAA) Application Performance Monitor (APM) feature as implemented in Cisco IOS Release 12.2(2)T. It includes the following sections:

- [Feature Overview, page 1](#)
- [Supported Platforms, page 3](#)
- [Supported Standards, MIBs, and RFCs, page 4](#)
- [Configuration Tasks, page 4](#)
- [Monitoring and Maintaining the SAA APM, page 8](#)
- [Command Reference, page 9](#)

## Feature Overview

The Cisco SAA is a Cisco IOS software feature that allows you to monitor network performance between a Cisco router and a remote device (which can be another Cisco router, an IP Host or an MVS host). Performance can be measured for real world scenarios through the configuration of SAA operations that are executed periodically. Various performance metrics measured include round trip response time, connect time, packet loss, application performance, and inter-packet delay variance (jitter). The SA Agent allows you to receive notifications and perform troubleshooting and problem analysis based on these metrics.

The SAA Application Performance Monitor (APM) allows you to monitor the performance of network-hosted applications by emulating the traffic of these applications. The SAA APM can also emulate and measure the performance of SAA Frame Relay and Path Jitter operations.

Monitoring the performance of network-hosted applications enables service providers and IT departments to verify that applications are performing as needed and to implement improvements as necessary.

APM operates differently from most SAA operations. Standard SA Agent operations allow the monitoring of protocol-based activity between a source and a destination, while APM operations monitor software application transactions between a source and a destination.

APM provides a way of monitoring client/server applications between devices by emulating application transactions. When using APM, one Cisco device is the application server node, and another is the application client node. Using SAA terminology, the transmitting device (the server) is the agent, and the receiving device (the client) is the responder. A single Cisco device can function as both a client and a server for network applications.

Applications are emulated through the use of downloadable scripts and configuration files. APM configuration files contain information about which script and scheduler files to run. APM configuration files use the “.cf” suffix. Script files are written in TCL and use the “.scr” suffix. Execution of APM operations can be scheduled through the use of scheduler files, which use the “.sch” suffix.

The following APM script files are embedded on the router running the SAA:

- **frm.scr**—Script for emulating Frame Relay Monitor operations.
- **iptv.scr**—Script for IPTV, NetMeeting, and RealNetworks audio and video file emulation
- **ldap.scr**—Script for LDAP (Lightweight Directory Access Protocol) emulation
- **lotus\_snd.scr**—Script for Lotus Notes “send email” emulation
- **nntp.scr**—Script for NNTP (Network News Transfer Protocol) emulation; measures the time required for retrieving a news article using NNTP
- **pattern.scr**—Script for ACSII/BINARY/HEX pattern matching for data integrity
- **pjm-many.scr**—Script for emulating Path Jitter Monitor operations
- **pop3.scr**—Script for POP3 “retrieve email” emulation
- **sap-auth.scr, sap-inv.scr, sap-login.scr, sap-pur.scr**—Script for SAP business-to-business database transaction emulation (SAP authentication processes, SAP invoice generation, SAP login process, and SAP purchase order generation)
- **smtplib.scr**—Script for SMTP (Simple Mail Transfer Protocol) “send email” emulation
- **tcp.scr**—Script for Round Trip Time measurement over TCP/IP.
- **udp.scr**—Script for Round Trip Time measurement over UDP

Each script (“.scr”) file has a corresponding configuration (“.cf”) file and data (“.dat”) file. To download the script, configuration, data, and scheduler files used by the SAA APM, and to download the documentation (“readme” files) for the scripts, go to the “Cisco SAA APM” page at <http://www.cisco.com/cgi-bin/tablebuild.pl/saa-apm>.

## Benefits

### Application Performance Monitoring

Monitoring the performance of applications is a high-priority task for service providers that host applications (application service providers), and for enterprise IT departments that support a multitude of applications on a day-to-day basis. By using the SAA APM, performance can be measured for a combination of parameters such as response time, throughput, and availability. By measuring performance, providers can define and verify service-level agreements (SLAs) for their customers.

### Frame Relay Monitoring

The SAA Frame Relay operation allows users to measure parameters such as response time (round trip latency), frame loss, and data integrity over Frame Relay circuits (such as PVCs). By measuring these parameters, providers can verify if the protocol is working correctly to meet customer needs. While a basic Frame Relay monitoring operation can be configured as a standard SAA operation using the CLI, the full performance monitoring functionality can only be configured using the SAA APM (using the Frame Relay APM script files).

## Related Features and Technologies

- NetFlow (<http://www.cisco.com/go/netflow>)
- Internetwork Performance Monitor (IPM) (<http://www.cisco.com/go/ipm>)
- Simple Network Management Protocol (SNMP)

## Related Documents

For details on configuring the Cisco SAA, refer to the “Network Monitoring Using Cisco Service Assurance Agent” chapter in the Release 12.2 *Cisco IOS Configuration Fundamental Configuration Guide* and the “Cisco Service Assurance Agent Commands” chapter in the Release 12.2 *Cisco IOS Configuration Fundamentals Command Reference*.

For other SAA enhancements introduced in Cisco IOS Release 12.2(2)T, including the Frame Relay monitoring operation, see the “SAA Support for Frame Relay, VoIP, and MPLS VPN Monitoring” feature module document.

For complete documentation on APM scripts and scheduler files, see the “readme” files contained in the .zip file available from <http://www.cisco.com/cgi-bin/tablebuild.pl/saa-apm>.

## Supported Platforms

- Cisco 2600 Series Multiservice Platforms
- Cisco 3600 Series Multiservice Platforms (Cisco 3620, 3640, and 3660 Routers)
- Cisco MC3810 Multiservice Access Concentrators
- Cisco 7200 Series Routers
- Cisco 7500 Series Routers (rsp images)

### Determining Platform Support Through Feature Navigator

Cisco IOS software is packaged in feature sets that support specific platforms. To get updated information regarding platform support for this feature, access Feature Navigator. Feature Navigator dynamically updates the list of supported platforms as new platform support is added for the feature.

Feature Navigator is a web-based tool that enables you to quickly determine which Cisco IOS software images support a specific set of features and which features are supported in a specific Cisco IOS image.

To access Feature Navigator, 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 at <http://www.cisco.com/register>.

Feature Navigator is updated regularly when major Cisco IOS software releases and technology releases occur. For the most current information, go to the Feature Navigator home page at the following URL:

<http://www.cisco.com/go/fn>

## Supported Standards, MIBs, and RFCs

### Standards

No new or modified standards are supported by this feature.

### MIBs

- The Cisco SAA Application Performance Monitor MIB (CISCO-SAA-APM-MIB.my) is introduced for this release.

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:

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

### RFCs

No new or modified RFCs are supported by this feature.

## Configuration Tasks

See the following sections for configuration tasks for the SAA APM feature. Each task is identified as either required or optional.

- [Setting the SAA APM Cache Size](#) (optional)
- [Copying APM Files to the SAA Device](#) (required)
- [Preparing a System for APM Operation Reception](#) (required for some operations)
- [Configuring SAA APM Operations](#) (required)
- [Changing the Memory Threshold for the SAA APM](#) (optional)
- [Erasing Files from the SAA APM Cache](#) (optional)

## Setting the SAA APM Cache Size

APM script and scheduler files are kept in an area of memory called the APM cache. The default APM cache size is 100,000 bytes. The cache size is checked by the system before each attempt to copy a new file to the cache. If the file to be downloaded puts the cache over its size limit, a cache trimming operation is performed, and all files in the cache not tagged with a “sticky bit” will be deleted. To set the size of the APM cache, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>saa apm cache-size</b> <i>bytes</i>	Sets the size of the SAA APM cache.

## Copying APM Files to the SAA Device

The APM script and scheduler files for the emulation to be performed must be copied to the routing device running the SAA prior to performing the operation. To copy script or scheduler files from an FTP server to the device that will initiate the APM operations, use the following commands in global configuration mode as needed:

Command	Purpose
Router(config)# <b>saa apm copy script</b> <b>ftp://</b> [ <i>user:password@</i> ] <i>server-name/path-to-file/filename</i> [ <b>sticky</b> ]	Copies an APM script file from the server specified to the APM cache in NVRAM. If the optional <b>sticky</b> keyword is used, the specified file will not be deleted from the APM cache during a cache trimming operation.
Router(config)# <b>saa apm copy scheduler</b> <b>ftp://</b> [ <i>user:password@</i> ] <i>server-name/path-to-file/filename</i> [ <b>sticky</b> ]	Copies an APM scheduler file from the server specified to the APM cache in NVRAM. If the optional <b>sticky</b> keyword is used, the specified file will not be deleted from the APM cache during a cache trimming operation.

Files tagged with a “sticky bit” can be deleted by using the **clear saa apm cache** global configuration command.

To confirm that the files were copied successfully, use the **show saa apm cache** command in EXEC mode.

## Preparing a System for APM Operation Reception

To prepare the destination device (the application client) for certain SAA APM operations, you must enable the SAA RTR Responder on the device. Enabling the SAA RTR Responder is only necessary if there is to be separate control and data transactions; in other words, if an application server is enabled on the destination device, the Responder is not necessary.

To enable the SAA RTR Responder, use the following command in global configuration mode:

Command	Purpose
Router# <b>rtr responder</b>	Enables the SAA RTR Responder.

The SAA RTR Responder can also be enabled from a network management system (NMS) using SNMP. To enable the Responder from an NMS, use the **rttMonApplResponder -i 1** SNMP command.

## Configuring SAA APM Operations

The APM configuration file for the APM operation should be kept on an FTP server accessible to the routing device running the SAA. The configuration file references the appropriate script (SCR), scheduler (SCH), and data (DAT) files. The configuration file also specifies the target of the APM operation (using the TARGET\_IP variable).

To create and start an application performance monitoring operation, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>saa apm operation</b> <i>operation-number</i> <b>start</b> <b>ftp://[user:password@]server-name/path-to-file/filename</b>	Configures an SAA APM operation by assigning an operation number, starting the operation, and indicating the location of the APM configuration file to be used for the operation.

The process of performing an APM operation involves starting and stopping the operation. After the operation is stopped, the data gathered during the operation can be retrieved using the **show saa apm** commands described in the “[Monitoring and Maintaining the SAA APM](#)” section. The recommended method for stopping operations is to configure the operation to stop after a certain number of iterations in the APM configuration file. However, you can also manually stop an APM operation using the CLI. To stop an APM operation manually, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>saa apm operation</b> <i>operation-number</i> <b>stop</b>	Stops a running SAA APM operation.

An APM operation will be removed from the system configuration when the ageout timer for the operation expires, or when the operation is deleted manually. The ageout timer is set using the OPER\_AGEOUT value in the APM configuration file, and begins to count down after an operation is stopped. To manually delete an operation, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>no saa apm operation</b> [ <i>operation-number</i> ]	Deletes the specified SAA APM operation. If an <i>operation-number</i> is not specified, all APM operations are deleted.

## Changing the Memory Threshold for the SAA APM

To specify how much memory must be available on the router to allow APM operations to be configured, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>saa apm lowWaterMark</b> bytes	Specifies the lowest amount of free memory (in bytes) that must be available on the system to allow additional SAA APM operations to be configured.

The **saa apm lowWaterMark** global configuration command configures the lowest amount of free memory that must be available on the system. If the amount of available free memory falls below the value specified in the **saa apm lowWaterMark** command, then the SAA will not allow new APM operations to be configured. (The **lowWaterMark** value is also referred to as the low-memory value or the low-memory-watermark value.) The default value is 25 percent of the memory available on the system at startup.



### Note

The smaller the low-memory-watermark value is, the more APM operations can be configured. If the value is set to 0, then APM operations can be created until the system runs out of memory. However, you should be careful not to set the low-memory-watermark too low, as all additional router processes must be able to run with the amount of memory specified by the **saa apm lowWaterMark** and **rtr low-memory** commands. Setting the low-memory-watermark to 0 is not recommended, as other router processes may not be left with enough system memory to function.

For example, if there are 6 MB of free memory when the system starts up, and the default low-memory-watermark of 25 percent is used, then the SAA APM can use up to 4.5 MB memory for creating operations. If the free memory drops below 1.5 MB, then new APM operations cannot be created.

The value of the **saa apm lowWaterMark** command should not exceed the amount of free memory available on the system. To determine the amount of free memory available on the system, use the **show memory EXEC** command.

The **show saa apm information EXEC** command will display the number of operations that can be run on the device in the “Max Number of oper supported” field.

## Erasing Files from the SAA APM Cache

To erase files from the SAA APM cache, use any of the following forms of the **clear saa apm cache** command in global configuration mode:

Command	Purpose
Router(config)# <b>clear saa apm cache local</b> [force]	Erases all local files stored in the APM cache. Use of the optional <b>force</b> keyword will delete those files tagged as “sticky.”

Command	Purpose
Router(config)# <b>clear saa apm cache remote</b> [ <b>force</b> ]	Erases all remote files stored in the APM cache. Use of the optional <b>force</b> keyword will delete those files tagged as “sticky.”
Router(config)# <b>clear saa apm cache file</b> <i>filename</i> [ <b>force</b> ]	Erases only the file specified with the <i>filename</i> argument. The <b>force</b> keyword is required to delete the file if that file is tagged as “sticky.”

## Monitoring and Maintaining the SAA APM

See the following sections for monitoring and maintenance tasks for the SAA APM feature:

- [Displaying SAA APM Operation Results](#)
- [Displaying SAA APM Status](#)

### Displaying SAA APM Operation Results

To view the results of the SAA APM operation, use the following command in EXEC mode:

Command	Purpose
Router# <b>show saa apm results</b> [ <i>operation-number</i> ]	Displays the data gathered using the SAA APM.

### Displaying SAA APM Status

To display information about the status of the SAA APM, use any of the following commands in EXEC mode:

Command	Purpose
Router# <b>show saa apm cache</b>	Displays information about all the files in APM cache.
Router# <b>show saa apm information</b>	Displays information about the APM application.
Router# <b>show saa apm operation</b> [ <i>operation-number</i> ]	Displays information about all APM operations running on the system, or about the specified operation.

# Command Reference

This section documents new commands. All other commands used with this feature are documented in the Cisco IOS Release 12.2 command reference publications.

- [clear saa apm cache](#)
- [debug saa apm](#)
- [saa apm cache-size](#)
- [saa apm copy](#)
- [saa apm lowWaterMark](#)
- [saa apm operation](#)
- [show saa apm cache](#)
- [show saa apm information](#)
- [show saa apm operation](#)
- [show saa apm results](#)

# clear saa apm cache

To delete files from the SAA Application Performance Monitor (APM) cache, use the **clear saa apm cache** command in global configuration mode.

```
clear saa apm cache {local | remote | file filename} [force]
```

## Syntax Description

<b>local</b>	Deletes all local files from the APM cache.
<b>remote</b>	Deletes all remote files from the APM cache.
<b>file filename</b>	Deletes only the specified file from the APM cache.
<b>force</b>	(Optional) Forces the local, remote, or specified file to be deleted. This keyword is required to delete those files tagged as “sticky.”

## Defaults

No default behavior or values.

## Command Modes

Global configuration

## Command History

Release	Modification
12.2(2)T	This command was introduced.

## Usage Guidelines

This command will not delete files tagged as “sticky” in the APM cache unless the **force** keyword is used. The sticky bit is set for a file when the file is copied to the router using the **saa apm copy** command. To check if files have the sticky bit set, use the **show saa apm cache** command; those files that show a value of 1 in the “SBit” column have the sticky bit enabled, while those with a sticky value of 0 do not have the sticky bit enabled.

**Examples**

In the following example, all files that are not tagged as “sticky” (as seen in the SBit column of the **show saa apm cache** output) are deleted from the APM cache:

```
Router# show saa apm cache

Cache Size (bytes):100000
Cache used (bytes):2056

    TimeCreated   TimeAccessed   Size Ref Loc Type SBit FileName
09/21 13:31:25 09/21 13:31:48 1170  0  1 SCR  0 user/scripts/ldap-rem.scr
09/21 13:31:20 09/21 13:31:27 1513  0  1 SCR  1 user/scripts/ldap.scr
09/20 14:29:13 09/20 14:29:36  735  0  1 SCR  0 user/scripts/udp-rem.scr

Router# configure terminal
Router(config)# clear saa apm cache local
Router(config)# end
Router# show saa apm cache

Cache Size (bytes):100000
Cache used (bytes):1513

    TimeCreated   TimeAccessed   Size Ref Loc Type SBit FileName
09/21 13:31:20 09/21 13:31:27 1513  0  1 SCR  1 user/scripts/ldap.scr
```

**Related Commands**

Command	Description
<a href="#">show saa apm cache</a>	Displays the amount of memory available in the SAA APM cache and information about the files stored in the cache.

# debug saa apm

To enable debugging output for the SAA Application Performance Monitor (APM), use the **debug saa apm** command in privileged EXEC mode. To disable SAA APM debugging output, use the **no** form of this command.

**debug saa apm**

**no debug saa apm**

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

**Defaults** No default behavior or values.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	12.2(2)T	This command was introduced.

**Examples** The following is sample output from the **debug saa apm** command:

```
Router# debug saa apm
Router# configure terminal
Router(config)# saa apm operation 123 start ftp://apm/config/iptv.cf

21:40:27: SAA-APM-123: downloading file (apm/config/iptv.cf) of size (534)
21:40:29: SAA-APM-123: downloading file (apm/scheduler/master.sch) of size (2500)
21:40:30: SAA-APM-123: downloading file (apm/scripts/iptv.scr) of size (1647)
21:40:32: SAA-APM-123: downloading file (apm/data/iptv.dat) of size (118)
21:40:32: SAA-APM-123: sending APM_CAPABILITIES_REQUEST message
21:40:32: sending control msg:
21:40:32: Ver: 1 ID: 29 Len: 48
21:40:32: SAA-APM-123: apm_engine version: major<1>, minor<0>
21:40:32: SAA-APM-123: sending APM_SCRIPT_DNLD message
21:40:32: sending control msg:
21:40:32: Ver: 1 ID: 30 Len: 148
21:40:37: SAA-APM-123: sending APM_SCRIPT_DNLD_STATUS message
21:40:37: sending control msg:
21:40:37: Ver: 1 ID: 31 Len: 148
21:40:38: SAA-APM-123: starting the operation
21:40:38: SAA-APM-123: sending APM_SCRIPT_START message
21:40:38: sending control msg:
21:40:38: Ver: 1 ID: 32 Len: 148
21:40:41: SAA-APM: 0,2144,0
.
.
.
21:49:42: SAA-APM-123: waiting for ageout timer to expire
21:55:13: SAA-APM-123: sending APM_SCRIPT_DONE message
21:55:13: sending control msg:
```

```
21:55:13: Ver: 1 ID: 42 Len: 148
21:55:13: SAA-APM-123: operation done
Router(config)# no saa apm operation 29
21:55:13: SAA-APM-123: sending APM_SCRIPT_DONE message
21:55:13: sending control msg:
21:55:13: Ver: 1 ID: 42 Len: 148
21:55:13: SAA-APM-123: operation done
```

# saa apm cache-size

To set the size of the SAA Application Performance Monitor (APM) cache, use the **saa apm cache-size** command in global configuration mode. To reset the SAA APM cache size to its default, use the **no** form of this command.

**saa apm cache-size** *bytes*

**no saa apm cache-size** *bytes*

## Syntax Description

*bytes* Number that specifies the size of the cache, in bytes.

## Defaults

The default APM cache size is 100000 bytes.

## Command Modes

Global configuration

## Command History

Release	Modification
12.2(2)T	This command was introduced.

## Usage Guidelines

SAA APM script and scheduler files are kept in an area of memory called the SAA APM cache. The cache size is checked by the system before each attempt to copy a new file to the cache. If the file to be downloaded puts the cache over its size limit, a “cache trimming” operation is performed, and all files in the cache not tagged with a “sticky bit” (sticky=1) will be deleted.

## Examples

In the following example, the SAA APM cache is set to 80,000 bytes (approximately 78 kilobytes):

```
Router(config)# saa apm cache-size 80000
Router(config)# end
Router#
00:01:50: %SYS-5-CONFIG_I: Configured from console by console
Router# show saa apm cache

Cache Size (bytes): 80000
Cache used (bytes): 793

File Name                               TimeCreated TimeAccessed ref Type sticky
apm.cf.1234567                           00:02:50    00:00:00    1 CFG  0
apm/config/sntp-1000.cfg                  00:02:50    00:00:00    1 CFG  0
```

## Related Commands

Command	Description
<a href="#">show saa apm cache</a>	Displays the amount of memory available in the SAA APM cache and information about the files stored in the cache.

## saa apm copy

To copy script or scheduler files from an FTP server to the device that will initiate the SAA Application Performance Monitor (APM) operations, use the **saa apm copy** command in global configuration mode.

```
saa apm copy {script | scheduler}
ftp://[username:password@]server-name/path-to-file/file-name [sticky]
```

Syntax Description		
<b>script</b>		Specifies that the file to be copied is an APM script file (.scr).
<b>scheduler</b>		Specifies that the file to be copied is an APM scheduler file (.sch).
<b>ftp://</b>		Begins the URL that specifies the file to copy from a remote FTP server.
<i>username:password@</i>	(Optional)	Specifies a username and password as part of the URL. Use these arguments only if they are required on the server.
<i>server-name</i>		The server-name component of the URL.
<i>path-to-file</i>		Folder-path component of the URL. A folder-path can contain multiple folder names. Each folder should be separated using a forward slash (/).
<i>filename</i>		Name of the file to be copied from the server.
<b>sticky</b>	(Optional)	Indicates that the copied file should not be deleted from the local APM cache during a cache trimming operation.

**Defaults** No default behavior or values.

**Command Modes** Global configuration

Command History	Release	Modification
	12.2(2)T	This command was introduced.

**Usage Guidelines** The **saa apm copy** command downloads an SAA APM script or scheduler file from an FTP server to the local SAA APM cache in NVRAM.

A file tagged as “sticky” will not be deleted from the local APM cache during a cache trimming operation. APM cache trimming operations are initiated when the **saa apm lowWaterMark** value is reached.

You can force a file tagged as “sticky” to be deleted using the **clear saa apm cache** command.

**Examples** In the following example, a Frame Relay emulation script titled “frm.scr” is downloaded from the FTP server FTP101. The username “joe” and the password “letmein” are used to access the server:

```
Router(config)# saa apm copy script ftp://joe:letmein@FTP101/userbin/joefiles/frm.scr
sticky
```

Related Commands	Command	Description
	<a href="#">clear saa apm cache</a>	Deletes files from the SAA APM cache.
	<a href="#">saa apm lowWaterMark</a>	Specifies the lowest amount of free memory that must be available on the system to allow additional SAAAPM operations to be configured.

## saa apm lowWaterMark

To specify the lowest amount of free memory that must be available on the system to allow additional SAA Application Performance Monitor (APM) operations to be configured, use the **saa apm lowWaterMark** command in global configuration mode. To restore the default low-memory-watermark value, use the **no** form of this command.

**saa apm lowWaterMark** *bytes*

**no saa apm lowWaterMark**

<b>Syntax Description</b>	<i>bytes</i>	Number that specifies the size of the cache, in bytes.
<b>Defaults</b>	The default APM low-memory-watermark is 25 percent of free memory at startup.	
<b>Command Modes</b>	Global configuration	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	12.2(2)T	This command was introduced.

**Usage Guidelines** The **saa apm lowWaterMark** global configuration command configures the lowest amount of free memory (low-memory-watermark) that must be available on the system. If the amount of available free memory falls below the value specified in the **saa apm lowWaterMark** command, then the SAA will not allow new APM operations to be configured. The default value is 25 percent of the memory available on the system at startup.



**Note**

The smaller the low-memory-watermark value is, the more APM operations can be configured. If the value is set to 0, then APM operations can be created until the system runs out of memory. However, you should be careful not to set the low-memory-watermark too low, as all additional router processes must be able to run with the amount of memory specified by the **saa apm lowWaterMark** and **rtr low-memory** commands. Setting the low-memory-watermark to 0 is discouraged, as other router processes may not be left with enough system memory to function.

For example, if there are 6 MB of free memory when the router starts up, and the default low-memory-watermark of 25 percent is used, then the SAA APM can use up to 4.5 MB memory for creating operations. If the free memory drops below 1.5 MB, then new APM operations cannot be created.

The value of the **saa apm lowWaterMark** command should not exceed the amount of free memory available on the system. To determine the amount of free memory available on the system, use the **show memory EXEC** command.

The **show saa apm information EXEC** command will display the number of operations that can be configured on the device in the “Max Number of oper supported” field.

**Examples**

In the following example, the SAA APM low-memory-watermark is set to 3,145,728 bytes (3 MB):

```
Router(config)# saa apm lowWaterMark 3145728
Router(config)# end
Router# show saa apm information
    Service Assurance Agent: Application Performance Monitor

    APM Engine Version: 1.0
Max Number of oper supported: 23
Number of configurable oper: 23
  Number of oper configured: 0
    Number of files in cache: 0
      Cache Size (bytes): 100000
      Cache used (bytes): 0
    APM low memory water-mark: 3,145,728
```

**Related Commands**

Command	Description
<a href="#">show saa apm information</a>	Displays details about the SAA APM.

## saa apm operation

To start or stop an SAA Application Performance Monitor (APM) operation, use the **saa apm operation** command in global configuration mode. To delete existing SAA APM operations, use the **no** form of this command.

```
saa apm operation operation-number {start
ftp://[user:password@]server-name/path-to-file/filename | stop}

no saa apm operation [operation-number]
```

Syntax Description		
<i>operation-number</i>	A number which uniquely identifies the APM operation. In the <b>no saa apm operation</b> form of this command, this argument is optional. If an operation-number is not specified in the <b>no</b> form of this command, all APM operations are removed from the system configuration.	
<b>start</b>	Starts the specified operation.	
<b>ftp://</b>	Begins the URL that specifies the configuration file to use for the APM operation.	
<i>user:password@</i>	(Optional) Allows you to specify a user-name and password as part of the URL if they are required on the server.	
<i>server-name</i>	Server-name component of the URL.	
<i>path-to-file</i>	Folder path component of the URL. Each folder should be separated using a forward slash (/).	
<i>filename</i>	Name of the APM configuration (.cf) file to be used for the operation.	
<b>stop</b>	Stops the specified operation.	

**Defaults** No default behavior or values.

**Command Modes** Global configuration

Command History	Release	Modification
	12.2(2)T	This command was introduced.

**Usage Guidelines** The following files are required to perform an SAA APM operation:

- script file (.scr) available on the routing device running SAA
- scheduler file (.sch) available on the routing device running SAA
- configuration file (.cf) available on an FTP server
- data file (.dat) available on an FTP server

All filenames can have a maximum of 255 characters.

The **saa apm operation start** command points to the APM configuration file to be used for the operation. The APM configuration file specifies the location of the other files used in the operation, and the target IP address for the operation.

To download script, configuration, data, and scheduler template files used by the SAA APM, and to download the documentation (“readme” files) for the scripts, go to the “Cisco SAA APM” page at <http://www.cisco.com/cgi-bin/tablebuild.pl/saa-apm>.

After an operation is started using the **saa apm operation start** command, the operation should be stopped using the **saa apm operation stop** command.

## Examples

In the following example, an SAA APM NNTP operation is started and stopped, and the operation is deleted from the configuration:

```
Router# config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# saa apm operation 2 start
ftp://user:password@saa-nms/apm/config/nntp-20.cf
Router(config)#
1d09h: SAA-APM-1: downloading file (apm/config/nntp-20.cf) of size (532)
1d09h: SAA-APM-1: using cached file (apm/scheduler/master.sch)
1d09h: SAA-APM-1: using cached file (apm/scripts/nntp.scr)
1d09h: SAA-APM-1: sending APM_SCRIPT_DONE message
1d09h: SAA-APM-1: operation done
Router(config)# saa apm operation 2 stop
Router(config)# no saa apm operation 2
```

## Related Commands

Command	Description
<a href="#">show saa apm results</a>	Displays the data gathered using the SAA Application Performance Monitor.

# show saa apm cache

To display the amount of memory available in the SAA Application Performance Monitor (APM) cache and information about the files stored in the cache, use the **show saa apm cache** command in EXEC mode.

## show saa apm cache

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

**Defaults** No default behavior or values.

**Command Modes** EXEC

Command History	Release	Modification
	12.2(2)T	This command was introduced.

**Usage Guidelines** SAA APM script and scheduler files are kept in an area of system memory called the SAA APM cache.

**Examples** The following is sample output from the **show saa apm cache** command:

```
Router# show saa apm cache

Cache Size (bytes): 100000
Cache used (bytes): 6849

TimeCreated   TimeAccessed   Size  Ref  Loc  Type  SBit  FileName
03/21 13:31:25 03/21 13:31:48 1170  0    1    SCR   0    user/scripts/ldap-rem.scr
03/21 13:31:23 03/21 13:31:48   38  0    1    DAT   0    user/data/ldap-rem.dat
03/21 13:31:22 03/21 13:31:27   69  1    0    DAT   0    user/data/ldap.dat
03/21 13:31:20 03/21 13:31:27 1513  1    0    SCR   0    user/scripts/ldap.scr
03/21 13:31:19 03/21 13:31:27 2500  1    0    SCH   0    user/scheduler/master.sch
03/21 13:31:17 03/21 13:31:27  256  1    0    CFG   0    apm.cfg.1
03/21 13:31:17 03/21 13:31:17  568  1    0    CFG   0    user/config/ldap.cf
03/20 14:29:13 03/20 14:29:36  735  0    1    SCR   0    user/scripts/udp-rem.scr
```

[Table 1](#) describes the significant fields shown in the display.

**Table 1** show saa apm cache Field Descriptions

Field	Description
Type	Type of file in the cache. Possible types are: <ul style="list-style-type: none"> <li>• CFG— APM configuration file</li> <li>• DAT — APM data file</li> <li>• SCR—APM script file</li> <li>• SCH—APM scheduler file</li> </ul>
Size	Size of the file, in bytes.
Ref	Ref-count. Indicates how many APM operations are accessing (referencing) the file.
Loc	“Local” value. Indicates whether the file is local or remote. Possible values are: <p>0—File is remote.</p> <p>1—File is local.</p>
SBit	“Sticky bit” value. Possible values are: <p>0—sticky bit not set; this file will be deleted from the APM cache during the next cache trimming operation, or when a <b>clear saa apm cache</b> command is executed.</p> <p>1—sticky bit is set; this file can only be deleted by using the <b>force</b> keyword with the <b>clear saa apm cache</b> command.</p>

**Related Commands**

Command	Description
<b>clear saa apm cache</b>	Deletes files from the SAA Application Performance Monitor cache.
<b>saa apm cache-size</b>	Sets the size of the SAA Application Performance Monitor (APM) cache.
<b>show saa apm operation</b>	Displays details about SAA Application Performance Monitor (APM).

# show saa apm information

To display details about SAA Application Performance Monitor (APM) running on the system, use the **show saa apm information** command in EXEC mode.

## show saa apm information

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

**Defaults** No default behavior or values.

**Command Modes** EXEC

Command History	Release	Modification
	12.2(2)T	This command was introduced.

**Examples** The following is sample output from the **show saa apm information** command:

```
Router# show saa apm information

Service Assurance Agent: Application Performance Monitor

      APM Engine Version: 1.0
Max Number of oper supported: 50
Number of configurable oper: 50
  Number of oper configured: 0
    Number of files in cache: 0
      Cache Size (bytes): 100000
        Cache used (bytes): 0
      APM low memory water-mark: 6708828
```

Related Commands	Command	Description
	<a href="#">saa apm lowWaterMark</a>	Specifies the lowest amount of free memory that must be available on the system to allow additional SAA APM operations to be configured.

## show saa apm operation

To display details about SAA Application Performance Monitor (APM) operations, use the **show saa apm information** command in EXEC mode.

```
show saa apm information [operation-number]
```

<b>Syntax Description</b>	<i>operation-number</i> (Optional) Number that uniquely identifies an APM operation.				
<b>Defaults</b>	Information for all APM operations is displayed.				
<b>Command Modes</b>	EXEC				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>12.2(2)T</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	12.2(2)T	This command was introduced.
Release	Modification				
12.2(2)T	This command was introduced.				

### Examples

The following is sample output from the **show saa apm operation** command:

```
Router# show saa apm operation

      Operation Information:

Operation ID: 1234567
Owner: CLI
ControlFile URL: ftp://user:password@saa-nms/apm/config/sntp-1000.cfg
SNMP Row Status: active
Latest Operation Time: *08:13:40.000 UTC Mon Oct 08 2001
Latest Operation Status: 0
```

# show saa apm results

To display the accumulated data for SAA Application Performance Monitor (APM) operations, use the **show saa apm results** command in EXEC mode.

**show saa apm results** [*operation-number*]

<b>Syntax Description.</b>	<i>operation-number</i>	(Optional) A number that uniquely identifies an APM operation. If an <i>operation-number</i> is not specified, all operation results in the buffer are displayed.
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**Defaults** All APM operation results are displayed.

**Command Modes** EXEC

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	12.2(2)T	This command was introduced.

**Usage Guidelines** SAA APM script and scheduler files are kept in an area of system memory called the SAA APM cache.

**Examples** The following is sample output from the **show saa apm results** command:

```
Router# show saa apm results

Cache Size (bytes): 100000
Cache used (bytes): 14188

File Name                               TimeCreated TimeAccessed ref Type sticky
-----
apm/data/ldap-13.dat                    13:37:20    13:37:25    1 DAT  0
apm.cf.9                                13:37:18    13:37:25    1 CFG  0
apm/config/ldap-13.cf                   13:37:18    00:00:00    1 CFG  0
apm/data/ldap-12.dat                    13:37:15    13:37:20    1 DAT  0
apm.cf.8                                13:37:14    13:37:20    1 CFG  0
apm/config/ldap-12.cf                   13:37:14    00:00:00    1 CFG  0
apm/data/ldap-11.dat                    13:37:11    13:37:16    1 DAT  0
apm.cf.7                                13:37:11    13:37:16    1 CFG  0
apm/config/ldap-11.cf                   13:37:11    00:00:00    1 CFG  0
apm/scripts/ldap.scr                    13:37:07    13:37:29    3 SCR  0
apm/data/iptv-2.dat                     13:36:49    13:36:54    1 DAT  0
apm/config/iptv-2.cf                    13:36:48    00:00:00    1 CFG  0
apm/scripts/iptv.scr                    13:36:47    13:37:08    1 SCR  0
apm/scheduler/master.sch                13:36:45    13:37:34    4 SCH  0
```

Table 2 describes the significant fields shown in the display.

**Table 2** *show saa apm cache Field Descriptions*

Field	Description
Type	Type of file in cache. Possible types are: <ul style="list-style-type: none"> <li>• CFG— APM configuration file</li> <li>• DAT — APM data file</li> <li>• SCR—APM script file</li> <li>• SCH—APM scheduler file</li> </ul>
sticky	“Sticky bit” value. Possible values are: 0—sticky bit not set; this file will be deleted from the APM cache during the next cache trimming operation, or when a <b>clear saa apm cache</b> command is executed.  1—sticky bit is set; this file can only be deleted by using the <b>force</b> keyword with the <b>clear saa apm cache</b> command.

**Related Commands**

Command	Description
<b>clear saa apm cache</b>	Deletes files from the SAA Application Performance Monitor cache.
<b>saa apm cache-size</b>	Sets the size of the SAA Application Performance Monitor cache.
<b>show saa apm operation</b>	Displays details about SAA Application Performance Monitor operations.