SAA for Frame Relay Interfaces

The Cisco Service Assurance Agent (SAA) is an embedded performance monitoring utility in Cisco IOS software. The SAA for Frame Relay Interfaces feature expands the capabilities of SAA by using service level monitoring (SLM) to provide detailed monitoring statistics for Frame Relay connections. This feature provides monitoring for Frame Relay connections; SLM and Frame Relay performance monitoring techniques provide the option to gather statistics for either physical links or circuits. Monitoring service levels for Frame Relay connections allows service providers to ensure that their networks are meeting or exceeding the performance outlined in service level agreements (SLAs).

Specifications for the SAA Monitoring for Frame Relay Cobnnections Feature

Feature History	
Release	**Modification**
12.2(11)T	The SAA for ATM Interfaces (Service Level Monitor) feature was introduced.
12.2(15)T	The SAA for ATM Interfaces (Service Level Monitor) feature was updated (command syntax changed).
12.3(1)	This feature (SAA for Frame Relay Interfaces) was introduced as an extension to the SAA Service Level Monitor.
Supported Platforms	
Cisco 1750, 2650, 2651, 3640 series, 3660 series, and 7200 series	
Document Version	
1.0	May 19, 2003
2.0	June 11, 2003

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Information About SAA for Frame Relay Interfaces

To configure the SAA for Frame Relay Interfaces feature, you should understand the following concepts:

Frame Relay Service Level Monitoring

An SAA Frame Relay monitoring operation ("**type frameRelay**") was introduced in Release 12.2(2)T. This operation is based on the architecture for the other standard monitoring operations in SAA, and uses responder-based probes. This operation sends the configured probe packers (synthetic traffic) from the source to the destination, and the SAA Responder on the destination device returns a reply. The primary metric provided by this operation is Response Time/ Round-Trip Time (RTT) on Frame Relay networks.

The new Frame Relay service level monitoring (SLM) operations are similar to the ATM service level monitoring operations introduced in 12.2(11)T. The SLM Frame Relay operation provides both active and passive monitoring and can be applied to either interfaces or circuits.

Specifically, this feature introduces two new SAA operations and enhances the previously introduced SLM interface/controller operation. These operations provide the following functions:

- Monitoring of a Physical Interface—The SLM interface/controller operation ("**type slm interface**") provides physical layer (Layer 1) data for interfaces or controllers configured for Frame Relay. This operation was enhanced to provide data for serial interfaces and to provide data for T3 (DS3) or E3 controllers.
- Monitoring of a Frame Relay Link—The SLM FR interface operation ("**type slm frame-relay interface**") provides Frame Relay link (Layer 2) data for a Frame Relay interface.
- Monitoring of a Frame Relay Circuit—The SLM FR circuit operation ("**type slm frame-relay pvc interface**") provides Frame Relay permanent virtual circuit (PVC) data.

By using these operations together, you can generate statistics for the physical interface, the Frame Relay connection as a whole, and for specific Frame Relay circuits (PVCs). Table 1 shows the correspondence between the operation name and the command used to enable the operation.

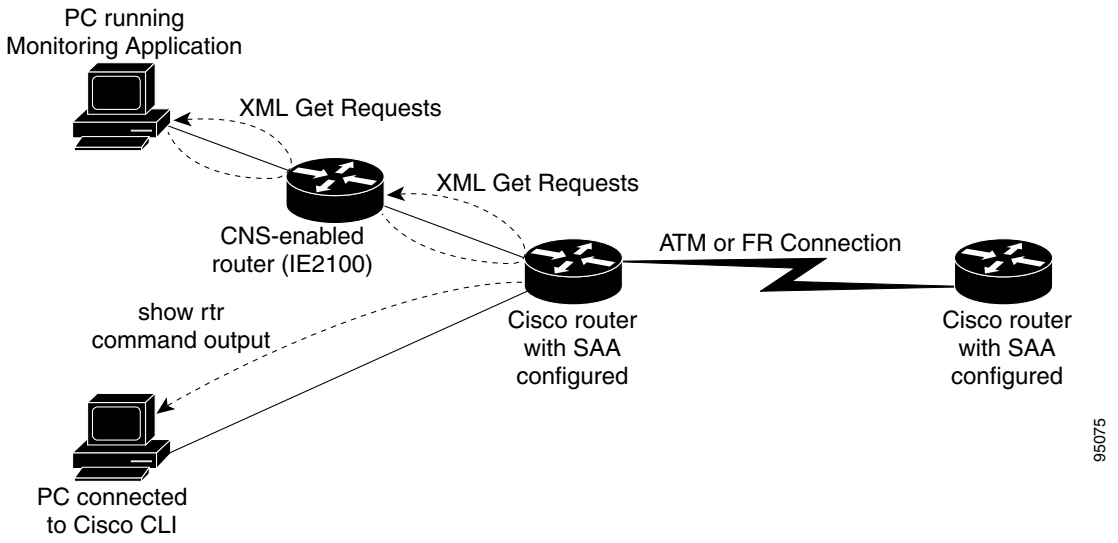
Table 1 Types of SAA Frame Relay Monitoring Operations

Operation	Purpose	Command	Name (Type) in CLI
Frame Relay Operation	Measures response time, frame loss, and data corruption across a Frame Relay PVC.	**type frame-relay interface**	"Frame Relay"
SLM Interface or Controller Operation	Monitors a physical interface configured for Frame Relay or ATM	**type slm** {**interface** | **controller**}	"slm interface" or "slm controller"
SLM FR Interface Operation	Monitors a Frame Relay link	**type slm frame-relay interface**	"Slm Frame-relay Interface"
SLM FR Circuit Operation	Monitors a Frame Relay circuit	**type slm frame-relay pvc interface**	"Slm Frame-relay Pvc"

The metrics provided by SAA service level monitoring operations, such as the Frame Relay operation, are designed to provide information useful in determining that service level agreements (SLAs) are being met (SLA validation). Service providers can use the SLM FR operations to determine round trip time (RTT), bandwidth usage, throughput, packet loss, burst analysis, delivery ratio, utilization, total frames transmitted, total frames received, and more. The SLM FR operations can provide over 100 different metrics for traffic analysis.

The SAA for Frame Relay Interfaces feature can be used with Cisco Networking Services (CNS). A device running CNS, such as the IE2100, can be used to retrieve the FR performance statistics generated by the SAA. An XML Get or Set request can be issued from the IE2100 after the router registers with the CNS event agent. Additionally, these results can be passed, in an XML format, to other devices running third-party monitoring software, such as Visual Networks' UpTime application.

Figure 1 Retrieval Methods for SAA SLM Operational Data



SAA, when used with external applications such as Visual UpTime, provides the information and toolsets required to:

- completely automate the collection, archiving, and presentation of data to validate a carrier SLA
- accurately measure network availability
- accurately measure network delay
- accurately measure throughput

Trending, reporting, troubleshooting and planning tools enhance the performance and availability of the integrated access network. This provides short and long-term cost savings through reduced downtime, increased productivity of network support staff, and optimization of the network.

Enabling Operations on Both Ends of the Connection

Unlike other SAA operations, you do not enable the SAA Responder on the operational target (replying) device. Instead, to get the full monitoring statistics for Frame Relay connections, you should enable the same operation on both the sending (agent) device and replying (target) device. SAA will automatically retrieve the additional statistics generated when the Frame Relay operations are configured on the target device. For Frame Relay SLM operations, it may be helpful to think of the routers as “near-end” and “far-end” devices instead of as “sending” and “replying” devices.

Restrictions for SAA for Frame Relay

There is no SNMP support for enhanced history; however, enhanced history statistics can be retrieved using XML.

How to Configure SAA Monitoring for Frame Relay Connections

To configure SAA Frame Relay monitoring, perform one or more of the following tasks:

- Configuring Monitoring of a Physical Interface or Controller, page 4
- Configuring Monitoring of a Frame Relay Link, page 10
- Configuring Monitoring of a Frame Relay Circuit, page 16
- Enabling CNS for SAA Data Retrieval, page 23

Configuring Monitoring of a Physical Interface or Controller

Frame Relay monitoring using SAA can be configured for an interface or controller at the physical layer, for an interface at the data layer, or for a specific circuit. The follow task describes configuring the SAA operation for a Frame Relay interface or controller at the physical layer.

All steps are required unless otherwise indicated.

Restrictions

To enable full statistics gathering for SAA Frame Relay service level monitoring operations, the operation must be configured on both ends of the Frame Relay connection.

Standard SAA distribution and history statistics are not supported in SLM operations; instead, use the **show enhanced-history** commands. Enhanced history data is stored as individual samples in each bucket. Aggregated (averaged) data for SLM operations is not available from the CLI.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **rtr slm frame-relay statistics**
4. **rtr** *operation-id*
5. **type slm interface** OR **type slm controller**
6. **enhanced history**
7. **owner** (optional)
8. **tag** (optional)
9. **timeout** (optional)
10. **exit**
11. Repeat Steps 1 through 7 on the device at the far end of the connection.
12. **rtr schedule**
13. **end**
14. **copy running-config startup-config** (optional)
15. Allow statistics to be gathered for the desired amount of time.
16. **show rtr operational-state** (optional)
17. **show rtr enhanced-history collection-statistics** (optional)
18. **show rtr enhanced-history distribution-statistics** (optional)

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**rtr slm frame-relay statistics** **Example:** `Router(config)# rtr slm frame-relay statistics`	Enables SAA to collect Frame Relay performance monitoring statistics. • This command is required to begin gathering statistics for the Frame Relay interface or circuit.

	Command or Action	Purpose
Step 4	**rtr** *operation-number* **Example:** `Router(config)# rtr 1`	Specifies an identification number (ID) for the operation being configured, and enters SAA RTR configuration mode.
Step 5	**type slm interface** *type number* OR **type slm controller** *controller-id* **Example:** `Router(config-rtr)# type slm interface Serial5/3` OR `Router(config-rtr)# type slm controller T1 0`	Specifies that the operation is an SLM physical interface operation, which provides information about the data link layer connection, and specifies the interface that the operation should be run on. • Interfaces that can be monitored using this operation include Serial, HSSI (high speed serial interface), and IMA. • Controllers that can be monitored using this operation include T1,E1,T3, and E3. • The specified interface or controller should be configured for Frame Relay. • The **type slm interface** or **type slm controller** commands bring you into SAA SLM Controller/Interface configuration mode.
Step 6	**enhanced-history interval** *seconds* **buckets** *number-of-buckets* **Example:** `Router(config-rtr-slm-if)# enhanced-history interval 900 buckets 100`	Enables SAA enhanced history for the operation. Performance statistics are stored in "buckets" which keep the accumulated data separate from each other. Each bucket consists of data accumulated over the specified interval. For Frame Relay SLM and ATM SLM operations, each bucket consists of 15 minutes (900 seconds) worth of statistics. The following line will be written to the configuration: **enhanced-history interval 900 buckets 100** **Note** Regardless of the values entered for *seconds* and *number-of-buckets*, the default of value of a 900 second interval and 100 history buckets will be used. Your input is overridden in the Frame Relay operations so that complete SLM statistics can be provided.
Step 7	**owner** *string* **Example:** `Router(config-rtr-slm-fr-if)# owner joeuser 209.165.200.225`	(Optional) Specifies an "owner" tag for the operation.
Step 8	**tag** *string* **Example:** `Router(config-rtr-slm-fr-if)# tag saa_group1`	(Optional) Specifies an "identity" tag for the operation. • An operation tag is normally used to logically link operations in a group. • Tags can be used to support automation (for example, by using the same tag for two different operations on two different routers echoing the same target).

	Command or Action	Purpose
Step 9	**timeout** *milliseconds* **Example:** `Router(config-rtr-slm-fr-if)# timeout 2500`	(Optional) Sets the amount of time the operation waits for a response from the operational target. The default is 5000 milliseconds (5 seconds). • If the timeout value is reached the operational return value and status is set to "timed-out."
Step 10	**exit** **Example:** `Router(config-rtr-slm-if)# exit`	Exits SAA SLM Controller/Interface configuration mode.
Step 11	Repeat Steps 1 through 7 on the device at the far end of the connection.	—
Step 12	**rtr schedule** *operation-number* {**start-time** {*hh*:*mm*[:*ss*] [*month day* | *day month*] | **pending** | **now** | **after** *hh*:*mm*:*ss*} [**ageout** *seconds*] [**life** {**forever** | *seconds*}] **Example:** `Router(config)# rtr schedule 1 start-time now life forever`	Specifies when the operation should start. • This step, unlike Steps 1 through 7, only has to be performed on one end of the Frame Relay connection. • For SLM operations, the operation will always start at the nearest 15 minute interval since the router start time. For example, even if the **rtr schedule 1 start-time now** command is used, the operation will not start until the next quarter-hour time increment.
Step 13	**end** **Example:** `Router(config)# end`	(Optional) Ends the current configuration session.
Step 14	**copy running-config startup-config** or **copy system:running-config nvram:startup-config** **Example:** `Router# copy running-config startup-config`	(Optional) Saves the configuration to NVRAM.
Step 15	Allow statistics to be gathered for the desired amount of time.	—
Step 16	**show rtr operational-state** *operation-number* **Example:** `Router# show rtr operation 1`	(Optional) Displays the state of the operation and the statistics for the last probe operation.

	Command or Action	Purpose
Step 17	**show rtr enhanced-history collection-statistics** *operation-number* **Example:** `Router# show rtr enhanced-history collection-statistics 1`	(Optional) Displays data for all collected history buckets for the specified SAA operation with failure data for each bucket.
Step 18	**show rtr enhanced-history distribution-statistics** *operation-number* **Example:** `Router# show rtr enhanced-history distribution-statistics 1`	(Optional) Displays enhanced history data for all collected buckets in a summary table. • Because the enhanced history aggregation interval is fixed at 900 seconds for SLM operations, the optional **interval** keyword available for this command will not work for SLM operations.

Example

```
Router> enable
Password:
Router# configure terminal
Enter configuration commands, one per line.
Router(config)# rtr slm frame-relay statistics
Router(config)# rtr 1
Router(config-rtr)# type slm controller T1 0
Router(config-rtr-slm-if)# enhanced-history interval 900 buckets 100
Router(config-rtr-slm-if)# exit
Router(config)# rtr schedule 1 start-time now life forever
Router(config)# end
Router#
Router# show rtr configuration 1 | include Type
Type of operation to perform: slm controller
Reaction Type: None
Router#
Router# show rtr operational-state 1
Entry number: 1
Modification time: *02:13:28.643 UTC Mon May 5 2003
Number of operations attempted: 9
Number of operations skipped: 0
Current seconds left in Life: Forever
Operational state of entry: Active
Last time this entry was reset: Never
Connection loss occurred: FALSE
Timeout occurred: FALSE
Over thresholds occurred: FALSE
Latest RTT (milliseconds): 0
Latest operation start time: *02:15:00.007 UTC Mon May 5 2003
Latest operation return code: OK

  Ds1StatRxLineStatus:  16385
  Ds1StatRxBPVs:  0,            Ds1StatRxCrcFrameErrors:  0
  Ds1StatRxErrSecs:  0,         Ds1StatRxSevereErrSecs:  0
  Ds1StatRxUnavailSecs:  0,     Ds1StatRxBurstyErrSecs:  0

Sample Index = 9


Router# show rtr enhanced-history collection-statistics 1
```

```
Entry number: 1
Aggregation Interval: 900

Bucket Index: 1
Aggregation start time 00:15:00.004 UTC Mon May 5 2003
Target Address:
Number of failed operations due to a Disconnect: 0
Number of failed operations due to a Timeout: 0
Number of failed operations due to a Busy: 0
Number of failed operations due to a No Connection: 0
Number of failed operations due to an Internal Error: 0
Number of failed operations due to a Sequence Error: 0
Number of failed operations due to a Verify Error: 0


  Ds1StatRxLineStatus:  16385
  Ds1StatRxBPVs:  0,            Ds1StatRxCrcFrameErrors:  0
  Ds1StatRxErrSecs:  0,         Ds1StatRxSevereErrSecs:  0
  Ds1StatRxUnavailSecs:  0,     Ds1StatRxBurstyErrSecs:  0

Sample Index = 1

Bucket Index: 2
Aggregation start time 00:30:00.005 UTC Mon May 5 2003
Target Address:
Number of failed operations due to a Disconnect: 0
Number of failed operations due to a Timeout: 0
Number of failed operations due to a Busy: 0
Number of failed operations due to a No Connection: 0
Number of failed operations due to an Internal Error: 0
Number of failed operations due to a Sequence Error: 0
Number of failed operations due to a Verify Error: 0


  Ds1StatRxLineStatus:  16385
  Ds1StatRxBPVs:  0,            Ds1StatRxCrcFrameErrors:  0
  Ds1StatRxErrSecs:  0,         Ds1StatRxSevereErrSecs:  0
  Ds1StatRxUnavailSecs:  0,     Ds1StatRxBurstyErrSecs:  0

Sample Index = 2

Bucket Index: 3
 .
 .
 .
Router# show rtr enhanced-history distribution-statistics 1
Point by point Enhanced History
Entry    = Entry Number
Int      = Aggregation Interval (seconds)
BucI     = Bucket Index
StartT   = Aggregation Start Time
Pth      = Path index
Hop      = Hop in path index
Comps    = Operations completed
OvrTh    = Operations completed over thresholds
SumCmp   = Sum of RTT (milliseconds)
SumCmp2L = Sum of RTT squared low 32 bits (milliseconds)
SumCmp2H = Sum of RTT squared high 32 bits (milliseconds)
TMax     = RTT maximum (milliseconds)
TMin     = RTT minimum (milliseconds)

Entry Int BucI StartT     Pth Hop Comps OvrTh SumCmp    SumCmp2L   SumCmp2H   n
1     900 1    900001     1   1   1     0     0         0          0
```

```
1      900 2    1800003    1   1   1      0      0          0          0
1      900 3    2700001    1   1   1      0      0          0          0
1      900 4    3600002    1   1   1      0      0          0          0
1      900 5    4500004    1   1   1      0      0          0          0
1      900 6    5400002    1   1   1      0      0          0          0
1      900 7    6300003    1   1   1      0      0          0          0
1      900 8    7200001    1   1   1      0      0          0          0
1      900 9    8100003    1   1   1      0      0          0          0
  .
  .
  .
```

What to Do Next

If SAA data is to be passed to a CNS enabled router, you should perform the task in the "Enabling CNS for SAA Data Retrieval" section on page 23.

Configuring Monitoring of a Frame Relay Link

Frame Relay monitoring using SAA can be configured for an interface at the physical layer, for an interface at the data link layer, or for a specific circuit. The follow task describes configuring the SAA operation for a Frame Relay interface at the data link layer.

Restrictions

To enable full statistic gathering for the SAA Frame Relay service level monitoring operation, the operation must be configured on both ends of the Frame Relay connection.

Standard SAA distribution and history statistics are not supported in SLM operations. Aggregated (averaged) data for SLM operations is not available from the CLI. Enhanced history data is stored as individual samples in each bucket.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **rtr slm frame-relay statistics**
4. **rtr** *operation-number*
5. **type slm frame-relay interface**
6. **enhanced history**
7. **owner** (optional)
8. **tag** (optional)
9. **timeout** (optional)
10. **exit**
11. Repeat Steps 1 through 7 on the device at the far end of the connection.
12. **rtr schedule**
13. **end**

14. **copy running-config startup-config** (optional)
15. Allow statistics to be gathered for the desired amount of time.
16. **show rtr operational-state** (optional)
17. **show rtr enhanced-history collection-statistics** (optional)
18. **show rtr enhanced-history distribution-statistics** (optional)

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**rtr slm frame-relay statistics** **Example:** `Router(config)# rtr slm frame-relay statistics`	Enables SAA to collect Frame Relay performance monitoring statistics. • This command is required to begin gathering statistics for the Frame Relay interface or circuit.
Step 4	**rtr** *operation-number* **Example:** `Router(config)# rtr 1`	Specifies an identification number for the operation being configured, and enters SAA RTR configuration mode.
Step 5	**type slm frame-relay interface** *type number* **Example:** `Router(config-rtr)# type slm frame-relay interface Serial5/3`	Specifies that the operation is an SLM FR interface operation, which provides data link (Layer 2) data for a Frame Relay link, and specifies the interface that the operation should be run on. • The specified interface should be configured for Frame Relay. • The Frame Relay interface link statistics are used to monitor the basic health of a Frame Relay interface. This information includes some traffic counters, assorted error counts, and some performance related counters.

	Command or Action	Purpose
Step 6	**enhanced-history interval** *seconds* **buckets** *number-of-buckets* **Example:** `Router(config-rtr-slm-fr-if)# enhanced-history interval 900 buckets 100`	Enables SAA enhanced history for the operation. Performance statistics are stored in "buckets" which keep the accumulated data separate from each other. Each bucket consists of data accumulated over the specified interval. For Frame Relay SLM and ATM SLM operations, each bucket consists of 15 minutes (900 seconds) worth of statistics. The following line will be written to the configuration: **`enhanced-history interval 900 buckets 100`** **Note** Regardless of the values entered for *seconds* and *number-of-buckets*, the default of value of a 900 second interval and 100 history buckets will be used. Your input is overridden in the Frame Relay operations so that complete SLM statistics can be provided.
Step 7	**owner** *string* **Example:** `Router(config-rtr-slm-fr-if)# owner joeuser 209.165.200.225`	(Optional) Specifies an "owner" tag for the operation.
Step 8	**tag** *string* **Example:** `Router(config-rtr-slm-fr-if)# tag saa_group1`	(Optional) Specifies an "identity" tag for the operation. • An operation tag is normally used to logically link operations in a group. • Tags can be used to support automation (for example, by using the same tag for two different operations on two different routers echoing the same target).
Step 9	**timeout** *milliseconds* **Example:** `Router(config-rtr-slm-fr-if)# timeout 2500`	(Optional) Sets the amount of time the operation waits for a response from the operational target. The default is 5000 milliseconds (5 seconds). • If the timeout value is reached the operational return value and status is set to "timed-out."
Step 10	**exit** **Example:** `Router(config-rtr-slm-fr-if)# exit`	Exits SAA SLM Frame-Relay Interface configuration mode.
Step 11	Repeat Steps 1 through 7 on the device at the far end of the connection.	—

	Command or Action	Purpose
Step 12	**rtr schedule** *operation-number* {**start-time** {*hh*:*mm*[:*ss*] [*month day* | *day month*] | **pending** | **now** | **after** *hh*:*mm*:*ss*} [**ageout** *seconds*] [**life** {**forever** | *seconds*}] **Example:** `Router(config)# rtr schedule 1 start-time now life forever`	Specifies when the operation should start. • This step, unlike Steps 1 through 7, only has to be performed on one end of the Frame Relay connection. • For SLM operations, the operation will always start at the nearest 15 minute interval since the router start time. For example, even if the **rtr schedule 1 start-time now** command is used, the operation will not start until the next quarter-hour time increment.
Step 13	**end** **Example:** `Router(config)# end`	(Optional) Ends the current configuration session.
Step 14	**copy running-config startup-config** or **copy system:running-config nvram:startup-config** **Example:** `Router# copy running-config startup-config`	(Optional) Saves the configuration to NVRAM.
Step 15	Allow statistics to be gathered for the desired amount of time.	—
Step 16	**show rtr operational-state** *operation-number* **Example:** `Router# show rtr operation 1`	(Optional) Displays the state of the operation and the statistics for the last probe operation.
Step 17	**show rtr enhanced-history collection-statistics** *operation-number* **Example:** `Router# show rtr enhanced-history collection-statistics 1`	(Optional) Displays data for all collected history buckets for the specified SAA operation with failure data for each bucket. • Because the command displays statistics per bucket, and SLM operations are configured for 100 buckets, this command may generate a large amount of output. To escape back to the command line, use Ctrl-Z.
Step 18	**show rtr enhanced-history distribution-statistics** *operation-number* **Example:** `Router# show rtr enhanced-history distribution-statistics 1`	(Optional) Displays enhanced history data for all collected buckets in a summary table. • Because the enhanced history aggregation interval is fixed at 900 seconds for SLM operations, the optional **interval** keyword available for this command will not work for SLM operations.

Example

```
Router> enable
```

```
Password:
Router# configure terminal
Enter configuration commands, one per line.
Router(config)# rtr slm frame-relay statistics
Router(config)# rtr 2
Router(config-rtr)# type slm frame-relay interface Serial0:0
Router(config-rtr-slm-fr-if)#?
SAA slm frame-relay interface Configuration Commands:
! The following list of commands apply to SLM operations:
  default                          Set a command to its defaults
  enhanced-history                 Enable enhanced history collection
  no                               Negate a command or return it to the default state
  owner                            Owner of Entry
  tag                              User defined tag
  timeout                          Timeout of an operation

Router(config-rtr-slm-fr-if)# enhanced-history interval 900 buckets 100
Router(config-rtr-slm-fr-if)# exit
Router(config)# rtr schedule 2 start-time now life forever
Router(config)# end
Router#
Router# show rtr configuration 2 | include Type
Type of operation to perform: Slm Frame-relay Interface
Reaction Type: None


Router# show rtr operational-state 2
Entry number: 2
Modification time: *00:12:35.526 UTC Thur May 1 2003
Number of operations attempted: 275
Number of operations skipped: 0
Current seconds left in Life: Forever
Operational state of entry: Active
Last time this entry was reset: Never
Connection loss occurred: FALSE
Timeout occurred: FALSE
Over thresholds occurred: FALSE
Latest RTT (milliseconds): 0
Latest operation start time: *20:44:59.993 UTC Sat May 3 2003
Latest operation return code: OK
LinkState :1
Tx Total Frames:  92                    Rx Total Frames:  92
Tx Total Octets:  1350                  Rx Total Octets:  1240
Tx FCSAlignErrors:  0                   Rx FCSAlignErrors:  0
Tx Aborted Frames:  0                   Rx Aborted Frames:  0
Tx Long Frames:  0                      Rx Long Frames:  0
Tx Short Frames:  0                     Rx Short Frames:  0
Tx MaxThroughput:  448                  Rx MaxThroughput:  528
Tx MaxUtilization:  0                   Rx MaxUtilization:  1
Tx MaxFramesSec:  2                     Rx MaxFramesSec:  2
UnavailSecs:  0                         Drop Events:  0
Tx OverFlowOctets:  0                   Rx OverFlowOctets:  0

Tx Burst Percent1(sec):  900              Rx Burst Percent1(sec): 900
Tx Burst Percent2(sec):  0                Rx Burst Percent2(sec): 0
Tx Burst Percent3(sec):  0                Rx Burst Percent3(sec): 0
Tx Burst Percent4(sec):  0                Rx Burst Percent4(sec): 0
Tx Burst Percent5(sec):  0                Rx Burst Percent5(sec): 0

Sample Index = 275


Router# show rtr enhanced-history collection-statistics 2
Entry number: 2
```

```
Aggregation Interval: 900
!-----------------------------------------------------!
Bucket Index: 1
Aggregation start time 20:14:59.989 UTC Fri May 2 2003
Target Address:
Number of failed operations due to a Disconnect: 0
Number of failed operations due to a Timeout: 0
Number of failed operations due to a Busy: 0
Number of failed operations due to a No Connection: 0
Number of failed operations due to an Internal Error: 0
Number of failed operations due to a Sequence Error: 0
Number of failed operations due to a Verify Error: 0

LinkState :1
Tx Total Frames:  92                      Rx Total Frames:  92
Tx Total Octets:  1350                    Rx Total Octets:  1240
Tx FCSAlignErrors:  0                     Rx FCSAlignErrors:  0
Tx Aborted Frames:  0                     Rx Aborted Frames:  0
Tx Long Frames:  0                        Rx Long Frames:  0
Tx Short Frames:  0                       Rx Short Frames:  0
Tx MaxThroughput:  448                    Rx MaxThroughput:  528
Tx MaxUtilization:  0                     Rx MaxUtilization:  1
Tx MaxFramesSec:  2                       Rx MaxFramesSec:  2
UnavailSecs:  0                           Drop Events:  0
Tx OverFlowOctets:  0                     Rx OverFlowOctets:  0

Tx Burst Percent1(sec):  900               Rx Burst Percent1(sec): 900
Tx Burst Percent2(sec):  0                 Rx Burst Percent2(sec): 0
Tx Burst Percent3(sec):  0                 Rx Burst Percent3(sec): 0
Tx Burst Percent4(sec):  0                 Rx Burst Percent4(sec): 0
Tx Burst Percent5(sec):  0                 Rx Burst Percent5(sec): 0

Sample Index = 177
!-----------------------------------------------------!
Bucket Index: 2
Aggregation start time 20:29:59.989 UTC Fri May 2 2003
Target Address:
Number of failed operations due to a Disconnect: 0
Number of failed operations due to a Timeout: 0
Number of failed operations due to a Busy: 0
Number of failed operations due to a No Connection: 0
Number of failed operations due to an Internal Error: 0
Number of failed operations due to a Sequence Error: 0
Number of failed operations due to a Verify Error: 0

LinkState :1
LinkState :1
Tx Total Frames:  92                      Rx Total Frames:  92
Tx Total Octets:  1350                    Rx Total Octets:  1240
Tx FCSAlignErrors:  0                     Rx FCSAlignErrors:  0
Tx Aborted Frames:  0                     Rx Aborted Frames:  0
Tx Long Frames:  0                        Rx Long Frames:  0
Tx Short Frames:  0                       Rx Short Frames:  0
Tx MaxThroughput:  448                    Rx MaxThroughput:  528
Tx MaxUtilization:  0                     Rx MaxUtilization:  1
Tx MaxFramesSec:  2                       Rx MaxFramesSec:  2
UnavailSecs:  0                           Drop Events:  0
Tx OverFlowOctets:  0                     Rx OverFlowOctets:  0

Tx Burst Percent1(sec):  900               Rx Burst Percent1(sec): 900
Tx Burst Percent2(sec):  0                 Rx Burst Percent2(sec): 0
Tx Burst Percent3(sec):  0                 Rx Burst Percent3(sec): 0
Tx Burst Percent4(sec):  0                 Rx Burst Percent4(sec): 0
Tx Burst Percent5(sec):  0                 Rx Burst Percent5(sec): 0
```

```
Sample Index = 178
!-----------------------------------------------------!
Bucket Index: 3
Aggregation start time 20:44:59.991 UTC Fri May 2 2003
 .
 .
 .
Router# show rtr enhanced-history distribution-statistics 2
Point by point Enhanced History
Entry    = Entry Number
Int      = Aggregation Interval (seconds)
BucI     = Bucket Index
StartT   = Aggregation Start Time
Pth      = Path index
Hop      = Hop in path index
Comps    = Operations completed
OvrTh    = Operations completed over thresholds
SumCmp   = Sum of RTT (milliseconds)
SumCmp2L = Sum of RTT squared low 32 bits (milliseconds)
SumCmp2H = Sum of RTT squared high 32 bits (milliseconds)
TMax     = RTT maximum (milliseconds)
TMin     = RTT minimum (milliseconds)

Entry Int BucI StartT     Pth Hop Comps OvrTh SumCmp     SumCmp2L   SumCmp2H TMax TMin
2     900 1    159300004  1   1   1     0     0          0          0
2     900 2    160200002  1   1   1     0     0          0          0
2     900 3    161100004  1   1   1     0     0          0          0
2     900 4    162000001  1   1   1     0     0          0          0
2     900 5    162900003  1   1   1     0     0          0          0
2     900 6    163800001  1   1   1     0     0          0          0
2     900 7    164700003  1   1   1     0     0          0          0
2     900 8    165600012  1   1   1     0     0          0          0
2     900 9    166500002  1   1   1     0     0          0          0
2     900 10   167400004  1   1   1     0     0          0          0
2     900 11   168300001  1   1   1     0     0          0          0
2     900 12   169200003  1   1   1     0     0          0          0
2     900 13   170100001  1   1   1     0     0          0          0
2     900 14   171000002  1   1   1     0     0          0          0
2     900 15   171900004  1   1   1     0     0          0          0
 .
 .
 .
```

What to Do Next

If SAA data is to be passed to a CNS enabled router, you should perform the task in the "Enabling CNS for SAA Data Retrieval" section on page 23.

Configuring Monitoring of a Frame Relay Circuit

Frame Relay monitoring using SAA can be configured for an interface at the physical layer, for an interface at the data link layer, or for a specific circuit. The follow task describes configuring the SAA operation for a Frame Relay circuit.

Restrictions

To enable full statistic gathering for the SAA Frame Relay service level monitoring operation, the operation must be configured on both ends of the Frame Relay connection.

Standard SAA distribution and history statistics are not supported in SLM operations; instead use the show enhanced history commands. Enhanced history data is stored as individual samples in each bucket. Aggregated (averaged) data for SLM operations is not available from the CLI.

SUMMARY STEPS

All steps are required unless otherwise indicated.

1. **enable**
2. **configure terminal**
3. **rtr slm frame-relay statistics**
4. **rtr** *operation-number*
5. **type slm frame-relay pvc interface**
6. **enhanced history**
7. **owner** (optional)
8. **tag** (optional)
9. **timeout** (optional)
10. **exit**
11. Repeat Steps 1 through 7 on the device at the far end of the connection.
12. **rtr schedule**
13. **end**
14. **copy running-config startup-config** (optional)
15. Allow statistics to be gathered for the desired amount of time.
16. **show rtr operational-state** (optional)
17. **show rtr enhanced-history collection-statistics** (optional)
18. **show rtr enhanced-history distribution-statistics** (optional)

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**rtr slm frame-relay statistics** **Example:** `Router(config)# rtr slm frame-relay statistics`	Enables SAA to collect Frame Relay performance monitoring statistics. • This command is required to begin gathering statistics for the Frame Relay interface or circuit.
Step 4	**rtr** *operation-number* **Example:** `Router(config)# rtr 1`	Specifies an identification number for the operation being configured, and enters SAA RTR configuration mode.
Step 5	**type slm frame-relay pvc interface** *type number dlci-number* **Example:** `Router(config-rtr)# type slm frame-relay pvc interface Serial0:0 111`	Specifies that the operation is an SLM FR circuit operation, which provides data for the specified circuit, and specifies the interface and PVC that the operation should be run on. • The specified interface should be configured with a permanent virtual circuit (PVC) connection. • The data link connection identifier (DLCI) is used to identify the PVC. • SAA Frame Relay circuit statistics are used to monitor the basic health of a Frame Relay circuit. This information includes some traffic counters, assorted error counts, and some performance related counters. • This command bring you into SAA SLM FR Circuit configuration mode.
Step 6	**enhanced-history interval** *seconds* **buckets** *number-of-buckets* **Example:** `Router(config-rtr-slm-fr-dlci)# enhanced-history interval 900 buckets 100`	Enables SAA enhanced history for the operation. Performance statistics are stored in "buckets" which keep the accumulated data separate from each other. Each bucket consists of data accumulated over the specified interval. For Frame Relay SLM and ATM SLM operations, each bucket consists of 15 minutes (900 seconds) worth of statistics. The following line will be written to the configuration: **`enhanced-history interval 900 buckets 100`** **Note** Regardless of the values entered for *seconds* and *number-of-buckets*, the default of value of a 900 second interval and 100 history buckets will be used. Your input is overridden in the Frame Relay operations so that complete SLM statistics can be provided.
Step 7	**owner** *string* **Example:** `Router(config-rtr-slm-fr-if)# owner joeuser 209.165.200.225`	(Optional) Specifies an "owner" tag for the operation.

	Command or Action	Purpose
Step 8	**tag** *string* **Example:** `Router(config-rtr-slm-fr-if)# tag saa_group1`	(Optional) Specifies an "identity" tag for the operation. • An operation tag is normally used to logically link operations in a group. • Tags can be used to support automation (for example, by using the same tag for two different operations on two different routers echoing the same target).
Step 9	**timeout** *milliseconds* **Example:** `Router(config-rtr-slm-fr-if)# timeout 2500`	(Optional) Sets the amount of time the operation waits for a response from the operational target. The default is 5000 milliseconds (5 seconds). • If the timeout value is reached the operational return value and status is set to "timed-out."
Step 10	**exit** **Example:** `Router(config-rtr)# exit`	Exits SAA SLM FR Circuit configuration mode.
Step 11	Repeat Steps 1 through 7 on the device at the far end of the connection.	—
Step 12	**rtr schedule** *operation-number* {**start-time** {*hh*:*mm*[:*ss*] [*month day* | *day month*] | **pending** | **now** | **after** *hh*:*mm*:*ss*} [**ageout** *seconds*] [**life** {**forever** | *seconds*}] **Example:** `Router(config)# rtr schedule 1 start-time now life forever`	Specifies when the operation should start. • This step, unlike Steps 1 through 7, only has to be performed on one end of the Frame Relay connection. • For SLM operations, the operation will always start at the nearest 15 minute interval since the router start time. For example, even if the **rtr schedule 1 start-time now** command is used, the operation will not start until the next quarter-hour time increment.
Step 13	**end** **Example:** `Router(config)# end`	(Optional) Ends the current configuration session.
Step 14	**copy running-config startup-config** or **copy system:running-config nvram:startup-config** **Example:** `Router# copy running-config startup-config`	(Optional) Saves the configuration to NVRAM.
Step 15	Allow statistics to be gathered for the desired amount of time.	—

	Command or Action	Purpose
Step 16	**show rtr operational-state** *operation-number* **Example:** `Router# show rtr operation 1`	(Optional) Displays the state of the operation and the statistics for the last probe operation.
Step 17	**show rtr enhanced-history collection-statistics** *operation-number* **Example:** `Router# show rtr enhanced-history collection-statistics 1`	(Optional) Displays data for all collected history buckets for the specified SAA operation with failure data for each bucket. • Because this command displays statistics per bucket, and SLM operations are configured for 100 buckets, this command may generate a large amount of output. To escape back to the command line, use Ctrl-Z.
Step 18	**show rtr enhanced-history distribution-statistics** *operation-number* **Example:** `Router# show rtr enhanced-history distribution-statistics 1`	(Optional) Displays enhanced history data for all collected buckets in a summary table. • Because the enhanced history aggregation interval is fixed at 900 seconds for SLM operations, the optional **interval** keyword available for this command will not work for SLM operations.

Examples

```
Router> enable
Password:
Router# configure terminal
Enter configuration commands, one per line.
Router(config)# rtr slm frame-relay statistics
Router(config)# rtr 3
Router(config-rtr)# type slm frame-relay pvc interface Serial0:0 111
Router(config-rtr-slm-fr-dlci)# enhanced-history interval 900 buckets 100
Router(config-rtr-slm-fr-dlci)# exit
Router(config)# rtr schedule 3 start-time now life forever
Router(config)# end
Router#
Router# show rtr configuration 3 | include Type
Type of operation to perform: Slm Frame-relay Pvc
Reaction Type: None

Router# show rtr operational-state 3
Entry number: 3
Modification time: *00:12:35.686 UTC Thur May 1 2003
Number of operations attempted: 276
Number of operations skipped: 277
Current seconds left in Life: Forever
Operational state of entry: Active
Last time this entry was reset: Never
Connection loss occurred: FALSE
Timeout occurred: FALSE
Over thresholds occurred: FALSE
Latest RTT (milliseconds): 16
Latest operation start time: *21:07:29.988 UTC Sat May 3 2003
Latest operation return code: OK
```

```
Sample Index = 277

Echo Receive Time = *00:22:30.005 UTC Thur May 1 2003
Echo Response Time = 21 (ms)
Remote IP Address     : 14.1.1.1        Remote Product Id     : 2198864392
Remote Interface Type : 32              Remote Interface Index: 11
Remote Circuit Index  : 111

Offered Frames/PDUs   : 2               Delivered Frames/PDUs: 2

Tx Total Frames:  2                        Rx Total Frames:  2
Tx Total Octets:  60                       Rx Total Octets:  70
Tx DeFrames:  0                            Rx DeFrames:  0
Tx MaxThroughput:  448                     Rx MaxThroughput:  528
Rx FecnSeconds:  0                         Rx BecnSeconds:  0
OctetsAboveCIR:  0                         FramesAboveCIR:  0
Unavailable Seconds:  0

Tx Burst Percent1(sec):  900               Tx Burst Percent2(sec): 0
Tx Burst Percent3(sec):  0                 Tx Burst Percent4(sec): 0
Tx Burst Percent5(sec):  0


Router# show rtr enhanced-history collection-statistics 3
Entry number: 3
Aggregation Interval: 900
!----------------------------------------------------!
Bucket Index: 1
Aggregation start time 21:37:29.988 UTC Fri May 2 2003
Target Address:
Number of failed operations due to a Disconnect: 0
Number of failed operations due to a Timeout: 0
Number of failed operations due to a Busy: 0
Number of failed operations due to a No Connection: 0
Number of failed operations due to an Internal Error: 0
Number of failed operations due to a Sequence Error: 0
Number of failed operations due to a Verify Error: 0


Sample Index = 183

Echo Receive Time = *00:22:30.006 UTC Thur May 1 2003
Echo Response Time = 21 (ms)
Remote IP Address     : 14.1.1.1        Remote Product Id     : 2198864392
Remote Interface Type : 32              Remote Interface Index: 11
Remote Circuit Index  : 111

Offered Frames/PDUs   : 2               Delivered Frames/PDUs: 2

Tx Total Frames:   2                       Rx Total Frames:   2
Tx Total Octets:  60                       Rx Total Octets:  70
Tx DeFrames:  0                            Rx DeFrames:  0
Tx MaxThroughput:  448                     Rx MaxThroughput:  528
Rx FecnSeconds:  0                         Rx BecnSeconds:  0
OctetsAboveCIR:  0                         FramesAboveCIR:  0
Unavailable Seconds:  0

Tx Burst Percent1(sec):  900               Tx Burst Percent2(sec): 0
Tx Burst Percent3(sec):  0                 Tx Burst Percent4(sec): 0
Tx Burst Percent5(sec):  0
!----------------------------------------------------!
Bucket Index: 2
Aggregation start time 21:52:29.990 UTC Fri May 2 2003
Target Address:
```

```
Number of failed operations due to a Disconnect: 0
Number of failed operations due to a Timeout: 0
Number of failed operations due to a Busy: 0
Number of failed operations due to a No Connection: 0
Number of failed operations due to an Internal Error: 0
Number of failed operations due to a Sequence Error: 0
Number of failed operations due to a Verify Error: 0


Sample Index = 184

Echo Receive Time = *00:22:30.007 UTC Thur May 1 2003
Echo Response Time = 21 (ms)
Remote IP Address     : 14.1.1.1        Remote Product Id     : 2198864392
Remote Interface Type : 32              Remote Interface Index: 11
Remote Circuit Index  : 111

Offered Frames/PDUs   : 2               Delivered Frames/PDUs: 2

Tx Total Frames:  2                        Rx Total Frames:  2
Tx Total Octets:  60                       Rx Total Octets:  70
Tx DeFrames:   0                           Rx DeFrames:  0
Tx MaxThroughput:  448                     Rx MaxThroughput:  528
Rx FecnSeconds:  0                         Rx BecnSeconds:  0
OctetsAboveCIR:  0                         FramesAboveCIR:  0
Unavailable Seconds:  0

Tx Burst Percent1(sec):  900               Tx Burst Percent2(sec): 0
Tx Burst Percent3(sec):  0                 Tx Burst Percent4(sec): 0
Tx Burst Percent5(sec):  0
!--------------------------------------------------!
Bucket Index: 3
Aggregation start time 22:07:29.993 UTC Fri May 2 2003
 .
 .
 .
Router# show rtr enhanced-history distribution-statistics 3

Point by point Enhanced History
Entry    = Entry Number
Int      = Aggregation Interval (seconds)
BucI     = Bucket Index
StartT   = Aggregation Start Time
Pth      = Path index
Hop      = Hop in path index
Comps    = Operations completed
OvrTh    = Operations completed over thresholds
SumCmp   = Sum of RTT (milliseconds)
SumCmp2L = Sum of RTT squared low 32 bits (milliseconds)
SumCmp2H = Sum of RTT squared high 32 bits (milliseconds)
TMax     = RTT maximum (milliseconds)
TMin     = RTT minimum (milliseconds)

Entry Int  BucI StartT     Pth Hop Comps OvrTh SumCmp     SumCmp2L   SumCmp2H   n
3     900  1    166050003  1   1   2     0     28         394        0
3     900  2    166950001  1   1   2     0     29         421        0
3     900  3    167850002  1   1   2     0     31         481        0
3     900  4    168750000  1   1   2     0     30         450        0
3     900  5    169650002  1   1   2     0     27         369        0
3     900  6    170550000  1   1   2     0     29         421        0
3     900  7    171450001  1   1   2     0     31         481        0
3     900  8    172350003  1   1   2     0     30         452        0
3     900  9    173250001  1   1   2     0     29         421        0
3     900  10   174150002  1   1   2     0     31         481        0
```

.
.
.

What to Do Next

If SAA data is to be passed to a CNS enabled router, you should perform the task "Enabling CNS for SAA Data Retrieval".

Enabling CNS for SAA Data Retrieval

If a CNS-enabled device will be used to retrieve data, you must also enable the CNS client on one of the devices running the SAA operation.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **cns id**
4. **cns event**
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**cns id** *type number* **ip-address event** **Example:** `Router(config)# cns id Ethernet2/0 ipaddress event`	Sets the unique event identification value (ID) used by the remote CNS agent. • The event ID value is used to identify the router for CNS event services. • The **ip-address** keyword specifies that the IP address for the interface should be used as the event ID. For SAA, only the IP-address should be used as the event ID.

	Command or Action	Purpose
Step 4	**cns event** {*hostname* | *ip-address*} [*port-number*] [**encrypt**] [**backup**] **keepalive** *seconds retry-count* [**source** *ip-address*] [**force-fmt1**] **Example:** `Router(config)# cns event 209.165.200.225 11027 keepalive 30 3`	Enables the Cisco Networking Services (CNS) event gateway, allowing access to the remote CNS agent.
Step 5	**end** **Example:** `Router(config)# end`	(Optional) Ends the current configuration session.

Configuration Examples for SAA Monitoring for Frame Relay Connections

The following example shows a typical configuration with all three Frame Relay SLM operations configured, as well as the CNS commands needed for passing this information to a remote CNS server.

```
Router# show running-configuration
Building configuration...
!
version 12.3
no service pad
service timestamps debug uptime
service timestamps log uptime
. . .
!
frame-relay switching
!
voice call carrier capacity active
no voice confirmation-tone
no voice hpi capture buffer
no voice hpi capture destination
!
voice-card 0
!
atm slm statistics
!
controller T1 0
 framing esf
 linecode b8zs
 channel-group 0 timeslots 24
!
!
interface Ethernet0
 ip address 209.165.202.129 255.255.255.224
 no ip mroute-cache
 no cdp enable
!
interface Serial0
 no ip address
 encapsulation frame-relay
 no ip mroute-cache
 shutdown
 clockrate 64000
```

```
 no fair-queue
 frame-relay class cisco
 frame-relay traffic-shaping
 frame-relay intf-type dce
!
interface Serial0.1 point-to-point
 frame-relay interface-dlci 101
!
interface Serial1
 description physical connection to clne-2
 mtu 5000
 no ip address
 encapsulation frame-relay
 no ip mroute-cache
 load-interval 30
 shutdown
 no arp frame-relay
 frame-relay lmi-type q933a
!
interface Serial0:0
 ip address 209.165.200.226 255.255.255.224
 encapsulation frame-relay
 frame-relay interface-dlci 111
 frame-relay intf-type dce
!
interface FR-ATM20
 no ip address
 encapsulation frame-relay
 shutdown
!
ip default-gateway 10.4.23.1
ip classless
ip route 0.0.0.0 0.0.0.0 Ethernet0
no ip http server
!
!
!
map-class frame-relay cisco
 frame-relay cir 64000
 frame-relay bc 8000
 frame-relay be 16000
 frame-relay mincir 32000
 frame-relay adaptive-shaping becn
 frame-relay fecn-create
!
map-class frame-relay set_fecn_becn
 frame-relay fecn-adapt
!
!
snmp-server enable traps rtr
snmp-server host 209.165.200.225 public
!
rtr slm frame-relay statistics
rtr responder
rtr 1
 type slm controller T1 0
 enhanced-history interval 900 buckets 100
rtr schedule 1 start-time now life forever
rtr 2
 type slm frame-relay interface Serial0:0
 enhanced-history interval 900 buckets 100
rtr schedule 2 start-time now life forever
rtr 3
 type slm frame-relay pvc interface Serial0:0 111
```

```
 enhanced-history interval 900 buckets 100
rtr schedule 3 start-time now life forever
!
 .
 .
 .
!
cns id Ethernet0 ipaddress event
cns event 172.19.209.172 11027 keepalive 30 3
!
cns notifications encapsulation snmp
```

Where to Go Next

If using this feature with an external networking monitoring application, refer to the documentation provided by the software provider.

Additional References

For additional information related to SAA Monitoring for Frame Relay Connections, refer to the following references:

Related Documents

Related Topic	Document Title
SAA Configuration	Cisco IOS Configuration Fundamentals and Network Monitoring Command Reference, Release 12.3
SAA Service Level Monitoring	SAA for ATM Interfaces, Release 12.2 T Feature Guide
CNS Configuration	• CNS Configuration Agent, Cisco IOS Release 12.2(2)T • CNS Event Agent, Cisco IOS Release 12.2(2)T • CNS Flow-Through Provisioning, Cisco IOS Release 12.2(8)T

Standards

No relevant standards.

MIBs

MIBs	MIBs Link
No relevant Cisco MIBs. There is no SNMP support for enhanced history; however, enhanced history statistics can be retrieved using XML.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

No relevant RFCs.

Technical Assistance

Description	Link
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.	http://www.cisco.com/public/support/tac/home.shtml

Command Reference

This section documents new and modified commands. All other commands used with this feature are documented in the Cisco IOS Release 12.3 command reference publications.

- **enhanced-history**
- **rtr slm frame-relay statistics**
- **show rtr enhanced-history collection-statistics**
- **show rtr enhanced-history distribution-statistics**
- **type slm controller**
- **type slm interface**
- **type slm frame-relay interface**
- **type slm frame-relay pvc interface**

enhanced-history

To enable enhanced history gathering for an SAA operation, use the **enhanced-history** command in one of the SAA RTR configuration modes.

enhanced-history interval *seconds* **buckets** *number-of-buckets*

Syntax Description

interval *seconds*	The number of seconds enhanced history should be gathered in each bucket (the "aggregation interval"). When this time expires, enhanced history statistics are gathered in a new bucket. The valid range is from 1 to 3600 seconds. The default is 900 seconds (15 minutes).
buckets *number-of-buckets*	The number of history buckets that should be retained in system memory. When this number is reached, statistics gathering for the operation ends. The valid range is from 1 to 100. The default is 100 buckets.

Defaults

No enhanced histroy data is collected.

Command Modes

SAA Echo operation configuration (config-rtr-echo)

SAA UDP Echo operation configuraiton (config-rtr-udp)

SAA TCP operation configuration (config-rtr-tcp)

SAA Jitter operation configuration (config-rtr-jitter)

SAA SLM Controller/Interface configuration (config-rtr-slm-if)

SAA SLM ATM Interface configuration (config-rtr-slm-atm-if)

SAA SLM Frame Relay Interface configuration (config-rtr-slm-fr-if)

SAA SLM ATM Circuit configuration (config-rtr-slm-atm-dlci)

SAA SLM Frame Relay Circuit configuration (config-rtr-slm-fr-dlci)

Command History

Release	Modification
12.2(11)T	This command was introduced.
12.3(1)	This command was made available for SAA SLM Frame Relay configuration modes.

Usage Guidelines

Performance statistics are stored in "buckets" which keep the accumulated data separate from each other. Each bucket consists of data accumulated over the specified interval. For example, if an aggregation interval of 1800 seconds (30 minutes) and 24 buckets of data is configured, you can analyze the network performance over a 12 hour period at 30 minute intervals.

Enhanced history buckets contain different data than standard history buckets. If this command is not used, no enhanced history buckets are stored on the router. To disable enhanced history collection for an operation, you must delete the entire operation using the **no rtr** *operation-number* command in global configuration mode.

To view the collected statistics, use the **show rtr enhanced-history** commands.

The configured aggregation interval cannot be less than the value of the operational frequency. Also, the aggregation interval has to be a multiple of the operational frequency.

Maximum value for the aggregation interval will be 3600 seconds

Maximum number of buckets per aggregation interval will be 24

For SLM Frame Relay and SLM ATM operations, each enhanced history bucket consists of 15 minutes (900 seconds) worth of statistics, and the operation collects statistics for 25 hours. Regardless of the values entered for *seconds* and *number-of-buckets*, the default of value of a 900 second interval and 100 history buckets will be used for SLM operations and the following line will be written to the configuration:

```
enhanced-history interval 900 buckets 100
```

Your input is overridden in the SLM ATM and SLM Frame Relay operations so that complete SLM statistics can be provided.

Examples

In the following example SAA operation 3 is configured with the standard enhanced history characteristics for an SLM Frame Relay Circuit operation:

```
Router(config)# rtr slm frame-relay statistics
Router(config)# rtr 3
Router(config-rtr)# type slm frame-relay pvc interface Serial0:0 111
Router(config-rtr-slm-fr-dlci)# enhanced-history interval 900 buckets 100
Router(config-rtr-slm-fr-dlci)# exit
Router(config)# rtr schedule 3 start-time now life forever
Router(config)# end
Router#
```

Related Commands

Command	Description
type slm interface	Specifies that the SAA operation is an SLM interface operation, and specifies the interface that the operation should be run on.
type slm controller	Specifies that the SAA operation is an SLM controller operation, and specifies the controller that the operation should be run on.
type slm frame-relay interface	Specifies that the SAA operation is an SLM FR interface operation, and specifies the interface that the operation should be run on.
type slm frame-relay pvc interface	Specifies that the SAA operation is an SLM FR circuit operation, and specifies the interface and DLCI number that the operation should be run on.
show rtr enhanced-history collection-statistics	Displays collected enhanced history statistics for all collected history buckets for SAA operations.

rtr slm frame-relay statistics

To enable the Service Assurance Agent (SAA) or CNS to collect Frame Relay performance monitoring statistics, use the **rtr slm frame-relay statistics** command in global configuration mode. To disable the collection of Frame Relay performance monitoring statistics, use the **no** form of this command.

rtr slm frame-relay statistics

no rtr slm frame-relay statistics

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Global configuration mode

Command History

Release	Modification
12.3(1)	This command was introduced.

Usage Guidelines

The **rtr slm frame-relay statistics** command should be issued prior to configuring any of the Frame Relay service level monitoring SAA operations (**type slm interface**, **type slm controller**, **type slm frame-relay** or **type slm frame-relay pvc**). Performance statistics are not retained for these operations until this command is issued.

This command does not affect the standard Frame Relay SAA operation (**type frame-relay**).

Examples

In the follwing example the SAA Frame Relay service level monitoring feature is enabled:

```
Router(config)# rtr slm frame-relay statistics
```

Related Commands

Command	Description
type slm interface	Specifies that the SAA operation is an SLM interface operation, and specifies the interface that the operation should be run on.
type slm controller	Specifies that the SAA operation is an SLM controller operation, and specifies the controller that the operation should be run on.
type slm frame-relay interface	Specifies that the SAA operation is an SLM FR interface operation, and specifies the interface that the operation should be run on.
type slm frame-relay pvc interface	Specifies that the SAA operation is an SLM FR circuit operation, and specifies the interface and DLCI number that the operation should be run on.

show rtr enhanced-history collection-statistics

To display collected enhanced history statistics for all collected history buckets for SAA operations, use the **show rtr enhanced-history collection-statistics** command in EXEC mode.

show rtr enhanced-history collection-statistics [*operation-number*] [**interval** *number*]

Syntax Description

operation-number	(Optional) Displays enhanced history distribution statistics for only the specified operation.
interval *number*	(Optional) Displays enhanced history distribution statistics for only the specified aggregation interval.

Defaults

No default behavior or values

Command Modes

EXEC

Command History

Release	Modification
12.2(15)T	This command was introduced.

Usage Guidelines

This command displays data for each bucket of enhanced history data shown individually (one after the other).

The number of buckets and the collection interval is set using the **enhanced-history interval** *seconds* **buckets** *number-of-buckets* SAA RTR configuration mode command.

For SLM operations, the enhanced history collection interval is set at 900 seconds and the number of buckets is set at 100. Because the enhanced history aggregation interval is fixed at 900 seconds, the optional **interval** keyword available for this command will not work for SLM operations.

Examples

The output of this command will vary depending on the operation type. The following examples show output for various SAA operations:

- Output for SLM Controller Operation, page 32
- Output for SLM Frame Relay Operation, page 34

Output for SLM Controller Operation

```
Router# show rtr configuration 1 | include Type
Type of operation to perform: slm controller
Reaction Type: None

Router# show running-config | begin rtr
. . .
rtr 1
```

```
 type slm controller T1 0
 enhanced-history interval 900 buckets 100
rtr schedule 1 start-time now life forever
. . .
Router# show rtr enhanced-history collection-statistics 1
Entry number: 1
Aggregation Interval: 900

Bucket Index: 1
Aggregation start time 00:15:00.003 UTC Thur May 1 2003
Target Address:
Number of failed operations due to a Disconnect: 0
Number of failed operations due to a Timeout: 0
Number of failed operations due to a Busy: 0
Number of failed operations due to a No Connection: 0
Number of failed operations due to an Internal Error: 0
Number of failed operations due to a Sequence Error: 0
Number of failed operations due to a Verify Error: 0


  Ds1StatRxLineStatus:  16385
  Ds1StatRxBPVs:  0,             Ds1StatRxCrcFrameErrors:  0
  Ds1StatRxErrSecs:  0,          Ds1StatRxSevereErrSecs:  0
  Ds1StatRxUnavailSecs:  0,      Ds1StatRxBurstyErrSecs:  0

Sample Index = 1

Bucket Index: 2
 .
 .
 .
```

Table 2 describes the significant fields shown in the display. “Ds1” represents both DS1 and E1 interfaces in the output of this command. DS1 and E1 Interfaces are physical interfaces that run at a medium speed (1544 Kbps for DS1 interfaces).

Table 2 show rtr enhanced-history Field Descriptions for SLM Controller Operations

Field	Description
`Aggregation Interval:`	The number of seconds the operation runs for each enhanced history bucket. For example, a value of 900 indicates that statistics were gathered for 15 minutes before the next bucket was created.
`Bucket Index:`	The number identifying the collection bucket. The number of buckets is set using the **enhanced-history** SAA RTR configuration command.
`Ds1StatRx`	**DS1 and E1 Received Statistics**—The Ds1StatRx prefix is used for DS1 and E1 interfaces. DS1 and E1 interfaces are physical interfaces that run at a medium speed (for example, 1544 Kbps for DS1 interfaces). “Rx” indicates “received.”

Table 2 show rtr enhanced-history Field Descriptions for SLM Controller Operations (continued)

Field	Description
Ds1StatRxLineStatus:	**Line Status**—This variable indicates the Line Status of the interface. The dsxLineStatus is a bit map represented as a sum, therefore, it can represent multiple conditions, like Excess Zeros and B8ZS detect, simultaneously. For example, the outOfFrame condition is implied by an outOfSignal condition. Possible values include: • 2 — yellowAlarm • 8 — blueAlarm • 32 — outOfFrame • 64 — outOfSignal • 8192 — excessZeros • 16384 — b8zsDetect
Ds1StatRxBPVs:	**Bi-Polar Violations**— The total number of Bipolar Violations (BPVs) received on the interface.
Ds1StatRxCrcFrameErrors:	**CRC or Frame Errors**—The total number of Cyclic Redundancy Check (CRC) Errors (with ESF framing) or Frame Errors (with D4 framing) received on the interface.
Ds1StatRxErrSecs:	**Errored Seconds**—The total number of Errored Seconds that have occurred on the interface. This includes both Line Errored and Path Errored Seconds.
Ds1StatRxSevereErrSecs:	**Severely Errored Seconds**—The total number of Severely Errored Seconds that have occurred on the interface. This includes both Line Severely Errored Seconds and Path Severely Errored Seconds.
Ds1StatRxUnavailSecs:	**Unavailable Seconds**—The total number of Unavailable Seconds that have occurred on the interface.
Ds1StatRxBurstyErrSecs:	**Type B Errored Seconds**—The total number of Type B (Bursty) Errored Seconds that have occurred on the interface.
Ds1StatRxREBEs:	**E1 Remote-End Block Errors**—The total number of Remote-End Block Error (REBE) Events received on an E1 interface. (This data does not appear for DS1 interfaces.)

Output for SLM Frame Relay Operation

```
Router# show rtr configuration 2 | include Type
Type of operation to perform: Slm Frame-relay Interface
Reaction Type: None
Router#
Router# show rtr enhanced-history collection-statistics 2
Entry number: 2
Aggregation Interval: 900
```

```
Bucket Index: 1
Aggregation start time 00:15:00.003 UTC Mon Mar 1 1993
Target Address:
Number of failed operations due to a Disconnect: 0
Number of failed operations due to a Timeout: 0
Number of failed operations due to a Busy: 0
Number of failed operations due to a No Connection: 0
Number of failed operations due to an Internal Error: 0
Number of failed operations due to a Sequence Error: 0
Number of failed operations due to a Verify Error: 0

LinkState :1
Tx Total Frames:  24                      Rx Total Frames:  24
Tx Total Octets:  312                     Rx Total Octets:  344
Tx FCSAlignErrors:  0                     Rx FCSAlignErrors:  0
Tx Aborted Frames:  0                     Rx Aborted Frames:  0
Tx Long Frames:  0                        Rx Long Frames:  0
Tx Short Frames:  0                       Rx Short Frames:  0
Tx MaxThroughput:  88                     Rx MaxThroughput:  152
Tx MaxUtilization:  0                     Rx MaxUtilization:  0
Tx MaxFramesSec:  1                       Rx MaxFramesSec:  1
UnavailSecs:  0                           Drop Events:  0
Tx OverFlowOctets:  0                     Rx OverFlowOctets:  0

Tx Burst Percent1(sec):  238              Rx Burst Percent1(sec): 238
Tx Burst Percent2(sec):  0                Rx Burst Percent2(sec): 0
Tx Burst Percent3(sec):  0                Rx Burst Percent3(sec): 0
Tx Burst Percent4(sec):  0                Rx Burst Percent4(sec): 0
Tx Burst Percent5(sec):  0                Rx Burst Percent5(sec): 0

Sample Index = 1

Bucket Index: 2
 .
 .
 .
```

Table 3 describes the significant fields shown in the display. In the output “Tx” indicates “transmitted,” “Rx” indicates “received.”

Table 3 show rtr enhanced-history collection-statistics Field Descriptions for SLM Frame Relay Operations

Field	Description
`LinkState:`	The Link State of the Frame Relay access channel being monitored. The link state is determined by the presence of LMI messages on the user and network side of the line. The link state can take the following values: • up(1)—Both sides of the access channel are up. • networkDown(2)—The network side of the circuit has not responded to at least frDlcmiErrorThreshold Status Enquiry messages. • userDown(3)—The user side of the access channel has not sent a Status Enquiry LMI message in FrConfigPollingTimeoutInterval (T391) seconds. • down(4)—Both sides of the access channel have been down over some portion of the sampling interval. • spoofNetworkUp(5)—The agent has been spoofing for the user over some portion of the sampling interval while the network side of the access channel has been up over the entire sampling interval. • spoofNetworkDown(6)— The agent has been spoofing for the user over some portion of the sampling interval while the network side of the access channel has been down over the entire sampling interval.
`Tx Total Frames:`	The total number of frames (including errored frames) transmitted by the interface. Aborted frames are not included in this count. (FrStatTxFrames)
`Rx Total Frames:`	The total number of non-errored frames received by the interface. Aborted frames are not included. (FrStatRxFrames)
`Tx Total Octets:`	The total number of octets transmitted in frames from the interface (excluding framing bits but including FCS octets). Octets in errored and aborted frames are included in this count. (FrStatTxOctets)
`Rx Total Octets:`	The total number of octets received by the interface in non-errored frames (excluding framing bits but including FCS octets). Octets in errored and aborted frames are included in this count. (FrStatRxOctets)

Table 3 show rtr enhanced-history collection-statistics Field Descriptions for SLM Frame Relay Operations (continued)

Field	Description
Tx FCSAlignErrors:	The total number of frames transmitted by the interface that had a length (excluding framing bits, but including FCS octets) of at least (5) octets, but had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error). Agents that cannot count this transmit-side object will return a value of zero. (FrStatTxFcsAlignErrors)
Rx FCSAlignErrors:	The total number of frames received by the interface that had a length (excluding framing bits, but including FCS octets) of at least (5) octets, but had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error). (FrStatRxFcsAlignErrors)
Tx Aborted Frames:	The total number of frames transmitted by the interface that were terminated by an abort. (FrStatTxAbortedFrames)
Rx Aborted Frames:	The total number of frames received by the interface that were terminated by an abort. (FrStatRxAbortedFrames)
Tx Long Frames:	The total number of non-errored frames transmitted on the interfaces that were longer than the interface's maximum frame length. The maximum frame length value should be specified by either the FrConfigMaxFrameLength variable or the HdlcConfigMaxFrameLength variable, depending on the interface. (FrStatTxLongFrames)
Rx Long Frames:	The total number of non-errored frames received by the interface that were longer than the interface's maximum frame length. (FrStatRxLongFrames)
Tx Short Frames:	The total number of frames transmitted on the interfaces that were shorter than five (5) octets, excluding framing bits, but including FCS octets. Agents that cannot count this transmit-side object should return a value of zero. (FrStatTxShortFrames)
Rx Short Frames:	The total number of frames received by he interfaces that were shorter than five (5) octets, excluding framing bits, but including FCS octets. (FrStatRxShortFrames)

Table 3 show rtr enhanced-history collection-statistics Field Descriptions for SLM Frame Relay Operations (continued)

Field	Description
`Tx MaxThroughput:`	The maximum effective rate of user data (ignoring frame relay overhead) transmitted by the interface during the current 15 minute interval, expressed in bits per second. (FrStatTxMaxThroughput)
`Rx MaxThroughput:`	The maximum effective rate of user data (ignoring frame relay overhead) received by the interface during the current 15 minute interval, expressed in bits per second. (FrStatRxMaxThroughput)
`Tx MaxUtilization:`	The best estimate of the maximum transmitted physical layer utilization on this interface during the current 15-minute interval, in hundredths of a percent. (FrStatTxMaxUtilization)
`Rx MaxUtilization:`	The best estimate of the maximum received physical layer utilization on this interface during the current 15-minute interval, in hundredths of a percent. (FrStatRxMaxUtilization)
`Tx MaxFramesSec:`	The maximum number of frames transmitted by the interface in any one second during the current 15-minute interval. (FrStatTxMaxFramesSec)
`Rx MaxFramesSec:`	The maximum number of frames received by the interface in any one second during the current 15-minute interval. (FrStatRxMaxFramesSec)
`UnavailSecs:`	The total number seconds that the network side of the circuit has been down/unavailable (not responding to Status Enquiry messages). (FrStatPortUnavailSecs)
`Drop Events:`	The total number of events in which frames were dropped by the operation due to lack of resources. A drop event occurs when a frame is not analyzed. Drop events do not imply that any frames were removed or not transmitted on the line. **Note** This number is not necessarily the number of frames dropped; it is just the number of times this condition has been detected. (FrStatDropEvents)
`Tx OverFlowOctets:`	The high order (overflow) count of the total number of octets transmitted in frames by the interface (excluding framing bits but including FCS octets). • Octets in aborted frames are not included in this count. • This counter is only used when 64 bit octet counters are required for the interface.

Table 3 show rtr enhanced-history collection-statistics Field Descriptions for SLM Frame Relay Operations (continued)

Field	Description
Rx OverFlowOctets:	The high order (overflow) count of the total number of octets received by the interface in non-errored frames (excluding framing bits but including FCS octets). • Octets in aborted frames are not included. • This counter is only used when 64 bit octet counters are required for the interface.
Tx Burst Percent1(sec):	The number of one second intervals where the transmitted throughput (t) is greater than or equal to zero and less than or equal to BurstLimit 1 (0 <= t <= BurstLimit1). BurstLimit1 is defined as a percentage of the CircuitBurstNominalRate.

Output for SLM Frame Relay Circuit Operation

```
Router# show running-config
. . .
rtr 3
 type slm frame-relay pvc interface Serial0:0 111
 enhanced-history interval 900 buckets 100
rtr schedule 3 start-time now life forever
. . .

Router# show rtr configuration 3 | include Type
Type of operation to perform: Slm Frame-relay Pvc
Reaction Type: None
Router#
Router# show rtr enhanced-history collection-statistics 3


Entry number: 3
Aggregation Interval: 900

Bucket Index: 1
Aggregation start time 21:37:29.988 UTC Fri May 2 2003
Target Address:
Number of failed operations due to a Disconnect: 0
Number of failed operations due to a Timeout: 0
Number of failed operations due to a Busy: 0
Number of failed operations due to a No Connection: 0
Number of failed operations due to an Internal Error: 0
Number of failed operations due to a Sequence Error: 0
Number of failed operations due to a Verify Error: 0

Sample Index = 2

Echo Receive Time = *00:22:30.007 UTC Sat May 3 2003
Echo Response Time = 20 (ms)
Remote IP Address     : 14.1.1.2        Remote Product Id     : 2203682392
Remote Interface Type : 32              Remote Interface Index: 12
Remote Circuit Index  : 111

Offered Frames/PDUs  : 0                  Delivered Frames/PDUs:  0

Tx Total Frames:  4                       Rx Total Frames:  4
```

```
Tx Total Octets:  150                    Rx Total Octets:  140
Tx DeFrames:  0                          Rx DeFrames:  0
Tx MaxThroughput:  832                   Rx MaxThroughput:  752
Rx FecnSeconds:  0                       Rx BecnSeconds:  0
OctetsAboveCIR:  0                       FramesAboveCIR:   0
Unavailable Seconds:  0

Tx Burst Percent1(sec):  1117             Tx Burst Percent2(sec): 0
Tx Burst Percent3(sec):  0                Tx Burst Percent4(sec): 0
Tx Burst Percent5(sec):  0

Bucket Index: 2
 .
 .
 .
```

Table 4 describes the significant fields shown in the display. In the output "Tx" indicates "transmitted," "Rx" indicates "received."

Table 4 show rtr enhanced-history collection-statistics Field Descriptions for SLM Frame Relay Circuit Operations

Field	Description
`Offered Frames/PDUs:`	Number of PDUs offered reported from the far-end of this circuit. If this statistic is not available its value is 0. (AtmVcStatOfferedPdus)
`Delivered Frames/PDUs:`	Number of PDUs delivered during the same interval that AtmVcStatOfferedPdus is calculated over. This will only be the same value as Received Frames (Rx Total Frames) if the inter-agent message passing occurs coincident with the sampling interval boundaries. If this statistic is not available its value is 0. (AtmVcStatDeliveredPdus)
`Tx Total Frames:`	Total number of non-errored frames transmitted on the circuit. • Errored frames and aborted frames are not included in this count. (FrCircuitTxFrames)
`Rx Total Frames:`	Total number of non-errored frames received on the circuit. • Errored frames and aborted frames are not included in this count. (FrCircuitRxFrames)
`Tx Total Octets:`	Number of octets transmitted on the circuit. • Octets in errored frames and aborted frames are not included in this count. (FrCircuitTxOctets)

Table 4 show rtr enhanced-history collection-statistics Field Descriptions for SLM Frame Relay Circuit Operations (continued)

Field	Description
Rx Total Octets:	Number of octets received on the circuit. • Octets in errored frames and aborted frames are not included in this count. (FrCircuitRxOctets)
Tx DeFrames:	The number of non-errored frames transmitted on the circuit that had the Discard Eligibility (DE) bit set. (FrCircuitTxDeFrames)
Rx DeFrames:	The number of non-errored frames received on the circuit that had the Discard Eligibility (DE) bit set. (FrCircuitRxDeFrames)
Tx MaxThroughput:	The maximum effective rate of user data (ignoring frame relay overhead) transmitted on the circuit during the current 15-minute interval, expressed in bits per second. (FrCircuitCurrentTxMaxThroughput)
Rx MaxThroughput:	The maximum effective rate of user data (ignoring frame relay overhead) received on the circuit during the current 15-minute interval, expressed in bits per second. (FrCircuitCurrentRxMaxThroughput)
Rx FecnSeconds:	The number of FECN Seconds that occurred for the circuit since it was created. A FECN Second is defined a second during which one or more non-errored frames were received with the Forward Explicit Congestion Notification (FECN) bit set. (FrCircuitRxFecnSeconds)
Rx BecnSeconds:	The number of BECN Seconds that occurred for the circuit since it was created. A BECN Second is defined a second during which one or more non-errored frames were received with the Backward Explicit Congestion Notification (BECN) bit set. (FrCircuitRxBecnSeconds)
OctetsAboveCIR:	The total number of octets transmitted on the circuit that has exceeded CIR during the current 15-minute interval. (FrCircuitCurrentOctetsAboveCIR)
FramesAboveCIR:	The total number of frames transmitted on the circuit that has exceeded CIR during the current 15-minute interval. (FrCircuitCurrentFramesAboveCIR)
Unavailable Seconds:	Number of seconds this circuit has not been available during the current 15-minute interval. (FrCircuitCurrentUnavailSecs)

Table 4 show rtr enhanced-history collection-statistics Field Descriptions for SLM Frame Relay Circuit Operations (continued)

Field	Description
`Tx Burst Percent1(sec):`	The number of one second intervals where the percentage of transmitted throughput to CIR (or line rate/2 if CIR=0) fell into this range on the interface during the current 15 minute interval. (FrCircuitCurrentTxBurstPercent1)
`Tx Burst Percent1(sec):`	The number of one second intervals where the percentage of transmitted throughput to CIR (or line rate/2 if CIR=0) fell into this range on the interface during the current 15 minute interval. (FrCircuitCurrentTxBurstPercent2)

show rtr enhanced-history distribution-statistics

To display enhanced history distribution statistics for SAA operations in tabular format, use the **show rtr enhanced-history distribution-statistics** command in user or privileged EXEC mode.

show rtr enhanced-history distribution-statistics [*operation-number*] [**interval** *seconds*]

Syntax Description

operation-number	(Optional) Displays enhanced history distribution statistics for only the specified operation.
interval *seconds*	(Optional) Specifies a distribution interval for the displayed statistics, in seconds. The valid range is from 1 to 3,600 seconds (1 hour). This syntax is not valid for SLM operations. The default is 900 seconds.

Defaults

The default distribution interval is 900 seconds.

Command Modes

User EXEC

Privileged EXEC

Command History

Release	Modification
12.3(1)	This command was introduced.

Usage Guidelines

The distribution statistics consist of the following:

- The sum of completion times (used to calculate the mean)
- The sum of the completion times squared (used to calculate standard deviation)
- The maximum and minimum completion times
- The number of completed attempts

You can also use the **show rtr enhanced-history collection-statistics** and **show rtr enhanced-history totals-statistics** commands to display additional statistical information.

If the character ‘n’ appears in your output and not all fields are displayed, you should increase the screen width for your CLI display (for example, using the **width** line configuration command).

Examples

The following is sample output from the **show rtr enhanced-history distribution-statistics** command for an SLM Frame Relay Circuit (Slm Frame-relay Pvc) operation.

```
Router# show rtr configuration 3 | include Type
Type of operation to perform: Slm Frame-relay Pvc
Reaction Type: None

Router# show rtr enhanced-history distribution-statistics 3

Point by point Enhanced History
Entry    = Entry Number
```

```
Int      = Aggregation Interval (seconds)
BucI     = Bucket Index
StartT   = Aggregation Start Time (seconds)
Pth      = Path index
Hop      = Hop in path index
Comps    = Operations completed
OvrTh    = Operations completed over thresholds
SumCmp   = Sum of RTT (milliseconds)
SumCmp2L = Sum of RTT squared low 32 bits (milliseconds)
SumCmp2H = Sum of RTT squared high 32 bits (milliseconds)
TMax     = RTT maximum (milliseconds)
TMin     = RTT minimum (milliseconds)

Entry Int BucI StartT    Pth Hop Comps OvrTh SumCmp   SumCmp2L  SumCmp2H   TMax     TMin
3     900 1    257850000 1   1   3     0     43       617        0          15       14
3     900 2    258750002 1   1   3     0     45       677        0          16       14
3     900 3    259650000 1   1   3     0     44       646        0          15       14
3     900 4    260550002 1   1   3     0     42       594        0          15       12
3     900 5    261450003 1   1   3     0     42       590        0          15       13
3     900 6    262350001 1   1   3     0     46       706        0          16       15
3     900 7    263250003 1   1   3     0     46       708        0          16       14
 .
 .
 .
```

The fields are defined at the beginning of the output for the command. RTT means round-trip time. The "StartT" column(Start Time) shows the start time of the operation using a timestamp. The timestamp is the number of seconds since the router was last restarted (rebooted).

Related Commands

Command	Description
rtr	Allows configuration of SAA operations by entering SAA RTR configuration mode for the specified operation number.
show rtr enhanced-history collection-statistics	Displays data for all collected history buckets for the specified SAA operation, with data for each bucket shown individually.

type slm controller

To configure a Service Assurance Agent (SAA) operation as an SLM interface operation, and to specify the interface that the operation should be run on, use the **type slm controller** command in SAA RTR configuration mode. To remove or replace a previously configured SAA operation, use the **no rtr** *operation-number* global configuration command.

type slm controller *controller-id*

Syntax Description

controller-id	The controller type and slot/port number. Valid controller types include **E1**, **E3**, **T1**, and **T3**.

Defaults

No default behavior or values

Command Modes

SAA RTR configuration mode (config-rtr)

Command History

Release	Modification
12.2(13)T	This command was introduced for controllers using ATM. This command replaces the **type t1-slm** command.
12.2(15)T	Support for T3 and E3 controllers was added.
12.3(1)	Support for controllers configured for Frame Relay was added.

Usage Guidelines

This SAA RTR configuration command specifies that the operation is an SLM physical controller operation, which provides information about the data link layer connection, and specifies the controller that the operation should be run on.

Controllers that can be monitored using this operation include T1, E1, T3, and E3.

The specified controller should be configured for Frame Relay or ATM.

Examples

In the following example, SAA operation 1 is configured as an SLM controller operation:

```
Router> enable
Password:
Router# configure terminal
Enter configuration commands, one per line.
Router(config)# rtr slm frame-relay statistics
Router(config)# rtr 1
Router(config-rtr)# type slm controller T1 0
Router(config-rtr-slm-if)# enhanced-history interval 900 buckets 100
Router(config-rtr-slm-if)# exit
Router(config)# rtr schedule 1 start-time now life forever
Router(config)# end
Router#
Router# show rtr configuration 1 | include Type
Type of operation to perform: slm controller
Reaction Type: None
```

```
Router#
```

Related Commands

Command	Description
rtr	Allows configuration of SAA operations by entering SAA RTR configuration mode for the specified operation number.
show rtr enhanced-history collection-statistics	Displays data for all collected history buckets for the specified SAA operation, with data for each bucket shown individually.
show rtr enhanced-history distribution-statistics	Displays enhanced history data for all collected buckets in a summary table.
type slm interface	Specifies that the SAA operation is an SLM interface operation, and specifies the interface that the operation should be run on.

type slm interface

To configure a Service Assurance Agent (SAA) operation as an SLM interface operation, and to specify the interface that the operation should be run on, use the **type slm interface** command in SAA RTR configuration mode. To remove or replace a previously configured SAA operation, use the **no rtr** *operation-number* global configuration command.

type slm interface *type number*

Syntax Description

type number	The interface type and number. Interface types include **Serial** and **FR-ATM**. Alternatively, an Inverse Multiplexing over ATM (IMA) group number can be specified.

Defaults

No default behavior or values

Command Modes

SAA RTR configuration mode (config-rtr)

Command History

Release	Modification
12.2(11)T	This command was introduced to support ATM SLM operations.
12.2(13)T	This command was updated to support T1 IMA (ATM) interfaces.
12.3(1)	This command was updated to support FR SLM operations (Serial interfaces).

Usage Guidelines

The **type slm interface** SAA RTR configuration command specifies that the operation is an SLM physical interface operation, which provides information about the data link layer connection. The specified interface should be configured for Frame Relay or ATM.

Interfaces that can be monitored using this operation include Serial or HSSI (high speed serial interface) for Frame Relay interfaces, and IMA for ATM interfaces. To specify an HSSI interface, use the **Serial** keyword as the *type*.

In order for this operation to work, either the **atm slm statistics** global configuration command or the **rtr slm frame-relay statistics** global configuration command must be enabled on the device.

This command puts the CLI into SAA SLM controller/interface configuration mode, in which you can configure optional characteristics for the operation. To view the available options, enter the **?** command at the (config-rtr-slm-if) prompt.

Examples

In the following example, SAA operation 1 is configured as an SLM interface operation for a Frame Relay interface:

```
Router> enable
Password:
Router# configure terminal
Enter configuration commands, one per line.
```

```
Router(config)# rtr slm frame-relay statistics
Router(config)# rtr 1
Router(config-rtr)# type slm interface Serial 0.1
Router(config-rtr-slm-if)# enhanced-history interval 900 buckets 100
Router(config-rtr-slm-if)# exit
Router(config)# rtr schedule 1 start-time now life forever
Router(config)# end
Router#
Router# show rtr configuration 1 | include Type
Type of operation to perform: slm interface
Reaction Type: None
Router#
```

Related Commands

Command	Description
rtr	Allows configuration of SAA operations by entering SAA RTR configuration mode for the specified operation number.
show rtr enhanced-history collection-statistics	Displays data for all collected history buckets for the specified SAA operation, with data for each bucket shown individually.
show rtr enhanced-history distribution-statistics	Displays enhanced history data for all collected buckets in a summary table.
type slm controller	Specifies that the SAA operation is an SLM controller operation, and specifies the controller that the operation should be run on.

type slm frame-relay interface

To configure a Service Assurance Agent (SAA) operation as an SLM Frame Relay (FR) interface operation, and to specify the interface that the operation should be run on, use the **type slm frame-relay interface** command in SAA RTR configuration mode. To remove or replace a previously configured SAA operation, use the **no rtr** *operation-number* global configuration command.

type slm frame-relay interface *interface-type interface-number dlci-number*

Syntax Description

interface-type interface-number	The interface type (**Serial**) and number. An intervening space is not required.
dlci-number	The data-link connection identifier for the PVC to be monitored.

Defaults

No default behavior or values

Command Modes

SAA RTR configuration mode (config-rtr)

Command History

Release	Modification
12.3(1)	This command was introduced.

Usage Guidelines

The SAA SLM FR interface operation provides Frame transfer (Layer 2) data for a Frame Relay link. The **type slm frame-relay interface** command specifies the operation type and the interface that the operation should be run on. The specified interface should be configured for Frame Relay.

Frame Relay interface link statistics are used to monitor the basic health of a Frame Relay interface. This information includes some traffic counters, assorted error counts, and some performance-related counters.

To view the gathered statistics, use the **show rtr enhanced-history distribution-statistics** command or the **show rtr enhanced-history collection-statistics** command. Statistics gathered with this operation can also be retrieved from external network monitoring applications via the CNS event gateway.

Examples

In the following example, SAA operation 2 is configured as an SLM Frame Relay Interface operation:

```
Router> enable
Password:
Router# configure terminal
Enter configuration commands, one per line.
Router(config)# rtr slm frame-relay statistics
Router(config)# rtr 2
Router(config-rtr)# type slm frame-relay interface Serial0:0
Router(config-rtr-slm-fr-if)# enhanced-history interval 900 buckets 100
Router(config-rtr-slm-fr-if)# exit
Router(config)# rtr schedule 2 start-time now life forever
Router(config)# end
Router#
```

```
Router# show rtr configuration 2 | include Type
Type of operation to perform: Slm Frame-relay Interface
Reaction Type: None
```

Related Commands

Command	Description
rtr	Allows configuration of SAA operations by entering SAA RTR configuration mode for the specified operation number.
show rtr enhanced-history collection-statistics	Displays data for all collected history buckets for the specified SAA operation, with data for each bucket shown individually.
show rtr enhanced-history distribution-statistics	Displays enhanced history data for all collected buckets in a summary table.

type slm frame-relay pvc interface

To configure an SAA operation as an SLM Frame Relay (FR) Circuit operation, and specify the interface that the operation should be run on, use the **type slm frame-relay pvc interface** command in SAA RTR configuration mode. To remove or replace a previously configured SAA operation, use the **no rtr** *operation-number* global configuration command.

type slm frame-relay pvc interface *type number dlci-number*

Syntax Description

type number	Type, slot and port number of the interface.
dlci-number	Data link connection identifier of the permanent virtual circuit (PVC) to be monitored.

Defaults

No default behavior or values

Command Modes

SAA RTR configuration mode

Command History

Release	Modification
12.3(1)	This command was introduced.

Usage Guidelines

This command specifies that the operation is an SAA SLM FR circuit operation, which provides data for the specified circuit. The specified interface should be configured with a permanent virtual circuit (PVC) connection.

The Frame Relay circuit statistics are used to monitor the basic health of a Frame Relay circuit. This information includes some traffic counters, assorted error counts, and some performance-related counters.

This command puts the CLI into SAA SLM FR Circuit configuration mode (config-rtr-slm-fr-dlci).

Examples

In the following example SAA operation 3 is configured as an SLM Frame Relay Circuit (or PVC) operation:

```
Router> enable
Password:
Router# configure terminal
Enter configuration commands, one per line.
Router(config)# rtr slm frame-relay statistics
Router(config)# rtr 3
Router(config-rtr)# type slm frame-relay pvc interface Serial0:0 111
Router(config-rtr-slm-fr-dlci)# enhanced-history interval 900 buckets 100
Router(config-rtr-slm-fr-dlci)# exit
Router(config)# rtr schedule 3 start-time now life forever
Router(config)# end
Router#
Router# show rtr configuration 3 | include Type
Type of operation to perform: Slm Frame-relay Pvc
```

```
Reaction Type: None
```

Related Commands

Command	Description
rtr	Allows configuration of SAA operations by entering SAA RTR configuration mode for the specified operation number.
show rtr enhanced-history collection-statistics	Displays data for all collected history buckets for the specified SAA operation, with data for each bucket shown individually.
show rtr enhanced-history distribution-statistics	Displays enhanced history data for all collected buckets in a summary table.