SAS Viya® 3.4 Administration: Monitoring

Monitoring: Overview

SAS Viya provides monitoring functions through several facilities. Use the monitoring system that matches your needs and your environment:
The SAS Viya operations infrastructure collects metrics from SAS Viya applications and services. See “Operations Infrastructure: Overview” in SAS Viya Administration: Operations Infrastructure for more information. SAS Environment Manager uses the collected data to display metric information and status in these interfaces:

- To quickly view the health and status of your SAS Viya environment, see “Use the SAS Environment Manager Dashboard for System Monitoring” on page 10.
- To view metrics, status, and performance charts for the machines in your environment, see “Monitoring: How to (SAS Environment Manager)” on page 2.
- To view detailed reports for the status and activity in your system, see “Use SAS Environment Manager Reports for System Monitoring” on page 4.

If you are using the SAS Viya programming-only interface, SAS Environment Manager is not deployed.

If you are using the SAS Viya programming-only interface, you can use CAS Server Monitor. CAS Server Monitor is a graphical web application that is embedded in the CAS server. It provides system-level monitoring for the machines and processes that run on the CAS server.

To view detailed information about the load and performance for the machines and processes running on a CAS server, see “Monitoring: How to (CAS Server Monitor)” on page 12. If you are not using the SAS Viya programming-only interface, CAS Server Monitor is not available.

CAS start-up or session options can enable returning of performance metric information each time a CAS action runs. The data provided by the metrics enables you to monitor the CPU load on the CAS grid and to determine how efficiently the CAS grid is processing the actions. See “CAS Action Metrics” on page 16 for a list of the metrics that are returned.

The CAS options are available in the SAS Viya programming-only environment.

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**Monitoring: Concepts**

A metric is a measurement that describes the performance of a component or a subsystem of SAS Viya. Because metrics are valuable only when they are regularly collected and evaluated, the operations infrastructure is dedicated to collecting data about the state of SAS Viya resources and services. A set of collector components from the infrastructure then publishes the data as a message to a RabbitMQ exchange, where a publisher sends it to ETL processes and a data mart. SAS Environment Manager uses the collected data from the data mart to display in various interfaces such as reports, tables, and availability indicators. See SAS Viya Administration: Operations Infrastructure for more information.

In a SAS Viya environment, CAS uses a controller node to distribute work to worker nodes. In this type of distributed environment, it is important to monitor the performance of each of the nodes in the environment, to ensure that nodes are not becoming overloaded and slowing down. You should also monitor session processes on the CAS nodes to ensure that individual processes are not consuming excessive resources.

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**Monitoring: How to (SAS Environment Manager)**

**Monitor Machines**

**Navigation**

In SAS Environment Manager, select Machines from the left navigation menu to display the Machines page.
The Machines page displays a list of machines across the top of the page. An icon next to the machine name indicates the status of the machine (available, unavailable, or partially available). Select a machine from the list to display information about the machine on the charts and tables in the Machines page.

**View the Status of a Machine**

1. In SAS Environment Manager, select Machines from the left navigation menu to display the Machines page.

2. On the Machines page, select a machine name from the list at the top of the page. An icon beside the machine name indicates whether the services on the machine are available ☑, partially available ▲, or completely unavailable ❌.

3. By default, the chart on the Machines page displays the percentage of total CPU utilization over the last hour. Click Last hour to change the display to the last 6, 12, or 24 hours. Place your pointer on a line on the graph to view detailed information about the CPU utilization, divided into User, System, Wait, and Stolen usage. Place your pointer in the chart and use the control wheel on your mouse to zoom in to the chart.

   **Note:** The chart is updated every two minutes. The data that is displayed on the chart is updated every five minutes.

4. Click Memory above the chart to display the percentage of memory that is used over the selected time period. Place your pointer on a line on the graph to view detailed information about memory usage.

5. The Machine Checks table displays the results of these predefined system checks that are performed on the machine:
   - **Disk utilization of SAS Config filesystem**
     The check passes if disk usage does not exceed 95%.
   - **Memory percent free**
     The check passes if memory usage does not exceed 95%.
   - **Serf Health Status**
     The check passes if the SAS Configuration Server is running.

   The table is refreshed every 10 seconds.

6. The Service Instances table displays a list of the service instances that are running on the selected machine and the status, address, and port for each service instance. The data is refreshed every 10 seconds.

7. To display the server properties, click Properties in the toolbar on the right side of the page. The Properties area displays information such as the host name, operating system, uptime, and total memory.

8. To display the collected metrics for the server, click System Metrics in the toolbar on the right side of the page. The System Metrics area displays detailed information about memory usage and availability.

9. To display the SAS packages that are installed on the machine, click SAS Packages in the toolbar on the right side of the page. The SAS Packages area displays the name and version number of the packages that are installed on the machine.

   **Note:** This information is not displayed if you are using Windows.

10. To display the system limits for the machine, click System Limits in the toolbar on the right side of the page. The System Limits area displays the resource limits for users on the machine.

   **Note:** This information is not displayed if you are using Windows.

**View CAS Server Metrics**

1. In SAS Environment Manager, select Server from the left navigation menu to display the Servers page.
2 Select a CAS server in the table.

3 At the right side of the page, select System Metrics.

4 The System Metrics area displays these metrics for the selected server:
   - Active sessions
   - Date and time that the last session was created or destroyed
   - Number of sessions created
   - Server uptime
   - User CPU time
   - System CPU time
   - Number of I/O operations performed
   - Number of active threads compared to the maximum number of threads
   - Amount of memory used
   - Maximum amount of memory used
   - Virtual machine size

Use SAS Environment Manager Reports for System Monitoring

Working with System Reports

SAS Environment Manager provides a set of predefined reports that provide a view of the most important metrics for monitoring a SAS Viya deployment. The Dashboard displays a thumbnail of each report, which you can use to access the full report in SAS Report Viewer. You must be an administrator in order to view system reports.

To display the report thumbnails, on the SAS Environment Manager Dashboard, select Show Reports. 

Note: This option is available only if you have specified one or more reports in the Public Dashboard Items application setting. See “Personalizing Your Dashboard” in SAS Viya Administration: Using SAS Environment Manager for more information.

The report thumbnails are not live views of the full reports but are snapshots of the report from the last time the thumbnail was generated. You must refresh the thumbnail in order to view the current state of the report. To refresh a report thumbnail, in the title bar for the report, select and then select Refresh. 

To open a report, in the title bar for the thumbnail report, select and then select Open. 

To return to SAS Environment Manager from the full view of a report, click your browser’s back button or select and select Manage Environment.

The CAS tables that are used to create these reports are refreshed every five minutes. In addition, during the deployment process, data might be delayed from appearing in these reports. The delay time varies and depends on how quickly SAS Infrastructure Data Server, RabbitMQ, CAS, and authentication services are operational and able to respond.

Note: In SAS Environment Manager 3.2, some system reports used data from the CAS_SYSTEM table. In SAS Environment Manager 3.3, these reports now use data that is collected by the operations infrastructure in order to provide a consistent view of SAS Viya metric data. The CAS_SYSTEM table will be removed from SAS Viya releases after SAS Viya 3.4. Therefore, if you have created any reports that use data from this table, they must be rewritten.
Monitor Application Activity

The Application Activity report provides detailed information about SAS applications and services running on your system. See “Working with System Reports” on page 4 for information about accessing and opening reports.

When you open the report, the machines in your environment are listed along the top of the report. Select a machine for which to display the report.

Select the report page to view. The report pages are organized into these tabs:

Main
Displays a chart of memory usage of the 10 applications or services that are consuming the most memory. The report displays the amount of used heap memory (HeapUsedMax) and of used non-heap memory (NonHeapUsedMax).

Place your cursor over a bar to view the name of the application and the memory usage values.

Application History
Displays the thumbnails of detailed reports for a selected service or application. Use the menu in the upper left corner of the page to select the service or application whose reports you want to view. If you do not select a service or application, the thumbnails display aggregate data for all services and applications. Use the slider control at the top of the page to select the time range for the reports. Click ☰ in the upper right of any chart to view a full-size version of the chart, including legends and labels. Click ✅ in the upper right of the full-size chart to return to the thumbnail view.

Place your cursor over a line in a graph to view detailed values.

Here are the available charts:

Heap usage
Displays the amount of heap memory that is used. The chart displays the metrics HeapCommitted, HeapUsed, NonHeapCommitted, and NonHeapUsed.

HTTP sessions
Displays the number of HTTP sessions that are used. The chart displays the metrics HTTPSessionsActive and HTTPSessionsMax.

Class Usage
Displays the number of classes that are used by the application or service. The chart displays the metrics Classes, ClassesLoaded, and ClassesUnloaded.

Data Source Usage
Displays the number of data sources that are used by the application or service. The chart displays the metrics DatasourcePrimaryActive and DatasourcePrimaryUsage.

Garbage Collection Time
Displays the amount of time that is used for garbage collection. The chart displays the metrics GcPsMarksweepTime and GcPsScavengeTime.

Threads
Displays the number of application threads that is used. The chart displays the metrics Threads, ThreadsDaemon, and ThreadsPeak.

Uptime
Displays the amount of time that the application or service has been running.

Garbage Collection Count
Displays the number of items that are collected during garbage collection. The chart displays the metrics GcPsMarksweepCount and GcPsScavengeCount.
System Session History
Displays a graph of the top 10 applications or services that have had the most active HTTP sessions over the previous eight hours.

Data collection status
Displays a chart of metric data points that are collected for each application.

Monitor CAS Activity
The CAS Activity report provides detailed information about CAS. See “Working with System Reports” on page 4 for information about accessing and opening reports.

When you open the report, the machines in your environment are listed along the top of the report. Select a machine for which to display the report.

Select the report page that you want to view. The report pages are organized into these tabs:

Main
Displays the Memory Used, I/O, and Threads charts.

CPU Usage
Displays the CPU Usage chart. The chart displays the metrics SystemCPU and UserCPU.

System Info
Displays the thumbnails of detailed reports for the CAS servers, including I/O wait time, IRQ time, open files, and free memory. This page is visible only if you are using SAS Visual Analytics.

System Details
Displays a table of detailed metric information about the CAS servers that is captured at one-minute intervals. The table includes data for load averages, free memory, idle time, and IRQ time. This page is visible only if you are using SAS Visual Analytics.

Node Details
Displays a table of information about the CAS server nodes.

CAS Details
Displays a table of detailed metrics for the CAS servers that are captured at one-minute intervals. The table includes these metrics:
- I/O count
- Maximum memory used (bytes)
- Maximum thread count
- Memory used (bytes)
- System CPU (seconds per second)
- System CPU count (seconds)
- Thread count
- Uptime (seconds per second)
- Uptime count (seconds)
- User CPU (seconds per second)
- User CPU count (seconds)

Monitor Disk Space
The Disk Space report provides detailed information about disk space and usage. See “Working with System Reports” on page 4 for information about accessing and opening reports.
The machines in your environment are listed in the **Machine** menu at top of the report. Select a machine for which to display the report.

Select the report page to view. The report pages are organized into these tabs:

**Main**
Displays a chart of the top 10 filesystems on SAS Viya machines that have the least amount of free space.

**Storage Dashboard**
Displays a chart of the total percentage of free disk space on each machine in the system. It also displays a series of charts of the top 10 file storage locations that have the least amount of available space.

In the **Bottom 10 paths by Percent available** charts, the black line represents the available space. The background of the chart is color-coded to indicate whether the available space is in the acceptable zone (cyan), the warning zone (yellow), or the danger zone (red). For example, the disk corresponding to this graph has 18% free space, which is in the danger zone.

![Graph showing disk usage with percentage bars]

**Machine disk usage over time**
Displays a chart of the total percentage of free disk space on each machine in the system. It also displays a chart of the percentage of free space on all paths for each machine over the previous 48 hours.

**Disk usage forecast**
Displays a chart of the percentage of free space for a selected machine and the path over the previous 24 hours. It also includes a projection of the free space that will be available over the next 48 hours. Select a machine from the list above the chart, and then select a path from the list below the machine list.

**Storage Map**
Displays a visual representation of the size and available free space of all disks in all machines. Each disk is represented by a color-coded block. The size of the block represents the size of the disk. The color of the block represents the amount of free space. The color shifts from blue to red as the disk space decreases. Place your pointer on a block to view the size and percentage of free space for the disk.

**Details**
Displays a table of the size and free space (in bytes) for a selected machine and path, and that is recorded at one-minute intervals. Select a machine from the list above the table, and then select a path from the list below the machine list.

When you are monitoring CAS disk usage, keep in mind that owned disk space is the space used by files that are created in CAS_DISK_CACHE directories from in-memory blocks. These files cannot be shared with other server processes or session processes. Shared disk space is the space that is used by existing SASHDAT files from a co-located data source (PATH, HDFS, or DNFS). These files can be shared with other server processes or session processes.

**Monitor SAS Infrastructure Data Server Tables**
The Infrastructure Data Server Tables report provides detailed information about the table size and usage on the SAS Infrastructure Data Server. See "Working with System Reports" on page 4 for information about accessing and opening reports.

Select the report page to view. The report pages are organized into these tabs:

**Main**
Displays a chart of the five largest tables in the SAS Infrastructure Data Server. The chart displays the metrics TableSize Max, IndexSize Max, and ToastSize Max for each table.

Place your cursor over a bar to view the name of the table and the values for each metric.
Application Usage History
Displays an animated chart of the size of the largest SAS Infrastructure Data Server tables over the previous 36 hours. Click ▶ below the chart to start the animation. The chart displays the size of the tables at the time indicated on the slider control below the chart. You can use the slider control to view the size of the tables at a selected time. The chart separately displays the metrics TableSize, IndexSize, and ToastSize for each table.

Place your cursor over a bar to view the name of the table and the values for each metric.

Table Usage Trend
Displays a graph of the total size of all SAS Infrastructure Data Server tables over the past 36 hours. The chart separately displays the metrics TableSize, IndexSize, and ToastSize for all tables.

Table Size History
Displays an animated chart of the size of the largest SAS Infrastructure Data Server tables over the previous five hours. Click ▶ below the chart to start the animation. The chart displays the size of the tables at the time indicated on the slider control below the chart. You can use the slider control to view the size of the tables at a selected time. The chart separately displays the metrics TableSize, IndexSize, and ToastSize for each table.

Monitor Message Queue Activity
The Message Queue Activity report provides detailed information about traffic and activity on the RabbitMQ message queues that used by the operations infrastructure to provide log messages, metric data, notifications, and alerts to consumers such as SAS Environment Manager. See “Working with System Reports” on page 4 for information about accessing and opening reports.

Select the report page to view. The report pages are organized into these tabs:

Main
Displays a chart of the total amount of data that is published to and from each message queue. The chart displays the PublishInCount and PublishOutCount metrics for each message queue.

Messaging Activity
Displays a graph of the amount of data that is published to a selected message queue over the previous 48 hours. Select the queue name from the list at the top of the chart. The chart displays the PublishIn and PublishOut metrics.

Messaging Animation
Displays an animated chart of the amount of data that is published to message queues over the previous 36 hours. Click ▶ below the chart to start the animation. The chart displays the amount of data that is published to the queue at the time indicated on the slider control below the chart. You can use the slider control to view the amount of data that is published at a selected time. The chart displays the PublishIn and PublishOut metrics.

System info
Displays charts illustrating the number of RunQueue instructions, the amount of data written to queues, and the amount of memory that is used over the previous 48 hours. The charts display the RunQueue, IoWriteBytes, and MemUsed metrics.

Monitor System Activity
The System Activity report provides detailed information about CPU usage, memory usage, and network activity. See “Working with System Reports” on page 4 for information about accessing and opening reports.

The machines in your environment are listed in the Machine menu at top of the report. Select a machine for which to display the report.

Select the report page to view. The report pages are organized into these tabs:
Main
Displays a chart of the memory usage for a selected machine over a selected time range. Select the machine from the list at the top of the chart. Select the time range using the slider control at the top of the chart.

CPU history
Displays a chart of the CPU usage for a selected machine over a selected time range. Select the machine from the list at the top of the chart. Select the time range using the slider control at the top of the chart. The chart displays separate lines for the metrics System CPU% and User CPU%.

Memory Usage history
Displays a chart of the free memory and the used memory for a selected machine over a selected time range. The orange area at the top of the chart represents the free memory, and the green area at the bottom of the chart represents the used memory. The two values together always add up to the total memory. Select the machine from the list at the top of the chart. Select the time range using the slider control at the top of the chart. The chart displays the metrics Used Memory and Free Memory.

Network Activity history
Displays charts of the network activity and the cumulative network I/O for a selected machine and an interface over a selected time range. Select the machine and the interface from the lists at the top of the chart. Select the time range using the slider control at the top of the chart. The Network Activity over time chart displays the TransmitBytes and ReceiveBytes metrics. The Cumulative Network I/O chart displays the TransmitBytes_cnt and ReceiveBytes_cnt metrics.

Memory Animation
Displays an animated chart of the used memory and the free memory for all machines over the previous 36 hours. Click ➤ below the chart to start the animation. The chart displays the memory usage at the time indicated on the slider control below the chart. You can use the slider control to view the memory usage at a selected time. The chart separately displays the metrics Used Memory and Free Memory for each machine. The orange area at the top of the chart represents the free memory, and the green area at the bottom of the chart represents the used memory.

CPU Details Animation
Displays an animated chart of the CPU usage for all machines over the previous 36 hours. Click ➤ below the chart to start the animation. The chart displays the CPU usage at the time indicated on the slider control below the chart. You can use the slider control to view the CPU usage at a selected time. The chart separately displays the metrics UserCPU, IoWaitCPU, SystemCPU, and StolenCPU for each machine.

Network Activity Animation
Displays an animated chart of the network activity for all machines over the previous 36 hours. Click ➤ below the chart to start the animation. The chart displays the network activity at the time indicated on the slider control below the chart. You can use the slider control to view the activity at a selected time. The chart separately displays the metrics TransmitBytes_cnt and ReceiveBytes_cnt for each machine.

System Details
Displays a table of detailed system metrics for selected machines over a selected time period, which is captured at one-minute intervals. The table includes information about memory usage, CPU usage, and system load. Select a machine from the list at the top of the table. Select a time period by using the slider control at the top of the table.

Network Details
Displays a table of detailed network metrics for the selected machines and the interfaces over a selected time period, which is captured at one-minute intervals. The table includes information about received data, transmitted data, and transmit errors. Select a machine and an interface from the lists at the top of the table. Select a time period by using the slider control at the top of the table.

Monitor User Activity
The User Activity report provides a view of audit information. See “Working with System Reports” on page 4 for information about accessing and opening reports.
Select the report page to view. The report pages are organized into these tabs:

**Main**
Contains thumbnail graphs for the charts **Most active users**, **Activity counts**, **Most active data**, and **User Actions over time**.

**Most Active Users**
Displays the **Most Active Users** and **Activity Over Time** charts, and a table of the audit records that are ordered by level of user activity. The table does not display audit records from SAS internal users. Select a bar in the **Most Active Users** chart to display the **Activity Over Time** chart for the selected user, and to list the audit records only for the selected user.

**Application Usage**
Displays the **Most used Applications** and **Application Activity** charts, and a table of the audit records that are ordered by level of application activity. Select a bar in the **Most used Applications** chart to display the **Application Activity** chart for the selected application, and to list the audit records only for the selected application.

**Report Activity**
Displays the **Top Report Usage** chart and a table of the audit records for report access. By default, the chart and the table display activity for all users. To view report usage and the audit records only for a specific user, select the user in the **Users** menu.

**Data Activity**
Displays the **Frequently Accessed Tables** chart and a table of the audit records for data table access. By default, the chart and the table display data table activity for all users. To view data table activity usage and the audit records only for a specific user, select the user in the **Users** menu.

**Data Plan Activity**
Displays the **Top Report Usage** chart and a table of the audit records for data plan access. By default, the chart and the table display activity for all users. To view data plan usage and the audit records only for a specific user, select the user in the **Users** menu.

**Failures**
Displays the **Failed Requests per Application** chart and the **Failed Activities** chart, and a table of the audit records only for failed requests. By default, the **Failed Activities** chart and the audit records table display failures for all applications. To view the **Failed Activities** chart and the audit records for a specific application, select the application’s bar in the **Failed Requests per Application** chart.

**Details**
Displays a table of audit records. By default, the table displays all audit records. To filter the table, use the menus at the top of the table to display only those records that match your selected criteria. You can filter by user, application, action, and state. You can also filter using multiple criteria.

**Note:** If the User Activity report is blank or displays the message **Cannot find the requested data source**, you must verify that the command-line interface (CLI) was deployed properly in your SAS Viya environment. See “Edit the Inventory File” in SAS Viya for Linux: Deployment Guide for more information.

### Use the SAS Environment Manager Dashboard for System Monitoring

#### Monitor Availability of Machines and Services
The **Availability** tile displays grids of color-coded boxes, and each box displays the status of each machine, service, and service instance. A green box indicates that the item is available, a yellow box indicates that it is partially available, and a red box indicates that it is unavailable. The tile is updated every 10 seconds.

Selecting a box on one of the grids highlights the corresponding boxes on the other two grids. The box that you select is outlined with a solid line, and the associated boxes are outlined with a dashed line. Here are the associations between the selected boxes:
When you click a box on the **Machines** grid, the services and the service instances that are running on that machine are highlighted on the **Services** grid and on the **Service Instance** grid.

When you click a box on the **Services** grid, the machines on which that service is running are highlighted on the **Machines** grid, and the instances of the service are highlighted on the **Service instances** grid.

When you click a box on the **Service instances** grid, the machines on which the service instance is running are highlighted on the **Machines** grid, and the service is highlighted on the **Services** grid.

**Note:** To deselect a box, hold down the Ctrl key and click the box. You can also hold down the Ctrl key and press the spacebar.

Place your cursor over a box to view the name of the machine, the service, or the service instance.

Double-click a box on the **Machine** grid (or right-click a box and select **View services**) to open the Machine Status dialog box, which lists the services that are running on that machine and their availability. Select **Machine Details** to open the Machines page for the selected machine.

Click a box on the **Service instances** grid to view the machine address and the port where the instance is running.

**Note:** Point to or click an instance of the postgres service to also identify whether the instance is a pgpool instance, whether it is a primary or standby data node, and whether SSL has been enabled for the node.

Use the **Search** field to display only certain machines, services, and service instances. When you enter characters in the **Search** field and click **P** or press **Enter**, the boxes that are displayed in the **Availability** area will change. The boxes that are displayed either match the filter that you specify or are associated with the boxes that are displayed. For example, entering the string **laun** in the **Search** field might cause the display of two **Services** boxes (for the Launcher service and the Launcher server), only the **Service instance** boxes that are associated with the displayed services, and only the **Machines** boxes that are associated with the displayed services.

### Evaluate CAS Nodes

The **System Health** tile displays graphs that give you a quick view of the state of the nodes (machines) in your SAS Viya cluster for a selected CAS server. The data that is displayed on the graphs reflects all the work (not just the CAS operations) that occurs on the nodes. If you are using a UNIX system, the tile displays the **Node Memory Usage** and the **Load Average** graphs. Use the buttons at the top of the tile to select the graph to view.

If you are using a Windows system, only the **Node Memory Usage** graph is displayed.

If your environment contains more than one CAS server, a menu above the graph enables you to select the server to view. When you display the dashboard, this functionality behind the tile attempts to connect to the default CAS server. If the default server cannot be found, the tile displays information for the first server to which it can connect. If it can connect to the default server, but the server does not respond within five seconds, the tile displays a message. You can then retry the server or choose another server. You specify the default server in the **default casServer** property. This property is one of the sas.casmanagement.global properties for the CAS Management service. See “Introduction” in SAS Viya Administration: Configuration Properties for information about setting this property.

Here are the graphs that are displayed in the **System Health** tile:

#### Load Average

Displays a graph of the 1-minute load average over the past five minutes for each node in your CAS cluster. This graph is displayed only on UNIX systems. The chart is updated every 10 seconds. Each node is represented by a separate line on the graph. The vertical scale of the graph changes, depending on the largest value that is displayed in the chart. Position your cursor over a line in the chart to identify both the node and the load average value.

#### Node Memory Usage

Displays a bar chart, which displays the percentage of memory usage for each node in your CAS cluster. This graph is displayed on both UNIX and Windows systems. Each bar represents a separate node. Bars for controllers use a different color than bars for workers. The colors that are displayed depend on the theme.
that you use. Point to a bar on the graph to view the name of the node, its type, and its memory usage. The chart is updated every 10 seconds.

**Note:** If your environment contains both a primary and a secondary controller node, this graph displays information only for the controller that is currently active.

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**Monitoring: How to (CAS Server Monitor)**

**Access CAS Server Monitor**

CAS Server Monitor is available only if you are using a SAS Viya programming-only environment.

Enable CAS Server Monitor by setting the CAS_START_MONITOR_UI environment variable to 1.

To log on to CAS Server Monitor, open a web browser and enter the following URL in the address field:

`https://http-proxy-machine-name/cas-tenant-name-deployment-instance-name-http`

You must have an active CAS Server session in order to access CAS Server Monitor.

For more information, see “Using CAS Server Monitor” in SAS Viya Administration: SAS Cloud Analytic Services.

**Monitor CAS Process Performance**

The CAS processes you can monitor with these steps correspond to SAS server processes. You can separately monitor each session that is started from the CAS server.

1. In CAS Server Monitor, beneath the Cloud Analytic Services banner, click .

2. Select Add View CAS Process CPU Usage.

   The Process CPU Usage panel on the window displays a set of histograms. There is one histogram for each machine and the corresponding CAS server process. The histogram in the upper left is the CAS controller node. If you are not an administrator, only the histogram for the CAS controller node is displayed.

   Each histogram displays the percentage of CPU usage, from 0 to 100%.

   ![Process CPU Usage Histogram](image)

   Use these histograms to note patterns of CPU usage among the CAS nodes.


   The CAS Process Metrics panel on the window displays a set of histograms. There is one set of three histograms for each machine and the corresponding CAS server process. If you are not an administrator, only the set of histograms for the CAS controller node is displayed.

   Each set of histograms displays the percentage of CPU used, amount of resident memory used, and amount of virtual memory used for the CAS process.
Monitor CPU Usage for a Session

1. In CAS Server Monitor, select on the left side of the window.

2. Select Add Session View and select a session.

The panel for the session displays a set of histograms, with one histogram for each machine in the grid. If you are not an administrator, only the histogram for the CAS controller node is displayed. The top half of the histogram displays the percentage of CPU load used by the session, and the bottom displays the amount of resident memory used for the session.

Monitor Host Performance

CAS Server Monitor displays histograms that enable you to view the CPU load and memory usage for all machines in your CAS server. Follow these steps:

1. In CAS Server Monitor, select on the left side of the window.

2. To view the CPU load, select Add View  Host CPU Load Average.

The Host CPU Load Average panel on the window displays a set of histograms. There is one histogram for each machine in the CAS grid. If you are not an administrator, only the histogram for the CAS controller node is displayed.

Each histogram displays the CPU load on the machine, using the same format as the Linux xload command. Each division on the histograms represents one load average point. The highest point on each histogram is displayed to the right of the histogram.

Use these histograms to note usage patterns among the CAS nodes. For example, if you notice that the load on a worker node machine is significantly and consistently higher than the load on other machines, you can
use the **Show Processes** function to check for other running processes or defunct processes. See “Monitor Process Information” on page 14 for instructions on this function.

3 To view the memory usage, select **Add View ⇒ Host Memory Usage**.

   The **Host Memory Usage** panel on the window displays a set of histograms. There is one histogram for each machine in the CAS grid. If you are not an administrator, only the histogram for the CAS controller node is displayed.

   Each histogram displays the percentage of memory used on the machine, from 0 to 100%. The percentage of memory used is displayed in green, at the top of the histogram. The percentage of virtual memory used is displayed in orange, at the bottom of the histogram.

Use these histograms to note patterns of memory usage among the CAS nodes. For example, if the memory usage is consistently high on a machine, its memory might need to be increased.

4 Click [ ] if you want to stop metric collection. Click [ ] to resume collection.

### Monitor Process Information

1 Perform one of these actions in CAS Server Monitor:

   - Select [ ] on the left side of the window and open one of the views from the **Add View** or **Add Session View** menus. Click [ ] to the right of a histogram. Select **Show Processes**.

   - Click [ ] and select the **Nodes** tab. Click [ ] on the right side of a node’s row and select **Show Processes**.

2 The **Processes** window appears. The window displays this information:

   - Metrics for the selected node, including uptime, number of processes, memory usage, CPU load, and file usage
   - A histogram of the CPU load for the node
   - A table containing the output from the **top** command for the selected node. The output includes metrics such as CPU usage, time, and threads for each process. If you are a SAS administrator, the window displays information about all processes. If you are not a SAS administrator, you can view information only about your own processes.

   If you are the process owner, you can open a terminal window to terminate processes that are causing problems. See “Open a Terminal Window on a Node” on page 14 for information.

### Open a Terminal Window on a Node

After using the monitoring functions of CAS Server Monitor to identify problems with CAS nodes, you might want to issue commands to end processes on a node. If you are the process owner, you can launch a terminal window to manage processes on the node. Follow these steps.

1 Perform one of these actions in CAS Server Monitor:
Select on the left side of the window and use the Add View menu to display the Host CPU Load Average, Host Memory Usage, CAS Process CPU Usage, or CAS Process Metrics views. Click on the right side of the histogram for a node. Select Launch Terminal. This option is available only if you are an administrator.

Click and select the Nodes tab. Click on the right side of a node’s row and select Launch Terminal.

2 A terminal window appears on the selected machine. Use the window to manage processes on the machine.

3 Type exit to close the terminal window.

Change the Monitoring Display Options

When you are viewing the histograms in the Grid Monitor view in CAS Server Monitor, you can control how the histograms are displayed.

- To change how quickly the graph data is refreshed, move the slider next to the Speed label.
- To change the size of the histograms, move the slider next to the Size label.
- The default layout for a histogram view is a grid. To change to a single column, click the column icon in the banner for a view. To return to a grid layout, click the grid icon.

To change the default view for the Grid Monitor view, select userid ➔ Settings in the upper right of the CAS Server Monitor window. You can select a default monitor view and layout.

Monitoring: How to (CAS Options)

View Performance Metrics for a CAS Action

To view metric performance data when you execute a CAS action, start the CAS server with the -metrics option, or set the cas.metrics configuration option to true.

To start displaying performance metrics for a running server, set the metrics session option to true.

If you enable metric collection, a standard set of metric data is returned to the log each time that a CAS action completes. The same data is displayed by both the server and the client, although the names of the metrics are different. See “CAS Action Metrics” on page 16 for a list of the metrics that are displayed.

Here is an example of the metrics that are displayed for a CAS action:

```
NOTE: Executing action 'tkimstat.summary'
NOTE: Action 'tkimstat.summary' used (Total process time):
NOTE: real time 0.024989 seconds
NOTE: cpu time 0.165974 seconds (664.19%)
NOTE: total nodes 4 (96 cores)
NOTE: total memory 377.85G
NOTE: memory 22.53M (0.01%)
```
performance = {
    elapsedTime = 0.024989,
    cpuUserTime = 0.132979,
    systemCores = 96,
    systemTotalMemory = 405711519744,
    cpuSystemTime = 0.032995,
    memoryOS = 45793280,
    memory = 23621664,
    memoryQuota = 47366144,
    systemNodes = 4,
}

**Evaluate CPU Utilization for an Action**

If you specify that performance metrics are collected when CAS actions are executed, you can use these metrics to evaluate the utilization of your CAS environment.

The server metric CPU time is displayed in both the number of seconds and a percentage. Here is an example:

cpu time 0.165974 seconds (664.19%)

The percentage is calculated as \((\text{cpuUserTime} + \text{cpuSystemTime})/\text{elapsedTime}\). On a single-threaded system, the maximum value for this metric is 100%. However, for a multi-core system, the maximum value is \(100\% \times \text{number of cores}\). In this example, the system has 96 cores, so the maximum value is 9600%.

### Monitoring: Troubleshooting

**Why Can I Not See Machine Information in SAS Environment Manager?**

If you are a tenant administrator, you do not have the permissions to look at machine health information or metric data. Your provider-level administrator can access this information.

If you are a provider-level administrator, verify that the CAS table that is used for machines information exists and that it is being updated. Use the Data page in SAS Environment Manager to verify that the SYSTEM table exists and contains data. The table is in the SystemData library. If the table exists and contains data, verify that the number of rows in the SYSTEM table changes over time as new messages are added. If the table does not exist or is not being updated, verify that the CAS server is running.

### Monitoring: Reference

**CAS Action Metrics**

If you enable metric collection for CAS actions, a standard set of metric data is returned each time that a CAS action completes. The same data is displayed by both the server and the client. Here is the data that is displayed:

<table>
<thead>
<tr>
<th>Server Metric Name</th>
<th>Client Metric Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>real time</td>
<td>elapsedTime</td>
<td>The number of seconds in actual time required to run the action.</td>
</tr>
<tr>
<td>Server Metric Name</td>
<td>Client Metric Name</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------</td>
<td>-------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>cpuUserTime</td>
<td></td>
<td>The total number of seconds taken by the action in user mode across all cores that were used to run the action.</td>
</tr>
<tr>
<td>cpuSystemTime</td>
<td></td>
<td>The total number of seconds taken by the action in system mode across all cores that were used to run the action.</td>
</tr>
<tr>
<td>cpu time</td>
<td></td>
<td>CPU time is measured and displayed in these formats:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- cpuUserTime + cpuSystemTime, displayed in seconds.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- (cpuUserTime + cpuSystemTime) / elapsedTime, displayed as a percentage.</td>
</tr>
<tr>
<td>total nodes</td>
<td>systemNodes</td>
<td>The number of nodes in the cluster (total nodes display both systemNodes and systemCores).</td>
</tr>
<tr>
<td>total nodes</td>
<td>systemCores</td>
<td>The number of cores in the cluster (total nodes display both systemNodes and systemCores).</td>
</tr>
<tr>
<td>total memory</td>
<td>systemTotalMemory</td>
<td>The total memory available to the system. Total memory is displayed in GB, and systemTotalMemory is displayed in bytes.</td>
</tr>
<tr>
<td>memory</td>
<td>memory</td>
<td>Memory used to execute the action.</td>
</tr>
<tr>
<td>memoryOS</td>
<td></td>
<td>Operating system used by the action.</td>
</tr>
<tr>
<td>contextVoluntary</td>
<td></td>
<td>The number of times a context switch occurred because a process relinquished its processor before its time slice had been completely used.</td>
</tr>
<tr>
<td>contextInvoluntary</td>
<td></td>
<td>The number of times a context switch occurred because a higher priority process was present or because the current process exceeded its time slice.</td>
</tr>
<tr>
<td>memoryQuota</td>
<td></td>
<td>The memory quota used by the action.</td>
</tr>
<tr>
<td>dataMovementTime</td>
<td></td>
<td>The amount of time, in seconds, taken by the data that moved between the memory and the processors.</td>
</tr>
<tr>
<td>dataMovementBytes</td>
<td></td>
<td>The number of bytes of data that moved between the memory and the processors.</td>
</tr>
</tbody>
</table>
See “View Performance Metrics for a CAS Action” on page 15 for information about displaying these metrics.