

## Leveraging SAS® Environment Manager for SAS® Customer Intelligence Implementations

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### ABSTRACT

SAS® Environment Manager helps SAS® administrators and system administrators manage SAS resources and effectively monitor the environment. SAS Environment Manager provides administrators with a centralized location for accessing and monitoring the SAS® Customer Intelligence environment. This enables administrators to identify problem areas and to maintain an in-depth understanding of the day-to-day activities on the system. It is also an excellent way to predict the usage and growth of the environment for scalability. With SAS Environment Manager, administrators can set up monitoring for SAS Customer Intelligence logs (for example, SASCustIntelCore6.2.log, SASCustIntelStudio6.3.log) and other general logs from the SAS® Intelligence Platform. This paper contains examples for administrators who support SAS Customer Intelligence to set up this type of monitoring. It provides recommendations for approaches and for how to interpret the results from SAS Environment Manager.

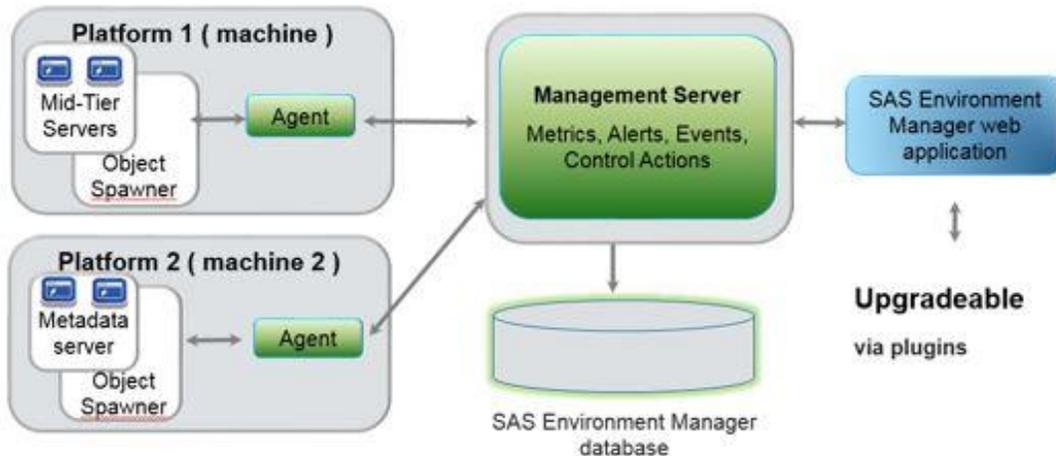
### INTRODUCTION

Administrators of SAS Customer Intelligence need to contend not only with multiple servers and machines, but also with a number of platform services running on each server. Furthermore, they must be mindful of the need to monitor the system for system metrics, overall system health, and various error messages in a multitude of log entries. Often administrators don't realize an issue has arisen until a business user alerts them (for example, when the user is not able to log on to SAS Customer Intelligence because the application is down). If and when a situation does arise, the administrator will have to be able to quickly assess and resolve whatever issue has developed in the system. SAS Environment Manager aids the administrator by providing a web-based application with an easy-to-understand dashboard for alerts, monitoring, and out-of-the-box reporting on the overall system.

Beginning with SAS® 9.4, SAS has licensed and included a commercial software suite of middle-tier technologies. These components are optimized and integrated for SAS middle-tier deployments. Among these components is SAS Environment Manager, which is included with other middle-tier components, such as with those in the SAS Customer Intelligence suite.

SAS Environment Manager is based on VMware vFabric Hyperic, which is a systems management and monitoring software application. SAS Environment Manager has been enhanced with functionality that is specific to SAS and streamlined to remove extraneous functionality.

The architecture of SAS Environment Manager consists of an agent process running on each platform in a SAS deployed environment. The agents then communicate to a central management server.



**Figure 1 SAS Environment Manager Architecture Overview**

SAS Environment Manager enables administrators to perform tasks such as the following:

- administer, monitor, and manage SAS resources
- collect data on metrics for monitoring of SAS resources
- graph data on those metrics collected
- monitor log events and reporting alerts
- create escalation paths for alerts, including enabling email alerts

The SAS Environment Manager resource inventory model consists of the following 3 levels:

- platforms—operating system platforms (physical or virtual)
- servers—web servers, web application servers, SAS servers running on the platforms
- services—web applications within the SAS® Web Application Server, Apache ActiveMQ, and so on

With the multiple platforms, servers, and services associated with a typical multi-tier SAS Customer Intelligence environment, as well as the number of logs and web applications bundled with SAS Customer Intelligence, administrators can face an environment with several locations of log files and services to monitor. SAS Environment Manager eases that situation by allowing administrators to log on to a single application to obtain a snapshot of their overall environment health.

## SAS ENVIRONMENT MANAGER DASHBOARD

As previously mentioned, SAS Environment Manager is based on VMware vFabric Hyperic. As a result, some server names in SAS Environment Manager don't match up with the names that are used in a typical SAS deployment. Use the following table to determine the name of the SAS server as it is displayed in SAS Environment Manager.

SAS Server Name	Name Displayed in SAS Environment Manager
SAS Environment Manager	Apache Tomcat 5.5, 6.0, 7.0
SAS Environment Manager	HQ Agent
SAS Web Server	vFabric Web Server 5.1, 5.2
SAS Web Application Server	SpringSource tc Runtime 7.0
SAS Web Infrastructure Platform Data Server	PostgreSQL 9.x HQ PostgreSQL 9.x vPostgreSQL 9.x
SAS JMS Broker	Active MQ 4.0, 5.0, 5.1, 5.3, 5.3, 5.4, 5.7

Figure 2 SAS Server Names as Displayed in SAS Environment Manager

The SAS Environment Manager Dashboard offers a centralized view of metrics, alerts, summaries, and graphs that administrators have defined and allows favorite resources and recent alerts to be displayed in a centralized and customizable location. The dashboard is a collection of portlets providing information at a glance and giving a graphical overview of performance statistics for reporting performance.

The dashboard is divided into two columns. Availability Summary, Saved Charts, Recently Added, Search Resources, and Summary Counts are the portlets on the left side. Auto-Discovery, Control Actions, Favorite Resources, Recent Alerts, Group Alerts Summary, Metric Viewer, and Problem Resources make up the right-side columns.

The screenshot displays the SAS Environment Manager dashboard interface. At the top, it shows the user 'sasadm@saspw' and a 'Recent Alerts' section indicating no alerts in the last 2 hours. The main dashboard is divided into several portlets:

- Select a Dashboard:** A dropdown menu currently set to 'sasadm@saspw'.
- Search Resources:** A search bar with 'Resource Name' and a 'Platforms' dropdown menu.
- Availability Summary Overall:** A table showing resource types and their availability status.
 

Resource Type	Availability
SAS Application Server Tier	1
Win32	1
- Availability Summary Physical OS Mounts:** A table showing resource types and their availability status.
 

Resource Type	Availability
FileServer Mount	3
- Availability Summary SAS Servers availability:** A table showing resource types and their availability status.
 

Resource Type	Availability
SpringSource tc Runtime 7.0	4
SAS Metadata Server 9.4	1
SAS Object Spawner 9.4	1
- Availability Summary SAS Spawning Servers:** A table showing resource types and their availability status.
 

Resource Type	Availability
SAS Object Spawner 9.4 SAS Logical Pooled Workspace Server	1
SAS Object Spawner 9.4 SAS Logical Stored Process Server	1
SAS Object Spawner 9.4 SAS Logical Workspace Server	1
SAS Object Spawner 9.4 SAS Operating System Services	1
SAS Object Spawner 9.4 SAS Pooled Workspace Server	1
SAS Object Spawner 9.4 SAS Stored Process Server	1
SAS Object Spawner 9.4 SAS Workspace Server	1
- Auto-Discovery:** A table showing discovered resources with columns for Resource Name, Status, and Changes.
 

Resource Name	Status	Changes
sasbp demo.sas.com - Microsoft Windows 2008	modified	IP set changed, server set changed
sasbp Decision ... - Experimental	new	N/A
- Metric Viewer to Runtime Manager Active Sessions:** A table showing active sessions for various managers.
 

Manager	Active Sessions
SpringSource tc Runtime 7.0 Manager	7.0
sasbp tc Runtime SASServer6 1 /SASCIStudio localhost Manager	4.0
sasbp tc Runtime SASServer12 1 /SASVisualAnalyticsDesigner localhost Manager	4.0
sasbp tc Runtime SASServer1 1 /SASLogon localhost Manager	4.0
sasbp tc Runtime SASServer2 1 /SASWebReportStudio localhost Manager	0.0
sasbp tc Runtime SASServer11 1 /SASEnterpriseMinerServices localhost Manager	0.0
sasbp tc Runtime SASServer11 1 /SASModelManager localhost Manager	0.0
sasbp tc Runtime SASServer6 1 /SASMarketingOptimization6.3 localhost Manager	0.0
sasbp tc Runtime SASServer7 1 /localhost Manager	0.0
sasbp tc Runtime SASServer7 1 /DCSVMonitor localhost Manager	0.0
sasbp tc Runtime SASServer7 1 /RTDM localhost Manager	0.0
- Metric Viewer WebApp Login Response Time:** A table showing response times for various HTTP endpoints.
 

Endpoint	Response Time
HTTP	66ms
SAS CI Studio	58ms
SAS Web Report Studio	54ms
SAS VA Designer	37ms
SAS Stored Process Web Application	19ms
SAS Content Server	

Figure 3 Sample Dashboard

## DASHBOARD PORTLETS

Commonly used portlets are the Availability Summary, Metric Viewer, and Saved Charts.

Availability Summary indicates the availability of selected resources grouped by the resource type. For example, a SAS Customer Intelligence administrator can set up the portlet to display the availability of SAS® Metadata Server, any SAS spawned servers, such as SAS® Stored Process Server and Logical Pooled Workspace Server, as well as any middle-tier components, such as the SpringSource tc Runtime server, vFabric Web Server, and ActiveMQ.

Resource Type	Availability
SpringSource tc Runtime 7.0	5
SAS Metadata Server 9.4	1
SAS Object Spawner 9.4	1
Updated: 2:56 PM	
Resource Type	Availability
SAS Object Spawner 9.4 SAS Logical Pooled Workspace Server	1
SAS Object Spawner 9.4 SAS Logical Stored Process Server	1
SAS Object Spawner 9.4 SAS Logical Workspace Server	1
SAS Object Spawner 9.4 SAS Operating System Services	1
SAS Object Spawner 9.4 SAS Pooled Workspace Server	1
SAS Object Spawner 9.4 SAS Stored Process Server	1
SAS Object Spawner 9.4 SAS Workspace Server	1
Updated: 2:56 PM	
Resource Type	Availability
ActiveMQ 5.7	1
SpringSource tc Runtime 7.0	5
Apache Tomcat 6.0	1
PostgreSQL 9.x	1
vFabric Web Server 5.3	1
Updated: 2:56 PM	

Figure 4 Availability Summary Portlet

Administrators can select the resource, such as SpringSource tc Runtime 7.0, and the portlet will display all the web application servers. Furthermore, the administrator can control and manage the deployed applications by starting and stopping the various web applications deployed on each SAS Server instance.

Server	Deadlocks Detected	Heap Memory Free	Percent Up Time in Garbage Collection	UpTime	Availability
sasbap tc Runtime SASServer11_1	0.0	1.6 GB	0.0	04:12:25.451	⚠
sasbap tc Runtime SASServer12_1	0.0	1.1 GB	0.2	04:11:44.529	⚠
sasbap tc Runtime SASServer1_1	0.0	2.1 GB	0.3	04:32:20.479	⚠
sasbap tc Runtime SASServer2_1	0.0	1.5 GB	0.0	04:14:13.972	⚠
sasbap tc Runtime SASServer6_1	0.0	1.7 GB	0.0	04:13:44.917	⚠
sasbap tc Runtime SASServer7_1	0.0	1.7 GB	0.0	04:13:04.8	⚠

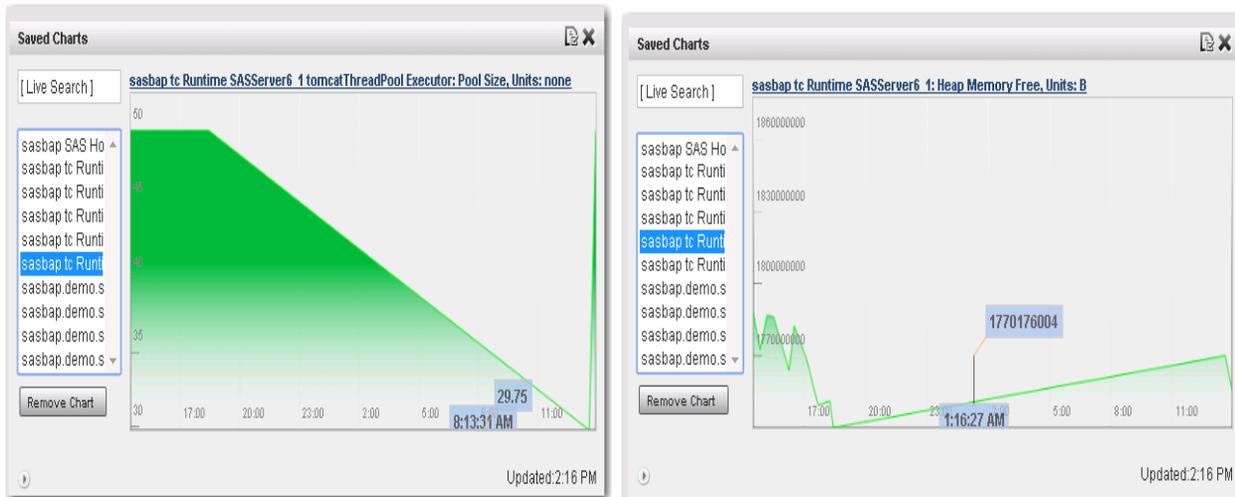
Figure 5 Availability of SpringSource tc Runtime

SAS Environment Manager provides visibility to over 2,000 metrics to meet the monitoring needs of most any situation. The Metric Viewer portlet surfaces those metrics and enables administrators to drill farther down to access the available metrics and charts. SAS Customer Intelligence administrators will typically set up these portlets to display metrics such as tc Runtime Manager Active Sessions, HTTP WebApp Login Response Times, Free Memory, Disk Space Usage, TCP Socket Response Times, and Thread Pool Size.



**Figure 6 Metric Viewer**

The Saved Charts portlet displays a selected number of charts and plays as a slideshow within the dashboard. A chart can be added by simply navigating to the desired resource to chart, selecting the metric chart to display, and then saving it to the dashboard. The charts then become shortcuts and grouped in the portlet.



**Figure 7 Saved Charts for SASServer6\_1 Thread Pool Size and Heap Memory Free**

### SAS ENVIRONMENT MANAGER ALERTS AND NOTIFICATIONS

Alerts are user-defined events that indicate a critical condition in a specified resource. When alerts occur, they must be acknowledged and will continue to be displayed until they are marked as being fixed. Escalation schemes can be defined to identify the actions that should happen if an alert is not fixed within a specified time. The metrics collected can then become events to activate alerts on.

The Alert Center provides a deployment-wide view of both alerts and alert definitions, whereas the Event Center provides a deployment-wide view of events that have been logged for the resources. Alerts are logged as events. SAS Environment Manager allows the capability to set up alerts to monitor metrics, scan log files, and monitor availability. Alerts are displayed in the Operations Center, as well as in the

Alert Center and on the dashboard. The following figure shows an example of a number of alerts displayed in the Operations Center:

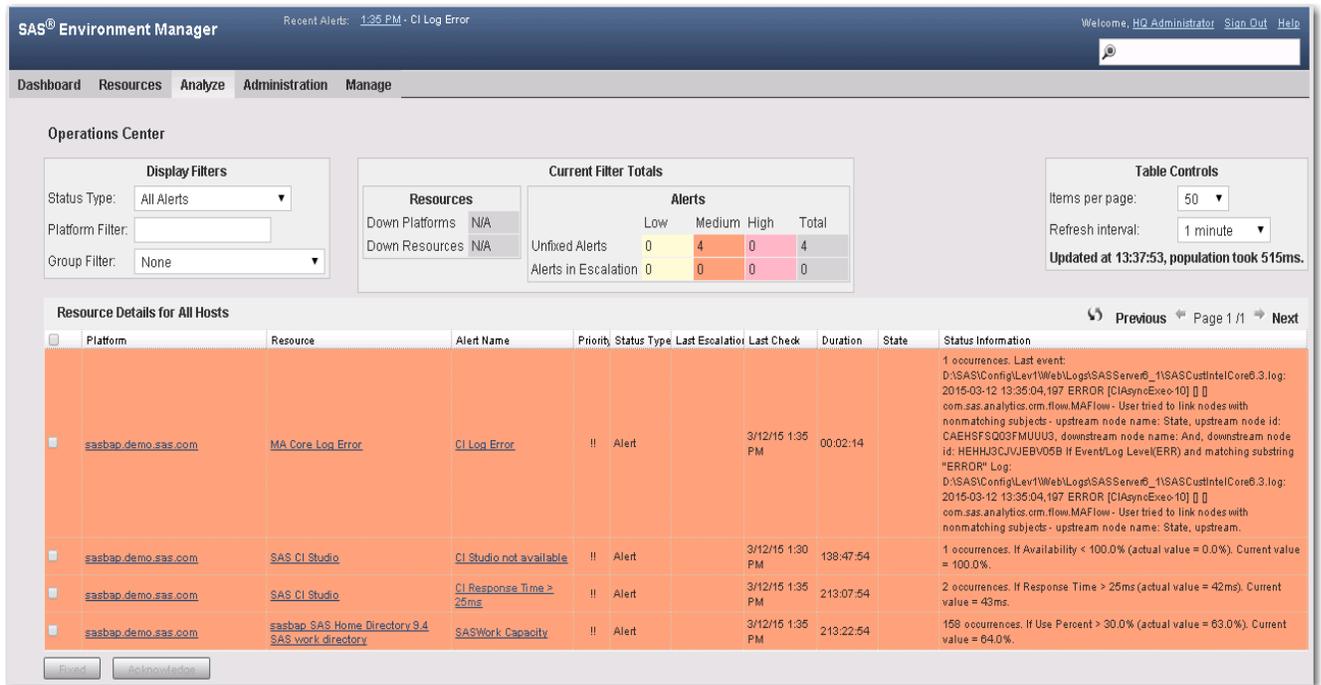


Figure 8 Alerts Displayed in Operations Center

For a typical SAS Customer Intelligence deployment, various alerts and notifications can be defined and enabled to allow the administrators access to specific predefined alerts. Typical alerts to set up in SAS Environment Manager can include the following:

- Alerts for Log Files—Alerts can be defined for a log file when certain messages appear in the logs. An alert can be triggered each time a specified message appears in a log, or whenever any message appears with a level of ERROR. The alert should be set to repeat each time an error appears in the log. For example, an alert can be set up to monitor the SAS Metadata Server log whenever a user is locked out, or in the SAS Customer Intelligence Core log whenever an ERROR message is encountered.
- Alerts for Directory Space—Alerts can be defined when SASWork (or any data directory, such as MATables or MAData) reaches a certain threshold percentage (for example, 90%) of its capacity.
- Alerts for Operating System (OS) Resources—Alerts can be defined for utilization of CPU, Memory, I/O, and Network Interface. For example, alerts can be configured for when free memory on the SAS Web Application Server falls below a certain percentage of the available memory. The alert can be configured to occur in a specified time period, such as every 15 minutes.
- Alerts for Configuration File Changes—Alerts can be triggered when a configuration file is changed, such as sasv9.cfg, MarketingAutomation\_autoexec\_usermods.sas, or any user-defined configuration file.
- Alerts for Server Health and Availability—Alerts can be set up for whenever servers are not available, such as when any SASServernn\_1 Java Virtual Machines (JVM) are not available, or when the HTTP

response time is above a certain threshold (for example, Response Time > 25ms), or when other thresholds are met on thread pool resources, including active count, max threads, and pool size.

With over 2,000 metrics available, an endless number of alerts can be set up and triggered in SAS Environment Manager for a SAS 9.4 deployment. The following figure displays various alerts that have been triggered and recorded in the Alert Center.

The screenshot shows the SAS Environment Manager Alert Center. The top navigation bar includes 'Dashboard', 'Resources', 'Analyze', 'Administration', and 'Manage'. The 'Alerts' tab is selected, and the 'Alerts' sub-tab is active. On the left, an 'Alert Filter' panel allows filtering by status (Not Fixed, In Escalation, All), alert type (Resource), minimum priority (Low), and group (All Groups). The main area displays a table of 'Resource Alerts' with columns for Date, Alert Definition, Resource, Platform, Fixed, Ack, and Priority. The table shows several alerts related to 'CI Response Time > 25ms' and 'SASWork Capacity' for 'sasbap SAS Home Directory 9.4 SAS work directory' on the 'sasbap.demo.sas.com' platform. All alerts are marked as 'Med' priority and have 'No' for both 'Fixed' and 'Ack'.

Date	Alert Definition	Resource	Platform	Fixed	Ack	Priority
3/3/15 3:30 PM	CI Response Time > 25ms	SAS CI Studio	sasbap.demo.sas.com	No		Med
3/3/15 3:25 PM	CI Response Time > 25ms	SAS CI Studio	sasbap.demo.sas.com	No		Med
3/3/15 3:15 PM	SASWork Capacity	sasbap SAS Home Directory 9.4 SAS work directory	sasbap.demo.sas.com	No		Med
3/3/15 3:10 PM	SASWork Capacity	sasbap SAS Home Directory 9.4 SAS work directory	sasbap.demo.sas.com	No		Med
3/3/15 3:05 PM	SASWork Capacity	sasbap SAS Home Directory 9.4 SAS work directory	sasbap.demo.sas.com	No		Med
3/3/15 3:00 PM	SASWork Capacity	sasbap SAS Home Directory 9.4 SAS work directory	sasbap.demo.sas.com	No		Med
3/3/15 2:55 PM	SASWork Capacity	sasbap SAS Home Directory 9.4 SAS work directory	sasbap.demo.sas.com	No		Med
3/3/15 2:50 PM	SASWork Capacity	sasbap SAS Home Directory 9.4 SAS work directory	sasbap.demo.sas.com	No		Med

Figure 9 Alert Center Displaying Various Alerts Messages

When alerts are not acknowledged or remedied within a certain timeframe, an escalation scheme can be defined to perform a series of actions. Escalation schemes can be applied to multiple alerts and can be defined to perform the following actions:

- sending email or SMS messages
- making an entry in a system log
- issuing an SNMP notification

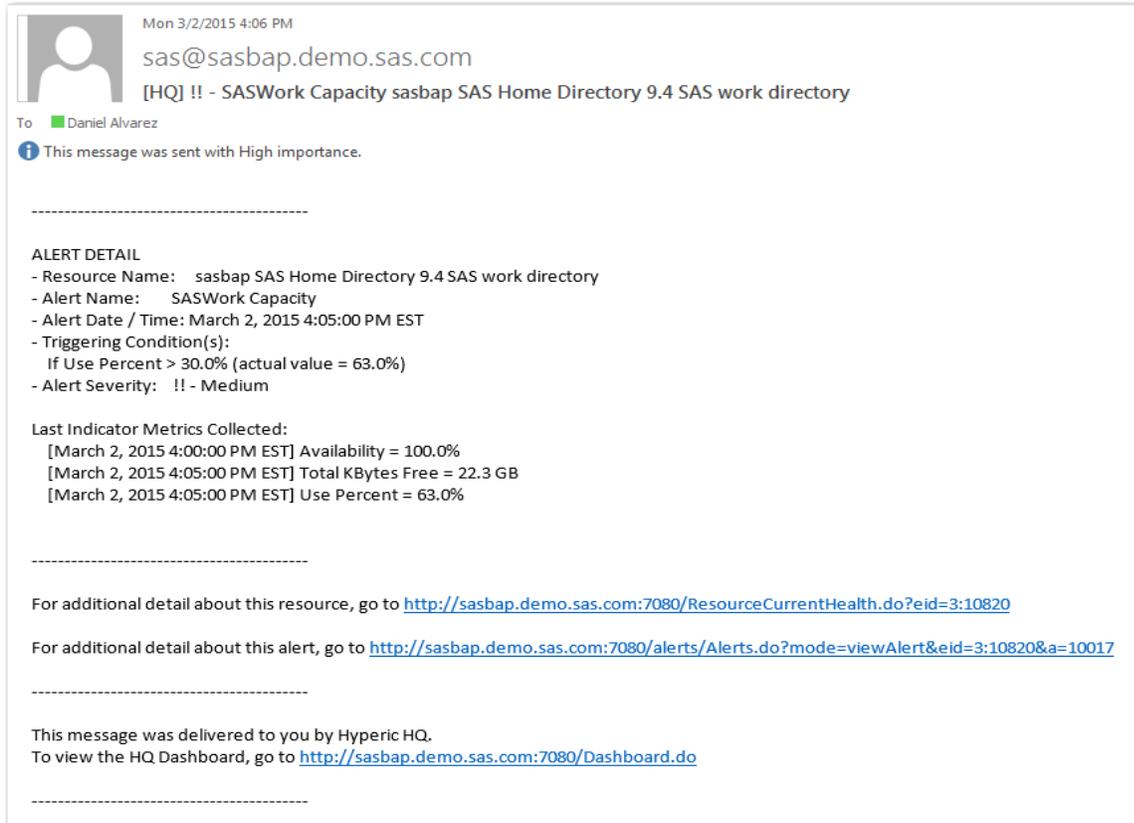


Figure 10 Email Message Escalation Scheme for SASWork Directory

## SAS ENVIRONMENT MANAGER EXTENDED MONITORING

Beginning with the October 6<sup>th</sup>, 2014 release of SAS 9.4, SAS Environment Manager includes the Service Architecture Framework. This package provides functions and capabilities enabling SAS Environment Manager to fit into a service-oriented architecture (SOA), by automating many of the monitoring, auditing, and user activity logging activities consistent with operational requirements of an SOA.

The SAS Environment Manager Service Architecture Framework installation and configuration process is included as part of the SAS Deployment Wizard process when the environment is initially set up. However, additional initialization is required before the SAS Environment Manager Service Architecture Framework is fully enabled and available. This initialization is accomplished by submitting various command-line scripts. The framework uses extract, transform, and load (ETL) processes to obtain metric data and load into the SAS Environment Manager data mart to produce a collection of tools, settings, and reports. The SAS Environment Manager Service Architecture Framework includes the following components:

- **Extended Monitoring**—Provides specific monitoring best practices through predefined alerts, resource groupings, and metric configurations.
- **Data Mart**—Is a standardized data repository for data collected by SAS Environment Manager agents.
- **Agent Collected Metrics (ACM) ETL**—Populates the data mart with data collected by SAS Environment Manager.
- **Audit, Performance Measurement (APM) ETL**—Provides the data mart with data extracted from various SAS server log files.
- **Report Center**—Provides a centralized page for prebuilt out-of-the-box reports as part of the SAS Environment Manager architecture. Data from ETL components listed previously is then used to produce the predefined reports.
- **Solution Kits**—Provide a framework for extending SAS Environment Manager to support specific solutions and technologies. A solution kit contains tools needed to support a specific solution, including key metrics and measurements, alerts, and log parsers.
- **Visual Analytics Auto Data Feed**—Enables data from SAS Environment Manager Data Mart to be used to auto-feed into SAS Visual Analytics via a specified drop zone directory.

SAS Environment Manager Extended Monitoring implements specific best practices in resource monitoring and alerting for a SAS deployment. Extended Monitoring includes these components:

- **Additional Resources**—Initializing Extended Monitoring automates the process of configuring any additional resources, enabling administrators to immediately start monitoring resources without a manual configuration process. For example, a set of HTTP check resources is defined to ping SAS web applications to monitor response time and availability. In a SAS Customer Intelligence environment, this can be set up to monitor the availability of the SAS Server6 service, as well as HTTP response time.
- **Resource Groups**—Logical collections of resources (including platforms, servers, and services) are grouped together and collected into predefined groups. These groups get automatically updated as resources are added and deleted.
- **Alerts**—Various optimized alerts are provided. These alerts can inform the administrator of various issues in the SAS environment, such as issues with disk space, server availability, storage, and hardware.
- **Metric Adjustments**—In order to optimize resource monitoring, some adjustments are made in the metrics collected. These include adjustments to the frequency of collection interval and enabling or disabling specific metrics.
- **Event Importing and Exporting**—Events can be exported for consumption by third-party monitoring applications, as well as imported from other SAS applications or third-party applications.

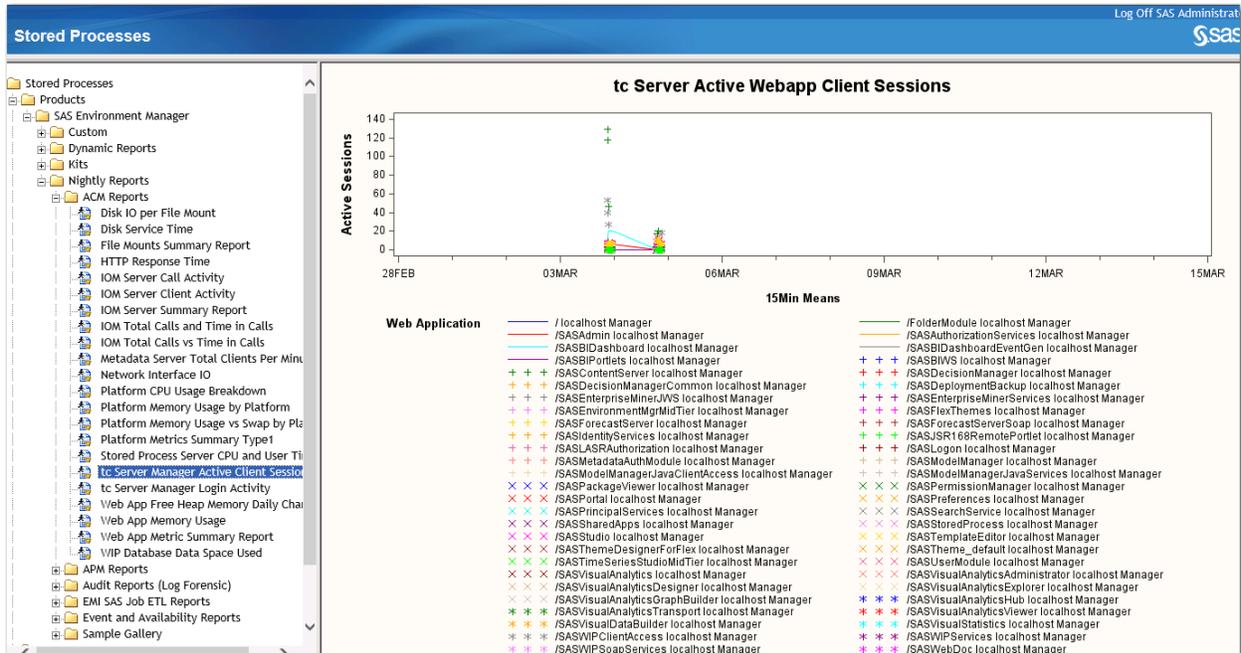


Figure 11 Out-of-Box Report for tc Server Active Webapp Client Sessions

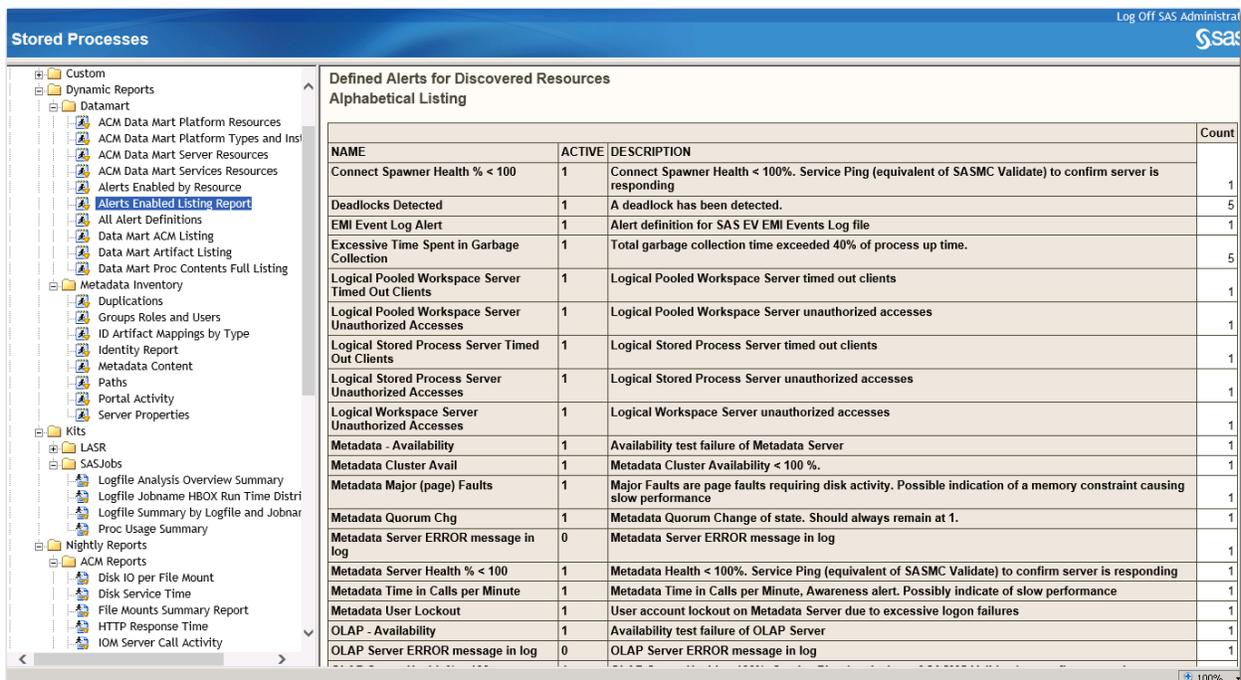


Figure 12 Out-of-Box Report for Defined Alerts Enabled

## CONCLUSION

Administrators of SAS Customer Intelligence and other SAS solutions are using the latest SAS 9.4 technologies on a number of platforms. SAS 9.4 includes a robust, efficient, and easy-to-use software package called SAS Environment Manager to monitor, control, and set up alerts in order to quickly assess an operational environment and identify key areas. SAS Environment Manager provides a web-based interface into an environment composed of many different platforms, servers, and services. SAS Environment Manager can help provide additional insight for future scaling and capacity planning in areas such as storage or additional resources. By setting up some simple metrics to monitor vital areas, administrators can keep their SAS 9.4 environment and solutions running smoothly and efficiently.

## REFERENCES

Peters, Amy, Bob Bonham, and Zhiyong Li. 2013. "Monitoring 101: New Features in SAS 9.4 for Monitoring Your SAS Intelligence Platform." *Proceedings of the SAS Global Forum 2013 Conference*. Cary, NC: SAS Institute Inc. Available <http://support.sas.com/resources/papers/proceedings13/463-2013.pdf>.

Sioss, Rob. 2014. "SAS 9.4 Web Application Performance: Monitoring, Tuning, Scaling, and Troubleshooting." *Proceedings of the SAS Global Forum 2014 Conference*. Cary, NC: SAS Institute Inc. Available <http://support.sas.com/resources/papers/proceedings14/SAS315-2014.pdf>.

## RECOMMENDED READING

- SAS® *Environment Manager 2.4: User's Guide*
- SAS® *9.4 Intelligence Platform: Middle-Tier Administration Guide, Second Edition*

## CONTACT INFORMATION

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