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# Systems Management of the SAS® 9.2 Enterprise Business Intelligence Environment

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# ABSTRACT

The evolution of the SAS 9.2 architecture provides a powerful, distributed, and flexible environment for real-time, responsive analytic and reporting capabilities. This paper describes how information technology (IT) and SAS administrators can use vendor and open source enterprise systems management products to ascertain the state or status of the SAS 9.2 Enterprise Business Intelligence environment, as well as generate alerts for user-specified conditions. The management products reviewed include IBM Tivoli Enterprise Console, HP Software OpenView, open source products Xymon and Hyperic, and the SAS 9.2 Audit and Performance Measurement package.

## INTRODUCTION

Systems management of the SAS 9.2 Enterprise Business Intelligence environment can be broadly divided into two unique functional areas or disciplines. The first area is systems management for the physical hardware and software environment, along with monitoring the real-time status of the SAS 9.2 deployment. The audience for this area is typically an IT team, which has the responsibility to ensure that the computing environment is operational and available for servicing the business operations. The second area is monitoring the internal usage and performance of the SAS Enterprise Business Intelligence computing architecture, including activities such as user workloads, responsiveness of the environment, tracking of server usage, and user audit-related activities.

The information presented in this paper describes the features and facilities that are available for the IT professional, SAS administrator, or executive who is responsible for the administration and operational management of the environment.

### **OVERVIEW: OPERATIONAL MANAGEMENT CONSIDERATIONS**

The considerations for managing the environment are dependent on the functional roles and responsibilities within an organization. SAS administrators, IT personnel, and executives often have a common set of questions related to the theme of monitoring and management. The following questions characterize the information that is required for monitoring and managing the environment:

- What is the operational state of the physical hardware, nodes, and network?
- What is the state of the software services that are executing in the environment?
- How can I ascertain the performance and load on the computing infrastructure?
- If a failure occurs, how quickly can an alert action be generated to respond to the event?
- If a failure occurs within the environment, how does that impact business operations?
- How many users are actively using the computing environment?
- Which SAS products, procedures, or data libraries are being used within the environment?
- Which SAS servers are consuming the most computing resources?
- How can I measure current workloads and predict future capacity requirements?
- Which users are logging into the environment and what services are they using?
- What authorization, access control and administration changes are occurring?
- Are there any attempts to access the environment without proper authentication or authorization?

These questions and the corresponding answers are integral to successfully managing the environment. The specific tools or services that a site employs are dependent on a number of organizational and operational considerations. This paper reviews several options that are available to a SAS 9.2 customer for monitoring and managing the environment. SAS has worked closely with our hardware and software partners to deliver integration management packages that are suitable for larger enterprise deployments, as well as monitoring and management solutions that exploit open source technology for sites that do not require a broad enterprise-wide management solution.

## **OVERVIEW: SAS 9 ENTERPRISE BUSINESS INTELLIGENCE ARCHITECTURE**

The SAS 9 Enterprise Business Intelligence framework is depicted in <u>Figure 1</u>. The key elements of the framework that are important to highlight include:

- Multiple integrated tiers within the framework, including:
  - o The SAS server tier, which is comprised of various analytic servers
  - o The SAS Web tier, which includes SAS Web-based applications to present SAS analytics
  - The SAS client tier, which includes a diverse set of desktop clients and Web browser applications that exploit services of the analytic server and Web tiers
- SAS Metadata Server, the hub of the deployment architecture, which includes:
  - Mapping for logical and physical computing services
  - Mapping of logical and physical SAS libraries and data sets
  - User ID authentication and authorization controls
  - Web tier and client tier context information for user-customized presentation services
- Distributed heterogeneous computing framework, which might include:
  - Server tier analytic applications deployed across multiple physical or logical server environments, as well as on different processor architectures
  - o Web tier applications deployed within multiple industry-standard Web application servers
  - o Client tier applications hosted on a diverse collection of hardware and software environments



Figure 1: SAS 9 Enterprise Business Intelligence Deployment Diagram

### ENTERPRISE SYSTEMS MANAGEMENT INTEGRATION

#### INTRODUCTION AND OVERVIEW

Enterprise systems management products share a number of common characteristics and behaviors. However, the underlying implementation and configuration of vendor and open source products differ significantly. The Enterprise Management Integration (EMI) team in the Platform Research and Development division at SAS is chartered with implementing packages that help SAS customers manage the SAS 9 Enterprise Business Intelligence environment using the features that each of the management products provide. Generally, each of the vendor products shares the following common behaviors and features:

• A centralized management console or Web interface that displays status and alerts for managed systems

- · Server(s) that collect and centralize statistics and data from managed nodes
- Deployed agents or remote execution services, on managed nodes, to collect statistics and data
- Host and/or operating system features that collect fundamental metrics for managed nodes. Examples include:
  - o Hardware state, network connectivity, and configuration
  - CPU utilization, memory usage, and disk utilization metric monitors
  - Methods to monitor processes or services associated with operating system functions
  - Alert event methods to emit alerts for metrics and parameters for failed conditions
  - o Extensions scripts or facilities to augment the features provided as part of the base product

Given the common and unique characteristics for the vendor products, the EMI team focuses on implementing management packages that allow SAS customers to manage the SAS 9 Enterprise Business Intelligence environment using features that fit naturally into the vendor product's environment. This allows a site to leverage its investment in an enterprise management package and extend the features of the package to manage a SAS 9 deployment. Additionally, where possible, the EMI team adds functionality to further optimize the monitoring and management of the SAS 9 environment within the vendor's monitoring framework.

The following sections describe the key features of the implementation packages that SAS has developed in cooperation with our partners. These packages are made available to our customers from our Research and Development teams at SAS World Headquarters in Cary, NC, USA, and are provided with no licensing fees or restrictions.

#### **IBM TIVOLI INTEGRATION**

The IBM Tivoli suite of management solutions provides a number of products to monitor and manage enterprise-wide computing resources. The EMI team worked closely with the IBM Tivoli development team to implement two monitoring packages for sites that depend on IBM for their monitoring and management solutions. The packages that we developed have been validated by the IBM Tivoli teams, and the packages have been registered in IBM's Open Process Automation Library (OPAL).

### SAS 9.2 WITH IBM TIVOLI ENTERPRISE MONITORING SERVER 6.2

The SAS 9.2 integration package uses IBM Tivoli Enterprise Monitoring Server 6.2 (TEMS) and IBM Tivoli Enterprise Portal Server 6.2 (TEPS). The package includes monitoring and management of SAS 9.2 deployments for UNIX environments.

SAS uses a number of default TEMS and TEPS features to monitor the state of SAS applications, and the IBM Tivoli Universal Agent is used to monitor SAS server processes and log files. SAS includes in the integration package a custom set of metadata definition (.mdl) files and helper scripts to monitor the SAS 9.2 deployment. The integration document also describes how to create custom TEP workspaces and situations for the SAS 9.2 environment. The following displays depict the IBM TEP SAS Workspace:

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SAS 9.2 Tivoli workspace integrated into the IBM TEP framework

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SAS 9.2 server state, using a Java utility supplied by SAS and integrated into the TEMS framework

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SAS 9.2 server status monitoring, demonstrating a "critical situation" within the TEMS framework

### SAS® 9.1.3 WITH IBM TIVOLI ENTERPRISE MONITORING 5.1.2 AND TIVOLI ENTERPRISE CONSOLE 3.9

SAS 9.1.3 customers have the ability to monitor and manage their SAS environments using earlier versions of IBM Tivoli Monitoring 5.1.2 and IBM Tivoli Enterprise Console (TEC) 3.9. The IBM TEC environment shares some of the same monitoring features and behaviors as the SAS 9.2 integration package. Additional information about the SAS 9.1.3 integration package can be found in the <u>IBM TEC Integration</u> section of the SAS EMI Web site.

The following display demonstrates the IBM TEC package with highlights for monitoring SAS Metadata Server log files (1 and 2), SAS connection client events (3), status alerts for server state (4), and messages that can be safely ignored within a server context (5).

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SAS 9.1.3 server status monitoring within the IBM TEC 3.9 framework

### HP OPENVIEW OPERATIONS MANAGER INTEGRATION

HP OpenView Operations Manager provides an extended suite of management facilities to enable consolidated monitoring and management of the computing infrastructure. OpenView includes support to monitor distributed servers, applications, services, and related processing on UNIX and Windows environments. OpenView includes a centralized console for monitoring and management and centralized methods to distribute agents throughout the enterprise. In addition to a centralized management console, OpenView includes a rich set of monitoring features such as:

- UNIX and Windows operator commands to remotely manage a distributed system
- UNIX and Windows process or service monitors for state, event, and log events
- Extensive features for alert events to include alert event state, continuation, and termination
- Java Web application administration, configuration, and alert event features
- Smart Plug-In (SPI) feature to create a customized suite of management tools

The SAS integration component with HP OpenView integration is delivered using the SPI technology and is delivered in a Windows install package for an HP OpenView Operations (OVO) Windows console environment.

The SAS SPI package includes the following features to monitor the SAS 9.2 server tier and Web tier environment and processes:

- · SAS scripts and HP OVO tools for both UNIX and Windows environments
- Administration features to auto-deploy and configure the SAS SPI
- Administration features to monitor key SAS servers and services, including remote methods to start, stop, pause, and continue server execution
- Facilities to monitor the state of SAS servers, monitor logs for key events, and report those events into the HP OVO operator's console framework
- HP OVO "service map" that depicts the logical and physical SAS 9 Enterprise Business Intelligence environment. The following display shows the SAS 9.2 SPI service tree and service map:



HP OVO console with a "tree node" and "service map" view of the environment

HP OVO includes dependency maps for services and processes, such that the failing processes and services will automatically report as failures in subordinate or superordinate events. The SAS 9 Metadata Server is the central hub of the SAS 9 Enterprise Business Intelligence architecture. Therefore, if the metadata server fails, all dependent processes are similarly reported as down in the "service map" view.





HP OVO also provides methods for classifying the severity of messages and surfacing alerts to the service map based on severity. For example, a message that is classified as "critical" can be evaluated by an operator, acknowledged, and the priority adjusted as necessary. Changes are automatically filtered to the "tree view" and "service map" views.

📔 HP OpenView Operations - [Operations Manager : RDC	EWLMV2\Nod	es\OpenView D	Petine	d Gro	ups/	Wind	dows	Windows Server 20	103\wtp112]				
🚰 File Action View Favorites Window Help													_ & ×
← →   🗈 📧   📽 । 😢 💵   🧐 🕸	🕮 🗛 🗛 🕯	🔁 🐴 🚮 세	💏 /	R 8	5	< 🖪	l Te						
Nodes	Severity 🗸	7 Duplicates	S	υI	A	0	NR	Received	Service	Node	Application	Object	Text
E To OpenView Defined Groups	Critical		-		-	х	- 1	I/10/2010 9:13:06 PM		wtp112		SAS [C	Service "SAS [Config-Lev1] SA
III III NNM Managed Nodes	📀 Normal	5	-	- >	- )	-	- 1	1/20/2010 6:33:29 PM	Services & Proc	wtp112	HP Open	opcmo	The policy SASSPI_MetadataS
E SNMP	📀 Normal	55	-	- >	- )	-	- 1	L/10/2010 9:12:05 PM	Services & Proc	wtp112	HP Open	opcle	The process 'sasspi_logfile_pa
	📀 Normal	1	-	- >	- 2	-	- 1	/10/2010 9:12:01 PM	Services & Proc	wtp112	HP Open	opcle	The process 'sasspi_logfile_pa
	📀 Normal	1	-	- >	- :	-	- 1	L/10/2010 9:12:00 PM	Services & Proc	wtp112	HP Open	opcle	The process 'sasspi_logfile_pa
E-LO WINDOWS 	📀 Normal	1	-	- >	- 3	-	- 1	l/10/2010 9:11:59 PM	Services & Proc	wtp112	HP Open	opcle	The process 'sasspi_logfile_pa
🗄 📃 Windows 2000													
🖃 🧓 Windows Server 2003													
😥 🛄 RDCEWLMV2 (Management Server)													
- 12 wtp112													

SAS 9 OLAP Server Critical event, depicted in the "tree view"



SAS 9 OLAP Server Critical event, reclassified as a Minor event

HP OVO features include the ability to administer, monitor, and configure industry leading Java Web application servers. The implementation is seamlessly integrated into the HP OVO operator's console, with the ability to respond to alerts and events on distributed nodes directly from the console.



HP OVO "service map" and "tree view" of a Critical event for a SAS 9 Web tier service

The integration package for SAS 9 Enterprise Business Intelligence monitoring for the HP OVO environment provides a significant benefit to sites that have invested in HP Software systems management products. Customers have the ability to implement default monitoring for SAS 9 services and can customize the features to meet unique site monitoring and management requirements.

### **XYMON OPEN SOURCE MONITOR**

The Xymon Monitor, formerly Hobbit Monitor, is a host and network monitoring package that is widely used by sites that have the flexibility to choose an open source product. Xymon is distributed under GNU General Public License (GPL) agreements. The Xymon Monitor features a Web-based server console to depict status and metrics for the monitored systems, along with drill-down capability to view detailed reports and history. The Xymon server executes in UNIX environments, and client agents are available for both UNIX and Windows operating systems.

Xymon inherits many of the features of more sophisticated enterprise management products and offers efficiencies such as a very low-overhead implementation cost, simplicity in configuration, and a robust set of extensions for custom monitoring requirements.

The SAS 9 integration package consists of detailed documentation and scripts to enable monitoring for the SAS 9 Enterprise Business Intelligence environment. The monitored features for the Xymon environment include:

- · Host and operating system monitoring for CPU, memory, and disk utilization
- Status of the SAS 9 Enterprise Business Intelligence servers and SAS Web applications
- Status of SAS processes, TCP/IP ports, and log files
- Event reporting facilities to include e-mail, Short Messaging Service (SMS), or customized messaging
- Custom alert levels for monitored metrics, tailored for a specific host or metric
- UNIX oriented scripting to create custom extensions

The following displays demonstrate the Web-based interfaces provided by Xymon. Descriptions of the depicted features are provided. In this scenario, the Xymon Monitor has detected that an event or multiple events exist for the managed systems. Selecting the specific server group icon will drill into a detailed page for the hosts associated with the grouping. Detailed graphs are also available for the monitored conditions, and an archive history is retained in an included RRD database.



Xymon top-level page, with hosts organized by functional areas and a **RED** background to indicate an active alert

😝 red : Hobbit - Status @ Sat Feb 06 18 🛛 🔆												
AIX Power5 Servers	<u>сөнн</u>	<u>cpu</u>	<u>disk</u>	<u>files</u>	<u>http</u>	<u>info</u>	<u>memory</u>	msgs	<u>ports</u>	<u>procs</u>	trends	
EMIAIX01	٠	٠		٠			٠	٠	٠	٠	٠	
EMIAIX02 (lpar1)	•	•		<b></b>		+	<b></b>	•	<b></b>	<b></b>	<b>•</b>	
EMIVIRT16 (lpar2)	•	•	+	+		•	•	•	+	٠	٠	
EMIVIRT17 (lpar3)	•	•	<b></b>	<b></b>		<b></b>	<b></b>	•	<b></b>	٠	<b>•</b>	
SAS 9.2 EBI (testdad)	•	•	<b></b>	+	۲	+	<b>•</b>	•			<b>•</b>	
one												

Xymon group detail page showing disk, ports, and procs metrics in alert states

🛛 😁 red : Hobbit - p	ports status for SAS 9 🔶			
Views	Reports Admir	inistration Help		
Hobbit			SAS 9.2 EBI (testdad) - ports	Sat Feb 06 18:19:39 2010
		Sat Feb 6 18:19:31 EST Connection: SASMain - Connection: SASMain - LB Conn 1: SASMain - LB Conn 2: SASMain - LB Conn 2: SASMain - Connection: SASMain - Connection: SASMain - Spawner Bridge Port:6 Spawner Bridge Port:6 Spawner Bridge Port:6 Spawner Bridge Port:6 Connection: SASMain Connection: SASMain	HISTORY T 2010 - Ports NOT ok - Workspace Server :8591 (found 1, req. 1 or more - Stored Process Server :8601 (found 1, req. 1 or Stored Process Server :8631 (found 0, req. norg Stored Process Server :8631 (found 0, req. norg - OLAP Server :5451 (found 0, req. 1 or more) - Spawner :8581 (found 1, req. 1 or more) 8591 (found 1, req. 1 or more) 8601 (found 1, req. 1 or more) 8701 (found 1, req. 1 or more) 9701 (found 1, req. 1 or more) 9 System Services :8451 (found 1, req. 1 or more) - Pooled Workspace Server :8701 (found 1, req. 1	SAS 9.2 OLAP Server failure
		Connection: SAS Contended	ent Server :9080 (found 1, req. 1 or more)	

SAS 9.2 Enterprise Business Intelligence on the UNIX host "testdad," showing TCP/IP port status for the SAS servers

AIX Power5 Servers	<u>conn</u>	<u>cpu</u>	<u>disk</u>	<u>files</u>	<u>http</u>	info	<u>memory</u>	<u>msgs</u>	ports	<u>procs</u>	<u>trends</u>
EMIAIX01	٠	*	٩	۲	2	٠		۲	۹		*
EMIAIX02 (lpar1)	\$	-	۲	۲		٠	•	۲	۲		٠
EMIVIRT16 (lpar2)		۲	۲	۲			۲	۲	۲	۲	٠
EMIVIRT17 (lpar3)	•		۲	۲		٠	٩	۲	۲	۲	*
SAS 9.2 EBI (testdad)	•	۲	۹	۲	۲	\$	۹	۲	۹	۲	*

Xymon reporting the disk space issue partially corrected and the SAS OLAP Server restarted

The EMI team Web site contains details about the <u>Xymon integration</u> package along with documentation and .sas programs to facilitate implementation.

# HYPERIC HQ ENTERPRISE MONITOR (SPRING SOURCE, VMWARE)

Hyperic HQ consists of two levels of monitoring solutions. Hyperic HQ Open Source is distributed without usage fees and is licensed under the GNU GPL v2 licensing model. Hyperic also offers the Hyperic HQ Enterprise monitor for large-scale environments in which more sophisticated monitoring and capacity planning features are required. Both versions share some of the same features and characteristics, including:

- · Web-based interface designed to manage Web applications, network resources, and applications
- Auto-discovery for a wide range of software applications, virtual and physical topology
- Performance metrics for operating system resources and applications and trend graphs
- Alert and event features to help manage system failures or resource constraints

In addition to the default features, Hyperic HQ also includes customized methods to add user-defined resources for unique site management and monitoring requirements.

The SAS 9.2 Hyperic HQ integration package consists of a suite of scripts, resource definitions, and documentation to enable Hyperic monitoring for SAS 9.2 Enterprise Business Intelligence deployments. The monitoring features that are enabled for SAS 9.2 environments include:

- A Hyperic HQ resource definition template for SAS 9.2 Enterprise Business Intelligence environments
- UNIX and Windows resource definitions for SAS processes, services, and Web applications
- Status, state, and event reporting for SAS servers and Web applications
- Resource metrics monitoring and events for CPU, memory, and disk usage of SAS resources
- Installation, configuration, and integration documentation

The following displays demonstrate the Hyperic HQ Dashboard and the monitoring features available with the SAS 9.2 Hyperic integration package.

HQ Dashboard - Windows Internet Explorer provided by SAS							
<ul> <li>+ 10 http://emix64s05.na.sas.com:7080/Dashboard.do</li> </ul>					💌 🍫 🗙 Google		8
🚱 👩 HQ Dashboard					🚺 • 📾 • 🖶 • 🕞	Page 🕶 🤇	) Tools + 🔞+
	There are no alerts in the l	ast 2 hours	.) 		Welcome, HQ Sign	Out Scr	eencasts Helj
Da	shboard Resources	Analyze	Administratio	on			₽ Search
The requested resource (/portal/null) is not available		The req	uested resource (/	/portal/null) is not availa	ble		
Availability Summary SAS 9.2 Bi Servers	¢ (	🛎 🔝 Fa	vorite Resource	IS			4÷ ¥
Resource Type	Availability	Resou	irce Name		Resource Type	Avail	ability Alerts
No resources to display, please click the USP icon above to add resources to Search Resources	portlet.	SAS 9	2 BI Environmen	t for Windows	Mixed Group - Platforms,Servers & Services		0
Resource Name Platforms		SAS 9	.2 BI Environmen	t for AIX	Mixed Group - Platforms,Servers & Services		0
Recently Added	袋					Up	dated: 1:41 PM
Resource Name	Time	Re Re	ecent Alerts				* 😫
testdad.unx.sas.com	22 hours ago		ate / Time +	Alert Name	Resource Name	Fixed	Ack
Add content to this column: Select Portlet		0	2/04/2010 03:40 PI	Availability less than 100%	SAS 9.2 OLAP Server - AIX	Yes	
		FIXE	ACKNOW	VLEDGE		Up	dated: 1:41 PM

Hyperic HQ Dashboard monitoring a SAS 9.2 Enterprise Business Intelligence deployment on Windows and UNIX

Resource availability events or alerts can be classified according to severity and are percolated into the dashboard based on the resource group definitions. A failure or event will be reported under the appropriate resource group. When the group is selected, a detailed view of the affected resources is presented. Alerts can also be directed to external collectors such as e-mail or distribution lists.

YPERIC	HQ Recent Alerts: 01:50	PM - Availability Less than 100%	recome, me orginour our concusts
	Dashboa	ard Resources Analyze Administration	ه. Se
oups > Mixed Group - P	latforms, Servers & Service	es > SAS 9.2 BI Environment for Windows	
cription: SAS 9.2 Enterprise Bl runnin	a	Owner: HQ Administrator (boadmin) - Change	
ols Menus	2 11		
-Inventory Views			
ieneral Properties			
Persources by Tu	tai: 12	SAS BI Server (5)	
Description	an: SAS 9.2 Enterprise BL running on Wind	ows Date Created: 02/05/2010.01:29 Bl	1
Locatio	on:	Date Modified: 02/05/2010 01:34 PM	
Resource Tvi	pe: Group	Modified By: HO Administrator (b	admin)
-			
EDITsi			
Name A	Vice resource types.	Description	Availability
SAS 9.2 BIDashboard	HTTP		Co Co
SAS 9.2 Content Server	нттр		ő
SAS 9.2 Metadata Server	SAS BI Server	SAS 9.2 Metadata Server residing on emiws02	0
SAS 9.2 Object Spawner	SAS BI Server		Ø
SAS 9.2 OLAP figrver	SAS BI Server		0
4			
SAS 9.2 Portal	HTTP		0
SAS 9.2 Portal SAS 9.2 Portal SAS 9.2 Remote Services	HTTP SAS BI Server		0
SAS 9.2 Portal SAS 9.2 Remote Services SAS 9.2 Remote Services SAS 9.2 Stored Process	HTTP SAS BI Server HTTP		0
SAS 9.2 Portal SAS 9.2 Remote Services SAS 9.2 Stored Process SAS 9.2 Table Server	HTTP SAS BI Server HTTP SAS BI Server		0
SAS 9.2 Portal SAS 9.2 Remote Services SAS 9.2 Stored Process SAS 9.2 Table Server SAS 9.2 WebDoc	HTTP SAS BI Server HTTP SAS BI Server HTTP		0 0 0
SAS 9.2 Portal SAS 9.2 Remote Services SAS 9.2 Stored Process SAS 9.2 Stored Process SAS 9.2 WebDoc SAS 9.2 WebDoc	HTTP SAS BI Server HTTP SAS BI Server HTTP HTTP		0 0 0 0

Hyperic HQ resource group on Windows, with a SAS OLAP Server failure

From:	이 hqadmin @emix64s05	Sent:	Thu 1/28/2010 2:41 PM
To:	Dan Lucas		
Cc			
Subject:	[HQ] !! - Availability Less than 100% SAS 9.2 OLAP Server		
SAS 9.2 Ava	OLAP Server has generated the following alert: ilability Less than 100% SAS 9.2 OLAP Server Availability (0.0%)		
ALERT D	ETAIL		
- Resou	rce Name: SAS 9.2 OLAP Server		
- Alert	Name: Availability Less than 100%		
- Alert	Date / Time: January 28, 2010 2:40:00 PM EST		
- Trigg	ering Condition(s):		
If	Availability < 100.0% (actual value = 0.0%)		
- Alert	Severity: !! - Medium		

#### Hyperic HQ e-mail alert event for the SAS 9.2 OLAP Server failure

Hyperic HQ offers the ability to track common metrics associated with defined resources. Alerts values and levels can be configured for the monitored metrics. Hyperic HQ includes a wide range of metrics for monitoring the performance of Web applications executing within a Web application server.



#### Hyperic HQ process metrics and graphs for a Windows service

The combination of Hyperic HQ features and the SAS 9.2 Enterprise Business Intelligence integration components allow sites to quickly and easily customize Web-based dashboards for their SAS 9 deployments. Additionally, Hyperic HQ offers a wide range of templates for monitoring distributed, heterogeneous hosts and applications from a consolidated Java Web-based dashboard.

### SAS 9.2 AUDIT AND PERFORMANCE PACKAGE

The SAS 9.2 Audit and Performance Measurement (EBIAPM92) instrumentation package is a collection of utilities provided by SAS that customers can download, install, and configure for their organizations. The package is available for UNIX, Windows, and z/OS environments and allows a site to monitor the state of the SAS 9 Enterprise Business

Intelligence architecture, implement audit reports for regulatory compliance, and report on the performance and usability of the SAS 9 analytic server environment. The key features include:

- SAS Enterprise Business Intelligence environment status reports
- Metadata server audit reporting
- SAS Enterprise Business Intelligence analytic server performance usage reports

The following display depicts the operational package as configured on a UNIX HTTP server, demonstrating the key features described previously:

	www.migcory_poonunaries_100is	Tieth					
	C X 🏠 S http://sw	w.sas.com	/~sasdvl/emi/bien	v.html		☆ 🔹 🛃 Google	
5AS 9.2 Er	nterprise BI Audit and P ×	SAS Info	ormation Delivery F	Portal 🗙 ∻			
SAS 9.	2 Enterprise BI Serve 20JAN2	er and 010:1	Web Tier 9 5:54	Status Report:	SAS 9.2 I Report N	Metadata Server Audit Reports	
Monitoring	Servers and Web App	Status	Validation Time	Last Checked	Date Rai	nge Last 7 Days	
Mid-Tier	Portal	Up	-	20JAN2010:00:01:04.03	Report F ODS Sty	format: HTML 🔽 le: SASWeb 🔹	
	SASBIDashboard SASContentServer	Up Up		20JAN2010:00:01:04.33 20JAN2010:00:01:04.50		Build Report   Reset	
	SASStoredProcess	Up		20JAN2010:00:01:04.57	SAS 9.2 Enterp	rise BI Server Performance Repo	rts
	SASWebDoc	Up		20JAN2010:00:01:04.72	Report URL	Report Description	
	SASWebOLAPViewer	Up		20JAN2010:00:01:05.00	ArtifactStats.html	Time Statistics for Artifact Usage	
	SASWebReportStudio	Up		20JAN2010:00:01:05.15	ArtifactUsageBusinessHours.html	Artifact Usage during Business Hours	
	Output the Output of Output	a di mata	22.22	20 10 10 00 00 00 00 10	CubeByUser.html	OLAP Cube Usage by User	
servers	Operating System Services	qu	32.30	20JAN2010:00:01:38.42	CubeTopUsers.html	Top OLAP Cube Users	
	SASMain - Connect Server	Up	20.20	20JAN2010:00:01:58.66	DataUsage.html	Most Heavily Used Datasets	
	SASMain - OLAP Server	Up	23.40	20JAN2010:00:02:22:10	DirectoryUsage.html	Most Heavily Used Directories	
		1			MetadataDuplication.html	Duplicate Metadata references for a directory	
	SASMain - Pooled Workspace Server	Up	22.23	20JAN2010:00:02:44.35	ProcUsage.html	SAS PROC Usage	
	CLONE: On Income	e stand	24.00	20 10 10 00 00 00 00 00	ReportUsageTopTen.html	Top 10 Report Usage	
	SASIMAIN - Stored Process Server	up	21.68	20JAN2010:00:03:06.07	ServerElapsedVsCPU.html	Server Comparsion of Elapsed versus CPU Time	
	SASMain - Workspace Server	Up	22.86	20JAN2010:00:03:28.97	ServerUsageByUser.html	SAS Server Usage by SAS User	
	SASTS - Table Server	Uip	22.71	20JAN2010:00:03:51.73	SIPReportAveResponse.html	Stored Process Average Response Time	
	CHARGES SOURCEMENTS		1.1200.00	Canadian and Constrained	STPReportByDuration.html	Stored Process Consumption by Elapsed Time	
					UsageInventory frame.html	Inventory of Metadata Artifacts	

### SAS 9.2 EBIAPM92 SERVER AND WEB TIER STATUS AND ALERTS

Real-time status for the SAS server and Web tiers are available via the status Web page. In the following example, the SAS OLAP Server and SAS Table Server are unavailable:

	SASWebReportStudio	Up		20JAN2010:00:01:05.15
Servers	Operating System Services	Up	22.21	20JAN2010:16:04:11.94
	SASMain - Connect Server	Up	20.46	20JAN2010:16:04:32.44
	SASMain - OLAP Server	Down	19.98	20JAN2010:16:04:52.52
	SASMain - Pooled Workspace Server	Up	20.83	20JAN2010:16:05:13.39
	SASMain - Stored Process Server	Up	21.50	20JAN2010:16:05:34.91
	SASMain - Workspace Server	Up	17.79	20JAN2010:16:05:52.74
	SASTS - Table Server	Down	20.75	20JAN2010:16:06:13.58

The server and Web tier status feature includes the ability to emit e-mail events via the SAS e-mail access method. Interfaces are available to create external alert events to partner systems management packages including IBM Tivoli, HP OpenView, Microsoft Event Viewer, and Xymon Server.

#### **SAS® 9.2 INFORMATION DELIVERY PORTAL WEB APPLICATION**

The package can also be surfaced through the SAS Information Delivery Portal Web application by using a URL portlet. This capability is demonstrated below, with the SAS 9.2 Information Delivery Portal running on IBM WebSphere Application Server on an IBM zSeries (z/990) computer with the z/OS operating system:

0008	Dented							Options+   Search	Log Off SAS Demo User   Help-
Home	SAS 9.2 for :	z/OS Audit and Perfe	ormance						Jour
SAS 9.2	for z/OS Enter	prise BI Web Status				3 @ × _	SAS Home Page		10 @ × _
SA	\$ 9.2 for z/O	S Enterprise BI	Veb Ti	er Status Re	eport: 29JAN20	010:17:22	SSAS. THE POWER TO KNOW.		NEWS EVENTS CI
	Monitoring	Servers and Web App	Status	Validation Time	Last Checked		Providing software solutions sinc	e 1976	
	Mid-Tier	SASBIDashboard	Up		29JAN2010.16:36:03	.60			
		SASContentServer	Up		29JAN2010:16:36:05	.88	Home Products & Solutions	Customer Success Part	ners Company Support & Tra
		SASPortal	Up		29JAN2010:16:36:06	.12	FORTUNE		
		SASStoredProcess	Up.		29JAN2010:16:36:06	.63	100 REST	SAS #1 on FC	DRTUNE '2010 100 E
		SASWebDoc	Up		29JAN2010:16:36:06	.98	COMPANIES 2		
		SASWebOLAPViewer	Up		29JAN2010:16:36:07	.79	TO WORK FOR	Find out ho	w a great workplace create
		SASWebReportStudio	Up		29JAN2010:16:36:11	.10	RECOMMENDED STARTING POINTS:	EXECUTIVE   IT PRO	OFESSIONAL   BUSINESS MANAGER  _
-							4		E
SAS 9.2	Metadata Audi	t Reports				_ × 🖞 🖉	SAS 9.2 Performance and Usage Rep	orts	I 🖉 🖉 🗙 💶
	SI	AS 9.2 for z/OS M	etadat	a Server Au	dit Reports		SAS 9.2 for z/OS Ent	erprise BI Server Perf	ormance Reports
		Report Name	A	en Control Char			Report URI	Report Description	
		Date Panco	Acce	ss control Chai	udes 🗾		ArtifactStats.htm]	Time Statistics for Artifact Usa	ge
		Date Range	Last	Days 💌			ArtifactUsageBusinessHours.html	Artifact Usage during Business Ho	urs

### SAS 9.2 EBIAPM92 AUDIT REPORTS

The package produces audit reports by analyzing the SAS Metadata Server audit logs and archiving the results in SAS data sets. Default formats for the reports include HTML, PDF, RTF, XML, and CSV styles. Reports are available for "access control changes," "administrator users," "userid," and "group" modifications. The following display is a partial report of access control changes in the previous seven days.

SAS Output	- Mozilla Firefox								
Eile Edit Vie	w History <u>B</u> ookmarks	Iools Help							
SAS 9.2 Ent	terprise BI Audit and Perfor	× SAS Output		× 🕒 SAS Output	🗙 😽 Magnificent7 System 3 - saspedia 🛛 📯 🔗				
			Access Cor	ntrol Changes on 01FEB201	0				
Administrator	DateTime	Object ID	Identity Name	Log_Line					
sasinad	15JAN2010:15:32:50.900	A5F0DWG8.B20001MZ	Sample: Shoe Sales by Region	2010-01-16T16:32:50,900 INFO [01182311] 5763:sasinad - Access Control change on ObjectType=ClassifierMap, Name=Sample: Shoe Sales by Region, Objld=A5F0DWG8.B20001MZ.					
	15JAN2010:15:33:25.778	A5F0DWG8.B20001MZ	Sample: Shoe Sales by Region	2010-01-15T15:33:25,778 INFO [01182434] 5783:sasinad - Access Control ohange on DbjectType=ClassifierMap, Name=Sample: Shoe Sales by Region, ObjId=A5F0DW68.B20001MZ.					
sasinde	06JAN2010:11:16:16.098	A5F0DWG8.AY0002FR	new test report.srx	2010-01-06T11:16:16,098 INFO [0000706 Name=new test report.srx, ObjId=A5F0DW	32] 109:sasinde - Access Control change on ObjectType=Transformation, IG8.AY0002FR.				
	15JAN2010:14:20:27.961	A5F0DWG8.AY0002FS	Market Forecast Pie Chart for STP fr	2010-01-15T14:20:27,961 INFO [0117052 Name=Market Forecast Pie Chart for STP	24] 5697:sasinde - Access Control change on ObjectType=Transformation, from WRS.sx, Objid=A5F0DW68.AY0002FS.				
	15JAN2010:15:35:49.024	A5F0DWG8.AY0002FT	Product Sales Stored Process Server	2010-01-15T15:35:49,024 INFO [0118310 Name=Product Sales Stored Process Serv	02] 5503:sasinde - Access Control change on ObjectType=Transformation, er via WRS.snx, Objid=A5F0DWG8.AY0002FT.				

### SAS 9.2 EBIAPM92 PERFORMANCE REPORTS

The performance and usage reports provide a wealth of information related to the specific usage and user performance of the SAS analytic server environment. The performance reports include details such as:

• Usage of SAS 9.2 metadata including libraries, cubes, reports, stored processes, and tables

- SAS OLAP Server cube reports based on top users, name, and frequency counts
- Workspace server utilization, including detailed metrics for elapsed time, CPU, I/O, and memory usage
- SAS PROC utilization based on server type and frequency metrics
- SAS Web Report Studio reports and SAS Stored Process utilization reports

The following sample reports demonstrate a few of the defaults available in the package:

S SAS 9.2 Enterprise BI Audit and Perfor × SSAS Output ×											
Artifact Usage - Time Statistics											
-											
artifactType=CUBE											
artifact	frequency	minElapsedTime	minElapsedTotalCPUTime	aveElapsedTime	aveElapsedTotalCPUTime	maxElapsedTime m	naxElapsedTotalCPUTime				
DT MAILORDERINFOCUBE	20	0.007801	0.00	0.023797	0.005	0.06306	0.01				
ProductSales	66	0.005690	0.00	0.026318	0.005	0.12779	0.04				
ProductSales118412	10	0.007922	0.00	0.016631	0.003	0.02777	0.02				
dvt_MAILORDERINFOCUBE	3	0.012390	0.01	0.073818	0.010	0.16418	0.01				
			artifactType	=STOREDPROC	ESS						
	-										
artifact	frequer	icy minElapsedTir	ne minElapsedTotalCPUTi	me aveElapsedTir	ne aveElapsedTotalCPUTi	me maxElapsedTim	e maxElapsedTotalCPUTime				
/Products/SAS Intelligence Platform/Samples/Sample: European Demographic Data		3 1.20	198 C	1.81 2.32	19 1.21	667 2.910	4 1.4				
/Products/SAS Intelligence Platform/Samples/Sample: Hel World	lo	9 0.08	i07 C	1.01 0.07	97 0.02	778 0.104	7 0.04				
/Products/SAS Intelligence Platform/Samples/Sample:		4 0.18	72 0	0.27	49 0.13	0.412	3 0.19				

SAS Metadata Server library report, artifactType, with metrics for each library

Enterprise	. SAS Uutj	put ×	SAS Outpu	t 🔤 SAS	Output	SAS Output	Magnificent7 S
	v	Vorkspa	ce Server <sup>-</sup>	Fop 10 Users	by Sessions	s for 2 Weeks	
User	Day of Week	Sessions	ElapsedTime	SystemCPUTime	TotalCPUTime	Session_IOCount_	Session_MemHigh_
BIDTEST	05JAN2010	66	98896.96	0.00	142.65	483637	3.8692E10
Total		66	98896.96	0.00	142.65	483637	3.8692E10
SASEMJ	04JAN2010	1	1483.05	0.00	1.01	. 2238	770840
	05JAN2010	15	31404.03	0.00	11.00	79679	5397096
Total		16	32887.08	0.00	12.01	81917	6167936
MAALLE	05JAN2010	7	957.38	0.00	2.26	10574	735840
Total	1	7	957.38	0.00	2.26	10574	735840
SASKRC	05JAN2010	6	1114.13	0.00	4.31	13748	735840
Total		6	1114.13	0.00	4.31	13748	735840
SASRKC	05JAN2010	4	11127.62	0.00	113.80	397376	4.29533E9
Total		4	11127.62	0.00	113.80	397376	4.29533E9
BCI1INS	05JAN2010	3	34.93	0.00	0.69	4	4096
Total		3	34.93	0.00	0.69	4	4096
MVS3INS	05JAN2010	3	3129.80	0.00	1.38	6663	367920
Total		3	3129.80	0.00	1.38	6663	367920
SASIDB2	02JAN2010	1	39.53	0.00	0.16		11
Total		1	39.53	0.00	0.16		8.
KEVANS	04JAN2010	1	2.81	0.00	0.14	4	4096
Total		1	2.81	0.00	0.14	4	4096
Grand Tota	/	107	148190.26	0.00	277.41	993923	4.2995E10
		Genera	ted by the S Refer to SA	AS System on	06JAN2010 ault User Me	at 4:21 PM trics	

z/OS workspace server user session report, with metrics for sessions, time, CPU, I/O, and memory



UNIX SAS procedure usage report chart and frequency table

The SAS 9.2 Audit and Performance reporting package is distributed with full source code, data model descriptions, and customization information. This allows sites to easily extend the package to create highly customized reports that are optimized for their unique organizational requirements.

### CONCLUSION

Enterprise systems management is evolving into a complex and sophisticated environment that is critical to providing computing and analytic capabilities to business operations. IT staff and administrators, SAS administrators, and executives have to implement, monitor, and manage an expansive set of distributed resources, hardware, network, and applications.

SAS offers a number of solutions and technologies that our customers can select from to effectively meet the systems management requirements of their organizations.

Customers can leverage their investments in our partner enterprise management products (IBM Tivoli or HP OpenView) to monitor the state and status of the SAS 9 Enterprise Business Intelligence framework. SAS customers that use open source solutions can investigate using the Xymon Monitor or Hyperic HQ monitor products to monitor the SAS 9 environment.

Finally, sites that have a need to understand detailed status, audit, and performance reports on the SAS 9 environment should consider implementing the SAS 9.2 Audit and Performance Package. The package includes usage reports for SAS libraries, SAS procedures, user workloads per server type, and detailed metrics related to resource utilization across the server environment.

Customers will find additional details about the information provided in this paper by referring to the Enterprise Management Integration section of the Focus Areas topic on the SAS Customer Support Web site.

### REFERENCES

The following references or sources can be used for additional information and research activities:

- SAS Customer Support home: <u>http://support.sas.com</u>
- SAS Enterprise Management Integration home: http://support.sas.com/rnd/emi
- SAS 9.2 Documentation home: http://support.sas.com/documentation/cdl\_main/index.html
- SAS 9.2 Intelligence Platform documentation:
  - o Installation and Configuration Guide
    - o System Administration Guide

## **CONTACT INFORMATION**

Our team is very interested in answering your questions or providing additional information related to your systems monitoring and management requirements. Please contact the author at:

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