Your Top Ten SAS® Middle-Tier Questions

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ABSTRACT

As SAS® products become more web-oriented and sophisticated, SAS administrators face an increased challenge to manage their SAS middle-tier environments. They want to know the answers to important critical questions when planning, installing, configuring, deploying, and administrating their SAS products. They also need to meet the requirements of high performance, high availability, increased security, maintainability, and more. In this paper, we identify the most common and challenging questions that most of our administrators and customers have asked. These questions range across topics such as SAS middle-tier architecture, clustering, performance, security, and administration using SAS Environment Manager. The questions come from many sources such as technical support, consultants, and internal customer experience testing teams.

The specific questions include: What is new in the SAS 9.4 middle-tier infrastructure, and why that is better for me? How can I tune middle-tier performance and improve the start-up time of my SAS Web Application Server? What are the upgrade policies and processes for the SAS Private JRE, SAS Web Server, and SAS Web Application Server? What is the security policy, what security patches are available, and how do I apply them? How do I architect and configure SAS Enterprise BI Server and SAS Visual Analytics to achieve high availability? Should I use the SAS Web Server, or can I use another third-party web server in my deployment? What options are available for configuring SSL? How do I install, update or add my products for cluster members? Where can I deploy custom-developed web applications and static content? How can I manage my middle-tier infrastructure and applications? How are users and accounts managed in SAS Environment Manager?

The paper will present detailed answers for these questions and also point out where you can find more information. With the answers to these questions, we believe that you, the SAS administrator, can implement and manage your SAS environment with a higher level of confidence and satisfaction.

INTRODUCTION

SAS 9.4 made dramatic changes to the SAS middle-tier infrastructure. SAS 9.4 also poses more requirements and challenges to SAS administrators. SAS has provided numerous resources to help customers better meet the high performance, high availability, increased security, and maintainability requirements of their SAS environments. Resources for administrators include updated documentation, white papers, and training materials. However, the questions discussed in this paper are still frequently brought up by our consultants and end users. The purpose of this paper is to provide a central place to answer these common questions and to point out where to find more information.

The paper will go straight to the list of questions listed in the abstract and provide answers to them. The questions are organized into the following categories:

- general
- performance and high availability
- security and upgrade policy
- deployment
- monitoring and management

Because of length constraints, we will not go into detail for many of the questions. However, we want to give you sufficient specifics and then point out where you can find the needed details.

GENERAL

What is new in the SAS 9.4 middle-tier environment, and why that is better for me?

Beginning with SAS 9.4, SAS is seeking to reverse the trend toward increasing cost and complexity, while maintaining and even expanding the functionality of the software and expanding the ability to integrate with enterprise IT and security infrastructure.

SAS seeks to accomplish these goals by embracing the latest technology directions, which lean away from heavyweight J2EE/Enterprise Java Beans and lean toward more flexible, lighter-weight coding paradigms such as SpringSource. By re-architecting the entire middle tier around these paradigms, SAS has been able to eliminate the requirement that the web applications be run on a J2EE server such as Oracle WebLogic, IBM WebSphere, or Red Hat JBoss. In SAS 9.4, all SAS web applications can run in a lightweight servlet container based on Apache Tomcat.

This approach provides SAS customers with many advantages, including the following:

Reduced Cost. SAS no longer requires that customers procure a third-party web application server and an associated maintenance contract. SAS provides the software and the support.

Reduced Time to Value. In many cases, once the SAS Deployment Wizard finishes, the software is completely functional. All of the applications are up and running. SAS has eliminated the need to wait for a separate web team to configure the third-party servers per written instructions and then deploy the applications before integration and acceptance testing can proceed.

Improved Deployment Experience. Because SAS now controls the entire middle-tier infrastructure, many of the deployment tasks that previously involved manual steps performed by web server teams can now be performed automatically by the SAS Deployment Wizard. This speeds and simplifies the software deployment process. Moreover, automated deployments lead to greater uniformity in the deployed architecture, which eliminates variations in the running applications and the inherent support issues that arise from increased variability.

Reduced Complexity and Increased Stability. Because SAS has standardized on a single web application server, customers are now guaranteed to be running their applications on the very same server, using the very same tuning parameters, that was used to develop and test the applications at SAS. Compromises between tuning options that benefited performance on one application server but were detrimental to another are no longer required. SAS web applications can now be tuned for optimal performance.

Improved Support for Virtualization and Cloud-based Deployments. The new architecture for the SAS Web Application Server tier was specifically selected to work well in the virtualized environments that are increasingly in demand. Because support for virtualization has been considered from the outset, customers who want to use a cloud-based infrastructure will find the process much simpler. Since all the commercial licenses required to run the middle-tier servers are with SAS, transitions to cloud-based deployments will be less costly.

Improved Customer Support. SAS offers first and second-level support for the HTTP server and web application server, so that customers can now turn to SAS Technical Support to resolve all issues. The SAS license agreement with Pivotal provides a mechanism to obtain bug fixes for problems or security vulnerabilities that might be discovered. These fixes will then be committed by Pivotal to the Apache code base and included with subsequent Apache releases of the open-source project. This eliminates the need for customers to contact two different support organizations.

Built-in Monitoring and Management. SAS Environment Manager includes enterprise monitoring software that provides a web interface for managing and monitoring the health and performance of the entire SAS deployment. Additional functions specifically for managing SAS software will be included with each SAS 9.4 maintenance release.

The 2014 SAS Global Forum paper "Migrating SAS® Java EE Applications from WebLogic, WebSphere, and JBoss to Pivotal tc Server" provides more details about the motivation, benefits, and technology related to the SAS 9.4 changes.

PERFORMANCE AND HIGH AVAILABILITY

How can I tune middle-tier performance and improve the start-up time of my SAS Web Application Server?

The SAS 9.4 middle tier is a typical multiple-tier J2EE application. It can consist of web servers, web application servers, and database servers. To achieve good performance, you need to tune all of these tiers. Tuning involves more than just changing the parameters in each tier. It also involves using the following process to implement a good-performing system;

- Select an appropriate deployment topology.

- Monitor the system and collect usage data.

- Analyze resource utilization.

- Tune the environment.

Tuning starts with understanding the options that are available in the deployment topology. For example, you can choose among various options for locating SAS components including the SAS Web Server, SAS Web Applications Servers, and SAS Web Infrastructure Platform Data Servers, and for determining which server instance to use for each of the SAS web applications. You can choose whether to use multiple server instances, and you can choose to use vertical or horizontal clustering for each tier and component.

The SAS automatic deployment process allows you to create at most one instance of the SAS Web Server and one instance of the SAS Web Infrastructure Platform Data server. However, you can add more instances for performance and failover. The SAS automatic deployment process allows you to create either horizontal or vertical clusters and to deploy your applications on multiple server instances. The next step is to monitor your SAS environment, which includes monitoring usage of your operating system resources, web server, web application server, database server, and application resources. In SAS 9.4, a new product called SAS Environment Manager was released, providing a one-stop place to serve these monitoring needs. The specific resources to monitor might include:

- Java virtual machine (JVM) memory usage, including heap and PermGen spaces

- TomcatThreadPool Executor thread pool for SAS Web Application Server

- Java Database Connectivity (JDBC) data sources for SAS Web Application Server

- max_connections for SAS Web Infrastructure Platform Data Server

- SAS Web Server thread utilization

- system CPU and memory usage

- system I/O and network interface usage

If the performance issues are related to SAS Web Application Server, then Java heap dumps, thread dumps, and garbage collection (GC) logs are the most useful sources for diagnosis and troubleshooting. Heap dumps are most useful for pinpointing memory leaks. When the system runs slow, hangs, or is unresponsive, a thread dump is helpful in identifying the cause of the problem. GC logging of the Java process can be used to analyze the health of the Java heap over time.

With the information gathered from the previous steps, you are ready to adjust the parameters for various tiers to tune the system for performance. Instructions for modifying these parameters can be found in the document *SAS 9.4 Web Applications: Tuning for Performance and Scalability* (see ref. 1).

SAS has also tuned the SAS Web Application Server start-up time by reducing the number of JAR files to be scanned and by turning on parallel web application loading.

In the third maintenance release for SAS 9.4, SAS is upgrading its use of Spring from version 3.0.5 to 3.2.11. This change, combined with the upgrade of related third-party JAR files, is expected to result in a 40 to 50 percent reduction in start-up time for the SAS Web Application Server.

**How do I architect and configure SAS Enterprise BI Server and SAS Visual Analytics to achieve high availability?**

The SAS Enterprise BI Server and SAS Visual Analytics products are used to provide insight into customer data and provide answers to solve business problems. SAS Visual Analytics enables ad hoc exploration of data using a visual interface. Since both SAS Enterprise BI Server and SAS Visual Analytics use the SAS middle tier, it is important to understand how the SAS middle tier can be configured for high availability.

Several middle-tier components can be configured for high availability, and each has different requirements and considerations. The official documentation is the chapter titled "High-Availability Features in the Middle Tier" in the *SAS 9.4 Intelligence Platform: Middle-Tier Administration Guide*. This documentation provides specific instructions for configuring each middle-tier component for high availability. As a first step, we also recommend the white paper "Best Practices for Implementing High Availability for SAS 9.4." The paper covers clustering on both the middle tier and the server tier. It provides basic terminology, topology diagrams, a description of the various components of the middle tier, and comprehensive information about high availability.

Here is a summary of each of the components:

SAS Web Application Server High Availability: The SAS Web Application Server supports both horizontal and vertical clustering. Horizontal clustering is typically used to enable clustering across different machines. Vertical clustering is used to enable clustering on the same machine, with each managed server running in a separate JVM. With vertical clustering, the machine that runs the vertical cluster is a single point of failure. If this machine fails, then the middle tier will no longer be available. With horizontal clustering, in which clusters are spread across different machines, the deployment will continue to run if one of the machines fails. In general, horizontal clustering is more robust than vertical clustering. The SAS Deployment Wizard supports the configuration of both horizontal and vertical clustering.

To add a SAS Web Application Server horizontal cluster node, select **Middle Tier Node (Optional)** from the drop-down menu on the Select Deployment Step page of the SAS Deployment Wizard, as shown here:
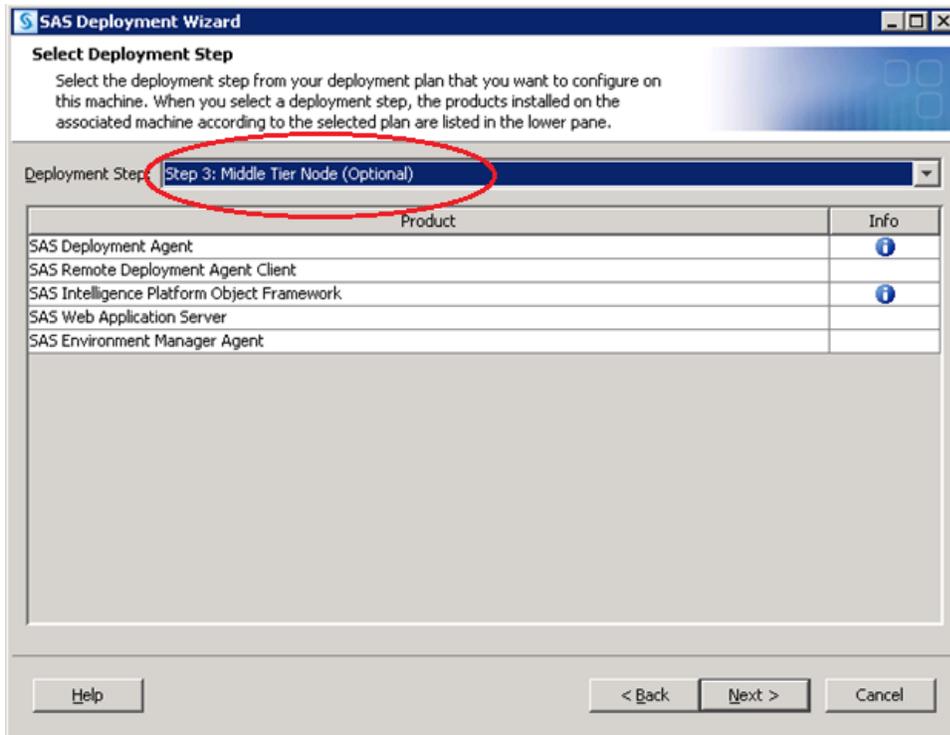
Note that **Middle-Tier Node (Optional)** is included in the plan file by default.

To add a SAS Web Application vertical cluster node during configuration of the middle tier, select a value greater than 1 in the **Cluster Member Multiplier** field on the Web Application Server: Server Ports page of the SAS Deployment Wizard, as shown here:
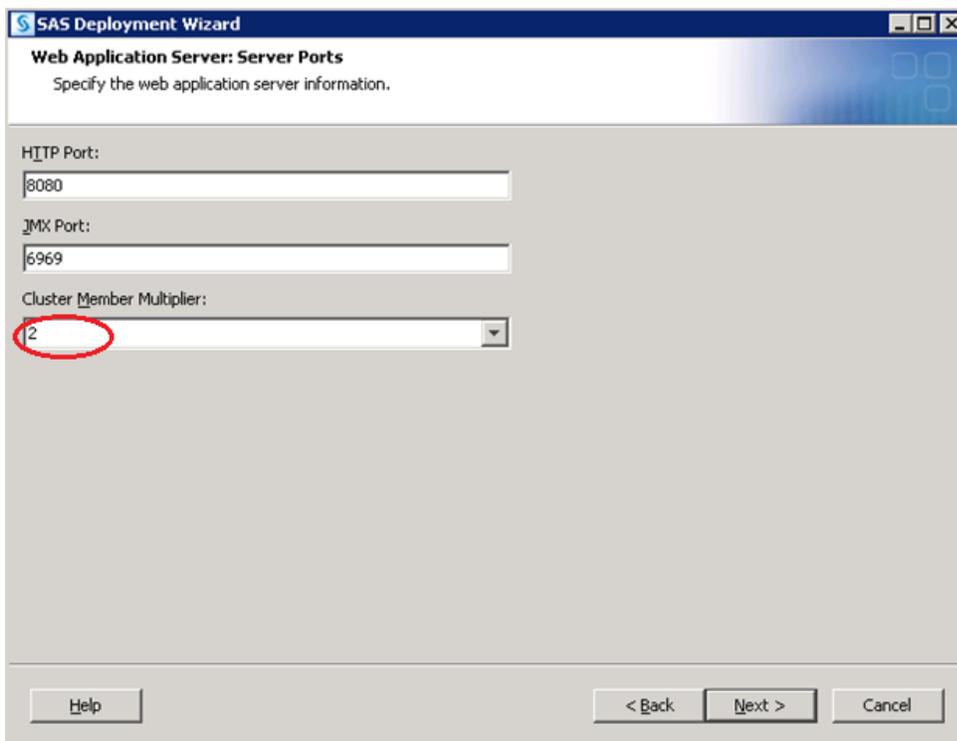
SAS Web Server High Availability. Three main strategies can be used to implement high availability of the SAS Web Server, as outlined in the *SAS 9.4 Intelligence Platform: Middle-Tier Administration Guide* (see ref. 2):

- **The hardware strategy** uses a hardware load balancer to balance multiple web server instances. Because the web server is stateless, each of the server instances can be cloned.

- **The round-robin DNS strategy** relies on multiple, identical web server instances running on different hosts and a special DNS name that is created to resolve to multiple IP addresses. When clients resolve the name with DNS, they receive a list of IP addresses to use.

- **The operating system strategy** uses high-availability features in the operating system to achieve failover for the web server. In this approach, you have a main machine and a hot standby.

Java Message Service (JMS) Broker High Availability. In SAS 9.4, the JMS broker is based on Apache ActiveMQ. The Apache documentation describes multiple strategies for enabling high availability. One method is to use the Shared File System Master Slave configuration, as documented in the *SAS 9.4 Intelligence Platform: Middle-Tier Administration Guide*.

Cache Locator High Availability. The middle tier includes a single cache locator. If your middle tier is deployed on a separate machine from the server tier, the SAS Deployment Wizard automatically adds a second cache locator on the server tier. The middle-tier and server-tier cache locators are peers and provide failover support for one another.

Additional cache locators can be added manually. For more information, see the Cache Locator topic in the chapter "High-Availability Features in the Middle Tier" in the *SAS 9.4 Intelligence Platform: Middle-Tier Administration Guide*.

SAS Environment Manager High Availability. The SAS Environment Manager high availability strategy uses a hot-standby failover cluster method. The hot-standby is running and ready to take over if the primary SAS Environment Manager fails.

SECURITY AND UPGRADE POLICY

What are the upgrade policies and processes for the SAS Private JRE, SAS Web Server, and SAS Web Application Server?

For all platforms other than z/OS, a private SAS Java Runtime Environment (JRE), a SAS Web Server, and a SAS Web Application Server are provided by SAS and installed by the SAS Deployment Wizard for the exclusive use of SAS products. All three of these products are released as part of the SAS platform, and therefore their versions are tied to platform versions.

At every major release and every maintenance release of the SAS platform, we consider whether to upgrade these products to the latest versions of the underlying vendor products. We do not necessarily upgrade every one of these products in every release. For example, in the second maintenance release for SAS 9.4, we upgraded the SAS Web Server but not the SAS Web Application Server. The decision about whether to upgrade a particular product depends on whether critical issues are included in the updated versions provided by the vendor. Another consideration is the need to keep SAS versions from falling too far behind the available vendors' versions.

It is also possible to upgrade these products outside of the regular schedule for major SAS releases and maintenance releases. In these situations, SAS might issue hot fixes for customers or provide manual instructions. These upgrades are usually due to critical security, performance, and functionality issues. For example, if Oracle reports critical vulnerabilities in the JRE and provides a new version, SAS might decide to provide updates for these vulnerabilities via a hot fix and manual process for the SAS Private JRE. As a result, customers have access to the upgrade without having to apply a maintenance release.

We are aware that some customers have a "zero day" policy for upgrades. This has occurred with JRE upgrades. In that scenario, customers can notify SAS via a Critical Support Track so that we can respond quickly through the hot fix process. Because of the platform impacts of updating these products, the update might not be available immediately. However, customers can use our manual instructions to

obtain the update directly from Oracle to satisfy their requirements. The updated JRE will not be officially supported by SAS until SAS has tested it fully to ensure that it works with SAS products. However, if you run into issues, SAS will work with you to resolve them.

As part of our procedure for maintaining proper security updates for the SAS Private JRE, SAS Technical Support has created a specific Java Runtime Environment product category. If you specify this category when submitting a problem ticket, as shown here, processing of the request will be expedited.

All Fields Marked * are Required

*E-mail: _____

*Confirm E-mail: _____

*Name: _____

*Company Name: _____

*Country: -Select a Country- ▼

*Phone: _____

*Site Number: _____ How do I find my site or customer number?

*Product: Java Runtime Environment ▼

Product Release: -Select a Release- ▼

*SAS Release: _____ ▼

*Operating System: -Select an Operating System- ▼

[Next Page] [Reset]

Figure 1. Problem Ticket with Product Category of "Java Runtime Environment"

JREs that are part of SAS solutions are upgraded as part of SAS Platform upgrades. They can also be upgraded by applying hot fixes.

It should be noted that the SAS Private JRE is not installed as a browser plugin. Therefore, it is not used by any browser that might be running on the customer's system, even if that browser is used to access SAS web applications. As a result, vulnerabilities associated with potential browser-based exploits are not applicable to the SAS Private JRE. For example, as of January 22, 2015, approximately two-thirds of the 358 Oracle JRE Java vulnerabilities tracked on Oracle's CVE Details page (see ref. 3) were browser related. The remaining vulnerabilities were server related and potentially locally exploitable. This means there is a lower potential for attacks with the SAS Private JRE.

The bundled JRE is fully tested by SAS and thus provides better performance for SAS software.

What is the security policy, what security patches are available, and how do I apply them?

SAS products are developed according to SAS Software Security Framework standards. Before products ship, security testing, included testing with IBM AppScan, is required. Any critical or high-security issues are required to be fixed except in unusual circumstances. When a security issue is identified, SAS evaluates its impact on our products and promptly issues either a statement with instructions for customers or security patches to address the problems.

For SAS Web Server (including OpenSSL), SAS Web Application Server, and the SAS Private JRE, SAS delivers security patches as hot fixes. Hot fixes are fully tested and fully supported. They can be downloaded from the SAS support website and then installed by running SAS Deployment Manager. Follow the instructions in the *SAS Deployment Wizard and SAS Deployment Manager 9.4: User's Guide* (see ref. 4).

As of this writing, SAS has not issued any hot fixes for the SAS Private JRE. SAS has issued several hot fixes for security issues related to the other middle-tier components, including SAS Web Server and SAS Web Application Server.

The SAS 9.4 Hot Fix Downloads page (see ref. 5) lists the hot fixes for SAS 9.4. For ease of reference, here is a list of hot fixes that have been issued to address security issues:

Hot Fix Number	Product	Applicable Releases	Issue Addressed
53609	SAS Web Infrastructure Platform	SAS 9.4 and 9.4_M1	A vulnerability exists in the Apache Struts 1.3.8 framework that is used by SAS® web applications
52725	SAS Web Server	SAS 9.4	ALERT - An OpenSSL Heartbleed vulnerability exists in SAS® 9.4 Web Server
53341	SAS Web Server	SAS 9.4	ALERT - OpenSSL vulnerabilities exist in the SAS® 9.4 Web Server
53069	SAS Web Application Server	SAS 9.4	SAS® Web Application Server might not provide adequate debug logging when you debug Microsoft Integrated Windows Authentication problems.
54700	SAS Web Server	SAS 9.41 and 9.4_M1	ALERT - OpenSSL vulnerabilities (06 Aug 2014 and 15 Oct 2014) exist in the SAS® 9.4 Web Server

What options are available for configuring SSL?

To increase the security of your deployment, you can choose to configure various components to use secure sockets. **Note:** Secure sockets are also referred to as Transport Layer Security (TLS), which is a successor to SSL, or generally as HTTPS.

Secure sockets can be configured for both the SAS Web Server and the SAS Web Application Server. This topic assumes that you have basic knowledge of secure sockets and how to generate a CA-signed certificate and a private key.

Configuring Web Server to Use Secure Sockets. Starting with SAS 9.4, the SAS Deployment Wizard supports automatic configuration of secure sockets for the SAS Web Server.

Before using the SAS Deployment Wizard to configure your SAS Web Server for secure sockets, you must generate a CA-signed certificate and a private key. Both must be in PEM format. The RSA private key should not be encrypted or use a pass phrase. More information about this topic can be found in the *SAS 9.4 Intelligence Platform: Middle-Tier Administration Guide.* (See ref. 6).

After you have the CA-signed certificate and private key, then install (but do not configure) the SAS Web Server. After the installation, you will need to import the certificate of the CA that signed the client certificate into the SAS Private JRE cacerts truststore. To do this, use the keytool command, which can be found in the jre/bin directory of the SAS Private JRE.

Note: Updating the JRE cacerts truststore enables the SAS Web Application Server to communicate with the SAS Web Server. After the JRE changes have been made, the SAS Web Application Server picks up the changes when the SAS Web Application Server is started.

Perhaps your deployment is already configured and is not using SSL. In this case, you can manually reconfigure your deployment to use SSL by following the instructions in the topic "Configuring SAS Web Server Manually for HTTPS" in the *SAS 9.4 Intelligence Platform: Middle-Tier Administration Guide*.

If you also want to add Client Certificate Authentication to the middle tier, follow the instructions in the topic "Support for SSL with Client Certificate Authentication" in the *SAS 9.4 Intelligence Platform: Middle-Tier Administration Guide.*

Configuring the SAS Web Application Server to use Secure Sockets. Configuration of the SAS Web Application Server to use secure sockets must be done manually. For instructions, see the topic "Configuring SAS Web Application Server to Use HTTPS" in the *SAS 9.4 Intelligence Platform: Middle-Tier Administration Guide.* These instructions explain how to configure one-way secure sockets between the SAS Web Application Server and the SAS Web Server.

DEPLOYMENT

Should I use the SAS Web Server, or can I use another third-party web server in my deployment?

In each middle-tier deployment starting in SAS 9.4, SAS provides a web server whose configuration and administration can be handled using tools provided by SAS. Whether by design, to conform to your IT policies, or for other reasons, you can choose to use your own third-party web server instead of the one provided by SAS. When making this decision, keep in mind that the web server provided by SAS is integrated into the SAS deployment process as well as maintenance operations such as starting and stopping, unconfiguring, reconfiguring, and upgrading to the latest SAS releases. Using your own web server means that you will need to maintain and integrate it with the rest of your SAS middle-tier deployment.

If you choose to use your own web server, you must install and configure it separately. For more information, see the installation and configuration documentation for your third-party web server.

After you have the web server and the SAS middle tier working, the next step is to reconfigure the SAS middle tier to integrate with the third-party web server. Follow the instructions in the topic "Configuring the Middle-Tier to Use an Existing Customer Reverse Proxy" in the *SAS 9.4 Intelligence Platform: Middle-Tier Administration Guide.*

How do I install, update, or add my products for cluster members?

In the SAS Web Application Server, members can be clustered both vertically and horizontally. If you are using vertical clustering, the installation, updating, or addition of new products happens automatically when the primary vertical cluster member on the same machine is modified. There is no need for any additional actions. Horizontal cluster members, however, require special considerations, which will be addressed in this topic.

Before getting started with clustering, we recommend reviewing basic middle-tier clustering concepts. A good place to start is the clustering scenario described in "Sample Middle-Tier Deployment Scenarios" in the *SAS 9.4 Intelligence Platform: Middle-Tier Administration Guide.*

In contrast to vertical cluster members, horizontal cluster members reside on different host machines. Thus, unlike vertical cluster members, horizontal cluster members have the concept of a primary machine. The primary machine is where the original non-clustered deployment took place. After the initial deployment, additional SAS Web Application Server horizontal cluster members can be added by running the deployment step called Middle Tier (Optional). This step is included by default in your plan file on another machine that is separate from your initial primary deployment.

When you run the Middle Tier (Option) plan step, the primary products are automatically installed on the horizontal cluster member. No additional steps are required.

To update or add products to a horizontal cluster node, you must first follow the instructions for either updating (that is, applying maintenance to) the primary machine or adding (that is, installing and configuring) products on the primary machine. Once these steps have been completed on the primary node, you must then re-run the SAS Deployment Wizard to configure each horizontal cluster node again. Configuring each horizontal node after the primary node has been updated ensures that the horizontal nodes are up-to-date and in sync with the primary node.

Where can I deploy custom-developed web applications and static content?

Since SAS 9.4 includes a prepackaged SAS Web Server and SAS Web Application Server, customers need to know where to install their custom-developed web applications and static content.

The SAS Web Server and the SAS Web Application Server are primarily used for SAS products. However, we also allow them to be used for web applications that you develop to integrate, use, and enhance SAS functions. You are not allowed to use the SAS Web Server and SAS Web Application Server to host web applications that have nothing to do with SAS products.

If your web applications fall into the allowed categories, you can deploy the applications into either a new SAS Web Application Server instance or the existing instance. Our recommendation is to deploy custom-developed web applications into a new SAS Web Application Server instance. On Windows, for example, you can use the following commands to create a new SAS Web Application Server instance:

- tcruntime-instance.bat create CustomerServer

- tcruntime-ctl.bat CustomerServer install

- tcruntime-ctl.bat CustomerServer start

The first command creates a server called CustomerServer. The second command installs the server as a service, and the third command starts the service.

If you have SAS Web Server configured, you will also need to update the following SAS Web Server configuration file to make sure your web application goes through the SAS Web Server:

> …/config/Lev1/Web/WebServer/conf/sas.conf

Instead of changing sas.conf directly, we recommend that you place your specific configuration in a different file, such as customer.conf. Then, in the httpd.conf file, add an "include" for your configuration file.

For custom static content such as JavaScript files, cascading style sheets, and graphics files, our packaging recommendations depend on how the content will be used:

- If the content is used in a SAS web application, it should be packaged with the SAS web application. The detailed process can be found at the following URL: http://support.sas.com/documentation/cdl/en/bimtag/66823/HTML/default/viewer.htm#p0plwle8uj04up n1vrsbstiwkhmz.htm

- If the content is used by a custom-developed web applications, it should be packaged with that web application.

- If the content is not used by any web applications, it should be deployed into the SAS Web Server. However, if resource consumption is not a concern, and if you want to avoid the risk of losing the content during a SAS Web Server upgrade, you can create a new SAS Web Server instance and serve the static content from that web server.

To obtain the most benefit from these recommendations, it is helpful to understand the two caching strategies that SAS Web Server supports:

- **Browser caching** is automatically configured to cache static content such as JavaScript files, cascading style sheet (ccs) files, and graphics files. This caching strategy instructs the browser to cache these MIME types with a time-out of one hour.

- **Proxy server caching** has been turned on for the Default Themes application. This strategy uses a caching algorithm. Initial requests for content are served by the web application server, and subsequent requests are served from the cache until the expiration period of one hour.

If you have ccs files that are used by a web application and you also want to enable proxy server caching, you will need to specify proxy caching for the ccs files. If you do not need proxy server caching, then no action is needed.

MONITORING AND MANAGEMENT

How can I manage my middle-tier infrastructure and applications?

Before SAS 9.4 was released, customers used administration tools and consoles packaged by various vendors to manage middle-tier infrastructure components such as IBM WebSphere, Oracle WebLogic, and Red Hat JBoss. In SAS 9.4, all this functionality and more is accomplished by a new product called SAS Environment Manager.

In the initial release of SAS 9.4, SAS Environment Manager focused on serving as an operational monitoring solution with plugins for the administration, management, and monitoring of SAS technologies, including the SAS Web Application Server. Additional functionality includes agent-based auto-discovery of resources, collection of resource consumption metrics, monitoring of log events, alerting, and flexible presentation and viewing of the collected information. Over the SAS 9.4 life cycle, SAS Environment Manager is being extended to provide more robust, centralized SAS administration and monitoring. For example, the following new features have been added to SAS Environment Manager since its initial release:

- a facility for managing user definitions in SAS metadata

- addition of the SAS Environment Manager Service Management Architecture

- the ability to view and store a snapshot of detailed system information

- several plugins, including:

  - the SAS Job Monitor plugin, which integrates information from SAS Data Integration Studio

  - the SAS Grid Manager plugin, which manages and monitors the grid environment.

- support for double-byte languages such as Chinese and Japanese

- significant fixes to make the product more robust, secure, and user-friendly

SAS Environment Manager consists of the following components:

- a web-based administrative interface

- an agent on each managed host with technology and solution-aware plugins

- a central server to manage and deploy the plugins

- a collection of reports and graphs that help characterize resource usage across the whole operational deployment.

SAS Environment Manager is shipped with plugins that interact with and gather consumption metrics for the operating system itself and for processes running on the operating system. For example, they monitor the operating system's CPU processor usage, memory usage, network interface I/O, disk I/O, and file system activity. For each process, the plugins monitor virtual memory size, resident memory size, CPU time consumed, threads, and open file descriptors. Together, these plugins bring together a wealth of resource usage consumption data. When viewed over time, this information helps administrators profile resource usage patterns and the needs of their software deployment.

Plugins are also shipped to support the SAS data tier and middle tier. For example, the SAS Web Application Server plugin includes the following capabilities:

- control actions, including starting, stopping, and restarting of a SAS web application

- configuration of operational control parameters and JVM run-time options such as heap size and debugging, default servers values for JSP and static content, and various SAS Web Application Server connectors

- definition of groups of SAS Web Application Server instances using command line utilities

- deployment of SAS web applications to a single or predefined group of servers

How are users and accounts managed in SAS Environment Manager?

User management in SAS Environment Manager has evolved with each release of SAS Environment Manager.

In SAS Environment Manager 2.0 (SAS 9.4), which was the first release of the software, SAS Environment Manager had its own user management system separate from the SAS Metadata Server. By default, this version of SAS Environment Manager used the SAS Logon Manager to authenticate users, which in turn used the SAS Metadata Server for authentication. However, SAS Environment Manager did not programmatically connect SAS Environment Manager users and metadata server users. When a user who was defined in the metadata server attempted to log on to SAS Environment Manager, the user was denied access if the user was not also defined in SAS Environment Manager. The user was required to be manually defined in both the SAS Metadata Server and SAS Environment Manager.

To address the problem and improve usability, SAS Environment Manager 2.1 (the first maintenance release for SAS 9.4) added a function that automatically synchronizes users from the SAS Metadata Server to SAS Environment Manager. There are two synchronization options: a synchronization button, and synchronization as part of the logon process. The button performs synchronization in batch mode from SAS Environment Manager groups in metadata to SAS Environment Manager. In addition, the logon process was enhanced to enable new metadata users to be synchronized to SAS Environment Manager when they log on. This synchronization is transparent to the user.

The synchronization operates at the user account level. A user in metadata can have multiple accounts, and these accounts are synchronized to user accounts in SAS Environment Manager. Three SAS Environment Manager groups are defined by default in metadata, and three SAS Environment Manager roles are defined by default in SAS Environment Manager. The synchronization process maps the user accounts in the metadata server groups to the corresponding roles in SAS Environment Manager.

In SAS Environment Manager 2.1, the following rules determined how user attributes in metadata were used to create user objects in SAS Environment Manager:

- If the Display Name in metadata contains a space character, then the part of the name before the space is mapped to the first name in SAS Environment Manager, and the part after the space is mapped to the last name in SAS Environment Manager.

- If the Display Name in metadata is empty, then the Name field in metadata is mapped to the first name in SAS Environment Manager, and the last name in SAS Environment Manager is empty.

With the release of SAS Environment Manager 2.3 (second maintenance release for SAS 9.4), we improved the mapping as follows:

- If the Display Name in metadata is not empty, it is mapped to first name in SAS Environment Manager. If the Display Name in metadata is empty, the name field in metadata is mapped to the first name in SAS Environment Manager.

- The last name in SAS Environment Manager is always set to an empty string.

- In the user interface in SAS Environment, the First Name field is now called Display Name. The Last Name field has been removed from the interface.

With this change, user mapping makes more sense and can also support I18N. However, the following user management issues still exist in SAS Environment Manager 2.3:

- Because accounts in metadata server are mapped to users in SAS Environment Manager, the following occurs:

  - Metadata server users do not exist in SAS Environment Manager, although their accounts exist.

  - If a user has multiple accounts in metadata, then multiple users are created in SAS Environment Manager.

- Users might encounter case sensitivity issues when they log on to SAS Environment Manager. Case sensitivity is inconsistent between the metadata server and SAS Environment Manager in the following ways:

  - User names are case sensitive in metadata. The case sensitivity for authentication is based on the authentication providers (for example, Windows and UNIX are different).

  - User names in SAS Environment Manager are case insensitive. User authentication in SAS Environment Manager is also case insensitive.

- Synchronization only synchronizes the user attributes once. Once a user has been synchronized, the user's attributes in SAS Environment Manager will not change if the user's attributes in metadata server are subsequently changed. This can introduce usability issues. For example, if a user's email address change in metadata, synchronization does not update the corresponding email address in SAS Environment Manager, so the user cannot receive emails at the new address.

The upcoming SAS Environment Manager 2.5 (third maintenance release for SAS 9.4) will address these problems and enhance user management to make it more efficient, reasonable, and robust, as follows:

- The metadata user name will be mapped to the SAS Environment Manager user name. They will be identical on both sides.

- Since attributes and groups belong to the user (rather than the account) in metadata, the mapping of each user's metadata group to the corresponding SAS Environment Manager role will work the same as it does currently. Since metadata accounts will not be used in the mapping, users that have multiple accounts will not result in the creation of multiple SAS Environment Manager users.

- Case sensitivity problems will be resolved, since we will be mapping users instead of accounts.

- If users' attributes are changed in the metadata server, those changes will be reflected in SAS Environment Manager the next time synchronization is executed.

CONCLUSION

In this paper, we covered most common questions from a variety of sources (such as SAS Technical Support, consultants, and SAS internal customer experience testing teams) about how to install, configure, and administer the SAS middle tier to meet the requirements of high performance, high availability, increased security, maintainability, and more. We also provided clear guidance for addressing these common questions and issues.

Additional details and supporting documentation are provided in the references section. We hope that you find this paper a valuable resource that enables you to administer, implement, and manage your SAS environment with a higher level of confidence and satisfaction.

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RECOMMENDED READING

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