

Paper 218-29

## 9.1 Steps to Success with SAS® 9.1 on Solaris™ 9

Maureen Chew, Sun Microsystems

While “Classic” SAS is a foundation of the 9.1 release, the new, distributed architecture of the Business Intelligence Platform brings powerful functionality and many new features. Supporting this environment requires a new level of complexity to train, administer, and manage. The intent of this paper is to provide a high level overview of installation considerations.

### Topics:

1. SAS 9.1 Anatomy 101
2. Installation and Configuration Highlights
3. Pre-Installation Considerations
4. Component Validation
5. Master Server Startup and Runtime Considerations
6. Enterprise Miner Installation
7. New 9.1 Administrative and Resource Management Features
8. Architectural Considerations
9. Installation Checklist

Disclaimer: Due to product component licensing differences, an individual installation experience may differ from one site to another in areas ranging from number of CDs received to screen appearances.

### SAS 9.1 Anatomy 101

The 3 main primary software platforms are:

- SAS Business Intelligence (BI) Server
- SAS ETL
- SAS Intelligence Storage

Each platform consists of various licensed components which are designated to run in a distributed 3-tier client, mid-tier, server environment. The tiers can consist of different vendor HW platforms or they can all run in a single server environment. The following table is a partial list of components in the BI Server:

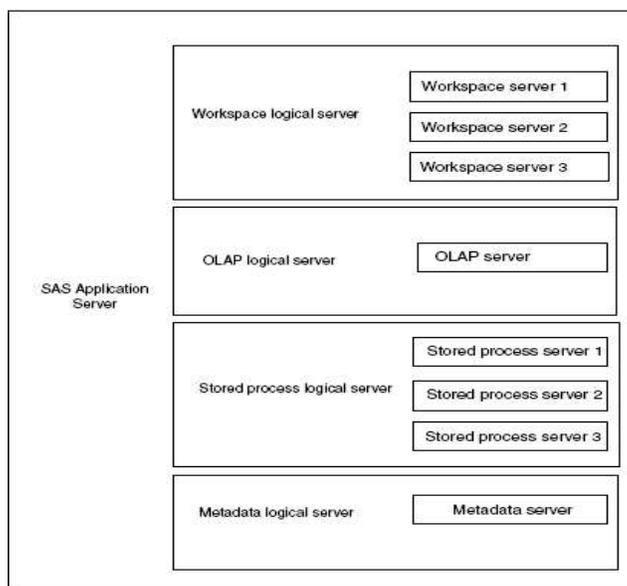
SAS Component	Deployment Tier
SAS 9.1 Foundation	Server
SAS Management Console	Client
SAS Web Infrastructure Kit	Mid-Tier
SAS Web Report Studio	Mid-Tier
SAS Foundation Services	Client
SAS Query and Reporting Services	Client
SAS Information Map Studio	Client

In contrast, the SAS Intelligent Storage platform would contain:

SAS Component	Deployment Tier
SAS 9.1 Foundation	Server
SAS Management Console(SMC)	Client
Scalable Performance Data Server	Server
SAS OLAP Cube Studio	Client
SAS OLAP Server Monitor for SMC	Client

Internally, SAS will have processes, services and servers running on the backend server tier while many of the new Java™ based services run in the mid-tier. All servers and services communicate through a metadata server called the SAS Open Meta Repository (OMR) which acts as the communications hub among all the various components.

The term server is somewhat overloaded. A SAS Application Server is a named entity representing a set or group of logical servers. Contrast this to a traditional application server such as Sun's Java Enterprise System Application Server or BEA's WebLogic application server which serve as EJB/web containers.



Logical SAS 9.1 Architecture

By default, the initial SAS application server is named SASMain. Logical server types include:

- OLAP server : creates and provides access to MDDB cubes
- Workspace server: creates a SAS execution environment on behalf of client requests.
- Stored Procedure server: creates a parameterized environment for execution of stored SAS procedures.
- OMR server: Metadata server

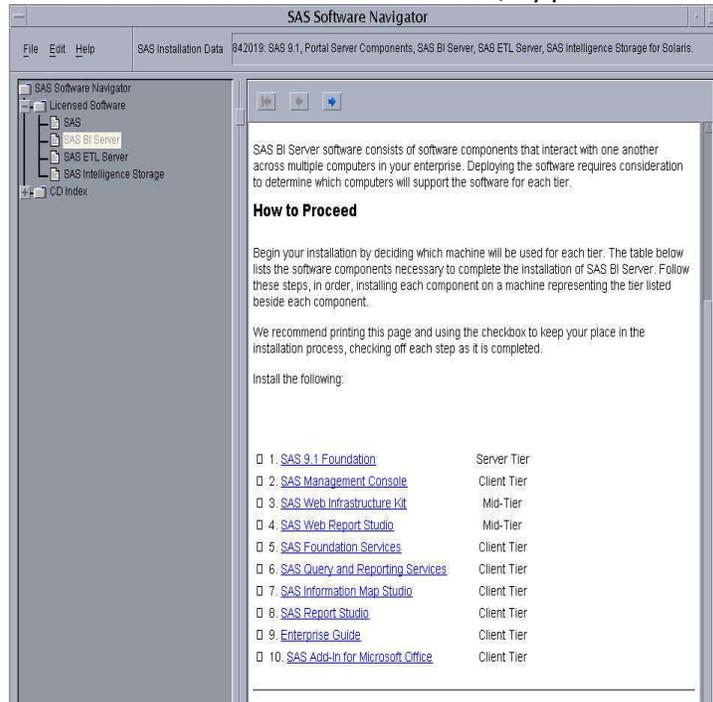
Each instance of a SAS Application Server can have only 1 of each type of logical server. However, the logical Workspace and Stored Procedure server can each have multiple instances (whereas the OLAP and OMR server can only have 1 instance per logical server).

Each of these logical servers can be configured to run on different (or the same) physical hardware server.

## Installation and Configuration Overview

Software installation is done by the SAS Software Navigator and configuration is done with the SAS Configuration Wizard. Prior to starting the installation, it will be necessary to have the SAS Installation Data (SID) or license information on hand or you will not get very far.

Installation can be done via 2 methods, by plan or via basic (aka: roll-your-own).



SAS Software Navigator sample screen

A plan file is an XML file generated by a SAS installation consultant based on a survey of licensed software, and architectural and planning discussion (what logical servers and components will run on what system). Plan files are then used as input to the SAS Software Navigator which is run on each SAS application server system participant. For instance, if the system ctcsun4 is designated to run the OMR/Metadata server and the midtier components, while ctcsun6 is designated to run the backend servers, the plan file would specify exactly which components needed to be installed where.

The basic install can be used for the installation if you are familiar with the process or can also be used to later install specific components which were not initially installed.

After the software has been installed, the SAS Configuration Wizard will be used to outline the steps necessary to finish the SAS Application server configuration. You will be asked to choose a directory to hold the server specific data which will be referred to as \$CONFIG\_DIR. During this process, you will also have an opportunity to specify user names, port numbers, etc. The wizard will then generate an HTML file documenting (more or less) the exact steps to finish the configuration.

NOTE: The default configuration directory will be a child of the "sas" users home directory. It is common practice for "home" directories to be NFS mounted partitions. One component stored in this configuration directory is the OMR repository which could potentially be extremely read or update intensive. Thus, be sure to specify a directory optimized for this level of I/O activity. Typically, OMR updates follow small, but frequent update patterns.

The SAS Management Console (SMC) is a standalone program used to complete many of the component configuration steps above (Metadata server creation, SAS Server definition, etc.)

## High Level Overview of the Steps

Note: The steps listed below were generated based

1. [Start your Metadata Server](#)
2. [Start the SAS Management Console](#)
3. [Define your Metadata Repository](#)
4. [Define your Metadata Users](#)
5. [Define your Web Users](#)
6. [Defining Default Authorizations](#)
7. [Define your SAS Application Server](#)
8. [Define your Stored Process Server](#)
9. [Define your OLAP Server](#)
10. [Define your Batch Server](#)
11. [Define your Object Spawner](#)
12. [Define your SAS/CONNECT Server](#)
13. [Define your SAS/CONNECT Spawner](#)
14. [Define your SAS/SHARE Server](#)
15. [Define your Job Scheduler Server](#)
16. [Define your HTTP Server](#)
17. [Load SAS Stored Process samples](#)
18. [Load Web Infrastructure Kit "primer" metadata](#)
19. [Start your Object Spawner](#)
20. [Start your OLAP Server](#)
21. [Start your SAS/CONNECT Spawner](#)
22. [Start your SAS/SHARE Server](#)
23. [Start your SAS Services Application](#)
24. [Deploying your Web Applications](#)
25. [Start your Tomcat Server](#)
26. [Using your Applications](#)
27. [Getting More Information](#)

Excerpt from dynamically generated SAS Configuration Wizard documentation

One area of consideration not addressed here will be the determination of the Metadata security policies (authorization, authentication and access roles).

## Pre-Installation Considerations

### Identities

The SAS installation should be done as the user sas. There are several other administrative and guest user ids (sas, sasadm, sastrust, sasguest, sasdemo, saswbadm) and group ids (sas) that should be created prior to the installation.

### Network Ports

The following table lists the default network ports which need to be verified as available and not subject to firewall constraints.

Property Name	Default Port Val	Description
OMAPORT	8561	SAS Metadata Server
CONNECT_PORT	7551	SAS/Connect Server

Property Name	Default Port Val	Description
SHAREPORT	8551	SAS/Share Server
OLAP_PORT	5451	SAS OLAP Server
SERVICES_RMI_PORT	5099	SAS Remote Services Application
SPAWNER_OPERATOR_PORT	8581	SAS Object Spawner Operator
SPAWNER_LOADBALANCING_PORT	8571	SAS Obj Spawner Load Balancing
STP_PORT	8601	SAS Stored Process
STP_PORT1	8611	Stored Process port 1
STP_PORT2	8621	Stored Process port 2
STP_PORT3	8631	Stored Process port 3
IOM_PORT	8591	SAS Workspace Server
DAV_PORT	80	WebDAV Server
WEBSRV_PORT	8080	Web Server
EM_APPSrv_PORT	1099	SAS Enterprise Miner Mid-Tier Srvr
LSF/Job Scheduler	6878,6979,6881, 6882, 1966	LSF, JobScheduler

### JDK Installation

SAS 9.1 requires JDK 1.4.1\_02 on Solaris; while the Foundation platform bundles a private JRE, this cannot be used for the components which require the full JDK. Installation of some components may complain that the correct version is not installed but as long as it matches 1.4.1\_02, it should be sufficient. For example, the installation printed some warnings about the version below.

```
bash-2.05$ /usr/j2se/bin/java -version
java version "1.4.1_02a"
Java(TM) 2 Runtime Environment, Standard Edition (build 1.4.1_02a-b01)
Java HotSpot(TM) Client VM (build 1.4.1_02a-b01, mixed mode)
```

If deploying the BI mid-tier components that are JSP/Servlet based, such as Web Report Studio, Web Infrastructure Kit, Information Portal Delivery, etc, install the Web server, WebDAV server and J2EE EJB/web container prior to the SAS installation. Web/DAV support is an optional repository for storage of Enterprise Miner projects.

### Component Validation

The classic SAS foundation layer can be installed in the same fashion as prior releases (vis sassetup) or it can be installed via the SAS software navigator.

Tests are available for both installation and operational qualification(sasoq). This is a good idea to run if updates and changes (via sas config files, catalog updates, etc) are made into \$SASROOT.

The installation qualification tool is run via sassetup:

```
bash-2.05$ /d7/SAS/sas9.1/sassetup -validate -valout ./valresults
```

You do not need to be a root user to run this if you specify a writable output directory.

#### SAS Installation for SUN 64

Install Attribute	Value
Date:	2004-02-01
Time:	18:51:53
User:	sasmau
Machine:	ctcsun8
Platform:	sl64
SASROOT:	/d7/SAS/sas9.1
Components Installed: 128	Passed Qualification: 128, Failed: 0
Files Validated: 13559	Passed Qualification: 13559, Failed: 0

The resulting output generated includes summary results in both html and pdf format. You may see 2 failures in the SAS/GRAPH tests in the operational tests if you do not uncompress the GIS maps.

SAS Installation quality test result summary

The operational tests are run using the `sasoq` command but the results are presented in similar fashion via both pdf and html.

```
bash-2.05$ cat runoq
#!/bin/sh
set -x
/d7/SAS/sas9.1/sastest/sasoq.sh \
  -tables '*:base' '*:dmime' \
  '*:ets' '*:graph' '*:hpf' '*:iml' \
  '*:insight' '*:irp' '*:lab' '*:or' \
  '*:qc' '*:stat' -outdir ./results \
  -verbose
```

#### SAS Operational Qualification - SUN 64

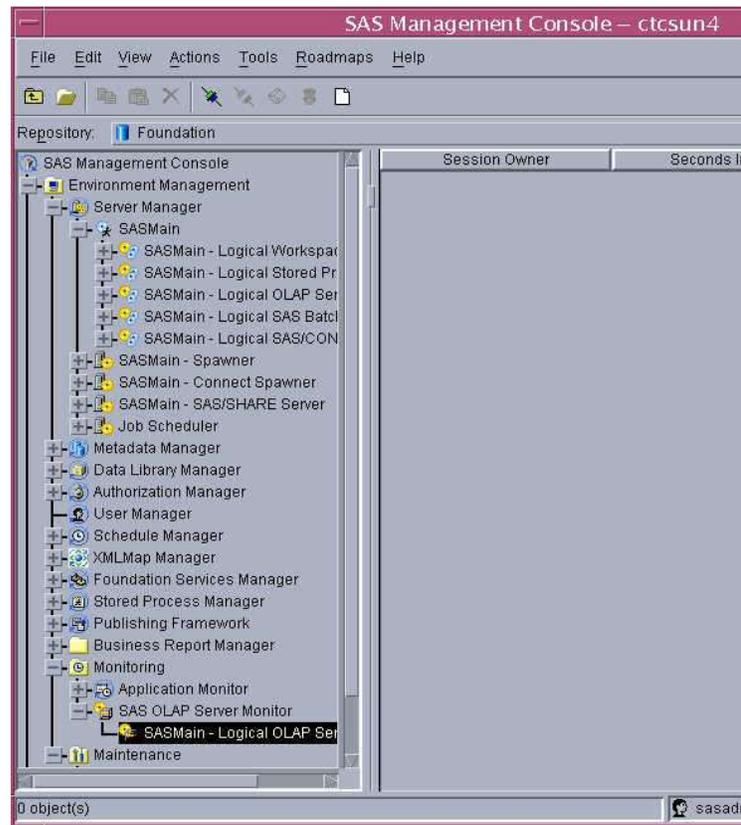
<b>Date:</b>	2004-02-01
<b>Time:</b>	18:20:54
<b>User:</b>	sasmau
<b>Machine:</b>	ctcsun8
<b>Platform:</b>	UNIX
<b>Components Tested:</b>	12
<b>Tests Executed:</b>	139
<b>Tests Passed:</b>	139
<b>Tests Failed:</b>	0

SAS Operational Quality test result summary

The SAS Configuration Wizard documentation output contains steps on how to perform basic validation for the following servers/services:

- Metadata servers
- Object Spawner
- Workspace Servers
- Stored Process Servers
- Web/WebDAV Servers
- Web Report Studio
- Web Report Viewer
- BI Web Services for Java

After running the SAS Configuration Wizard, the SMC display should look something similar to the diagram below.



SAS Management Console Display after Initial Configuration

Additionally, you can test connection status with the OLAP Server if the SAS Management Console, OLAP Server plugin has been installed. As highlighted, select the following: Monitoring -> SAS OLAP Server Monitor -> SASMain Logical OLAP Server -> Connect

## Master Server Startup & Runtime Considerations

The configuration steps above result in a number of shell scripts which start the various server components. Most, but not all, scripts can be used to both start and stop the servers. A master script should be created and added to /etc/init.d (e.g.: sas.sh) and linked to /etc/rc3.d and /etc/rc0.d (e.g.: S97sas, K97sas respectively) if the servers should be started automatically on a reboot.

```
bash-2.05$ cat sas.sh
#!/bin/sh

CONFIG_DIR=/d0/apps/SAS/CONFIG/ctcsun4/Levl/SASMain
export EM_HOME=/d0/apps/SAS/SASEMiner/5.1/EM51

# Start the spawner
case "$1" in
  start)
    set -x
    # Spawner
```

```

$CONFIG_DIR/ObjectSpawner/ObjectSpawner.sh start

# OLAP Server
$CONFIG_DIR/OLAPServer/OLAPServer.sh start

# SAS/CONNECT
$CONFIG_DIR/ConnectServer/ConnectServer.sh start

# SAS/SHARE
$CONFIG_DIR/ShareServer/ShareServer.sh start

# SAS Remote Services Application
# Must start before web container started
$CONFIG_DIR/./web/StartRemoteServices.sh

# SAS Enterprise Miner
export JAVA_HOME=/usr/j2se
$EM_HOME/bin/startserver &
;;
stop)
# Spawner
$CONFIG_DIR/ObjectSpawner/ObjectSpawner.sh stop

# OLAP Server
$CONFIG_DIR/OLAPServer/OLAPServer.sh stop

# SAS/CONNECT
$CONFIG_DIR/ConnectServer/ConnectServer.sh stop

# SAS/SHARE
$CONFIG_DIR/ShareServer/ShareServer.sh stop
;;
*)
echo "Usage: control.sh {start|stop}"
exit 1
esac

```

At this point, its worth mentioning again that certain directories in \$CONFIG\_DIR above can be very I/O intensive. Ensure that it is not being accessed from the server as an NFS partition.

Lastly, many of these servers create potentially large log files in their respective server directories above. For instance, OMR logs to \$CONFIG\_DIR/MetadataServer/logs. Check these directories periodically.

The ObjectSpawner log can typically reveal the nature of many of the basic configuration problems. This file is located in \$CONFIG\_DIR/ObjectSpawner/logs.

## Enterprise Miner Installation Considerations

The SAS Configuration Wizard does not generate directions to finish the EM configuration. To do so, run \$EM\_HOME/bin/emconfigure to create \$EM\_HOME/bin/login.config and \$EM\_HOME/bin/client.config.

To start the EM Mid-tier Server:

```
bash-2.05$ $EM_HOME/bin/startserver &
```

From the client

```
bash-2.05$ $EM_HOME/bin/em <EM_Mid-Tier_Server_Name>
```

This assumes that the EM Mid-Tier server is running on the default port, 1099. After invoking this command, you should be presented with a login screen. The specified user

must be registered in the SAS OMR server. A successful login implies that a simple validation test was successful.

The SAS OMR concept of a user, might be considered more like a group in UNIX environments. Each OMR user can have multiple logins, e.g.: the OMR user, marketing, might have several logins: allen, maureen, tom, gary, david.

## New 9.1 Administrative and Resource Management Features

- Restricted Options
- UTILLOC
- REALMEMSIZE
- CPUCOUNT
- SWAP Space

### Restricted Options

Starting with SAS 9.1, the concept of system wide restricted options is in place for all UNIX platforms. Administrators can impose system wide config options that can't be overridden at the user level.

These config files are stored in \$SASROOT/misc/rstropts and can be specified on system wide basis, by user or by group. The files have the same syntax as the standard sasv9.cfg file. System wide settings would be in rsasv9.cfg, while group specific restrictions would be in groups/"group\_name"\_rsasv9.cfg files and user specific would be in users/"user\_name"\_rsasv9.cfg. In the example below, \$SASROOT/misc/rstropts contains system wide restrictions in rsasv9.cfg while restrictions specific to user id maureen are stored in users/maureen\_rsasv9.cfg

Set the system wide MEMSIZE limitation to 256M, but user maureen is allowed 512M.

```
# cat rsasv9.cfg
-memsize 256m
```

```
# cat users/maureen_rsasv9.cfg
-memsize 512m
```

For the user, root, display the MEMSIZE setting (should be 256M)

```
# /d0/apps/SAS/SAS_9.1/sas -nodms
```

```
...
```

```
1? proc options restrict;
2? run;
```

```
Option Value Information For SAS Option MEMSIZE
```

```
Option Value: 268435456
```

```
Option Scope: SAS Session
```

```
How option value set: Site Administrator Restricted
```

As the user, maureen, ask for 2G memory, then display MEMSIZE (should be 512M)

```
bash-2.05$ /d0/apps/SAS/SAS_9.1/sas -memsize 2G -nodms
```

```
...
```

```
1? proc options restrict;
2? run;
```

```
Option Value Information For SAS Option MEMSIZE
```

```
Option Value: 536870912
```

```
Option Scope: SAS Session
```

How option value set: Site Administrator Restricted

For the root user, the setting obtained was the global restriction of 256M while the user, maureen, received the user specific setting of 512M.

#### UTILLOC

Procs SORT, SUMMARY, DMREG are able to create temporary utility files in an area other than SAS WORK to help balance the I/O pressure on a server. The UTILLOC parameter must be set at the invocation of the SAS session in a fashion similar to:

```
$SASROOT/sas -UTILLOC '( location_1 location_2 location_3)' foo.sas
```

UTILLOC is used differently between these 3 PROCs:

- SUMMARY will write its utility files to the first location directory listed.
- SORT will write its utility files to the second location directory listed.
- DMREG creates multiple utility files; the number of files is equal to CPUCOUNT. It writes the first file to the first location directory listed, the second to the second directory listed, until it writes all its utility files. If there are not enough directories listed, then it round-robins through the list.

REALMEMSIZE represents amount of real (rather than virtual) memory available to SORT and SUMMARY; and is set by default to 80% of MEMSIZE .

CPUCOUNT – while not new to 9.1, take care to reset this value on large SMP systems to 2 or 4. By default, CPUCOUNT is set to the total number of system CPUs (even if running in a processor set). A number of SAS procs make thread allocation decisions based on CPUCOUNT. For large systems, it would be unwise for all users to assume that they had exclusive use of the entire system. Set this option in \$SASROOT/sasv9.cfg.

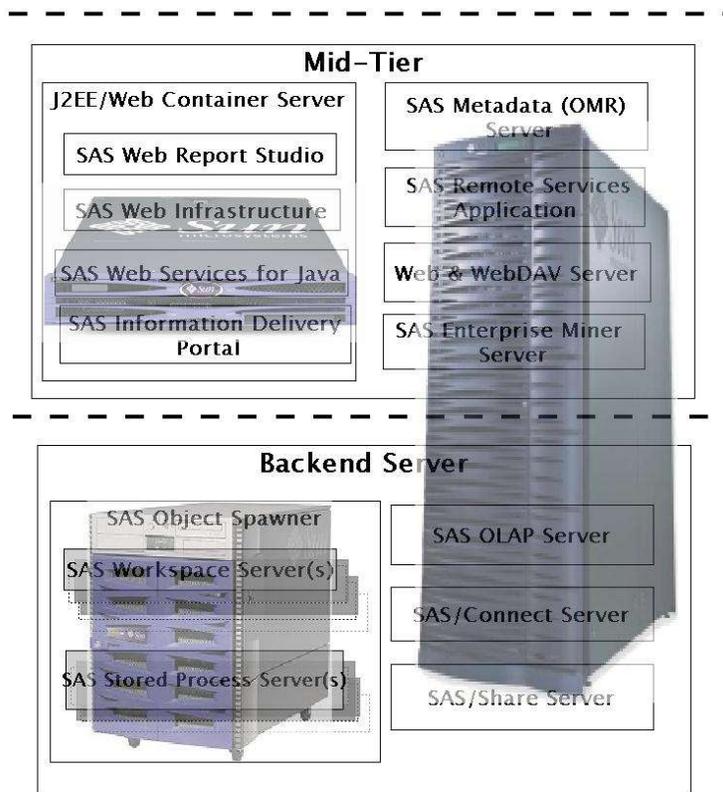
SWAP space – SWAP space reservations are made for all SAS memory allocations. Even if you have a large RAM configuration and are sure that all concurrent memory applications fit in RAM, you still need an equivalent SWAP area or you may unexpectedly get “Out of memory” in your SAS application logs. This is true for all releases of SAS.

### Architectural Considerations

There is no one-size-fits-all architecture for deployment. Many factors can influence the design and overall performance. The only certain variable is that of uncertainty. The topic of performance and performance monitoring has been covered in other papers ( SAS Version 9.1 on Solaris 9 Performance, Monitoring & Optimization Tips/Chew, Performance Tuning & Sizing Guide for SAS Users and Sun System Administrators / Keefer,Kearns). It may take a feedback loop mechanism to adjust the configuration based on actual usage patterns. The SAS 9.1 architecture provides a lot of flexibility in the ability to adjust and move resources.

Below are 2 example configurations representing a small and large enterprise configuration. For the small configuration, a 2 way Sun Fire™ V240 sits in the Mid-Tier while a Sun Fire™ V880 handles the heavily lifting from the SAS OLAP, Workspace and Stored Procedure servers. The Solaris™ 9 Operating Environment is a highly performing OS with many features targeted towards reliability, flexibility, availability and serviceability. One such feature is the Solaris Resource Manager bundled in with Solaris 9. This allows you to provide fine grained resource allocation on either a group basis or defined set of SAS services. For instance, the SAS OLAP server might be allocated 2-3

## Client Tier



Sample SAS 9.1 on Sun Deployment Architectures

CPUs, while the Workspace servers should be allocated 4 CPUs. A simple cookbook example of configuring SAS and Solaris Resource Manager can be found in the Optimization paper above). For large enterprise configurations, a MidframeSun Fire™ 4810 or High-End Server Sun Fire™ 12K make excellent platform choices since you can consolidate both the Mid-Tier and Backend tier onto a single platform. These HW platforms provide domaining capability with the added flexibility for dynamic reconfiguration of system boards which can be done in flight. If you find that the SAS Workspace server needs more resources while the Mid-Tier domain had idle resources, system boards can be easily migrated from one domain to another with no interruption in service. Additionally, Solaris 9 Resource Manager can be used within a domain to enable IT departments the ability to provide service level agreements to various groups or departments.

For application needs with large data requirements, server consolidating starts to make more sense due to the need for applications to be close to their data.

### Installation Checklist

A simple checklist below provides the basic steps for the installation and configuration procedure.

1. Locate License data, create online software library from CDs
2. Determine deployment and security architecture
3. Install correct version of JDK
4. Install Web/WebDAV/J2EE Application Server if deploying BI mid-tier components
5. Create SAS user ids, groups, verify network port usage
6. Use SAS Software Navigator to install software
7. Run Configuration Wizard to generate site specific change list, implement changes
8. Validate components
9. Create master startup script, implement monitoring of log file sizes
10. Document processes, create performance feedback loop

## Summary

If you have read through the paper and have never done a SAS 9.1 install, hopefully you have a better idea of the steps and effort involved. This is not intended to be a substitute for reading the installation documentation!

The title mentioned 9.1 tips for a successful installation and 9 have been discussed thus far. Tip 9.1 – choose to have a great attitude and you'll have a lot more fun. On that note, feel free to email the author (address below) or [sas-on-sun@sas.com](mailto:sas-on-sun@sas.com) if you have any comments, suggestions or questions. 😊

## References

SAS Version 9.1 on Solaris 9 Performance, Monitoring & Optimization Tips  
( M. Chew – 2003)  
<http://www.sas.com/partners/directory/sun/v9on9.pdf>

Performance Tuning & Sizing Guide for SAS Users and Sun System Administrators  
(T. Keefer / W. Kearns – 2003)  
<http://www.sas.com/partners/directory/sun/sugi28.pdf>

Pushing the Envelope: SAS System Considerations for Solaris/UNIX in Threaded, 64 bit Environments  
( M. Chew – 2002 )  
<http://www.sas.com/partners/directory/sun/64bit.pdf>

Peace between SAS Users & Solaris/Unix System Administrators  
( M. Chew / L. Ihnen / T. Keefer – 1999)  
<http://www.sas.com/partners/directory/sun/performance/index.html>

Collaborating with Sun to Optimize Performance  
<http://support.sas.com/news/feature/03oct/suntune.html>

SAS 9.1 Intelligence Architecture: Planning and Installation Guide

SAS 9.1 for Solaris, Installation and Administration Information  
<http://support.sas.com/documentation/installcenter/solaris/91/ts1m0/index.html>

UNIX 9.1 Configuration Guide  
[http://support.sas.com/documentation/installcenter/unix/91/ts1m0/unix91\\_config.pdf](http://support.sas.com/documentation/installcenter/unix/91/ts1m0/unix91_config.pdf)

Solaris 9 Operating Environment

<http://www.sun.com/software/solaris/index.html#features>

Solaris 9 12/02 System Administrator Collection ->

System Administration Guide: Resource Management and Network Services

<http://docs.sun.com/db/doc/816-7125?q=Resource+Manager>

Sun BluePrints[tm] OnLine - Resource Management in the Solaris[tm] 9  
Operating Environment - Stuart J. Lawson

<http://www.sun.com/solutions/blueprints/browsesubject.html#resource>

Sun BluePrints[tm] OnLine - Performance Oriented System Administration - Bob Larson

<http://www.sun.com/solutions/blueprints/1202/817-1054.pdf>

### Acknowledgements

Many thanks to Tom Keefer of SAS for his endless support and enthusiasm.

Thanks also goes to the cast of many from SAS R&D who have been so helpful and supportive. A sincere thanks.

There are many Sun team members who have provided countless hours of time, support, encouragement and help. Support from the compiler, tools, Solaris kernel, Processors, SAE, PAE, and Java engineering teams has been phenomenal. Many thanks to Allen Watson, Sanjay Goil, Bob Larson, James Liu, Charles Andres, Yousef Yacoub, Akiko Marti, Marty Itzkowitz, Jonathan Chew, Darrin Johnson, Raj Aggarwal.

Lastly, a thanks to Tony, Rita, Michael and Kipp.

### About the Author

Maureen Chew, Staff Engineer, has been with Sun Microsystems for 16 years. She is a resident of Chapel Hill, NC and can be reached at [maureen.chew@sun.com](mailto:maureen.chew@sun.com).

SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc. □  
in the USA and other countries. © indicates USA registration. Other brand and product names are trademarks of their □  
respective companies. □