Installation Instructions for Platform Suite for SAS®
Version 6.1 for UNIX®
Copyright Notice


*Installation Instructions for Platform Suite for SAS® Version 6.1 for UNIX*
Copyright © 2011, SAS Institute Inc., Cary, NC, USA.

All rights reserved. Printed in the United States of America. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, by any form or by any means, electronic, mechanical, photocopying, or otherwise, without the prior written permission of the publisher, SAS Institute Inc. Limited permission is granted to store the copyrighted material in your system and display it on terminals, print only the number of copies required for use by those persons responsible for installing and supporting the SAS programming and licensed programs for which this material has been provided, and to modify the material to meet specific installation requirements. The SAS Institute copyright notice must appear on all printed versions of this material or extracts thereof and on the display medium when the material is displayed. Permission is not granted to reproduce or distribute the material except as stated above.

U.S. Government Restricted Rights Notice. Use, duplication, or disclosure of the software by the government is subject to restrictions as set forth in FAR 52.227-19 Commercial Computer Software-Restricted Rights (June 1987).


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.
# Table of Contents

Chapter 1 - Introduction ................................................................. 1  
Platform RTM for SAS ...................................................................... 2  
Architecture ...................................................................................... 2  
Installation Directories ................................................................. 4  
Pre-Installation Requirements .......................................................... 5  
Example: Preparing a Shared Directory Using NFS ............................ 6  
  Prerequisites for creating shares .................................................... 6  
  Create and share the LSF directories on the file server ..................... 6  
  Mount directories on each machine in the grid (LSF hosts) .............. 7  

Chapter 2 - Installing Process Manager and LSF ................................ 9  
Testing the Installation ..................................................................... 17  

Chapter 3 - Installing Grid Management Service (GMS) ..................... 19  
Testing the Installation ..................................................................... 20  

Chapter 4 - Installing LSF on Grid Nodes or SAS Foundation Grid Clients .... 21  
Testing the Installation ..................................................................... 21  
Adding Nodes or SAS Foundation Clients to the Grid ....................... 22  
Converting a Grid Node Machine to a Grid Client ............................. 23  
Adding a New Machine Type to the Grid .......................................... 23  

Chapter 5 – Installing Platform MPI ................................................... 25  

Chapter 6 - LSF Quick Reference ..................................................... 27  
  Check Cluster Configuration (lsadmin) ........................................... 28  
  Find Out Cluster Status (lsid and lsload) ....................................... 29  
  Check LSF Batch Configuration (badmin) ....................................... 30  
  Find Out LSF Batch System Status (bhosts and bqueues) ................. 31  
  Verifying the Network Setup .......................................................... 32  
    Overview .................................................................................. 32  
    Host Addresses ......................................................................... 32  
    Host Connectivity .................................................................... 33  
    Host Ports .............................................................................. 33  
  For More Information .................................................................... 34  

Appendix – LDAP Authentication ...................................................... 35  
  Configure LDAP Authentication for Process Manager Server: .......... 35  
  Configure LDAP Authentication for GMS ....................................... 35
Chapter 1 - Introduction

This document describes how to install the Platform Suite for SAS, version 6.1, on UNIX hosts for use with SAS products and solutions. The Platform Suite for SAS can be an individual addition to several SAS products and solutions to provide enterprise-level scheduling capabilities on a single server environment. The Platform Suite for SAS is also included as part of the SAS Grid Manager product to enable:

- distributed enterprise scheduling
- workload balancing
- parallelized workload balancing

SAS 9.3 includes Platform Suite for SAS 6.1. The primary difference between Platform Suite for SAS 5.1 and Platform Suite for SAS 6.1 is the addition of support for AIX 7.1, Red Hat Enterprise Linux 6 for x64, and SUSE Linux 6 for x64. For most customers there will be no reason to upgrade from Platform Suite for SAS 5.1 to Platform Suite for SAS 6.1. If you want to upgrade, contact SAS Technical Support for instructions.

The Platform Suite for SAS includes the following components:

- **Process Manager** – the interface used by the SAS scheduling framework to control the submission of scheduled jobs to LSF and manage any dependencies between the jobs. The Flow Manager and Calendar Editor clients are included with Process Manager and may be optionally installed. These clients are not required by SAS; however, they do provide additional functionality.
  - **Flow Manager** - provides a visual representation of flows that have been created for a Process Manager Server. These include flows that were created and scheduled in SAS Management Console’s Schedule Manager, as well as reports that have been scheduled through SAS Web Report Studio. Platform Flow Manager provides information about each flow’s status and associated dependencies. You can view or update the status of jobs within a flow, and you can run or rerun a single job regardless of whether the job failed or completed successfully.
  - **Calendar Editor** - a scheduling client for a Process Manager Server. This client enables you to create new calendar entries for time dependencies for jobs that are scheduled to run on the server. You can use it to create custom versions of the calendars that are used to create time dependencies for jobs.

- **LSF** – dispatches all jobs submitted to it, either by Process Manager or directly by SAS, and returns the status of each job. LSF also manages any resource requirements and performs load balancing across machines in a grid environment.

- **Grid Management Services** – provides the run-time information about jobs, hosts and queues for display in the SAS Grid Manager Plug-in for SAS Management Console.

- **Platform MPI for SAS** – SAS 9.3 includes Platform MPI for SAS, a message passing interface used to program parallel computers in SAS PROCs that have grid-enabled code. Platform MPI is only supported on machines using Linux for x64.
Platform RTM for SAS

SAS 9.3 also includes Platform RTM for SAS, a Web-based tool that provides IT administrators a way to graphically view the status of devices and services within their SAS grid environment as well as manage the policies and configuration of their grid. It is a visual tool to quickly track and diagnose issues before they affect service levels. Platform RTM for SAS includes drill-down capabilities to view details of hosts, jobs, queues, and user activities while instant alerts on job performance and grid efficiency allow administrators to optimize usage and workloads. It includes customizable graphs to visually analyze resource usage, workload trends, and job behavior. It also includes GUI interfaces to allow administrators to update the policies and rules in the grid configuration as well as set up high availability for any of the services that are critical to the operation of the grid as well as the applications executing in the grid. Platform RTM for SAS helps system administrators improve decision-making, reduce costs and increase service levels for SAS grid deployments.

You can download Platform RTM for SAS from SAS Demos and Downloads site at http://www.sas.com/apps/demosdownloads/platformRTM_PROD__sysdep.jsp?packageID=000669. System requirements and installation instructions for Platform RTM for SAS are provided on the download page and are therefore not covered in this document.

Architecture

SAS® Scheduling Architecture
Job scheduling on a single machine requires that you install Platform Process Manager 8.1. During the Process Manager install, you will also install Platform LSF 7.06. See the “Chapter 2 - Installing Process Manager and LSF” for the instructions on installing on a single server.

Several types of machines make up a SAS grid environment. These machines have been defined to clarify the software components that must be installed on each one as well as the SAS metadata that must be configured. The SAS metadata server is shown on a separate machine in this sample architecture. It is common to dedicate a machine to running the SAS metadata server, but you may choose to run the metadata server on the grid control server. The three machine types specific to a grid installation are defined as follows:

- **grid client** - a grid client submits work to the grid but is not part of the grid resources available to execute work. Examples of a grid client include:
  - a SAS Data Integration Studio client (Platform LSF not installed on this client machine)
  - a SAS Enterprise Miner client (Platform LSF not installed on this client machine)
  - a SAS Management Console client using the Schedule Manager plug-in or any other applications scheduling SAS workflows. (Platform LSF not installed on this client machine)
  - a SAS Foundation install (minimum Base SAS, SAS/CONNECT, and Platform LSF) used to run a program that submits work—both whole programs or programs broken into parallel chunks—to the grid. Installation of the Platform LSF component is required in this case in order for SAS/CONNECT to submit the work to the grid.
  - Platform RTM for SAS (requires Platform LSF)
• **grid control server** - any machine in the grid can be designated as the grid control server. More software is installed on the grid control server and more SAS metadata configuration takes place on this machine. You should start the installation of the Platform Suite for SAS on this machine. In a SAS Data Integration Studio and SAS Enterprise Miner scenario the grid control server runs a workspace server that executes programs that utilize SAS/CONNECT to distribute work to the grid nodes. The grid control server can be configured as a grid resource capable of receiving work to execute or not, depending on the needs of your environment.

• **grid node** - a grid node is a grid computing resource capable of receiving the work that is being distributed. Each grid node must be running a minimum of Base SAS, SAS/CONNECT and Platform LSF.

Installation of Platform Suite for SAS is performed first on the grid control server and is followed by installation on all of the grid node machines. Installation of Platform LSF on the grid control server can be installed as a part of the Process Manager installation or it can be installed by itself. This document will only show LSF being installed as part of the Process Manager installation.

Not only do machines that do processing for the grid need Platform LSF installed, but machines that submit jobs to run on the grid must also have Platform LSF installed on them. Grid clients such as SAS Data Integration Studio or SAS Enterprise Miner do not submit jobs directly but rather work with a SAS workspace server or a stored process server that does the job submission. Since those grid clients do not submit jobs, they do not need Platform LSF installed, but the machine where the workspace server or stored process server would need it installed. If you are writing your own grid-enabled SAS program in SAS Foundation and want to run the program, that grid client workstation must have Platform LSF installed since it will be doing the actual submission of jobs to the grid.


SAS Grid Manager Control Server requires Platform Process Manager 8.1 and Platform Grid Management Service 7.11. Platform LSF 7.06 will be installed during the Platform Process Manager 8.1 installation. See “Chapter 2 - Installing Process Manager and LSF” for the instructions on installing Process Manager and LSF. See “Chapter 3 - Installing Grid Management Services (GMS)” for instructions on installing Grid Management Services. SAS Grid Manager Node and SAS Grid Manager Client require only Platform LSF 7.06. See “Chapter 4 - Installing LSF on Grid Nodes or Foundation SAS Grid Clients” for the instructions on installing LSF.

### Installation Directories

*Caution: Do not install Process Manager and LSF to the same directory.*

The Platform Suite for SAS installation produces the following directory structure:

- **JS_TOP** is the local directory in which the Process Manager Server and Client files are installed, (for example, /usr/share/pm).
- **LSF_TOP** is the shared directory in which LSF files are installed (for example, /usr/share/lsf). Generally, LSF_TOP is mounted from a file server and all files associated with LSF (state files, binaries for the different architectures, configuration files) are stored in
this file share. **LSF_TOP** must be a shared directory between all the machines in the grid. For increased high availability (HA) this file server could be a machine that is not part of the grid.

- The Grid Management Service (GMS) files are installed in the LSF directory structure under their own directory, **gms** (for example, /usr/share/lsf/gms).
- Platform MPI is installed in /opt/platform_mpi.
- Machine-dependent files are installed under **LSF_TOP/7.0/platform_name**. These directories and the files underneath represent the machine-dependent files. Machine-dependent files are specific to a particular host type and are the LSF command binaries, server daemons, libraries and utilities.
- Machine-independent files are independent of the host type, and are shared by all host types (man pages, configuration files, include files, examples, etc.)

**Pre-Installation Requirements**

1. Contact your system administrator to create a network share that all computers on your cluster can access. This can be an NFS mount, a directory on a SAN, an SMBFS/CIFS mount, or any other method of creating a directory that is shared among all the machines in the grid. All machines in the grid must be able to access this share at boot time so have your system admin set that up based on the type of share. All machines in the grid must also have root access, since any machine may become the grid master. This will be referred to as **LSF_TOP**, the LSF top-level installation directory. This installation will assume that **LSF_TOP** is mounted on each machine as /usr/share/lsf. Make sure root has read/write access to this subdirectory. See the section titled “Prepare Shares to Install LSF on a File Server” on the next page for more details.

2. Create a directory on the grid control server that will contain the Process Manager files. This will be referred to as **JS_TOP**, the Process Manager top-level installation directory. This installation will assume that **JS_TOP** is /usr/share/pm.

3. Make a list of the names of all the computers that will participate in the cluster.

4. Choose a name for the cluster.

5. Locate the SAS93_*txt and LSF93_*txt file located in the sid_files directory in your SAS Software Depot. The LSF93_*txt file will license all components of Platform Suite for SAS in a scheduling capabilities on a single server environment. The SAS93_*txt will license all the components of Platform Suite for SAS as part of the SAS Grid Manager.

6. Determine the types of all computers in the grid using `uname -a` so that the correct tar files can be copied for the install. This will allow you to determine the subdirectory in your SAS Software Depot that contains the software for all the UNIX operating system types and CPU architectures in the grid. The files are in the **third_party** directory of the SAS Software Depot. The install requires a `pm7*.tar` of the same operating system and CPU architecture as the single machine or grid control server. The `pm7*` files are in **Platform_Process_Manager/8_1** directory under the sub-directory named for the host you are installing on. The install requires a `gms7.11_install.tar.Z` and the `gms7.11_*.tar.Z` for the OS/CPU type as the grid control server. The `gms7.11_*.tar.Z` files are in **Platform_Grid_Management_Service/7_11** directory under the sub-directory named for the host you are installing on. The install requires the `lsf7Update5_1sfinstall.tar.Z` and `lsf7Update5_*.tar.Z` files for all other grid nodes OS/CPU types. The `lsf7Update5*` files are in **Platform_LSF/7_06** directory under the sub-directory named for the host you are installing on. As an example, if the grid control server is a Solaris 10 SPARC system, but the grid contains Linux 2.6 machines with x86, and Linux 2.6 x86-64 machines, the following tar files will be needed:
Installation Instructions for Platform Suite for SAS for UNIX

- **Platform Process Manager/8_1/64-bit Enabled Solaris/pm8.1_sas_sparc-sol10-64.tar** (which contains lsf7Update6_sparc-sol10-64.tar.Z)
- **Platform Grid Management Service/7_11/64-bit Enabled Solaris/gms7.1_install.tar.Z**
- **Platform Grid Management Service/7_11/64-bit Enabled Solaris/gms7.1_sparc-sol10-64.tar.Z**
- **Platform LSF/7_06/Linux/lsf7Update6_lsfinstall.tar.Z**
- **Platform LSF/7_06/Linux/lsf7Update6_linux2.6-glibc2.3-x86.tar.Z**
- **Platform LSF/7_06/Linux_for_x64/lsf7Update6_linux2.6-glibc2.3-x86_64.tar.Z**

7. If your operating system performs user authentication against an LDAP server, you will need to contact SAS Technical Support to obtain an updated version of GMS that supports authentication through the PAM interface. Additionally, you will need to make some configuration changes to allow GMS and PM to use the PAM interface. The instructions for making those configuration changes are located in the appendix.

8. LSF uses RSH/RLOGIN by default to execute certain commands on machines in the grid. If you would prefer to use SSH, please refer to the “Encrypt transmission of LSF commands for remote execution and login” section of the Platform LSF Security document for a list of required changes.

**Example: Preparing a Shared Directory Using NFS**

**Prerequisites for creating shares**

Regardless of whether you install on one host and share the distribution or whether you install on a dedicated server, the share must be set up so that root can write to the file system from the client. This is controlled with the root option of the Solaris share command, or the `exportfs` command in other UNIX platforms such as HP-UX.

**Create and share the LSF directories on the file server**

1. Log on to the file server host as root.
2. Create the share.
   - **Solaris:**
     - Edit the `/etc/dfs/dfstab` file and add the line:
       ```bash
       share -F nfs -o rw,root=<grid control server>:<grid node 1>:<grid node 2>...:<grid node N> -d "LSF share" /export/lsf
       ```
     - Run the command `shareall`
   - **Other UNIX platforms:**
     - Edit the `/etc/exports` file and add the line:
       ```bash
       /export/lsf -root=<grid control server>:<grid node 1>:<grid node 2>...:<grid node N>
       ```
     - If the host has not shared a file system before, you may need to start the NFS service using a script in `/etc/init.d`, `/sbin/init.d`.
     - Run the command `exportfs /export/lsf`
3. Make sure the NFS service is started and that NFS will start at boot. On many systems it is possible to share a file system but that will not automatically start NFS.

**Mount directories on each machine in the grid (LSF hosts)**

Repeat the following steps on each machine in the grid (LSF host).

1. Log on as root to each machine in the grid (LSF host) that will be running jobs.
2. Edit the `/etc/fstab` file (`/etc/vfstab` on Solaris) and add an entry such as:
   ```
   fileserv: /export/lsf /usr/share/lsf nfs hard,bg,intr 0 0
   ```
   Refer to your local man pages for fstab and mount to see the local format. The options ‘hard,bg,intr’ are recommended but not mandatory.
3. Make sure the `/usr/share/lsf` directory exists on each machine (host).
4. Mount the directory. Run the command:
   ```
   mount /usr/share/lsf
   ```
Chapter 2 - Installing Process Manager and LSF

_Caution:_ Do not install Process Manager and LSF to the same directory.

1. Log on to the machine as the administrator (**lsfadmin**).
2. Create a Process Manager install directory (i.e., `/local/pm_install`) to hold the install files.
3. Copy the `pm8.1_sas_*_tar` file from the appropriate location (see step #6 from the pre-installation requirements section) to the install directory. If this is part of a grid installation and there are machines in the grid that are a different operating system or CPU architecture than the grid control server then copy the appropriate `lsf7Update6_*_tar.Z` files for those operating systems/CPUs.
4. Change the working directory to the Process Manager install directory.
5. Extract the `pm8.1_sas_*_tar` file. For example, under Linux you can use the command `tar xvf pm8.1_sas_linux2.6-glibc2.3-x86.tar`. This should create a `pm8.1_sas_pinstall` subdirectory in the Process Manager install directory.
6. Change into the `pm8.1_sas_pinstall` subdirectory.
7. Copy the license file obtained from SAS (For example, "LSF*" in the `sid_files` directory in your SAS Software Depot) into the current directory and rename it `license.dat`.
8. Edit the `install.config` file and change the following sections:

<table>
<thead>
<tr>
<th>Required Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>JS_TOP</strong></td>
<td>Directory to install Process Manager. This does not need to be a network share but recommended. For example: JS_TOP=/usr/share/pm</td>
</tr>
<tr>
<td><strong>JS_HOST</strong></td>
<td>Host that will be the Process Manager host. Specify the machine’s fully qualified domain name (FQDN). For a grid installation this should be the grid control server. JS_HOST=example.com</td>
</tr>
<tr>
<td><strong>JS_ADMINS</strong></td>
<td>User ID of administrators. For example: JS_ADMINS=lsfadmin</td>
</tr>
<tr>
<td><strong>LSF_INSTALL</strong></td>
<td>Flag indicating whether to install LSF. This must be “true”.</td>
</tr>
<tr>
<td><strong>LSF_TOP</strong></td>
<td>Network share containing the LSF installation mentioned in the pre-installation requirements. For example: LSF_TOP=/usr/share/lsf</td>
</tr>
<tr>
<td><strong>LSF_MASTER_LIST</strong></td>
<td>List of servers that are going to participate as master candidates. The first server in the list will be considered the default LSF master machine. The LSF master machine is the grid control server for a grid installation and the machine containing Process Manager. LSF_MASTER_LIST=gridcontrolserver.example.com</td>
</tr>
<tr>
<td><strong>LSF_ADD_SERVERS</strong></td>
<td>List of servers that are going to participate in the cluster that will not participate as master candidates. LSF_ADD_SERVERS=example1.example.com, example2.example.com</td>
</tr>
<tr>
<td><strong>LSF_CLUSTER_NAME</strong></td>
<td>Name of cluster. For example: LSF_CLUSTER_NAME=sas_cluster</td>
</tr>
<tr>
<td><strong>LSF_ADD_CLIENTS</strong></td>
<td>List of hosts that will only submit jobs to the grid.</td>
</tr>
</tbody>
</table>
9. Optionally, these sections can be also specified:

<table>
<thead>
<tr>
<th>Optional Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>JS_PORT</td>
<td>Process Manager port number. Use default of 1966 unless it is in use by another program.</td>
</tr>
<tr>
<td>JS_TARDIR</td>
<td>Path of directory to Process Manager distribution files. If not used, the tar files are expected to be in the current directory running jsinstall.</td>
</tr>
<tr>
<td>JS_LICENSE</td>
<td>Full path to Process Manager/LSF license file. If not used, the license.dat file is expected to be in the current directory running jsinstall.</td>
</tr>
<tr>
<td>JS_MAILHOST</td>
<td>The name of the mail server host if you want to receive email from LSF. For example: JS_MAILHOST=[SMTP</td>
</tr>
<tr>
<td>LSF_TARDIR</td>
<td>Path of directory to architecture specific tar files. If not used, the tar files are expected to be in the current directory running jsinstall.</td>
</tr>
</tbody>
</table>

The resulting file should contain something like this:

```
# --------------------------
JS_TOP=/usr/share/pm
# --------------------------
# REQUIRED. You must uncomment this keyword and specify a value.

# --------------------
JS_HOST=myhost
# --------------------
# REQUIRED. You must uncomment this keyword and specify a value.

# ----------------------
# OPTIONAL. The default port number is 1966.
JS_PORT=
# ----------------------

# ---------------------
JS_ADMINS=lsfadmin
# ---------------------
# REQUIRED. You must uncomment this keyword and specify a value.

# ---------------------
LSF_INSTALL=true
# ---------------------
# REQUIRED. You must uncomment this keyword and specify a value.

# ---------------------
LSF_TOP="/usr/share/lsf"
# ---------------------
# REQUIRED. You must uncomment this keyword and specify a value.

# ---------------------
LSF_CLUSTER_NAME="sas_cluster"
# ---------------------
# REQUIRED. You must uncomment this keyword and specify a value.

# ---------------------
LSF_MASTER_LIST="myhost"
# ---------------------
```
10. Change to the **root** user and execute the command `.jsinstall -f install.config`. This will install LSF first and then Process Manager. A directory is created for each component and an `Install.log` file is created in each directory. All the events of the installation are logged here.

```
$ ./jsinstall -f install.config
Starting jsinstall...
Verifying the working directory...
Reading configuration file...
Updating JS and LSF config files.
This may take a few minutes...
Starting LSF installation...
```

11. Read and agree to the LSF End User License Agreement.

```
To print a copy of this Agreement use the file named license_agreement.txt located in the directory where you installed the software, or go to http://www.platform.com/license_agreements.

This software is furnished under a license and may be used and copied only in accordance with the terms of such license and with the inclusion of the above copyright notice. This software or any other copies thereof may not be provided or otherwise made available to any other person. No title to and ownership of the software is hereby transferred.

You must have a software license key to run LSF. If you do not have a license key, contact your LSF vendor and obtain one before attempting to run LSF.

Have you purchased LSF? (y/n) [n] y
Do you accept the terms and conditions of the END USER SOFTWARE LICENSE AGREEMENT?
(y/n) [n] y
You have accepted the terms and conditions END USER SOFTWARE LICENSE AGREEMENT.
Thank you for installing LSF at your site.
```

12. When asked which architecture specific tar files to install, include all tar files for all OS/CPU machine types in your cluster.

```
Have you purchased LSF? (y/n) [n] y
Do you accept the terms and conditions of the END USER SOFTWARE LICENSE AGREEMENT?
(y/n) [n] y
You have accepted the terms and conditions END USER SOFTWARE LICENSE AGREEMENT.
Thank you for installing LSF at your site.

Checking selected tar file(s) ...
... Done checking selected tar file(s).
```
13. Wait while the install unpacks the architecture specific files, creates the LSF working directories, adds server hosts, configures the cluster, configures the license file, and creates the **lsf getting started.html** and **lsf quick admin.html** files.

Pre-installation check report saved as text file: /install/pm_install/pm8.1_sas_pinstall/lsf7Update5_lsfinstall/prechk.rpt.

... Done LSF pre-installation check.

Installing LSF binary files " lsf7Update6_linux2.6-glibc2.3-x86_64"
Creating /usr/share/lsf_7.06/7.0 ...

Copying lsfinstall files to /usr/share/lsf_7.06/7.0/install
Creating /usr/share/lsf_7.06/7.0/install ... 
Creating /usr/share/lsf_7.06/7.0/install/scripts ...
Creating /usr/share/lsf_7.06/7.0/install/instlib ...
Creating /usr/share/lsf_7.06/7.0/install/patchlib ...
... Done copying lsfinstall files to /usr/share/lsf_7.06/7.0/install

Installing linux2.6-glibc2.3-x86_64 ...

Please wait, extracting lsf7Update6_linux2.6-glibc2.3-x86_64 may take up to a few minutes ...

... Adding package information to patch history.
... Done adding package information to patch history.
... Done extracting /install/pm_install/pm8.1_sas_pinstall/lsf7Update6_linux2.6-glibc2.3-x86_64.tar.Z.

Creating links to LSF commands ...
... Done creating links to LSF commands ...

Modifying owner, access mode, setuid flag of LSF binary files ...
... Done modifying owner, access mode, setuid flag of LSF binary files ...

Creating the script file lsf_daemons ...
... Done creating the script file lsf_daemons ...

... linux2.6-glibc2.3-x86_64 installed successfully under /usr/share/lsf_7.06/7.0.

... Done installing LSF binary files "linux2.6-glibc2.3-x86_64".

Creating LSF configuration directories and files ...
Creating /usr/share/lsf_7.06/work ...
Creating /usr/share/lsf_7.06/log ...
Creating /usr/share/lsf_7.06/conf ...
Creating /usr/share/lsf_7.06/conf/lsbatch ...
... Done creating LSF configuration directories and files ...

Creating a new cluster "sas_cluster" ...
Adding entry for cluster sas_cluster to /usr/share/lsf_7.06/conf/lsf.shared.
Installing lsbatch directories and configurations ...
Creating /usr/share/lsf_7.06/conf/lsbatch/sas_cluster ...
Creating /usr/share/lsf_7.06/conf/lsbatch/sas_cluster/configdir ...
Creating /usr/share/lsf_7.06/work/sas_cluster ...
Creating /usr/share/lsf_7.06/work/sas_cluster/logdir ...
Creating /usr/share/lsf_7.06/work/sas_cluster/lsf_indir ...
Creating /usr/share/lsf_7.06/work/sas_cluster/lsf_cmddir ...
Upating PRODUCTS line in /usr/share/lsf_7.06/conf/lsf.cluster.sas_cluster ...
1. Backup /usr/share/lsf_7.06/conf/lsf.cluster.sas_cluster to /usr/share/lsf_7.06/conf/lsf.cluster.sas_cluster.old
2. Remove LSF_Data and LSF_Parallel

Setting common HPC external resources to /usr/share/lsf_7.06/conf/lsf.shared
- Enabling LSB_SHORT_HOSTLIST in /usr/share/lsf_7.06/conf/lsf.conf ...
- Enabling schmod_aps in /usr/share/lsf_7.06/conf/lsbatch/sas_cluster/configdir/lsb.modules ...
- Adding default HPC queues to /usr/share/lsf_7.06/conf/lsbatch/sas_cluster/configdir/lsb.queues ...
- Setting LSF_VPLUGIN path in /usr/share/lsf_7.06/conf/lsf.conf ...
- Setting LSF_ASPPLUGIN path in /usr/share/lsf_7.06/conf/lsf.conf ...
- Setting LSF_BMPLUGIN path in /usr/share/lsf_7.06/conf/lsf.conf ...
- Setting LSF_CFUSERLIB path in /usr/share/lsf_7.06/conf/lsf.conf ...
- Enabling LSF_ENABLE_EXTSCHEDULER in /usr/share/lsf_7.06/conf/lsf.conf ...
- Setting LSB_RLA_PORT in /usr/share/lsf_7.06/conf/lsf.conf ...
- Setting LSB_CPUSET_BESTCPUS in /usr/share/lsf_7.06/conf/lsf.conf ...
- Enabling schmod_cpuset in /usr/share/lsf_7.06/conf/lsbatch/sas_cluster/configdir/lsb.modules ...
- Adding LSB_SUB_COMMANDNAME=Y to /usr/share/lsf_7.06/conf/lsf.conf ...

Adding server hosts ...

Host(s) "myhost" has (have) been added to the cluster "sas_cluster".

Adding LSF_MASTER_LIST in lsf.conf file...

... LSF configuration is done.
... Creating EGO configuration directories and files ...
- Creating /usr/share/lsf_7.06/conf/ego ...
- Creating /usr/share/lsf_7.06/conf/ego/sas_cluster ...
- Creating /usr/share/lsf_7.06/conf/ego/sas_cluster/kernel ...
... Done creating EGO configuration directories and files.
- Configuring EGO components...
... EGO configuration is done.

... LSF license setup is done.
- Creating lsf_getting_started.html ...
... Done creating lsf_getting_started.html

- Creating lsf_quick_admin.html ...
... Done creating lsf_quick_admin.html

lsfinstall is done.

To complete your LSF installation and get your cluster "sas_cluster" up and running, follow the steps in "/install/pm_install/pm8.1_sas_pinstall/lsf7Update5_lsfinstall/lsf_getting_started.html".

After setting up your LSF server hosts and verifying your cluster "sas_cluster" is running correctly, see "/usr/share/lsf_7.06/7.0/lsf_quick_admin.html" to learn more about your new LSF cluster.

After installation, remember to bring your cluster up to date by applying the latest updates and bug fixes. To do so, obtain and install the latest package. You can always download the most recent software updates from ftp.platform.com or www.platform.com.
14. After the LSF install completes, the Process Manager install will start. You should see the following:

Starting JS installation...

Logging installation sequence in
/install/pm_install/pm8.1_sas_pinstall/pm8.1_install/Install.log

Searching for Process Manager tar files in /install/pm_install/pm8.1_sas_pinstall,
Please wait ...

1) [SAS] Linux2.6-glibc2.3-x86_64 Server
2) [SAS] Linux2.6-glibc2.3-x86_64 Client

List the numbers separated by spaces that you want to install.
(E.g. 1 3 7, or press Enter for all):

Type 1 2 to install the Process Manager Server and Client. Press Enter to continue.

15. The install will extract files, create directories, and modify access to files. After all operations have been performed, you will see the following:

You have chosen the following tar file(s):
pm8.1_server_sas_linux2.6-glibc2.3-x86_64
pm8.1_client_sas_linux2.6-glibc2.3-x86_64

Process Manager pre-installation check ...

Checking the JS_TOP directory /usr/share/pm_8.10 ...
... Done checking the JS_TOP directory /usr/share/pm_8.10 ...
Checking selected tar file(s) ...
... Done checking selected tar file(s).

Checking Process Manager Administrators ...
Process Manager administrator(s): "lsfadmin"
Primary Process Manager administrator: "lsfadmin"

Checking Process Manager Control Administrators ...
/install/pm_install/pm8.1_sas_pinstall/license.dat includes SAS license.
... Done checking the license ...

Pre-installation check report saved as text file:
/install/pm_install/pm8.1_sas_pinstall/pm8.1_install/prechk.rpt.
... Done Process Manager pre-installation check.

Installing binary files " pm8.1_server_sas_linux2.6-glibc2.3-x86_64
pm8.1_client_sas_linux2.6-glibc2.3-x86_64"
Creating /usr/share/pm_8.10/8.1 ...

Copying jsinstall files to /usr/share/pm_8.10/8.1/install
Creating /usr/share/pm_8.10/8.1/install/instlib ...
... Done copying jsinstall files to /usr/share/pm_8.10/8.1/install

Installing linux2.6-glibc2.3-x86_64 Server...
Please wait, extracting pm8.1_server_sas_linux2.6-glibc2.3-x86_64 may take up to 5
Installation Instructions for Platform Suite for SAS for UNIX

minutes ...

... Done extracting
/install/pm_install/pm8.1_sas_pinstall/pm8.1_server_sas_linux2.6-glibc2.3-
x86_64.tar.Z.

... linux2.6-glibc2.3-x86_64 Server installed successfully under
/usr/share/pm_8.10/8.1.

Installing linux2.6-glibc2.3-x86_64 Client...

Please wait, extracting pm8.1_client_sas_linux2.6-glibc2.3-x86_64 may take up to 5
minutes ...

... Done extracting
/install/pm_install/pm8.1_sas_pinstall/pm8.1_client_sas_linux2.6-glibc2.3-
x86_64.tar.Z.

... linux2.6-glibc2.3-x86_64 Client installed successfully under
/usr/share/pm_8.10/8.1.

Modifying owner, access mode of binary files ...

... Done modifying owner, access mode of binary files ...

Done installing binary files ...

Creating /usr/share/pm_8.10/work/templates ...

Creating configuration directories and files ...

Creating /usr/share/pm_8.10/work/alarms ...

Creating /usr/share/pm_8.10/log ...

Creating /usr/share/pm_8.10/conf ...

... Done creating configuration directories and files ...

Adding queue unicodecmd to
/usr/share/lsf_7.06/conf/lsbatch/sas_cluster/configdir/lsb.queues

Done creating configuration directories and files ...

... Process Manager license setup is done.

Creating /usr/share/pm_8.10/work/calendar/ ...

Please read /usr/share/pm_8.10/README for instructions on how
to start the Process Manager

jinstall completed successfully. Done.
16. Change into the LSF_TOP/7.0/install subdirectory (for example, /usr/share/lsf/7.0/install). Run the following command to set up the proper initialization files for future reboots:

```
./hostsetup --top="/usr/share/lsf" --boot="y" --profile="y" --start="y"
```

**Notes:** There are two dashes “--” in the options. See “Chapter 5 – LSF Quick Reference” for more information on the hostsetup command.

```
$ # ./hostsetup --top="/usr/share/lsf_7.06" --boot="y" --profile="y" --start="y"
Logging installation sequence in /usr/share/lsf_7.06/log/Install.log
------------------------------------------------------------
LSF HOSTSETUP UTILITY
------------------------------------------------------------
This script sets up local host (LSF server, client or slave) environment.
Setting up LSF server host "myhost" ...
Checking LSF installation for host "myhost" ... Done
Installing LSF RC scripts on host "myhost" ... Done
LSF service ports are defined in /usr/share/lsf_7.06/conf/lsf.conf.
Checking LSF service ports definition on host "myhost" ... Done
... Setting up LSF server host "myhost" is done
... LSF host setup is done.
$```

17. Type `ps -ef | grep <LSF_TOP>` and make sure all daemons are running. `mbatchd` and `mschd` only run on the master machine so they may not show up.

```
$ . profile.lsf
$ lsadmin limstartup
Starting up LIM on <myhost> ...... done
$ lsadmin resstartup
Starting up RES on <myhost> ...... done
$ badmin hstartup
Starting up slave batch daemon on <myhost> ...... done
$ ps -ef | grep /usr/share/lsf
root     12910     1  0 10:47 ?        00:00:00 /usr/share/lsf_7.06/7.0/linux2.6-glibc2.3-x86_64/etc/lim
root     12911 12910  0 10:48 ?        00:00:00 /usr/share/lsf_7.06/7.0/linux2.6-glibc2.3-x86_64/etc/pim
root     12912 12910  0 10:48 ?        00:00:00 /usr/share/lsf_7.06/7.0/linux2.6-glibc2.3-x86_64/etc/pem
lsfadmin 12913 12910  0 10:48 ?        00:00:00 /usr/share/lsf_7.06/7.0/linux2.6-glibc2.3-x86_64/etc/vemkd
lsfadmin 12919 12913  0 10:48 ?        00:00:00 /usr/share/lsf_7.06/7.0/linux2.6-glibc2.3-x86_64/etc/egosc
root     12926     1  0 10:48 ?        00:00:00 /usr/share/lsf_7.06/7.0/linux2.6-glibc2.3-x86_64/etc/egoc
root     12926 12926  0 10:48 ?        00:00:00 /usr/share/lsf_7.06/7.0/linux2.6-glibc2.3-x86_64/etc/sbatchd
root     12930     1  0 10:48 ?        00:00:00 /usr/share/lsf_7.06/7.0/linux2.6-glibc2.3-x86_64/etc/mbatchd
root     12930 12930  0 10:48 ?        00:00:00 /usr/share/lsf_7.06/7.0/linux2.6-glibc2.3-x86_64/etc/smbatchd
root     12934 12930  0 10:48 ?        00:00:00 /usr/share/lsf_7.06/7.0/linux2.6-glibc2.3-x86_64/etc/mbatchd -d /usr/share/lsf_7.06/conf
lsfadmin 12941 12934  0 10:48 ?        00:00:00 /usr/share/lsf_7.06/7.0/linux2.6-glibc2.3-x86_64/etc/mbschd
root     12962 28334  0 10:49 pts/1 00:00:00 grep /usr/share/lsf_7.06
$```
Installation Instructions for Platform Suite for SAS for UNIX

18. Start up the Process Manager Server. This can be done easily by rebooting the computer or doing the following as root:
   a. Set up the Process Manager environment by sourcing the profile.js file. This can be done by executing the following command: . <JS_TOP>/conf/profile.js. Please note the period ‘.’ which is the command to ‘source’ the file.
      Note: Since all Process Manager commands require the environment set up by sourcing the profile.js file, it is a best practice to source the profile.js file in the default profile for the shell.
   b. Start the jfd daemons with the command jadmin start.
   c. To Start the jfd daemon at boot time, run the command bootsetup located in JS_TOP/8/install.
   d. Type ps -ef | grep jfd and make sure the daemon is running.

$ jadmin start
Starting up jfd ...
$ cd .../8.1/install
$ bootsetup
Logging installation sequence in /usr/share/pm_8.10/8.1/install/Install.log
Copying /etc/init.d/jstartup, /etc/init.d/rc5.d/S96jstartup and /etc/init.d/rc4.d/K05jstartup
Installing Process Manager RC scripts on host "disuse" ... Done ...
Process Manager boot setup is done.
$ ps -ef | grep jfd
lsfadmin 16417 1 0 15:03 ? 00:00:00 /usr/share/pm_8.10/8.1/linux2.6-glibc2.3-x86_64/etc/jfd
root 16566 944 0 15:04 pts/0 00:00:00 grep jfd
$

Testing the Installation

Once the system has rebooted, you can follow these steps to make sure LSF on the grid control server or scheduling server is operating properly.

1. Log onto the machine as the administrator (i.e., lsfadmin).
2. Make sure the LSF daemons are running by executing the command ps -ef | grep <LSF_TOP>. This should list multiple daemons such as lim, pim, res, sbatchd, mbatchd and mbschd.
3. Run the command lsid. This should display the cluster name and the grid control server (LSF master machine) name. If you cannot find the lsid command, you may have to source the profile first by opening a command prompt and executing the following command:
   . <LSF_TOP>/conf/profile.lsf
   Please note the period ‘.’ which is the command to ‘source’ the file.
   Note: The hostsetup command should have sourced profile.lsf for each user, but if it did not you will need to source it yourself.
4. Run the command lshosts. This should display static information about the grid control server (LSF master machine).
5. Run the command lsload. This should display dynamic information about the grid control server (LSF master machine).
6. Run the command bsub sleep 100. This will submit a job to the grid control server since it is the only machine so far in the cluster.
7. Run the command `bjobs`. This will display the job information. As you repeat this command, you should see the job go from `PEND`, to `RUN`, to being removed from the queue. The following is sample output assuming the grid control server (LSF master machine) is `grid3.testgrid.com`.

```bash
$ lsid
Platform LSF HPC 7 Update 6, Dec 01 2010
Copyright 1992-2010 Platform Computing Corporation

My cluster name is sas_cluster
My master name is myhost
Cluster in ISV mode : SAS

$ lshosts
HOST_NAME  type     model      cpuf ncpus maxmem  maxswp server RESOURCES
myhost      X86_64 Intel_EM 60.0 4 16048M 2055M    Yes (mg)

$ lsload
HOST_NAME status r15s r1m r15m ut pg ls it tmp swp mem
myhost      ok  1.0  1.0  1.0 25% 0.0 1 1 365G 2043M   14G

$ bhosts
HOST_NAME STATUS  JL/U MAX NJOBS RUN SSUSP USUSP RSV
myhost      ok   -   1 0 0 0 0 0
```

8. Set up the Process Manager environment by sourcing the `profile.js` file. This can be done by executing the following command: `. <JS_TOP>/conf/profile.js`. Please note the period `.` which is the command to ‘source’ the file.

**Note:** Since all Process Manager commands require the environment set up by sourcing the `profile.js` file, it is a best practice to source the `profile.js` file in the default profile for the shell.

9. Run the command `jid`. When prompted for username and password provide the administrator (lsfadmin) credentials. This will display static information about the Process Manager Server.

```bash
$ jid
User name: lsfadmin
Password:
My Process Manager Server name is myhost.
Platform Process Manager 8.1 (for SAS)
Copyright 1992-2010 Platform Computing Corporation
License in ISV mode: SAS.
```

10. Run the command `flowmanager`. This will execute a client application to verify client communication to the Process Manager Server.

**Note:** If you are installing Platform Suite for SAS for single machine scheduling, you are done and should stop here. If you are installing Platform Suite for SAS for use with SAS Grid Manager, continue with the next chapter.
Chapter 3 - Installing Grid Management Service (GMS)

Grid Management Service is a daemon that is used by the Grid Manager Plug-in for the SAS Management Console to display grid information. After installing this service, you should be able to use the SAS Management Console to view grid information.

1. Log onto the grid control server as the LSF administrator (lsfadmin).
2. Create a Grid Management Service install directory to hold the install files.
3. Copy the gms7.11_install.tar.Z file from the appropriate location (see step #6 from the pre-installation requirements section) to the install directory along with the gms7.11_<platform>_tar.Z specific to the operating system and architecture of the grid control server.
4. Change the working directory to the Grid Management Service install directory.
5. Untar the gms7.11_install.tar.Z file. For example, under Linux you can use the command gunzip -d gms7.11_install.tar.Z followed by tar xvf gms7.11_install.tar. This should create a gms7.11_install subdirectory in the Grid Management Service install directory.
6. Change into the gms7.11_install subdirectory.
7. Edit the install.config file and change the following sections:

<table>
<thead>
<tr>
<th>Required Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSF_TOP</td>
<td>Network share containing the LSF installation mentioned in the pre-installation requirements. For example: LSF_TOP=/usr/share/lsf.</td>
</tr>
<tr>
<td>LSF_TARDIR</td>
<td>Path of directory to architecture specific tar files. If not used, the tar files are expected to be in the parent directory of the current working directory. For example: LSF_TARDIR=/usr/share/lsf/7.0/install</td>
</tr>
<tr>
<td>GABD_PORT</td>
<td>Port GMS should use for incoming connections. If not specified, it will be 1976. Note: This configuration variable is not commented in the install.config file and needs to be added if the default is not wanted.</td>
</tr>
<tr>
<td>BOOT</td>
<td>Setting BOOT=&quot;Y&quot; will install a script that will start the service to start at boot time. Default is not to start at boot time.</td>
</tr>
</tbody>
</table>
8. Change to the root user and execute the following command: 
./gmsinstall -f install.config. This will install the Grid Management Service.

```
$ ./gmsinstall -f install.config

Logging installation sequence in /install/gms_install/gms7.11_install/Install.log
pre-installation check ...
uncompress is /usr/bin/uncompress

Please wait, extracting /install/gms_install/gms7.11_linux2.6-glibc2.3-x86_64.tar.Z may take up to 5 minutes ...

Creating /usr/share/lsf_7.06/gms ...
Creating /usr/share/lsf_7.06/gms/log ...
... Done extracting /install/gms_install/gms7.11_linux2.6-glibc2.3-x86_64.tar.Z.
Install Platform Grid Management Service 7.11
Creating /usr/share/lsf_7.06/gms/7.11/misc ...

Modifying owner, access mode, setuid flag of files ...
... Done modifying owner, access mode, setuid flag of files ...

Creating script for starting daemon: /usr/share/lsf_7.06/gms/bin/gaadmin
Installation of Platform Grid Management Service 7.11 completed
```

9. Start the service by either rebooting the machine, running the script created in the <GMS_TOP>/bin directory, or using a service management tool available on your platform. In the example above, the following command would start the service (assuming you are logged on as 'root'):

```
/usr/share/lsf/gms/bin/gaadmin start
```

**Testing the Installation**

Once SAS has been installed and configured, the SAS Grid Manager Plug-in in the SAS Management Console can be used to test that the Grid Management Service is working properly.
Chapter 4 - Installing LSF on Grid Nodes or SAS Foundation Grid Clients

When you filled out the install.config file, you listed machines that you want to be part of the grid. Some of those machines will process jobs, some may submit jobs and some may do both. Grid nodes process jobs for the grid and can optionally submit jobs to the grid. SAS Foundation Grid Clients only submit jobs to the grid without processing grid jobs.

1. Verify the host information is already in the LSF cluster file LSF_CONFDIR/lsf.cluster.cluster_name. If it is not, then edit the Host section of the cluster file to add the host. For more information about the Host section, see “Configuring lsf.cluster.cluster_name Host Section” in your Administering Platform™ LSF™ document found in the docs directory of your SAS Software Depot containing Platform LSF.

2. Log onto each newly added machine as root.

3. Make sure access to the shared directory where LSF was installed is available. Also, make sure the share is available for the boot initialization process.

4. Add the lsfadmin user if this was not done before the installation process was started.

5. Change into the <LSF_TOP>/7.0/install share directory (in our example, it is /usr/share/lsf/7.0/install).

6. Run the following command to set up the proper initialization files for future reboots:

   ```
   ./hostsetup --top="/usr/share/lsf" --boot="y" --profile="y" --start="y"
   ```

   **Notes:** There are two dashes “--” in the options. See “Chapter 5 – LSF Quick Reference” for more information on the hostsetup command.

7. Run the following two commands on the grid control node to make the new node known:

   ```
   lsadmin reconfig
   badmin reconfig
   ```

Testing the Installation

Once the system has rebooted, you can follow these steps to make sure LSF on the cluster is operating properly.

1. Log onto the grid control server as lsfadmin.

2. Run the command lshosts. This should display static information about the grid control server and all grid node machines.

3. Run the command lsload. This should display dynamic information about the grid control server and all grid node machines.

4. Run the command bsub sleep 1000. This will submit a job to the cluster. Repeat this command once for each node in the cluster.

5. Run the command bjobs. This will display the job information. As you repeat this command, you should see the job go from PEND, to RUN, to being removed from the queue.

The following is sample output of a homogeneous cluster where the grid control server (LSF master machine) is myhost running Linux and the grid nodes are node1, node2, node3, and node4, all running Linux.
Adding Nodes or SAS Foundation Clients to the Grid

A grid can have machines added to it any time in the future. If a new machine needs to be added to the grid after an initial install, the procedures are similar to adding grid nodes to a new LSF cluster. To add a node to an existing LSF cluster, do the following:

1. Edit the `lsf.cluster.<cluster_name>` file (e.g., `lsf.cluster.sas_cluster` in our case) and add the new machine names in the host section. This section looks like

   ```
   BEGIN HOST
   HOSTNAME            model type    server r1m mem swp RESOURCES
   #Keywords
   myhost               ! LINUX86 1 - - (linux)
   node1                ! LINUX86 1 - - (linux)
   node2                ! LINUX86 1 - - (linux)
   node3                ! LINUX86 1 - - (linux)
   node4                ! LINUX86 1 - - (linux)
   myhost               ! LINUX86 1 - - (linux)
   
   END HOST
   ```

   For example, to add `node5` to the previous cluster, the resulting Host section would look like

   ```
   BEGIN HOST
   HOSTNAME            model type    server r1m mem swp RESOURCES
   #Keywords
   myhost               ! LINUX86 1 - - (linux)
   node1                ! LINUX86 1 - - (linux)
   node2                ! LINUX86 1 - - (linux)
   node3                ! LINUX86 1 - - (linux)
   node4                ! LINUX86 1 - - (linux)
   node5                ! LINUX86 1 - - (linux)
   
   END HOST
   ```

2. Follow the steps at the beginning of this chapter.
Converting a Grid Node Machine to a Grid Client

In the case where you are only going to run SAS Foundation for the purposes of submitting jobs to the grid without allowing that machine to participate as a grid node and you installed Platform LSF on a machine as an “LSF Server” host type then the following steps will prevent jobs from running on the machine making it essentially a “LSF Client” machine. This is accomplished by changing the state of a machine to ‘closed’. To change a machine’s state to ‘closed’, do the following:

1. Log on as the LSF Administrator.
2. Run the command `badmin hclose <host_name>`.

When you run the `bhosts` command, the host should display a status of ‘closed’.

Adding a New Machine Type to the Grid

Before adding a new machine type to an existing grid, verify that the host type does not already exist in your cluster by logging onto any host in the cluster and listing the contents of the `LSF_TOP/<version>` directory. If the host type currently exists, there will be a subdirectory with the name of the host type, and you should edit the `LSF_CONFDIR/lsf.cluster.<clusternickname>` file to add the hostname in the HOST section. Then go to step 5 below. If the host type does not already exist, complete all the steps below.

1. Get the LSF distribution tar file for the host type you want to add.
2. Log on as root to any host that can access the LSF install directory.
3. Change to the LSF install directory.
4. Edit `install.config`:
   a. For `LSF_TARDIR`, specify the path to the tar file. For example:
      
      ```
      LSF_TARDIR="/usr/share/lsf_distrib/7.0"
      ```
   b. For `LSF_ADD_SERVERS`, list the new host names enclosed in quotes and separated by spaces. For example:
      
      ```
      LSF_ADD_SERVERS="hosta hostb"
      ```
   c. Run `./lsfinstall -f install.config`
      
      This automatically creates the host information in `lsf.cluster.cluster_name`
5. Run `lsadmin reconfig` to reconfigure LIM.
6. Run `badmin reconfig` to reconfigure mbatchd.
7. Run `hostsetup` to set up the new host and configure the daemons to start automatically at boot. For example, from an install directory such as `/usr/share/lsf/7.0/install`:
      
      ```
      ./hostsetup --top="/usr/share/lsf" --boot="y" --profile="y" --start="y"
      ```
      
      **Notes:** There are two dashes “--” in the options. See “Chapter 5 – LSF Quick Reference” for more information on the `hostsetup` command.
8. Start LSF on the new host:

   ```
   lsadmin limstartup
   lsadmin resstartup
   badmin hstartup
   ```
Chapter 5 – Installing Platform MPI

Platform MPI is a fully integrated message passing interface (MPI) solution that enables users to take advantage of the leading interconnect technologies to build high performance applications, while simplifying the number of binary distributions required.

Platform MPI must be installed on each Linux for x64 machine in the grid, including grid nodes and the grid control server.

1. Locate the platform_mpi-8.01.00.00-20101215r.x86_64.rpm in your SAS Software Depot, in the following directory:
   \third_party\Platform_MPI\8_1\Linux_for_x64

2. Use RPM to install the product using the command below. This will install Platform MPI into the /opt/platform_mpi subdirectory which is where SAS Deployment Wizard expects to find it by default.
   rpm -i platform_mpi-8.01.00.00-20101215r.x86_64.rpm

   To install MPI to a location other than the default, use the relocate option:
   rpm -i --relocate=/opt/platform_mpi=<full destination path>
   platform_mpi-8.01.00.00-20101215r.x86_64.rpm

Note that Platform MPI must be installed on the same location on each machine in the grid. For instance, if you install Platform MPI in /opt/platform_mpi on one machine, it must be installed in that same directory for each machine in the grid.
## Chapter 6 - LSF Quick Reference

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>lsid</td>
<td>Displays version number, cluster name, and the grid control server (LSF master host) name. Useful to see if the grid daemons are running and if running in SAS mode.</td>
</tr>
<tr>
<td>lshosts</td>
<td>Displays information about the hosts recognized by LSF along with their static resource information.</td>
</tr>
<tr>
<td>lsload</td>
<td>Displays the dynamic resource information for the hosts in the grid (cluster).</td>
</tr>
<tr>
<td>bhosts</td>
<td>Displays batch information about all hosts in the grid (cluster).</td>
</tr>
<tr>
<td>bjobs</td>
<td>Displays information about current user’s LSF jobs.</td>
</tr>
<tr>
<td>lsfstartup</td>
<td>Starts the LIM, RES, sbatchd, and mbatchd daemons on all hosts in the cluster. Must be run as root and all hosts must be running rsh or ssh daemons.</td>
</tr>
<tr>
<td>lsfrestart</td>
<td>Restarts the LIM, RES, sbatchd, and mbatchd daemons on all hosts in the cluster. Must be run as root and all hosts must be running rsh or ssh daemons.</td>
</tr>
<tr>
<td>lsfshutdown</td>
<td>Shuts down the LIM, RES, sbatchd, and mbatchd daemons on all hosts in the cluster. Must be run as root and all hosts must be running rsh or ssh daemons.</td>
</tr>
<tr>
<td>lsadmin</td>
<td>Administrative tool for LSF available to LSF administrators. Useful subcommands are</td>
</tr>
<tr>
<td>reconfig</td>
<td>Restarts all LIMs in the cluster to read any changes in the configuration files.</td>
</tr>
<tr>
<td>limstartup</td>
<td>Starts LIM on the local host</td>
</tr>
<tr>
<td>limrestart</td>
<td>Restarts LIM on the local host</td>
</tr>
<tr>
<td>resstartup</td>
<td>Starts RES on local host</td>
</tr>
<tr>
<td>resrestart</td>
<td>Restarts RES on local host</td>
</tr>
<tr>
<td>bhist</td>
<td>Displays historical information about jobs. Useful parameters are</td>
</tr>
<tr>
<td>-p</td>
<td>-r</td>
</tr>
<tr>
<td>-l</td>
<td>Display in long format.</td>
</tr>
<tr>
<td>-u &lt;user&gt;</td>
<td>all</td>
</tr>
<tr>
<td>&lt;job ID&gt;</td>
<td>Displays only specified job information.</td>
</tr>
<tr>
<td><strong>badim</strong></td>
<td>Administrative tool for LSF’s batch processing facility available to LSF administrators. Useful subcommands are</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>reconfig</strong></td>
<td>Reconfigures the batch facility without restarting sbatchd or mbatchd to read any changes in the configuration files.</td>
</tr>
<tr>
<td><strong>hstartup</strong></td>
<td>Starts sbatchd on the local host</td>
</tr>
<tr>
<td><strong>hrestart</strong></td>
<td>Restarts sbatchd on the local host</td>
</tr>
<tr>
<td><strong>mbdrestart</strong></td>
<td>Restarts mbatchd. Needs to be done when new hosts are added to the grid (cluster).</td>
</tr>
<tr>
<td><strong>hclose &lt;host&gt;</strong></td>
<td>Closes a host preventing it from running jobs.</td>
</tr>
<tr>
<td><strong>hopen &lt;host&gt;</strong></td>
<td>Opens a host to allow it to run jobs.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>bsub</strong></th>
<th>Submit a job to the grid. Useful parameters are</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>-I</strong></td>
<td>Interactive. Remote output displayed locally.</td>
</tr>
<tr>
<td><strong>-m</strong></td>
<td>Submit to a specific host.</td>
</tr>
<tr>
<td><strong>-R “res_req”</strong></td>
<td>Submit with specified resource</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>hostsetup</strong></th>
<th>Sets up a host to use the LSF cluster and configures LSF daemons to start automatically.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>--top</strong></td>
<td>Top-level installation directory that contains the cluster the local host belongs to. (&lt;path&gt;) must be accessible to local host where hostsetup is running</td>
</tr>
<tr>
<td><strong>--boot</strong></td>
<td>Configure system scripts to automatically start and stop LSF at system startup and shutdown. The local host where hostsetup is running must be an LSF server in the cluster.</td>
</tr>
<tr>
<td><strong>--profile</strong></td>
<td>Add cshrc.lsf and profile.lsf to system wide environment and startup programs.</td>
</tr>
<tr>
<td><strong>--start</strong></td>
<td>Start LSF on the local host after hostsetup. The local host where hostsetup is running must be an LSF server in the cluster.</td>
</tr>
<tr>
<td><strong>--quiet</strong></td>
<td>Do not display detailed messages</td>
</tr>
</tbody>
</table>

The LSF commands shown in this section show examples of typical output. The output you see will differ according to your local configuration.

The commands are described briefly so that you can easily use them as a “sanity check” for your LSF installation. See the *LSF Reference* for complete usage and command options. You can use these commands on any LSF host. If you get proper output from these commands, your cluster is ready to use. If your output from the commands discussed in this section has errors, see the *LSF Reference* for help.

**Check Cluster Configuration (lsadmin)**

`lsadmin ckconfig -v`

The *lsadmin* command controls the operation of an LSF cluster and LSF configuration files. The `-v` flag displays detailed information about the LSF configuration:
Installation Instructions for Platform Suite for SAS for UNIX

$ lsadmin ckconfig -v

Checking configuration files ... 

Platform EGO 1.2.3.138877, Nov 23 2009
Copyright (C) 1992-2009 Platform Computing Corporation

binary type: linux2.6-glibc2.3-x86_64 
Reading configuration from 
/usr/share/lsf_7.06/conf/ego/cluster1/kernel/ego.conf 
Jan 21 15:08:54 2010 10145 6 1.2.3 LIM starting... 
Jan 21 15:08:54 2010 10145 6 1.2.3 LIM is running in advanced workload execution mode. 
Jan 21 15:08:54 2010 10145 6 1.2.3 Master LIM is not running in 
EGO_DISABLE_UNRESOLVABLE_HOST mode. 
Jan 21 15:08:54 2010 10145 5 1.2.3 /usr/share/lsf_7.06/7.0/linux2.6- 
glibc2.3-x86_64/etc/lim -C 
Jan 21 15:08:54 2010 10145 3 1.2.3 domanager(): /usr/share/lsf_7.06/conf/lsf.cluster.cluster1(13): The cluster manager is the invoker <lsfsadmin> in debug mode 
Jan 21 15:08:54 2010 10145 6 1.2.3 reCheckClass: numhosts 1 so reset exchIntvl to 15.00 
Jan 21 15:08:54 2010 10145 6 1.2.3 Checking Done. 
------------------------------------------------------------------
No errors found.
The messages shown are typical of normal output from lsadmin ckconfig -v. Other messages may indicate problems with your LSF configuration. See the LSF Reference for help with some common configuration errors.

Find Out Cluster Status (lsid and lsload)

lsid

Tells you if your LSF environment is set up properly. Lsid displays the current LSF version number, cluster name, and host name of the current grid control server (LSF master host) for your cluster. The grid control server (LSF master) name displayed by lsid may vary, but it is usually the first host configured in the Hosts section of LSF_CONFDIR/lsf.cluster.cluster_name.

lsid

Platform LSF HPC 7 Update 6, Nov 23 2009
Copyright 1992-2009 Platform Computing Corporation

My cluster name is sas_cluster
My master name is myhost
Cluster in ISV mode: SAS

If you see the message

Cannot open lsf.conf file

the LSF_ENVDIR environment variable is probably not set correctly. Use cshrc.lsf or profile.lsf to set up your environment.
**lsload**

Displays the current load levels of the cluster. The output contains one line for each host in the cluster. The status should be `ok` for all hosts in your cluster. For example:

```
lsload
```

<table>
<thead>
<tr>
<th>HOST_NAME</th>
<th>status</th>
<th>r15s</th>
<th>r1m</th>
<th>r15m</th>
<th>ut</th>
<th>pg</th>
<th>ls</th>
<th>it</th>
<th>tmp</th>
<th>swp</th>
<th>mem</th>
</tr>
</thead>
<tbody>
<tr>
<td>hosta</td>
<td>ok</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>6%</td>
<td>0.2</td>
<td>2</td>
<td>1365</td>
<td>97M</td>
<td>65M</td>
<td>29M</td>
</tr>
<tr>
<td>hostb</td>
<td>ok</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>9%</td>
<td>0.0</td>
<td>4</td>
<td>1</td>
<td>130M</td>
<td>319M</td>
<td>12M</td>
</tr>
<tr>
<td>hostc</td>
<td>ok</td>
<td>2.5</td>
<td>2.2</td>
<td>1.9</td>
<td>64%</td>
<td>56.7</td>
<td>50</td>
<td>0</td>
<td>929M</td>
<td>931M</td>
<td>4000M</td>
</tr>
<tr>
<td>hostd</td>
<td>ok</td>
<td>0.2</td>
<td>0.2</td>
<td>1%</td>
<td>0.0</td>
<td>0</td>
<td>367</td>
<td>93M</td>
<td>86M</td>
<td>50M</td>
<td></td>
</tr>
<tr>
<td>hoste</td>
<td>busy</td>
<td>*6.0</td>
<td>2.2</td>
<td>1.9</td>
<td>64%</td>
<td>56.7</td>
<td>50</td>
<td>0</td>
<td>929M</td>
<td>931M</td>
<td>4000M</td>
</tr>
<tr>
<td>hostf</td>
<td>avail</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A busy status is shown for hosts with any load index beyond its configured thresholds. An asterisk (*) marks load indices that are beyond their thresholds, causing the host status to be busy. A minus sign (-) in front of the value `ok` means that RES is not running on that host.

If you see the message

```
LIM is down
```

or

```
LIM is not responding
```

after starting or reconfiguring LSF, wait a few seconds and try `lsload` again to give the LIMs time to initialize. `lsload` also shows if LSF is licensed for the host. If you see the message

```
Host does not have a software license
```

you must install a valid LSF license or make sure that the license server is running properly.

There are also a couple of other useful commands:

- The `lshosts` command displays configuration information for LSF hosts and their static resource information.
- The `lsinfo` command displays cluster configuration information about resources, host types, and host models.

**Check LSF Batch Configuration (badmin)**

`badmin ckconfig -v`

The `badmin` command controls and monitors the operation of the LSF Batch system. Use the `badmin ckconfig` command to check the LSF Batch configuration files. The `-v` flag displays detailed information about the configuration:

```
badmin ckconfig -v
Checking configuration files ...  
-----------------------------------------------
No errors found.
```

The messages shown above are the normal output from `badmin ckconfig -v`. Other messages may indicate problems with the Platform LSF Batch configuration. See the *LSF Reference* for help with some common configuration errors.
Find Out LSF Batch System Status (bhosts and bqueues)

bhosts

The `bhosts` command tells you if LSF Batch is running properly. `bhosts` displays the status and other details about the grid nodes (LSF Batch server hosts) in the cluster:

- Maximum number of job slots allowed by a single user
- Total number of jobs in the system, jobs running, jobs suspended by users, and jobs suspended by the system
- Total number of reserved job slots

The status should be `ok` for all grid nodes (hosts) in your cluster. For example:

```
   bhosts

   HOST_NAME  STATUS  JL/U  MAX  NJOBS  RUN  SSUSP  USUSP  RSV
   hosta  ok  -  -  0  0  0  0
   hostb  ok  -  -  0  0  0  0
   hostc  ok  -  -  0  0  0  0
   hostd  ok  -  -  0  0  0  0
```

If you see the message

```
   lsbatch daemons not responding
```

after starting or reconfiguring LSF, wait a few seconds and try `bhosts` again to give the SBDs time to initialize.

bqueues

LSF Batch queues organize jobs with different priorities and different scheduling policies. The `bqueues` command displays available queues and their configuration parameters. For a queue to accept and dispatch jobs, the status should be `Open:Active`.

```
   bqueues

   QUEUE_NAME  PRIO  STATUS  MAX  JL/U  JL/P  JL/H  NJOBS  PEND  RUN  SUSP
   owners  43  Open:Active  -  -  -  -  0  0  0  0  0
   priority  43  Open:Active  -  -  -  -  0  0  0  0  0
   night  40  Open:Inact  -  -  -  -  0  0  0  0  0
   chkpnt_rerun_qu  40  Open:Active  -  -  -  -  0  0  0  0  0
   short  35  Open:Active  -  -  -  -  0  0  0  0  0
   license  33  Open:Active  -  -  -  -  0  0  0  0  0
   normal  30  Open:Active  -  -  -  -  0  0  0  0  0
   hpc_linux  30  Open:Active  -  -  -  -  0  0  0  0  0
   hpc_linux_tv  30  Open:Active  -  -  -  -  0  0  0  0  0
   unicodecmd  30  Open:Active  -  -  -  -  0  0  0  0  0
   idle  20  Open:Active  -  -  -  -  0  0  0  0  0
```

The queue information displayed by `bqueues` is configured in `lsb.queues`. Eight queues are defined by default in `lsb.queues`. Modify this file to add, delete, or change queues.
bqueues -l

To see more detailed queue information, use bqueues -l:

bqueues -l normal

QUEUE: normal
-- For normal low priority jobs, running only if hosts are lightly loaded.
This is the default queue.

PARAMETERS/STATISTICS
PRIO NICE STATUS MAX JL/U JL/P JL/H NJOBS PEND RUN SSUSP USUSP RSV
30 20 Open:Active - - - - 0 0 0 0 0 0

SCHEDULING PARAMETERS
loadSched r15s r1m r15m ut pg io ls it tmp swp mem
loadStop

USERS: all
HOSTS: all

bqueues -l shows the following kinds of information about the queue:

- What kinds of jobs are meant to run on the queue
- Resource usage limits
- Nodes (hosts) and users that are able to use the queue
- Scheduling threshold values:
  - loadSched is the threshold for LSF to dispatch a job automatically
  - loadStop is the threshold for LSF to suspend a job automatically

There are a couple of other useful commands:

- The bparams command displays information about the LSF Batch configuration parameters.
- The bhist command displays historical information about jobs.

Verifying the Network Setup

Overview

The first step in troubleshooting problems with a SAS grid is to verify that all computers in the grid can communicate with one another through the ports that are used by the grid middleware.

Host Addresses

Check the /etc/hosts file on each grid node to ensure that the machine name is not mapped to the 127.0.0.1 address. This mapping causes the signon connection to the grid node to fail or to hang. This happens because the SAS session being invoked on the grid node cannot determine the correct IP address of the machine on which it is running. A correct IP address must be returned to the client session in order to complete the connection. For example, delete the name "myserver" if the following line is present in the /etc/hosts file:

127.0.0.1 myserver localhost.localdomain localhost
Host Connectivity

You must verify that the network has been set up properly and that each machine knows the network address of all the other machines in the grid. Follow these steps to test the network setup:

1. Run the `hostname` command on every machine in the grid (including grid nodes, grid control servers, and SAS Foundation grid clients).
2. Run the `ping` command on all grid node machines and the grid control machine against every other machine in the grid (including grid client machines). When you ping a grid client machine, use the host name without the domain suffix.
3. Run the `ping` command on each grid client machine against every other machine in the grid (including itself). When a grid client machine pings itself using the value from the `hostname` command, verify that the returned IP address is the same IP address that is returned when the grid nodes ping the client. However, this might not occur on machines with multiple network adapters.

If the network tests indicate a problem, you must either correct the DNS server or add entries to each machine's `hosts` file. Contact your network administrator for the best way to fix the problem.

Platform LSF assumes that each host in the grid has a single name, that it can resolve the IP address from the name, and that it can resolve the official name from the IP address. If any of these conditions are not met, LSF needs its own `hosts` file, which is located in its configuration directory (`LSF_ENVDIR/conf/hosts`).

Host Ports

You must verify that the ports that SAS and LSF use for communication are accessible from other machines. The ports might not be accessible if a firewall is running on one or more machines. If firewalls are running, you must open ports so that communication works between the LSF daemons and the instances of SAS. Issue the `telnet <host><port>` command to determine whether a port is open on a specific host.

The default ports used in a grid are:

- LSF: 6878, 6881, 6882, 7869, 7870, 7871, 7872
- Grid Monitoring Service: 1976
- Platform Process Manager: 1966

If you need to change any port numbers, modify these files:

- LSF ports: `LSF_ENVDIR/conf/lsf.conf` and `EGO_CONFDIR/ego.conf`
- Grid Monitoring Service port: `gms/conf/ga.conf`
- Platform Process Manager port: `pm/conf/js.conf`

If you change the Grid Monitoring Service port, you must also change the metadata for the Grid Monitoring Server. If you change the Platform process Manager port, you must also change the metadata for the Job Scheduler Server.

Ports might be used by other programs. To check for ports that are in use, stop the LSF daemons and issue the command `netstat -an |grep (UNIX)` or `findstr (Windows)`. Check the output of the command for the LSF ports. If a port is in use, reassign the port or stop the program that is using the port.
SAS assigns random ports for connections, but you can restrict the range of ports SAS uses by using the `-tcpportfirst <first-port>` and the `-tcpportlast <last-port>` options. You can specify these options in the SAS configuration file or on the SAS command line. For remote sessions, you must specify these options either in the grid command script (`sasgrid.cmd` on Windows or `sasgrid` on UNIX) or in the Command field in the logical grid server definition in metadata. For example, adding the following parameters to the SAS command line in the grid script restricts the ports that the remote session uses to between 5000 and 5005:

```
-tcpportfirst 5000 -tcpportlast 5005
```

**For More Information**

See the *LSF Administrator’s Guide* for more information about seeing the status of your cluster.

See the *LSF Reference* for detailed information about the commands described in this section.

See *Administering Process Manager* for detailed information about Process Manager configuration and maintenance.

These documents are also available at [http://support.sas.com/rnd/scalability/platform/index.html](http://support.sas.com/rnd/scalability/platform/index.html).
Appendix – LDAP Authentication

Configure LDAP Authentication for Process Manager Server:

On UNIX systems, Process Manager supports LDAP authentication through PAM (pluggable authentication modules). PAM is a third-party tool that can be configured to use the `pam_ldap` module from the `libpam-ldap` package to log into the LDAP server for password checking.

To enable LDAP authentication for Process Manager, perform the following steps:

1. Set `JS_LOGIN_REQUIRED=true` in `js.conf`.
2. Modify the PAM configuration on your system to add a service name `eauth_userpass` for the module type `auth`.

   For example, on Linux, create a new file `eauth_userpass` under the `/etc/pam.d` directory, and then add the following entry to the file:
   ```
   auth required /lib/security/$ISA/pam_ldap.so
   ```

   On Solaris, modify `/etc/pam.conf` to add the following entries:
   ```
   eauth_userpass auth requisite /usr/lib/security/64/pam_authtok_get.so.1
   eauth_userpass auth required /usr/lib/security/64/pam_dhkeys.so.1
   eauth_userpass auth required /usr/lib/security/64/pam_unix_cred.so.1
   eauth_userpass auth binding /usr/lib/security/64/pam_passwd_auth.so.1
   server_policy
   eauth_userpass auth required /usr/lib/security/64/pam_ldap.so.1
   ```

   On AIX, modify `/etc/pam.conf` to add the following entry:
   ```
   eauth_userpass auth required /usr/lib/security/64/pam_aix
   ```

   Note that the absolute path for the `pam_ldap` module may be different on your system. Ensure that you specify the 64-bit `pam_ldap` module on 64-bit operating systems.

3. Restart Process Manager server `jfd`.

Configure LDAP Authentication for GMS

On UNIX systems, GMS supports LDAP authentication through PAM (pluggable authentication modules). PAM is a third-party tool that can be configured to use the `pam_ldap` module from the `libpam-ldap` package to log into the LDAP server for password checking.

To enable LDAP authentication for GMS, perform the following steps

1. Set `GA_PAM_ENABLE=Y` in `ga.conf`.
2. Modify the PAM configuration on your system You have two options for this step.

   Option 1: Modify the existing PAM module: `passwd`

   For example, on Linux, make sure `/etc/pam.d/passwd` has the following entry:
   ```
   auth required pam_stack.so service=system-auth
   ```
Then modify `/etc/pam.d/system-auth` to add the following:

```bash
auth sufficient /lib/security/$ISA/pam_ldap.so use_first_pass
```

On Solaris, modify `/etc/pam.conf` to add the following:

```bash
passwd auth requisite /usr/lib/security/64/pam_authtok_get.so.1
passwd auth required /usr/lib/security/64/pam_dhkeys.so.1
passwd auth required /usr/lib/security/64/pam_unix_cred.so.1
passwd auth binding /usr/lib/security/64/pam_passwd_auth.so.1
server_policy
passwd auth required /usr/lib/security/64/pam_ldap.so.1
```

On AIX, modify `/etc/pam.conf` to add the following:

```bash
passwd auth required /usr/lib/security/64/pam_aix
```

**Option 2: Configure a new PAM module specified by GA_PAM_SERVICE in `ga.conf`**

For example, in `ga.conf`, set the following:

```bash
GA_PAM_ENABLE=Y
GA_PAM_SERVICE=ga_auth
```

On Linux, create a new file `ga_auth` under `/etc/pam.d` directory, and add the following entry to the file:

```bash
auth required /lib/security/$ISA/pam_ldap.so
```

On Solaris, modify `/etc/pam.conf` to add the following entries:

```bash
ga_auth auth requisite /usr/lib/security/64/pam_authtok_get.so.1
ga_auth auth required /usr/lib/security/64/pam_dhkeys.so.1
ga_auth auth required /usr/lib/security/64/pam_unix_cred.so.1
ga_auth auth binding /usr/lib/security/64/pam_passwd_auth.so.1
server_policy
ga_auth auth required /usr/lib/security/64/pam_ldap.so.1
```

On AIX, modify `/etc/pam.conf` to add the following entry:

```bash
ga_auth auth required /usr/lib/security/64/pam_aix
```

Note that the absolute path for the `pam_ldap` module may be different on your system. Make sure you specify the 64-bit `pam_ldap` module on 64-bit operating systems.

Option 1 is recommended. Use option 2 if your site does not allow changing of the `passwd` module.

3. Restart GMS daemon `gabd`. 
support.sas.com

SAS is the world leader in providing software and services that enable customers to transform data from all areas of their business into intelligence. SAS solutions help organizations make better, more informed decisions and maximize customer, supplier, and organizational relationships. For more than 30 years, SAS has been giving customers around the world The Power to Know®. Visit us at www.sas.com.