



Scheduling in SAS® 9.4, Second Edition

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What's New in SAS Scheduling 9.4

Overview

In SAS 9.4M8, support for high availability has been added.

Support for High Availability

In SAS 9.4M7 or earlier, if the node that contains the SAS Job Flow Scheduler Trigger service fails, the following happens:

- Job flows that are scheduled in SAS Job Flow Scheduler are not passed to a new node.
- The job flows no longer run as scheduled.

However, starting with SAS 9.4M8, you can enable high availability. Then, if one node fails, another node is available to continue running the job flows. For details, see [“Changes in SAS 9.4M8” on page 12](#).

Chapter 1

SAS Scheduling Overview

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About SAS Scheduling

The SAS scheduling tools enable you to automate the scheduling and execution of SAS jobs across your enterprise computing environment. Scheduling typically uses these four main components:

SAS application

SAS applications create the jobs to be scheduled. These applications include SAS Data Integration Studio, SAS Web Report Studio, and SAS Marketing Automation. In addition, you can schedule SAS programs that are not produced by a SAS application.

Schedule Manager

This plug-in for SAS Management Console sets or enables you to edit the schedule and conditions for execution of the job and specifies the scheduling server. Some applications (such as SAS Web Report Studio and SAS Marketing Automation) bypass the Schedule Manager to create jobs, but you can still use Schedule Manager to edit these jobs.

Scheduling server

This server determines when a job's schedule (as specified in the Schedule Manager) has been met and runs the scheduled job. The scheduling server also determines when other events specified by the Schedule Manager have occurred. The scheduling process can use any of these scheduling server types:

- SAS Job Flow Scheduler scheduling server
- Process Manager server (part of the Platform Suite for SAS)
- a server that uses the scheduling functions provided by the operating system
- a distributed in-process service, which runs as a process inside a SAS application or is sent to the operating system where the scheduler is installed
- an Oozie scheduling server (used only with SAS Grid Manager for Hadoop)

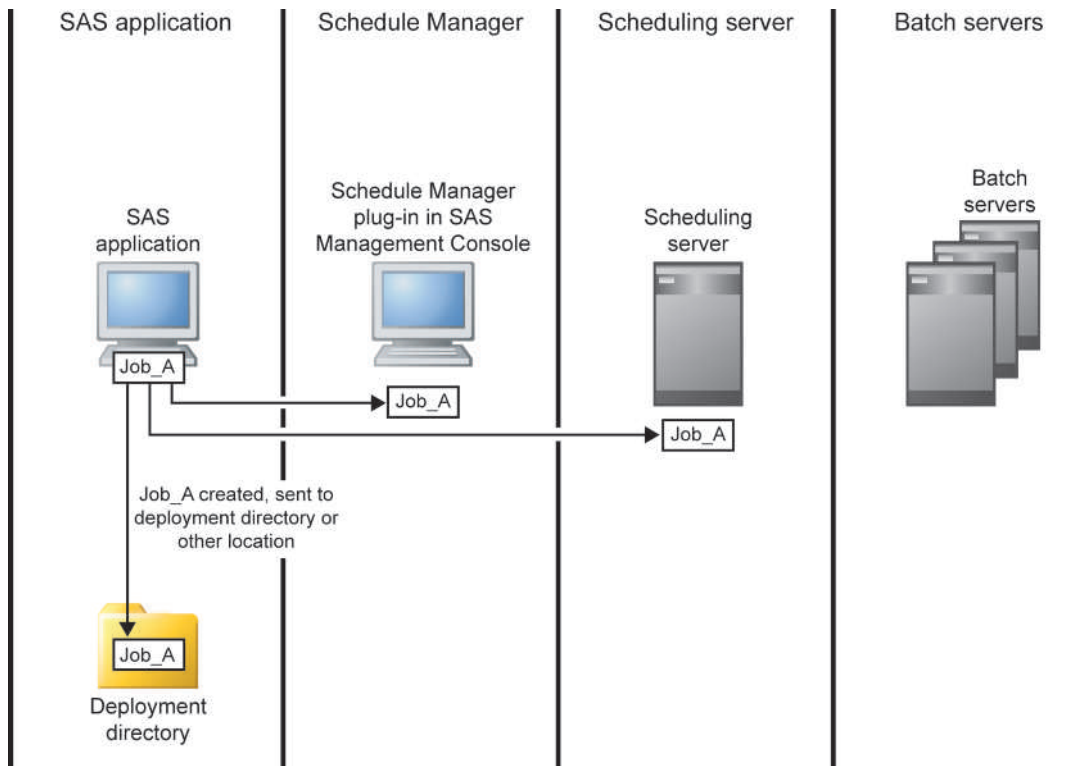
Batch server

This server provides the application-specific command that is needed to run the scheduled job. The command is run by the scheduling server when the specified scheduling conditions are met. Several types of batch servers are supported (Java batch server, SAS DATA step batch server, and generic batch server), each of which runs jobs from a specific SAS application or solution.

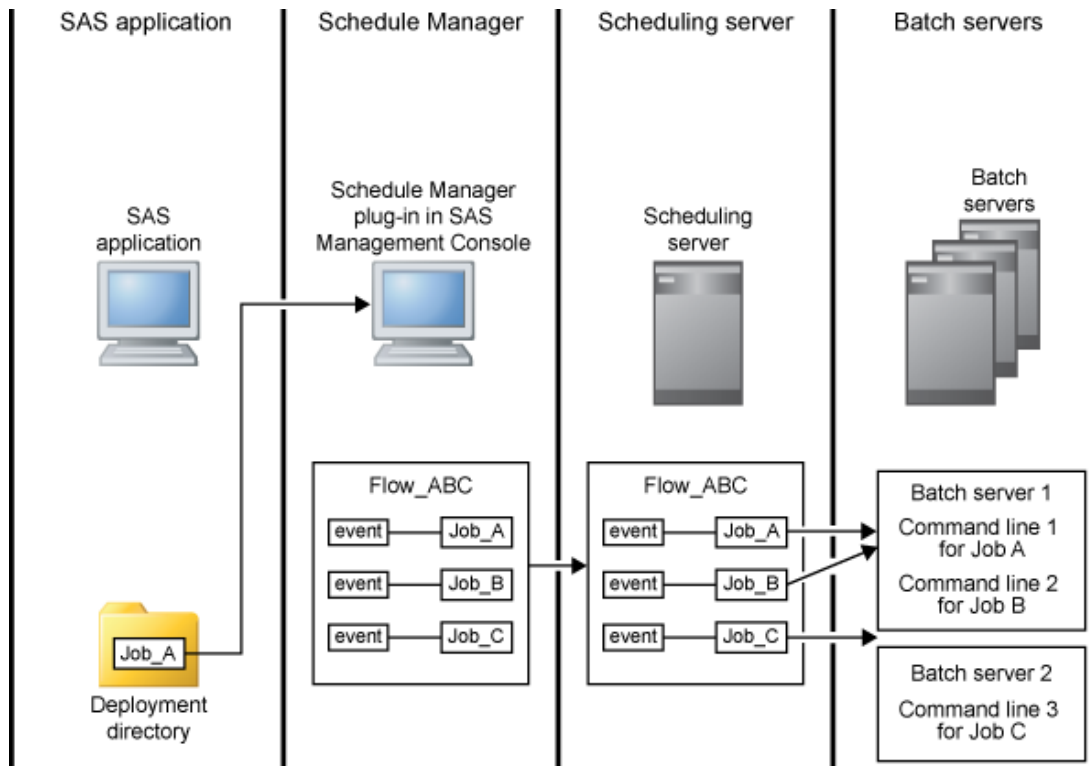
Overview of the Scheduling Process

The following example provides an overview of the scheduling process and how the components work together to generate, schedule, and run a job.

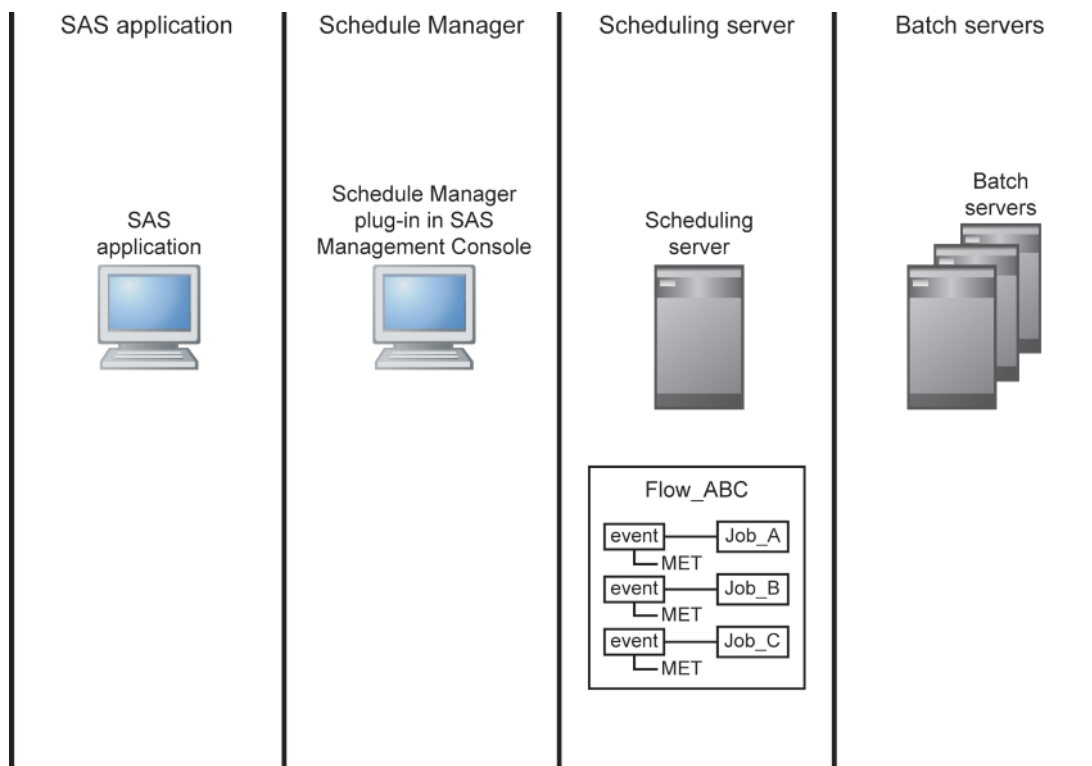
1. A SAS application (such as SAS Data Integration Studio) creates a job that needs to be scheduled. If the job was created by SAS Data Integration Studio, the job is placed in a deployment directory. If the job was created by SAS Marketing Automation, the job is sent either to the SAS Metadata Server (where the Schedule Manager can view it) or directly to the scheduling server (depending on the user's permissions). SAS programs and jobs from other applications are also sent to the SAS Metadata Server, where the Schedule Manager can access them.



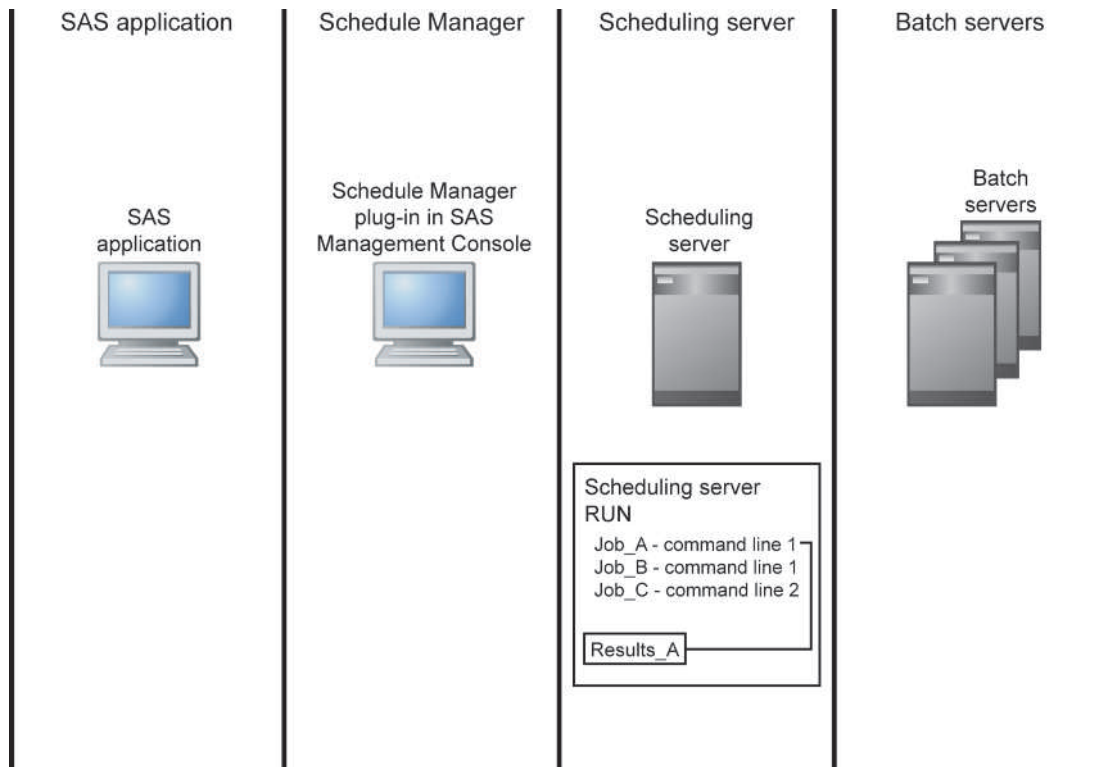
2. A user set up to administer scheduling can use the Schedule Manager plug-in in SAS Management Console to prepare the job for scheduling, or users can schedule jobs directly from other SAS applications. The job is added to a flow, which can include other jobs and events that must be met (such as the passage of a specific amount of time or the creation of a specified file). The Schedule Manager also specifies which scheduling server should be used to evaluate the conditions in the flow and which batch server should provide the command to run each job. The type of events that you can define depends on which type of scheduling server you choose. When the Schedule Manager has defined all the conditions for the flow, the flow is sent to the scheduling server, which retrieves the command that is needed to run each job from the designated batch server.



3. The scheduling server evaluates the conditions that are specified in the flow to determine when to run a job. When the events specified in the flow for a job are met, the scheduling server uses the command obtained from the appropriate batch server to run the job. If you have set up a recurring scheduled flow, the flow remains on the scheduling server and the events continue to be evaluated.



4. The scheduling server uses the specified command to run the job in the batch server, and then the results are sent back to the scheduling server.



About Scheduling Servers

Types of Scheduling Servers

SAS supports scheduling through these types of scheduling servers:

- SAS Job Flow Scheduler server
- Platform Process Manager server
- Operating system scheduling server
- Distributed In-Process scheduling server
- In-Process scheduling server
- Oozie scheduling server

The type that you choose depends on the level of scheduling functions your organization requires, the budget and resources available to support a scheduling server, and the applications that will be creating jobs to be scheduled. (The Oozie scheduling server also requires that you be using SAS Grid Manager for Hadoop.) When you create a flow in SAS Management Console's Schedule Manager, you specify which scheduling server the flow is to be associated with. Schedule Manager then passes the flow information to the appropriate scheduling server.

You can create a definition for a scheduling server by using the Server Manager plug-in in SAS Management Console or an application that directly schedules jobs.

The following topics contain an overview of each of the types of scheduling servers.

SAS Job Flow Scheduler Server

SAS Job Flow Scheduler enables users and applications to schedule flows that contain jobs. If SAS Grid Manager is installed and configured, SAS Job Flow Scheduler automatically sends the jobs from the flow to the grid. If the grid is not available, SAS Job Flow Scheduler automatically sends the jobs to the operating system.

SAS Job Flow Scheduler can be licensed separately for use on a single server. It is also included as part of SAS Grid Manager to enable scheduling of SAS jobs across multiple machines in a SAS Grid. You must perform additional tasks to install, configure, and maintain all components of SAS Grid Manager. However, the components that are included with the application also provide functions such as load balancing and the execution of jobs on a SAS Grid when used as part of SAS Grid Manager.

The metadata for a SAS Job Flow Scheduler server contains the name of the server.

Platform Process Manager Server

The Platform Process Manager server, which is part of Platform Suite for SAS, provides full-featured enterprise scheduling capabilities, including features such as workload prioritization and policy-based scheduling. The server enables you to schedule jobs using a variety of recurrence criteria and dependencies on other jobs, time events, or file events. You can use the Flow Manager application (also part of Platform Suite for SAS) to manage scheduled jobs, including deleting and stopping previously scheduled jobs.

Platform Suite for SAS can be licensed separately for scheduling on a single server. It is also included as part of SAS Grid Manager for Platform to enable scheduling of SAS jobs across multiple machines in a SAS Grid. It requires you to perform additional tasks to install, configure, and maintain all components of the application. However, the components included with the application also provide functions such as load balancing and the execution of jobs on a SAS Grid when used as part of SAS Grid Manager for Platform.

The metadata for a Process Manager Server includes the following information:

- the network address or host name of a machine
- the port number for the server

Operating System Scheduling Server

Operating system scheduling provides the ability to schedule jobs through the services provided through a server's operating system. Using operating system scheduling provides a basic level of scheduling at no additional cost, because the service is provided by software you already own. However, this type of scheduling does not support advanced scheduling capabilities, such as the use of many types of dependencies. The specific scheduling functions that are supported vary according to the operating system used, which can make it more difficult to set up consistent scheduling criteria on several servers. Managing scheduled jobs requires you to issue operating system commands, rather than using a graphical user interface.

The metadata for an operating system scheduling server includes the following:

- the network address of a machine
- the port number for the server

- the directory on the server where scheduled flows should be stored (control directory)
- the command to start a SAS session on the server

Distributed In-Process Scheduling Server

Distributed in-process scheduling provides basic scheduling services for scheduling jobs directly from certain SAS applications. The scheduling server also has the capability to schedule flows from the Schedule Manager plug-in for SAS Management Console. This type of scheduling server does not provide the control that is provided by the SAS Job Flow Scheduler server or the Platform Process Manager server, and because it is not scalable, it is not suitable for use with a grid. However, it offers basic scheduling capabilities without incurring any additional cost or requiring many installation or configuration tasks

In-Process Scheduling Server

In-process scheduling provides the ability to schedule jobs from certain web-based SAS applications without using a separate scheduling server. With in-process scheduling, the scheduling functions run as a process within the application. Although in-process scheduling is supported only for certain applications (such as SAS Web Report Studio), it offers basic scheduling capabilities without incurring any additional cost or requiring many installation or configuration tasks. Because an in-process scheduling server runs as part of the application, this type of scheduling also eliminates the need for the application to authenticate scheduled jobs to a separate server. However, the application must be running when the scheduled job attempts to run.

Oozie Scheduling Server

An Oozie scheduling server enables you to schedule jobs in a SAS Grid Manager for Hadoop environment. You can use this server to schedule SAS DATA Step Batch programs. You can specify a single time event as a trigger and specify only job events as dependencies within flows. Process flows only support AND conditions.

About Schedule Manager in SAS Management Console

The Schedule Manager plug-in for SAS Management Console is a user interface that enables you to create flows, which consist of one or more SAS jobs. A SAS job is any single command used to perform a batch task. Each job within a flow can be triggered to run based on criteria such as a date and time, the state of a file on the file system, or the status of another job within the flow. The available scheduling criteria depend on the type of scheduling server used.

The flows can include jobs that were created in SAS Data Integration Studio, SAS Marketing Automation, and SAS Web Report Studio. You can also use Schedule Manager to deploy and schedule SAS jobs that are independent of a specific SAS application.

Schedule Manager is designed as a scheduler-neutral interface. When you create a flow, you specify which scheduling server the flow is to be associated with. Schedule Manager

converts the flow information to the appropriate format and submits it to the scheduling server (a SAS Job Flow Scheduler server, the Platform Computing server, an operating system scheduling server, a distributed in-process scheduling server, or an Oozie scheduling server).

About Batch Servers

Batch servers provide the command needed to run the programs that have been submitted for scheduling. Several batch server types are supported, each of which provides the command to run a scheduled SAS job from a specific application in a specific environment. This command is included in the metadata definition for each server. The batch server's commands are independent of the type of scheduling server used.

Batch server metadata objects are components of the SAS Application Server (for example, SASApp) and can be created by using the Server Manager plug-in in SAS Management Console. Each batch server object includes the following attributes:

- the network address of the associated machine

Note: This address is for documentation purposes only. The batch job executes on the machine that is specified in the scheduling server's metadata.

- a command that runs in batch mode on the machine that is specified in the scheduling server's metadata

The following types of batch servers are supported:

SAS Java Batch server

is used for scheduling Java applications that are supplied by SAS and that are invoked and launched by the standard `java.exe` shell. This server definition is used for reports that are created by applications such as SAS Web Report Studio and campaigns created by SAS Marketing Automation. The subtype of the server specifies which Java application is invoked (for example, the **report** subtype runs **outputgen**, and the **marketing automation** subtype runs **malauncher**). Each SAS Java Batch server instance provides the command for a single application, so if you need to schedule jobs from multiple applications, you must configure a SAS Java Batch server for each application (for example, one server for SAS Web Report Studio and one for SAS Marketing Automation).

SAS DATA Step Batch server

is used for scheduling SAS programs that contain DATA step and procedure statements. These programs include jobs that are created in and deployed from SAS Data Integration Studio.

The metadata definition for a SAS DATA Step Batch server must include a SAS start command that will run in batch mode.

SAS Generic Batch server

supports scheduling jobs from SAS applications or solutions without requiring any knowledge of the command that is required to schedule the job. This type of server is used most often for scheduling jobs from SAS applications that are not specifically supported by the SAS Java Batch server types. If a SAS application adds support for scheduling jobs before a new type of SAS Java Batch server has been created, you can use the SAS generic batch server to provide a command to run jobs from the application. Because the server does not have any knowledge about the command

required by the application, the server cannot add command-line arguments (for example, to enable output logging).

About Scheduling Metadata

Overview of Scheduling Metadata

The SAS Metadata Server provides central storage and management of metadata about scheduling resources. Before you can use SAS scheduling, metadata must exist for the following resources:

- a scheduling server
- a batch server
- one or more deployment directories (required only for SAS DATA Step Batch servers)
- one or more jobs that have been deployed for scheduling

Scheduling servers and batch servers have been discussed in previous topics. Metadata definitions for deployment directories, jobs, and flows are described in the following topics.

About Deployment Directory Definitions

A deployment directory is a location on the file system of your SAS Application Server that contains a batch server. When a SAS Data Integration Studio user deploys a job for scheduling, a DATA step job is generated and placed in this directory. When the job is executed, the job information is read from this directory. The directory is also used when deploying SAS DATA step programs for scheduling from the Schedule Manager.

In order for SAS Data Integration Studio users to deploy jobs, a metadata definition for the deployment directory must exist in the metadata repository. The metadata definition includes the following information:

- the name of the SAS Application Server with which the directory is associated
- a name for the directory
- the path to the directory (either fully qualified or a relative path from the SAS Application Server)

About Job and Flow Metadata

Job metadata becomes available to the Schedule Manager when you use a SAS application such as SAS Data Integration Studio, SAS Web Report Studio, or the Schedule Manager plug-in in SAS Management Console to schedule a job. The job metadata includes the following information:

- the command that is to be used to execute the job
- the name of the SAS batch server that is associated with the job
- the deployment directory that is associated with the job (required only for SAS DATA Step Batch servers)

- the file name of the executable program (required only for SAS DATA Step Batch servers)

Flow metadata is created when you use Schedule Manager to create a flow and when you use SAS Web Report Studio to schedule a report. The flow metadata includes the following information:

- the name of the scheduling server that is to execute the jobs in the flow
- the triggers and dependencies that are associated with the jobs in the flow

Depending on the scheduling server that the user specifies, Schedule Manager converts the flow metadata to the appropriate format and submits it to the scheduling server. Flows that are created by SAS Web Report Studio are automatically directed to the Process Manager Server or the in-process scheduling server.

Chapter 2

Setting Up Scheduling Using SAS Job Flow Scheduler Scheduling

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About Scheduling with SAS Job Flow Scheduler

The SAS Job Flow Scheduler enables users and applications to schedule flows that contain jobs. When the flow is executed, the jobs are sent either to a SAS Workload Orchestrator grid or to the operating system scheduler. If SAS Workload Orchestrator is installed and configured, SAS Job Flow Scheduler automatically sends the jobs to the grid. If the grid is not available, SAS Job Flow Scheduler automatically sends the jobs to the operating system.

How Scheduling with SAS Job Flow Scheduler Works

The Scheduling Process

Scheduling with SAS Job Flow Scheduler uses three main components:

- the SAS Job Flow Scheduler service
- the SAS Job Flow Scheduler Orchestrator
- the SAS Job Flow Scheduler Trigger

When a flow is submitted for execution, the SAS Job Flow Scheduler service handles the request to schedule the flow. The service uses the configuration options and the parameters of the flow to determine what information to send to the SAS Job Flow Scheduler Orchestrator and the SAS Job Flow Scheduler Trigger.

The SAS Job Flow Scheduler Trigger service uses services in the operating system to start the flow.

- On UNIX, it uses crontab.
- On Windows, it uses the Windows Task Scheduler.

After the flow is started, the SAS Job Flow Scheduler Orchestrator service handles the execution of the jobs in the flow:

- If the grid is available, it sends jobs to the SAS Workload Orchestrator grid.
- If the grid is not available, it sends jobs to the operating system.

When the jobs are completed, SAS Job Flow Scheduler Orchestrator service returns the results.

Changes in SAS 9.4M8

The following changes are available starting with SAS 9.4M8 (or with a set of hot fixes for SAS 9.4M7).

The High Availability Feature

In SAS 9.4M7 or earlier, if the node that contains the SAS Job Flow Scheduler Trigger service fails, the following happens:

- Job flows that are scheduled in SAS Job Flow Scheduler are not passed to a new node.
- The job flows no longer run as scheduled.

Note: The failing node does not have to be the SAS Grid Manager controller node.

However, starting with SAS 9.4M8 (or with a set of hot fixes for SAS 9.4M7), you can enable high availability. Then, if one node fails, another node is available to continue running the job flows.

Important:

- Starting with SAS 9.4M8 (or with a set of hot fixes for SAS 9.4M7), SAS Job Flow Scheduler uses the Java Messaging Service (JMS) to queue requests between the two systems. JMS has replaced all use of TCP.
- On SAS 9.4M7 and earlier, SAS Job Flow Scheduler communicated between its scheduling server and the SAS® Web Infrastructure Platform Database via TCP connections on ports 1964 and 1981.

Here is how the process works: The high-availability environment uses a process called the OSTriggerService. SAS® Workload Orchestrator manages the OSTriggerService process. When this process fails, SAS® Workload Orchestrator restarts the OSTriggerService process for another node (or even the same node). Then the OSTriggerService process performs these actions:

1. Registers its node as the primary node for SAS Job Flow Scheduler.
2. Synchronizes the triggers of the scheduled flows to SAS Job Flow Scheduler on the current node, retrieving the trigger information from the WebDAV service in the SAS middle tier.

3. Starts listening for messages to schedule, unschedule, or reschedule flows.

For more information, see [“Enabling High Availability with SAS Job Flow Scheduler” on page 15](#).

The Launcher Server

Starting with SAS 9.4M8 (or with a set of hot fixes for SAS 9.4M7), SAS Job Flow Scheduler requires the Launcher Server in order to work. The Launcher Server must be running on all primary nodes in order for the OSTriggerService process to failover correctly.

The `launcher.sh` script starts the Launcher Server. The script is located in the `SASCONFIG/Levn/Launcher` directory.

You can also use this script to determine whether the Launcher Server is running. Issue the following command from the directory:

```
launcher.sh status
```

Summary of Setup Tasks

To enable scheduling with SAS Job Flow Scheduler, you must set up a scheduling server.

- You must include **SAS Job Flow Scheduler** and the **Web Infrastructure Platform Data Server** in your plan file.
- You must select **Web Infrastructure Platform Scheduling Services**, **SAS Job Flow Scheduler Server**, **SAS Job Flow Scheduler Orchestrator**, and **SAS Job Flow Scheduler Trigger** in the SAS Deployment Wizard.
- If you are using SAS Job Flow Scheduler in a grid, you must also include **SAS Grid Manager Control Server** in your plan file and select **SAS Workload Orchestrator** in the SAS Deployment Wizard.
- During installation, you must provide the name of the SAS Job Flow Scheduler server.

SAS Deployment Wizard@rdcesx01002

SAS Job Flow Scheduler Configuration
Specify the name and description for the Job Flow Scheduler.

Name:
Job Flow Scheduler - <server>

Description:
The Job Flow Scheduler schedules and orchestrates the flow of execution of jobs on the SAS Grid or

Help < Back Next > Cancel

Credentials to authenticate to SAS Workload Orchestrator are stored in either an authinfo file or in metadata. See [Client Authentication Using an Authinfo File](#) for more information about managing credentials in an authinfo file. You can use SAS Management Console, SAS Personal Login Manager, or SAS Enterprise Guide to manage the credentials stored in metadata. See the Online Help for these applications for more information about managing credentials in metadata.

Scheduling with SAS Job Flow Scheduler

After you install and configure SAS Job Flow Scheduling, you can use the scheduler in any application that supports SAS scheduling, including SAS Management Console Schedule Manager plug-in.

The scheduler does not support file events in flows.

Although you can use multiple time events as triggers for a flow, you cannot specify that all of the events must be true in order for the flow to be triggered.

These job dependencies are not supported:

- Job missed scheduled time
- Job fails to start
- Job cannot run

These subflow dependencies are not supported:

- Flow missed scheduled time
- Flow cannot run
- Flow runs more than
- Flow runs less than

In UNIX, end dates for time events are not recognized.

Enabling High Availability with SAS Job Flow Scheduler

Overview

High availability is supported for SAS Job Flow Scheduler in SAS 9.4M8 and, if you install the hot fixes, in SAS 9.4M7.

High availability is provided through primary host failover. See “[High Availability in SAS Grid Manager](#)” in *Grid Computing in SAS* for more information about high availability.

Enable High Availability in SAS 9.4M7

In order to use high availability with SAS Job Flow Scheduler in SAS 9.4M7, you must apply a set of four hot fixes.

Important: If you apply any of the hot fixes but do not apply all four, SAS Job Flow Scheduler does not work, even with high availability disabled.

See the installation instructions for the hot fixes for more information.

Enable High Availability in SAS 9.4M8

To enable high availability with SAS Job Flow Scheduler, complete the following steps:

1. Update the SAS Grid Manager configuration file.

Important:

- These fields impact all other services that are managed by SAS Grid Manager.
- These fields appear (and are set to default values) only after any service is added to SAS Grid Manager Grid.

- a. Open the SAS Workload Orchestrator Web Interface. See “[Accessing the SAS Workload Orchestrator Web Interface](#)” in *Grid Computing in SAS*.

Note: You must log on to the Web interface as a SAS grid administrator for the **Configuration** option to appear.

- b. Select **Configuration** in the left navigation area.
- c. On the Configuration page, select the **General** tab.
- d. In the **Service update (seconds)** field, enter **30**.
- e. In the **Service wait (seconds)** field, enter **60**.

- f. Select  to save the configuration change.
2. Define the OSTRiggerService process as a high-availability service.

Important: The Launcher Server must be running on all primary nodes in order for the OSTRiggerService process to failover correctly. For more information, see [“The Launcher Server” on page 13](#).

- a. On the Configuration page in the SAS Workload Orchestrator web interface, select the **Services** tab.
- b. Select **New service** and specify a name such as **OS Trigger Service**.
- c. In the **Number of instances** field, specify **1**.
- d. Select **Auto start**.
- e. Specify two or more hosts on which the service can run. You can specify values for **Host names** or **Host types**. You do not have to specify both fields.
- f. In the **Script file path** field, specify the complete path and file name for the OSTRiggerService script:


```
$grid_shared_directory/SASJFS/ostriggerservice.sh
```

where *\$grid_shared_directory* is the grid shared directory path.
- g. Specify the user ID and password under which the service runs.

Note: When High Availability is enabled, the unrestricted user account can be used only if that same user is running the SAS Workload Orchestrator handled process (OSTriggerService).
- h. Select  to save the configuration change.

For more details, see [“Defining High Availability Services on a SAS Grid Manager Grid” in *Grid Computing in SAS*](#).

3. Edit the ostriggerservice.sh script.
 - a. Locate the line that sets the **jmsUrl** value.
 - b. Update the value in the following way (all on one line):

```
jmsUrl="-jmsUrl failover:(tcp://middletierhost1:61616,
tcp://middletierhost2:61616)?randomize=false"
```

Where:

- *middletierhost1* is the middle-tier host on which JMS is running.
- *middletierhost2* is a second middle-tier host on which JMS is running, and it is available for failover if *middletierhost1* fails.

Note: If you have configured the JMS Broker for TLS, replace **tcp** with **ssl**. Here is an example: **jmsUrl="-jmsUrl failover:(ssl://middletierhost1:61616,ssl://middletierhost2:61616)?randomize=false"**. You must also update the value in SAS Management Console. See Step 6 of [“Configure TLS for the SAS JMS Broker Manually” in *SAS Intelligence Platform: Middle-Tier Administration Guide*](#).

- c. Save the file. The **jmsURL** value is automatically filled in the SAS Job Flow Scheduling server properties in Server Manager.

TIP To locate this value after it has been filled in, complete these steps:

1. In SAS Management Console, expand the **Server Manager** plug-in and navigate to the **SAS Job Flow Scheduling** server definition.
2. Select the **Options** tab to view the **JMS Naming Provider URL** field.

Chapter 3

Setting Up Scheduling Using Platform Suite for SAS

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About Platform Suite for SAS

Platform Suite for SAS is an integrated enterprise job scheduler from Platform Computing Corporation. Platform Suite for SAS is specifically designed to manage job flows that are generated by SAS software, and includes the following components:

Process Manager Server

controls the submission of jobs to Platform Load Sharing Facility (LSF) and manages all dependencies among jobs.

Platform 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 the SAS Management Console 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.

Platform Calendar Editor

is a scheduling client for a Process Manager Server. This client enables you to create new calendar entries. You can use it to create custom versions of calendars that are used to create time dependencies for jobs that are scheduled to run on the server.

Platform Load Sharing Facility (LSF)

handles the load balancing and execution of batch commands (which represent jobs). Platform LSF manages and accelerates batch workload processing for computer- and data-intensive applications. Process Manager Servers use Platform LSF for the execution of the jobs within a flow. You must install Platform LSF on all SAS batch servers as well as all other servers that will execute scheduled SAS jobs.

Summary of Platform Suite for SAS Installation and Configuration Tasks

To use the scheduling capabilities of Platform Suite for SAS, complete the following installation and configuration tasks:

1. Determine where to install Platform Suite for SAS.
2. Create the necessary users, groups, and logins.
3. Install Platform Suite for SAS.
4. Define the Process Manager Server (if it has not already been set up by the SAS Deployment Wizard).

Determining Where to Install Platform Suite for SAS

The first consideration when configuring scheduling using Platform Suite for SAS is where to install the software. The location that you choose affects the availability of scheduling functions as well as the ability to schedule jobs.

For scheduling on a single machine, install Platform Suite for SAS on a single machine in your network.

If you install a Platform LSF on more than one machine in your network, you must use SAS Grid Manager to configure the other machines to use for scheduling. Refer to *Grid Computing in SAS® 9.4* for more information about configuring scheduling in a grid environment.

If you are using a multi-tier configuration with SAS Data Integration Studio (consisting of a client tier, a middle tier running a web application server, and a server tier) and you want to schedule jobs from SAS Data Integration Studio as well as reports from SAS Web Report Studio, you must install the Platform Process Manager server and SAS Business Intelligence Report Services on the server tier.

If you are scheduling reports using SAS Web Report Studio, you must install the Platform Process Manager on the same system as SAS Business Intelligence Report Services. By default, SAS Business Intelligence Report Services is installed on the server tier. If you want to install it on a different machine, you must use a custom installation plan.

If you use both SAS Web Report Studio and SAS Data Integration Studio, Platform Process Manager and SAS Business Report Services must always be installed on the SAS Application Server tier, which contains a SAS Workspace Server and an object spawner.

Defining Users

In order to schedule jobs using Platform Suite for SAS, users must be defined (in the operating system of the server) and configured. The following table lists these users.

Table 3.1 *User Definition Summary*

User ID	Description	Locations	Permissions
any user ID that is an LSF administrator	Primary administrator for the Platform scheduling server; owns the Process Manager server	Created in operating system; must be part of Administrators Group	Must have full control of LSF and Process Manager directories; on Windows, must also have Act as part of operating system and Log on as a batch job user rights
any user ID that is an LSF user	User who has permission to schedule jobs using the Schedule Manager plug-in	Created in operating system; not required to be defined in metadata, but can be defined in metadata to avoid prompting for credentials; part of SAS Server Users Group	Must have the Log on as a batch job user right
lsfuser	Default user ID used by SAS Web Report Studio to schedule reports	Created in operating system; added in metadata as the login for the LSF Services group to support centralized password management	Must have the Log on as a batch job user right

Using Single Sign-on with Platform Suite for SAS

If you are using Release 10.1 or later of the Platform Suite for SAS, you can schedule jobs by using the single sign-on option. This option means you neither have to provide a password nor does a password have to be stored in metadata.

Note: Release 10.1 of the Platform Suite for SAS is available as of SAS 9.4M5.

Follow these steps to enable single sign-on for Platform Suite for SAS:

1. On the Process Manager server, update the file `js.conf`. Set the **JS_LOGIN_REQUIRED** parameter to false.
2. On the SAS Management Console machine, create a directory, referred to here as the *eauth* directory. The directory must meet the following criteria:
 - It must be in a location that is readable by Schedule Manager.
 - It must be created with Read access to all users.
3. In your environment, locate a Windows machine that is installed with an IBM Spectrum LSF Process Manager 10.1 (or later) client (that is, Flow Manager).
4. From the `%JS_ENVDIR%` directory on the Windows machine, copy the `lsf.conf` and `ego.conf` files to the *eauth* directory on the SAS Management Console machine.
5. From the `%JS_SERVERDIR%\..\etc` directory on the Windows machine, copy the `eauth.exe` file to the *eauth* directory on the SAS Management Console machine.

Note: Complete the following steps on the SAS Management Console machine.

6. Update the `sasmc.ini` file. Specify the following parameter:

```
-Dsas.sch.JSLoginRequired=eauth
```

Where *eauth* is the directory created in step 2.

7. Update the file `<SASHome>\SASManagementConsole\9.4\Config\security\login.config` where `<SASHome>` is typically located in the `C:\Program Files` directory. Add these lines:

```
eauth {
    com.platform.LSF.security.EauthLogin required ;
};
```

8. Create a connection profile for SAS Management Console in which the option **Use Integrated Windows authentication (single signon)** is selected.

Installation Considerations

Install Platform Suite for SAS on the scheduling server, using the installation documentation available from <http://support.sas.com/rnd/scalability/platform>. The following software will be installed:

- Platform Process Manager Server
- Platform Process Manager clients (Flow Manager and Calendar Editor)

- Platform LSF

Process Manager Server and Platform LSF must both be installed on the same machine. Platform LSF can also be installed on additional machines to support grid configurations. The Process Manager clients can be installed on any machine or machines.

When the Platform Process Manager Setup Wizard prompts for the owner of the Process Manager Server, specify the LSF administrative user. For Windows installations, be sure to specify the user's domain or, for local accounts, a dot (.) with the user ID.

When the installation process is complete, verify that the following services are running on the server, with the LSF administrative user as owner:

- LSF *cluster name* LIM
- LSF *cluster name* RES
- LSF *cluster name* SBD
- Process Manager

Note: For report scheduling to work, Platform LSF must be installed on the same machine as SAS Business Intelligence Report Services.

Migration Considerations

If you install a version of Platform Suite for SAS on a different server than the previous version was installed on, you must manually copy the Process Manager calendar metadata to the new location. To copy the calendar metadata, install Platform Suite for SAS in the new location and then follow these steps:

1. Log on to the old Process Manager server.
2. Change to the **JS_TOP/work/calendar** directory. JS_TOP corresponds to the Platform Process Manager installation directory.
3. Copy all files except those ending in “**sys**” from this directory to the **JS_TOP/work/calendar** directory on the new server.

Resolving Issues Related to Scheduling with Platform Suite for SAS

Check Error Messages in Platform Flow Manager

Platform Flow Manager enables you to view status and other information about the jobs that have been scheduled on Platform scheduling servers. To view error messages in Platform Flow Manager, follow these steps:

1. Open Platform Flow Manager on the scheduling server. On Windows systems, click **Start** ⇒ **All Programs** ⇒ **Platform Process Manager** ⇒ **Flow Manager**.
2. Log on as the scheduling user. You might need to include a domain name or machine name with the user ID.

3. On the left pane of Flow Manager, expand the folder for the scheduling user. If you selected **Run Now** when you scheduled the report, the job will be in a folder called **adhoc**. In the folder, look for the most recently scheduled flow. If the job failed, its name might include (**Exit**).
4. Double-click on the flow name (for example, **1 (Done)**). An icon for each job in the flow will appear in the right pane. A red icon indicates that errors occurred, and a blue icon indicates that the job was successful.
5. Right-click the icon in the right pane, and select **View History**.

Note: You can also examine the contents of logs in the LSF directory.

Resolving Issues on Windows Related to Scheduling with Platform Suite for SAS

To properly install Platform Suite for SAS on Windows systems, you must supply a valid user ID and password to run and administer the services. The user ID that is used to run the installation program must have **Act as part of the operating system** privileges. The user ID that you specify to run the services must have **Log on as a batch job** privileges. Issues can occur if this user does not have the required privileges, if the user's password has expired, or if the wrong domain name is provided.

One simple way to test the domain, user, and password is to do the following:

1. Bring up a DOS command prompt or select **Start** ⇨ **Run**.
2. Enter the **runas** command using the following syntax to bring up a new DOS prompt running under the other user ID:


```
>runas /user:DOMAIN\userid cmd
```
3. Enter the password. If the user ID authenticates successfully, a new DOS command prompt appears.

From the new DOS command prompt, you can run the various scheduled commands that are failing. If the commands succeed when they are entered at the prompt, this indicates that there are some issues with the scheduling setup. If the commands fail, then additional information might appear in the DOS command window to help you determine the problem.

In a multi-user environment, in which more than one user is submitting and running flows, the appropriate permission settings must be in place on certain folders. The Platform scheduling server folders should already have the correct permissions set for the scheduler service and administrator accounts and should need no further changes. Make sure that the following files installed by LSF have the following permissions (LSF_TOP corresponds to the LSF installation directory, such as **C:\lsf_10.0**):

Table 3.2 Permissions for Files Installed by LSF

Folder	User Group	Permissions
LSF_TOP\work	LSF service accounts	Full control (All)(All)
LSF_TOP\work	LSF administrators	Full control (All)(All)
LSF_TOP\work	Everyone	Special access (R)(R)

Folder	User Group	Permissions
LSF_TOP\logs	LSF service accounts	Full control (All)(All)
LSF_TOP\logs	LSF administrators	Full control (All)(All)
LSF_TOP\logs	Everyone	Special access (R)(R)
LSF_TOP\conf\lsfuser.passwd	Job scheduler service accounts	Special access (R)(R)

Make sure that the files installed by Platform scheduling servers have the following permissions (JS_TOP corresponds to the Platform Process Manager installation directory):

Table 3.3 Permissions for Files Installed by the Platform Scheduling Server

Folder	User Group	Permissions
JS_TOP\work	LSF service accounts	Full control (All)(All)
JS_TOP\work	JS administrators	Full control (All)(All)
JS_TOP\work	Everyone	Special access (R)(R)
JS_TOP\log	JS service accounts	Full control (All)(All)
JS_TOP\log	JS administrators	Full control (All)(All)
JS_TOP\log	Everyone	Special access (R)(R)

Resolving SAS Exit Behavior When Using Platform Suite for SAS

During the installation process, the SAS Deployment Wizard creates a script called **sasbatch** in the following path:

SAS-config-dir\Lev1\SASApp\BatchServer

As a default, deployed jobs run using this script.

If you are not using this script, then the Platform scheduling server will report your SAS jobs as completing with a status of **Exit** instead of **Done**. This situation occurs because Platform scheduling servers treat any nonzero exit code as **Exit** instead of **Done**.

To resolve this issue, you can use the **sasbatch** script that was created by the SAS Deployment Wizard. If you are using a different script, you can modify the script to prevent the error in the following ways.

To use a job starter on Windows installations, modify your script as follows:

```
rem This program is just used as a wrapper script to invoke the sas.bat
rem at the Application level
rem It is here in case there is common processing that you want to add
rem when sas is invoked specific to running this script.
```

```

rem
rem Variables Used:
rem
rem $APPSERVER_DIR$=D:\SAS\config\Levl\SASMain

cd /D D:\SAS\config\Levl\SASMain

if not {%username%}=={} (
call sas.bat %*%
)else(
call sas.bat -sasuser work %*%
)
set rc=%ERRORLEVEL%
if %rc%==1 goto makenormalexit
exit /b %rc%
:makenormalexit
exit /b 0

```

For UNIX installations, edit the script as follows:

```

# Comment out exec line to allow the return code to be captured
# eval exec $cmd

# Add this code to capture exit=1 (SAS warning) and make it exit=0
eval $cmd
rc=$?
if [ $rc -eq 1 ]; then
    exit 0
else
    exit $rc
fi

```

Resolving Calendar Issues When Using Platform Suite for SAS

If you use the Calendar Editor to create a specific date calendar, the date of the first occurrence cannot be later than the end of the year that follows the current year. If you create a specific date calendar that violates this behavior, Process Manager fails with an exception message.

For example, if the current year is 2017, any specific date calendar that you create must have its date of first occurrence on or before 31 December 2018. You can set subsequent dates in the calendar as far ahead as you need.

Using Platform Suite for SAS with z/OS

Overview

Platform Process Manager works with IBM z/OS systems through file transfer protocol (FTP) technology. Platform Process Manager uses FTP to submit a proxy job to the z/OS system. You can then use FTP to monitor the progress of the job. To set up scheduling with a z/OS system, you must verify that the JCL that is submitted with each job is correct for your system.

You cannot suspend or resume jobs that run on z/OS systems.

Configuring Scheduling on z/OS with Platform Suite for SAS

To configure your environment for using Platform Suite for SAS with a z/OS system, follow these steps:

1. If your z/OS configuration uses a configuration other than the default, you must modify the template file.
2. Copy the **zos_Template.xml** file from the JS_TOP/7/examples directory to the JS_TOP/work/templates directory. JS_TOP corresponds to the Platform Process Manager installation directory.
3. Make any modifications to **zos_Template.xml** to match your system configuration.
4. Edit the **zos.conf** file, which is located in the JS_TOP/conf directory. This file contains configuration settings for your FTP environment.
5. Define a batch server, specifying z/OS as the subtype.

Canceling Scheduled Jobs in z/OS Systems under Windows

If Platform Suite for SAS is installed on a Windows system, you must use a queue, rather than Flow Manager, to cancel a scheduled job on a z/OS system. An administrator creates a queue that contains the job to be canceled and submits the queue to the z/OS system using FTP. The queue must contain a TERMINATE job control and the path to the script that cancels the job. An example queue is as follows:

```
Begin Queue
QUEUE_NAME=zos_jobs
DESCRIPTION=Cancel zOS jobs
JOB_CONTROL=TERMINATE[C:\pm\10.1\etc\zos -k]
End Queue
```


Chapter 4

Setting Up Scheduling Using Operating System Scheduling

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About Operating System Scheduling

An operating system scheduling server provides a method for scheduling SAS jobs without licensing and installing Platform Suite for SAS. Flows that are sent to the server are run using the scheduling commands that are built into the server's operating system.

The process of deploying and scheduling jobs and flows is the same whether you are using an operating system scheduling server or a Platform Process Manager server, although the two servers use different processes when running scheduled flows.

However, there are some limitations in the capabilities of operating system scheduling servers as compared to a Process Manager server. You must use operating system commands instead of the Flow Manager for operations such as stopping or deleting a scheduled flow.

Note: SAS Web Report Studio does not support operating system scheduling.

Capabilities and Limitations of Operating System Scheduling Servers

For specific information about the scheduling capabilities and limitations for each operating system, see the following topics:

- [“Limitations of Windows Operating System Scheduling Servers” on page 34](#)
- [“Limitations of UNIX Operating System Scheduling Servers” on page 35](#)
- [“Limitations of z/OS Operating System Scheduling Servers” on page 35](#)

Summary of Setup Tasks

To enable operating system scheduling, you must have a scheduling server. If you use the SAS Deployment Wizard to install and configure an operating system scheduling environment, all required items are automatically configured. You must include **Operating System Services Scheduling Server 9.4** and **SAS DATA Step Batch Server 9.4** in your plan file and select these two items in the SAS Deployment Wizard.

The setup tasks are as follows:

1. Assign local administration rights to users (Windows only).
2. Assign directory and file permissions.
3. Define an operating system scheduling server.
4. Assign a spawner to the operating system scheduling server.

Step 1: Assign Local Administration Rights to Users (Windows Only)

On Windows systems, the user ID under which the job will be run must have **Local Administration** rights on the scheduling server. To grant these rights, add the user to the Administrators Group.

This task is performed automatically by the SAS Deployment Wizard.

Step 2: Assign Directory and File Permissions

You must assign operating system Read and Write permissions to the following directories:

Windows:

- `sas-config-dir/Lev1/SchedulingServer`
- `sas-config-dir/Lev1/SchedulingServer/logs`
- `sas-config-dir/Lev1/SchedulingServer/sasuser`

UNIX and z/OS:

- `sas-config-dir/Lev1/SchedulingServer`
- `sas-config-dir/Lev1/SchedulingServer/logs`
- `sas-config-dir/Lev1/SchedulingServer/sasuser`

Note: You can use either forward or backward slashes on Windows systems.

You must also assign Execute permission to `sas-config-dir/Lev1/SchedulingServer/SchedulingServer.bat` (Windows) or `sas-config-dir/Lev1/SchedulingServer/SchedulingServer.sh` (UNIX and z/OS).

This task is performed automatically by the SAS Deployment Wizard.

On UNIX systems, verify that the **at** command is enabled for use by the scheduling server's user ID. To determine whether the command is enabled, run a test of the **at** command. Here is an example test:

```
echo touch /tmp/attest | at now
sleep 5
ls /tmp/attest
```

If the **at** command is not enabled, contact your system administrator to grant the scheduling server's user ID permission to use it.

If you are using operating system scheduling with SAS Model Manager on UNIX, you must make these permission changes:

- The user scheduling jobs on SAS Model Manager must have Execute permission on the file `[config_path]/Lev1/Web/Applications/SASWIPSSchedulingServices9.4/servicetrigger`.
- Permissions on the directory containing the file `gemfire.log` must be changed to `drwxrwxrwx`.

Step 3: Define an Operating System Scheduling Server

Define an operating system scheduling server in the metadata repository. This task is performed automatically by the SAS Deployment Wizard. When created, the server definition has the following properties:

SubType

Specifies the operating system being used for scheduling

Control Directory

Contains the path for the directory that will store the script for executing a flow. For a default installation, the directory is *sas-config-dir/Lev1/SchedulingServer*.

Command

The appropriate SAS command for starting the scheduling server. Sample commands are as follows:

- Windows:
`"sas-config-dir\Lev1\SchedulingServer\Schedulingserver.bat"`
- UNIX:
`"sasc-config-server/Lev1/SchedulingServer/schedulingserver.sh"`
- z/OS:
`sas-config-dir/Lev1/SchedlingServer/SchedulingServer.sh`

Object Server Parameters

applevel=2

Authentication Domain

DefaultAuth

Host Name

The name of the machine that hosts the scheduling server.

Port

8451

Step 4: Assign the Operating System Scheduling Server to a Spawner

Associate the operating system scheduling server with a spawner definition. This task is performed automatically by the SAS Deployment Wizard. However, if you need to perform this task manually, follow these steps:

1. In SAS Management Console, right-click the spawner that is associated with the same application server on which you defined the scheduling server (for example, **SASApp Spawner**), and select **Properties**.
2. In the Spawner Properties dialog box, select the **Servers** tab.
3. From the **Available Servers** list, select the operating system scheduling server and move it to the **Selected Servers** list.
4. Restart the spawner.
5. Click **OK**.

This task is performed automatically by the SAS Deployment Wizard.

You can now use Schedule Manager in SAS Management Console to schedule flows. See the following topics:

- [“Using Operating System Scheduling on Windows Systems” on page 33](#)

- “Using Operating System Scheduling on UNIX Systems” on page 34
- “Using Operating System Scheduling on z/OS Systems” on page 35

Using Operating System Scheduling on Windows Systems

How Operating System Scheduling Works on Windows Systems

When you schedule a flow using a Windows operating system scheduling server, Schedule Manager creates a script file called *flowname.vbs*.

The script file and the job status information are written to the path *outdir\user-name\flowname*, where *outdir* is the value of the Control Directory attribute in the operating system scheduling server definition.

The path must be a valid Windows path. Valid Windows paths include relative paths, Universal Naming Convention (UNC) paths (for example, *\\server\volume\directory*), and mapped paths. If the path is invalid, or if it points to a file instead of a directory, then an error message is written to the SAS log.

Manually Submitting a Flow for Execution on a Windows Operating System Scheduling Server

If you need to manually submit a flow that has been scheduled on a Windows operating system, you can do any of the following:

- Execute the generated script *flowname.vbs*. The file is located in the following path:

outdir\user-name\flowname

Either double-click the file name in Windows Explorer, or execute it from a command prompt.

- Use the Windows Task Scheduler to manually schedule the script. To access the Task Scheduler, select **Scheduled Tasks** on the Control Panel. You can also use the **schtasks** command line interface to surface many functions of the Task Scheduler.
- Use the **at** command to manually schedule the script. The capabilities of this command are more limited than those of the Task Scheduler. See your operating system documentation for details.

Manually Canceling a Scheduled Flow on a Windows Operating System Scheduling Server

If you need to manually cancel a flow that has been scheduled on Windows, you can do either of the following:

- Use the Windows Task Scheduler to cancel the job.
- Use the **/del** option of the **at** command. You can use this method only if the job was submitted manually with the **at** command.

After a scheduled flow has been canceled, you can remove the script that was created for the flow.

Limitations of Windows Operating System Scheduling Servers

Jobs in a flow are run sequentially so that the status of each job can be logged in the status file.

The user ID under which the job will be run must have **Local Administration** rights. To grant these rights, you must add the user to the Administrators Group.

The following types of trigger events are not supported on Windows:

- **Skip interval** is greater than 1 and the interval type is Monthly or Yearly.
- **Last Day** is selected and the interval type is Monthly or Yearly.

If you specify one of these triggers, then a script is created. However, the script is not submitted for execution, and an error message similar to the following is written to the log:

```
ERROR: One or more flows were not successfully scheduled.
ERROR: triggeroption is currently not supported for
intervaltype events on Windows systems
```

Always test the command that is contained in a job before you schedule the job.

Using Operating System Scheduling on UNIX Systems

How Operating System Scheduling Works on UNIX Systems

When you schedule a flow using a UNIX operating system scheduling server, Schedule Manager creates the following files:

- a flow command script called *flowname_unique_suffix.sh*
- a log for the submitted script, called *flowname_unique_suffix.log*

The files are written to the path *outdir/username/flowname*, where *outdir* is the value of the Control Directory attribute in the operating system scheduling server definition.

Since the scheduler does not delete either of these files, you must delete them manually when they are no longer needed. Any user that schedules a flow will need Read and Write permissions to both the *outdir* directory and the log.

Manually Submitting a Flow for Execution on a UNIX Operating System Scheduling Server

If you need to manually submit a flow that has been scheduled on a UNIX operating system scheduling server, follow these steps:

1. Change to the directory where the file *flowname.sh* is located.
2. Enter **sh flowname.sh now** at the UNIX shell prompt.

The user that scheduled the flow is also permitted to submit the flow manually.

Manually Canceling a Scheduled Flow on a UNIX Operating System Scheduling Server

If you need to manually cancel a flow that has been scheduled on a UNIX operating system scheduling server, follow these steps:

1. Open the file *flowname.log*, and find the job identifier for the job that you want to cancel. The log will contain a separate job identifier for each date and time that the flow is scheduled. Here is an example:

```
05/04/20 14:57:30 Flow DailyTestFlow starting
commands will be executed
using /bin/ksh
job 1114107300.a at Wed Jun 23 17:02:00 2008
```

2. At the UNIX shell prompt, enter **at -l**.

Scheduled jobs will be displayed in the following format:

```
1114107300.a Wed Jun 23 17:02:00 2008
```

3. Enter the following command at the UNIX shell prompt, where *job-id* is the identifier of the job that you want to cancel: **at -r job-id**.

For example, if the job identifier is 1114107300.a, enter **at -r 1114107300.a**.

Limitations of UNIX Operating System Scheduling Servers

Jobs in a flow are run sequentially so that the status of each job can be logged in the status file.

On UNIX operating system scheduling servers, SAS 9.4 supports the scheduling of flows that have a single time event as a trigger.

Using Operating System Scheduling on z/OS Systems

Limitations of z/OS Operating System Scheduling Servers

On z/OS operating system scheduling servers, SAS 9.4 supports the scheduling of flows that have a single time event as a trigger. The jobs in a flow are submitted to the Job Entry Subsystem (JES) for execution in an asynchronous manner.

How Operating System Scheduling Works on z/OS Systems

When you schedule a flow, Schedule Manager creates the following files:

- a REXX program called **RunFlow_yyyyymmddhhmmsssss.rex**, which submits each batch job to run on the requested schedule.
- a file called *jobname.status*, which contains information about the status of the job.
- the following files, each of which invokes the REXX program to log the job status:

- **logstart_jobname**, which is executed as the first step of each job
- **logend_jobname**, which is executed as the last step of the job if all previous steps have a return code of 0
- **logfail_jobname**, which is executed as the last step of the job if any of the previous steps has a return code other than 0
- **flowname.cmd**, which contains the statements that execute the program for the flow. This file is passed to the **at** command to be executed when the time event trigger occurs.
- **flowname.lock**, which serializes the execution of the REXX exec by simultaneously executing jobs.
- **flowname.log**, which contains the log information for the flow.
- **flowname.status**, which contains the current status of the flow.

The files are written to a subdirectory called *username/flowname* in the Control Directory that was specified in the operating system scheduling server definition, where *username* is the identity that scheduled the flow.

Manually Submitting a Flow for Execution on a z/OS Operating System Scheduling Server

Note: On z/OS, unexpected results can occur if you manually submit a flow without having selected **Manually Schedule** when you scheduled the flow.

If you need to manually submit a flow that has been scheduled on a z/OS operating system scheduling server, follow these steps:

1. Change to the directory where the flow's files are located (*/outdir/username/flowname*), where *outdir* is the value of the Control Directory attribute in the operating system scheduling server definition.
2. At the prompt, enter a command with the following syntax:

```
RunFlow_yyyyymmddhhmmsssss.rex <runonce|start>
```

Specify **runonce** if you want to run the flow just once, or specify **start** if you want to resume a recurrence that was specified for the flow.

Canceling a Scheduled Flow on a z/OS Operating System Scheduling Server

If you need to cancel a flow that has been scheduled on a z/OS operating system scheduling server, follow these steps:

1. At the prompt, enter **at -l**.

Note: Enter a lowercase L, not the numeral 1.

A list of jobs appears, as in the following example:

```
1116622800.a  Fri May 20 17:00:00 2005
1116734400.a  Sun May 22 00:00:00 2005
1116820800.a  Mon May 23 00:00:00 2005
1116620801.a  Mon May 23 00:00:00 2005
1117029000.a  Wed May 25 09:50:00 2005
```

2. For each job that you want to cancel, enter the following command at the USS prompt: **at -r at-jobid**, where *jobid* is the first part of each line of the list of jobs (for example, **at -r 1116622800.a**).

Chapter 5

Setting Up Scheduling Using SAS Distributed In-Process Scheduling

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About Distributed In-Process Scheduling

Distributed in-process scheduling provides basic scheduling services for scheduling jobs directly from certain SAS applications (such as the SAS Web Infrastructure Platform and SAS Visual Analytics Designer). Communication with SAS applications takes place by posting messages and receiving results on Java Messaging Service (JMS) queues. The scheduling server also has the capability to run jobs from the Schedule Manager plug-in for SAS Management Console by using the appropriate Java command if the jobs are not scheduled by a SAS application.

Note: Distributed in-process scheduling does not support subflows.

How Distributed In-Process Scheduling Works

Jobs that are scheduled by the distributed in-process scheduler fall into two groups:

- jobs that can be run by a normal SAS process
- jobs that can be run by a SAS application that works with distributed in-process scheduling

Jobs that are executed by a SAS process run like jobs in other types of schedulers. When the Distributed In-Process scheduler determines that it is time for the job to run, the scheduler uses a command-line job runner to issue the SAS command to run the job.

Note: Jobs that are sent to the command-line job runner run as the user of the distributed in-process scheduling server process, rather than as the user that scheduled the flow. Jobs that are sent to applications are run using the application's submission methods. Jobs sent from SAS Visual Analytics Designer run as the submitting user.

Certain SAS applications can tag a job that is sent to the scheduler to indicate that the job can be run by the application. When the Distributed In-Process scheduler determines that it is time for the job to run, it adds the job to the JMS queue. The middle tiers for the application, which are checking the jobs in the JMS queue, recognize the submitted job and perform the execution. The application that runs the job can be on any machine.

Summary of Setup Tasks

To enable distributed in-process scheduling, you must have a distributed in-process scheduling server and JMS Queue Manager. If you use the SAS Deployment Wizard to install and configure the Job Execution Service, the scheduling server and the queue manager are automatically configured.

Tuning a Distributed In-Process Scheduling Server

Because the distributed in-process scheduling server and the JMS queue manager are automatically configured, the default configuration values are acceptable for most situations. However, you can use these tips to optimize the performance of distributed in-process scheduling:

- If flows are not completing because of competition with new flows, reduce the value of the **Max running flows** field on the Operation Options dialog box.
- If the distributed in-process scheduling server or the job runners cannot keep up with the number of jobs running, reduce the value of the **Max running jobs** field on the **Options** tab.
- If too much disk space is being taken up by flow histories, reduce the value of the **Max histories per flow** field on the **Options** tab. You also might want to reduce this value if users do not want to see a large number of histories.
- If your flows need to be highly responsive to file changes that are used as file events, reduce the value of the **File trigger/condition check frequency** field on the Operation Options dialog box. If your flows contain a large number of file events, you might want to increase the value in order to reduce the amount of time that the system takes to poll the file system for changes.

Use these tips to optimize processing of jobs that use the default job runner (jobs that are executed by a SAS process):

- If the jobs that are scheduled are CPU-intensive, lower the value of the **Max simultaneous jobs** field on the **Options** tab of the Properties dialog box.
- If you have defined multiple distributed in-process scheduling servers, decrease the value of the **Max simultaneous jobs** field on all server definitions.
- If you want the job runner to check more often for jobs that are waiting to be run, reduce the value of the **Polling frequency** field on the Renderer Options dialog box. Increase this value if you want to reduce the amount of overhead used by the job runner.
- If you want to increase the amount of time before getting a new job, increase the value of the **Max wait time** field on the Renderer options dialog box.

- If the jobs are not CPU-intensive, the job runner can start processing new jobs more quickly, so you can increase the value of the **Job count before wait** field on the Renderer options dialog box.
- If the jobs are CPU-intensive, increase the wait time for each job by increasing the value of the **Base wait time** field on the Renderer options dialog box.

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Setting Up Scheduling Using SAS In-Process Scheduling

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About In-Process Scheduling Servers

If you are scheduling jobs from applications such as SAS Web Report Studio, you can use in-process scheduling. An in-process scheduling server runs as a process inside SAS Web Report Studio, which eliminates the need to send the jobs to an external scheduling server. The in-process server is installed as part of the SAS Web Report Studio installation, which eliminates the need to install, maintain, and license separate scheduling servers. In addition, using an in-process scheduling server simplifies authentication, because scheduled jobs do not have to be authenticated to an external scheduling server. When using in-process scheduling, you schedule jobs from within your application, rather than using the Schedule Manager plug-in.

In-process scheduling servers are supported only in SAS Web Report Studio.

Limitations of In-Process Scheduling

If you are using a release of SAS Web Report Studio prior to version 4.3, in-process scheduling within SAS Web Report Studio works with a single execution instance of SAS Web Report Studio. It cannot be used in a web cluster. If your environment includes multiple instances of SAS Web Report Studio, you should have only one instance of SAS Web Report Studio running in a cluster in order to use in-process scheduling.

If you are using version 4.3 or later of SAS Web Report Studio, in-process scheduling in a clustered environment is supported by default.

A maximum of five scheduled jobs can be simultaneously running when using in-process scheduling within SAS Web Report Studio. Any additional jobs are automatically placed in a queue and run when one of the running jobs completes. To

change the number of scheduled jobs that can run simultaneously, specify the number in the SAS Web Report Studio property

`wrs.scheduling.inProcess.maxSimultaneousJobs`.

Setup Tasks

To set up an in-process scheduling server, install and deploy SAS Web Report Studio. The installation and configuration procedure automatically installs and configures the in-process server. While using the SAS Deployment Wizard, you must specify whether you will use an in-process server or a Platform Computing server to schedule reports.

After you have installed SAS Web Report Studio and the in-process server, you must create a metadata definition for the in-process server.

1. In SAS Management Console, right-click the Server Manager and select **Actions** ⇒ **New Server**.
2. On the first page of the New Server Wizard, under Scheduling Servers, select **SAS In-Process Services**. Click **Next**.
3. In the following pages of the wizard, provide a name and description for the server and then verify the server version.
4. On the final page, review the settings and click **Finish**.

You must define only a single in-process scheduling server. Using multiple servers will cause errors when you attempt to schedule a report.

Configuration Options in a Clustered Environment

If you are using version 4.3 or later of SAS Web Report Studio, support for a clustered environment is provided by default. However, you might want to change configuration options if you have port conflicts or you are using a non-clustered environment. Follow these steps to change the configuration options:

1. In SAS Management Console, expand the **Plug-ins** ⇒ **Configuration Manager** ⇒ **SAS Application Infrastructure** folder. Right-click the Web Report Studio 4.3 folder and select **Properties**. The Web Report Studio 4.3 Properties window appears.
2. Click the **Settings** tab.
3. If you are using a clustered environment and have port conflicts, select different ports in the three **Cluster Scheduling Port** fields.
4. If you are using a non-clustered environment, you can improve performance by changing the value of the **Web Container is Clustered** field to **No**. However, a value of **Yes** is valid for both clustered and non-clustered environments.

Note: If you are using a clustered environment, the value of this field must be set to **Yes**.

5. When you have finished making configuration changes, close the Web Report Studio 4.3 Properties window. The changes will take effect the next time SAS Web Report Studio is started.

Using In-Process Scheduling

After you have defined the in-process scheduling server in SAS Management Console, SAS Web Report Studio users can start to schedule reports. If users are authorized to schedule reports inside SAS Web Report Studio, they can set up the report schedule and submit the report for scheduling. See *SAS® Web Report Studio: User's Guide* for more information about scheduling reports.

Chapter 7

Setting Up Scheduling Using Oozie Scheduling

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About Oozie Scheduling

An Oozie scheduling server provides scheduling capabilities for SAS Grid Manager for Hadoop installations. You can use the Oozie scheduling server to schedule flows containing SAS DATA step jobs. When a deployed flow is scheduled, it generates these two XML files:

workflow file

contains a list of tasks that must be performed for the scheduled job

coordinator file

contains the triggers that control when the job is to be run

These files are stored in HDFS locations specified in the Oozie scheduling server definition when running the SAS Deployment Wizard. Oozie uses these files to run the scheduled job at the specified time and returns the results.

Capabilities and Limitations of Oozie Scheduling Servers

The following limitations apply to Oozie scheduling:

- Only SAS DATA step batch programs can be scheduled.
- Only a single time event can be specified as a trigger for the job.

- Subflows are not supported.
- Only AND conditions are supported in process flow diagrams.
- Job events are the only supported type of dependency for a scheduled flow.
- Deployed flows cannot be unscheduled in the Schedule Manager plug-in, and flow history is not available.
- Jobs deployed to HDFS or MAPRFS cannot be exported.

Setting Up Scheduling with Oozie Scheduling Servers

Summary of Setup Tasks

1. Set up Oozie in Hadoop.
2. Set up Oozie scheduling server in the SAS Deployment Wizard.

Configuring the Hadoop Environment

In order to use Oozie scheduling with SAS Grid Manager for Hadoop, Oozie must be installed on your Hadoop cluster. After Oozie is installed, you must complete these tasks:

1. Create a user definition in SAS metadata for the Oozie system user.
2. Create a home directory in YARN for the system user by specifying the value of the `yarn.nodemanager.user-home-dir` property. For example, in Cloudera manager, select **Yarn** ⇒ **Config** ⇒ **Node Manager Default Group** ⇒ **Advanced**, select **NodeManagerAdvanced Configuration Snippet (Safety Valve)** for `yarn-site.xml`, and add the following property:


```
<property>
<name>yarn.nodemanager.user-home-dir</name>
<value>/u/${USER}</value>
</property>
```
3. Create a user directory in HDFS for the system user (for example, `hdfs://user/username`).
4. Ensure that the system user has Write access to the job and log directories in HDFS.

Configuring Scheduling Servers

After you configure the Hadoop environment for Oozie scheduling, run the SAS Deployment Wizard to install and configure the servers needed for Oozie scheduling. You must define and configure a SAS DATA Step Batch server and an Oozie scheduling server. You must provide the following information when defining the Oozie scheduling server:

Host

specifies the machine on which the Oozie server runs.

Port

specifies the port for the Oozie server. The default value is 11000.

Resource Manager

specifies the HTTP address of the Resource Manager web application. This parameter is optional. If it is specified, it overrides the value obtained from the Hadoop configuration XML file.

Web HDFS NameNode

specifies the address and port of the namenode when accessed through REST API services. Unless you are using MapR, this parameter is optional. If it is specified, it overrides the value obtained from the Hadoop configuration XML file. Because the MapR distribution does not include the parameter in its configuration file, this field is required if you are using MapR.

HDFS NameNode

specifies the address and port of the namenode. This parameter is optional. If it is specified, it overrides the value obtained from the Hadoop configuration XML file.

Coordinator Path

specifies the path where the coordinator XML files are stored. These files contain recurring time event and scheduling information.

Workflow Path

specifies the path where the workflow XML files are stored. These files contain the scheduled jobs and dependencies.

Common Properties

specifies any additional properties for the server. For example, if you are using HortonWorks, you can specify this value in this field:

```
oozie.launcher.mapreduce.map.memory.mb=2048;
oozie.launcher.yarn.app.mapreduce.am.resource.mb=1024
```

Using Oozie Scheduling

When scheduling a flow using an Oozie scheduling server, use the standard scheduling process, as described in [Chapter 9, “Scheduling Jobs Using Schedule Manager,” on page 57](#).

If you are using an Oozie scheduling server, you can deploy jobs to a location in HDFS. If you specify a location in HDFS, the Oozie scheduling server must be on the same machine as the SAS DATA Step Batch server. The metadata definitions for both the Oozie scheduling server and the SAS DATA Step Batch server must specify the same machine.

Resolving Common Issues with Oozie Scheduling

Here are some common sources of errors when creating and scheduling flows using an Oozie scheduling server:

- Flows cannot contain OR gates. Only AND gates are allowed when creating flows. You can edit an existing AND gate to appear to be an OR gate, but it still operates as an AND gate.

- A scheduled process flow can fork into two or more parallel paths in the flow. However, fork and join nodes must be used in pairs. Every time a process flow forks, the parallel paths must rejoin the process flow at the same join node. If a possible path from a fork could go outside of the collection of steps in the flow, the flow will fail.
- Flows can contain only job events.
- You cannot run flows using the **Manually to the Scheduling Server** option.
- If the Oozie scheduling server is in a high-availability environment, you might receive an error when running a flow. If the Oozie scheduling server attempts to run on a node that is in a standby state, it will fail. If the flow fails, you can change the Oozie scheduling server parameters. Change the value of the **HDFS NameNode** or the **Resource Manager** field (which are in the Advanced Properties window of the scheduling server definition) to specify the active node. You can also bring down the active node so that the standby node becomes the active node.
- If you deploy a job to HDFS and then later delete that job, the corresponding **.sas** file is not deleted. You must manually remove the file.

Chapter 8

Creating Batch Servers

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Understanding Batch Servers

A batch server is a component of a SAS Application Server that provides the command necessary for a scheduled job to be executed. When the job is submitted to the scheduling server, a specified batch server is queried to retrieve the command needed to run the job. The scheduling server then issues the command at the appropriate time to run the scheduled job.

Because the commands needed to run a job differ according to the application that was used to create the job, several types and subtypes of batch servers are provided. You must assign each scheduled job to the appropriate batch server as part of the scheduling process.

The following batch server types and subtypes are supported:

SAS Java batch server

supports jobs from a SAS application or solution. When you define a SAS Java batch server, you must specify the subtype to specify the specific application or solution that the server supports.

SAS DATA Step Batch server

supports SAS DATA step jobs that are submitted for scheduling.

SAS generic batch server

supports jobs from SAS applications or solutions without requiring any knowledge of the command that is required. This type of server is most often with SAS applications or solutions that are not listed as supported subtypes by the SAS Java batch server. The SAS generic batch server lets you work with jobs from applications or solutions that add support for scheduling but are not yet supported by the SAS Java batch server. Because the server does not have any knowledge about the command required by the application, the server cannot add command-line arguments (for example, to enable output logging).

Defining a SAS Java Batch Server

A SAS Java batch server is a component of a SAS Application Server definition that provides the command to run a job from a supported list of SAS applications and solutions. Only one logical SAS Java Batch server component is allowed in each SAS Application Server. If you need to define a batch server for more than one application, you must define each one either in a separate SAS Application Server or by adding a server to an existing logical Java batch server definition. Depending on your installation, a SAS Java batch server might already be defined by the software deployment wizard when SAS is installed. If you need to set it up manually, follow these steps:

1. In SAS Management Console, expand the **Server Manager** node.
2. Right-click the application server name with which the SAS Java Batch server is associated (for example, **SASApp**), and select **Add Application Server Component**.
3. On the first page of the New SAS Application Server Component Wizard, select **SAS Java Batch Server** and click **Next**.
4. On the next wizard page, enter a name (for example, **SAS Java Batch Server**), and click **Next**.
5. On the next wizard page, do the following:
 - From the **Associated Machine** drop-down list, select the name of the machine that contains the SAS Application Server.
Note: The machine name attribute is for documentation purposes only. SAS scheduling does not use this machine name to set up or execute the job.
 - From the **SubType** list, specify the type of jobs that will be processed by the server. This value corresponds to the SAS solution whose scheduled jobs will be run by the server.
 - In the **Command line** box, enter the path to the command that runs the scheduled job.
 - In the **Target Host** field, specify the operating system of the server machine.
 - Click **Next**.
6. On the next wizard page, review the information that you have entered. If it is correct, click **Finish**.

When you finish the wizard, the server appears as a component under the selected SAS Application Server.

Defining a SAS DATA Step Batch Server

Define the DATA Step Batch Server

A SAS DATA Step Batch server is a component of a SAS Application Server that provides the command to run a SAS DATA step job or a job from SAS Data Integration Studio. Depending on your installation, a SAS DATA Step Batch server might already be

defined by the software deployment wizard when SAS is installed. If you need to set it up manually, follow these steps:

1. In SAS Management Console, expand the **Server Manager** node.
2. Right-click the application server name with which the SAS DATA Step Batch server is associated (for example, **SASApp**), and select **Add Application Server Component**.
3. On the first page of the New SAS Application Server Component Wizard, select **SAS DATA Step Batch Server** and click **Next**.
4. On the next wizard page, enter a name (for example, **SAS DATA Step Batch Server**), and click **Next**.
5. On the next wizard page, do the following:
 - From the **Associated Machine** drop-down list, select the name of the machine that contains the SAS Application Server.

Note: The machine name attribute is for documentation purposes only. SAS scheduling does not use this machine name to set up or execute the job.

Note: If you are using an Oozie scheduling server and will be deploying flows to a location in HDFS, the SAS DATA Step Batch server and the Oozie scheduling server must be on the same machine.

 - From the **SubType** list, select the operating system of the associated machine.
 - In the **Command** box, enter the path to the command that starts a SAS session on the scheduling server. Your initial configuration provides a command in the following path: *SAS-config-dir/Lev1/SASApp/BatchServer/sasbatch*.
 - In the **Logs Directory** box, enter the path for the directory where the SAS log is to be stored. Your initial configuration provides a logs directory in the following path: *SAS-config-dir/Lev1/SASApp/BatchServer/logs*.
 - If you want to change the rolling log options, click **Advanced Options**. For a list of the log options, see the information about the LOGPARM= system option in *SAS® 9.4 Language Reference: Dictionary*.
 - Click **Next**.
6. On the next wizard page, review the information that you have entered. If it is correct, click **Finish**.

When you finish the wizard, the server appears as a component under the selected SAS Application Server.

Define a Deployment Directory

In addition to defining the SAS DATA Step Batch server, you must also define a deployment directory, which contains the jobs deployed for scheduling. The deployment directory definition and the corresponding physical directory should have been set up during your initial installation and configuration. If you need to set them up manually, follow these steps:

1. Create the physical deployment directory in the file system of the scheduling server machine. Assign Write permission to this directory to the users who will be deploying jobs for scheduling.
2. In SAS Management Console, right-click the **Schedule Manager** node and select **Deployment Directories**.

3. In the Deployment Directories dialog box, select the application server (for example, **SASApp**) that is associated with the scheduling server machine. Then click **New**.
4. In the New Directory dialog box:
 - a. Enter a name for the deployment directory (for example, **Batch Jobs**).
 - b. Enter the path for the deployment directory, or click **Browse** to navigate to the path. You can enter either a fully qualified path, or a path that is relative to the application server configuration directory (*SAS-config-dir/Lev1/SASApp*).

If you are using an Oozie scheduling server, you can specify a deployment directory in HDFS by starting the path with **HDFS://**, or **MAPRFS://** if you are using MapR. If you specify a location in HDFS, an Oozie scheduling server must be on the same machine as the SAS DATA Step Batch server
 - c. Click **OK**.
5. Click **OK** to exit the Deployment Directories dialog box.

Defining a Generic Batch Server

A generic batch server is a component of a SAS Application Server that provides the command to run jobs from SAS applications or solutions without requiring any knowledge of the command. This capability enables you to schedule jobs from SAS applications or solutions that are not specifically supported by the SAS Java Batch server subtypes, but it does not provide the ability to add command-line arguments for the SAS application. If a release of a SAS application or solution adds support for scheduling, you can schedule jobs using a generic batch server until the SAS Java Batch server subtypes are updated.

Follow these steps to define a SAS generic batch server:

1. In SAS Management Console, expand the **Server Manager** node.
2. Right-click the application server name with which the generic batch server is associated (for example, **SASApp**), and select **Add Application Server Component**.
3. On the first page of the New SAS Application Server Component Wizard, select **SAS Generic Batch Server** and click **Next**.
4. On the next wizard page, enter a name (for example, **SAS Generic Batch Server**), and click **Next**.
5. On the next wizard page, do the following:
 - From the **Associated Machine** drop-down list, select the name of the machine that contains the SAS Application Server.

Note: The machine name attribute is for documentation purposes only. SAS scheduling does not use this machine name to set up or execute the job.
 - In the **Command** box, enter the appropriate command for the scheduling server.
 - Click **Next**.
6. On the next wizard page, review the information that you have entered. If it is correct, click **Finish**.

7. When you finish the wizard, the server appears as a component under the selected SAS Application Server.

Chapter 9

Scheduling Jobs Using Schedule Manager

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What Is the Schedule Manager?

The Schedule Manager is a SAS Management Console plug-in that works with scheduling servers to create and schedule flows that include jobs that you create in other applications and jobs that are created from DATA step programs.

The scheduled flows are run on a defined scheduling server.

After you have defined the scheduling servers and batch servers and created and deployed jobs for scheduling, you can use the Schedule Manager to create a flow that contains a job, define or edit the schedule for the flow, and submit the flow for scheduling. Using the Schedule Manager, you can perform these tasks:

- create or edit deployed flows, which contain one or more deployed jobs for scheduling.
- create or edit dependencies for jobs in the flow, which are criteria that must be met in order for the job to run. Dependencies can be based on time, other jobs, or files.
- schedule or reschedule a flow to run based on specified conditions (run now, run manually, or run whenever a dependency is met).

This is the basic procedure for scheduling a job using the Schedule Manager:

1. Create a flow, and then add one or more jobs to the flow. A flow is a group of jobs and dependencies. See [“Creating a Flow” on page 59](#).
2. Specify the scheduling server for the flow. The type of scheduling server that you select affects the dependencies that are available for the flow. See [“Creating a Flow” on page 59](#).
3. Specify dependencies for the jobs in the flow. Dependencies are events that must occur before the job runs. You can create these types of dependencies:

Time event dependencies

specify that the job runs only when a time-related event occurs (such as a specific date and time being reached or a specified time interval passing)

File event dependencies

specify that the job runs only when a file-related event occurs (such as a file being created or a file reaching a certain age or size). The available options for file event dependencies depend on the type of scheduling server used to schedule the flow.

Job event dependencies

specify that the job runs only when an event related to another job in the flow occurs (such as a job starting or a job completing successfully)

See [“Specifying Dependencies” on page 60](#).

4. Submit the flow to the scheduling server. See [“Scheduling Flows” on page 67](#).

In order to use the Schedule Manager plug-in, your role must have the Schedule Manager capability assigned under Management Console 9.4 capabilities.

Deploying a SAS DATA Step Program as a Job

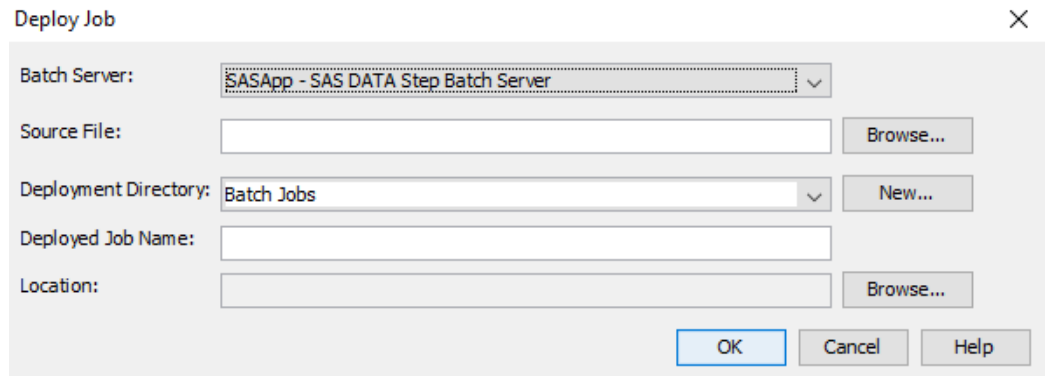
In addition to working with jobs that are deployed for scheduling by other SAS applications, you can use the Schedule Manager plug-in to define a SAS DATA step or procedure program as a job that can be scheduled. After the job is defined, it can be scheduled to run as part of a flow.

Before you can deploy a SAS program for scheduling, a SAS Application Server that will contain the deployed SAS job and a SAS DATA Step batch server that is part of the SAS Application Server must be defined. These servers are defined during the configuration process.

In addition, you must write or locate the SAS program to be deployed. The program must exist on the machine associated with the SAS Application Server that you defined.

Follow these steps to deploy a SAS program for scheduling:

1. Right-click on the **Schedule Manager** plug-in and select **Deploy SAS DATA Step Program**. The Deploy Job dialog box displays.



The image shows a 'Deploy Job' dialog box with a close button (X) in the top right corner. It contains the following fields and buttons:

- Batch Server:** A dropdown menu showing 'SASApp - SAS DATA Step Batch Server'.
- Source File:** A text input field with a 'Browse...' button to its right.
- Deployment Directory:** A dropdown menu showing 'Batch Jobs' with a 'New...' button to its right.
- Deployed Job Name:** A text input field.
- Location:** A text input field with a 'Browse...' button to its right.
- At the bottom right are three buttons: 'OK' (highlighted with a blue border), 'Cancel', and 'Help'.

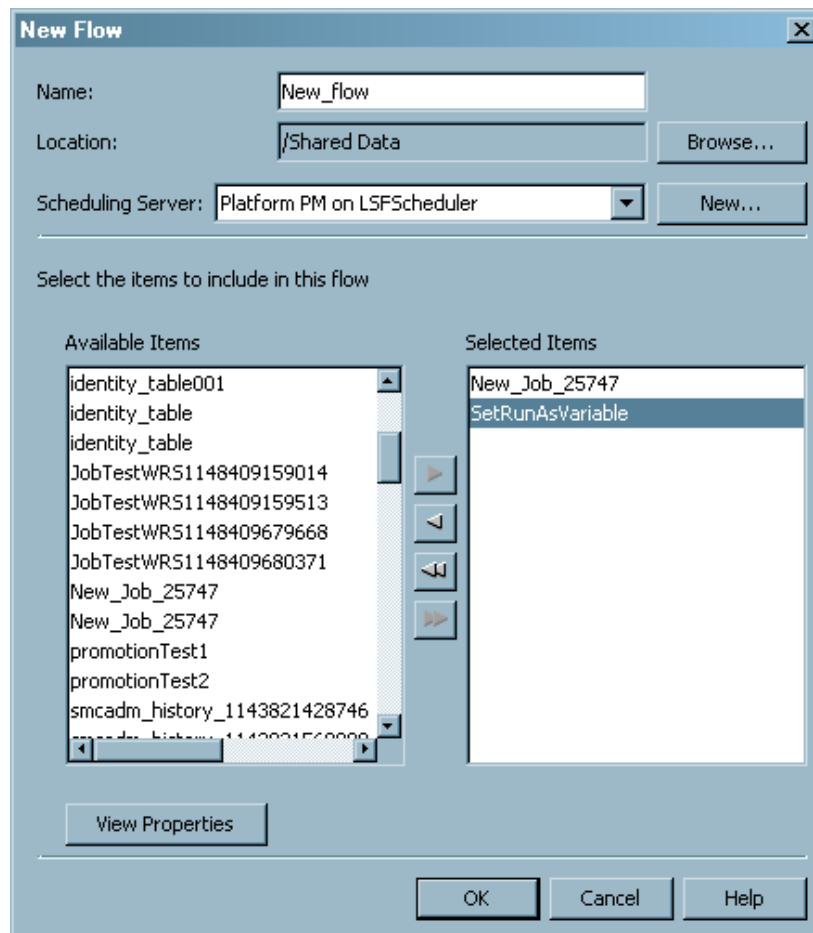
2. Select the SAS DATA Step batch server that will be used to run the deployed SAS program, and click **OK**. The Logon to [application_server] dialog box appears.
3. Select **Browse** next to the **Source File** field. Log on to the SAS Workspace server. The Select a File window appears.
4. Use the Select a File window to browse for and select a SAS program that you want to deploy. The window browses the contents of the machine that is associated with the selected SAS Workspace server. Select a SAS program and click **Open**.
5. In the Deploy Job dialog box, use the **Deployment Directory** field to select the directory on the SAS Application Server in which the deployed job will be stored. Select **New** to define a new directory.
6. Specify the name for the deployed job in the **Deployed Job Name** field. By default, the job name is the same as the name of the SAS program, but you can rename the job to any valid job name.
7. Select **Browse** next to the **Location** field to select a location in the SAS Metadata Server for the scheduled job.
8. Click **OK** to finish defining the SAS program as a deployed job. A message appears when the metadata for the job has been written to the repository.

Creating a Flow

In order to schedule a job, you must first create a job object, and then add it to a flow or create a new flow. A deployed flow is a group of jobs and their dependencies that have been deployed for scheduling.

To create a new flow,

1. From the navigation tree, select the Schedule Manager plug-in, and then select **New Flow** from the **Actions** menu, the pop-up menu, or the toolbar. The New Flow window appears.



2. In the New Flow window, provide a name and location for the flow. Then select the scheduling server and the jobs that the flow should contain. The drop-down list for the **Scheduling Server** field lists all of the defined scheduling servers. Select the server that you want to use to run the current flow.

The **Available Items** field lists all of the jobs that have been defined and deployed for scheduling. Select a job and use the arrows to move the job to the **Selected Items** list to include it in the flow.

Note: Flows stored in project repositories are not visible in the Folders view in SAS Management Console. Flows scheduled using an in-process scheduling server cannot be scheduled using Schedule Manager. They must be scheduled from within the SAS application (such as SAS Web Report Studio).

3. Click **OK** to close the window and create the flow.

Specifying Dependencies

Overview of Dependencies

After you have created a flow, you can specify dependencies for the flow. Without dependencies, all of the jobs in the flow are available to run immediately. The actual order in which they are processed is undetermined, but depends on the environment and conditions. Jobs sent to operating system scheduling servers will never run in parallel.

Dependencies let you specify the conditions that must be met before a job in a flow runs. The types of dependencies are:

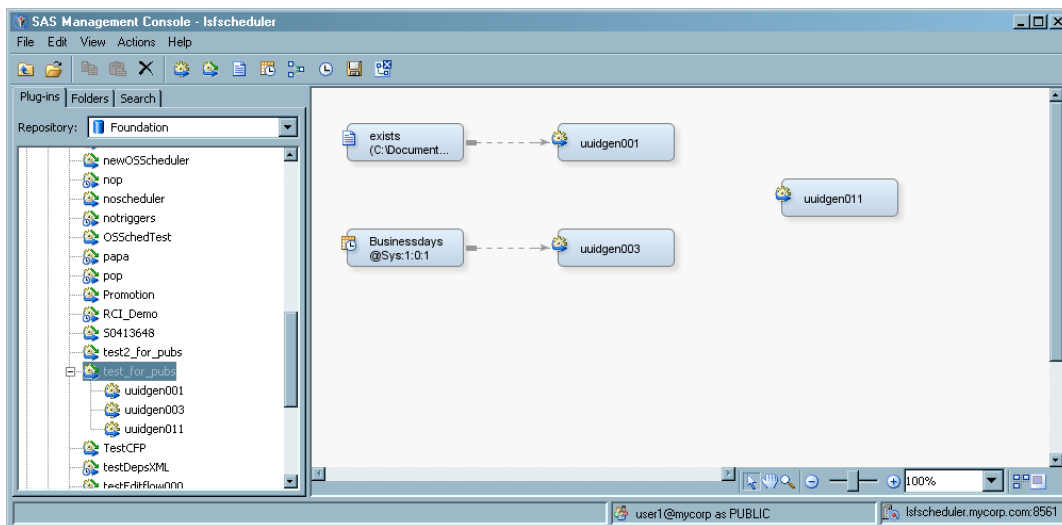
- Time dependency, which specifies that the job runs on a specified day at a specified time. For example, you can specify that the job runs every weekday at a specified time. Time dependencies are not supported if you are using an Oozie scheduling server or an operating system scheduling server.
- Job dependency, which specifies that the current job runs if a specified event occurs with another job. For example, you can specify that the current job runs when Job A completes successfully, or you can specify that it runs when Job A ends with a specified exit code.
- File dependency, which specifies that the current job runs if a condition is met on a specified file. For example, you can specify that the current job runs whenever File B is created, or that it runs when File B becomes larger than a specified size. File dependencies are not supported if you are using SAS Job Flow Scheduler, an Oozie scheduling server, or an operating system scheduling server.

Using the Visual Flow Editor

After you have selected the jobs to be included in a flow, you can use the visual editor to graphically display the flow. The visual editor displays the dependencies and relationships between the jobs, enabling you to better understand the structure of complex flows. You can also add jobs and gate nodes to the flow.

To use the visual editor, follow these steps:

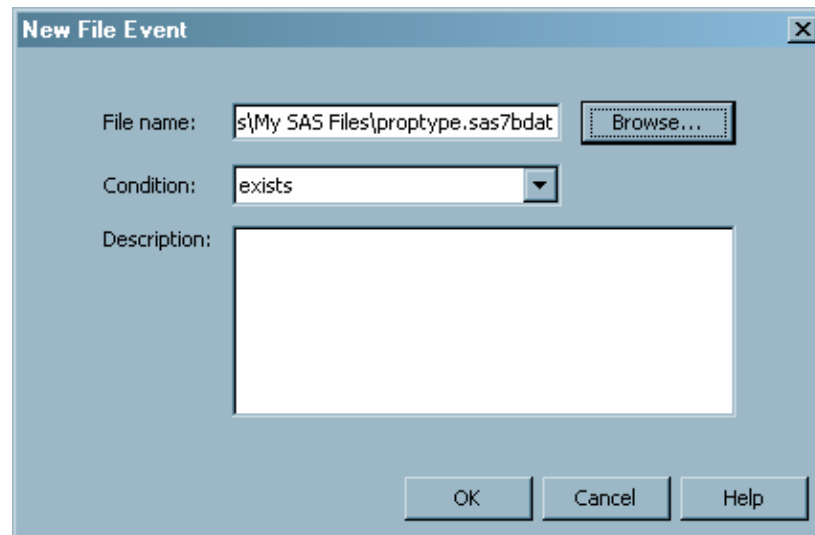
1. In the navigation area, select a defined flow and select **Actions** ⇌ **Edit Flow**. The flow is displayed graphically in the display area.



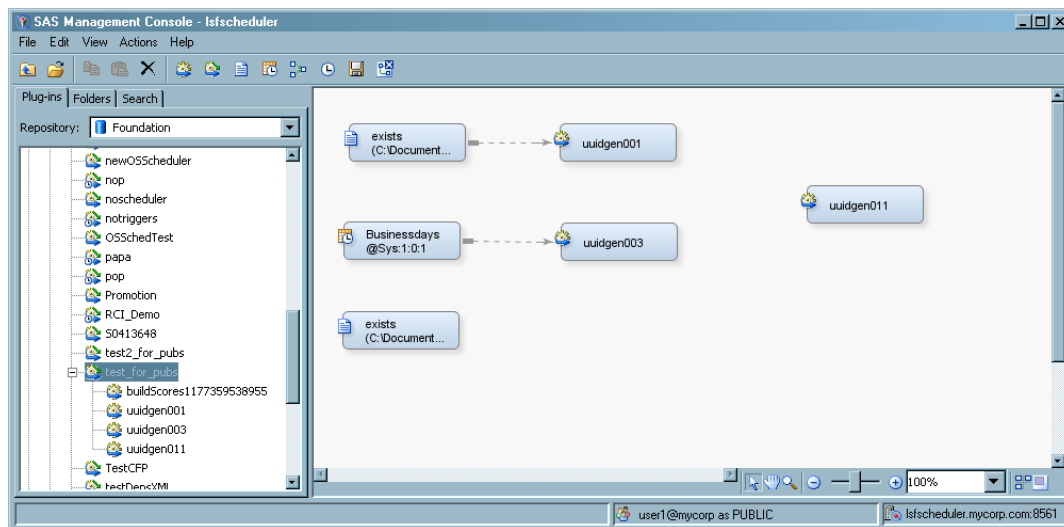
The dashed lines identify the relationship between a job and a dependency. You can select and move any element in the window. To connect elements in the window, move the cursor to an open end of the element and drag the line to another element. Inputs are on the left side of an element and outputs are on the right side.

2. Add a file event, a time event, a deployed job, or a subflow to the flow by selecting the appropriate choice from the **Actions** menu, the toolbar, or the pop-up menu. When file events and time events are added, they are not associated as a dependency with any job. You must incorporate the event into the flow in order for the event to function.

For example, when you select **Actions** ⇒ **Add File Event**, the New File Event dialog box appears.



After you specify the information required to define the file event, the event appears in the visual flow editor. Connect the event to the job for which it will serve as a dependency.

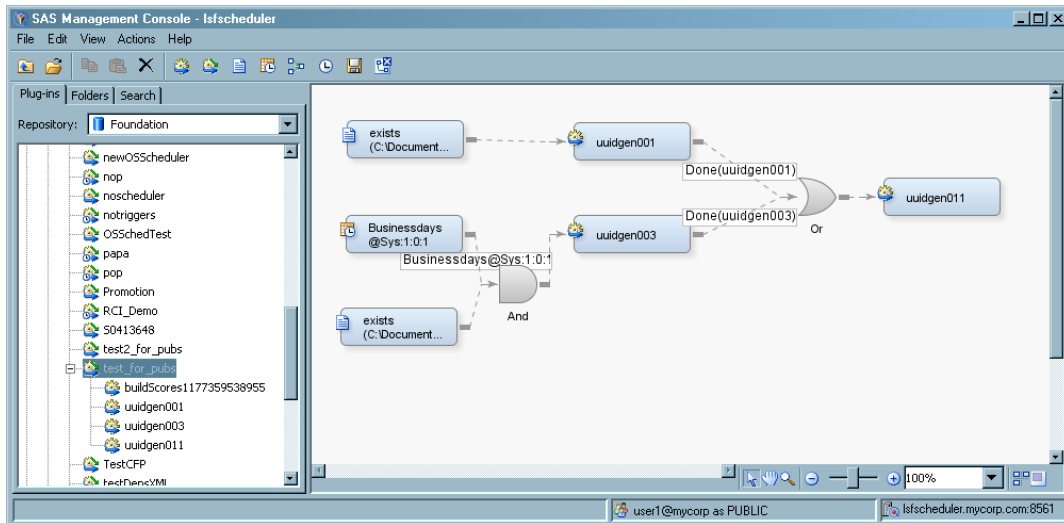


3. Add a gate node to the flow by selecting **Actions** ⇒ **Add Gate**. The Add a Gate Node dialog box appears. A gate node specifies a condition where a job runs when either one or more specified conditions occur (an OR gate) or all specified conditions occur (an AND gate). Select the type of gate that you want to use and click **OK**. The node appears in the editor, but is not identified with any jobs.

Note: If you are using an Oozie scheduling server, the only supported gate type is a gate where all specified conditions must occur (AND gate). If you change an AND gate type to an OR gate type, the gate continues to operate as an AND gate.

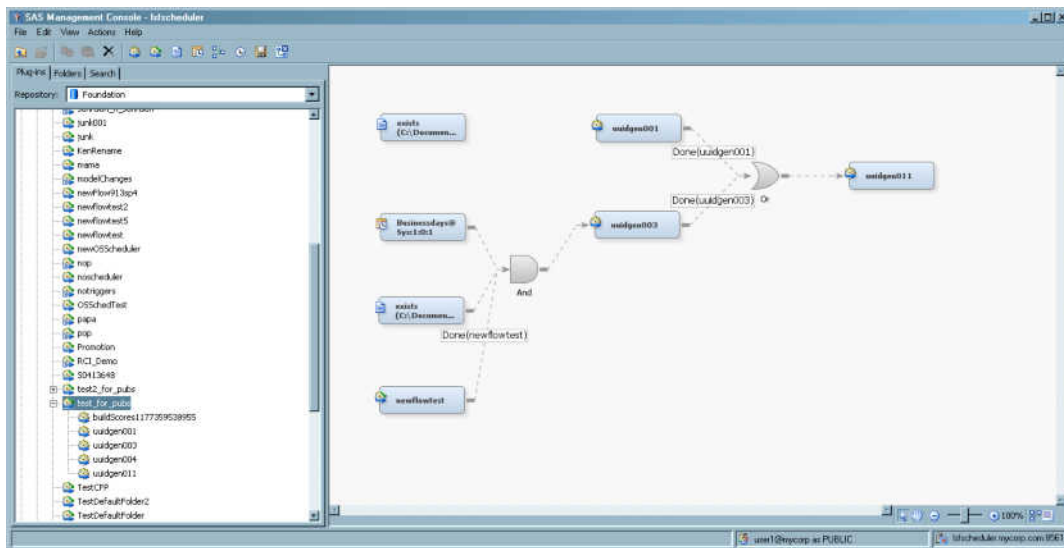
4. To specify the input for a gate, move the cursor to the open end of a job or event and drag the dashed line to the input for the gate. When you connect a job to a gate, the New Job Event dialog box appears, where you can specify the condition for the event.

To specify the output for the gate, move the cursor to the output end of the gate and drag the line to the input for the job.



5. Add a subflow by selecting **Actions** ⇒ **Add Subflow**. The Add Subflow dialog box appears. Select a flow that you want to include as a subflow in your flow and click **OK**. The subflow appears in the editor as a job event. You can specify the subflow as a job event dependency for a job in the flow or add it as an input for a gate node.

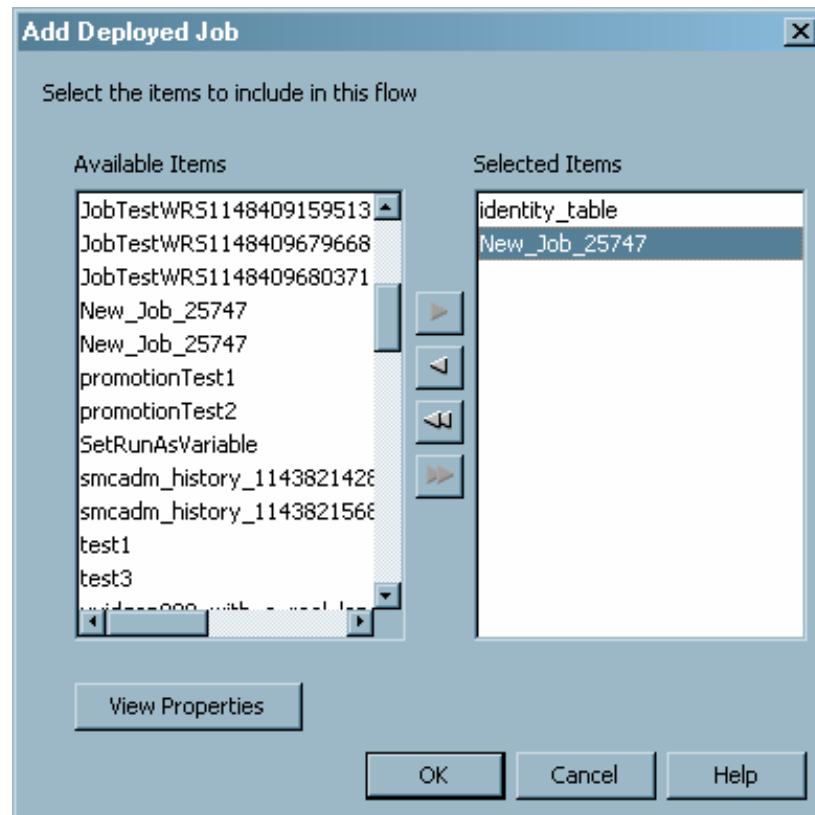
Note: Subflows are supported only if you are using Platform Suite for SAS.



6. Select **Actions** ⇒ **Save Flow** to save the flow and leave the visual editor open. Select **Actions** ⇒ **Close Flow** to save the flow and close the visual editor. Select **Actions** ⇒ **Schedule Flow** to save and schedule the flow on the selected scheduling server.

Adding Jobs to a Deployed Flow

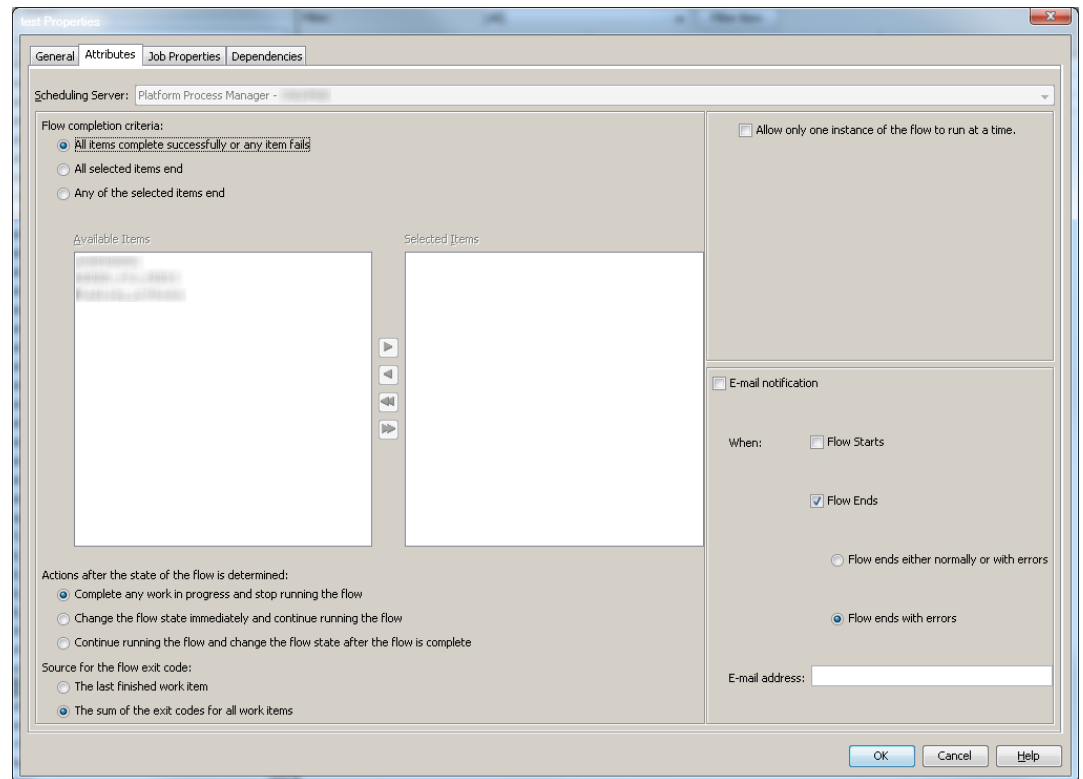
You can add jobs to an existing deployed flow after it has been created. Select a flow, and then select **Add a Job** from the pop-up menu, the toolbar, or the **Actions** menu. Use the Add Deployed Job dialog box to select from the jobs that have been deployed for scheduling.



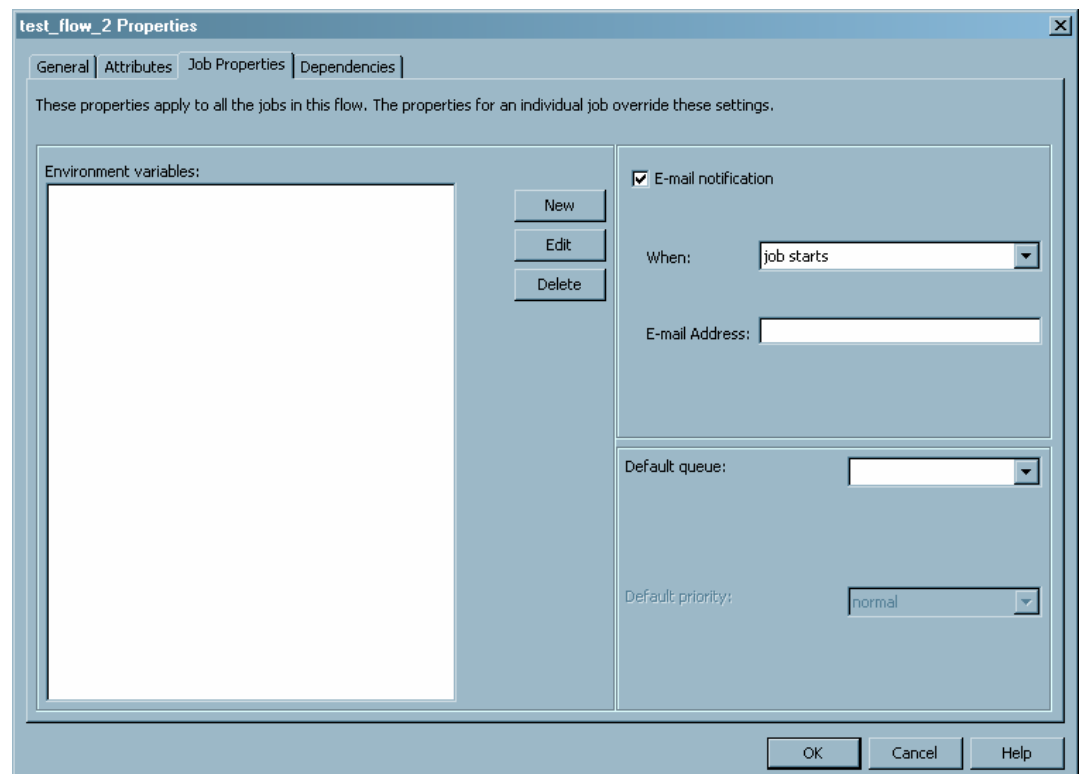
Setting Deployed Flow Properties

After you have created a flow, you can use the Schedule Manager to view properties for the flow or jobs that are part of the flow. Select a deployed flow or job in the navigation tree and then select **Properties** from the pop-up menu or the **File** menu. You can also use the Properties window to define authorization settings for the flow or job.

The Properties window for a flow also lets you specify options for the flow. The **Attributes** tab enables you to specify the condition for the flow to be considered as completed, whether only one instance of the flow can run at once, and any email notifications that you should receive based on the condition of the flow. The attributes available depend on the type of scheduling server associated with the deployed flow.



The Job Properties tab specifies the properties that are applied to all jobs in the flow, including environment variables, email notification for job events, and the default queue. However, any properties that you set on an individual job override the properties set on the **Job Properties** tab.



The Dependencies tab contains a table of all the dependencies in the flow and their relationships to the jobs in the flow.

test_for_pubs Properties

General | Attributes | Dependencies | Authorization

Flow dependency information (reorder or resize columns by dragging their headings or borders):

Predecessors	Id	Name	Type	Event	Run as	Description
	1	Flow Trigger	FileEvent	exists (C:\Docum...		exists (C:\Docum...
	2	uuidgen001	JOB	sas -log /test_for...		
	4	Businessdays@Sy...	TimeEvent	Businessdays@Sy...		Businessdays@Sy...
	5	exists (C:\Docum...	FileEvent	exists (C:\Docum...		exists (C:\Docum...
4,5,6	3	uuidgen003	JOB	C:\SAS\DIServer\...		
	6	Completes succes...	JobEvent	Done(newflowtest)		Depends on 'newf...
	8	Businessdays@Sy...	TimeEvent	Businessdays@Sy...		Businessdays@Sy...
	9	exists (C:\Docum...	FileEvent	exists (C:\Docum...		exists (C:\Docum...
8,9,6	7	uuidgen011	JOB	C:\SAS\DIServer\...		
	6	Completes succes...	JobEvent	Done(newflowtest)		Depends on 'newf...
	10	newflowtest	JOB			

OK Cancel Help

Deleting Jobs and Flows

To delete a job, follow these steps:

1. In the navigation area, select the **Schedule Manager** node and select **Manage Deployed Jobs** from the **Actions** menu or the pop-up menu. The Manage Deployed Jobs dialog box displays.
2. The Manage Deployed Jobs dialog box contains a list of all deployed jobs, organized depending on whether the job is in a flow.
3. Select a job and click **Delete**. The job is deleted and is no longer available for scheduling.

To remove a job from a flow, follow these steps:

1. In the navigation area, expand the flow that contains the job that you want to delete.
2. Select the job and then select **Delete** from the pop-up menu or the **Edit** menu. The Delete Deployed Job dialog box displays.

3. Choose whether you want to delete the job only from the current flow, or also from all flows that contain the job. The dialog box contains a list of all of the flows that contain the job.
4. If you specify that you want to remove the job from all flows, you can also specify whether the job should remain available for scheduling. If it remains available, you can include the job in other flows. Otherwise, the job is removed entirely and cannot be scheduled.

To delete a flow that has not been scheduled, select the flow in the navigation area and select **Delete** from the pop-up menu or the **Edit** menu.

To delete a scheduled flow, you must first unschedule it.

Scheduling Flows

After you have created a deployed flow and defined dependencies for the jobs in the flow, you can schedule the flow to run. Scheduled deployed flows are sent to the scheduling server, where the dependencies are evaluated. You can specify that a selected deployed flow is scheduled to run according to a specified trigger.

To schedule a deployed flow,

1. From the navigation tree in SAS Management Console, select the Schedule Manager and select the deployed flow that you want to schedule. Select **Schedule Flow** from the pop-up menu, the toolbar, or the **Actions** menu. The Schedule Flow window appears.

Note: The Schedule Flow window differs depending on the type of scheduling server selected.

Figure 9.1 Schedule Flow Window, Platform Process Manager Server

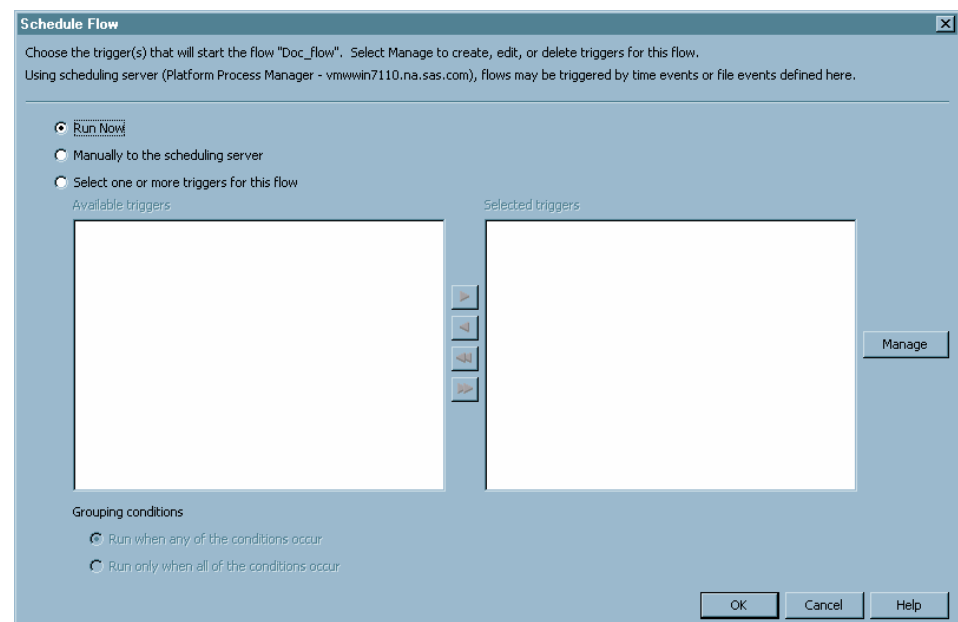
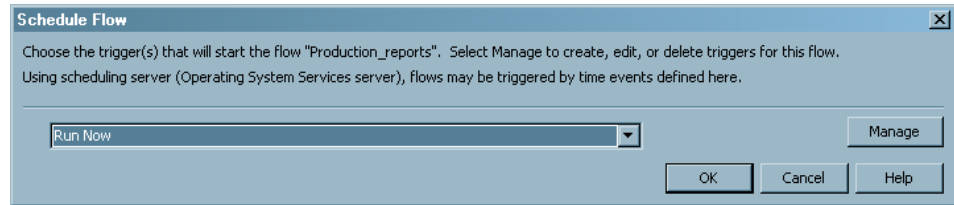


Figure 9.2 Schedule Flow Window, Operating System Scheduling Server

2. If you are using a Platform Process Manager or an Oozie scheduling server, select the condition under which the flow should run, which can include specifying multiple triggers for the flow. Select the appropriate radio button. Selections are as follows:

Run Now

specifies that the flow is sent to the scheduling server. The scheduling server evaluates any dependencies, immediately submits the jobs in the flow, and executes them one time only. If the flow is already scheduled, the schedule is not affected and continues to run as defined. This option is useful for testing purposes.

Manually to the Scheduling Server

specifies that the flow is sent to the scheduling server without a trigger. The flow is held until the jobs are run manually.

Note: This option cannot be used with an Oozie scheduling server.

Select one or more triggers for this flow

specifies that one or more defined dependencies for the flow are triggers for the deployed flow. The dependencies are defined only for the flow. A flow that uses one or more dependencies as a trigger runs each time the conditions for the dependencies are met. To define a new time or file dependency as a trigger for the flow, click **Manage**. This option is useful for scheduling flows for production.

Note: If you are using an Oozie or operating system scheduling server, only time dependencies are supported.

If you are using an operating system scheduling server, select the condition under which the flow should run. Make a selection from the **Trigger** drop-down list. Selections are as follows:

Run Now

specifies that the flow is sent to the scheduling server, which evaluates any dependencies and immediately submits the jobs in the flow to be executed by the scheduling server one time only. This option is useful for testing purposes.

Manually in Flow Manager

specifies that the flow is sent to the scheduling server, which evaluates any dependencies but does not run the jobs in the deployed flow. The flow is held until the jobs are run manually with the operating system commands.

<selected dependency>

specifies that a defined dependency for the flow is a trigger for the deployed flow. The dependency is defined only for the flow. A flow that uses a dependency as a trigger runs each time the conditions for the dependency are met. To define a new time or file dependency as a trigger for the flow, click **Manage**. This option is useful for scheduling flows for production.

3. If you scheduled the flow on a Platform Process Manager scheduling server, you can use the Flow Manager application to view the history of a deployed flow or job,

rerun a flow or job, or stop a flow from running. If you scheduled the job on an operating system scheduling server, you can use operating system commands to manage the deployed flow. See the Help for the Schedule Manager for more information.

Unschedulering Flows

If you want to stop a scheduled flow from running without deleting the flow, you can unschedule it. Unscheduling prevents a scheduled flow from running, even if the starting trigger is met, until the flow is scheduled again. The flow is removed from the scheduling server, but not from the SAS Metadata Server.

To unschedule a flow, select the flow and select **Unscheduler Flow** from the pop-up menu, the toolbar, or the **Actions** menu.

Note: Unscheduling flows from the Schedule Manager plug-in is not supported if you are using an Oozie scheduling server.

Chapter 10

Scheduling Jobs from SAS Data Integration Studio

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Overview of Scheduling for SAS Data Integration Studio

To schedule jobs that are created by SAS Data Integration Studio, you can use either Platform Suite for SAS or your operating system scheduler. If you use the operating system scheduler, fewer scheduling features are available.

Scheduling of SAS Data Integration Studio jobs works as follows:

1. Users create jobs by using SAS Data Integration Studio. The job definitions are stored in job objects in the metadata repository.
2. Users deploy jobs for scheduling by using SAS Data Integration Studio. The deployment process does the following:
 - a. creates a SAS program based on the job metadata
 - b. places the SAS program in the specified deployment directory on the SAS batch server
 - c. creates a metadata object for the deployed job
3. An administrator uses Schedule Manager in SAS Management Console to create and schedule a flow that includes the deployed job. Schedule Manager passes the schedule information and the associated commands to the designated scheduling server (either the Process Manager Server or an operating system scheduling server). To construct the commands, Schedule Manager uses the Command Line and Log Directory attributes of the SAS DATA Step Batch server definition.
4. If you are using Platform Suite for SAS, then Platform Process Manager submits the scheduled job to Platform LSF at the designated time (or after the designated dependent event), and the SAS DATA Step Batch server executes the job. Information about the job status is stored on the scheduling server. Administrators can use Platform Flow Manager to view the status of the job.

If you are using an operating system scheduling server, then the operating system submits the job at the designated time. Administrators can use operating system tools to view the status of all scheduled flows. Users who are not administrators can view and edit only the flows that they own.

Enabling the Scheduling of SAS Data Integration Studio Jobs

In addition to the scheduling server, a scheduling environment for SAS Data Integration Studio jobs requires the following:

a deployment directory

A deployment directory is a location on the file system of the SAS Application Server that contains the scheduling server component. The scheduling server must have access to the deployment directory. A corresponding definition for the deployment directory must exist in the metadata repository. When a SAS Data Integration Studio user deploys a job for scheduling, a job is generated and placed in this directory. When the job is executed, the job information is read from this directory.

The initial configuration process should have created a physical deployment directory in the path *SAS-config-dir/Lev1/SASApp/SASEnvironment/SASCode/Jobs*, and a corresponding deployment directory definition in the metadata repository.

If you need to set up a deployment directory manually, see [“Define a Deployment Directory” on page 53](#).

a SAS DATA Step Batch Server

A SAS DATA Step Batch server is a metadata object that specifies the command to execute SAS code that is generated by SAS Data Integration Studio jobs. The metadata specifies the location of the command on the scheduling server and where the resulting log files are to be stored on the SAS Application Server that contains the scheduling server component.

If your configuration plan included the SAS DATA Step Batch server, the initial configuration process should have created a definition for a server called SAS DATA Step Batch server, which is a component of your SAS Application Server (for example, SASApp).

If you need to set up a SAS DATA Step Batch server manually, see [“Defining a SAS DATA Step Batch Server” on page 52](#).

Deploying Data Integration Studio Jobs for Scheduling

When you have completed the appropriate setup tasks, SAS Data Integration Studio users can deploy jobs for scheduling. The procedure for deploying jobs is as follows:

1. In SAS Data Integration Studio, right-click a job and select **Scheduling** ⇒ **Deploy**.
2. In the Deploy a Job for Scheduling dialog box, do the following:

- a. Select the batch server (for example, **SASApp - SAS DATA Step Batch Server**) where the job is to be executed.
 - b. Select the deployment directory where the generated job is to be stored.
 - c. A default file name for the job is displayed. You can modify the file name, but it cannot contain blanks or other characters that are invalid on the operating system.
 - d. Click **OK**.
3. If you are prompted for a user ID and password for the application server, enter the appropriate credentials. The credentials are validated through the application server's workspace server connection.
 4. Click **OK** in the Deploy for Scheduling dialog box.

SAS Data Integration Studio generates SAS code from the job metadata, transfers the file to the deployment directory location on the scheduling server, and creates job metadata for the Schedule Manager to use.

For information about using Schedule Manager to schedule a job, see [Chapter 9, “Scheduling Jobs Using Schedule Manager,” on page 57](#).

Troubleshooting the Scheduling of SAS Data Integration Studio Jobs

User credentials play an important role in the scheduling and execution of SAS Data Integration Studio jobs. When SAS Data Integration Studio deploys a job for scheduling, it generates a SAS file as the `-sysin` value for running SAS in batch mode. Generated SAS programs often contain LIBNAME statements that specify credentials for the data sources in the library. If an issue occurs in scheduling or executing a SAS Data Integration Studio job, check to determine whether one of the following situations has occurred:

- Has a user's password changed? If the password has changed, you will need to either redeploy the job to update the SAS file with the new credentials, or edit the generated SAS file to update the credentials.
- Are the specified credentials valid in the scheduling environment? The user who generated the job might have credentials that are valid in SAS Data Integration Studio but not in the scheduling environment. Typically, the user who runs the scheduled job is also the user who scheduled the job in SAS Management Console, although you can use the Advanced Properties dialog box to specify another user to run the job. If the credentials are not valid, you will need to either redeploy the job with the appropriate credentials, or edit the generated SAS file to update the credentials.

For additional troubleshooting information, see [“Resolving Issues Related to Scheduling with Platform Suite for SAS” on page 23](#).

Chapter 11

Enabling the Scheduling of Reports

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How Report Scheduling Works

Scheduling of SAS reports is done within SAS Web Report Studio, which in turn uses either Platform Suite for SAS or an in-process scheduling server.

Note: SAS reports cannot be scheduled using an Oozie scheduling server.

The scheduling process from SAS Web Report Studio is as follows:

1. Users create reports using SAS Web Report Studio. The report definitions (.srx files) are stored in the WebDAV repository or on a file system, and metadata about the reports (including permissions information) is stored in the metadata repository.
2. Users create schedules for particular reports using SAS Web Report Studio. Information about the scheduled report jobs is stored in the metadata repository. The job information is also passed to the in-process scheduling server or to the Process

Manager Server. The command for the job is created using information from the SAS Java Batch server definition.

3. Jobs and flows are automatically created when the report is scheduled in SAS Web Report Studio. Users can use the Schedule Manager in SAS Management Console to reschedule the flow and change the report schedule.
4. Depending on the scheduling server used, either the Platform Process Manager server submits the job for execution or the in-process scheduling server submits the job to SAS Web Report Studio for execution at the designated time (or after the designated dependent event).
5. The Batch Generation Tool, running on the scheduling server, executes the report and places the output in the location designated by the repository (the WebDAV server or the file system). Metadata about the report output is stored in the metadata repository. If you are scheduling using Platform Suite for SAS, information about the job status is stored on the Process Manager Server. Administrators can use Platform Flow Manager to view the status of the job.

If report distribution has been set up, then the report output is also sent to the appropriate destinations when the user bursts the report. For information about report distribution, see “Scheduling and Distributing Pre-generated Reports” in the *SAS® 9.4 Intelligence Platform: Web Application Administration Guide*.

6. Users can view the static output by using SAS Web Report Studio (or another application, such as the SAS Information Delivery Portal).

To schedule reports, you must install and configure Platform Suite for SAS or configure a SAS in-process scheduling server.

Enabling Report Scheduling with In-Process Scheduling

Overview of Tasks

To enable users to use the report scheduling capabilities of SAS Web Report Studio with in-process scheduling, several setup tasks are required. If you implemented scheduling when you installed SAS Web Report Studio, all setup tasks were performed automatically.

If you implement scheduling after installation is complete, you must complete these setup tasks:

1. Verify or define a SAS Java Batch Server with a subtype of Reporting and a SAS In-Process Services Server.
2. Identify the scheduling server type to SAS Web Report Studio.
3. Define archive paths for publishing reports to channels.
4. Test the configuration.

Step 1: Define Servers

A SAS Java Batch Server definition and a SAS In-Process Services Server definition are automatically created by the SAS Deployment Wizard. Verify that Reporting is selected as the value for the **SubType** field in the SAS Java Batch Server definition.

If you did not implement scheduling when you installed SAS, you might need to define a SAS Java Batch Server or SAS In-Process Services Server manually. Use the Server Manager plug-in in SAS Management Console to create the definitions. See [“Defining a SAS Java Batch Server” on page 52](#) for detailed information. You must select a value of Reporting for the **SubType** field in the SAS Java Batch Server definition.

Note: Do not define more than one SAS In-Process Services server. Using multiple servers will cause errors when you attempt to schedule a report.

Step 2: Identify the Scheduling Server Type

In order to ensure that SAS Web Report Studio uses in-process scheduling, you must specify the type of scheduling server that the application uses. This step is particularly important if you have both a SAS In-Process Services server and a Platform Process Manager server defined. Follow these steps:

1. In the SAS Management Console **Plug-Ins** tab, expand the **Configuration Manager** plug-in.
2. Right-click **Web Report Studio 4.4** to display the Web Report Studio 4.4 Properties dialog box.
3. Select the **Settings** tab.
4. In the **Application** field, select **Scheduling**.
5. In the **Scheduling Enabled** field, select **Yes**.
6. In the **Scheduling Server Type** field, select **SAS In-Process Services**.
7. Close the Properties dialog box and restart your web application server.

Step 3: Define Archive Paths

Scheduled reports can be distributed to channels that are defined using the SAS Publishing Framework. If users will be distributing reports to channels that use archive locations (persistent stores), then the archive location must be accessible to SAS Web Report Studio.

To specify the appropriate archive path, follow these steps:

1. In SAS Management Console, expand the **Publishing Framework** node.
2. Expand the appropriate metadata repository node.
3. Expand the **Channels** node.
4. Right-click the channel to which you will be publishing reports, and select **Properties**.
5. In the Properties dialog box, select the **Persistent Store** tab.
6. In the **Type of persistent store** area, select the **Archive** radio button.

7. In the **Path** box, specify the path to a network location that all users who will be creating content can write to.
8. Click **OK**.

You might also need to update the permissions on the physical folder to allow access for the users who will be publishing reports. For information about setting up publication channels, see “Adding SAS Publication Channels” in the *SAS® 9.4 Intelligence Platform: Web Application Administration Guide*.

Step 4: Test the Configuration

After you have completed all of the configuration steps, use the following procedure to test your configuration. To create a report, you must have the Create Report capability in the Web Report Studio: Report Creation role. To schedule a report, you must have the Schedule Own Report capability from the Web Report Studio: Report Creation role.

1. On a client machine, use SAS Web Report Studio to create and schedule a report as follows:
 - a. Create and save a simple report.
 - b. Click **View Report** to display the report.
 - c. Select **File** ⇒ **Schedule**.
 - d. On the Schedule Report page, select **Now**, and click **Next**.
 - e. On the next page, click **Finish**. If the word **Running** appears in the status field, wait for the job to finish.
2. In SAS Management Console, check the properties of the scheduled report as follows:
 - a. Select the **Folder View** tab and expand the folders until you locate the report that you scheduled.
 - b. Right-click the report, and choose **Properties**.
 - c. Select the **Content** tab. A folder called **Batch** should be displayed on this tab. The folder contains the output of the scheduled report.
3. If the **Batch** folder is present on the report's **Content** tab, as described in the previous step, then return to SAS Web Report Studio and complete these steps:
 - a. Log off, and then log back in.
 - b. Open the report. The following message should appear at the top of the report:

To interact with this report, you must first refresh the data.

 If this message appears, then a batch copy of the report is displayed and the configuration is correct.

Enabling Report Scheduling with Platform Suite for SAS

Overview of Enabling Report Scheduling

To enable users to use the report scheduling capabilities of SAS Web Report Studio, you must first install and configure Platform Suite for SAS.

Note: If you are using a Platform Process Manager server, the Platform LSF scheduling server machine must be the same machine on which the SAS Business Intelligence Report Services is installed.

When the preceding requirements are in place, complete the following additional setup tasks:

1. Create the necessary users, groups, and logins.
2. Verify that a SAS Java Batch Server with a subtype of Reporting has been created.
3. Identify the scheduling server type to SAS Web Report Studio.
4. Update the SAS Web Report Studio configuration information.
5. Update the LSF password file (Windows only).
6. Verify logging for the Output Generation Tool.
7. Edit the initialization file for the Output Generation Tool.
8. Define archive paths for publishing reports to channels (optional).
9. Test the configuration.

The scheduling software must be installed on the same machine as the commands that it executes. For SAS Web Report Studio, this is the location where the Output Generation Tool is installed.

Step 1: Create the Necessary Users, Groups, and Logins

Ensure That the Required Operating System User Accounts Are Present

The following user accounts must be added to the operating system of the scheduling server:

Table 11.1 User IDs Needed for Report Scheduling

User ID	Purpose
lsfuser (suggested name)	Used by Web Report Studio to connect to Platform Suite for SAS and to run the Output Generation Tool, which creates scheduled reports in batch mode. This user is sometimes referred to as the scheduling user.

User ID	Purpose
sastrust@saspw	Used by the Output Generation Tool to obtain user credentials from the metadata server. In a default installation, this user already exists in the metadata repository.
sassrv	Used by SAS Web Report Studio to perform the nightly cleanup of partially deleted jobs. In a default installation, this user already exists in the metadata repository.

Ensure That Metadata Logins Exist for Users Who Will Schedule Reports

For each user who will use SAS Web Report Studio to schedule reports, a login (including a password) must exist in the metadata repository.

To add a login for a user,

1. While you are logged on to SAS Management Console as the SAS Administrator, select **User Manager**. A list of users and groups appears in the right pane.
2. Right-click the user to whose login you want to add a password, and select **Properties**.
3. In the Properties dialog box, select the **Logins** tab. Then right-click the login to which you want to add a password, and click **Modify**.
4. In the Edit Login Properties dialog box, enter the user's password in the **Password** and **Confirm Password** boxes. Then click **OK**.
5. Click **OK** in the Properties dialog box.

Users can manage their own passwords by using the SAS Login Manager.

Step 2: Verify That a SAS Java Batch Server Has Been Defined

A SAS Java Batch Server must be defined as a component of your SAS Application Server. This server is set up automatically by the SAS Deployment Wizard.

To create the server manually, follow the instructions in [“Defining a SAS Java Batch Server” on page 52](#). When defining the server, you must specify the following information:

- In the **Associated Machine** field, you must choose a machine that has Platform LSF and SAS Business Intelligence Report Services installed.
- In the **SubType** field, you must select a value of Reporting.
- In the **Command Line** box, enter a command that contains the following components:

“path-to-outputgen-executable”

The fully qualified path to the **outputgen** executable file, enclosed in quotation marks.

--spring-xml-filespring-file-location

The fully qualified path to the spring.xml file, which provides configuration services information to enable outputgen to connect to the SAS Metadata Server. This component must be preceded by two hyphens (- -).

--repositorymetadata-repository

The name of the repository that contains the job definitions. This component must be preceded by two hyphens (- -)

Here are examples of valid commands:

Windows example

```
C:\SAS\Config\Lev1\ReportBatch\rptbatch.bat
--spring-xml-file C:\SAS\Config\Lev1\Web\Applications\
SASBIReportServices4.4\spring.xml --repository Foundation
```

Note: Enter the command with no line breaks, and be sure to put quotation marks around the arguments as shown in the example. If you copy and paste the command, be sure to include a space after **outputgen.exe**. You can verify the command by pasting it into a DOS command window. The command should execute with no errors. (You can ignore **Missing option** messages, unless they pertain to the **--config-file** option or the **--repository** option.)

UNIX example

```
usr/local/Config/Lev1/ReportBatch/rptbatch.sh
--spring-xml-file usr/local/Config/Lev1/Web/Applications/
SASBIReportServices4.4/spring.xml --repository Foundation
```

Note: Enter the command with no line breaks. If you copy and paste the command, be sure to include a space after **outputgen**. You can verify the command by pasting or entering it into a Telnet window. The command should execute with no errors. (You can ignore **Missing option** messages, unless they pertain to the **--repository** option.)

CAUTION:

If you have a SAS Java Batch Server that was defined for a release prior to SAS Web Report Studio 3.1, then create a new definition, reschedule the reports on the new server, and delete the old definition.

Step 3: Identify the Scheduling Server Type

In order to ensure that SAS Web Report Studio uses Platform Suite for SAS scheduling, you must specify the type of scheduling server that the application uses. This step is particularly important if you have both an In-Process Scheduling Services server and a Platform Process Manager server defined. Follow these steps:

1. In the SAS Management Console, expand the **Configuration Manager** plug-in.
2. Right-click **Web Report Studio 4.4** to display the Web Report Studio 4.4 Properties dialog box.
3. Select the **Settings** tab.
4. In the **Application** field, select **Scheduling**.
5. In the **Scheduling Enabled** field, select **Yes**.
6. In the **Scheduling Server Type** field, select **Platform Process Manager**.
7. Close the Properties dialog box and restart your web application server.

Step 4: Update the SAS Web Report Studio Configuration

The credentials of the user ID **lsfuser** must be available to SAS Web Report Studio.

If you have installed and configured SAS 9.2M2, the credentials are managed by the SAS Deployment Manager. You do not need to perform this step.

If you are using a version of SAS that is prior to SAS 9.2M2, or if you have installed SAS 9.2M2 without performing the configuration step, you might have already provided these credentials during the installation. To verify that the credentials are present, and to update the credentials (if necessary), you must use one of the following two procedures.

The first procedure creates the LSF Services group and adds users to the group. Follow these steps:

1. Use the User Manager plug-in in SAS Management Console to create a new authentication domain. The domain must be named LSFServicesAuthWRS.
2. Use the User Manager plug-in in SAS Management Console to create a new group. The group must be named LSFServices.
3. In the Properties dialog box for the LSFServices group, select the **Accounts** tab and add the user ID that schedules reports in SAS Web Report Studio (typically `lsfuser`). On Windows systems, you must preface the user ID with a domain (*hostname* \lsfuser). You must also select the LSFServicesAuthWRS authorization domain for the user and provide the current password for the user ID.
4. In the **Members** tab, add the trusted user (SAS Trust User) as a member of the LSFServicesGroup.

Alternatively, you can add the credentials directly to the SAS Web Report Studio properties. Although this procedure is somewhat less complex, it does have the disadvantage of having credentials in a publicly readable area. To modify the properties, follow these steps:

1. Start SAS Management Console and connect to the metadata server using the credentials of the user who installed the software on this host.
2. Expand the **Application Management** node. Under that node, expand the **Configuration Manager** node.
3. Right-click the **Web Report Studio** node, and select **Properties**.
4. In the Properties dialog box, select the **Advanced** tab.
5. In the list of properties in the **Advanced** tab, look at the value of the **wrs.scheduling.LSFSchedulingServerUID** property (or add the property if it does not exist). If the **Property Value** column does not contain the user ID `lsfuser`, enter that user ID in the **Property Value** field. On Windows systems, the ID must be qualified with a domain or machine name.
6. For the **wrs.scheduling.LSFSchedulingServerPW** property, enter the password for `lsfuser` (if the password is not already present) in the **Property Value** field. Add the property if it does not exist. You can use a password that is encoded by SAS.
7. Click **OK** to close the Properties dialog box.
8. If you have edited the configuration information, you must restart SAS Web Report Studio.

Step 5: Update the LSF Password File (Windows Only)

If your scheduling server is running on a Windows machine, then you must supply the scheduling server with the credentials for the user ID `lsfuser`.

The user name and password that you provide in this step must match the ones that you provided in the SAS Web Report Studio configuration, as described in [“Step 4: Update the SAS Web Report Studio Configuration” on page 81](#).

Follow these steps:

1. On the scheduling server, open a Command Prompt window.
2. Use the program **lspasswd** to register the credentials for the user ID lsfuser, as follows:
 - a. Issue a command similar to this:


```
C:\LSF_7.0\7.0\bin\lspasswd.exe -u .\lsfuser
```

The program prompts you for this user's password.
 - b. Enter the user's password and then confirm it. This completes the registration process.

Step 6: Verify Logging for the Output Generation Tool

SAS Web Report Studio uses the Output Generation Tool to create sets of reports in batch mode. When a scheduled report is executed on Windows, the tool records information in a logs directory. (On UNIX systems, the log statements are directed to the console when a scheduled report is executed.) Verify that the directories have been created.

For a default Windows installation, the path is as follows:

```
C:\SAS\config
\Lev1\Web\Logs\SASBIReportServices4.4.log
```

For a default UNIX installation, the path is as follows:

```
SAS-config-dir/levx/Applications/SASBIReportServices44/logs
```

Step 7: Edit the Initialization File for the Output Generation Tool (Windows Only)

On Windows systems, you must edit the initialization file for the Output Generation Tool to specify the directory location of the logs that are created when a scheduled report is executed. Complete the following steps:

1. Open the **outputgen.ini** file in a text editor. The file is located in the installation directory for SAS Business Intelligence Report Services.
2. Locate the line that starts with this code:


```
applogloc=
```
3. After the equal sign, enter the path to the directory in which you want the tool to create the log file. This should be the same directory that you created in [“Step 6: Verify Logging for the Output Generation Tool” on page 83](#).
4. Save your changes.

Step 8: Define Archive Paths for Publishing Reports to Channels

Scheduled reports can be distributed to channels that are defined using the SAS Publishing Framework. If users will be distributing reports to channels that use archive locations (persistent stores), then the archive location must be accessible to both SAS Web Report Studio and the scheduling software. If the scheduling software and SAS Web Report Studio reside on different machines, then the archive location should be specified as a network path rather than a local path. This step is optional.

To specify the appropriate archive path, follow these steps:

1. In SAS Management Console, expand the **Publishing Framework** node.
2. Expand the appropriate metadata repository node.
3. Expand the **Channels** node.
4. Right-click the channel to which you will be publishing reports, and select **Properties**.
5. In the Properties dialog box, select the **Persistent Store** tab.
6. In the **Type of persistent store** area, select the **Archive** radio button.
7. In the **Path** box, specify the path to a network location that all users who will be creating content can write to.
8. Click **OK**.

You might also need to update the permissions on the physical folder to allow access for the users who will be publishing reports. For information about setting up publication channels, see “Adding SAS Publication Channels” in the *SAS® 9.4 Intelligence Platform: Web Application Administration Guide*.

Step 9: Test the Configuration

After you have completed steps 1 through 8, use the following procedure to test your configuration:

1. On a client machine, use SAS Web Report Studio to create and schedule a report as follows:
 - a. Create and save a simple report.
 - b. Click **View Report** to display the report.
 - c. Select **File** ⇒ **Schedule**.
 - d. On the Schedule Report page, select **Now**, and click **Next**.
 - e. On the next page, click **Finish**. If the word **Running** appears in the status field, wait for the job to finish.
2. In SAS Management Console, check the properties of the scheduled report as follows:
 - a. Select the **Folder View** tab and then expand the folders until you locate the report that you scheduled.
 - b. Right-click the report, and choose **Properties**.
 - c. Select the **Content** tab. A folder called **Batch** should be displayed on this tab. The folder contains the output of the scheduled report.

3. If the **Batch** folder is present on the report's **Content** tab, as described in the previous step, then return to SAS Web Report Studio and complete these steps:
 - a. Log off, and then log back in.
 - b. Open the report. The following message should appear at the top of the report:

To interact with this report, you must first refresh the data.

If this message appears, then the configuration is correct.

If the configuration is not correct, see [“Troubleshooting the Configuration” on page 85](#).

Rescheduling a Report

In some cases (such as migration), you might need to reschedule reports that have been previously scheduled. To reschedule a report, follow these steps:

1. Select **File** ⇒ **Manage Files** ⇒ **View scheduled and distributed reports** to display the Scheduled and Distributed Reports window.
2. Select **Actions** ⇒ **Schedule** to update the schedule for the report.

Troubleshooting the Configuration

If you experience problems when you test the configuration, first use Platform Flow Manager to check for error messages on the Platform scheduling server. For instructions, see [“Check Error Messages in Platform Flow Manager” on page 23](#).

Then, check to determine whether any logs were created by the Output Generation Tool. For a default Windows installation, the logs are located in the following path:

C:\Program Files\SASHome\SASBIReportServices\4.4\logs

For a default UNIX installation, the path is as follows:

SAS-config-dir/levx/Applications/SASBIReportServices44/logs

If no logs are present in this path, verify that you have completed these tasks:

- created a logs directory, and assigned the appropriate user rights to the directory. See [“Step 6: Verify Logging for the Output Generation Tool” on page 83](#).
- verified that the **applogloc** statement in the **outputgen.ini** file is correct. See [“Step 7: Edit the Initialization File for the Output Generation Tool \(Windows Only\)” on page 83](#).
- accurately entered the command in the **Command Line** field when you defined the SAS Java Batch Server in SAS Management Console. See [“Step 2: Verify That a SAS Java Batch Server Has Been Defined” on page 80](#).

Make sure that quotation marks appear around the arguments, as shown in the example. If you copied and pasted the command, make sure that a space appears after **outputgen.exe**.

On Windows systems, you can verify the command by pasting it into a DOS command window. The command should execute with no errors.

If logs are present in the path, then check for the following error messages:

**An error occurred: Unable to login user. Cause: Access denied.
or Caused by: com.sas.iom.SASIOmDefs.GenericError: Error
authenticating user SAS Trusted User in function LogonUser.**

Make sure that the user ID and password for the SAS Trusted User (sastrust) are specified correctly in the `OutputManagementConfigTemplate.xml` file. You might need to remove the domain, or make sure that the domain is followed by a forward slash (/) rather than a backward slash (\).

**An error occurred: Exception while rendering report in batch.
Cause: cxp.002.ex.msg: The connection factory requires an
identity for the authentication domain "DefaultAuth", but the
user context provided for user "SAS Demo User" does not have
any identities for that domain. Therefore, the user cannot be
authorized to use the connection factory.**

Make sure that the SAS Web Report Studio user who is trying to schedule the report has a login (including a password) in the metadata repository. See [“Ensure That Metadata Logins Exist for Users Who Will Schedule Reports”](#) on page 80 .

For additional troubleshooting information, see [“Resolving Issues Related to Scheduling with Platform Suite for SAS”](#) on page 23 .

Chapter 12

Scheduling Jobs from SAS Marketing Automation

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Overview of Scheduling for SAS Marketing Automation

SAS Marketing Automation campaigns are scheduled using the Platform Computing scheduling server. Depending on the permissions held by the SAS Marketing Automation user, campaigns can be scheduled directly by the user or sent to an administrator for scheduling.

Note: SAS Marketing Automation campaigns cannot be scheduled using an Oozie scheduling server.

Here is an overview of the process of scheduling campaigns from SAS Marketing Automation:

- Users create campaigns using the Customer Intelligence Studio. Campaigns include a start and end date and specify any recurrence.
- The user executes the campaign. If the user has the appropriate permissions, the job is sent directly to the scheduling server. Otherwise, the job is deployed for scheduling by an administrator.
- If the campaign is to be scheduled by an administrator, the administrator uses the Schedule Manager to create and schedule a flow that includes the deployed campaign. Schedule Manager passes the schedule information and the associated commands to the scheduling server.
- The Platform Scheduling server executes the campaign at the designated time.

Enabling the Scheduling of SAS Marketing Automation Jobs

Requirements for Scheduling SAS Marketing Automation Jobs

In addition to the scheduling server, a scheduling environment for SAS Marketing Automation jobs includes the following:

a SAS Java Batch server

A SAS Java Batch server is a metadata object that specifies the command to execute SAS code that is generated by SAS Marketing Automation jobs. The initial configuration process should have created a definition for a server called SAS Java Batch Server, which is a component of your SAS Application Server (for example, SASApp). The server must have a subtype of Marketing Automation.

Define a SAS Java Batch Server

A SAS Java Batch server should have been set up during your initial installation and configuration. If you need to set it up manually, follow these steps:

1. In SAS Management Console, expand the **Server Manager** node.
2. Right-click the application server name with which the SAS Java Batch server is associated (for example, **SASApp**), and select **Add Application Server Component**.
3. On the first page of the New SAS Application Server Component Wizard, select **SAS Java Batch Server** and click **Next**.
4. On the next wizard page, enter a name (for example, **SAS Java Batch Server**), and click **Next**.
5. On the next wizard page, do the following:
 - From the **Associated Machine** drop-down list, select the name of the machine that contains the SAS Application Server.

Note: The machine name attribute is for documentation purposes only. SAS scheduling does not use this machine name to set up or execute the job.

- From the **SubType** list, select **Marketing Automation**.
 - In the **Command** box, enter the path to the command that starts a SAS session on the scheduling server.
 - Click **Next**.
6. On the next wizard page, review the information that you have entered. If it is correct, click **Finish**.

Deploying and Scheduling SAS Marketing Automation Jobs

When you have completed the appropriate setup tasks, SAS Marketing Automation users can submit jobs for scheduling. For information about scheduling SAS Marketing Automation jobs, see *SAS Marketing Automation: User's Guide*.

