

Paper SAS 4131-2020

## SAS® Grid Manager: Inside Look into Grid Launched Servers

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### ABSTRACT

As a SAS® Grid Manager administrator, you might wonder whether you can improve utilization of compute resources so that your organization has better return on investment. You start SAS® server processes in your grid environment by running server start-up scripts and through application invocation. SAS server configuration in SAS metadata determines how a server is launched. This paper presents best practices for instantiating SAS servers within a grid environment. Grid-launched servers benefit from SAS Grid Manager features including workload balancing, parallel processing, high availability, and flexibility with scaling the architecture.

### INTRODUCTION

SAS 9.2 introduced server-side load balancing for SAS workspace servers using SAS Grid Manager. When a client such as SAS® Enterprise Guide® that uses this server requests a workspace server to run a job, the object spawner launches the server process on the best host, as chosen by SAS Grid Manager. SAS Grid Manager uses Platform LSF as workload manager to make this decision. Support for grid load balancing for stored process servers, pooled workspace servers, and OLAP servers was included in SAS 9.3. Support for grid-launched servers was added starting with SAS 9.4.

With server-side load balancing through grid-launched SAS workspace servers, when a client requests a workspace server, the object spawner launches the server process in the grid on a host based on configured SAS Grid Manager policies [1]. Client code, which is running as a grid job, is invoked on the workspace server. Starting with the first maintenance release after SAS 9.4, stored process servers and pooled workspace servers can also be grid-launched.

In SAS 9.4M6, the product name for a grid using Platform LSF was changed to SAS Grid Manager for Platform. SAS Grid Manager product introduced a new grid provider, which consists of SAS® Workload Orchestrator for workload management and SAS® Job Flow Scheduler for enterprise scheduling. The object spawner uses SAS Workload Orchestrator instead of Platform LSF to start the server process. Grid-launched features are applicable to both SAS Grid Manager for Platform and SAS Grid Manager, and the configuration is identical. SAS code that runs in grid-launched servers remains unchanged with the introduction of SAS Grid Manager using SAS Workload Orchestrator [2].

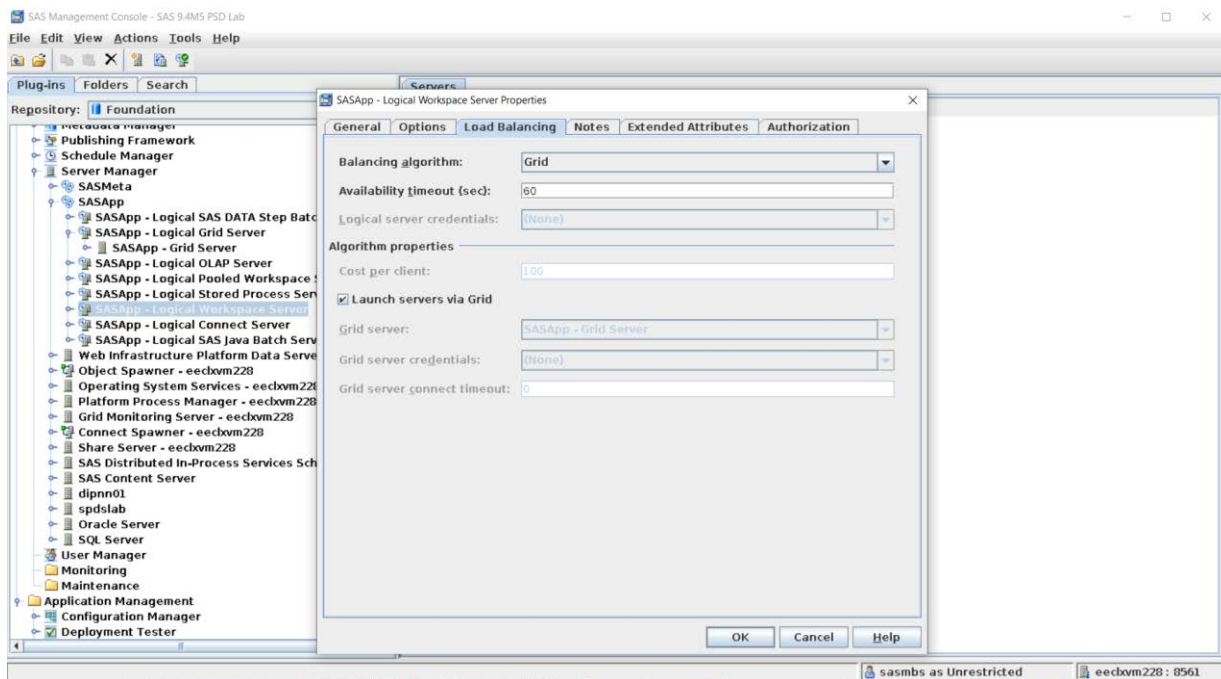
### CONFIGURING GRID-LAUNCHED SERVERS

If you are deploying SAS Grid Manager for Platform, you install Platform Suite for SAS, which includes Platform LSF as a workload manager, prior to installing SAS software. If you are deploying a SAS 9.4M6 Grid Manager environment, your SAS Grid Manager installation includes SAS Workload Orchestrator software. Configuring server-side load balancing using grid-launched servers is identical to both environments. You update server definitions in SAS Management Console to configure grid-launched servers.

## LOGICAL WORKSPACE SERVER

Navigate to the Server Manager plug-in in SAS Management Console. Select a SAS Application Server context and convert the logical workspace server to load balancing. For load balancing options, specify Grid as the load balancing algorithm. Select the Launch Servers via Grid checkbox. This option is only applicable for workspace servers, stored process servers, and pooled workspace servers.

Figure 1 shows how the logical workspace server load balancing properties for the selected SAS Application Server context look.



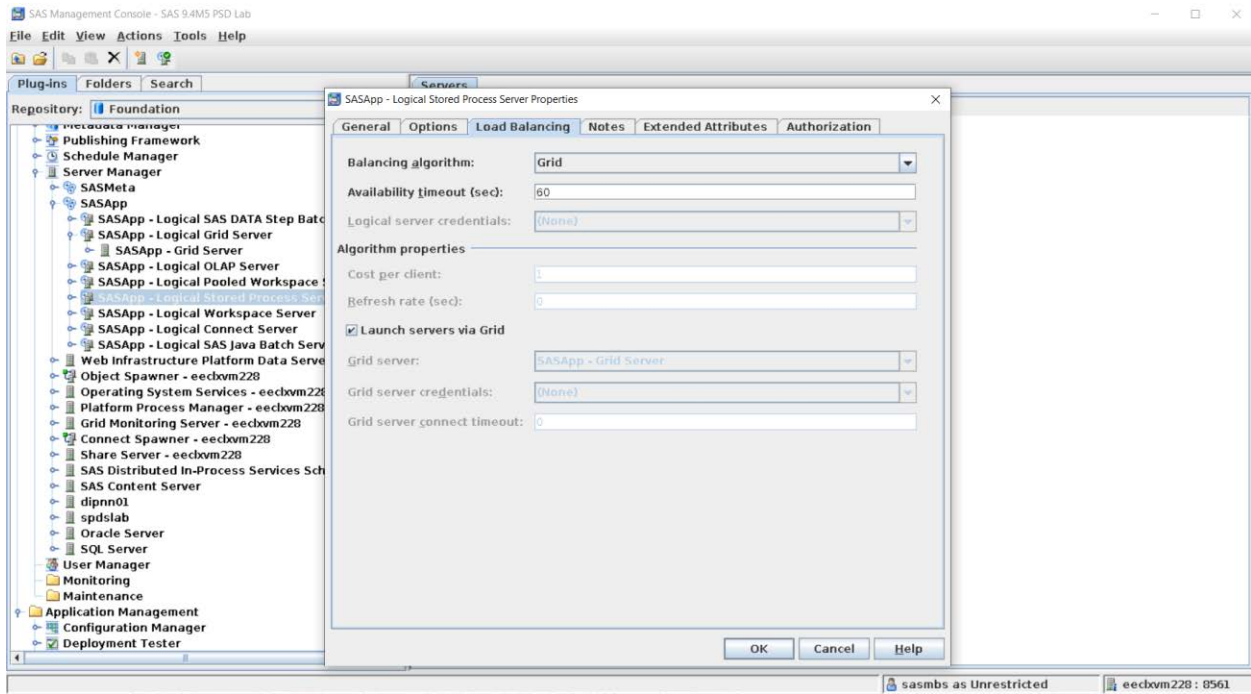
**Figure 1: Logical Workspace Server Load Balancing Properties**

If you are using SAS Grid Manager for Platform, add `ENABLE_HOST_INTERSECTION=Y` in the `lsb.params` LSF configuration file. This option prevents errors when a grid-launched workspace server is configured with more hosts than the `HOSTS=` specification in the LSF queue definition.

## LOGICAL STORED PROCESS SERVER

Navigate to the Server Manager plug-in in SAS Management Console. Select a SAS Application Server context and select the logical stored process server. Select Properties from the Actions menu or the context menu. The Properties dialog box appears. Select the Load Balancing tab. For load balancing options, specify Grid as the load balancing algorithm. Select Launch Servers via Grid checkbox.

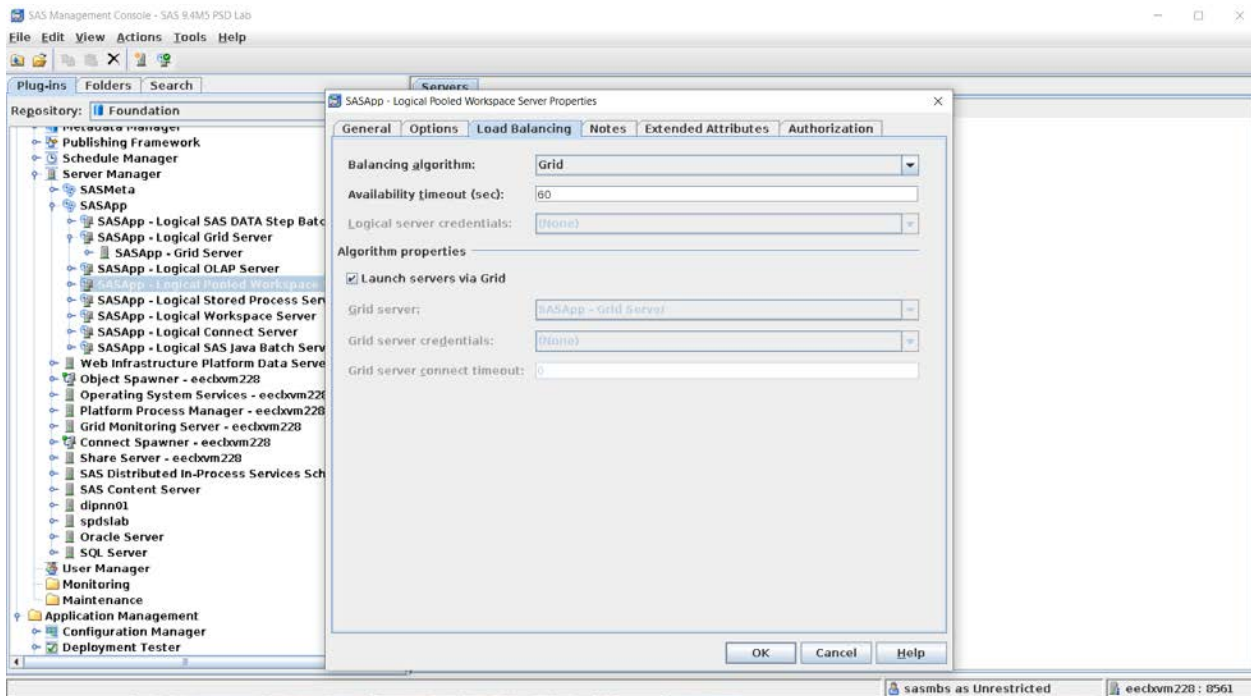
Figure 2 shows how the logical stored process server load balancing properties for the selected SAS Application Server context look.



**Figure 2: Logical Stored Process Server Load Balancing Properties**

## LOGICAL POOLED WORKSPACE SERVER

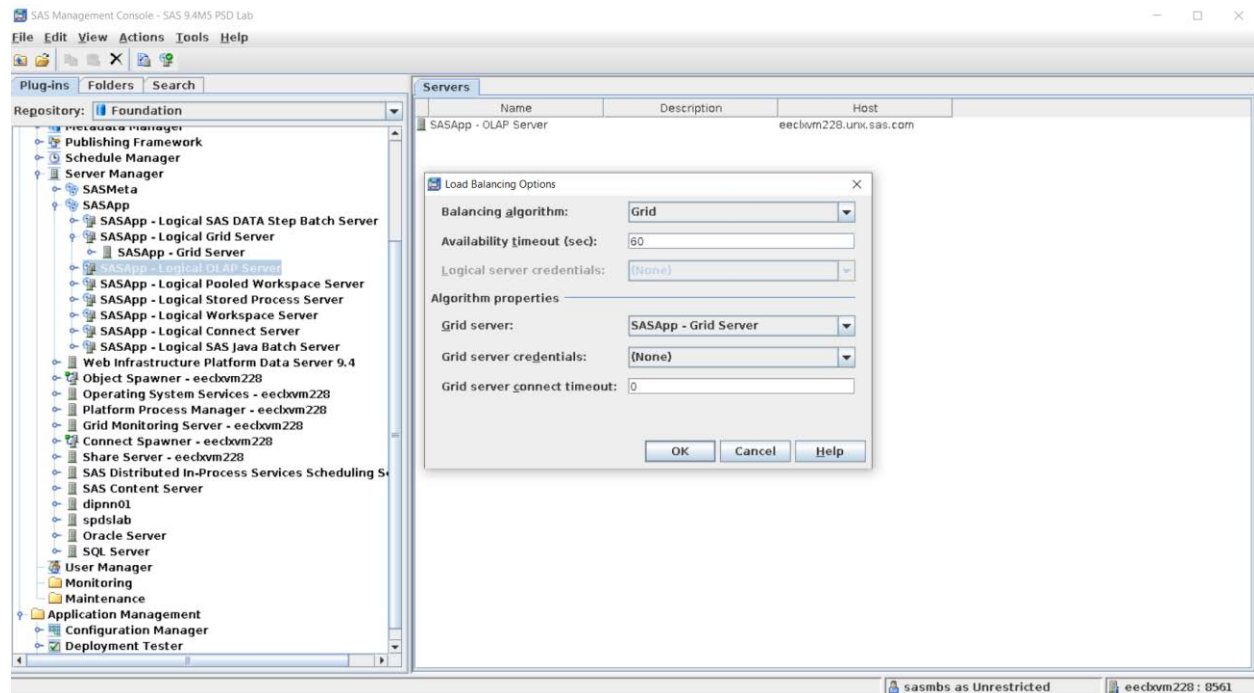
You configure the logical pooled workspace server by following the same steps as for the logical stored process server.



**Figure 3: Logical Pooled Workspace Server Load Balancing Properties**

## LOGICAL OLAP SERVER

Grid-launched features are not applicable for OLAP servers, so the Launch Servers via Grid checkbox option is not available.



**Figure 4: Logical OLAP Server Load Balancing Options**

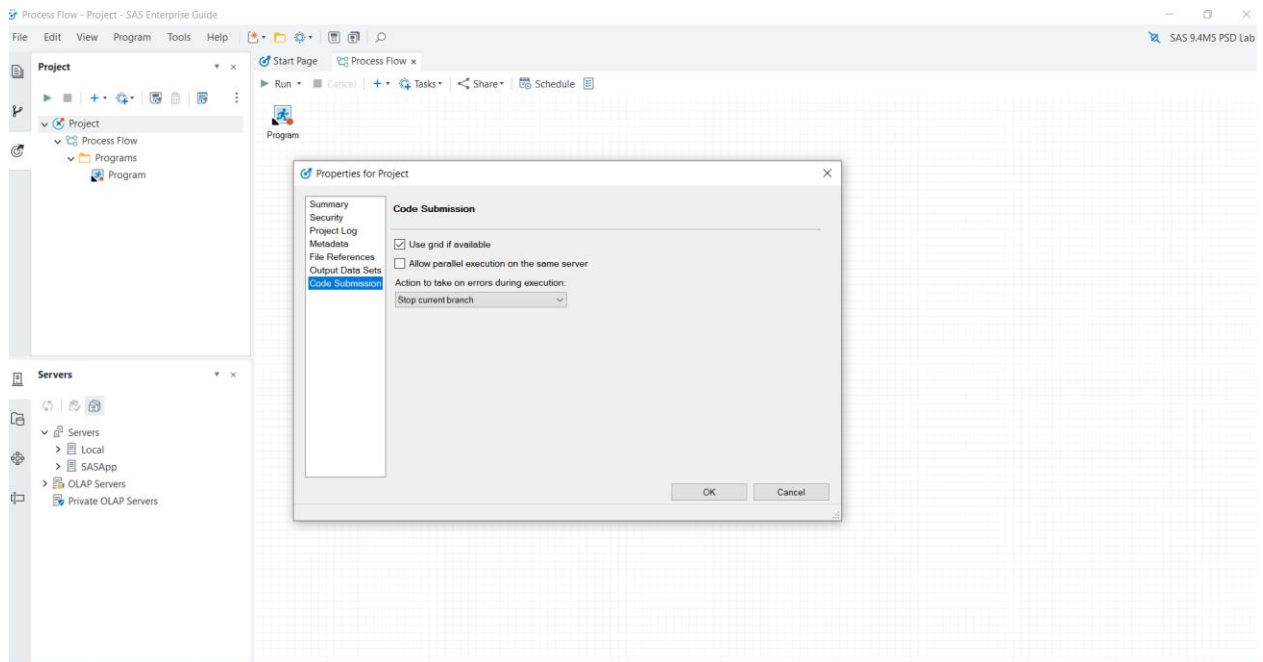
## ALTERNATE CONFIGURATIONS USING LOGICAL GRID SERVER

Alternate configurations without using grid-launched features are available to grid-enable SAS Enterprise Guide and SAS® Add-In for Microsoft Office clients.

The following methods use a logical grid server definition in the server metadata to launch a grid server session. The object spawner starts the workspace server session. Jobs are submitted to the grid server session.

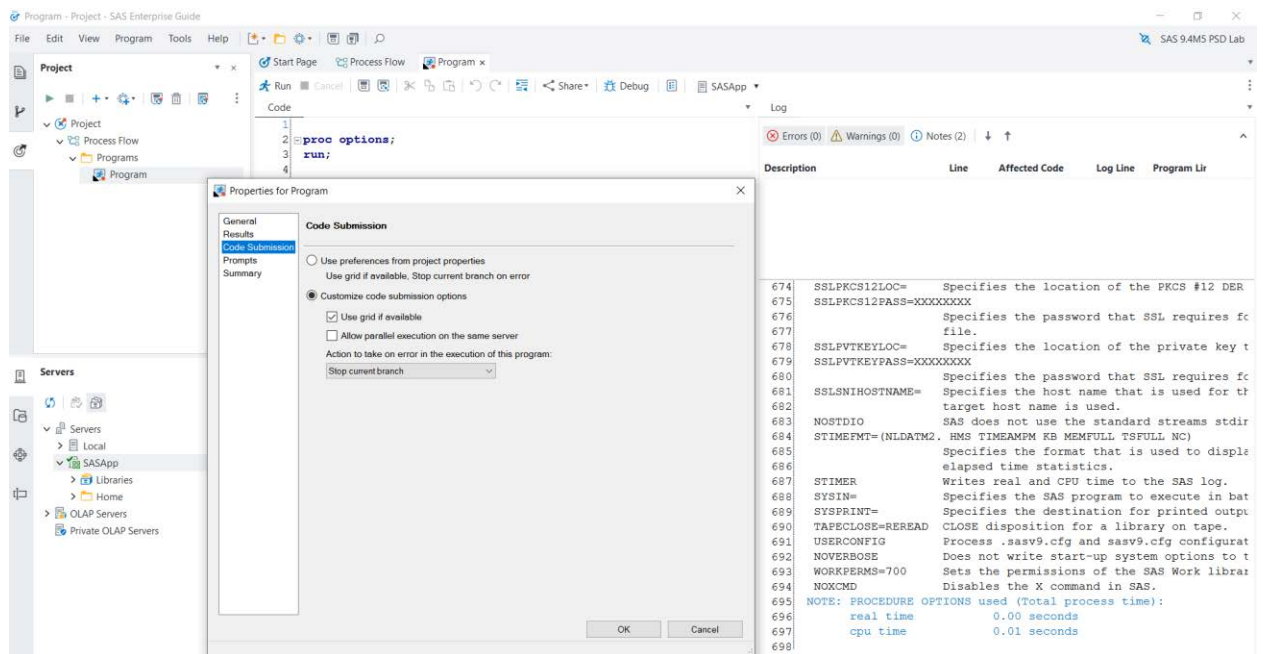
## CLIENT-SIDE CONFIGURATION

SAS Enterprise Guide submits jobs to the grid if the Use grid if available option is selected on element properties or the project properties. To enable the grid at a project level, Select File -> Project Properties and click Code Submission. Select the Use grid if available option.

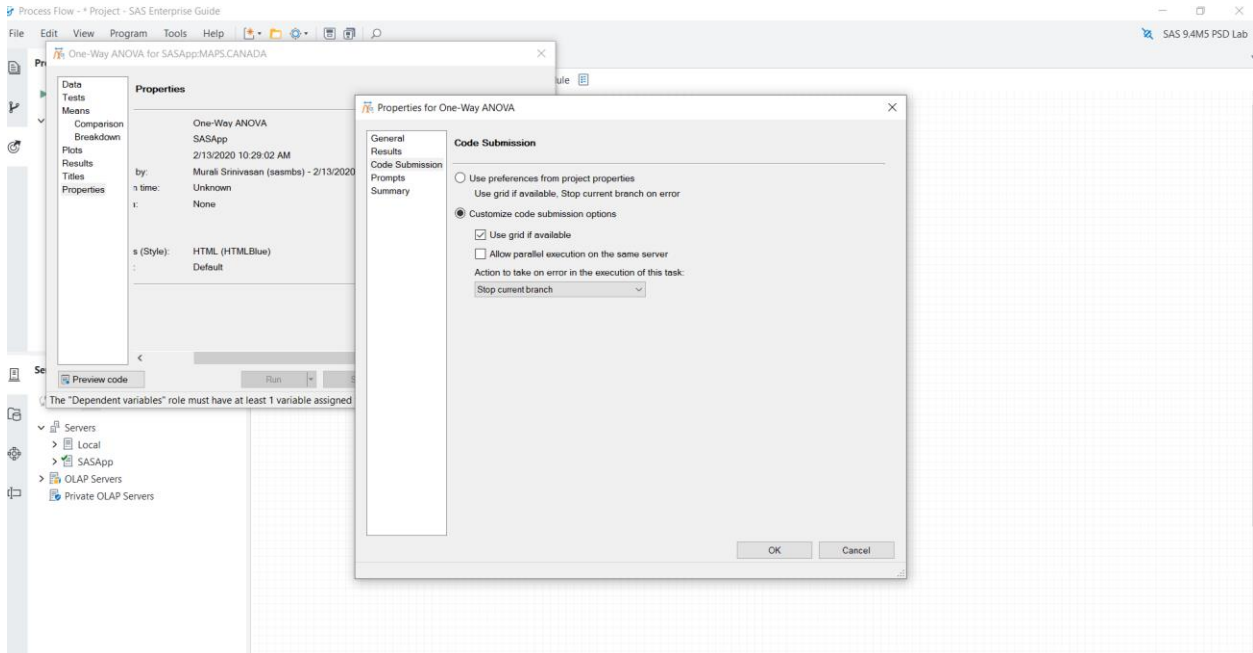


**Figure 5: SAS Enterprise Guide Project Properties**

To enable the grid at an individual program or task level, select the properties for the program or task, and use the Code Submission page. Select the Use preferences from project properties radio button to show the current configuration from the project properties. Selecting Customize code submission options to override this at the element level.

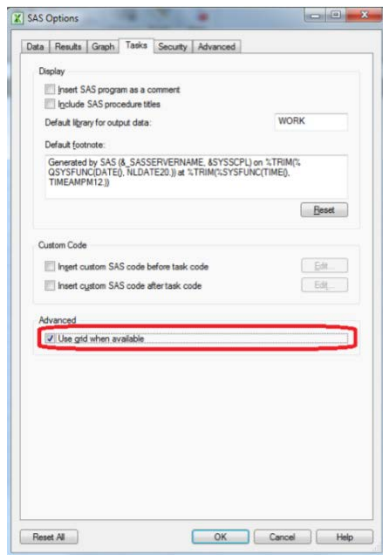


**Figure 6: SAS Enterprise Guide Program Properties**



**Figure 7: SAS Enterprise Guide Task Properties**

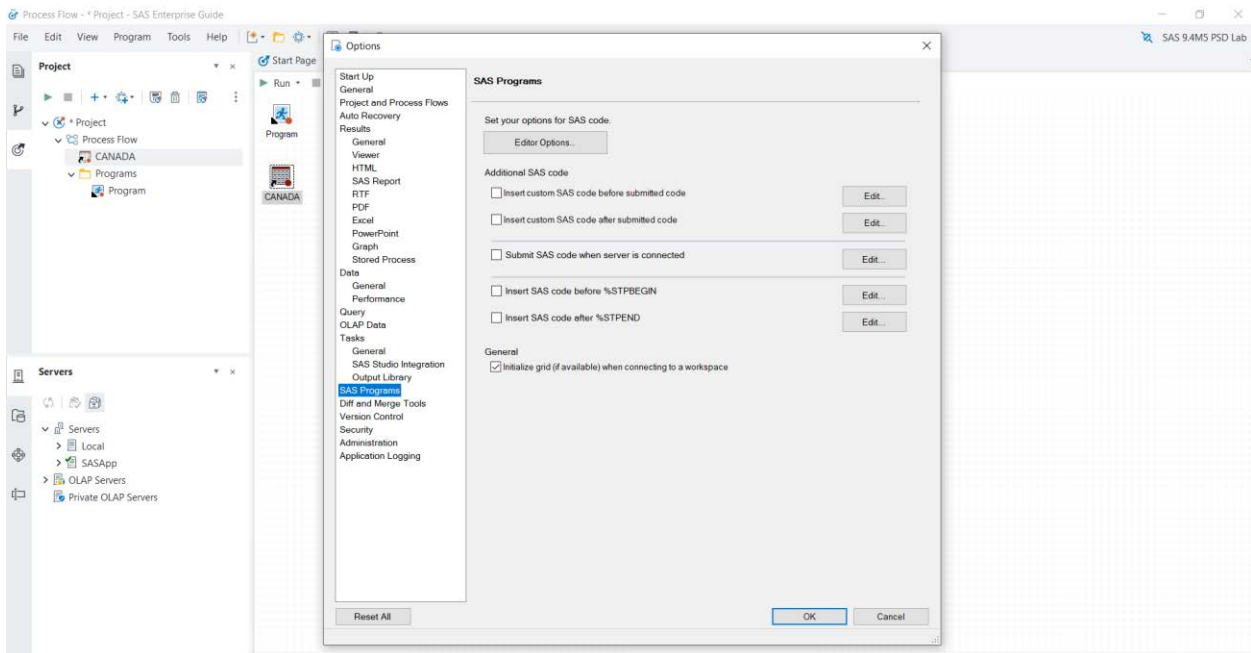
SAS Add-In for Microsoft Office is a Component Object Model (COM) add-in to Microsoft Office. To grid-enable SAS Add-In for Microsoft Office, open the SAS tab from the Microsoft Office application on the desktop and select SAS -> Tools -> Options. In the SAS Options dialog box, click the Tasks tab and set the options illustrated in Figure 8.



**Figure 8: SAS Add-In for Microsoft Office Properties**

To create a grid session for initial processing, in SAS Enterprise Guide select Tools -> Options -> SAS Programs. In the General group, select Initialize grid (if available) when connecting to a workspace. This option specifies that SAS Enterprise Guide connects to a workspace server. It also connects to and initializes a grid server session. However, this option does not cause SAS Enterprise Guide to submit to the grid. SAS Enterprise Guide submits jobs to the grid only by selecting the Use grid if available option

in the element properties or project properties, or by overriding the option with the server metadata configuration.

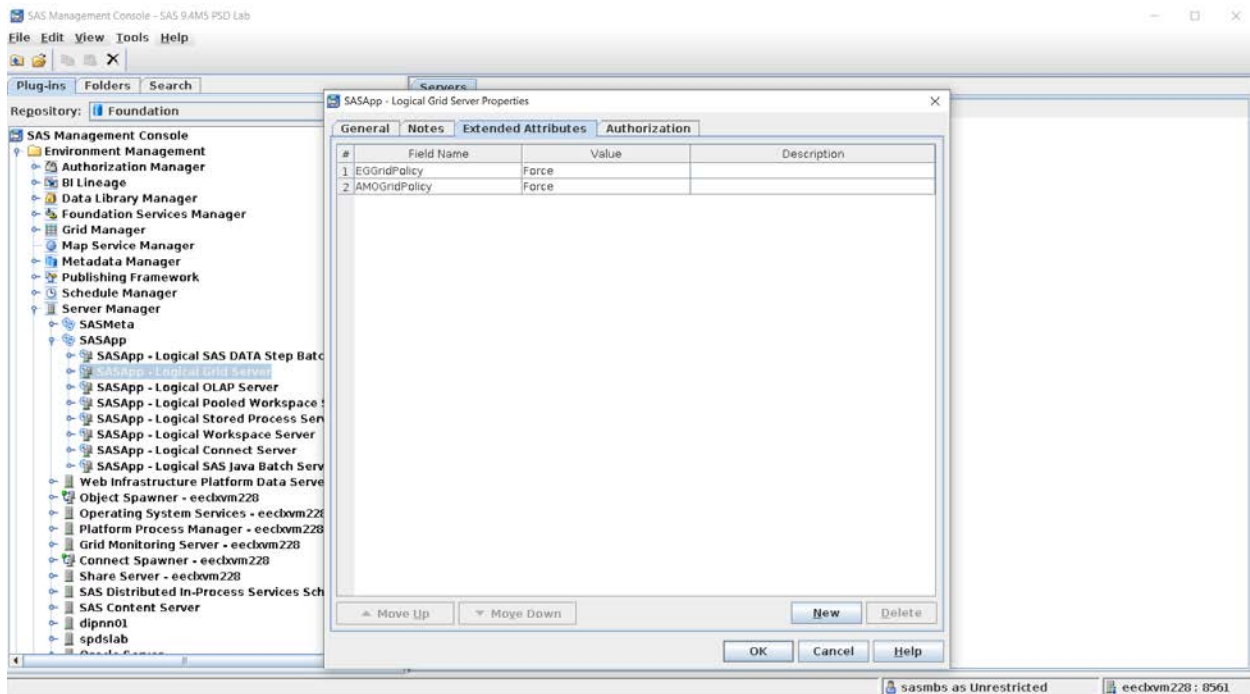


**Figure 9: SAS Enterprise Guide Initialize Grid Properties**

## SERVER METADATA CONFIGURATION

You can override client-side configurations with server metadata settings if you do not want to allow end-user control of grid features from individual desktop applications.

To control grid usage from server metadata, use the EGGridPolicy and AMOGridPolicy extended attributes on the logical grid server definition. Set EGGridPolicy and AMOGridPolicy to Force to always send jobs to the grid using the logical grid server definition, regardless of whether the Use grid if available client-side configuration option is specified. If this attribute is set to Noforce, whether jobs are sent to the grid depends on the value of the Use grid if available client-side option. If this attribute is set to Ignore, jobs are never sent to the grid, regardless of the value of the Use grid if available option.



**Figure 10: Forcing Grid with Server Metadata**

In this scenario, code from the client is shipped to SAS workspace server and automatically wrapped with RSUBMIT/ENDRSUBMIT statements. This results in a grid server session that runs SAS statements within the RSUBMIT/ENDRSUBMIT block.

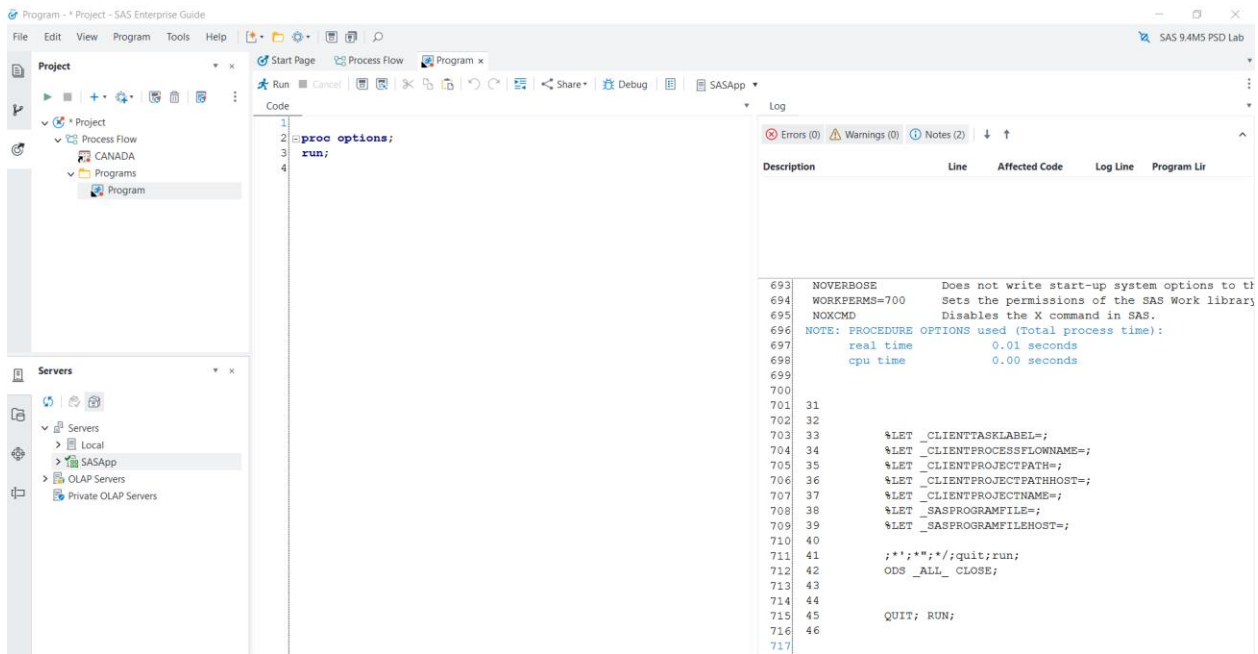
## IGNORING DIRECT GRID FEATURES

Grid enabling by using one of the alternate options along with the grid-launched server option results, in two grid sessions, a workspace server in the grid, and an additional grid server session using the logical grid server definition.

In this scenario, SASApp (the SAS Application Server context) is configured in the server metadata to use a grid-launched workspace server. The SASApp extended attribute EGGridPolicy is specified with a value of Force.

In SAS Enterprise Guide, select SASApp from the Servers pane. Right-click and then click Connect. Notice that there is a tick mark and a grid symbol next to SASApp.





**Figure 11: SAS Enterprise Guide Output**

Figure 12 is the output of the `bjobs` command before connecting to grid from SAS Enterprise Guide. There are no grid jobs for the user.

```

[sas@eeclxvm228 ObjectSpawner]$ bjobs -w -u sasmbms
No unfinished job found
[sas@eeclxvm228 ObjectSpawner]$
[sas@eeclxvm228 ObjectSpawner]$

```

**Figure 12: Bjobs Output Before**

Figure 13 is the output of the `bjobs` command after establishing a connection to grid from SAS Enterprise Guide. Notice there are two grid jobs. Job 2791 is a grid-launched workspace server for the user. Job 2792 is an additional grid server session for the user. This additional grid server session is redundant and not required. Because the workspace server is started as a grid job, user code can directly run on the grid-launched workspace server.

```

[sas@eeclxvm228 ObjectSpawner]$
[sas@eeclxvm228 ObjectSpawner]$
[sas@eeclxvm228 ObjectSpawner]$ bjobs -w -u sasmbms
JOBID  USER  STAT  QUEUE          FROM_HOST  EXEC_HOST  JOB_NAME             SUBMIT_TIME
2791   sasmbms  RUN   qeg           eeclxvm228.unx.sas.com eeclxvm229.unx.sas.com SAS Enterprise Guide_SASApp - Worksp
ace Server_0E977435-5EBA-EA4A-B054-F75BEC6CEC04 Feb 14 07:45
2792   sasmbms  RUN   normal       eeclxvm229.unx.sas.com eeclxvm229.unx.sas.com EG.sasmbms.50704 Feb 14 07:46
[sas@eeclxvm228 ObjectSpawner]$

```

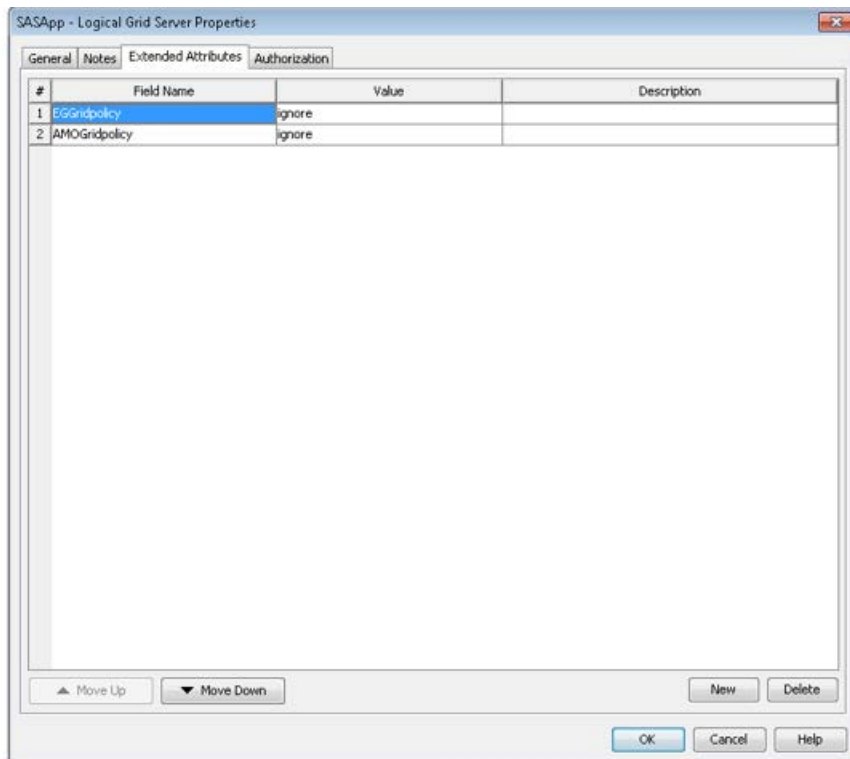
**Figure 13: Bjobs Output After**

To safeguard from using both direct grid features and grid-launched features at the same time, you must set the `EGGridPolicy` and `AMOGGridPolicy` extended attributes on the logical grid server definition to `Ignore`.

Setting these attributes prevents SAS Enterprise Guide and SAS Add-In for Microsoft office from using the direct grid features and starting an additional grid server session while using a grid-launched workspace server. An additional grid server session is not required, because the workspace server is running in the grid.

This server-side setting overrides SAS Enterprise Guide or SAS Add-In for Microsoft Office client-side options such as `Use grid if available` and `Initialize grid (if available) when`

connecting to a workspace. Jobs are always sent to the grid-launched workspace server regardless of the value of the option Use grid if available.

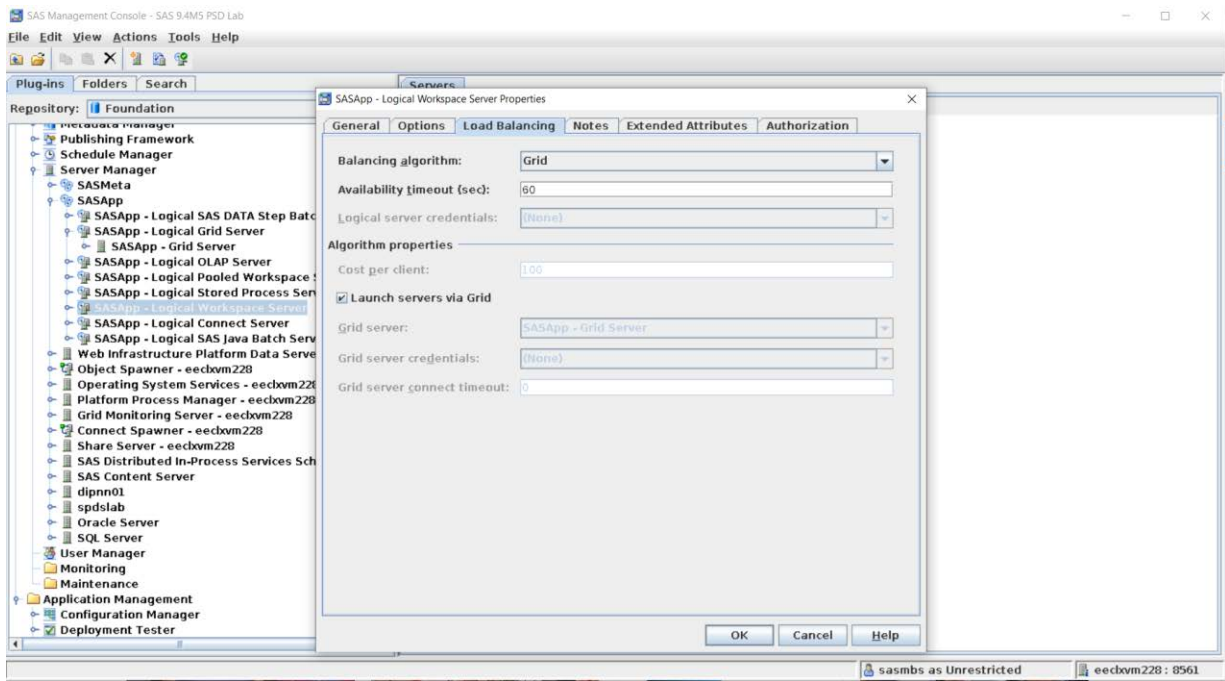


**Figure 14: Ignoring Direct Grid Features for Grid-Launched Servers**

## NEWER CLIENTS

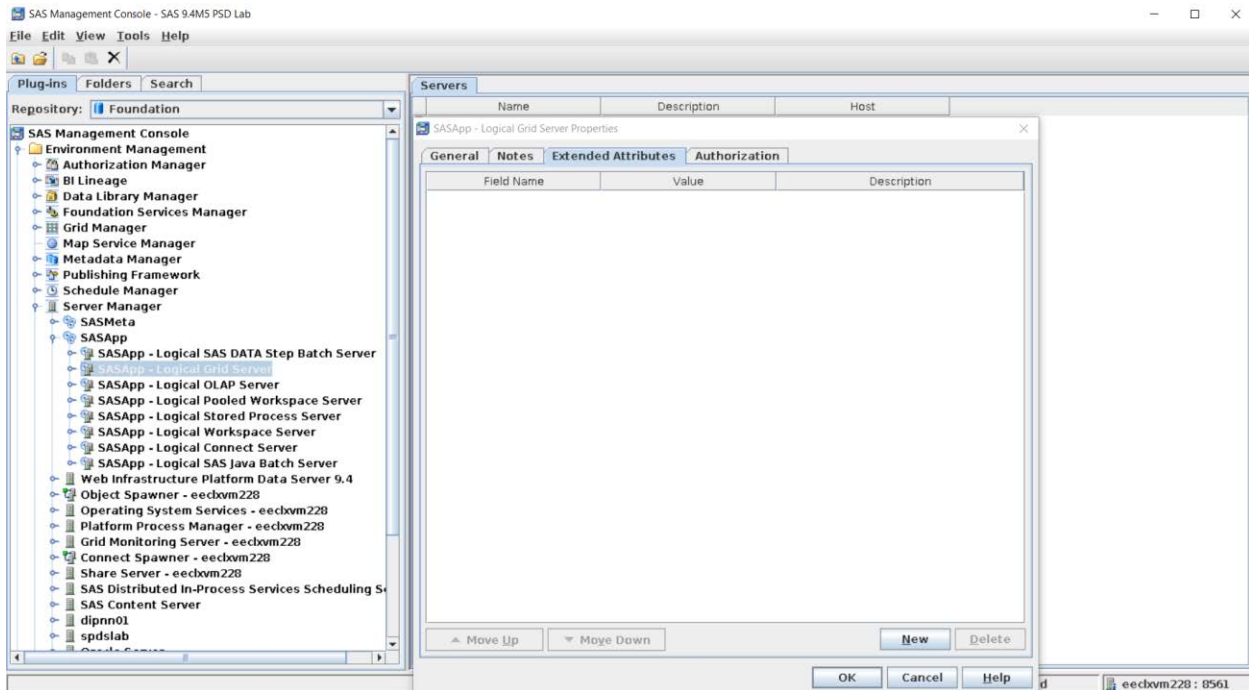
SAS Enterprise Guide 8.2 and later and SAS Add-in for Microsoft Office 8.2 and later automatically ignore direct grid features when the Launch Servers via Grid checkbox is selected. For these clients, you do not have to set the EGGridPolicy and AMOGGridPolicy attributes to Ignore.

Figure 15 illustrates a grid-launched workspace server specification in server metadata.



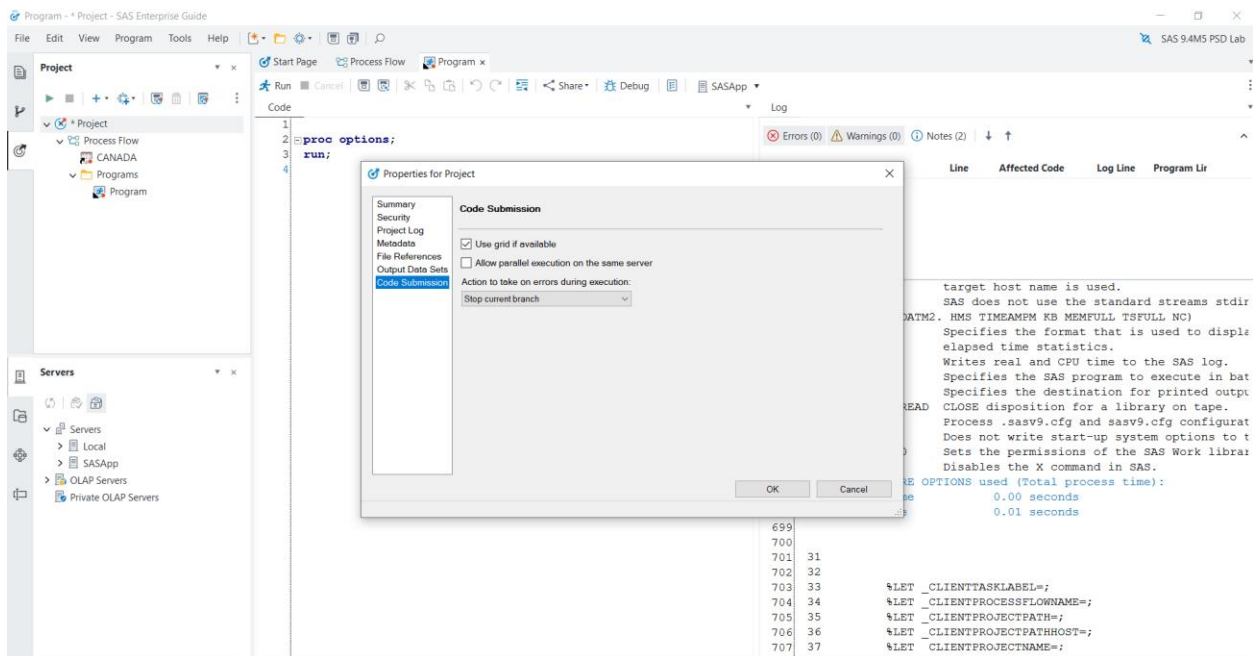
**Figure 15: Grid-Launched Workspace Server**

Figure 16 illustrates the extended attributes for SASApp (the SAS Application Server logical grid server context). EGGridPolicy and AMOGridPolicy attributes are not specified.



**Figure 16: Logical Grid Server Extended Attributes Properties**

Figure 17 illustrates the client-side configuration. The Use grid if available project property is enabled in SAS Enterprise Guide 8.2.



**Figure 17: SAS Enterprise Guide Use Grid if Available Project Property**

Figure 18 illustrates the output of the `bjobs` command before establishing a grid connection from SAS Enterprise Guide. There are no grid jobs for the user.

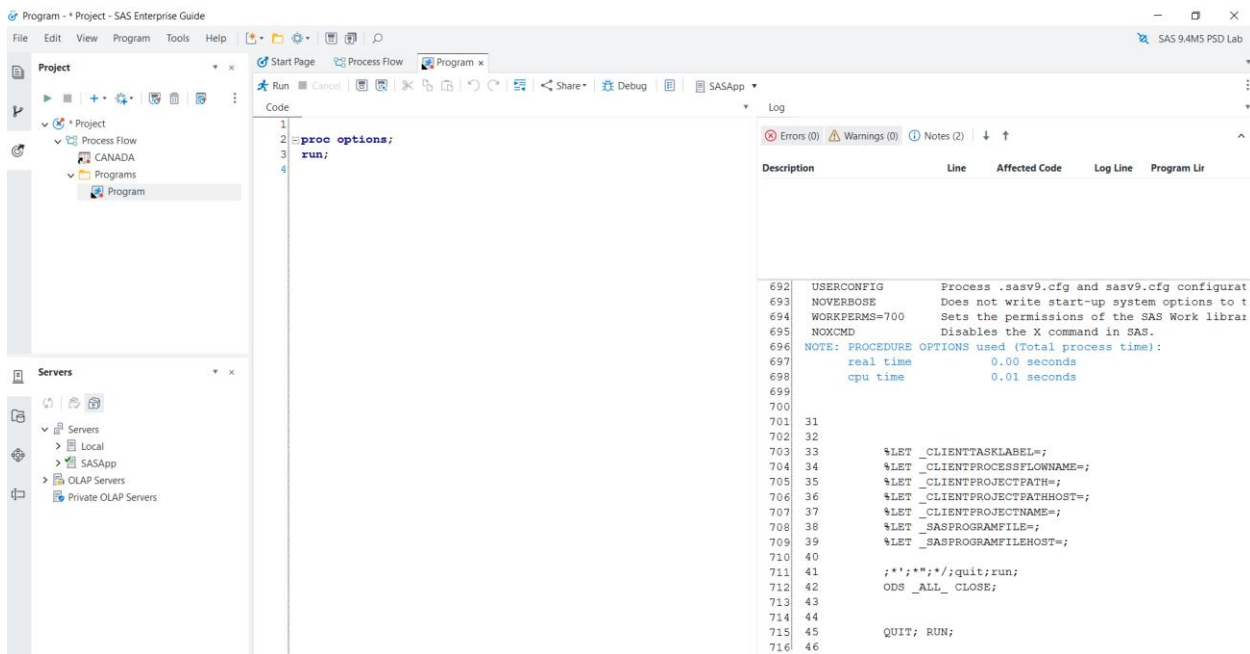
```

[sas@eeclxvm228 Lev1]$
[sas@eeclxvm228 Lev1]$
[sas@eeclxvm228 Lev1]$ bjobs -w -u sasmb
No unfinished job found
[sas@eeclxvm228 Lev1]$

```

**Figure 18: Bjobs Output Before**

Figure 19 illustrates the SAS Enterprise Guide output after running the SAS program. Notice a connection to SASApp with the green tick mark.



**Figure 19: SAS Enterprise Guide Output**

Figure 20 illustrates the output of the `bjobs` command after running code from SAS Enterprise Guide. Notice that a single workspace server session has started in the grid. The additional, redundant, grid server session is not started. Direct grid features are automatically ignored while using a grid-launched workspace server.

```
[sas@eeclxvm228 Lev1]$
[sas@eeclxvm228 Lev1]$ bjobs -w -u sasmbms
JOBID USER STAT QUEUE FROM HOST EXEC HOST JOB_NAME SUBMIT TIME
2784 sasmbms RUN qeg eeclxvm228.unx.sas.com eeclxvm229.unx.sas.com SAS Enterprise Guide_SASApp - Workspa
ce Server 4FD05977-DB9C-0448-B47B-92327ACD53AB Feb 13 13:26
[sas@eeclxvm228 Lev1]$
```

**Figure 20: Bjobs Output After**

## SAS CLIENTS AND GRID-LAUNCHED SERVERS

You can take advantage of grid capabilities by configuring SAS clients to run SAS programs on the grid. Only certain SAS clients support grid-launched servers, and not all SAS servers can be configured as grid-launched. There are performance considerations to configuring certain SAS clients to use grid-launched servers.

SAS Enterprise Guide and SAS Add-In for Microsoft Office clients should be enabled with grid-launched workspace servers.

When you use server-side load balancing without selecting the Launch Servers via Grid option, the object spawner launches the workspace server instead of the workload manager (Platform LSF or SAS Workload Orchestrator). In this scenario, a grid job is not generated for the SAS program, and your SAS Grid Manager workload management policies such as job slots, queues, and CPU utilization thresholds are not in effect.

Alternate methods that are available to grid-enable SAS Enterprise Guide and SAS Add-In for Microsoft Office clients launch a grid server session as well as the workspace server session using the logical grid server.

In the case of grid-launched workspace server, client code runs on a SAS workspace server in the grid. An additional grid server session is not required. Hence, configuring and using grid-launched workspace servers is more efficient and is a best practice. Client options such as Use grid if available and Initialize grid (if available) when connecting to a workspace should be ignored. This is done by setting the EGGridPolicy and AMOGridPolicy extended attributes to a value of Ignore in server metadata.

It is a best practice to configure SAS® Studio Enterprise Edition to use grid launched workspace servers in the same way as SAS Enterprise Guide. SAS code runs on SAS workspace server in the grid. An alternate approach is to use SAS/CONNECT GRDSVC\_ENABLE, SIGNON, and RSUBMIT functions in a SAS code to submit to the grid for processing. In this scenario, a SAS workspace server and an additional grid server session are required to run your SAS code on the grid. You can avoid the overhead of grid enabling your SAS code when using grid-launched workspace servers.

You can benefit from a grid-launched workspace server configuration for SAS® Enterprise Miner™ 14.2 client. If you are using a version of SAS Enterprise Miner prior to 14.2, configure the object spawner instead of Platform LSF in order to start SAS workspace servers.

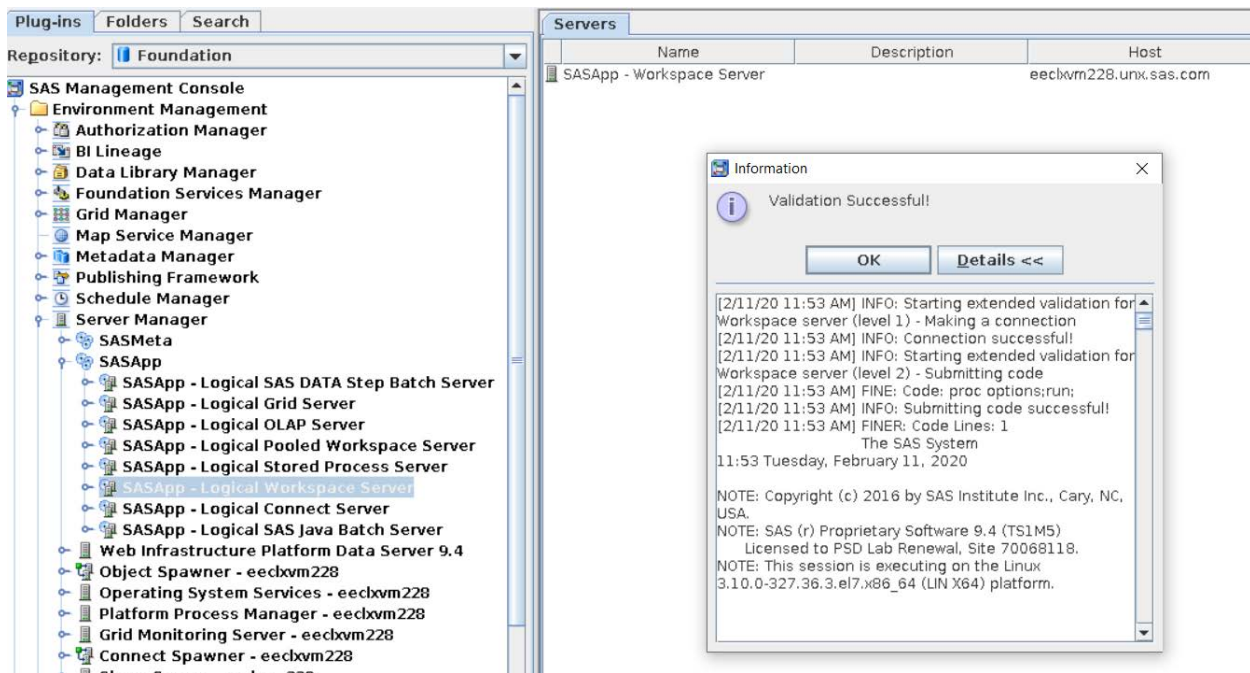
SAS Grid Manager Client Utility (SASGSUB) does not use grid-launched servers. When you submit a SAS program to the grid using SASGSUB, LSF runs a sasgrid script that starts SAS in batch mode. This grid command is defined in the Grid Server Properties dialog box in server metadata. Grid-launched servers are applicable only to SAS IOM servers such as SAS workspace servers, SAS stored process servers and SAS pooled workspace servers.

## VALIDATIONS

### GRID-LAUNCHED WORKSPACE SERVER VALIDATION

Navigate to the Server Manager plug-in in SAS Management Console. Select a SAS Application Server context that is configured with grid-launched workspace server. Select the logical workspace server, right-click, and select Validate.

You should see the message box illustrated in Figure 21, with a Validation Successful message. Click the Details button to view more information about the validation.



**Figure 21: Validate Grid-Launched Workspace Server**

The validation action causes the object spawner to start a workspace server as a grid job using Platform LSF and the SAS Management Console Java client to establish a successful connection to the server. A PROC OPTIONS program is submitted to the workspace server session.

You can verify the grid job by using either the SAS Grid Manager for Platform module for SAS Environment Manager or a command-line interface. Figure 22 illustrates the `bjobs` output before the Validate action.

```
[sas@eeclxvm229 ObjectSpawner]$ bjobs -a -u all
JOBID  USER  STAT  QUEUE  FROM_HOST  EXEC_HOST  JOB_NAME  SUBMIT_TIME
2763   sas   RUN   normal eeclxvm229. eeclxvm228. sleep 10   Feb 11 11:52
2762   sas   DONE  normal eeclxvm229. eeclxvm229. sleep 10   Feb 11 11:52
```

**Figure 22: Bjobs Output Before Validate**

Figure 23 illustrates the `bjobs` output after the Validate action. Notice the presence of a new job with a job id of 2764, a job name `*_SASApp_WorkspaceServer_*`, and a status of DONE for the user who ran the Validate action.

```
[sas@eeclxvm229 ObjectSpawner]$ bjobs -a -w -u all
JOBID  USER  STAT  QUEUE  FROM_HOST  EXEC_HOST  JOB_NAME  SUBMIT_TIME
2762   sas   DONE  normal eeclxvm229.unx.sas.com eeclxvm229.unx.sas.com sleep 10   Feb 11 11:52
2763   sas   DONE  normal eeclxvm229.unx.sas.com eeclxvm228.unx.sas.com sleep 10   Feb 11 11:52
2764   sasmb  DONE  normal eeclxvm229.unx.sas.com eeclxvm229.unx.sas.com ConnectionService 904500_SASApp
- Workspace Server_EA54B6E6-83CE-5D42-8158-53A2C16F5245 Feb 11 11:53
[sas@eeclxvm229 ObjectSpawner]$
```

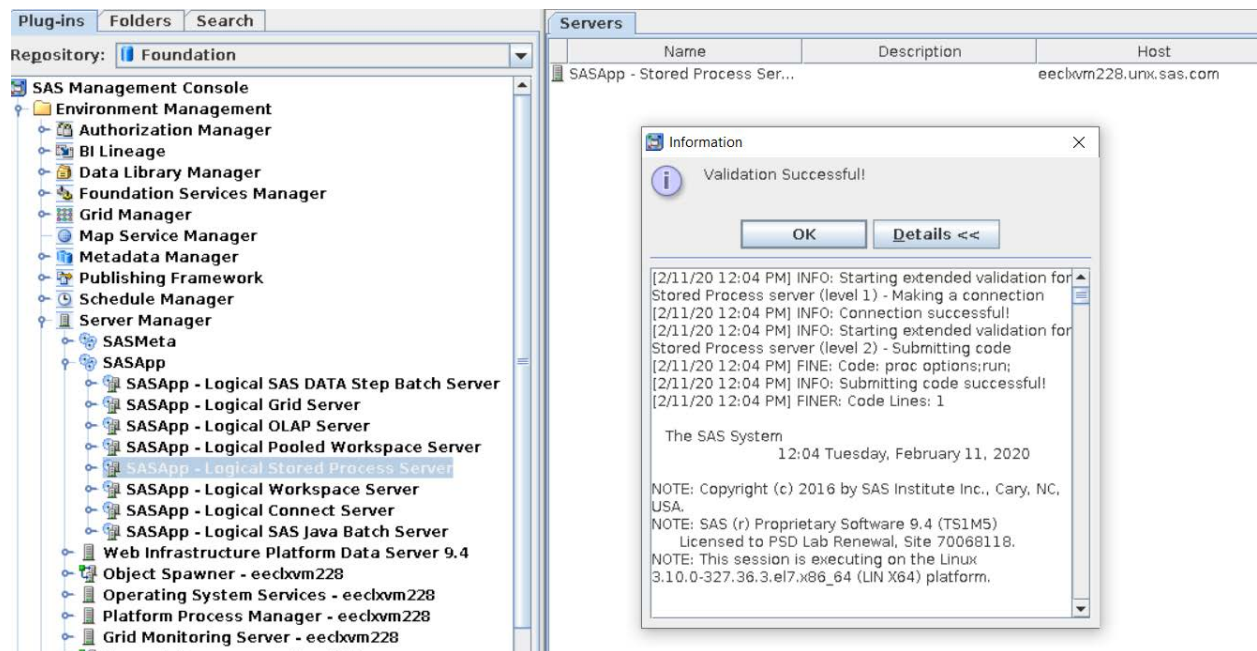
**Figure 23: Bjobs Output After Validate**

A workspace server was started as a grid job to perform the validation. The grid job ends after validation.

## GRID-LAUNCHED STORED PROCESS SERVER VALIDATION

Navigate to the Server Manager plug-in in SAS Management Console. Select a SAS Application Server context that is configured with a grid-launched stored process server. Select the logical stored process server, right-click, and the select Validate.

You should see the message box in Figure 24 with a Validation Successful message. Click the Details button for more information about the validation.



**Figure 24: Validate Grid-Launched Stored Process Server**

You can verify the grid job using either the SAS Grid Manager for Platform module for SAS Environment Manager or a command-line interface. Figure 25 illustrates the `bjobs` output before the Validate action. Notice there are no stored process server grid jobs.

```

[sas@eeclxvm229 ObjectSpawner]$ bjobs -a -w -u all
JOBID  USER  STAT  QUEUE          FROM_HOST  EXEC_HOST  JOB_NAME             SUBMIT_TIME
2762   sas    DONE  normal        eeclxvm229.unx.sas.com eeclxvm229.unx.sas.com sleep 10         Feb 11 11:52
2763   sas    DONE  normal        eeclxvm229.unx.sas.com eeclxvm228.unx.sas.com sleep 10         Feb 11 11:52
2764   sasmb  DONE  normal        eeclxvm229.unx.sas.com eeclxvm229.unx.sas.com ConnectionService 904500_SASApp
- Workspace Server_EA54B6E6-83CE-5D42-8158-53A2C16F5245 Feb 11 11:53
[sas@eeclxvm229 ObjectSpawner]$
  
```

**Figure 25: Bjobs Output Before Validate**

Figure 26 illustrates the `bjobs` output after the Validate action. Notice the presence of a new job with job id of 2765, a job name of `*_SASApp - Stored Process Server_*`, and a status of RUN for the `sassrv` user. The stored process server runs under the `sassrv` user account.

```

[sas@eeclxvm229 ObjectSpawner]$ bjobs -a -w -u all
JOBID  USER  STAT  QUEUE          FROM_HOST  EXEC_HOST  JOB_NAME             SUBMIT_TIME
2765   sassrv RUN    normal        eeclxvm228.unx.sas.com eeclxvm228.unx.sas.com SASApp - Stored Process Server_6
F042120-1C3C-C545-A100-CFD307923625 Feb 11 12:04
2762   sas    DONE  normal        eeclxvm229.unx.sas.com eeclxvm229.unx.sas.com sleep 10         Feb 11 11:52
2763   sas    DONE  normal        eeclxvm229.unx.sas.com eeclxvm228.unx.sas.com sleep 10         Feb 11 11:52
2764   sasmb  DONE  normal        eeclxvm229.unx.sas.com eeclxvm229.unx.sas.com ConnectionService 904500_SASApp
- Workspace Server_EA54B6E6-83CE-5D42-8158-53A2C16F5245 Feb 11 11:53
[sas@eeclxvm229 ObjectSpawner]$
  
```

**Figure 26: Bjobs Output After Validate**

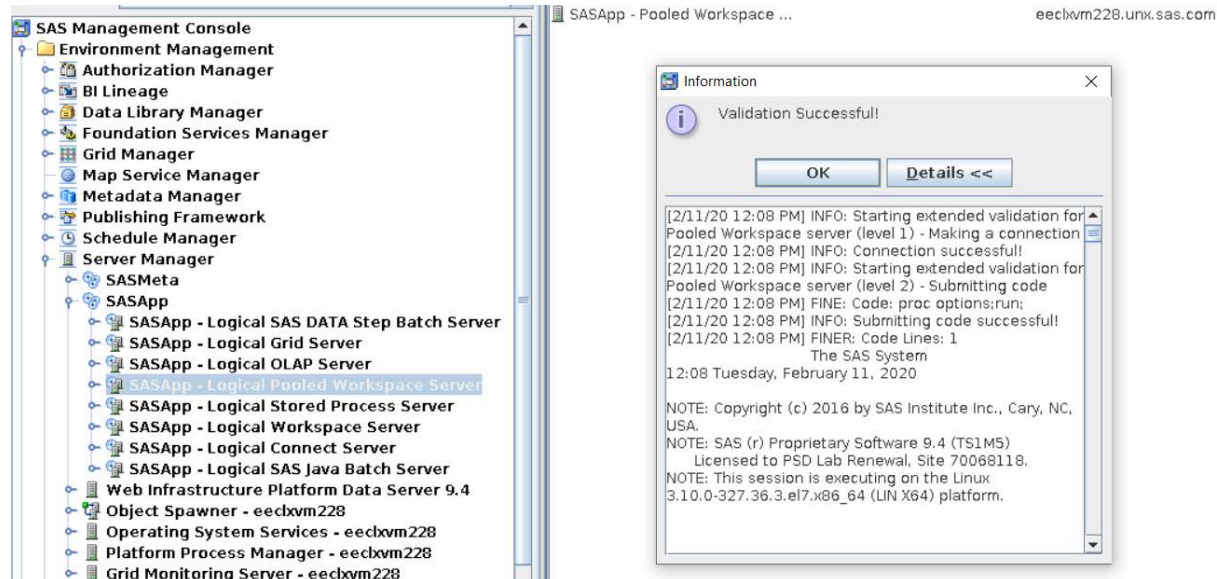
A stored process server was started as a grid job to perform the validation. The grid job continues to RUN to process subsequent stored process server client requests after validation. If required, additional stored process server grid jobs are launched based on load balancing properties and the number of client requests.



## GRID-LAUNCHED POOLED WORKSPACE SERVER VALIDATION

Navigate to the Server Manager plug-in in SAS Management Console. Select a SAS Application Server context configured with a grid-launched stored process server. Select the logical pooled workspace server, right-click, and select Validate.

You should see the message box illustrated in Figure 27 with a Validation Successful message. Click the Details button.



**Figure 27: Validate Grid-Launched Pooled Workspace Server**

You can verify the grid job using either the SAS Grid Manager for Platform module for SAS Environment Manager or a command-line interface. Figure 28 illustrates the `bjobs` output before the Validate action. Notice there are no pooled workspace server grid jobs.

```
[sas@eeclxvm229 ObjectSpawner]$ bjobs -a -w -u all
JOBID  USER  STAT  QUEUE  FROM_HOST  EXEC_HOST  JOB_NAME  SUBMIT_TIME
2765   sassrv  RUN   normal eeclxvm228.unx.sas.com eeclxvm228.unx.sas.com SASApp - Stored Process Server_6
F042120-1C3C-C545-A100-CFD307923625 Feb 11 12:04
2762   sas    DONE  normal eeclxvm229.unx.sas.com eeclxvm229.unx.sas.com sleep 10   Feb 11 11:52
2763   sas    DONE  normal eeclxvm229.unx.sas.com eeclxvm228.unx.sas.com sleep 10   Feb 11 11:52
2764   sasmb  DONE  normal eeclxvm229.unx.sas.com eeclxvm229.unx.sas.com ConnectionService 904500_SASApp
- Workspace Server_EA54B6E6-83CE-5D42-8158-53A2C16F5245 Feb 11 11:53
[sas@eeclxvm229 ObjectSpawner]$
[sas@eeclxvm229 ObjectSpawner]$
```

**Figure 28: Bjobs Output Before Validate**

Figure 29 illustrates the `bjobs` output after the Validate action. Notice the presence of a new job with job id of 2766, a job name of `*_SASApp - Pooled Workspace Server_*`, and a status of RUN for the sassrv user. The pooled workspace server runs under the sassrv user account.

```
[sas@eeclxvm229 ObjectSpawner]$ bjobs -a -w -u all
JOBID  USER  STAT  QUEUE  FROM_HOST  EXEC_HOST  JOB_NAME  SUBMIT_TIME
2765   sassrv  RUN   normal eeclxvm228.unx.sas.com eeclxvm228.unx.sas.com SASApp - Stored Process Server_6
F042120-1C3C-C545-A100-CFD307923625 Feb 11 12:04
2766   sassrv  RUN   normal eeclxvm228.unx.sas.com eeclxvm228.unx.sas.com SASApp - Pooled Workspace Server
_5904E7AB-F1E0-A24E-B765-F712CCA99EB3 Feb 11 12:08
2762   sas    DONE  normal eeclxvm229.unx.sas.com eeclxvm229.unx.sas.com sleep 10   Feb 11 11:52
2763   sas    DONE  normal eeclxvm229.unx.sas.com eeclxvm228.unx.sas.com sleep 10   Feb 11 11:52
2764   sasmb  DONE  normal eeclxvm229.unx.sas.com eeclxvm229.unx.sas.com ConnectionService 904500_SASApp
- Workspace Server_EA54B6E6-83CE-5D42-8158-53A2C16F5245 Feb 11 11:53
[sas@eeclxvm229 ObjectSpawner]$
```

**Figure 29: Bjobs Output After Validate**

A pooled workspace server was started as a grid job to perform the validation. The grid job continues to RUN to process subsequent pooled workspace server client requests after validation. Creation of subsequent grid jobs is dependent on server-side pooling properties and the number of client requests.

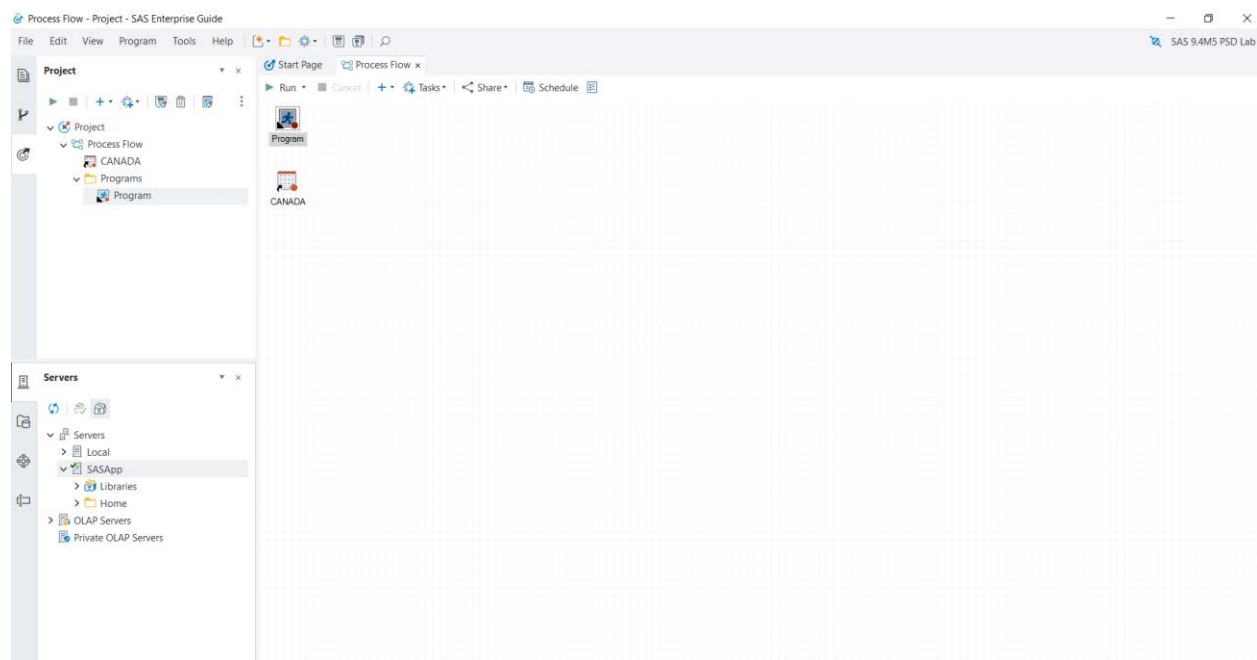
## SAS ENTERPRISE GUIDE VALIDATION

Launch SAS Enterprise Guide and check the `bjobs` output. Notice there are no grid jobs, as shown in Figure 30.

```
[sas@eeclxvm228 Lev1]$ bjobs -u sasmbms
No unfinished job found
[sas@eeclxvm228 Lev1]$ bjobs -u sasmbms
No unfinished job found
```

**Figure 30: Bjobs Output Before Validate**

Navigate to the Servers pane, right-click SASApp (the SAS Application Server context) and click Connect.

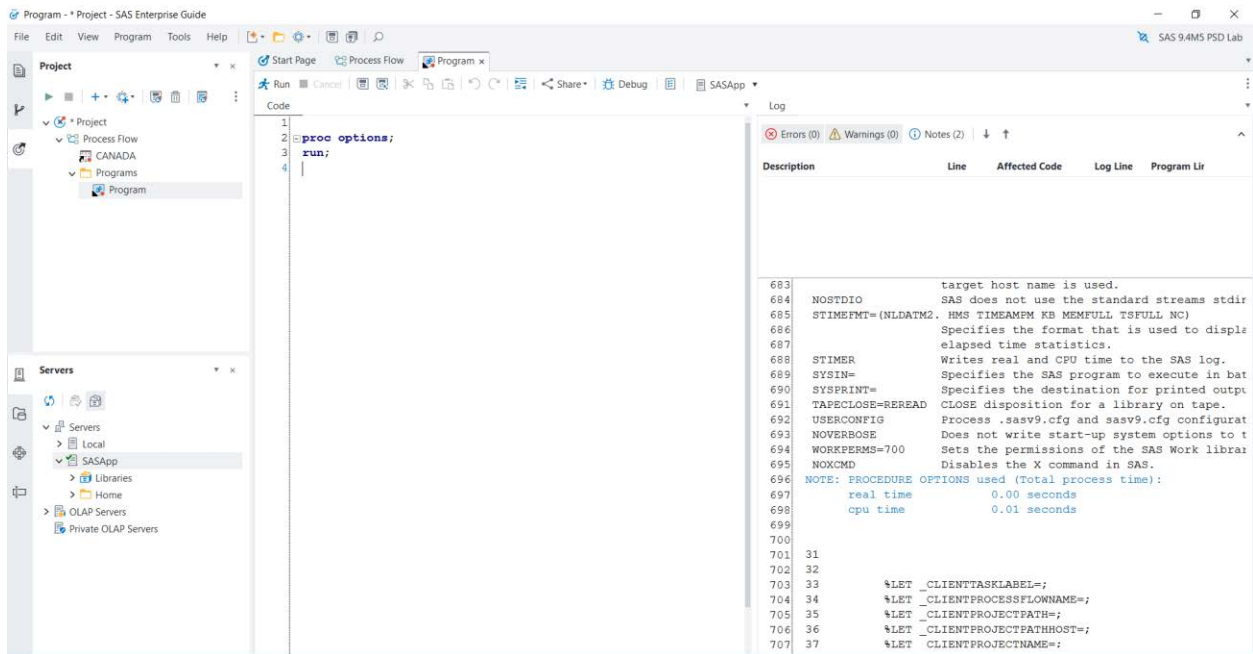


**Figure 31: SAS Enterprise Guide SASApp Connect**

You can verify the grid job using either the SAS Grid Manager module for SAS Environment Manager or a command-line interface. Figure 32 illustrates the `bjobs` output after the Connect action. A workspace server is started as a grid job on behalf of the user. The grid job continues to RUN to process subsequent requests from the connected SAS Enterprise Guide client. Any SAS program or task invoked from the same client application runs on the same workspace server session in the grid.

```
[sas@eeclxvm228 Lev1]$ bjobs -w -u sasmbms
JOBID  USER  STAT  QUEUE          FROM_HOST  EXEC_HOST  JOB_NAME  SUBMIT_TIME
2781   sasmbms  RUN   qeg           eeclxvm228.unx.sas.com eeclxvm229.unx.sas.com SAS Enterprise Guide_SASApp - Workspa
ce Server_2F408FA0-0136-3340-8B27-7563933D5EF7 Feb 13 12:28
[sas@eeclxvm228 Lev1]$
```

**Figure 32: Bjobs Output After Validate**



**Figure 33: SAS Enterprise Guide PROC OPTIONS Output**

## GRID-LAUNCHED VS NO GRID-LAUNCHED

You can use SAS Enterprise Guide to compare the results from running with a grid-launched workspace server configuration to an alternate configuration that does not use a grid-launched workspace server.

Figure 34 illustrates the detailed `bjobs` output when using a grid-launched workspace server. Job 2777 is a workspace server session started by the object spawner, using LSF for the user. Code submitted from SAS Enterprise Guide runs directly on this session as a grid job.

```

[sas@eeclxvm229 ObjectSpawner]$
[sas@eeclxvm229 ObjectSpawner]$ bjobs -w -u all
JOBID  USER  STAT  QUEUE          FROM_HOST  EXEC_HOST  JOB_NAME  SUBMIT_TIME
2777   sasmb RUN   qeg           eeclxvm228.unx.sas.com eeclxvm228.unx.sas.com SAS Enterprise Guide_SASApp - Workspa
ce Server_567D67E8-AF17-2549-B279-47B00FAABD18 Feb 11 13:24
[sas@eeclxvm229 ObjectSpawner]$
[sas@eeclxvm229 ObjectSpawner]$ bjobs -l 2777

Job <2777>, Job Name <SAS Enterprise Guide_SASApp - Workspace Server_567D67E8-A
F17-2549-B279-47B00FAABD18>, User <sasmb>, Project <defau
lt>, Status <RUN>, Queue <qeg>, Command </data/lab/sas/con
f17w38/Levl/SASApp/WorkspaceServer/WorkspaceServer.sh -not
erminal -noxcmd -netencryptalgorithm SASProprietary -metas
erver eeclxvm228.unx.sas.com -metaport 8561 -metarepositor
y Foundation -locale en US -objectserver -objectserverparm
s "delayconn sph=eeclxvm228.unx.sas.com protocol=bridge sp
awned spp=38302 cid=0 pb classfactory=440196D4-90F0-11D0-9
F41-00A024BB830C server=OMSOBJ:SERVERCOMPONENT/A57XK4M3.AY
00000C cel=credentials lb recon grid" -METAUSER "sasmb@!
*(generatedpassworddomain)!*" -METAPASS b5Ca7d6F5010b66A9
29e47316DF43f1a >
Tue Feb 11 13:24:57: Submitted from host <eeclxvm228.unx.sas.com>, CWD <$HOME>,
Specified Hosts <eeclxvm228.unx.sas.com>, <eeclxvm229.unx
.sas.com>;
Tue Feb 11 13:24:57: Started 1 Task(s) on Host(s) <eeclxvm228.unx.sas.com>, All
located 1 Slot(s) on Host(s) <eeclxvm228.unx.sas.com>, Exec
ution Home </home/sasmb>, Execution CWD </home/sasmb>;
Tue Feb 11 13:25:03: Resource usage collected.
MEM: 30 Mbytes; SWAP: 0 Mbytes; NTHREAD: 27
PGID: 13036; PIDs: 13036 13038 13040 13163

MEMORY USAGE:
MAX MEM: 30 Mbytes; AVG MEM: 26 Mbytes

SCHEDULING PARAMETERS:
      r15s  r1m  r15m  ut      pg  io  ls  it  tmp  swp  mem
loadSched -  -  -  0.70  -  -  -  -  -  -  -
loadStop  -  -  -  0.95  -  -  -  -  -  -  -

RESOURCE REQUIREMENT DETAILS:
Combined: select[type == any] order[r15s:pg]
Effective: select[type == any] order[r15s:pg]

[sas@eeclxvm229 ObjectSpawner]$ █

```

**Figure 34: SAS Enterprise Guide Bjobs Detailed Output with Grid-Launched Server**

Figure 35 illustrates the detailed bjobs output from using the Use grid if available client-side configuration while not using grid-launched server features in server metadata. The object spawner starts a workspace server session that is not a grid job. Job 2774 is a grid server session for the user started by LSF using the sasgrid script. Code submitted from SAS Enterprise Guide runs on this session as a grid job.

```

[sas@eeclxvm229 ObjectSpawner]$
[sas@eeclxvm229 ObjectSpawner]$
[sas@eeclxvm229 ObjectSpawner]$ bjobs -w -u all
JOBID  USER  STAT  QUEUE  FROM_HOST  EXEC_HOST  JOB_NAME  SUBMIT_TIME
2774   sasmb  RUN   normal  eeclxvm228.unx.sas.com eeclxvm228.unx.sas.com EG.sasmb.56321 Feb 11 13:02
[sas@eeclxvm229 ObjectSpawner]$
[sas@eeclxvm229 ObjectSpawner]$
[sas@eeclxvm229 ObjectSpawner]$ bjobs -l 2774

Job <2774>, Job Name <EG.sasmb.56321>, User <sasmb>, Project <default>, Status <RUN>, Queue <normal>, Command </data/lab/sas/conf17w38/Levl/SASApp/GridServer/sasgrid SASDAEMONHOST:eeclxvm228.unx.sas.com SASDAEMONPORT:45034 SASCLIENTPORT:1 "SASARM4CORL8R:Acj/ADQ0MjBGM0MzLT1EOUUtMTA0RC05NThBLTNBMjUyQUNDMDFNA=">, Share group charged </sasmb>
Tue Feb 11 13:02:41: Submitted from host <eeclxvm228.unx.sas.com>, CWD <${HOME}>, Requested Resources <SASApp>;
Tue Feb 11 13:02:42: Started 1 Task(s) on Host(s) <eeclxvm228.unx.sas.com>, Allocated 1 Slot(s) on Host(s) <eeclxvm228.unx.sas.com>, Execution Home </home/sasmb>, Execution CWD </home/sasmb>;
Tue Feb 11 13:03:38: Resource usage collected.
MEM: 37 Mbytes; SWAP: 0 Mbytes; NTHREAD: 31
PGID: 56623; PIDs: 56623 56625 56627 56731 56768

MEMORY USAGE:
MAX MEM: 37 Mbytes; AVG MEM: 34 Mbytes

SCHEDULING PARAMETERS:
      r15s  r1m  r15m  ut      pg   io  ls   it   tmp  swp  mem
loadSched -   -   -   0.70  -   -   -   -   -   -   -
loadStop  -   -   -   0.95  -   -   -   -   -   -   -

RESOURCE REQUIREMENT DETAILS:
Combined: select[(SASApp) && (type == any)] order[r15s:pg]
Effective: select[(SASApp) && (type == any)] order[r15s:pg]

[sas@eeclxvm229 ObjectSpawner]$

```

**Figure 35: SAS Enterprise Guide Bjobs Detailed Output without Grid-Launched Server**

## CONCLUSION

There is a cost associated with starting a workspace server and a grid server for every user request to run a grid job. Grid-launched servers start server sessions in the grid. An additional grid server session is not required. It is efficient to run code directly on the grid-launched workspace server. There are cases when you do not want to use grid-launched server features. For example, some SAS web applications might perform better using server-side grid load balancing and enabling the object spawner instead of the workload manager to start the SAS server. In this scenario, LSF is used to select the best host to start the SAS session, but the workload is not managed by LSF policies, because there is no grid job.

## REFERENCES

1. SAS Institute Inc. 2018. *Grid Computing in SAS 9.4*. 5<sup>th</sup> ed. Cary NC: SAS Institute Inc. Available <https://documentation.sas.com/?docsetId=gridref&docsetTarget=titlepage.htm&docsetVersion=9.4&locale=en>
2. Haigh, Doug. 2019. "Introducing SAS Workload Orchestrator, the New SAS Grid Manager Workload Manager." *Proceedings of the SAS Global Forum 2019 Conference*. Cary, NC: SAS Institute Inc. Available <https://www.sas.com/content/dam/SAS/support/en/sas-global-forum-proceedings/2019/3430-2019.pdf>

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