

Super Happy Fun Times: Diagnosing and Resolving an Intermittent Failure with the SAS® 9.4 Grid Workspace Server

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ABSTRACT

As any SAS® user or Administrator knows – intermittent problems are often the most difficult to diagnose. This paper will explore a real world scenario in which the client experienced intermittent failures when attempting to assign a logical application server in Enterprise Guide or when attempting to validate the Workspace Server in SAS Management Console. These attempts would succeed approximately 1 out of 3 times. The issue stemmed from changes in how the Object Spawner functions in SAS 9.4 versus previous releases of SAS and how this can manifest itself in a SAS Grid environment. In this paper we will discuss and review those changes and the temporary and permanent solutions.

INTRODUCTION

SAS environments are complex with many moving parts. It is imperative to have working knowledge of the different pieces and the ability to validate their health. This paper will address the identification, diagnosis, and resolution of an issue with the SAS Object Spawner in a Grid environment. The key components are the SAS Object Spawner, ephemeral versus static network ports, and SAS Grid.

The SAS Object Spawner “runs on the same machine as the SAS Application Server components. The spawner listens for incoming client requests for workspace servers, pooled workspace servers, and stored process servers, and it launches instances of these servers as needed. Although the object spawner is not part of the SAS Application Server hierarchy, it is essential to the operation of workspace servers, stored process servers, and pooled workspace servers.” [1]

SAS Servers listen on network ports. Generally, they are assigned static ports – individual numbers that do not change. A familiar example would be the Metadata Server listening on port 8561. There is also a concept known as ephemeral ports. These are a range of ports that are assigned at random at the time of invocation of a server process.

“A SAS grid computing environment is one in which SAS computing tasks are distributed among multiple computers on a network, all under the control of SAS Grid Manager. In this environment, workloads are distributed across a grid cluster of computers.” [2] The distributed nature of a SAS Grid can turn a consistently repeatable problem into an intermittent one because your Workspace Server session can end up on any one of a number of different machines. A problem may not present itself on one machine whereas it does present itself on another machine. This can be confusing and frustrating, which makes it important to understand the complexity that distributed computing introduces into your environment.

The problem scenario the client experienced was when assigning SASApp in Enterprise Guide, or validating the Grid / Workspace Server in SAS Management Console, they would receive intermittent failures after bouncing their servers.

IDENTIFICATION & DIAGNOSIS

The problem case for the client arose after they performed a restart of their SAS Servers. Once the SAS Servers initialized after the restart, the client performed the standard health-check validations and identified that assigning a logical application server in Enterprise Guide or validating a Workspace or Grid Server in SAS Management Console would sometimes yield a success and sometimes failure.

Example error in the Workspace Server log:

```
[4/10/17 10:28 PM] FINE: NOTE: Remote session ID T1 will use the grid service
_ALL_.
[4/10/17 10:28 PM] FINE: NOTE: Remote signon to T1 commencing (SAS Release
9.04.01M4P110916).
[4/10/17 10:28 PM] FINE: NOTE: SIGNON request submitted to grid as job ID '3982'.
[4/10/17 10:28 PM] FINE: ERROR: A communication subsystem partner link setup
request failure has occurred.
[4/10/17 10:28 PM] FINE: ERROR: Could not start grid job or grid job failed.
```

```
[4/10/17 10:28 PM] FINE: NOTE: SAS.Connect.SIGNON| _DISARM| STOP| _DISARM| 2017-04-10T22:28:42,871-04:00| _DISARM|
SAS/CONNECT:T1| _DISARM| SAS|
[4/10/17 10:28 PM] FINE: _DISARM| | _DISARM| | _DISARM| | _DISARM| |
_DISARM| | _DISARM| | _DISARM| 0.010000|
_DISARM| 11.024436| _DISARM|
[4/10/17 10:28 PM] FINE: 1807496911.847531| _DISARM| 1807496922.871967| _DISARM|
0.000000| _DISARM| | _ENDDISARM
[4/10/17 10:28 PM] FINE: ERROR: Remote signon to T1 canceled.
[4/10/17 10:28 PM] FINE: ERROR: Invalid or unspecified remote session ID. Set
OPTIONS REMOTE=session_id.
[4/10/17 10:28 PM] FINE: NOTE: Subsequent lines will be ignored until ENDRSUBMIT.
[4/10/17 10:28 PM] FINE: ERROR: Remote submit to UNKNOWN canceled.
[4/10/17 10:28 PM] FINE: NOTE: No active remote sessions exist; SIGNOFF is not
necessary.
[4/10/17 10:28 PM] SEVERE: ERROR: A communication subsystem partner link setup
request failure has occurred.
ERROR: Could not start grid job or grid job failed.
ERROR: Remote signon to T1 canceled.
ERROR: Invalid or unspecified remote session ID. Set OPTIONS REMOTE=session_id.
ERROR: Remote submit to UNKNOWN canceled.
[4/10/17 10:28 PM] SEVERE: The grid server cannot be validated. Click Details to
view the errors.
```

Figure 1 Workspace Server Log Error

Example bhist output from a failed SAS® Enterprise Guide logical application server attempt:

```
[sas@sasgrid1 home]$ bhist -l 4316

Job <4316>, Job Name <SAS Enterprise Guide_SASApp - Workspace Server_14FBD5A0-7
17B-9147-B490-31DB00BB9B59>, User <sasdemo>, Project <defa
ult>, Command </sas/config/Lev1/SASApp/WorkspaceServer/Wor
kspaceServer.sh -noterminal -noxcmd -netencryptalgorithm S
ASProprietary -metaserver sasman1.company.com -metaport 8561 -
metarepository Foundation -locale en_US -objectserver -obj
ectserverparms "delayconn sph=sasgrid3.company.com protocol=br
idge spawned spp=46106 cid=7 pb classfactory=440196D4-90F0
-11D0-9F41-00A024BB830C server=OMSOBJ:SERVERCOMPONENT/A5FC
KIGL.AY00000D cel=credentials lb recon grid" -METAUSER "'s
asdemo@!*(generatedpassworddomain)*!'" -METAPASS xxxxxxxxx
xxxxxxxxxxxxxxxxxxxx >
Tue Apr 11 00:59:53: Submitted from host <sasgrid3.company.com>, to Queue <normal>,
CWD <$HOME>, Specified Hosts <sasgrid1.company.com>, <sasgrid
2.company.com>, <sasgrid3.company.com>;
Tue Apr 11 00:59:53: Dispatched 1 Task(s) on Host(s) <sasgrid2.company.com>, Alloca
ted 1 Slot(s) on Host(s) <sasgrid2.company.com>, Effective RES
_REQ <select[type == any] order[r15s:pg] >;
Tue Apr 11 00:59:54: Starting (Pid 31920);
Tue Apr 11 00:59:54: Running with execution home </home/sasdemo>, Execution CWD
</home/sasdemo>, Execution Pid <31920>;
Tue Apr 11 00:59:55: Exited with exit code 2. The CPU time used is 0.2 seconds;
Tue Apr 11 00:59:55: Completed <exit>;

Summary of time in seconds spent in various states by Tue Apr 11 00:59:55
PENDING PSUSP RUN USUSP SSUSP UNKNWN TOTAL
0 0 2 0 0 0 2
```

Figure 2 bhist Output Example from Failed Enterprise Guide Logical Application Server Assignment Attempt

After working with SAS Technical Support we were able to determine that in the failure case, one of the ports on which the Object Spawner was listening – the conversation port – was a port not opened up in the firewall.

When installing a SAS environment one of the prerequisites you undertake is opening firewall rules to all port ranges listed in the PIRD – the Pre-Installation Requirements Document. The typical ports for the Object Spawner are listed in this document. However, a change occurred in SAS 9.4 versus previous releases. The conversation port for the object spawner was changed from being a static port to an ephemeral port. These ephemeral ports were not opened up to firewall rules. Therefore, any Grid Session that was spawned from Grid Node 1 and landed on Grid Node 1 would succeed. Any Grid Session that was spawned from Grid Node 1 and attempted to land on Grid Node 2 or 3 would fail. Ephemeral ports are a range of ports that your Linux Administrators can designate. They are not usually blocked for outbound traffic – but in the client's environment they are blocked for inbound traffic.

This was not an issue until SAS 9.4, with the introduction of Grid-launched Workspace Servers. Previously when the Object Spawner would launch a Workspace Server, it would be on the same server as the Object Spawner that launched it. Now in 9.4, the Object Spawner is creating a Grid Session for the Workspace Server that can end up on a node other than the one the Object Spawner is sitting on. Therefore, the conversation port needs to be able to talk to the other Grid Nodes.

SAS chose to allow the conversation port to use ephemeral ports (instead of just designating another specific range) to attempt to listen to customer feedback complaining about too many designated ports. However, there is the option to convert the default behavior of using ephemeral ports to have the conversation port listen on a static port. There is no issue with making the conversation port static, which is why they included that as an option.

RESOLUTION

There are two methods you can take to address this issue – a quick temporary fix and a permanent solution.

TEMPORARY WORKAROUND

Find the port that the Object Spawner is currently listening on that doesn't have a firewall rule set and open the firewall for that specific port.

You can determine which port the Object Spawner is listening on by running a combination of:

`ps -ef | grep -i obj` to determine the process ID of the Object Spawner

`lsof -p <process ID> | grep LISTEN` to determine which ports the Object Spawner process is listening on

```
[root@sasgrid1 zones]# lsof -p 25203 |grep LISTEN
objspawn 25203 sas 3u IPv4 1997392 0t0 TCP *:35692 (LISTEN)
objspawn 25203 sas 16u IPv6 1997401 0t0 TCP *:8581 (LISTEN)
objspawn 25203 sas 17u IPv6 1997404 0t0 TCP *:8451 (LISTEN)
objspawn 25203 sas 18u IPv6 1997407 0t0 TCP *:8701 (LISTEN)
objspawn 25203 sas 20u IPv6 1985399 0t0 TCP *:8601 (LISTEN)
objspawn 25203 sas 25u IPv6 1985411 0t0 TCP *:8591 (LISTEN)
objspawn 25203 sas 26u IPv6 1985414 0t0 TCP *:8702 (LISTEN)
objspawn 25203 sas 27u IPv6 1985417 0t0 TCP *:8592 (LISTEN)
objspawn 25203 sas 28u IPv6 1985420 0t0 TCP *:8593 (LISTEN)
objspawn 25203 sas 29u IPv6 1985423 0t0 TCP *:42869 (LISTEN)
[root@sasgrid2 zones]# lsof -p 11282 |grep LISTEN
objspawn 11282 sas 3u IPv4 1736072 0t0 TCP *:34992 (LISTEN)
objspawn 11282 sas 16u IPv6 1736081 0t0 TCP *:8581 (LISTEN)
objspawn 11282 sas 17u IPv6 1736084 0t0 TCP *:8701 (LISTEN)
objspawn 11282 sas 19u IPv6 1725241 0t0 TCP *:8601 (LISTEN)
objspawn 11282 sas 24u IPv6 1725253 0t0 TCP *:8591 (LISTEN)
objspawn 11282 sas 25u IPv6 1725256 0t0 TCP *:8593 (LISTEN)
objspawn 11282 sas 26u IPv6 1728143 0t0 TCP *:39825 (LISTEN)
[root@sasgrid3 zones]# lsof -p 8140 |grep LISTEN
objspawn 8140 sas 3u IPv4 1730709 0t0 TCP *:45038 (LISTEN)
objspawn 8140 sas 16u IPv6 1727347 0t0 TCP *:8581 (LISTEN)
objspawn 8140 sas 17u IPv6 1727350 0t0 TCP *:8701 (LISTEN)
objspawn 8140 sas 19u IPv6 1729639 0t0 TCP *:8601 (LISTEN)
objspawn 8140 sas 24u IPv6 1729651 0t0 TCP *:8591 (LISTEN)
objspawn 8140 sas 25u IPv6 1729654 0t0 TCP *:8593 (LISTEN)
objspawn 8140 sas 26u IPv6 1729657 0t0 TCP *:45193 (LISTEN)
objspawn 8140 sas 37u IPv6 1737490 0t0 TCP *:40079 (LISTEN)
```

Figure 3 Identifying Object Spawner Listening Port Example

Object Spawner log excerpt example when the conversation port is ephemeral:

```
2017-03-17T08:24:24,854 INFO [00000030] :sas - Reserved IPv6 port 8581 for
administrator listen (connection 2).
2017-03-17T08:24:24,854 INFO [00000030] :sas - Reserved IPv6 port 8451 for server
listen (connection 3).
2017-03-17T08:24:24,854 INFO [00000030] :sas - Reserved IPv6 port 8701 for server
listen (connection 4).
2017-03-17T08:24:24,897 INFO [00000030] :sas - Reserved IPv6 port 8601 for server
listen (connection 5).
2017-03-17T08:24:24,897 INFO [00000030] :sas - Reserved IPv6 port 8611 for server
listen (connection 6).
2017-03-17T08:24:24,897 INFO [00000030] :sas - Reserved IPv6 port 8621 for server
listen (connection 7).
2017-03-17T08:24:24,897 INFO [00000030] :sas - Reserved IPv6 port 8631 for server
listen (connection 8).
2017-03-17T08:24:24,904 INFO [00000030] :sas - Reserved IPv6 port 8591 for server
listen (connection 9).
2017-03-17T08:24:24,905 INFO [00000030] :sas - Reserved IPv6 port 8702 for server
listen (connection 10).
2017-03-17T08:24:24,912 INFO [00000030] :sas - Reserved IPv6 port 8592 for server
listen (connection 11).
2017-03-17T08:24:24,912 INFO [00000030] :sas - Reserved IPv6 port 8593 for server
listen (connection 12).
2017-03-17T08:24:24,915 INFO [00000030] :sas - Reserved IPv6 port 40590 for
launched server connect back listen (connection 13).
```

Figure 4 Object Spawner Log with Conversation Port Ephemeral Example

This solution is temporary because any time you bounce the servers you would need to go through this exercise again.

PERMANENT SOLUTION

Update the ObjectSpawner.sh script CMD_OPTIONS line with -conversation port <port> which will assign the conversation port to a static port instead of an ephemeral port. Open up the firewall for that specific static port.

Script location: <SASCONFIG>/Lev1/ObjectSpawner/ObjectSpawner.sh

Modification: CMD_OPTIONS="- dnsmatch \$HOSTNAME -sspi -conversationport 8888 "

Object Spawner logs after making the conversation port static:

```
[sas@sasgrid3 Logs]$ cat ObjectSpawner_2017-04-12_sasgrid1_3604.log | grep Reserved
2017-04-12T10:51:30,012 INFO [00000030] :sas - Reserved IPv6 port 8581 for
administrator listen (connection 2).
2017-04-12T10:51:30,012 INFO [00000030] :sas - Reserved IPv6 port 8451 for server
listen (connection 3).
2017-04-12T10:51:30,012 INFO [00000030] :sas - Reserved IPv6 port 8701 for server
listen (connection 4).
2017-04-12T10:51:30,150 INFO [00000030] :sas - Reserved IPv6 port 8601 for server
listen (connection 5).
2017-04-12T10:51:30,150 INFO [00000030] :sas - Reserved IPv6 port 8611 for server
listen (connection 6).
2017-04-12T10:51:30,150 INFO [00000030] :sas - Reserved IPv6 port 8621 for server
listen (connection 7).
2017-04-12T10:51:30,150 INFO [00000030] :sas - Reserved IPv6 port 8631 for server
listen (connection 8).
2017-04-12T10:51:30,158 INFO [00000030] :sas - Reserved IPv6 port 8591 for server
listen (connection 9).
2017-04-12T10:51:30,158 INFO [00000030] :sas - Reserved IPv6 port 8702 for server
listen (connection 10).
```

```

2017-04-12T10:51:30,166 INFO [00000030] :sas - Reserved IPv6 port 8592 for server
listen (connection 11).
2017-04-12T10:51:30,166 INFO [00000030] :sas - Reserved IPv6 port 8593 for server
listen (connection 12).
2017-04-12T10:51:30,175 INFO [00000030] :sas - Reserved IPv6 port 8888 for launched
server connect back listen (connection 13).
[sas@sasgrid3 Logs]$ cat ObjectSpawner_2017-04-12_sasgrid2_1784.log | grep Reserved
2017-04-12T10:52:22,074 INFO [00000030] :sas - Reserved IPv6 port 8581 for
administrator listen (connection 2).
2017-04-12T10:52:22,074 INFO [00000030] :sas - Reserved IPv6 port 8701 for server
listen (connection 3).
2017-04-12T10:52:22,254 INFO [00000030] :sas - Reserved IPv6 port 8601 for server
listen (connection 4).
2017-04-12T10:52:22,254 INFO [00000030] :sas - Reserved IPv6 port 8611 for server
listen (connection 5).
2017-04-12T10:52:22,254 INFO [00000030] :sas - Reserved IPv6 port 8621 for server
listen (connection 6).
2017-04-12T10:52:22,254 INFO [00000030] :sas - Reserved IPv6 port 8631 for server
listen (connection 7).
2017-04-12T10:52:22,262 INFO [00000030] :sas - Reserved IPv6 port 8591 for server
listen (connection 8).
2017-04-12T10:52:22,262 INFO [00000030] :sas - Reserved IPv6 port 8593 for server
listen (connection 9).
2017-04-12T10:52:22,265 INFO [00000030] :sas - Reserved IPv6 port 8888 for launched
server connect back listen (connection 10).
[sas@sasgrid3 Logs]$ cat ObjectSpawner_2017-04-12_sasgrid3_20789.log | grep
Reserved
2017-04-12T10:52:37,949 INFO [00000030] :sas - Reserved IPv6 port 8581 for
administrator listen (connection 2).
2017-04-12T10:52:37,949 INFO [00000030] :sas - Reserved IPv6 port 8701 for server
listen (connection 3).
2017-04-12T10:52:38,132 INFO [00000030] :sas - Reserved IPv6 port 8601 for server
listen (connection 4).
2017-04-12T10:52:38,132 INFO [00000030] :sas - Reserved IPv6 port 8611 for server
listen (connection 5).
2017-04-12T10:52:38,133 INFO [00000030] :sas - Reserved IPv6 port 8621 for server
listen (connection 6).
2017-04-12T10:52:38,133 INFO [00000030] :sas - Reserved IPv6 port 8631 for server
listen (connection 7).
2017-04-12T10:52:38,141 INFO [00000030] :sas - Reserved IPv6 port 8591 for server
listen (connection 8).
2017-04-12T10:52:38,141 INFO [00000030] :sas - Reserved IPv6 port 8593 for server
listen (connection 9).
2017-04-12T10:52:38,144 INFO [00000030] :sas - Reserved IPv6 port 8888 for launched
server connect back listen (connection 10).

```

Figure 5 Object Spawner Log with Conversation Port Static Example

The static port you designate can be anything that is not already designated for a particular purpose – port 8888 is just an example that we chose in this client's environment.

CONCLUSION

The change in the default behavior of the Object Spawner conversation port from static to ephemeral in SAS 9.4 created a situation that manifests itself in a distributed computing environment like SAS Grid. In client environments with firewall rules at the host-layer or between hosts, this change may cause intermittent failures when starting or validating Workspace Servers. Changes to the Object Spawner conversation port setting can offer a permanent fix for this issue, while changes to firewall rules on-the-fly support temporary resolution.

REFERENCES

- [1] SAS Institute Inc. 2015. "Overview of Other SAS Servers and Spawners ". SAS® 9.4 Intelligence Platform: System Administration Guide, Fourth Edition. Cary, NC: SAS Institute Inc. Available at <http://support.sas.com/documentation/cdl/en/bisag/68240/HTML/default/viewer.htm#n0hi2hkikutdj5n15aawp yxaz3ib.htm>
- [2] SAS Institute Inc. 2014. "SAS Grid Computing Basics ". Grid Computing in SAS® 9.4, Third Edition. Cary, NC: SAS Institute Inc. Available at <http://support.sas.com/documentation/cdl/en/gridref/67371/HTML/default/viewer.htm#n049jf2x471mybn1pn9 f6tpz3400.htm>

ACKNOWLEDGMENTS

I would like to thank the dedicated resources in SAS Technical Support for their continued excellence. Special thanks to the team members of DLL Consulting, Inc. and Cached Consulting, Inc. for their continued support including Don Hayes, Spencer Hayes, and Michael Shealy.

RECOMMENDED READING

- SAS® 9.4 Intelligence Platform: System Administration Guide, Fourth Edition
- Grid Computing in SAS® 9.4, Third Edition

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