

Tracking Down the Culprit of a SAS® Workspace Server Initialization Delay

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ABSTRACT

When a SAS® Workspace Server session is launched, many components are activated and many actions are set in motion. Any number of components, for any number of reasons, can cause a delay in the workspace-server initialization step. Identifying the problem can be time-consuming. Meanwhile, users who are affected by the delays are left waiting. When users first report the warning signs of a sneaky culprit that is causing the delay, their administrators must then be swift and agile in their efforts to eliminate it. Tracking down the cause and making the necessary changes to resolve the delay is an important mission that can be extremely challenging.

This paper is intended for SAS administrators, system administrators, and network administrators, and the goal is to help you work together to investigate the warning signs in order to determine whether there is an initialization delay and, if so, what is causing it. The discussion includes steps to show you how to run network diagnostic tools that can reveal the typical causes of workspace initialization delays. The tools are applicable in both Linux and Microsoft Windows operating environments. In addition, the paper describes how to enlist the help of SAS Technical Support and what to expect from that process.

INTRODUCTION

Business organizations can feel the threat of workspace-server initialization delays when users cannot perform their jobs in a timely manner. These types of delays can affect the entire organization, and they need to be corrected as soon as possible to prevent a loss of time, resources, and money.

When your users run SAS jobs, delays can occur for several reasons. After you determine whether there is a delay, you need to identify whether the delay is truly a workspace-server initialization delay.

This paper provides the starting point (and hopefully the ending point) for where to look for such delays so that you can take corrective action. This paper guides you in how to determine what the causes of such delays are in both Linux and Windows environments and what techniques you can use to prevent or circumvent the delay. The discussion considers culprits that are both non-network and network related. However, the discussion does not cover solutions for your situation because every environment is different. The cause of your delay might be one or more of the topics discussed in this paper. You must test each item to see whether your delay improves or is eliminated.

If you cannot identify the root cause of the delay, this paper also explains how to obtain more help from SAS Technical Support, and what to expect when you do contact SAS Technical Support.

The next sections help coach you through the process of investigating the cause of workspace-server initialization delays:

- determining whether you have an initialization delay
- determining whether a delay is non-network or network related
- contacting SAS Technical Support for more help

DETERMINING WHETHER YOU HAVE AN INITIALIZATION DELAY

When you suspect that you have a workspace-server initialization delay, there are certain resources you can investigate first to determine the source of the delay. Specifically, object-spawner logs and workspace-server logs are very helpful in determining the causes of such delays.

OBJECT-SPAWNER LOGS

What should you look for in the object-spawner log? First, you want to ensure that you review a log that is produced when the delay occurs and after a restart of the object spawner. Object-spawner logs are in the following directories:

- Windows: *SAS-configuration-directory*\Lev1\ObjectSpawner\Logs
- Linux: *SAS-configuration-directory*/Lev1/ObjectSpawner/Logs

Starting at the top of the log, review the timestamps to determine whether a delay occurred during the start-up of the object spawner. An initialization delay occurs before the following message is displayed in the log:

```
INFO [00000003] :SYSTEM@nodeName - SAS Object Spawner Daemon III is running under the user identity SYSTEM@nodeName.
INFO [00000003] :SYSTEM@nodeName - SAS Object Spawner Daemon III has completed initialization.
INFO [00000003] :SYSTEM@nodeName - SAH021999I Server SAS Object Spawner Daemon III (8581), State, running
```

Display 1. Example of an Object-Spawner Initialization Message

If you see a significant timestamp difference between the first timestamp in the object-spawner log and the timestamp of the initialization message above, then that can indicate the presence of an initialization delay.

WORKSPACE-SERVER LOGS

Another place you can investigate to help determine an initialization delay is the workspace-server logs. Workspace-server logging is not normally enabled by default because such logging can cause performance issues if it is left enabled. Workspace-server logs are in the following directories:

- Windows: *SAS-configuration-directory*\Lev1\SASApp\WorkspaceServer\Logs
- Linux: *SAS-configuration-directory*/Lev1/SASApp/WorkspaceServer/Logs

To verify that the delay occurs in the workspace server during initialization, you must enable logging by following the steps in the section "Create a Log File for Workspace Server Troubleshooting" ("Chapter 10: Administering Logging for SAS Servers") in the *SAS® 9.4 Intelligence Platform: System Administration Guide, Fourth Edition*.

(support.sas.com/documentation/cdl/en/bisag/68240/HTML/default/viewer.htm#p0atyzdgfzbsjfnlj4bbbt14ic7t.htm)

After you enable workspace-server logging, you must run a job or perform workspace-server validation in SAS® Management Console to produce a log. After the log is produced (see [Display 2 on the next page](#)), review it to determine whether there is a delay and where that delay appears in the log. If the delay appears before the following section of the log and not at DNSNAME option, then the delay is not likely a result of pre-assigned libraries, which can be a cause for delays. (Pre-assigned libraries are discussed later.)

```

:UserID@Domain - Server is executing on host NodeName.SAS.com (ab12::c345:6d7:ef8c:9abc%1).
:UserID@Domain - Also known as:
:UserID@Domain -     localhost
:UserID@Domain -     NodeName
:UserID@Domain -     ab12::c345:6d7:ef8c:9abc%1
:UserID@Domain -     ab12::c345:6d07:ef8c:9abc%2
:UserID@Domain -     fe80::1c56:e841:1234:a345%3
:UserID@Domain -     1234:123:1234:a123:bc12:dl2e:1f23:abc
:UserID@Domain -     123.12.12.123
:UserID@Domain -     111.222.3.444
:UserID@Domain -     ::1
:UserID@Domain -     127.0.0.1
:UserID@Domain - IOM CALL svcGetOption(): opt=SPAWNED no value
:UserID@Domain - Loading the tkioobj support extension (9.4.0.170906)

```

Display 2. Reviewing the Workspace-Server Log for an Initialization Delay

If you see that the delay occurs at the line with the DNSNAME option, as shown below, this indicates that the delay likely occurs when the operating system returns host and Internet Protocol (IP) information. The DNSNAME line looks like the following example:

```

70 2017-10-30T09:34:07,184 DEBUG [00000004] :sas - IOM CALL svcGetOption(): opt=TIMEOUTSECONDS not found
71 2017-10-30T09:34:07,185 DEBUG [00000004] :sas - IOM CALL svcGetOption(): opt=DNSNAME not found
72 2017-10-30T09:35:03,236 DEBUG [00000004] :sas - IOM CALL svcGetOption(): opt=LOG not found
73 2017-10-30T09:35:03,236 DEBUG [00000004] :sas - IOM CALL svcGetOption(): opt=LOGFILE not found
74 2017-10-30T09:35:03,236 DEBUG [00000004] :sas - IOM CALL svcGetOption(): opt=RESOURCE not found

```

Display 3. Example of an Initialization Delay as Shown in a Workspace-Server Log

DETERMINING THE CAUSE OF THE DELAY AND RESOLVING THE ISSUES

If you identify an initialization delay after you review the object-spawner and workspace-server logs, you can work through the following items to determine what might be contributing to the delay.

TYPICAL NON-NETWORK CAUSES FOR AN INITIALIZATION DELAY IN MICROSOFT WINDOWS AND LINUX ENVIRONMENTS

Typical non-network causes for an initialization delay include the following:

- pre-assigned libraries or autoexec code
- hardware issues

Pre-Assigned Libraries

Pre-assigned libraries are allocated from metadata during the initialization of every workspace-server session. These libraries are assigned during the initialization period. If they take a long time to assign, that process can contribute to a workspace-server initialization delay. SAS Technical Support recommends that you not pre-assign libraries unless they are required because assigning each library adds additional time to the start-up of a server session.

The following sections explain how you can determine whether pre-assigned libraries are the cause of your delay and how to remove the assignment of these libraries to prevent such delays.

Verifying Whether Pre-Assigned Libraries Are Causing Delays in All SAS® 9.4 Maintenance Releases

Under Linux, you can verify whether pre-assigned libraries are the culprit behind delays, as follows:

1. Open a command window and, as a regular user, submit the following command:

```
./WorkspaceServer.sh -nodms
```

(list continued)

Review the Linux command window to see how much time it takes for the 1? prompt to be displayed, as shown below. You need to manually time the submission of the script file.

```
NOTE: SAS initialization used:
      real time      1.44 seconds
      cpu time       0.04 seconds

NOTE: No preassigned object definitions were found on the metadata server.
NOTE: No preassigned object definitions were found on the metadata server.

NOTE: AUTOEXEC processing beginning; file is
      /sas94/config/compute/Lev1/SASApp/WorkspaceServer/autoexec.sas.

NOTE: There were 3 observations read from the data set SASHELP.VOPTION.
      WHERE optname in ('DMR', 'LOG', 'OBJECTSERVER');
NOTE: DATA statement used (Total process time):
      real time      0.42 seconds
      cpu time       0.02 seconds

NOTE: DATA statement used (Total process time):
      real time      0.02 seconds
      cpu time       0.00 seconds

NOTE: AUTOEXEC processing completed.

█ 1?
```

Display 4. Submitting the `./WorkspaceServer.sh -nodms` Command to Determine an Autoexec Issue

If the delay occurs when you submit the command shown earlier in this step, the problem is likely a result of a pre-assigned library or code from an autoexec file.

2. To confirm whether an autoexec file is the culprit, submit the following command with the `-NOAUTOEXEC` argument:

```
./WorkspaceServer.sh -nodms -noautoexec -metaautoresources
                    nonexistent-SAS-application-server-context
```

3. If the delay is corrected when you submit the command in step 2, submit the command again without the `-NOAUTOEXEC` option. If no delay occurs, then the problem is a result of your system allocating a pre-assigned library from metadata.

If you still have a delay, submit the following command to determine what code in the autoexec file is causing the delay:

```
./WorkspaceServer.sh -nodms -echoauto
```

Under Windows, follow these steps to determine whether pre-assigned libraries are the culprit behind delays:

1. Open a command window on the compute server and, using the credentials of the user who encountered the delay, submit the following command to start a CMD session:

```
runas /user:domain\user-ID cmd
```

2. Navigate to the `SAS-configuration-directory\Lev1\WorkspaceServer` directory and submit the following command to determine whether a delay occurs when the SAS sessions tries to launch:

```
./WorkspaceServer.bat
```

Display 5 shows an example of navigating to your `WorkspaceServer.bat` file.

```
cmd (running as I10d195\sasdemo)
Microsoft Windows [Version 10.0.16299.192]
(c) 2017 Microsoft Corporation. All rights reserved.

C:\Windows\system32>d:

D:\>cd SAS\Config\Lev1\SASApp\WorkspaceServer

D:\SAS\Config\Lev1\SASApp\WorkspaceServer>WorkspaceServer.bat
```

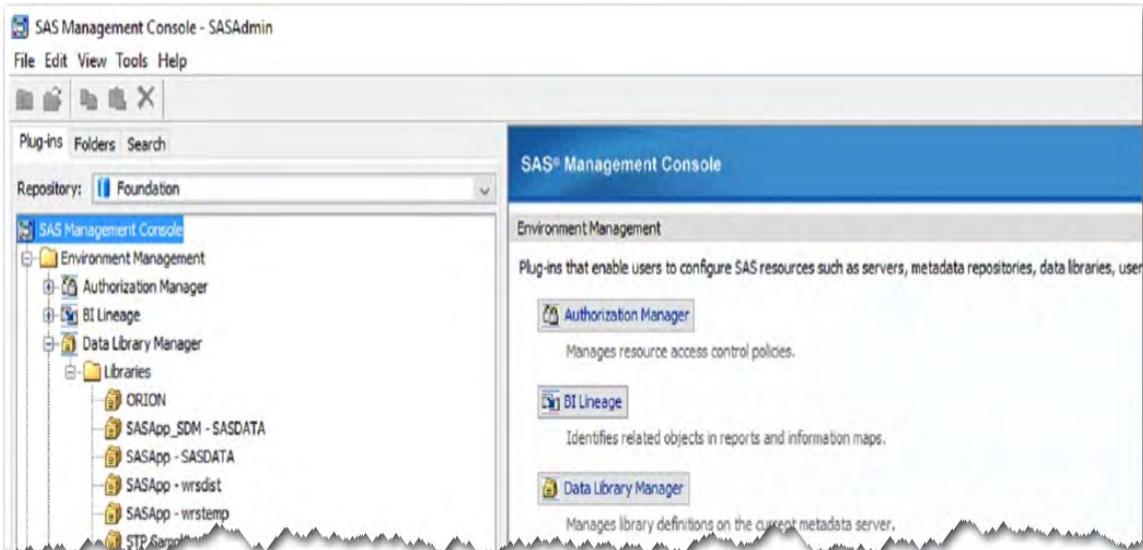
Display 5. Running the `./WorkspaceServer.bat` Command to Determine Whether a Delay Occurs When a SAS® Session Launches

Once you submit the command, you need to time how long it takes for the SAS session to open and complete. If a delay occurs, that indicates that pre-assigned libraries are likely the culprit. You need to remove the assignment of these libraries to see whether that stops the delay issues.

If you discover a delay when you run the `WorkspaceServer.sh` or `WorkspaceServer.bat` files, you need to use SAS Management Console to determine which libraries are pre-assigned so that you can remove those assignments.

To remove those assignments:

1. Open SAS Management Console
2. Log on as an administrator (for example, `sasadm@saspw`). On the **Plug-ins** tab, select **Data Library Manager ► Libraries**.

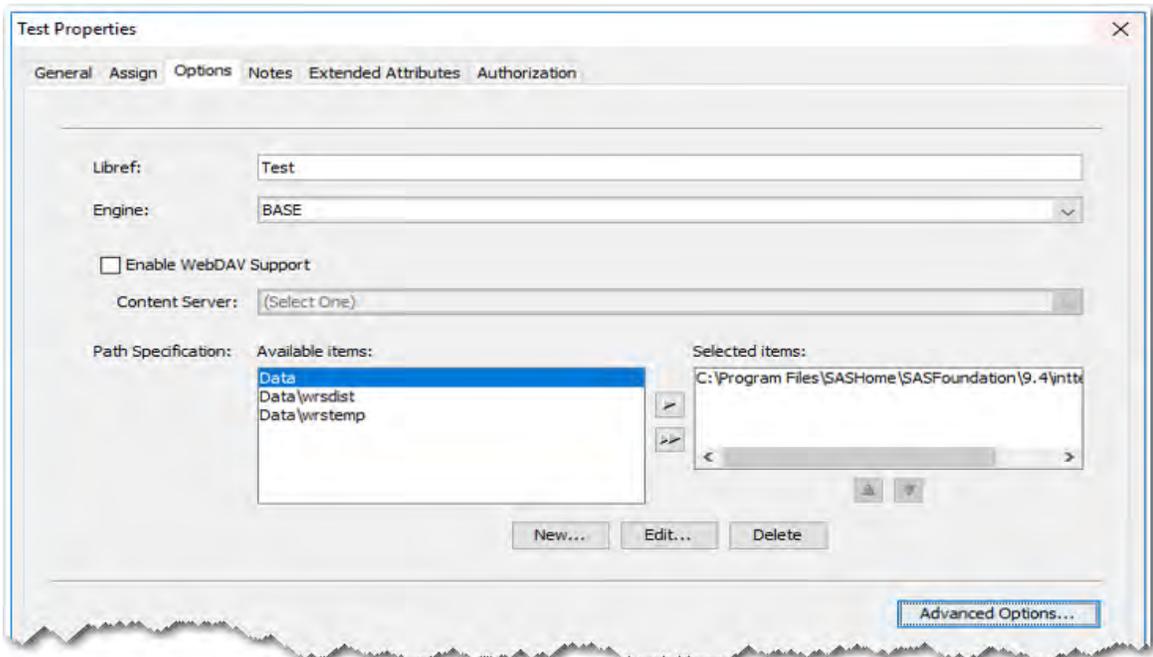


Display 6. Location of Libraries in SAS® Management Console

3. Right-click a library and select **Properties**.

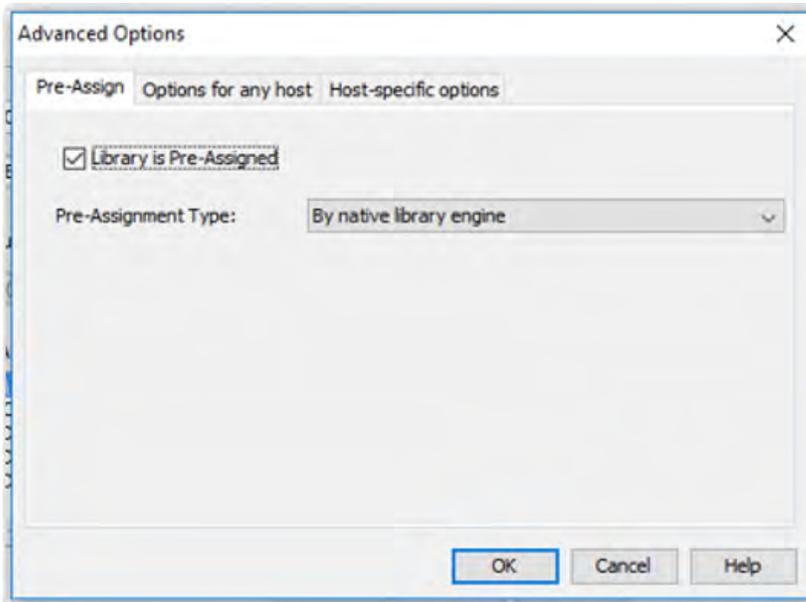
(list continued)

4. Click the **Options** tab.



Display 7. Library Properties Dialog Box

5. Click **Advanced Options**.
6. On the **Pre-Assign** tab, verify whether the library that you selected in step 3 is pre-assigned. If it is pre-assigned, the **Library is Pre-Assigned** check box is selected, as shown here:

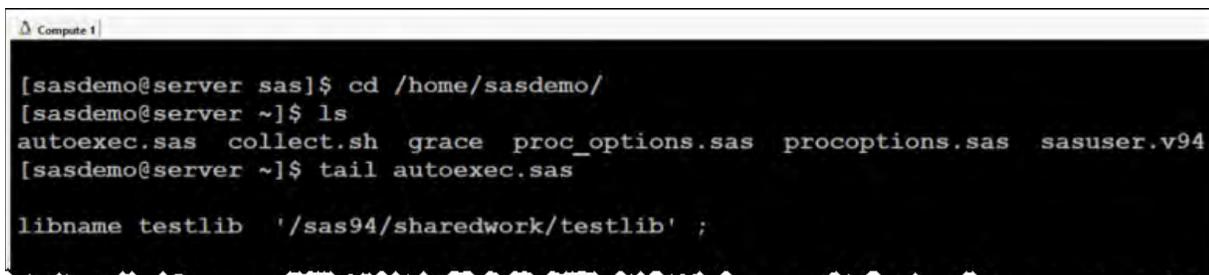


Display 8. Verifying Whether Libraries Are Pre-Assigned

7. To remove the pre-assignment of the library, clear the **Library is Pre-Assigned** check box.
8. Test for the delay again by using the user ID for which the original issue occurred.
9. Repeat the steps above for each library in the **Libraries** list, and retest for the delay again after you clear each one.

If you still have delays after removing any pre-assigned libraries as noted above, the delay might be user specific. In that case, you need to then check for any pre-assigned libraries in the autoexec.sas file for the user ID that is experiencing the problem.

To do that, submit commands similar to the ones that are shown below.



```
Compute 1
[sasdemo@server sas]$ cd /home/sasdemo/
[sasdemo@server ~]$ ls
autoexec.sas  collect.sh  grace  proc_options.sas  procoptions.sas  sasuser.v94
[sasdemo@server ~]$ tail autoexec.sas

libname testlib '/sas94/sharedwork/testlib' ;
```

Display 9. Checking for Pre-Assigned Libraries in a Specific User's autoexec.sas File

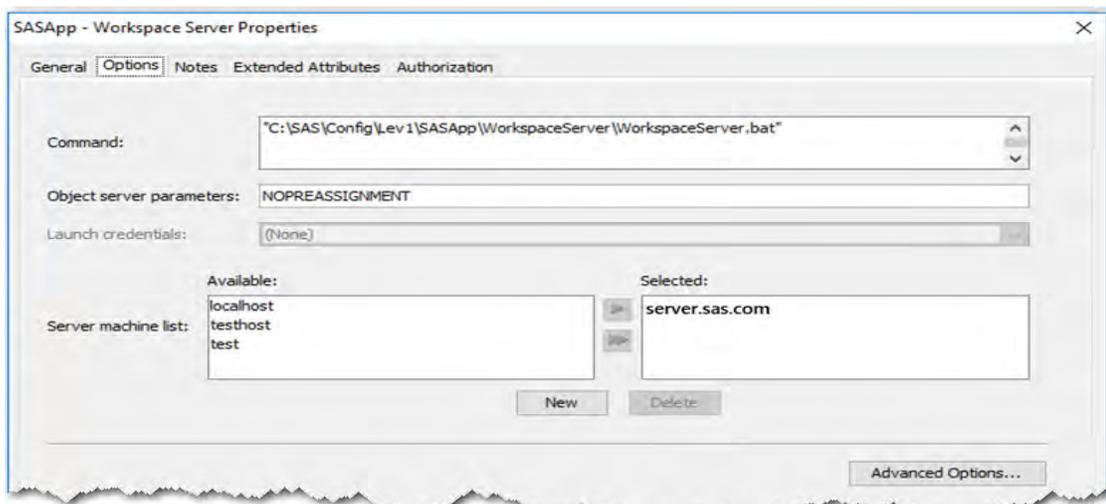
In this display, you can see that the library `testlib` is pre-assigned for the user `sasdemo` user through the `autoexec.sas` file, which is stored in the user's directory. To determine whether this pre-assigned library is the culprit, you need to add comment delimiters around the pre-assigned library and test the `sasdemo` ID again to see if the delay disappears or improves.

At times, bad or slow database connections can cause delays during library pre-assignments. You can identify those types of connections by removing the assignment of the libraries. If you have a bad or slow database connection and you remove the assignment, the delay should improve. At that point, you can further diagnose what might be causing the pre-assigned library to take so long by investigating your database connection or by contacting your database administrator for additional help.

Specifying That Libraries Not Be Pre-Assigned For SAS® 9.4 TS1M4 and Later

Starting in SAS 9.4 TS1M4, you can specify that libraries not be pre-assigned by adding the `NOPREASSIGNMENT` to the workspace server's **Object server parameters** field in SAS Management Console, as explained in the following steps. Be aware that adding this parameter affects all users that use the workspace-server definition in which you add the parameter:

1. Open SAS Management Console and select **Server Manager ► SASApp ► SASApp – Logical Workspace Server**.
2. Right-click **SASApp -Workspace Server** and select **Properties**.
3. In the properties dialog box, click the **Options** tab.
4. Enter `NOPREASSIGNMENT` as the value for the **Object server parameters** field, as shown below:



Display 10. Adding the NOPREASSIGNMENT Parameter in SAS® Management Console

(list continued)

5. Click **OK** (at the bottom of the dialog box above, but not shown here) to save the change.
6. Restart or refresh the object spawner that is associated with the affected workspace server for this change to be applied.

To verify that the parameter is being applied, validate the workspace server and then open a workspace-server log. If you see the following line in the log, the parameter is being applied:

```
Library preassignment is disabled.
```

After you enable the `NOPREASSIGNMENT` parameter, test to determine whether the delay still occurs. If it does occur, then the delay is likely a result of something other than pre-assigned libraries. For example, the culprit might be hardware issues, which are discussed in the next section.

Hardware Issues

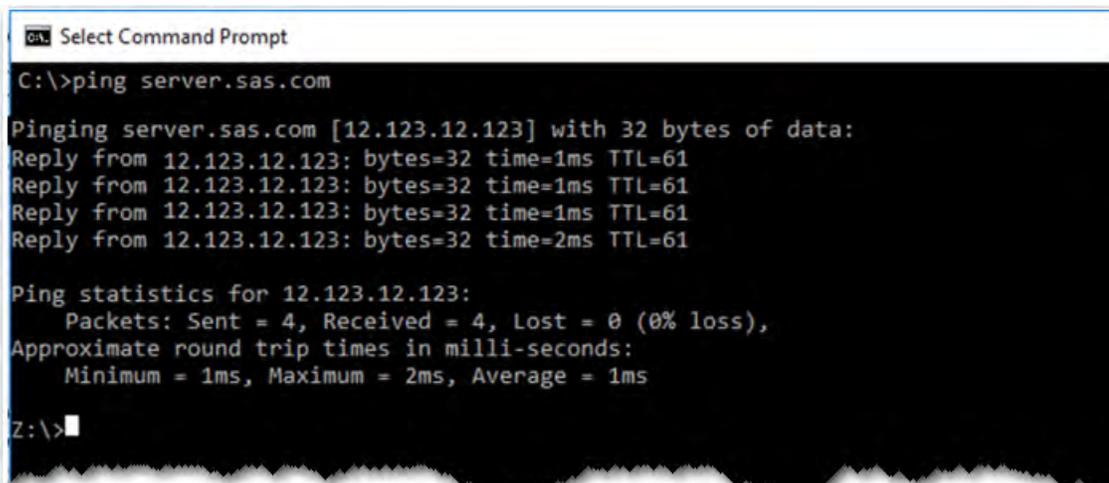
If you determine that the delay is not a result of pre-assigned libraries, then the culprit might be a result of a hardware failure or malfunction. Typical hardware issues include lost network packets, bad network-interface cards, and server performance issues.

Lost Network Packets

Packet loss occurs when packets do not reach their destination, which is typically a result of a network blockage. Network blockages can create delays because the packets must be retransmitted, which takes more time.

You can detect packet loss by using the following methods:

1. **Use a ping query:** You can issue a ping query between your tiers (for example, between the metadata and compute tiers) to determine whether they are experiencing a packet loss. You want to look at the `% loss` results, as shown below, and pay attention to the amount of time it takes for packets to be sent. If you find that you are losing packets or that it takes a long time to send them, you need to further investigate your network.



```
CA Select Command Prompt
C:\>ping server.sas.com

Pinging server.sas.com [12.123.12.123] with 32 bytes of data:
Reply from 12.123.12.123: bytes=32 time=1ms TTL=61
Reply from 12.123.12.123: bytes=32 time=1ms TTL=61
Reply from 12.123.12.123: bytes=32 time=1ms TTL=61
Reply from 12.123.12.123: bytes=32 time=2ms TTL=61

Ping statistics for 12.123.12.123:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 2ms, Average = 1ms

Z:\>
```

Display 11. Using a Ping Query to Determine Packet Loss or Long Sending Times

2. **Use the `tracert` utility:** The `tracert` utility diagnoses transit delays by tracing the IP network route that packets take to their destinations. You want to check the amount of time it takes for packets to traverse each route. Long amounts of time can also indicate that a router is the cause of a delay, since you see a lot of time used to get from one leg of the route to another. Under Windows, you issue the command `tracert .` to invoke the utility. Under Linux, the comparable command is `tracert`.

(list continued)

The following example uses the `tracert` command to trace the route for `google.com`:

```
Command Prompt
Microsoft Windows [Version 10.0.16299.192]
(c) 2017 Microsoft Corporation. All rights reserved.

Z:\>tracert google.com

Tracing route to google.com [172.217.13.238]
over a maximum of 30 hops:

  0  1 ms    1 ms    <1 ms  router1.sas.com [12.12.1.1]
  1  15 ms   1 ms   216 ms router2.sas.com [13.13.2.1]
  2  4 ms    2 ms    1 ms  router3.sas.com [14.14.12.2]
  3  2 ms    1 ms    1 ms  router4.sas.com [156.15.156.1]
  4  3 ms    2 ms    2 ms  xe-832.bar1.Raleigh1.Level3.net [4.71.162.13]
  5  *        *        *      Request timed out.
  6  9 ms    10 ms   9 ms  Google-level3-60G.WashingtonDC.Level3.net [4.68.71.186]
  7  *        *        *      Request timed out.
  8  10 ms   10 ms   10 ms 108.170.232.213
  9  10 ms   10 ms   9 ms  iad23s61-in-f14.1e100.net [172.217.13.238]

Trace complete.
```

Display 12. Using the traceroute Utility to Determine Transit Delays

3. **Check the router:** Typically, most routers have tools available that you can use to view the performance of the router. Your network administrator can check the router to determine whether any packet loss was reported over a period.

Bad Network-Interface Cards

A Network-Interface Card (NIC) enables your computer to connect to the computer network. If that card has any issues, a delay can occur. Your network administrator can help to diagnose whether you have a bad NIC. If that is the source of the delays, the solution is to replace the card.

Server Performance Issues

Server performance issues (for example, not enough system resources and server congestion) can cause delays. Such issues can reduce the data transfer speed to account for the lack of system resources. Your system administrator can monitor your server's performance through several monitoring tools to determine whether the cause of the delay is a lack of system resources.

TYPICAL NETWORK CAUSES FOR AN INITIALIZATION DELAY IN A LINUX ENVIRONMENT

If you find that your delays are not a result of pre-assigned libraries or system hardware, the next place to look is in your network configuration, including configuration files and network settings. The next sections discuss typical network issues that can cause workspace-server initialization delays in a Linux environment. Those issues include the following:

- unreliable Domain Name System (DNS) servers
- bad ordering of sources from which to obtain name-service information
- ordering of Name Servers and Search List Entries in the Resolver Configuration File
- resolution order of your internet protocol

Before you make any changes, be sure to back up any files before you edit them. In addition, you might need to restart your networking service after you test each of the items to see whether the changes took place. To restart the networking service, submit either of the following commands:

Command 1:

```
$ sudo service networking restart
```

Command 2:

```
$ sudo /etc/init.d/networking restart
```

Unreliable Domain Name System (DNS) Servers

The `nslookup` program queries the internet Domain Name System (DNS) for information about domains and hosts. Be aware that this program does not query the `/etc/hosts` directory for resolution; it only queries the DNS. If the DNS server that is returned is unreliable, it can contribute to an initialization delay.

```
[sas@server]$ nslookup server.test.sas.com
Server:          123.123.4.56
Address:         123.123.4.56#53

Name:   server.test.sas.com
Address: 11.123.45.123
```

Display 13. Using the `nslookup` Program to Find Unreliable DNS Server Information

As you can see, the `nslookup` command displays the address of the DNS server that the system is using. Verify that this is the correct DNS address that should be used and make sure there are no issues with that DNS server.

Also, submit the `nslookup` command and observe the time from start to finish. If the amount of time expended indicates a delay, you might have an issue with your DNS server. (Cherensen, 2010) If you find that there is a delay when you run `nslookup`, you should check the order that is set in your Name Service Switch configuration file, as discussed in the next section. If `dns` is listed in the file first, then you need to switch the search order and then test to see whether that resolves the delay.

Bad Ordering of the Sources from Which to Obtain Name-Service Information

The Name Service Switch (NSS) configuration file (`nsswitch.conf`) is used to determine the sources from which to obtain name-service information in a range of categories, and in what order. The category is identified by a database name. If the order of the sources is not ideal, that ordering can attribute to an initialization delay.

Note: As mentioned earlier, be sure to make a backup copy of the file (`nsswitch.conf`) before you make any changes. You might need to restart the server or network service to apply the changes that you make. If you find that the changes do not improve the delay or that they add time onto it, revert to the original file and restart the server.

In the `nsswitch.conf` file, you want to locate the line where the hosts are listed, as shown in this example:

```
hosts: dns files myhostname
```

In the `hosts` line above, the order of services is the DNS, local `etc/hosts` files, and `myhostname`.

The `myhostname` service resolves the locally configured system host name by using the `gethostname(2)` host function. Kerrisk (2018) recommends that you place `myhostname` last in the `nsswitch.conf` `hosts:` line to ensure that this mapping is only used as a fallback and that any mapping based on DNS or `/etc/hosts` takes precedence.

To resolve a delay that is, possibly, caused by bad ordering in the `nsswitch.conf` file, attempt to change the order in which the name-service is established. Using the `hosts` line above again, enter the following line with the items in a different order:

```
hosts: files dns myhostname
```

In this example, the local `etc/hosts` file is used first. If you run `nslookup` in the previous section and determine that the DNS server has a delay, you need to switch the search order to see whether that switch in order eliminates your delay.

If you still have the delay, revert to the original and continue with other suggestions or methods in this paper.

To learn more about the `nsswitch.conf` file and attributes, see "nsswitch.conf – Name Service Switch configuration file," available at man7.org/linux/man-pages/man5/nsswitch.conf.5.html.

Ordering of Search-List Entries and Name Servers in the Resolver Configuration File

The resolver configuration file (`resolv.conf`) contains DNS information that is read when a process is started by the resolver routines for the first time. If this file is nonexistent, the local machine is queried instead for the name server. If name servers that are listed are unreliable, the search list contains non-local servers, or more than six domains with a maximum of 256 characters are listed, then initialization delays might occur.

The `resolv.conf` file is typically located in the `/etc` directory. The two items you should focus on are the search list and name servers.

Note: As mentioned earlier, be sure to make a backup copy of the file (`resolv.conf`) before you make any changes. You might need to restart the server or network service to apply the changes that you make. If you find that the changes do not improve the delay or that they add time onto it, revert to the original file and restart the server.

```
Generated by NetworkManager
search server.sas.com sas.com. test.sas.com. server2.sas.com. test.com. test2.com.
nameserver 123.456.7.89
nameserver 123.567.8.90
nameserver 11.222.33.4
```

Display 14. Checking the Contents of the `Resolv.conf` File for Issues

Search List

Check the search list in `/etc/resolv.conf` to make sure that it is not the cause of the delay. If the domains that are listed in the search list contain non-local servers, performance issues can occur. The name resolution also times out if one of the servers that is listed for the domain becomes unresponsive. Test reversing the order of one or more of the domains that are listed. You can also try removing one or more of the domains because, currently, you can only have six domains listed with a maximum of 256 characters.

```
Generated by NetworkManager
search sas.com. test.sas.com. test.com. server.sas.com.
nameserver 11.222.33.4
nameserver 123.456.7.89
nameserver 123.567.8.90
```

Display 15. Deleting Domains and Re-Ordering the Search List

Name Servers

The order of the name servers can create a delay if there is an unreliable name server listed before a reliable name server. Try reversing the order of the name servers to see if that affects the delay. For example, Display 14 shows the name servers in a different order than is shown in Display 16.

```
Generated by NetworkManager
search server.sas.com. sas.com. test.sas.com. server2.sas.com. test.com. test2.com.
nameserver 11.222.33.4
nameserver 123.456.7.89
nameserver 123.567.8.90
```

Display 16. Changing the Order of the Name Server to Resolve Delays

Resolution Order of Your Internet Protocol

Using Internet Protocol Version 6 (IPv6) over Internet Protocol Version 4 (IPv4) has been found to be a cause of delays during initialization for the workspace server. This problem occurs because when IPv6 is enabled, your network tries to use that protocol before using IPv4. After the system attempts to use IPv6 several times (which causes a delay), it will try to use IPv4 instead. When this problem occurs, you do not receive an error to indicate the issue with IPv6. You just experience a delay while your system sorts out the address. In many cases, forcing IPv4 resolution over IPv6 stops the delay from occurring.

To determine whether IPv6 is enabled in your system, submit the `lsmod` command shown below. If the system returns `ipv6`, as shown below, then IPv6 is enabled in your environment. That might indicate that you have delay issues because of resolution order.

```
[sas@server]$ lsmod |grep ipv6
ipv6                123456      80
```

Display 17. Determining Whether IPv6 Is Enabled

When you have a possible issue with the resolution address for your internet protocol, it is helpful to look at how that address is called. Your system uses the `Getaddrinfo` host function to call and resolve the address. This function converts binary host names, IP addresses, and domain names into IPv4 or IPv6 addresses that are readable by humans.

There are two programs that you can run to see whether there might be an issue returning the address or which protocol is returned first. One program is a Python script; the other is a Perl script. These programs are explained in the next sections.

Using the `Getaddrinfo.py` Python Script to Determine When a Delay Is outside of SAS® during the Return of the `Getaddrinfo` Call

The `Getaddrinfo.py` script, by Garrett Allred (SAS Technical Support), determines whether there is a delay occurring from outside of SAS during the return of the `getaddrinfo` call. Running the Python scripts shows what is returned from the `Getaddrinfo` call. You need to time the return of that value to see if a delay occurs.

If there is a delay in the return, you need to further investigate how `getaddrinfo` is called by your system. The methods for further investigating how `getaddrinfo` is called (for example, investigating the configurations of some system files) are discussed later in this section.

To use the Python script, save the following code as a Python (.py) file:

```
import sys, socket

result=socket.getaddrinfo(sys.argv[1], None, 0, socket.SOCK_STREAM)

counter=0
for item in result:
    print ("% -2d: %s" % (counter, item[4]))
    counter += 1
```

After you save the python script, run it by submitting a command like the following, with your host name:

```
[root@server]# python getaddrinfo.py localhost
0 : ('::1', 0, 0, 0)
1 : ('127.0.0.1', 0)
[root@server]# python getaddrinfo.py server.sas.com
0 : ('12.123.45.678', 0)
```

Display 18. `Getaddrinfo.py` to Determine a Delay outside of SAS

If the `Getaddrinfo` function returns 0, then the call is successful. If the return is a negative number, then there is an issue with obtaining the IP address. Display 18 shows a successful run of the script.

Using the Getaddrinfo.pl Perl Script to Determine the Order in Which the IP Version Is Resolved

After you run a successful `getaddrinfo.py` Python script where an address is returned in a timely manner, you then need to determine which protocol is being returned first. Executing the following Perl script (written by Ronnie Johnson, SAS Technical Support), shows whether IPv4 or IPv6 is used first. If IPv6 is returned first, you might need to adjust the `gai.conf` configuration file to force IPv4 resolution before IPv6. The `gai.conf` file is discussed in more detail in the section "Using the `/etc/gai.conf` Configuration File to Force Resolution of IPv4 before IPv6," later in his paper.

To use the Perl script, save the following code as a Perl (`.pl`) file:

```
#!/usr/bin/perl

use warnings;
use strict;

use Socket qw(:DEFAULT AI_CANONNAME IPPROTO_TCP IPPROTO_UDP IPPROTO_RAW
             SOCK_STREAM SOCK_DGRAM SOCK_RAW getaddrinfo
             inet_ntop inet_pton);

# map protocol number to name
sub pprotocol {
    my ($proto)=@_;
    if ($proto == IPPROTO_TCP) {
        return 'IPPROTO_TCP';
    } elsif ($proto == IPPROTO_UDP) {
        return 'IPPROTO_UDP';
    } else {
        return 'n/a';
    }
}

# map socket type number to name
sub psocktype {
    my ($socktype)=@_;
    if ($socktype == SOCK_STREAM) {
        return 'SOCK_STREAM';
    } elsif ($socktype == SOCK_DGRAM) {
        return 'SOCK_DGRAM';
    } elsif ($socktype == SOCK_RAW) {
        return 'SOCK_RAW';
    } else {
        return 'unknown';
    }
}
```

(code continued)

```

die "Must specify name to resolve" if (not $ARGV[0] and not $ARGV[1]);

my $name=$ARGV[0] or undef;
my $service=$ARGV[1] or undef;

# we want the canonical name on the first entry returned
if ($ARGV[0]) {
    $hints->{flags}=AI_CANONNAME;
}

my ($err, @addrs)=getaddrinfo ($name, $service, $hints);

die "getaddrinfo: error or no results" if $err;

# If we get here, each element of @addrs is a hash
# reference with the following keys (addrinfo struct members):

# 'family'      (AF_INET, AF_INET6)
# 'protocol'    (IPPROTO_TCP, IPPROTO_UDP)
# 'canonicalname' (Only if requested with the AI_CANONNAME flag, and only on
the first entry)
# 'addr'        This is a sockaddr (_in or _in6 depending on the address
family above)

```

After you save the Perl script, you can run it by submitting the following command:

```
Perl getaddrinfo.pl host-name
```

The following example shows a sample command along with the output it generates.

```

[sas@server ~]$ perl getaddrinfo.pl localhost
IPv6:
  ::1, port: 0, protocol: 6 (IPPROTO_TCP), socktype: 1 (SOCK_STREAM),
(scope id: 0, flowinfo: 0), canonicalname: localhost
IPv4:
  127.0.0.1, port: 0, protocol: 6 (IPPROTO_TCP), socktype: 1
(SOCK_STREAM), canonicalname:

```

In the previous results, you can see that IPv6 is called and returned first.

If you modify the `gai.conf` file and the resubmit the Perl script, you receive the output that is shown below (see the next section, "Using the `/etc/gai.conf` Configuration File to Force Resolution of IPv4 before IPv6," for details about the steps you need to do to make this modification).

```

sas@server ~]$ perl getaddrinfo.pl localhost
IPv4:
  127.0.0.1, port: 0, protocol: 6 (IPPROTO_TCP), socktype: 1
(SOCK_STREAM), canonicalname: localhost
IPv6:
  ::1, port: 0, protocol: 6 (IPPROTO_TCP), socktype: 1 (SOCK_STREAM),
(scope id: 0, flowinfo: 0), canonicalname:

```

Using the `/etc/gai.conf` Configuration File to Force Resolution of IPv4 before IPv6

The `gai.conf` file enables system administrators to dynamically change the sorting that occurs when a call is made to the `getaddrinfo` because the static rules are not always satisfactory. You can modify `gai.conf` to force resolution of IPv4 over IPv6, discussed in the previous section, to help resolve a delay.

To modify the `gai.conf` file, navigate to the `/etc` directory.

- If the `gai.conf` file exists in that directory, locate the following line and remove any comment delimiters if they are present:

```
Precedence ::ffff:0:0/96 100
```
- If `gai.conf` does not exist, create it and add only the `Precedence` line above in that file. This will force IPv4 resolution before IPv6. So, if IPv6 is still getting invoked somehow, this should override it.

```
[root@server]# cd /etc/
[root@server etc]# vi gai.conf

Precedence ::ffff:0:0/96 100
```

Display 19. Example of the `Gai.conf` File

When you add the `Precedence` keyword to the `gai.conf` file, the default table is not used in sorting.

Determining Whether the `/etc/hosts` File Contains Bad Entries

The `hosts` file in the `/etc` directory is used to map host names to IP addresses. The file converts human-readable host names into binary addresses for the computer network to connect to its network nodes. If the file contains bad entries, a delay can occur when your system attempts to retrieve the IP address.

Another item that can contribute to a delay is the `:::1` entry in `/etc/hosts` because that entry is an IPv6 entry. If you place this entry within a comment delimiter, as shown in Display 20, the system first tries to map to the IPv4 address. Once you make that change, you can see whether you still have a delay issue.

Note: As mentioned earlier, be sure to make a backup copy of the file before you make any changes. You might need to restart the server or network service to apply the changes that you make. If you find that the changes do not improve the delay or that they add time onto it, revert to the original file and restart the server.

```
[sas@server]$ cd /etc/
[sas@server etc]$ vi hosts

127.0.0.1    localhost localhost.localdomain localhost4 localhost4.localdomain4
#:::1      localhost localhost.localdomain localhost6 localhost6.localdomain6
```

Display 20. Adding a Comment Delimiter around `:::1` to Force Resolution of IPv4 First

Also verify that the IP address, the fully qualified domain name (FQDN), and the short host name are in the correct order (IP, FQDN, host name;) in `/etc/hosts`. (for example: `123.321.123.123 host.domain.com host-name`)

If these elements are not in the correct order in the file, you need to update the file so that they are in the correct order.

Disabling Internet Protocol 6

If you find that you still have issues with IPv6, you can disable it all together. However, this is not typically recommended because IPv6 is required by other technologies such as NIC bonding. If you do decide to disable IPv6, you can modify or create the `ipv6.conf` file in the `/etc/modprobe.d` directory and add the following line to the file (as shown below in Display 21):

```
install ipv6/bin/true
```

Note: As mentioned earlier, be sure to make a backup copy of the file (`ipv6.conf`) before you make changes. You might need to restart the server or network service to apply the changes that you make. If you find that the changes do not improve the delay or that they add time onto it, revert to the original file and restart the server.

```
[root@server]# cd /etc/
[root@server etc]# cd modprobe.d
[root@server modprobe.d]# ls
anaconda.conf  blacklist.conf  dist-alsa.conf  dist.conf  dist-oss.conf  libcxgb3.conf  libcxgb4.conf  libmlx4.conf  mlx4.conf
[root@server modprobe.d]# touch ipv6.conf
[root@server modprobe.d]# ls
anaconda.conf  blacklist.conf  dist-alsa.conf  dist.conf  dist-oss.conf  ipv6.conf  libcxgb3.conf  libcxgb4.conf  libmlx4.conf
[root@trcv052 modprobe.d]# vi ipv6.conf

install ipv6/bin/true
```

Display 21. Creating and Modifying the IPv6.conf File

After you add that line to the `ipv6` file, resubmit the `lsmmod | grep ipv6` command. The command should not return anything. Then, to determine whether IPv6 was the cause of the delay, retest to see whether you still have a delay or whether there is an improvement in the delay time.

TYPICAL NETWORK CAUSES FOR AN INITIALIZATION DELAY IN A WINDOWS ENVIRONMENT

For Windows, if you find that you do not have issues with pre-assigned libraries or system hardware, the next place to start looking is in your network configuration (including configuration files and network settings). This section covers typical network causes for workspace-server initialization delays in a Windows environment.

Remember to re-test for the delay after each change that you make. If the delay does not change at all, you can revert to the original settings.

Determining Domain Name System Server Issues

Domain Name System (DNS) server issues can be a network culprit for delays. You can use the `nslookup` program (described earlier in this paper) to troubleshoot DNS server problems (for example, host-name resolution). When you invoke `nslookup`, the program displays the host name and IP address of the DNS server that is configured for your local system, as shown in the following example: (Microsoft Corporation, 2018)

```
C:\> nslookup server.sas.com
Server:      dns.server.sas.com
Address:     12.34.56.789

Name:       server.sas.com
Address:    12.12.12.123
```

Display 22. Results That Are Obtained with the nslookup Program

You can use `nslookup` in a couple of ways to help resolve delays:

(list continued)

- Use `nslookup` to check for DNS resolution issues or delays. If the program indicates a delay, then follow the steps in the next section to set IPv4 so that it resolves before IPv6. Then restart the network adapter by disabling and then re-enabling it., if necessary.
- Use `nslookup` to determine what DNS server is being used. Once you know that information, you can try to use a different DNS server to see whether that eliminates or improves the delay. If so, the original DNS server might have issues that are contributing to the delay.

Keep in mind that `nslookup` lists only the DNS server to which it connects initially. If the name-resolution request is forwarded to other domain-name system servers, those servers are not listed.

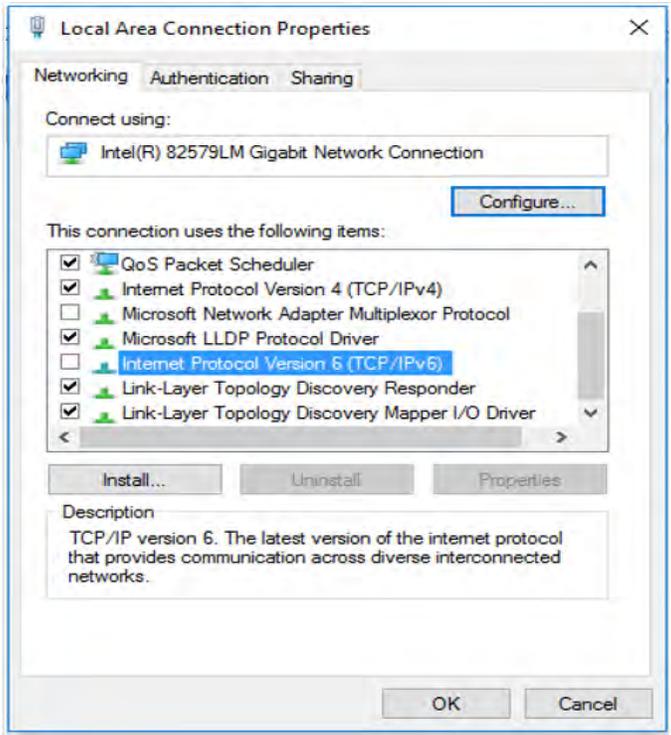
Resolving Internet Protocol Version 4 before Internet Protocol Version 6

If IPv6 resolves first in your network, that behavior can contribute to a delay in some environments where IPv6 is faulty. IPv6 tries to resolve first, and when it cannot, the system tries to resolve IPv4. As a result, a delay occurs. If you think this might be the case in your environment, it is best to first try to set the environment to resolve IPv4 before IPv6. Microsoft has provided procedures that are downloadable from the Microsoft website that you can use to set IPv4 to resolve first. Those procedures are available on the web page "How to disable IPv6 or its components in Windows." (support.microsoft.com/en-us/help/929852/how-to-disable-ipv6-or-its-components-in-windows)

If you find that you still have issues with IPv6, you can disable it all together. However, this is not typically recommended because IPv6 is required by other technologies (for example, such as NIC bonding and other Windows components).

To disable IPv6 in Windows:

1. Select **Start ► Control Panel**. (For Windows 10, right-click the Windows **Start** menu icon and select **Control Panel**.)
2. Click **Network and Sharing Center**. (For Windows 10, click **Network and Internet**.)
3. In the left pane of the Network and Sharing Center, click **Change adapter settings** (Windows 7 or later) or **Manage network connections** (Microsoft Vista).
4. In the Network Connections window, right-click the ethernet adapter for which you want to disable IPv6 and select **Properties**.
5. In the Local Area Connection Properties dialog box, clear the check box for **Internet Protocol Version 6 (TCP/IPv6)**.



Display 23. Disabling IPv6 in Windows

Determining Whether Your Local Domain Server Name Is Correct

To find out which DNS server you are using, submit the `ipconfig/all` command, as shown below. This command lists all your current configuration values.

```
Z:\>ipconfig /all

Windows IP Configuration

Host Name . . . . . : servername
Primary Dns Suffix . . . . . : SAS.com
Node Type . . . . . : Hybrid
IP Routing Enabled. . . . . : No
WINS Proxy Enabled. . . . . : No
DNS Suffix Search List. . . . . : sas.com
                                   search.sas.com
                                   example.sas.com
                                   search.com
                                   example.com

Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix . . : sas.com
    Description . . . . . : Intel(R) 12345 Gigabit Network Connection
    Physical Address. . . . . : A1-B2-C3-D4-E5-F6
    DHCP Enabled. . . . . : Yes
    Autoconfiguration Enabled . . . . : Yes
    Link-local IPv6 Address . . . . . : ab12::ab12:cd34:cd34:ef56%7 (Preferred)
    IPv4 Address. . . . . : 11.22.33.456 (Preferred)
    Subnet Mask . . . . . : 255.255.0.0
    Lease Obtained. . . . . : Monday, November 1, 2017 4:54:36 PM
    Lease Expires . . . . . : Sunday, January 1, 2018 4:54:34 PM
    Default Gateway . . . . . : 11.12.0.1
    DHCP Server . . . . . : 123.45.6.78
    DHCPv6 IAID . . . . . : 123456789
    DHCPv6 Client DUID. . . . . : 01-02-03-0A--0B-2C-1D-2E-12-1A-A2-12-34
    DNS Servers . . . . . : 12.3.4.56
                                   12.34.5.67
                                   12.43.5.76
                                   11.12.123.4
    NetBIOS over Tcpip. . . . . : Enabled

> nslookup serverFQDN.sas.com
Server: sas.com
-- INSERT --
```

Display 24. Listing Domain-Name System Servers with the ipconfig /all Command

If any of the domain-name system servers that are listed are not correct or are unreliable, switch to use a more appropriate DNS server and see if the delay improves. Your network administrator can help you to switch your DNS servers.

Ensuring That Your Multicast Reverse Lookup Functions Properly

Multicast reverse lookup prevents routing loops from occurring. When a routing loop occurs, all packets are routed from one interface to another and vice versa. This behavior causes packets to route in both directions, which continues until the interface's IP time-to-live (TTL) mechanism expires. If the multicast reverse lookup does not function properly, delays can occur. There are a couple of methods you can use to test if your multicast reverse lookup is functioning properly. Your network administrator can help you with the tools that are discussed, which are specific to your hardware.

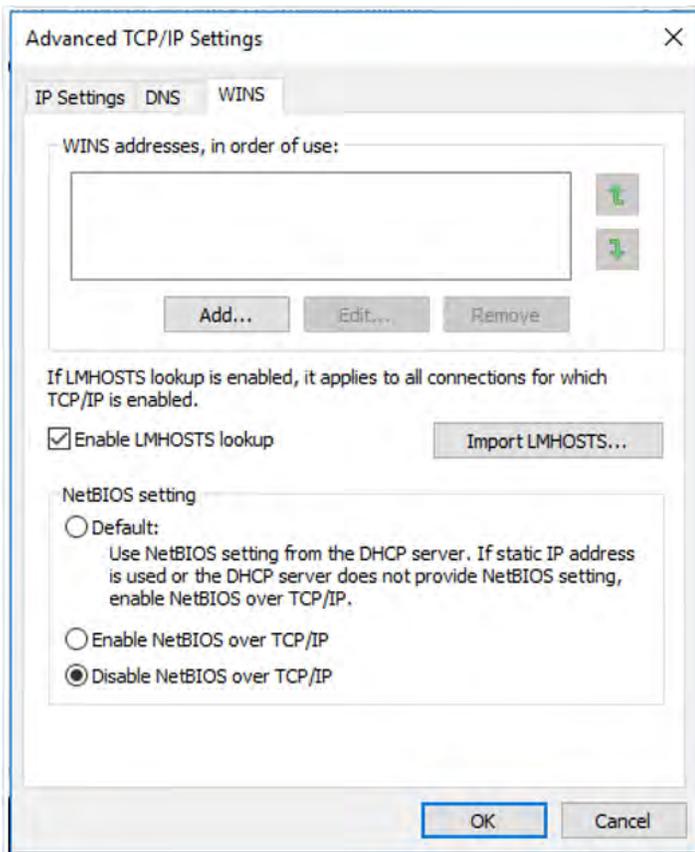
Disabling the NetBIOS over TCP/IP Option

NetBIOS over TCP/IP is a networking protocol that enables you to use legacy computer applications that rely on the NetBIOS API on modern TCP/IP networks. If you have a cluster of network interface cards (NIC), SAS Technical Support recommends that you disable the **NetBIOS over TCP/IP** option for NICs that are not general-connectivity NICs. Disabling the NetBIOS over TCP/IP option forces the client to use the DNS server instead, which can improve network performance.

When you submit the `ipconfig/all` command, the output lists whether NetBIOS over TCP/IP is enabled on the ethernet adapters. (See [Display 24](#) for an example.)

To disable NetBIOS over TCP/IP:

1. Select **Start ► Control Panel**. (For Windows 10, right-click the Windows **Start** Menu icon and select **Control Panel**.)
2. Click **Network and Sharing Center**. (For Windows 10, click **Network and Internet**.)
3. In the left pane of the Network and Sharing Center, click **Change adapter settings** (Windows 7 or later) or **Manage network connections** (Vista).
4. In the Network Connections window, right-click the ethernet adapter for which you want to disable NetBIOS over TCP/IP and select **Properties**.
5. In the Local Area Connection Properties dialog box, select **Internet Protocol Version 4(TCP/IPv4) ► Properties**.
6. In the Internet Protocol Version 4 (TCP/IP) Properties dialog box, click **Advanced**.
7. In the Advanced TCP/IP Settings dialog box, click the WINS tab
8. Select the **Disable NetBIOS over TCP/IP** radio button, as shown below:



Display 25. Disabling NetBIOS over TCP/IP on the Ethernet Adapter

Addressing Issues with `gethostbyaddress` Calls in Virtual Machine Environments

This section, based on information and code written by Greg Granger (SAS Research and Development), addresses issues that occur with `gethostbyaddress` calls in virtual environments. When you have unnamed local IP addresses, such as when a virtual machine is installed, delays can occur when the system retrieves the `gethostbyaddress` calls. The operating system's network stack is asked to resolve IP addresses that have no name, which then causes the delay.

One way to test for this issue is as follows:

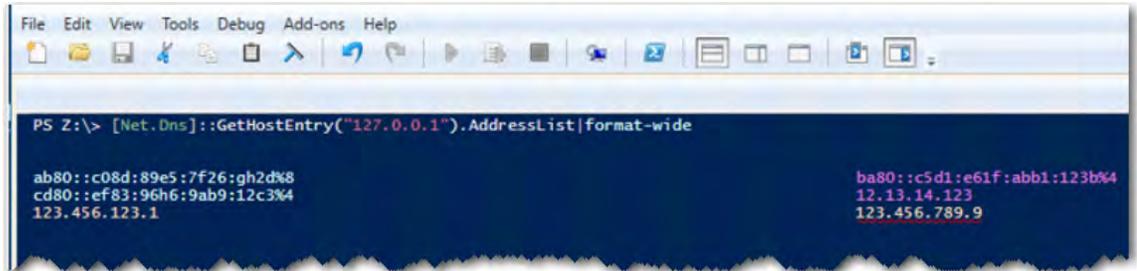
1. Open a PowerShell window:
 - o For IPv4, submit this command:

```
[Net.Dns]::GetHostEntry("127.0.0.1").AddressList|format-wide'
```

- o For IPv6, submit this command:

```
[Net.Dns]::GetHostEntry("::1").AddressList|format-wide'
```

This command generates a list of IP addresses, as shown in this example:



Display 26. Running GetHostEntry in Windows PowerShell to Test for Delays

2. Test each of the listed addresses for delays by submitting the following commands:

```
[Net.Dns]::GetHostEntry(<ip>)
> (Measure-Command
{[Net.Dns]::GetHostEntry("123.456.123.1")}).TotalSeconds
5.0034683
> (Measure-Command
{[Net.Dns]::GetHostEntry("123.456.789.9")}).TotalSeconds
0.0003953
```

If it takes significantly more time to return the name of an IP address that is local to your machine, then you have a configuration issue.

3. To fix the configuration issue, create an entry in the hosts file of your `%windir%\system32\drivers\etc\` directory and define a name for that address, as shown in this example:

```
123.456.123.1      host_123_456_123_1
```

After you include this address, you should see improvements in the return when you resubmit the measured commands.:

```
> (Measure-Command
{[Net.Dns]::GetHostEntry("123.456.123.1")}).TotalSeconds
0.0008567
> (Measure-Command
{[Net.Dns]::GetHostEntry("123.456.789.9")}).TotalSeconds
0.0007495
```

CONTACTING SAS TECHNICAL SUPPORT FOR HELP

If the techniques described earlier in this paper do not resolve your delay issues, you can open a tracking entry with SAS Technical Support for further help in determining the cause of the delay.

Before you open a tracking entry with SAS Technical Support, you need to gather the following information:

- site number
- operating system
- SAS release and maintenance release

- the workspace server log that is generated when the delay occurs
- An object spawner log from after it was restarted that shows an initialization delay
- The SAS® Metadata Server log that is generated when the delay occurs

Once you collect the information above, you can open a tracking entry by calling or emailing SAS Technical support or by submitting your request online.

- SAS Technical Support Phone Number:
 - 1-800-727-0025
 - 1-919-677-8008
- SAS Technical Support Email: support@sas.com
- Online form: support.sas.com/ctx/supportform/createForm

After you submit your problem, SAS Technical Support reviews the logs that you sent to determine whether your problem is truly an initialization delay. Technical Support staff will report their findings to you via the tracking entry. If the problem is not an initialization delay, the consultants will explain what they believe to be the actual cause of the problem, and they will provide next steps for further diagnosis of the problem. Based on that diagnosis, you will receive further suggestions for resolving the problem.

CONCLUSION

When you detect a workspace-server initialization delay, it is very important to trace the source of and resolve the delay quickly to prevent an impact on performance, time, resources, and profit. After you determine that you have a workspace-server initialization delay, you should investigate whether the culprit is pre-assigned libraries, hardware malfunctions, or networking settings in both Linux and Windows environments. If you exhaust these options and still have the delay, SAS Technical Support is available for further help in identifying the culprit of your problem

As Emo Philips said, “A computer once beat me at chess, but it was no match for me at kick boxing.” The moral of that quote—do not give up! Follow all the steps described in this paper thoroughly until you catch the culprit!

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