Paper 461-2013

Tips and Techniques for Deploying SAS® in an Application Virtualization Environment

Chuck Hunley, Michael King, Max Blake, and Rob Hamm, SAS Institute Inc.

ABSTRACT

Application virtualization is being increasingly used by many organizations to more easily deploy, maintain, and manage their desktop applications. There are many vendors and products on the market to choose from, including VMware, Citrix, and Microsoft. Each vendor's technology comes with its unique set of features and nuances. What do you need to know to get SAS® up and running?

This paper explores some best practices, gotchas, and guidelines that will help you succeed when deploying and using SAS in an application virtualization environment.

INTRODUCTION

The SAS Product Support for Virtualization Environments policy groups virtualization into three categories: Hardware Virtualization, Presentation Virtualization, and Application Virtualization. Application virtualization is the emulating of the operating system to an application via encapsulation. The underlying operating system does not "see" the application as a physically installed entity; however, the application uses the underlying operating system and hardware for its processing power. By separating or isolating the application from the operating system, the application can be more easily deployed, managed, and maintained. In order to achieve this separation between the application and operating system, an application needs to be installed, analyzed, and packaged so that it can be deployed to the encapsulation layer. Once an application has been packaged, techniques such as streaming the package down to the endpoint to mimic a just-in-time installation can be used. This paper explores recommendations for sequencing (packaging) and deploying (executing) various SAS applications.

EVALUATION ENVIRONMENT

SAS Software

- SAS® 9.3 (TS1M2)
- SAS® Enterprise Guide® 5.1
- SAS® Management Console 9.3m2
- SAS® Data Integration Studio 4.5
- SAS® Add-in for Microsoft Office 5.1
- Jmp® Pro 10.0.2 64-bit Edition

Microsoft Software
- Office Professional Plus 2010

Microsoft Application Virtualization 5.0 (App-V)
- Microsoft Application Management, Publishing, and Reporting Server – Windows Server 2008 R2 Standard SP1
- Microsoft Application Virtualization Sequencer – Virtual Machine running Windows 7 Enterprise 64-bit
- Microsoft Application Virtualization Client – Windows 7 Enterprise 64-bit and Windows 8 Enterprise 64-bit

VMware ThinApp 4.7
- Capture/Sequencer computer – Virtual Machine running Windows 7 Enterprise 64-bit
- Client – Windows 7 Enterprise 64-bit and Windows 8 Enterprise 64-bit.

SEQUENCING

Sequencing is the process of capturing and packaging an application to be used in a virtual environment. During the sequencing step, the manner in which the application is deployed to a physical computer is analyzed and dependencies are captured. This step enables the just-in-time installation of the application to the encapsulation or sandbox that resides on the endpoint system (which is, in most cases, a desktop system). Proper sequencing is the key to success.

Prerequisites

Many SAS products require Microsoft components to function correctly on the Windows operating system. These components can be installed by the SAS® Deployment Wizard and are captured during sequencing. These additional components contribute to an increased package size and more complexity. We recommend installing these additional components on the sequencing computer prior to starting any sequencer application. These components should also be deployed to endpoints (desktops) prior to publishing any virtualized application via some form of Electronic Software Delivery (ESD). By separating these dependencies beforehand, the package size will be reduced and potential conflicts can be avoided.

The following Microsoft components should be installed in the following order. We recommend installing not only the 32-bit components but also the 64-bit components on 64-bit Windows operating systems. SAS includes these components, and they can be located in your SAS Software Depot. See SAS Note 45588 for details.

1. Microsoft .Net 4.0
2. Microsoft Office Access Database Engine 2010
3. Microsoft Runtime Components 7.1
4. Microsoft Runtime Components 8.0 SP1 (32- and 64-bit)
5. Microsoft Runtime Components 9.0 SP1 (32- and 64-bit)
6. Microsoft Runtime Components 10 (32- and 64-bit)
7. Microsoft Visual Studio Tools 2010 for Office (required for the SAS Add-In for Microsoft Office)

Sequencing with Microsoft Application Virtualization 5.0

During the sequencing process, the Microsoft Application Virtualization Sequencer presents a panel for applications to be run. This allows the application to complete any necessary configuration. SAS recommends not running any SAS applications for both functional and security purposes. Functionally, when some SAS products start, they save profiles and other data in the user profile. During sequencing, this change to the system will be captured and stored. The user profile used during sequencing is most likely different than the end user executing the virtualized application. From a security perspective, any user credentials such as user ID and password will also be captured and stored, and therefore should not be entered. Once the virtualized application is deployed, the credentials will be available to all users. For example, SAS Enterprise Guide can be used to access SAS servers. A profile is typically created, which requires a user ID and password to be entered. The Microsoft Application Virtualization Sequencer will capture and store this information, and end users will have access to it when they execute the virtualized application on the client computer.

The Microsoft Application Virtualization Sequencer also captures some applications that are not required or that will not function as desired in an end-user environment. SAS recommends that shortcuts to these applications be removed. The Microsoft Package Editor can remove these application shortcuts.   The application shortcuts can be found in the Package Editor by clicking the "Shortcuts and FTAs" tab. Removing the shortcut does not remove the application from the package. The only change that has really been made is that the shortcut is not displayed on the endpoint. The following items can be removed if they appear:

- SAS Operational Qualification Tool
- Java Platform SE Binary
- Java Web Start Launcher
- Manage SAS File Types
- Renew SAS Software
- SAS® Deployment Manager
- SAS Install Qualification Tool
- SAS Service Configuration Utility
- Notepad

SAS® Foundation

Microsoft has increased the package size limitation to 10 GB in App-V 5.0. This increase in package size makes the sequencing of SAS Foundation possible. The resulting package size for SAS Foundation 9.3 (TS1M2) English only with all products selected is about 6.2 GB.

Connection Groups

Connection Groups in Microsoft Application Virtualization allows multiple applications that have been virtualized in separate packages to interact. This interaction allows for smaller package size, reduces servicing complexity, and allows secondary packages such as Java Runtime Environment (JRE) to be reused in primary applications. SAS applications that use Java such as SAS Management Console and Jmp®10 are good candidates for Connections Groups. However, we have found that SAS Management Console 9.3 does not function correctly when it coexists with SAS Data Integration Studio 4.5 in the same connection group. Other SAS application combinations might exhibit similar issues. Therefore, SAS recommends caution when using Connection Groups. To use SAS applications with a virtualized Java JRE, follow this workflow:

1. Start with a clean Sequencer computer.
2. Start the Microsoft Application Virtualization Sequencer.
3. Sequence the Java JRE as "Middleware" on the Sequencer computer. Make note of the installation path to the Java JRE (for example, C:\Program Files (x86)\Java\Jre6.) Save the package on the Microsoft Application Virtualization Management Server content storage.
4. To sequence a SAS application, start with a clean Sequencer computer.
5. At this point, the sequencing process for the primary SAS application can begin.
6. Copy the Java package back to the Sequencer computer. The Microsoft Application Virtualization Sequencer will need access to this package.
7. Start the Microsoft Application Virtualization Sequencer
8. Expand the Java package back to the local system.
9. Select "Create a New Virtual Application Package".
10. Select "Create Package (default) for the Packaging Method".
11. Select "Middleware" in the Microsoft Application Virtualization Sequencer for the Type of Application to sequence.
12. When prompted to select the installer, point to the setup.exe in your SAS Software Depot.
13. In the Package Name panel, enter the Primary Virtual Application Directory. The default directory for SAS software is c:\Program Files\SASHome. The directory entered here must be used in the SAS Deployment Wizard when specifying the SAS Home location.
14. Proceed through the SAS Deployment Wizard. When prompted for Java, select "Select an existing Java Runtime Environment" and enter the path to the existing Java JRE. This path must be the same as the installation path when the Java JRE was previously sequenced.
15. When prompted on the Prepare for Streaming panel, do not run any applications when asked to do so to finish configuration.
16. On the Create Package panel, select "Continue to modify the package without saving using the package editor" and continue.
17. In the Package Editor, select the "Shortcuts and FTAs" tab and remove any unnecessary or undesired shortcuts.
18. Save the primary package and copy it to the Microsoft Application Virtualization Management Server content storage.
19. Log in to the Microsoft Application Virtualization Management Server Console.
20. Add the Java package and the SAS application package.
21. Select "Connection Groups" and "ADD CONNECTION GROUP".
22. Rename the Connection Group as desired (for example, "SAS Clients").
23. Add the Java JRE to the connection group.
24. Add any SAS applications to the connection group.
25. Select the appropriate Active Directory access group.
26. Publish the new Connection Group.

SAS Enterprise Guide and SAS Foundation

Projects and programs in SAS Enterprise Guide can be run on a SAS Server (SAS Workspace Server or SAS Stored Process Server) or on a local SAS Foundation installation. What if SAS Foundation and SAS Enterprise Guide are both virtual applications? If sequenced and published separately, SAS Enterprise Guide will not be aware of the locally available SAS Foundation. This is a case where sequencing as Middleware and Connection Groups can be used. To allow SAS Enterprise Guide to use a locally available SAS Foundation, follow this workflow:

1. Start with a clean Sequencer computer.

2. Start the Microsoft Application Virtualization Sequencer, select "Create Package" (default), and later select "Middleware" as the Type of Application to sequence.
3. When prompted to select the installer, point to the setup.exe in your SAS Software Depot. Your SAS Software Depot will need to be accessible on your Sequencer computer.
4. In the Package Name panel, enter the Primary Virtual Application Directory. The default directory for SAS software is c:\Program Files\SASHome. The directory entered here must be used in the SAS Deployment Wizard when specifying the SAS Home location.
5. Proceed with the SAS Deployment Wizard, selecting to install SAS Foundation.
6. On the next panel select the desired SAS Foundation Products and proceed.
7. When prompted on the Prepare for Streaming panel, do not run any applications when asked to do so.
8. When prompted, select "Continue" to modify package without saving using the package editor and continue.
9. In the Package Editor, select the "Shortcuts and FTAs" tab. Remove any unnecessary or undesired shortcuts.
10. Save the package on the Microsoft Application Virtualization Management Server content storage.
11. To sequence SAS Enterprise Guide, start with a clean Sequencer computer.
12. Copy the SAS Foundation package back to the Sequencer computer.
13. Start the Microsoft Application Virtualization Sequencer.
14. Expand the SAS Foundation package back to the local system.
15. Sequence SAS Enterprise Guide and select "Middleware" in the Microsoft Application Virtualization Sequencer.
16. When prompted on the "Prepare for Streaming panel, do not run any applications when asked to do so to finish configuration.
17. On the Create Package panel, select "Continue to modify package without saving using the package editor" and continue.
18. In the Package Editor, select the "Shortcuts and FTAs" tab and remove any unnecessary or undesired shortcuts.
19. Save the SAS Enterprise Guide package and it copy to the Microsoft Application Virtualization Management Server content storage.
20. Log in to the Microsoft Application Virtualization Management Server Console.
21. Add the SAS Foundation and the SAS Enterprise Guide packages.
22. Select "Connection Groups" and "ADD CONNECTION GROUP".
23. Rename the Connection Group as desired (for example, "SAS Clients").
24. Add the SAS Foundation package to the connection group.
25. Add the SAS Enterprise Guide package to the connection group.
26. Select the appropriate Active Directory access group for the connection group.
27. Publish the new Connection Group.

SAS Add-In for Microsoft Office

With the SAS Add-In for Microsoft Office and Microsoft Office applications such as Microsoft Excel, Microsoft PowerPoint, Microsoft Word, and Microsoft Outlook e-mail, users can access data, reporting, and analytics directly from within these applications. This section describes how to sequence the SAS Add-In for Microsoft Office as an add-on to Microsoft Office.

As with SAS Enterprise Guide, the SAS Add-In for Microsoft Office can be sequenced with SAS Foundation or as a stand-alone installation configured to access SAS servers (SAS Workspace Server and SAS Stored Process Server) remotely, such as with an Enterprise Business Intelligence deployment. The following workflow focuses on creating a virtual appliance that contains Microsoft Office and the SAS Add-In for Microsoft Office. The SAS servers will be remote with users providing their credentials to connect to the servers when they configure the SAS Add-In for Microsoft Office via the Tools -> Connections menu for the add-on. The user might have to also provide the machine and port for the SAS Metadata Server if these values were not specified in a connection profile during the installation. Similar to the section describing how to sequence SAS Enterprise Guide and SAS Foundation, two application packages need to be created. The first application package contains Microsoft Office. The second application package contains the SAS Add-In for Microsoft Office. These two application packages are combined into a Connection Group to be published for consumption by the client systems. The first time the user runs Microsoft Office application package with the SAS Add-In for Microsoft Office, they are prompted to install the add-on. This is necessary in order to activate the add-on within the Microsoft Office application.

1. Start with a clean Sequencer computer. In addition to the Microsoft component system requisites documented in the "Prerequisites" section of this document, Microsoft Visual Studio 2010 Tools for Office is

       also required. It is best to have these system requisites already installed before sequencing. These same system requisites are also required on the client where the application package will be executed.

2. Start the Microsoft Application Virtualization Sequencer.
3. Sequence Microsoft Office as Standard Application type.
4. When prompted for the installer application on the Select Installer panel, point to the setup executable for Microsoft Office.
5. Complete the Microsoft Office installation, selecting the Microsoft Office products and features to install. When the Microsoft Application Virtualization Sequencer process is complete, create the package and save to content storage.
6. To sequence the SAS Add-In for Microsoft Office, start with a clean Sequencer computer.
7. At this point, the sequencing process for creating the add-on package for the SAS Add-In for Microsoft Office can begin.
8. Copy the Microsoft Office application package back to the Sequencer computer. The Microsoft Application Virtualization Sequencer will need access to this package.
9. Start the Microsoft Application Virtualization Sequencer, select "Create Package" for the Packaging Method and later select "Add-on or Plug-in" for the Type of Application to sequence.
10. When prompted to select the installer, point to the setup.exe in your SAS Software Depot. Your SAS Software Depot will need to be accessible on your Sequencer computer.
11. When asked to install the primary parent program, Microsoft Office, select "Expand Package" and point to the Microsoft Office application package created with steps 1–5. This will take some time to expand depending on how many Microsoft Office products and features were sequenced in the application package. When this is complete, "I have installed the primary parent program" should be checked. Leave this checked and continue.
12. Give the SAS Add-In for Microsoft Office application package a name, and select the Primary Virtual Application Directory. It is very important that the directory selected here is the same as the directory you intend to select while installing the SAS Add-In for Microsoft Office. The default directory for the SAS software is C:\Program Files\SASHome.
13. The Microsoft Application Virtualization Sequencer will now launch the SAS Deployment Wizard. Proceed through the SAS Deployment Wizard, selecting to install the SAS Add-In for Microsoft Office.
14. When the SAS Deployment Wizard is finished and you have clicked "Finish", select "I am finished installing" and continue. The Microsoft Application Virtualization Sequencer examines the changes made to the system, which should not take too long if only the SAS Add-In for Microsoft Office was selected.
15. The Microsoft Application Virtualization Sequencer shows an installation report. The files excluded from the package can be ignored because they are logs and temporary files used during the installation.
16. There is no need to further customize, so continue in order to create the package.
17. Log in to the Microsoft Application Virtualization Management Server Console.
18. Add the Microsoft Office and SAS Add-In for Microsoft application packages.
19. Select "Connection Groups" and "ADD CONNECTION GROUP"
20. Rename the Connection Group as desired.
21. First add the Microsoft Office application package to the connection group.
22. Next add the SAS Add-In for Microsoft Office application package to the connection group.
23. Select the appropriate Active Directory access group for the connection group.
24. Publish the new Connection Group.

License Renewal for SAS Foundation with Microsoft Application Virtualization 5.0

SAS Foundation and its associated products will eventually require a license renewal. The new license must be applied to the packaged application and not to the end-user client computer. To apply new licenses to an existing package, follow these steps:

1. Obtain a new SAS installation Data File.
2. Copy the existing package to the clean Sequencer computer.
3. Start the Microsoft Application Virtualization Sequencer and expand the packaged application to be updated back to the local system.
4. Select "Modify an Existing Application Virtualization Package".
5. Select "Update Application in Existing Package".
6. Enter the path to the package to modify.
7. When prompted for an installer, select "Perform a custom installation".
8. Follow the instructions received with the renewal license to run the SAS Renewal Utility.
9. When the SAS Renewal Utility completes, select "I am finished installing" in the Sequencer.
10. On the Installation Report panel, click "Next".
11. On the Create Package panel, select "Continue to modify package without saving using the package editor".

Click "Next", and then click "Close".
12. In the Package Editor, select the "Shortcuts and FTAs" tab and remove any unnecessary or undesired shortcuts.
13. Save package and publish.

Applying SAS Hotfixes with Microsoft Application Virtualization 5.0

SAS Hot Fixes need to be applied to the packaged application and not to the end-user client computer. The SAS Hotfix Analysis, Download and Deployment Tool (SASHFADD) tool and the ViewRegistry utility (SAS Note 35968) will not function properly on a Sequencer computer with an expanded package. To apply SAS Hot Fixes to an existing package, follow these steps:

1. Start with a clean Sequencer computer.
2. Copy the existing package to the Sequencer computer.
3. Determine which SAS Hot Fix is required and manually download it.
4. Start the Microsoft Application Virtualization Sequencer and expand the packaged application to be updated back to the local system.
5. Select "Modify an Existing Application Virtualization Package".
6. Select "Update Application in Existing Package".
7. On the Select Package panel, select the package to be upgraded.
8. When prompted for an installer, do not enter anything. Instead, select "Perform a custom installation" and click Next.
9. The SAS Deployment Manager must be run outside the Microsoft Application Virtualization Sequencer with special command-line options. When the Sequencer expands packages back to the local system, created and modified dates are not preserved from the installation. All files receive the current system date and time. However, the SAS Deployment Manager bases its updates on file dates and times. Due to this, the SAS Deployment Manager must be run with the –alwaywoverwrite command-line option. When the Installation panel appears, open a command prompt and enter the path to sasdm.exe with the –alwaysoverwrite option. For example, in SAS 9.3 the location is <SASHOME>\SASDeploymentManager\9.3\sasdm.exe -alwaysoverwrite. <SASHOME> is the location where SAS software is installed on a computer. By default, for SAS 9.3, the location is c:\Program Files\SASHome.
10. Once the SAS Deployment Manager starts, select "Apply Hot Fixes". Continue following the instructions in the *SAS Deployment Wizard and SAS Deployment Manager 9.3: User's Guide* for "Applying Hot Fixes after the Initial Installation". When the Hot Fix installation is complete, select "I am finished installing" in the Microsoft Application Virtualization Sequencer.
11. Proceed as if sequencing the application for the first time. When prompted, skip running any applications.
12. The updated packaged will be saved with _# at the end of the APPV filename. The number is the package iteration (version) (for example, SASEnterpriseGuide_2.appv).
13. The package is ready to be published and deployed.

Capturing with VMware ThinApp 4.7

As with Microsoft Application Virtualization, SAS recommends not starting the SAS applications and clients during the capture process. VMware ThinApp differs from Microsoft Application Virtualization in that no client application needs to be installed to use ThinApp packages. NOTE: VMware ThinApp 4.7 does not support 64-bit applications. If available, choose SAS 32-bit applications during capture and deployment. The ThinApp Setup Capture wizard generates entry points for each selected executable. As with Microsoft Application Virtualization, some of the applications will not function correctly. On the ThinApp Setup Capture Entry Points panel, deselect any unnecessary entry points, such as, but not limited to, the following:

- SAS Operational Qualification Tool
- Java Platform SE Binary
- Java Web Start Launcher
- Manage SAS File Types
- Renew SAS Software
- SAS Deployment Manager
- SAS Install Qualification Tool

Linking Applications with VMware ThinApp 4.7

Similar to Microsoft Application Virtualization Connection Groups, VMware ThinApp also has the capability to link applications. SAS applications that use Java such as SAS Management Console and Jmp®10 are examples of applications that can be linked to a separate Java JRE package. In order to link applications, set the RequiredAppLinks parameter in the Package.ini file of the primary application. The typical workflow example is as follows:

1. Log on to the computer with the ThinApp project and VMWare ThinApp installed.
2. Capture the desired Java JRE and build the package. Save the package to the desired content storage. Make note of the .dat file in the package (for example, Java(TM) 6 Update 24.dat). Also make note of the installation path to the Java JRE (for example, C:\Program Files (x86)\Java\Jre6).
3. Start the capture of the SAS application such as SAS Management Console.
4. When prompted in the SAS Deployment Wizard for Java, select "Select an existing Java Runtime Environment" and enter the path to the existing Java JRE. This path must be the same as the installation path when the Java JRE was previously captured.
5. Complete the deployment.
6. When prompted in the ThinApp Setup Capture – Ready to Build panel, select "Edit Package.ini".
7. Under "General Purpose Parameters", add a single RequiredAppLinks line. For example:

   ```
   RequiredAppLinks=Java(TM) 6 Update 24.dat
   ```

   If the Java package is to reside in a different folder from the primary application package, then a path can be appended to the .dat file. For example:

   ```
   RequiredAppLinks=\\server\share\Java(TM) 6 Update 24.dat
   ```

8. Save the Package.ini file.
9. Build the project.
10. When the build is complete, the project package is ready to be distributed to end users.

Applying SAS Hot Fixes with VMware ThinApp 4.7

SAS hot fixes must be applied to the ThinApp project. Therefore, it is recommended, that ThinApp projects be saved in a safe location after capture. The SAS Hotfix Analysis, Download and Deployment Tool (SASHFADD) tool and the ViewRegistry utility (SAS Note 35968) currently will not function properly when used against a SAS application ThinApp project. To apply SAS hot fixes to an existing ThinApp project, follow these steps:

1. Log on to the computer with the ThinApp project and VMWare ThinApp installed.
2. Determine which SAS hot fix is required and manually download.
3. Edit the project PACKAGE.INI file (for example, c:\Program Files (x86)\VMware\VMware ThinApp\Captures\SAS Enterprise Guide 5.1\Package.ini).
4. Enable cmd.exe and sasdm.exe by setting their respective Disabled= parameter to 0.
5. Run build.bat to rebuild the project. cmd.exe should now appear in the project bin folder.
6. Run the virtual cmd.exe from the project bin folder. This is required to be able to modify files in the project sandbox.
7. From the virtual cmd.exe, run the SAS Deployment Manager (sasdm.exe) from the project bin folder.
8. Once the SAS Deployment Manager starts, select "Apply Hot Fixes". Continue following the instructions in the *SAS Deployment Wizard and SAS Deployment Manager 9.3: User's Guide* for "Applying Hot Fixes after the Initial Installation". When prompted, enter the path to the downloaded SAS hot fix zip file.
9. Exit the SAS Deployment Manager.
10. Exit cmd.exe
11. Run a native cmd.exe and cd to the project folder (for example, c:\Program Files (x86)\VMware\VMware ThinApp\Captures\SAS Enterprise Guide 5.1).
12. Run ..\..\sbmerge.exe print. This produces a report of the changes SAS Deployment Manager made to the sandbox. Verify the files to be changed.
13. Run ..\..\sbmerge.exe apply. This moves the changes in the sandbox to the project.
14. Edit the project Package.ini file and disable cmd.exe and sasdm.exe by setting their respective Disable= parameter to 1.
15. Run build.bat to rebuild the project.
16. When the build is complete, the project package is ready to be distributed to end users.

DEPLOYING (EXECUTING)

There is usually a performance penalty the first time any virtualized application is executed. The initial penalty is typical, especially if the application needs to be downloaded, or streamed from a server to the endpoint. With Microsoft Application Virtualization 5.0, we have seen a 20–25 minute initial start cost for SAS Foundation and SAS Management Console; other SAS applications might exhibit similar start-up performance. The SAS Add-In for Microsoft Office might also exhibit a small delay when loaded for the first time, and a pop-up dialog box is initially displayed for the end user to complete the add-in installation.   After the applications are completely downloaded and cached, the start-up time should be close to, if not the same as, the time it would take if the application were physically installed. SAS recommends allowing application download to complete before using.   After the application is started, performance should be the same as with a normally installed application.

LIMITATIONS

Due to the complexities of SAS software and application virtualization, it is possible that some features of SAS software that has been virtualized might not function correctly. As of February 2013, extensive functional testing of virtualized SAS products has not been completed. If issues arise, please contact SAS Technical Support for assistance.

After a virtualized application is deployed to the endpoint, it runs in its encapsulation or sandbox environment. It is important to note that the sandbox area cannot be directly edited. If a configuration file edit is attempted in the sandbox, the edit cannot be saved. If it is determined that configuration file edits are necessary, the sequencing administrator should take care of this during the sequence time of the package. This best practice approach is a better solution for the end user because no post work is needed.

SAS Enterprise Guide 5.1 Known Limitations

- Scheduling – Scheduling Process Flows and Projects currently does not function.
- Send To – None of the "Send To" items function

SAS Add-In for Microsoft Office Known Limitations

- Scheduling does not function.

LICENSING

Virtualized SAS clients do not typically pose a licensing problem. This is due to the requirements for the licensing of back-end servers. SAS products that have been virtualized and that require a license must comply with the SAS licensing policies. For SAS licensing information, contact your SAS Contracts Support representative.

CONCLUSION

Application virtualization is becoming a viable alternative to deploying and managing software directly to end-user computers. Complex application suites such as the SAS suites discussed in this paper can present challenges, and not all features my function correctly. Due to the number of application virtualization vendors and the complexity of all the combinations and permutations of SAS software products that can be licensed and deployed, SAS does not provide detailed and comprehensive "recipes" for sequencing SAS software products. However, SAS will provide assistance and guidance as we gain more experience with the various application virtualization technologies.

REFERENCES

- Fisher, Karl and Clarke Thacher. 2009. "Virtualization: What does it mean for SAS®?" Proceedings of the SAS Global Forum 2009 Conference. Cary, NC: SAS Institute Inc. Available at http://support.sas.com/resources/papers/sgf09/347-2009.pdf.

- SAS Institute Inc. 2009. SAS Note 35968. "Using the ViewRegistry Report and other methods to determine the SAS® 9.2 and SAS® 9.3 software releases and hot fixes that are installed. Available at http://support.sas.com/kb/35/968.html.

- SAS Institute Inc. "SAS® Product Support for Virtualization Environments."   Available at http://support.sas.com/techsup/pcn/virtualization.html.

RECOMMENDED READING

- Microsoft Corporation. *Microsoft Application Virtualization 5.0 Sequencing Guide.* Available at http://microsoft.com.

- SAS Institute Inc. 2012. *SAS® Deployment Wizard and SAS® Deployment Manager 9.3: Users's Guide.* Available at http://support.sas.com/documentation/installcenter/en/ikdeploywizug/64204/PDF/default/user.pdf.

- SAS Institute Inc. *SAS Hot Fix Analysis, Download and Deployment Tool SASHFADD Version 2.0.2 Usage Guide.* Available at ftp://ftp.sas.com/techsup/download/hotfix/HF2/SASHFADD_usage.pdf.

- SAS Institute Inc. 2012. SAS Note 45588: "Microsoft components that might be needed during the System Requirements phase of a SAS® 9.3 installation." Available at http://support.sas.com/kb/45/588.html.

- VMware, Inc. *ThinApp User's Guide.* Available at http://www.vmware.com/support/pubs/.

CONTACT INFORMATION

Your comments and questions are valued and encouraged. Contact the author at:

Chuck Hunley
SAS Institute, Inc.
SAS Campus Dr.
Cary, NC 27513
+1 919-531-2351
Chuck.Hunley@sas.com
www.sas.com

Michael King
SAS Institute, Inc.
SAS Campus Dr.
Cary, NC 27513
+1 919-531-4979
Michael.King@sas.com
www.sas.com

Max Blake
SAS Institute, Inc.
SAS Campus Dr.
Cary, NC 27513
+1 919-531-7659
Max.Blake@sas.com
www.sas.com

Rob Hamm
SAS Institute, Inc.
SAS Campus Dr.
Cary, NC 27513
+1 919-531-4970
Rob.Hamm@sas.com
www.sas.com