

Paper 354-2012

Zen and the Art of SAS® Maintenance:**Maintaining and Upgrading a Well-Oiled SAS Deployment**

Mark Schneider, Donna Bennett, Jane Stovic, Jason Losh, and Shannon Leslie

SAS Institute Inc., Cary, NC

ABSTRACT

As a SAS Administrator, you are responsible for managing changes to your deployed SAS environment. You likely have questions about best practices. How can you keep track of the SAS hot fixes and maintenance releases? How often should you apply them? What happens when you run the tools? What best practices will help make sure that changes will not negatively impact your production SAS system?

This paper highlights the planning processes and available tools and resources that can help when you are implementing software changes. Making changes to a working SAS deployment is easier when you understand the key components that should be included in your planning cycle, and when you have some insight into the tasks performed by the SAS tools.

Learn tips for determining whether a hot fix that you have just read about has been applied to your SAS deployment. Learn more about the difference between uninstalling and removing a configuration. Develop a list of things to consider when you are making changes, whether you are applying hot fixes and or a maintenance release, upgrading software versions, adding SAS software, or moving your SAS deployment to different hardware.

INTRODUCTION

SAS delivers software updates in various formats, from hot fixes targeted for specific issues to maintenance releases that collect sets of fixes and enhanced capabilities to new product releases that deliver new features. This paper focuses on planning for and applying changes associated with a maintaining a single major release of the SAS platform, such as SAS 9.2 or SAS 9.3. Processes for upgrading from one major release to another major release of the SAS platform are generally described as migration and are outside the scope of this paper.

GENERAL CONSIDERATIONS

When maintaining your SAS software environment, you should keep the following in mind:

- Although SAS Software Depots can be deleted after you complete a deployment, keeping the depots can simplify the maintenance process. Not only will using an existing depot shorten the amount of software that needs to be downloaded for subsequent orders (due to overlapping order content), but using an existing depot will ease the process of deploying software on additional machines not involved in the original deployment (for example, on additional clients).
- If you receive a custom deployment plan from SAS, save it for future reference, preferably in the `plan_files` directory within your depot.
- Use the same operating system account to apply updates that was used to initially deploy the software.
- When you update to new SAS product releases or apply maintenance releases to any machine in your environment, you need to update all machines and tiers in your environment.
- When you add new products to a SAS deployment, you must first update your existing software to the latest releases that are available in your new order. The SAS Deployment Wizard checks the update status.
- When you update the SAS software, you should review and update all related configurations of the software. The SAS Deployment Wizard updates the software in the SAS installation directory (SASHOME). If you have more than one configuration directory pointing to this SASHOME, you will need to run the SAS Deployment Wizard for each configuration directory.

Zen and the Art of SAS® Maintenance (354-2012) , continued

HOW OFTEN SHOULD I APPLY CHANGES TO MY SOFTWARE?

Administrators who maintain software deployments must balance the need for stability with the value of changes. There is no single best or “right” answer about when and why you should update your SAS deployment. The options can be described in several general categories:

- Apply changes as soon as they are released from SAS
- Apply changes if they address a problem you have encountered
- Apply changes on a fixed schedule
- Apply changes “as needed”

A survey of SAS administrators at SAS Global Forum 2011 concluded that about one-third of organizations apply software updates as needed while another third apply updates as they become available. Notably, however, 6% of the organizations update software on a fixed schedule, with a fairly even split across monthly, quarterly, and annual frequency. These organizations require adherence to strong change management policies and controls. Another 8% noted that they apply maintenance releases (or service packs) as needed, but they do not apply individual hot fixes.

Factors that can influence your choice of when to update software include:


- Corporate policies regarding software changes
- User community tolerance for change
- Size of the user community
- Collection of SAS products that are licensed and used together
- Desire for new capabilities
- Issues that are causing problems for users
- Availability of software updates

Bottom line: You need to choose the frequency that works for your site, and you need to regularly review information about new software releases and updates.

WHAT ARE THE BEST WAYS OF STAYING INFORMED ABOUT THE LATEST MAINTENANCE RELEASE, HOT FIXES, AND SOFTWARE RELEASES

SAS does not automatically ship new software releases. To stay informed about available software releases, you will need to review information sources associated with the software you are running. You should also review your planned updates with your SAS contacts. The sections below identify several sources for information.

Publications

- Newsletters
 - SAS distributes newsletters targeted to specific audiences. A partial list includes: SAS Tech Report, SAS Statistics and Operations Research News, and SAS Global Certification News. You can view archives of past newsletters – and subscribe – on the SAS support site at <http://support.sas.com/community/newsletters/>.
- Mailing lists and RSS feeds
 - TSNEWS-L -- Hot fix announcements and other important news from SAS Technical Support are posted to this listserv: <http://support.sas.com/techsup/news/tsnews.html>.
 - SAS provides RSS feeds and blogs for some information. Whenever you see this icon  on the SAS support site, click it to read or subscribe to a related feed. For more information, see <http://support.sas.com/community/rss/index.html>.
- Maintenance and upgrades pages provide announcements of new maintenance releases and access to documentation related to maintenance releases. Note that information pertaining to SAS 9.2 and SAS 9.3 are presented in separate tabs: choose the tab appropriate for your release.
 - Maintenance Releases and Product Upgrades (<http://support.sas.com/software/updates/>)

Zen and the Art of SAS® Maintenance (354-2012) , continued

- Maintenance Release Announcement (<http://support.sas.com/software/maintenance/>)
- Administrator tab on <http://support.sas.com> – provides content for the person who updates, manages, and maintains a SAS deployment

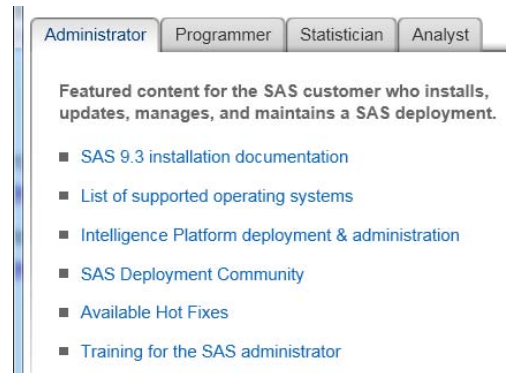


Figure 1. Administrator Tab on support.sas.com

- Product Pages, documentation, and What's New information

The [Software Product pages](#) provide a starting point for information related to a particular product: news, documentation, training, usage notes, samples, and discussion forums. Quick links to installation information and focus areas are also provided

In addition to What's New information in product documentation, SAS provides a consolidated document for each major SAS release. This document is updated as maintenance releases and new product releases are shipped. This information can help you decide whether you want to upgrade. To view the latest version of the What's New document, see <http://support.sas.com/documentation/whatsnew/>

- SAS Notes

SAS Notes are written to provide supplemental information about product usage, deployment, or hot fixes. Choose the Samples and SAS Notes tab in the Knowledge Base on the support site to search and review SAS Notes. You can select one or more categories for a search, and you can also filter by the priority level. SAS recommends that you include "Alert" level notes in your regular reviews.

- SAS Hot Fix Analysis, Download, and Deployment tool (SASHFADD)

Starting with SAS 9.2, the SAS Hot Fix Analysis, Download and Deployment tool (SASHFADD) is available to help streamline the hot fix identification, download, and installation process. You can download and run the SASHFADD tool directly or access it by clicking the "Available Hot Fixes" link on the Administrator tab on the SAS support site. More information about this tool is provided in the "Hot Fixes" section of this paper and on the SAS Technical Support page.

- Announcements on the home page for support.sas.com

Peers and people

Talking with your peers and your contacts at SAS, sharing proven practices, and asking questions is a valuable part of developing and reviewing an update plan. Connect with your peers at user group meetings, in SAS training classes, and via social media connections such as the SAS discussion communities.

- User group meetings
- Discussion communities
- Meetings with SAS teams

Requesting updated software

When you determine that you want to apply newly released software, the SAS Customer Representative for a site

Zen and the Art of SAS® Maintenance (354-2012), continued

must initiate a request. You can request a new copy of the software licensed for your site using the online [SAS Upgrade Request form](https://support.sas.com/sastools/upgradeRequest) (<https://support.sas.com/sastools/upgradeRequest>), or you can contact your SAS Account Representative. Your new software order will contain the most current releases of the software that you have licensed. Additional options are also available on the SAS Administrator Services site (which requires an administrator login) at <https://support.sas.com/sastools/welcome>.

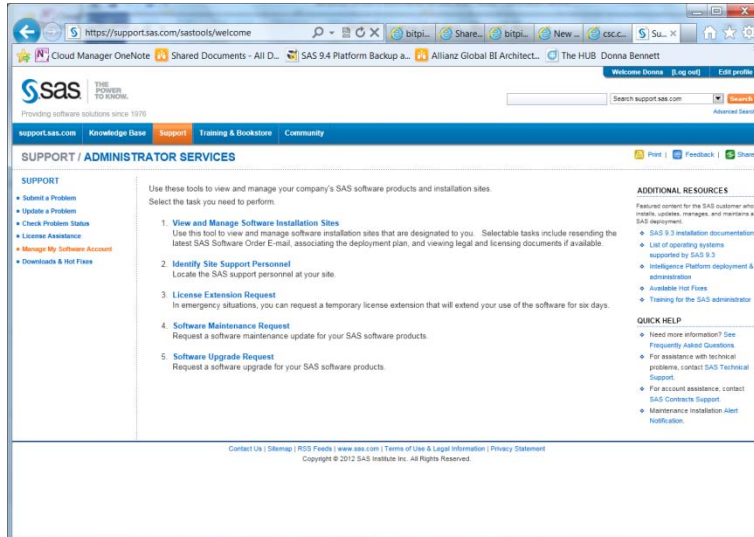


Figure 2. SAS Administrator Services Site

UPDATE MODE - APPLYING MAINTENANCE RELEASES AND UPGRADING TO NEW SOFTWARE RELEASES

Update mode is a specialized SAS Deployment Wizard mode that will bring all of your software in the designated SASHOME to the most current release. The order summary document contains a complete inventory of all software included in the order. If the order contains newer product releases or applies a maintenance release to software that has been deployed in SASHOME, the SAS Deployment Wizard switches into Update mode. Update mode is an important feature in order to ensure that all software within SASHOME remains compatible. You must apply updates to existing software before you can add new software to your deployment.

As part of the deployment process, the SAS Deployment Wizard creates (or updates) a SAS deployment registry to track the SAS software installed in a specific SASHOME. In Windows environments, there is typically one SASHOME and one corresponding SAS deployment registry. In UNIX environments, it is common to have multiple SASHOMES, and each SASHOME has its own deployment registry. Regardless of the operating environment, different SASHOMES are needed for each major release of SAS Foundation (that is, a separate SASHOME is required for SAS 9.2 and for SAS 9.3).

When the SAS Deployment Wizard has determined the SASHOME location for the SAS deployment to be updated, the SAS Deployment Wizard reads the software inventory described in the SAS deployment registry, compares the inventory in the deployment registry with the software inventory in your order, and begins updating the software that is currently installed in your deployment. (In Windows environments, the SAS Deployment Wizard determines the location of SASHOME automatically, but in UNIX environments, the administrator must specify the location of SASHOME.) If your order also contains new software components or newly licensed SAS software, then the administrator must run the SAS Deployment Wizard again to add the new software to the existing SASHOME. See the “Adding New SAS Software” section in this paper for more information.

The SAS Deployment Wizard indicates that it is in Update mode by displaying the software that will be updated. This panel lists the current release of the software in your deployment and the release that will be deployed during execution of Update mode. Note that the SAS Deployment Wizard also distinguishes between maintenance releases and new releases of software. This distinction provides greater insight as to what software in your order is triggering the SAS Deployment Wizard to enter Update mode.

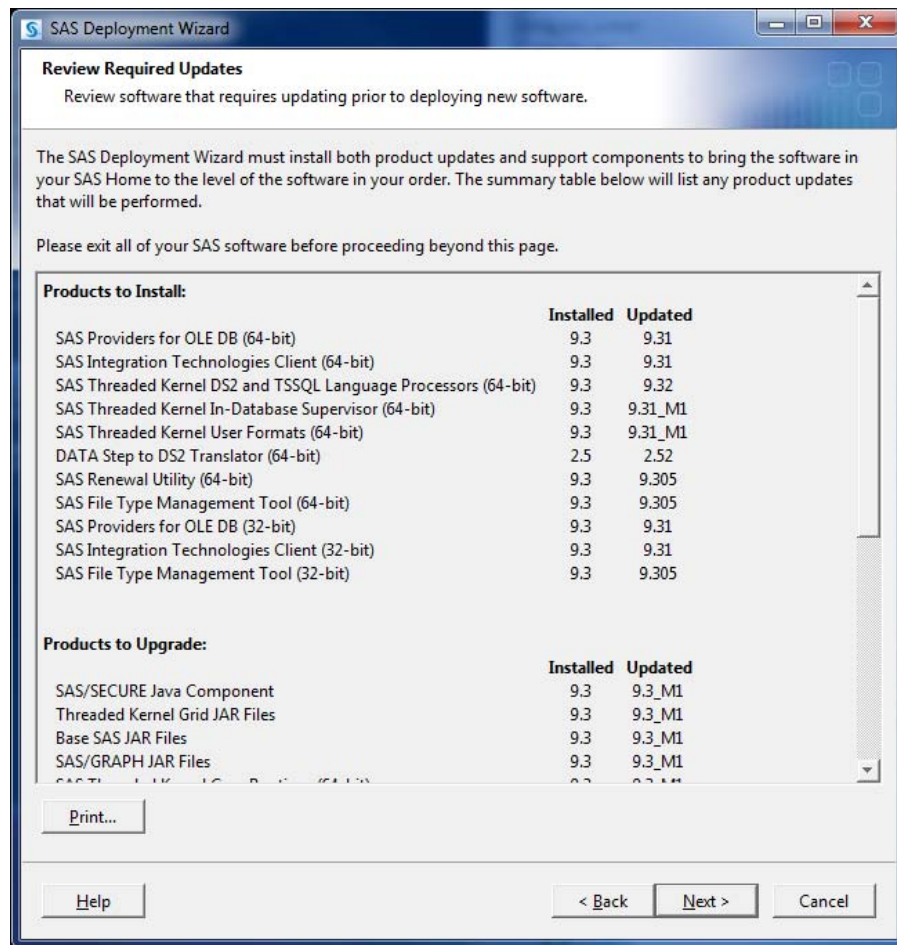


Figure 3. Review Required Updates Step in the SAS Deployment Wizard

To streamline the update process, the SAS Deployment Wizard does not prompt for a deployment plan, SAS installation data (SID), or language selections when it runs in Update mode. Clicking **Next** on the “Review Required Updates” panel moves to the system check panel and from there into the deployment execution chain. Clicking **Start** from the Deployment Summary panel begins execution of the update process.

When the SAS Deployment Wizard runs in Update mode, it does not add new products or languages. You must run the SAS Deployment Wizard a second time in order to add software. Note also that the SAS Deployment Wizard does not perform any migration steps as part of Update mode. It only brings existing software up to the current release.

Perform updates in the same order as is required for the initial deployment, and ensure that you update all machines in your deployment. For example, first update the machine that is hosting the SAS Metadata Server. Then update the machine that is hosting one or more SAS Application Server(s). Last, update the machine that is hosting the SAS middle tier. In some cases, you can continue to use existing releases of desktop client software after you update SAS server software: for example, SAS Enterprise Guide, the SAS Add-In for Microsoft Office, and JMP will work with servers at newer maintenance levels and can be updated at a later time than other SAS servers.

During the update process, the SAS Deployment Wizard creates backup files for every file that is replaced during the update. SAS does this in order to roll back to a last known good state should a problem be encountered in Update mode. The backup files remain in SASHOME and are not used by SAS products. If disk space is a concern the backup files can be removed. To remove these backup files, see “Remove Update Backup Files” in the SAS *Intelligence Platform: Installation and Configuration Guide* at

<http://support.sas.com/documentation/cdl/en/biig/62611/HTML/default/viewer.htm#n09002intelplatform00install.htm>

Zen and the Art of SAS® Maintenance (354-2012) , continued

MANAGING DEPLOYMENTS, INCLUDING UNCONFIG AND UNINSTALL

The SAS Deployment Manager is used to perform post-installation and on-going management tasks (such as “Update Passwords”, “Rebuild Web Applications”, “Uninstall SAS Software” and “Remove a configuration/Unconfigure”) of your planned SAS Intelligence Platform deployment.

The SAS Deployment Manager (a sister application to the SAS Deployment Wizard) was introduced in SAS 9.2 and has been enhanced in SAS 9.3. Beginning in SAS 9.3, the SAS Deployment Manager provides the administrative interface for uninstall tasks and for running the hot fix application utility.

The SAS Deployment Manager is installed as part of a new or maintenance installation for both basic and planned deployments and can be found in the following directory:

```
<SASHOME>\SASDeploymentManager\<SASRelease>
```

The figure below depicts the main page of the SAS Deployment Manager. Note that the task list will be automatically customized for the products installed in the corresponding SASHOME.

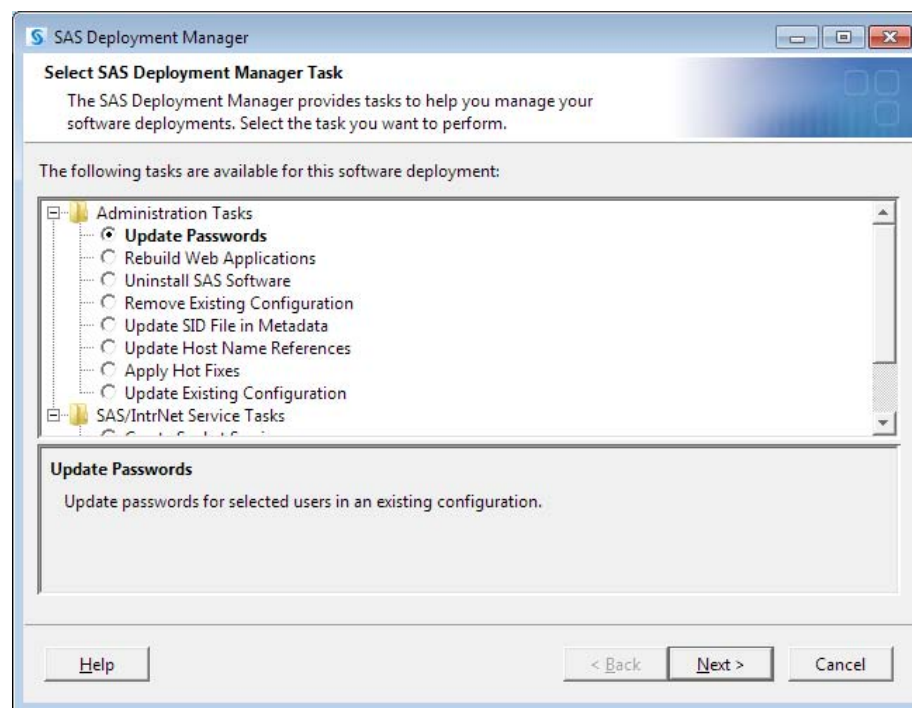


Figure 4. The SAS Deployment Manager

UNCONFIGURE SAS SOFTWARE (REMOVE A SAS CONFIGURATION)

When you remove a SAS configuration (“unconfigure”), you delete metadata and remove content from the configuration and may remove some related user content. This “unconfigure” process does not remove or alter the SAS software that has been installed in SASHOME. There are various reasons for removing a SAS configuration, such as moving an Application Server to another machine or re-running the SAS Deployment Wizard to implement different configuration options during the initial deployment. You need to unconfigure the SAS software before re-running a configuration step in the same configuration directory.

Typically, a planned deployment spans multiple tiers or machines. When you unconfigure a planned deployment, reverse the order of the initial installation and configuration processes:

Zen and the Art of SAS® Maintenance (354-2012) , continued

1. Unconfigure the SAS deployment on the Middle tier(s) in the following order:
 - Web applications, then
 - SAS Web Infrastructure Platform, then
 - SAS Foundation Services
2. Unconfigure the SAS Application Server tier(s) (if separate from Metadata tier)
3. Unconfigure the Metadata tier

When you remove select components from your SAS 9.3 deployment, the “Remove Existing Configuration” utility in the SAS Deployment Manager will perform dependency checking to ensure that dependent products are not accidentally orphaned in the remaining configuration.

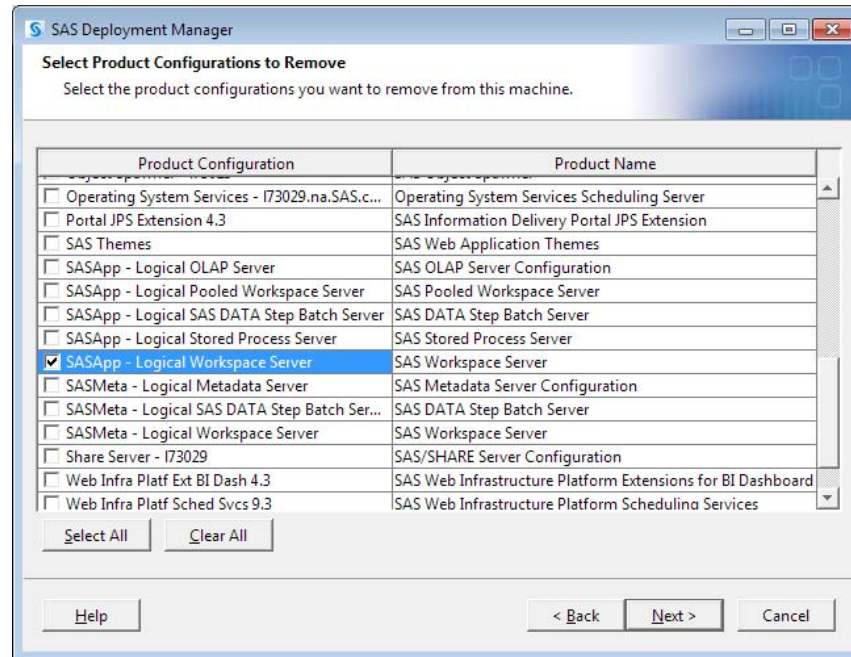


Figure 5. Select Product Configurations to Remove Step in the SAS Deployment Manager

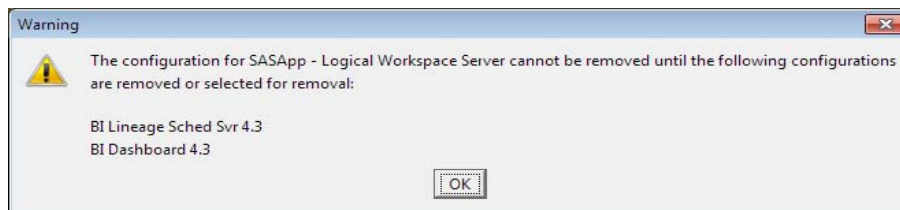


Figure 6. Example of Warning Message to Show Dependency between SAS Products

For more information about removing a configuration and uninstalling the SAS Intelligence Platform, see “Removing a SAS Configuration” in the *SAS Intelligence Platform: Installation and Configuration Guide* at <http://support.sas.com/documentation/cdl/en/biig/62611/HTML/default/viewer.htm#n09026intelpatform00install.htm>

UNINSTALL SAS SOFTWARE

To remove your SAS software from your system, run the uninstall utility that is designated for the release of SAS being removed. You may choose to remove your SAS software, for example, when you have deployed a newer release and do not need to access the previous release any longer. To remove SAS 9.2, you need to use the SAS

Zen and the Art of SAS® Maintenance (354-2012) , continued

Uninstall Wizard. To remove SAS 9.3, you need to run the SAS Deployment Manager and select the **Uninstall SAS Software** option.

SAS 9.3

The SAS 9.3 uninstall utility, accessed via the SAS Deployment Manager, provides a simple way to uninstall the SAS products in a specific SAS deployment. When the **Uninstall SAS Software** option is selected, a dialog box displays and lists the products that can be selected. The utility performs product dependency checking: if a product is selected for uninstall and other products rely on that product to operate properly, the user is notified. Before proceeding, the user will need to select the dependent products for uninstall or adjust the request.

In the example below, SAS Web Infrastructure Platform has been selected for uninstall, and the system alerts the user that there are dependent products.

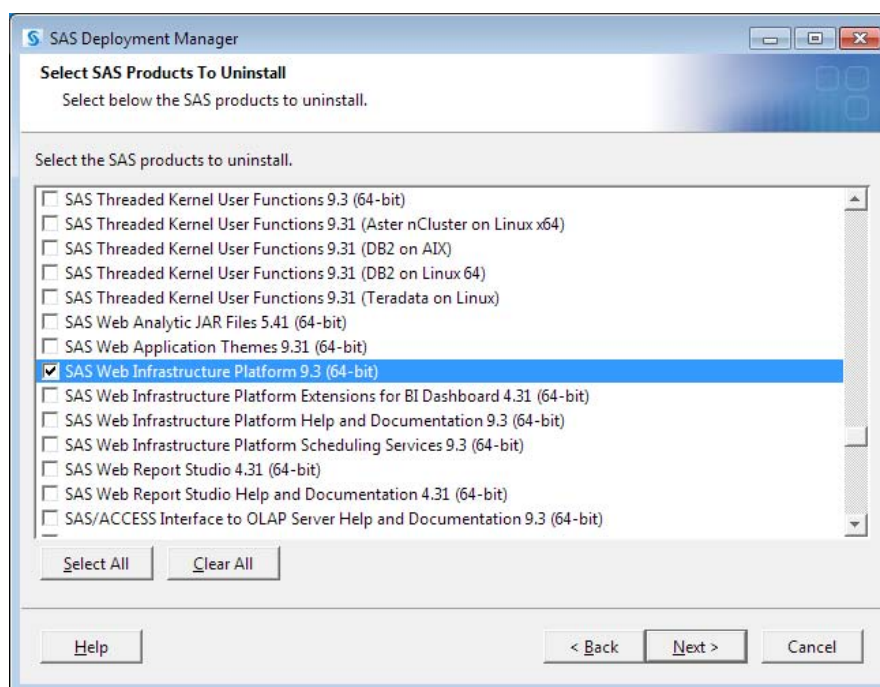


Figure 7. Select SAS Products to Uninstall Step in the SAS Deployment Manager

After the **Next** button is selected, the following dialog box appears to explain what other dependent products also need to be selected for uninstall:

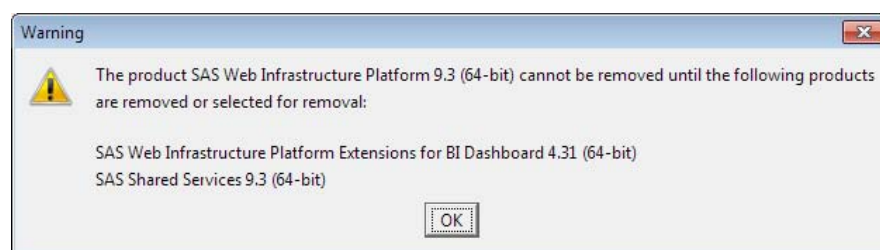


Figure 8. Example of Warning Message to Show Dependency between SAS Products

For more information, see “Uninstall SAS Software (Graphical User Interface Uninstall Tool)”_ in the *SAS Deployment Wizard and SAS Deployment Manager 9.3: User's Guide* at <http://support.sas.com/documentation/installcenter/en/ikdeploywizug/64204/PDF/default/user.pdf>, or the “Uninstalling

Zen and the Art of SAS® Maintenance (354-2012) , continued

the SAS Intelligence Platform” chapter on in the *SAS Intelligence Platform: Installation and Configuration Guide* at <http://support.sas.com/documentation/cdl/en/biig/62611/HTML/default/viewer.htm#p10intellplatform00installgd.htm>

SAS 9.2

To uninstall software from a SAS 9.2 deployment on a UNIX or z/OS system, simply use operating system commands (e.g., “rm”) to remove the corresponding files. To uninstall software from a SAS 9.2 deployment on a Windows system, use the stand-alone utility called the SAS Uninstallation Wizard. The SAS Uninstallation Wizard is located in your SAS Software Depot in the utilities directory: <SAS Depot>\utilities\uninstallwizard).

The SAS Uninstallation Wizard can be used to remove all of the SAS products or to selectively uninstall specific products using advanced options. Note that the SAS Uninstallation Wizard does not provide the dependency checking supported in the SAS 9.3 uninstall utility. For more information about using the SAS Uninstall Wizard, see *SAS Deployment Wizard: User's Guide* at <http://support.sas.com/documentation/installcenter/en/ikdeploywizug/62130/PDF/default/user.pdf>.

UTILITIES TO MANAGE A PLANNED DEPLOYMENT

The SAS Deployment Manager is the “one-stop” tool for performing on-going management tasks for your SAS deployments. The following SAS Deployment Manager tasks or utilities are used to manage a planned deployment.

Update Passwords

Passwords for some SAS service accounts are managed within the SAS deployment. There will be times, likely due to IT policies, when you want to update these passwords. Use the **Update Passwords** task in the SAS Deployment Manager to perform these updates. SAS does not manage or update passwords that are stored outside of SAS, such as in an LDAP directory or an OS-based authentication file. For more information about updating SAS passwords, see “Update a Managed Password” in the *SAS Intelligence Platform: Security Administration Guide* at <http://support.sas.com/documentation/cdl/en/bisecag/63082/HTML/default/viewer.htm#p0kb2gtnuyjnrnn1hduu5by88u4f.htm>.

Rebuilding SAS Web Applications

SAS Web Applications need to be rebuilt and redeployed on the Web application server when they have been changed, after applying hot fixes, and after changing configuration values. The **Rebuilding SAS Web Applications** task supports rebuilding any or all of the Web applications configured on the current machine. For more information about rebuilding SAS Web Applications, see “Rebuilding SAS Web Applications” in the *SAS Intelligence Platform: Middle-Tier Administration Guide* at <http://support.sas.com/documentation/cdl/en/bimtag/64207/HTML/default/viewer.htm#p0plwle8uj04upn1vrsbstiwkkmz.htm>.

Updating the SID File in Metadata for SAS Solutions

A metadata-based SID entry must be updated when adding a SAS solution to an existing deployment or when the license for a deployed SAS solution needs to be renewed. This is a separate step from updating the basic SID file. For more information, see “Updating the SID File in Metadata for SAS Solutions” in the *SAS Intelligence Platform: Installation and Configuration Guide* at <http://support.sas.com/documentation/cdl/en/biig/62611/HTML/default/viewer.htm#n09019intellplatform00install.htm>.

Update Host Name References

Because SAS configuration information references host names, you will need to run the SAS Deployment Manager task to **Update Host Name References** when a the host name of a server machine in your SAS deployment or the network domain(s) to which these machines belong has been changed. You might also use it if you are using the cloning utilities in your operating environment to move a complete machine image to an equivalent but differently named machine (for example, to upgrade hardware). For more information, see the “Hardware and Hostnames” section in this paper and “Using the SAS Deployment Manager to Update Host Name References” in the *SAS Intelligence Platform: System Administration Guide* at <http://support.sas.com/documentation/cdl/en/bisag/63132/HTML/default/viewer.htm#p1gs13ueroyethn11y3tpku021sd.htm>.

GENERAL SAS DEPLOYMENT MANAGER TASKS

This section covers the SAS Deployment Manager tasks that apply to both basic and planned deployments. The inclusion of these tasks in the menus may vary based on the products that are installed in your SASHOME.

Zen and the Art of SAS® Maintenance (354-2012) , continued

Apply Hot Fixes

Starting with SAS 9.3, the SAS Deployment Manager includes a utility to apply hot fixes. For more information, see the “Hot Fixes” section of this paper.

SAS/IntrNet Service Tasks

These utilities are enabled when SAS/IntrNet® software is installed and should be used to configure the desired service or Load Manager.

SAS/ACCESS Configuration

These options are new in SAS 9.3 and are used to configure SAS/ACCESS® software to enable the interfaces between the specified SAS/ACCESS product and their related database product. Prior to SAS 9.3, you needed to follow manual steps outlined in installation documents.

For more information about the SAS/IntrNet Service and SAS/ACCESS configuration options, see *SAS Deployment Wizard and SAS Deployment Manager 9.3: User Guide*.

LICENSE RENEWAL OR UPDATES

The SAS installation data file (SID) contains customized installation and product authorization data.

Initial Deployment

The SAS Deployment Wizard will apply the license in the SID file to your SAS System at initial deployment. This initial license will eventually expire, so it will be necessary to renew your license.

Renewal

To renew the license applied to your SASHOME, you will need to use the renewal method appropriate for your operating environment on every machine that runs SAS software. After you receive the updated license file, use the appropriate program to apply that license file. For specific details, perform an Advanced Search in the on-line Install Center, with keywords “renewal” and “9.3”, and choose the document for UNIX, Windows, or z/OS

(http://support.sas.com/idsearch?charset=iso-8859-1&nh=25&col=suppprd&la=en&ct=200000&filter=spr%3A%229.3qq_%22&q=spr%3A%229.3qq_%22+renewal+&s1=3&searchterm=renewal&Find=+Search).

If you have a SAS 9.3 solution that includes a middle tier, you also need to run the “Updating the SID File in Metadata for SAS Solutions” utility from the SAS Deployment Manager in addition renewing the license in SASHOME.

When Adding SAS Software

When installing additional SAS software to a pre-existing SAS deployment, the SAS Deployment Wizard will apply the new license received with your add-on order just as it did at the time of your initial deployment. If the add-on includes a SAS 9.3 solution, you should also run the SAS Deployment Manager utility to update the SID data in metadata and ensure that the middle-tier can access the new license.

HOT FIXES

SAS provides hot fixes to previously shipped software. A hot fix will be created to resolve a number of problems ranging from an isolated code fix for a critical bug uncovered by a specific customer application to a frequently recurring problem in a common code base.

The hot fix tooling has changed over time to simplify their identification and installation. The following sections discuss at a high level how the hot fix process works from SAS 9.1.3 and beyond. Some customers choose to periodically download and apply a set of hot fixes as system maintenance. For more information, see the “How often should I apply updates to my software” section of this paper.

Each hot fix from SAS is tested and fully supported and then typically incorporated into the next maintenance release or full release of the software component or product.

Hot fixes are packaged or grouped in three different ways:

Zen and the Art of SAS® Maintenance (354-2012) , continued

1. Individual hot fixes - created to fix one product or software component.
2. Container hot fixes - created to provide fixes for one or more software components that must be hot fixed together in order to provide a complete resolution to the problem being addressed. In order to fully install the container hot fix, the container needs to be applied to each machine in the deployment that contains one or more of the products being hot fixed by the container. For more information about container hot fixes, see http://ftp.sas.com/techsup/download/hotfix/faq.html#container_define.
3. Hot fix bundles – an accumulation of one or more individual hot fixes. These bundles tend to be produced (and named) for products such as and may contain a number of fixes for different components within the product. Bundling these fixes makes it simpler for you to obtain and install them. For more information about hot fix bundles, see <http://ftp.sas.com/techsup/download/hotfix/faq.html#bundle>.

The table below provides an overview of the evolution of hot fix changes and improvements over the last three major releases of SAS.

SAS 9.1.3	SAS 9.2	SAS 9.3
Download hot fixes individually	SASHFADD tool introduced to identify and download hot fixes	SASHFADD tool enhanced
Install hot fixes individually	Maintenance Installation Tool, triggered by the SASHFADD tool	SAS Deployment Manager
Service packs	Maintenance releases, hot fix bundles	Maintenance releases, hot fix bundles
N/A	Introduced product-specific release numbers	Broader use of release numbers
Verification of hot fixes via audit files	Verification via Deployment Registry	Verification via Deployment Registry

TIPS AND BEST PRACTICES FOR INSTALLING HOT FIXES

- Container hot fixes often include hot fixes to be applied to multiple products across multiple tiers in a deployment. It is good practice when applying these container hot fixes to begin with the server tiers first and then apply the hot fixes on the client tier machines. It is important to note in this situation these hot fixes work together to solve a particular problem in the software. Therefore to keep the tiers in sync, the client tiers should be updated with the hot fixes as soon as possible after updating the server tier.
- When performing an initial or “out-of-the-box” planned deployment where you want to include the latest hot fixes, it is recommended that you separate the install and configure steps. When the install of the software is complete, obtain and apply the appropriate hot fixes for the software that you just installed. Then run the SAS Deployment Wizard again to configure. Separating these steps will prevent the potential need to unconfigure and reconfigure any hot fixed products or to rebuild and redeploy WAR files to the Web application server in deployments that include a middle tier.

SAS 9.1.3

For SAS 9.1.3, users need to individually download and install hot fixes or hot fix bundles from the SAS Technical Support Hot Fix site. This entails reviewing the hot fixes available by SAS product, operating environment, or priority level (for example, “Alert”) and determining which hot fixes are appropriate to apply. After that determination is made, the hot fixes must be individually downloaded and installed per the instructions appropriate for your operating environment. In SAS 9.1.3, SAS created Service Packs to apply maintenance releases to previously released products, and the Service Packs also contained the hot fixes produced since the previous Service Pack. At this time, SAS 9.1.3 Service Pack 4 must be installed before installing any available SAS 9.1.3 hot fixes, with exceptions for some Solutions. Service Pack 4 is available for download or can be requested on media from the Technical Support Hot Fix site. For more information about Service Packs and the fixes they contain, see http://ftp.sas.com/techsup/download/hotfix/faq.html#serv_packs.

SAS 9.2

New processes for identifying and installing hot fixes were introduced with SAS 9.2. Each SAS product now has an individual product release number that is updated as new releases (including maintenance releases) of the product become available. (For more information, see [SAS® 9.2 Provides New Product-Specific Release Numbers](http://support.sas.com/software/92/productnumbers.html) <<http://support.sas.com/software/92/productnumbers.html>>.) These product release numbers are visible in the About box in the software and in the SAS deployment registry. Information about hot fixes on the Technical Support Hot Fix site is now organized by the new product-specific release numbering scheme, though hot fixes can still be sorted and viewed by operating environment or hot fix release date as well.

SAS Hot Fix Analysis and Download Tool (introduced in SAS 9.2)

Starting with SAS 9.2, the SAS Hot Fix Analysis, Download and Deployment tool (SASHFADD) is available to help streamline the hot fix identification, download, and installation process. The SASHFADD tool should be used to determine all the hot fixes for the SAS products installed in a (single or multi-machine) deployment. When you run the SASHFADD tool on each machine in the deployment, SAS performs an analysis of the products installed based on the information stored in the SAS deployment registry.

The SASHFADD tool does not read the SAS deployment registry directly, so it is necessary to first produce a DeploymentRegistry.txt file by using the ViewRegistry utility. This file is generated by running the ViewRegistry utility which as of the second maintenance release for SAS 9.2 is located with the SAS Deployment Registry in the <SASHOME>/deploymntreg directory. You must run the ViewRegistry utility in each SASHOME for every machine in your deployment in order to obtain the correct set of hot fixes to apply to your entire SAS deployment. If you know you have a set of identically configured SAS client machines, it is possible to use the DeploymentRegistry.txt file generated on one client machine and run the SASHFADD tool against it and apply the downloaded hot fixes to all the client machines.

When the SASHFADD tool executes, it produces the following artifacts:

- A directory containing the items produced by the tool and logs.
- A custom report with links to all of the new hot fixes currently available for that SASHOME. This report will not include hot fixes that have already been installed. This report will contain links to the individual hot fixes and must be reviewed for pertinent pre-installation and post-installation instructions before proceeding to the download step.
- A script that can be used to download the specified hot fixes via anonymous FTP. The report can be modified to adjust the list of hot fixes to download.
- A script that can be used to silently install the downloaded hot fixes in SAS 9.2 Windows and UNIX environments.

The SASHFADD tool is supported in Windows and UNIX environments. To produce the appropriate hot fix report in z/OS and OpenVMS Itanium environments, run the SASHFADD tool against the DeploymentRegistry.txt file that is produced by the View Registry tool on the deployment registry in SASHOME. For more information about how to use the SASHFADD tool, see http://ftp.sas.com/techsup/download/hotfix/HF2/SASHFADD_usage.html.

Maintenance Installation Tool (SAS 9.2)

A specific tool, separate from the SAS Deployment Manager, is provided to install hot fixes for SAS 9.2 deployments. That application is the Maintenance Installation Tool. This tool is automatically invoked once a hot fix is downloaded and executed either directly or by the install script generated via the SASHFADD tool. The Maintenance Installation Tool handles installing hot fixes for all supported operating environments and performs the following tasks:

- Checks that the correct release of SAS is installed.
- Checks that the product associated with the hot fix is installed.
- Checks that the operating environment is appropriate for the hot fix to be installed.
- Performs a back-up of the files on the system to be replaced prior to installing the hot fix. (Making a full backup of your SAS system before updating software is still recommended prior to hot fix installation.)

For more information about the Maintenance Installation Tool, see http://ftp.sas.com/techsup/download/hotfix/HF2/Maint_Install_Tool.pdf.

Zen and the Art of SAS® Maintenance (354-2012) , continued

SAS 9.3

Starting in SAS 9.3, the SAS Deployment Manager should be used to install hot fixes. You can use the SASHFADD tool to identify and download fixes appropriate for your deployment; however, rather than installing the hot fixes individually or by using the script generated by the SASHFADD tool, use the SAS Deployment Manager utility.

Choose the **Apply Hot Fixes** option in the Administration Tasks section in the SAS Deployment Manager Task step to interactively install hot fixes to your SAS 9.3 deployment. You will supply the path to the directory that contains the hot fixes. All hot fixes in this directory will be applied if they have not previously been installed. When complete, a page is displayed that indicates what hot fixes were installed.

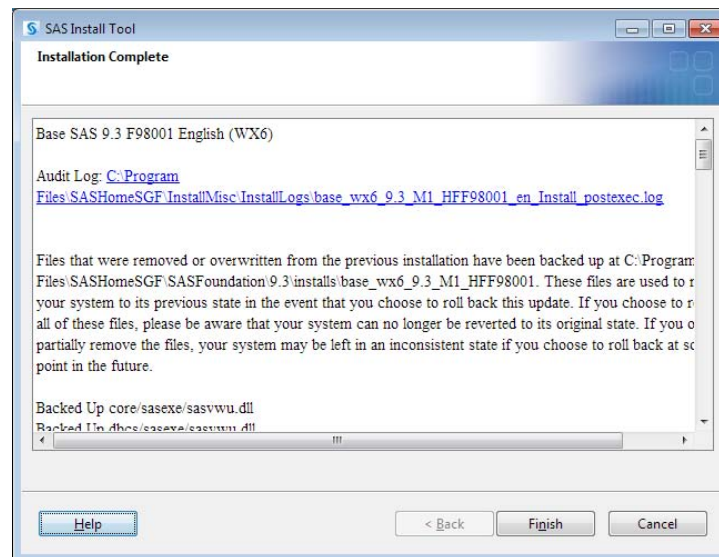


Figure 9. Information about the Applied Hot Fixes in the SAS Install Tool

You can install hot fixes silently in SAS 9.3 by using hot fix launcher scripts that can be found with the executable for the SAS Deployment Manager. This method should be deployed when rolling out hot fixes to multiple machines in an enterprise-wide SAS deployment or when running in line mode on z/OS. For more information, see the *SAS Deployment Wizard and SAS Deployment Manager 9.3: User's Guide*.

VERIFICATION OF HOT FIX INSTALLATION

The method for determining what hot fixes have been installed varies by SAS release. In SAS 9.1.3, an audit file is included in SAS Foundation hot fixes. The audit file is named for the hot fix and describes the important information about the hot fix. Starting with SAS 9.2, the installation of hot fixes is documented in the SAS deployment registry. You can run the ViewRegistry utility to get a report of the hot fixes installed. Additionally, you can use the SASHFADD tool (version 2.0 or later) to produce an HTML report of the hot fixes installed. For more information about identifying installed hot fixes, see

http://ftp.sas.com/techsup/download/hotfix/faq.html#hf_installed.

HOT FIX DOCUMENTATION

It is important to closely review the pre-installation and post-installation instructions that accompany hot fixes to ensure the correct steps are taken. For example, when a hot fix is installed to a Web application, you might need to run the SAS Deployment Manager after applying a hot fix to rebuild the WAR file for the Web Application Server.

For more information on hot fixes, see the SAS Technical Support Hot Fix site at <http://ftp.sas.com/techsup/download/hotfix/hotfix.html>.

CHANGING THIRD-PARTY ASPECTS OF YOUR ENVIRONMENT

SAS software products leverage a variety of third-party software, including Web Application Servers, Java Development Kits (JDKs), Java Runtime Environments (JREs), databases, and the operating systems themselves. It is common for vendors of this software to release new versions at different intervals from SAS software. As such, it is important to know when and how to go about incorporating these new versions into your SAS environment. You might also be interested in moving from one third-party software package to another without changing the release of SAS software deployed in your environment.

Note: For a general overview of the components of a SAS deployment, including third-party components, refer to the paper 'Anatomy of a SAS Deployment' listed in the "Reference" section of this paper.

Confirming compatibility with the SAS software in your deployment is a key consideration when changing third-party software, such as the operating system, Java components, Web components, and databases. Additionally, it is important to review – and update if needed – configuration details that enable integration between the SAS deployment and third-party components. The following sections summarize changes and dependencies that are associated with several specific change scenarios.

COMPATIBILITY

Before you schedule an upgrade of any third-party software, ensure it is compatible with the release of SAS that you are deploying or have already deployed. The comprehensive source of this information is the Third-Party Software Requirements for Use with SAS Software and Applications site at <http://support.sas.com/resources/thirdpartysupport/index.html>. The site is organized by SAS releases, both at major releases and maintenance releases. The baselines for supported third-party software typically change from major release to major release while the complete list of supported third-party software often grows from one maintenance release to the next within a given major SAS release.

SAS abides by the “and higher” policy described at http://support.sas.com/resources/thirdpartysupport/baseline_plus.html. In general, SAS defines the “baselines” (minimum versions) for third-party software for each SAS software release (major and maintenance). New baseline versions can be introduced during major or maintenance SAS releases. SAS drops support for older versions of software over time and announces plans to deprecate supported versions via release notes and reference pages on the SAS support site. SAS allows updates to third-party software minor versions, usually without the need to update SAS software itself. You can find specific details related to operating systems, Web browsers, Java application servers, and others on the “and higher” policy page.

OPERATING SYSTEMS

It is common practice to upgrade the operating systems that host a SAS deployment. As with any other software package, you should first make sure that your SAS software is supported on the new version of the operating system, and that the upgrade facility for the operating system does not force you to reinstall software. Operating system updates, in the form of maintenance, patches, service packs or other update packages from vendors typically fall under the previously mentioned “and higher” policy. Upgrading to new major versions of an operating system may require a new version of SAS. If you are moving from a 32-bit operating system to a 64-bit operating system, you might need to update your SAS software, and you might need to convert data structures.

HARDWARE AND HOSTNAMES

The hostname that is associated with the machines running a SAS deployment can change for a variety of reasons, including “IT changed internal naming policies” and “IT is changing the hardware”. When the hostname of the machine running a metadata-based SAS deployment changes, you need to use the SAS Deployment Manager to update the hostname references within the SAS deployment.

Changing physical machines where SAS software is hosted usually involves redeploying SAS software as well as the supporting third-party software. One exception is an identical machine replacement. You can take an operating system-level image backup of the entire system and restore it to another system. During this process, you maintain the pertinent environment settings like TCP ports and user accounts. If your hostnames changed in the process, you

Zen and the Art of SAS® Maintenance (354-2012) , continued

can use the SAS Deployment Manager to sweep through your metadata and configuration directories to make the corresponding string substitutions (see Figure 10) to reflect the new hostname.

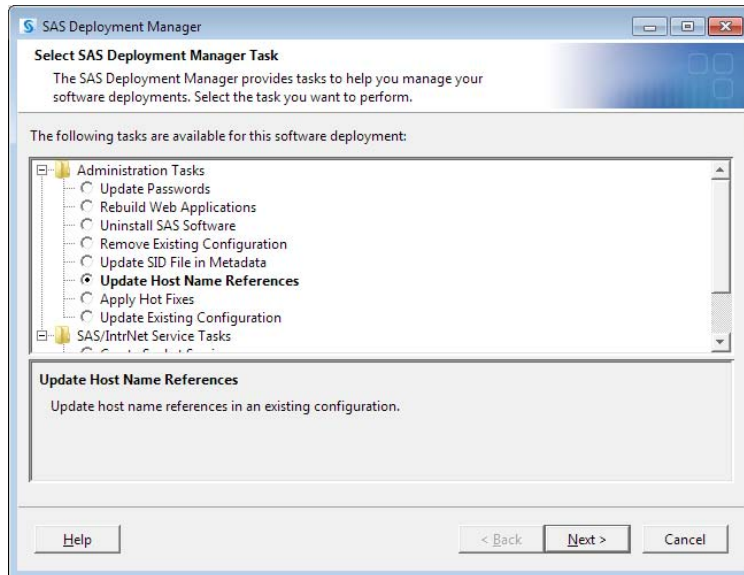


Figure 10. Updating Host Name References in the SAS Deployment Manager

JAVA RUNTIME ENVIRONMENT AND JAVA DEVELOPMENT KIT

When you originally install SAS software, it is wired up to a specific version of the Java Runtime Environment (JRE) and Java Development Kit (JDK). SAS ships a supported (and recommended) version of the JRE with your order. You either choose it, or point the SAS Deployment Wizard to a preinstalled JRE which meets the supported version requirements listed at <http://support.sas.com/resources/thirdpartysupport/index.html>. Because SAS does not ship a JDK, you must preinstall a supported version before installing SAS software.

In either case, at some point you might want to upgrade your JRE or JDK, which typically involves installing the new version in a different location. There are several things you must change in order to rewire SAS to use a new version of the JRE. They include:

- SAS Foundation library path in sasenv (UNIX) or sasv9.cfg (Windows)
- Default client application launcher in <SASHOME>/sassw.config
- (Optional) Individual client application launchers (for example, SAS® Data Integration Studio) in the *.ini file which is stored in the same directory as the application executable. This step is necessary only if you choose *not* to modify sassw.config and instead choose to point a subset of your applications to the new JRE.
- SAS Remote Services in the SAS configuration directory

If you are upgrading your JDK, you simply need to reconfigure your Web Application Server to point to it.

Details on accomplishing JRE and JDK upgrades can be found on the SAS support site pages specific to your SAS release. For example, the SAS 9.3 instructions are at <http://support.sas.com/resources/thirdpartysupport/v93/AlternateJRE.html>.

WEB APPLICATION SERVERS

SAS deployments that include Web applications require a preinstalled Web Application Server. The SAS support policy for upgrading Web Application Server versions is described in the previously mentioned “and higher” policy. If you are moving from one Web Application Server vendor to another (for example, from a JBoss Application Server to a IBM WebSphere Application Server Network Deployment), an easy way to accomplish this is to “migrate” your SAS

Zen and the Art of SAS® Maintenance (354-2012) , continued

deployment. To migrate, you run the SAS Migration Utility to package up all the configuration and metadata information about your current environment. You then run the SAS Deployment Wizard to read the data in your migration package, and create a new deployment using your new Web Application Server.

For more information about migration, see the *SAS Intelligence Platform: Migration Guide* for your target SAS release. The SAS 9.3 guide is at

<http://support.sas.com/documentation/cdl/en/bimig/62613/HTML/default/viewer.htm#titlepage.htm>.

DATABASES

In addition to SAS data sets, users frequently store data in third-party databases, such as MySQL, DB2, and Oracle. Since SAS supports direct access to such data via SAS/ACCESS software, you can move from one database to another by using a vendor-supplied transport mechanism to move the data, and then SAS® Management Console to update metadata references to it (for example, the library definitions). As long as you have licensed the corresponding SAS/ACCESS software, SAS will now point to the new location.

SAS software running under a Web Application Server depends on a framework of services called the SAS® Web Infrastructure Platform (WIP). You deploy this alongside your other SAS Web applications, such as SAS® Web Report Studio. The WIP takes advantage of a relational database. The default WIP database in SAS 9.2 is the SAS® Table Server, and in SAS 9.3 is the SAS® Framework Data Server. In either case, these databases simply store persistent data and support the services provided by the WIP. You can choose an alternate relational database when configuring your software via the SAS Deployment Wizard.

As with Web Application Servers, if you want to change the database used by the WIP, you need to use the SAS Migration Utility to migrate your SAS deployment. Then when you run the SAS Deployment Wizard, you will set your desired database type.

ADDING NEW SAS SOFTWARE

Adding new SAS software to an existing SAS deployment is covered in the *SAS Intelligence Platform: Installation and Configuration Guide*. For SAS 9.3, the specific section is at

<http://support.sas.com/documentation/cdl/en/biig/62611/HTML/default/viewer.htm#n09010intelplatform00install.htm>.

Your scenario could be one of the following:

- Licensing one or more additional SAS Foundation products (For example, SAS/STAT® software, SAS/OR® software, or SAS/QC® software)
- Moving from a traditional SAS Foundation-only deployment to a planned deployment involving a SAS Metadata Server
- Adding a new SAS solution to a planned deployment for example, SAS® Marketing Automation, SAS® Risk Management for Banking, or SAS® Enterprise Miner™)

In all cases, you first need to place a new order to get the new software. If you have more than one installation of SAS on the same machines, then you need to review which deployment you are updating. If you have more than one machine in a given deployment, you must update all machines to use the latest release of software in your order before proceeding. If you have multiple configuration levels in a single SASHOME, be aware that software updates and additions will affect all of the configuration levels.

When you are licensing new products (or installing an update that includes new components), your SAS software order will represent a superset of your current products as well as any new products being added. You download this order in the same way as your original order, following the instructions in your Software Order E-mail. SAS recommends that you download your order into the same SAS Software Depot used to hold your original order. Your download will go much faster, as only new and changed products will be downloaded. Furthermore, two orders in the same depot take up significantly less space than if they are stored in separate depots.

The following sections outline several topics which come into play when adding SAS products.

THIRD-PARTY PREREQUISITES

Your new products might have additional third-party requirements. Before installing anything from your new order,

Zen and the Art of SAS® Maintenance (354-2012) , continued

you need to consult the Third-Party Software Requirements for Use with SAS Software and Applications site at <http://support.sas.com/resources/thirdpartysoftware/index.html>. Any existing third-party software which is incompatible with your new product set must be upgraded or replaced with supported versions.

PLANNED VS. NON-PLANNED DEPLOYMENT

If your deployment includes a SAS Metadata Server, then you fall into the “Planned” category of deployments. A planned deployment means you used a deployment plan when you installed your SAS software, and you performed both installation and configuration steps by using the SAS Deployment Wizard. If you are updating a planned deployment, you must first stop all running SAS server processes. If you attempt to add SAS products to a system while SAS server processes are running, you are likely to see a window like that shown in Figure 11.

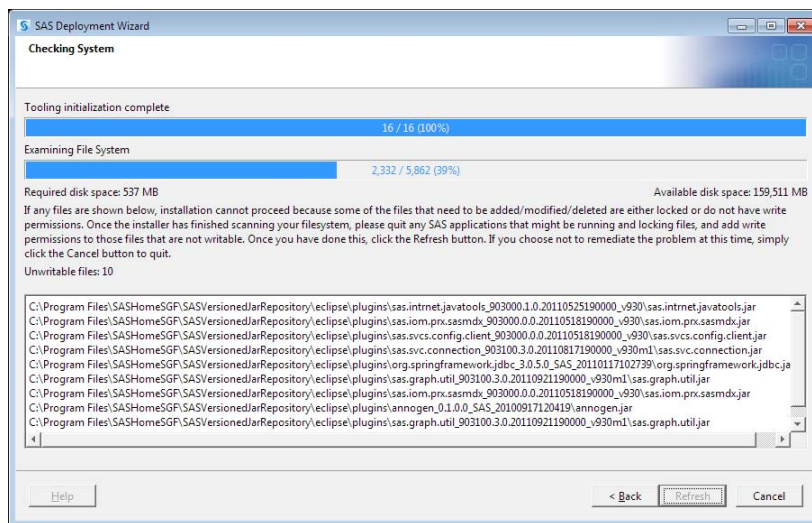


Figure 11. A Listing of Locked Files in the SAS Deployment Wizard

Adding products to a planned deployment typically involves using a new standard or custom deployment plan. The deployment plan specifies where you want to deploy the new products, and includes information about all the previously deployed products. In a nutshell, a deployment plan should always cover all SAS products in your environment, both old and new. The reason your plan needs information on all products in your environment, and not just the ones being added, is that the new product configuration depends on knowing the complete set of deployed products.

When you run the SAS Deployment Wizard to install and configure your new products, it will only install and configure what is missing. During the installation phase, the SAS Deployment Wizard will select all products from your deployment plan, but simply skip over those products that were previously installed. During the configuration phase, the SAS Deployment Wizard will attempt to configure only those products from your plan that were not previously configured.

Adding products to a non-planned deployment is a bit easier since you do not have to worry about server processes or deployment plans. However, you still need to make sure users are not accessing the SAS image at the time you deploy the new products.

NEW SAS FOUNDATION PRODUCT

If you are adding one or more SAS Foundation products to your deployment, you need to install the new products on the machines currently hosting SAS Foundation, and apply the accompanying software installation data (SID) file. You do this by running the SAS Deployment Wizard from the depot containing your newly downloaded order.

Make sure no users or server processes are currently accessing the SAS image. As long as no one is running SAS processes, the SAS Deployment Wizard will allow you to proceed. You will specify your new order and SID file in

Zen and the Art of SAS® Maintenance (354-2012) , continued

corresponding prompts. Select **SAS Foundation** in the product selection panel, and choose the Foundation products to be added in the Select SAS Foundation Products step (see Figure 12). The SAS Deployment Wizard will install the chosen products and apply the new license. You can then restart your servers, if applicable, and notify users that they can again access the SAS image.

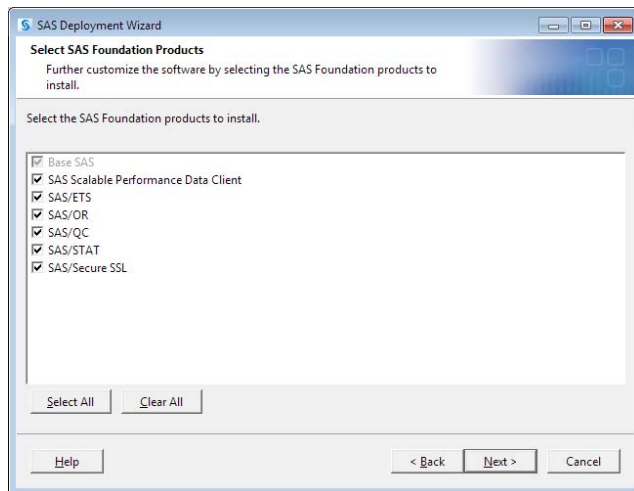


Figure 12. Selecting SAS Foundation Products in the SAS Deployment Wizard

Note that choosing SAS Foundation products that are already installed on your machine does no harm. The SAS Deployment Wizard will detect the previously installed files and skip them.

UPDATING BEFORE ADDING

When you attempt to add products using your new order, the SAS Deployment Wizard first checks to make sure all installed products are using the latest release as indicated in your new order. Remember that add-on orders contain all products in your environment, both old and new. As such, it is important to bring existing products up to the same level as they appear in your order. This ensures that you end up with a set of product versions that are verified to work together.

If you have more than one server (machine) involved in your deployment, you must update all servers to use the latest release of software in your order before proceeding. You should do so in the same machine order as used to initially deploy the software (i.e., first the SAS Metadata Server, followed by SAS Application Server machines, following by middle-tier machines).

If the SAS Deployment Wizard detects that you have out-of-date products, it will immediately go into Update mode. In this mode, there is minimal prompting. You are simply presented with a list of products to be updated, either by applying a maintenance release or by upgrading to a new release of a product. After you confirm the list to be updated, the SAS Deployment Wizard will proceed to install and optionally configure the updated products. You cannot bypass Update mode.

After all existing products are brought up to the levels contained in your add-on order, you can then run the SAS Deployment Wizard to select and deploy any of your additional products.

MULTIPLE SAS DEPLOYMENTS ON SAME MACHINE ADDING NEW SOFTWARE

If you have multiple SAS deployments running on the same machine or set of machines, you should take care to specify the correct SAS installation directory (also known as SASHOME) into which the new products are to be installed. If you have multiple configuration levels (denoted by “Lev0”, “Lev1”, etc. in your configuration directory) pointing to the same SASHOME, you must run the configuration step in the SAS Deployment Wizard on each of the configuration levels in addition to doing a single installation operation for the shared SASHOME.

INSTALLATION VERSUS CONFIGURATION

As mentioned, when adding products by using the SAS Deployment Wizard, you will select the additional ones to install. If you accidentally or intentionally choose to install a preexisting product, the SAS Deployment Wizard will

Zen and the Art of SAS® Maintenance (354-2012) , continued

detect its presence and skip the associated files. Thus reinstalling products has no negative consequences. The same is not true for configuration. Care must be taken not to select already configured products when performing an add-on deployment as configuration is not always re-entrant. In fact, in certain cases, reconfiguring a SAS product can result in the need to recover your configuration directory and metadata repository from your backup files.

For more information, see the *SAS Intelligence Platform: Installation and Configuration Guide* at <http://support.sas.com/documentation/cdl/en/biig/62611/HTML/default/viewer.htm#n09010intelpatform00install.htm>.

CONCLUSION

Maintaining a software deployment is an art that requires orchestrating a set of changes. As with an initial deployment, you must take care to plan changes to your environment. Whether you are updating SAS or third-party product versions, installing a maintenance release or hot fixes, updating licenses, adding products, or changing hardware, you need to assess the impact and map out a strategy before jumping right in with SAS deployment tools. SAS software tools and processes continue to evolve to make this practice easier, ensuring your SAS environment remains a well-oiled machine.

TERMINOLOGY

The following list identifies terms that are relevant when describing how to maintain and upgrade your SAS deployment. Most of the terms are used in this document.

configuration, unconfiguration

During the configuration phase of the deployment process, you run tools that create and define the connections and customizations for your SAS deployment.

Information managed by SAS is stored in the metadata repository and in the configuration directory. While many configuration tasks are performed using the SAS Deployment Wizard and the SAS Deployment Manager, some tasks require manual steps.

Unconfiguration is the removal of the existing configuration, which is also performed by the SAS Deployment Manager. This step deletes metadata and removes content from the configuration directory.

deployment, SAS deployment

A SAS deployment is an instance of operational SAS software and related components, including SAS components, required third-party software, integration with the host environment, and content.

The deployment process includes installation and configuration tasks and phases. The SAS Deployment Wizard and the SAS Deployment Manager are the primary SAS tools used to support the deployment process.

A SAS deployment is sometimes referred to as a SAS instance or a SAS environment.

deployment plans

A deployment plan is an XML file that provides input to the SAS Deployment Wizard. The file contains information about what software should be installed and configured on each machine in a SAS deployment.

Standard deployment plans are delivered with SAS software and support most simple and basic distributed topologies. Custom deployment plans can be created by SAS support personnel for specialized requirements.

hot fixes

A hot fix is a software update which is critical, or that might affect a large number of customers. Hot fixes are made available to customers on the Technical Support hot fix download site <http://ftp.sas.com/techsup/download/hotfix/hotfix.html>.

installation

During the installation phase of the deployment process, you run tools that put SAS software in the appropriate directory locations. The installation phase requires access to a SAS Software Depot.

machine

The term “machine” refers to the resources, real or virtualized, that host a computing environment for

Zen and the Art of SAS® Maintenance (354-2012) , continued

software.

In some conversations, the terms “server,” “computer,” and “system” are used to mean the same thing as “machine.”

migration

Migration is a process of populating a new deployment of SAS software with the content, data, or metadata (or a combination of these) from an existing deployment. Migrating might include upgrading to a new software release, converting data or metadata, or other changes to ensure compatibility.

release

The term “release” describes the version of software. When planning maintenance and upgrade activities, there is a critical distinction between “maintenance releases” and a new version of the SAS platform.

SAS installation data

The SAS installation data, or SID, is your SAS license information.

SAS Deployment Wizard, SAS Deployment Manager

The SAS Deployment Wizard and the SAS Deployment Manager are deployment tools used to administer your SAS deployment. You use the SAS Deployment Wizard to install, configure, upgrade, and apply maintenance releases to SAS products. You also use it to manage the SAS Software Depots that contain your orders. You use the SAS Deployment Manager with an existing deployment to perform administrative tasks, such as updating passwords, rebuilding Web applications, and changing host names.

The SAS Deployment Wizard is located in the root of the SAS Software Depot. The SAS Deployment Manager is located in your SASHOME directory.

SASHFADD

SASHFADD, or SAS Hot Fix Analysis, Download and Deployment, is a tool that streamlines the hot fix identification, download, and installation process.

update

Updating is the process of bringing all of your software in SASHOME up to the most current levels. If your order contains newer releases or maintenance releases of software deployed in SASHOME, the SAS Deployment Wizard switches into Update mode. You must update your SAS software to use the latest release before adding new software to the deployed SASHOME.

upgrade

Upgrading is the process of installing and configuring new releases of SAS products that are already deployed on your system.

ACKNOWLEDGMENTS

Colleagues from across SAS have contributed to this paper by asking questions, researching answers, and sharing comments and insight. Thanks to the participation from this broad virtual team, this paper provides a comprehensive view of maintaining a SAS deployment.

RECOMMENDED READING

Chandran, Saravana R. 2010. “The Art of Managing SAS® 9.2 Middle Tier.” *Proceedings of the SAS Global Forum 2010 Conference*. Cary, NC: SAS Institute Inc. Available at: <http://support.sas.com/resources/papers/proceedings10/309-2010.pdf>. This paper contains a good overview of the configuration directories for the middle tier, as well as some troubleshooting tips for the middle tier.

Crevar, Margaret. 2009. “How to Maintain Happy SAS®9 Users.” *Proceedings of the SAS Global Forum 2009 Conference*. Cary, NC: SAS Institute Inc. Available at <http://support.sas.com/resources/papers/proceedings09/310-2009.pdf>.

Kalich, Tanya and Bubba Talley. 2011. “Troubleshooting Your SAS BI Deployment.” *Proceedings of the SAS Global Forum 2011 Conference*. Cary, NC: SAS Institute Inc. Available at

Zen and the Art of SAS® Maintenance (354-2012) , continued

<http://support.sas.com/resources/papers/proceedings11/373-2011.pdf> .

SAS Institute Inc. 2010. SAS® 9.2 *Intelligence Platform: Overview*. 2nd. ed. Cary, NC: SAS Institute Inc. Available at <http://support.sas.com/documentation/onlinedoc/intellplatform/index.html#intell92>.

SAS Institute Inc. (2011). Product Documentation: SAS Intelligence Platform. SAS Institute Inc. Available at <http://support.sas.com/documentation/onlinedoc/intellplatform/index.html#intell92>. Accessed on February 13, 2012.

SAS Institute Inc. (2011). Standard Deployment Plans. SAS Institute Inc. Available at http://support.sas.com/demosdownloads/sysdep_t3.jsp?packageID=000501 . Accessed on February 13, 2012. This Web site provides standard deployment plans and related checklists and diagrams.

SAS Institute Inc. (2011). Third Party Software Requirements for Use with SAS® Products. SAS Institute Inc. Available at <http://support.sas.com/resources/thirdpartysupport/> . Accessed on February 13, 2012. This Web site provides reference notes for configuring and customizing middle-tier components, lists of supported versions of third-party software components, links to external sites, and tips for managing third-party software.

Schneider, Mark, Donna Bennett, and Connie Robison. 2011. "Understanding the Anatomy of a SAS® Deployment: What's in My Server Soup?." *Proceedings of the SAS Global Forum 2011 Conference*. Cary, NC: SAS Institute Inc. Available at: <http://support.sas.com/resources/papers/proceedings11/363-2011.pdf>.

CONTACT INFORMATION

Your comments and questions are valued and encouraged. Contact the authors :

Mark Schneider
SAS Campus Drive
SAS Institute Inc.
Mark.Schneider@sas.com

Donna Bennett
SAS Campus Drive
SAS Institute Inc.
Donna.Bennett@sas.com

Jane Stovic
SAS Campus Drive
SAS Institute Inc.
Jane.Stovic@sas.com

Jason Losh
SAS Campus Drive
SAS Institute Inc.
Jason.Losh@sas.com

Shannon Leslie
SAS Campus Drive
SAS Institute Inc.
Shannon.Leslie@sas.com

SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc. in the USA and other countries. ® indicates USA registration.

Other brand and product names are trademarks of their respective companies.