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Steps for a Successful Deployment

Before You Begin

Because the contents of this guide are subject to continual updates, make sure that you have the latest guide. You can always access the latest release of this guide from the following site:

SAS Viya Deployment Guides

If you accessed this guide directly from the Software Order Email (SOE), you are viewing the latest guide. If you are viewing a saved copy of the PDF version of this guide, the content might be outdated.

To use this guide successfully, you should have a working knowledge of Microsoft Windows PowerShell and the Windows operating system. To learn about the deployment tools and the differences between a full deployment and a programming-only deployment, see “How Deployment Works” on page 2.

Step 1 — Prepare for the Deployment

1 Perform one of the following tasks:

- To update or add software to an existing deployment, go directly to "Managing Your Software” on page 65.
- To deploy a new instance of the software, continue with the following the steps.

2 Go to “System Requirements” on page 5 to learn about requirements for hardware, software, data sources and storage, user accounts, security, and clients.

3 Go to “Pre-installation Tasks” on page 19 to prepare your environment before you deploy the software.
Step 2 — Perform the Deployment

1. Go to “Installing SAS Viya” on page 29 to deploy the software.
2. Go to “Post-installation Tasks” on page 39 to configure your environment.

Step 3 — Validate and Complete the Deployment

1. Go to “Validating the Deployment” on page 55 to log on to SAS Studio and perform other validation tasks, such as that verifying that the servers were deployed correctly and that SAS can access your data.
2. Go to “Completing the Deployment” on page 61 to learn about post-deployment best practices and to find documentation about administrative tasks.

How Deployment Works

Using Deployment Scripts to Deploy SAS Viya

The Basics

Here is an overview of how the deployment works:

- To prepare for deployment, you must create the deployment scripts that are used to install and configure the software that you ordered. To do that, you download and run a tool provided by SAS called the SAS Orchestration Command Line Interface (CLI). You can run the SAS Orchestration CLI on a machine with a supported version of Windows, Linux, or Macintosh.

The instructions for downloading the SAS Orchestration CLI and creating the deployment scripts are provided in this guide. Also, the Software Order Email (SOE) that SAS sends to your business or organization contains a file attachment which is required to create the deployment scripts. The file attachment in the SOE contains information that is specific to your order.

Note: During deployment, the software to which you are entitled is downloaded from repositories that are maintained by SAS, or from mirror repositories at your own site. Creating mirror repositories is an optional task that you can perform before deployment. The instructions for using the SAS Mirror Manager utility to create mirror repositories are provided in this guide.

- To deploy the software, you run (as Administrator) a setup.bat command that executes the deployment scripts. Each time you run the command, the software is securely downloaded from repositories that are maintained by SAS, or from the mirror repositories that you have created.

Deployment Types

By default, you deploy the full suite of products and user interfaces that you ordered. In the SAS documentation, this type of deployment is referred to as a “full deployment.”

Although SAS recommends a full deployment, you can configure a deployment script to perform a “programming-only” deployment. A programming-only deployment limits support to data scientists and programmers who use SAS Studio, or direct programming interfaces such as Python or REST APIs. Understand that this type of deployment does not include SAS Drive, SAS Environment Manager, and the complete suite of
services that are included with a full deployment. Therefore, make sure that you are providing your users with the features that they require.

Your version of SAS Studio depends on which type of deployment you perform. If you deploy a full environment, then your environment contains both SAS Studio 5.1 and SAS Studio 4.4. By default, users will log on to SAS Studio 5.1. If you deploy a programming-only environment, then your environment contains SAS Studio 4.4.

Note: To deploy SAS Data Science, perform a programming-only deployment. A full deployment does not support SAS Data Science.

Note: To deploy SAS Event Stream Manager, perform a full deployment. A programming-only deployment does not support SAS Event Stream Manager.

How a SAS Viya Deployment Differs from a SAS 9 Deployment

The SAS Viya deployment differs from a SAS 9 deployment in the following ways:
- The SAS Deployment Wizard and the SAS Deployment Manager that support SAS 9.4 are not used to install and configure SAS Viya.
- Because the MSI-based deployment model works with repositories that are native to your operating system, a SAS Software Depot is not required for your SAS Viya software.

SAS Products and Supporting Components

This guide provides information for deploying the following software:

| SAS Cloud Analytic Services for Viya 3.4 | SAS Visual Analytics (on SAS Viya) 8.3 |
| SAS Data Science 8.3 (for more information about SAS Data Science, see the SAS Data Science product page) | SAS Visual Data Mining and Machine Learning 8.3 |
| SAS Event Stream Manager 6.1 | SAS Visual Statistics (on SAS Viya) 8.3 |
| SAS Event Stream Processing (SAS Viya Enabled) 6.1 | SAS/ACCESS Interface to ODBC (on SAS Viya) |
| SAS Event Stream Processing (SAS Viya Enabled) 5.2 | SAS/ACCESS Interface to PC Files (on SAS Viya) |
| SAS Studio 5.1 | SAS/ACCESS Interface to PostgreSQL (on SAS Viya) |
| SAS Studio 4.4 | SAS/CONNECT (on SAS Viya) |
| SAS Text Analytics (for languages) |

Note: Check your Software Order Email (SOE) for the list of software that you have licensed.

Contact SAS Technical Support

Technical support is available to all customers who license SAS software. However, you are encouraged to engage your designated on-site SAS support personnel as your first support contact. If your on-site SAS support personnel cannot resolve your issue, have them contact SAS Technical Support to report your problem.
Before you contact SAS Technical Support, explore the SAS Support website at support.sas.com/techsup/. This site offers access to the SAS Knowledge Base, as well as SAS communities, Technical Support contact options, and other support materials that might answer your questions.

When you contact SAS Technical Support, you are required to provide information, such as your SAS site number, company name, email address, and phone number, that identifies you as a licensed SAS software customer.
System Requirements

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**Hardware Requirements**

**General Hardware Considerations**

A full deployment is the recommended configuration for most customer requirements. To deploy SAS Event Stream Manager, you must perform a full deployment. However, SAS Data Science is always deployed as programming-only. SAS Viya 3.4 for Microsoft Windows supports single-machine deployments only.
SAS strongly recommends consulting with a sizing expert to obtain an official hardware recommendation that is based on your deployment type, the estimated SAS workload, and the number of users. To request sizing expertise, contact your SAS account representative. If you need assistance in determining your SAS account representative, send an email to contactcenter@sas.com.

**Host Requirements**

Use a dedicated host for your SAS Viya deployment. Co-installation with SAS 9.4 is not supported.

The machine target for the deployment must have the following attributes:

- A static IP address
- A fully qualified domain name that is 64 characters or fewer in length.
  
  This restriction is related to the implementation of transport layer security (TLS). One of the specifications for the certificate revocation list is a 64-character limit for the common name (CN=) attribute. For more information, see RFC 5280.

**CPU and RAM Recommendations**

SAS Viya has undergone rigorous performance testing with various hardware combinations. In addition to being tested on high-performing Intel Xeon E3-E7 series microprocessors, SAS Viya has also been tested with newer Intel chips, such as Intel Xeon Scalable Processors. SAS Viya also supports 64-bit AMD chipsets. Thirty-two-bit chipsets are not supported.

Consider the following as you prepare for the deployment process:

- The hardware guidelines in this guide apply to a production environment. For a test environment, CPU, RAM, and disk resources can be reduced slightly.

- Overall system performance will improve with the addition of both RAM and CPU cores. The start-up times for the various services in the environment and the level of performance that they deliver will also improve as resources are added.

- Test machines were equipped with RAM that had a minimum memory clock speed of 1600 MHz.

**Architectural Considerations**

SAS Viya 3.4 for Microsoft Windows is supported on single-machine deployments only.

The SAS Viya architecture consists of three categories of components that you should consider as you plan your deployment. These components should each be considered individually to determine the attributes of the server to host SAS Viya on Windows:

- **CAS Server**
  
  The CAS Server is required for all deployments, regardless of type (full or programming-only). It is licensed by CPU core, with a minimum license size of 4 cores.

  The amount of RAM that is required for the CAS Server is determined by the amount of data that is processed, and by the level of user activity in the environment. However, out of the box, the amount of RAM that is required to start the CAS Server is less than 1 GB.

- **Programming Runtime**
  
  The Programming Runtime consists of multiple components that are required for all deployments. It includes the SAS compute server, SAS Foundation, SAS Studio, SAS Workspace Server, SAS/CONNECT Server, and any SAS/ACCESS engines that you have licensed.

  The number of CPU cores that are required for the Programming Runtime depends on your specific license. If your CAS license is for $N$ cores, you are also entitled to run the Programming Runtime on the same
number of cores. However, the minimum requirement is 2 cores. SAS recommends that you allocate at least
4 cores for optimal performance.

The minimum required amount of RAM for the Programming Runtime is 4 GB. SAS recommends that you
allocate at least 16 GB of RAM or that you allocate 4 GB for each CPU core that you have licensed,
whichever is greater.

- **Service Layer**

  This category consists of components that are required for a full deployment, as well as services that support
specific SAS products. These components are not usage restricted. They include the Core Services host
group and all the other services that support SAS Viya analytics processing.

---

**Hardware Guidelines for a Programming-Only Deployment**

A programming-only deployment consists of the CAS server, SAS Programming Runtime, and SAS Studio. Use
the following formula to determine the minimum suggested core count to support the SAS processes that are
running on your server:

\[
2 + (\text{number-of-licensed-CAS-cores} \times 2)
\]

For example, for a 4-core CAS license, the minimum recommendation is 10 CPU cores. This level of resources
supports the following execution environment:

- CAS (4 cores)
- SAS Programming Runtime processes (4 cores)
- SAS Studio and other system overhead (2 cores)

**Note:** These 10 cores are in addition to the resources that are required in order to execute the additional
workload on your server.

The minimum recommended RAM calculation for a programming-only deployment is the sum of the following:

- 2 GB for SAS Studio
- Anticipated \( \text{maximum-number-of-concurrent-users} \times 4 \text{ GB} \)
  **Note:** These RAM resources support the SAS Programming Runtime sessions for each user.
- 1 GB + \( \text{total-size-of-data-to-be-loaded-into-CAS-memory} \)
  **Note:** This amount of RAM is specific to your anticipated usage.

---

**Hardware Requirements for a Full Deployment**

The following table lists products that can be separately licensed. It also specifies the RAM and the number of
CPU cores that are needed to support individual components when they are installed on a single machine.
These out-of-the-box requirements should be increased for larger deployments.

*Table 2.1 Minimum Hardware Requirements for Each Product*

<table>
<thead>
<tr>
<th>Products</th>
<th>RAM (GB)</th>
<th>CPU Cores</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAS Visual Analytics</td>
<td>48</td>
<td>8</td>
</tr>
<tr>
<td>SAS Visual Analytics and SAS Visual Statistics</td>
<td>48</td>
<td>8</td>
</tr>
</tbody>
</table>
Taking your license into consideration, you can estimate the total number of CPU cores that are required for a full deployment by using this equation:

\[
\text{number-of-CPU-cores-from-table} + ((\text{number-of-licensed-CAS-cores} - 4) \times 2) + \text{number-of-CPU-cores-for-overhead} = \text{total cores needed}
\]

- **number-of-CPU-cores-from-table**
  Use the table to find this number, which is based on the products that you ordered.

- **((number-of-licensed-CAS-cores - 4) \times 2)**
  Find the number of cores that you have licensed above the minimum 4 licensed cores, and multiply by 2.

- **number-of-CPU-cores-for-overhead**
  Find the number of CPU cores that are required to support additional operating system overhead and other processing that will be performed on this server.

For example, if your license is for SAS Visual Analytics, SAS Visual Statistics, and SAS Visual Data Mining and Machine Learning for 8 CAS cores, and the server is to be dedicated to SAS processing only, then the estimated number of cores (including 2 cores for additional operating system overhead) that are required for the machine would be calculated as follows:

\[
12 + ((8 - 4) \times 2) + 2 = 22 \text{ cores}
\]

To estimate the RAM that is required for the same license, consider the following:

- **RAM from the information in the table, based on your license**
- **(Number of concurrent SAS Studio users + Number of concurrent SAS Visual Data Mining and Machine Learning users) \times 4**
  These resources are required to support the SAS Programming Runtime processes.

- **1 GB + Total size of data to be loaded into CAS memory**

Consider the following hypothetical usage scenario:

- An order includes SAS Visual Analytics, SAS Statistics, and SAS Visual Data Mining and Machine Learning
- 10 concurrent users of SAS Studio
- 4 concurrent users of SAS Visual Data Mining and Machine Learning
- Maximum of 128 GB of data to be concurrently loaded into CAS memory

For this scenario, you can calculate the estimated RAM that would be required:

\[
64 \text{ GB} + (14 \times 4 \text{ GB}) + 128 \text{ GB} = 248 \text{ GB of RAM}
\]

Therefore, a machine that is provisioned with 256 GB of RAM should be able to accommodate the SAS resource usage and operating system overhead.

**Important:** These scenarios are hypothetical. SAS recommends that you obtain an official sizing from SAS, based on your specific requirements.

SAS Viya installs executables into `C:\Program Files\SAS` and creates configuration directories in `C:\ProgramData\SAS`. The minimum available disk space that is required to install and start a full deployment of SAS Viya is less than 50 GB. However, logs and operational data will quickly grow to exceed that amount. Therefore, the actual disk space that is required will depend on the amount of data and the level of activity in your specific deployment.
Operating System Requirements

Supported Operating Systems
For the full list of supported operating systems, see: https://support.sas.com/en/documentation/third-party-software-reference/viya/34/support-for-operating-systems.html.

SAS Support for Alternative Operating Systems
SAS provides support on a limited basis for alternative operating system distributions that customers might select. For more information, see the official support policy statement at http://support.sas.com/techsup/pcn/altopsys.html.

Server Software Requirements

Windows PowerShell Requirements
Microsoft Windows PowerShell version 5.1 or later is required in order to install SAS Viya on Windows. PowerShell is a framework that supports a scripting language and configuration management capabilities on Windows. Running the deployment scripts in Windows PowerShell Integrated Scripting Environment (ISE) is not supported.

Follow these steps to determine the current version of PowerShell if it is already installed:

1. Start PowerShell.
2. At the PowerShell command prompt, enter the following command to find out the PowerShell version:

   ```
   $PSVersionTable.PSVersion
   ```

   In the output, verify that the major version is 5 and that the minor version is 1 or later.

3. If required, install a newer version of PowerShell by installing Windows Management Framework 5.1.
   - Note: You can skip these steps if you are installing SAS Viya on Microsoft Windows Server 2016.
   - On Windows Server 2012 R2, follow these steps:
     b. Double-click the executable, and follow the prompts to install it.
     d. Double-click the executable, and follow the prompts to install it. A restart of your machine might be required.

4. SAS Viya will use PowerShell scripts to configure and run services. SAS supports all the PowerShell execution policies except Undefined and Restricted. Manually enable script execution in PowerShell by running the following command:
Set-ExecutionPolicy -scope LocalMachine execution-policy

Note: For more information about the PowerShell execution policies, see About Execution Policies.

PowerShell does not require a graphical user interface. It can be run on a machine that lacks a monitor.

Additional Software Requirements

Microsoft Windows Defender Credential Guard is not supported. If you are installing on Windows Server 2016, you must disable it before you start the deployment process. In addition, you must disable it on any client systems that are running Windows 10.

If you are installing on Windows Server 2012 R2, the Microsoft .NET Framework 4.6.1 or later is required. It is also required for the Microsoft Windows Management Framework, which is typically installed in order to obtain PowerShell. Therefore, do not uninstall the .NET Framework after you install PowerShell.

The Microsoft Visual C++ Redistributable Packages for Visual Studio 2013 and 2015 (64-bit versions) are required for all supported platforms.

You can download the packages from the following Microsoft websites:


Java Requirements

A 64-bit version of the Java Runtime Environment (JRE) must be installed on the machine where you install SAS Viya components. For a list of supported JRE distributions, see https://support.sas.com/en/documentation/third-party-software-reference/viya/34/support-for-jre.html.

Third-party distributions of the JRE are supported as long as the version matches the one that is listed on the SAS Support website. However, IBM SDK, Java Technology Edition is not supported.

Determine the Version of Java on the Machine

To determine the version of Java that is installed on the local machine, follow these steps:

1. Open the Windows Control Panel.
2. Navigate to Programs and Features.
   - If Java is installed on the computer, one or more Java versions are listed in the Programs and Features panel.

Additional Requirements for Oracle Java

If you have installed Oracle Java, a few required files might be missing. By default, earlier versions of the Oracle Java installation on Microsoft Windows lacked the Java Cryptography Extension (JCE) Unlimited Strength Jurisdiction Policy files. However, more recent Java releases, version 1.8.0_161-b12 and later, contain the feature, which is enabled by default, and some earlier Java releases might include the feature without enabling it.

To determine whether your version of Oracle Java has the JCE files, see the Release Notes for your particular release.

If you have an earlier version of Oracle Java, follow these steps:

2 Accept the license agreement.

3 Download the link for the ZIP file, jce_policy-8.zip.

4 Uncompress the files in the directory where Java is installed on your machine, such as `c:\Program Files\Java\jre1.8.0_131\lib\security`.

**Set the SAS_JAVA_HOME Environment Variable**

If you want to specify a different JRE for SAS Viya to use, you can set the SAS_JAVA_HOME environment variable to the location of a supported JRE. By default, the deployment process sets the variable automatically when it locates a JRE on the machine.

1 Click the **Windows** key and open **This PC**.

2 Right-click **This PC** and select **Properties**.

3 In the Control Panel window, click **Advanced system settings**. When the System Properties dialog box appears, click **Environment Variables**.

4 When the Environment Variables dialog box appears, in the System Variables section, click **New**.

5 Enter SAS_JAVA_HOME for the **Variable name** parameter.
   
   For the **Variable value**, navigate to the location of an installed JRE that meets SAS requirements.

6 Click **OK** to save the new environment variable.

**Disable Microsoft IIS Web Server**

If Microsoft Internet Information Services (IIS) for Windows is installed on the machine where you plan to install SAS Viya, be sure to disable or uninstall it before you start the deployment process. Otherwise, port conflicts will occur. You must restart the machine after uninstalling IIS in order to complete the deployment process.

---

**Data Source and Storage Requirements**

**Overview of Data Warehouse and Storage Requirements**

You can install software to enable data retrieval from various data storage appliances. Depending on your data sources, you might also install one or more SAS/ACCESS products.

Refer to the section that corresponds to your SAS/ACCESS product for additional system requirements that might apply.

**Supported Data Sources**

SAS Viya supports the following data sources:

- PC files
- Data sources that are accessible with an ODBC driver
- PostgreSQL

*Note:* The ODBC and PostgreSQL data sources require a SAS/ACCESS interface product. Some SAS/ACCESS engines have individual system requirements.
SAS Viya also supports CSV files. Files of this type do not require a SAS/ACCESS product and can be accessed directly.

**Requirements to Transfer Data from SAS 9.4**

For SAS 9.4 deployments that are earlier than SAS 9.4 TS1M5 (SAS 9.4M5), SAS/CONNECT is required in the environment in order to transfer data to SAS Viya. SAS/CONNECT is not included with a standard SAS Viya order, and must be separately licensed.

By contrast, SAS 9.4M5 is integrated with SAS Viya directly. As a result, SAS/CONNECT is no longer required in order to transfer data from SAS 9.4M5. All SAS programming clients in a 9.4M5 environment can call procedures that are enabled in SAS Viya and submit DATA step code, operating directly on CAS data sources. Examples of SAS programming clients are SAS Studio, SAS Enterprise Guide, SAS Data Integration Studio, and SAS Data Management Studio.

SAS/CONNECT is still supported, but if you are running SAS 9.4M5, it is no longer required in order to transfer data into SAS Viya.

Transport Layer Security (TLS) is supported for SAS/CONNECT, but it is not enabled by default. SAS provides a self-signed certificate to assist you in enabling TLS for SAS/CONNECT as a post-deployment task. For more information, see [Configure SAS/CONNECT to Use TLS (Windows)](https://support.sas.com/en/documentation/third-party-software-reference/viya/34/ConfigureSASCONNECTtoUseTLSWindow) in *Encryption in SAS Viya: Data in Motion*.

**Requirements for SAS/ACCESS Interface to ODBC**

SAS/ACCESS Interface to ODBC (on SAS Viya) enables access to multiple data source types by means of a generic ODBC driver. SAS/ACCESS Interface to ODBC includes SAS Data Connector to ODBC.


**Requirements for SAS/ACCESS Interface to PC Files**

SAS/ACCESS Interface to PC Files (on SAS Viya) includes SAS Data Connector to PC Files. SAS/ACCESS Interface to PC Files enables access to the following file formats:

- .jmp
- .spss
- .stata
- .xlsx or .xls

No additional software is required.

**Requirements for SAS/ACCESS Interface to PostgreSQL**

SAS/ACCESS Interface to PostgreSQL (on SAS Viya) includes SAS Data Connector to PostgreSQL.

User Account Requirements

Installation User Account Requirements

The user account that initiates the deployment process requires Administrator privileges for the machine where the deployment is launched.

Additional Required User Accounts

The following tables describe SAS Viya user accounts. These accounts are required for installation, for running services during the product's normal operation, and for access to user interfaces. Account requirements depend on your deployment type.

Here are the user account requirements for a full deployment:

Table 2.2  Required User Accounts for a Full Deployment

<table>
<thead>
<tr>
<th>Account Name</th>
<th>Description</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| cas          | A domain administrator must create this user account as a domain account before you begin the deployment process. An administrator must also add this user account to the Local Administrators group of the computer where the CAS server is installed. The cas account requires the following privileges:  
- Log on as a Service  
- Replace Process Level Token  
You can grant these privileges using the Windows Local Security Policy editor.  
The user name cas is recommended. However, the name must be unique for the equivalent user on the domain. The maximum length of the name is 20 characters.  
This account requires a password. If the password expires, the CAS service will no longer start. When you create the user account, clear the check box that requires the user to change the password at the next logon. | Owns the CAS service and is required for managing and enabling CAS and backup files. Also, it acts as the file owner of many of the files that are copied to the computer by the installation.  
Before you start the installation, you must save the user ID and password to an encrypted configuration file. For more information, see “Specify Credentials for the cas User Account” on page 29. |
<table>
<thead>
<tr>
<th>Account Name</th>
<th>Description</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| PostgreSQL server user account  | A domain administrator must create this user account as either a local account or a domain account before you begin the deployment process. It must be a standard user account that does not have administrator privileges. The user name `postgres` is recommended. This account requires:  
  - The privilege to Log on as a Service.  
    You can grant this privilege using the Windows Local Security Policy editor.  
  - A password that does not expire.  
    If the password expires, the PostgreSQL service will no longer start. When you create the user account:  
    - Clear the check box labeled **User must change the password at the next logon**.  
    - Select the check box labeled **User cannot change password**.  
    - Select the check box labeled **Password never expires**. | Enables the SAS Infrastructure Data Server, which runs on PostgreSQL, to start automatically.  
Before you start the installation, you must save the user ID and password to an encrypted configuration file. For more information, see “Specify Credentials for the postgres User Account” on page 30. |
| sasboot                         | Administrative user account that is created automatically during the deployment process, with an expired password. The sasboot user is internal only to SAS. It does not exist on a machine or in LDAP. | Used for preliminary access to the visual administration interface after the deployment process has completed. Use this account to log on to the SAS Viya visual interface in order to configure the connection to your identity provider and to set up user accounts. The sasboot account is typically not used after you have completed configuration activities. However, it can be used as an indirect logon option in case your identity provider becomes unavailable. |

Here are the user account requirements for a programming-only deployment:
Table 2.3 Required User Accounts for a Programming-Only Deployment

<table>
<thead>
<tr>
<th>Account Name</th>
<th>Description</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| cas          | A domain administrator must create this user account as a domain account before you begin the deployment process. An administrator must also add this user account to the Local Administrators group of the machine where the CAS server is installed.  

The cas account requires the following privileges:
- Log on as a Service
- Replace Process Level Token

You can grant these privileges using the Windows Local Security Policy editor.  

The user name cas is recommended. However, the name must be unique for the equivalent user on the domain. The maximum length of the name is 20 characters.  

This account requires a password. If the password expires, the CAS service will no longer start. When you create the user account, clear the check box that requires the user to change the password at the next logon. Owns the CAS service and is required for managing and enabling CAS. Also, it acts as the owner of many of the files that are copied to the machine during installation.  

Before you start the installation process, you must save the user ID and password to an encrypted configuration file. For more information, see “Specify Credentials for the cas User Account” on page 29. |
| User accounts for SAS Studio access | Host accounts with access to the machine where SAS Viya has been deployed.  

These user accounts require the privilege to Log on as Batch Job. SAS Studio 4.4 does not support Kerberos authentication. The privilege to Log on as Batch Job enables user access in a programming-only deployment. |

**TIP** The Windows privilege to Log on as Batch Job, which is required for users in a programming-only deployment, is also helpful in a full deployment, which includes Kerberos. Users of SAS Viya products who have this privilege can specify a user name and password for authentication of batch jobs from command-line interfaces if they are not using Kerberos. If a user’s Kerberos ticket has expired, the privilege enables SAS Viya to check the credential store to authenticate that user.

---

**Security Requirements**

**LDAP Requirements**

LDAP is required for SAS Viya visual interfaces. It is not required in a programming-only deployment.

To support the visual interfaces, SAS Viya must have Read access to your LDAP provider. SAS Viya requires a userDN and password in order to bind to the LDAP server. Anonymous binding is supported for clients that are authenticating to the LDAP server.

If the mail attribute is specified for LDAP accounts, it must have a non-null value that is unique for each user. LDAPS is supported, but the required certificates are not configured automatically by the deployment process.

Configuring your LDAP provider is a required post-installation task. For more information, see “Configure the Connection to Your Identity Provider” on page 40.
**Authentication Requirements**

Kerberos is the required network authentication protocol for SAS Viya deployments on Windows. By default, Kerberos 5 is implemented on Windows Server operating systems.

**Note:** Kerberos is not supported for a programming-only deployment of SAS Viya. For a programming-only deployment, users must have local Windows accounts that are authorized to log on to SAS Studio 4.4.

For a full deployment, Windows security integrates with the Kerberos Key Distribution Center, which uses the Active Directory database for user accounts. Therefore, Kerberos support requires Active Directory Domain Services.

SAS provides a utility, SAS Viya Deployment Assistant for Windows, to perform initial Kerberos configuration on your system. You can obtain the package when you download the SAS Orchestration CLI package. Running this utility is optional, but recommended. For more information, see “Evaluate the Kerberos Configuration and Windows Tuning” on page 32.

Running SAS Viya Deployment Assistant for Windows will assist you in fulfilling the following requirements:

- A user account that can be used as a service account for the HTTP proxy server (the Apache HTTP Server) must exist in Active Directory.
- A service principal name (SPN) must be mapped to the service account for the Apache HTTP Server. The HTTP SPN must follow the convention HTTP/host-name, where host-name is the fully qualified domain name of the Apache HTTP proxy server in the deployment.
  
  The domain account that functions as a service account is the owner of the SPN. Multiple SPNs can be added to the account if aliases are required.
- The SPN must be mapped to the principal name.
- A keytab file is required, with a filename in the format host-name.keytab. Access to the Kerberos utilities is required to generate this file.
- An SPN for the CAS server is required. The CAS SPN must follow the convention sascas/host-name, where host-name is the fully qualified domain name of the machine where the CAS server is running. The SPN must be registered on the service account that is running the CAS server (the cas account).
  
  If desired, you can designate the same service account that was used to register the HTTP SPN for this purpose.
- The cas account must be trusted for delegation.
- The machine object must be trusted for delegation in Active Directory.
- Kerberos Constrained Delegation is not supported and must be disabled.

The sasboot user account is used to configure Kerberos authentication in SAS Environment Manager after the deployment process has completed. For more information, see Configure Kerberos.

**Transport Layer Security**

The deployment process provides a default level of security by enabling TLS on connections to the Apache HTTP Server. However, this level of security requires you to block external connections to the server on port 80. You can also enforce HTTPS for access to SAS Viya by redirecting port 80 to 443 for web browser access.

The certificate that the deployment provides to secure the Apache HTTP Server is self-signed. SAS recommends that you enhance the security by replacing this certificate with a custom certificate that is generated according to the security standards at your organization.
How Default Security Is Applied

An Apache HTTP server is used as a reverse proxy server to secure your environment. By default, TLS is enabled for Apache httpd, and the server is secured with a self-signed certificate (sas.crt) and a private key (sas.key) that the deployment process generates.

TLS is not enabled on the CAS server by default. However, after the deployment has completed, a system administrator can enable TLS by running a PowerShell script that is provided with SAS Viya. This script creates a certificate file (sas_encrypted.crt), a private key file (sas_encrypted.key), and a passphrase file (encryption.key) for the private key file. It also configures SAS Cloud Analytic Services (CAS) and Windows to use these files in order to enable TLS.

You can replace the self-signed certificate that is used to enable TLS for the CAS server. For details, see Update Certificates and Configure TLS on CAS in Encryption in SAS Viya: Data in Motion.

You can also replace the self-signed certificate that is used to enable TLS for the Apache HTTP Server. For details, see Update Apache HTTP Server TLS Certificates and Cryptography in Encryption in SAS Viya: Data in Motion.

Replacing the certificates will require you to restart the Apache and CAS servers. This will cause a brief outage. If you do not add custom certificates and instead keep the default security settings and certificates, users will see a standard web browser warning message. SAS recommends that you replace the certificates that are created by the deployment before you give users access to the software.

Enhance Default Security Settings

SAS recommends that you enhance the default security that is applied by the deployment process. For more information about configuring additional security settings, see Tasks to Harden Security for Your Windows Deployment in Encryption in SAS Viya: Data in Motion.

As a best practice, follow these steps as soon as the deployment process has completed:

1. Secure the Apache HTTP Server by adding certificates that conform to the policies at your enterprise.
2. Enable TLS for the CAS server.
3. If you are using SAS/CONNECT to access data from earlier versions of SAS 9.4, enable TLS for SAS/CONNECT.
   For more information, see Configure SAS/CONNECT to Use TLS (Windows) in Encryption in SAS Viya: Data in Motion.
4. Enforce HTTPS for access to SAS Viya by blocking external connections to port 80 and by redirecting port 80 to 443 for browser access.
5. Prevent administrators from altering the default permissions on subdirectories of Program Files\SAS \Viya and ProgramData\SAS. Use your preferred network monitoring or security tool to monitor permissions on these subdirectories after the deployment has completed.

Client Requirements

Web Browsers

End users can access the product user interfaces for SAS Viya applications from a desktop computer, using a supported web browser. Because SAS software is not installed on this machine, the requirements are minimal. UNIX and 64-bit Windows operating systems are supported.
Some SAS Viya user interfaces include some advanced features that require recent versions of popular web browsers. For information about supported web browsers and the corresponding platforms to access SAS user interfaces, see: https://support.sas.com/en/documentation/third-party-software-reference/viya/34/support-for-web-browsers.html.

Mobile Platform and Touchscreen Support
The SAS Visual Analytics Apps run natively on iOS, Android, and Windows 10, and provide the ability to view and explore reports using a touchscreen.

Some SAS Viya user interfaces are not currently supported on mobile devices.

For more information about mobile device support, see: https://support.sas.com/en/documentation/third-party-software-reference/viya/34/support-for-web-browsers.html.

Database Drivers
Make sure that each client where users will access SAS software has the required database drivers already installed.

Screen Resolution
The minimum screen resolution for each client machine that will access the SAS Viya user interfaces is 1280 x 1024.
Pre-installation Tasks

(Optional) Create a Mirror Repository

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(Optional) Create a Mirror Repository

Overview

SAS Mirror Manager is a command line utility for synchronizing a collection of software repositories from SAS. Its primary use is to create and manage mirror repositories for software deployment. Mirror repositories are optional and should be used if your deployment does not have access to the internet, or if you must always deploy the same version of software (such as for regulatory reasons).

As you select a location for your mirror repository, keep in mind that SAS Mirror Manager can be used to place the files in several locations, such as on a web server that serves the files by HTTP, or on a shared NFS mount. The default location for the files that SAS Mirror Manager will download is the C: \Users\user-ID \sas_repos directory. Ensure that the default location or the location that you select has adequate space. Also ensure that the machine where the mirror repository will be located has adequate space.

Using SAS Mirror Manager with a Proxy Server

If your environment requires a proxy server and is set up to use it, the SAS Mirror Manager commands will work automatically. However, if your environment is not set up to send data through the proxy, you can add an environment variable to the command to run SAS Mirror Manager. The environment variable identifies where the proxy is located and what is required to send data through it.
Use the environment variable that is appropriate for the target of the query that passes through the proxy. For example, if you are trying to reach a SAS repository, you should use the HTTPS environment variable because the SAS repository is on an HTTPS site. In most cases, the HTTPS environment variable is appropriate.

Here are some examples of SAS Mirror Manager commands that include environment variables.

**Example 1:** An HTTPS site.

```plaintext
set https_proxy=http://user-name:password@internet-proxy-server-FQDN:proxy-port
```

For example:

```plaintext
set https_proxy=http://proxyid:password@proxy.company.com:3129
```

*Note:* If you use the https_proxy variable, the command for SAS Mirror Manager might also require the `--cacert` option, which indicates the location of the certificate that the proxy will use. The proxy certificate will be one that your organization manages.

**Example 2:** An HTTP site.

```plaintext
set http_proxy=http://user-name:password@internet-proxy-server-FQDN:proxy-port
```

For example:

```plaintext
set http_proxy=http://proxyid:password@proxy.company.com:443
```

**Using SAS Mirror Manager**

To create a mirror repository with SAS Mirror Manager:

1. The Software Order Email (SOE) indicated that you should save the SAS_Viya_deployment_data.zip file attachment. If you have not already saved the file, save it now.

2. Download SAS Mirror Manager from the SAS Mirror Manager download site to the machine where you want to create your mirror repository.

   *Note:* If you use Internet Explorer to download the Linux or Macintosh version, save the file as a .tgz file instead of a .gz file.

3. Uncompress the downloaded file.

4. At a command prompt, run the following command:

   ```plaintext
   mirrormgr.exe mirror --deployment-data path-to-deployment-zip-file-from-SOE --latest
   ```

   *Note:* If you have an HTTPS proxy, you might also need the `--cacert` option, which indicates the location of the certificate that the proxy will use. The proxy certificate will be one that your organization manages.

   By default, the repositories are placed in `C:\%USERPROFILE%\sas_repos`. You can change this location by using the `--path` option, followed by the full directory location of the mirror destination. This guide refers to that location as `\sas_repos`. However, if you want to use a different location, replace instances of `\sas_repos` in this guide with the actual location that you select.

   The default location for the logs for SAS Mirror Manager is `C:\%LOCALAPPDATA%\mirrormgr\mirrormgr.log`. To specify an alternative log location:

   ```plaintext
   mirrormgr.exe mirror --deployment-data path-to-deployment-zip-file-from-SOE --path location-of-mirror-repository --log-file location-of-logs\mirrormgr.log --latest
   ```

   *Note:* Specify the command on a single line. Multiple lines are used here to improve readability.

The `\sas_repos` directories are explained as follows:

- The `entitlements.json` is a list of the repositories to which you are entitled.
- The `location_group_declarations.json` file and the `sasmd` directory contain data that is used by the SAS Orchestration CLI to create the order-specific tools for your deployment.
Any remaining directories are the software repositories, organized by native deployment tools:
- repos contains yum files for Linux.
- win contains MSI files for Windows.
- deb contains APT files for Debian.

5 (Optional) After the initial download is complete, move the file structure to a web server or shared NFS mount. The destination machine does not have to be connected to the internet.

Create the Deployment Scripts

The SAS Orchestration Command Line Interface (CLI) uses the order information that was included in your Software Order Email (SOE) to create deployment scripts for your SAS Viya software. The SAS Orchestration CLI can be run on Linux or Windows and it requires the Java Runtime Environment 1.8.x. It also requires access to the internet, unless you are deploying from a mirror repository.

Before you use the SAS Orchestration CLI, ensure that the SAS_Viya_deployment_data.zip file attachment from your SOE is copied to a directory on a machine that runs the Linux, Macintosh, or Windows operating system.

Download the SAS Orchestration CLI

1 The SOE indicated that you should save the SAS_Viya_deployment_data.zip file attachment. If you have not already saved the file, save it now.

2 Go to the SAS Orchestration CLI download site and download the SAS Orchestration CLI for the operating system where you stored the ZIP file. The SOE recommended that you save the ZIP file to a machine that runs Windows, which is where you will install your SAS Viya software. But you could also store it on a machine that runs Macintosh or Linux. If you use Internet Explorer to download the Linux or Macintosh version, save the file as a .tgz file instead of a .gz file.

3 Uncompress the .tgz file (Linux or Macintosh) or ZIP file (Windows) in the same location where you downloaded it. The result is a file named sas-orchestration on Linux or Macintosh or a file named sas-orchestration.exe on Windows.

Create the Deployment Scripts with the SAS Orchestration CLI

Basic Command

To create the deployment scripts, use the command that is appropriate for the operating system where the SAS Orchestration CLI is located.

Note: The following commands are organized by the operating system where the SAS Orchestration CLI will run, rather than by the operating system where your SAS Viya software will be deployed. After you create the deployment scripts, you can move them to the machine where you will deploy your software.

Linux or Macintosh

./sas-orchestration build --input location-of-ZIP-file-including-file-name

Windows

./sas-orchestration.exe build --input location-of-ZIP-file-including-file-name

Using the SAS Orchestration CLI creates a new file named sas-viya-deployment-script.zip.
Options

Use a Proxy Server

If you use an unauthenticated proxy to reach the internet, you must add the following option to the run command in order to make an outgoing connection:

```
--java-option "-Dhttps.proxyHost=proxy-server-IP-address-or-host-name"
```

In addition, if the proxy server is not using the default proxy port of 80, you must also add the following option:

```
--java-option "-Dhttps.proxyPort=proxy-server-port-number"
```

If you use both options, they should not be combined into a single option. Here is an example of using both options on a Linux machine:

```
./sas-orchestration --java-option "-Dhttps.proxyHost=my.proxy.com --java-option "-Dhttps.proxyPort=1111"
build --input /tmp/SAS_Viya_deployment_data.zip
```

The `--java-option` tags must come before the `build` command.

Specify the Deployment Type

You can perform either of two types of deployment for SAS Viya software:

- Full deployment
  Includes all the software to which you are entitled.
- Programming-only deployment
  Excludes SAS Drive, most graphical user interfaces, and most services. It is the simplest and smallest type of deployment.

SAS typically recommends a full deployment. However, if your software includes SAS Data Science, it must be deployed as programming-only.

To deploy your software as programming-only, add the `--deployment-type` option, as shown in this example:

```
./sas-orchestration build --input c:\sas\install\SAS_Viya_deployment_data.zip
--deployment-type programming
```

Use a Mirror Repository

If you created a mirror repository with SAS Mirror Manager, you must include its location with the `--repository-warehouse` option.

```
./sas-orchestration build --input c:\sas\install\SAS_Viya_deployment_data.zip
--repository-warehouse URL-to-mirror-repository-content
```

Here is an example:

```
./sas-orchestration build --input c:\sas\install\SAS_Viya_deployment_data.zip
--repository-warehouse c:\DeploymentFiles\sas_repos
```

For more information about SAS Mirror Manager, see "(Optional) Create a Mirror Repository" on page 19.

Help with Options

The SAS Orchestration CLI includes several options. To learn about all the options for the SAS Orchestration CLI, use the appropriate command:

**Linux or Macintosh**

```
./sas-orchestration build --help
```
Windows

`.\sas-orchestration.exe build --help`

**Store the Deployment Scripts**

As a best practice, create a directory where you can store the files that are used to deploy and maintain your software. SAS recommends using `C:\sas\install`. This guide assumes that you will use `C:\sas\install`. Otherwise, replace those references with the actual location that you select.

Save the deployment scripts to your hard drive.

1. If necessary, move the `sas-viya-deployment-script.zip` file to the machine where you will deploy your software. The recommended location is `C:\sas\install`.

2. In the same directory where you have saved `sas-viya-deployment-script.zip`, uncompressed it.

**Deployment Scripts and Security**

The deployment scripts that are created by the SAS Orchestration CLI are PowerShell scripts. The PowerShell scripts are not digitally signed because they are created at deployment time based on your software order and the options that you set when you run the SAS Orchestration CLI. If your organization requires that PowerShell scripts be digitally signed, you must sign the created scripts yourself. For information about how to digitally sign PowerShell scripts, see "About Signing" at the Microsoft PowerShell support site.

By default, the deployment scripts bypass any PowerShell security policy that might be set up. However, to enforce a PowerShell security policy:

1. Open one of the multiple `.bat` files from the uncompressed ZIP file. If you accepted the defaults, those files are located in `C:\sas\install\powershell-deployment`.

2. Locate the following line:
   ```
   set ARGS=%ARGS% -ExecutionPolicy Bypass
   ```

3. Revise the line using one of the following methods:
   - Disable the command. Add `rem` (remark) to the beginning of the line.
     ```
     rem set ARGS=%ARGS% -ExecutionPolicy Bypass
     ```
     Later, you can restore the command by removing the remark from the line.
   - Delete the line completely.

4. Save and close the `.bat` file.

5. Repeat these steps for each `.bat` file in the directory.

---

**Enable Required Ports**

The following ports are used by SAS Viya and should be available before you begin to deploy your software. The same ports should also be available for any firewalls that are configured on the operating system or the network.
### Table 3.1  Ports to Be Made Available

<table>
<thead>
<tr>
<th>Process</th>
<th>Required Port</th>
<th>Requires Allowed Inbound Traffic From</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apache HTTP Server</td>
<td>80 (internal)</td>
<td>anywhere (workstation)</td>
<td>See note below.</td>
</tr>
<tr>
<td></td>
<td>443 (external)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Erlang Port Mapper Daemon (epmd) port</td>
<td>4369</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAS Infrastructure Data Server</td>
<td>5430–5439</td>
<td></td>
<td>For a single server deployment with no failover, ports 5430-5432 must be opened in order to use the PostgreSQL tools, pgAdmin and pgpoolAdmin. Additional standby nodes each get the next available port number sequentially up to 5439.</td>
</tr>
<tr>
<td>CAS Server</td>
<td>5570, 19000–19999</td>
<td>workstation</td>
<td>Used by clients to make binary connections to CAS.</td>
</tr>
<tr>
<td>SAS Message Broker</td>
<td>5672, 15672, 25672</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAS Studio</td>
<td>7080</td>
<td></td>
<td>Required only for SAS Studio 4.4 and for programming-only deployments.</td>
</tr>
<tr>
<td>SAS Configuration Server</td>
<td>8300, 8301, 8302, 8500, 8501</td>
<td></td>
<td>SAS uses HashiCorp Consul as its configuration server. Ports 8301, 8302, and 8600 are open for both UDP and TCP traffic.</td>
</tr>
<tr>
<td>Object Spawner</td>
<td>8591</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAS Server Monitor</td>
<td>8777</td>
<td></td>
<td>Used by clients to make REST HTTP calls to CAS, as with the Python REST interface.</td>
</tr>
<tr>
<td>SAS/CONNECT Spawner management</td>
<td>17541</td>
<td>anywhere (SAS 9.X servers, workstation)</td>
<td>Used to monitor the health of the SAS/CONNECT Spawner</td>
</tr>
<tr>
<td>SAS/CONNECT Spawner</td>
<td>17551</td>
<td>anywhere (SAS 9.X servers, workstation)</td>
<td></td>
</tr>
<tr>
<td>SAS Job Execution launcher context</td>
<td>18501–18600</td>
<td></td>
<td>Use a range of ports. The compute server gets the port range from the launcher during startup and attempts to use an open port in the range.</td>
</tr>
</tbody>
</table>

**Note:** In order to secure web access to your SAS Viya software, only port 443 (HTTPS) should be open externally on the machine where SAS Viya is deployed, and port 80 should be open internally.

If your order included SAS Event Stream Processing, any ports that will be used for ESP servers must be open to HTTP traffic. For more information, see *Using the ESP Server* in *SAS Event Stream Processing*. 
In addition, the user port range should be updated. From a command prompt, run the following commands, based on the version of your Internet protocol:

```
netsh int ipv{n} set dynamicport tcp start=32768 num=32767
netsh int ipv{n} set dynamicport udp start=32768 num=32767
```

where \( n \) indicates the version of your Internet protocol and is either 4 or 6.

After you run the command, restart Windows.

---

**Tune Your Windows System**

**Update the Windows Registry**

Microsoft recommends performing a system backup before editing the registry.

1. At a command prompt, type `REGEDIT`. The Registry Editor opens.
2. Go to the `HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\Tcpip\Parameters` registry subkey.
3. Add the DWORD value with a name of `TcpTimedWaitDelay` and a value of `30 Decimal`.
4. Go to the `HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\PriorityControl` registry subkey.
5. Add the DWORD value with a name of `Win32PrioritySeparation` and a value of `36 decimal`.
6. Go to the `HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\AFD\Parameters` registry subkey.
7. Add the following DWORD values:

<table>
<thead>
<tr>
<th>Name</th>
<th>Recommended Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EnableDynamicBacklog</td>
<td>1 decimal</td>
</tr>
<tr>
<td>MinimumDynamicBacklog</td>
<td>20 decimal</td>
</tr>
<tr>
<td>MaximumDynamicBacklog</td>
<td>1000 decimal</td>
</tr>
<tr>
<td>DynamicBacklogGrowthDelta</td>
<td>10 decimal</td>
</tr>
</tbody>
</table>

The recommended values specify the number of connections that you want to be available. These values request a minimum of 20 and a maximum of 1000 available connections. The number of available connections is increased by 10 each time.

8. Modify the SubSystems registry value.
   
   **Note:** If you are performing a programming-only deployment, skip this step.
   a. Go to the `HKEY_LOCAL_MACHINE\System\CurrentControlSet\Control\Session Manager \SubSystems\Windows` registry subkey. Here is an example of the value:
   
   `%SystemRoot%\system32\csrss.exe ObjectDirectory=\Windows SharedSection=1024,20480,768...`
   
   b. Right-click the Windows registry name and select **Modify**. The Edit String window appears.
Change the value for the third number in the SharedSection entry according to 20480. Here is an example of the revised entry:

```
%SystemRoot%\system32\csrss.exe ObjectDirectory=\Windows SharedSection=1024,20480,20480
```

9 Click OK.

10 Close the Registry Editor.

11 Restart Windows.

### Additional Tuning Suggestions

The following list includes general recommendations for configuring Windows systems:

- Disable Windows indexing on any directories that are used by SAS software.
- Set Windows performance settings so that background processes are favored.
- Set the maximum power profile in the system BIOS for all systems, except Intel Sandy Bridge.
- Disable the C1E BIOS setting on Dell systems.

### Set Environment Variables for SAS Event Stream Processing

You must set several environment variables before you install SAS Event Stream Processing. Some variables are required to support core product features. Others are required only to support optional components and features. If your order did not include SAS Event Stream Processing, you can skip this section.

1 Open the Control Panel from the Start menu. Navigate to System and Security.

2 Click System ⇒ Advanced System Settings in the left pane.

   The System Properties dialog box appears. Click Environment Variables.

3 Click New to add the following variable definitions. Or select the variable from the list and click Edit to modify an existing variable definition:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DFESP_HOME</td>
<td><code>C:\PROGRA~1\SAS\Viya\SASEventStreamProcessingEngine\version</code></td>
</tr>
</tbody>
</table>
|              | The setting for this variable does not affect the default installation location, which is `C:\Program Files\SAS\Viya`.
|              | For version, specify the appropriate version of the SAS Event Stream Processing software, such as 5.2 or 6.1. |
|              | If you installed in a location other than the default, update the path to match the installation directory. |
Set Environment Variables for SAS Event Stream Processing

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
</table>
| PATH                      | %PATH%;%DFESP_HOME%\bin;C:\PROGRA~1\SAS\Viya \SASFoundation\sasexe;C:\PROGRA~1\SAS\Viya \SASEventStreamProcessingEngine\version\ssl\bin
For version, specify the appropriate version of the SAS Event Stream Processing software, such as 5.2 or 6.1.
If you installed in a location other than the default, update the path to match the installation directory. |
| (Optional) DFESP_SSLPATH  | Drive:\path-to-OpenSSL-shared-object
By default, when the Encryption and Authentication Overlay package is installed, the path is %DFESP_HOME%\bin. |
| (Optional) PYTHONPATH or PYTHONHOME | Add the Python Lib directory to PYTHONPATH. Or set PYTHONHOME to the top-level Python directory:
- PYTHONPATH=C:\Program Files\Miniconda3\envs \pythonversion\Lib
- PYTHONHOME=C:\Program Files\Miniconda3\envs \pythonversion

4 Click OK to save your variable settings.

SAS Event Stream Processing includes the internal component SAS Micro Analytic Service. To use the Anaconda Python support in SAS Micro Analytic Service, you must set one of the optional variables listed in the table for your version of Python. For more information, see SAS Micro Analytic Service: Programming and Administration Guide, which is available on the SAS Event Stream Processing product page.
## Specify Credentials for the cas User Account

Use a deployment script to save the credentials for the cas user account that you created previously. For more information, see “Additional Required User Accounts” on page 13. Be sure to complete these steps before you start the deployment process.

**Note:** The name for this user account, cas, is recommended. However, you might have selected another name for this account when you created it.

1. Navigate to the directory where you extracted the contents of the sas-viya-deployment-script.zip file that you created using the SAS Orchestration CLI.
   
   The recommended location is `C:\sas\install`.

2. In the `C:\sas\install\powershell-deployment` directory, verify the presence of the `encryptCasUser.bat` script.
   
   **Note:** The `setup.bat` script and the `encryptCasUser.bat` script must be in the same directory.

3. From that directory, run the following command:

   ```
   .\encryptCasUser.bat
   ```

4. The script prompts you for the user ID and password of the cas user account. Since the cas user account is a domain account, the user name should include the domain.
The script creates a file named casUser.xml in the same directory.

**Note:** Do not delete the casUser.xml file. Deployment components continue to use it after the deployment process has completed. Similarly, do not delete the cas user account. It becomes the owner of the CAS service.

---

**Specify Credentials for the postgres User Account**

**Note:** This section is applicable only if you have a full deployment. If you have a programming-only deployment, skip this section.

Use a deployment script to save the credentials for the postgres user account that you created previously. This user account enables the SAS Infrastructure Data Server, which runs on PostgreSQL, to start automatically. For more information, see “Additional Required User Accounts” on page 13. Be sure to complete these steps before you start the deployment process.

**Note:** The name for this user account, postgres, is recommended. However, you might have selected another name for this account when you created it.

1. Navigate to the directory where you extracted the contents of the sas-viya-deployment-script.zip file that you created using the SAS Orchestration CLI.
   The recommended location is C:sas\install.

2. In the C:sas\install\powershell-deployment directory, verify the presence of the encryptPostgresUser.bat script.
   **Note:** The setup.bat script and the encryptPostgresUser.bat script must be in the same directory.

3. From that directory, run the following command:
   ```
   .\encryptPostgresUser.bat
   ```

4. The script prompts you for the user ID and password of the postgres user account. If you are using a localhost account, you should provide only the user name. If you are using a domain account, the user name should include the domain name.
   ```
   domain-name\user-name
   ```
   As the script runs, it creates a file named postgresUser.xml in the same directory.

**Note:** Do not delete the postgresUser.xml file. Deployment components continue to use it after the deployment process has completed. Similarly, do not delete the postgres user account.

---

**Modify Deployment Variables**

**Modify the PostgreSQL Settings**

**Note:** This section is applicable only if you have a full deployment. If you have a programming-only deployment, skip this section.
SAS Viya uses PostgreSQL as the SAS Infrastructure Data Server. For SAS Viya 3.4 on Windows, the PostgreSQL deployment consists of one data node. You can modify the settings for the PostgreSQL deployment in the vars.psd1 file.

1 Open the vars.psd1 file in a text editor.

2 Locate the Postgres invocation definitions section.

   # Postgres invocation definitions.
   NODE_DATA_ROOT_DIR = "C:\ProgramData\SAS\Viya\data\sasdatasvrc"
   PG_PORT = "5432"

3 Replace the default values with the values that you want to use.

   # Postgres invocation definitions.
   NODE_DATA_ROOT_DIR = "PostgreSQL-data-files-directory"
   PG_PORT = "port-used-by-clients-for-database-connections"

4 Save and close the vars.psd1 file.

Change the CAS Server Monitor Port Number

By default, the SAS Cloud Analytics (CAS) server listens for REST HTTP calls through port 8777. To change the port number:

1 Open the vars.psd1 file in a text editor.

2 Locate the cas_httpport variable.

   # HTTP port in cas.settings file.
   cas_httpport = "8777"

3 Change the default value to the one that you want to use.

   # HTTP port in cas.settings file.
   cas_httpport = "new-HTTP-port-number"

4 Save and close the vars.psd1 file.

Modify the Kerberos Settings

To modify your Kerberos configuration settings in order to accurately reflect your system:

1 Open the vars.psd1 file in a text editor.

2 Locate the settings for kerberos_kdc and kerberos_realm.

   # Port in cas.settings file.
   cas_port = "5570"
   kerberos_kdc = ""
   kerberos_realm = ""

3 For these variables, specify the appropriate values within the quotation marks.

   - For kerberos_kdc, use the fully qualified domain name for the Kerberos authentication server.
   - For kerberos_realm, use the name of the Kerberos authentication administrative domain. The realm is typically the DNS domain and is specified in all uppercase letters.

Note: For information about the values to use, contact your system administrator.

Here is an example:
Set Up the CAS Data Directory

Note: If you are performing an upgrade, skip this section.

By default, product caslibs are written to C:\ProgramData\sas\viya\config\data\cas\default, which is often hosted on a single hard disk drive with limited storage. To ensure proper performance of your SAS solutions, SAS recommends that the CASDATADIR option be configured to point to a high-performance storage platform. Examples of high-performance storage platforms include SAN, NVMe, and multiple drive disk arrays.

The storage platform that you use must be owned by the cas user.

Optimizing the performance of the CAS data directory is especially useful for solutions that can be resource-intensive, such as SAS Visual Forecasting, SAS Visual Data Mining and Machine Learning, and SAS Visual Text Analytics.

To set up a different CAS data directory:

1. Open the vars.psd1 file.
2. Add the following line to the end of the file.
   ```yaml
   casenv_casdatadir = "path-to-CAS-data-directory"
   ``
   
   Note: The CAS data directory must be accessible from the CAS controller.
3. Save and close the vars.psd1 file.

Post-Deployment Configuration

After the software has been deployed, you cannot make changes to the configuration using the vars.psd1 file. For information about changing the configuration after deployment, see Reference in SAS Viya Administration: SAS Cloud Analytic Services.

Evaluate the Kerberos Configuration and Windows Tuning

SAS Viya Deployment Assistant for Windows is a utility for evaluating an installation of Kerberos to determine whether it meets the requirements for deploying SAS Viya. In addition, a user with the appropriate rights can configure security principals and keytabs, as necessary. Also, the SAS Viya Deployment Assistant for Windows can evaluate whether the host meets the system requirements and has the appropriate system settings.

Requirements for SAS Viya Deployment Assistant for Windows

SAS Viya Deployment Assistant for Windows has the following requirements:

- The Active Directory computer account must be trusted for delegation.
- The following service principals must exist:
HTTP/Service Principal Name (SPN)
- sascas/SPN
- The Kerberos keytab must contain HTTP SPN information.
- The Local Security Policy must grant the service account rights to log on as a service and to replace a process-level token.

**Deploy SAS Viya Deployment Assistant for Windows**

1. Go to the [SAS® Viya Deployment Assistant for Windows for SAS Viya 3.4](#) page.
2. Download the sas-wvda-windows.zip file to the Windows machine where you will deploy your SAS Viya software.
3. Unzip the sas-wvda-windows.zip file in the same location.

**Validation Tests**

The following is the list of the validation tests that are performed by SAS Viya Deployment Assistant for Windows. Each test is followed by information about manually modifying your host to pass the test. If you prefer that SAS Viya Deployment Assistant for Windows programmatically remediate the issues that it finds, then also see “Configure the Kerberos Environment and Tune Windows Programmatically” on page 36.

**Operating System**

- The operating system is a 64-bit environment.
  - See “Supported Operating Systems” on page 9.
- The operating system is a supported version of Microsoft Windows.
  - See “Supported Operating Systems” on page 9.

**Third-Party Software**

- JAVA_HOME points to a 64-bit version of Java 8.
  - See “Java Requirements” on page 10.
- The installed version of Microsoft .NET Framework is 4.6 or higher.
  - See “Additional Software Requirements” on page 10.
- The installed version of PowerShell is 5.1 or higher.
- The Microsoft Visual C++ 2013 Redistributable (x64) is installed.
  - See “Additional Software Requirements” on page 10.
- The Microsoft Visual C++ 2015 Redistributable (x64) is installed.
  - See “Additional Software Requirements” on page 10.

**Active Directory**

- The host is part of a Windows domain.
  - Your domain administrator should add the host to a Windows domain.
- The host is a member of an Active Directory.
  - Your Active Directory administrator should add the host to an Active Directory.
The host account for the machine being installed on is trusted for delegation in Active Directory.
Your Active Directory administrator should add the machine to the Trusted for Delegation security policy in Active Directory.

The sascas/Service Principal Name has been added to Active Directory.
Your Active Directory administrator should add the Service Principal Name to Active Directory.

The http/Service Principal Name has been added to Active Directory.
Your Active Directory administrator should add the Service Principal Name to Active Directory.

Additional Users

A cas user account exists on the host.

The cas user ID and password are valid.

The cas user and password are encrypted.
See "Specify Credentials for the cas User Account" on page 29.

The cas user account has the Log on as a Service privilege.

The cas user account has the Replace Process Level Token privilege.

A PostgreSQL user account exists on the host.

The PostgreSQL user ID and password are valid.

The PostgreSQL user and password are encrypted.
See "Specify Credentials for the postgres User Account" on page 30.

The PostgreSQL user account is a member of the local users group and not a local administrator.

The PostgreSQL user account has the Log on as a Service privilege.

Tuning

The third parameter of the SharedSystem registry subkey is set to 20480 or greater.
See "Update the Windows Registry" on page 25.

The TcpTimedWaitDelay registry subkey is set to 30.
See "Update the Windows Registry" on page 25.

The Win32PrioritySeparation registry subkey is set to 36.
See "Update the Windows Registry" on page 25.

The TCP ephemeral port range starts with port 32768 or lower.
See "Enable Required Ports" on page 23.

The TCP ephemeral port quantity is 32767 or greater.
See "Enable Required Ports" on page 23.
Certificates

The SAS public code signing certificates are installed.
Note that this required only if you are running PowerShell with an execution policy of AllSigned. See “Install the SAS Signing Certificates” on page 37.

Keytab

The keytab is usable by Java-based services.
The domain or Active Directory administrator needs to create a working keytab file. See “Authentication Requirements” on page 16.

Evaluate Your Windows System

From the directory where you unpacked the ZIP file, use the following command to run the utility:

```
sas-wvda.ps1 -keyTabPath keytab-location -validate option
```

The `keytab-location` is the path to the keytab that contains credentials for the HTTP/host-name principal.

Here are the values for the -validate option:

- `adconfig` Validates that the domain entities are correctly configured.
- `all` Performs all validations.
- `host` Validates the host configuration.
- `keytab` Validates that the keytab can be used successfully by kinit. If you use this option, you must also use the -keyTabPath option.
- `postgres` Validates that the postgres service account is correctly configured.
- `sas` Validates the credentials for the CAS server and PostgreSQL (see “Specify Credentials for the cas User Account” on page 29 and “Specify Credentials for the postgres User Account” on page 30 for more information). It also validates that the CAS server credentials match the account that owns the sascas/host-name SPN.
- `tuning` Validates that the recommended tuning has been applied to this host. (See for more information.)”Tune Your Windows System” on page 25

If the value for -validate is sas or all, the -DeployDir argument must also be used. Here is an example:

```
sas-wvda.ps1 -keyTabPath keytab-location -validate all -DeployDir path-to-user-XML-files
```

The path that is used should be the path to the postgresUser.xml and casUser.xml files described in “Specify Credentials for the cas User Account” on page 29 and “Specify Credentials for the postgres User Account” on page 30.

The output of this command is a list of the validation tests that were performed and the results (success or failure).
Configure the Kerberos Environment and Tune Windows Programmatically

You can use SAS Viya Deployment Assistant for Windows to remediate any issue that is identified when -validate is used.

```
sas-wvda.ps1 -keyTabPath keytab-location -remediate [options-for-addressing-issues]
```

SAS Viya Deployment Assistant for Windows essentially performs a validation using -validate all as it remediates the system. When it finds an issue that fails the validation, it attempts to remediate the issue. Here are additional options that can be used with -remediate:

- **CASAcct <string>**
  If the string is specified, the name of the CAS domain account name will match the string. If the string is not specified, the name will be svcAcctPrefix-host-name-CCAS. If that is longer than 20 characters, the NETBIOS name will be truncated to 20 characters.

- **CASPassword <string>**
  If the string is specified, the password for the CAS domain account will match the string. If the string is not specified, the password will be random.

- **cmdFileOnly**
  Specifies that the utility should not attempt to create Active Directory entities at execution time. Instead, a script will be created to perform any remediation. This can be helpful for situations where the SAS Administrator is a local server administrator but not a domain administrator. The script can be provided to a domain admin. The output of the script is a ZIP file that the domain administrator should return to the SAS administrator for subsequent use during deployment of SAS Viya.

- **cmdFilePath <string>**
  Specifies the output path and filename of the command file script.

  By default the script will be placed in the current directory and be named SASViyaADEntitySetup.ps1.

- **createADEntities**
  Specifies that the utility should attempt to create any AD entities that are not found.

  Note: This flag requires that account running the utility has administrative permission to create and modify accounts in Active Directory.

- **createKeytab**
  Creates the keytab file that contains the HTTP/SPN.

- **HTTPAcct <string>**
  If the string is specified, the name of the domain account used by the HTTP service will match the string. If the string is not specified, the name will be svcAcctPrefix-host-name-HTTP. If that is longer than 20 characters, the NETBIOS name will be truncated to 20 characters.

- **HTTPPassword <string>**
  If the string is specified, the password for the domain account used by the HTTP service will match the string. If the string is not specified, the password will be random.

- **PostgresAcct <string>**
  If the string is specified, the name of the account for the local PostgreSQL will match the string. If the string is not specified, the name will be svcAcctPrefixpostgresql.

- **PostgresPassword <string>**
  If the string is specified, the local PostgreSQL account password will match the string. If the string is not specified, the password will be random.

- **pwLength <Int32>**
  The default is 20.

  If accounts are created with random passwords, specifies the length of the password.
-pwNumSpecialChars <Int32>
   The default is 8.
   If accounts are created with random passwords, specifies the number of special characters that can be used in the password.

-svcAcctOUName <string>
   The default is Default: OU=serviceAccounts.
   If domain accounts are created, specifies the location within the structure of Active Directory to house the accounts. The distinguished names (DNs) for the realm of the host will be added to this string. If the specified location does not exist, the default location for your Active Directory will be used.

-svcAcctPrefix <string>
   The default is svc-sas-
   Specifies the account name prefix for all default account names that are created.

-svcAcctSuffix <string>
   The default is an empty string.
   Specifies the account name suffix for all default account names that are created.

---

**Install the SAS Signing Certificates**

All PowerShell scripts from SAS are signed using SAS signing certificates. If your PowerShell installation has an execution policy of AllSigned, PowerShell must confirm that those scripts originate from SAS. Therefore, SAS has included signing certificates in the ZIP file that contains the SAS Viya Deployment Assistant for Windows. The certificates must be installed in the TrustedPublisher certificate store on the Windows machine where the scripts will be run.

As an administrator, install the certificates using the following command:

```
certutil -addstore "TrustedPublisher" .\SAS_Code_Signing_Certs.p7b
```

---

**Install SAS Viya**

1. Navigate to the `C:\sas\install\` directory where you uncompressed the sas-viya-deployment-script.zip file that you created.

2. Locate the setup.bat file in the `C:\sas\install\powershell-deployment` directory. You can use this file in one of two ways:
   - Right-click the file, and select **Run as Administrator** from the menu. Using this method does not include command options. The software is downloaded and installed on the local machine, then the script configures and starts any necessary services.
   - Open a command prompt (being sure to select **Run as administrator**) from the Windows Start menu. Run the following command:
     ```
     setup.bat options
     ```

      When the command is run without options, the script downloads and installs software on the local machine and then configures and starts any necessary services. Descriptions of the optional flags follow.
      - `-install`
Only installs the software and services. If you use this option, the software and services will not be configured and the services will not be started.

- **config**

Configures the installed software, and configures and starts the services. This option fails if you run the command before the software and services have been installed.

As the batch job runs, a `\Downloads` folder is created in the directory where you are running the batch script. The software is downloaded from secure repositories to this new folder on your computer.

To conserve space, after the setup.bat script has been run and the deployment is complete, you can delete the `.msi` files in the `C:sas\install\powershell-deployment\downloads` directory.

If the deployment process fails, but you are able to recover from the error, be sure to restart the deployment using the appropriate deployment commands. In addition, if you receive a message to reboot during the deployment process, make sure that use the same deployment commands.
Post-installation Tasks

Configure Security

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Configure Security

Configure Your Environment with SAS Environment Manager

Note: The tasks in this section are applicable if you deployed all of your software. If you deployed the programming interface only, skip this section.

Sign In as the sasboot User

Your SAS environment is deployed with an initial administrator account that is named sasboot. The password for this account has expired by default, so you must reset the password before you can sign in.

To reset the password:

1. Locate the most recent log for the SAS Logon service in the C:\ProgramData\SAS\Viya\var\log \saslogon\default directory.

2. Search the log for the characters, sasboot.

   Here is a typical message:
   
   Reset password for initial user sasboot using link:

3. Sign in from a URL with this format:
Make a note of this URL to share with other administrative users of your SAS Viya software, as described in “Share Important Deployment Information with the Administrators” on page 61.

4 Follow the instructions on the web page that is displayed in order to reset the password.

Note: If the URL has expired, stop and start the SAS Logon Manager Service.

Then return to the log and obtain the new URL. The URL expires 24 hours after the SAS Logon service restarts. For security purposes, the URL that is specified in a browser or in a text editor also expires, even if the password is not reset.

After you reset the password, SAS Environment Manager automatically opens in your browser.

5 Click Yes to opt in to all the assumable groups so that you have the permissions to perform subsequent tasks.

Configure the Connection to Your Identity Provider

After completing the installation of SAS Viya, you must configure the connection to your identity provider before your users can access SAS Environment Manager and SAS Visual Analytics.

While signed in as sasboot, configure the connection to your identity provider:

Note: Only LDAP-based identity providers are supported. You need to have basic familiarity with LDAP administration. For more information about the properties that are relevant for this procedure, see “sas.identities.providers.ldap” in SAS Viya Administration: Configuration Properties.

1 Select the \ from the side menu to open the Configuration page.

2 On the Configuration page, select Basic Services from the list, and then select the Identities service from the list of services.

3 To configure user properties, in the sas.identities.providers.ldap.user section, click New Configuration:

   a Specify a value for the baseDN required field. For the remaining fields, review the default values and make changes, as necessary. The default values are appropriate for most sites.

   For each property that represents a user-level field in SAS, specify a corresponding property in the LDAP server software.

   TIP Consider specifying a custom filter to limit the user accounts that SAS Viya returns from your LDAP server.

   b Click Save.

4 To configure group properties, in the sas.identities.providers.ldap.group section, click New Configuration. In the New Configuration window:

   a Specify a value for the baseDN required field. For the remaining fields, review the default values and make changes, as necessary. The default values are appropriate for most sites.

   For each property that represents a group-level field in SAS, specify a corresponding property in the LDAP server software.

   TIP Consider specifying a custom filter to limit the accounts that SAS Viya returns from your LDAP server.

   b Click Save.
5. To configure connection properties, in the `sas.identities.providers.ldap.connection` section, click **New Configuration**. In the New Configuration window:

   a. Specify values for the following required fields: **host**, **password**, **port**, **url**, and **userDN**. For the remaining fields, review the default values and make changes, as necessary. The default values are appropriate for most sites.

   b. Click **Save**.

6. To verify user and group information, from the SAS Environment Manager side menu, select **to open the Users page.**

   On the Users page, select **Users** from the list in the toolbar. Your users should appear after a few minutes. It is not necessary to restart any servers or services. Then select **Groups** from the list to display your groups.

7. Verify that user and group information is displayed correctly. If not, make any necessary changes to the identities service properties then restart the Identities and SAS Logon Manager services:

   **Note:** When using the LDAP protocol, passwords are transmitted over the network as clear-text. To secure the deployment, SAS recommends that you configure encrypted LDAP connections. For more information, see **Encrypt LDAP Connections** in *Encryption in SAS Viya: Data in Motion*.

---

### Set Up Administrative Users

**CAUTION!** Be sure to complete these steps before you configure Kerberos as the identity provider. Kerberos authentication will prevent you from signing in as sasboot. You will have to use one of these administrative accounts to access the system when Kerberos has been enabled.

While you are signed in to SAS Environment Manager as the sasboot user, set up at least one SAS Administrator user, as follows:

1. **On the Users page in SAS Environment Manager, select Custom Groups from the list in the toolbar.**

2. **In the left pane, click SAS Administrators.**

3. **In the Members section of the right pane, click , and add one or more members to the group (including your own account, if applicable).**

4. **Sign out from SAS Environment Manager so that you are no longer signed in as the sasboot user.**

5. **Test the configuration by signing back in to SAS Environment Manager. If you added your own account to the SAS Administrators group, you can sign in using that account. Otherwise, sign in as one of the administrative users that you have added.**

   Open SAS Environment Manager from a URL with the following format:

   ```
   https://reverse-proxy-server/SASEnvironmentManager/
   ```

   **TIP**  Because SAS Administrators is an assumable group, the following prompt is displayed: Do you want to opt in to all of your assumable groups? Select **Yes** if you want to enable the additional permissions that are associated with the SAS Administrators group. The selection remains in effect until you sign out.

---

### Configure Kerberos

After installing a new SAS Viya deployment, you must configure the connection to Kerberos before your users can access SAS Environment Manager and SAS Visual Analytics. To configure Kerberos, see **Configure Kerberos** in *SAS Viya Administration: Authentication*. 
Important: Complete those steps while you are signed in as the sasboot user. However, be aware that as soon as Kerberos is enabled, the sasboot account can no longer be authenticated. Therefore, it is important that you create at least one SAS Administrator, as explained in “Set Up Administrative Users” on page 41 before you enable Kerberos authentication. Otherwise, you cannot access SAS Viya after Kerberos is enabled.

Sign In Using Kerberos

Open SAS Environment Manager from a URL with the following format:

https://reverse-proxy-server/SASEnvironmentManager/

Sign in as one of the SAS Administrators that you set up in “Set Up Administrative Users” on page 41.

Configure the Connection to the Mail Service

After installing a new SAS Viya deployment, you must configure the connection to your mail service. Complete these steps while you are signed in as one of the SAS Administrators.

1. Select the $ from the side menu to open the Configuration page.
2. On the Configuration page, select Basic Services from the list, and then select Mail service from the list of services.
3. In the sas.mail section, click $ . In the Edit Configuration window, follow these steps:
   a. Specify a value for the following required fields: host and port. For the remaining fields, review the default values and make changes, as necessary. The default values are appropriate for most sites.
   b. Click Save.
4. (Optional) To enable the health check for the mail service:
   a. Select the $ from the side menu to open the Configuration page.
   b. On the Configuration page, select Basic Services from the list, and then select Mail service from the list of services.
   c. In the management.health.mail section, click $ .
   d. Turn the enabled toggle to on.
   e. Click Save.

When this toggle is set, health checks will be enabled after the mail service is restarted. If the mail host is not configured or is configured incorrectly, or if it cannot connect to the SMTP mail server, the mail service will indicate it is in a failed state.

Disable the Password Reset Feature and Reset the sasboot Password

When you have finished setting up Kerberos and the initial administrative users, you should reset the password for the sasboot user. For additional security, you can then disable the password reset feature. This action prevents password reset links from being written to the log each time the SASLogon service is restarted.

1. Sign in to SAS Environment Manager as an administrative user and select $ from the side menu to open the Configuration page.
2. On the Configuration page, select Definitions from the drop-down list.
In the left pane, select `sas.logon.initial`. Then click the **New Configuration** button at the top of the right pane. If a definition already exists, you can select to edit the existing definition.

In the New `sas.logon.initial` Configuration window or the Edit `sas.logon.initial` Configuration window, set `reset.enabled` to **off**.

Click **Save**.

Restart the SAS Logon service. For more information, see General Servers and Services: Operate (Windows) in SAS Viya Administration: General Servers and Services.

**Note:** After you disable this feature, you can still change the sasboot password if the existing password is known. Enter the URL for SAS Viya with the path `/SASLogon/change_password`. If you are already signed in as another user, first sign out and then sign back in as sasboot using the current password. You can then complete the steps to change the password.

**Configure SAS Viya to Encrypt the LDAP Connection**

SAS Viya supports encrypted connections between the LDAP client and server. To configure a secure LDAP connection, see Encrypt LDAP Connections in Encryption in SAS Viya: Data in Motion.

**Change the Administrative User Password for SAS Message Broker**

**Note:** The tasks in this section are applicable only if you deployed all your software. If you deployed the programming interface only, skip this section.

You must change the administrative user password for SAS Message Broker as soon as possible after you have deployed SAS Viya. When you execute the following steps, the administrative password is updated in SAS Configuration Server (Consul).

1. Using the installer user ID, open a Windows PowerShell with the **Run As Administrator** privilege.

2. Change to the following directory:
   
   ```
   cd \Program Files\SAS\Viya\bin
   ```

3. Run the message broker account tool:
   
   ```
   .\sas-rabbitmq-acct-admin.ps1 change_passwd -t account-type -u user-ID -promptpw
   ```

   `- account-type` specifies the account user type, which is always the `client` type. The client user has full administrative rights. These rights can change in future releases.

   `-u user-ID` identifies the client user ID for SAS Message Broker. By default, the user ID is `sasclient`.

   `-promptpw` prompts for the new password for the client user ID for SAS Message Broker. The password that you enter is hidden, by default.

   Here is an example that changes the password for the default administrative user:

   ```
   .\sas-rabbitmq-acct-admin.ps1 change_passwd -t client -u sasclient -promptpw
   ```

4. Open the Services Window.

5. Restart the SAS Message Broker. You must change the administrative user password for SAS Message Broker as soon as possible after you have deployed SAS Viya.
6 Restart all SAS Viya services. Restarting the SAS Viya services activates the changes to the credentials for SAS Message Broker.

For more information, refer to SAS Viya Administration: General Servers and Services.

---

**Configure the Machines**

**Create a Backup Configuration**

The tasks in this section are applicable only if you deployed all your software. If you deployed the programming interface only, skip this section. For information about backing up a programming-only deployment, see Backing Up and Restoring Programming-Only Deployments in SAS Viya Administration: Backup and Restore.

1 In SAS Environment Manager, confirm that the DEFAULT_BACKUP_SCHEDULE has been created. For details, see Initial Tasks in the SAS Viya Administration: Backup and Restore.

2 Check the logs at `C:\ProgramData\SAS\Viya\var\log\deploymentBackup\default` and `C:\ProgramData\SAS\Viya\var\log\backupagent\default`. If the following message is in the deploymentBackup log, restart the deploymentBackup service.

   ```log
   ServiceSchedule] c.sas.backup.util.BackupScheduleManager : service [BACKUP_SCHEDULT_ERROR] Cannot schedule backup since maximum retry attempt is reached and one of the dependent services is still not running
   ```

   Restart the deploymentBackup service. Confirm that the following message is now in the log:

   ```log
   ServiceSchedule] c.sas.backup.util.BackupScheduleManager : service Default schedule created for BackupService to run backup job every Sunday 1AM
   ```

3 Set the sharedVault location and ensure that the permissions on the designated location are set. For details, see Initial Tasks in the SAS Viya Administration: Backup and Restore.

4 In SAS Environment Manager, click Jobs.

5 Right-click the DEFAULT_BACKUP_SCHEDULE and then select Run from the pop-up menu to immediately run the backup.

6 To confirm that the backup ran successfully, in the Jobs list, click the Monitoring tab.

7 On the Monitoring tab of the Jobs page, ensure that the jobs are running without any warnings and errors.

**(Optional) Create a Local Copy of Documentation**

You can configure your software to give your users access to local documentation. Here are two instances where access to local documentation would be useful:

- You have customized your documentation.
- Your SAS system is highly secure, and it does not have access to the internet. Because the SAS documentation is cloud-hosted, it cannot be reached without internet access.

**Note:** The cloud-hosted SAS documentation is frequently updated. The SAS administrator should refresh the local copy on a regular basis to ensure that your users have up-to-date information.

You can download PDF versions of the documentation, or you can create customized versions of the documentation. Create an HTML page with links to all documents that make up your local documentation collection, and create a link to this page.
To configure local documentation:

1. Access SAS Environment Manager.
2. Select **Configuration** from the left navigation bar.
3. Under the **View** menu, select **Definitions**.
4. Select the sas.htmlcommons definition.
5. Click **New Configuration**.
6. On the New sas.htmlcommons Configuration pane, click **Add Property** to add the following two properties:
   - `additionalHelpMenuUrl` — Specify the path to the HTML page that contains links to your local documentation.
   - `additionalHelpMenuLabel` — Provide a meaningful label for the link that your users can access.
     If you do not provide this parameter, a default label of **Additional Help** is used.
7. Click **Save** on the New htmlcommons Configuration pane.

Users see a new item in the **Help Menu** list, between the **Help Center** and **About** entries. Clicking this link opens the specified HTML page.

### Configure Locale and Encoding

#### Overview

SAS Viya 3.4 supports all the SAS session encodings that are available in SAS 9.4. By default, SAS Foundation is configured to use UTF-8 as the SAS session encoding and en_US, for English (United States), as the default SAS LOCALE. You can change the SAS LOCALE option, the ENCODING option, or both options to configure SAS Foundation. For more information, see **Data Migration to UTF-8 Encoding** in the *SAS and SAS Viya Programming Documentation*.

#### SAS Foundation Configuration

The primary configuration file for SAS Foundation is located in the `C:\Program Files\SPRE\SASFoundation\sasv9.cfg` file. After deployment, this file contains a single option setting:

```
-CONFIG "!SASROOT\nls\u8\sasv9.cfg"
```

The ENCODING and LOCALE options are set in the sasv9.cfg file, which is referenced by the -CONFIG option.

#### Changing the LOCALE

If you want to use UTF-8 as the SAS Foundation encoding, and you want to change the LOCALE setting, edit the `C:\Program Files\SAS\SPRE\SASFoundation\nls\u8\sasv9.cfg` file. Change the LOCALE option setting so that it contains the following line:

```
-LOCALE five-character-POSIX-locale-code
```

Here is an example that sets the LOCALE option to French:

```
-LOCALE fr_FR
```

The POSIX locale must be one that is supported by SAS Foundation. For a list of SAS locales, see the **Values for the LOCALE= System Option** table in the *National Language Support (NLS): Reference Guide*, and locate the appropriate POSIX locale that you want to use.

**Note:** The -ENCODING option in the nls/u8/sasv9.cfg file must always be set to UTF-8.
Changing the ENCODING

Before you change the SAS Foundation encoding for SAS Viya 3.4, be aware that any character data that you migrate to CAS must be transcoded to UTF-8. The section Data Migration to UTF-8 Encoding in the SAS and SAS Viya Programming Documentation gives guidelines and features that will help you migrate your data successfully.

If you want to configure SAS Foundation to use a different session encoding, you must modify the `C:\Program Files\SAS\SPRE\SASFoundation\sasv9.cfg` file. You can set the `-CONFIG` option to a different sasv9.cfg file. Select the sasv9.cfg that contains resources to support the encoding that you want to use.

The following table lists the NLS directories that are included with your SAS Foundation deployment. The table also lists the LOCALE and ENCODING options that are set in the sasv9.cfg file.

<table>
<thead>
<tr>
<th>NLS Subdirectory</th>
<th>Default LOCALE</th>
<th>Default ENCODING</th>
</tr>
</thead>
<tbody>
<tr>
<td>u8</td>
<td>en_US</td>
<td>UTF-8</td>
</tr>
<tr>
<td>1d</td>
<td>ja_JP</td>
<td>shift-jis</td>
</tr>
<tr>
<td>ar</td>
<td>Arabic</td>
<td>warabic</td>
</tr>
<tr>
<td>da</td>
<td>Danish</td>
<td>wlatin1</td>
</tr>
<tr>
<td>de</td>
<td>German</td>
<td>wlatin1</td>
</tr>
<tr>
<td>en</td>
<td>en_US</td>
<td>wlatin1</td>
</tr>
<tr>
<td>es</td>
<td>Spanish</td>
<td>wlatin1</td>
</tr>
<tr>
<td>fr</td>
<td>French</td>
<td>wlatin1</td>
</tr>
<tr>
<td>hu</td>
<td>Hungarian</td>
<td>wlatin2</td>
</tr>
<tr>
<td>it</td>
<td>Italian</td>
<td>wlatin1</td>
</tr>
<tr>
<td>iw</td>
<td>Hebrew</td>
<td>whebrew</td>
</tr>
<tr>
<td>ja</td>
<td>ja_JP</td>
<td>shift-jis</td>
</tr>
<tr>
<td>ko</td>
<td>ko_KR</td>
<td>euc-kr</td>
</tr>
<tr>
<td>nl</td>
<td>Dutch</td>
<td>wlatin1</td>
</tr>
<tr>
<td>no</td>
<td>Norwegian</td>
<td>wlatin1</td>
</tr>
<tr>
<td>pb</td>
<td>pt_BR</td>
<td>wlatin1</td>
</tr>
<tr>
<td>pl</td>
<td>Polish</td>
<td>wlatin2</td>
</tr>
<tr>
<td>pt</td>
<td>Portuguese</td>
<td>wlatin1</td>
</tr>
<tr>
<td>ru</td>
<td>Russian</td>
<td>wcyrillic</td>
</tr>
</tbody>
</table>
Configure SAS Data Access

(Optional) Configure Java for the ACCELWHERE Option

Important: If you want to configure your Java installation to improve Hadoop cluster processing speed, perform these tasks.

The ACCELWHERE option that is available with SAS Scalable Performance Data Engine leverages MapReduce when interacting with HDFS. It improves processing speed by optimizing data subsetting that occurs in the Hadoop cluster. For more information about the ACCELWHERE option, see WHERE Processing Optimization with MapReduce in SAS 9.4 and SAS Viya 3.4 Programming Documentation SAS SPD Engine: Storing Data in the Hadoop Distributed File System.

To enable the ACCELWHERE option for your Java installation:

1. Go to the location where Java is installed. If you are unsure of the location, the value for the JAVA_HOME environment variable is the fully qualified pathname of the top level of the Java directory tree.

2. Determine whether the JAVA_HOME/lib/tools.jar file exists. If it exists, then the ACCELWHERE option is already enabled and no further action is required. If it does not exist, continue with these steps to copy a tools.jar file to the appropriate location.

3. At the top level of the JAVA_HOME directory, create a subdirectory named lib.

   ```
   mkdir lib
   ```

4. Find out the version of Java that you are using. Most deployments of Java have a version number in the name of the directory that is used as JAVA_HOME. For example, if the directory is named jre1.8.0_144,
you are using Java version 1.8.0_144. Similarly, if the directory is named `jdk1.8.0_161`, you are using Java version 1.8.0_161. If the directory name does not contain a version number, you should consult with your system administrator to find out the version of Java that is installed.

5 Locate a copy of the `tools.jar` file from the version of the JDK that matches the version of Java that is installed. Here are two methods for locating a copy of the `tools.jar` file:

- Download the correct version of the JDK from the Oracle website and unpack the downloaded file to find the `tools.jar` file.
- Look in an existing Java installation for the correct version of the JDK.

6 Copy the located `tools.jar` file to the `lib` directory that you created.

7 Repeat these steps for each machine that runs SAS software.

---

**Configure SAS Data Science**

**Software Order Associated with SAS Data Science**

One other software order is associated with deploying SAS Data Science. The software order contains SAS Embedded Process for Hadoop and SAS Embedded Process for Teradata on Linux. The Software Order Email (SOE) specifies the location of the deployment documentation: SAS Embedded Process: Deployment Guide. You should deploy this order only if you are using SAS in-Database Technologies for Hadoop or SAS in-Database Technologies for Teradata.

**Note:** The SOE for the associated order does not refer to SAS Data Science explicitly.

---

**Configure SAS Event Stream Processing**

**Complete SAS Event Stream Processing Setup**

If your order included SAS Event Stream Processing, take a few steps to complete the deployment. Otherwise, you can skip this section.

**Enable Metering for ESP Servers**

The deployment process applies the product license on each machine where you have deployed SAS Event Stream Processing. However, additional steps are required in order to enable the license. You must set up and run at least one metering server to track the number of incoming events and to maintain event counts.

The metering server aggregates counts that are based on the license, the source window, and the hour of day. It stores aggregated results so that a client can query and track the total volume of messages that are processed. Enabling the metering server ensures that your ESP server is in compliance with the terms of its license. Event metering is not required on development servers because they do not contribute to the event volume that is assigned to a license.

1 Log on to the Windows server as an administrator.

2 Type `cmd` in the Windows Search box. In the search results, right-click `Command Prompt` and select `Run as Administrator`.  

---
3 Run the following command:

```bash
%DFESP_HOME%\bin\dfesp_metering.bat -d
```

The `-d` argument creates a log file in the configuration directory.

For more information about the metering server, see Using the Metering Server in the SAS Event Stream Processing user documentation.

### Start SAS Event Stream Processing Studio and Log On

Additional steps might be required to use SAS Event Stream Processing Studio, which provides a user interface for creating models. It is automatically started during the installation. However, you can start it manually if you find that the service is not running.

1 Verify that you have set the required environment variables. For more information, see “Set Environment Variables for SAS Event Stream Processing” on page 26.

2 (Optional) Verify that the SAS Event Stream Processing Studio service is running. Click **Start**, and enter `services.msc` in the **Search** box. Select `services.msc` from the search results.

   The **Services** panel is displayed.

3 Scroll through the list of services and locate the **SAS Event Stream Processing Studio** service. If required, click the **Start** link to start the service.

4 When the service is running, you can access the SAS Event Stream Processing Studio user interface from a web browser that is running on Windows or Linux. The URL format depends on your deployment topology:

   ```
   scheme://reverse-proxy-server/SASEventStreamProcessingStudio
   scheme://esp-studio-hostname:port/SASEventStreamProcessingStudio
   ```

   In a programming-only deployment, the scheme is http. In a full deployment, the scheme is https.

   For **reverse-proxy-server**, specify the hostname of the machine that you assigned to the [httpproxy] host group in the inventory file. Use this format when SAS Event Stream Processing Studio uses the same authentication method and proxy server as other SAS Viya products.

   For **esp-studio-hostname** and **port**, specify values that are appropriate for your deployment. Use this format when SAS Event Stream Processing Studio is an independent installation that does not use the same authentication method and proxy server as other SAS Viya products.

   The default port is 8080.

5 Start the ESP server. For more information, see “Start the ESP Server” on page 49.

### Start the ESP Server

When the deployment script has completed, the SAS Event Stream Processing processes are already running. Before you can open or create a model in SAS Event Stream Processing Studio, you must start the ESP server.

If you have deployed SAS Event Stream Manager, you can take some additional steps to set up a connection between the ESP server and SAS Event Stream Manager. For more information, see “Start the ESP Server” on page 51.

To start an ESP server:

1 Open a command prompt by clicking **Start** and entering `cmd` in the **Search** box.

2 Start the ESP server. Here is an example of the command:

   ```bash
   $DFESP_HOME\bin\dfesp_xml_server
   ```
The values that provide server start-up instructions are defined in the esp-properties.yml configuration file. For more information, see Server Configuration Properties.

3 The following message is displayed:

Access control disabled (permissions.yml not present)

The file that is referenced is required only to enable access control on the ESP server. You can ignore this message.

For more information about the ESP server, see SAS Event Stream Processing: Using the ESP Server.

**Log on to Streamviewer**

SAS Event Stream Processing Streamviewer is a web-based client that visualizes events that stream through event stream processing models. Streamviewer is installed automatically along with SAS Event Stream Processing.

When the deployment process has completed, take the following steps to access Streamviewer:

1. The Streamviewer process is started automatically during the deployment. If it is not running, start the Streamviewer service from the Windows Services panel.

2. Open the following URL:

   http://ESP-server-host-name/SASEventStreamProcessingStreamviewer

   For ESP-server-host-name, substitute the host name of the machine where Streamviewer is installed.

3. Enter your user ID and password and click Sign in.

When you successfully log on to Streamviewer, the home page appears.

**Encryption and Authentication Options**

SAS Event Stream Processing provides optional encryption and authentication features. You can enable encryption on TCP/IP connections within an event stream processing engine. You can also configure ESP servers to require client authentication for SAS TCP/IP clients.

To enable encryption, the OpenSSL libraries must be installed on all computer systems that run the ESP server and clients. Version 1.0.2 or later of the Transport Layer Security (TLS) Protocol is required in order to take advantage of ECDH support for encryption ciphers used in encrypted connections.

Authentication and encryption apply to the following ESP server APIs:

- The ESP Server (XML Server) HTTPS API
  - Connections that are created by a client to communicate with an ESP server
  - Connections that are created by a file and socket connector or adapter that acts as a socket client or server
  - Connections that are created by the Streamviewer component (streamviewer.html) to communicate with the ESP server using the HTTPS protocol

- C, Java, or Python Publish/Subscribe API
  - Connections that are created by a client that uses the C, Java, or Python Publish/Subscribe API to communicate with an ESP server
  - Connections that are created by an adapter to communicate with an ESP server

Configuration of these security options has been greatly simplified in recent releases of SAS Event Stream Processing. For more information about enabling security for an ESP server or for Streamviewer, see SAS Event Stream Processing: Security.
**Complete SAS Event Stream Manager Setup**

If your order included SAS Event Stream Manager, you must complete setup after the installation has completed. Otherwise, skip this section.

**Log On to SAS Event Stream Manager**

If your order included SAS Event Stream Manager, it is installed in your environment by the playbook. SAS Event Stream Manager uses SAS Logon Manager for logon functionality. SAS Logon Manager requires LDAP for user authentication.

1. Open SAS Event Stream Manager from a URL with the following format:

   https://reverse-proxy-server/SASEventStreamManager

   For `reverse-proxy-server`, use the host name from the machine that you assigned to the [httpproxy] host group in the inventory file.

   The Sign In to SAS window is displayed.

2. Enter your user ID and password, and click Sign In.

   Successful logon to the SAS Event Stream Manager user interface indicates that the software has been installed correctly.

**Start the ESP Server**

When the deployment script has completed, the SAS Event Stream Processing processes are already running. Before you can open or create a model in SAS Event Stream Processing Studio, you must start the ESP server.

In addition, to manage SAS Event Stream Processing instances with SAS Event Stream Manager, you must manually locate and define ESP servers that are running in your environment. However, you can start your ESP servers with some additional instructions that enable secure, persistent sockets between SAS Event Stream Manager and ESP servers. If you have deployed SAS Event Stream Manager, the optional steps are recommended.

To start an ESP server:

1. Provide SAS Logon Manager with a client ID and client secret for SAS Event Stream Manager.

   Run a curl command to request a registration token for a new client. In this example, the client is named app:

   ```
   curl -X POST "http://localhost/SASLogon/oauth/clients/consul?callback=false&serviceID=app" -H "X-Consul-Token: 29c4700f-ea89-41cd-8bc4-4198ccaa5bf9"
   ``

   **Note:** This request must pass a `callback=false` query string parameter and authenticate directly by passing a SAS Configuration Server (Consul) token. If the Consul token on your local machine is valid, SAS Logon Manager returns the OAuth access token for registration in the response.

2. Use the registration token to register the client ID. This step establishes the ESP server as a new client of SAS Logon Manager. Run the following curl command:

   ```
   "client_id": "client-id",
   "client_secret": "client-secret",
   }
   ```

3. Configure SAS Event Stream Processing...
Note: You can find more information about the required steps to configure a new client for SAS Logon Manager in Obtain an Access Token Using Password Credentials in SAS Viya Administration: Authentication.

3 Create an XML file with filename esm.xml. Make sure that it uses the required syntax.

Here is an example:

```xml
<esm>
  <server name="SAS-Event-Stream-Manager-host">
    <url>http://fully-qualified-host-name</url>
    <auth>
      <clientId>client-ID</clientId>
      <clientSecret>client-secret</clientSecret>
      <user>user-name</user>
      <password>password</password>
    </auth>
  </server>
</esm>
```

a For SAS-Event-Stream-Manager-host, substitute the host name of the machine where SAS Event Stream Manager is running.

b For fully-qualified-host-name, substitute the fully qualified domain name of the machine where the SAS Event Stream Manager server is running.

c For client-ID, substitute the client ID that you provided to SAS Logon Manager for the SAS Event Stream Manager instance.

d For client-secret, substitute the client secret that you provided to SAS Logon Manager for SAS Event Stream Manager.

e For user-name, substitute a user name for an LDAP user account that is valid for use with SAS Logon Manager.

f For password, substitute the password that corresponds to the user account that you specified.

Repeat the `<server></server>` section of the file as many times as required to accommodate all SAS Event Stream Manager servers.

4 Save the file in a network-accessible directory.

5 Open a command prompt by clicking Start and entering cmd in the Search box.

6 Start the ESP server. Here is an example of the command:

```
$DFESP_HOME\bin\dfesp_xml_server -esm file:\\esm.xml
```

The `-esm file:\\esm.xml` argument is recommended if you have deployed SAS Event Stream Manager. It is ignored if you have not deployed SAS Event Stream Manager. Other values that provide server start-up instructions are defined in the esp-properties.yml configuration file. For more information, see Server Configuration Properties.

7 The following message is displayed:

```
Access control disabled (permissions.yml not present)
```
The file that is referenced is required only to enable access control on the ESP server. You can ignore this message.

When it is started with the optional `-esm file: \esm.xml` argument, the ESP server automatically registers with SAS Event Stream Manager, which can then manage it. The `esm.xml` file instructs the ESP server where to locate SAS Event Stream Manager. The ESP server registers itself with SAS Logon Manager as a new client with a new secret. SAS Logon Manager can then provide a token that enables the ESP server to set up a persistent web socket for secure communications with SAS Event Stream Manager.

For more information about the ESP server, see *SAS Event Stream Processing: Using the ESP Server*. 
Validating the Deployment

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Verify Access to SAS Logon and SAS Drive

Note: The following information applies only if you are performing a full deployment. If you are performing a programming-only deployment, skip this section.

To verify that you can access SAS Logon and SAS Drive:

1. To verify SAS Logon, open it using a URL with this format:
   http://host-address/SASLogon

2. To verify SAS Drive, open it using a URL with this format:
   http://host-address/SASDrive

For more information about SAS Drive, see SAS Drive in SAS Drive 1.2: Getting Started.

Log On to Your Version Of SAS Studio

Your version of SAS Studio depends on which type of deployment you performed:

- If you deployed a programming-only environment, then your environment contains SAS Studio 4.4.
If you deployed a full environment, then your environment contains both SAS Studio 4.4 and SAS Studio 5.1. By default, you will log on to SAS Studio 5.1.

To ensure that your default version of SAS Studio has been deployed correctly and is working, log on to it:

1. Open SAS Studio from a URL with this format:
   - For SAS Studio 4.4:
     http://hostname/SASStudio
   - For SAS Studio 5.1:
     http://hostname/SASStudioV

   Make a note of this URL to share with any other users of your SAS Viya software, as described in “Share Important Deployment Information with the Administrators” on page 61.

2. Log on using the credentials for your operating system account.

Note: To log off from SAS Studio, click Sign Out on the toolbar. Do not use the Back button on your web browser.

---

**SAS Viya File Locations**

After the deployment process has completed, default directories will be populated with installation and configuration files. The following table lists default directory and file locations that you can verify as part of deployment validation. The table also describes recommended locations for installation files to assist you in locating them later:

<table>
<thead>
<tr>
<th>Directory Path</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>%ProgramFiles%\SAS\Viya</td>
<td>SAS Viya home directory, which contains the application files. The default location is typically C:\Program Files\SAS\Viya.</td>
</tr>
<tr>
<td>%ProgramData%\SAS\Viya</td>
<td>SAS Viya configuration directory.</td>
</tr>
<tr>
<td>%ProgramFiles%\SAS\SPRE</td>
<td>Home directory for the SAS Foundation programming runtime environment and files to support SAS 9.4 integration. The default location is typically C:\Program Files\SAS\SPRE.</td>
</tr>
<tr>
<td>%USERPROFILE%\sas_repos</td>
<td>Default location of the SAS software repositories that are created and populated, based on your order, when you create a mirror repository.</td>
</tr>
<tr>
<td>%LOCALAPPDATA%\mirrormgr \mirrormgr.log</td>
<td>Default location for SAS Mirror Manager logs.</td>
</tr>
<tr>
<td>%ProgramData%\sas\viya\data\cas \default</td>
<td>Default location for persistent storage for the predefined system caslibs and the Public caslib. You can change this location by editing the vars.psd1 file. For more information, see “Set Up the CAS Data Directory” on page 32.</td>
</tr>
<tr>
<td>Directory Path</td>
<td>Description</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------</td>
</tr>
<tr>
<td>C:\sas\install</td>
<td>Recommended location where you can uncompress the sas-viya-deployment-script.zip file. You created this ZIP file when you used the SAS Orchestration CLI to create the deployment scripts.</td>
</tr>
<tr>
<td>C:\sas\install\sas-viya-deployment-script\powershell-deployment</td>
<td>Location for all files (EXE and BAT) that are required for the deployment. Individual files that provide configuration options are stored in subdirectories of \powershell-deployment. When you uncompress the sas-viya-deployment-script.zip file, it creates and populates these subdirectories.</td>
</tr>
<tr>
<td>C:\sas\install\sas-viya-deployment-script\downloads</td>
<td>Directory that is created automatically when you run the setup.bat script to install SAS Viya. This directory is used for temporary storage of installation files that are downloaded from SAS secure repositories. To conserve space, you can delete the MSI files in the \downloads directory after the deployment has been completed.</td>
</tr>
<tr>
<td>%ProgramData%\SAS\Viya\var\log \service\default*.log</td>
<td>Directories where logs are generated. For service, substitute the name of the microservice, such as Identities, or the name of the service, such as Consul.</td>
</tr>
<tr>
<td>%ProgramData%\SAS\SPRE\var\log \service\default*.log</td>
<td>Note: The SPRE directories contain files for the SAS Programming Runtime and for the SAS Foundation programming environment.</td>
</tr>
<tr>
<td>%ProgramData%\SAS\Viya\etc \SASSecurityCertificateFramework</td>
<td>Default location of SAS-provided TLS certificates to enable encryption of data in motion.</td>
</tr>
<tr>
<td>%ProgramData%\SAS\Viya\backup</td>
<td>Also referred to as “local vault.” The location where the backup files for data sources are created. The local vault location cannot be changed. As a last step in the backup process, the contents of the local vault are moved to the shared vault. The SAS Viya administrator sets the location of the shared vault parameter in SAS Environment Manager as a post-deployment step. For more information, see Backup and Restore: Terms and Concepts in SAS Viya Administration.</td>
</tr>
<tr>
<td>%ProgramData%\SAS\Viya\var\log \deploymentBackup\default</td>
<td>Locations for backup activity logs.</td>
</tr>
<tr>
<td>%ProgramData%\SAS\Viya\var\log \backupagent\default</td>
<td></td>
</tr>
</tbody>
</table>

**Access CAS Server Monitor**

**Note:** This section is applicable only if you have a programming-only deployment. If you have a full deployment, skip this section.

To verify that CAS Server Monitor has been successfully deployed, access it by opening a web browser and entering the URL in the address field in the following format:

http://reverse-proxy-server/cas-shared-default-http

Here is an example:
Log on using one of the SAS Administrator users that you established in “Set Up Administrative Users” on page 41.

**Access SAS Environment Manager**

**Note:** This section is applicable only if you have a full deployment. If you have a programming-only deployment, skip this section.

1. Open SAS Environment Manager from a URL with the following format:
   
   https://reverse-proxy-server/SASEnvironmentManager/

2. Sign on as one of the SAS Administrators that you set up in “Set Up Administrative Users” on page 41.

**Verify SAS Message Broker**

**Note:** This section is applicable only if you have a full deployment. If you have a programming-only deployment, skip this section.

1. Open a browser and go to the following address:
   
   **Note:** For information about resetting credentials, see “Change the Administrative User Password for SAS Message Broker” on page 43.

   - If HTTPS is enabled:
     
     https://RabbitMQ-IP-address:15672/#/
     
     **Note:** If you did not add compliant certificates and instead kept the default security settings and certificates, you will see the Your connection is not private message. SAS recommends that you replace the certificates before you give end users access to SAS Viya. For details, see HTTPS Access to SAS Message Broker.

   - If HTTP is enabled:
     
     http://RabbitMQ-IP-address:15672/#/

     If the RabbitMQ logon window appears, then SAS Message Broker is functioning as expected.

**Verify SAS Infrastructure Data Server**

**Note:** This section is applicable only if you have a full deployment. If you have a programming-only deployment, skip this section.

Use these steps to verify that SAS Infrastructure Data Server has been deployed correctly.

1. Open a Windows PowerShell Integrated Scripting Environment (ISE).

2. Change the directory to the sasdatasvrc script directory. By default, it is the C:\Program Files\SAS\Viya\libexec\sasdatasvrc\script directory.
Overview of Data Access Verification

Overview

Your version of SAS Studio depends on which type of deployment you performed:

- If you deployed a programming-only environment, then your environment contains SAS Studio 4.4.
- If you deployed a full environment, then your environment contains both SAS Studio 4.4 and SAS Studio 5.1.
  By default, you will log into SAS Studio 5.1.

After starting a CAS session, run the SAS code as specified in the verification section for your data connector(s). If any of the verification steps for data access return an error, perform the appropriate configuration steps again.

Verify with SAS Studio 4.4

To verify the SAS Data Connectors:

1. Open SAS Studio from a URL with this format:
   http://hostname/SASStudio

2. Log on using the credentials for your operating system account.

3. Start a new CAS session.
   a. In the navigation pane, open the Snippets section.
   c. Right-click Create CAS Connection and select Open. The snippet opens in the code editor.
      In the code, specify the cashost and the casport. (Default is casport of 5570).
   d. In the toolbar, click to run the new CAS session code.
   e. Right-click New CAS Session and select Open. The snippet opens in the code editor.
   f. In the toolbar, click to run the new CAS session code.

Run the SAS code as specified in the verification section for your data connector(s). If any of the verification steps for data access return an error, perform the appropriate configuration steps again.

To verify the database, call the function by running the following command:

C:\Program Files\SAS\Viya\libexec\sasdatasvrc\script> .\Invoke-PostCheckPostgres.ps1 -batchJob

Here are typical results:

Config Environment Variable file located:
C:\ProgramData\SAS\Viya\etc\sasdatasvrc\postgres\node0\ConfigEnvironmentVariables.psd1
abccom16:5432 - accepting connections
Postgres server check was successful
Verify with SAS Studio 5.1

1. Open SAS Studio from a URL with this format:
   
   http://hostname/SASStudio

2. Log on using the credentials for your operating system account.

3. Start a new CAS session.
   
   a. In the left navigation pane, click on the Snippets icon.
   
   
   c. Right-click New CAS Session and select Open. The snippet opens in the code editor.
   
   d. In the toolbar, click to run the new CAS session code.

Run the SAS code as specified in the verification section for your data connector(s). If any of the verification steps for data access return an error, perform the appropriate configuration steps again.

Verify SAS/ACCESS Interface to ODBC

Note: The information in this section is applicable only if you ordered SAS/ACCESS Interface to ODBC (on SAS Viya).

1. From SAS Studio, edit and run the following SAS code to verify the SAS/ACCESS to ODBC LIBNAME statement:

   libname olib odbc dsn="DSN-from-odbc.ini" user="user-ID" password="password";

   If SAS/ACCESS to ODBC was successfully deployed, the execution of the LIBNAME statement will return results without error.

2. From SAS Studio, edit and run the following SAS code to verify SAS Data Connector to ODBC:

   caslib odbclib datasource=(srctype="odbc", username="user-ID", password="password", odbc_dsn="DSN-from-odbc.ini");

   proc casutil;
   list files incaslib="odbclib";
   run;

   If the data connector was successfully deployed, the results are the names of the tables in ODBC.

   If an error was returned on the execution of the LIBNAME statement or no table information was returned for the data connector, you should perform the configuration steps again.
Completing the Deployment

Share Important Deployment Information with the Administrators
If other persons are responsible for administering your SAS deployment, SAS recommends that you share the following important information with them:

- The deployment type: Did you deploy the programming interface only or did you perform a full deployment? The type was determined by whether you used programming-only orchestration or not (see “Specify the Deployment Type” on page 22).

- The location of the directory on each machine where you stored deployment and maintenance files. For more information about this directory, see “Store the Deployment Scripts” on page 23.

- The URL to access the software: What products did you deploy?
  - If you deployed products from the SAS Event Stream Processing Family, share the URL for SAS Event Stream Processing Studio: https://reverse-proxy-server/SASEventStreamProcessingStudio.
    - If your order also included SAS Event Stream Manager, share the following URL:
      https://reverse-proxy-server/SASEventStreamManager
  - If you deployed the programming interface only, your administrators should use SAS Studio. The URL is http://reverse-proxy-server/SASSudio.
  - If you performed a full deployment, your administrators should use SAS Environment Manager. You used SAS Environment Manager to configure your environment for a full deployment as described in “Configure Your Environment with SAS Environment Manager” on page 39. Use the same URL that you used in that section.

Next Steps for SAS Event Stream Processing Users
If your order included SAS Event Stream Processing, you might need to consult some additional documentation:
The Streamviewer component was also installed along with SAS Event Stream Processing. Streamviewer is a graphical user interface that enables you to visualize events as they stream through event stream processing models. Its use is optional.

To access Streamviewer, navigate to the following URL:
https://reverse-proxy-server/SASEventStreamProcessingStreamviewer

For reverse-proxy-server, substitute the host name from the machine that you assigned to the [httpproxy] host group in the inventory file.

Log in when prompted.

For a complete guide to Streamviewer usage, see Visualizing Event Streams with Streamviewer.

If your order included SAS Event Stream Processing for CAS, you now have the option to use an additional CAS action set, espCluster. A second SAS Event Stream Processing action set, loadStreams, is included with all SAS Viya orders. For more information, see Using SAS Event Stream Processing with SAS Cloud Analytic Services Actions in SAS Event Stream Processing: Advanced Topics.

Read additional documentation about SAS Event Stream Processing. Links to all SAS Event Stream Processing documentation are available on the SAS Event Stream Processing product page. All product user documentation is also available via single sign-on from the SAS Event Stream Processing user interfaces.

Refer to Additional Documentation

- To perform initial administrative tasks, see SAS Viya Administration: Initial Tasks.
- To locate administration and additional documentation for solutions and offerings, go to the SAS Viya documentation page:
  http://support.sas.com/documentation/onlinedoc/viya/index.html
- To locate usage information, refer to the Help that is available from the SAS Viya product and administrative interfaces.

SAS Viya File Locations

After the deployment process has completed, default directories will be populated with installation and configuration files. The following table lists default directory and file locations that you can verify as part of deployment validation. The table also describes recommended locations for installation files to assist you in locating them later:

<table>
<thead>
<tr>
<th>Directory Path</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>%ProgramFiles%\SAS\Viya</td>
<td>SAS Viya home directory, which contains the application files. The default location is typically C:\Program Files\SAS\Viya.</td>
</tr>
<tr>
<td>%ProgramData%\SAS\Viya</td>
<td>SAS Viya configuration directory.</td>
</tr>
<tr>
<td>Directory Path</td>
<td>Description</td>
</tr>
<tr>
<td>----------------</td>
<td>-------------</td>
</tr>
<tr>
<td>%ProgramFiles%\SAS\SPRE</td>
<td>Home directory for the SAS Foundation programming runtime environment and files to support SAS 9.4 integration. The default location is typically C:\Program Files\SAS\SPRE.</td>
</tr>
<tr>
<td>%USERPROFILE%\sas_repos</td>
<td>Default location of the SAS software repositories that are created and populated, based on your order, when you create a mirror repository.</td>
</tr>
<tr>
<td>%LOCALAPPDATA%\mirrormgr \mirrormgr.log</td>
<td>Default location for SAS Mirror Manager logs.</td>
</tr>
<tr>
<td>%ProgramData%\sas\viya\data\cas \default</td>
<td>Default location for persistent storage for the predefined system caslibs and the Public caslib. You can change this location by editing the vars.psd1 file. For more information, see “Set Up the CAS Data Directory” on page 32.</td>
</tr>
<tr>
<td>C:\sas\install</td>
<td>Recommended location where you can uncompress the sas-viya-deployment-script.zip file. You created this ZIP file when you used the SAS Orchestration CLI to create the deployment scripts.</td>
</tr>
<tr>
<td>C:\sas\install\sas-viya-deployment-script\powershell-deployment</td>
<td>Location for all files (EXE and BAT) that are required for the deployment. Individual files that provide configuration options are stored in subdirectories of \powershell-deployment. When you uncompress the sas-viya-deployment-script.zip file, it creates and populates these subdirectories.</td>
</tr>
<tr>
<td>C:\sas\install\sas-viya-deployment-script\downloads</td>
<td>Directory that is created automatically when you run the setup.bat script to install SAS Viya. This directory is used for temporary storage of installation files that are downloaded from SAS secure repositories. To conserve space, you can delete the MSI files in the \downloads directory after the deployment has been completed.</td>
</tr>
<tr>
<td>%ProgramData%\SAS\Viya\var\log \service\default*.log</td>
<td>Directories where logs are generated. For service, substitute the name of the microservice, such as Identities, or the name of the service, such as Consul. Note: The SPRE directories contain files for the SAS Programming Runtime and for the SAS Foundation programming environment.</td>
</tr>
<tr>
<td>%ProgramData%\SAS\Viya\etc \SASSecurityCertificateFramework</td>
<td>Default location of SAS-provided TLS certificates to enable encryption of data in motion.</td>
</tr>
<tr>
<td>%ProgramData%\SAS\Viya\backup</td>
<td>Also referred to as “local vault.” The location where the backup files for data sources are created. The local vault location cannot be changed. As a last step in the backup process, the contents of the local vault are moved to the shared vault. The SAS Viya administrator sets the location of the shared vault parameter in SAS Environment Manager as a post-deployment step. For more information, see Backup and Restore: Terms and Concepts in SAS Viya Administration.</td>
</tr>
<tr>
<td>%ProgramData%\SAS\Viya\var\log \deploymentBackup\default</td>
<td>Locations for backup activity logs.</td>
</tr>
</tbody>
</table>
Note: The ProgramData directory location might be hidden by default in Microsoft Windows File Explorer.
Managing Your Software

Overview

What Is an Update?
An update replaces some or all of your deployed software with the latest versions of that software. Updated software is intended to be compatible with existing configuration, content, and data. To perform an update, you will run the same tools that were run during the initial deployment. You do not need a new order to perform an update. You might determine that your software needs updating or you might be notified by SAS that updates are available.

What Is an Add-On Product?

What Is an Upgrade?
What Is an Add-On Product?

An add-on product is new software that you can order and then install with your currently deployed software. You will need a new order for an add-on product.

Because an add-on product is added to the currently deployed software in an environment, you might need to expand your environment's capacity before installing an add-on product.

What Is an Upgrade?

An upgrade adds significant feature changes or improvements to your deployed software. To perform an upgrade, you will run the same tools that were run during the initial deployment. You will need a new order to upgrade your deployed software. Add-on products that are included in the order will be installed as part of the upgrade process. An upgrade might require changes to the deployed software's configuration.

You might determine that your software needs upgrading or you might be notified by SAS that upgrades are available. SAS recommends creating a backup of the deployed software environment before performing an upgrade.

Updating Your SAS Viya Software

Overview

An update replaces some or all of your deployed software with the latest versions of that software. You perform the update with the same command that was used to install SAS Viya and use the same software order.

- To see what updates are available for your deployed software, go to the SAS Viya Hot Fix Availability web page at http://ftp.sas.com/techsup/download/hotfix/HF2/Viya_home.html.
- You can update your deployment from programming-only to full. See “Update the Deployment Type” on page 69.
- SAS Data Science is deployed as programming-only. However, to obtain the visual interface for the components of SAS Data Science, different products must be licensed. The resulting order should be deployed using the instructions in “Add to Your SAS Viya Software” on page 69. Contact your SAS account representative to determine the exact products that are required.

An outage period is required during which all SAS Viya services must be stopped and then restarted.

Note: The process preserves any user-modified configuration values in the vars.psd1 file, but changes made to other files in the deployment might be lost. Therefore, SAS recommends that you make changes to vars.psd1 when possible in order to avoid any loss of customizations that you made to other files.

Before you begin, you should review the “Introduction” on page 1, the “System Requirements” on page 5, and “Pre-installation Tasks” on page 19 chapters of this guide.

You will need the location of the directory on each machine where you stored deployment and maintenance files. For more information about this directory, see “Store the Deployment Scripts” on page 23.

See SAS Note 64084 to determine whether a symbolic link was used during your deployment of SAS Viya to place the configuration files into a location other than the default %ProgramData%\SAS directory. Refer to SAS Note 64084 before performing the tasks in this section if a symbolic link was used for your deployment.

If you are using a PDF version of this guide, go to the Deployment Guides web page at https://support.sas.com/en/documentation/install-center/sas-viya/deployment-guides.html and verify that you have the latest version of the deployment documentation before you start the update process. The release date of each document is located in the bottom right corner of the front page.
**User Requirements**

You must have administrator privileges for the machine.

**(Optional) List the Packages That Are Available for Update**

**Deployments without a Mirror Repository**

To list the packages that are available for the update process:

1. To list the packages that are available for the update process, run the following command:

   ```
   setup.bat -update
   ```

   Available updates are displayed, followed by a prompt.

2. At the prompt **Do you wish to download updates? [yes/no]**, review the available updates and then enter **no**.

**Deployments with a Mirror Repository**

*Important:* How you list packages for deployments with a mirror repository depends on whether you have internet access.

**With Internet Access**

To list packages in a mirror repository in a deployment with internet access:

1. To list the packages that are available for the update process, run the following command on the machine where the mirror repository is located:

   ```
   mirrormgr mirror diff --deployment-data path-to-deployment-zip-file-from-SOE
   --path path-to-mirror-destination --latest
   ```

2. To synchronize the deployment's mirror repository with SAS' mirror repository, run the following command on the machine where the mirror repository is located:

   ```
   mirrormgr mirror --deployment-data path-to-deployment-zip-file-from-SOE
   --path path-to-mirror-destination --latest
   ```

**Without Internet Access**

To list packages in a mirror repository in a deployment without internet access:

1. To list the packages that are available for the update process, run the following command on the machine where the connected mirror repository is located:

   ```
   mirrormgr mirror diff --deployment-data path-to-deployment-zip-file-from-SOE
   --path path-to-mirror-destination --latest
   ```

2. Before performing an update, synchronize the mirror repository with SAS. To synchronize, run the following command on the machine where the connected mirror repository is located:

   ```
   mirrormgr mirror --deployment-data path-to-deployment-zip-file-from-SOE
   --path path-to-mirror-destination --latest
   ```
3 Move the files from the machine where the connected mirror repository is located to the machine where the unconnected mirror repository is located.

**Prepare to Update SAS Viya Software**

If the user performing the update is different from the user that performed the original deployment, or the passwords for the cas or postgres accounts have changed, the casUser.xml and postgresUser.xml files must be regenerated using the respective encryptCasUser.bat and encryptPostgresUser.bat scripts. See “Specify Credentials for the cas User Account” on page 29 and “Specify Credentials for the postgres User Account” on page 30.

**Update Your SAS Viya Software**

To update a SAS Viya deployment on Windows, perform one of the following two options for each Windows machine in the deployment.

**Review Available Updates Before Updating**

1 Stop all SAS Viya services. For more information, see Start and Stop Servers and Services in General Servers and Services:SAS Viya Administration.

2 (Optional) To verify that the Windows deployment is correctly configured:
   a Download and install the current version of SAS Viya Deployment Assistant for Windows. See “Deploy SAS Viya Deployment Assistant for Windows” on page 33.
   b To programmatically remediate settings in your Windows deployment, run the SAS Viya Deployment Assistant for Windows using -remediate in the command line. See “Configure the Kerberos Environment and Tune Windows Programmatically” on page 36.

3 To list the packages that are available for the update process, run the following command:
   ```
   setup.bat -update
   ```

4 If no updates are available, the following prompt will be displayed:
   ```
   No updates available
   Press any key to continue . . .
   ```

   Press any key to exit the update prompt.

5 If updates are available, a prompt similar to the following example will be displayed:
   ```
   Updates found:
   Package          Installed Version -> Update Version
   msiespstvwr      5.3.0.1 -> 5.3.1.1
   Do you wish to download updates? [yes/no]
   ```

6 To download and install the updates, enter yes.

7 The following prompt will be displayed:
   ```
   Downloading packages...
   Downloading msiespstvwr
   Download complete
   Install complete.
   Press any key to continue . . .
   ```

   Press any key to exit the update prompt.

8 To configure the updated products and start all of the services, run the following command:
Update without Reviewing Available Updates

1. Stop all SAS Viya services. For more information, see Start and Stop Servers and Services in General Servers and Services: SAS Viya Administration.

2. (Optional) To verify that the Windows deployment is correctly configured:
   b. To programmatically remediate settings in your Windows deployment, run the SAS Viya Deployment Assistant for Windows using -remediate in the command line. See “Configure the Kerberos Environment and Tune Windows Programmatically” on page 36.

3. Run the following command:
   ```
   setup.bat -update -noprompt
   ```
   Available updates will be displayed, downloaded, and installed.

4. To configure the updated products and start all of the services, run the following command:
   ```
   setup.bat -config
   ```

Update the Deployment Type

You can update your deployment from programming-only to full.

Note: If you make changes to the proxy.conf file and then rerun the deployment script, those changes are overwritten. A copy of the proxy.conf should be created in the /etc/httpd/conf.d directory when you rerun the deployment script. Use this copy with the instructions in “Post-installation Tasks” on page 39 to make changes to the updated proxy.conf file.

To update a SAS Viya deployment from programming-only to full:

1. Complete the task in “Create the Deployment Scripts” on page 21.
   Note: Do not select the programming-only option in the SAS Orchestration CLI when generating the new playbook. The default deployment script generated will be for a full deployment.

2. To change from a programming-only deployment to a full deployment, complete the configuration for the visual attributes of the deployment. For more information, see “Post-installation Tasks” on page 39.
   Note: When the programming-only interface is deployed, SAS Studio is accessible on port 7080. However, when updating from a programming-only deployment to a full deployment, SAS Studio uses a dynamically assigned port.

Add to Your SAS Viya Software

Overview

Here are some common scenarios for adding SAS Viya software to your existing deployment:

- Adding new software from your initial SAS Viya order
You ordered software and did not install all of it

Deploying additional software from a new SAS Viya order

The additional software is not a part of your original SAS Viya order. You might have made another order and now have to download and deploy the new order.

An outage period is required during which all SAS Viya services must be stopped and then restarted.

**Note:** The process preserves any user-modified configuration values in the vars.psd1 file, but changes made to other files in the deployment might be lost. Therefore, SAS recommends that you make changes to vars.psd1 when possible in order to avoid any loss of customizations that you made to other files.

Before you begin, you should review the “Introduction” on page 1, the “System Requirements” on page 5, and “Pre-installation Tasks” on page 19 chapters of this guide.

You will need the location of the directory on each machine where you stored deployment and maintenance files. For more information about this directory, see “Store the Deployment Scripts” on page 23.

See [SAS Note 64084](https://support.sas.com/en/documentation/install-center/sas-viya/deployment-guides.html) to determine whether a symbolic link was used during your deployment of SAS Viya to place the configuration files into a location other than the default %ProgramData%\SAS directory. Refer to SAS Note 64084 before performing the tasks in this section if a symbolic link was used for your deployment.

If you are using a PDF version of this guide, go to the Deployment Guides web page at [https://support.sas.com/en/documentation/install-center/sas-viya/deployment-guides.html](https://support.sas.com/en/documentation/install-center/sas-viya/deployment-guides.html) and verify that you have the latest version of the deployment documentation before you start the update process. The release date of each document is located in the bottom right corner of the front page.

**User Requirements**

You must have administrator privileges for the machine.

**Prepare to Add SAS Viya Software**

SAS recommends that you create a backup of the deployed software environment before adding SAS Viya software to an existing deployment.

To prepare to add SAS Viya software:

1. If the user performing the SAS Viya software process is different from the user that performed the original deployment, or the passwords for the cas or postgres accounts have changed, the casUser.xml and postgresUser.xml files must be regenerated using the respective encryptCasUser.bat and encryptPostgresUser.bat scripts. See “Specify Credentials for the cas User Account” on page 29 and “Specify Credentials for the postgres User Account” on page 30.

2. If you are adding SAS Viya software to a SAS Viya deployment that used a mirror repository and you want to use a mirror repository again, download the current version of SAS Mirror Manager. For more information, see “(Optional) Create a Mirror Repository” on page 19.

3. When you add SAS Viya software, you receive a new Software Order Email (SOE) from SAS. Use your SOE to download the SAS Orchestration CLI.

4. Using the SAS Orchestration CLI that you downloaded, create new deployment scripts using the instructions on the SAS Orchestration Command Line Interface (CLI) download site. For more information, see “Create the Deployment Scripts” on page 21.

5. Extract the new deployment scripts to a location that is different from that of your original deployment scripts. For example, if you extracted your original deployment scripts to C:\ProgramData\SAS, you might extract the new deployment scripts to C:\ProgramData\SASasddon instead. Extract the new deployment scripts to a location that is different from the one that you used for your deployment for these reasons:

   - To preserve the original vars.psd1 file.
To ensure that the directory that contains the deployment scripts correctly reflects what is delivered. If the new deployment scripts are accidentally extracted over existing deployment scripts, the files that were removed in the new deployment scripts would still be available and could negatively affect the process for researching and resolving deployment issues.

To extract the new deployment scripts, see “Create the Deployment Scripts” on page 21.

6 Copy the casUser.xml and postgresUser.xml files that are used to store the encrypted passwords for the cas and postgres user accounts from the previously generated deployment scripting directory to the newly generated deployment scripting directory.

7 Follow the steps that are described in “Tune Your Windows System” on page 25 on the target machine before starting the add SAS Viya software process.

8 System requirements for RAM, CPU, and disk space are likely to change with each SAS Viya release. Verify that your environment meets the requirements that are listed in “System Requirements” on page 5.

Merge the User-Modified Files

Merging user-modified files includes the following actions:

- compare the existing deployment’s vars.psd1 file with the new vars.psd1 file
- find any post-deployment edits in the existing deployment’s vars.psd1 file
- update the new vars.psd1 file with any post-deployment edits in the existing deployment’s vars.psd1 file

You will find or create original, unedited versions of the vars.psd1 file from the original deployment. You will compare the three vars.psd1 files described here and edit the new vars.psd1 file.

This guide refers to the three types of vars.psd1 files as follows:

- vars_original.psd1 — the vars.psd1 file for the original SAS Viya deployment as it was received from SAS or created by SAS tools.
- vars_current.psd1 — the vars.psd1 file for your current SAS Viya deployment that might contain post-deployment edits.
- vars.psd1 — the new vars.psd1 file as it was received from SAS or created by SAS tools.

To merge the user-modified files:

1 Locate the existing vars.psd1 for your current SAS Viya deployment that might contain post-deployment edits, and save a copy of the file by renaming the file as vars_current.psd1.

2 Perform one of the two following steps:

   - If you have the original and unedited vars.psd1 that was generated by the SAS Viya Orchestration CLI during the original deployment, copy that unedited vars.psd1 file and save it with the name vars_original.psd1.
   - Otherwise, run the SAS Viya Orchestration CLI from the original deployment to create new and unedited SAS Viya deployment scripts using the original SOE attachments. Extract the vars.psd1 from the newly created deployment scripts. Name it vars_original.psd1.

3 Compare the file that is currently in use, vars_current.psd1, to the new file, vars.psd1.

4 Make a list of any variables that are present in vars_current.psd1 that are not present in vars.psd1.

5 Compare the list of variables that you made to vars_original.psd1.

   - Any variable in the list that is not present in vars_original.psd1 is probably a customization that you want to retain. Add the variable to vars.psd1.
Any variable in the list that is present only in vars_original.psd1 represents a deprecated variable. Do not add these variables to vars.psd1.

6 If you created a sitedefault.yml in the previous deployment, copy it to sitedefault_original.yml to use as reference for any future deployments.

Note: Do not edit sitedefault.yml or sitedefault_original.yml.

7 If TLS is enabled for the Windows deployment, perform the following steps.

a To preserve the output of the Enable-CAS-TLS.ps1 script in C:\ProgramData\SAS\Viya\etc\cas\default, locate the following environment variables in casconfig.lua:

   env.CAS_CLIENT_SSL_REQUIRED=true
   env.CAS_CLIENT_SSL_CERTSERIAL="190000AB8122B4DEC1D0AD1A780000000AB57"
   env.CAS_CLIENT_SSL_CERTISS="Company SHA2 Issuing CA02"

b Copy these environment variables and their values from casconfig.lua to the end of the casconfig_usermods.lua file, also located in C:\ProgramData\SAS\Viya\etc\cas\default.

For information about the Enable-CAS-TLS.ps1 script, see Configure CAS TLS to Use SAS Viya Default Certificates (Windows) in SAS Viya Administration / Data in Motion.

Add SAS Viya Software

To add SAS Viya software and update a SAS Viya deployment:

1 Stop all SAS Viya services. For more information, see Start and Stop Servers and Services in General Servers and Services: SAS Viya Administration.

2 If you have deployed SAS Event Stream Processing, perform the following steps:

a Stop the SAS Event Stream Processing Studio service from the Windows Services panel.

b If Streamviewer 5.2 is part of the current deployment, stop the Streamviewer 5.2 process:

   dfesp_xml_client -url "http://host-name:http-port/exit"

Replace host-name with the host name of the machine where Streamviewer 5.2 is running.

Replace http-port with the port number that you provided when you started Streamviewer 5.2 with the start-up script. For more information, see Examples for Starting Streamviewer on Windows.

c Stop the metering server:

   dfesp_xml_client -url "http://host-name:port/SASESP/exit"

Replace host-name:port with the host name and port of the machine where the metering server is running. By default, it uses port 31001.

3 Complete the tasks in “Data Source and Storage Requirements” on page 11, as appropriate.

4 (Optional) To verify that the Windows deployment is correctly configured:

a Download and install the current version of SAS Viya Deployment Assistant for Windows. See “Deploy SAS Viya Deployment Assistant for Windows” on page 33.

b To programmatically remediate settings in your Windows deployment, run the SAS Viya Deployment Assistant for Windows using -remediate in the command line. See “Configure the Kerberos Environment and Tune Windows Programmatically” on page 36.

5 Run the following command:
setup.bat

Available updates and newly added products will be downloaded and installed.

6 If any SAS Viya services are running, the following message is displayed:

Viya services are still running.

Please shut down all Viya services before an install or update.

See 'General Servers and Services: Start and Stop All Servers and Services' in the 'SAS Viya Administration' documentation for instructions on shutting down Viya services.

Stop all services as described in Step 1 on page 72, and then run setup.bat.

7 At the end of the process, one of the following two events will happen:

- If a reboot is not required, setup.bat exits to a prompt.
- If a reboot is required, the following message is displayed:
  
  You must reboot in order to complete install
  
  Reboot the machine, and then run setup.bat -config to configure the new products and start all of the services.

8 After you install the software, complete the post-installation tasks that are appropriate for your deployment.

a  “Configure the Connection to the Mail Service” on page 42.

b  If SAS Event Stream Processing was added, set environment variables for SAS Event Stream Processing on page 26 and complete SAS Event Stream Processing setup on page 48.

c  If the output of the Enable-CAS-TLS.ps1 script was not preserved as shown in Step 7 on page 72, and TLS needs to be enabled, re-run the Enable-CAS-TLS.ps1 script. See Configure CAS TLS to Use SAS Viya Default Certificates (Windows) in SAS Viya Administration / Data in Motion.

d  If the default Apache HTTP Server certificates were replaced by custom certificates, then add the CA root certificate and intermediate certificates to the SAS Viya truststores. To add the certificates to the truststore, see Add Certificates to the Trustedcerts Files in SAS Viya Administration / Data in Motion.

e  If the default CAS TLS certificates were replaced by custom certificates, then add the CA root certificate and intermediate certificates to the SAS Viya truststores. To add the certificates to the truststore, see Add Certificates to the Trustedcerts Files in SAS Viya Administration / Data in Motion.

f  See "Validating the Deployment" on page 55.

g  See "Completing the Deployment" on page 61.

h  Configure additional SAS products as appropriate.

9 To access the software changes that were added to your deployment, users must log back in to any running SAS Studio session or CAS session. If the data mining service is deployed, restart all data mining service instances.
Upgrading Your SAS Viya Software

Overview
An upgrade adds significant feature changes or improvements to your deployed software. To perform an upgrade, you will run the same tools that were run during the initial deployment. You will need a new software order to upgrade your deployed software. An upgrade might require changes to the deployed software’s configuration.

You might determine that your software needs to be upgraded or you might be notified by SAS that upgrades are available.

Add-on products that are present in the order will be installed as part of the upgrade process.

An outage period is required during which all SAS Viya services must be stopped and then restarted.

This chapter includes all the steps that are required for the upgrade process regardless of the version of the source environment or the software installed.

Note: The process preserves any user-modified configuration values in the vars.psd1 file, but changes made to other files in the deployment might be lost. Therefore, SAS recommends that you make changes to vars.psd1 when possible in order to avoid any loss of customizations that you made to other files.

Before you start the upgrade, it is recommended that you review all the steps to determine the tasks that are applicable to your deployed software. During your review, identify the tasks that can be performed before a scheduled outage and those that must be performed during a scheduled outage.

First, review the “Introduction” on page 1, the “System Requirements” on page 5, and and “Pre-installation Tasks” on page 19 chapters of this guide.

You will need the location of the directory on each machine where you stored deployment and maintenance files. For more information about this directory, see “Create the Deployment Scripts” on page 21.

See SAS Note 64084 to determine whether a symbolic link was used during your deployment of SAS Viya to place the configuration files into a location other than the default %ProgramData%\SAS directory. Refer to SAS Note 64084 before performing the tasks in this section if a symbolic link was used for your deployment.

If you are using a PDF version of this guide, go to the Deployment Guides web page at https://support.sas.com/en/documentation/install-center/sas-viya/deployment-guides.html and verify that you have the latest version of the deployment documentation before you start the upgrade process. The release date of each document is located in the bottom right corner of the front page.

User Requirements
You must have administrator privileges for the machine.

Prepare to Upgrade SAS Viya Software
SAS recommends that you create a backup of the deployed software environment before performing an upgrade.

To prepare to upgrade a SAS Viya deployment:

1. If the user performing the upgrade is different from the user who performed the original deployment, or if the passwords for the cas or postgres accounts have changed, the casUser.xml and postgresUser.xml files must be regenerated using the respective encryptCasUser.bat and encryptPostgresUser.bat scripts. See “Specify
If you are upgrading a SAS Viya deployment that used a mirror repository and you want to use a mirror repository again, download the current version of SAS Mirror Manager. For more information, see “(Optional) Create a Mirror Repository” on page 19.

When you upgrade SAS Viya, you receive a new Software Order Email (SOE) from SAS. Use your SOE to download the SAS Orchestration CLI.

Using the SAS Orchestration CLI that you downloaded, create new deployment scripts using the instructions on the SAS Orchestration Command Line Interface (CLI) download site. For more information, see “Create the Deployment Scripts” on page 21.

Extract the new deployment scripts to a location that is different from that of your original deployment scripts. For example, if you extracted your original deployment scripts to C:\ProgramData\SAS, you might extract the new deployment scripts to C:\ProgramData\SASupgrade instead. Extract the new deployment scripts to a location that is different from the one that you used for your deployment for these reasons:

- To preserve the original vars.psd1 file.
- To ensure that the directory that contains the deployment scripts correctly reflects what is delivered. If the new deployment scripts are accidentally extracted over existing deployment scripts, the files that were removed in the new deployment scripts would still be available and could negatively affect the process for researching and resolving deployment issues.

To extract the new deployment scripts, see “Create the Deployment Scripts” on page 21.

Copy the casUser.xml and postgresUser.xml files used to store the encrypted passwords for the cas and postgres user accounts from the previously generated deployment scripting directory to the newly generated deployment scripting directory.

Follow the steps that are described in “Tune Your Windows System” on page 25 on the target machine before starting the upgrade process.

System requirements for RAM, CPU, and disk space are likely to change with each SAS Viya release. Verify that your environment meets the requirements that are listed in “System Requirements” on page 5.

### Merge the User-Modified Files

Merging user-modified files includes the following actions:

- compare the existing deployment's vars.psd1 file with the new vars.psd1 file
- find any post-deployment edits in the existing deployment's vars.psd1 file
- update the new vars.psd1 file with any post-deployment edits in the existing deployment's vars.psd1 file

You will find or create original, unedited versions of the vars.psd1 file from the original deployment. You will compare the three vars.psd1 files described here and edit the vars.psd1 file for the upgrade.

This guide refers to the three types of vars.psd1 files as follows:

- vars_original.psd1 — the vars.psd1 file for the original deployment as it was received from SAS or created by SAS tools.
- vars_current.psd1 — the vars.psd1 file for your current deployment that might contain post-deployment edits.
- vars.psd1 — the vars.psd1 file for the deployment as it was received from SAS or created by SAS tools.

To merge the user-modified files:
1 Locate the existing vars.psd1 for your current deployment that might contain post-deployment edits, and save a copy of the file by renaming the file as vars_current.psd1.

2 Perform one of the two following steps:
   - If you have the original and unedited vars.psd1 that was generated by the SAS Orchestration CLI during the original deployment, copy that unedited vars.psd1 file and save it with the name vars_original.psd1.
   - Otherwise, run the SAS Orchestration CLI from the original deployment to create new and unedited deployment scripts using the original SOE attachments. Extract the vars.psd1 from the newly created deployment scripts. Name it vars_original.psd1.

3 Compare the file that is currently in use, vars_current.psd1, to the file from the deployment scripts, vars.psd1.

4 Make a list of any variables that are present in vars_current.psd1 that are not present in vars.psd1.

5 Compare the list of variables that you made to vars_original.psd1.
   - Any variable in the list that is not present in vars_original.psd1 is probably a customization that you want to retain. Add the variable to vars.psd1.
   - Any variable in the list that is present only in vars_original.psd1 represents a deprecated variable. Do not add these variables to vars.psd1.

6 If you created a sitedefault.yml in the previous deployment, copy it to sitedefault_original.yml to use as reference for any future deployments.
   Note: Do not edit sitedefault.yml or sitedefault_original.yml.

7 If TLS is enabled for the Windows deployment, perform the following steps.
   a To preserve the output of the Enable-CAS-TLS.ps1 script, in C:\ProgramData\SAS\Viya\etc\cas\default, locate the following environment variables in casconfig.lua:
      ```
      env.CAS_CLIENT_SSL_REQUIRED=true
      env.CAS_CLIENT_SSL_CERTSERIAL="190000AB8122B4DEC1D0AD1A780000000AB57"
      env.CAS_CLIENT_SSL_CERTISS="Company SHA2 Issuing CA02"
      ```
      Copy these environment variables and their values from casconfig.lua to the end of the casconfig_usermods.lua file, also located in C:\ProgramData\SAS\Viya\etc\cas\default.
   b For information about the Enable-CAS-TLS.ps1 script, see Configure CAS TLS to Use SAS Viya Default Certificates (Windows) in SAS Viya Administration / Data in Motion.

Prepare to Upgrade SAS Event Stream Processing

If you are upgrading SAS Event Stream Processing software:

1 Check for configuration files that have been customized.
   The version of the SAS Event Stream Processing software to which you are upgrading uses a new configuration file, esp-properties.yml. Some customizations that you have made to your installed software will not be used after the upgrade process has completed unless you merge them into the new file.
   On the machine where SAS Event Stream Processing is installed, compare any modified files with the copies that were included with the older version of the software. Run the following commands:
   Note: Specify each command on a single line. Multiple lines are used here for improved readability.
   ```
   fc /N "%DFESP_HOME%\etc\connectors.excluded" C:\ProgramData\SAS\Viya\etc\SASEventStreamProcessingEngine\default\connectors.excluded
   ```
Upgrade Your SAS Viya Software

To upgrade a SAS Viya deployment on Windows, perform the following steps:

1. Stop all SAS Viya services. For more information, see Start and Stop Servers and Services in General Servers and Services: SAS Viya Administration.

2. Complete the tasks in “Data Source and Storage Requirements” on page 11, as appropriate.

3. (Optional) To verify that the Windows deployment is correctly configured:
   b. To programmatically remediate settings in your Windows deployment, run the SAS Viya Deployment Assistant for Windows using -remediate in the command line. See “Configure the Kerberos Environment and Tune Windows Programatically” on page 36.

4. To upgrade a SAS Viya deployment, run the following command:

   setup.bat

   Available upgrades will be downloaded and installed.

5. If any SAS Viya services are running, the following message is displayed:

   Viya services are still running.
Please shut down all Viya services before an install or update.

See 'General Servers and Services: Start and Stop All Servers and Services' in the 'SAS Viya Administration' documentation for instructions on shutting down Viya services.

Stop all services as described in Step 1 on page 77, and then run setup.bat.

6 At the end of the upgrade, one of the following two events will happen:
   - If a reboot is not required, setup.bat exits to a prompt and the upgrade is complete.
   - If a reboot is required, the following message is displayed:
     You must reboot in order to complete install
     Reboot the machine, and then run setup.bat -config to configure the upgraded products and start all the services.

7 After you install the software, complete the post-installation tasks that are appropriate for your deployment.
   a “Configure the Connection to the Mail Service” on page 42.
   b If the output of the Enable-CAS-TLS.ps1 script was not preserved as shown in Step 7 on page 76, and TLS needs to be enabled, re-run the Enable-CAS-TLS.ps1 script. See Configure CAS TLS to Use SAS Viya Default Certificates (Windows) in SAS Viya Administration / Data in Motion.
   c If the default Apache HTTP Server certificates were replaced by custom certificates, then add the CA root certificate and intermediate certificates to the SAS Viya truststores. To add the certificates to the truststore, see Add Certificates to the Trustedcerts Files in SAS Viya Administration / Data in Motion.
   d If the default CAS TLS certificates were replaced by custom certificates, then add the CA root certificate and intermediate certificates to the SAS Viya truststores. To add the certificates to the truststore, see Add Certificates to the Trustedcerts Files in SAS Viya Administration / Data in Motion.
   e See “Validating the Deployment” on page 55.
   f See “Completing the Deployment” on page 61.
   g If you are upgrading SAS Event Stream Processing, complete the steps in “Complete SAS Event Stream Processing Upgrade Steps” on page 78.
   h Configure additional SAS products as appropriate.

8 To access the software changes that were added to your deployment, users must log back in to any running SAS Studio session or CAS session. If the data mining service is deployed, restart all data mining service instances.

Complete SAS Event Stream Processing Upgrade Steps

Earlier, you were instructed to compare versions of SAS Event Stream Processing configuration files and save a file reflecting the differences between them. Now merge the newer information in the configuration files into the new configuration file for SAS Event Stream Processing 6.1, named esp-properties.yml.

1 Open the file that contains the results of the fc commands that you saved in “Prepare to Upgrade SAS Event Stream Processing” on page 76.

2 Use your preferred text editor to modify the following file: %ProgramData%\SAS\Viya\etc \SASEventStreamProcessingEngine\default\esp-properties.yml.

3 For the customizations that you found in connectors.excluded, locate the connectors: section of esp-properties.yml. For each connector that you excluded, set the connector’s value to false.
4 For the customizations that you found in esp-logger.xml, copy the changes from your comparison file to the logging: section of esp-properties.yml.

5 For the customizations that you found in metatags.conf, copy the changes from your comparison file to the meta: section of esp-properties.yml.

6 For the customizations that you found in security-properties.yml, copy the changes from your comparison file to the security: section of esp-properties.yml.

7 When you have completed the modifications, save esp-properties.yml.

8 Set environment variables for SAS Event Stream Processing on page 26.

9 Complete the tasks that are described in Complete SAS Event Stream Processing Setup on page 48.
Uninstalling SAS Viya

Overview

You can remove your SAS Viya software by using the remove.bat script or by using the Windows control panel. After the software is removed, you must clean up the deployment by performing a few steps.

Use the Software Removal Script

1. Navigate to the C:sas\install\ directory where you uncompressed the sas-viya-deployment-script.zip file that you created.
   SAS Viya software is installed by default in the C:Program FilesSAS and C:ProgramDataSAS directories.

2. Locate the remove.bat file in the C:sas\install\powershell-deployment directory. You can use this file in one of two ways:
   - Right-click the file, and select Run as Administrator from the menu.
   - Open a command prompt (being sure to select Run as administrator) from the Windows Start menu.
     Run the following command:
     remove.bat
     The services will be stopped, and the SAS Viya software and services will be uninstalled.

Use the Windows Control Panel

1. Go to the Control Panel for your Windows machine and select either Add/Remove Programs or Programs and Features, whichever is appropriate for the version of Windows that you are using.

2. Select SAS Viya, right-click, and select Uninstall.
The services will be stopped, and the SAS Viya software and services will be uninstalled.

Final Cleanup Steps

1. After most of the software is removed, the SAS Package Manager for Windows will still be installed. To remove SAS Package Manager for Windows:
   a. Go to the Control Panel for your Windows machine and select either Add/Remove Programs or Programs and Features, whichever is appropriate for the version of Windows that you are using.
   b. Select SAS Package Manager for Windows, right-click, and select Uninstall.

2. Manually remove the C:\Program Files\SAS and C:\ProgramData\SAS directories.
   Note: C:\ProgramData is a hidden directory. If it is not viewable, go to the View tab on Windows Explorer and select Hidden Items under Show/hide.
   After the directories are manually removed, the removal of your SAS Viya deployment is complete.
Appendix 1

Troubleshooting

Setup Fails When PostgreSQL Starts Up

Explanation
While attempting to deploy, the setup failed with the following message:

Start-Service : Service ‘SAS Infrastructure Data Server - Postgres - Datanode0 (sas-viya-sasdatasvrc-postgres-datanode0)’ cannot be started
due to the following error: Cannot start service sas-viya-sasdatasvrc-postsgres-datanode0 on computer '.'

Resolution
Review the messages in the Windows event viewer and correct any pre-installation, installation, or configuration steps, and then retry the deployment.

From Any Browser: Connection Is Not Private

Explanation
The default self-signed certificates are not in the operating system truststore by default. The Apache Web Server is configured to use a certificate that is signed by this Certificate Authority (CA). When you open any SAS URL and navigate to the web server from a machine that does not have this CA in the truststore, you will receive the message Your connection is not private. The message does not indicate that there is any problem with the SAS deployment.

Resolution
SAS recommends that you replace the certificates before you give end users access to SAS Viya. For details, see the Security section of the System Requirements chapter.

From Google Chrome: Connection Is Not Private

Error
When attempting to access SAS Viya software from Google Chrome, the following message is displayed:

Your connection is not private.
Explanation
If you have previously accessed a website using https, when you access the website again, Google Chrome automatically redirects to https.

Resolution
To reset Google Chrome so that it does not redirect to https:

1. In the Chrome address bar, enter this command:

   chrome://machine-name/#hsts

2. Under **Query domain**, in the **Domain** box, enter the name of the machine that was used in the URL that you were attempting to access.

3. Click **Query** to determine whether the machine is known to the browser.

4. If the machine is known to the browser, under **Delete domain**, enter that machine name in the **Domain** box. Click **Delete**.

The corrected URL should now work with the HTTP protocol.