



# SAS<sup>®</sup> Event Stream Processing 5.1 on Linux: Deployment Guide

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**SAS® Event Stream Processing 5.1 on Linux: Deployment Guide**

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# Introduction

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## About This Guide

SAS Event Stream Processing enables developers to build applications that can quickly process and analyze a large number of continuously flowing events in real time. The deployment installs the programming tools that are required to build and execute event stream processing applications.

SAS Event Stream Processing 5.1 is compatible with both SAS 9.4 and with the SAS Viya platform. When installed along with the Cloud Analytic Services (CAS) components, SAS Event Stream Processing can provide data for analytic processing in SAS Viya. It uses the same deployment tools and process as SAS Viya. However, SAS Event Stream Processing can still be installed as a stand-alone product without additional SAS Viya components.

Use this guide to deploy SAS Event Stream Processing in your environment.

To use this guide successfully, you should have a working knowledge of the Linux operating system and basic commands.

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## What's New in SAS Deployment

### SAS Repositories

To ensure that you deploy the latest software, SAS provides the SAS Event Stream Processing software in repository packages that are maintained by SAS. Specifically, the software is packaged in the RPM Package Manager (RPM) format, which simplifies installation, uninstallation, and upgrade tasks. Each time you deploy or update your software, you automatically receive the latest RPM packages that are available.

**Note:** The RPM-based deployment model works with repositories that are native to your operating system. As a result, a SAS Software Depot is not required in your environment.

## Industry Standard Tools

You can now deploy SAS Event Stream Processing with tools that are designed for deploying and updating software on Linux operating systems. SAS Viya deployment takes advantage of yum, a software package manager for Linux operating systems. Yum commands are used for secure access to RPM packages and for deploying and updating software in your environment.

**Note:** The SAS Deployment Wizard and the SAS Deployment Manager that support SAS 9.4 are not used to install and configure SAS Event Stream Processing 5.1.

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## Upgrading Models and Data

Upgrading SAS Event Stream Processing from version 4.3 to version 5.1 is supported. For earlier versions, uninstalling the older version of the software is required.

**Note:** The term *upgrade* is used to refer to a type of software update that introduces new functionality. At SAS, an upgrade generally involves a new release number. By contrast, an *update* refers to minor changes to the software such as fixes. For more information about upgrading or updating the software, see [“Managing Your Software” on page 25](#).

Migrating models and data that you generated from a previous release of SAS Event Stream Processing is supported on a limited basis. You can import files from SAS Event Stream Processing 3.2, 4.1, 4.2, or 4.3. However, if you plan to import files that you created with SAS Event Stream Processing 3.2, be aware of the following issues:

- Multiple XML elements in SAS Event Stream Processing 5.x have changed since 3.2. You must replace the elements that differ. Opening a legacy project in SAS Event Stream Processing Studio does not automatically upgrade your XML code to a valid format.  
You can use the `dfesp_xml_migrate` script to migrate your XML code to the 5.x XML schema.
- Review your C++ code that was used with SAS Event Stream Processing 3.2. You must replace the `registerMethod_ds2` function with the `registerMethod_DS2TS` function.
- The default date format of `%Y-%m-%d %H:%M:%S` for CSV timestamp and datetime fields is no longer valid. The new `ESP_DATETIME` fields contain a 64-bit integer that represents seconds since UNIX epoch. The new `ESP_TIMESTAMP` fields contain a 64-bit integer that represents microseconds since UNIX epoch.
- In addition, you can no longer specify an alternative date format when initializing an ESP server. To pass CSV events using an alternative date format, that format must now be specified on the connector or adapter that is the source or sink of CSV data. All connectors and adapters that support CSV include an optional `DateFormat` parameter for this purpose.

**Note:** Previous versions of SAS Event Stream Processing referred to an ESP server as an engine, or SAS Event Stream Processing engine.

To upgrade models that you created in SAS Event Stream Processing 4.3 to 5.1, follow these steps:

- 1 In SAS Event Stream Processing Studio 4.3, export the 4.3 models that you want to use in the newer version of SAS Event Stream Processing.
- 2 Install SAS Event Stream Processing 5.1.
- 3 Use SAS Event Stream Processing Studio to import the 4.3 models that you previously exported. For more information, see *SAS Event Stream Processing: Using SAS Event Stream Processing Studio*.

To import models that you created in SAS Event Stream Processing Studio 3.2, a separate migration step is required. As noted, you must run the `dfesp_xml_migrate` script to migrate your XML code to the 5.x XML schema. For more information about the migration script, contact SAS Technical Support.

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## Contact SAS Technical Support

Technical support is available to all customers who license SAS software. However, we encourage you 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 call, explore the SAS Support website at [support.sas.com/techsup/](https://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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## General Hardware Considerations

SAS Event Stream Processing has a flexible architecture and a base set of features that have no dependencies on SAS Foundation or on SAS Viya. The SAS Event Stream Processing software is licensed per event, so you can install the software on multiple machines without violating the license agreement.

To use SAS Foundation in SAS Event Stream Processing deployments, as when, for example, you want to run SAS in a procedural window, SAS Event Stream Processing must be installed on the same machine as SAS Foundation. Depending on your version of SAS, a SAS/ACCESS engine might also be required. The following hardware requirements do not attempt to account for all usage scenarios.

## Hardware Requirements

SAS Event Stream Processing can be installed as a stand-alone product. It can also coexist with either SAS Viya or with SAS 9.4.

A single machine for the SAS Event Stream Processing components (ESP server, the web application server, and SAS Event Stream Processing Studio) is the minimum requirement. SAS Event Stream Processing can be deployed on a redundant machine for failover, or it can be distributed across multiple machines. On-premises deployments as well as cloud deployments are supported. You can also deploy the software on the compute layer of a Hadoop cluster, or even at the edge (on a gateway node) of a Hadoop cluster.

The following table describes a standard set of specifications for a machine where SAS Event Stream Processing is deployed:

Item	Recommended Level*
CPU	4 cores (x86 architecture) Intel Xeon chip set with a minimum speed of 2.6 GHz
Memory	8 - 16 GB of RAM Memory clock speed of 1600 MHz
Disk Space and Speed	10 GB 10,000 RPM

\*The bare minimum requirements for an installation of SAS Event Stream Processing are 4 cores, 4 GB of memory, and 1 GB of disk space. However, a minimum configuration is not recommended.

An additional machine can be used as a thin client from which end users can access the user interface for SAS Event Stream Processing Studio. This machine requires minimal processing power and storage space and can run on Windows or UNIX.

---

## Operating System Requirements

### Supported Operating Systems

For a list of supported operating systems, see <https://support.sas.com/en/documentation/third-party-software-reference/viya/support-for-operating-systems.html>.

**Note:** SAS Event Stream Processing can also be installed on Microsoft Windows, but a separate package, based on your software order, is required.

### Linux Prerequisites

The typical Linux installation includes all of the packages and libraries that SAS requires. Problems can occur if default packages were removed from the base operating system (for example, X11 libraries and system utilities). The following libraries are required:

- glibc-2.12-1.166.el6 and later (on Red Hat Enterprise Linux 6.x or the equivalent). Refer to [RHBA-2015:1465](#) to obtain the latest updated package list.  
glibc-2.17-107.el7 and later (on Red Hat Enterprise Linux 7.x or the equivalent). Refer to [RHSA-2016:2573](#) to obtain the latest updated package list.
- libpng (on Red Hat Enterprise Linux 6.x or the equivalent)  
libpng12 (on Red Hat Enterprise Linux 7.x or the equivalent)
- libXp
- libXmu
- net-tools
- the numactl package
- the X11/Xmotif (GUI) packages
- xterm

On Linux 7.x, verify that the systemd package on each machine is at version 219-30 or later. Run the following command:

```
rpm -qa | grep systemd
```

If the version that is returned is not at least 219-30, run the following command to retrieve the most recent package from Red Hat:

```
yum update systemd
```

## Additional Linux Requirements

The ESP server libraries were built using gcc-4.4.7-16 and the Boost library 1.58. The Boost library 1.58 is automatically installed with SAS Event Stream Processing. The libraries were compiled using the following compiler options:

```
-D_REENTRANT
```

```
-D_THREAD_SAFE
```

All the SAS Event Stream Processing applications that you build with SAS Event Stream Processing Studio must also use the same compiler options.

The SAS Event Stream Processing 5.x libraries have been built using gcc-4.4.7-16 on Red Hat Enterprise Linux Server 6.7 using libc-2.12.so, libstdc++.so.6.0.13, and libgcc\_s-4.4.7-20120601.so.1.

## 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>.

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# Software Requirements

## Java Requirements

The Java Runtime Environment (JRE) must be installed on each machine where you install SAS Event Stream Processing components. Only the JRE is required. The full JDK is not required. For a list of supported JRE distributions, see

<https://support.sas.com/en/documentation/third-party-software-reference/viya/support-for-jre.html>.

## Web Browsers

SAS Event Stream Processing Studio and Streamviewer include some advanced user interface features, which require a newer web browser. For information about supported browsers, see

<https://support.sas.com/en/documentation/third-party-software-reference/viya/support-for-web-browsers.html>.

If you cannot install one of the supported web browsers for use with SAS Event Stream Processing, be aware of possible unexpected user interface behavior. Because session cookies are required in order to maintain session state, be sure to enable cookies in your browser.

## User Accounts

The user account that you are using for the deployment must have super user (sudo) access. To verify that the user ID is included in the sudoers file, run the following command:

```
sudo -v
```

To verify your sudoers privileges, run the following command:

```
sudo -l
```

**Note:** The ability to start a shell (with the `!SHELL` entry in some sudoers files) as root is not required.

During the software deployment, one required user account (sas) and one group (also named sas) are created for you unless they already exist. Because the sas account is required for the SAS Event Stream Processing Studio component to run during normal product operation, you must not delete it or change its name. It does not run as root. If you must log on to this account, use sudo to access it.

The following table describes the predefined sas user account:

Account Name and Group	Parameters	Purpose
sas; member of sas group	<p>Non-login service account without user restrictions.</p> <p>No password; can add password after installation if desired.</p> <p>Password does not expire.</p> <p>Default user name is required until the installation is complete. Any post-installation changes to this account do not prevent future software updates.</p>	<p>Required for the installation.</p> <p>The installation process sets user and group ownership permissions on all of the installation files. This user must exist to enable ownership.</p> <p>After the installation has completed, this user account enables required components to run, including the web application server for SAS Event Stream Processing Studio.</p>

Sudoers privileges are not required after the installation to run SAS Event Stream Processing. The installation directory path enables write access per user group, and it is owned by the sas user. To grant permission to edit the configuration files, the administrator must add any user requiring write access to these files to the sas group.

## (Optional) Enable Encryption and Authentication for SAS Event Stream Processing

SAS Event Stream Processing provides optional encryption and authentication features. The required OpenSSL encryption libraries are installed automatically when you install SAS Event Stream Processing. You can then enable encryption with OpenSSL 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. Authentication and encryption apply to the following ESP server APIs:

- The ESP Server (XML Server) HTTPS API
  - Connections that are created by the XML Client (dfesp\_xml\_client) to communicate with an ESP server using the HTTPS protocol
  - Connections that are created by the Streamviewer component (streamviewer.html) to communicate with the ESP server using the HTTPS protocol

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

If you enable authentication for an ESP server, you must then provide authentication tokens or credentials in Streamviewer. You can copy and paste the token directly into an appropriate dialog box in Streamviewer. Alternatively, you can specify a URL that supplies the token. Authentication tokens and credentials are cached for the duration of a Streamviewer session.

For more information about enabling security for an ESP server or for Streamviewer, see [SAS Event Stream Processing: Security](#).



# Pre-installation Tasks

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## Obtain the Required Files

When you order SAS software, SAS sends a Software Order Email (SOE) to your business or organization that includes information about the software order. Follow the steps in this section to save the attached ZIP file and download the additional file that is required.

- 1 Save the `SAS_Viya_deployment_data.zip` file that was attached to your SOE to a directory on the machine where you intend to deploy your software.

This file contains entitlement certificates that will enable you to download the SAS software.

- 2 Your SOE also provided a link to a website where you could download an additional file, `sas-esp-deployment-script.tgz`. Download it onto the machine where you plan to launch your deployment.

Save the TGZ file in the same directory where you saved the `SAS_Viya_deployment_data.zip` file.

- 3 In the directory where you saved `sas-esp-deployment-script.tgz`, uncompress it. It creates a new file, `customized_deployment_script.sh`.

- 4 In the directory where you saved `SAS_Viya_deployment_data.zip`, uncompress it.

Several subdirectories are created: `/ca-certificates`, `/entitlement-certificates`, and a `/licenses` directory.

You will run `customized_deployment_script.sh` after you have completed the pre-installation tasks.

## Set Environment Variables

You must set some environment variables before you start SAS Event Stream Processing. For a shell that will only invoke SAS Event Stream Processing, run the following commands:

```
export DFESP_HOME=/opt/sas/viya/home/SASEventStreamProcessingEngine/5.1.0
export LD_LIBRARY_PATH=$DFESP_HOME/lib:/opt/sas/viya/home/SASFoundation/sasexe
export PATH=$PATH:$DFESP_HOME/bin
```

If you need to maintain your `LD_LIBRARY_PATH` setting for another SAS product, change the second command that is listed above to the following:

```
export LD_LIBRARY_PATH=$DFESP_HOME/lib:/opt/sas/viya/home/SASFoundation/sasexe:$LD_LIBRARY_PATH
```

(Optional) To enable SSL on connections between SAS Event Stream Processing Studio and SAS Event Stream Processing engine, configure the following environment variable:

```
DFESP_SSLPATH=path-to-OpenSSL-shared-object
```

This setting assumes that you have installed the OpenSSL libraries on all computer systems that run the client and server. When you install SAS Event Stream Processing Encryption and Authentication Overlay, you install OpenSSL. The DFESP\_SSLPATH environment variable should be set to the path that contains libssl.so and libcrypto.so. By default, when the Encryption and Authentication Overlay package is installed, the path is as follows:

```
/opt/sas/viya/home/SASEventStreamProcessingEngine/5.1.0/ssl/lib
```

or \$DFESP\_HOME/lib.

SAS Event Stream Processing includes the internal component SAS Micro Analytic Service. To use the Anaconda Python support in SAS Micro Analytic Service, you need to set additional variables for your version of Python. For instructions, see *SAS Micro Analytic Service: Programming and Administration Guide*, which is available on the [SAS Event Stream Processing product page](#).

Depending on the shell environment that you use, you can also add these export commands to your .bashrc file or .profile file to update the settings automatically. Another option is to create a configuration shell script and copy it to your /etc/profile.d directory.



# Installing SAS Event Stream Processing

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## Deploy with Yum

Use the procedures in this section to deploy your SAS software using yum. You can deploy all SAS Event Stream Processing components using yum, with the exception of the optional SAS Event Stream Manager component. If an order includes SAS Event Stream Manager, a separate installation and SOE are required.

## Run the Deployment Script

The steps in this section assume that you have completed the steps that were provided in your SOE, saving the ZIP file and downloading the deployment script (`customized_deployment_script.sh`). If you have not already done so, uncompress the ZIP file. For more information about the SOE, see [“Obtain the Required Files” on page 11](#).

Now you are ready to run the deployment script to install the software. Perform the following steps to install all SAS Event Stream Processing components on the same machine:

- 1 Navigate to the directory where you uncompressed the ZIP file that was attached to your SOE.
- 2 Verify that you have saved the `customized_deployment_script.sh` file in the same directory.
- 3 Run the script:

```
sudo ./customized_deployment_script.sh
```

- 4 (Optional) When prompted, enter `y` to install the product user interface component, SAS Event Stream Processing Studio (with filename `sas-espvm`).

**Note:** SAS Event Stream Processing Studio can be installed on a separate machine from the SAS Event Stream Processing server.

Additional steps are required to configure SAS Event Stream Processing Studio. For more information, see [“Configure SAS Event Stream Processing Studio” on page 15](#).

- 5 (Optional) When prompted, enter `y` to install the Streamviewer component (with filename `sas-espstrmvwr`).

**Note:** Streamviewer can be installed on a separate machine from SAS Event Stream Processing.

Additional steps are required to configure Streamviewer. For more information, see [Setting Up and Running Streamviewer](#).

- 6 When prompted to install the SAS Event Stream Manager agent component (with filename `sas-esm-agent`), enter `n`. The agent component must be installed along with SAS Event Stream Manager. SAS plans to remove this prompt in a future version of the software.

- 7 (Optional) When prompted, enter **y** to install the SAS Text Analytics component (with filename `sas-txmineng`).

A valid license file is required in order to run any applications that use SAS Event Stream Processing. The installation copies the license file to the required location on the target machine. If this step fails to complete, the following message is displayed:

```
License file could not be located and will have to be copied manually.
```

To copy the license file manually:

- a Locate the license file (in TXT format) in the `/licenses` subdirectory.
- b Copy the license file to the default license directory. For `license.txt`, substitute the filename of the license file that you received from SAS:

```
sudo cp license.txt /opt/sas/viya/home/SASEventStreamProcessingEngine/5.1.0/etc/license/license.txt
```

# Post-installation Tasks

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## Enable Metering for ESP Servers

If your order included SAS Event Stream Processing, you must take additional steps to enable the product license. The playbook applies the product license on each machine where you have deployed SAS Event Stream Processing. However, you must set up and run at least one metering server to track the number of incoming events and to maintain event counts on your ESP servers.

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.

For more information about enabling metering, see [Using the Metering Server](#) in the SAS Event Stream Processing user documentation.

---

## Configure SAS Event Stream Processing Studio

SAS Event Stream Processing Studio is an optional user interface that generates XML code based on the visual models that it helps you create. It is not automatically started during the installation. This section describes the additional steps that are required to use SAS Event Stream Processing Studio.

### Start SAS Event Stream Processing Studio

Additional steps are required to use SAS Event Stream Processing Studio, which provides a user interface for creating models. It is not automatically started during the installation.

- 1 SAS Event Stream Processing Studio requires Java 1.8. If Java 1.8 is not the default version of Java on your system, update the following script to set the SAS\_JAVA\_HOME environment variable:

```
/opt/sas/viya/config/etc/sysconfig/sas-javaesntl/sas-java
```

Here is an example:

```
SAS_JAVA_HOME=/usr/java/jdk1.8.0_101/jre
```

Or supply the location of the JDK, if applicable. For example:

```
SAS_JAVA_HOME=/usr/java/jdk1.8.0_101
```

**Note:** Do not include the `/bin/java` portion of the path for the definition of `SAS_JAVA_HOME`.

- 2 To start SAS Event Stream Processing Studio, run the following command on Red Hat Enterprise Linux 6.x:

```
sudo service sas-viya-espvm-default start
```

Run the following command on Red Hat Enterprise Linux 7.x:

```
sudo systemctl start sas-viya-espvm-default
```

- 3 After you have started the service, you can access SAS Event Stream Processing Studio using a web browser that is running on Windows or Linux. Open SAS Event Stream Processing Studio from a URL with the following format:

```
http://esp-studio-hostname:port/SASEventStreamProcessingStudio
```

**Note:** For `esp-studio-hostname` and `port`, specify values that are appropriate for your deployment. The default port is 8080. For information about changing the default port, see [“\(Optional\) Change the SAS Event Stream Processing Studio Port” on page 16](#).

- 4 Before you can open or create a model in SAS Event Stream Processing Studio, you must start the ESP server. Change directories to the following location:

```
cd /opt/sas/viya/home/SASEventStreamProcessingEngine/5.1.0/bin
```

- 5 Run the following command:

```
dfesp_xml_server -pubsub n -http port &
```

The `-pubsub` argument specifies a port for publish and subscribe actions. Replace `n` with the appropriate port number.

The `-http` argument Specifies the port for the HTTP REST API. The value of `port` cannot exceed 65535.

The ampersand (&) enables additional commands to be entered in the same window that started the server.

**Note:** If you have a project that is predefined, use the `-model url` argument and supply the URL to the XML model. Specify the full path (`file://path`).

For more information about the ESP server, see [SAS Event Stream Processing: Using the ESP Server](#).

- 6 (Optional) To check the status of SAS Event Stream Processing Studio, run the following command on Red Hat Enterprise Linux 6.x:

```
sudo service sas-viya-espvm-default status
```

Run the following command on Red Hat Enterprise Linux 7.x:

```
sudo systemctl status sas-viya-espvm-default
```

## (Optional) Change the SAS Event Stream Processing Studio Port

You can change the port settings for SAS Event Stream Processing Studio. The default port, 8080, is appropriate for most environments.

**Note:** Before you change the default port, you must update the software. For more information, see [“Updating SAS Event Stream Processing on Linux” on page 26](#).

- 1 Use your preferred text editor to create the following file:

```
sudo vi /opt/sas/viya/config/etc/sysconfig/espvm.conf
```

- 2 Add the following line to the file:

```
export JAVA_OPTS="-Dserver.port=value"
```

For *value*, substitute the new port at which SAS Event Stream Processing Studio will listen.

- 3 Save and close the file.

- 4 Restart the espvm service by running the following commands on Red Hat Enterprise Linux 6.x:

```
sudo service sas-viya-espvm-default stop
sudo service sas-viya-espvm-default start
```

Run the following commands on Red Hat Enterprise Linux 7.x:

```
sudo systemctl stop sas-viya-espvm-default
sudo systemctl start sas-viya-espvm-default
```

## (Optional) Enable Encryption for SAS Event Stream Processing Studio

Secure Sockets Layer (SSL) encryption can be applied to the connections that are made between SAS Event Stream Processing Studio and SAS ESP servers. To enable SSL for SAS Event Stream Processing Studio and the clients that access it, you must generate a pair of certificates, copy them to the required locations, and add the client certificate to your browser and to the Java keystore.

- 1 Verify that the OpenSSL libraries exist on all machines where SAS Event Stream Processing components or clients will run.

Locate the `libcrypto.so` and `libssl.so` files. They are installed by default in `/opt/sas/viya/home/SASEventStreamProcessingEngine/5.1.0/ssl/lib`. Obtain them from OpenSSL if required.

- 2 Verify that the `DFESP_SSLPATH` environment variable specifies the pathname for the OpenSSL shared libraries.
- 3 Obtain SSL certificates for the machine where SAS Event Stream Processing Studio is installed and for the clients that will access the user interface. Use OpenSSL or your preferred method to generate site-signed or third-party-signed certificates.
- 4 On the machines from which end users will access SAS Event Stream Processing Studio, import the client certificate to the certificates store of your preferred web browser.
- 5 On the machine where SAS Event Stream Processing Studio is running, import the client certificate to the Java keystore by running the following command:

```
$JAVA_HOME/jre/bin/keytool -importcert -keystore keystore-location -file path-to-file
-storepass password -noprompt -alias alias
```

Here is an example:

```
$JAVA_HOME/jre/bin/keytool -importcert -keystore $JAVA_HOME/jre/lib/security/cacerts
-file $DFESP_HOME/etc/ca.pem -storepass P4ssw0rd -noprompt -alias myalias
```

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

- 6 Restart the SAS Event Stream Processing Studio service. Run the following command, as appropriate:

For Red Hat Enterprise Linux 6.7:

```
sudo service sas-viya-espvm-default stop
```

```
sudo service sas-viya-espvm-default start
```

For Red Hat Enterprise Linux 7.0 and later:

```
sudo systemctl stop sas-viya-espvm-default
```

```
sudo systemctl start sas-viya-espvm-default
```

---

## Directory Structure and Permissions

After you install SAS Event Stream Processing, the files for the engine, the user interface components, and the authentication package are located in the following directory:

```
/opt/sas/viya/home/SASEventStreamProcessingEngine/
```

Configuration files for adapters and logs are located in the following directory:

```
/opt/sas/viya/config/etc/SASEventStreamProcessingEngine/default
```

Later, if you update your deployment, the configuration files are not altered.

The basic directory path enables write access per user group, and it is owned by the sas user. To grant permission to users to edit the configuration files, the administrator must add them to the sas group.

---

## (Optional) Configure Database Connectivity

Database connections are optional for SAS Event Stream Processing. To enable database connectivity, you can perform a few configuration tasks after installation has completed.

For a full discussion of database connections and configuration options, see [Using the Database Connector and Adapter](#).

# Validating the Deployment

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## Verify the RPM Packages

To obtain a list of all SAS Event Stream Processing RPM packages that are deployed on your system, run the following command:

```
rpm -qa sas-esp*
```

Then you can run this basic command to verify an individual RPM package from the list that is returned:

```
rpm -Vv package-name
```

The full name of each RPM is not required. For example, to verify the contents of the `sas-espbase-5.1.0-20170109.060004533214.x86_64` package, run the following command:

```
rpm -Vv sas-espbase
```

**Note:** Run the preceding commands for each host on which you have deployed SAS Event Stream Processing and its optional web application components.

You can also create a for loop command for verifying multiple packages that share a common naming convention. For example, to verify all packages whose names begin with `sas-`, use the following query:

```
for i in $(rpm -qg "SAS");do sudo rpm -Vv $i;done
```

A successful verification shows the list of files that make up the RPM and with no error indicators, as follows:

```
rpm -Vv sas-espexam
..... /opt/sas/viya/home/lib/esp/sas-init-functions
```

An unsuccessful verification provides error indicators beside the filename. Here is an example:

```
rpm -Vv sas-espexam
package sas-espexam is not installed
```

The error indicators are shown in the following format:

```
SM5DLUGT c
```

In addition, if a file is missing, the error message contains the word “missing”:

```
missing /opt/sas/viya/home/lib/esp/sas-init-functions
```

The meaning of each error indicator is described as follows:

- S

File size. RPM keeps track of file sizes. A difference of even one byte triggers a verification error.

## ■ M

File mode. The permissions mode is a set of bits that specifies access for the file's owner, group members, and others. Even more important are two additional bits that determine whether a user's group or user ID should be changed if they execute the program that is contained in the file. Since these bits permit any user to become root for the duration of the program, you must be cautious with a file's permissions.

## ■ 5

MD5 checksum. The MD5 checksum of a file is a 128-bit number that is mathematically derived from the contents of the file. The MD5 checksum conveys no information about the contents of the original file, but any change to the file results in a change to the MD5 checksum. RPM creates MD5 checksums for all files that it manipulates, and stores the checksums in its database. If one of these files is changed, the MD5 checksum changes and the change is detected by RPM.

## ■ D

Major and minor numbers. Device character and block files contain a major number. The major number is used to communicate information to the device driver that is associated with the special file. For example, under Linux, the special files for SCSI disk drives should have a major number of 8, and the major number for an IDE disk drive's special file should be 3. Any change to a file's major number could produce disastrous effects. RPM tracks such changes.

A file's minor number is similar to the major number, but conveys different information to the device driver. For disk drives, this information can consist of a unit identifier.

## ■ L

Symbolic link. If a file is a symbolic link, RPM checks the text string that contains the name of the symbolically linked file.

## ■ U

File owner. Most operating systems keep track of each file's creator, primarily for resource accounting. Linux and UNIX also use file ownership to help determine access rights to the file. In addition, some files, when executed by a user, can temporarily change the user's ID, normally to a more privileged ID. Therefore, any change of file ownership might have significant effects on data security and system availability.

## ■ G

File group. Similar to file ownership, a group specification is attached to each file. Primarily used for determining access rights, a file's group specification can also become a user's group ID if that user executes the file's contents. Therefore, any changes in a file's group specification are important and should be monitored.

## ■ T

Modification time. Most operating systems keep track of the date and time that a file was last modified. RPM keeps modification times in its database.

## ■ c

Configuration file. This is useful for quickly identifying configuration files because they are likely to change and therefore are unlikely to verify successfully.

Verification failures are expected for files that contain frequently changing content, such as environment-specific Java paths, newly generated TLS certificates, or SAS license information. Such verification failures for these types of files usually do not indicate any errors in the files.

---

## View Deployment Logs

To view the logs of your yum deployment, run the following commands:



```
sudo yum history  
sudo less /var/log/yum.log
```



# Completing the Deployment

---

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## Code Examples

Code examples to help you write programs are installed along with the software. You can find the examples in the following directory after the deployment has completed:

```
/opt/sas/viya/home/SASEventStreamProcessingEngine/5.1.0/examples/
```

The examples directory includes files for C++, XML, Python, and Java. It also includes a `readme_examples.txt` file, which briefly describes each example and its usage.

SAS recommends that you copy the examples that you require to a writable directory on the local computer so that you can run them.

Two documents are helpful in understanding the examples. You can find links on the SAS Event Stream Processing product page to the following user guides:

- *DataFlux® Expression Language Reference Guide*
- *SAS® Micro Analytic Service Programming and Administration Guide*

## Product Documentation

After you install, configure, and verify the deployment, you are ready to begin writing applications that capture and analyze streaming event data in real time.

The next step is to consult the product documentation. The product documentation is included in SAS Help Center. A link to all SAS Event Stream Processing documentation is 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 (SAS Event Stream Processing Studio and Streamviewer).

SAS recommends starting with *SAS Event Stream Processing 5.1: Overview*, which provides an introduction to product features and explains how to proceed with creating event stream processing models and incorporating them into applications.

If you have set up the optional Streamviewer component, you can find more information about it in a separate guide. For a full set of instructions about using Streamviewer, see [Visualizing Event Streams with Streamviewer](#).



# Managing Your Software

---

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---

## Overview

SAS Event Stream Processing on Linux supports both updates and upgrades. The two procedures are distinct and separate.

### 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 software order to perform an update.

You might determine that your software requires an update, or you might be notified by SAS that updates are available.

### 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 software order to upgrade your deployed software. An upgrade might require changes to the deployed software's configuration.

SAS Event Stream Processing 5.1 supports upgrades from version 4.2 or 4.3.

SAS recommends that you create a backup of the deployed software environment before you perform an upgrade.

---

## Updating SAS Event Stream Processing on Linux

You can use yum to apply all available updates to SAS Event Stream Processing software on a selected machine.

- 1 Create a backup copy of the SAS Event Stream Processing Studio database in order to preserve project files. Follow these steps:

- a Stop the SAS Event Stream Processing Studio (espm) service by running the following command on Red Hat Enterprise Linux 6.x:

```
sudo service sas-viya-espm-default stop
```

Run the following command on Red Hat Enterprise Linux 7.x:

```
sudo systemctl stop sas-viya-espm-default
```

- b Create a backup copy of the database, which is a single binary file (studio.mv.db). You can copy it to any directory location outside the SAS Event Stream Processing installation directory structure.

The location and filename of the database are determined by the environment variable `ESP_STUDIO_DB`. By default, it is stored in `/opt/sas/viya/config/data/espm/`.

To create the backup, run the following command:

```
cp studio.mv.db directory-name
```

- 2 (Optional) If you installed Streamviewer, stop the Streamviewer process:

```
$DFESP_HOME/bin/dfesp_xml_client -url "http://host-name:http-port/exit"
```

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

Replace *http-port* with the port number that you provided when you started Streamviewer with the start-up script.

- 3 Stop the Metering Server:

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

Replace *host-name* with the host name of the machine where the Metering Server is running.

Replace *http-port* with the port number for the Metering Server. By default, it uses port 31001.

- 4 To update all SAS Viya software on the machine, run the following command:

```
sudo yum update $(rpm -qq SAS)
```

- 5 At the prompt `Is this ok`, review the available updates and then enter `y`.

- 6 Repeat these steps on each machine where you have installed SAS Event Stream Processing.

- 7 Restart SAS Event Stream Processing Studio. Run the following command on Red Hat Enterprise Linux 6.x:

```
sudo service sas-viya-espm-default start
```

Run the following command on Red Hat Enterprise Linux 7.x or SUSE Linux:

```
sudo systemctl start sas-viya-espm-default
```

- 8 (Optional) Restart the Streamviewer component. Follow the steps that are appropriate for the operating system where you have installed it and the database that it is using. For more information, see [Starting Streamviewer](#).

---

# Upgrading SAS Event Stream Processing 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 upgrading or you might be notified by SAS that upgrades are available. SAS recommends creating a backup of the deployed software environment before you perform an upgrade.

## Prepare to Upgrade SAS Event Stream Processing

To prepare to upgrade a SAS Event Stream Processing deployment:

- 1 (Optional) Record what is installed before you begin.

SAS Event Stream Processing components can be installed on separate machines. They can also be installed on the same machines as other SAS Viya products. Create a file that lists the names and versions of all the RPM packages of the SAS software that are installed. For example, you can run the following command to create a text file that lists all the SAS RPM packages:

```
sudo rpm -qg SAS > /sas/install/viya_rpms.txt
```

On each machine in your deployment, create a file that lists the SAS yum groups that are installed on a machine. For example, you can run the following command to create a text file that lists all the SAS yum groups:

```
sudo yum grouplist "SAS*" > /sas/install/viya_yumgroups.txt
```

- 2 When performing an upgrade, you receive a new Software Order Email (SOE) from SAS. Save the SAS\_Viya\_deployment\_data.zip file that was attached to your SOE to an empty directory on the machine where you intend to deploy your upgrade packages.

This file contains entitlement certificates that will enable you to download the SAS software. Do not use the same directories that were created when you installed the previous version of SAS Event Stream Processing.

- 3 Your new SOE also provided a link to a website where you could download an additional file, sas-esp-deployment-script.tgz. Download it to the machine where you plan to launch your deployment.

Save the TGZ file in the same directory where you saved the SAS\_Viya\_deployment\_data.zip file.

- 4 In the directory where you saved sas-esp-deployment-script.tgz, uncompress it. It creates a new file, customized\_deployment\_script.sh.

- 5 In the directory where you saved SAS\_Viya\_deployment\_data.zip, uncompress it.

Several subdirectories are created: `/ca-certificates`, `/entitlement-certificates`, and a `/licenses` directory.

## Upgrade SAS Event Stream Processing

To upgrade a SAS Event Stream Processing deployment:

- 1 Create a backup copy of the SAS Event Stream Processing Studio database in order to preserve project files. Follow these steps:

- a Stop the SAS Event Stream Processing Studio (esvvm) service by running the following command on Red Hat Enterprise Linux 6.x:

```
sudo service sas-viya-esvvm-default stop
```

Run the following command on Red Hat Enterprise Linux 7.x:

```
sudo systemctl stop sas-viya-esvvm-default
```

- b Create a backup copy of the database, which is a single binary file (studio.mv.db). You can copy it to any directory location outside the SAS Event Stream Processing installation directory structure.

The location and filename of the database are determined by the environment variable `ESP_STUDIO_DB`. By default, it is stored in `/opt/sas/viya/config/data/esvvm/`.

To create the backup, run the following command:

```
cp studio.mv.db directory-name
```

- 2 (Optional) If you installed Streamviewer, you must stop the Streamviewer service. Find the process ID of the Streamviewer process:

```
ps -ef
```

Then kill the Streamviewer process, substituting the process ID that was returned in the previous step:

```
kill -9 process-id
```

- 3 Delete the license file from `etc/license`:

```
sudo rm /opt/sas/viya/home/SASEventStreamProcessingEngine/installed-version/etc/license/*
```

For *installed-version*, substitute the version of SAS Event Stream Processing that is currently installed, such as 4.3.0.

- 4 Install your software.

Follow the steps in the Installation chapter, beginning with [“Run the Deployment Script” on page 13](#).

- 5 After the software has been installed, complete the tasks that are described in the Post-installation Tasks and Validating the Deployment chapters of this deployment guide.



# Uninstalling SAS Event Stream Processing

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## Uninstall SAS Event Stream Processing

Use yum to uninstall your SAS software:

- 1 Create a backup copy of the SAS Event Stream Processing Studio database in order to preserve project files. Follow these steps:

- a Stop the SAS Event Stream Processing Studio (espm) service.

Run the following command on Red Hat Enterprise Linux 6.x:

```
sudo service sas-viya-espm-default stop
```

Run the following command on Red Hat Enterprise Linux 7.x:

```
sudo systemctl stop sas-viya-espm-default
```

- b Create a backup copy of the database, which is a single binary file (studio.mv.db). You can copy it to any directory location outside the SAS Event Stream Processing installation directory structure.

The location and filename of the database are determined by the environment variable ESP\_STUDIO\_DB. By default, it is stored in `/opt/sas/viya/config/data/espm/`.

To create the backup, run the following command:

```
cp studio.mv.db directory-name
```

- 2 (Optional) If you installed Streamviewer, stop the Streamviewer process:

```
$DFESP_HOME/bin/dfesp_xml_client -url "http://host-name:http-port/exit"
```

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

Replace *http-port* with the port number that you provided when you started Streamviewer with the start-up script.

For more information, see [Starting Streamviewer](#).

- 3 Stop the Metering Server:

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

Replace *host-name* with the host name of the machine where the Metering Server is running.

Replace *http-port* with the port number for the Metering Server. By default, it uses port 31001.

**4** Delete the license file from `etc/license`:

```
sudo rm /opt/sas/viya/home/SASEventStreamProcessingEngine/5.1.0/etc/license/*
```

**5** Locate your `orderinputs.sh` file, and use a text editor to open it.

This file was included in the root directory of the `SAS_Viya_deployment_data.zip` file, which was attached to the SOE.

**6** Uninstall the software by running the “yum groupremove” command against each yum group that is listed in the `install_yum_groups` function in your `orderinputs.sh` file. Run the commands only on the hosts where the yum groups have been deployed.

**Note:** The “yum groupremove” command will uninstall dependencies that are shared by other products on the host. The removal of some yum groups might mean that there is no software to uninstall when items have been removed by a previous “groupremove” command.

```
sudo yum groupremove 'SAS Event Stream Processing'
sudo yum groupremove 'SAS Event Stream Processing Studio'
sudo yum groupremove 'SAS Event Stream Processing Streamviewer'
sudo yum groupremove 'SAS Event Stream Processing Analytics'
sudo yum groupremove 'SAS Text Analytics for English'
```

**7** Remove SAS repository definitions, which are contained in the `orderinputs.sh` file:

```
sudo yum erase "sas-espanalyt-***-x64_redhat_linux_6-yum-latest"
"sas-esp-***-x64_redhat_linux_6-yum-latest"
```

For the asterisks (\*), substitute the names of the repositories that are listed in your order inputs file. For improved formatting, the command is shown on multiple lines.

**8** Remove the main repository definition:

```
sudo yum erase sas-meta-repo-1-1
```

**9** Remove any remaining SAS products that were not removed by removing the yum groups:

```
sudo rpm -e $(rpm -qg SAS)
```

**10** Remove the entitlement certificate:

```
sudo rm /etc/pki/sas/private/entitlement_certificate.pem
```

**11** Rename or remove the SAS Viya directories using the applicable command:

```
sudo mv /opt/sas/viya/ /opt/sas/viya_$(date +%s)
sudo rm -rf /opt/sas
```

**12** (Optional) Run the cleanup script to clean out the yum cache and remove any data that might remain after you have removed the SAS yum repository definitions:

**Note:** This step returns the hosts to a state in which the software can be redeployed. However, you should proceed with caution and consult with a Systems Administrator.

```
sudo yum clean all
```

If you have questions about removing a specific file, you might want to consult a professional. For more information, see [“Contact SAS Technical Support” on page 3](#).

# Appendix 1

## Creating and Using a Yum Mirror Repository

---

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---

### Overview

By default, SAS downloads and installs the latest software available from the applicable software repositories. 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, or to preserve a testing environment), you can create and use a mirror repository for the deployment.

---

### Prepare the Yum Repository

The topics in this section explain how to deploy on a Red Hat Enterprise Linux platform using a yum repository. Follow these steps to create a local copy of the secure SAS repositories.

#### Create and Run the Setup Script

To prepare the target host where you will create a local copy of the SAS software repository, follow these steps:

- 1 Copy the SAS\_Viya\_deployment\_data.zip to a directory on the machine where you plan to create the local repository. Then uncompress the ZIP file.
- 2 Use your preferred text editor to create a file named setup\_repos.sh. Then copy and paste the following content into the file:

```
#!/bin/bash
# The following is a list of commands that you will need when deploying your SAS
# software. These commands have been customized according to the contents of your
# software order. The deployment guide will tell you when to use this script. Do
```

```

# not attempt to use this script without direction from the deployment guide.

#load order input values
. ./orderinputs.sh

# Set these variables to the location of the directories where the certificates
# and licenses are located
CERTDIR=ca-certificates
ENTITLEMENTDIR=entitlement-certificates
LICENSESDIR=licenses

# Download the RPM file used to establish yum connectivity to the central SAS
# catalog of repositories

curl -OLv --cert $ENTITLEMENTDIR/entitlement_certificate.pem --cacert $CERTDIR/SAS_CA_Certificate.pem
https://ses.sas.download/ses/repos/meta-repo//sas-meta-repo-1-1.noarch.rpm

# Install the downloaded RPM file
yum install sas-meta-repo-1-1.noarch.rpm

# Copy the entitlement certificate into place for use
cp $ENTITLEMENTDIR/entitlement_certificate.pem /etc/pki/sas/private/entitlement_certificate.pem

# Install definitions of the specific repositories for the ordered products
yum install $entitledRepos

```

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

**3** Set the Execute bit for setup\_repos.sh:

```
chmod +x setup_repos.sh
```

**4** Save the file to the directory where you unzipped SAS\_Viya\_deployment\_data.zip.

**5** Run setup\_repos.sh to enable the repository mirror host to mirror the content:

```
sudo ./createrepos.sh
```

## Complete the Setup of the Local Repository

To create the local copy of the SAS repository:

**1** Install the required yum utilities package by running the following command:

```
sudo yum install createrepo yum-utils
```

**2** Using a text editor, create a new file named createrepos.sh that contains the following content:

```

#!/bin/bash
rpm --import /etc/pki/sas/rpm-gpg/RPM-GPG-KEY-sas
mkdir -p /var/www/html/pulp/repos
for f in $(ls /etc/yum.repos.d/sas-*.repo | cut -f4 -d/ | sed s/.repo//g | grep -v sas-meta)
do
    reposync --gpgcheck -l -n --repoid=${f} \
        --download_path=/var/www/html/pulp/repos --downloadcomps --download-metadata
    cd /var/www/html/pulp/repos/${f}
    createrepo -v /var/www/html/pulp/repos/${f}/ -g comps.xml
done

```

**3** Set the Execute bit for createrepos.sh:

```
sudo chmod +x createrepos.sh
```

#### 4 Run createrepos.sh:

```
sudo ./createrepos.sh
```

---

## Deploy the Software

Perform these steps to install the SAS Event Stream Processing components on the machine where you have created a mirror repository.

The software order email (SOE) that you received from SAS directs you to save the required files to a directory on the host from which you will perform the installation. You must save those files before performing any steps in this section.

- 1 Follow the internal processes at your organization to set up a hosted repository from the local copy of the SAS repository that you have downloaded. For example, some organizations configure a web server using Apache httpd to serve this content.
- 2 After you have set up a hosted repository, use the procedures that are appropriate for your environment to install all of the RPMs that are available in your hosted repository.
- 3 Apply the license file. For more information, see [“Apply the License ” on page 33](#).

---

## Complete the Installation

The procedures in the following topics are required to complete the installation on all platforms.

### Apply the License

A valid license file is required in order to run any applications that use SAS Event Stream Processing.

Your SOE contained a license file that you were instructed to save. Now you must apply the license file to the local machine by saving it to the default license directory.

- 1 Locate the license file that you previously saved.
- 2 Copy the license file to the default license directory.

Substitute the actual name of the license file in the following command:

```
sudo cp license-filename /opt/sas/viya/home/SASEventStreamProcessingEngine/5.1.0/etc/license
```

### Start the Software

Before you try to start SAS Event Stream Processing, be sure to set the required environment variables. For more information, see [“Set Environment Variables” on page 11](#).

Take a few more steps to start the SAS processes and verify that the software is running.

- 1 On the machine where you installed SAS Event Stream Processing, run the following command to start the ESP server:

```
$DFESP_HOME/bin/dfesp_xml_server -http-admin 9900
```

The `-http-admin` argument runs the ESP server as a factory server that supports the creation of projects. Port 9900 in the example corresponds to the `adminport` parameter, which designates the port that is used for HTTP administration requests.

- 2 Validate the deployment. For more information, see [“Validating the Deployment” on page 19](#).
- 3 Perform any required steps that apply to your environment in the chapter titled [“Post-installation Tasks” on page 15](#).