SAS® Open Model Manager 1.2 for Containers: Deployment Guide
# Contents

**Chapter 1 / Introduction**  
Steps for a Successful Deployment ......................................................... 1  
Contact SAS Technical Support ................................................................. 2  

**Chapter 2 / System Requirements** .............................................................. 3  
Virtual Infrastructure Requirements ....................................................... 3  
Security Requirements .............................................................................. 5  
User and Group Requirements ................................................................. 5  
Client Requirements ................................................................................ 6  

**Chapter 3 / Pre-deployment Tasks** ............................................................ 9  
Obtain the Required Files .......................................................................... 9  
Enable Required Ports ............................................................................... 9  
Download the SAS Viya Image ................................................................. 10  

**Chapter 4 / Deploying Your Software** ..................................................... 13  
Install with Docker ..................................................................................... 13  
Configure the Users with the Administration CLI ........................................ 13  
Log On to SAS Open Model Manager ....................................................... 13  

**Chapter 5 / Completing the Deployment** .................................................. 15  
Refer to Additional Documentation ........................................................... 15  

**Chapter 6 / Managing Your Software** ...................................................... 17  
Update the Software ................................................................................ 17  
Add to the SAS Viya Image ..................................................................... 18  
Backup and Recovery Considerations ..................................................... 18  
Apply a New License ................................................................................. 19  
Access Logs ................................................................................................. 20  
Remove the Software ................................................................................. 20
Steps for a Successful Deployment

Before You Begin

- This guide provides information for deploying SAS Open Model Manager 1.2.
- 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 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 deploy the software successfully, you should have a working knowledge of Docker.
- Make sure that you have the SOE, which includes information about the software order and file attachments.
- If you plan to copy and paste commands from this guide (in PDF), SAS recommends that you copy from the HTML version of this guide instead. Copy and paste from PDF might introduce extraneous line breaks or invalid characters that will cause commands to fail in your environment.

Step 1 — Prepare for the Deployment

1 Perform one of the following tasks:
To update the software, go directly to “Update the Software” on page 17.
To deploy a new instance of the software, continue these steps.

2 Go to Chapter 2, “System Requirements,” on page 3 to learn about requirements for the virtual infrastructure, data sources, security, and more.

3 Go to Chapter 3, “Pre-deployment Tasks,” on page 9 to prepare your environment for the deployment.

Step 2 — Deploy the Software

Go to Chapter 4, “ Deploying Your Software,” on page 13 to deploy the image.

To locate documentation for administrative tasks and usage information, see Chapter 5, “Completing the Deployment,” on page 15.

Step 3 — Manage the Software

Go to Chapter 6, “Managing Your Software,” on page 17 to learn about adding software to the container, backup and recovery, applying a new license, accessing logs and more.

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

Virtual Infrastructure Requirements

General Host Machine Requirements
The Docker host (the machine where the container is created) must be running Linux. Windows is not supported for the deployment. This machine can be a physical or virtual machine.

In this release, SAS Open Model Manager cannot be installed on a managed container service such as AWS Elastic Container Service (ECS).

Hardware Requirements for the Host Machine
Hardware requirements for SAS products are typically dependent on the number of users who access the SAS Open Model Manager environment and the amount of data that is imported and analyzed.
Here are the minimum hardware requirements for the host machine where the container is running:

**Table 2.1 Resource Requirements**

<table>
<thead>
<tr>
<th>Resource</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMs</td>
<td>1</td>
</tr>
<tr>
<td>VCPUs</td>
<td>4 cores</td>
</tr>
<tr>
<td>RAM</td>
<td>48 - 64 GB</td>
</tr>
<tr>
<td></td>
<td>The amount of RAM required depends on the workload and number of concurrent users.</td>
</tr>
<tr>
<td>Disk Space</td>
<td>32 GB</td>
</tr>
<tr>
<td></td>
<td>This value assumes that data is not stored in the file systems inside the running container.</td>
</tr>
</tbody>
</table>

Be sure to prepare for the growth of log file data over time. SAS recommends mounting an external storage volume to store logs.

**Run-time Environment**

SAS Open Model Manager can be deployed using Docker version 17.05.0 or later. Both Docker Community Edition (CE) and Docker Enterprise Edition (EE) are supported. SAS Open Model Manager has been tested with Docker 17.05.0-ce.

To check the Docker version on your machine:

```
docker -v
```

SAS Open Model Manager includes a CentOS 7 distribution for Docker.

**Orchestration Requirements**

SAS Open Model Manager supports deployments in private Docker registries.

You can use Docker and a shell script to perform the deployment. SAS recommends using `docker run` as the command for deploying with Docker.
Security Requirements

Authentication Requirements

SAS Open Model Manager requires host authentication in order to secure the SAS Open Model Manager user interface. The container includes support for the Linux System Security Services Daemon (SSSD). To configure it, supply an sssd.conf file and, if required by the security policies at your enterprise, an sssd.cert file.

SAS Open Model Manager includes an example of a configuration file, named sssd_sample.conf, which can configure SSSD to integrate with the identity and authentication provider at your organization. You can use the example file as a template for setting the required SSSD properties.

Go to the SAS Open Model Manager site on GitHub at https://github.com/sassoftware/open-model-manager-resources/tree/master/runOpenMM and access the readme.md file for instructions.

Default Security Settings

SAS Open Model Manager is deployed with Transport Layer Security (TLS) to secure network connections and is fully compliant with SAS security standards. As soon as the container starts, connections to the HTTP Server are encrypted using TLS. However, network connections from the Apache HTTP Server to back-end services are not encrypted by default.

You can harden the deployment by blocking external connections to port 80, by adding custom certificates to the Docker host, and by upgrading the security protocol and ciphers, which are enabled by default.

The Docker run-time container might expose additional vulnerabilities. SAS recommends following the best practices that are documented in the Docker Container Security Considerations section of the SAS Open Model Manager: Administration Guide.

User and Group Requirements

Requirements for the User Who Manages the Container

By default, the Docker daemon runs as a user with root privileges. As a result, the user who performs the deployment would require sudo or root privileges in order to
run the required Docker commands. However, you can also enhance the run-time security of the Docker container by instead running Docker in rootless mode. For more information about rootless mode, refer to the following page on the Docker website: https://docs.docker.com/engine/security/rootless/.

As another alternative, instead of granting sudoers privileges to any user who will run Docker commands, you can create a Linux group named docker on the Docker host machine. Any users that you add to this group will automatically have Read/Write ownership of the Docker process. They will be able to run Docker commands without using sudo. Any user account that is a member of the docker group does not require additional root or sudoers access to the container.

For more information about the docker group, see https://docs.docker.com/install/linux/linux-postinstall/.

### User Account Requirements

End users will log on to the SAS Open Model Manager user interface. SAS Open Model Manager uses LDAP for user authentication.

Here are the requirements for SAS Open Model Manager users:

- Accounts that require Administrator privileges should be added to the docker group. They must also be configured in LDAP.
- SAS Open Model Manager users also require an LDAP account.
- Each user must log on with an account that has a home directory. SAS Open Model Manager requires home directories.

If you configure host authentication for the container using SSSD, multiple users can log on to the container using their LDAP credentials.

### Client Requirements

#### Web Browsers

End users can access the user interface for SAS Open Model Manager from a desktop computer, using a supported web browser. Because SAS software is not installed on this machine, the requirements are minimal. The desktop machine can run on 64-bit UNIX or 64-bit Windows operating systems.

The SAS Open Model Manager user interface includes 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/35/support-for-web-browsers.html.
Mobile Platform and Touchscreen Support

You can view performance results for models using SAS Visual Analytics. Even though the SAS Open Model Manager user interface is not supported on mobile devices, SAS Visual Analytics Apps are available in app stores. They run natively on iOS, Android, and Windows 10, and provide the ability to view and explore reports using a touchscreen.

For more information about mobile device support, see: https://support.sas.com/en/documentation/third-party-software-reference/viya/35/support-for-web-browsers.html.

Screen Resolution

The minimum screen resolution for each client machine that will access the SAS Open Model Manager user interfaces is 1280 x 1024.
Pre-deployment Tasks

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. The SOE directs you to save its attached ZIP file and the license file to a directory on your local machine.

In the same directory where you have saved the ZIP file, uncompress the file.

`unzip SAS_Viya_deployment_data.zip`

The following file structure is created in the directory where the ZIP file was uncompressed:

- `licenses/SASViyaV0300_order-number_Linux_x86-64.txt`
- `licenses/SASViyaV0300_order-number_site-number_Linux_x86-64.jwt`
- `ca-certificates/SAS_CA_Certificate.pem`
- `ca-certificates/SAS_CA_Certificate.p7b`
- `entitlement-certificates/entitlement_certificate.pem`
- `entitlement-certificates/entitlement_certificate.pfx`

Enable Required Ports

The following ports are used by SAS Open Model Manager. If you have a firewall, open these ports before you begin the deployment process.


Table 3.1 Required Ports

<table>
<thead>
<tr>
<th>Process</th>
<th>Required Port</th>
<th>Must Allow Inbound Traffic From</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS Server</td>
<td>5570</td>
<td>SAS Viya servers only</td>
<td>Only users of SAS Scripting Wrapper for Analytics Transfer (SAS SWAT) require this port to be open so that they can access the CAS server.</td>
</tr>
<tr>
<td>HTTP, HTTPS</td>
<td>8080, 443</td>
<td>anywhere (SAS Viya servers, client workstations)</td>
<td></td>
</tr>
</tbody>
</table>

Download the SAS Viya Image

Access the SAS Repository

The SAS Viya image is located in a repository that is hosted by SAS. To access the SAS repository, you use SAS Mirror Manager, which is a command-line utility that you run locally.

1. In the directory where you uncompressed the ZIP file from your SOE, download SAS Mirror Manager from the [SAS Mirror Manager download site](#).
2. Uncompress the downloaded file.
3. List the name of the image that is in the SAS repository:

   ```bash
   mirrormgr list remote docker tags --deployment-data ${pwd}/SAS_Viya_deployment_data.zip --latest
   
   Here is example output:
   
   ses.sas.download/modmgrsta-100.0.0-x64_redhat_linux_7-docker/sas-open-modelmanager:1.2.7-20191016.1571221515272
   
   Note: The values from the preceding example output are used in examples throughout this guide. The syntax of the output is `sas-repository/docker-namespace/image-name:tag`
Download the SAS Viya Image

1 Configure Docker to use the certificates that were saved from the ZIP file from your SOE. Run the commands as root or as a user with elevated privileges.

   Note: Enter each command on a single line.

   mkdir /etc/docker/certs.d/ses.sas.download -p
   cp -v $(pwd)/ca-certificates/SAS_CA_Certificate.pem /etc/docker/certs.d/ses.sas.download/ca.crt
   cp -v $(pwd)/entitlement-certificates/entitlement_certificate.pem /etc/docker/certs.d/ses.sas.download/client.cert
   cp -v $(pwd)/entitlement-certificates/entitlement_certificate.pem /etc/docker/certs.d/ses.sas.download/client.key

2 Pull and inspect the image. Here is an example:

   Note: Enter each command on a single line.

   docker pull ses.sas.download/modmgrsta-100.0.0-x64_redhat_linux_7-docker/sas-open-modelmanager:1.2.7-20191016.1571221515272
   docker inspect ses.sas.download/modmgrsta-100.0.0-x64_redhat_linux_7-docker/sas-open-modelmanager:1.2.7-20191016.1571221515272

Here is the syntax of each command:

   docker pull sas-repository/docker-namespace/image-name:tag
   docker inspect sas-repository/docker-namespace/image-name:tag

Tag and Push the Image to a Docker Registry

The SAS Viya image is a Docker image that can be tagged and stored in a Docker registry. Pushing the image to a Docker registry might save time and can protect against download limits because you can pull from a local copy instead of the remote SAS repository.

   Note: Using a Docker registry and performing the following steps are optional.

   1 Tag the pulled image with the Docker registry's address. Here is an example:
Note: Enter the command on a single line.

docker tag ses.sas.download/
modmgrsta-100.0.0-x64_redhat_linux_7-docker/
sas-open-modelmanager:1.2.7-20191016.1571221515272 registry:5000/
modmgrsta-100.0.0-x64_redhat_linux_7-docker/
sas-open-modelmanager:1.2.7-20191016.1571221515272

Here is the syntax of the command:
docker tag sas-repository/docker-namespace/image-name:tag
docker-registry-host-name:port/docker-namespace/image-name:tag

2 Push the image to the local Docker registry. Here is an example:

Note: Enter the command on a single line.

docker push registry:5000/
modmgrsta-100.0.0-x64_redhat_linux_7-docker/
sas-open-modelmanager:1.2.7-20191016.1571221515272

Here is the syntax of the command:
docker push docker-registry-host-name:port/docker-namespace/
image-name:tag

After you push the image, users can pull the image and run it from the Docker registry.

Note: You can keep the same tag that is used for the image that was downloaded, or you can change it using the tag command. In the preceding steps, the tag for the image in the local Docker registry is the same as the tag for the image that was downloaded from the SAS repository. In the example commands and file names throughout this guide, the Docker image from the SAS repository is used.
Deploying Your Software

Install with Docker

The instructions and script for creating and running the SAS Open Model Manager container are located at https://github.com/sassoftware/open-model-manager-resources/tree/master/runOpenMM. Go to that site and follow the instructions in the readme.md file.

When you finish the steps in the readme.md file, return to this document to complete your deployment.

Configure the Users with the Administration CLI

For information about configuring users and user groups, see Managing Permissions in SAS Open Model Manager: Administrator’s Guide.

Log On to SAS Open Model Manager

To ensure that SAS Open Model Manager has been deployed correctly, log on to it:

1. Open SAS Open Model Manager from a URL with this format:
   http://host-name-where-docker-is-running:sas-http-port/SASModelManager

2. Log on using the credentials for your operating system account.
Note: To log off from SAS Open Model Manager, click **Sign Out** on the toolbar. Do not use the **Back** button on your web browser.
Completing the Deployment

Refer to Additional Documentation

After you validate the deployment, you can perform initial administrative tasks. For more information, see SAS Open Model Manager: Administrator’s Guide at http://documentation.sas.com/?docsetId=openmmag&docsetVersion=1.2.

For usage information, refer to the Help that is available from the SAS Open Model Manager product and administrative interfaces.
Managing Your Software

Update the Software

Updating the software requires an update and a restart of the Docker image. You will perform the update with the same software order that was used for deployment.

Note: You will need the location of the directory where you stored the deployment and maintenance files. For more information about this directory, see “Obtain the Required Files” on page 9.

1 Find the latest Docker tag.

    Note: Run the command on a single line.

    `mirrormgr list remote docker tags --deployment-data $(pwd)/SAS_Viya_deployment_data.zip --latest`

    Here is example output:

    `ses.sas.download/modmgrsta-100.0.0-x64_redhat_linux_7-docker/sas-open-modelmanager:1.2.7-20191016.1571221515272`

2 Obtain the latest image.

    `docker pull output-from-step-1`

3 Determine whether the container is running.

    Note: Run the command on a single line.

    `...`
docker ps -filter name=openmodelmanager --format "table {{.ID}} \t{{.Names}} \t{{.Image}} \t{{.Status}} \t{{.Size}}"

Here is example output:

<table>
<thead>
<tr>
<th>CONTAINER ID</th>
<th>IMAGE</th>
<th>COMMAND</th>
<th>CREATED ...</th>
</tr>
</thead>
</table>

In the example, the table is empty. If the table is empty, skip to Step 5.

4 Stop the container.

docker stop openmodelmanager

5 Remove the container.

docker rm openmodelmanager

6 Run the run_docker_container script using the appropriate values for the variables to start the new image.

Note: Run the command on a single line.

./run_docker_container --container-name openmodelmanager --image registry-URL/namespace/image:tag --order SAS-order-number [--http-port port|--https-port port] [--debug, --tls]

Add to the SAS Viya Image

The instructions and scripts for adding to the SAS Open Model Manager container are located at https://github.com/sassoftware/open-model-manager-resources/tree/master/addons. Go to that site and follow the instructions in the README file.

You can do the following:

- Install extra Python packages for the SAS Open Model Manager container.
- Create a CAS, Amazon Web Services (AWS), or Private Docker publishing destination using a Python script.
- Create container base images for Python2, Python3, and R models using a Python script.
- Change the PyMAS configuration in the container.
- Enable debugging for a specific service using the sas-admin CLI.

Backup and Recovery Considerations

Persistent storage that is attached to the containers can ensure that data sources that are not handled by the backup utilities can be retained and recovered.

Assets that retain information or the state between CAS sessions or SAS sessions (for example, CAS controls and caslib information) should be backed up on
persistent disks. User home directories must also be NFS mounts and capable of being backed up through your organization’s standard persistent disk backup procedures.

Apply a New License

You apply a new license to enable new products or to extend expiration dates on existing products.

Applying a license requires an outage period. During the process, all SAS services must be stopped and then restarted.

Note: You will need the location of the directory where you stored the deployment and maintenance files. For more information about this directory, see “Obtain the Required Files” on page 9.

Note: If you plan to copy and paste commands from this guide (in PDF), SAS recommends that you copy from the HTML-formatted version of this guide instead. Copy and paste from PDF might introduce extraneous line breaks or invalid characters that will cause commands to fail in your environment.

1 (Optional) To make a backup, copy the existing license file to a new file and save it.

Note: Run the command on a single line.

docker cp path-to-SAS-license/license.sas path-to-SAS-license/license.orig

2 Determine whether the container is running.

Note: Run the command on a single line.

docker ps --filter name=openmodelmanager --format "table {{.ID}}
\t{{.Names}}\t{{.Image}}\t{{.Status}}\t{{.Size}}"

Here is example output:

CONTAINER ID IMAGE COMMAND CREATED ...

In the example, the table is empty. If the table is empty, skip to Step 5.

3 Stop the container.

docker stop openmodelmanager

4 Remove the container.

docker rm openmodelmanager

5 Copy the new license file to the local directory that contains the run_docker_container script.
6 To start the container with the new license, run the run_docker_container script again using the `order_id` of your new SOE in the `--order` parameter. For more information, see

The instructions and script for creating and running the SAS Open Model Manager container are located at https://github.com/sassoftware/open-model-manager-resources/tree/master/runOpenMM. Go to that site and follow the instructions in the README.md file.

For additional information about licensing, see Licensing in SAS Viya Administration: Licensing.

---

### Access Logs

Run the following command:

```
docker logs openmodelmanager
```

---

### Remove the Software

1 Stop the container.
   ```
docker stop openmodelmanager
   ```

2 Determine whether the container is still listed.
   ```
Note: Enter the command on a single line.

docker ps -a --filter name=openmodelmanager --format "table {{.ID}}
\t{{.Names}}\t{{.Image}}"
   ```
   Here is example output:

   ```
   0180fa635ac2        openmodelmanager
   ses.sas.download/modmgrsta-100.0.0-x64_redhat_linux_7-docker/sas-open-modelmanager:1.2.7-20191016.1571221515272
   ```
   If the output is empty, skip to Step 4 on page 20.

3 Remove the container.
   ```
docker rm openmodelmanager
   ```

4 (Optional) If the image is no longer needed, then remove it. Here is an example:
   ```
Note: Enter the command on a single line.
```
docker rmi ses.sas.download/
modmgrsta-100.0.0-x64_redhat_linux_7-docker/
sas-open-modelmanager:1.2.7-20191016.1571221515272