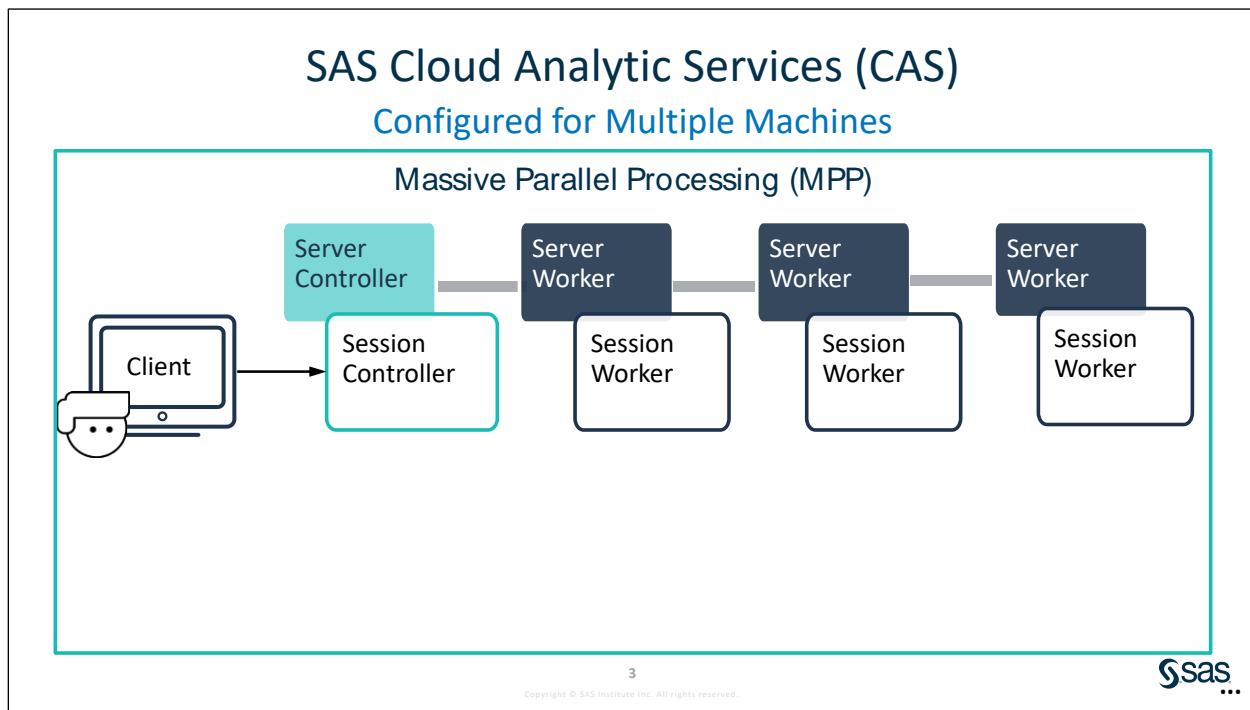


Lesson 4 Data and Security Tasks

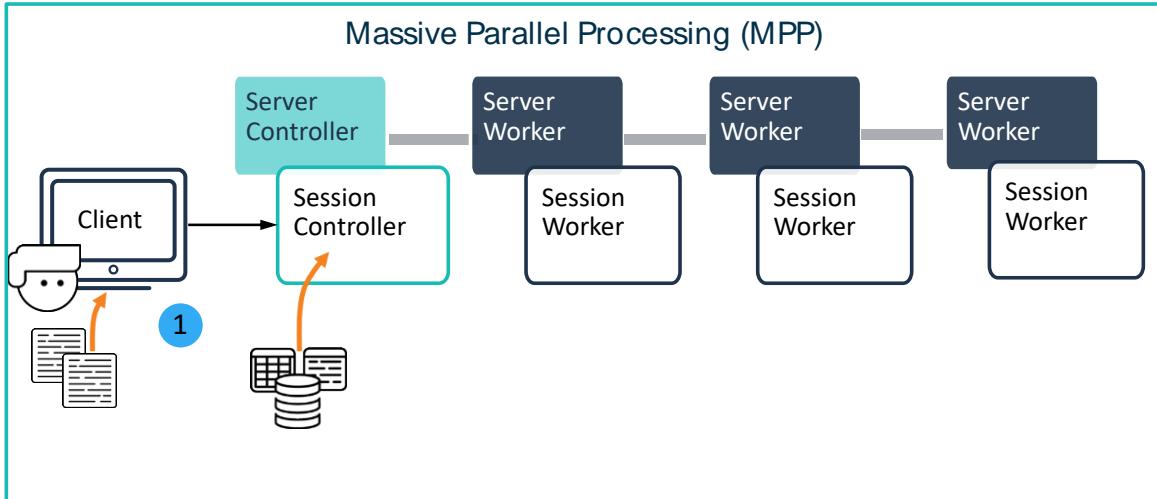
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4.1 CAS Data Loading



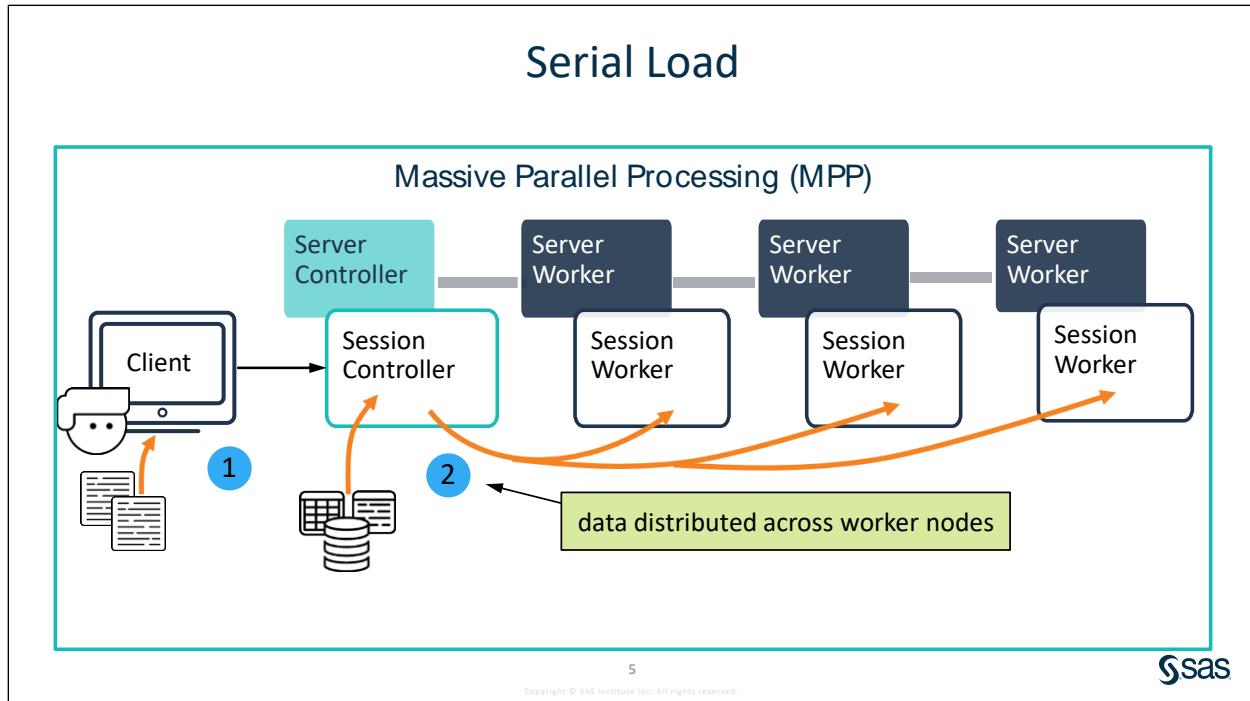
CAS is designed to run in a multi-machine configuration so that it can take advantage of parallel processing. A CAS configuration with multiple machines is known as *massive parallel processing*, or MPP. When a CAS server is running in massive parallel processing mode, one machine is designated as the controller and the other machines are worker nodes.

Client-Side and Server-Side Data Access

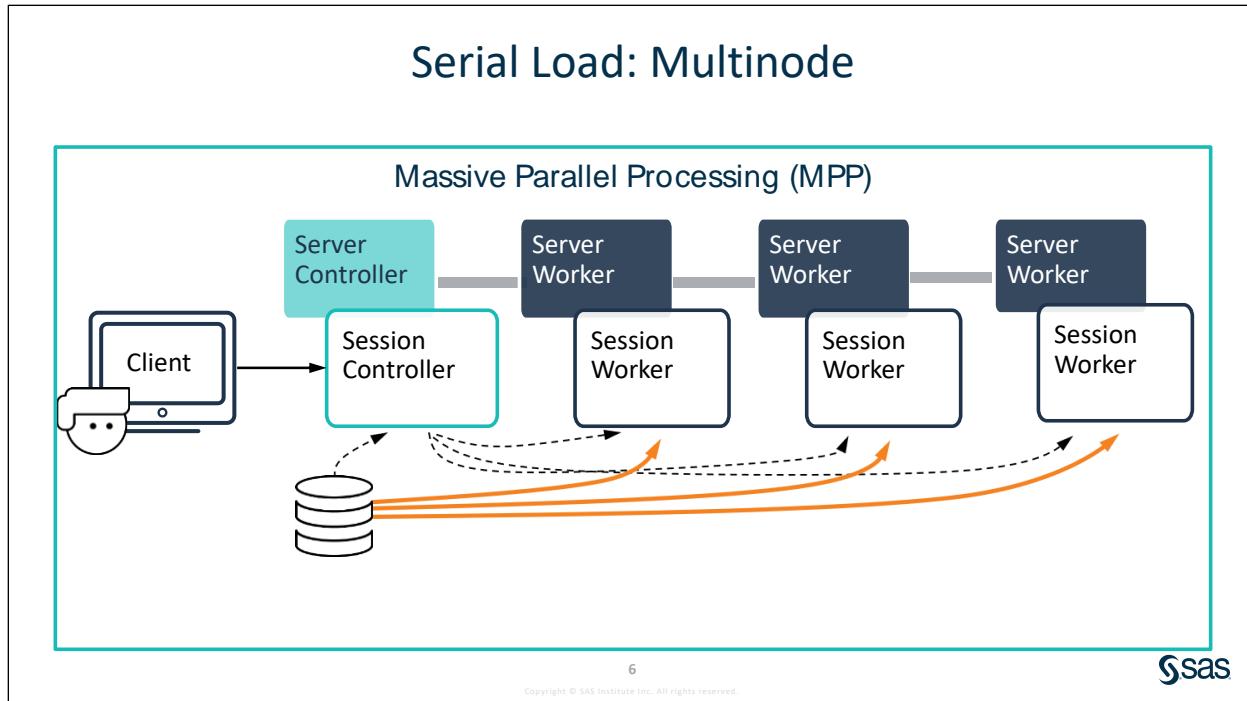


Data can be loaded into SAS Viya in multiple ways. You can use different techniques depending on the location of the source data. Data that is referenced from the client machine is referred to as *client-side data access* (for example, data files such as Excel that are referenced from the same machine that is hosting SAS Studio).

Server-side data access is the process of loading data into CAS that CAS can access directly, such as the databases LASR, Teradata, Hadoop, PostgreSQL, and Oracle.

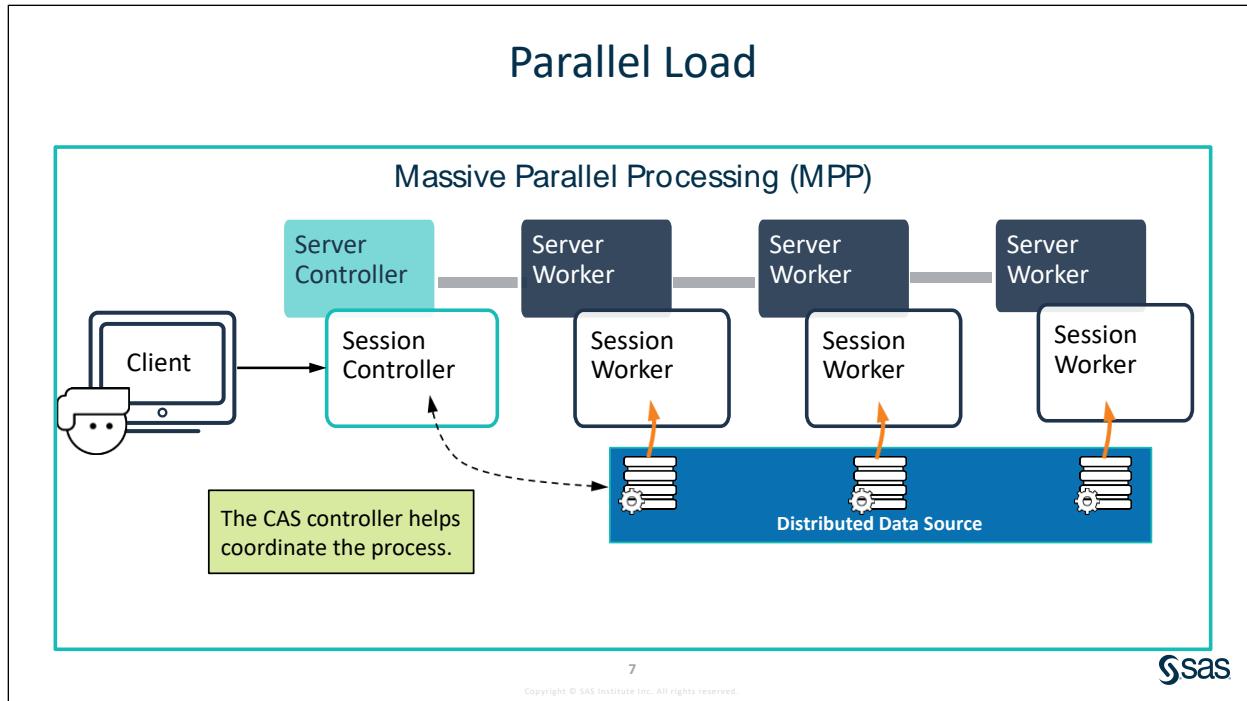


Data is loaded in serial when, at some point, it must pass through a single physical interface or channel. *Serial* is the typical default transfer mode and is always available, if you assume that the infrastructure is operating at minimum requirements.



A CAS controller node controls data transfer to and from worker nodes through n concurrent connections with the data source. This controller node directs each CAS worker node about how to query the source data to obtain the needed data. Therefore, each worker node connects directly to the data source independently. As a result, multiple data streams can move data simultaneously.

The [database] client must be installed on the CAS controller machine **and** on the **CAS worker nodes**.



Data is loaded in parallel when it transfers across multiple interfaces or channels from the source to the destination. Parallel transfer of data multiplies the speed at which data is loaded into CAS.

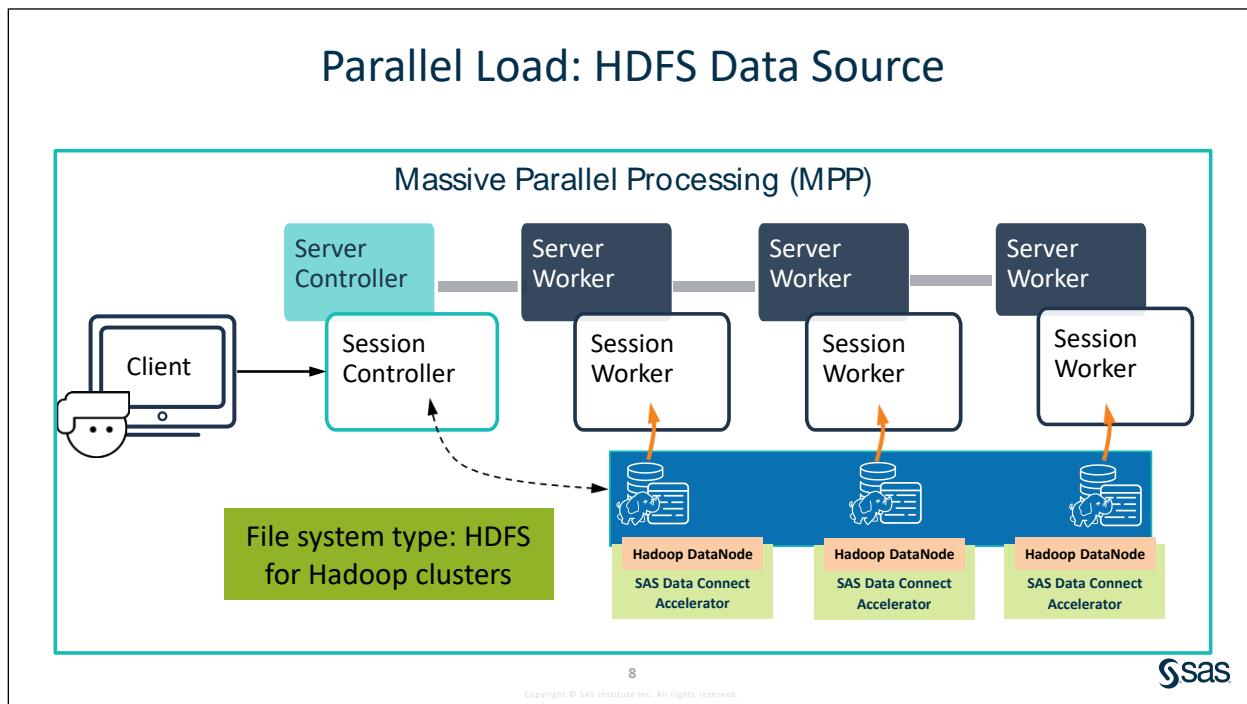
Comparison of serial versus parallel loading and multinode loading from a database:

Serial	Parallel
✓ Compatible with more data sources	Compatible with few data sources
Limited I/O rate	Scalable I/O rate
Limited data volumes (due to transfer time)	Scalable data volumes
✓ Provides correct fallback if failure	Complexity increases possible failure
✓ Already built in	Requires MPP CAS (and SAS Embedded Process or DNFS/shared file system, or HDFS)

Technologies for serial loading are a prerequisite to enabling parallel loading. If some aspect of the parallel load fails, then there is still a possibility to perform the transfer serially.

Multinode

- joins the benefits of SAS serial data transfer technologies with the benefits of a parallel I/O
- has many routine fallback options before it reverts to purely serial transfer
- does require MPP CAS, but it does not rely on the other parallel SAS technologies (SAS Embedded Process, DNFS, HDFS).



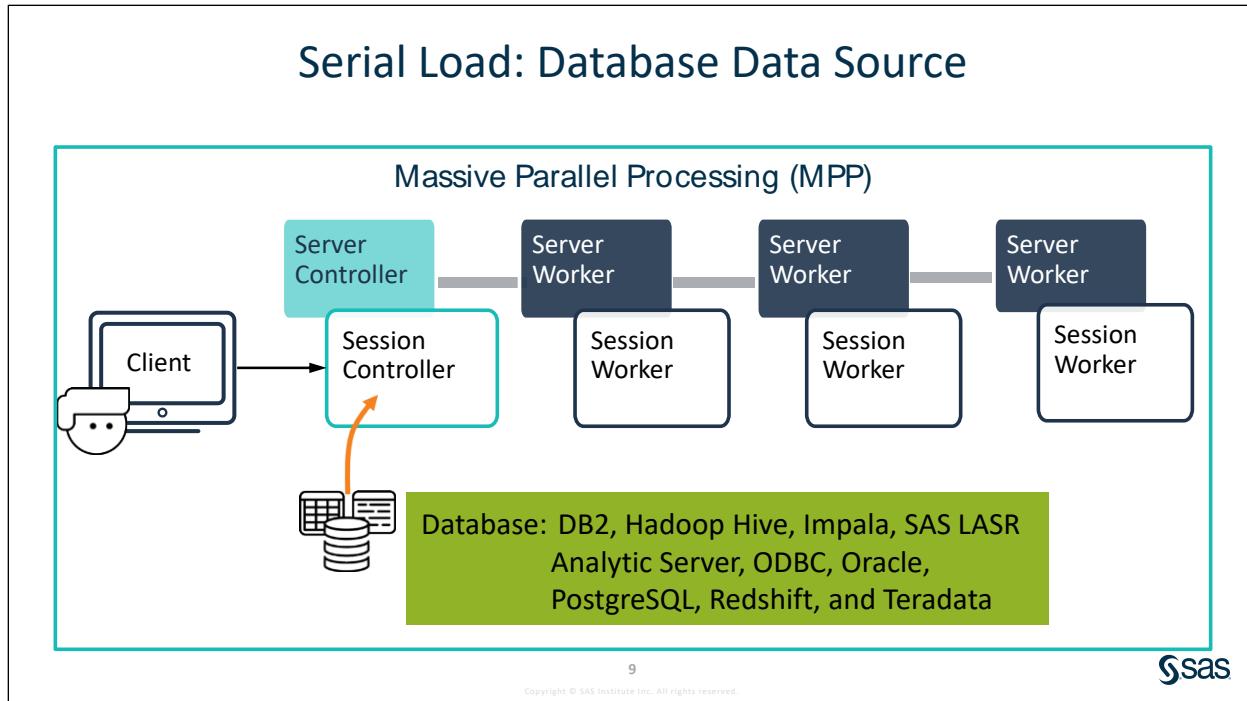
Note: The SAS Plug-ins for Hadoop must be installed on the Hadoop cluster.

Note: Your Hadoop cluster and CAS controller and workers do not need to be co-located.

Data Connect Accelerator is also available for Teradata.

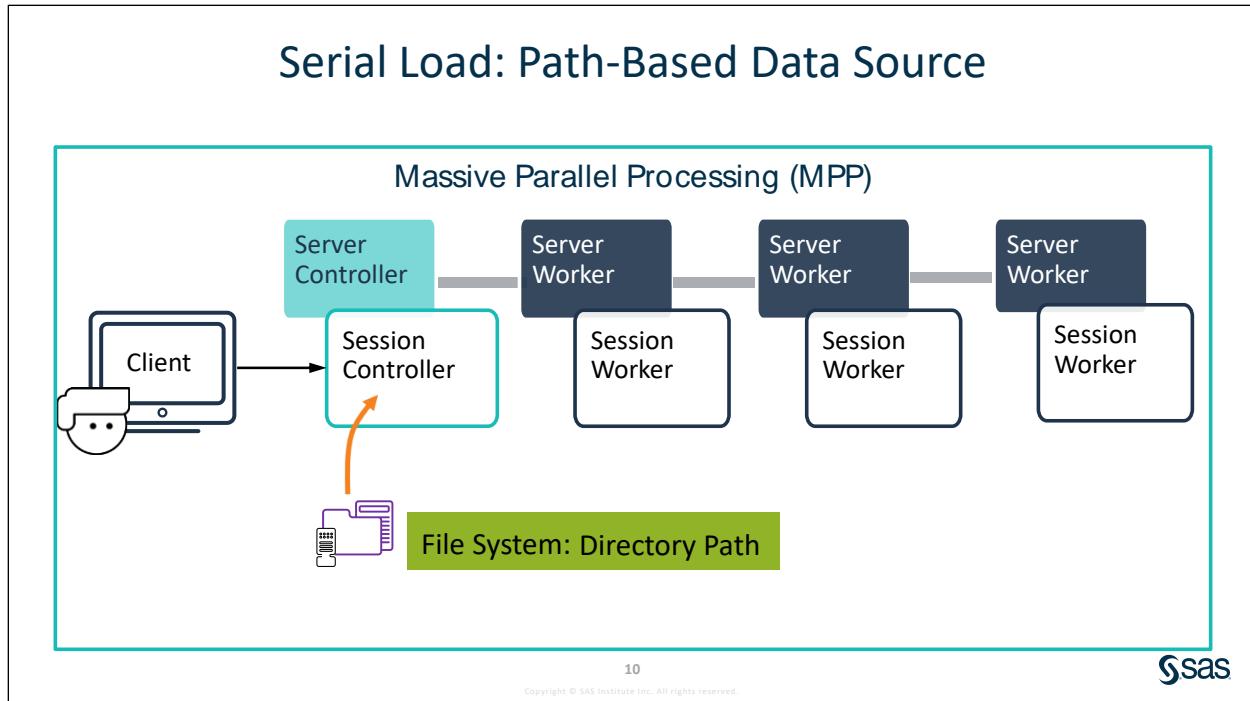
You can load data in parallel with a SAS Data Connect Accelerator. This parallel loading capability exists for distributed configurations and uses a SAS Data Connect Accelerator powered by SAS Embedded Process technology.

SAS Embedded Process technology is a flexible, efficient way to leverage increasing amounts of data by integrating select SAS technology into databases or data warehouses. It uses the massive parallel processing (MPP) architecture of the database or data warehouse for scalability and better performance. You can run scoring models, some SAS procedures, and formatted SQL queries inside the database. With Greenplum, Hadoop, and Teradata, you can also execute DS2 thread programs in parallel inside the database. With Hadoop and Teradata, you can perform data quality operations and extract and transform data.

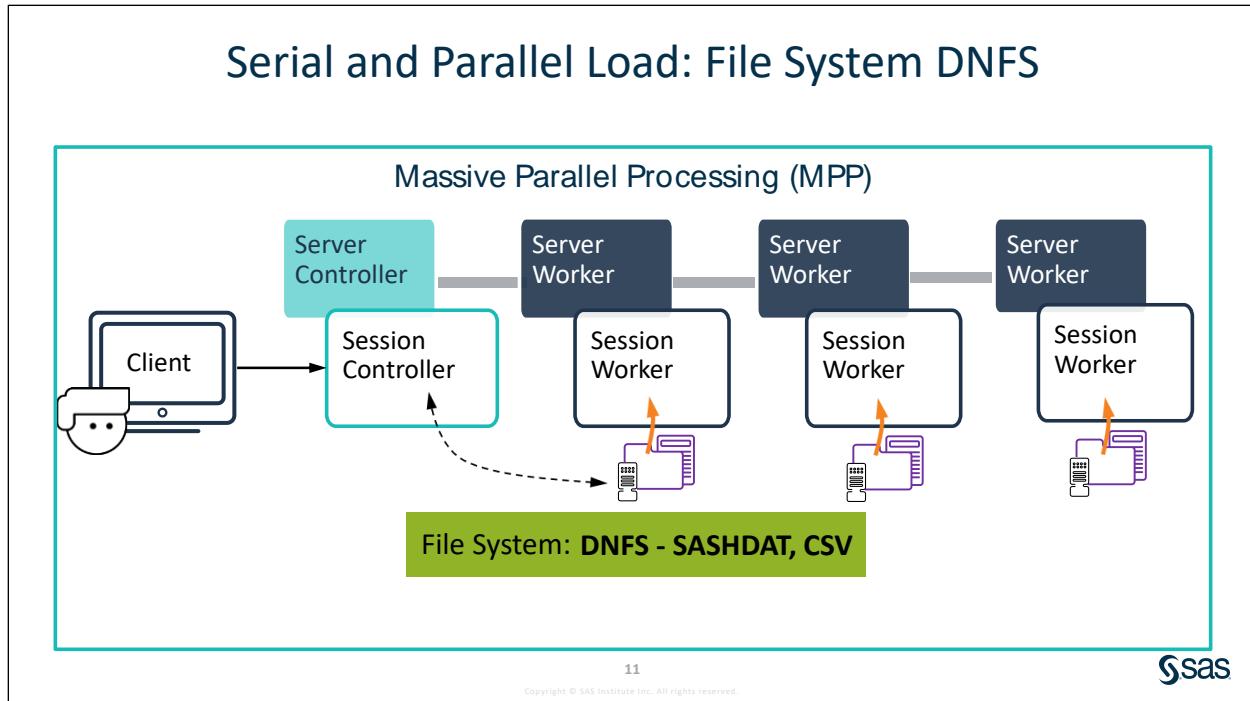


For Hadoop data source:

- If you need a place to save large volumes of data, then the HDFS caslib data source might fit your needs.
- If you already use Hadoop to store and analyze data, then the data connector and a Hadoop caslib data source enables CAS to read that data and enables SAS to push jobs to the Hadoop cluster.



Data sources can also be from a server-side directory or file system that a CAS controller can access.



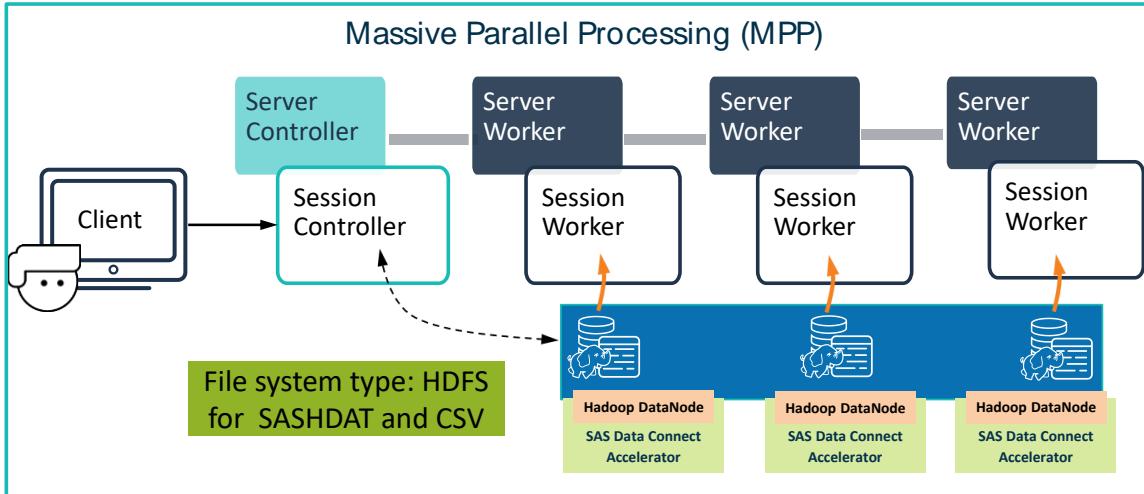
One such file system type is DNFS, or distributed network file system. This data source type provides support for distributed data access to NFS directories. The directory path for a DNFS caslib must be mounted on every machine so that DNFS performs parallel read and write for SASHDAT and CSV files that are stored in the directory path. SASHDAT is a SAS proprietary format that is optimized for high-performance analytics environments.

DNFS, or distributed network file system, is a SAS technology concept that is used as an umbrella term to describe a shared file system that is mounted identically on all CAS host machines.

Several systems such as MapR-FS, EMC Isilon, and others provide high-availability, replicated, high-performance, stand-alone storage clusters with an NFS interface. These systems offer popular alternatives to Hadoop. DNFS provides a good alternative for deployments where the customer does not want to deploy a Hadoop cluster for HDFS and yet must provide similar capabilities.

Note: SAS data sets or CSV files can load data in parallel by specifying the following option in the path type caslib: `datatransfermode="parallel"`. However, all CAS hosts (not only the CAS controller) must specify the directory path in the caslib to reference a common shared file system.

Parallel Load: HDFS Data Source



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4.01 Activity

Log on to SAS Environment Manager as Christine.

Select Data ⇒ Data Sources tab ⇒ Connect icon .

Review the Connection Settings window and answer the following questions:

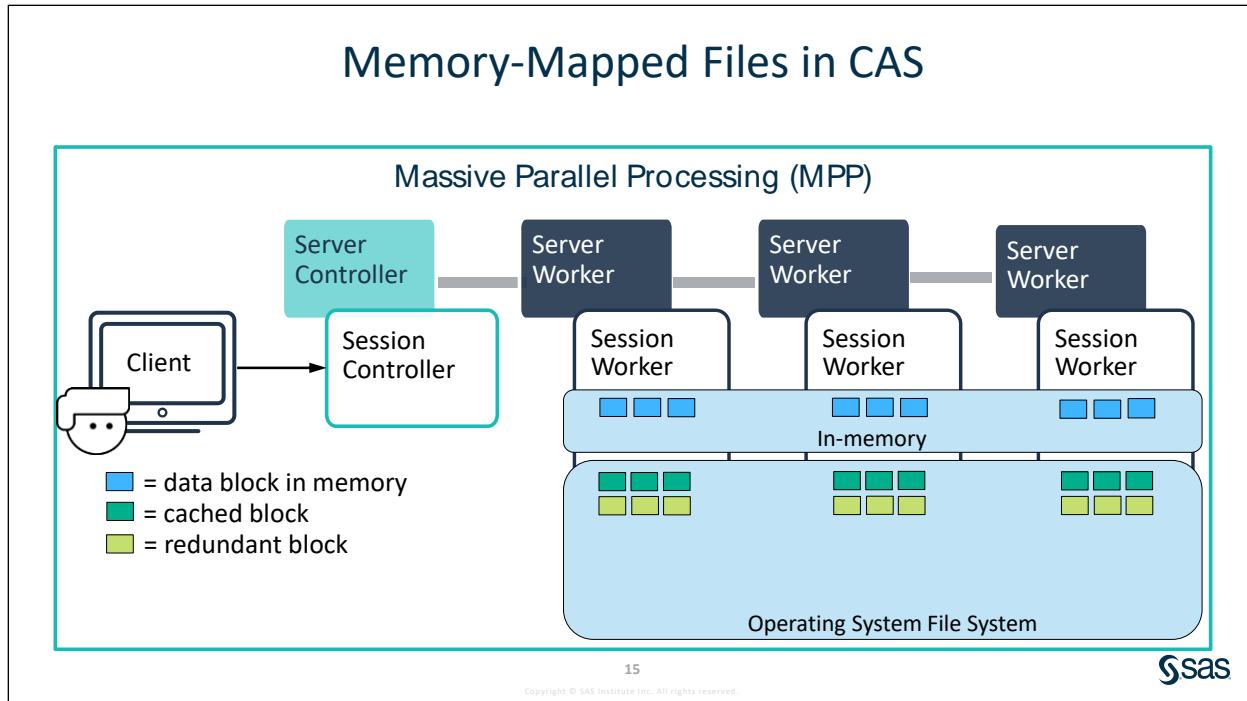
1. How many Source types are available for type: **Database**?
2. What Source types are available for type: **Filesystem**?
3. Where can you specify parameters such as domains and how data can be read for this data source?

Click Cancel.

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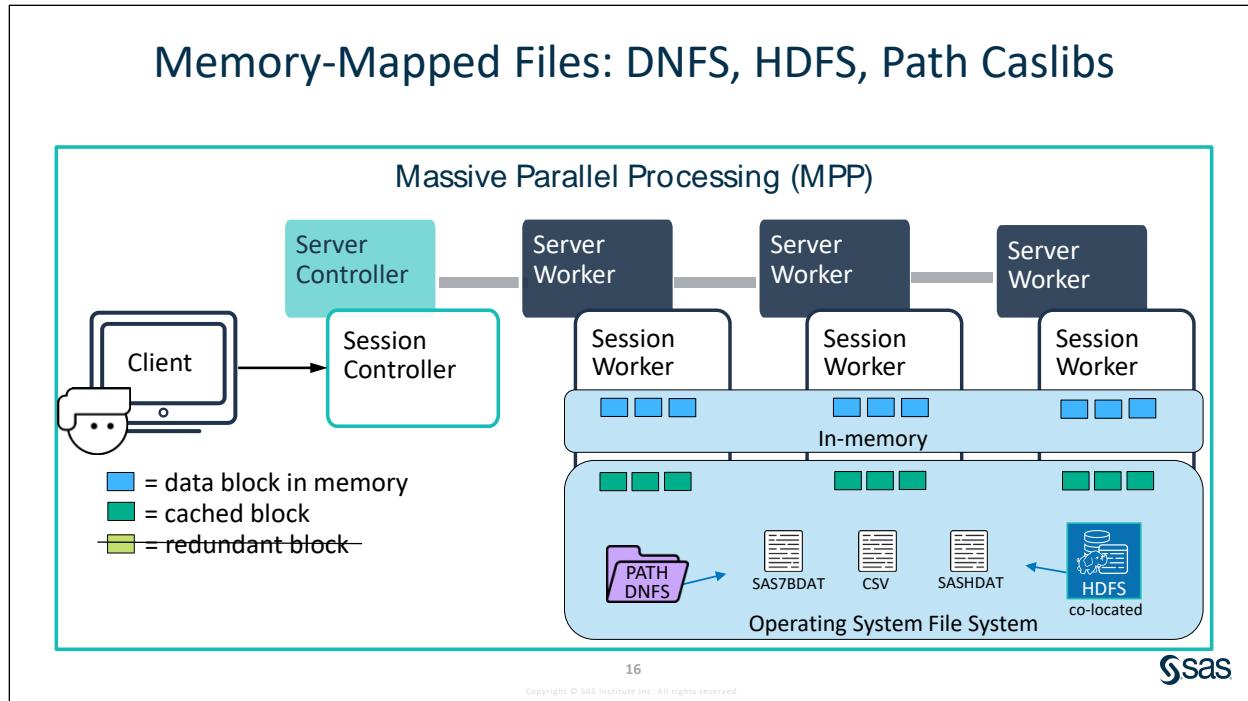


CAS is an in-memory server that uses in-memory tables. The goal of the server is to use memory efficiently and provide the best performance for the available amount of physical memory and the data volume to analyze. This is accomplished by using file-based memory-mapped files.

CAS provides failover protection if a CAS worker goes offline unexpectedly, because by default, CAS maintains a copy of data on a separate node to guard against node failure. The inactive data blocks become active in case one of the CAS nodes fails.

Some of the benefits of memory mapping are as follows:

- **Avoid paging to system swap space:** The system swap space is small compared to the overall disk space for the host. The swap space is used when memory demand is high. The cost to page out data is high because performance is limited to the write speed of disk drives. With memory mapping, the host can write in-memory blocks to the cache during idle time and avoid poor performance when free memory is extremely low. The read speed for disk drives is high, so the cost to read memory-mapped blocks is low.
- **Data that exceeds physical memory capacity:** By memory-mapping blocks, the server can analyze data that is larger than the physical memory capacity. This applies to both single large tables and when the combined size of many tables exceeds memory capacity. Blocks are read from the memory until the physical memory limit is met. Then, because the blocks are memory-mapped, some physical memory can be freed (without the performance penalty that is associated with paging out). Blocks are paged in from the next series of memory-mapped files.
- **Memory efficiency:** For global-scope tables and all tables loaded from SASHDAT files, the use of memory mapping enables multiple sessions to share the same physical memory. If many sessions access the same global-scope table or SASHDAT-backed table, only one instance of the data is in physical memory.

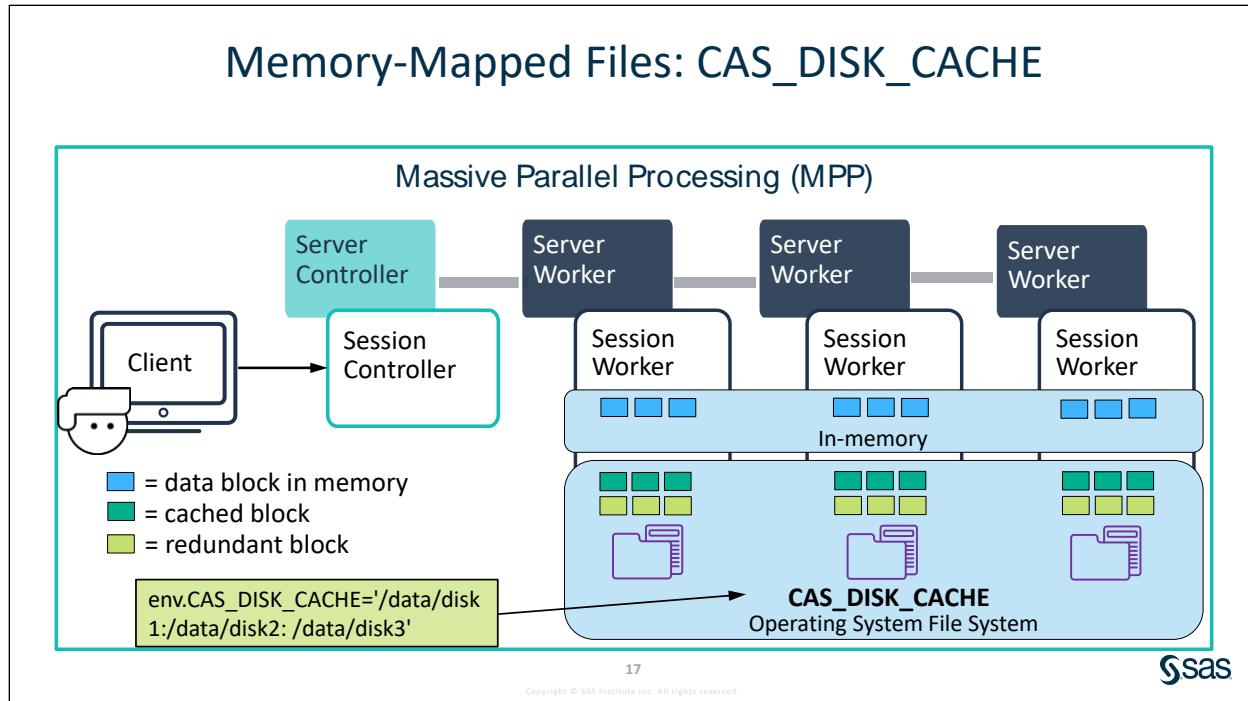


SASHDAT, SAS data sets, and CSV files can be directly memory mapped by CAS and thus represent the backing store. This is the case when the data source types for caslibs correspond to Path, DNFS, and symmetrically co-located HDFS, in which hdat source files are used.

When a server has local data access to these files, the server does not copy blocks to the CAS_DISK_CACHE because the server can memory map the file itself and there is no need for a redundant block. A surviving worker node can access the file and load the blocks that the failed node had.

For HDFS, if it is co-located, then the server accesses the original blocks. HDFS has redundant copies built into it. The server knows which blocks are lost with a failed worker. HDFS can identify which hosts have redundant copies, and those hosts load the redundant copies.

If HDFS is not co-located, then there is no special treatment for the SASHDAT files. Copies are stored in CAS_DISK_CACHE.



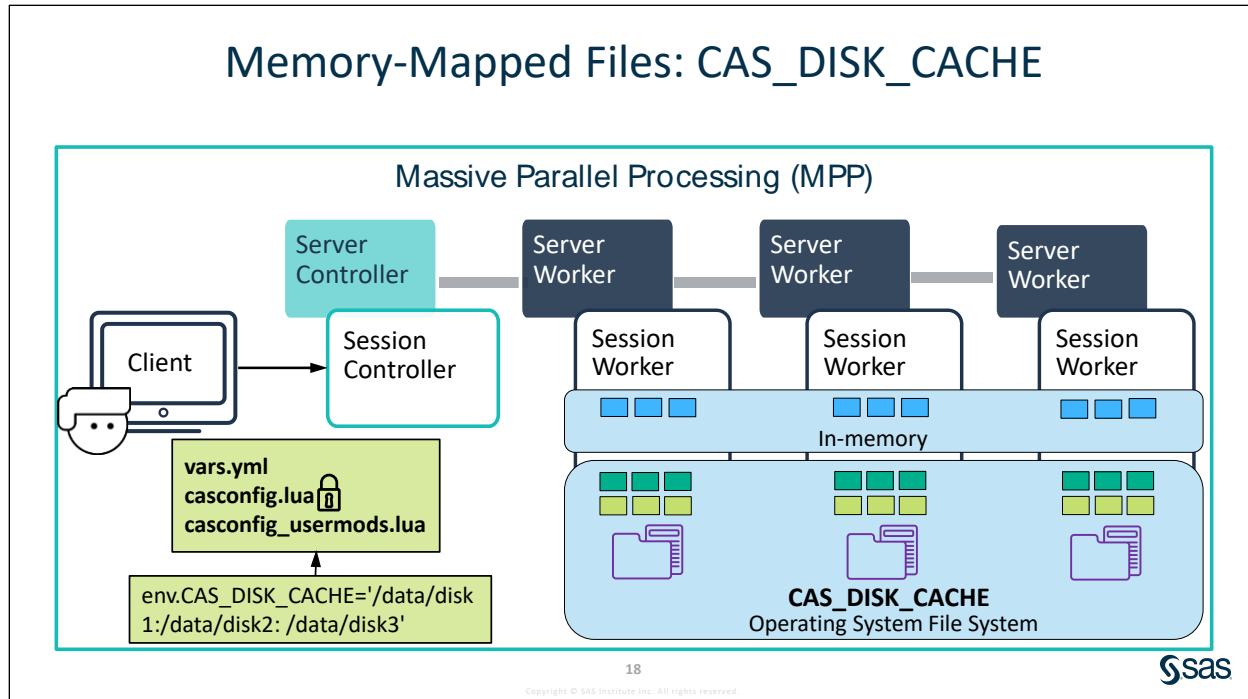
For other file types and data sources, CAS uses the directories that are associated with the environment variable CAS_DISK_CACHE for the disk-based backing store.

Note: The CAS controller also uses space that is allocated to CAS_DISK_CACHE for temporarily staging incoming serial data loads.

Notes:

- The space assigned for CAS_DISK_CACHE is dedicated per CAS host.
- When you use multiple threads, mapping files can occur concurrently if multiple disks are used.
- Hadoop also uses multiple physical disks. Therefore, there is an advantage to using a set of disks that map to both Hadoop data and CAS_DISK_CACHE directories.
- Data loading where CAS_DISK_CACHE is relied on as a backing store is not complete until all blocks reside on disk, not only in RAM.
- If CAS must fetch data from CAS_DISK_CACHE, the speed of that transfer affects the total response time.
- If CAS must often rely on CAS_DISK_CACHE to relieve pressure on RAM (swapping active tables to or from disk), then the I/O performance of CAS_DISK_CACHE might become a critical bottleneck.
- For small tables, the overhead of MPP communication might be too much. For small tables, distribute the data to a subset of the CAS workers.

The best practice is to set the directories during deployment.



Location where CAS_DISK_CACHE can be specified (env.CAS_DISK_CACHE):

File	When	Description
sas_viya_playbook/ vars.yml	At install	The default used by CAS
.../cas/ casconfig.lua	At start-up on CAS Controller	The default used by CAS Controller; notifies workers
.../cas/ casconfig_usermods.lua	At start-up on CAS Controller after casconfig.lua	Overrides the default CAS Controller: notifies workers
.../cas/ node.lua	At start-up on each CAS host after casconfig_usermods.lua	Overrides the value from CAS Controller

4.02 Multiple Choice Question

When loading a SASHDAT file from a DNFS caslib:

- a. the server memory-maps the original file.
- b. the server stores copies of the data in the directories defined by MAX_TABLE_MEM on the CAS controller.
- c. the server stores copies of the data in the directories specified by CAS_DISK_CACHE on the CAS controller.

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4.03 Multiple Choice Question

When loading an Oracle database table:

- a. the server memory-maps the original file.
- b. the server stores copies of the data in the directories defined by MAX_TABLE_MEM on the CAS controller.
- c. the server stores copies of the data in the directories specified by CAS_DISK_CACHE on the CAS controller.

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4.04 Question

The CAS_DISK_CACHE value determines the number of redundant blocks to store in a CAS distributed environment.

- True
- False

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4.05 Multiple Answer Question

In which file can CAS_DISK_CACHE be set? (Select all that apply.)

- a. sasv9.cfg
- b. node.lua
- c. vars.yml
- d. casconfig_usermods.lua
- e. Inventory.ini

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SAS Cloud Analytic Services (CAS) Configured for a Single Machine

Symmetric Multi-Processing (SMP)



Server Controller

Session Controller

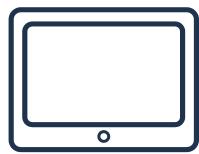
27

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SAS Cloud Analytic Services (CAS) Configured for a Single Machine

Symmetric Multi-Processing (SMP)



Server Controller

Session Controller



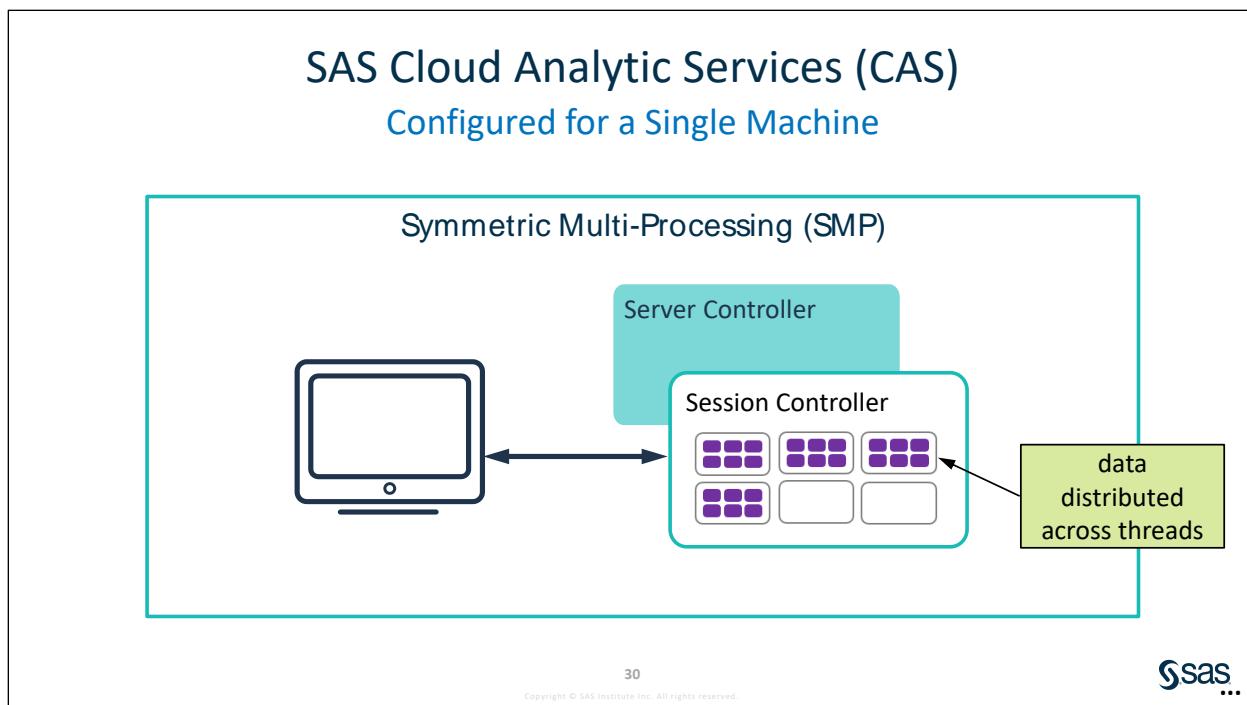
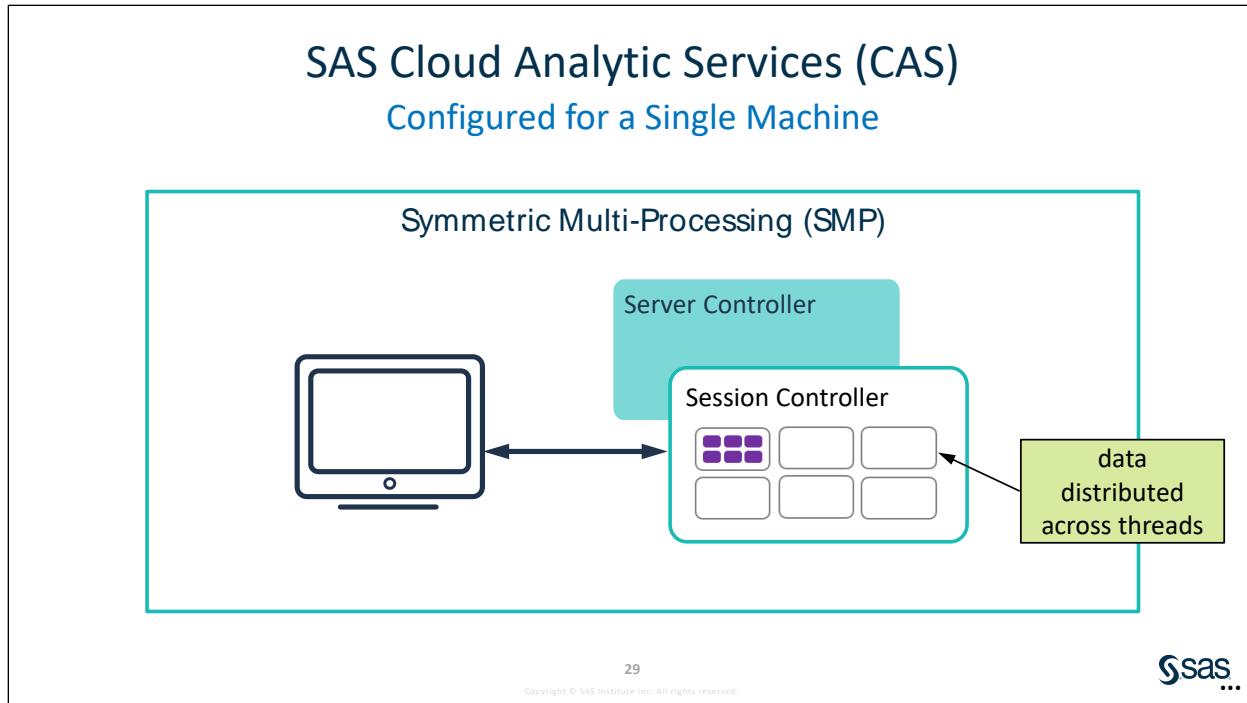
multiple threads

28

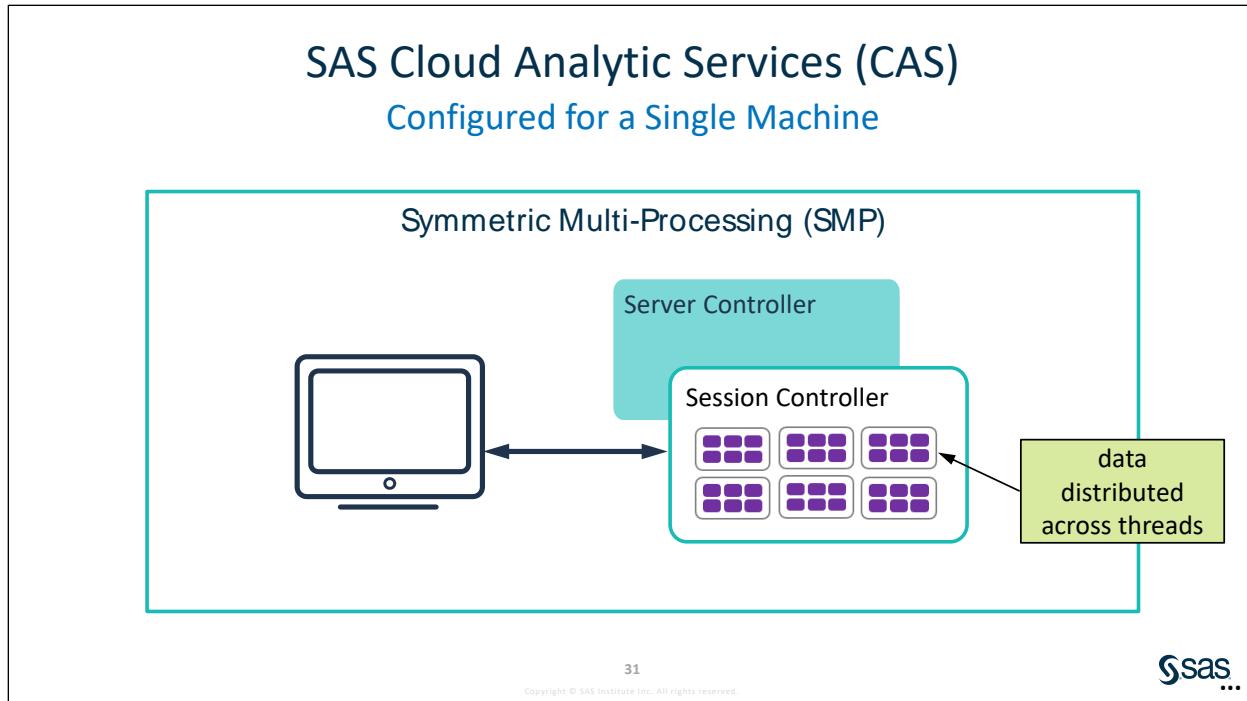
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When CAS is configured to run on a single machine, the machine uses multiple CPUs or threads to speed up the processing.



Because there are no worker nodes in this setup, the host acts as a controller and a worker too. The rows of data are spread across the multiple CPU threads.



The session controller node performs the processing. This is known as symmetric multiprocessing, or SMP, and is much faster than a single threaded environment.

Note: For both architectures, MPP and SMP, the server is multi-threaded for high-performance analytics.



Viewing Data in SAS Environment Manager and Loading Data into Caslibs

This demonstration illustrates the use of the Data page in SAS Environment Manager to view and import data.

1. In SAS Environment Manager, select **Data** from the side menu. (Make sure you are signed in as Christine.)

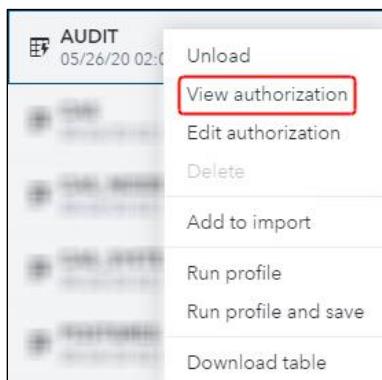
Note that this page is similar to the SAS Data Explorer application that is included with a Data Preparation license.

2. Click the **Available** tab if not there already. The Available tab displays all tables and files that have been loaded to memory from any CAS server to which you have access (based on who you are logged on as). Most of these tables that are displayed are generated by the operations infrastructure, because we have not added caslibs to this environment.

3. Click the object inspector next to the Audit to see that it belongs to the SystemData caslib. The lightening bolt signifies that it is loaded into memory.

AUDIT 05/26/20 02:07 PM • sas.ops-agentsrv	Name: Date modified: Location:	AUDIT 05/26/20 02:07 PM cas-shared-default/SystemData
---	--------------------------------------	---

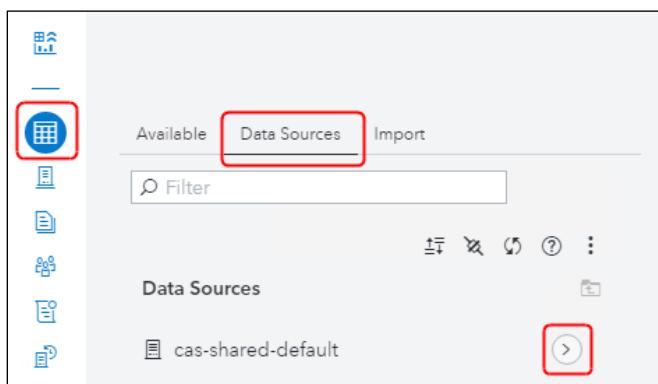
4. Right-click a table and select **View authorization**.



Only SAS Administrators can see these system tables.

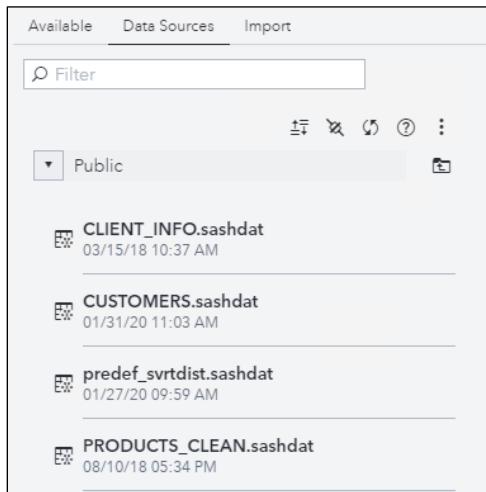
		View Authorization											
Principal	Access Level	ReadInfo	Select	LimitedPromote	CreateTable	DropTable	DeleteSource	Insert	Update	Delete	AlterTable	ManageAccess	
		(empty)	(empty)	(empty)	(empty)	(empty)	(empty)	(empty)	(empty)	(empty)	(empty)	(empty)	
Authenticated Users	No Access	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	
SAS Administrators	Custom	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✓	
sasapp	Full Control	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Christine	Custom	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✓	

5. Click the **Data Sources** tab. The Data Sources tab enables you to create a connection to a database server or a remote file system and work with caslibs and tables on a CAS server.



6. Expand **cas-shared-default** ⇒ **Public** caslib. This is the default shared and writeable caslib. It is accessible to all users. Notice the physical path location where the data is stored.

Items with the lightning bolt  beside them are physical tables that are accessible to the CAS server and have been loaded to memory. The tables on disk are also shown, but without the lightning bolt.



The screenshot shows the SAS Viya interface with the 'Available' tab selected. Below it, the 'Import' tab is highlighted with a red box. A search bar labeled 'Filter' is present. Under the 'Public' section, four datasets are listed:

- CLIENT_INFO.sashdat (03/15/18 10:37 AM)
- CUSTOMERS.sashdat (01/31/20 11:03 AM)
- predef_svrdist.sashdat (01/27/20 09:59 AM)
- PRODUCTS_CLEAN.sashdat (08/10/18 05:34 PM)

7. Click the **Import** tab to import a SAS data set into the Public caslib. The Import tab enables you to copy documents, local files, or social media content to a caslib. It also enables you to copy a table or a file on the Data Sources tab or the Available tab to a caslib. (Local data files are local to the browser where your SAS Viya web application is running.)

Note: You use the Public caslib to facilitate training. By default, all imported files are accessible to everyone if the files are imported to the Public caslib. A more secure caslib would be used for production environments.

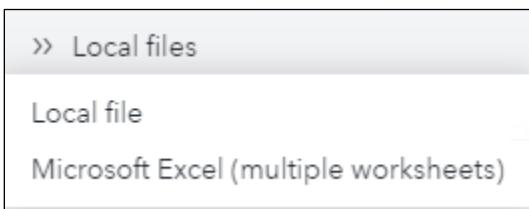


The screenshot shows the SAS Viya interface with the 'Available' tab selected. Below it, the 'Import' tab is highlighted with a red box.

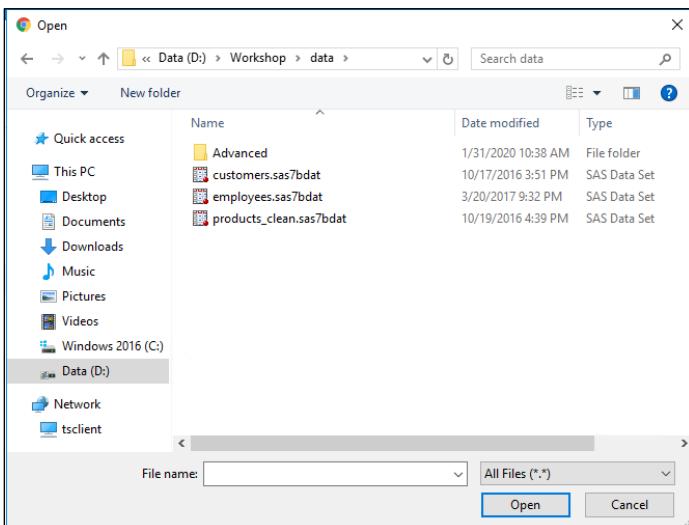
The following types of data can be imported to CAS:

Local	You can import data from a Microsoft Excel spreadsheet (XLS or XLSX), a text file (CSV or TXT), a SAS data set (SASHDAT or SAS7BDAT), or data from the clipboard.
Server	After providing connection information, you can import a table to the CAS server from a database (Teradata, Oracle, Hadoop, PostgreSQL, Impala) or from the SAS LASR Analytic Server.
Social Media	After authenticating with Facebook, Google Analytics, Twitter, or YouTube and providing search criteria, you can import data to the CAS server. Note: Your access to, and use of, social media data through a social media provider's public APIs is subject to the social media provider's applicable license terms, terms of use, and other usage terms and policies.

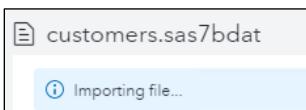
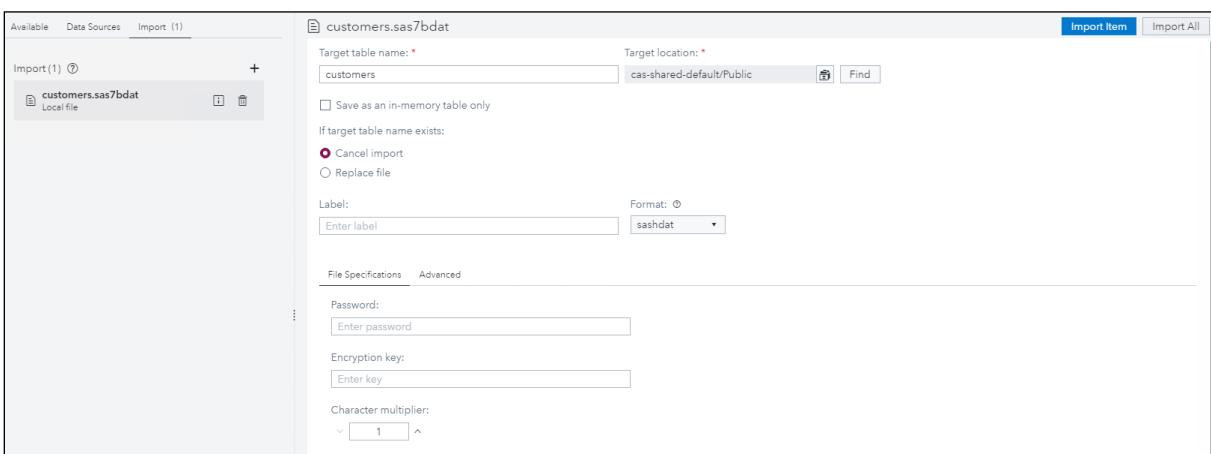
8. Select Local File.



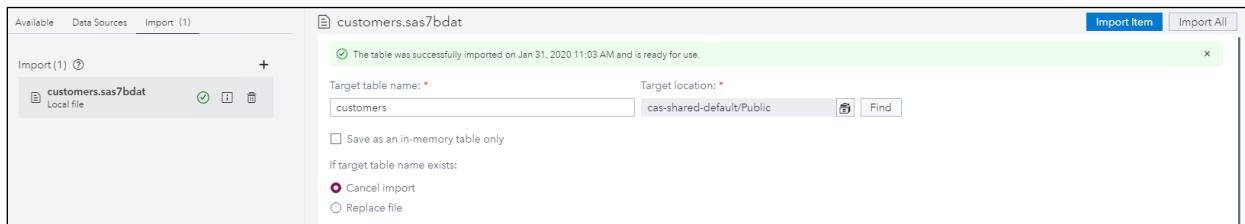
9. Navigate to D:\Workshop\data and select customers.sas7bdat. Click Open.



10. Click Import Item.



You need to wait for the message to see that the table was imported.



11. Click **Data Sources**. The **Customers** table is loaded to memory, and there is also the table on disk with the extension of **sashdat**.

Data									
Available		CUSTOMERS							
		#	Name	Label	Type	Raw Le...	Format...	Format	Tags
		1	City	City Name	char	45	45		
		2	Continent	Continent...	char	45	45		
		3	Postal_Code	Postal code	char	15	15		
		4	State_Province	State Name	char	38	38		
		5	Street_Name	Name of ...	char	68	68		
		6	xyContinentLat	xyContinent...	double	8	15	F	
		7	xyContinentLon	xyContinent...	double	8	15	F	
		8	Customer_ID	Customer...	double	8	12	F	
		9	Employee_ID	Employee...	double	8	12	F	
		10	Street_ID	Street ID	double	8	12	F	

Date profiled: (none)

Columns 24 Rows 951.7 K

Size 530.2 MB

Label: (not available)

Location: cas-shared-default/Public

Date created: Jan 31, 2020 11:03 AM

Date modified: Jan 31, 2020 11:03 AM

The Import data task **copies** data into the SAS Cloud Analytic Services (CAS) environment.

Load source data into CAS using one of the following methods:

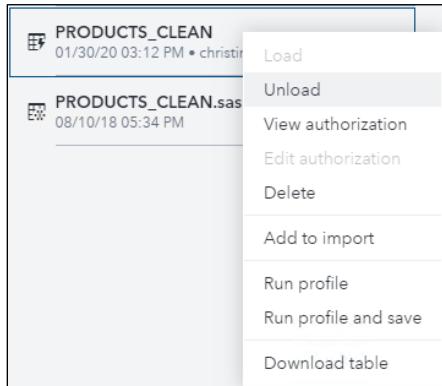
- importing data using SAS Environment Manager
- creating plans in SAS Data Studio
- uploading data using the task in SAS Enterprise Guide
- executing SAS code
- executing other supported open languages (Python, Lua, Java)

The ability to import data or tables in SAS Environment Manager is affected by two factors:

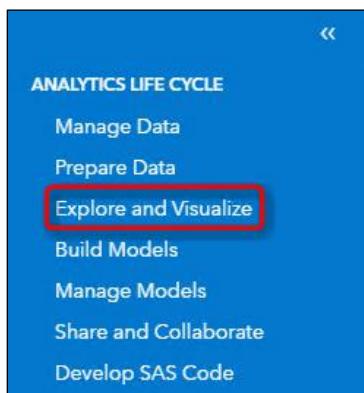
- whether you have Read permission on the /casManagement_capabilities/importData object URI in the Security - Rules area of SAS Environment Manager
- whether you have the necessary access to the target caslib

12. The **PRODUCTS_CLEAN** table exists in the Public caslib and it is loaded in memory.

You could right-click the table and select **unload**.

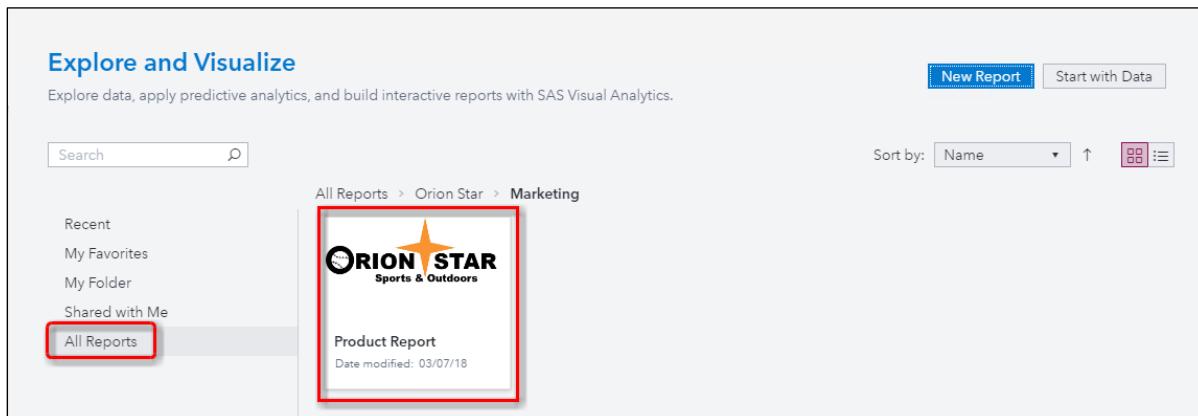


13. When you open a report that uses this table as input, the table will be automatically loaded in memory. Click **Show applications menu** \Rightarrow **Explore and Visualize**.

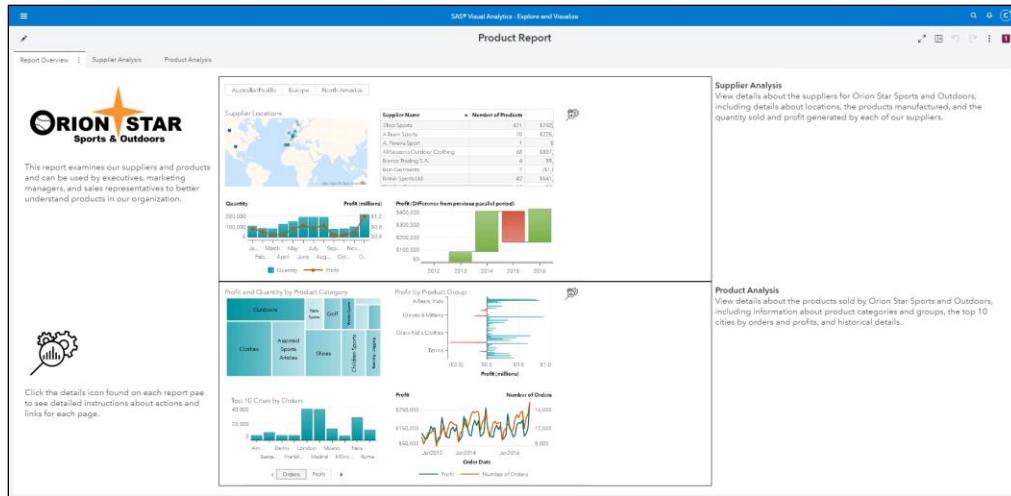


The SAS Report Viewer is one of many layouts that is supported by SAS Visual Analytics. A *report* is a type of document that contains various objects (for example, text, a table, or a linear regression). These objects are added to pages in a report.

14. Click **All Reports** and double click Orion star to open it.

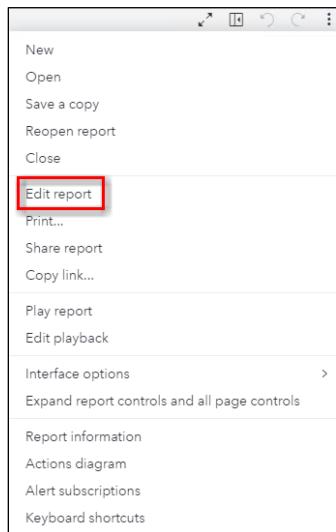


Note: Users have access to different functionality, depending on the assigned rules. Rules can give Authenticated Users access to functionality or they can provide access to functionality to special categories of users.



15. The report is open with many actions and links to different aspects of the report.

Click **More options** from the upper right toolbar to see more options and select **Edit Report**.



This brings us to another application of SAS Visual Analytics – Explore and Visualize Data.

16. Select **Data** from the side menu.

The **PRODUCTS_CLEAN** table is used in this report. It was not loaded in the Public caslib.

The screenshot shows the SAS Environment Manager interface with the 'Data' tab selected. In the center, a list of tables is displayed under the heading 'Data'. The table 'PRODUCTS_CLEAN' is highlighted with a blue selection bar at the top. Below it, other tables listed include 'City Name - 11K', 'Continent Name - 5', 'Country - 47', 'Customer ID - 68K', 'Delivery Date - 1.8K', 'Employee ID - 648', 'Name of Street - 21K', 'Order Date - 1.8K', and 'Order ID - 748K'. On the left, there is a sidebar with sections for 'Data', 'Objects', 'Suggest', and 'Outline', each containing various items like 'New data item', 'Category', and specific table names with their sizes.

17. Return to the Data page in SAS Environment Manager. Select the applications menu **Manage Environment** **Data**.

18. Click **Refresh**. By accessing a report that uses the **PRODUCTS_CLEAN** table, the table is automatically loaded in the Public caslib.

The screenshot shows the SAS Environment Manager interface with the 'Data Sources' tab selected. A list of datasets is shown under the 'Public' caslib. The dataset 'PRODUCTS_CLEAN' is highlighted with a red box around its row. Other datasets listed include 'CLIENT_INFO.sashdat', 'CUSTOMERS', 'CUSTOMERS.sashdat', 'predef_svrdist.sashdat', and 'PRODUCTS_CLEAN'. Each dataset entry includes a timestamp and a user name (e.g., 'christine'). At the top, there are tabs for 'Available', 'Data Sources', and 'Import (1)'. Below the list are standard file operations icons: a folder icon, a refresh icon (highlighted with a red box), a question mark icon, and a more options icon.

19. There is a property that is set to limit the size of a table to be imported. Select **Configuration** from the side menu.

The screenshot shows the SAS Management Console interface. On the left, there is a sidebar with a 'SYSTEM' category containing links for Data, Servers, Content, Users, Licensed Products, Backup and Restore, and Configuration. The 'Configuration' link is highlighted with a blue border. To the right of the sidebar is a search bar with the text 'cas'. Below the search bar is a list of services: CAS Management service, CAS Proxy service, CAS Row Sets service, cas-shared-default, cas-shared-default-http, and casAccessManagement. The 'CAS Management service' is highlighted with a gray background.

20. On the View drop-down menu, select **All services** ⇒ **CAS Management service**.

21. Scroll to the **fileUpload** section.

A size limit for file imports is set in the CAS Management service configuration window. The default size is 4GB. The local file importer has a 4GB limit because that is a limit in Internet Explorer. However, Chrome and other browsers allow larger file sizes. Therefore, there is a property that enables an administrator to set a higher limit. A modification to the max-file-size property requires a restart of the CAS Management service.

Social media and DBMS importers have no explicit limits. However, there is a limitation of the disk size where CAS management service is running, because the uploaded file is written to a temporary file on the server where the service is running.

The screenshot shows the configuration window for the CAS Management service. In the 'fileUpload:' section, it says 'The set of properties used by datafile upload'. In the 'fileUploadEnabled:' section, there is a toggle switch that is turned on (purple). Below it, the text 'Enable datafile upload' is shown. In the 'maxFileUploadSize:' section, the value '4,096' is displayed, with the note 'The maximum datafile upload size in megabytes (-1 = no limit)' below it.

End of Demonstration



Practice

1. Importing Data Using SAS Environment Manager

In this practice, you use the SAS Environment Manager Data page to import data to a caslib.

- Sign in to SAS Environment Manager as **christine** with a password of **Student1**. Click **Yes** to opt in to the SASAdministrators group.
- Select **Data** from the side menu.
- Click the **Import** tab to import a SAS data set into the Public caslib.
- Select **Local File**.
- Navigate to **D:\Workshop\data** and select **customers.sas7bdat**. Click **Open**.
- You need to import the table to an existing caslib. Keep the default of **Public** for the target destination. Click **Import Item**.

Note: The import fails if there is already a table of the same name.

You need to wait for the message to see that the table was imported.

- Click **Data Sources**.

(You might need to expand **cas-server-default** ⇒ **Public** caslib if you are not already taken to this level.)

How many CUSTOMERS tables are displayed? Why?

- Find the physical location of the **customers.sashdat** file. Click **Up one level** next to the **Public** caslib.
- Click **Public**. Note the operating system path on the right.
- In mRemoteNG, open a session as the user **christine**.
- Navigate to the path that was specified in the properties of the Public caslib in SAS Environment Manager.

```
cd /opt/sas/viya/config/data/cas/default/public
```

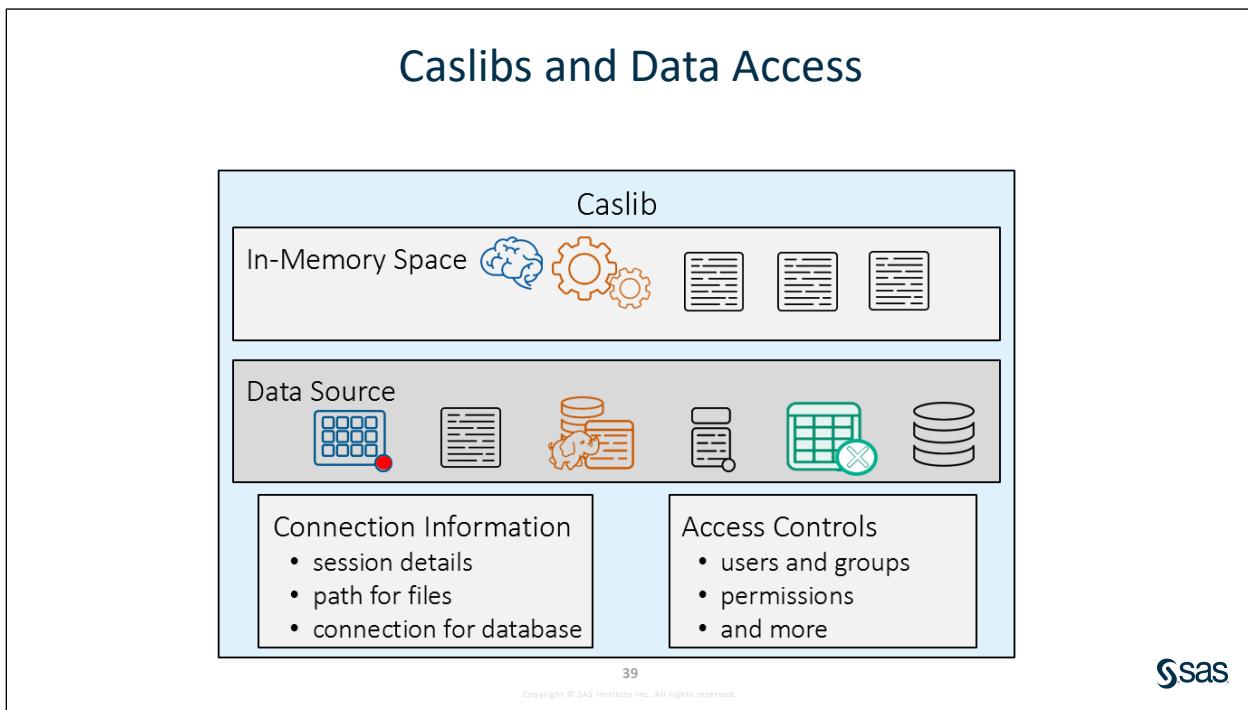
- Enter the command to view a list of the files.

```
ls -la
```

Verify that the copy of the SAS data set that you loaded via the import capability was found.

End of Practices

4.2 Caslib Management



The CAS library, or caslib, is the mechanism by which data is accessed in the SAS Viya environment. At its simplest, a caslib is a container that has two main areas: an in-memory space where the processing takes place, and a data source.

A caslib is similar to a SAS®9 library or a LASR library:

- A SAS®9 library makes data available to a SAS server.
- A LASR library makes data available to a LASR Analytic Server.
- A caslib makes data available to the CAS engine and CAS actions.

The data in the associated data source is referred to as a *file*. For path-based caslibs, these files are SASHDAT files, CSV files, SAS data sets, and so on. For server-based caslibs, such as an Oracle database, the term *file* is still used to create a distinction between data from the caslib data source and an in-memory copy of the data.

A caslib includes connection information for the source data. This could include directory paths for files and connection information for a database.

It also includes authorization information such as user IDs and permissions to control access to data and other resources.

Caslib Scope

Session versus Global



Session-Scope

Visible to the CAS session where it was created.

Best used for general purpose programming.

Deleted upon termination of CAS session.

Typically provides better performance than global-scope tables because concurrency locks are not used.

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Caslibs have either global scope or session scope. A session-scope caslib is available only to the CAS session where it was created. When the CAS session ends, the session-scope caslib goes away. Session-scope caslibs are useful when you do not need to share data across sessions.

Caslib Scope

Session versus Global

	Session-Scope	 Global-Scope
Visible to the CAS session where it was created.	Best used for general purpose programming.	Visible across CAS sessions.
Deleted upon termination of CAS session.	Best used for tables that are accessed by a large number of users, especially the visual interfaces.	<i>Not</i> deleted upon termination of CAS.
Typically provides better performance than global-scope tables because concurrency locks are not used.	Cannot be replaced. You must drop it and load the replacement data.	

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A global-scope caslib is available to anyone who has access permission. They are useful if you want to share data across sessions. When the CAS session ends, the global-scope caslib is ***not*** deleted. Because it is global, it persists between CAS sessions.

Global CASLIB definitions are persisted in the permstore, a subdirectory of the SAS Viya configuration directory. When the CAS server is restarted, CASLIB definitions are available. The default location of the permstore is <config>/etc/cas/default/permstore/.

Visual Analytics uses only global tables.

Caslib Types

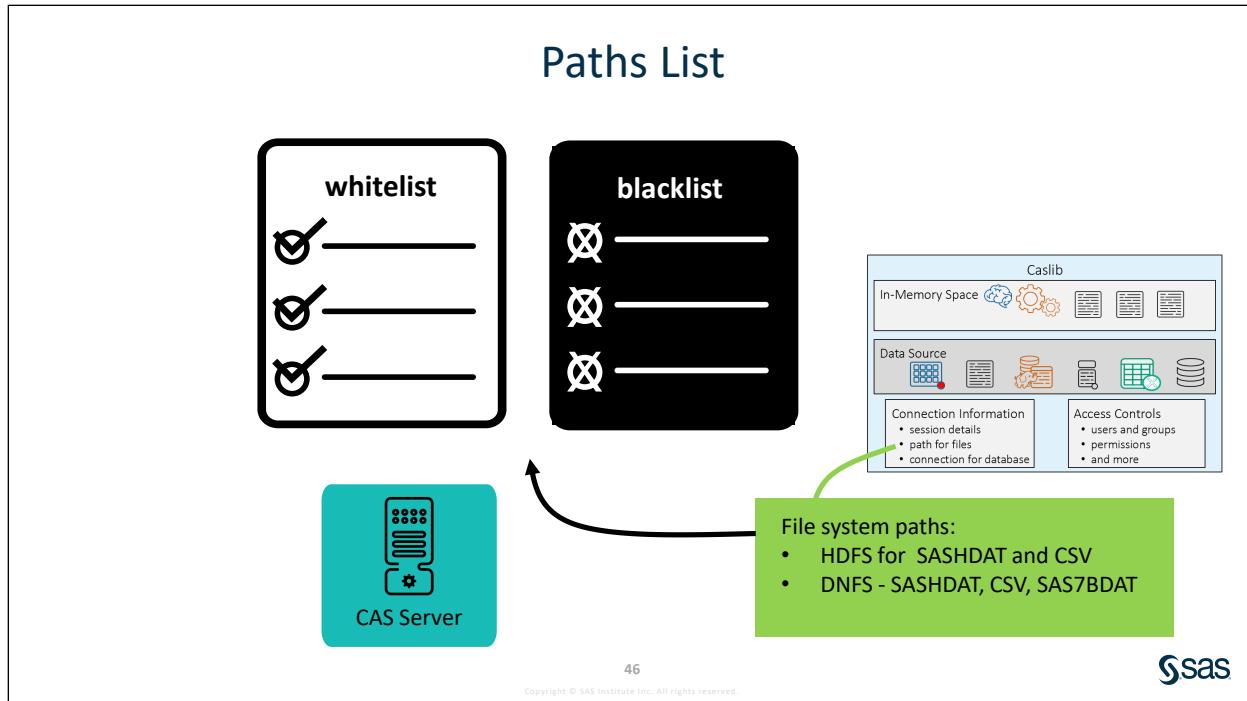
	Personal	Predefined	Manually added
availability	automatically available at the start of each session	administrator defines and manages	added by administrators and authorized users only
scope	global	global	session or global
access	only you can access your personal caslib	administrator controls access	administrator controls access
typical use	your own personal place to work with data in CAS	popular shared data sources	ad hoc data access

There are three types of CASLIBS: *personal*, *pre-defined*, and *manually added*.

Your personal caslib will be available automatically when you start a session. Personal caslibs have global scope, which means that you can access your personal caslib from any session or application that you start. Only you have access to the data in your personal caslib. Think of it as your own personal place to work with data in CAS.

Pre-defined caslibs are defined and managed by an administrator and have global scope. The administrator sets data access controls. Pre-defined caslibs typically contain popular shared data sources for your site.

Only administrators and authorized users can manually add caslibs. By default, manually added caslibs are session scope, but they can be created with global scope. Access to manually added caslibs is controlled by the administrator. These might be added in a program for ad hoc data access.



From a CAS server, all access to file system paths (host and HDFS directories) is through caslibs. To limit the paths that are available to non-administrators when they create or edit a caslib, you can create a blacklist of paths that should not be available, or create a whitelist of paths that should be available.

Notes:

- Paths must be absolute.
- Paths must be unique. CAS automatically removes any duplicate paths.
- On Linux, if a blacklist path is changed to a symbolic link, then the blacklist should be updated using the fully resolved path.
- All subdirectories of each specified path are affected.
- Paths list constraints do not affect access to existing caslibs.
- If you do not define a blacklist or whitelist, no paths list constraints are in effect.
- Paths list constraints do not apply to users who assume the Superuser role or the Data role.
- Only users who assume the Superuser role for a server can see and manage that server's paths list.
- Access to third-party databases is not affected by a server's blacklist or whitelist.

4.06 Activity

1. In SAS Environment Manager, select **Servers**.
2. Assume the Superuser role.
3. Right-click **cas-shared-default** and select **Settings**.
4. Is there an active white list or black list?

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4.07 Multiple Answer Question

Which of the following statements is true regarding paths lists?

(Select all that apply.)

- a. If you do not define a blacklist or whitelist, no paths list constraints are in effect.
- b. Paths must be absolute.
- c. A server's blacklist or whitelist affects third-party databases.
- d. Only users who assume the Superuser role for a server can see and manage that server's paths list.
- e. Paths list constraints do not affect access to existing caslibs.

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Methods to Define Caslibs and Load Data

SAS Environment Manager
Data Area



Command-Line Interface



```
sas-admin cas caslibs create path -name salesdl  
-path /data -server cas-shared-default

sas-admin cas tables load --caslib salesdl  
--table salesmaster --server cas-shared-default
```

SAS Data Explorer



Programming

SAS | Python | Java | Lua | R | REST



```
proc cas;  
table.addcaslib / datasource={srcType="DNFS"}  
name="salesdl" path="/path/to/data" session=false  
quit;
```

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Currently, database caslibs can be added via the user interfaces, but they cannot be edited.

Note: REST APIs can also define caslibs and load data. REST APIs provide a way to access the capabilities of SAS Viya using standard, open HTTP network protocols. With the REST APIs, you can create and access SAS Viya resources using any client technology. All that is necessary is a standard library for executing HTTP requests and parsing or generating JSON data. For documentation on these REST APIs, see the Extended Learning Page.



Exploring Caslibs in SAS Environment Manager

This demonstration illustrates using SAS Environment Manager to manage caslibs and CAS tables interactively.

1. Select **Data** from the side menu in SAS Environment Manager.
2. Click the **Data Sources** tab and expand **cas-shared-default**. All global and personal caslibs that you are authorized to see are displayed. Items with  beside them are global caslibs on the selected CAS server. (Global caslibs with names such as CASUSER(user-ID) or CASUSERHDFS(user-ID) are personal caslibs. Only your user ID can access the data in your personal caslib.)

Note: To manage global caslibs, you must be a CAS Administrator or be granted CASLIB Management privileges by an administrator.

caslib	PATH
AppData	PATH
CASUSER(christine)	PATH
DIDP	PATH
Formats	PATH
ModelPerformanceData	PATH
Models	PATH
ModelStore	PATH

3. To create a new caslib, click the **Connect** icon.

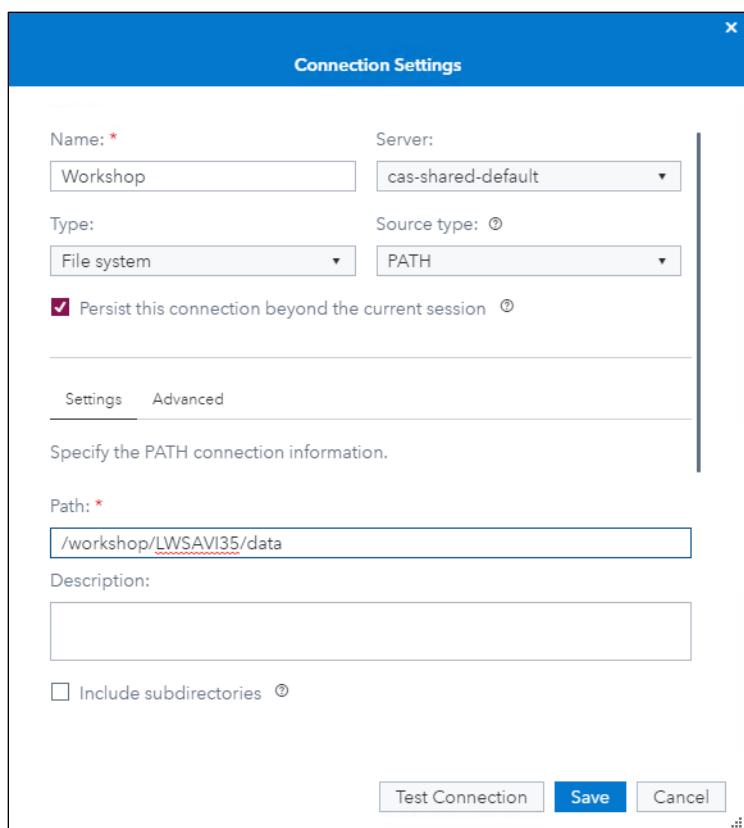
4. In the Connection Settings window:

Name: **Workshop**

Type: **File System**

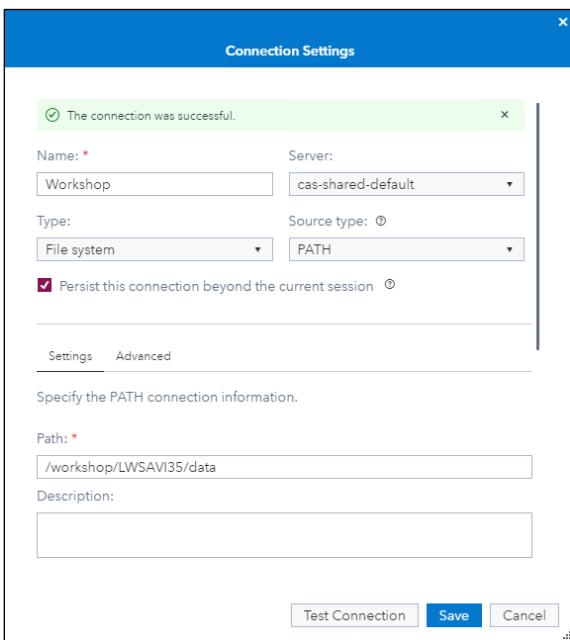
Source type: **PATH**

Under Settings, Path: **/workshop/LWSAVI35/data**

5. Click the question mark next to **Persist this connection beyond the current session**.

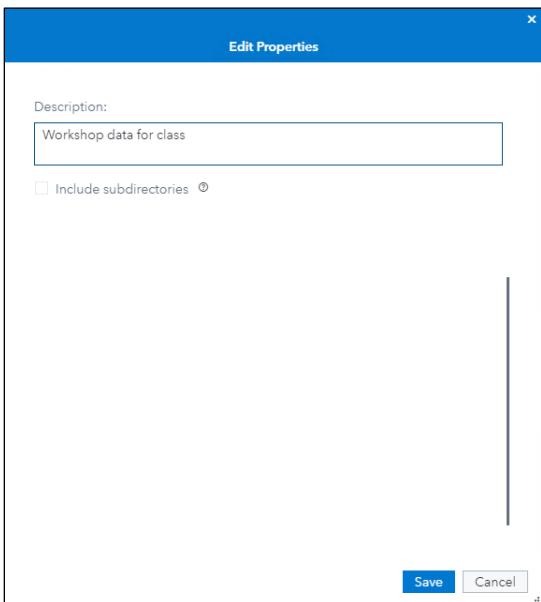
Select this check box to add a global caslib for this connection. Deselect this check box to add a session-based caslib for this connection. For more information, see [Caslibs on the Data Sources Tab and Import Tab](#) in *SAS Data Explorer: User's Guide*.

6. Click **Test Connection.**



7. Click **Save.**

8. Right-click the **Workshop** caslib and select **Edit** to add a description.
9. Enter **Workshop data for class** in the **Description** field.



10. Click **Save.**

11. Click **Down one level next to the Workshop caslib.**

Three tables are listed, but the tables are not loaded into memory.

The screenshot shows the SAS Data Sources interface. At the top, there are tabs for 'Available', 'Data Sources', and 'Import'. Below the tabs is a search bar labeled 'Filter' with a magnifying glass icon. To the right of the search bar are several icons: a funnel for filtering, a gear for settings, a question mark for help, and a vertical ellipsis for more options. A dropdown menu is open, showing the path 'Workshop' followed by a folder icon. Below this, three datasets are listed:

- demographics.csv**
08/10/18 04:56 PM
- employees.sas7bdat**
08/10/18 04:56 PM
- insight_toy_company_2017.sas7bdat**
08/10/18 04:56 PM

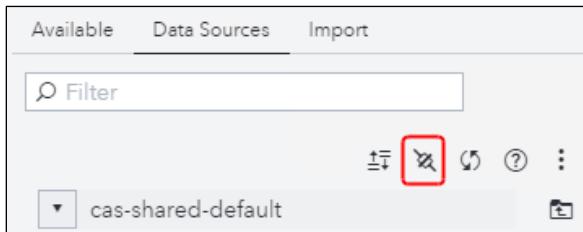
End of Demonstration



Practice

2. Adding a Caslib Using SAS Environment Manager

- Sign in to SAS Environment Manager as **Christine** with the password **Student1**.
- Select the **Data** page from the side menu.
- Click the **Data Sources** tab.
- Click the **Connect** icon to add a caslib.



- In the Connection Settings window:

Name: **Workshop**

Type: **File System**

Source type: **PATH**

Under Settings, Path: **/workshop/LWSAVI35/data**

Description: **Workshop data for class**

- Click **Test Connection**.
- Click **Save**.
- Expand the **Workshop** caslib to see the tables.

Three tables are listed, but the tables are not loaded into memory.

Note: There is a CLI script to create the Workshop caslib:

```
/workshop/LWSAVI35/scripts/L04/practice02_addWorkshopCaslib.sh
```

3. Adding a Caslib Using the Command-Line Interface

- Use the Christine connection in MRemoteNg.
- Enter the following command:

```
/opt/sas/viya/home/bin/sas-admin cas caslibs create path --
caslib Finance --path /Finance --server cas-shared-default --
description "Finance data"
```

Note: You might need to regenerate a token for Christine in order to use the sas-admin command. Run the following script: **/workshop/LWSAVI35/createCLIprofile.sh**.

- c. Enter the following command to see a list of caslibs:

```
/opt/sas/viya/home/bin/sas-admin --output text cas caslibs
list -server cas-shared-default
```

Note: There is a CLI script to create the Finance caslib:

```
/workshop/LWSAVI35/scripts/L04/practice03_addFinanceCaslib.sh
```

4. Loading Data into Memory for the Workshop Caslib

Use CLI or SAS Environment Manager to load data into memory for the Workshop caslib.

CLI

Enter the following command:

```
/opt/sas/viya/home/bin/sas-admin cas tables load --
caslib=Workshop --table=* --server cas-shared-default
```

SAS Environment Manager

- On the Data page in SAS Environment Manager, click the **Data Sources** tab.
- Expand **cas-shared-default** ⇒ **Workshop**.
- Right-click each table and select **Load**.

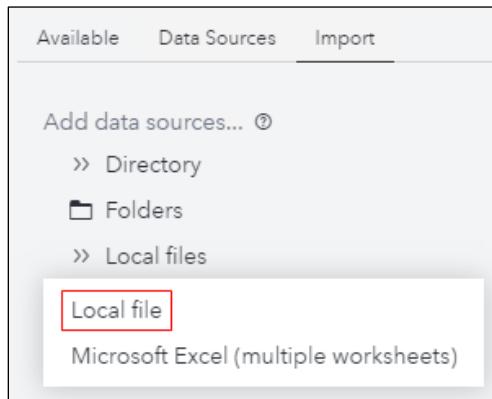
Note: There is a CLI script to load Workshop tables:

```
/workshop/LWSAVI35/scripts/L04/practice04_loadWorkshopTables.sh
```

5. Importing Local Data to the Finance Caslib

- On the Data page in SAS Environment Manager, click the **Import** tab.
- Click the **Add** icon to the right of Import and select **Local File**.

(Or you might see the immediate option of choosing from the list.)



- Navigate to **D:\Workshop\desp42\data**. Highlight **prospect.csv** and click **Open**.
- Change the target caslib to **Finance**.
- Click **Import Item**.

What type of file is loaded into memory?

Is the file also written to the Finance caslib physical location? If so, what is the data type?

6. (Optional) Exploring the CASLIB Scope

- a. In SAS Environment Manager, select **Servers** from the side menu.
- b. Right-click **cas-shared-default** and select **Settings**.
- c. Click the **Caslib Management Privileges** tab.
Can Authenticated Users create and delete global caslibs?
- d. Click **Close**.
- e. Open **Firefox** from the Start menu or Windows taskbar.
- f. Click **SAS Studio** on the Favorites bar.
- g. Sign in to SAS Studio as **lynn**. Use the **Student1** password.
- h. Copy or enter the program below on the Program 1 tab. (If all the editor tabs are closed, you can use the F4 function key to open a new SAS Program tab.) Hold down the Ctrl key and press C to copy this code. Hold down the Ctrl key and press V to paste it into the CODE window in SAS Studio.

```
/* Start a session named mySession to the CAS server */
CAS mySession SESSOPTS=(CASLIB=casuser TIMEOUT=99 LOCALE="en_US");

/* create a session scoped CAS library (myCaslib) for the path
"/tmp/" */

CASLIB myCaslib PATH="/tmp/" TYPE=path;

/* Load a data table to CAS under caslib myCaslib */
PROC CASUTIL;
    LOAD DATA=sashelp.air OUTCASLIB="MYCASLIB" CASOUT="air";
RUN;

/* Show CASLIB in SAS Studio */
CASLIB _ALL_ ASSIGN;

/* List CAS table information from caslib myCaslib */
proc casutil;
    list tables incaslib="MYCASLIB";
run;
```

- Click  (the **Submit SAS Code** icon) to run the code.

View the Results tab. Notice the caslib information. It indicates that the session is local, and the table is not promoted to be shared with other users.

The CASUTIL Procedure	
Caslib Information	
Library	MYCASLIB
Source Type	PATH
Path	/tmp/
Session local	Yes
Active	Yes
Personal	No
Hidden	No
Transient	No

- Open the **AIR** CAS table to view the data.
 - In the navigation pane, navigate to **Libraries** \Rightarrow **SASHELP** \Rightarrow **AIR**.
 - Double-click the **AIR** table to open it.
- Execute the following code to promote the CAS table. On the Program 1 tab, click the **CODE** tab. Paste the code below at the bottom of the existing code, highlight it, and click  (the **Submit SAS Code** icon).

```
/* Promote CAS table 'air' to share with other users */
proc casutil outcaslib="MYCASLIB";
  promote casdata="air";
quit;
```

- Review the log from the code execution and notice the error messages. The log indicates that Mycaslib is a session caslib, and the table cannot be promoted to the global scope.
- Attempt to access the caslib from another CAS session as the same user.
 - Use the F4 function key to open a second SAS Program tab. Paste the code below to open a new CAS session. Access the caslib and table that were created in the previous steps.

```
/* New CAS session */
CAS mySession2 SESSOPTS=(CASLIB=casuser TIMEOUT=999
                      LOCALE="en_US");

/* list caslib and table detail from caslib */
proc casutil;
  list tables incaslib="MYCASLIB";
run;
```

- 2) Review the log. Notice the error message in the log. Even the same user cannot access a session caslib in a different session. A session caslib is accessible only in the session where it was created.

Note: You cannot change the scope of a caslib after it is added.

```
86 /* list caslib and table detail from caslib */
87 proc casutil;
NOTE: The UUID '4c225755-8ab0-2a4d-8312-9b9df4087108' is connected using session MYSESSION2.
88   list tables incaslib="MYCASLIB";
ERROR: The caslib 'MYCASLIB' does not exist in this session.
ERROR: The action stopped due to errors.
ERROR: The caslib 'MYCASLIB' does not exist in this session.
ERROR: The action stopped due to errors.
NOTE: Cloud Analytic Services processed the combined requests in 0.00081 seconds.
89 run;
```

- n. Go back to the SAS Program tab 1 and the code window.
- o. Modify the LOAD statement in the PROC CASUTIL step to promote the **Air** table to the Casuser caslib. Then highlight it and click  (the **Submit SAS Code** icon).

Alternatively, you can paste the code below at the bottom of the existing code, highlight it, and click  (the **Submit SAS Code** icon).

```
/* Load a data table to CAS under caslib CASUSER */
PROC CASUTIL;
  LOAD DATA=sashelp.air OUTCASLIB="CASUSER" CASOUT="air";
RUN;
```

You loaded a table to the personal CASUSER caslib. The scope is global by default.

- p. Return to the Program 2 tab and the code window.

```
/* New CAS session */
CAS mySession2 SESSOPTS=(CASLIB=casuser TIMEOUT=999
                        LOCALE="en_US");

/* list caslib and table detail from caslib */
proc casutil;
  list tables incaslib="CASUSER";
run;
```

- q. Modify the LIST TABLES statement in the PROC CASUTIL step to list tables in the Casuser caslib. Then highlight it and click  (the **Submit SAS Code** icon).

Alternatively, you can paste the code below at the bottom of the existing code, highlight it, and click  (the **Submit SAS Code** icon).

```
/* list caslib and table detail from caslib */
proc casutil;
  list tables incaslib="CASUSER";
run;
```

The CASUTIL Procedure									
Caslib Information									
Library	CASUSER(lynn)								
Source Type	PATH								
Description	Personal File System Caslib								
Path	/opt/sas/viya/config/data/cas/default/casuserlibraries/lynn/								
Session local	No								
Active	Yes								
Personal	Yes								
Hidden	No								
Transient	Yes								

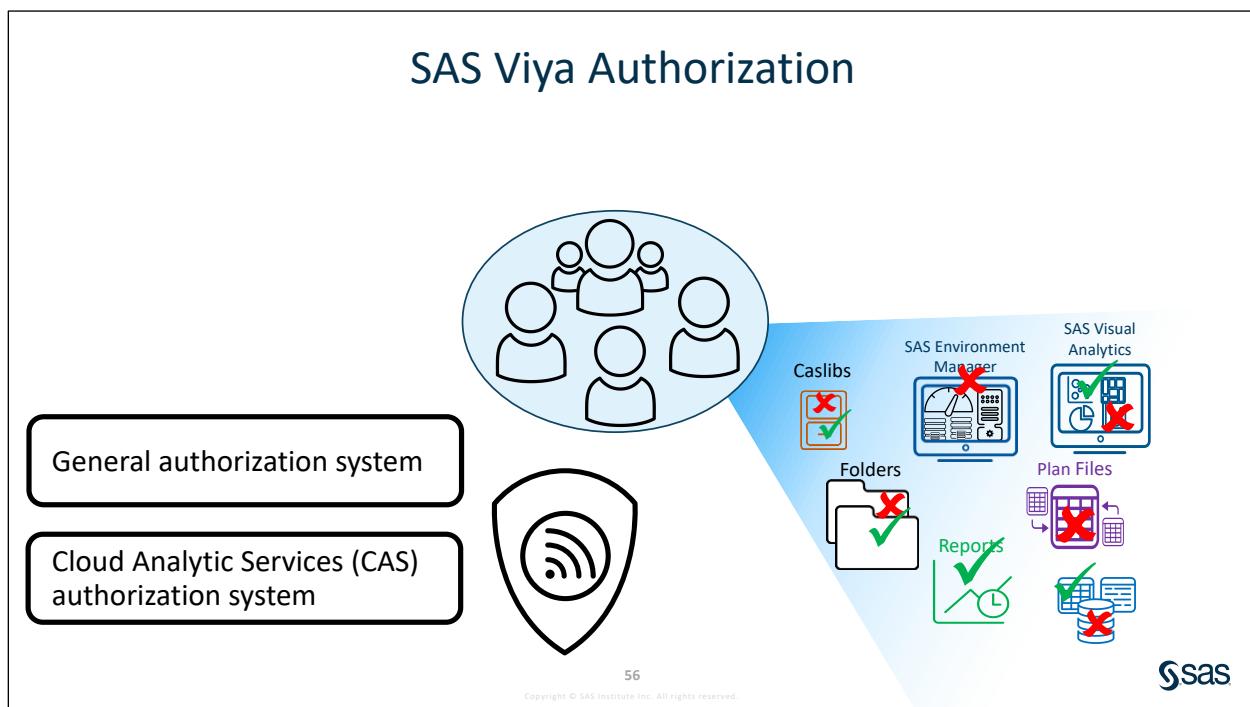
The CASUTIL Procedure									
Table Information for Caslib CASUSER(lynn)									
Table Name	Label	Number of Rows	Number of Columns	Indexed Columns	NLS encoding	Created	Last Modified	Promoted Table	Repeated Table
AIR	airline data (monthly: JAN49-DEC60)	144	2	0	utf-8	2020-01-31T15:11:54-05:00	2020-01-31T15:19:47-05:00	Yes	No

- r. Terminate your CAS sessions. Submit the following code on each of your SAS Program tabs:

```
cas mySession terminate;
```

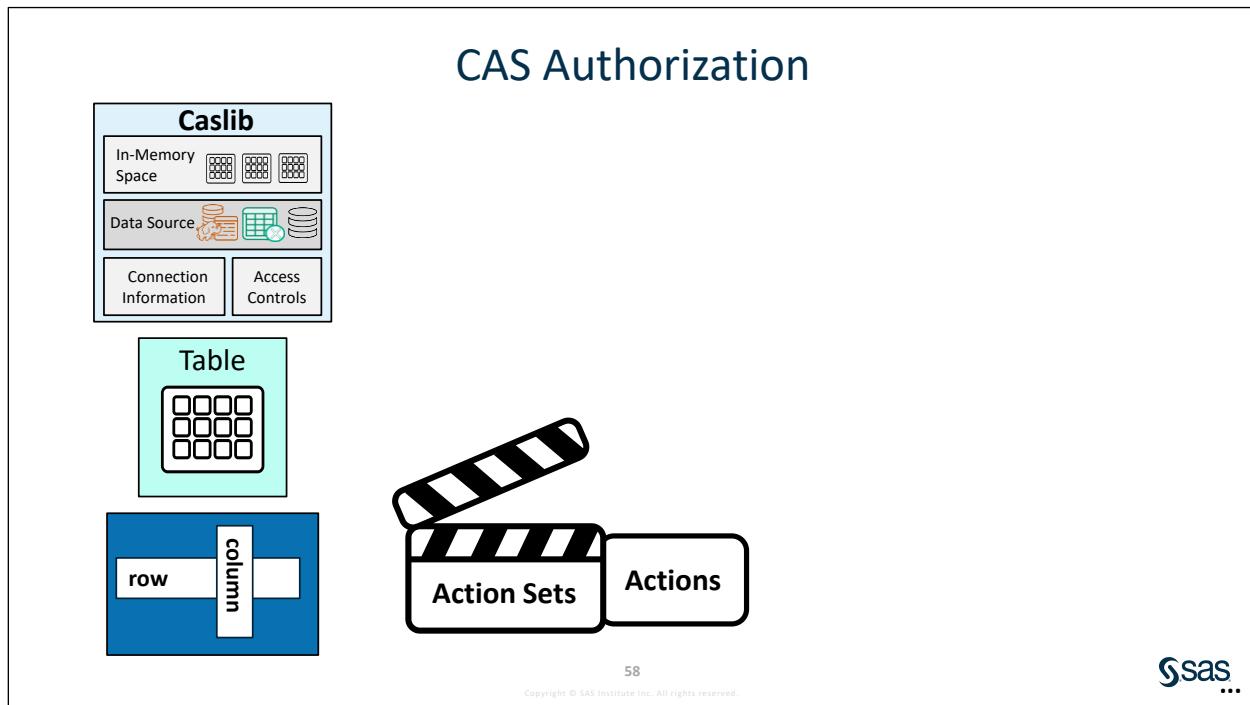
End of Practices

4.3 CAS Authorization



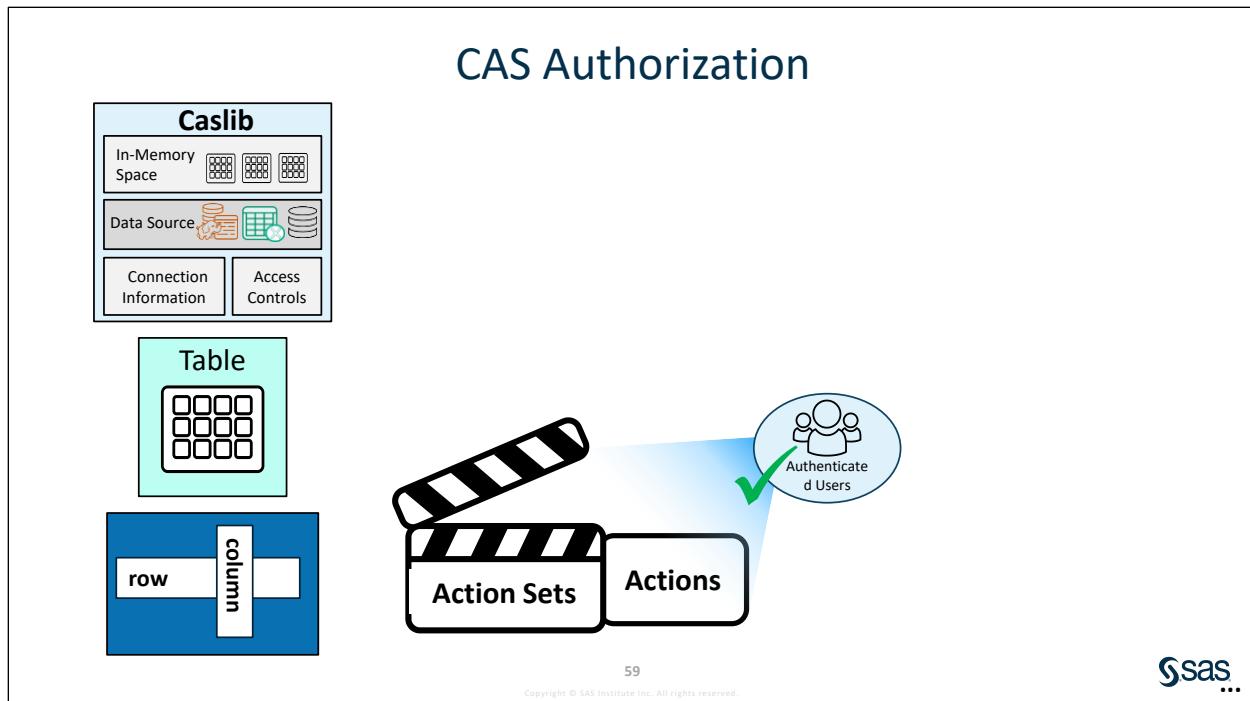
The SAS Viya authorization layer consists of two authorization systems: general authorization system and Cloud Analytic Services authorization system.

- Both systems implicitly disallow any access that is not granted.

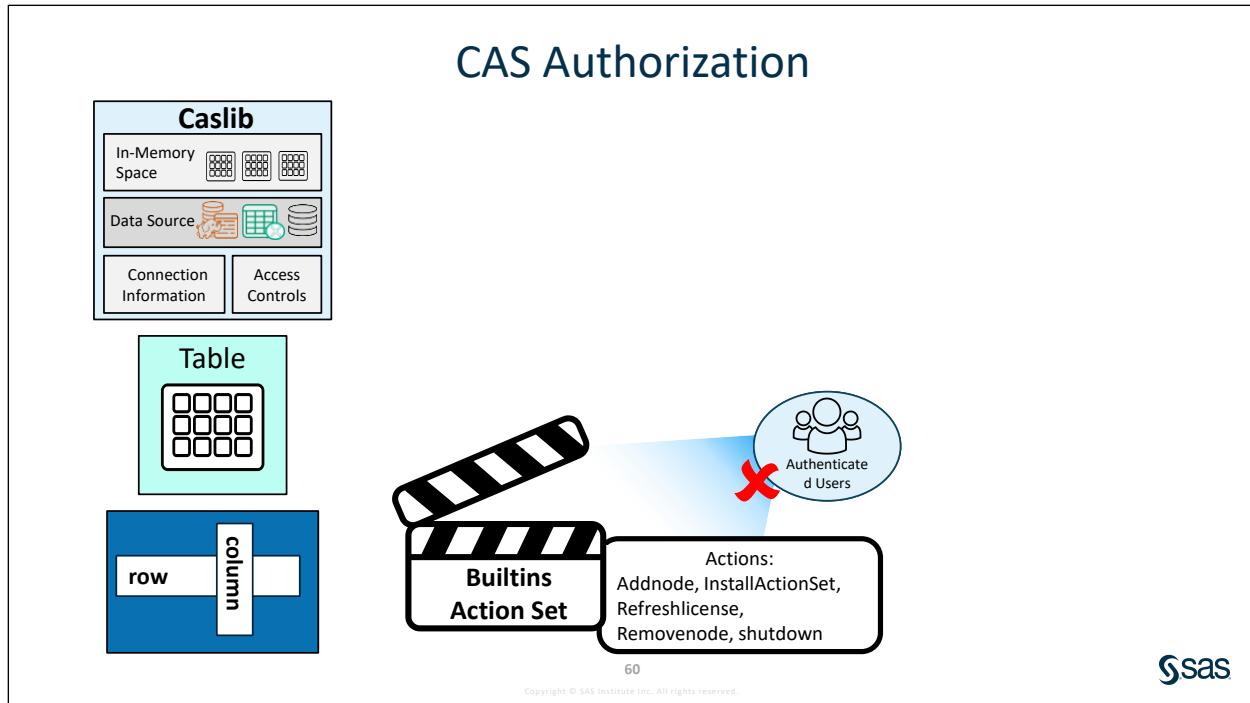


CAS authorization manages access to all caslibs, CAS tables within caslibs, and the columns and rows within a table.

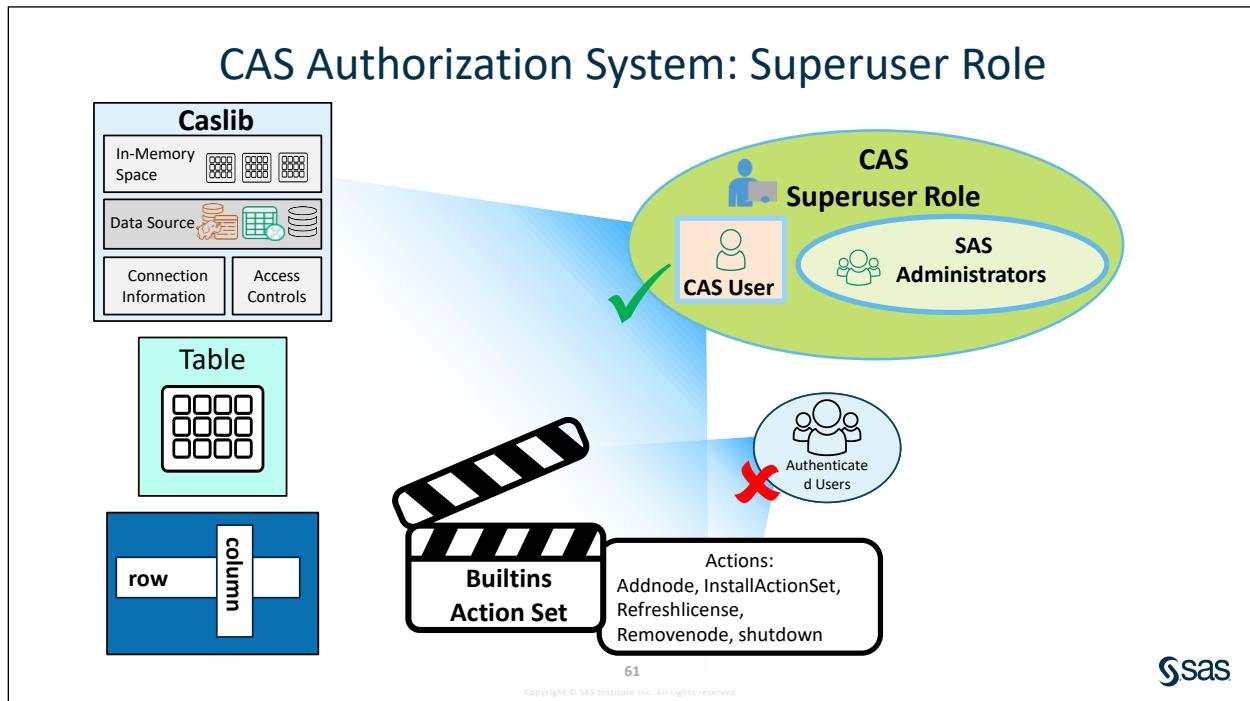
CAS authorization system also manages action sets and actions. CAS actions are the smallest unit of functionality in CAS and are submitted to the CAS server by SAS procedures, the CAS language, or third-party languages like Python, Lua, or Java.



Most CAS actions are available to Authenticated Users. This is okay because in general, the ability to perform a particular task is managed by access controls on the target data, not by access controls on actions.



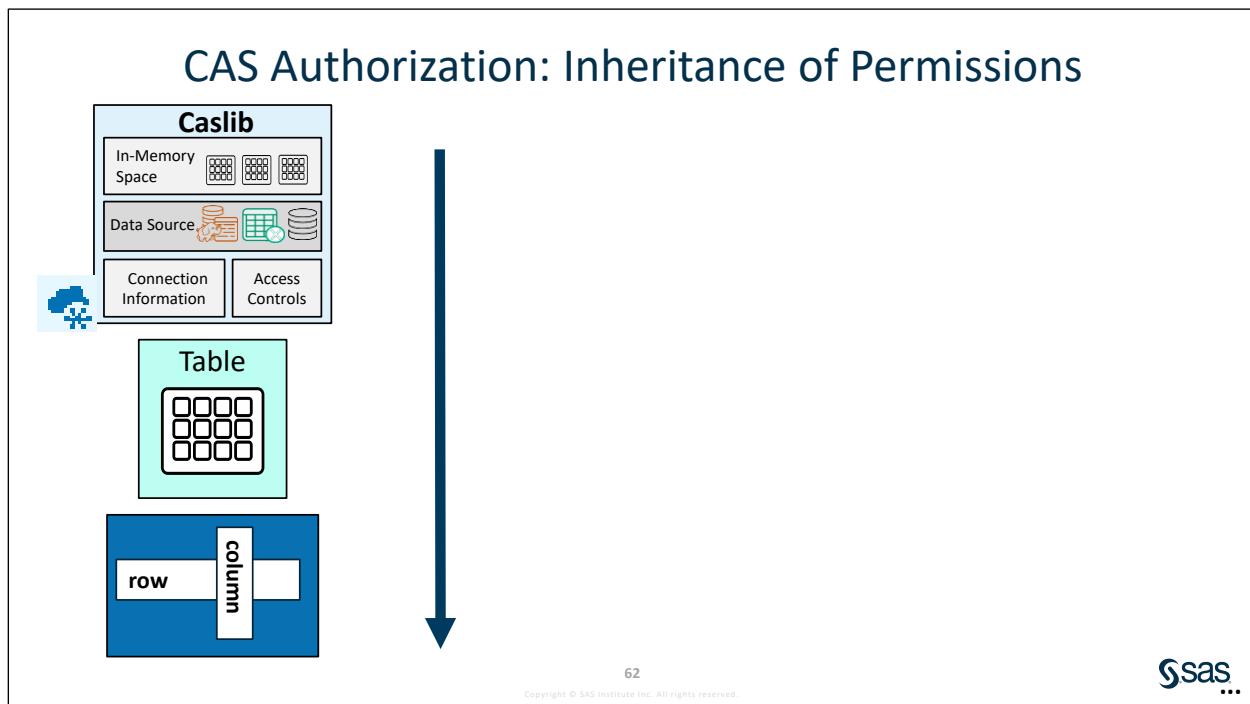
One exception is actions for adding nodes and stopping the CAS server, which falls under the Builtins action set. The initial configuration denies Authenticated Users the Execute permission for those actions.



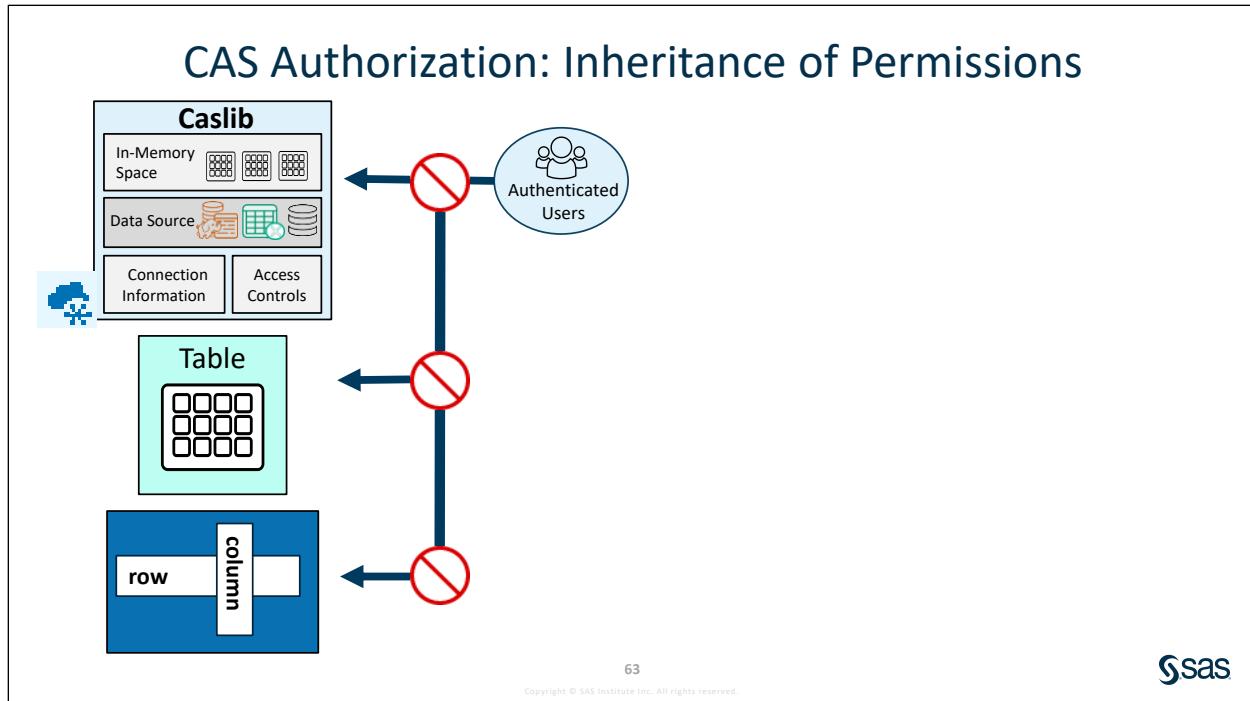
Only Superusers can add nodes or stop the server. The superuser role is exempt from the CAS authorization system, so anyone who has assumed that the superuser role has unrestricted access to caslibs, tables, and actions.

Note: Access to data (caslibs) is not included. For example, users in this role can create, run, and view reports only if they have explicitly been granted access to the underlying data. To give users with this role access to data, you must modify access controls to explicitly grant them access.

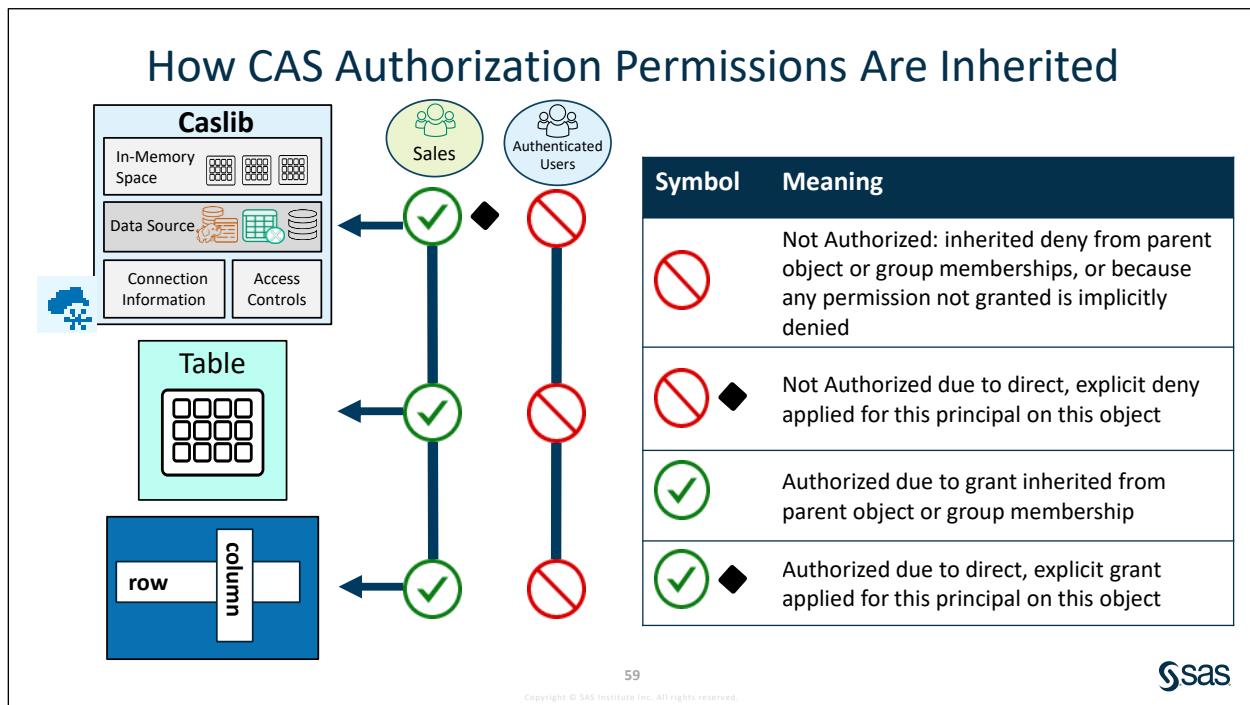
The CAS authorization system does not apply to a target object if it is not sharable. For example, the target is a table in a personal caslib, a session caslib, or the session scope of a global caslib.

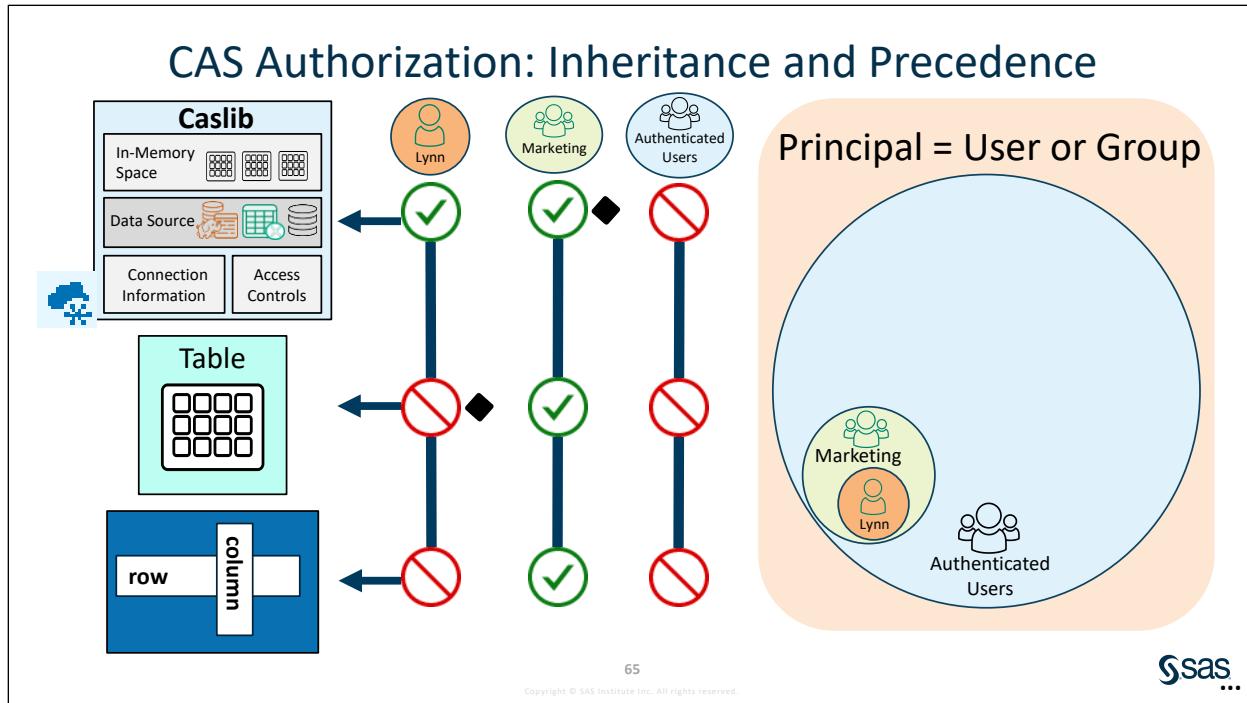


Access flows through a hierarchy of objects. The caslib is the top object. There is no object above it, such as a folder. Permissions flow from caslibs to tables and from tables to rows and columns.

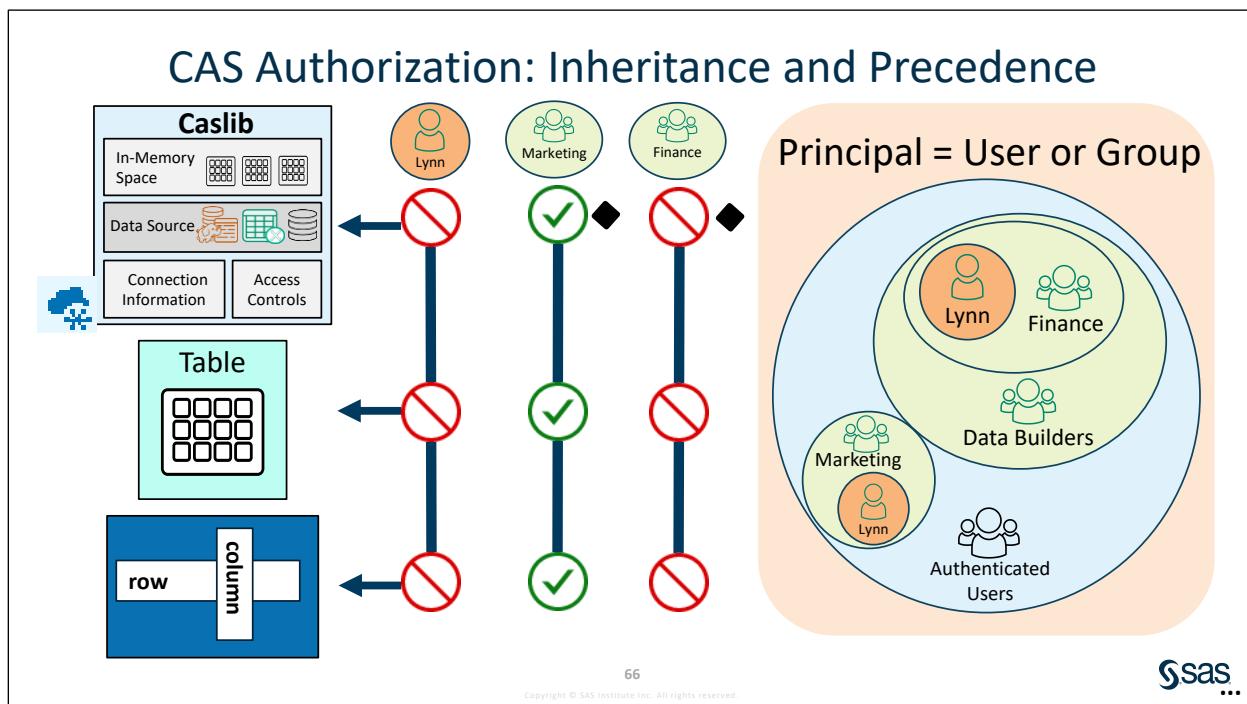


By default, each caslib always has implicit denials of all permissions for Authenticated Users. Those denials prevent access if there are no higher precedence grants.

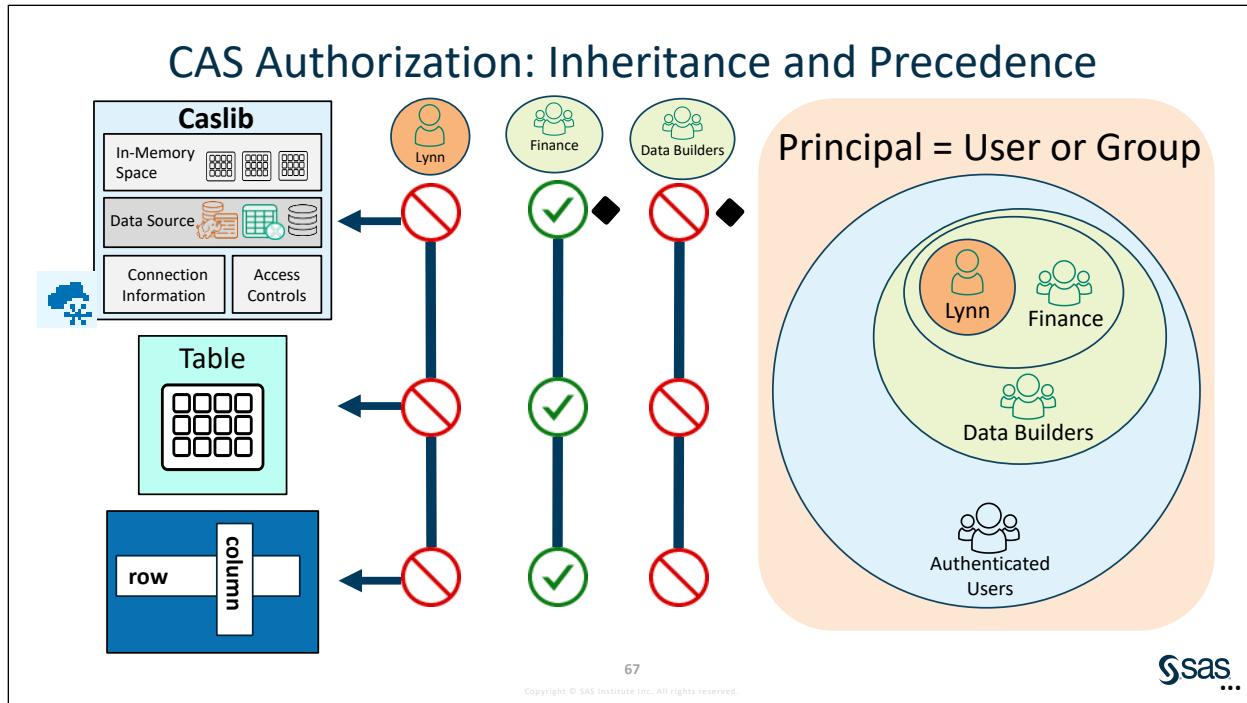




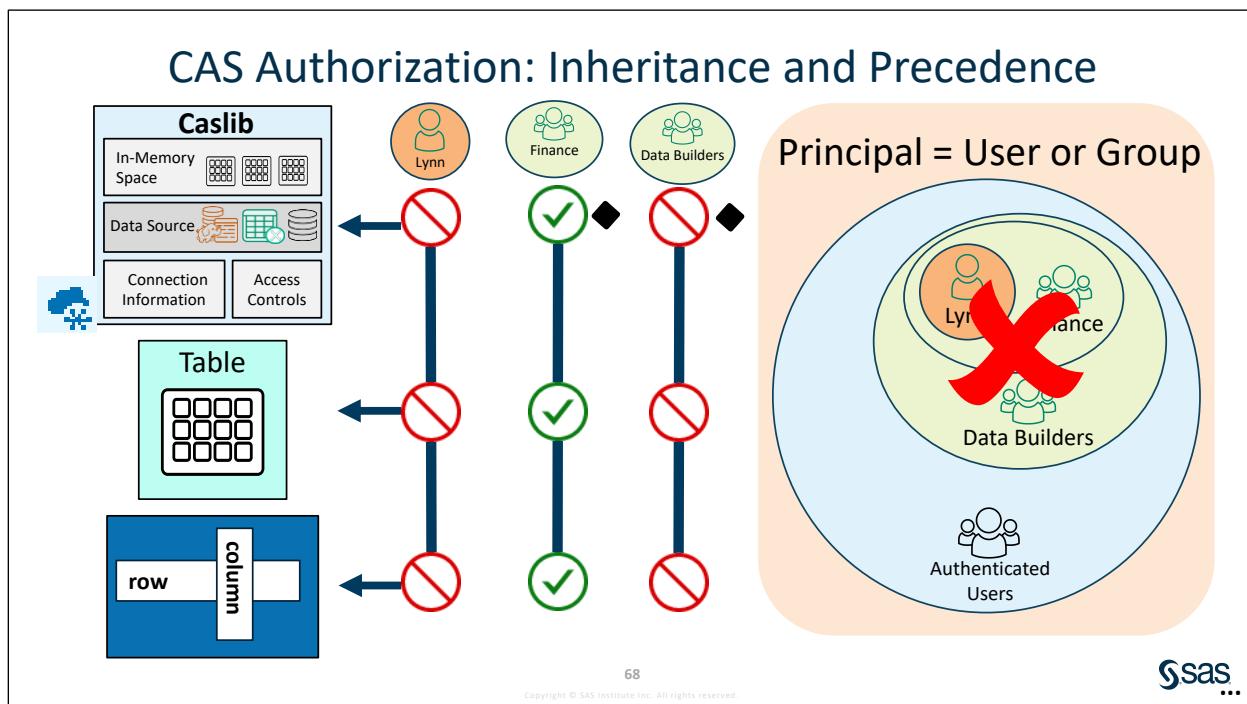
The principal is a user, group, or custom group that an access control is assigned to. Direct access controls have precedence over inherited access controls, regardless of who the principal is. For example, the Marketing group was given a direct grant on the caslib. But Lynn, who is a member of the Marketing group, was given a direct deny on a table within the caslib.



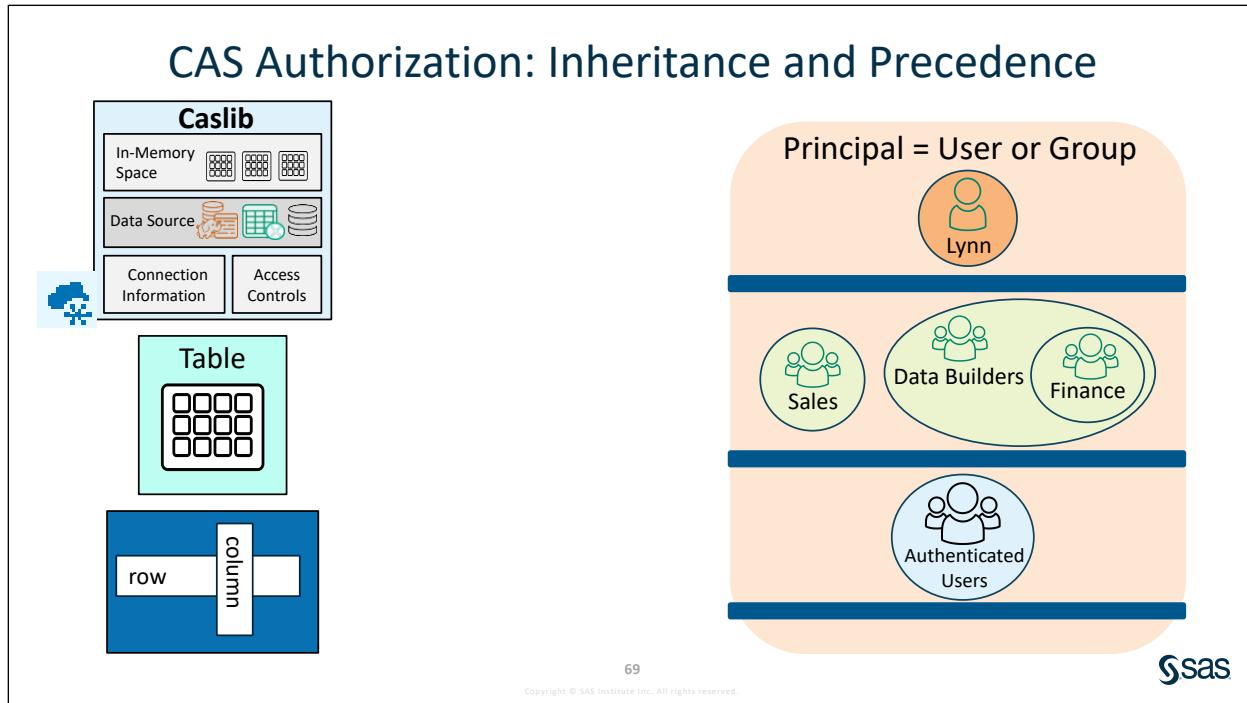
If a user is in two groups and if any of her groups that she belongs to has a direct deny for a permission, then she will have a deny.



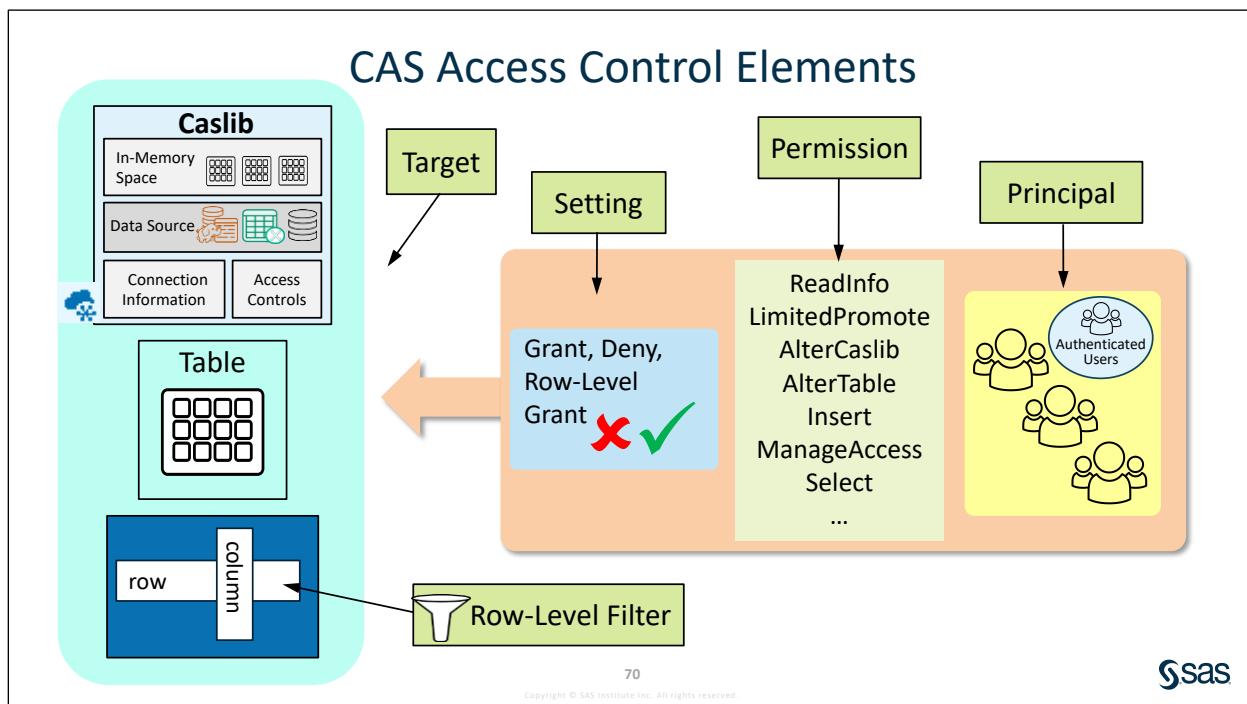
All user group memberships are at the same level of precedence, even if groups are nested. If there are conflicts of permissions at the group level, regardless of whether Lynn is a direct or indirect member, the outcome is a deny. In this example, there is an explicit deny for Data Builders and the nested group Finance has an explicit grant, and the outcome for Lynn is a deny.



The outcome is deny for all group members in the nest. The interface will show grants, but in actuality, Finance and all of its members are denied.



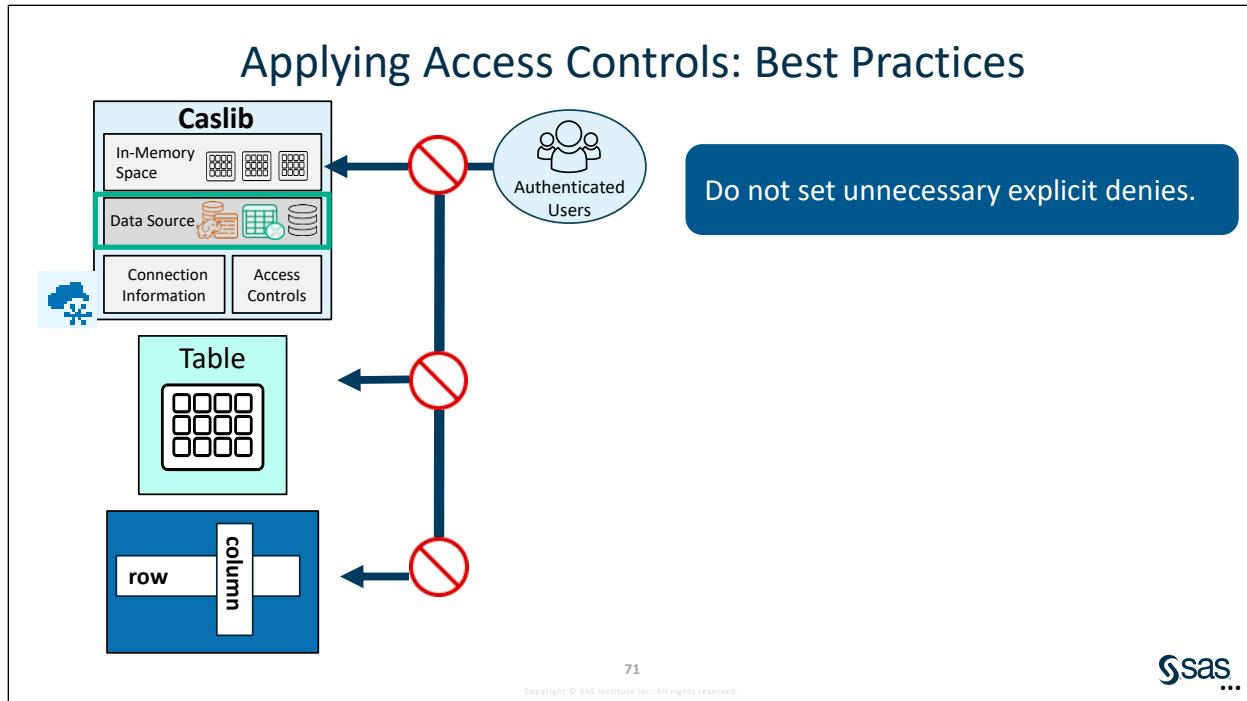
The principal precedence hierarchy consists of only the following three levels of hierarchy: 1) individual users, 2) user groups, and 3) Authenticated Users. All user group memberships are at the same level of precedence, even if groups are nested. For CAS authorization, the identity precedence does not exist at the group level.



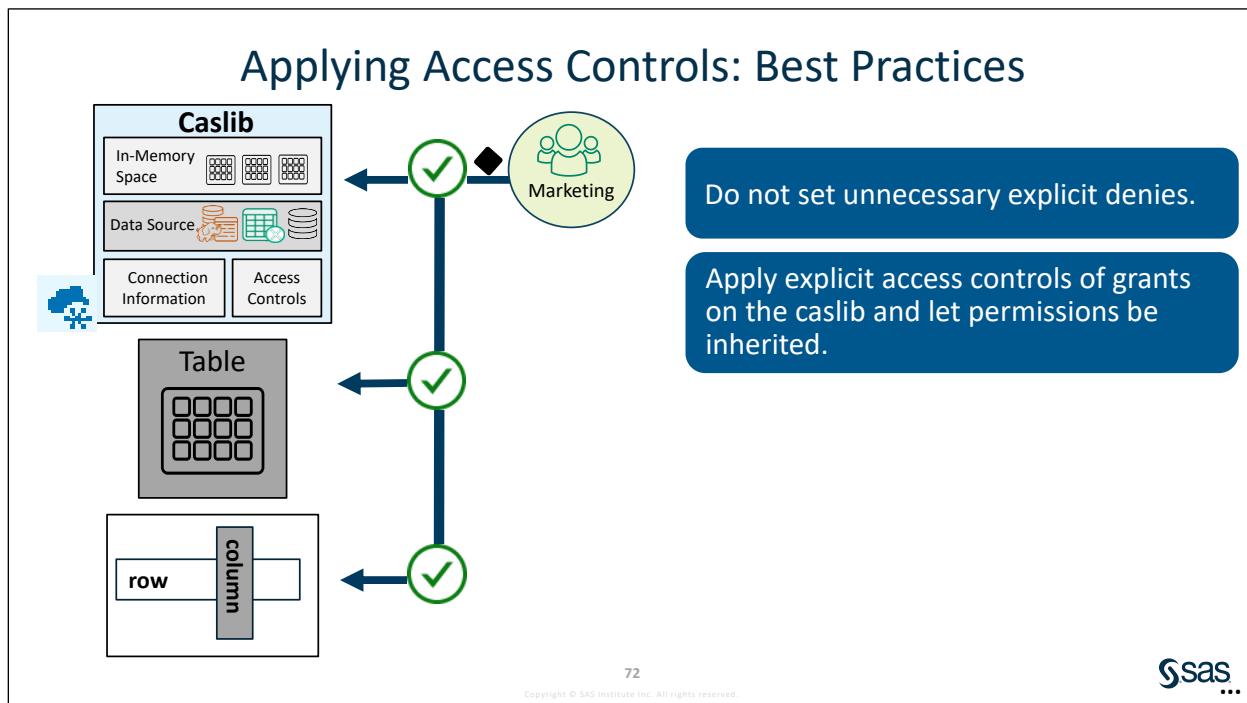
CAS access controls are a composite of authorization elements. The target is the resource, such as a caslib or table. The principal in an access control is the user group to which the access control is assigned. The setting is an indication of whether access is provided for a permission for the principal. The applicable permissions will vary depending on whether the target is a caslib or a table.

For example: An access control grants ReadInfo to groupA on caslibA.

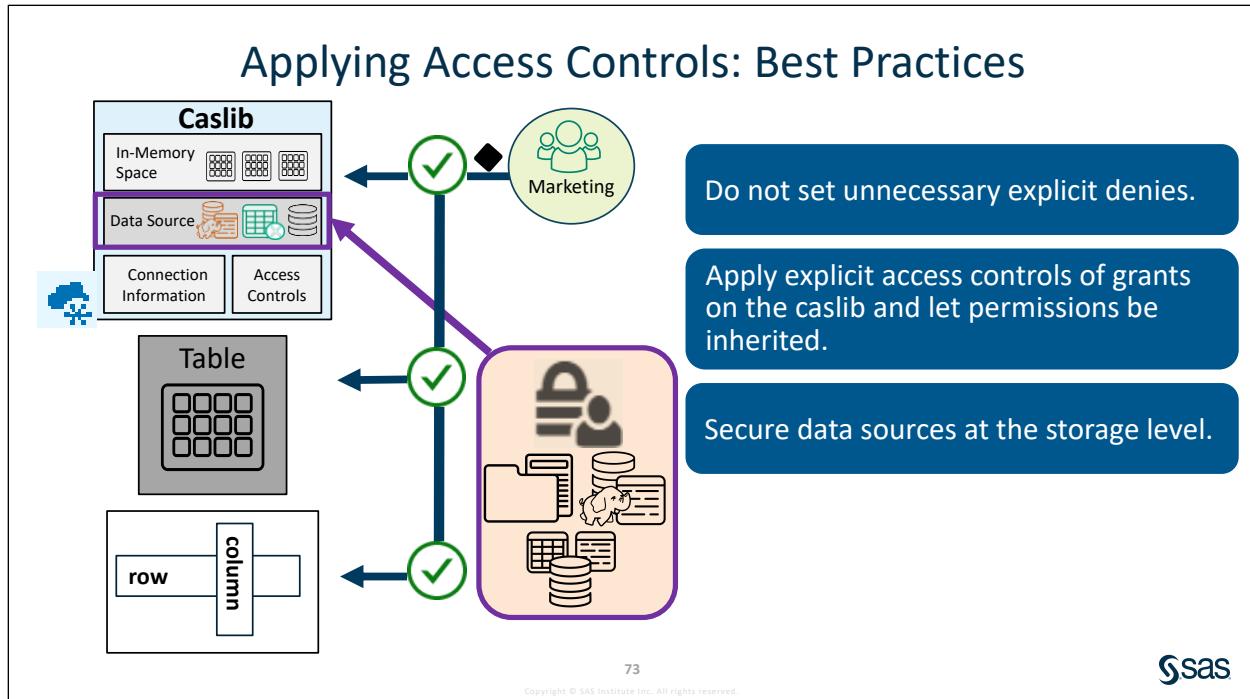
Permission	Caslib	Table	Affected Activities
AlterCaslib	✓		Change the properties of a caslib
AlterTable		✓	Change the attributes or structure of a table
Insert		✓	Add rows
Delete		✓	Delete rows
Update		✓	Change data values
Execute			Run an action
Load			Load an action set
ManageAccess	✓	✓	Set access controls
ReadInfo	✓	✓	View and traverse objects
LimitedPromote		✓	Promote from a source in the same caslib
Promote	✓		Promote from any caslib
CreateTable	✓	✓	Save (persist) a table
DeleteSource		✓	Delete a physical source table
DropTable		✓	Remove a table from the global scope
Select		✓	Read data values



As a best practice, when you apply access controls to caslibs, you do not need to apply explicit direct denies, because by default, the Authenticated Users group always has inherited denials of all permissions.

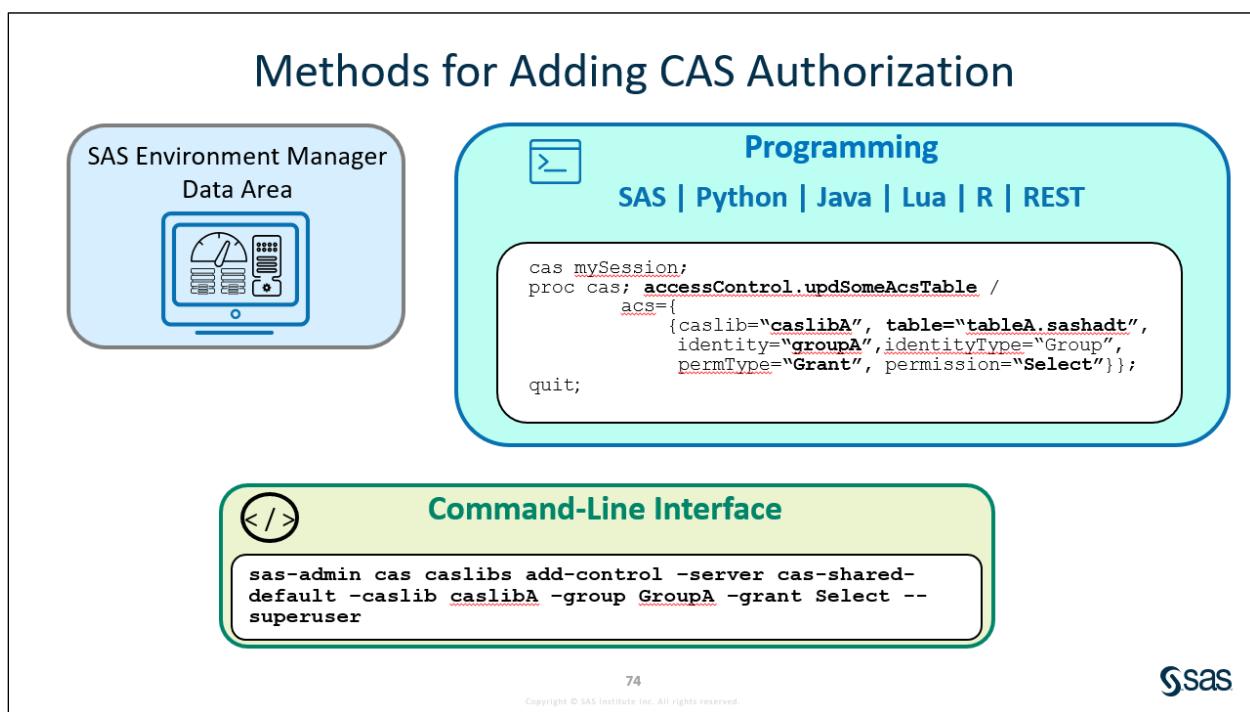


Put direct access control grants for a principal on the caslib and let the permissions be inherited to the caslib tables and columns.



For the source files or database tables, secure the data sources with their native authorization system, either at the OS level or in the database.

Note: Access to underlying data depends on who is running the process.





Reviewing CAS Authorization on a Caslib and a Table

This demonstration illustrates CAS authorization on a caslib and table.

1. Sign into SAS Environment Manager as **christine** with the password **Student1**.
2. Navigate to the **Data** page and click **Data Sources** tab to view caslibs.
3. Expand **cas-shared-default**.

4. Right-click the **Public** caslib and select **View authorization**. Note that we can view authorization only and not edit authorization, because Christine has not assumed the superuser role. Authenticated Users have an explicit deny of Alter Caslib and ManageAccess. Therefore, Christine, without assuming the superuser role, has a deny of both of those permissions. Also, there are no grants for the SAS Administrators group.

It is the **ManageAccess** permission that affects the ability to set permissions.

Principal	Access Level	RowInfo	Select	LimitedPromote	Promote	CreateTable	DropTable	DeleteSource	Insert	Update	Delete	AlterTable	AlterCaslib	ManageAccess
Authenticated Users	Write	✓ +	✓ +	✓ +	✓ +	✓ +	✓ +	✓ +	✓ +	✓ +	✓ +	✓ +	✓ +	✗ +
cas	Full Control	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗ +
Christine	Write	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗

5. Click **Close**.

6. Right-click **Finance** and select **View authorization**.

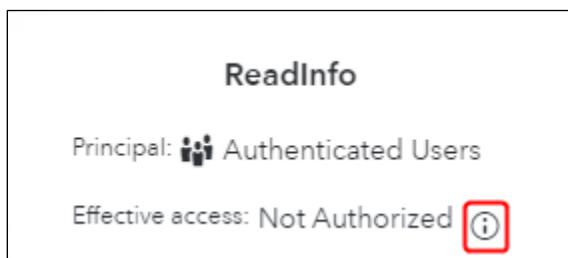
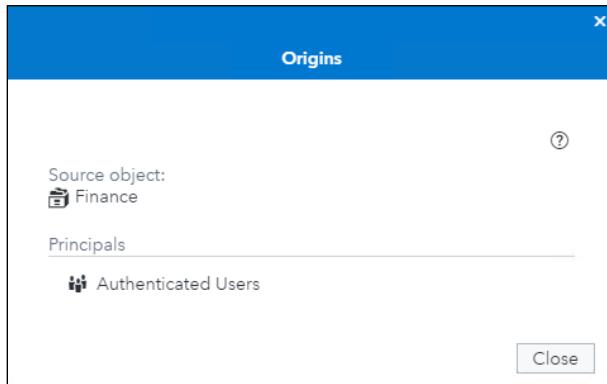
The screenshot shows the 'View Authorization' interface for the 'Finance' object. The interface has a header 'View Authorization' and a toolbar with various permission icons. The main area is a grid titled 'View Authorization' with columns for 'Principal' and 'Access Level'. The 'Principal' column lists 'Authenticated Users' and 'Christine'. The 'Access Level' column shows 'No Access' for 'Authenticated Users' and 'Full Control' for 'Christine'. The grid contains numerous permission checkboxes, many of which are checked (green) for 'Christine' and unchecked (red) for 'Authenticated Users'. Buttons for 'Edit' and 'Close' are at the bottom right.

Principal	Access Level	ReadInfo	Select	LimitedPromote	Promote	CreateTable	DropTable	DeleteSource	Insert	Update	Delete	AlterTable	AlterCaslib	ManageAccess
Authenticated Users	No Access	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Christine	Full Control	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

- There is always a row for Authenticated Users.
- There is always a row for the currently connected user who is using the display.
- There is a row for each principal that is assigned to an access control that affects access to the current object.
- If you add an identity and do not give that identity at least one direct setting, that identity is automatically removed from the display.
- You cannot directly remove a row. If you remove all direct settings for an identity, that identity is automatically removed from the display.
- Only the permissions that are relevant for an object (directly or for inheritance purposes) are displayed for that object.
- The display does not reflect the impact of CAS role membership or status.

7. Click a cell to view or edit one permission.

The screenshot shows the 'ReadInfo' permission details dialog. It displays the principal as 'Authenticated Users' and the effective access level as 'Not Authorized'. The 'Direct setting' dropdown is set to 'Deny'. The dialog has a 'ReadInfo' title bar and a 'Deny' button at the bottom.

8. Click **Origins**.9. Click **Close**.10. Click **Edit**. The Access Level provides an alternative to interacting with individual permissions.

By moving the circle to the first tick, you activate **ReadInfo** and **Select**.

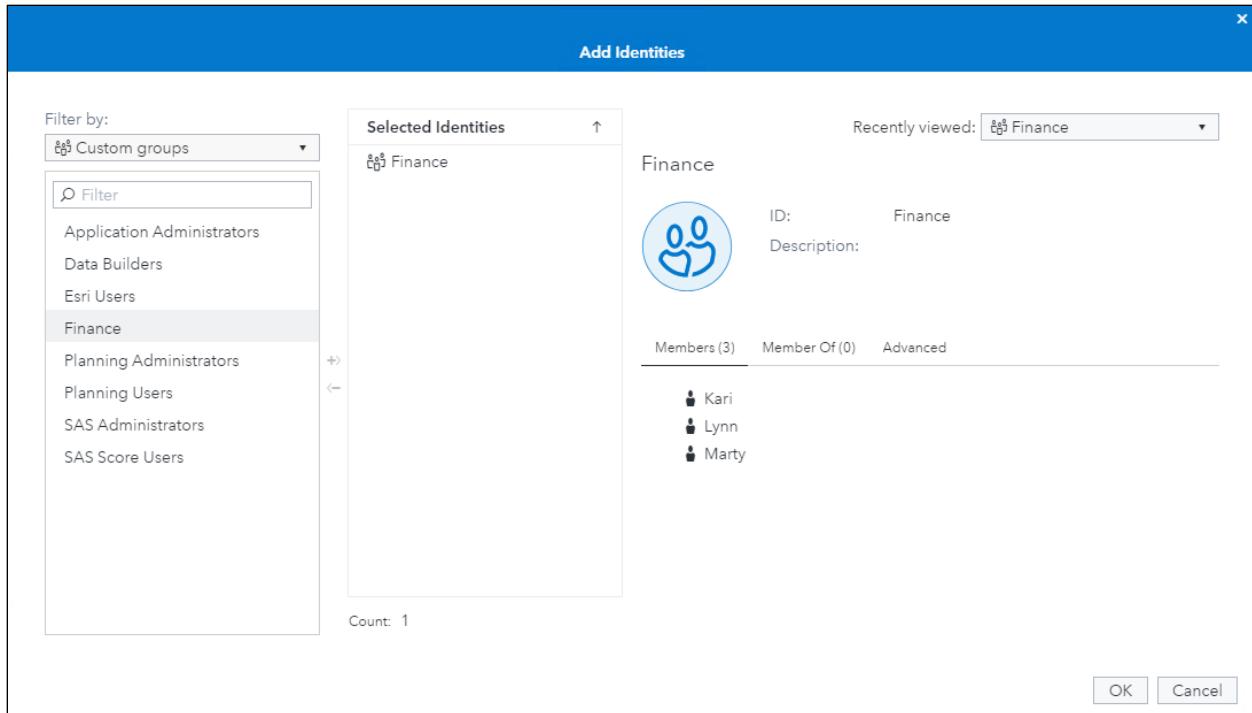
		Edit Authorization													
		Finance													
		Show individual permissions													
Principal	Access Level	ReadInfo	Select	LimitedPromote	Promote	CreateTable	DropTable	DeleteSource	Insert	Update	Delete	AlterTable	AlterCaslib	ManageAccess	
Authenticated Users	Read	○ +	○ +	○	○	○	○	○	○	○	○	○	○	○	
Christine	Full Control	○ +	○ +	○ +	○ +	○ +	○ +	○ +	○ +	○ +	○ +	○ +	○ +	○ +	

11. Only Christine, who is our administrator and created this caslib, has full control. All other users are denied all access. Add the **Finance** group as a principal. Click (the **Add Identities** icon).

12. Highlight **Finance** and use the arrow to move it to the **Selected Identities** box.

Note: If the Finance group is not present, run the following script:

```
/workshop/LWSAVI35/scripts/L03/addFinanceGroup.sh
```



13. Click **OK**.
 14. Give grants to the Finance group for the permissions **ReadInfo**, **Select**, and **LimitedPromote** on the Finance caslib.
- ReadInfo enables viewing and traversing objects, Select enables reading data values, and LimitedPromote enables promoting from a source in the same caslib. This is good for SAS Visual Analytics users who need to view reports in which data is not loaded into memory. This is referred to as *just-in-time loading*.

The screenshot shows the 'Edit Authorization' dialog box. It displays a grid of permissions for three principals: 'Authenticated Users', 'Finance', and 'Christine'. The columns represent various SAS permissions: ReadInfo, Select, LimitedPromote, Promote, CreateTable, DropTable, DeleteSource, Insert, Update, Delete, AlterTable, AlterCaslib, and ManageAccess. The 'Authenticated Users' row shows 'No Access' with red crossed-out icons. The 'Finance' row shows 'Custom' access with green checkmarks. The 'Christine' row shows 'Full Control' with green checkmarks. At the bottom are 'Preview', 'Save', and 'Cancel' buttons.

Principal	Access Level	Edit Authorization											
		ReadInfo	Select	LimitedPromote	Promote	CreateTable	DropTable	DeleteSource	Insert	Update	Delete	AlterTable	AlterCaslib
Authenticated Users	No Access	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Finance	Custom	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗
Christine	Full Control	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

15. Click **Save**.

16. Expand the **Finance** caslib to see tables.

The screenshot shows the SAS Data Explorer interface. A folder icon labeled "Finance" is expanded, revealing three data files listed below it:

- goalies.sas7bdat (11/06/17 12:14 PM)
- hockey.sas7bdat (11/06/17 12:02 PM)
- na_hurricanes.sas7bdat (11/28/17 04:15 PM)

17. Right-click **hockey** and select **View authorization**.

The screenshot shows the SAS Data Explorer interface with the "Finance" caslib expanded. The "hockey.sas7bdat" file is selected, and a context menu is displayed. The menu items are:

- Load
- Unload
- View authorization** (highlighted with a red box)
- Edit authorization
- Delete
- Add to import
- Run profile
- Run profile and save
- Download table

Permissions are inherited from the caslib.

Principal		Access Level	ReadInfo	Select	LimitedPromote	CreateTable	DropTable	DeleteSource	Insert	Update	Delete	AlterTable	ManageAccess
Authenticated Users		No Access	🚫	🚫	🚫	🚫	🚫	🚫	🚫	🚫	🚫	🚫	🚫
Finance		Custom	✓	✓	✓	🚫	🚫	🚫	🚫	🚫	🚫	🚫	🚫
Christine		Full Control	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

18. Click **Close**.

End of Demonstration



Practice

7. Setting CAS Access Controls on Finance Caslib Using SAS Environment Manager

- a. In SAS Environment Manager, select **Data** from the side menu. (Make sure you are logged on as Christine.)
- b. On the Data Sources tab, expand **cas-shared-default**.
- c. Right-click the **Finance** caslib and select **Edit Authorization**.
- d. Add Finance and Sales groups as principals.
 - 1) Click the **Add identities** icon.
 - 2) Move **Finance** from Custom groups and **Sales** from Groups to the **Selected Identities** column. Click **OK**.
- e. Grant the groups ReadInfo, Select, and LimitedPromote permissions.
 - 1) Click the permission for **ReadInfo** for **Finance** and select **Grant**.
 - 2) Repeat the above step for **Select** and **LimitedPromote** for **Finance**.
 - 3) Repeat the above steps for **Sales**.
- f. Click **Preview** first to preview and then click **Save**.
- g. Expand the **Finance** caslib, right-click **hockey.sas7bdat** table, and select **Edit authorization**.

How would you apply a filter for the Finance group so that they see only the rows of players for the Pittsburgh Penguins? (**name = “Pittsburgh Penguins”**) Hint: Look at the Select permission.

- h. Click **Cancel**. **Do not** make any changes to the authorization of the table.

Note: There is a CLI script to add access controls on the Finance caslib:

```
/workshop/LWSAVI35/scripts/L04/practice07_addFinanceACLs.sh
```

8. Setting CAS Access Controls on Workshop Caslib Using CLI

Use the **sas-admin cas caslibs add-control** command to add access controls for the Sales group.

- a. Bring up mRemoteNG and enter the following commands:

```
/opt/sas/viya/home/bin/sas-admin cas caslibs add-control --grant readInfo --server cas-shared-default --caslib Workshop --group Sales
```

```
/opt/sas/viya/home/bin/sas-admin cas caslibs add-control --grant select --server cas-shared-default --caslib Workshop --group Sales
```

```
/opt/sas/viya/home/bin/sas-admin cas caslibs add-control --grant limitedpromote --server cas-shared-default --caslib Workshop --group Sales
```

- b. List the source tables in the Workshop and Finance path-based caslibs.

Enter the following commands:

```
/opt/sas/viya/home/bin/sas-admin --output text cas sources  
list --caslib=Workshop --server=cas-shared-default
```

```
/opt/sas/viya/home/bin/sas-admin --output text cas sources  
list --caslib=Finance --server=cas-shared-default
```

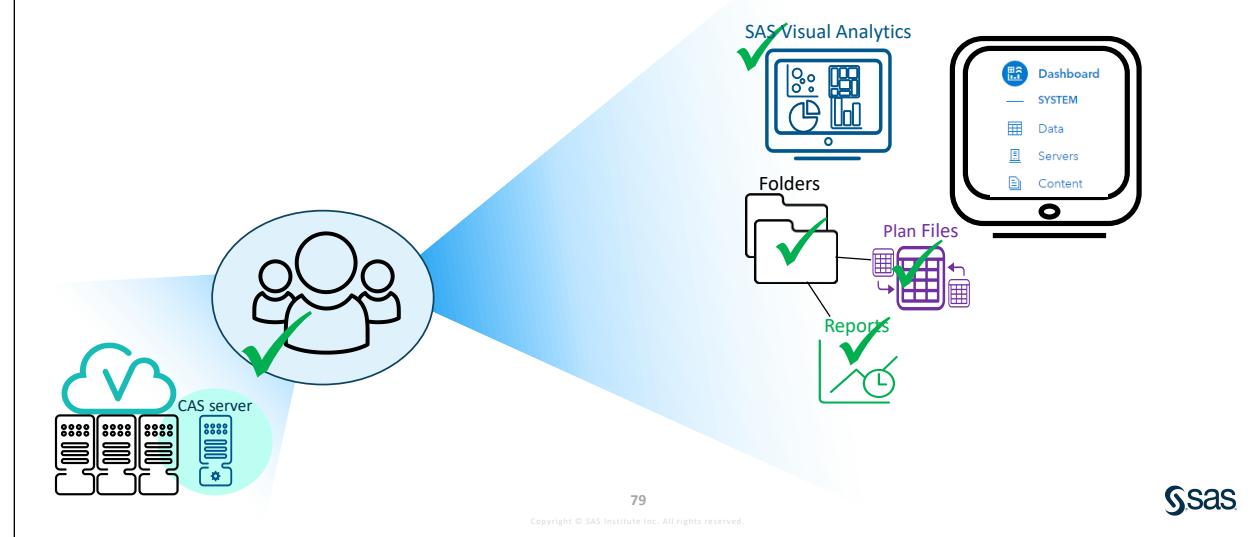
Note: There is a CLI script to add access controls on the Workshop caslib:

```
/workshop/LWSAVI35/scripts/L04/practice07_addWorkshopACLs.sh
```

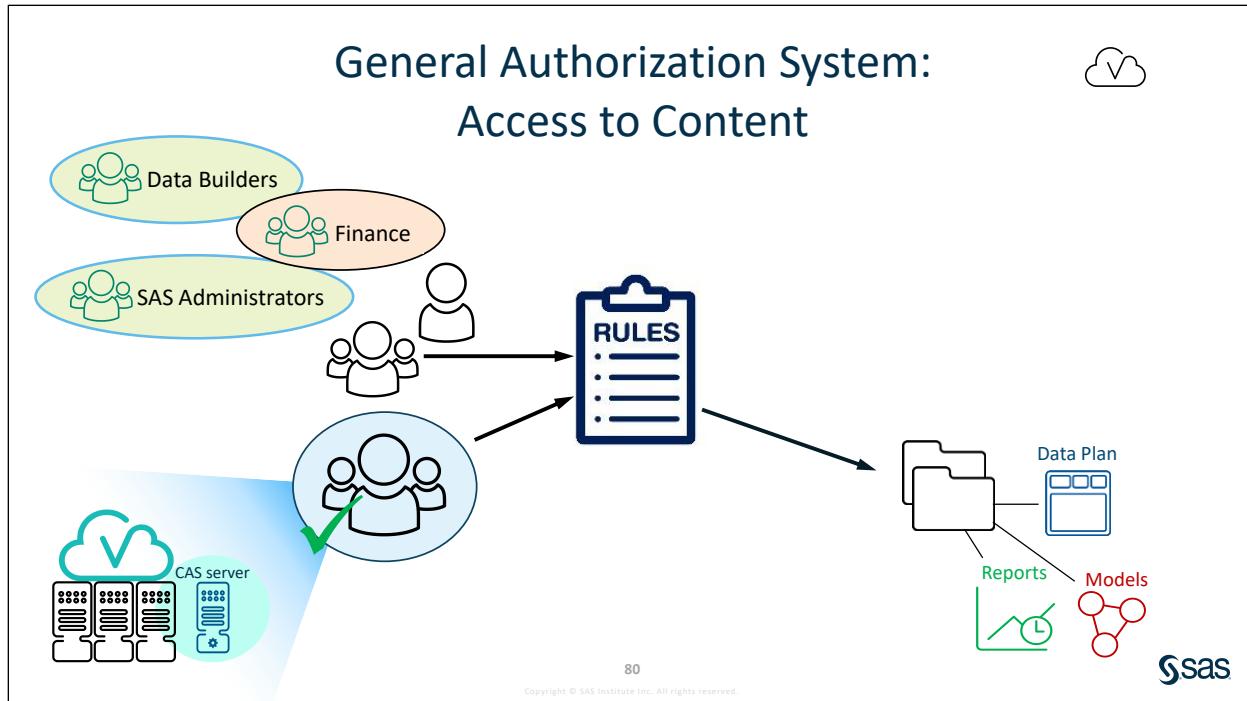
End of Practices

4.4 Access to Content and Functionality

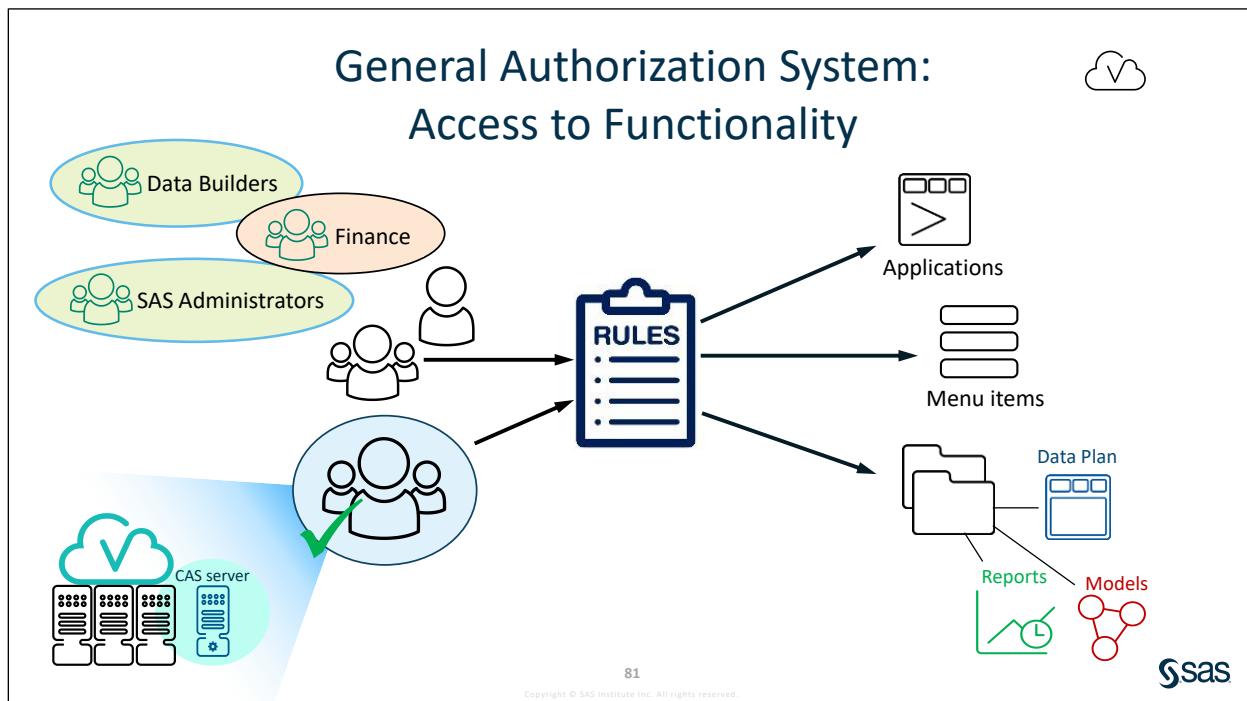
Implicit Group: Authenticated Users (Review)



The Authenticated Users group has implicit membership in which anyone who authenticates to SAS Viya automatically belongs. This group can initially access the Dashboard, Data, and Content pages in SAS Environment Manager. The group can initially access SAS Visual Analytics and perform operations on folders and on the objects in the folders, although the group is subject to permissions.

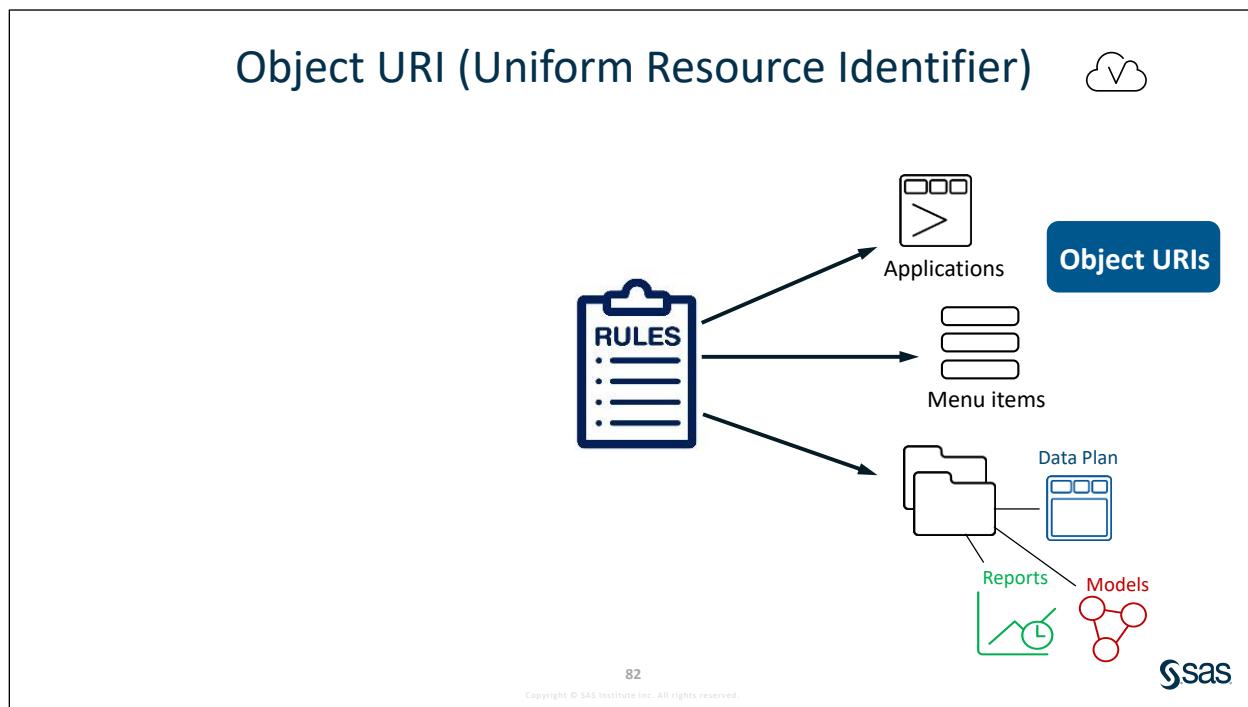


The general authorization system in SAS Viya controls access to folders, and the user-created content such as reports and data plans within folders. This SAS Viya authorization layer is based on rules.



Rules also determine access to the functionality of SAS Viya applications and the menu items or pages that are available for view after an application is opened. The combination of your group membership and the defined rules determine what you can see and therefore do within SAS Viya.

Custom Group	Initial Access	Initial Membership
SAS Administrators	All tasks in SAS Environment Manager and CAS Server Monitor and all folders and objects	Group is a member of the CAS superuser role
Application Administrators	Can access selected administrative functions within applications. Is not an assumable group.	None
Data Builders	SAS Data Studio	None
Esri Users	ESRI system for geo map access	None
Authenticated Users	SAS Visual Analytics and the Dashboard, Data, and Content pages in SAS Environment Manager	All users who can authenticate to SAS Viya
Everyone Note: The Everyone implicit group is used only when guest access is enabled.	SAS Report Viewer SAS Visual Analytics Apps	Authenticated Users and any anonymous users

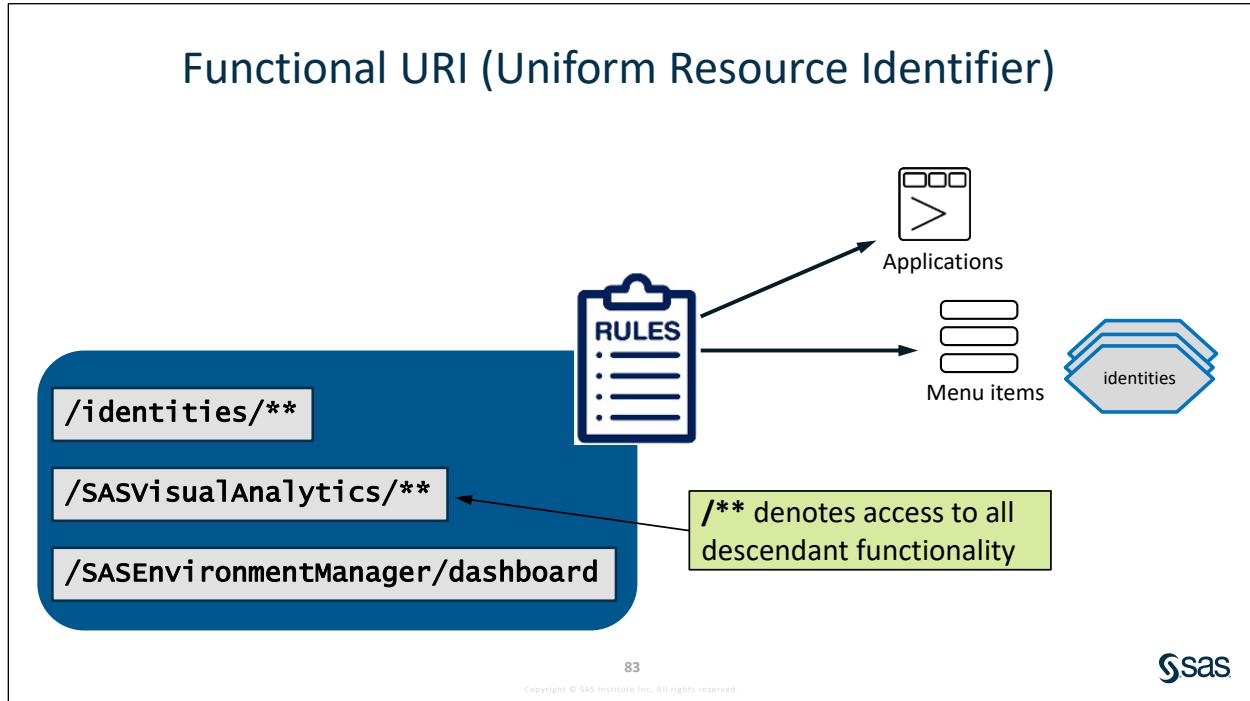


Access to functionality is managed by rules that target a service, a service end point, or an object. These rules, which are identified by URIs (Uniform Resource Identifiers), are created and enforced using the general authorization model.

SAS provides an initial set of rules that give Authenticated Users access to functionality that is appropriate for a typical user. There are also rules in place that give special categories of users access to additional functionality (for example, access to administrative functions). To apply these rules, you add users or groups to a predefined custom group such as SAS Administrators.

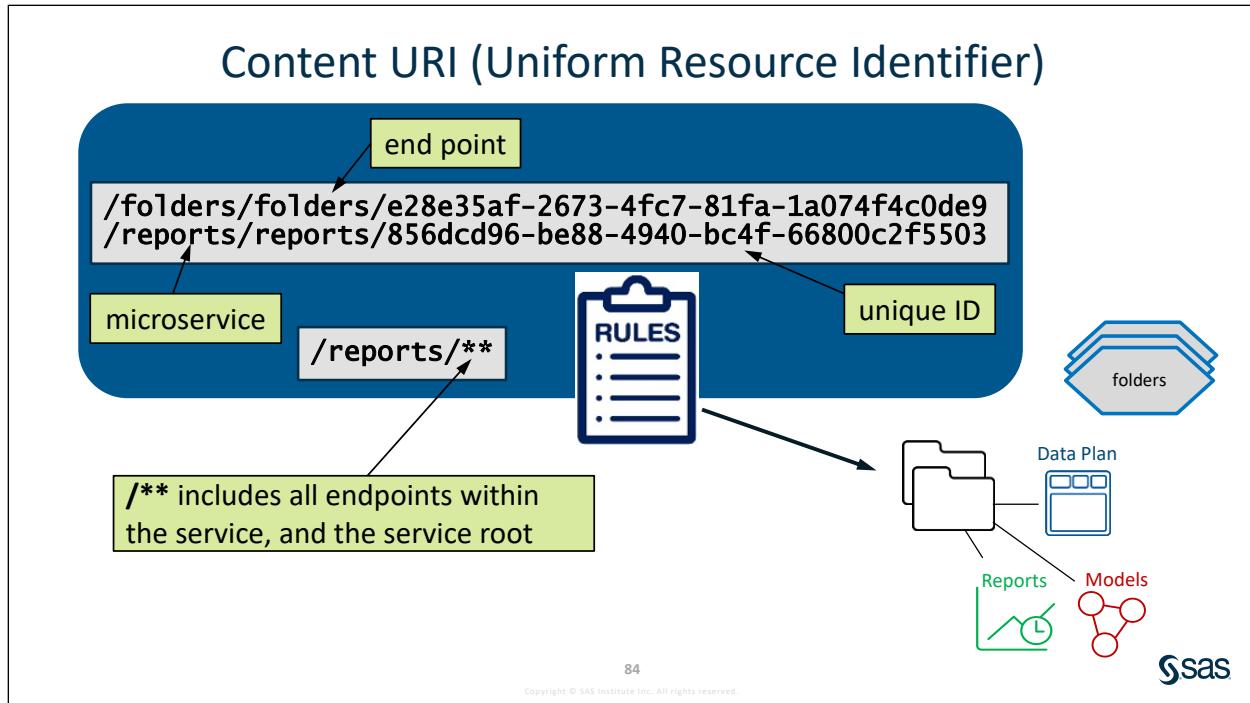
In most cases, the initial rules provide a sufficient level of control.

If, after gaining experience with SAS Viya, you identify the need for more granular control, you can make adjustments to the rules' applicability.



Access to functionality is managed by rules that target a service or a service endpoint. These rules are identified by the URI.

An object URI that includes the `/**` suffix affects access to all descendant functionality. For an object URI that references a service, such as SAS Visual Analytics, the `/**` affects access to the service and all its end points, or sub-functions within the service.



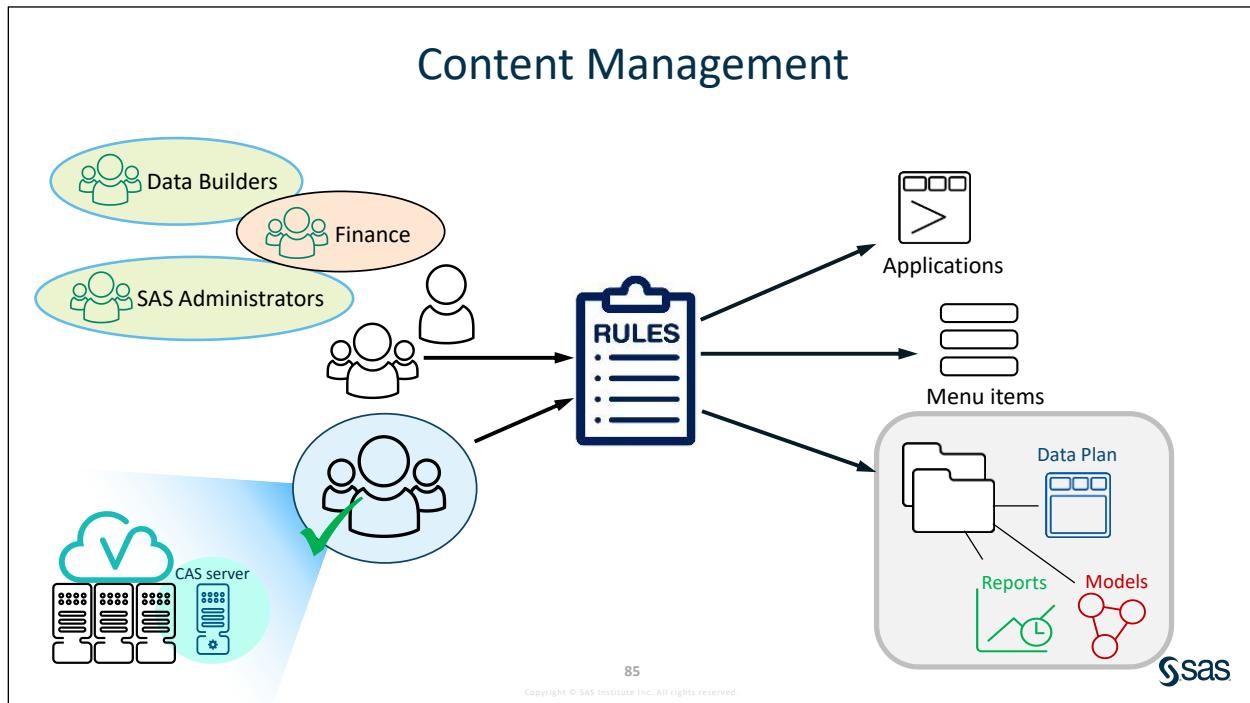
Content URI includes the unique ID for a specified object, such as reportA or folderB.

For an object URI that references an object within a service, the `/**` suffix provides access to the associated service's end points in the context of that particular object. But it does not impact descendant content objects (such as reports within a folder, which is represented by the unique ID).

In general, rules that specify the object URI for a content object (such as a folder or report) should include the `/**` suffix. Inadvertently omitting the suffix narrows the effects of a rule and can yield unintended results due to insufficient access.

Scope of a Target URI: Examples from Reports Service

Rule's Target URI	Rule's Scope
/reports	The root of the reports service. Relevant to requests that omit a trailing slash.
/reports/	The root of the reports service. Relevant to requests that include a trailing slash.
/reports/*	All first-level end points within the service (not the service root, lower-level end points, or individual reports).
/reports/*/report-id	All first-level end points within the service (for the specified report).
/reports/**	All reports, and all second-level end points beneath the reports end point.
/reports/**/report-id	All end points within the service (for the specified report).
/reports/reports/*	All reports, and all second-level end points beneath the reports end point.
/reports/reports/report-id	The specified report.



Content that is created and saved by users of the SAS Viya system is stored and organized in folders. A folder is a virtual container rather than a representation of a physical file system. A folder contains members, which are object URLs for other folders or SAS resources.



Exploring Content in SAS Environment Manager

This demonstration shows how to use SAS Environment Manager to view and manage content.

1. Sign in to **SAS Environment Manager** as **christine** with the password **Student1**. Opt in to the SASAdministrator assumable group.
2. Select **Content** from the side menu. Content such as reports and data plans that you or other users save is stored and organized in folders. A folder is a virtual container rather than a representation of a physical file system.

Data plans – a collection of actions performed in SAS Data Studio.

Reports – created by SAS Viya applications; able to be shared via the web or on a mobile device.

Some of the advanced statistical products create and use other types of content such as models and model projects.

The Predefined folder structure includes the following items:

My Favorites	Shortcuts to objects that you add to favorites
My Folder	Personal folder for objects that you do not want to share with other users (same as /Users/username/My Folder)
Shared	If you share items with other users, references to those items are stored in the Shared by me folder here. Similarly, when other users share items with you, references to those items are stored in the Shared with me folder here.
Recycle Bin	Items that you delete are placed in the recycle bin. From this location, you can delete them permanently or restore them to their original location

Inside the **SAS Content** folder, there are additional predefined content folders.

Products	Samples and examples created by SAS
Public	Folder for general access shared content
Users	Contains the private folder for all users (only visible to administrators)

Your deployment might contain other predefined folders, depending on your organization's needs and configuration.

3. You always have access to your own data in the folder named My Folder. (This is automatically created for you when you log on for the first time.) This is a shortcut to your user folder that is located under Users.

Expand **Users**.

The SAS Administrators custom group is able to view all user folders and content.

Folders > SAS Content > Users

- bruno
- christine
- eric
- jacques
- kari
- lynn
- sas.dataMining
- sas.dataMiningModels
- sas.textAnalytics
- sasboot
- student

All content objects, or folder members, can have only one parent and have a unique identifier (URI-uniform resource identifier). Child members can be moved to another folder with proper authorization, but child members cannot be copied or duplicated.

A member in a folder can be either a child or a reference. A reference member is a pointer to a resource that exists as a child in another folder (similar to a Windows shortcut). Reference members in multiple folders can point to the same object.

4. Navigate through the folder structure: **SAS Content** ⇒ **Orion Star** ⇒ **Marketing**. In the Marketing folder, there is a Product Report.

The screenshot shows the SAS Content interface. On the left, the folder structure is displayed: Folders > SAS Content > Orion Star > Marketing. The 'Product Report' item is selected. On the right, the properties of the selected item are shown in a details panel:

Basic Properties	
Name:	Product Report
URI:	/reports/reports/4df447b6-5e38-417c-b8e6-548af9ab44fe
Description:	
Type:	Report
Location:	/Orion Star/Marketing/Product Report

At the bottom right of the panel, there is a link labeled '> Advanced'.

5. Select **Product Report**. Notice the URI for the Product Report and that the type is **Report**.

The screenshot shows the SAS Content interface. On the left, the folder structure is displayed: Folders > SAS Content > Orion Star > Marketing. The 'Product Report' item is selected. On the right, the properties of the selected item are shown in a details panel. The 'URI' field is highlighted with a red box:

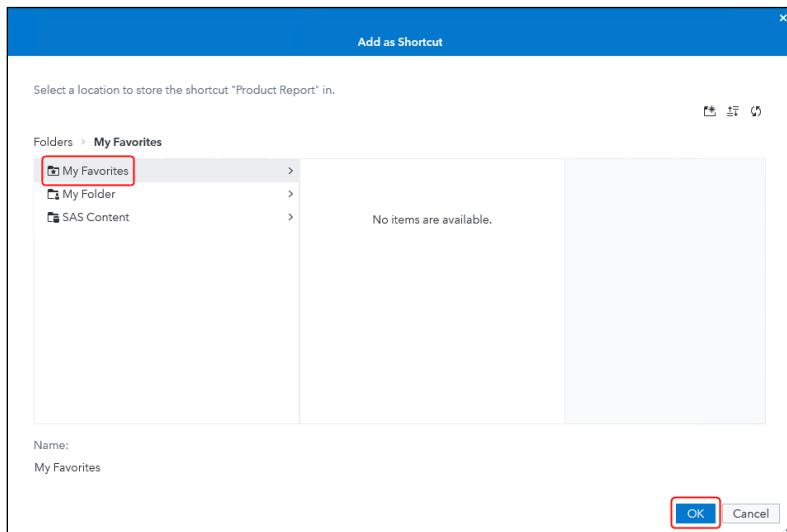
Basic Properties	
Name:	Product Report
URI:	/reports/reports/4df447b6-5e38-417c-b8e6-548af9ab44fe
Description:	
Type:	Report
Location:	/Orion Star/Marketing/Product Report

At the bottom right of the panel, there is a link labeled '> Advanced'.

6. Right-click **Product Report** and select **Add as shortcut**.

The screenshot shows the SAS Content interface. On the left, the folder structure is displayed: Folders > SAS Content > Orion Star > Marketing. The 'Product Report' item is selected. A context menu is open, listing the following options: Delete, Rename, Add as shortcut (which is highlighted with a red box), Move to folder, View authorization, Edit authorization, Export, and Pin to dashboard.

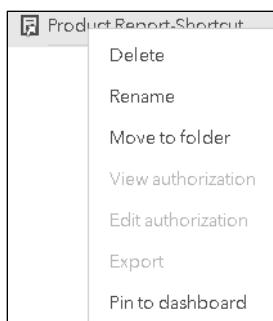
7. Select **My Favorites** in the list of folders in the Add as Shortcut window. Click **OK**.



8. Navigate to the **My Favorites** folder and select **Product Report-Shortcut**. Notice that the URI is the same as the original report, but the type is **Reference** and not Report. The URI that is associated with a content object remains constant, regardless of its location.

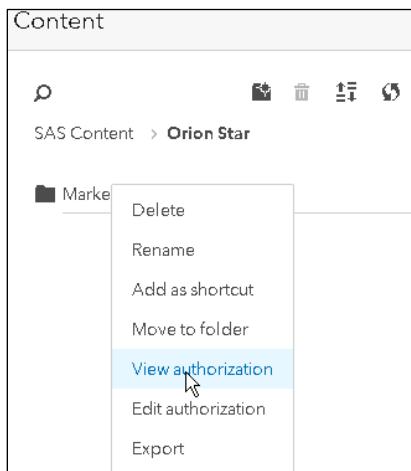
Basic Properties	
Name:	Product Report
URI:	/reports/reports/4df447b6-5e38-417c-b8e6-548af9ab44fe
Description:	(empty)
Type:	reference
Location:	/My Favorites/Product Report-Shortcut

9. Right-click **Product Report-Shortcut**. You cannot manage authorization on a reference.



10. Return to **SAS Content** ⇒ **Orion Star** ⇒ **Marketing** and create another shortcut. Place it in the Projects folder.
11. Navigate to the **Projects** folder and confirm that the shortcut is there. Notice that the same object can have references in multiple folders.

12. Return to **Orion Star** and right-click **Marketing** and select **View authorization**.



The following permissions are required to move an object:

Source Folder – Read, Update, Remove, Read (convey), Update (convey)

Object in Source Folder – Read, Update

Target Folder – Read, Update, Add

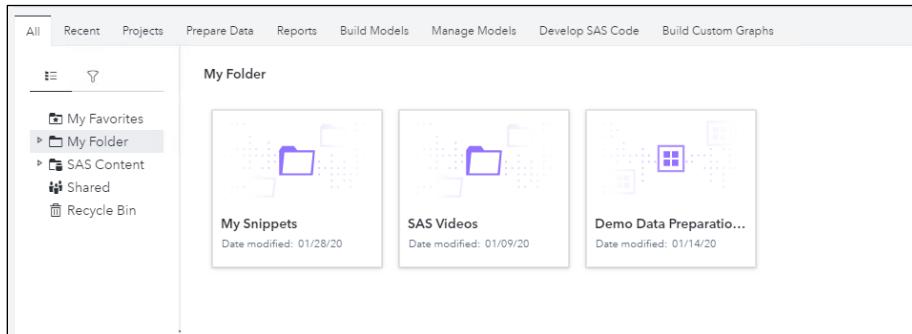
View Authorization												
Inheritance flows to child members from only the second set of permissions.												
Principal	Read	Update	Delete	Secure	Add	Remove	Read (convey)	Update (convey)	Delete (convey)	Secure (convey)	Add (convey)	Remove (convey)
Authenticated Users	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
SAS Administrators	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗
Christine	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

13. Click **Close**.

14. Select **Share and Collaborate** from the applications menu to get to **SAS Drive**.



15. Content types are grouped into tabs. Click the **All** tab in SAS Drive if not already there.



Application Administrators and SAS Administrators are able to view all content. Users who are not in either group are able to see only content that they created or that is shared with them.

End of Demonstration



Practice

9. Moving Content in SAS Environment Manager

In this practice, you use SAS Environment Manager to move content.

- a. Sign in to SAS Environment Manager as the user **christine** with the password **Student1**.
- b. On the SAS Environment Manager side menu, select **Content**.
- c. Expand **SAS Content** ⇒ **Orion Star** ⇒ **Marketing** folder by selecting the arrow to the right of each folder.
- d. Select **Product Report**. Notice the URI, type, and location of the report in the Basic Properties pane.
- e. Right-click **Product Report** and select **Move to Folder**.
- f. In the Choose a Location window, select **Public**. Click **OK** to move the report.
- g. Verify that the report is no longer in the Marketing folder.
- h. Navigate to the **Public** folder and verify that the report is there.
- i. Select **Product Report**. Notice the URI, type, and location of the report in the Basic Properties pane. Did anything change?

10. Using SAS Environment Manager to Add Folders

In this practice, you use SAS Environment Manager and the Content page to add a new folder.

- a. In SAS Environment Manager, select the **Content** page from the side menu.
- b. Add the **Sales** and **Finance** folders below the **Orion Star** folder using the graphical user interface.

Note: There is a CLI script to add these folders:

```
/workshop/LWSAVI35/scripts/L04/practice10_addfolders.sh
```

11. Using the CLI to Add Folders

In this practice, you use the command-line interface to add folders beneath the Marketing, Finance, and Sales folders.

- As **christine** in an mRemoteNG session, run the CLI script:

```
/workshop/LWSAVI35/scripts/L04/practice11_addsubfolders.sh
```

The contents of the script:

```
/opt/sas/viya/home/bin/sas-admin folders create --name "Analyses" --parent-path "/Orion Star/Marketing"
/opt/sas/viya/home/bin/sas-admin folders create --name "Work in Progress" --parent-path "/Orion Star/Marketing"
/opt/sas/viya/home/bin/sas-admin folders create --name "Work in Progress" --parent-path "/Orion Star/Marketing"
/opt/sas/viya/home/bin/sas-admin folders create --name "Analyses" --parent-path "/Orion Star/Finance"
/opt/sas/viya/home/bin/sas-admin folders create --name "Data Plans" --parent-path "/Orion Star/Finance"
/opt/sas/viya/home/bin/sas-admin folders create --name "Models" --parent-path "/Orion Star/Finance"
/opt/sas/viya/home/bin/sas-admin folders create --name "Analyses" --parent-path "/Orion Star/Sales"
/opt/sas/viya/home/bin/sas-admin folders create --name "Work in Progress" --parent-path "/Orion Star/Sales"
/opt/sas/viya/home/bin/sas-admin folders create --name "Models" --parent-path "/Orion Star/Sales"
```

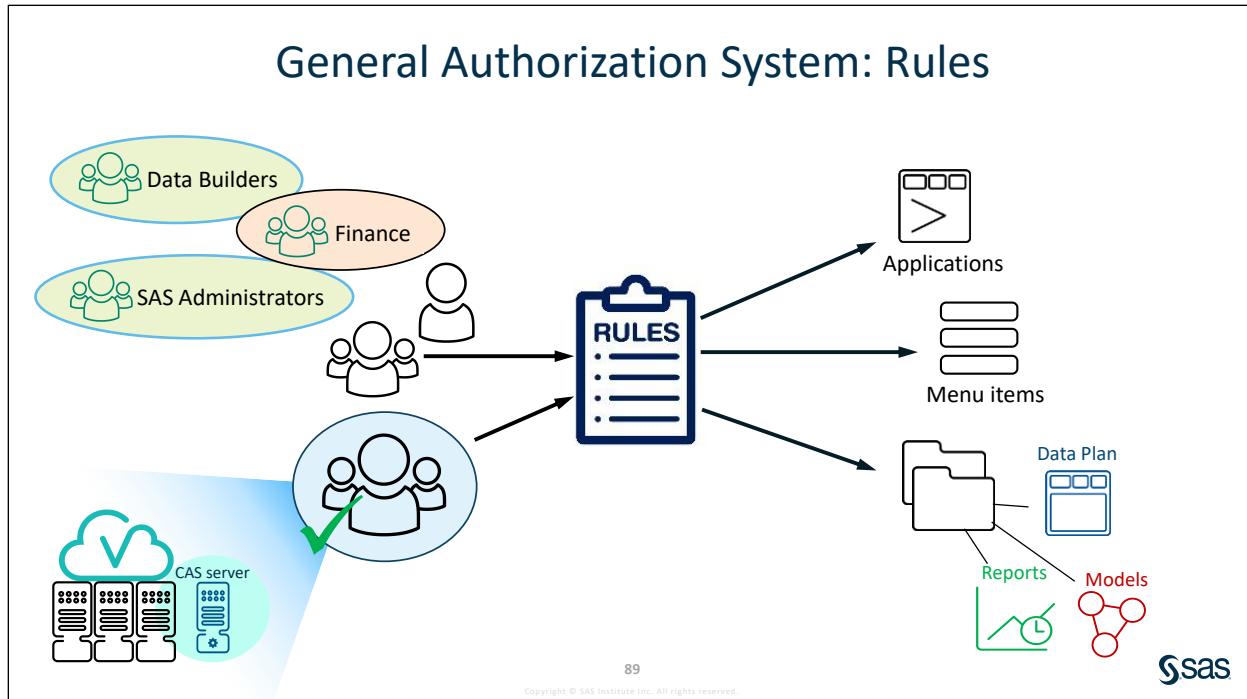
- Enter the following command to get a list of folders:

```
/opt/sas/viya/home/bin/sas-admin --output text folders list-members --path "/Orion Star/" --recursive
```

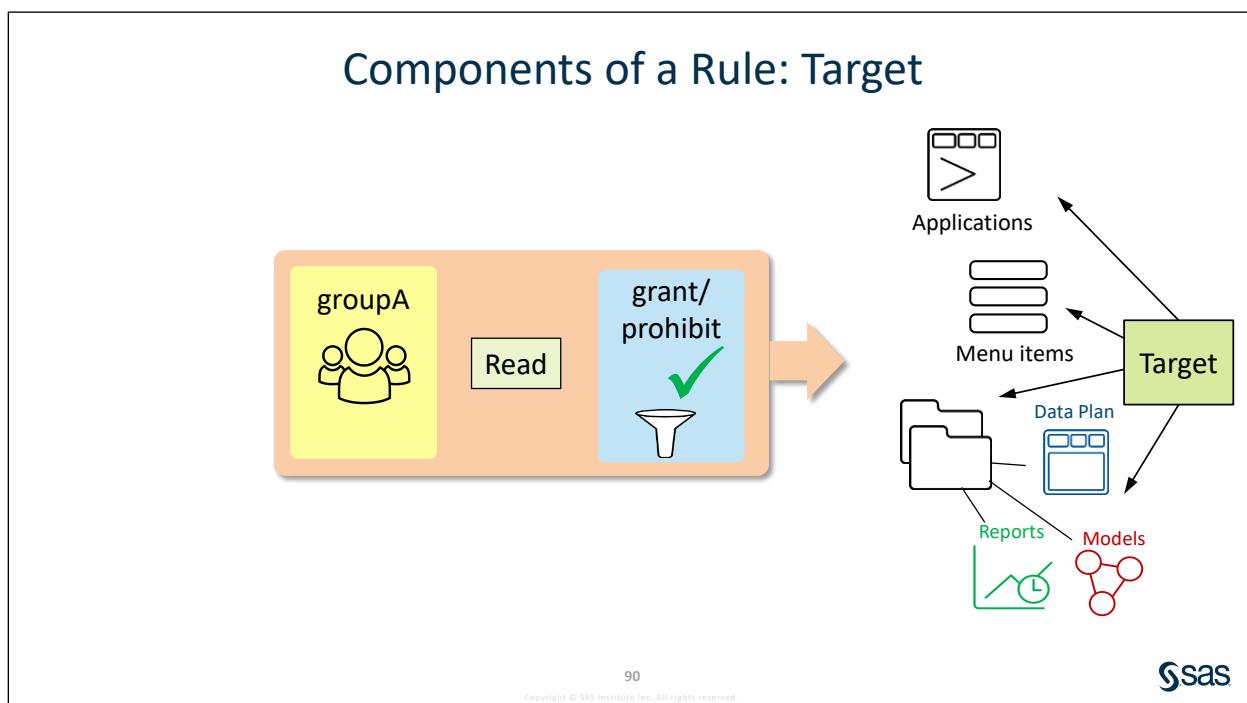
Id	Name	Type	Description	Uri
21f8831f-5ad9-4903-8397-9cd4ea2a08fc	Finance	child		/folders/folders/02241f23-16fb-42e3-9f5e-bd0d7ddd5604
35930985-0dc1-4f25-b2e5-46e8a48cbd71	Marketing	child		/folders/folders/0973a08e-4fb0-43ad-88c9-4ca8608134b2
caac90d3-cbe9-43ac-bece-sea77a461075	Sales	child		/folders/folders/8d0d3468-2ff2-4954-9e28-9d03ff45b582
113d9620-59f8-49b5-b11f-00461b78195b	Analyses	child		/folders/folders/03e853f1-db02-479e-b029-585404673e09
3b294144-d0cf-40fa-988a-59f1544a8c6d	Data Plans	child		/folders/folders/08cfa255-d575-4903-8fa0-0fd240e01a25
f0850df1-15ed-4b62-b5ac-de6423f0a000	Models	child		/folders/folders/e57193ba-dbac-4411-9910-a6c76bc58759
2cf1aa3-617d-488e-9d78-5elf947027e7	Analyses	child		/folders/folders/1689292a-b3a6-41fd-bcc0-6d1134b0b685
766calb6-aa62-441b-9bdf-43ccf5b919e7	Reports	child		/folders/folders/6876ea56-94d0-40ba-97c2-5e4b688f158a
52eaab6b-8ec1-44e6-a89e-60ba8c6ed309	Work in Progress	child		/folders/folders/1281eb6a-d40e-4ae1-836a-e1068b1e8cc4
bc7900aa-2dal-4a2b-8149-b9d9bb21fc20	Analyses	child		/folders/folders/820d04b2-47f3-4bfe-a012-1c7015a1788d
922a1adc-4d4e-4581-82f2-b41ab95752a8	Models	child		/folders/folders/06b8e8fc-37e4-4c34-96da-097cc86fc9a1
95e84309-5404-4809-91a1-994039f92526	Work in Progress	child		/folders/folders/3d402d4b-4ec3-4a3d-9a66-2f68fc1b56ac

- (Optional) Use the Content page in SAS Environment Manager to confirm that the folders were added.

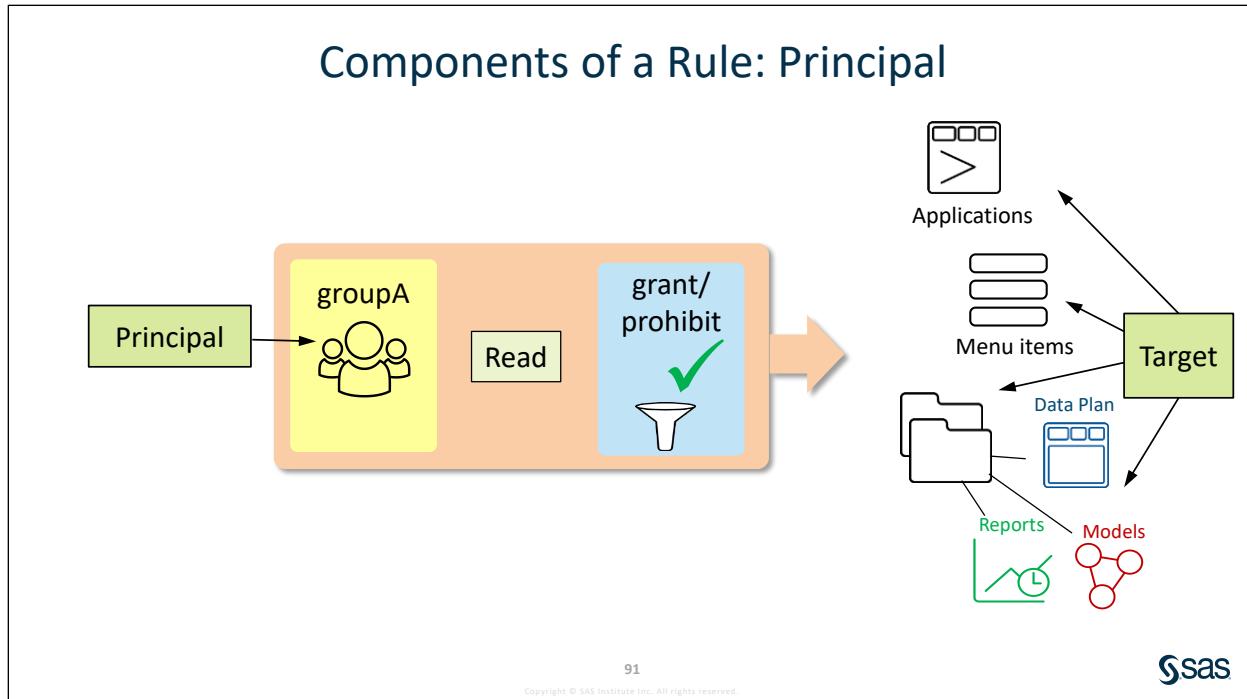
End of Practices



Attribute-based access control uses attributes as building blocks in a structured language that defines access control rules and describes access requests. Attributes are sets of labels or properties that can be used to describe all the entities that must be considered for authorization purposes.



Each rule affects a target, such as an individual object, a set of objects, a service, or a service end point. The target-related attribute is referenced by the URI (Uniform Resource Locator). Examples are folderA, reportA, SASVisualAnalytics.

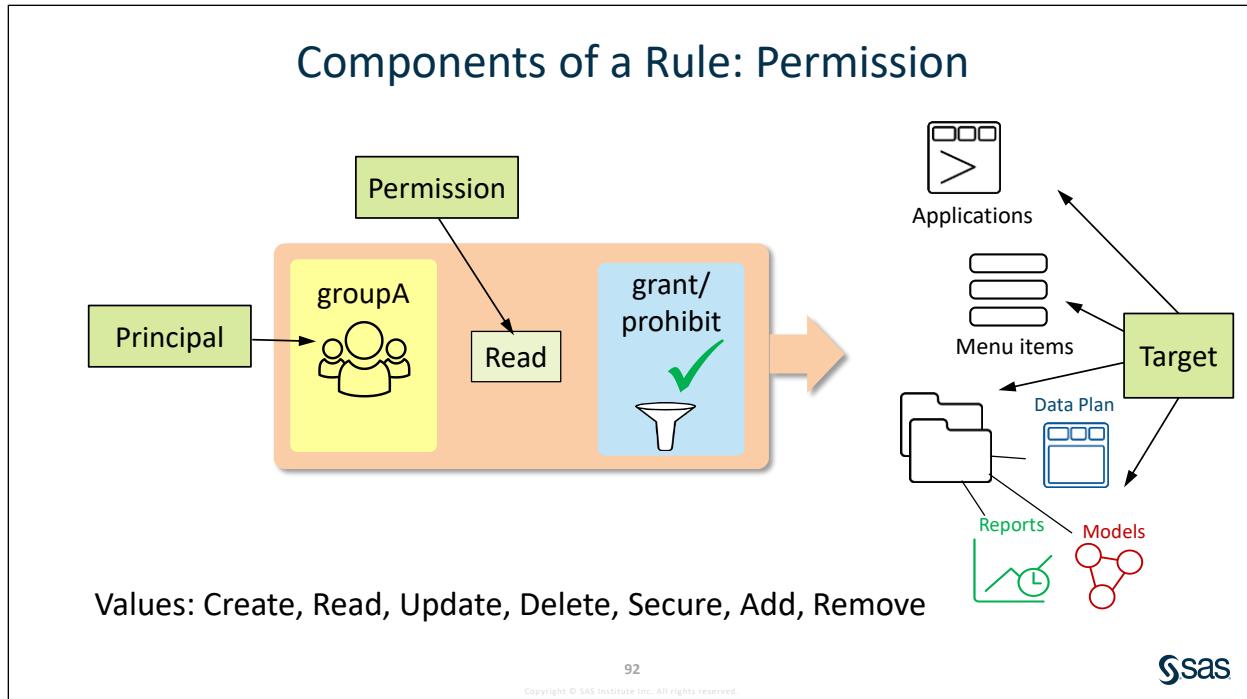


The principal in an authorization rule is the user, group, or custom group to which the rule is assigned. For example, the principal could be Authenticated Users or the SAS Administrators custom group.

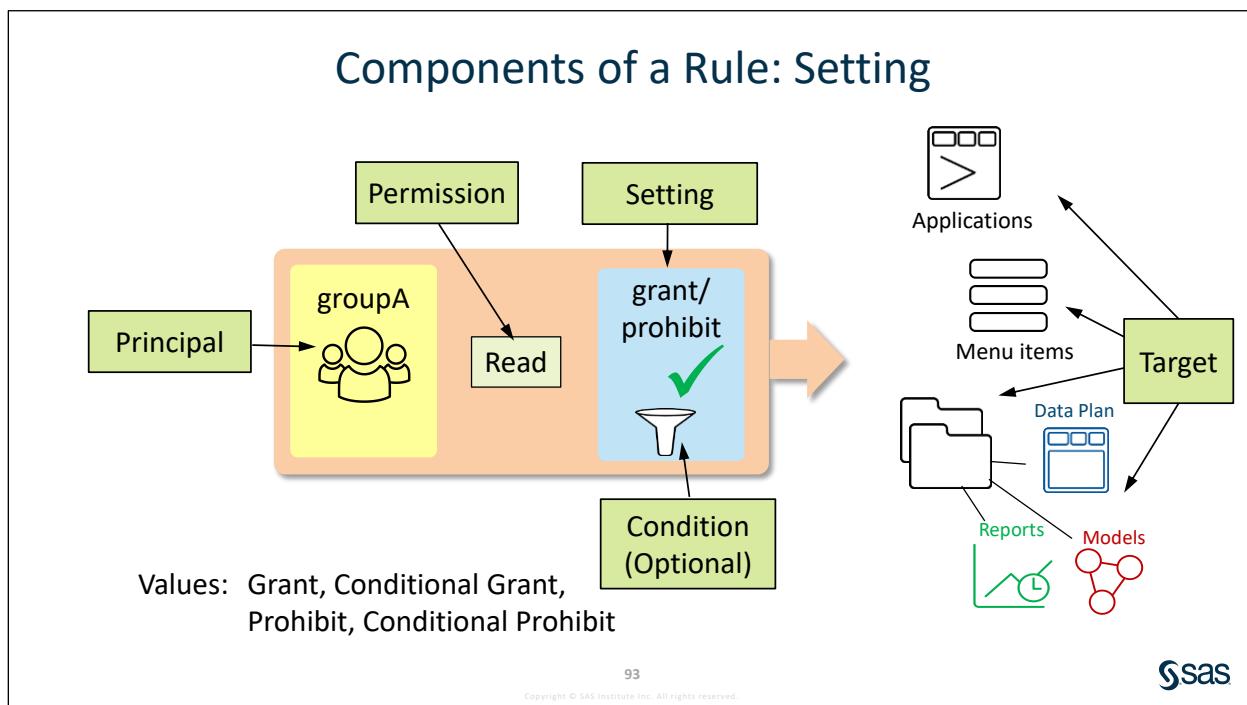
The general authorization system supports the following principals:

- A *user* is either an individual authenticated user or a service account.
- A *user group* is either a custom group or a group in your authentication provider.
- *Authenticated Users* is the principal type that represents all authenticated users.
- *Everyone* is the principal type that represents all principals.
- *Guest* is the principal type that facilitates guest access. Guest is not part of Authenticated Users, but is part of Everyone.

Note: When a principal is deleted, rules that are assigned to that principal are not automatically deleted. Such rules are reused if a new principal of the same type and ID is created. The general authorization system does not have an automated cleanup process for orphaned rules.



A permission in the rule specifies the type of access, such as read, create, update, delete, add, remove, and secure.



The setting in a rule is the indication of whether access is provided. The setting can be conditional, using a constraint expression. Most rules do not include a condition.

If a rule has an invalid condition, an error is logged and access is restricted as follows:

- If a grant rule has an invalid condition, the rule is always ignored.
- If a prohibit rule has an invalid condition, the rule is always applied.

Examples: `localDate('US/Eastern').dayOfWeek != T(java.time.DayOfWeek).SUNDAY`
`localDate('US/Eastern').dayOfWeek != T(java.time.DayOfWeek).SATURDAY`

Key Term	Definition
Rule	A composite of authorization elements 19. Example: A rule grants the Add permission to groupA on folderA.
Target	A resource or set of resources 20. Examples: folderA, reportA
Principal	The user, group, or construct to which an access control or rule is assigned 21. Examples: UserA, GroupA, Authenticated Users
Permission	A type of access 22. Values: Create, Read, Update, Delete, Secure, Add, Remove
Setting	An indication of whether (and to what extent) access is provided 23. Example: Grant, Conditional Grant, Prohibit, Conditional Prohibit
Condition	The constraint expression (Most rules do not include a condition.) 24. Example: <code>localDate('US/Eastern').dayOfWeek != T(java.time.DayOfWeek).SUNDAY</code> or <code>localDate('US/Eastern').dayOfWeek != T(java.time.DayOfWeek).SATURDAY</code>
Effective access	A context-neutral description of the net result of all relevant rules (Effective access does not incorporate evaluation of any conditions.) 25. Values: Authorized, Not Authorized, Conditional
Access outcome	In a context-aware access request, the authorization decision 26. Values: Authorized, Not Authorized



Exploring The Rules Page in SAS Environment Manager

This demonstration explores the Rules page in SAS Environment Manager. The Rules page is an advanced interface. It is available only to SAS Administrators. You can use the authorization windows to set permissions on content such as folders and reports.

1. In SAS Environment Manager, select **Rules** from the side menu. The Rules page is where you can manage rules: edit, update, or even add new rules.
2. The Rules Filter enables you to filter on a URI or a Principal.

Object URI	Principal	Setting
/authorization/rules/	Authenticated Users	Grant
/authorization/rules	Authenticated Users	Conditional Gra
/authorization/rules	Authenticated Users	Grant
/authorization/rules/*	Authenticated Users	Conditional Gra
/authorization/rules/*	Authenticated Users	Conditional Gra
/**	SASAdministrators	Grant
/authorization/rules/conditionValidation	Everyone	Grant
/authorization/rules/conditionValidation/	Everyone	Grant
/authorization/rules/**	sasa00	Grant

Authentication Users group members can initially access the Dashboard, Data, and Content pages in SAS Environment Manager, access functionality in SAS Visual Analytics, and perform operations on folders and on the objects that the folders contain.

3. Check the box next to **Authenticated Users** under Principal and click **Apply**.

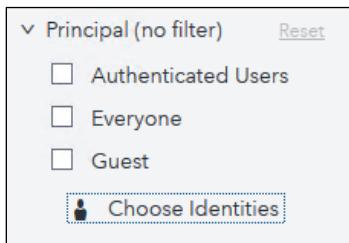
Object URI	Principal
/authorization/rules/	Authenticated Users
/authorization/rules	Authenticated Users
/authorization/rules	Authenticated Users
/authorization/rules/*	Authenticated Users
/authorization/rules/*	Authenticated Users
/authorization/decision	Authenticated Users
/authorization/decisions	Authenticated Users
/authorization/bulkDecision	Authenticated Users
/authorization/rules/bulkAction	Authenticated Users

Access Applications

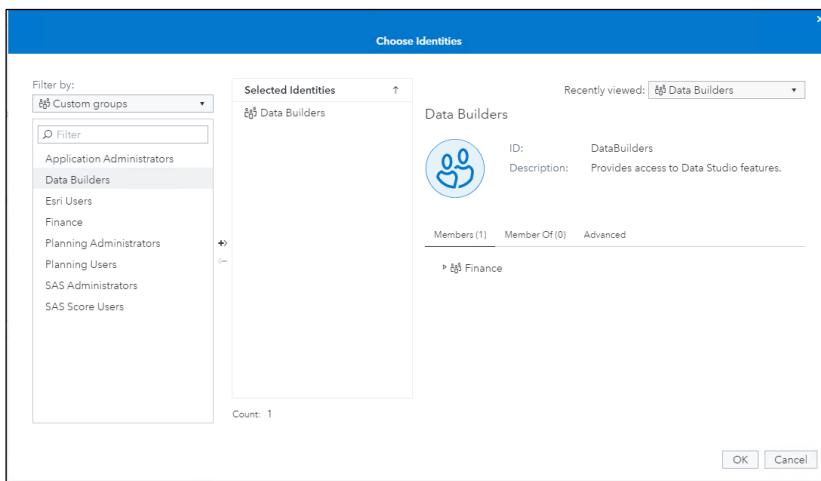
Application or Function	Object URI
SAS Environment Manager (all functionality)	/SASEnvironmentManager/**
SAS Environment Manager (gatekeeper)	/SASEnvironmentManager/
Dashboard page in SAS Environment Manager	/SASEnvironmentManager/dashboard
Data page in SAS Environment Manager	/SASEnvironmentManager/data
Content page in SAS Environment Manager	/SASEnvironmentManager/content
Jobs page in SAS Environment Manager	/SASEnvironmentManager/jobs
Servers page in SAS Environment Manager	/SASEnvironmentManager/servers
My Credentials page in SAS Environment Manager	/SASEnvironmentManager/credentials
SAS Visual Analytics	/SASVisualAnalytics/**
SAS Data Explorer	/SASDataExplorer/**
SAS Report Viewer	/SASReportViewer/**
SAS Graph Builder	/SASGraphBuilder/**
SAS Visual Analytics App	/SASMobileBI/**
SAS Theme Designer	/SASThemeDesigner/**
SAS Visual Analytics	/SASVisualAnalytics/**
SAS Data Explorer	/SASDataExplorer/**
SAS Drive	/SASDrive/**

4. Filter on Data Builders.

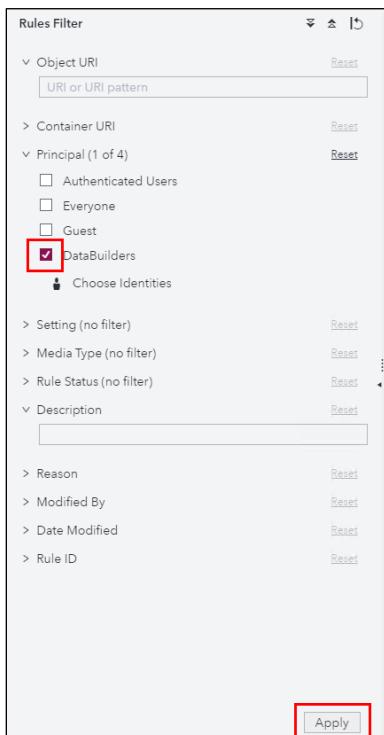
a. Select **Choose Identities** under Principal.



- b. Move the Data Builders custom group to the **Selected Identities**. Click **OK**.



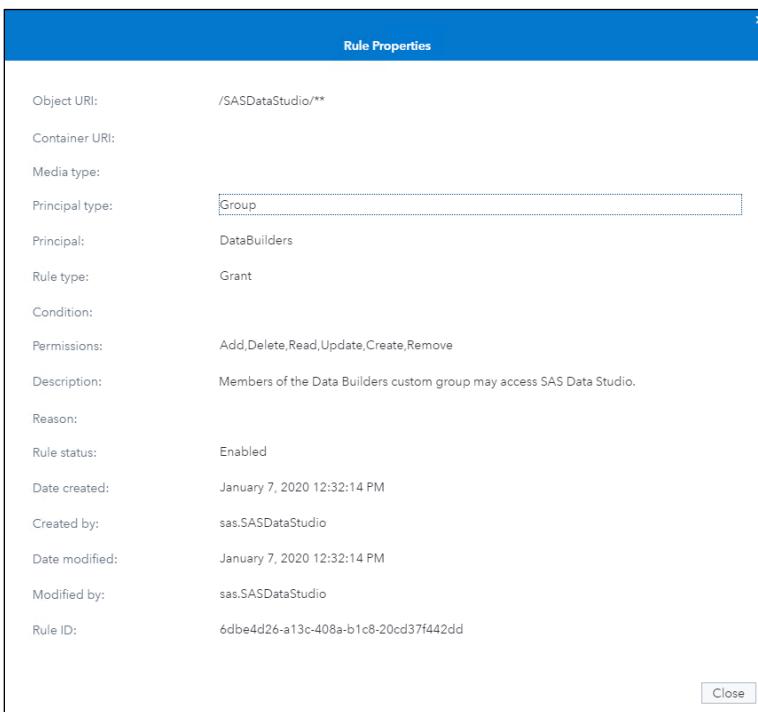
- c. Check the box next to **Data Builders** and click **Apply**.



5. SAS Data Studio is a web application that can be accessed only by Data Builders and the SAS Administrators custom group, by default. Highlight the rule and click the **Properties** icon.

DataBuilders			
Object URI	Principal	Setting	Permissions
/SASDataStudio/**	DataBuilders	Grant	Add, Delete, Read, Update, Create, Remove

6. Review the Rule Properties, and then click **Close**.

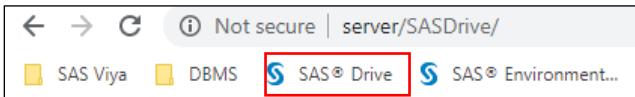


7. Select the applications menu \Rightarrow **Prepare Data** action. Christine is now accessing SAS Data Studio web application.



8. Sign out and sign back on as **Jacques (Student1)**. They receive an error because they are in the Marketing group but not the Finance group. The Finance group is a member of Data Builders. They cannot access the Data Studio action.

Click the **SAS Drive** on the Favorites bar. You can access SAS Drive as Jacques, but they cannot see the Prepare Data action.



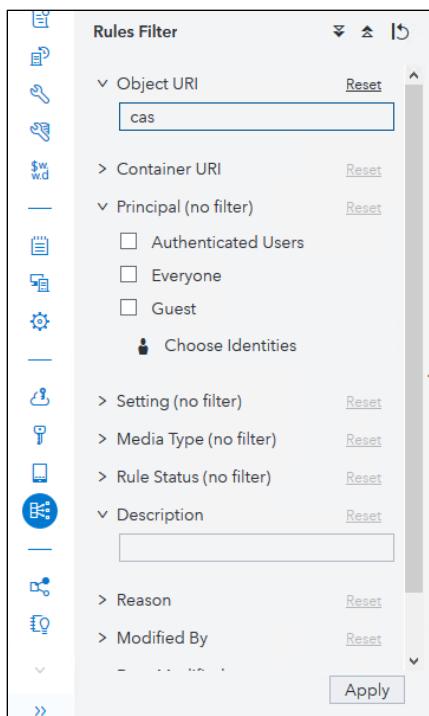
9. Sign out and sign back in as **christine** and return to the **Rules** page in SAS Environment Manager.



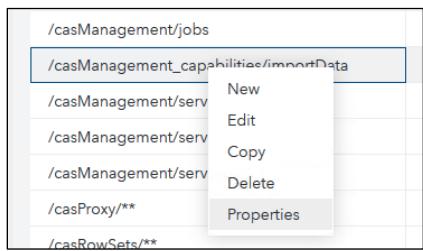
10. Let's look at another example of a rule.

By default, all users via the Authenticated Users implicit group can import data into CAS. Giving everyone this capability might not be desired. A rule can be adjusted to enable only a subset of all the users to import data.

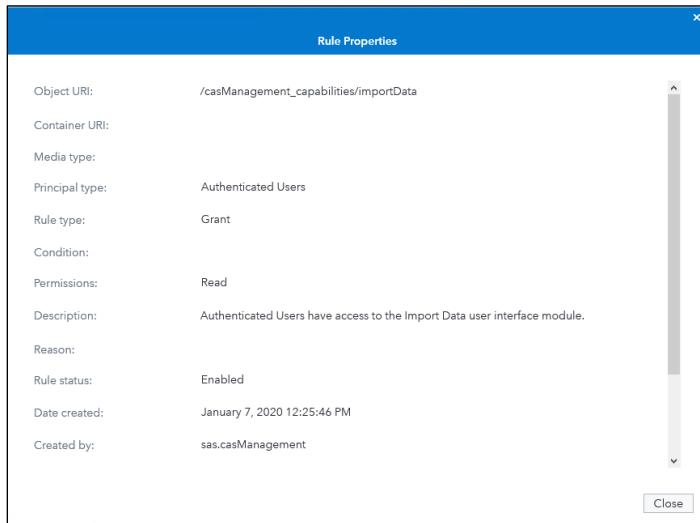
In the Object URI search box, enter **cas** and click **Apply**.



11. Right-click **/casManagement_capabilities/importData** and select **Properties**.



For a user to have access to the Import Data user interface module, the SAS administrator must grant Read permission to the user (or a group that the user belongs to) for the /casManagement_capabilities/importData rule.



Note: In our environment, all users in the Authenticated Users group have permission to use the Import Data user interface module.

12. Click **Close**.

For rules that affect access to functionality, only certain modifications to certain rules are supported.

Administrators can modify only end points documented in the SAS Viya Administration guide. For those end points, you have these options:

- replace the principal
- update the description
- copy a rule in order to create a new rule with a changed principal



There is much more that an administrator can do with the rules manager. The interface will not prevent a user from making changes that are not supported. However, it is very easy to break the system and might be very difficult to recover if unsupported changes are made to the rules that govern access to functionality.

End of Demonstration



Practice

12. Creating a Report Developers Custom Group

- a. Create a custom group called **Report Developers** and add the **Marketing** group as a member.
 - 1) Select **Users** from the side menu in SAS Environment Manager.
 - 2) Select **Custom groups** from the **View** drop-down menu.
 - 3) Click the **New custom group** icon.
 - 4) Fill in the following:

Name: **Report Developers**

ID: **ReportDevelopers** (no space in between names)

Description: **Users who can create reports**

The screenshot shows a modal dialog titled "New Custom Group". Inside, there are three input fields: "Name:" with a red asterisk containing "Report Developers", "ID:" with a red asterisk containing "ReportDevelopers", and "Description:" containing "Users who can create reports". At the bottom right are two buttons: "Save" and "Cancel".

- 5) Click **Save**.
- 6) Click the **edit** icon in the **Members** area.
- 7) Move **Marketing** over to the **Selected Identities** column. Click **OK**.

13. Modifying a Rule to Limit Access to SAS Visual Analytics

The new custom group that was created in the previous practice is used in the SAS Visual Analytics rule to control access to the SAS Visual Analytics interface.

- a. Select **Rules** from the side menu.
 - b. In the Rules filter, type **/SASV** under Object URI in the search box. Click **Apply**.
 - c. Highlight the **/SASVisualAnalytics/**** rule. This rule determines who can use SAS Visual Analytics.
- Click the **Edit** icon.

- d. It currently grants Read access to Authenticated Users.

Change **Principal type** to **ReportDevelopers**.

- 1) Select **Group** from the drop-down menu next to **Principal type**.
- 2) Click the **Choose identity** icon in the **Principal** field.
- 3) Change the **Filter by** field to **Custom groups** and highlight **Report Developers**. Click **OK**.
- 4) Keep everything else the same and click **Save**.

14. Examining the Effects of Adding the Custom Group to the Rule

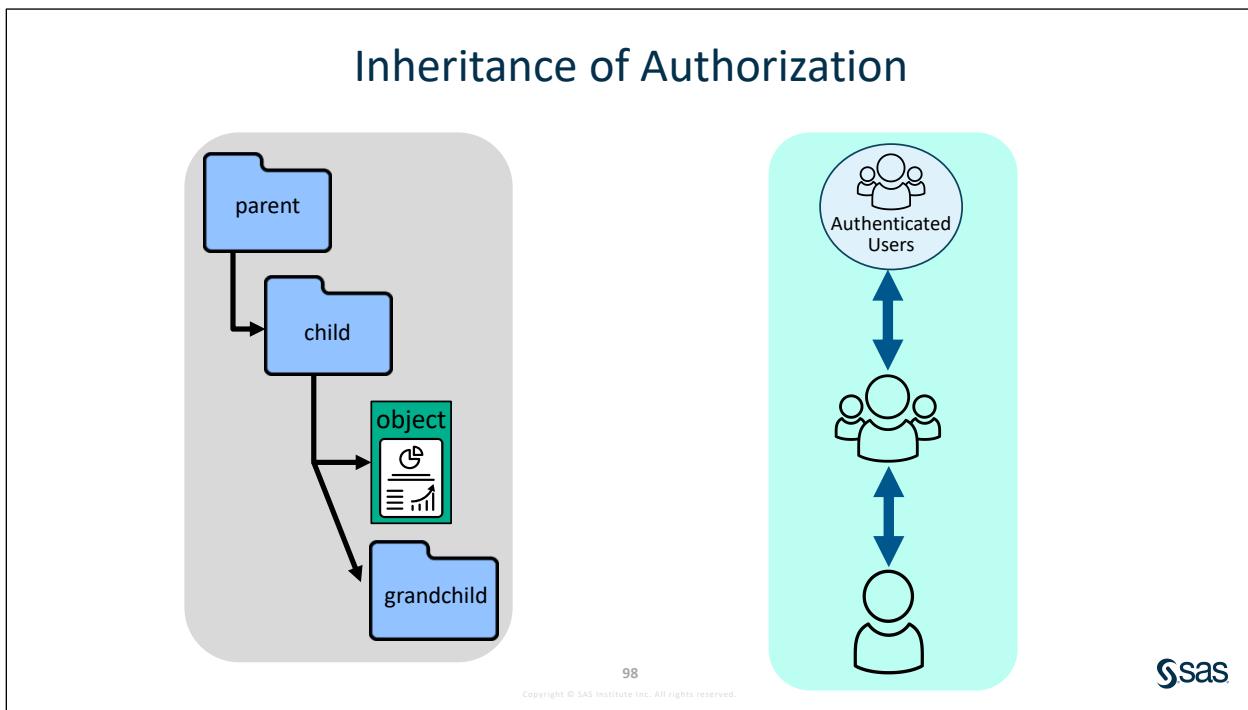
The effects of using the Report Developers group on the SAS Visual Analytics rule are investigated. The interface differences between Lynn and Kari are compared.

- a. Sign in to SAS Drive as **lynn**. Use the **Student1** password. (She is a member of the Marketing group, and therefore the Report Developer group.)
- b. Does Lynn see the **Explore and Visualize Data** action from the applications menu?
- c. Sign out of SAS Drive as **lynn**.
- d. Sign in to SAS Drive as **kari**. Use the **Student1** password. (She is a member of the Finance group, and therefore the Data Builders group.)

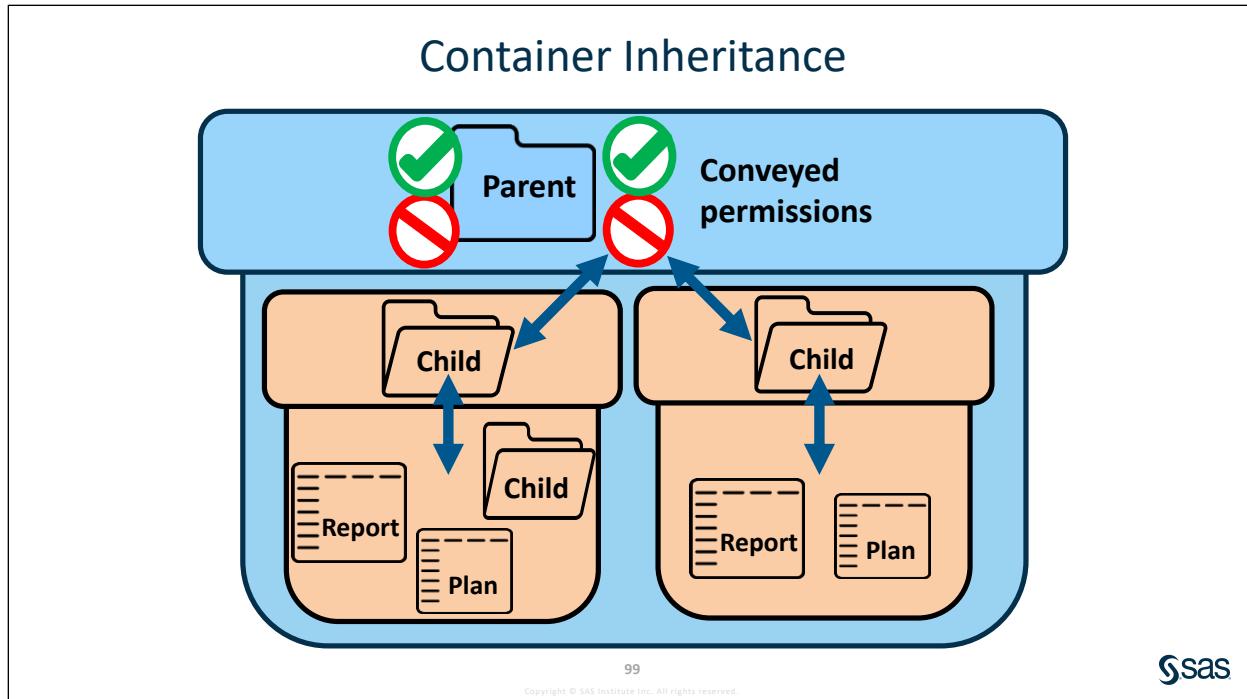
Does Kari see the **Explore and Visualize Data** action from the applications menu?

End of Practices

4.5 General Authorization System



Inheritance is the passing of permissions from a parent object to a child object, or from a group to a group member. However, there is no precedence among groups in general authorization. A prohibit will always win regardless of group hierarchy. After a group, including Authenticated Users group, is given a direct prohibit, there is no granting back to a subgroup.



Regarding folders, access flows through a hierarchy of containers. Each container conveys settings to its child members. Each child member inherits settings from its parent container. For example, a folder's child members might include reports and other folders. You can manage access that a container conveys independently from access to the container.

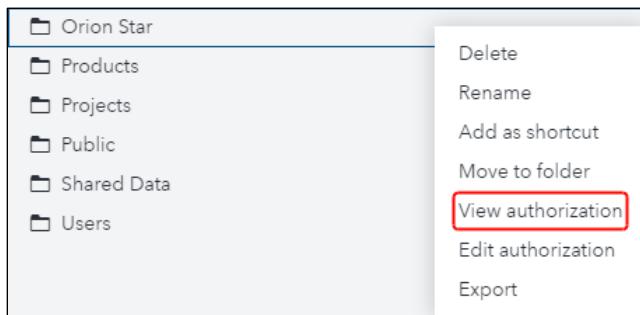
Note: A reference member (such as a shortcut) does not inherit access from its parent folder.



Examining Permissions on Folders

This demonstration illustrates how you can manage access that a container conveys independently from access to the container.

1. Select **Content** from the side menu in SAS Environment Manager.
2. Open the SAS Content folder, and right-click the **Orion Star** folder to **View authorization**.



3. Christine, the SAS Administrator, created this folder and therefore has all grants for this folder. A folder has both object permissions (permissions that apply directly to the object) and container permissions (permissions for the object's children).

Principal	Read	Update	Delete	Secure	Add	Remove	Read (convey)	Update (convey)	Delete (convey)	Secure (convey)	Add (convey)	Remove (convey)
Authenticated Users	✓	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗
SAS Administrators	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗
Christine	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

- Read or view the object
- Update or edit the object
- Delete the object
- Set permissions on the object
- Add an object to a folder or remove an object from a folder

View Authorization

Inheritance flows to child members from only the second set of permissions.

Orion Star

Show horizontal column headings | ?

Principal	Read	Update	Delete	Secure	Add	Remove	Read (convey)	Update (convey)	Delete (convey)	Secure (convey)	Add (convey)	Remove (convey)
Authenticated Users	✓	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗
SAS Administrators	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗
Christine	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

The container permissions are relevant only for container objects, such as folders. The Edit or View authorization windows will not show the container permissions for objects such as reports, models, data plans, and so on.

The Authenticated Users group has a direct grant of Read on the folder and a Read (convey) on the container folder, so Authenticated Users can see objects within this folder.

4. Click **Edit**.
5. Click the **Read (convey)** field for Authenticated Users and change **Direct setting** to **(none)**.

Read (convey)

Properties	Contributing Rules (1)	Contributing Shares (0)
Principal:	Authenticated Users	
Effective access:	Authorized	
Direct setting:	<input style="border: 1px solid #ccc; padding: 2px; margin-right: 10px;" type="button" value="Grant"/> <input style="border: 1px solid #ccc; padding: 2px; margin-right: 10px;" type="button" value="Conditional Grant"/> <input style="border: 1px solid #ccc; padding: 2px; margin-right: 10px;" type="button" value="Prohibit"/> <input style="border: 1px solid #ccc; padding: 2px; margin-right: 10px;" type="button" value="Conditional Prohibit"/> <input style="border: 1px solid red; border-radius: 5px; padding: 2px; background-color: white; color: red; font-weight: bold;" type="button" value="(none)"/>	

6. Click **Preview**.

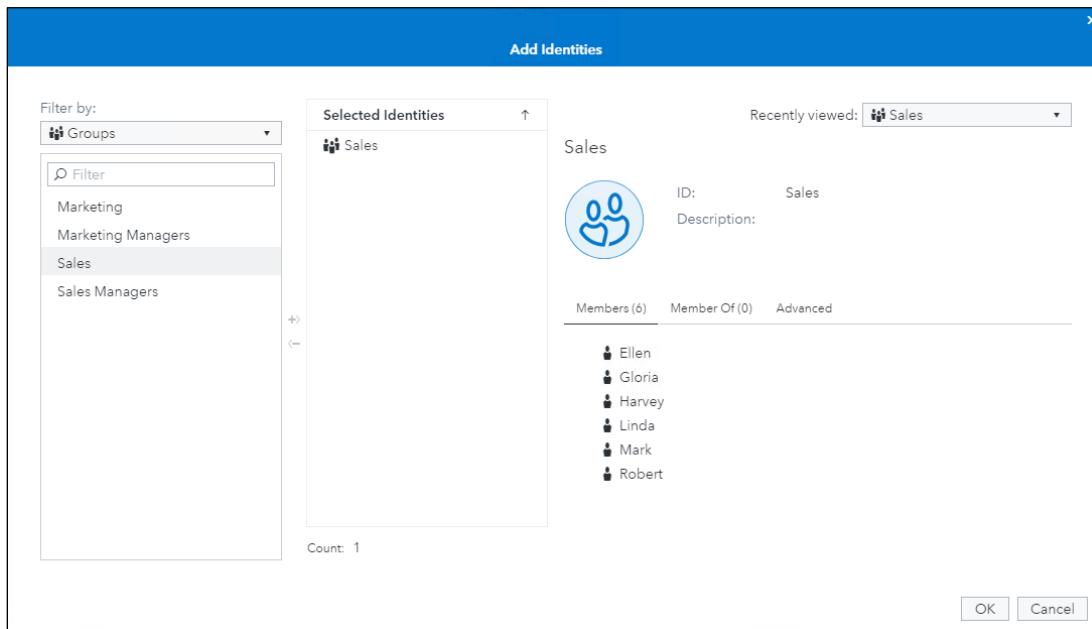
The screenshot shows the 'Edit Authorization' dialog box. At the top, there is a message: 'Inheritance flows to child members from only the second set of permissions.' Below this is a section titled 'Orion Star' with a folder icon. To the right of the folder icon are three buttons: 'Show horizontal column headings' (unchecked), a person icon, a gear icon, and a question mark icon. The main area is a grid table with 'Principal' in the first column. The rows represent three principals: 'Authenticated Users', 'SAS Administrators', and 'Christine'. The columns represent various permissions: Read, Update, Delete, Secure, Add, Remove, Read (convey), Update (convey), Delete (convey), Secure (convey), Add (convey), and Remove (convey). Most cells contain green checkmarks or red crossed-out symbols, indicating specific access levels. The 'Read (convey)' column for 'Authenticated Users' contains a grey circle. The 'Update (convey)' column for 'SAS Administrators' contains a red crossed-out symbol. The 'Delete (convey)' column for 'Christine' contains a red crossed-out symbol. The 'Secure (convey)' column for 'Authenticated Users' contains a red crossed-out symbol. The 'Add (convey)' column for 'SAS Administrators' contains a red crossed-out symbol. The 'Remove (convey)' column for 'Christine' contains a red crossed-out symbol. At the bottom right of the grid are three buttons: 'Preview' (highlighted with a red box), 'Save', and 'Cancel'.

The SAS Administrators group also has an inherited deny of **Read (convey)** due to identity inheritance.

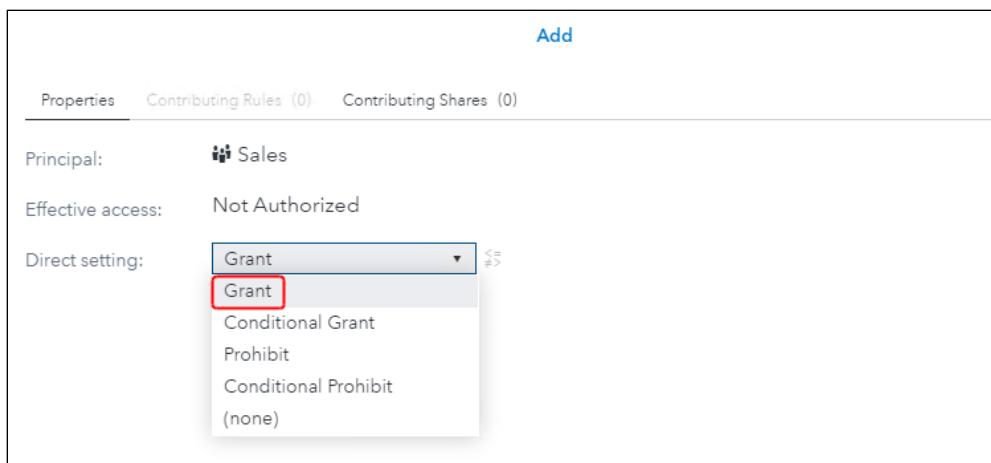
7. Click the **Add identities** icon.



8. Change the **Filter by** field to **Groups** and move **Sales** to the **Selected Identities** column. Click **OK**.



9. Sales has the inherited grant of Read and an inherited deny of Read (convey) from Authenticated Users. We need to make a change in order to keep Sales on the authorization of this folder object. Set a direct grant for **Add** and **Remove** permissions.



10. Click **Preview**.

Edit Authorization

Inheritance flows to child members from only the second set of permissions.

Orion Star

Show horizontal column headings | 🔍 ⚙️ 🌐 ?

Principal	Read	Update	Delete	Secure	Add	Remove	Read (convey)	Update (convey)	Delete (convey)	Secure (convey)	Add (convey)	Remove (convey)
Authenticated Users	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Sales	✓	✗	✗	✗	✓	✓	✗	✗	✗	✗	✗	✗
SAS Administrators	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗
Christine	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Preview | Save | Cancel

11. Click **Save**.

- Open another browser and sign in as **ellen** with the password **Student1**. (Ellen is a member of the Sales group.)
- Select **Content** from the side menu in SAS Environment Manager.

The screenshot shows the SAS Environment Manager sidebar on the left and a main content area on the right. The sidebar has the following menu items:

- Dashboard
- SYSTEM
- Data
- Servers
- Content** (highlighted with a red box)
- MONITOR
- Jobs and Flows
- SECURITY
- My Credentials
- RESOURCES
- Quality Knowledge Bases

The main content area displays a list of folders under the heading "Folders".

Folder	Action
My Favorites	>
My Folder	>
SAS Content	>
Shared	>
Recycle Bin	>

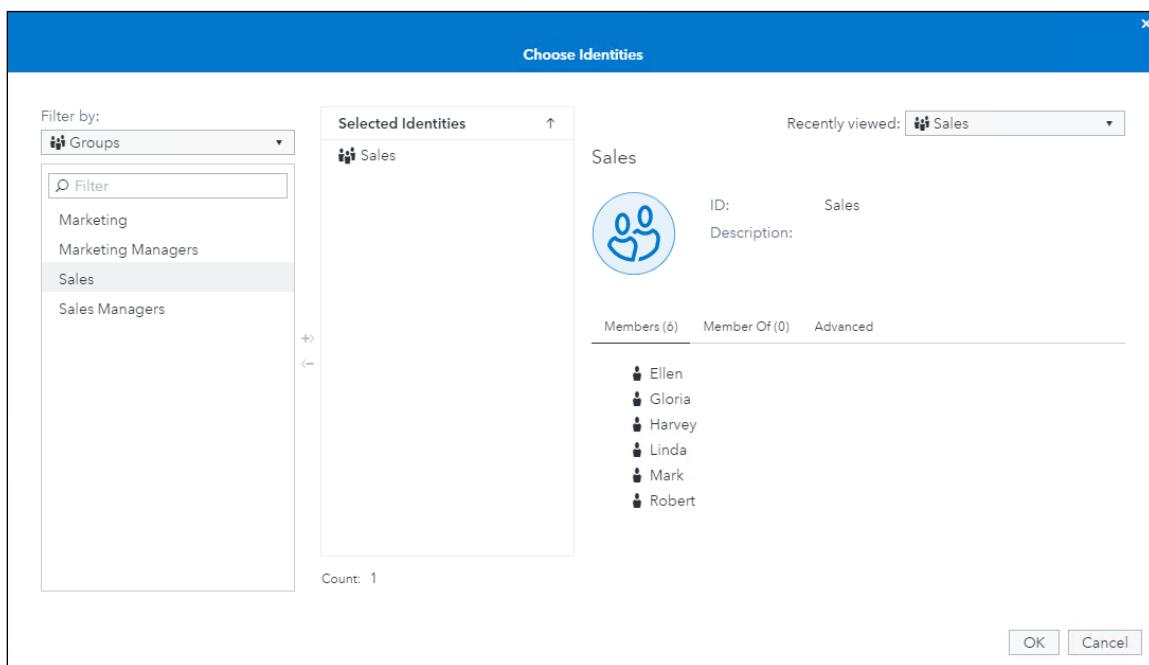
14. Expand **SAS Content** ⇒ **Orion Star**. Ellen cannot see any of the folders below because the Read (convey) permission is a prohibit for Authenticated Users and therefore also Sales.

15. Switch back to **SAS Environment Manager** where Christine is logged on.
 16. Right-click the **Orion Star** folder and select **Edit authorization**.
 17. Change the **Read (convey)** permission to a grant for **Sales**.
 18. Click **Preview**. Click **Save**.

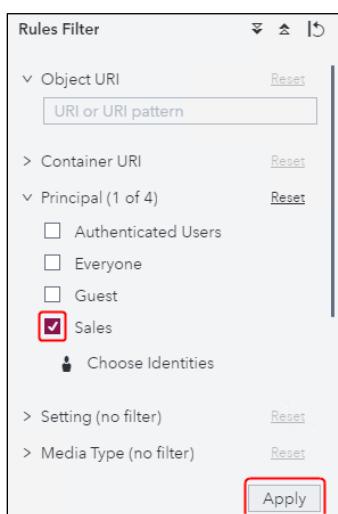
Principal	Read	Update	Delete	Secure	Add	Remove	Read (convey)	Update (convey)	Delete (convey)	Secure (convey)	Add (convey)	Remove (convey)
Authenticated Users	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Sales	✓	✗	✗	✗	✓	✓	✓	✗	✗	✗	✗	✗
SAS Administrators	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗
Christine	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

19. Return to Ellen's SAS Environment Manager. Refresh the view and Ellen should now see the folders below **Orion Star**.
 20. Return to Christine's SAS Environment Manager. Select **Rules** from the side menu.
 21. Filter on the **Sales** group. Select **Choose Identities**.

22. Move **Sales** from the **Filter by: Groups** column to the **Selected Identities** column and click **OK**.



23. Check the box next to **Sales** and click **Apply**.

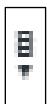


24. Two rules were created when Christine added the direct grants for the Sales group.

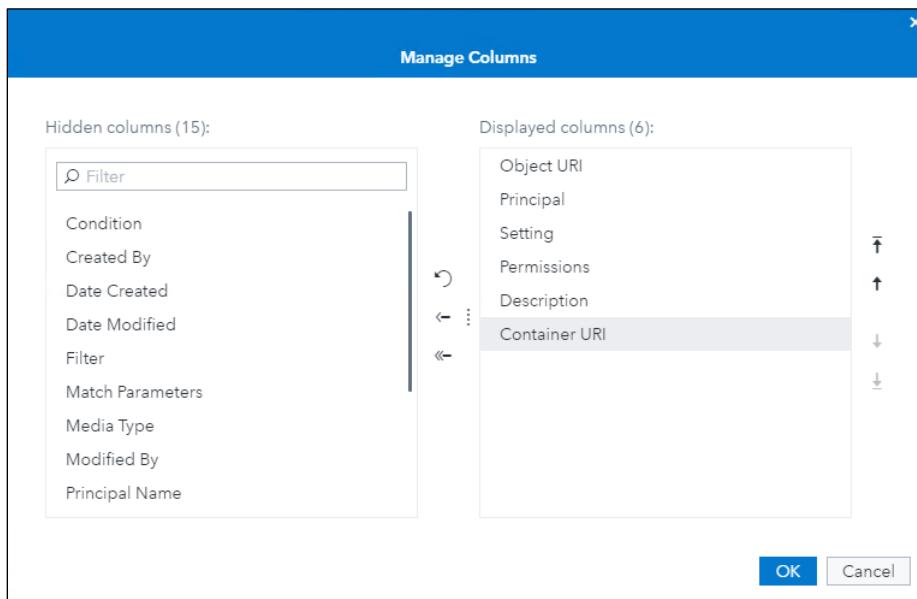
Rules are the internal representation of permission settings, that is, the 'encoding' of permissions.

Rules			
Object URI	Principal	Setting	Permissions
/folders/folders/0e7d225d-201d-40dd-81ab-8ba9...	Sales	Grant	Add, Remove
	Sales	Grant	Read

25. Click the **Options** icon and **Manage Columns**.



26. Move **Container URI** over and then use the single arrow to move it below the **Object URI**. Click **OK**.



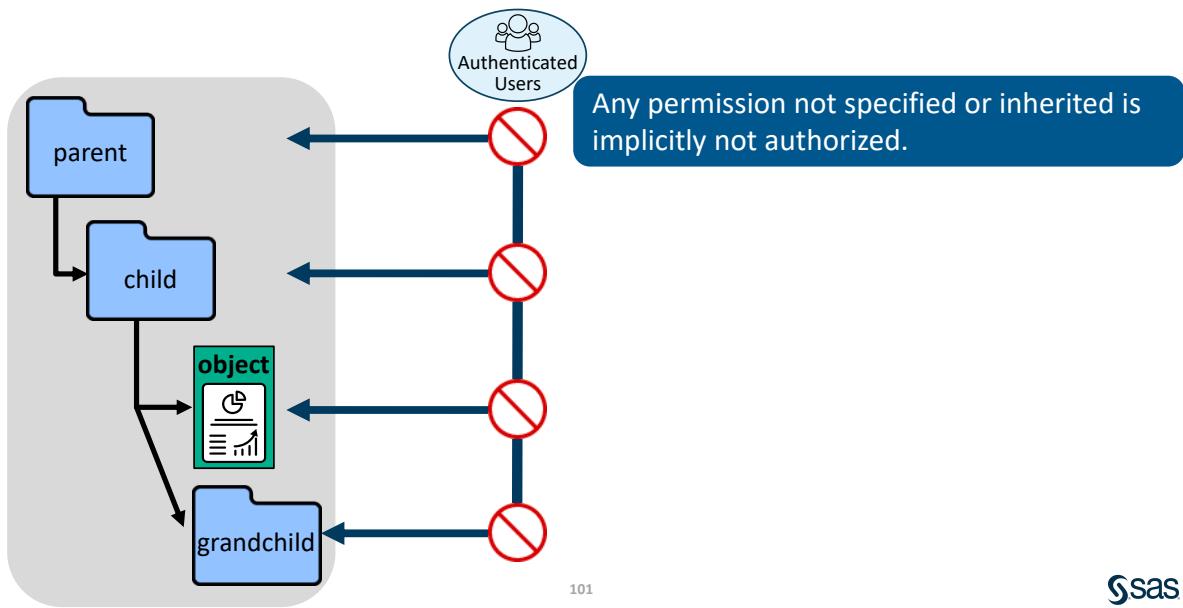
27. A rule that targets the object aspect of a container (the `objectUri` attribute) has different effects than a rule that targets the container aspect of a container (the container's `containerUri` attribute).

Object URI	Container URI	Principal	Setting	Permissions
/folders/folders/0e7d225d-201d-...		Sales	Grant	Add, Remove
	/folders/folders/0e7d225d-201d-...	Sales	Grant	Read

ContainerUri settings are never derived from or implicitly matched to objectUri settings. This separation enables you to provide Write access to the objects in a container without providing Write access to the container itself.

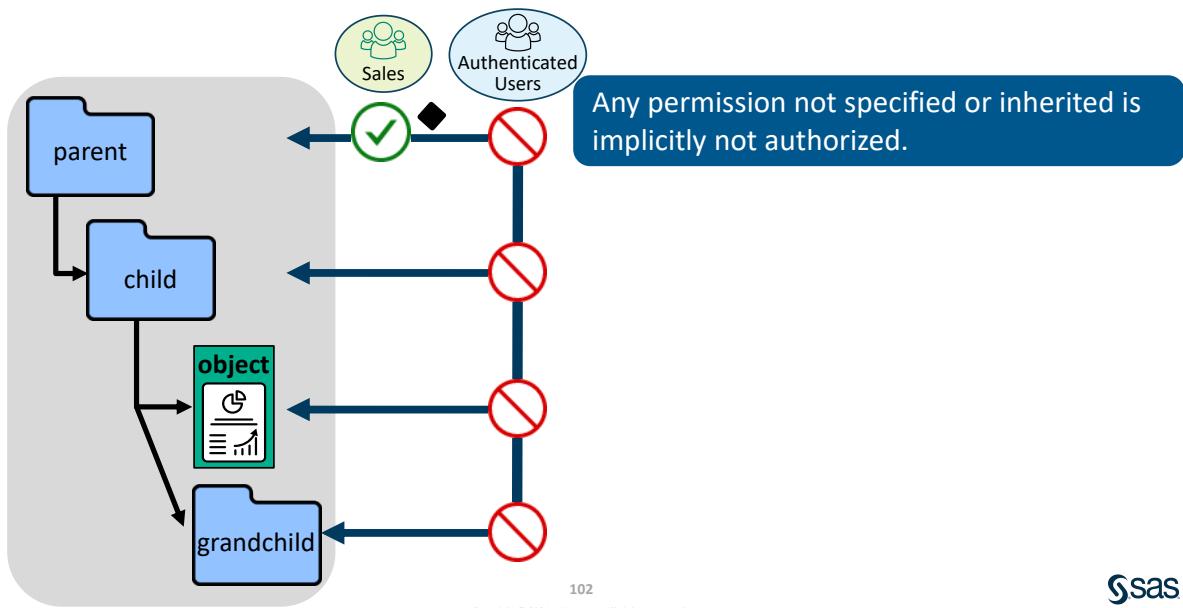
End of Demonstration

How General Authorization Permissions Are Inherited



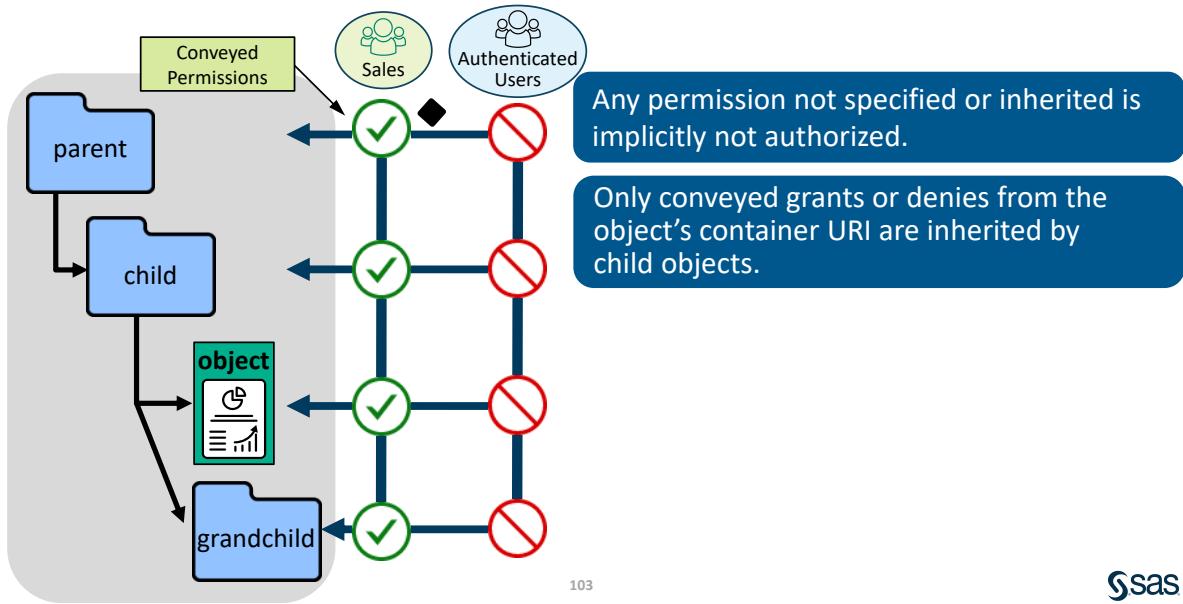
Any permission not specified or inherited is implicitly prohibited to Authenticated Users. Authorization decisions for a particular resource evaluate all rules that have target URIs that match the requested URI. If no rules apply to an object or any of its parent objects, access is implicitly not authorized.

How General Authorization Permissions Are Inherited



A direct grant on an object will take precedence over an implicit prohibit, resulting in effective access being granted, and a diamond symbol is displayed to indicate that it was granted due to a direct grant on the object itself, for this principal.

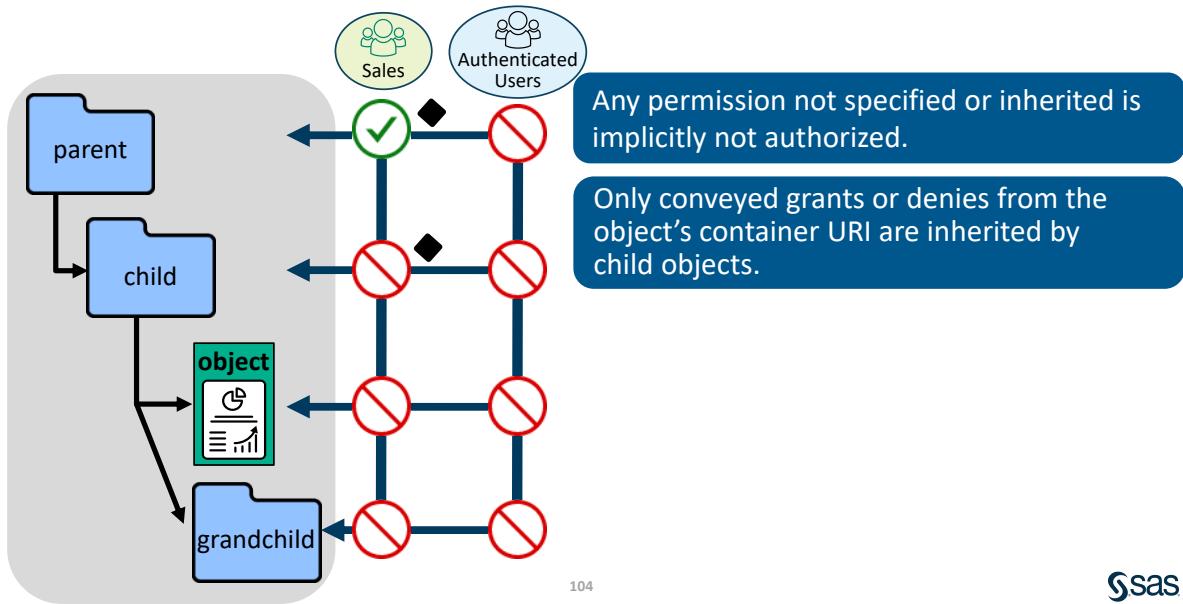
How General Authorization Permissions Are Inherited



Only conveyed grants or denies from the object's **container URI** are inherited by child objects. Permissions that target the object itself (and not its container) are not inherited by the object's children.

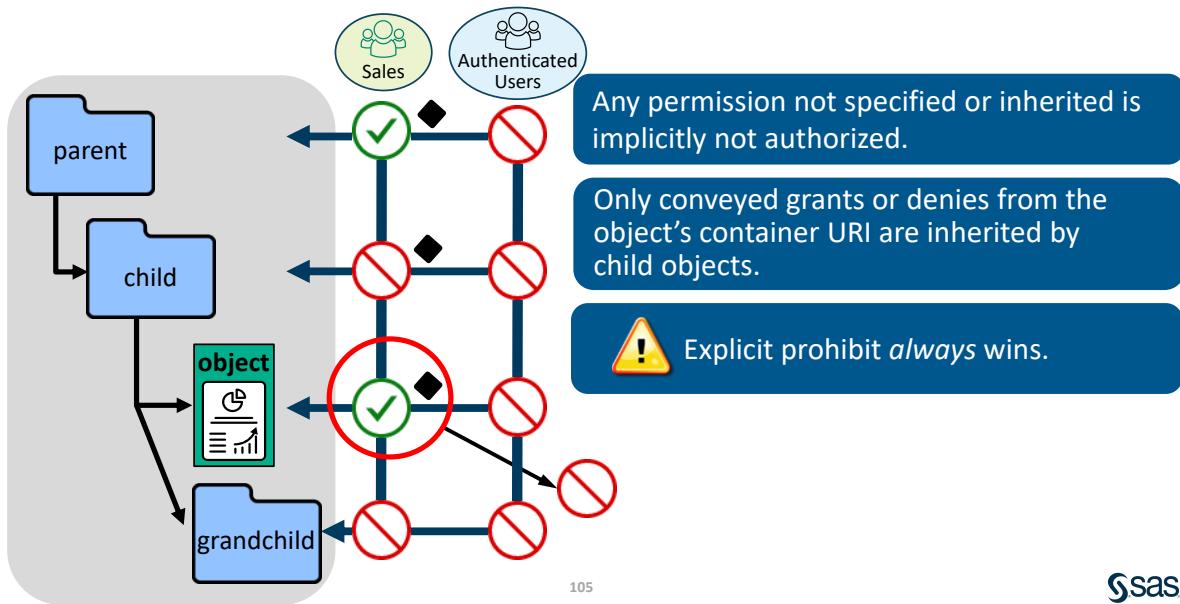
Note: There is no permission specified, but this is an example of inheritance of settings.

How General Authorization Permissions Are Inherited



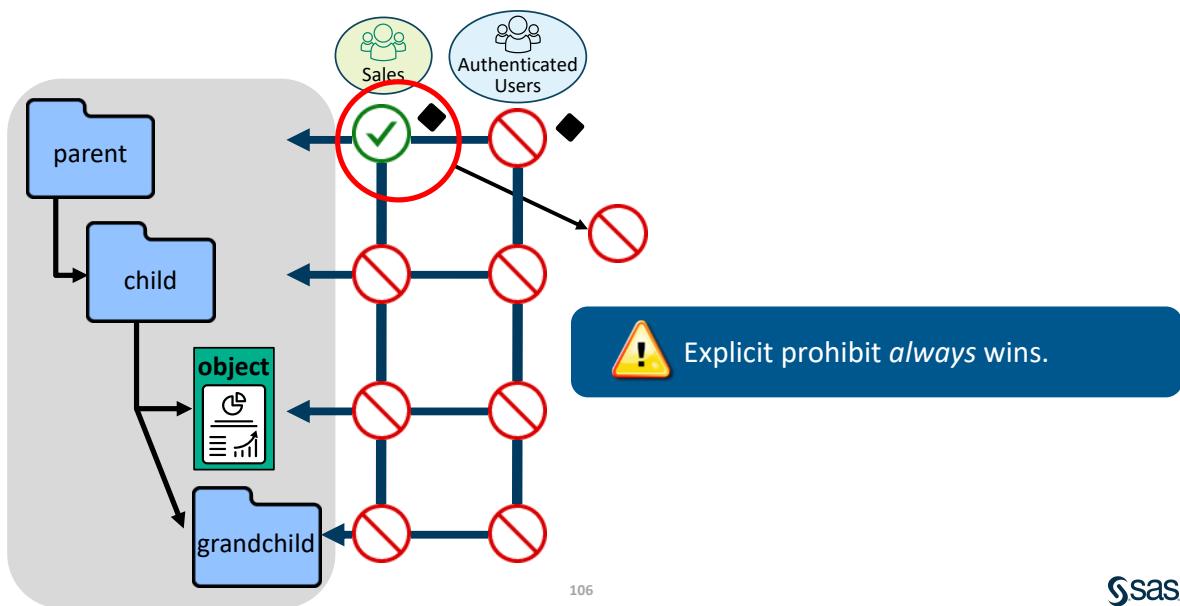
A direct prohibit will override an inherited grant.

How General Authorization Permissions Are Inherited



However, a direct grant **cannot** override an inherited prohibit, in contrast to what you might expect if you are familiar with SAS®9 metadata authorization.

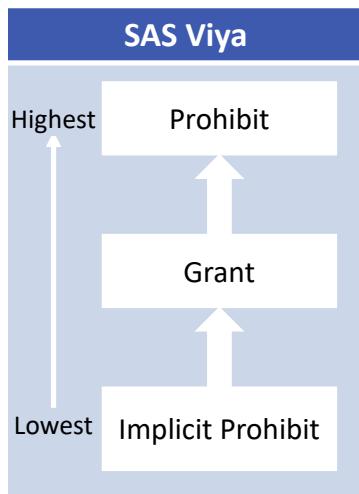
How General Authorization Permissions Are Inherited



An explicit prohibit applied to an object for any permission always beats any grants including explicit grants.

Do not use explicit prohibit permissions anywhere because you cannot override a prohibit (except by disabling or removing the rule that applies it).

Precedence of Authorization



Explicit prohibit *always* wins.



If you explicitly prohibit authenticated users, you impact SAS administrators as well.

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General Authorization Guidelines

- Minimize the use of prohibit rules.
- A direct prohibit cannot be overridden by a direct grant.
- Limit membership in administrative groups.
- Use groups, not individual users, as principals.
- Use folders, not individual objects, as targets.
- Use conditions only if you cannot efficiently express your authorization requirements another way.
- Perform a backup before and after you make significant changes to your system.

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Designing a Security Model

1. Gather information from representatives of all key stakeholders in the organization to understand the following information:
 - what data they use, how they create, store, manipulate, and consume that data, that is, data storage and flow
 - how users, teams, departments, and projects are organized
 - which users should have what access to each type of data and content

Do not skip this step, or your security model would not meet your needs.
2. In detail, document what you learn. It is better to document ***why*** rather than ***what***. Document your security model ***before*** you implement it.

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Examples of organizing users into groups:

- Data consumers: Can they load tables?
 - Trusted consumers are permitted to load data.
 - Untrusted users and guests are not permitted to load data.
- Data Creators
- Report Creators
- Executives – need to read and also be able to load data.

Methods for Adding General Authorization

SAS Environment Manager:

Content Page



Command-Line Interface

```
sas-admin cas authorization add-control --server cas-shared-default --caslib caslibA --group GroupA --grant Select --superuser
```

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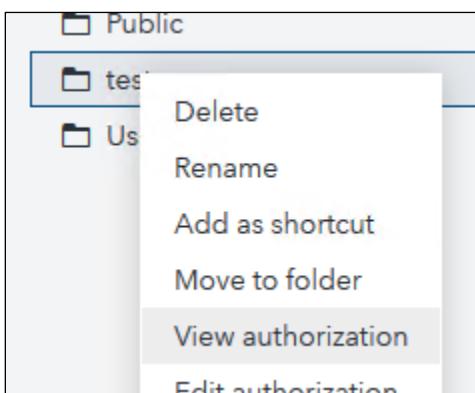
Examining Permissions in General Authorization

This demonstration illustrates general authorization settings. After a permission is set to a direct prohibit for a principal, that permission cannot be overridden by a direct grant.

1. Select **Content** from the side menu in SAS Environment Manager (logged on as **christine**).
2. Create a folder called **test** under SAS Content. Click the **New folder** icon.



3. Right-click the **test** folder and select **View authorization**.



4. Christine has full access because she created the folder. Authenticated Users are implicitly prohibited, and SAS Administrators are implicitly granted to manage the test folder object but not the test folder container object. Click **Edit**.

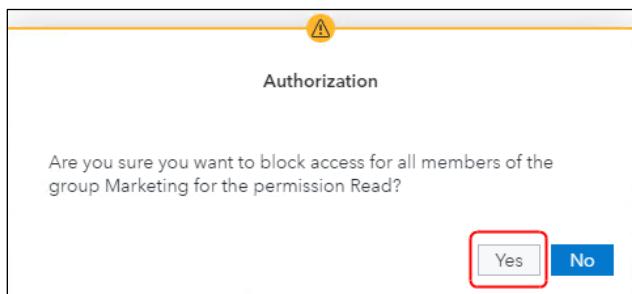


5. Add **Finance**, **Marketing**, and **Lynn** as principals to the authorization. Click **Add identities** ⇒ move **Finance**, **Marketing**, and **Lynn** to the **Select Identities** column ⇒ click **OK**.

(Lynn is a member of both groups.)

6. Give grants of Read to **Finance** and **Lynn**. Then give a prohibit of Read to **Marketing**.

7. Click **Yes** to the warning message.



8. Click **Preview**. Even though Lynn was given a grant for Read, the prohibit setting placed on Marketing will have higher precedence. In the general authorization system, precedence is extremely flat. The **only** factor that affects precedence is the type of rule (grant or prohibit) and prohibit rules have **absolute** precedence.

Principal	Read	Update	Delete	Secure	Add	Remove	Read (convey)	Update (convey)	Delete (convey)	Secure (convey)	Add (convey)	Remove (convey)
Authenticated Users	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Finance	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Marketing	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
SAS Administrators	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗
Christine	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lynn	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗

9. Change Marketing's prohibit of Read to **(none)**.

The screenshot shows the 'Edit Authorization' dialog for the 'test' folder. In the 'Read' column for the 'Marketing' principal, a dropdown menu is open, showing options: 'Grant', 'Conditional Grant', 'Prohibit', 'Conditional Prohibit', and '(none)'. The '(none)' option is highlighted.

Principal	Read
Authenticated Users	Prohibit
Finance	Grant
Marketing	(none)
SAS Administrators	Grant
Christine	Grant
Lynn	Prohibit

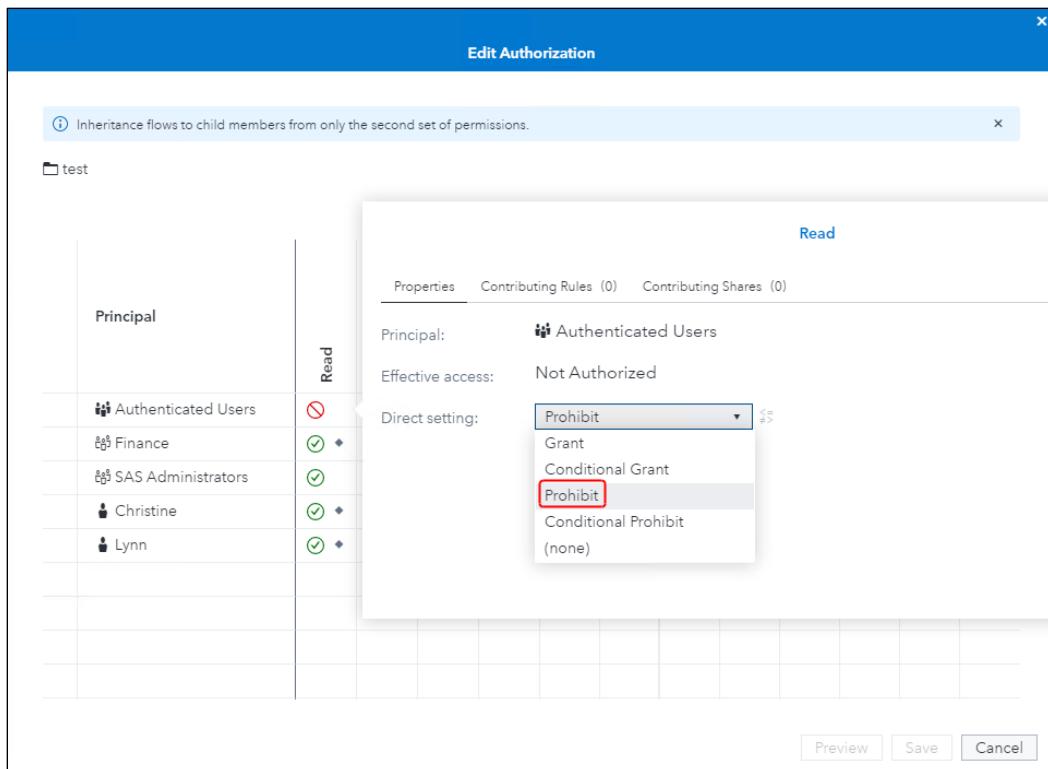
10. Click **Preview**. Lynn's now has the setting of Grant for Read.
11. Click **Save**.
12. Right-click again on the **test** folder and select **View authorization**.
13. Click the **Read** field for **Lynn** and click the **Contributing Rules** tab.

The screenshot shows the 'View Authorization' dialog for the 'test' folder. The 'Contributing Rules' tab is selected for the 'Read' column of the 'Lynn' row. The table shows:

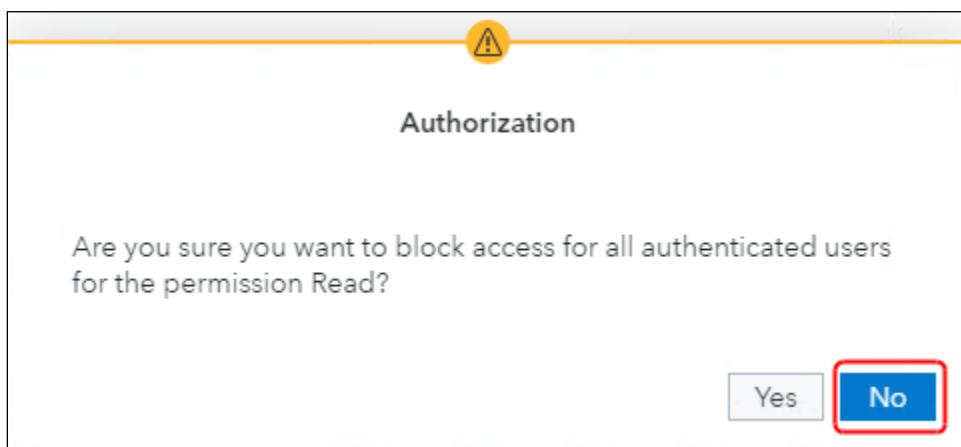
Principal	Setting	Target Name	Object URI
Finance	Grant	/test/** (folder)	/folders/folders...
Lynn	Grant	/test/** (folder)	/folders/folders...

14. Change the implicit prohibit of Read for Authenticated Users to a direct prohibit. You will need to click **Edit** to modify permissions.

Edit



15. Review the warning message warning you that you are about to lose your access to this folder.
Click **No**.



End of Demonstration



Practice

15. Securing the Finance Folder

Set permissions on the Finance folder so that only the Finance group has access to their folders.

- Select **Content** from the side menu in SAS Environment Manager. (Make sure you are signed in as **christine** with the password **Student1.**)
- Right-click the **Orion Star** folder and select **View Authorization**.

Authenticated Users have a grant for Read and Read (convey). This is indicated by the diamond next to green check mark on the permission . The Orion Star folder was added by an administrator. The Orion Star folder needs to be updated so that it is accessible to all users, but not modified or deleted. And the **Read (convey)** permission should be changed to the implicit prohibit.

- Click **Edit**.
- Click the green check mark in the **Read (convey)** field for Authenticated Users and change the **Direct setting** field to **(none)**.

- e. Until the permission setting is saved, the setting in that column is an empty circle. Click **Preview**.
- f. Click **Save**.
- g. Expand the **Orion Star** folder, right-click the **Finance** folder, and select **Edit Authorization**.
- h. Click the **Add identities** icon.
- i. Move **Finance** to the **Selected Identities** column. (Finance is a custom group.) Click **OK**.
- j. Give Finance direct grants for the following:
 - Read
 - Add
 - Remove
 - Read (convey)
 - Update (convey)
 - Delete (convey)
 - Add (convey)
 - Remove (convey)

All other users have the permissions of the Authenticated Users group.

- 1) Click the **Read** field for **Finance** and change the **Direct setting** field to **Grant**.
 - 2) Repeat step 1 for **Add**, **Remove**, **Read (convey)**, **Update (convey)**, **Delete (convey)**, **Add (convey)**, and **Remove (convey)** permissions.
- k. Click **Preview**. The settings should look like this:

Principal	Read	Update	Delete	Secure	Add	Remove	Read (convey)	Update (convey)	Delete (convey)	Secure (convey)	Add (convey)	Remove (convey)
Authenticated Users	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Finance	✓ +	✗	✗	✗	✓ +	✓ +	✓ +	✓ +	✓ +	✓ +	✓ +	✓ +
Sales	✓	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗
SAS Administrators	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗
Christine	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

- I. Click **Save**. (If you think you made a mistake, you can click **Cancel** and not save the changes.)
- m. Select **Content** from the side menu.

- n. Navigate to **SAS Content** ⇒ **Orion Star**.
 - o. Select the **Finance** folder.
 - p. Under **Basic Properties** copy the URI for finance.
 - q. Select **Rules**.
 - r. Paste the URI in the **Object URI field**.
 - s. Click **Apply**.
- Is the rule listed the same as the direct permissions that are shown in the authorization window of the **Finance** folder?
- t. Click the **Manage Columns** icon.
 - u. Move **Container URI** to the **Displayed columns** column. Highlight **Container URI** and move it up second to the top by using the up arrow. Click **OK**.
 - v. Copy the URI in the Object URI.
 - w. Reset the filter. Click **Reset all**.
 - x. Expand **Container URI** and paste the finance folder URI
 - y. Click **Apply**.

Is the rule the same as the direct permissions for the container URI that are shown in the authorization window of the **Finance** folder?

16. Securing the Sales Folder

- a. Navigate to the Sales folder from the Content page in SAS Environment Manager. Copy the URI.

Content	
<input style="width: 20px; height: 20px; vertical-align: middle;" type="button" value="New"/> <input style="width: 20px; height: 20px; vertical-align: middle;" type="button" value="Open"/> <input style="width: 20px; height: 20px; vertical-align: middle;" type="button" value="Save"/> <input style="width: 20px; height: 20px; vertical-align: middle;" type="button" value="Delete"/> <input style="width: 20px; height: 20px; vertical-align: middle;" type="button" value="Copy"/> <input style="width: 20px; height: 20px; vertical-align: middle;" type="button" value="Move"/> <input style="width: 20px; height: 20px; vertical-align: middle;" type="button" value="Properties"/> <input type="checkbox"/> Orion Star	Basic Properties Name: Sales URI: /folders/folders/8d5894c7-a74e-4a31-ab82-ef49b6ff4eb5 Description: Type: Folder Location: /Orion Star/Sales
<input type="checkbox"/> Finance <input type="checkbox"/> Marketing <input type="checkbox"/> Sales	

- b. Modify the following script replacing the object-uri and the container-uri with the URI that you copied from the previous step.

Note: Make sure to keep the double asterisk (**) that follows the object-uri in the path. The double asterisk is not needed for the container-uri.

```
/opt/sas/viya/home/bin/sas-admin authorization authorize --  
permissions Read,Add,Remove,Update,Delete --group Sales --  
object-uri /folders/folders/65b7c04b-c7a7-4def-bc43-  
aad4a9033ca3/** --container-uri /folders/folders/65b7c04b-  
c7a7-4def-bc43-aad4a9033ca3
```

- c. Run the modified script.

```
Detailed Messages:  
    traceId: 47185989ce910652  
    path: /authorization/rules  
        FieldError: objectUri: [ /folders/folders/8487181e-1db1-427e-94f2  
-8210d5598cfc** ]: the URI uses an invalid wildcard syntax.  
[christine@server bin]$ /opt/sas/viya/home/bin/sas-admin authorization au  
thorize --permissions Read,Add,Remove,Update,Delete --group Sales --objec  
t-uri /folders/folders/8487181e-1db1-427e-94f2-8210d5598cfc/** --containe  
r-uri /folders/folders/8487181e-1db1-427e-94f2-8210d5598cfc  
Id          a8f23e33-67c4-40f7-9f6e-6a3c001bd2fe  
ObjectUri   /folders/folders/8487181e-1db1-427e-94f2-8210d5598cfc/**  
Principal   Sales  
PrincipalType group  
Type         grant  
Permissions  [add read delete update remove]  
The authorization rule has been created.
```

End of Practices

4.6 Solutions

Solutions to Practices

1. Importing Data Using SAS Environment Manager

In this practice, you use the SAS Environment Manager Data page to import data to a caslib.

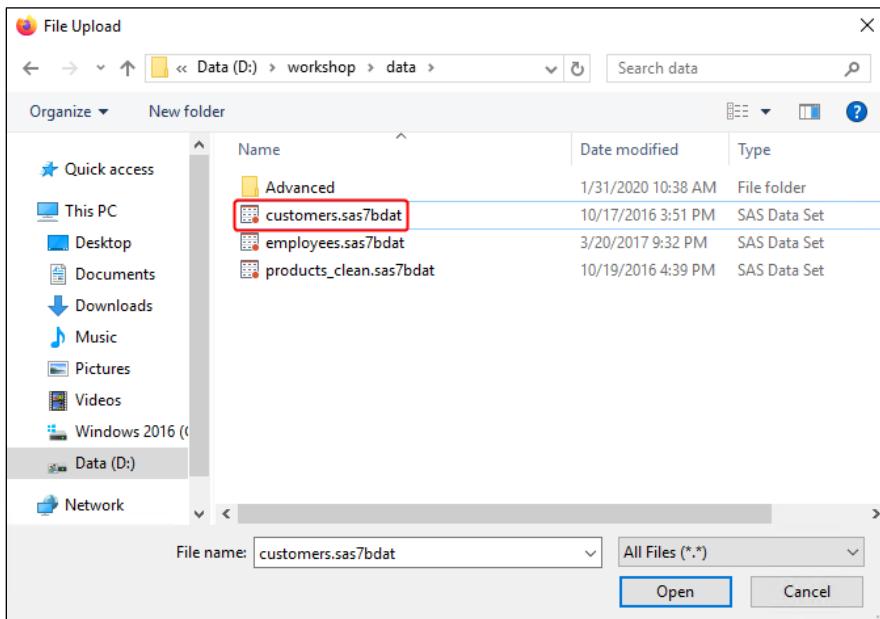
- a. Sign in to SAS Environment Manager as **christine** with a password of **Student1**. Click **Yes** to opt in to the SASAdministrators group.
- b. Select **Data** from the side menu.
- c. Click the **Import** tab to import a SAS data set into the Public caslib.



- d. Select **Local File**.



- e. Navigate to D:\Workshop\data and select **customers.sas7bdat**. Click **Open**.



- f. You need to import the table to an existing caslib. Keep the default of **Public** for the target destination. Click **Import Item**.

Note: The import fails if there is already a table of the same name.

The screenshot shows the SAS Data Import interface. On the left, under 'Import (1)', the file 'customers.sas7bdat' is selected. On the right, the 'Data' tab is active, showing the import configuration. The 'Target table name:' field contains 'customers' and the 'Target location:' field contains 'cas-shared-default/Public'. Below these fields are options for handling existing tables: 'Save as an in-memory table only' (unchecked), 'Cancel import' (radio button selected), and 'Replace file' (radio button unselected). At the bottom, the 'Label:' field is set to 'Enter label' and the 'Format:' dropdown is set to 'sashdat'.

This screenshot shows the progress of the import. A modal window titled 'customers.sas7bdat' displays the message 'Importing file...' with an information icon.

You need to wait for the message to see that the table was imported.

The screenshot shows the SAS Data Import interface after the import has completed successfully. The 'Import (1)' list now shows 'customers.sas7bdat' with a green checkmark. On the right, a green success message at the top states: 'The table was successfully imported on May 22, 2020 10:54 AM and is ready for use.' The 'Target table name:' field contains 'customers' and the 'Target location:' field contains 'cas-shared-default/Public'. The other import settings remain the same as in the previous screenshot.

- g. Click **Data Sources**.

(You might need to expand **cas-server-default** ⇒ **Public** caslib if you are not already taken to this level.)

How many CUSTOMERS tables are displayed? 2 Why? **The CUSTOMERS table is loaded to memory, and there is also the table on disk with the extension in this case of sashdat.**

#	Name	Label	Type	Raw Length	Formatted...	Format	Tags
1	City	City Name	char	45	45		
2	Continent	Continent Na...	char	45	45		
3	Postal_Code	Postal code	char	15	15		
4	State_Province	State Name	char	38	38		
5	Street_Name	Name of Street	char	68	68		
6	xyContinentLat	xyContinentLat	double	8	15	F	
7	xyContinentLon	xyContinentLon	double	8	15	F	
8	Customer_ID	Customer ID	double	8	12	F	
9	Employee_ID	Employee ID	double	8	12	F	
10	Street_ID	Street ID	double	8	12	F	

- h.** Find the physical location of the **customers.sashdat** file. Click **Up one level** next to the **Public** caslib.

- i.** Click **Public**. Note the operating system path on the right.

Name:
Public

Description:
Shared and writeable caslib, accessible to all users.

Server:
cas-shared-default

Source type:
PATH

Personal:
false

Path:
/opt/sas/viya/config/data/cas/default/public/

Include subdirectories
false

- j.** In mRemoteNG, open a session as the user **christine**.

- k. Navigate to the path that was specified in the properties of the Public caslib in SAS Environment Manager.

```
cd /opt/sas/viya/config/data/cas/default/public
```

- l. Enter the command to view a list of the files.

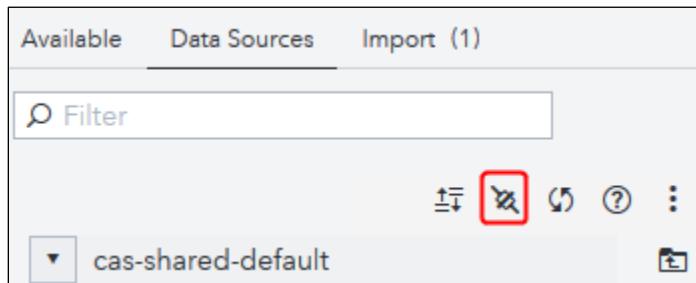
```
ls -la
```

```
[christine@server Finance]$ cd /opt/sas/viya/config/data/cas/default/public
[christine@server public]$ ls -la
total 1271876
drwxrwxrwx.  2 cas sas      92 Oct 31 18:09 .
drwxr-xr-x. 16 cas sas     248 Jul 28 18:59 ..
-rwxr-xr-x.  1 cas sas 555939576 Oct 31 18:09 CUSTOMERS.sashdat
-rw-r--r--.  1 cas sas    78872 Oct 30 11:28 predef_svrtdist.sashdat
-rwxr-xr-x.  1 cas sas 746376720 Aug 10 17:34 PRODUCTS_CLEAN.sashdat
[christine@server public]$
```

Verify that the copy of the SAS data set that you loaded via the import capability was found.

2. Adding a Caslib Using SAS Environment Manager

- Sign in to SAS Environment Manager as **Christine** with the password **Student1**.
- Select the **Data** page from the side menu.
- Click the **Data Sources** tab.
- Click the **Connect** icon to add a caslib.



- e. In the Connection Settings window:

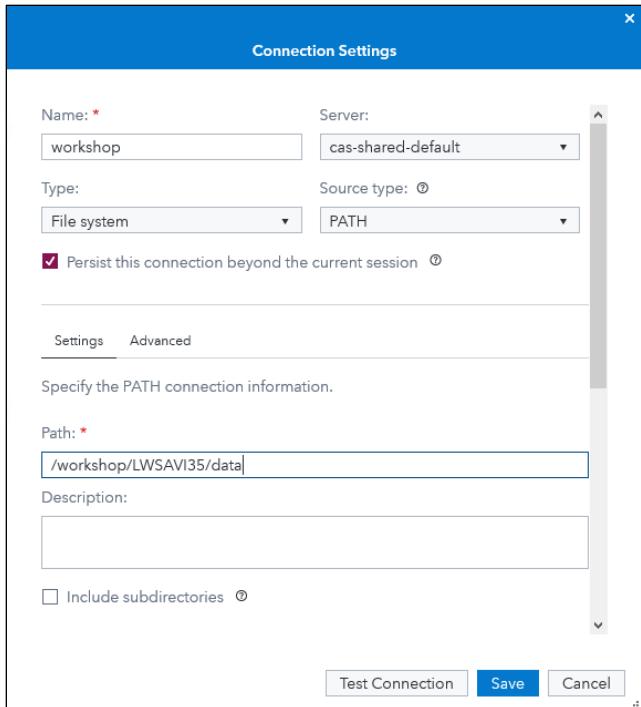
Name: **Workshop**

Type: **File System**

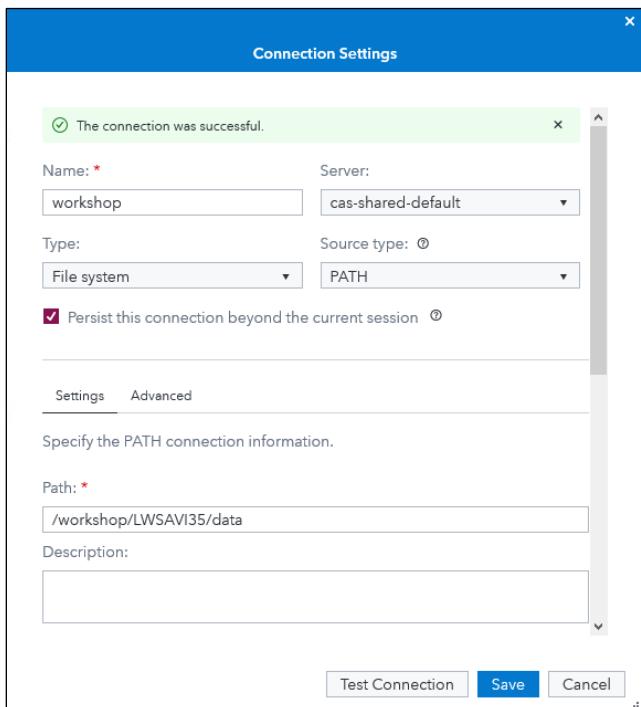
Source type: **PATH**

Under Settings, Path: **/workshop/LWSAVI35/data**

Description: **Workshop data for class**



f. Click Test Connection.



g. Click Save.

h. Expand the Workshop caslib to see the tables.

Three tables are listed, but the tables are not loaded into memory.

Note: There is a CLI script to create the Workshop caslib:

```
/workshop/LWSAVI35/scripts/L04/practice02_addWorkshopCaslib.sh
```

3. Adding a Caslib Using the Command-Line Interface

- Use the Christine connection in MRemoteNg.
- Enter the following command:

```
/opt/sas/viya/home/bin/sas-admin cas caslibs create path --
caslib Finance --path /Finance --server cas-shared-default --
description "Finance data"
```

Note: You might need to regenerate a token for Christine in order to use the sas-admin command. Run the following script: `/workshop/LWSAVI35/createCLIProfile.sh`.

```
The requested caslib "Finance" has been added successfully.

Caslib Properties
Name           Finance
Server         cas-shared-default
Description    Finance data
Source Type   PATH
Path           /Finance/
Scope          global

Caslib Attributes
active        true
personal      false
subDirs       false
```

- Enter the following command to see a list of caslibs:

```
/opt/sas/viya/home/bin/sas-admin --output text cas caslibs
list -server cas-shared-default
```

```
[christine@server bin]$ ./sas-admin --output text cas caslibs list -server cas-shared-default
Name          Source Type  Description
CASUSER(christine)  PATH      Personal File System Caslib
onfig/data/cas/default/casuserlibraries/christine/
CPSAppData    PATH      Stores data for the planning service.
onfig/data/cas/default/cpsAppData/
Finance       PATH      Finance data
Formats        PATH      Stores user defined formats.
onfig/data/cas/default/formats/
ModelPerformanceData  PATH      Library for Model Management performance objects.
onfig/data/cas/default/modelMonitorLibrary/
Models         PATH      Stores models created by Visual Analytics for use in other
onfig/data/cas/default/models/
Public         PATH      Shared and writeable caslib, accessible to all users.
onfig/data/cas/default/public/
Samples        PATH      Stores sample data, supplied by SAS.
onfig/data/cas/default/samples/
SystemData    PATH      Stores application generated data, used for general report
onfig/data/cas/default/sysData/
Workshop      PATH      workshop data for class
I34/data/
```

Note: There is a CLI script to create the Finance caslib:

```
/workshop/LWSAVI35/scripts/L04/practice03_addFinanceCaslib.sh
```

4. Loading Data into Memory for the Workshop Caslib

Use CLI or SAS Environment Manager to load data into memory for the Workshop caslib.

[CLI](#)

- Navigate to `/opt/sas/viya/home/bin` if you are not already there.
- Enter the following command:

```
/opt/sas/viya/home/bin/sas-admin cas tables load --caslib=Workshop --table=* --server cas-shared-default
```

```
[christine@server bin]$ ./sas-admin cas tables load --caslib=Workshop --table=* --server cas-shared-default
The table "DEMOGRAPHICS" has been loaded to CAS.
The table "EMPLOYEES" has been loaded to CAS.
The table "INSIGHT TOY COMPANY 2017" has been loaded to CAS.
```

SAS Environment Manager

- On the Data page in SAS Environment Manager, click the **Data Sources** tab.
- Expand **cas-shared-default** \Rightarrow **Workshop**.

The screenshot shows the SAS Environment Manager interface. The top navigation bar has tabs for 'Available', 'Data Sources', and 'Import (1)'. Below the tabs is a search bar with a magnifying glass icon and a 'Filter' button. Underneath is a toolbar with icons for filter, refresh, and help. A dropdown menu is open, showing 'workshop' selected. The main content area displays three data sources under 'workshop': 'demographics.csv' (CSV file, 08/10/18 04:56 PM), 'employees.sas7bdat' (SAS7BDAT file, 08/10/18 04:56 PM), and 'insight_toy_company_2017.sas7bdat' (SAS7BDAT file, 08/10/18 04:56 PM).

- Right-click each table and select **Load**.

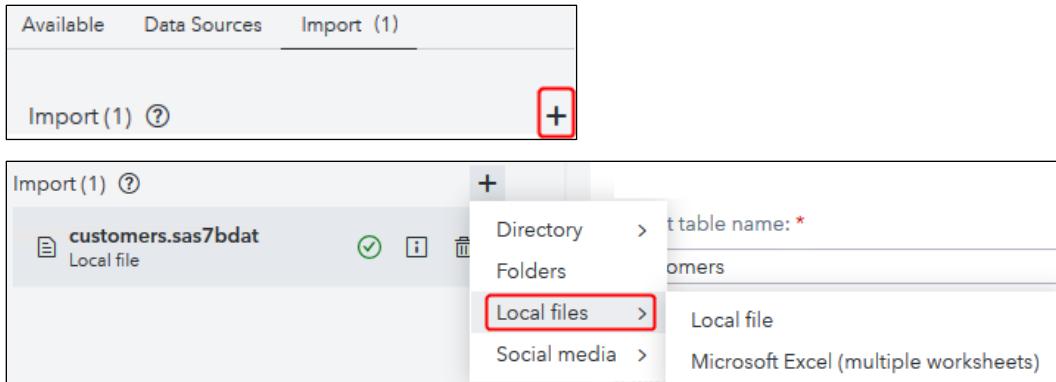
The screenshot shows a context menu for the 'demographics.csv' entry in the 'workshop' folder. The menu options are: Load (highlighted with a red box), Unload, View authorization, Edit authorization, Delete, Add to import, Run profile, Run profile and save, and Download table.

Note: There is a CLI script to load Workshop tables:

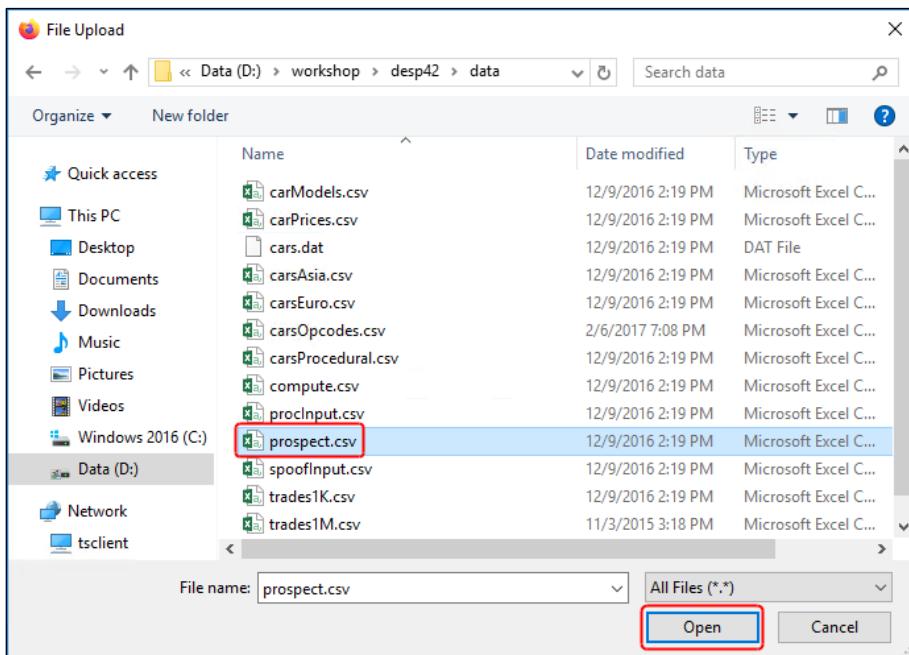
```
/workshop/LWSAVI35/scripts/L04/practice04_loadWorkshopTables.sh
```

5. Importing Local Data to the Finance Caslib

- On the Data page in SAS Environment Manager, click the **Import** tab.
- Click the **Add** icon to the right of Import and select **Local File**.



- c. Navigate to D:\Workshop\desp42\data. Highlight **prospect.csv** and click **Open**.



- d. Change the target caslib to **Finance**.

Target location: *	<input type="text" value="cas-shared-default/Finance"/>	<input type="button" value="Find"/>
--------------------	---	-------------------------------------

e. Click Import Item.

What type of file is loaded into memory? **sashdat**

The screenshot shows the 'Import (2)' tab in the SAS Environment Manager. A search bar labeled 'Filter' is at the top. Below it, a dropdown menu is set to 'Finance'. The list contains several files:

- goalies.sas7bdat (11/06/17 12:14 PM)
- hockey.sas7bdat (11/06/17 12:02 PM)
- na_hurricanes.sas7bdat (11/28/17 04:15 PM)
- PROSPECT** (05/22/20 01:24 PM • christine) - This file is highlighted with a red box.
- PROSPECT.sashdat (05/22/20 01:24 PM)

Is the file also written to the Finance caslib physical location? **Yes**

If so, what is the data type? **sashdat**

```
[christine@server bin]$ cd /Finance
[christine@server Finance]$ ll
total 13904
-rw-r--r--. 1 root root 1048576 Nov  6  2017 goalies.sas7bdat
-rw-r--r--. 1 root root 1769472 Nov  6  2017 hockey.sas7bdat
-rw-r--r--. 1 root root 6553600 Nov 28  2017 na_hurricanes.sas7bdat
-rwxr-xr-x. 1 cas sas  4863016 May 22 13:24 PROSPECT.sashdat
```

6. (Optional) Exploring the CASLIB Scope

- In SAS Environment Manager, select **Servers** from the side menu.
- Right-click **cas-shared-default** and select **Settings**.

The screenshot shows the 'Servers' section of the SAS Environment Manager. A list of servers is shown, with 'cas-shared-default' selected. A context menu is open over 'cas-shared-default', displaying the following options:

- Configuration
- Settings** - This option is highlighted with a red box.
- Assume the Superuser role

- Click the **Caslib Management Privileges** tab.

Server Settings

Superuser Role Membership Caslib Management Privileges Logging

Specify who can create and delete caslibs.

Identity	Session Caslibs	Global Caslibs
Superuser Role (assumed)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Authenticated Users	<input checked="" type="checkbox"/>	<input type="checkbox"/>
cas	<input type="checkbox"/>	<input checked="" type="checkbox"/>
SAS Administrators	<input type="checkbox"/>	<input checked="" type="checkbox"/>
sasapp	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Can Authenticated Users create and delete global caslibs? **No**

- d. Click **Close**.
- e. Open Firefox from the Start menu or Windows tasks.
- f. Click **SAS Studio Enterprise** on the Favorites bar.
- g. Sign in to SAS Studio as **lynn**. Use the **Student1** password.
- h. Copy or enter the program below on the Program 1 tab. (If all the editor tabs are closed, you can use the F4 function key to open a new SAS Program tab.) Hold down the Ctrl key and press C to copy this code. Hold down the Ctrl key and press V to paste it into the CODE window in SAS Studio.

```
/* Start a session named mySession to the CAS server */
CAS mySession SESSOPTS=(CASLIB=casuser TIMEOUT=99 LOCALE="en_US");

/* create a session scoped CAS library (myCaslib) for the path
"/tmp/" */

CASLIB myCaslib PATH="/tmp/" TYPE=path;

/* Load a data table to CAS under caslib myCaslib */
PROC CASUTIL;
    LOAD DATA=sashelp.air OUTCASLIB="MYCASLIB" CASOUT="air";
RUN;

/* Show CASLIB in SAS Studio */
CASLIB _ALL_ ASSIGN;

/* List CAS table information from caslib myCaslib */
proc casutil;
    list tables incaslib="MYCASLIB";
run;
```

- i. Click  (the **Submit SAS Code** icon) to run the code.

View the Results tab. Notice the caslib information. It indicates that the session is local and the table is not promoted to be shared with other users.

The CASUTIL Procedure	
Caslib Information	
Library	MYCASLIB
Source Type	PATH
Path	/tmp/
Session local	Yes
Active	Yes
Personal	No
Hidden	No
Transient	No

- j. Open the **AIR** CAS table to view the data.
- 1) In the navigation pane, navigate to **Libraries** \Rightarrow **My Libraries** \Rightarrow **MYCASLIB**.



- 2) Double-click the **AIR** table to open it.

	DATE	AIR
1	JAN49	112
2	FEB49	118
3	MAR49	132
4	APR49	129
5	MAY49	121
6	JUN49	135
7	JUL49	148
8	AUG49	148
9	SEP49	136
10	OCT49	119
11	NOV49	104
12	DEC49	118
13	JAN50	115
14	FEB50	126
15	MAR50	141
16	APR50	135
17	MAY50	125
18	JUN50	149

- k. Execute the following code to promote the CAS table. On the Program 1 tab, click the **CODE** tab. Paste the code below at the bottom of the existing code, highlight it, and click (the **Submit SAS Code** icon).

```
/* Promote CAS table 'air' to share with other users */
proc casutil outcaslib="MYCASLIB";
  promote casdata="air";
quit;
```

- I. Review the log from the code execution and notice the error messages. The log indicates that **MYCASLIB** is a session caslib, and the table cannot be promoted to the global scope.

- m. Attempt to access the caslib from another CAS session as the same user.

- 1) Use the F4 function key to open a second SAS Program tab. Paste the code below to open a new CAS session. Access the caslib and table that were created in the previous steps.

```
/* New CAS session */
CAS mySession2 SESSOPTS=(CASLIB=casuser TIMEOUT=999
  LOCALE="en_US");

/* list caslib and table detail from caslib */
proc casutil;
  list tables incaslib="MYCASLIB";
run;
```

- 2) Review the log. Notice the error message in the log. Even the same user cannot access a session caslib in a different session. A session caslib is accessible only in the session where it was created.

Note: You cannot change the scope of a caslib after it is added.

```

86  /* list caslib and table detail from caslib */
87  proc casutil;
88  list tables incaslib="MYCASLIB";
NOTE: The UUID 'd3cf2cfe-6328-4d44-b8b1-694fa260d311' is connected using session MYSESSION2.
89
ERROR: The caslib 'MYCASLIB' does not exist in this session.
ERROR: The action stopped due to errors.
ERROR: The caslib 'MYCASLIB' does not exist in this session.
ERROR: The action stopped due to errors.
NOTE: Cloud Analytic Services processed the combined requests in 0.000847 seconds.

```

- n. Go back to the SAS Program tab 1 and the code window.
- o. Modify the LOAD statement in the PROC CASUTIL step to promote the **Air** table to the **CASUSER** caslib. Then highlight it and click  (the **Submit SAS Code** icon).

Alternatively, you can paste the code below at the bottom of the existing code, highlight it, and click  (the **Submit SAS Code** icon).

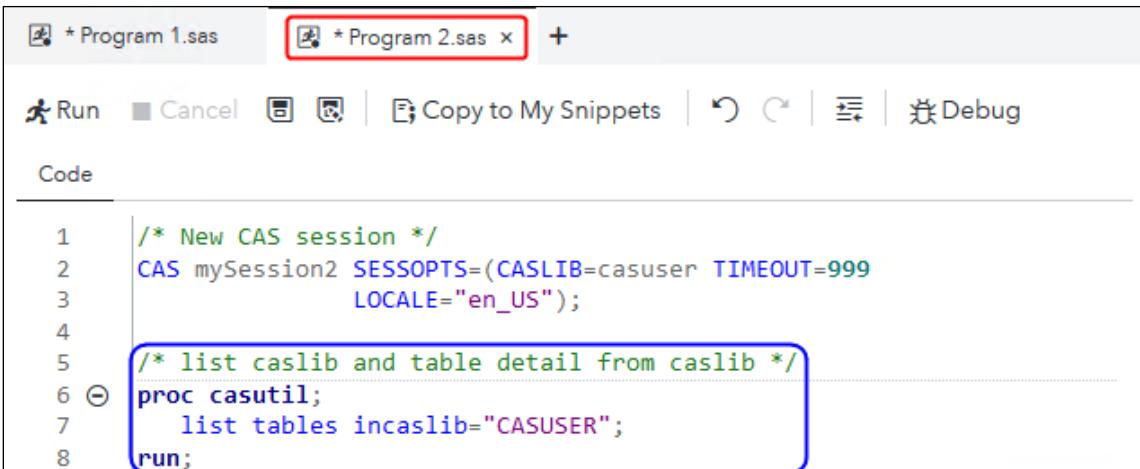
```

/* Load a data table to CAS under caslib CASUSER */
PROC CASUTIL;
  LOAD DATA=sashelp.air OUTCASLIB="CASUSER" CASOUT="air";
RUN;

```

You loaded a table to the personal CASUSER caslib. The scope is global by default.

- p. Return to the Program 2 tab and the code window.



```

* Program 1.sas * Program 2.sas + Run Cancel Copy to My Snippets Debug

Code

1  /* New CAS session */
2  CAS mySession2 SESSOPTS=(CASLIB=casuser TIMEOUT=999
3                                LOCALE="en_US");
4
5  /* list caslib and table detail from caslib */
6  proc casutil;
7    list tables incaslib="CASUSER";
8  run;

```

- q. Modify the LIST TABLES statement in the PROC CASUTIL step to list tables in the CASUSER caslib. Then highlight it and click  (the **Submit SAS Code** icon).

Alternatively, you can paste the code below at the bottom of the existing code, highlight it, and click  (the **Submit SAS Code** icon).

```

/* list caslib and table detail from caslib */
proc casutil;
  list tables incaslib="CASUSER";
run;

```

The CASUTIL Procedure											
Caslib Information											
Library	CASUSER(lynn)										
Source Type	PATH										
Description	Personal File System Caslib										
Path	/opt/sas/viya/config/data/cas/default/casuserlibraries/lynn/										
Session local	No										
Active	Yes										
Personal	Yes										
Hidden	No										
Transient	Yes										

The CASUTIL Procedure											
Table Information for Caslib CASUSER(lynn)											
Table Name	Label	Number of Rows	Number of Columns	Indexed Columns	NLS encoding	Created	Last Modified	Promoted Table	Repeated Table	View	Compressed
AIR	airline data (monthly: JAN49-DEC60)	144	2	0	utf-8	2020-05-22T13:40:31-04:00	2020-05-22T13:40:31-04:00	No	No	No	No

- r. Terminate your CAS sessions. Submit the following code on each of your SAS Program tabs:

```
cas mySession terminate;
```

7. Setting CAS Access Controls on Finance Caslib Using SAS Environment Manager

- In SAS Environment Manager, select **Data** from the side menu. (Make sure you are logged on as Christine.)
- On the Data Sources tab, expand **cas-shared-default**.

The screenshot shows the SAS Environment Manager interface with the 'Data Sources' tab selected. A search bar labeled 'Filter' is at the top. Below it, a tree view shows the 'cas-shared-default' folder expanded. Underneath are four entries: 'AppData PATH', 'CASUSER(christine) PATH', 'DIDP PATH', and 'Finance PATH'. Each entry has a circular arrow icon to its right.

- Right-click the **Finance** caslib and select **Edit Authorization**.

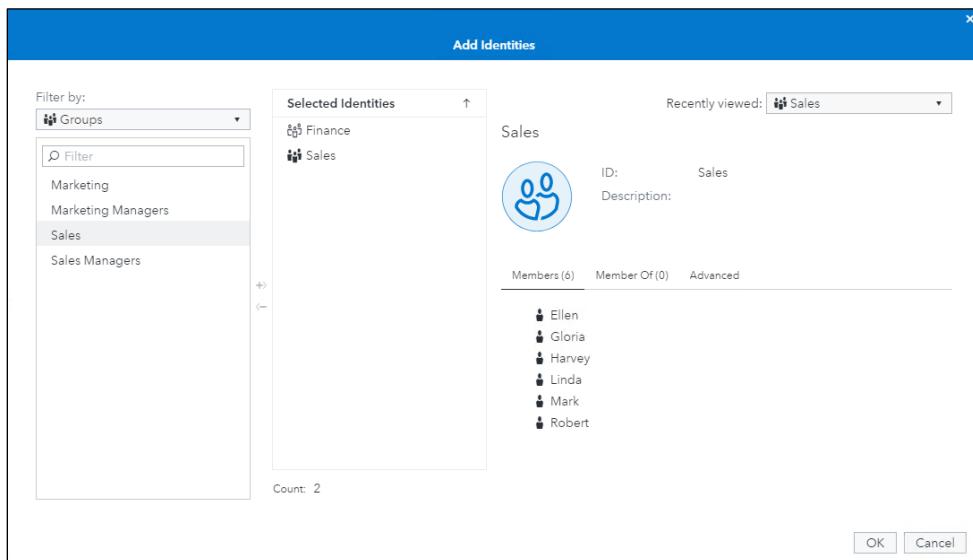
The screenshot shows a context menu for the 'Finance' caslib. The menu items are: 'Set as default target location', 'Import from library', 'View authorization', 'Edit authorization' (which is highlighted with a red box), 'Edit', and 'Remove'.

- Add the Finance and Sales groups as principals.

- 1) Click **Add identities** icon.

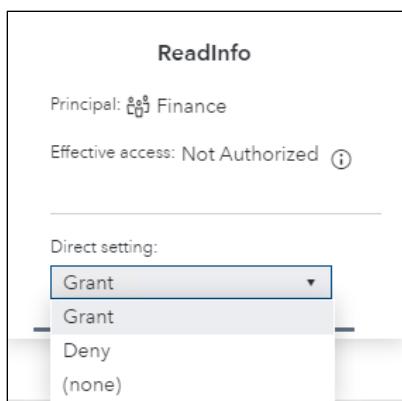


- 2) Move **Finance** from Custom groups and **Sales** from Groups to the **Selected Identities** column. Click **OK**.



- e. Grant the groups ReadInfo, Select, and LimitedPromote permissions.

- 1) Click the permission for **ReadInfo** for **Finance** and select **Grant**.



- 2) Repeat the above step for **Select** and **LimitedPromote** for **Finance**.

- 3) Repeat the above steps for **Sales**.

- f. Click **Preview** first to preview and then click **Save**.

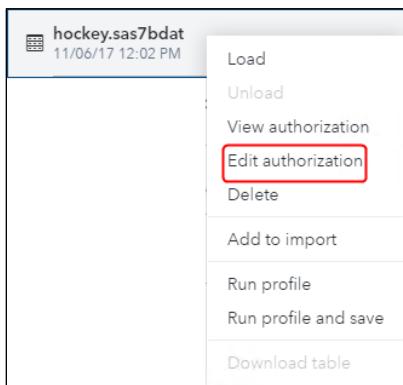
Edit Authorization

The screenshot shows the 'Edit Authorization' dialog for the 'Finance' caslib. It lists four principals: 'Authenticated Users' (No Access), 'Christine' (Full Control), 'Finance' (Custom), and 'Sales' (Custom). The 'Access Level' column indicates the overall access level for each principal. The main area is a grid where rows represent permissions (ReadInfo, Select, LimitedPromote, Promote, CreateTable, DropTable, DeleteSource, Insert, Update, Delete, AlterTable, AlterCalls, ManageAccess) and columns represent principals. Red circles indicate denied permissions, while green circles indicate granted permissions. A legend at the top right of the grid explains the symbols.

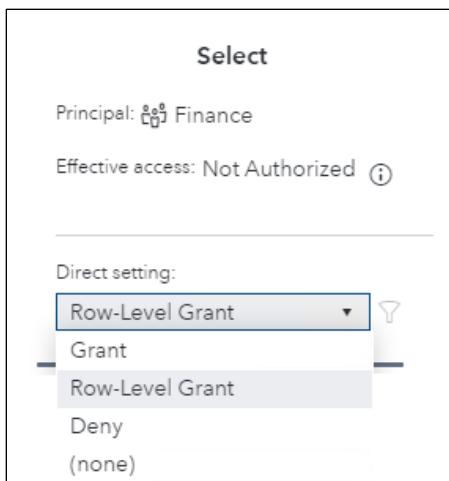
Principal	Access Level	ReadInfo	Select	LimitedPromote	Promote	CreateTable	DropTable	DeleteSource	Insert	Update	Delete	AlterTable	AlterCalls	ManageAccess
Authenticated Users	No Access	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Christine	Full Control	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Finance	Custom	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Sales	Custom	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗

Preview Save Cancel

- g. Expand the **Finance** caslib, right-click the **hockey.sas7bdat** table, and select **Edit authorization**.



How would you apply a filter for the Finance group so that they see only the rows of players on the Pittsburgh Penguins team? (`name = "Pittsburgh Penguins"`) Hint: Look at the Select permission.



- h. Click **Cancel**. **Do not** make any changes to the authorization of the table.

Note: There is a CLI script to add access controls on the Finance caslib:

```
/workshop/LWSAVI35/scripts/L04/practice07_addFinanceACLs.sh
```

8. Setting CAS Access Controls on Workshop Caslib Using CLI

Use the **sas-admin cas caslibs add-control** command to add access controls for the **Sales** group.

- Bring up mRemoteNG and enter the following commands:

```
/opt/sas/viya/home/bin/sas-admin cas caslibs add-control --grant readInfo --server cas-shared-default --caslib Workshop --group Sales
```

```
/opt/sas/viya/home/bin/sas-admin cas caslibs add-control --grant select --server cas-shared-default --caslib Workshop --group Sales
```

```
/opt/sas/viya/home/bin/sas-admin cas caslibs add-control --grant limitedPromote --server cas-shared-default --caslib Workshop --group Sales
```

```
[christine@server bin]$ /opt/sas/viya/home/bin/sas-admin cas caslibs add-control --grant readInfo --server cas-shared-default --caslib Workshop --group Sales
The requested permission, "readInfo", and type, "grant", was applied to the identity, "Sales" on the caslib "Workshop".
[christine@server bin]$ /opt/sas/viya/home/bin/sas-admin cas caslibs add-control --grant select --server cas-shared-default --caslib Workshop --group Sales
The requested permission, "select", and type, "grant", was applied to the identity, "Sales" on the caslib "Workshop".
[christine@server bin]$ /opt/sas/viya/home/bin/sas-admin cas caslibs add-control --grant limitedPromote --server cas-shared-default --caslib Workshop --group Sales
Both server [$SAS_CLI_DEFAULT_CAS_SERVER] and caslib [$SAS_CLI_DEFAULT_CASLIB] must be specified.
```

- List the source tables in the Workshop and Finance path-based caslibs.

Enter the following commands:

```
/opt/sas/viya/home/bin/sas-admin --output text cas sources list --caslib=Workshop --server=cas-shared-default
```

```
/opt/sas/viya/home/bin/sas-admin --output text cas sources list --caslib=Finance --server=cas-shared-default
```

```
[christine@server bin]$ /opt/sas/viya/home/bin/sas-admin --output text cas sources list --caslib=Workshop --server=cas-shared-default
Source          Owner    Group   Size (kb)  Created On      Permissions  Encryption
demographics.csv  christine  users     18        2018-08-10T15:56:31-05:00 -rw-r--r--
insight_toy_company_2017.sas7bdat  christine  users   187712    2018-08-10T15:56:32-05:00 -rw-r--r--
employees.sas7bdat  christine  users     320       2018-08-10T15:56:32-05:00 -rw-r--r--

[christine@server bin]$ /opt/sas/viya/home/bin/sas-admin --output text cas sources list --caslib=Finance --server=cas-shared-default
Source          Owner    Group   Size (kb)  Created On      Permissions  Encryption
PROSPECT.sashdat  cas      sas     4749      2018-11-05T15:30:17-05:00 -rwxr-xr-x  NONE
hockey.sas7bdat  sas      sas     1728      2017-11-06T12:02:09-05:00 -rw-rw-r--
goalies.sas7bdat  sas      sas     1024      2017-11-06T12:14:22-05:00 -rw-rw-r--
na_hurricanes.sas7bdat  sas      sas     6400      2017-11-28T16:15:57-05:00 -rw-rw-r--
```

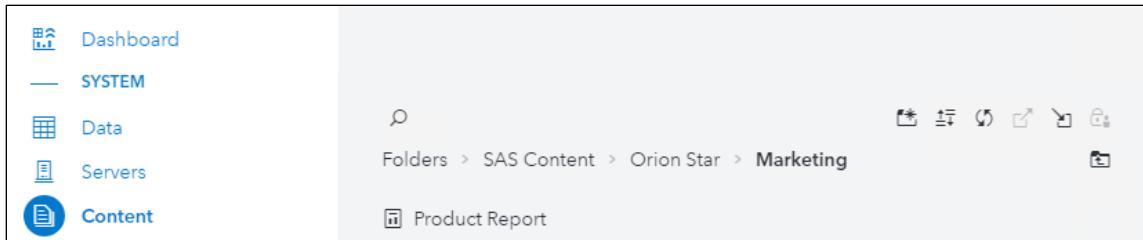
Note: There is a CLI script to add access controls on the Workshop caslib:

```
/workshop/LWSAVI35/scripts/L04/practice07_addWorkshopACLs.sh
```

9. Moving Content in SAS Environment Manager

In this practice, you use SAS Environment Manager to move content.

- Sign in to SAS Environment Manager as the user **christine** with the password **Student1**.
- On the SAS Environment Manager side menu, select **Content**.
- Expand **Orion Star** \Rightarrow **Marketing** folder by selecting the arrow to the right of each folder.



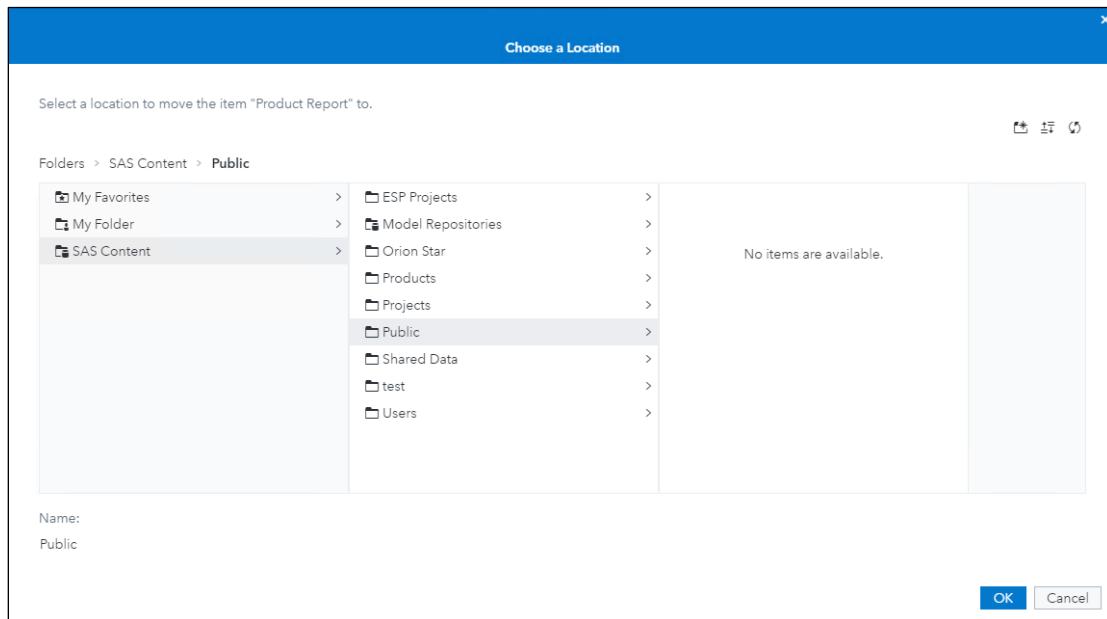
- d. Select **Product Report**. Notice the URI, type, and location of the report in the Basic Properties pane.

Name:	Product Report
URI:	/reports/reports/4df447b6-5e38-417c-b8e6-548af9ab44fe
Description:	(empty)
Type:	Report
Location:	/Orion Star/Marketing/Product Report

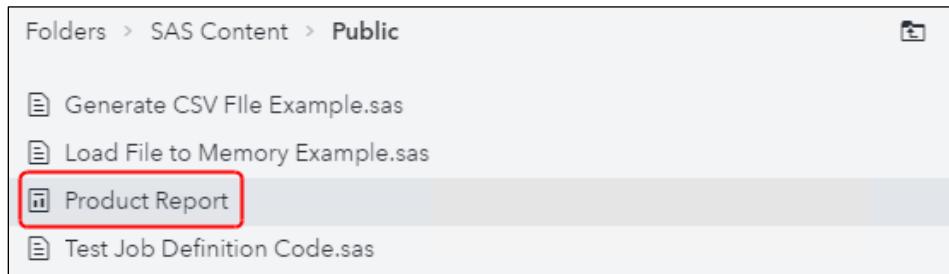
- e. Right-click **Product Report** and select **Move to Folder**.

- Delete
- Rename
- Add as shortcut
- Move to folder**
- View authorization
- Edit authorization
- Export
- Pin to dashboard

- f. In the Choose a Location window, select **Public**. Click **OK** to move the report.



- g. Verify that the report is no longer in the Marketing folder.
h. Navigate to the **Public** folder and verify that the report is there.

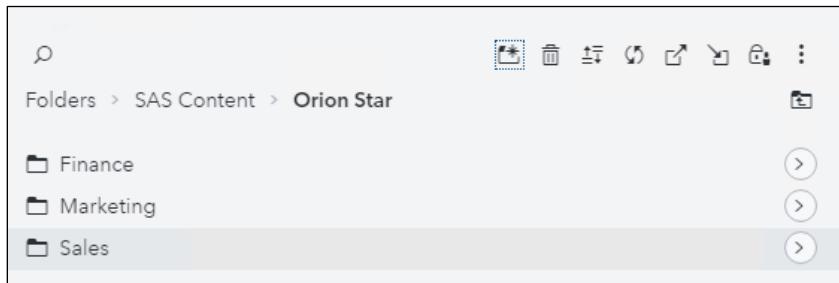


- i. Select **Product Report**. Notice the URI, type, and location of the report in the Basic Properties pane. Did anything change? **Yes, the location has changed.**

10. Using SAS Environment Manager to Add Folders

In this practice, you use SAS Environment Manager and the Content page to add a new folder.

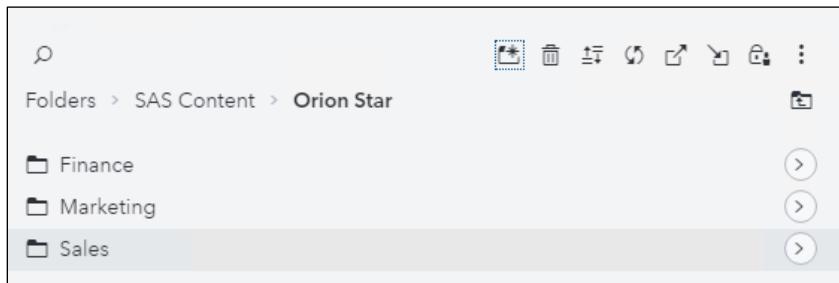
- In SAS Environment Manager, select the **Content** page from side menu.
- Add the **Sales** and **Finance** folders below the **Orion Star** folder using the graphical user interface.
- 1) Expand the **Orion Star** folder.



- 2) Click the **New Folder** icon to create the new folder. Change the name **New Folder** to **Sales**.



- 3) Repeat step 2 for to create the **Finance** folder.



Note: There is a CLI script to add these folders:

```
/workshop/LWSAVI35/scripts/L04/practice10_addfolders.sh
```

11. Using the CLI to Add Folders

In this practice, you use the command-line interface to add folders beneath Marketing, Finance, and Sales folders.

- As **christine** in an mRemoteNG session, run the CLI script:

```
/workshop/LWSAVI35/scripts/L04/practice11_addsubfolders.sh
```

The contents of the script:

```
/opt/sas/viya/home/bin/sas-admin folders create --name "Analyses" --parent-path "/Orion Star/Marketing"
/opt/sas/viya/home/bin/sas-admin folders create --name "Work in Progress" --parent-path "/Orion Star/Marketing"
/opt/sas/viya/home/bin/sas-admin folders create --name "Work in Progress" --parent-path "/Orion Star/Marketing"
/opt/sas/viya/home/bin/sas-admin folders create --name "Analyses" --parent-path "/Orion Star/Finance"
/opt/sas/viya/home/bin/sas-admin folders create --name "Data Plans" --parent-path "/Orion Star/Finance"
/opt/sas/viya/home/bin/sas-admin folders create --name "Models" --parent-path "/Orion Star/Finance"
/opt/sas/viya/home/bin/sas-admin folders create --name "Analyses" --parent-path "/Orion Star/Sales"
/opt/sas/viya/home/bin/sas-admin folders create --name "Work in Progress" --parent-path "/Orion Star/Sales"
/opt/sas/viya/home/bin/sas-admin folders create --name "Models" --parent-path "/Orion Star/Sales"
```

```
[christine@server bin]$ /opt/sas/viya/home/bin/sas-admin folders create --name "Analyses" --parent-path "/Orion Star/Marketing"
{
  "description": "",
  "id": "1689292a-b3a6-41fd-bcc0-6d1134b0b685",
  "memberCount": 0,
  "name": "Analyses",
  "parentFolderUri": "/folders/folders/0973a08e-4fb0-43ad-88c9-4ca8608134b2",
  "type": "folder"
}
The folder was created successfully.
```

- Enter the following command to get a list of folders:

```
/opt/sas/viya/home/bin/sas-admin --output text folders list-members --path "/Orion Star/" --recursive
```

```
[christine@server bin]$ /opt/sas/viya/home/bin/sas-admin --output text folders list-members --path "/Orion Star/" --recursive
Id          Name      Type     Description   Uri
21f8831f-5ad9-4903-8397-9cd4ea2a08fc  Finance    child    /folders/folders/02241f23-16fb-42e3-9f5e-bd0d7ddd5604
35930985-0dc1-4f25-b2e5-46e8a48cb71  Marketing   child    /folders/folders/0973a08e-4fb0-43ad-88c9-4ca8608134b2
caac90d3-cbe9-43ac-bece-ee77a461075  Sales      child    /folders/folders/8d0d3468-2ff2-4954-9e28-9d03ff45b582
113d9620-59f8-49b5-b11f-00461b78195b  Analyses   child    /folders/folders/03e853f1-db02-479e-b029-585404673e09
3b294414-d0cf-40fa-988a-59f1544a8c6d  Data Plans child    /folders/folders/08cfa255-d675-4903-8fa0-0fd240e01a25
f0850df-15ed-4b62-b5ac-de6423f0a000  Models     child    /folders/folders/e57193ba-dbac-4411-9910-a6c76bc58759
2cfaf1aa3-617d-488e-9d78-5elf947027e7  Analyses   child    /folders/folders/1689292a-b3a6-41fd-bcc0-6d1134b0b685
766calb6-aa62-441b-9bdf-43ccf5b519e7  Reports    child    /folders/folders/6876ea56-94d0-40ba-97c2-5e4b688f158a
52eaab6b-8ec1-44e6-a89e-60ba8c6ed309  Work in Progress child  /folders/folders/1281eb6a-d40e-4ae1-836a-e1068b1e8cc4
bc7900aa-2dal-4a2b-8149-b9d9bb21fc20  Analyses   child    /folders/folders/820d04b2-47f3-4bff-a012-1c7015a1788d
922a1adc-4d4e-4581-82f2-b41ab95752a8  Models     child    /folders/folders/06b8e8fc-37e4-4c34-96da-097cc86fc9a1
95e84309-5404-4809-91a1-994039f92526  Work in Progress child  /folders/folders/3d4024db-4ec3-4a3d-9a66-2f68fc1b56ac
```

- c. (Optional) Use the Content page in SAS Environment Manager to confirm that the folders were added.

Folders > SAS Content > Orion Star > Sales

- Analyses
- Models
- Work in Progress

12. Creating a Report Developers Custom Group

- a. Create a custom group called **Report Developers** and add the **Marketing** group as a member.
- 1) Select **User** from the side menu in SAS Environment Manager.
 - 2) Select **Custom groups** from the **View** drop-down menu.
 - 3) Click the **New custom group** icon.

Users

View: Custom groups

Filter

Application Administrators

- 4) Fill in the following:
- Name: **Report Developers**
- ID: **ReportDevelopers** (no space in between names)
- Description: **Users who can create reports**

New Custom Group

Name: *
Report Developers

ID: *
ReportDevelopers

Description:
Users who can create reports

Save Cancel

- 5) Click **Save**.

- 6) Click the **edit** icon in the **Members** area.

Report Developers

ID: ReportDevelopers
Description: Users who can create reports

Members (0) Member Of (0) Advanced

⑦

- 7) Move **Marketing** over to the **Selected Identities** column. Click **OK**.

Edit Members for Report Developers

Filter by: Groups

Marketing

Selected Identities

Marketing

Marketing

ID: Description:

Members (5) Member Of (0)

Eric Henri Jacques Lynn Stephanie

13. Modifying a Rule to Limit Access to SAS Visual Analytics

The new custom group that was created in the previous practice is used in the SAS Visual Analytics rule to control access to the SAS Visual Analytics interface.

- a. Select **Rules** from the side menu.

SAS® Environment Manager - Manage Environment

Rules

Object URI

/authorization/rules/
/authorization/rules/
/authorization/rules/
/authorization/rules/*
/authorization/rules/*
/**
/authorization/rules/conditionValidation
/authorization/rules/conditionValidation/
/authorization/rules/*
/authorization/rules/decision

- b. In the Rules filter, type **/SASV** under Object URI in the search box. Click **Apply**.

The screenshot shows the 'Rules' interface with a search bar at the top containing 'Object URI: /SASV'. A table below lists rules, with one row highlighted: '/SASVisualAnalytics/**' where the Principal is 'Authenticated Users'. The left sidebar contains a 'Rules Filter' section with a dropdown for 'Object URI' set to '/SASV'.

Object URI	Principal
/SASVisualAnalytics_capabilities/buildAnalyti...	Authenticated Users
/SASVisualAnalytics/rest/customGraphTypes/**	ApplicationAdministrators
/SASVisualAnalytics_capabilities/shareDataVi...	ApplicationAdministrators
/SASVisualAnalytics/rest/defaultReportDataVi...	ApplicationAdministrators
/SASVisualAnalyticsCommon_capabilities/ex...	Authenticated Users
/SASVisualAnalytics_capabilities/edit	Authenticated Users
/SASVisualAnalytics/**	Authenticated Users
/SASVisualAnalyticsCommon_capabilities/sh...	Authenticated Users

- c. Highlight the **/SASVisualAnalytics/**** rule. This rule determines who can use SAS Visual Analytics.

Click the **Edit** icon.

The screenshot shows the same 'Rules' interface as before, but now the row for '/SASVisualAnalytics/**' is selected. A context menu is open at the bottom right of this row, with the 'Edit' option highlighted by a red box. The top right corner of the main table area also has a red box around it.

Object URI	Principal	Setting
/SASVisualAnalytics_capabilities/buildAnalyti...	Authenticated Users	Grant
/SASVisualAnalytics/rest/customGraphTypes/**	ApplicationAdministrators	Grant
/SASVisualAnalytics_capabilities/shareDataVi...	ApplicationAdministrators	Grant
/SASVisualAnalytics/rest/defaultReportDataVi...	ApplicationAdministrators	Grant
/SASVisualAnalyticsCommon_capabilities/ex...	Authenticated Users	Grant
/SASVisualAnalytics_capabilities/edit	Authenticated Users	Grant
/SASVisualAnalytics/**	Authenticated Users	Grant
/SASVisualAnalyticsCommon_capabilities/sh...	Authenticated Users	Grant

- d. It currently grants Read access to Authenticated Users.

The screenshot shows the 'Edit Rule' dialog box. The 'Object URI' field contains '/SASVisualAnalytics/**'. The 'Principal type:' dropdown is set to 'Authenticated Users'. The 'Rule type:' dropdown is set to 'Grant'. The 'Permissions:' section shows 'Read' selected. The 'Description' field contains 'Access SAS Visual Analytics'. The 'Reason' field contains 'Message for prohibited users'. The 'Rule status:' switch is turned on. At the bottom are 'Save', 'Reset', and 'Cancel' buttons.

Change Principal type to ReportDevelopers.

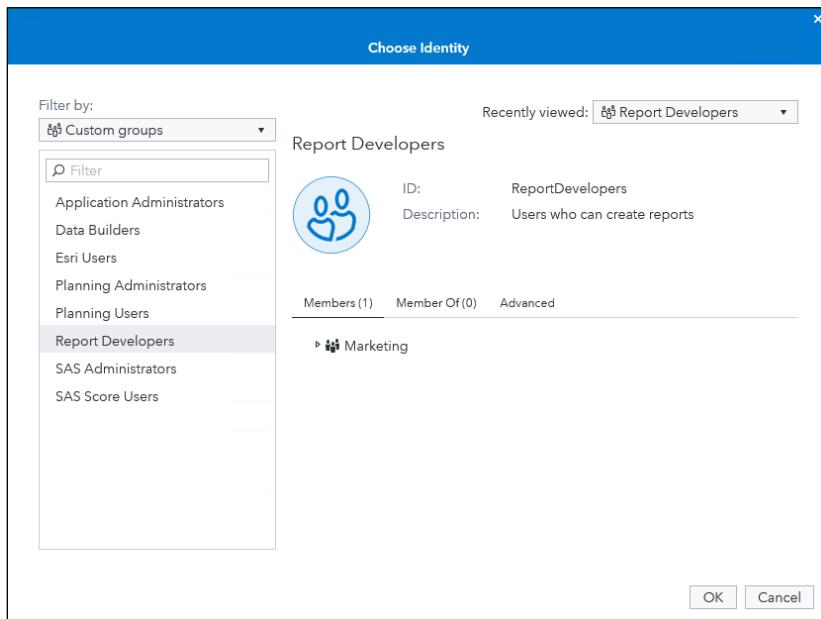
- 1) Select **Group** from the drop-down menu next to **Principal type**.

The screenshot shows the 'Principal type:' dropdown expanded. The options are 'Authenticated Users', 'User', 'Group', 'Authenticated Users', 'Everyone', and 'Guest'. The 'Group' option is highlighted with a red border.

- 2) Click the **Choose identity** icon in the **Principal** field.

The screenshot shows the 'Principal:' field containing 'Group ID' and the 'Choose identity' icon (a person icon with a plus sign) is highlighted with a red box. The 'Rule type:' field is set to 'Grant'.

- 3) Change the **Filter by** field to **Custom groups** and highlight **Report Developers**. Click **OK**.

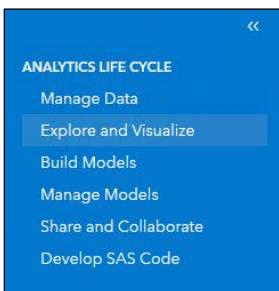


- 4) Keep everything else the same and click **Save**.

14. Examining the Effects of Adding the Custom Group to the Rule

The effects of using the Report Developers group on the SAS Visual Analytics rule are investigated. The interface differences between Lynn and Kari are compared.

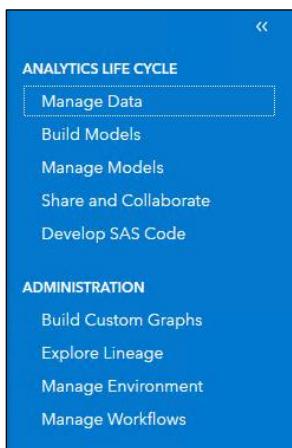
- Sign in to SAS Drive as **lynn**. Use the **Student1** password. (She is a member of the Marketing group, and therefore the Report Developer group.)
- Does Lynn see the **Explore and Visualize Data** action from the applications menu? **Yes**



- Sign out of SAS Drive as **lynn**.

- d. Sign in to SAS Drive as **kari**. Use the **Student1** password. (She is a member of the Finance group, and therefore the Data Builders group.)

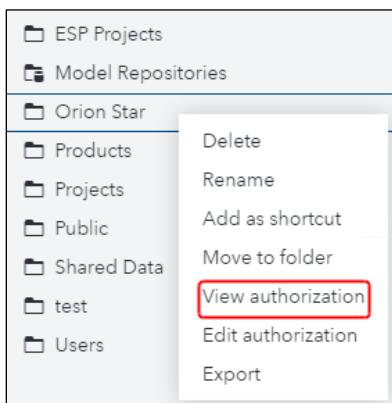
Does Kari see the **Explore and Visualize Data** action from the applications menu? **No**



15. Securing the Finance Folder

Set permissions on the Finance folder so that only the Finance group has access to their folders.

- Select **Content** from the side menu in SAS Environment Manager. (Make sure you are signed in as **Christine** with the password **Student1**.)
- Right-click the **Orion Star** folder and select **View Authorization**.



Authenticated Users have a grant for Read and Read (convey). This is indicated by the diamond next to green check mark on the permission . The Orion Star folder was added by an administrator. The Orion Star folder needs to be updated so that it is accessible to all users, but not modified or deleted. And the **Read (convey)** permission should be changed to the implicit prohibit.

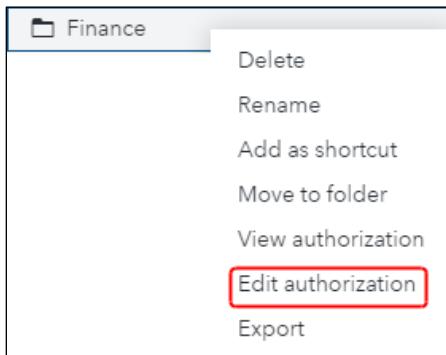
Principal	Read	Update	Delete	Secure	Add	Remove	Read (convey)	Update (convey)	Delete (convey)	Secure (convey)	Add (convey)	Remove (convey)
Authenticated Users												
SAS Administrators												
Christine												

- Click **Edit**.
- Click the green check mark in the **Read (convey)** field for Authenticated Users and change the **Direct setting** field to **(none)**.

Read (convey)	
Properties	Contributing Rules (1)
Contributing Shares (0)	
Principal:	Authenticated Users
Effective access:	Authorized
Direct setting:	<input type="button" value="Grant"/> <input type="button" value="Conditional Grant"/> <input type="button" value="Prohibit"/> <input type="button" value="Conditional Prohibit"/> <input style="background-color: #cccccc; color: #000000; border: 1px solid #ccc; padding: 2px; font-size: 10px; margin-left: 10px;" type="button" value="none"/>

- e. Until the permission setting is saved, the setting in that column is an empty circle. Click **Preview**.

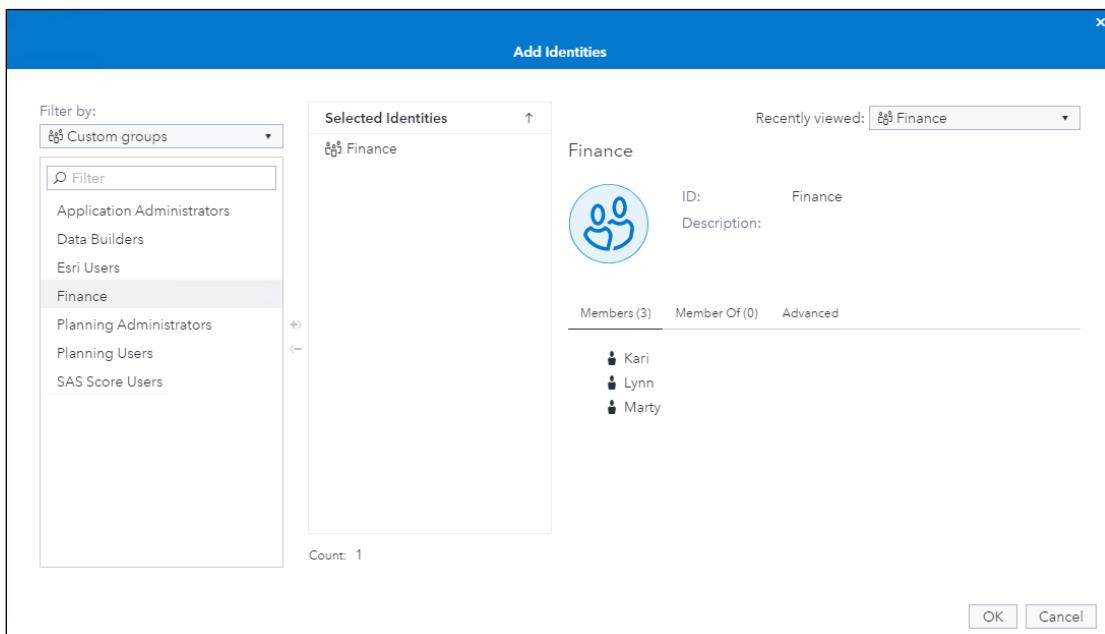
- f. Click **Save**.
 g. Expand the **Orion Star** folder, right-click **Finance** folder, and select **Edit Authorization**.



- h. Click the **Add identities** icon.



- i. Move Finance to the **Selected Identities** column. (Finance is a custom group.) Click **OK**.



- j. Give Finance direct grants for the following:

- Read
- Add
- Remove
- Read (convey)
- Update (convey)
- Delete (convey)
- Add (convey)
- Remove (convey)

All other users have the permissions of the Authenticated Users group.

- 1) Click the **Read** field for **Finance** and change the **Direct setting** field to **Grant**.

The screenshot shows the 'Read' permission configuration page. At the top, there's a tab labeled 'Read'. Below it, there are tabs for 'Properties', 'Contributing Rules (0)', and 'Contributing Shares (0)'. Under 'Properties', there are two sections: 'Principal:' set to 'Finance' and 'Effective access:' set to 'Not Authorized'. In the 'Direct setting:' section, there's a dropdown menu currently showing 'Grant'. A dropdown menu is open, listing five options: 'Grant', 'Conditional Grant', 'Prohibit', 'Conditional Prohibit', and '(none)'. The 'Grant' option is highlighted with a blue background.

- 2) Repeat step 1 for **Add**, **Remove**, **Read (convey)**, **Update (convey)**, **Delete (convey)**, **Add (convey)**, and **Remove (convey)** permissions.
- k. Click **Preview**. The settings should look like this:

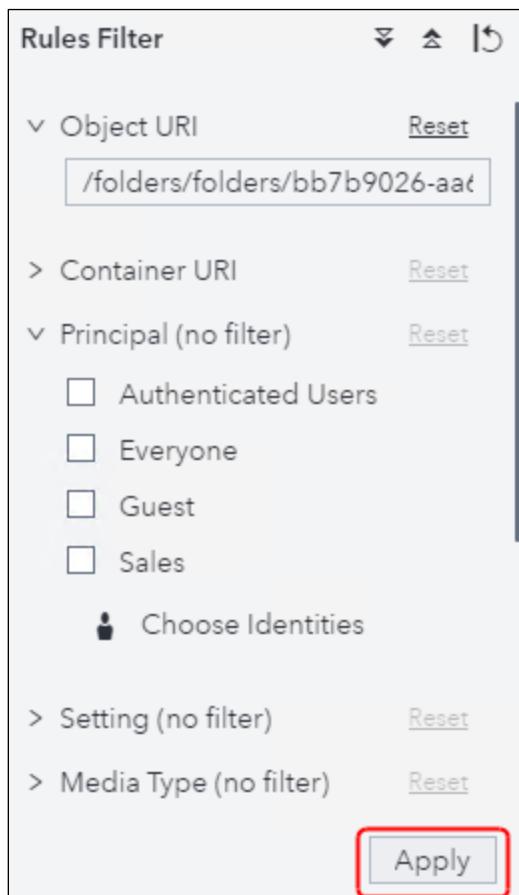
		Edit Authorization									
		Inheritance flows to child members from only the second set of permissions.									
		Finance									
Principal		Read	Update	Delete	Secure	Add	Remove	Read (convey)	Update (convey)	Delete (convey)	Secure (convey)
Authenticated Users		✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Finance		✓ ✦	✗	✗	✗	✓ ✦	✓ ✦	✓ ✦	✓ ✦	✗	✓ ✦ ✓ ✦
SAS Administrators		✓	✓	✓	✓	✓	✓	✗	✗	✗	✗
Christine		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

- I. Click **Save**. (If you think you made a mistake, you can click **Cancel** and not save the changes.)
- m. Select **Content** from the side menu.
- n. Navigate to **SAS Content** ⇨ **Orion Star**.
- o. Select the **Finance** folder.
- p. Under **Basic Properties** copy the **URI** for finance.
- q. Select **Rules**.
- r. Paste the URI in the **Object URI** field.

Rules Filter

Object URI [Reset](#)

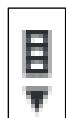
s. Click **Apply**.



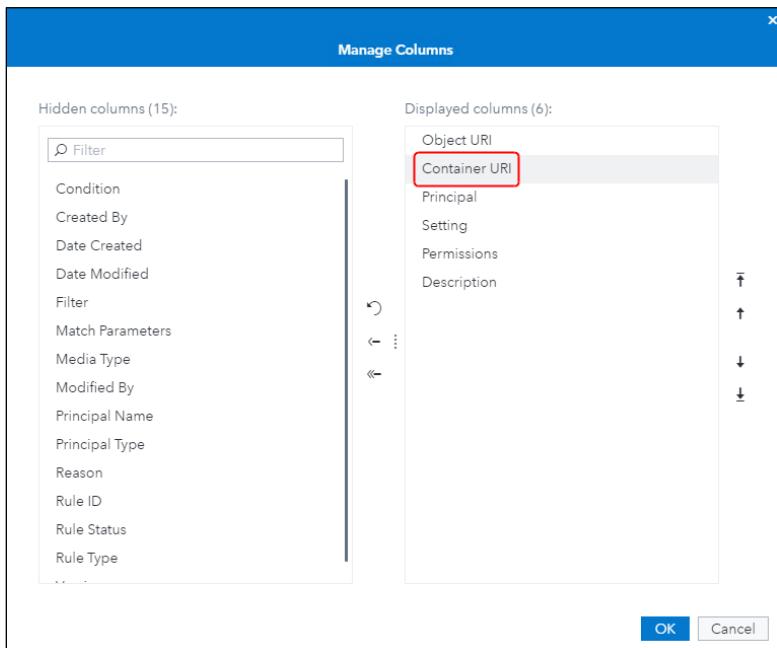
Is the rule listed the same as the direct permissions that are shown in the authorization window of the **Finance** folder? Yes

Object URI: /folders/folders/bb7b9026-aa6f-437c-b7fc-86c247ce6724 x			
Object URI	Principal	Setting	Permissions
/folders/folders/bb7b9026-aa6f-437c-b7fc-8...	Finance	Grant	Add, Read, Remove

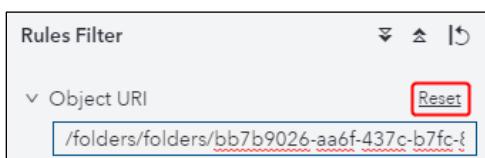
t. Click the **Manage Columns** icon.



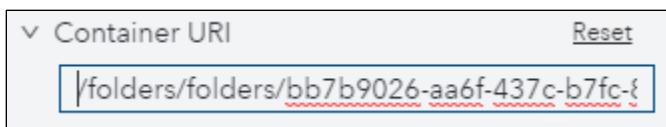
- u. Move **Container URI** to the **Displayed columns** column. Highlight **Container URI** and move it up second to the top by using the up arrow. Click **OK**.



- v. Copy the URI in Object URI.
w. Reset the filter. Click **Reset all**.



- x. Expand **Container URI** and paste the finance folder URI



y. Click **Apply**.

Rules Filter

Object URI [Reset](#)

Container URI [Reset](#)

Principal (no filter) [Reset](#)

- Authenticated Users
- Everyone
- Guest
- Sales
- [Choose Identities](#)

Setting (no filter) [Reset](#)

Media Type (no filter) [Reset](#)

Rule Status (no filter) [Reset](#)

Description [Reset](#)

Reason [Reset](#)

Modified By [Reset](#)

Date Modified [Reset](#)

Rule ID [Reset](#)

Apply

Is the rule listed the same as the direct permissions for the container URI that are shown in the authorization window of the **Finance** folder? Yes

Container URI: /folders/folders/bb7b9026-aa6f-437c-b7fc-86c247ce67... x				
<input type="text"/> Search ? New Edit				
Object URI	Container URI	Principal	Setting	Permissions
/folders/folders/bb7b9026-aa...	/folders/folders/bb7b9026-aa...	Finance	Grant	Update, Add, Read, Remove, Delete

16. Securing the Sales Folder

- a. Navigate to the Sales folder from the Content page in SAS Environment Manager. Copy the URI.

The screenshot shows the SAS Environment Manager interface. On the left, there is a tree view of folders under 'Orion Star': 'Finance', 'Marketing', and 'Sales'. The 'Sales' folder is selected and highlighted in grey. On the right, the 'Basic Properties' panel is open for the selected 'Sales' folder. The properties listed are:

Name:	Sales
URI:	/folders/folders/8d5894c7-a74e-4a31-ab82-ef49b6ff4eb5
Description:	
Type:	Folder
Location:	/Orion Star/Sales

At the bottom right of the properties panel, there is a link labeled '> Advanced'.

- b. Modify the following script replacing the object-uri and the container-uri with the URI that you copied from the previous step.

Note: Make sure to keep the double asterisk (/**) that follows the object-uri in the path. The double asterisk is not needed for the container-uri.

```
/opt/sas/viya/home/bin/sas-admin authorization authorize --  
permissions Read,Add,Remove,Update,Delete --group Sales --  
object-uri /folders/folders/65b7c04b-c7a7-4def-bc43-  
aad4a9033ca3/** --container-uri /folders/folders/65b7c04b-  
c7a7-4def-bc43-aad4a9033ca3
```

c. Run the modified script.

```
Detailed Messages:
  traceId: 47185989ce910652
  path: /authorization/rules
    FieldError: objectUri: [ /folders/folders/8487181e-1db1-427e-94f2
-8210d5598cfc** ]: the URI uses an invalid wildcard syntax.
[christine@server bin]$ /opt/sas/viya/home/bin/sas-admin authorization au
thorize --permissions Read,Add,Remove,Update,Delete --group Sales --objec
t-uri /folders/folders/8487181e-1db1-427e-94f2-8210d5598cfc/** --containe
r-uri /folders/folders/8487181e-1db1-427e-94f2-8210d5598cfc
Id          a8f23e33-67c4-40f7-9f6e-6a3c001bd2fe
ObjectUri   /folders/folders/8487181e-1db1-427e-94f2-8210d5598cfc/**
Principal   Sales
PrincipalType group
Type         grant
Permissions  [add read delete update remove]
The authorization rule has been created.
```

```
"items": [
  {
    "description": "",
    "id": "1ble5934-23ae-4a06-b6bd-406eec15be86",
    "name": "Analysis of Sales, Quantity, and Capacity by Month",
    "type": "child",
    "uri": "/reports/reports/e7e7db85-99af-4151-b464-3e316b1369ee"
  },
  {
    "description": "",
    "id": "2fa2b0d4-2604-45eb-b829-974385ca5a30",
    "name": "Product Sales by Products Report",
    "type": "child",
    "uri": "/reports/reports/38c63dba-b7e6-4187-bbc2-3cca52dce08a"
  },
  {
    "description": "",
    "id": "7adb3668-5ec4-47dc-bbdf-f4f34dec5ad7",
    "name": "Report 1",
    "type": "child",
    "uri": "/reports/reports/97f6f96f-fe33-4dca-8d28-f696761859f4"
  }
]
```

End of Solutions

Solutions to Activities and Questions

4.01 Activity – Correct Answer

Log on to SAS Environment Manager as Christine.

Select Data  ⇒ Data Sources tab ⇒ Connect icon .

Review the Connection Settings window and answer the following questions:

1. How many Source types are available for type: Database?
10
2. What Source types are available for type: Filesystem?
HDFS, DNFS, Path
3. Where can you specify parameters such as domains and how data can be read for this data source?
Advanced tab

Click Cancel.

4.02 Multiple Choice Question – Correct Answer

When loading a SASHDAT file from a DNFS caslib:

- a. the server memory-maps the original file.
- b. the server stores copies of the data in the directories defined by MAX_TABLE_MEM on the CAS controller.
- c. the server stores copies of the data in the directories specified by CAS_DISK_CACHE on the CAS controller.

4.03 Multiple Choice Question – Correct Answer

When loading an Oracle database table:

- a. the server memory-maps the original file.
- b. the server stores copies of the data in the directories defined by MAX_TABLE_MEM on the CAS controller.
- c. the server stores copies of the data in the directories specified by CAS_DISK_CACHE on the CAS controller.

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4.04 Question – Correct Answer

The CAS_DISK_CACHE value determines the number of redundant blocks to store in a CAS distributed environment.

- O True
- O False

The COPIES= CAS option determines the number of redundant blocks to store in a CAS distributed environment.

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4.06 Activity – Correct Answer

1. In SAS Environment Manager, select **Servers**.
2. Assume the Superuser role.
3. Right-click **cas-shared-default** and select **Settings**.
4. Is there an active whitelist or blacklist? **Yes, a blacklist**

The screenshot shows the 'Server Settings' interface for a specific server. The 'Paths List' tab is selected, displaying the 'Active list: Blacklist'. Below this, under 'Paths', a list of absolute paths is shown:

- /home/cas
- /opt/sas/spre
- /opt/sas/viya/config/data/cas/default/projects
- /opt/sas/viya/config/etc
- /opt/sas/viya/config/lib
- /opt/sas/viya/config/srv
- /opt/sas/viya/config/var
- /opt/sas/viya/home

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4.07 Multiple Answer Question – Correct Answer

Which of the following statements is true regarding paths lists?

(Select all that apply.)

- a. If you do not define a blacklist or whitelist, no paths list constraints are in effect.
- b. Paths must be absolute.
- c. A server's blacklist or whitelist affects third-party databases.
- d. Only users who assume the Superuser role for a server can see and manage that server's paths list.
- e. Paths list constraints do not affect access to existing caslibs.

50

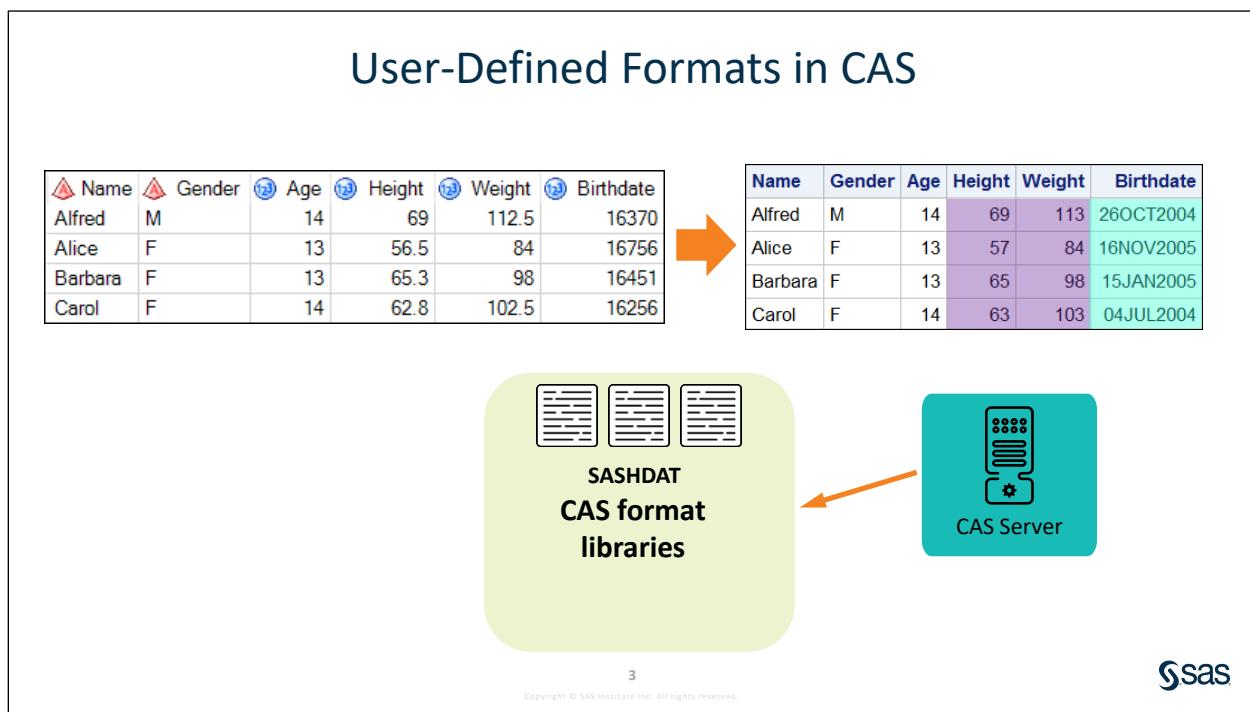


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Lesson 5 Managing CAS Server and Data

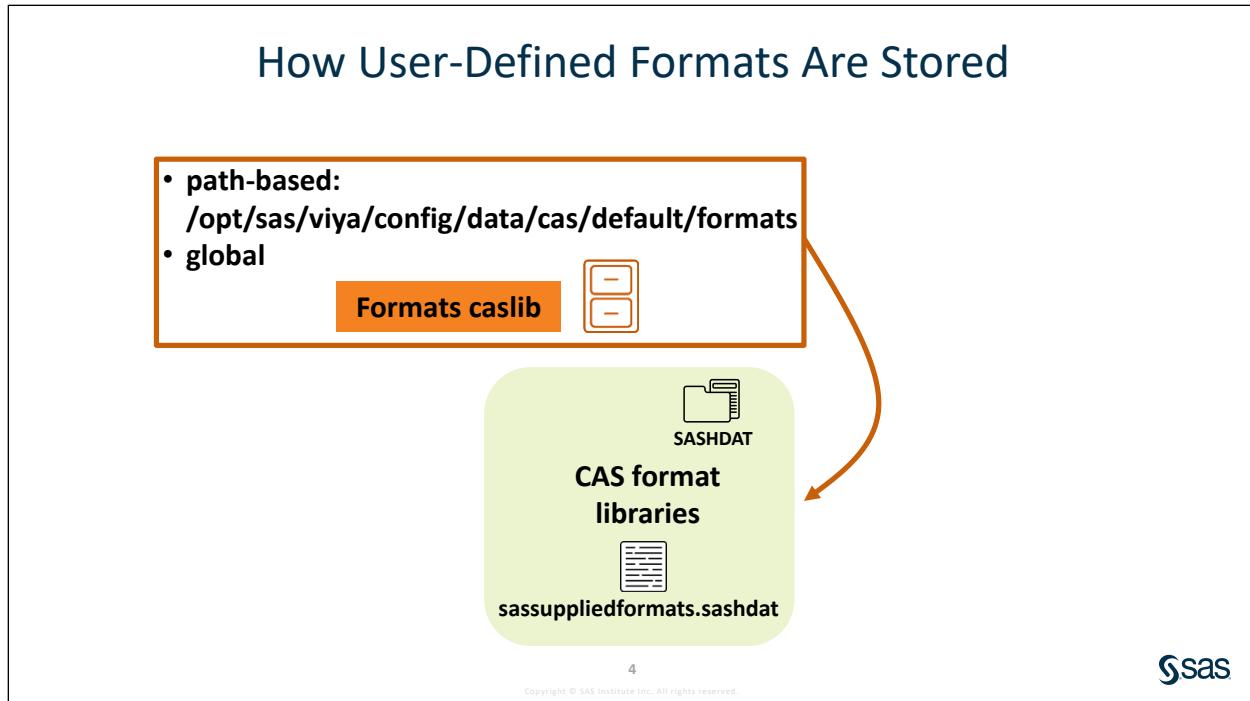
5.1 Managing Data and Formats.....	5-3
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5.1 Managing Data and Formats



Formats are used to specify how data values are to be displayed. The CAS server needs to see these formats in order for the table to use them. Formats are stored in CAS format libraries as special SASHAT files.

Note: CAS cannot directly read SAS catalogs (SAS 9.4) that store user-defined formats.

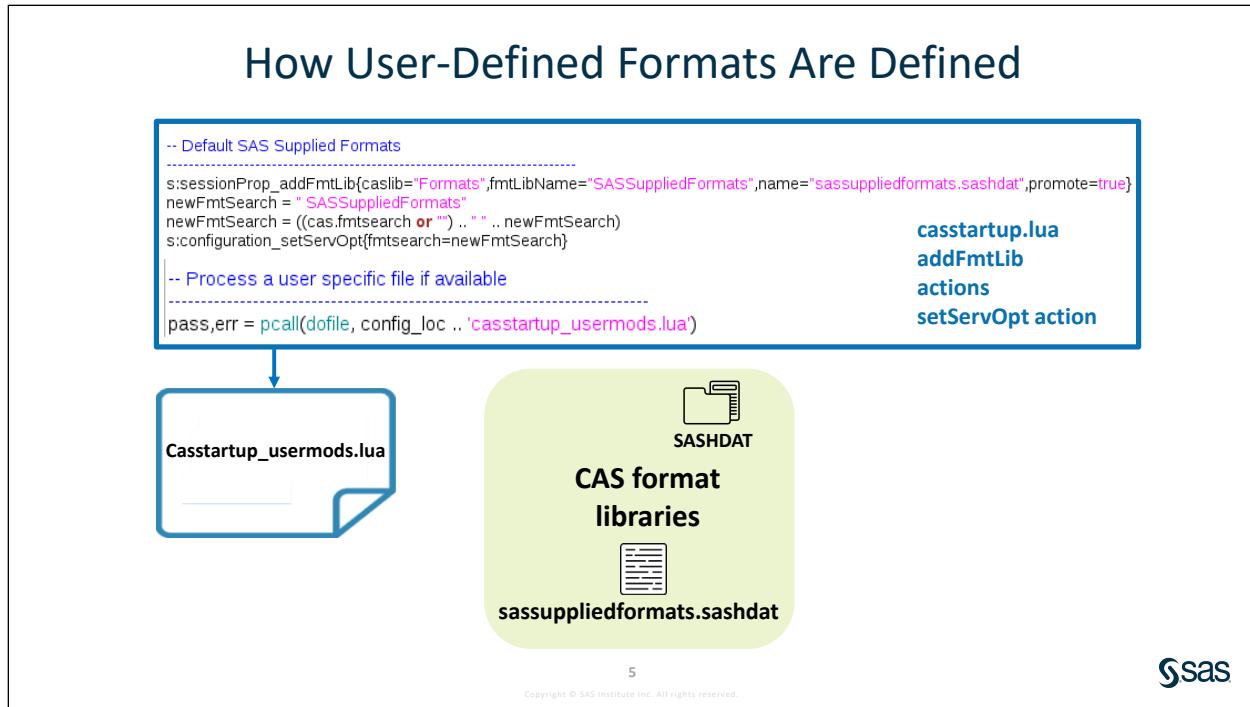


SAS®9 comparison:

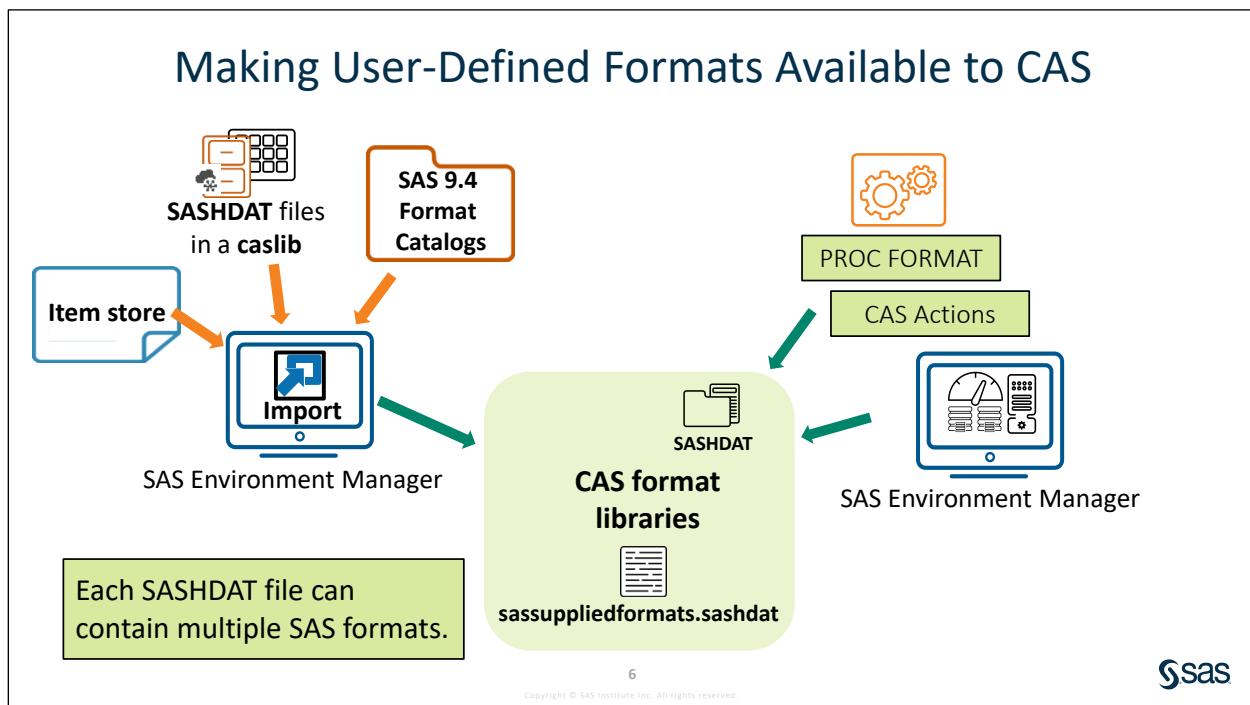
- The LIBNAME statement in SAS®9 is equivalent to **formats caslib**.
- The format catalog in SAS®9 is equivalent to the format library (for example, **sassuppliedformats.sashdat**).

Notes:

- Each SASHDAT file can contain multiple SAS formats.
- Do not modify **sassuppliedformats.sashdat**, as it contains formats that are used by the Environment Manager data mart.
- The path-based global caslib that will be used to reference the CAS format libraries is defined in the **perm.xml** file used to bootstrap the CAS server.

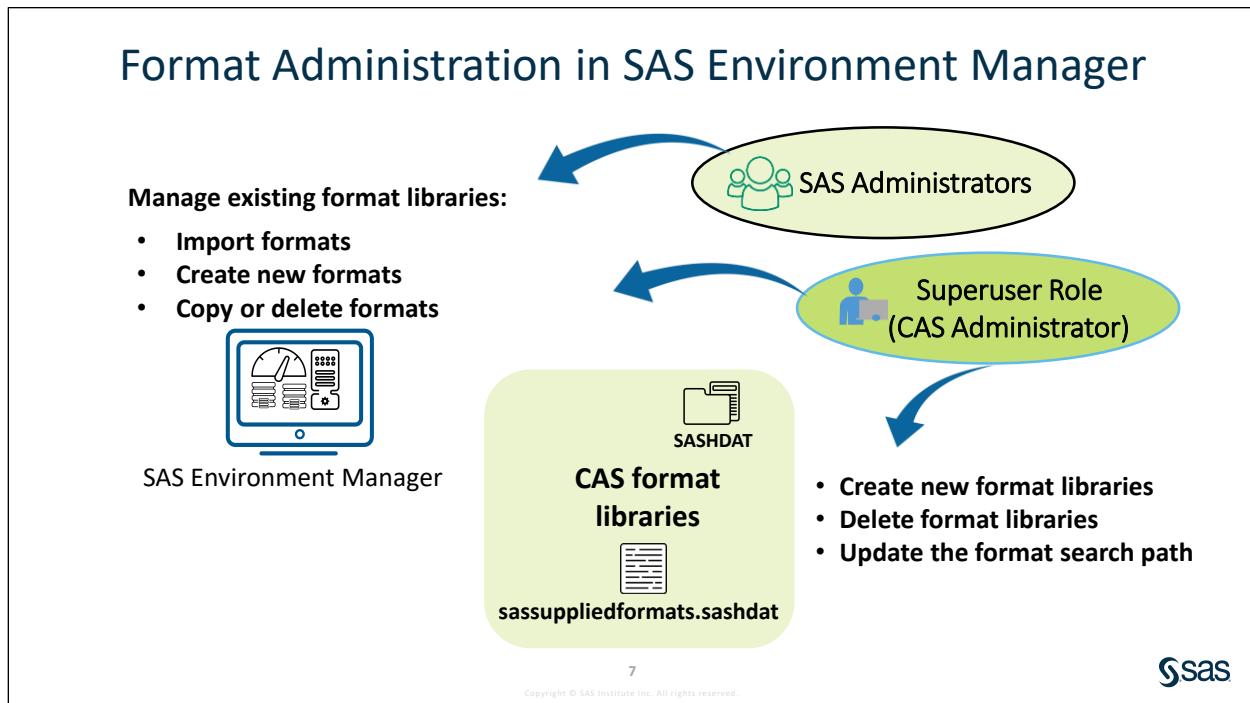
**Notes:**

- The casstartup.lua file is used to perform static, default deployment tasks as the CAS server starts.
- The casstartup.lua file is processed as a Lua client session into the CAS server.



Notes:

- For SAS 9.4 format catalogs, the file must be accessible from the machine that runs the compute service, and because the execution of that file occurs on the compute server, this requires that you have a host account defined on the compute server. Also, the file must be UTF-8 encoded in order to import.
- For all users to access a CAS format library, it must be promoted to a global format library in a global caslib.
- It is a best practice keep formats consistent between SAS and CAS.
- You can use the CLI to manage user-defined formats.



CAS Server Format Configuration

```
-- Add User Defined Formats permanently and reloadable
.....
---- Additional user formats
s:sessionProp_addFmtLib (caslib='Formats',
    fmtLibName='hformats',
    name='hformats.sashdat',
    promote=true
)

----Create the new custom FmtSearch list, and order the format libraries
customFmtSearch = "hformats"

----Create the new global FmtSearch list and include the customFmtSearch at the begining of the fmtSearch list
newGlobalFmtSearch = (customFmtSearch .. ":" .. (casFmtSearch or ""))
--Set the new global FmtSearch list
s:configuration_setServOpt (fmtsearch=newGlobalFmtSearch)
```

casstartup_usermods.lua

SAS Environment Manager

CAS format libraries

SASHDAT

sassuppliedformats.sashdat

- Create new format libraries
- Delete format libraries
- Update the format search path

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sas



Managing User-Defined Formats in SAS Environment Manager

This demonstration illustrates how to manage user-defined formats in SAS Environment Manager.

1. In SAS Environment Manager, select **User-Defined Formats** from the side menu. (You must be logged in as a SAS Administrator to manage user-defined formats.)

The Format Filter pane displays the default format library called **SASSUPPLIEDFORMATS**, a special SASHDAT file. It contains five formats that are used with system tables, so do not remove or modify these formats.

Note: Session formats are not shown in the User-Defined Formats area.

Format	Format Library
\$obfsusr	SASSUPPLIEDFORMATS
\$shift2txt	SASSUPPLIEDFORMATS
\$shiftxt2id	SASSUPPLIEDFORMATS
shift	SASSUPPLIEDFORMATS
shifttxt	SASSUPPLIEDFORMATS

2. As a SAS administrator, you can import, add, and manage user-defined formats. Click **Add** .
3. Generally, your users would be creating formats through program code, but this interface enables you to create a format, either character or numeric, and save it to an existing format library. There is one default **sassuppliedformats** library that we can add to as an administrator.

Click **Cancel**.

New Format

Format library: SASSUPPLIEDFOR... Type: Character Current locale prefix: en_US

Name: \$

Save without locale

Range

Name	Value
No ranges are loaded.	

Save Cancel

4. Click **Import** .

You can import

- SASHDAT files
- a SAS item store that was created with the FMTC2ITM procedure
- SAS7BCAT files, which are SAS 9.4 formats.

Note: The source path must be in a location that the CAS server can access. It must also have the needed permissions to open and read the file.

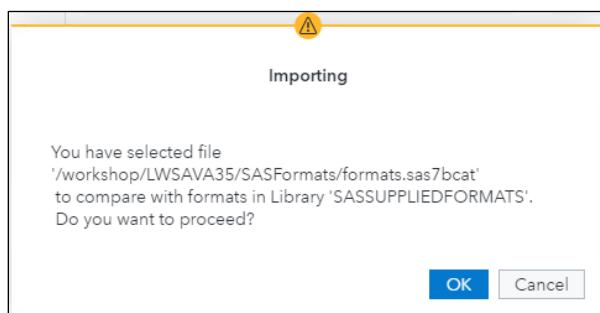
Note: A SAS7BCAT file must be UTF-8 encoded in order to import. Currently, you cannot import native encoded SAS7BCAT files. As an alternative, you can convert a SAS7BCAT file to a UTF-8 encoded SAS item store. You can use the ENCODING= option with the FMTC2ITM procedure.

5. Enter `/workshop/LWSAVA35/SASFormats/formats.sas7bcat` into **Source path** field.

Source path:	Target format library:
<code>/workshop/LWSAVA35/SASFormats/formats.sas7bcat</code>	SASSUPPLIEDFORMATS  

6. Click **Compare**.

7. Click **OK**.



8. We receive an error. Let's look at the log for the Compute service. Click **Close**.



9. In mRemoteNG, navigate to `/opt/sas/viya/config/var/log/compsrv/default`.

```
cd /opt/sas/viya/config/var/log/compsrv/default
```

10. Use gedit or vi to open the most recent program log.

```

ComputeServer_2019-06-10_server_99613.pgm.log
/opt/sas/viya/config/var/log/comparv/default

2019-06-10T16:19:27.642000-04:00|PGM|server|christine|99613|   cpu time      0.01 seconds
2019-06-10T16:19:27.642000-04:00|PGM|server|christine|99613|
2019-06-10T16:19:27.642000-04:00|PGM|server|christine|99613|
2019-06-10T16:19:27.643000-04:00|PGM|server|christine|99613|
2019-06-10T16:19:27.644000-04:00|PGM|server|christine|99613| NOTE: The infile MYLOG is:
2019-06-10T16:19:27.644000-04:00|PGM|server|christine|99613|   filename=/opt/sas/viya/config/var/tmp/compsrv/
2019-06-10T16:19:27.644000-04:00|PGM|server|christine|99613| default/3c23508b-8f70-4a71-941d-540b984d682d/SAS_workAAC30001851D_server.demo.sa
2019-06-10T16:19:27.644000-04:00|PGM|server|christine|99613|   s.com#/LN00006,
2019-06-10T16:19:27.644000-04:00|PGM|server|christine|99613|   Owner Name=christine,Group Name=users,
2019-06-10T16:19:27.644000-04:00|PGM|server|christine|99613|   Access Permission=rw-r--r-
2019-06-10T16:19:27.644000-04:00|PGM|server|christine|99613|   Last Modified=10Jun2019:16:19:27,
2019-06-10T16:19:27.644000-04:00|PGM|server|christine|99613|   File Size (bytes)=1122
2019-06-10T16:19:27.644000-04:00|PGM|server|christine|99613|
2019-06-10T16:19:27.645000-04:00|PGM|server|christine|99613| NOTE: PROCEDURE PRINTTO used (Total process time):
2019-06-10T16:19:27.645000-04:00|PGM|server|christine|99613|   real time      0.00 seconds
2019-06-10T16:19:27.645000-04:00|PGM|server|christine|99613|   cpu time      0.00 seconds
2019-06-10T16:19:27.645000-04:00|PGM|server|christine|99613|
2019-06-10T16:19:27.645000-04:00|PGM|server|christine|99613| ERROR: Data does not appear to be in the expected encoding
2019-06-10T16:19:27.645000-04:00|PGM|server|christine|99613| ERROR: Data does not appear to be in the expected encoding
2019-06-10T16:19:27.645000-04:00|PGM|server|christine|99613| ERROR: Data does not appear to be in the expected encoding
2019-06-10T16:19:27.645000-04:00|PGM|server|christine|99613|   [REDACTED] The SAS System
Monday, June 10, 2019 04:19:00 P
2019-06-10T16:19:27.645000-04:00|PGM|server|christine|99613| M
2019-06-10T16:19:27.645000-04:00|PGM|server|christine|99613| ERROR: Data does not appear to be in the expected encoding
2019-06-10T16:19:27.645000-04:00|PGM|server|christine|99613| ERROR: Data does not appear to be in the expected encoding

```

The format catalog is not in the UTF-8 encoding that is necessary for the CAS server.

In the practice, you will create a format with the correct encoding and import the catalog into a new format library that you create.

End of Demonstration



Practice

1. **Creating a New Format Library and Importing SAS 9.4 Formats in SAS Environment Manager**
 - a. Log on to SAS Studio (Enterprise) as **christine** with the password **Student1**.
 - b. Expand **Server Files and Folders** on the left side. Expand **Files (/)** ⇒ **workshop** ⇒ **LWSAVA35** ⇒ **UTF8_SASFormats**.
 - c. Double-click **create_utf8_formats.sas** to bring the program into the editor window.

```

Run Cancel Copy to My Snippets Debug
Code
1 libname fmtloc cvp "/workshop/LWSAVA35/SASFormats";
2 libname fmtloc2 "/workshop/LWSAVA35/UTF8_SASFormats";
3
4 proc format library=fmtloc2.formats cntlin=fmtloc.outfmts;
5 run;

```

- d. Click or click **F3** to run the program. Check the log for errors.
- e. In SAS Environment Manager, click the **User-Defined Formats** page.
- f. Creating format libraries requires that you assume the Superuser role. Click the icon.
- g. Click **New format library**
- h. Enter **workshopformats** for the format library name.
- i. Check the box next to **Create empty format library** and keep **Search order as Append**.

The dialog box has a blue header bar with the title "New Format Library". The main area contains the following fields:

- Format library name:** A text input field containing "workshopformats".
- Create empty format library:** A checked checkbox.
- Search order:** A dropdown menu set to "Append".

At the bottom right are "Save" and "Cancel" buttons.

Values for **Search order**:

- **Append** -- The new format library is appended to the existing format search order.
- **Prepend** -- The new format library is prepended to the existing format search order.
- **Replace** -- The new format library replaces the libraries that are listed in the existing format search order. **CAUTION:** The Replace option overwrites the existing format library search order and replaces it with this newly created format library.

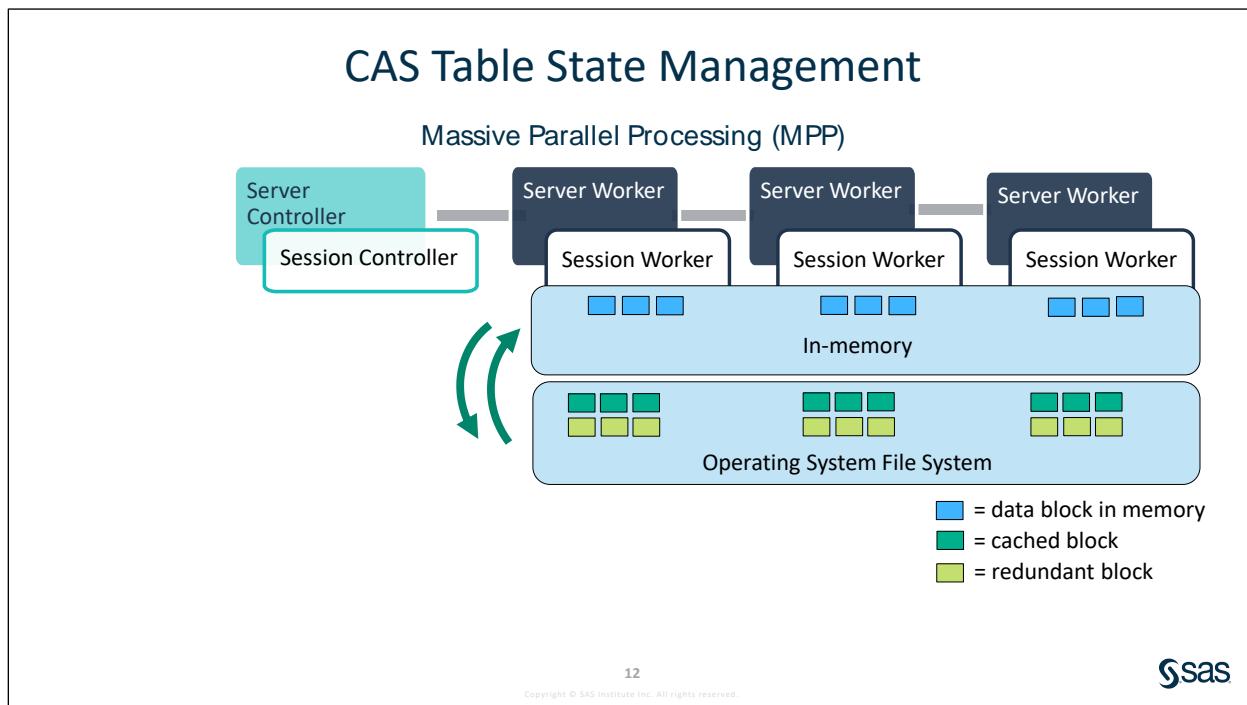
- None -- The new format library is not added to the existing format search order.
- j. Click **Save**.
 - k. Click **Format library search order**  to check the new search order.
 - l. Click **Cancel**.
 - m. Click **Import** .
 - n. Enter **/workshop/LWSAVA35/UTF8_SASFormats/formats.sas7bcat** for the source path.
Change the target format library to **WORKSHOPFORMATS** from the drop-down menu.

Source path:	Target format library:
/workshop/LWSAVA35/UTF8_SASFormats/formats.sas7bcat	WORKSHOPFORMATS ▾
Compare	

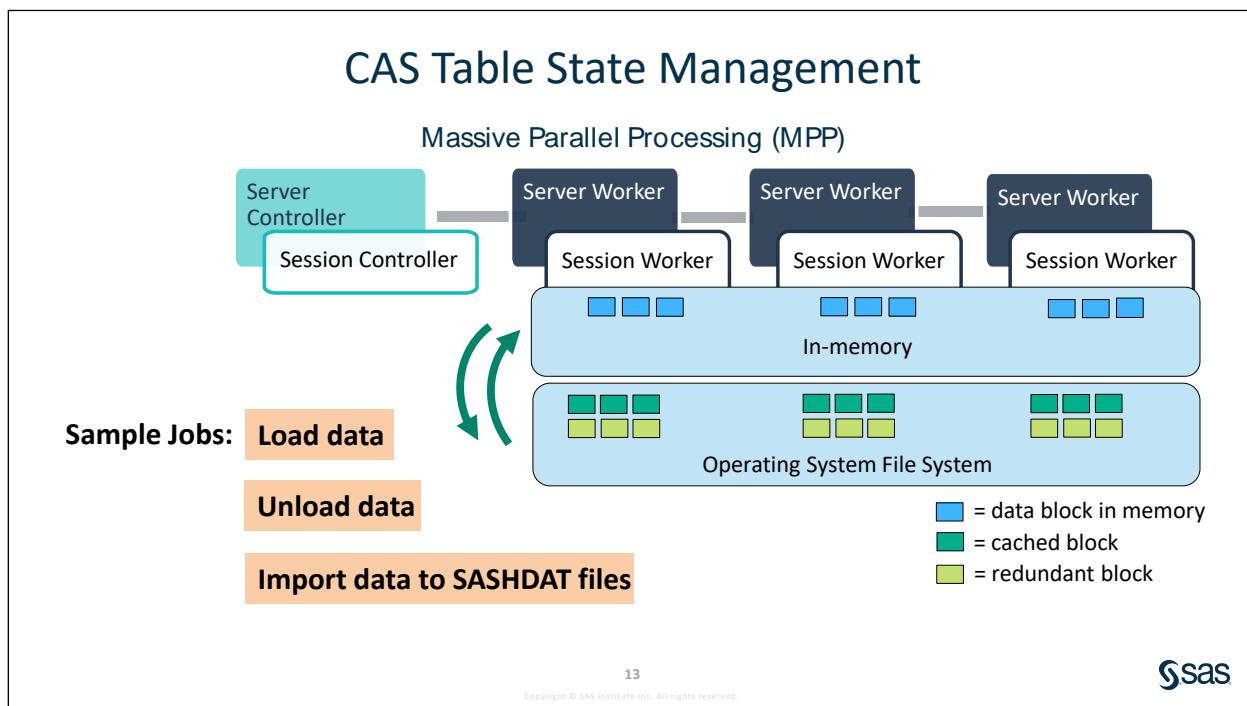
- o. Click **Compare**.
- p. Click **OK**.
- q. Check **Select all** box to import all of the formats.
- r. Click **Import**.

End of Practices

5.2 CAS Table State Management



CAS processes data in memory and it remains in-memory until it is dropped or the CAS server restarts.



For SAS Viya, there are three sample jobs that are provided by SAS for managing table state:

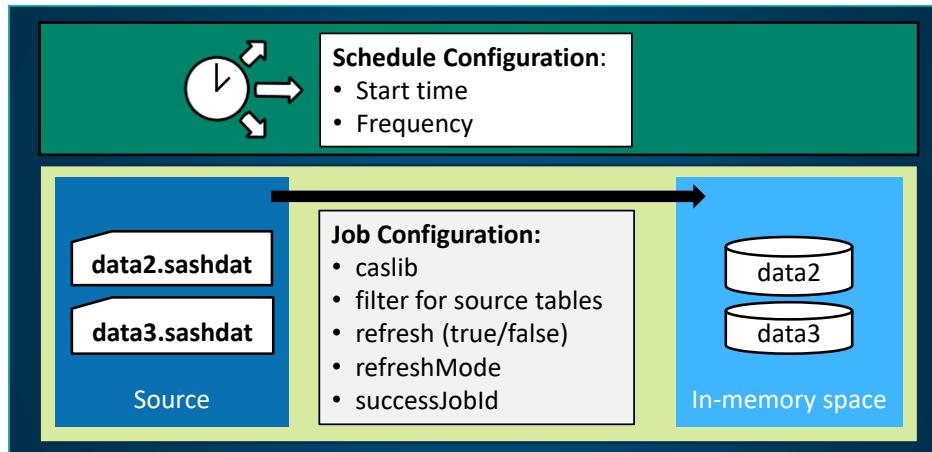
- **Sample: Import cas-shared-default Public data** demonstrates settings that import all CSV, SAS7BDAT, and Excel files in the Public caslib to SASHDAT files in the same caslib.
- **Sample: Load cas-shared-default Public data** demonstrates how to load all SASHDAT files found in the Public caslib.
- **Sample: Unload cas-shared-default Public data** demonstrates how to unload all loaded CAS tables in the Public caslib that have not been accessed within the past seven days

Note: CAS table state management jobs cannot be deleted. You can modify the job options only on copies of the jobs. If you schedule one of these jobs and then make a copy of the job, only the job is copied, not any triggers that are associated with the job.

Note: You can also implement data loading on CAS server start-up.

Job Scheduling	
Application	Types of Jobs
SAS Environment Manager: CAS Table State Management	Load, unload, and import data to SASHDAT files
SAS Data Explorer	Load individual tables to memory and save them
SAS Data Studio	Prepare and transform data
SAS Visual Analytics	Schedule the distribution of reports
SAS Job Execution	Create, manage, and execute SAS Viya program jobs

Sample: Load cas-shared-default Public Data



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Note: Jobs can be defined and scheduled in SAS Environment Manager, or via the scheduling command-line interface.



Exploring CAS Table State Management in SAS Environment Manager

This demonstration explores three sample jobs that can be copied and scheduled to run in SAS Environment Manager.

1. Log on to SAS Environment Manager as Christine. Select **Jobs** area \Rightarrow **Scheduling** tab.

The screenshot shows the 'Scheduling' tab of the 'Jobs' area in SAS Environment Manager. On the left, there is a 'Filter' sidebar with sections for Type (Flow, Job), Scheduler (Default SAS Job Flow Scheduler), Scheduled By (no filter), and Date Created. The main pane displays a table titled 'Jobs and Flows (7)' with columns for Name, Scheduled, and Description. The listed items are:

Name	Scheduled	Description
BINARY_BACKUP_SCHEDULE		This job is created by sas.deploymentBackup t...
DEFAULT_BACKUP_SCHEDULE		This job is created by sas.deploymentBackup t...
Demo Data Preparation Job Flow		
Demo Data Preparation Plan_Job_20201295638		
Sample: Import cas-shared-default Public data		Imports csv, sas7bdat, and excel files to sashdat...
Sample: Load cas-shared-default Public data		Loads data in cas-shared-defaultPublic
Sample: Unload cas-shared-default Public data		Unloads infrequently accessed data in cas-shar...

There are three sample jobs that are provided by SAS:

- Import cas-shared-default Public data: import all CSV, SAS7BDAT, and Excel files in the Public caslib to SASHDAT files in the same caslib
- Load cas-shared-default Public data: load all SASHDAT files found in the Public caslib
- Unload cas-shared-default Public data: unload all loaded CAS tables in the Public caslib that have not been accessed within the past seven days

The screenshot shows a detailed view of the 'Jobs' table under the 'Scheduling' tab. The table has columns for Name, Scheduled, Description, and Date Created. The data is identical to the previous screenshot, listing the three sample jobs: BINARY_BACKUP_SCHEDULE, DEFAULT_BACKUP_SCHEDULE, and Sample: Load cas-shared-default Public data.

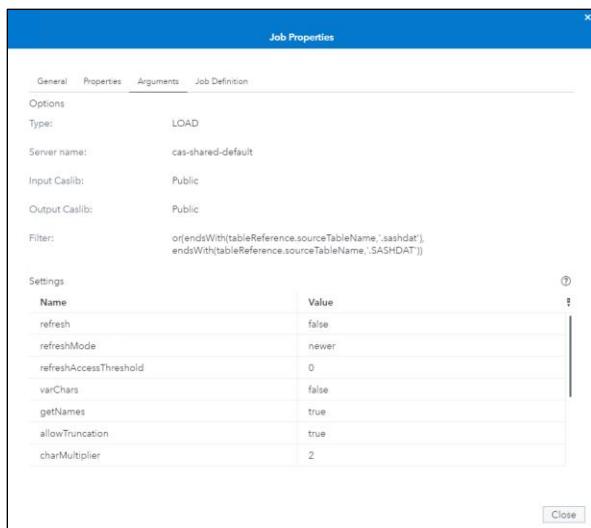
2. Highlight **Sample: Load cas-shared-default Public data** and select **Properties**

- Click the **Arguments** tab. This job performs a load operation on managed files or tables in the Public caslib. It then creates an in-memory CAS table of the same name in the Public caslib. For SAS Viya, only SASHDAT format files can be loaded. For CSV, SAS7BDAT, or Excel files, you must first import the files to SASHDAT format files.

This job enables you to preload tables for which there is a high user demand, or for scenarios where the amount of time needed to load the table is too long due to data size.

In the practice, you will copy this job and edit the new copied jobs.

Note: CAS table state management jobs cannot be deleted. You can modify the job options only on copies of the jobs. If you schedule one of these jobs and then make a copy of the job, only the job is copied. No triggers that are associated with the job are copied.



- Click **Close**.

End of Demonstration



Practice

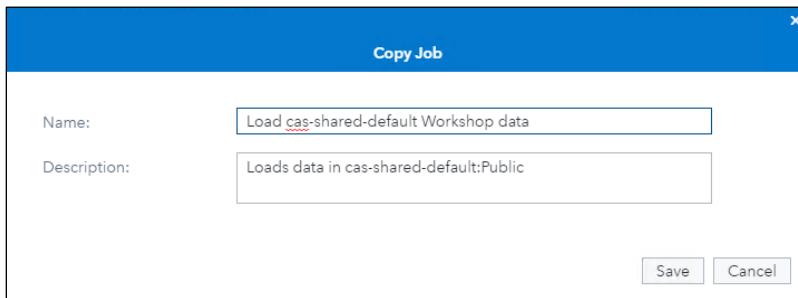
2. Automatically Refreshing the Data from a Caslib

In this practice, you create a new job that can be scheduled to refresh the data.

- In SAS Environment Manager, select **Jobs and Flows** from the side menu.
- Click the **Scheduling** tab.
- Right-click **Sample: Load cas-shared-default Public data** and select **Copy**. (You can also highlight the job and click **Copy** from the toolbar.)
- In the dialog box, enter the following:

Name: Load cas-shared-default Workshop data

Description: Loads data in cas-shared-default:Workshop



- Click **Save**.
- Right-click **Load cas-shared-default Workshop data** and select **Properties**. (You can also highlight the job and click **Properties** from the toolbar.)
- Click the **Arguments** tab ⇒ **Edit**.

Note: If you did not create the Workshop caslib from a previous practice, run the following script to create it:

```
/workshop/LWSAVA35/addcaslibs.sh
```

- Modify the following fields:

InputCaslib: Workshop

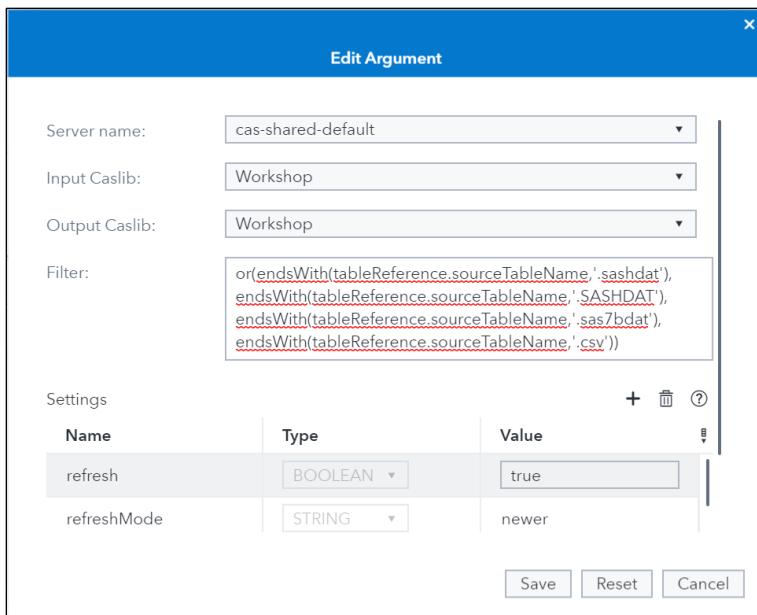
OutputCaslib: Workshop

Filter: filter to include **SAS7BDAT** and **CSV**. Copy the following code:

```
or(endsWith(tableReference.sourceTableName, '.sashdat'),
endsWith(tableReference.sourceTableName, '.SASHDAT'),
endsWith(tableReference.sourceTableName, '.sas7bdat'),
endsWith(tableReference.sourceTableName, '.csv'))
```

refresh: true

refreshMode: newer



- i. Click **Save** and click **Close**.
- j. Test the new job. Right-click the new job and select **Execute**.
- k. Click the **Monitoring** tab.
- l. In the job monitor, check the status of the job and click on the download link under **Log** to view the log.
- m. Select **Data** area from the side menu \Rightarrow **Data Sources** tab.
- n. Expand **cas-shared-default** \Rightarrow **Workshop** caslib. Verify that the tables are loaded.

Note: You might need to click **Refresh** .

- o. Select **Jobs** from the side menu and click the **Scheduling** tab to schedule the job that periodically refreshes the data.
- p. Right-click **Load cas-shared-default Workshop data** and select **Schedule**.
- q. Select the plus sign (+) to add a new trigger.

In the trigger definition, enter the following information:

- Name: **Refresh sales every 15 minutes**
- Frequency: **Minutes**
- Every: **15**
- Start time: *<Choose a time in the near future.>*
- Time zone: *<Choose the time zone that you are in.>*
- Start date: *<Use today's date.>*
- End: **Never**

New Trigger

Name: * Refresh sales every 15 minutes

Frequency: Minutes

Every: 15 minutes

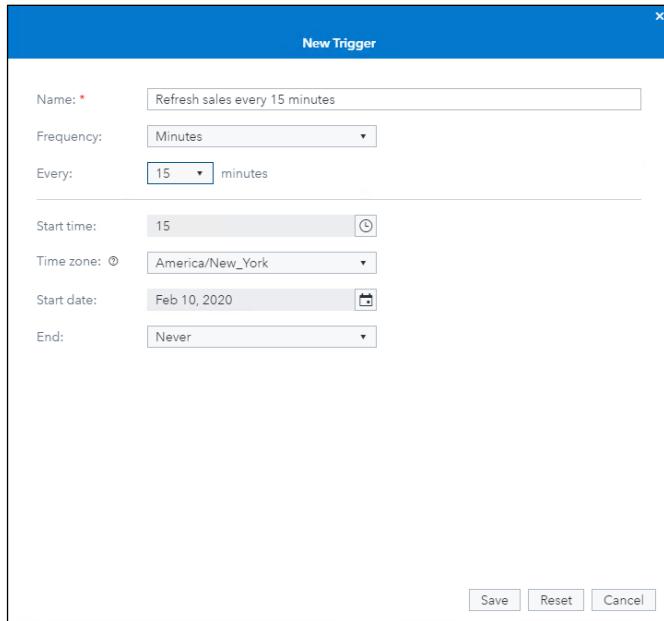
Start time: 15

Time zone: America/New_York

Start date: Feb 10, 2020

End: Never

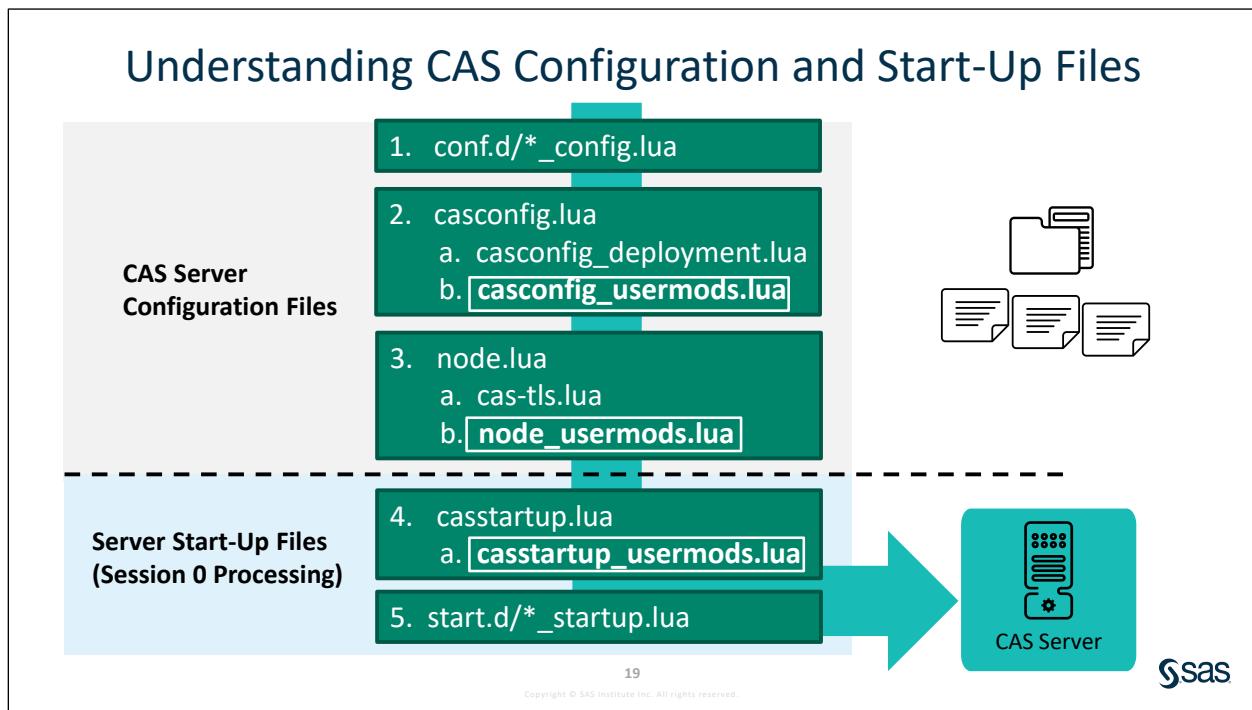
Save Reset Cancel



- r. Click **Save**.
- s. Click **Save** again.

End of Practices

5.3 CAS Server Start-Up Options



When the CAS server starts, configuration files are processed. After the configuration is complete, the server runs start-up scripts. You might need to customize your server deployment with CAS server options and environment variables, which should always be done in the usermods files.

.d directories:

conf.d: Similar to the casconfig.lua file, contains files to configure CAS server options required by SAS solutions. These files should not be modified.

start.d: Similar to the casstartup.lua file, contains files to perform CAS start-up actions required by SAS solutions. These files should not be modified.

They will be processed in alphabetic order.

node files on CAS worker node host machines:

node.lua: Contains host-specific configuration. One possible use is for a security setup that relies on the host name.

node_usermods.lua: contains host-specific custom CAS options set by the SAS administrator (CAS options or environment variables).

Configuration File Options

Editing casconfig_usermods.lua

Example:

- CAS server machines have more cores than permitted by license
- Need to split license between multiple CAS servers

You can specify the total number of physical cores available to the CAS server:
cas.MAXCORES='number-of-cores'

cas.CPUSHARES='number'

cas.LOGCFGLOC='path'

cas.TIMEOUT=seconds

cas.PERMSTORE= 'path'

cas.DATASTEPREPLACETABLE=true | false

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Note: For sites that use Ansible, it is recommended that you make your CAS server configuration changes to vars.yml and rerun Ansible to apply these changes.

Enabling Performance Metrics

Editing casconfig_usermods.lua

Example:

To debug or monitor all CAS actions in a program log, enable CAS metrics.

Permanently:

- **cas.METRICS= true|false**
set in the **casconfig_usermods.lua** file
- starting the CAS server with or without the **-metrics** option on the startup command line

cas.METRICS= true|false

Performance metrics for each CAS action will be displayed in the log.

Temporarily when setting the metrics option programmatically:

```
proc cas;
  setsessopt /
  metrics=<true|false>;
run;
```

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Performance Metrics Details

Server Metric Name	Client Metric Name	Description
real time	<ul style="list-style-type: none"> ❖ elapsedTime ❖ cpuUserTime ❖ cpuSystemTime 	<ul style="list-style-type: none"> ➤ The number of seconds in actual time required to run the action. ➤ The total number of seconds taken by the action in user mode across all cores that were used to run the action. ➤ The total number of seconds taken by the action in system mode across all cores that were used to run the action.
CPU time		<p>CPU time is measured and displayed in these formats:</p> <ul style="list-style-type: none"> • cpuUserTime + cpuSystemTime, displayed in seconds • (cpuUserTime + cpuSystemTime) / elapsedTime, displayed as a percentage
total nodes	<ul style="list-style-type: none"> ❖ systemNodes ❖ systemCores 	<ul style="list-style-type: none"> ➤ The number of nodes in the cluster (total nodes displays systemNodes + systemCores). ➤ The number of cores in the cluster (total nodes displays systemNodes + systemCores).
total memory	systemTotalMemory	The total memory available to the system. Total memory is displayed in gigabytes, and systemTotalMemory is displayed in bytes.
memory	<ul style="list-style-type: none"> ❖ memory ❖ memoryOS ❖ contextVoluntary ❖ contextInvoluntary ❖ memoryQuota ❖ dataMovementTime ❖ dataMovementBytes 	<ul style="list-style-type: none"> ➤ Memory used to execute the action. ➤ Operating system used by the action. ➤ The number of times a context switch occurred because a process relinquished its processor before its time slice had been completely used. ➤ The number of times a context switch occurred because a higher priority process was present or because the current process exceeded its time slice. ➤ The memory quota used by the action. ➤ The amount of time, in seconds, taken by the data that moved between the memory and the processors. ➤ The number of bytes of data that moved between the memory and the processors.

Server Start-Up Files (Session 0 Processing)

Editing casstartup_usermods.lua

Pre-load large tables to memory:

- For large files (to prevent penalizing initial user)
- If report creators are not allowed to load data (only loaded tables are available for selection when creating reports)
- If data loading options need to be specified such as:
 - Compress
 - Partitioning

Example Lua code to load a table:

```
s:table_loadTable{  
  caslib="sales",  
  path="salesHistory.sashdat",  
  promote=true,  
  casout={name="sales"}}
```

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After the configuration is complete, the server runs start-up scripts. The start-up scripts run before the server accepts any client connections. This is also referred to as *session-zero processing*.

6.01 Short Answer Question

What other administrative task have we seen that can be done by adding Lua code to the **casstartup_usermods.lua** file?

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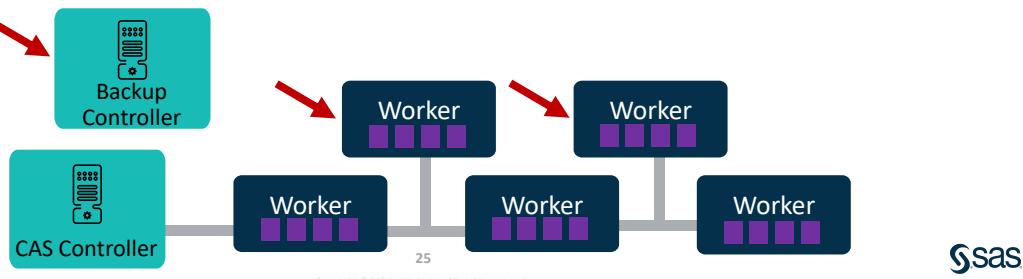


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Adding Backup Controller and Worker Nodes

CAS Distributed Environment

- Have license
- Same shared file system / users' home directories if CASHostAccountRequired group is implemented
- Use latest mirror repository
- CAS user account (cas) and group (sas) set up
- Passwordless SSH
- Use correct playbook: inventory.ini, vars.yml, site.yml

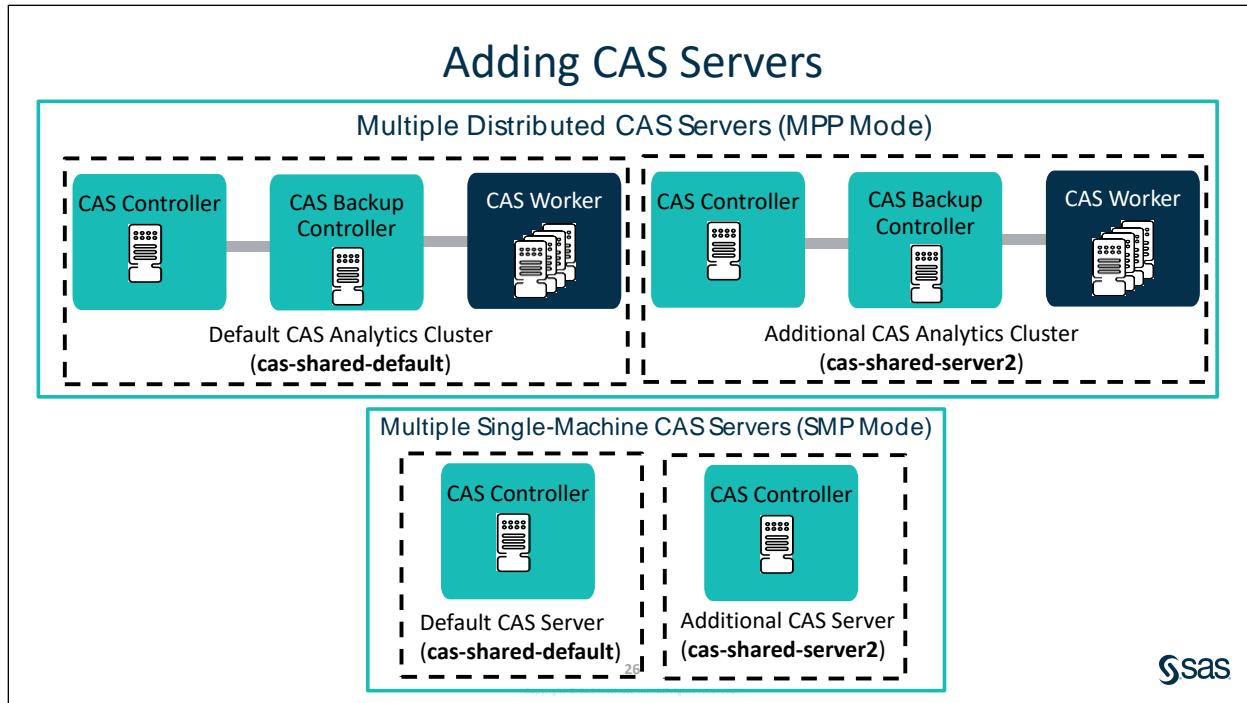


A CAS backup controller provides fault tolerance for the CAS controller. A backup controller is used only in a distributed server architecture and is optional. You can add the backup controller at any time if not done at initial deployment.

When CAS starts, the backup controller process is also started. In the event that the controller experiences a disruption, such as a loss of network connectivity or disk full scenarios, the backup controller enables the CAS server to continue running. When the backup controller takes control of client communication, the transfer is seamless.

Note: CAS supports one backup controller only.

You can also add more worker nodes if more in-memory space is needed, or if more processing power is required.

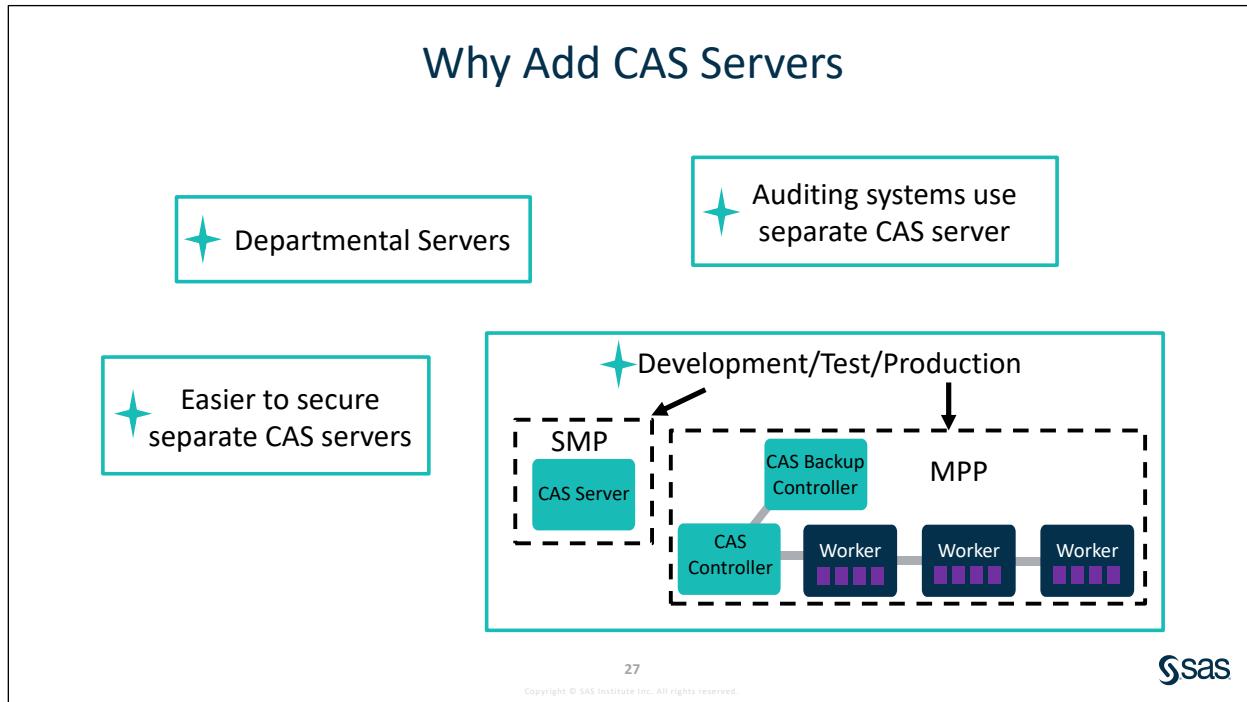


It is possible to have multiple instances of CAS servers within a single instance of SAS Viya.

Requirements

- You can add a CAS server to a machine that does not already host existing SAS Viya software.
- CAS servers that are added to a SAS Viya deployment cannot be removed, without removing your entire SAS Viya deployment.
- A multi-tenant environment does not support multiple CAS servers per tenant. (Each tenant has exclusive access to a single CAS Server.)
- In SAS Viya environments that have more than one CAS server, the default CAS server (typically, cas-shared-default) must be running. The default CAS server needs to be running even if a customer is using another CAS server, so that certain caslibs such as AppData, ReferenceData, and SystemData can be accessed from the default CAS server. (These caslibs contain data needed by applications such as SAS Visual Analytics, which depends on AppData for map data.) The default CAS server is defined in the `sas.casmanagement.global.casServer` configuration property.
- Make sure that you are licensed for the additional CAS servers that you are planning to add. When properly set, the CAS server option `cas.MAXCORES` specifies the limit for the total number of physical cores that are available to a CAS server.
- Your SAS Viya deployment must be a Linux deployment. Multiple CAS servers are not supported on Windows environments.
- You are limited to one CAS controller or one CAS backup controller per machine.
- If you are adding a distributed CAS server that contains a backup controller, make sure that the backup controller and the CAS controller (the primary controller) both use the same shared file system.
- Every machine on which you are installing a CAS server must contain the CAS user account (cas) and group (sas).

- For programming-only deployments and visual deployments that use the CASHostAccountRequired custom group, there is an additional requirement for users' home directories. In these two cases, a user's Casuser caslib is mapped to ~/casuser. Therefore, the home directories (\$HOME) for all CAS users must be shared so that they can be accessed from both the controller and the backup controller machines. Sharing users' home directories ensures that the path for the CASUSER library is available during CAS session start-up. For most other CAS session scenarios, the CASUSER library is set to a path in the shared file system.





Exploring gridmon.sh to Monitor CAS Server

gridmon.sh is a console or terminal application that can be run from a Linux terminal or a terminal emulator like PuTTY.

Note: gridmon.sh is supported only on Linux platforms.

1. In mRemoteNG, use Christine's session. To start gridmon.sh, run the following command:

```
sudo /opt/sas/viya/home/SASFoundation/utilities/bin/gridmon.sh
```

Note: You must log on to the CAS controller machine as a user with passwordless ssh access to all CAS nodes. The user also needs sudo privileges on all CAS nodes to run Grid Monitor commands that require root access, such as viewing process limits and killing jobs.

2. gridmon.sh displays data streamed from all the machines on your CAS server showing information about jobs, individual machines on the server, and attached disks.

UserName	Job	ID	SessId	%CPU	Memory	Time	Ranks	Port	Active	Pending	Completed	Owned Disk	Shared Disk
cas	cas	19143		0	1.9G	7d 2:56	1	5570	12		50090	4.0G	752.7M
cas(sas.planning)	cas	19143	38	0	1.0G	7d 2:31	1			setSessOpt(100%)	3	0.0	0.0
cas(christine)	cas	19143	49490	0	1.5G	2:00	1			echo(100%)	64	0.0	0.0
cas(christine)	cas	19143	49501	0	1.1G	1:59	1			groupBy(100%)	5	0.0	0.0
cas(christine)	cas	19143	49520	0	1.4G	1:59	1			valueCount(100%)	8	0.0	0.0
cas(sas.reportImag..)	cas	19143	49934	0	996.3M	0:35	1			tableInfo(100%)	8	0.0	0.0
cas(lynn)	cas	19143	49936	0	1.0G	0:34	1			tableInfo(100%)	22	0.0	0.0
cas(lynn)	cas	19143	49942	0	1.7G	0:34	1			groupBy(100%)	10	0.0	711.6M
cas(sas.SASVisualA..)	cas	19143	50027	0	958.4M	0:16	1			listSessio(100%)	5	0.0	0.0
cas(sas.modelRepos..)	cas	19143	50028	0	958.4M	0:16	1			listSessio(100%)	5	0.0	0.0
cas(sas.planning)	cas	19143	50029	0	965.9M	0:15	1			listSessio(100%)	5	0.0	0.0
christine(christin..)	cas	19143	50017	0	992.0M	0:20	1			setsessopt(100%)	6	0.0	0.0
christine(christin..)	cas	19143	50076	0	1.7G	0:06	1			addtable(100%)	7	675.1M	0.0
christine	sas	89608		0	1.9G	0:08	1						
christine	sas	89741		0	1.8G	0:08	1						
root	tkemon	50380		0	644.1M	1d 6:20	1						

Note: Shared Disk consists of the sum of HDFSSize, DNFSSize, and Global FSSize across all ranks. Owned Disk is the sum of disk space in CAS_DISK_CACHE across all CAS worker nodes.

By default, gridmon.sh runs in job mode. In job mode, there are two menus. The **show ranks** menu is displayed. gridmon.sh enables you to kill a job.

```
cas(christ+-----+
cas(christ|  Show Ranks
root   |  Kill Job
      |  Kill Jobs with user: cas
      |  Kill Jobs with user: cas ID: 19143
      |  Kill Jobs at least this old
      |  Stack Trace all Ranks
```

3. Type ? to show Help information for gridmon.sh.

```

Job Mode 'j'
Up/Down arrows and Page Up/ Page Down moves through the list of jobs.
Right/Left arrows changes the column for sorting the list.
'h' key moves to top of list.
Enter shows menu options for the selected job.
Show Ranks choice moves to Ranks sub-mode.
Arrow keys moves through list.
Enters shows menu option for selected process.
Show Details moves to Details sub-mode.
Arrow keys move details window to next/previous machine.
(Xterm, Perf Top, and Attach Debugger require an open X Server)

Machine Mode 'm'
Up/Down arrows and Page Up/ Page Down moves through the list of jobs.
Enter shows menu options for the selected machine.
(Xterm, and Perf Top require an open X Server)

Disk Mode 'd'
Up/Down arrows and Page Up/ Page Down moves through the list of jobs.
Enter shows selected disk use on machines where the disk is present.

Backspace or Escape cancels current menu, prompt, or sub-mode.
Use 'q' to exit.

Menu options that can produce lengthy results redirect the output
to a vi editor. Closing vi returns to gridmon.

In playback mode, 2 doubles playback speed up to 32x, 1 sets to normal speed, 0 to pause.
The '--' key pauses playback and rewinds 5 cycles.

```

4. To run in machine mode, enter **m**.

Hostname	%CPU	Free Mem	Total Mem	Net Read	Net Write
server	162	45.5G	119.8G	1.7K	3.4K

5. Click Enter to show menu options for the selected machine.

Hostname	%CPU	Free Mem	Total Mem	Net Read	Net Write
server	44.9G	119.8G	1.4K	779.0	
Details					
Top					
Xterm					
Perf Top					

6. To run in disk mode, enter **d**.

Filesystem	Size	Used	Available	Use%
/ (/dev/xvda3)	299.0G	279.8G	19.2G	94%
/dev (devtmpfs)	59.9G	0.0	59.9G	0%
/dev/shm (tmpfs)	59.9G	80.0K	59.9G	0%
/run (tmpfs)	59.9G	58.8M	59.9G	0%
/sys/fs/cgroup (tmpfs)	59.9G	0.0	59.9G	0%
/boot (/dev/xvdal)	246.7M	113.7M	133.0M	46%
/run/user/1001 (tmpfs)	12.0G	4.0K	12.0G	0%
/run/user/2276 (tmpfs)	12.0G	0.0	12.0G	0%
/run/user/0 (tmpfs)	12.0G	0.0	12.0G	0%
/run/user/2380 (tmpfs)	12.0G	0.0	12.0G	0%

7. Enter **j** to go back to job mode. Select **Enter** ⇒ **Show Ranks** ⇒ **Enter**.

```
cas: cas 19143 Port: 5570 HTTP Port: 443 Active: 11 Completed: 50186
+-----+
| Show Details |
| Kill Rank    |
| Stack Trace  |
| Process Limits|
| FileHandle Count|
| FileHandle List|
| Environment   |
| List Memory Maps|
| Numa Stats    |
| Show CGroups  |
| Xterm         |
| Perf Top      |
| Attach Debugger|
+-----+
```

For **gridmon.sh** commands, see “SAS Cloud Analytic Services: Reference” on the Extended Learning Page.

Show Details Menu Commands	
Command	Description
Show Details	Shows process ID, CPU use, virtual memory, and if not zero, the following fields: <ul style="list-style-type: none">• DFSSize: Disk space in <code>CAS_DISK_CACHE</code> owned by the current process.• HDFSSize: Disk space mapped from HDFS.• DNFSsize: Disk space mapped from DNFS.• Global FSSize: Disk space in <code>CAS_DISK_CACHE</code> for global tables, owned by the main server process.• CGroup Limit: Size of memory cgroup, as specified by <code>cas.MEMORYSIZE</code>.• CGroup Usage: Amount of the CGroup memory that is in use by all processes belonging to this server on the current machine.• Faults/s: The number of page faults per second for the process, most commonly caused by paging in table data. (Faults can help you determine whether the process is paging.)
Kill Rank	Kills the selected rank or process.
Stack Trace	Runs the gstack application on all processes in this job and collects results. gstack displays its results in your vi editor.
Process Limits	Displays the contents of <code>/proc/pid/limits</code> .
FileHandle Count	Counts the files owned by the process.
FileHandle List	Lists the files owned by the process.
Environment	Displays the process's environment handles from <code>/proc/pid/environ</code> .
List Memory Maps	Shows the process's memory maps from <code>/proc/pid/maps</code> .
Numa Stats	Shows the output from the Linux numastat command for this process.
Show CGroups	Shows the Linux cgroups that this process belongs to.
Xterm 1	Starts an Xterm on the selected machine.
Perf Top 1	Runs the perf top application on this process in a new Xterm window. Note: The perf package must be installed.
Attach Debugger 1	Attaches a debugger to the running process. Requires a new X window. Note: Attach Debugger is for use only when directed by SAS Technical Support or by SAS R&D.
1 Requires that an X Server be running on the CAS controller machine.	

8. Enter **q** to exit. (Backspace or Escape cancels current menu, prompt, or sub-mode).

End of Demonstration



Practice

3. Viewing CAS Start-Up Options and Environment Variables in SAS Environment Manager

You can view environment variable and command-line option values used to run a CAS server.

a. In SAS Environment Manager, select the **Servers** area.

b. Select **cas-shared-default** and on the right side, click **System Metrics** .

The System Metrics area displays these metrics for the selected server:

- Active sessions
- Date and time that the last session was created or destroyed
- Number of sessions created
- Server uptime
- User CPU time
- System CPU time
- Number of I/O operations performed
- Number of active threads compared to the maximum number of threads
- Amount of memory used
- Maximum amount of memory used
- Virtual machine size

c. Right-click **cas-shared-default** and select **Configuration**.

d. Select the **Nodes** tab. CAS start-up options and environment variables are displayed. This is coming from CAS configuration files.

What is the value for **CAS_DISK_CACHE**?

e. To return to the Servers area, click  in the top left corner of the window.

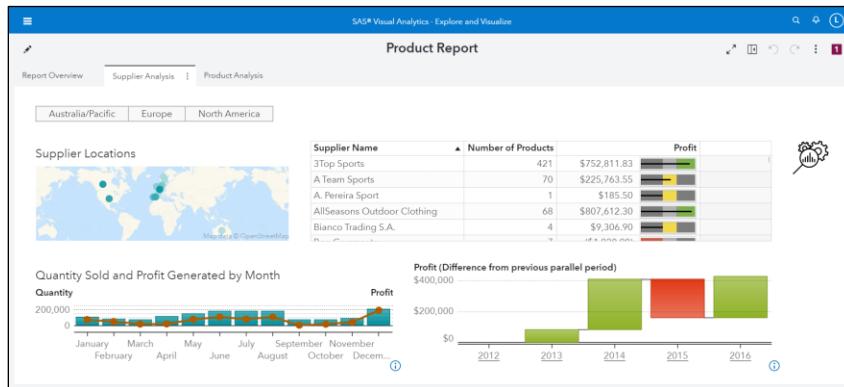
4. Using the gridmon.sh Terminal Application to Monitor CAS Server Jobs

a. Start CAS sessions.

- 1) In a web browser, open **SAS Drive**. Log on as **lynn** with the password **Student1**.

Open the **Product Report** from **SAS Content** \Rightarrow **Orion Star** \Rightarrow **Marketing**. (Double-click **Product Report** to open it.)

Be sure to move to different tabs in the report.



- 2) In a new browser window, log on to SASStudio Basic as **eric** with the password **Student1**.

Expand **Server Files and Folders** \Rightarrow **Files (/)** \Rightarrow **workshop** \Rightarrow **LWSAVA35**.

Double-click **create_large_table.sas** to bring the program into a code editor window.

Notice that the **metrics=true** option has been added to the CAS statement.

```

Run Cancel Copy to My Snippets Debug
Code
1 /* Create a dummy dataset that is large */
2 data junk;
3   do i=1 to 30000000; /*30 million*/
4     j=i/i;
5     k=i/j;
6     output;
7   end;
8 run;
9
10 /* Create a new CAS session */
11
12 cas mySession sessopts=(caslib=casuser timeout=1800 locale="en_US" metrics=true);
13
14 /* copy the dataset into the default caslib, so that it becomes a table in memory */
15 proc casutil;
16   load data=work.junk outcaslib="casuser" casout="CASJunkTable" replace;
17 run;

```

Run the program.

Check the log for errors and review the system metrics used per action.

```

93  cas mySession sessopts=(caslib=casuser timeout=1800 locale="en_US" metrics=true);
NOTE: The session MYSESSION connected successfully to Cloud Analytic Services server.demo.sas.com using port 5570. The UUID is
      9f58837a-5e96-9645-a252-5005dee57c51. The user is eric and the active caslib is CASUSER(eric).
NOTE: The SAS option SESSREF was updated with the value MYSESSION.
NOTE: The SAS macro _SESSREF_ was updated with the value MYSESSION.
NOTE: The session is using 0 workers.
NOTE: 'CASUSER(eric)' is now the active caslib.
NOTE: Action 'sessionProp.setSessOpt' used (Total process time):
NOTE:    real time          0.002666 seconds
NOTE:    cpu time           0.002649 seconds (99.36%)
NOTE:    total nodes        1 (16 cores)
NOTE:    total memory       119.83G
NOTE:    memory             359.91K (0.00%)
NOTE: The CAS statement request to update one or more session options for session MYSESSION completed.
94
95  /* copy the dataset into the default caslib, so that it becomes a table in memory */
96  proc casutil;
NOTE: The UUID '9f58837a-5e96-9645-a252-5005dee57c51' is connected using session MYSESSION.
97
97 ! load data=work.junk outcaslib="casuser" casout="CASJunkTable" replace;
NOTE: Executing action 'table.addTable'.
NOTE: Action 'table.addTable' used (Total process time):
NOTE:    real time          2.831087 seconds
NOTE:    cpu time           2.836068 seconds (100.18%)
NOTE:    total nodes        1 (16 cores)
NOTE:    total memory       119.83G
NOTE:    memory             25.42M (0.02%)
NOTE: WORK.JUNK was successfully added to the "CASUSER(eric)" caslib as "CASJUNKTABLE".

```

- b.** View CAS sessions in SAS Environment Manager.
 - 1) In a new browser window, log on to SAS Environment Manager as **christine** with the password **Student1**.
 - 2) Select the **Servers** area. Right-click **cas-shared-default** and select **Assume the Superuser role**.
 - 3) Double-click **cas-shared-default** or right-click on the server and select **Configuration** to see CAS sessions of both Lynn and Eric.
- c.** To start gridmon.sh, run the following command in Christine's session of MRemoteNG:

```
sudo /opt/sas/viya/home/SASFoundation/utilities/bin/gridmon.sh
```

For gridmon.sh commands, see “SAS Cloud Analytic Services: Reference” on the Extended Learning page.

- 1) What job consumed the most memory?
- 2) Is any job using **Shared Disk?** (cas-disk-cache)?
- d.** For more detail:
 - 1) Click one of the job sessions and click **Show Ranks**.

```

cas(lynn) +-----+
cas(christ|   Show Ranks
cas(christ|   Kill Job
eric(eric)|   Kill Jobs with user: cas
eric(eric)|   Kill Jobs with user: cas ID: 84462
root      |   Kill Jobs at least this old
            |   Stack Trace all Ranks

```

- 2) Click **server** to show the menu and review options.

The screenshot shows two windows. The top window is a menu with a dashed border containing 14 items: Show Details, Kill Rank, Stack Trace, Process Limits, FileHandle Count, FileHandle List, Environment, List Memory Maps, Numa Stats, Show CGroups, Xterm, Perf Top, and Attach Debugger. The 'Show Details' option is highlighted with a black rectangle. The bottom window is titled 'Show Details Menu Commands' and lists the same 14 items with their descriptions. The 'Show Details' item's description includes details about disk space usage and memory limits.

Show Details Menu Commands	
Command	Description
Show Details	Shows process ID, CPU use, virtual memory, and if not zero, the following fields: <ul style="list-style-type: none">• DFSSize: Disk space in <code>CAS_DISK_CACHE</code> owned by the current process.• HDFSSize: Disk space mapped from HDFS.• DNFSsize: Disk space mapped from DNFS.• Global FSSize: Disk space in <code>CAS_DISK_CACHE</code> for global tables, owned by the main server process.• CGroup Limit: Size of memory cgroup, as specified by <code>cas.MEMORYSIZE</code>.• CGroup Usage: Amount of the CGroup memory that is in use by all processes belonging to this server on the current machine.• Faults/s: The number of page faults per second for the process, most commonly caused by paging in table data. (Faults can help you determine whether the process is paging.)
Kill Rank	Kills the selected rank or process.
Stack Trace	Runs the gstack application on all processes in this job and collects results. gstack displays its results in your vi editor.
Process Limits	Displays the contents of <code>/proc/pid/limits</code> .
FileHandle Count	Counts the files owned by the process.
FileHandle List	Lists the files owned by the process.
Environment	Displays the process's environment handles from <code>/proc/pid/environ</code> .
List Memory Maps	Shows the process's memory maps from <code>/proc/pid/maps</code> .
Numa Stats	Shows the output from the Linux numastat command for this process.
Show CGroups	Shows the Linux cgroups that this process belongs to.
Xterm 1	Starts an Xterm on the selected machine.
Perf Top 1	Runs the perf top application on this process in a new Xterm window. Note: The perf package must be installed.
Attach Debugger 1	Attaches a debugger to the running process. Requires a new X window. Note: Attach Debugger is for use only when directed by SAS Technical Support or by SAS R&D.
1 Requires that an X Server be running on the CAS controller machine.	

- 3) Click **Show Details**.
 4) Click **Backspace** twice on your keyboard to return to the jobs menu.
 e. To run in machine mode, enter **m**. Click Enter to show menu options for the selected machine.

The screenshot shows two tables. The top table is a summary of host resources for 'server': Hostname (server), %CPU (162), Free Mem (45.5G), Total Mem (119.8G), Net Read (1.7K), and Net Write (3.4K). The bottom table is a detailed view for 'server': Hostname (server), %CPU (44.9G), Free Mem (44.9G), Total Mem (119.8G), Net Read (1.4K), and Net Write (779.0). A submenu for 'server' is displayed in the bottom table, listing Options, Details, Top, Xterm, and Perf Top. The 'Details' option is highlighted with a black rectangle.

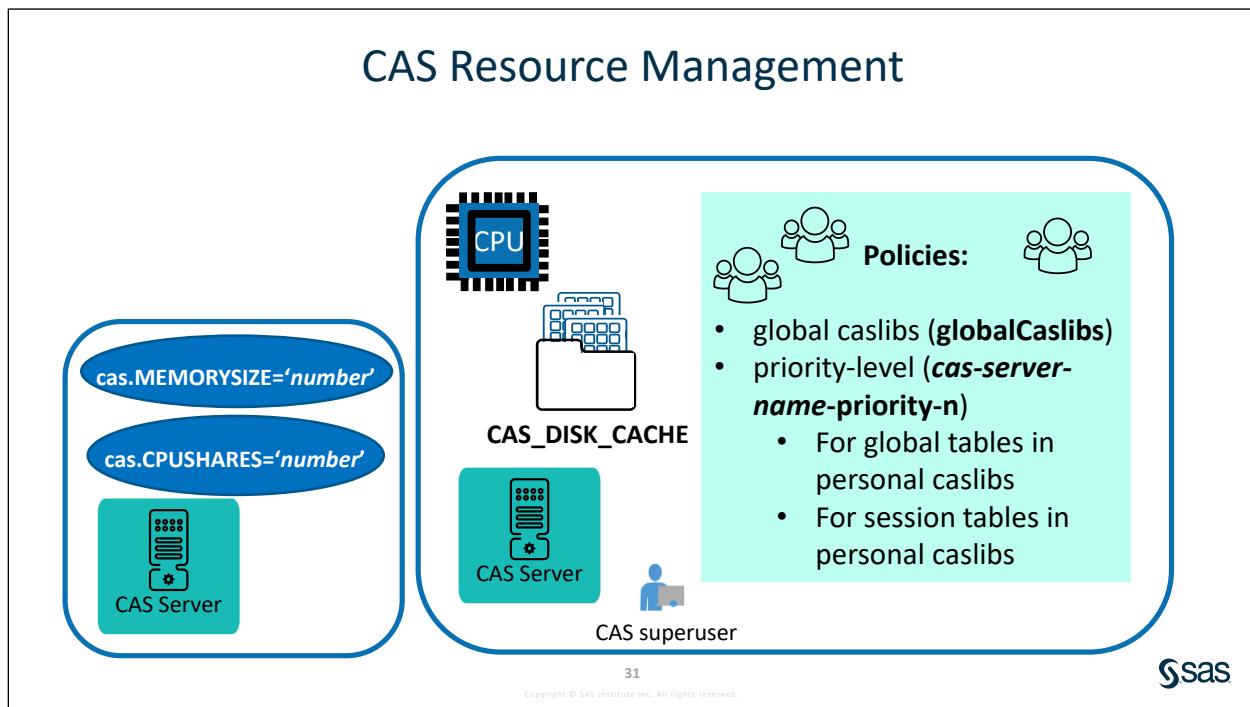
Hostname	%CPU	Free Mem	Total Mem	Net Read	Net Write
server	162	45.5G	119.8G	1.7K	3.4K

Hostname	%CPU	Free Mem	Total Mem	Net Read	Net Write
server	44.9G	44.9G	119.8G	1.4K	779.0

- f. Enter **q** to exit gridmon.sh.

End of Practices

5.4 CAS Resource Management



CAS has resource management capabilities that enable administrators to control CAS table size (disk cache) and CPU consumption. You can implement resource management broadly through the use of the `cas.MEMORYSIZE` and `cas.CPUSHARES` server configuration options, or more specifically through policies that you create with the SAS Viya CLI.

These policies will

- apply to all machines in a distributed CAS server
- be created with the **sas-admin** command
- be stored in the SAS Configuration Server
- be created and managed by CAS Superusers.

CAS Resource Management Policy Types

The diagram illustrates four policy types:

- global caslibs (`globalCaslibs`)**: One policy per CAS server that places a disk cache space quota on global caslibs.
- priority-level (`cas-server-name-priority-n`)**: A maximum of five policies per CAS server that place a disk cache space quota on personal caslibs and a CPU consumption limit on CAS sessions. Priority levels are numbered from 1 (highest) to 5 (lowest).
- priorityAssignments**: One policy per CAS server to force the priority level for specific users.
- CAS Server**: Represented by a server icon.

Icons include: CPU (microchip), CAS_DISK_CACHE (disk with bars), Linux cgroups (two people), and priorityAssignments (three people).

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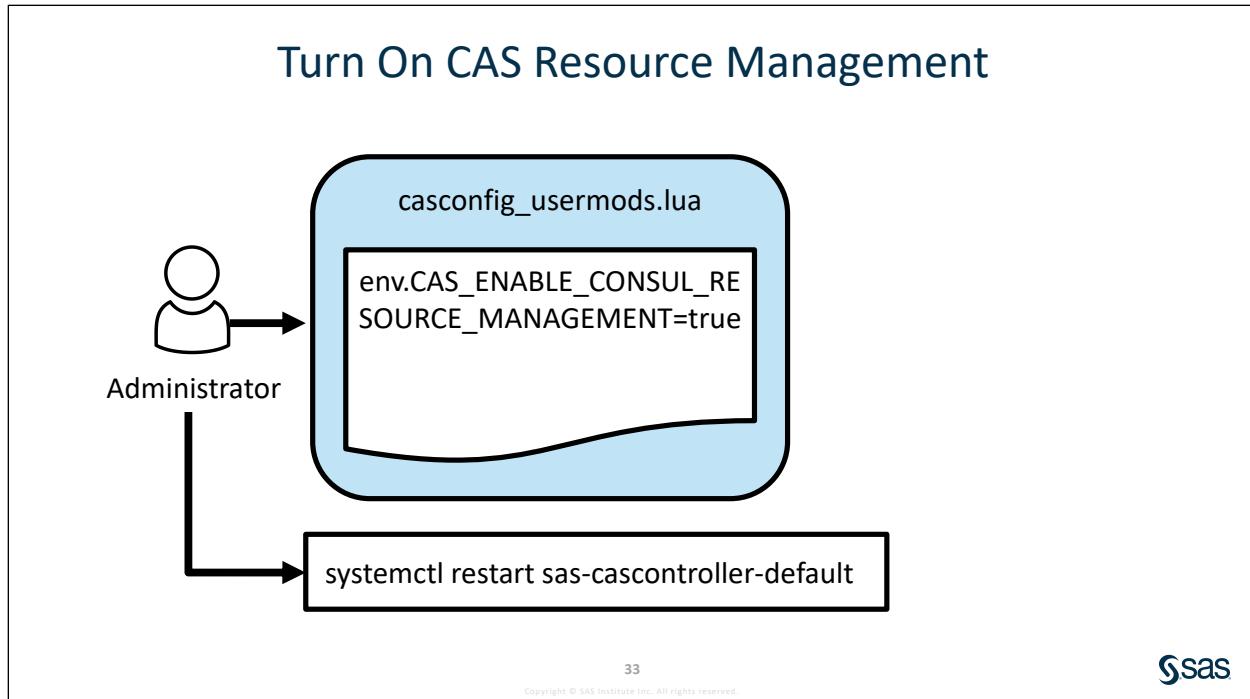
Sas

CAS provides one policy for global caslibs and up to five priority-level policies to which you can assign resources. The administrator can assign users to these priority-level policies based on their identity group memberships, or they can explicitly assign priority-level policies to individual users.

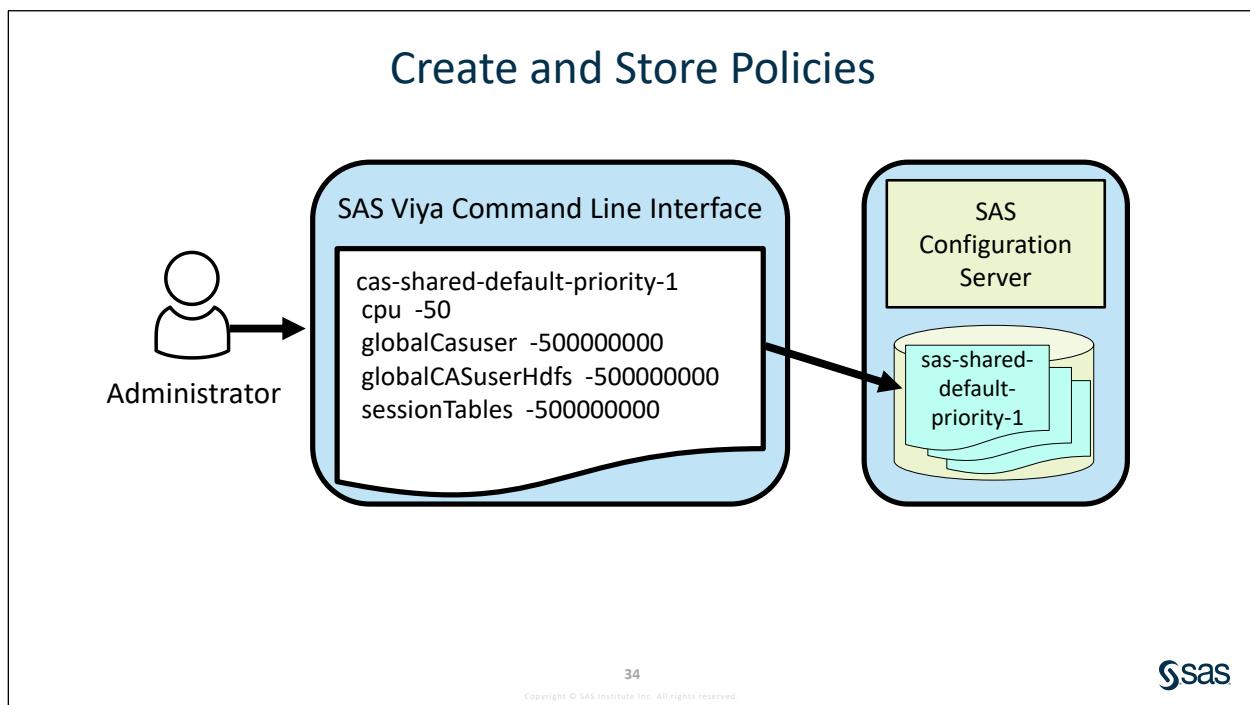
If policies are defined, a CAS server reads its policy information directly from the configuration server. For each priority-level policy it finds that contains a CPU consumption value, CAS creates a corresponding Linux cgroup. These cgroups are created at CAS server start-up, and destroyed when the CAS server is shut down.

Notes:

- CAS relies on the Linux kernel feature of cgroups to provide the CPU and memory consumption control. You must implement cgroups before you can fully use CAS resource management.
- CAS resource management use of CPU shares from SAS Configuration Server applies only on Linux. But CAS resource management use of quotas is applicable on both Linux and Windows.
- It is supported for distributed (MPP) and non-distributed (SMP) CAS servers.
- It is turned off by default.
- CAS resource management is achieved on the CAS server, with a policy or server option that applies to a specific server. If you have additional CAS servers on which you want to manage resources, then you must create a unique policy or server option definition for each. No steps need to be performed on the client side.



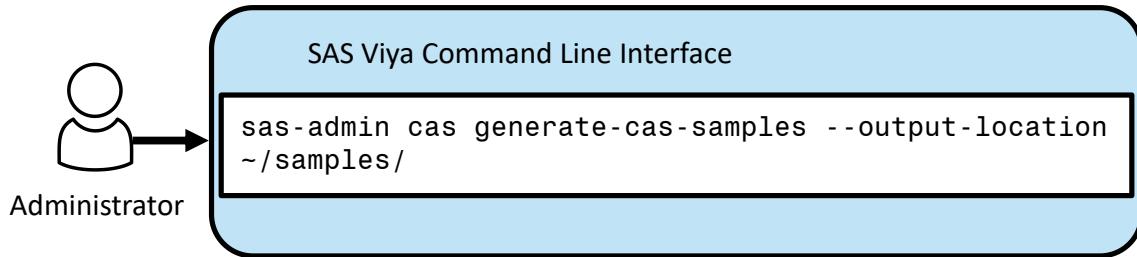
A best practice is to restart the CAS server after the CAS Resource Management policies are defined.



Using the SAS Viya command line interface, an administrator creates a priority-level policy. The policy, cas-shared-default-priority-1, is stored in the SAS Configuration Server.

Create and Store Policies

1. Generate Sample Policy Files



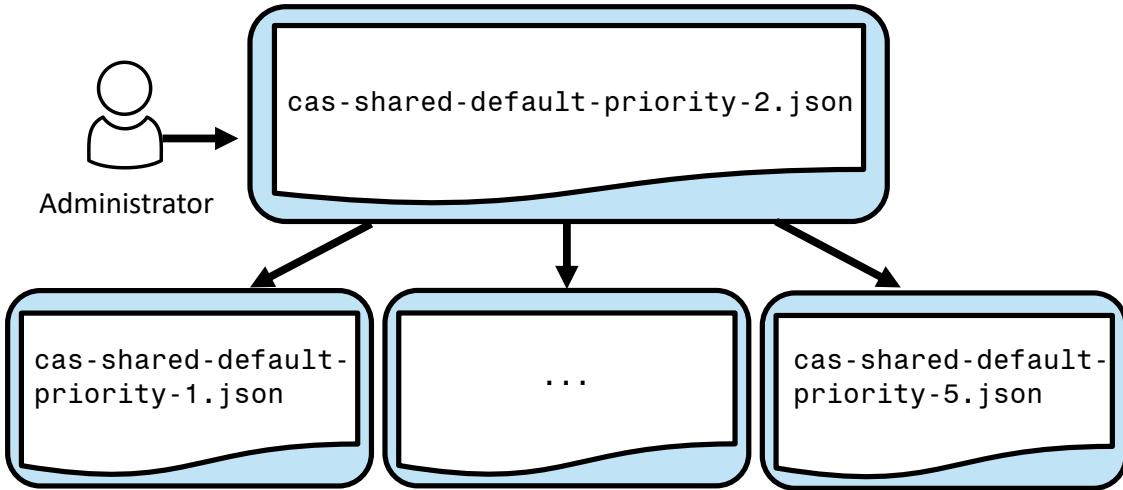
```
[christine@server bin]$ ll ~/samples/policies-examples/
total 12
-rw-r--r--. 1 christine sasadmins 608 Feb 20 13:41 cas-shared-default-priority-2.json
-rw-r--r--. 1 christine sasadmins 618 Feb 20 13:41 globalCaslibs.json
-rw-r--r--. 1 christine sasadmins 557 Feb 20 13:41 priorityAssignments.json
```

35



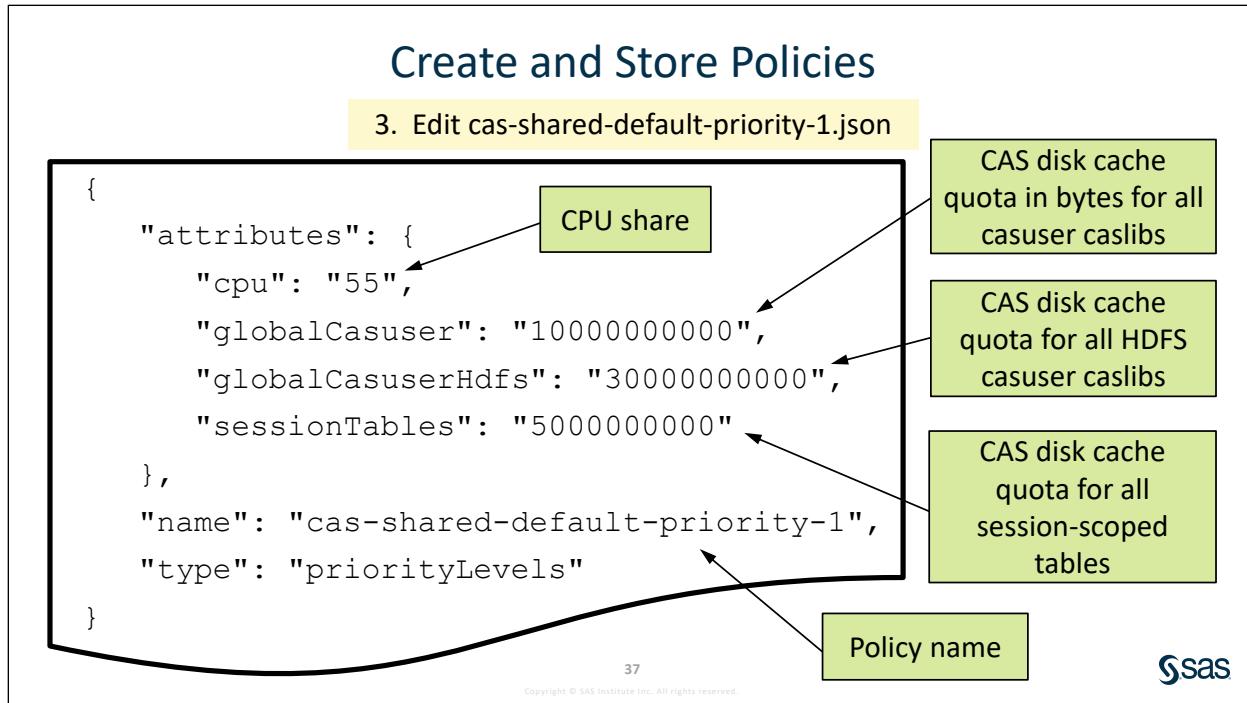
Create and Store Policies

2. Duplicate Priority Levels Template



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Note: The recommended practice is to define CPU shares for all policies to total 100, thus defining percentages.

Note: A sample byte conversion tool is available on the Extended Learning Page.

Parameters:

cpu: Specifies the CPU share that is granted to members of this priority level.

global-casuser: Specifies the quota to be placed on global casuser access (in bytes).

global-casuser-hdfs: Specifies the quota to be placed on global casuser access across HDFS (in bytes).

priority: Specifies the priority for this resource management policy. The valid values range from 1 (highest) to 5 (lowest).

server: Specifies the CAS server to define resource management policies for.

session-tables: Specifies the quota to be placed on session-scoped tables (in bytes).

The name of the policy will be a combination of the --server and --priority parameters. For example, -server cas-shared-default --priority 1 results in the name "cas-shared-default-priority-1".

Create and Store Policies

4. Edit globalCaslibs.json

```
{
  "attributes": {
    "CustomerCreatedCaslib1": "40000000000",
    "Public": "5000000000",
    "ReferenceData": "15000000000",
    "SystemData": "20000000000"
  },
  "name": "globalCaslibs",
  "type": "globalCaslibs"
}
```

Explicit CAS disk cache quota in bytes for global CAS libraries.

There is only one globalCaslibs policy for a CAS Server.

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Note: When _ALL_ is specified, *quota* specifies the total amount of disk cache space that can be used for all global tables, regardless of the caslibs to which the tables belong.

Create and Store Policies

5. Edit priorityAssignments.json

```
{
  "attributes": {
    "userID1": "5",
    "userID2": "2",
    "userID3": "5",
    "userID4": "4"
  },
  "name": "priorityAssignments",
  "type": "priorityAssignments"
}
```

Explicit priority level for the user

There is only one priorityAssignments policy for a CAS Server.

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This could be used to resolve conflicts when users are members of multiple resource management groups.

Create and Store Policies

6. Load Policies to SAS Configuration Server

SAS Viya Command Line Interface

Load policyLevels: (repeat for each priorityLevel)

```
sas-admin cas servers policies define priority-levels --server cas-shared-default --priority 1 --source-file cas-shared-default-priority-1.json
```

Load globalCaslibs policy:

```
sas-admin cas servers policies define global-caslibs --server cas-shared-default --source-file cas-shared-default-globalCaslibs.json
```

Load priorityAssignments: (optional)

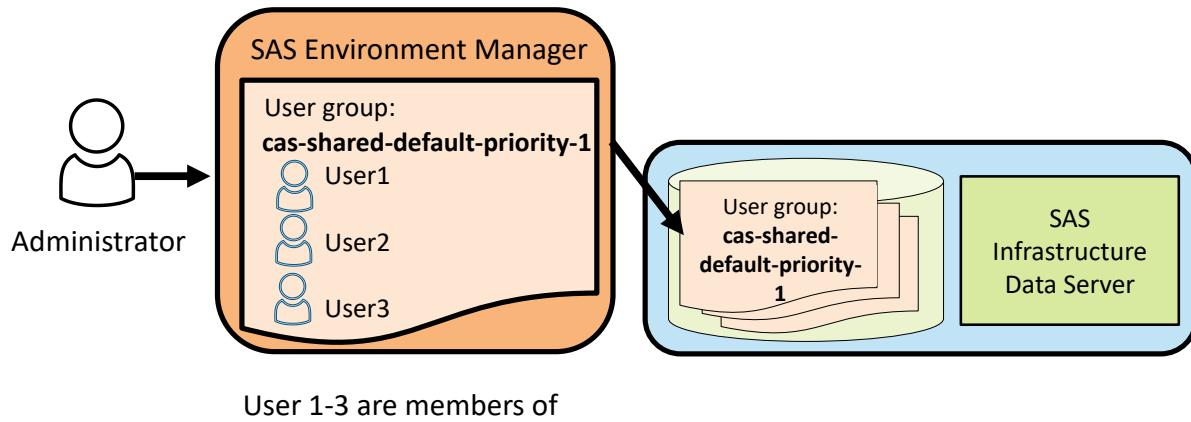
```
sas-admin cas servers policies define priority-assignments --server cas-shared-default --source-file cas-shared-default-priorityAssignments.json
```

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Create Custom Groups



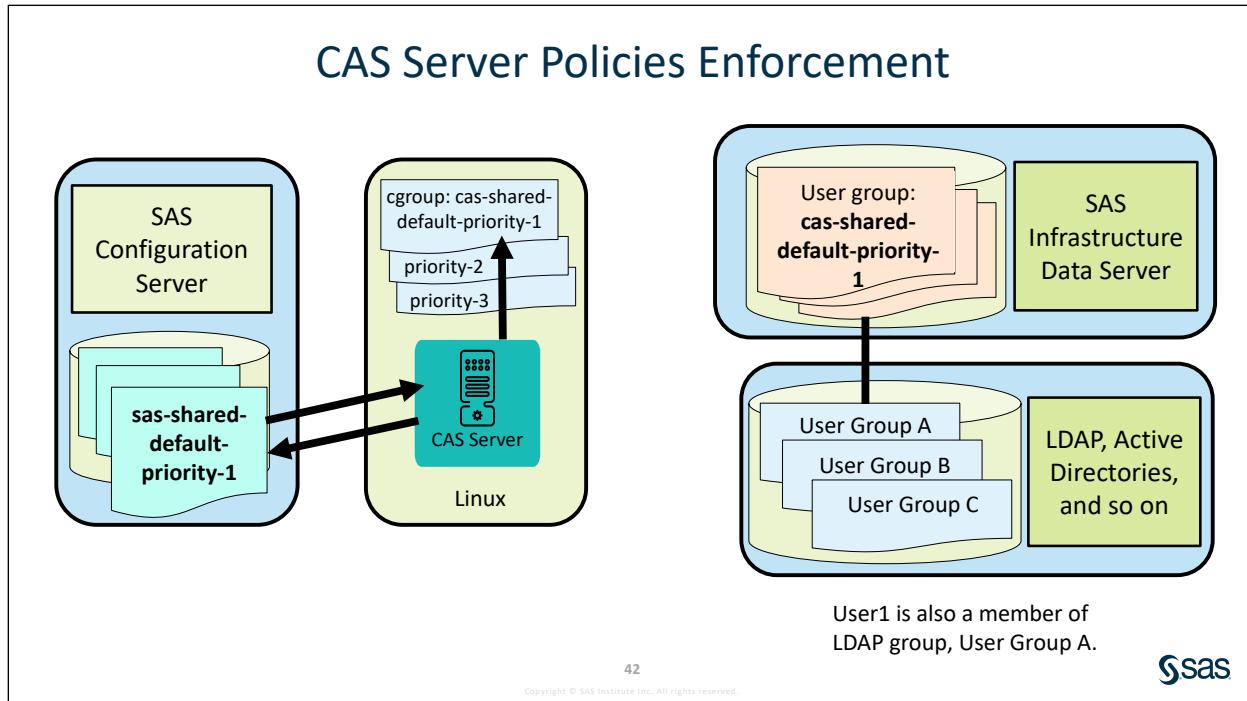
41

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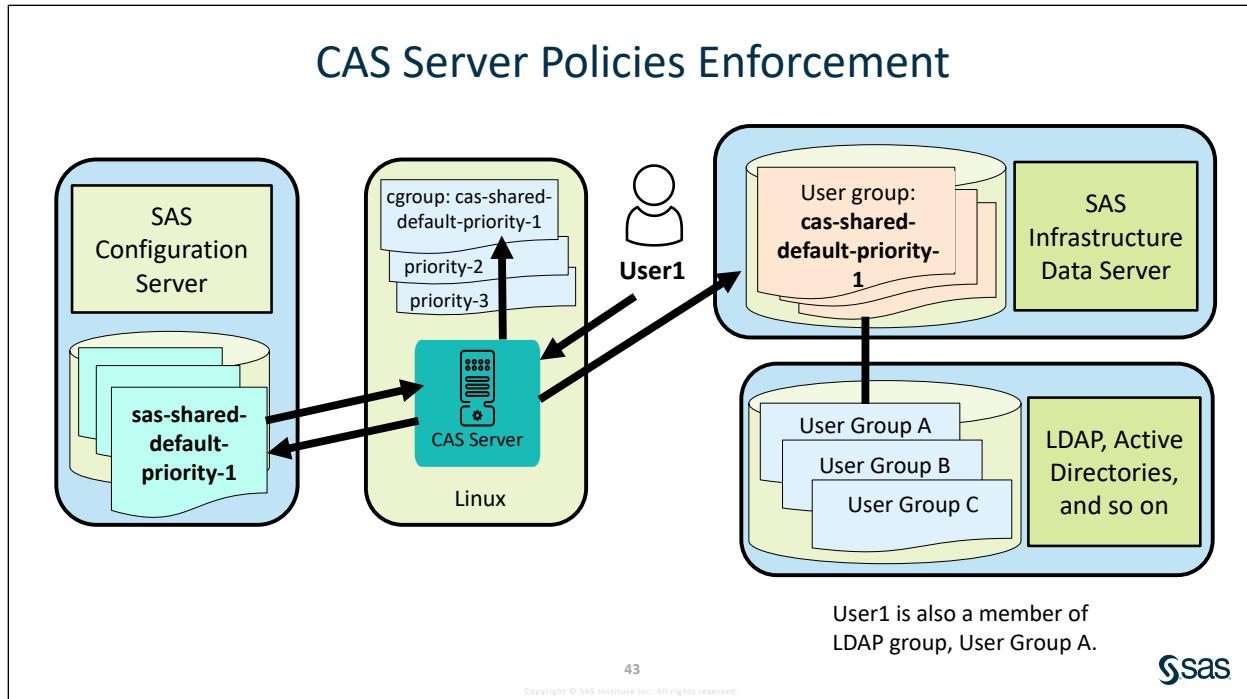
The administrator creates a custom group named **cas-shared-default-priority-1** and assigns several CAS users to this group. SAS Environment Manager stores the group in SAS Infrastructure Data Server.

Note: Custom group names must match name of the priorityLevels policies.

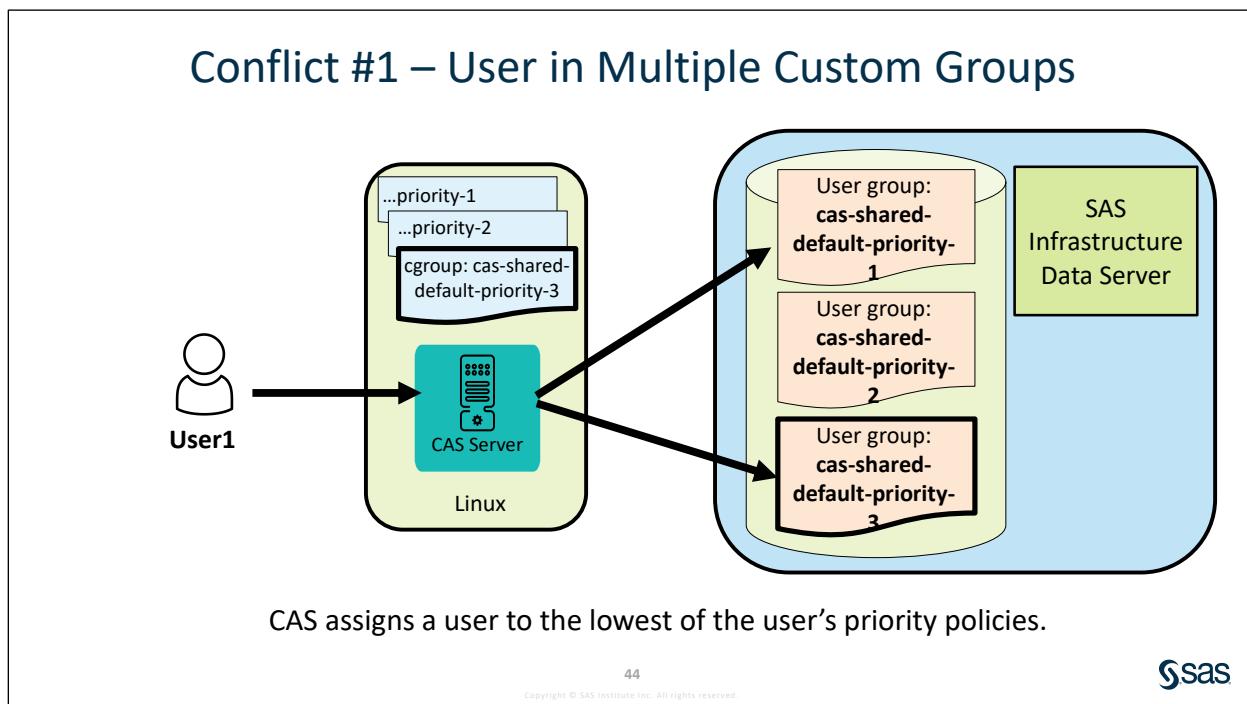


CAS Resource Management creates the required cgroups at CAS server start-up, based on policies rules stored in the SAS Configuration Server. The cgroups are removed at CAS server shutdown.

Note: Red Hat Enterprise Linux and CentOS 6 provides a new kernel feature: *control groups*, which are called by their shorter name *cgroups*. cgroups enable you to allocate resources (such as CPU time, system memory, network bandwidth, or combinations of these resources) among user-defined groups of tasks (processes) running on a system. By using cgroups, system administrators gain fine-grained control over allocating, prioritizing, denying, managing, and monitoring system resources. Hardware resources can be appropriately divided up among tasks and users, increasing overall efficiency.



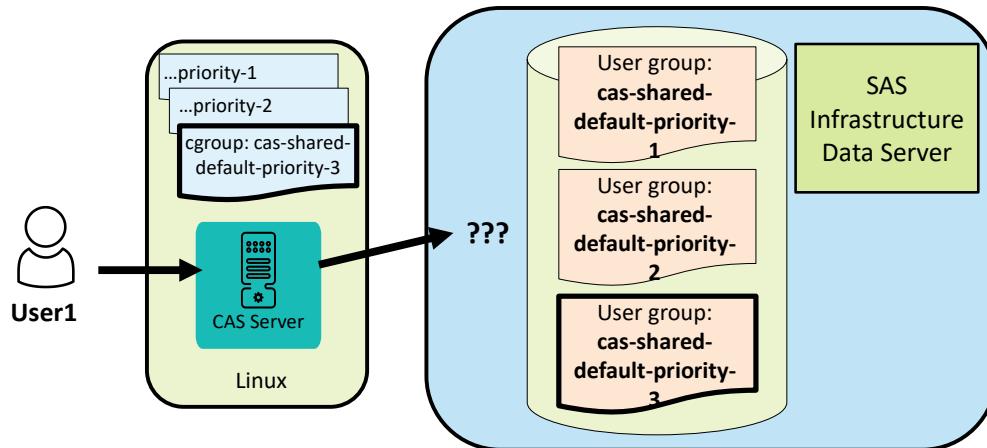
When User1 starts a CAS session, CAS searches User1's identity groups. If a match is found with a CAS policy **cas-shared-default-priority-1** and the user group **cas-shared-default-priority-1**, then CAS imposes any CPU limits found in the corresponding group and imposes any disk cache space quota that it finds in the policy.



If a user is a member of multiple resource management groups, CAS assigns him to the lowest of his priority policies.

Note: Priority levels are numbered from 1 (highest) to 5 (lowest).

Conflict #2 – User Not in a Custom Group



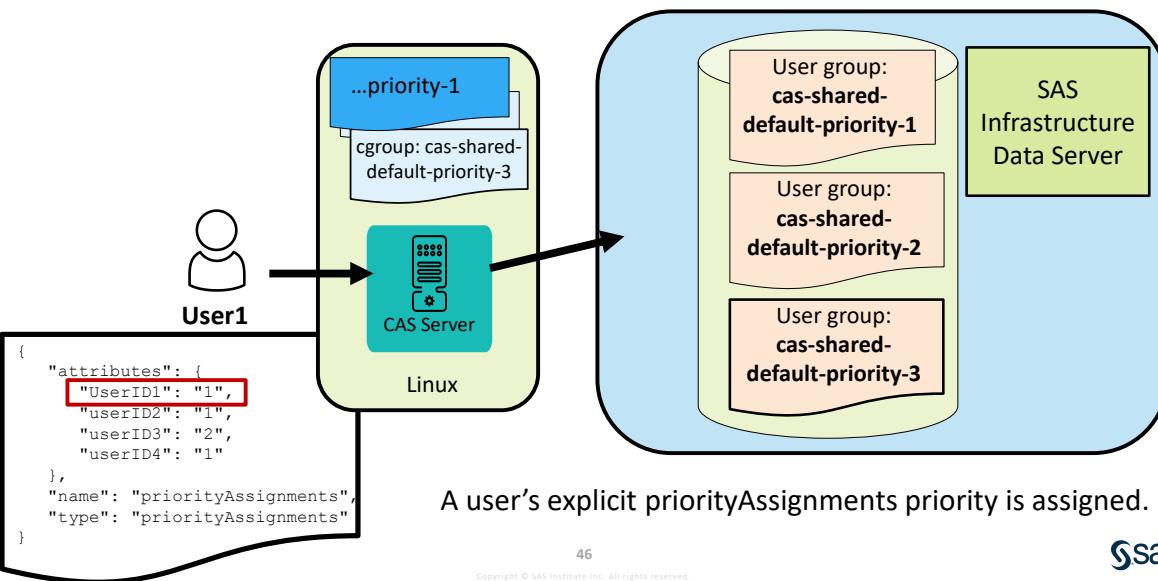
CAS assigns a user to the lowest defined priority.

45


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If a user is not a member of a resource management group and he has not been explicitly assigned a priority level, then CAS assigns him the lowest defined priority.

Conflict #3 – User in the Priority Assignments Policy



A user's explicit priorityAssignments priority is assigned.

46


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Regardless of whether a user is a member of a resource management group, the user's explicit priorityAssignments priority is assigned.

Considerations

- If you define a resource management policy for one group, you should define policies for all groups. Otherwise, unlisted groups default to the lowest priority policy.
- When making share assignments for policies, be sure to consider the potential number of users and their load.
- On a completely busy system, resource management policies are enforced to restrict resources. But, during off hours, when there is excess CPU capacity, resource restriction is not enforced.



Practice

5. (Optional) Reviewing Resource Management Policies for the CAS Server

CAS relies on the Linux kernel feature, cgroups, to provide the CPU and memory consumption control. You must implement cgroups before you can fully use CAS resource management.

- a. Review CAS resource management from the documentation.

- 1) Click the following link to *SAS Cloud Analytics Services: Concepts*:
<https://documentation.sas.com/?cdId=calc&cdcVersion=3.5&docsetId=calserverscas&docsetTarget=n05000viyaservers00000admin.htm&locale=en#>
- 2) Click **CAS Resource Management** section.

CAS Resource Management

[Overview](#)

[Policy Details](#)

[How Policies Work](#)

[CPU Shares \(Linux\)](#)

- 3) To support CAS resource policies, your Linux system environment must meet certain requirements. What needs to be implemented in the operating system?

Find out what those requirements are in *SAS Viya for Linux: Deployment Guide*. Click the link located in the CAS Resource Management Overview section.

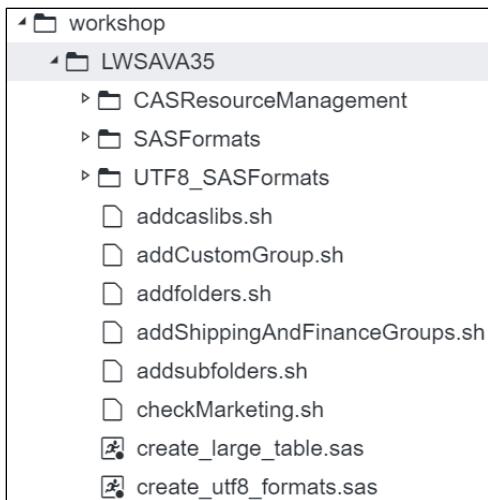
information, see [\(Optional\) Additional Requirements for CAS Resource Management in SAS Viya for Linux: Deployment Guide](#).

End of Practices

5.5 Solutions

Solutions to Practices

1. Creating a New Format Library and Importing SAS 9.4 Formats in SAS Environment Manager
 - a. Log on to SAS Studio Basic as **christine** with the password **Student1**.
 - b. Expand **Server Files and Folders** on the left side. Expand **Files (/) ⇒ workshop ⇒ LWSAVA35 ⇒ UTF8_SASFormats**.



- c. Double-click **create_utf8_formats.sas** to bring the program into the editor window.

```

Run Cancel Copy to My Snippets | ⌂ ⌂ Debug

Code

1 libname fmtloc cvp "/workshop/LWSAVA35/SASFormats";
2 libname fmtloc2 "/workshop/LWSAVA35/UTF8_SASFormats";
3
4 proc format library=fmtloc2.formats cntlin=fmtloc.outfmts;
5 run;

```

- d. Click or click **F3** to run the program. Check the log for errors.

```

CODE LOG RESULTS
Errors, Warnings, Notes
Errors
Warnings
Notes (55)

1 OPTIONS NONOTES NOSTIMER NOSOURCE NOSYNTAXCHECK;
2
3 libname fmtloc cvp "/workshop/LWSAVA34/SASFormats";
NOTE: Libref FMTLOC was successfully assigned as follows:
  Engine:          Cvp
  Physical Name:  /workshop/LWSAVA34/SASFormats
4 libname fmtloc2 "/workshop/LWSAVA34/UTF8_SASFormats";
NOTE: Libref FMTLOC2 was successfully assigned as follows:
  Engine:          V9
  Physical Name:  /workshop/LWSAVA34/UTF8_SASFormats
5
6 proc format library=fmtloc2.formats cntlin=fmtloc.outfmts;
NOTE: Data file FMTLOC.OUTFORMATS.DATA is in a format that is native to another host, or the file encoding does not match the current host's encoding. Cross Environment Data Access will be used, which might require additional CPU resources and memory performance.
7
8 NOTE: Format AGEGROUP is already on the library FMTLOC2.FORMATS.
NOTE: Format AGEGROUP has been written to FMTLOC2.FORMATS.
NOTE: Format CHMONTH is already on the library FMTLOC2.FORMATS.
NOTE: Format CHMONTH has been written to FMTLOC2.FORMATS.
NOTE: Format CUSTGRP is already on the library FMTLOC2.FORMATS.
NOTE: Format CUSTGRP has been written to FMTLOC2.FORMATS.
NOTE: Format CUSTTYPE is already on the library FMTLOC2.FORMATS.

```

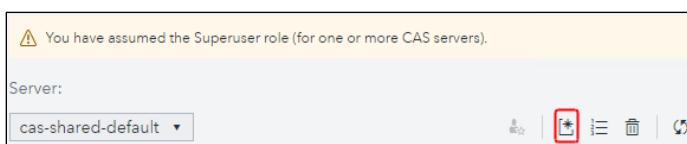
- e. In SAS Environment Manager, click **User-Defined Formats** page.



- f. Creating format libraries requires that you assume the Superuser role. Click the  icon.

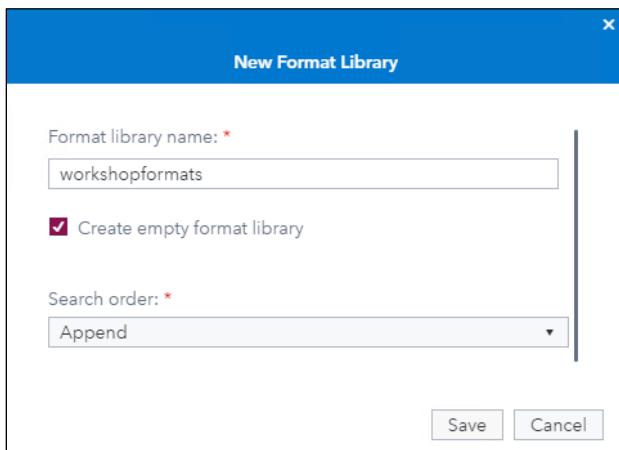


- g. Click **New format library** .



- h. Enter **workshopformats** for the format library name.

- i. Check the box next to **Create empty format library** and keep **Search order as Append**.



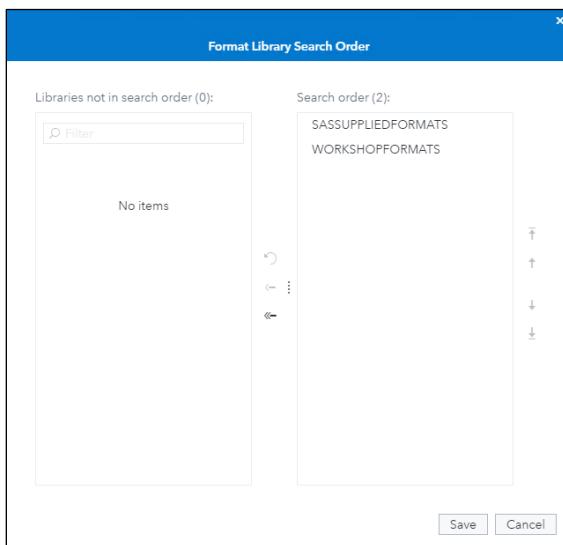
Values for Search order:

- Append -- The new format library is appended to the existing format search order.
- Prepend -- The new format library is prepended to the existing format search order.
- Replace -- The new format library replaces the libraries that are listed in the existing format search order. CAUTION: The Replace option overwrites the existing format library search order and replaces it with this newly created format library.
- None -- The new format library is not added to the existing format search order.

- j. Click **Save**.



- k. Click **Format library search order** to check the new search order.



- l. Click **Cancel**.

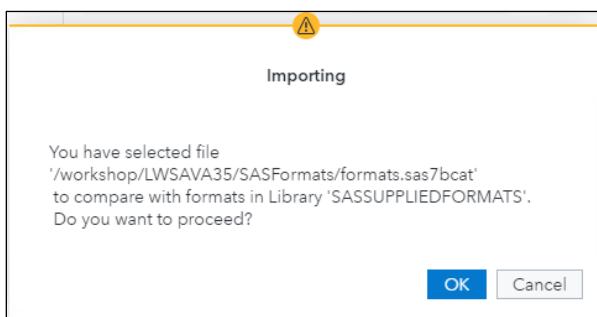
- m. Click **Import**

- n. Enter **/workshop/LWSAVA35/UTF8_SASFormats/format.sas7bcat** for the source path. Change the target format library to **WORKSHOPFORMATS** from the drop-down menu.

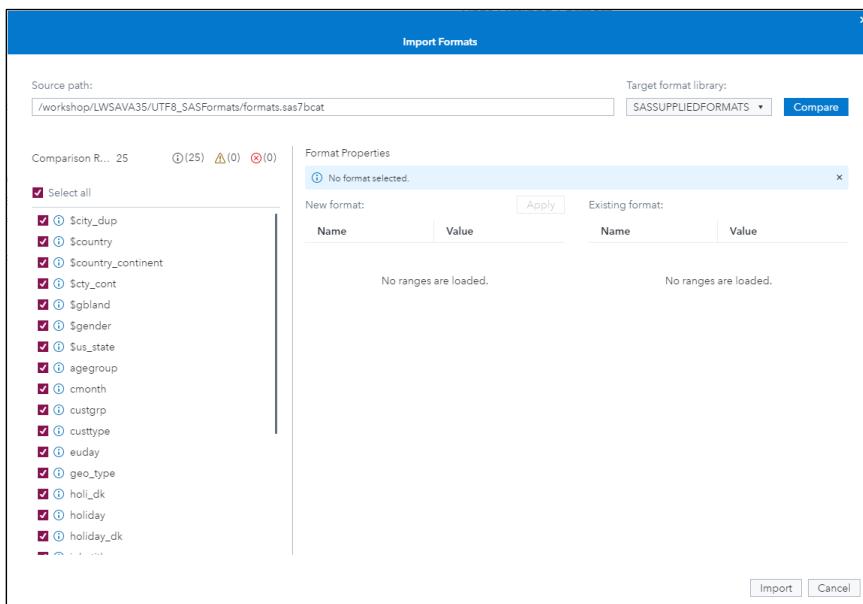


- o. Click **Compare**.

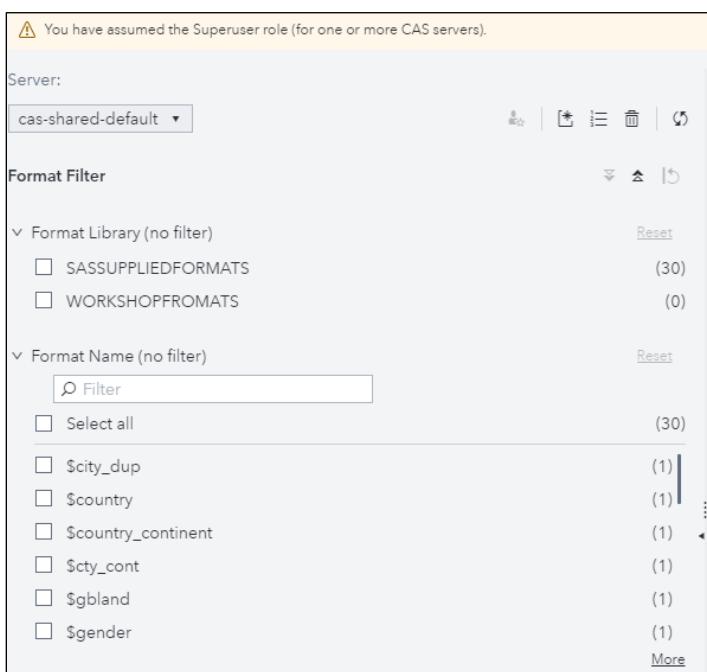
- p. Click **OK**.



- q. Check **Select all** box to import all of the formats.



- r. Click **Import**.



2. Automatically Refreshing the Data from a Caslib

In this practice, you create a new job that can be scheduled to refresh the data.

- In SAS Environment Manager, select **Jobs** from the side menu.
- Click the **Scheduling** tab.

The screenshot shows the 'Scheduling' tab selected in the top navigation bar. On the left, there is a 'Filter' sidebar with sections for Type (Flow or Job), Scheduler (Default SAS Job Flow Scheduler), Scheduled By (None), and Date Created. The main area displays a table titled 'Jobs and Flows (7)' with columns for Name, Scheduled, and Description. The listed jobs include various scheduled tasks like 'BINARY_BACKUP_SCHEDULE', 'DEFAULT_BACKUP_SCHEDULE', and several 'Demo Data Preparation' and 'Sample' jobs.

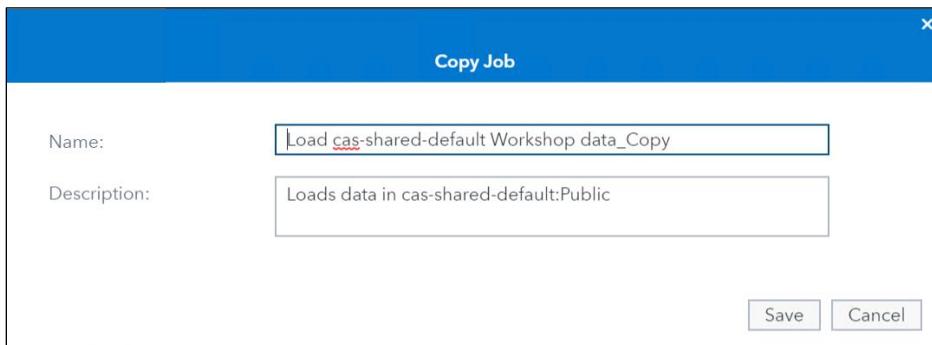
Name	Scheduled	Description
BINARY_BACKUP_SCHEDULE	○	This job is created by sas.deploymentBackup to ru...
DEFAULT_BACKUP_SCHEDULE	○	This job is created by sas.deploymentBackup to ru...
Demo Data Preparation Job Flow		The job flow checks for the source table and then ...
Demo Data Preparation Plan_Job_20201295638		
Sample: Import cas-shared-default Public data		Imports csv, sas7bdat, and excel files to sashdat fil...
Sample: Load cas-shared-default Public data		Loads data in cas-shared-default:Public
Sample: Unload cas-shared-default Public data		Unloads infrequently accessed data in cas-shared-...

- Right-click **Sample: Load cas-shared-default Public data** and select **Copy**.

- In the dialog box, enter the following:

Name: **Load cas-shared-default Workshop data**

Description: **Loads data in cas-shared-default:Workshop**



- Click **Save**.
- Right-click **Load cas-shared-default Workshop data** and select **Properties**. (You can also highlight the job and click **Properties** from the toolbar.)
- Click the **Arguments** tab .
- Modify the following fields:

InputCaslib: Workshop

OutputCaslib: Workshop

Filter: filter to include **SAS7BDAT** and **CSV**. Copy the following code:

```
or(endsWith(tableReference.sourceTableName, '.sashdat') ,
endsWith(tableReference.sourceTableName, '.SASHDAT') ,
endsWith(tableReference.sourceTableName, '.sas7bdat') ,
endsWith(tableReference.sourceTableName, '.csv'))
```

refresh: true

refreshMode: newer

Name	Type	Value
refresh	BOOLEAN	true
varChars	BOOLEAN	false
getNames	BOOLEAN	true
allowTruncation	BOOLEAN	true
stripBlanks	BOOLEAN	false
refreshAccessThreshold	NUMBER	0
charMultiplier	NUMBER	2

- i. Click **Save** and click **Close**.
- j. Test the new job. Right-click the new job and select **Execute**.
- k. Select **Monitoring** tab.
- l. In the job monitor, check the status of the job and click on the download link under **Log** to view the log.

- m. Select **Data** area from the side menu and click the **Data Sources** tab.

- n. Expand **cas-shared-default** ⇒ **Workshop** caslib. Verify that the tables are loaded.

Note: You might need to click Refresh .

The screenshot shows the SAS Data Explorer window with the 'Available' tab selected. A search bar at the top has 'Filter' entered. Below it, a toolbar includes icons for refresh, search, and help. A dropdown menu is open, showing 'Workshop' selected. Under 'Workshop', there are three entries: 'DEMOGRAPHICS' (last modified 02/18/20 02:19 PM by christine), 'EMPLOYEES' (last modified 02/18/20 02:19 PM by christine), and two versions of 'INSIGHT_TOY_COMPANY_2017' (both last modified 02/18/20 02:19 PM by christine). Each entry has a small preview icon and a timestamp.

- o. Select **Jobs** from the side menu and click the **Scheduling** tab to schedule the job that periodically refreshes the data.
- p. Right-click **Load cas-shared-default Workshop data** and select **Schedule**.

The screenshot shows the SAS Jobs interface. On the left, a list of jobs is visible: 'Load cas-shared-default Workshop data_Copy', 'Sample: Import cas-shared-default Public data', 'Sample: Load cas-shared-default Public data', and 'Sample: Unload cas-shared-default Public data'. A context menu is open over the first job, listing options: Execute, Run as, Schedule (which is highlighted in blue), Unschedule, Execution history, Copy, Delete, and Properties.

- q. Select the plus sign (+) to add a new trigger.

In the trigger definition, enter the following information:

- Name: **Refresh sales every 15 minutes**
- Frequency: **Minutes**
- Every: **15**
- Start time: *<Choose a time in the near future.>*
- Time zone: *<Choose the time zone that you are in.>*
- Start date: *<Use today's date.>*
- End: **Never**

Name: * Refresh sales every 15 minutes

Frequency: Minutes

Every: 15 minutes

Start time: 15

Time zone: America/New_York

Start date: Feb 10, 2020

End: Never

Save Reset Cancel

r. Click **Save**.

s. Click **Save** again.

3. Viewing CAS Start-Up Options and Environment Variables in SAS Environment Manager

You can view environment variable and command-line option values used to run a CAS server.

a. In SAS Environment Manager, select the **Servers** area.

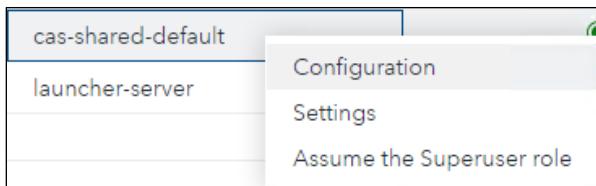
b. Select **cas-shared-default**, and on the right side, click **System Metrics** .

System Metrics	
Active sessions (count/maximum):	3/5000
Last session created or destroyed:	February 20, 2020 12:48:18 PM
Sessions created:	9,885
Uptime:	1 Day(s) 22 Hour(s) 54 Minute(s) 26 Second(s)
User CPU time:	0 Day(s) 0 Hour(s) 41 Minute(s) 40 Second(s)
System CPU time:	0 Day(s) 0 Hour(s) 6 Minute(s) 50 Second(s)
IO count:	6,393,064
Threads (count/maximum):	30/76
Memory used:	120.43 MB
Maximum memory used:	120.43 MB
VM Size:	1.92 GB

The System Metrics area displays these metrics for the selected server:

- Active sessions
- Date and time that the last session was created or destroyed
- Number of sessions created
- Server uptime
- User CPU time
- System CPU time
- Number of I/O operations performed
- Number of active threads compared to the maximum number of threads
- Amount of memory used
- Maximum amount of memory used
- Virtual machine size

c. Right-click **cas-shared-default** and select **Configuration**.



d. Click the **Nodes** tab and select **server.demo.sas.com**. CAS start-up options and environment variables are displayed. This is coming from CAS configuration files.

What is the value for **CAS_DISK_CACHE**? /tmp

CAS Configuration		
Nodes		
server.demo.sas.com		
Environment Variable	↑	Value
CAS_CERTLOC		/opt/sas/viya/config/etc/SASSecurityCertificateFramework/tls/certs/cas/shared/default/sas_encrypted.crt
CAS_CFGPATH		/opt/sas/viya/config/etc/cas/default
CAS_CLIENT_SSL_CA_LIST		/opt/sas/viya/config/etc/cas/default/../../SASSecurityCertificateFramework/cacerts/trustedcerts.pem
CAS_CLIENT_SSL_CERT		/opt/sas/viya/config/etc/SASSecurityCertificateFramework/tls/certs/cas/shared/default/sas_encrypted.crt
CAS_CLIENT_SSL_KEY		/opt/sas/viya/config/etc/SASSecurityCertificateFramework/private/cas/shared/default/sas_encrypted.key
CAS_CLIENT_SSL_KEYPW		*****
CAS_CLIENT_SSL_KEYPWLOC		/opt/sas/viya/config/etc/SASSecurityCertificateFramework/private/cas/shared/default/encryption.key
CAS_CLIENT_SSL_REQUIRED		true
CAS_CONSUL_TOKEN		/opt/sas/viya/config/etc/SASSecurityCertificateFramework/tokens/cas
CAS_CONSUL_TOKENLOC		/opt/sas/viya/config/etc/SASSecurityCertificateFramework/tokens/cas/shared/default/client.token
CAS_DISK_CACHE		/tmp
CAS_EXE		/opt/sas/viya/home/SASFoundation/utilities/bin/cas
CAS_HOME		/opt/sas/viya/home/SASFoundation
CAS_INITIAL_WORKER_COUNT		1
Count: 110		

e. To return to the Servers area, click in the top left corner of the window.

4. Using gridmon.sh Terminal Application to Monitor CAS Server Jobs

a. Start CAS sessions.

- 1) In a web browser, open **SAS Drive**. Log on as **lynn** with the password **Student1**.

Open the **Product Report** from **SAS Content** \Rightarrow **Orion Star** \Rightarrow **Marketing**. (Double-click **Product Report** to open it.)

The screenshot shows the SAS Content interface with the following navigation bar:

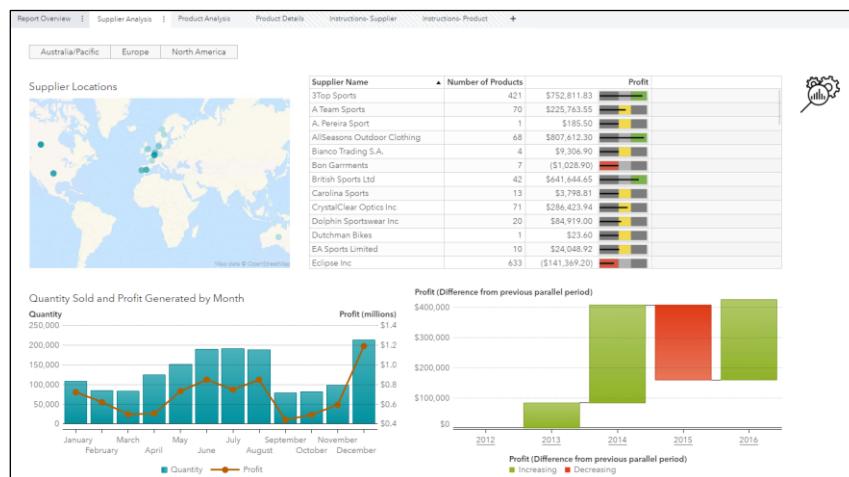
- All
- Recent
- Projects
- Prepare Data
- Reports
- Build Models
- Manage Models

The left sidebar shows the following hierarchy:

- My Favorites
- My Folder
- SAS Content
 - ESP Projects
 - Model Repositories
 - Orion Star
 - Marketing

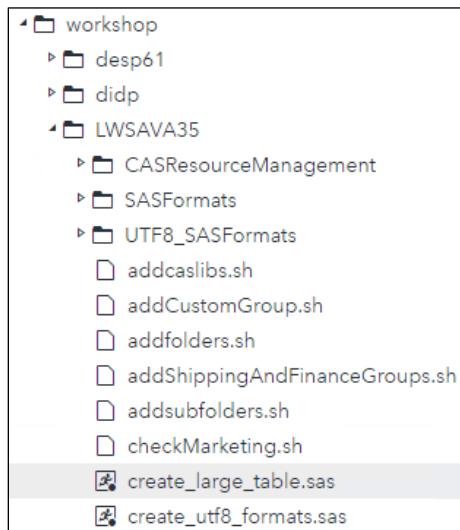
The main content area displays the **ORION STAR Sports & Outdoors** logo and the title **Product Report**. Below the title, it says **Date modified: 03/07/18**.

Be sure to move to different tabs in the report.



- 2) In a new browser window, log on to SAS Studio (Basic) as **eric** with the password **Student1**.

Expand **Server Files and Folders** ⇒ **Files (/)** ⇒ **workshop** ⇒ **LWSAVA35.**



Double-click **create_large_table.sas** to bring the program into a Code Editor window.

Notice that the **metrics=true** option has been added to the CAS statement.

The screenshot shows the SAS Studio interface with a code editor containing SAS code. The code is as follows:

```
1 /* Create a dummy dataset that is large */
2 @data junk;
3     do i=1 to 30000000; /*30 million*/
4         j=i/i;
5         k=i/j;
6         output;
7     end;
8 run;
9
10 /* Create a new CAS session */
11
12 cas mySession sessopts=(caslib=casuser timeout=1800 locale="en_US" metrics=true);
13
14 /* copy the dataset into the default caslib, so that it becomes a table in memory */
15 @proc casutil;
16     load data=work.junk outcaslib="casuser" casout="CASJunkTable" replace;
17 run;
```

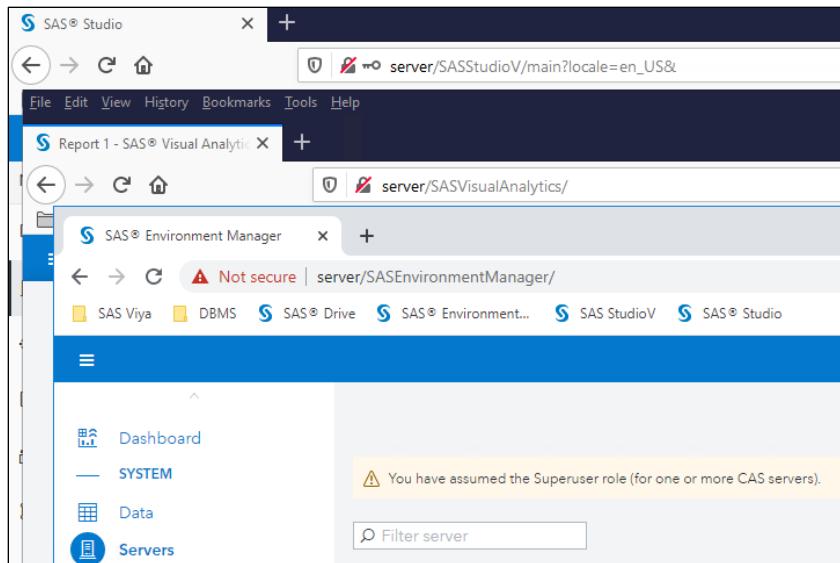
Run the program.

Check the log for errors and review the system metrics used per action.

```
93 cas mySession sessopts=(caslib=casuser timeout=1800 locale="en_US" metrics=true);
NOTE: The session MYSSESSION connected successfully to Cloud Analytic Services server.demo.sas.com using port 5570. The UUID i
9f58837a-5e96-9645-a252-5005dee57c51. The user is eric and the active caslib is CASUSER(eric).
NOTE: The SAS option SESSREF was updated with the value MYSSESSION.
NOTE: The SAS macro _SESSREF_ was updated with the value MYSSESSION.
NOTE: The session is using 0 workers.
NOTE: 'CASUSER(eric)' is now the active caslib.
NOTE: Action 'sessionProp.setSessOpt' used (Total process time):
NOTE:      real time          0.002666 seconds
NOTE:      cpu time          0.002649 seconds (99.36%)
NOTE:      total nodes        1 (16 cores)
NOTE:      total memory       119.83G
NOTE:      memory            359.91K (0.00%)
NOTE: The CAS statement request to update one or more session options for session MYSSESSION completed.
94
95 /* copy the dataset into the default caslib, so that it becomes a table in memory */
96 proc casutil;
NOTE: The UUID '9f58837a-5e96-9645-a252-5005dee57c51' is connected using session MYSSESSION.
97
97 ! load data=work.junk outcaslib="casuser" casout="CASJunkTable" replace;
NOTE: Executing action 'table.addTable'.
NOTE: Action 'table.addTable' used (Total process time):
NOTE:      real time          2.831087 seconds
NOTE:      cpu time          2.836068 seconds (100.18%)
NOTE:      total nodes        1 (16 cores)
NOTE:      total memory       119.83G
NOTE:      memory            25.42M (0.02%)
NOTE: WORK.JUNK was successfully added to the "CASUSER(eric)" caslib as "CASJUNKTABLE".
```

b. View CAS sessions in SAS Environment Manager.

- 1) In a new browser window, log on to SAS Environment Manager as **christine** with the password **Student1**.
 - 2) Select the **Servers** area. Right-click **cas-shared-default** ⇒ **Assume the Superuser role**.



- 3) Double-click **cas-shared-default** or right-click on the server and select **Configuration** to see CAS sessions of both Lynn and Eric.

Session Overview			
Sessions	CAS Configuration	Nodes	
Filter by: <input type="text" value="Name"/> <input type="button" value="Filter"/>			
Name	Session ID	Owner	State
Session:Wed Feb 12 13:58:07 2020	51ca6c71-240f-6b47-9163-7930169059b4	lynn	connected
Session:Wed Feb 12 13:53:54 2020	c0898139-c22e-94d4-a5c8-c7eadfcf293	eric	connected
Session:Wed Feb 12 13:46:07 2020	78999b90c-60e9-f245-bfe9-3ab2e5edc32e	christine	connected
Session:Wed Feb 12 13:41:33 2020	bc44bf4c-6-b20-eed4-8b40-afb263e590d	christine	connected
Session:Wed Feb 12 13:41:12 2020	0c47f18-c8e7-ea47-95be-4f2b5c1d002	christine	connected
Session:Wed Feb 12 13:30:47 2020	e1fb5699-ac8a-e44d-9998-a378e038310a	christine	connected
SAS Environment Manager:Wed Feb 12 13:58:03 2020	76509d0-0fae-9741-92d-3cb3d0ff9e89	lynn	disconnected
SAS Environment Manager:Wed Feb 12 13:53:49 2020	1a2d2314-b347-b24b-85e6-d13b17d6e944	eric	disconnected

c. To start gridmon.sh, run the following command in Christine's session of MRemoteNG:

```
sudo /opt/sas/viya/home/SASFoundation/utilities/bin/gridmon.sh
```

UserName	Job	ID	SessId	*CPU	Memory	Time	Ranks	Port	Active	Pending	Completed	Owned	Disk	Shared	Disk
cas	cas	84462		0	1.9G	3d 19:09	1	5570	9		26512	2.9G	752.7M		
cas(sas.planning)	cas	84462	36	0	968.8M	3d 18:43	1		setSessionOpt(100%)		3	0.0	0.0		
cas(christine)	cas	84462	25880	0	1010.4M		1:04	1	groupBy(100%)		5	0.0	0.0		
cas(christine)	cas	84462	25883	0	1.4G		1:04	1	valueCount(100%)		8	0.0	0.0		
cas(lynn)	cas	84462	26187	0	972.0M		0:56	1	tableInfo(100%)		22	0.0	0.0		
cas(lynn)	cas	84462	26196	0	1.6G		0:56	1	tableInfo(100%)		17	0.0	711.6M		
cas(christine)	cas	84462	26495	0	1.3G		0:05	1	listNodes(100%)		52	0.0	0.0		
cas(christine)	cas	84462	26496	0	1.4G		0:05	1	echo(100%)		45	0.0	0.0		
eric	sas	64300		0	1.9G	1:00	1								
eric	sas	64711		0	1.9G	1:00	1								
eric(eric)	cas	84462	26139	0	1001.5M		1:00	1	caslibInfo(100%)		19	0.0	0.0		
eric(eric)	cas	84462	26140	0	1.6G		1:00	1	tableInfo(100%)		41	675.1M	0.0		
root	tkemon	50380		0	644.1M	5d 2:34	1								

- 1) What job consumed the most memory? **Answers will vary.**
 - 2) Is any job using **Shared Disk**? (cas-disk-cache)? **Answers will vary.**

d. For more detail:

- 1) Click one of the job sessions and click **Show Ranks**.

```
cas(lynn) +-----+
cas(christ| Show Ranks
cas(christ| Kill Job
eric(eric)| Kill Jobs with user: cas
eric(eric)| Kill Jobs with user: cas ID: 84462
root      | Kill Jobs at least this old
           | Stack Trace all Ranks
```

- 2) Click **server** to show menu and review options.

```
+-----+
| Show Details
| Kill Rank
| Stack Trace
| Process Limits
| FileHandle Count
| FileHandle List
| Environment
| List Memory Maps
| Numa Stats
| Show CGroups
| Xterm
| Perf Top
| Attach Debugger
+-----+
```

Show Details Menu Commands	
Command	Description
Show Details	Shows process ID, CPU use, virtual memory, and if not zero, the following fields: <ul style="list-style-type: none">• DFFSSize: Disk space in <code>CAS_DISK_CACHE</code> owned by the current process.• HDFSSize: Disk space mapped from HDFS.• DNFSsize: Disk space mapped from DNFS.• Global FSSize: Disk space in <code>CAS_DISK_CACHE</code> for global tables, owned by the main server process.• CGroup Limit: Size of memory cgroup, as specified by <code>cas.MEMORYSIZE</code>.• CGroup Usage: Amount of the CGroup memory that is in use by all processes belonging to this server on the current machine.• Faults/s: The number of page faults per second for the process, most commonly caused by paging in table data. (Faults can help you determine whether the process is paging.)
Kill Rank	Kills the selected rank or process.
Stack Trace	Runs the gstack application on all processes in this job and collects results. gstack displays its results in your vi editor.
Process Limits	Displays the contents of <code>/proc/pid/limits</code> .
FileHandle Count	Counts the files owned by the process.
FileHandle List	Lists the files owned by the process.
Environment	Displays the process's environment handles from <code>/proc/pid/environ</code> .
List Memory Maps	Shows the process's memory maps from <code>/proc/pid/maps</code> .
Numa Stats	Shows the output from the Linux numastat command for this process.
Show CGroups	Shows the Linux cgroups that this process belongs to.
Xterm 1	Starts an Xterm on the selected machine.
Perf Top 1	Runs the perf top application on this process in a new Xterm window. Note: The perf package must be installed.
Attach Debugger 1	Attaches a debugger to the running process. Requires a new X window. Note: Attach Debugger is for use only when directed by SAS Technical Support or by SAS R&D.
1 Requires that an X Server be running on the CAS controller machine.	

- 3) Click **Show Details**.

```
cas: cas (lynn) 84462 26196 tableInfo(100%)
+-server-----+
| PID          74067 |
| CPU          0%   |
| Virt Memory   1.6G |
| Global FSSize 711.6M|
```

- 4) Click **Backspace** twice on your keyboard to return to the jobs menu.
- e. To run in machine mode, enter **m**. Click Enter to show menu options for the selected machine.

Hostname	%CPU	Free Mem	Total Mem	Net Read	Net Write
server	162	45.5G	119.8G	1.7K	3.4K

Hostname	%CPU	Free Mem	Total Mem	Net Read	Net Write
server		44.9G	119.8G	1.4K	779.0
	Details				
	Top				
	Xterm				
	Perf Top				

- f. Enter **q** to exit gridmon.sh.

5. (Optional) Reviewing Resource Management Policies for the CAS Server

CAS relies on the Linux kernel feature, cgroups, to provide the CPU and memory consumption control. You must implement cgroups before you can fully use CAS resource management.

- a. Review CAS resource management from the documentation.

- 1) Click the following link to *SAS Cloud Analytics Services: Concepts*:
<https://documentation.sas.com/?cdId=calcdc&cdcVersion=3.5&docsetId=calserverscas&docsetTarget=n05000viyaservers00000admin.htm&locale=en#>
- 2) Click the **CAS Resource Management** section.

CAS Resource Management

- [Overview](#)
- [Policy Details](#)
- [How Policies Work](#)
- [CPU Shares \(Linux\)](#)

- 3) To support CAS resource policies, your Linux system environment must meet certain requirements. What needs to be implemented in the operating system? **cgroups**

Find out what those requirements are in the *SAS Viya for Linux: Deployment Guide*. Click the link located in the CAS Resource Management Overview section.

information, see [\(Optional\) Additional Requirements for CAS Resource Management in SAS Viya for Linux: Deployment Guide](#).

End of Solutions

Solutions to Activities and Questions

6.02 Short Answer Question

What other administrative task have we seen that can be done by adding Lua code to the **casstartup_usermods.lua** file?

Make custom formats available to users

```
-- Add User Defined Formats permanantly and reloadable
-----
---- Additional user formats
s:sessionProp_addFmtLib (caslib="Formats",
                         fmtLibName="hrformats",
                         name="hrformats.sashdat",
                         promote=true
                         )

----Create the new custom FmtSearch list, and order the format libraries
customFmtSearch = "hrformats"

----Create the new global FmtSearch list and include the customFmtSearch at the begining of the fmtSearch list
newGlobalFmtSearch = (customFmtSearch .. " " .. (cas.fmtsearch or ""))
-----Set the new globabl FmtSearch list
s:configuration_setServOpt (fmtsearch=newGlobalFmtSearctch)
```

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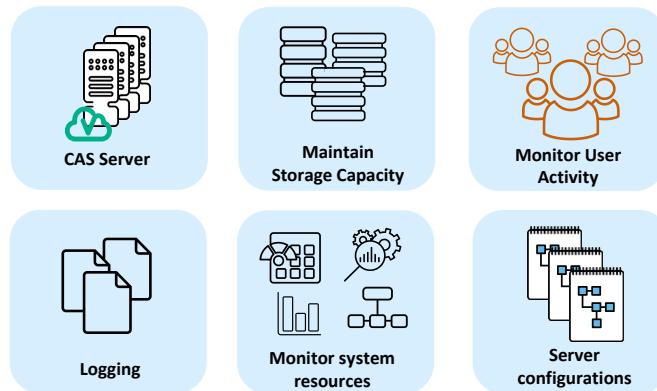


Lesson 6 Monitoring and Logging

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6.1 SAS Viya Operations Infrastructure

Monitoring a SAS Viya Environment



3

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Some of these tasks of the administrator:

- monitoring system resources such as CPU, memory, disk space, network
- locating and interpreting logs and configure additional logging
- auditing system use and user activity
- orchestrating system start-up and shutdown
- managing disk space
- perform system cleanup:
 - logs
 - backup archives

SAS Viya provides monitoring functions through several facilities: SAS Environment Manager, the CLI, or the CAS Server Monitor in a programming-only environment.

Monitoring in SAS Environment Manager



A metric is a measurement that describes the performance of a component or a subsystem of SAS Viya.

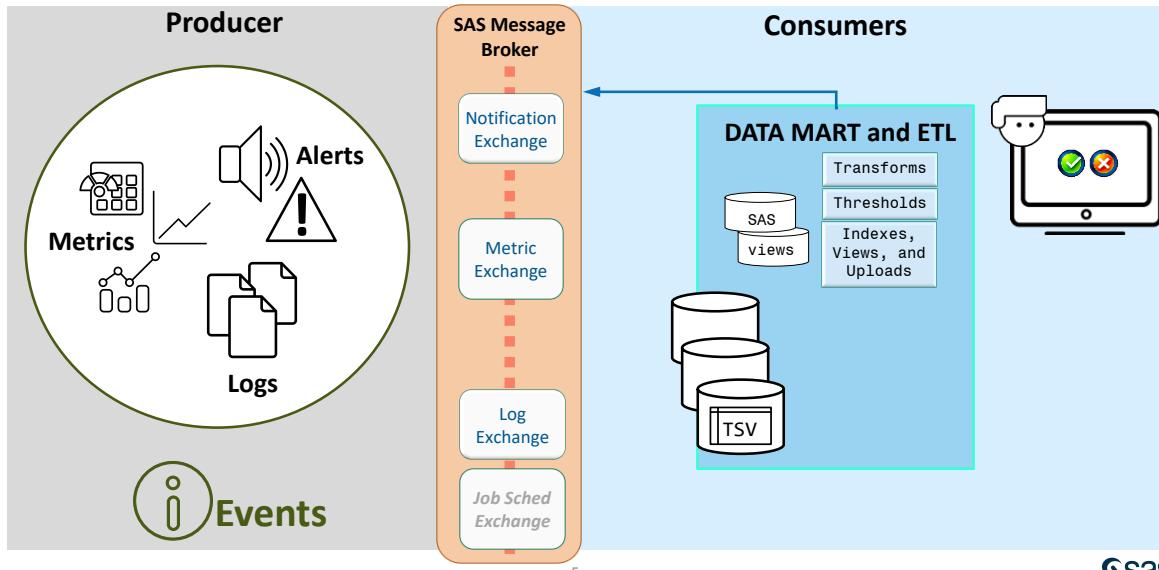
4

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You can monitor your SAS Viya system through SAS Environment Manager. It provides an overall look of your environment's health and status, as well as detailed views of metric information for the machines and services within your deployment. It uses collected data generated by the operations infrastructure.

SAS Viya Operations Infrastructure



5

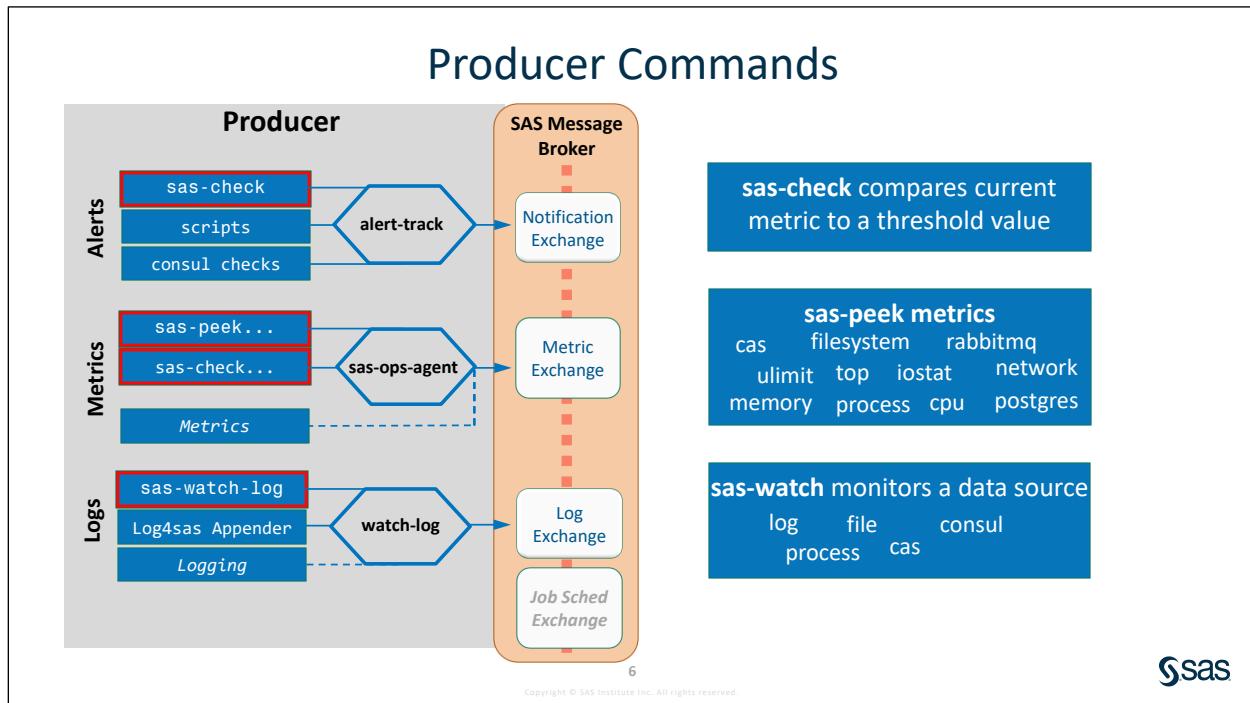
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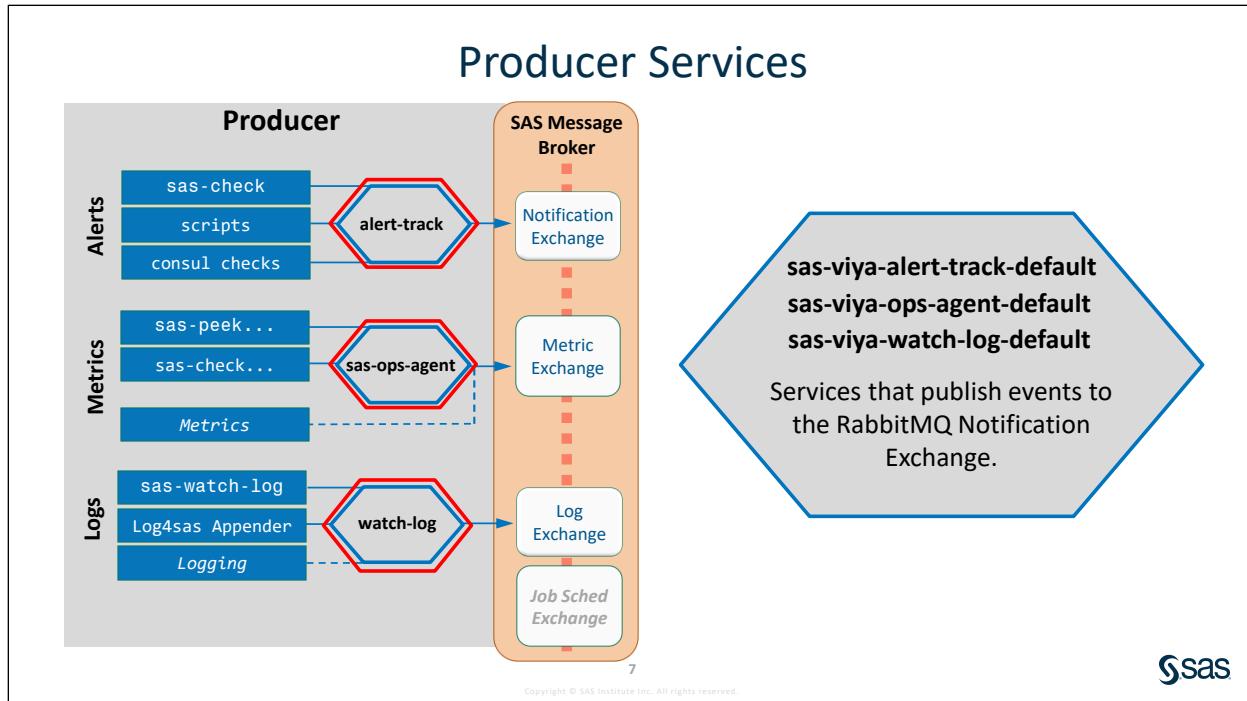
The *operations infrastructure* is an event-driven architecture that underlies monitoring, logging, and auditing of the SAS Viya system.

An event in this architecture represents some unit of information, such as a metric reading or CPU usage over time, or a log message, such as a microservice has failed, or an alert notification.

The architecture keeps separate the producer of the events and consumers of the events. The producer of an event collects information and publishes that information to a message exchange without knowledge about the consumer of the information. The information consumer looks for specified types of information and retrieves the information when it is found. Types of consumers include extract, transform, and load (ETL) processes or a data mart. Likewise, the consumer has no knowledge about the source of the information.

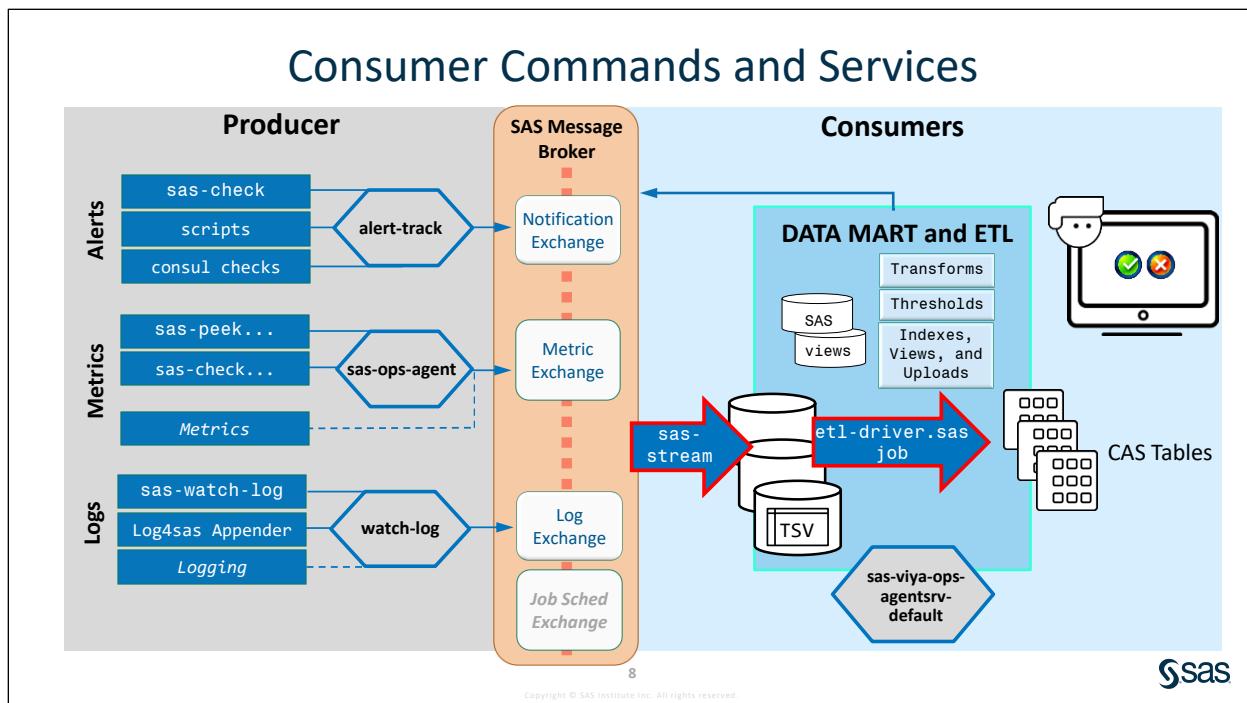


The sas-peek, sas-check, and sas-watch commands collect metric data, log events, alert messages, and notification messages.



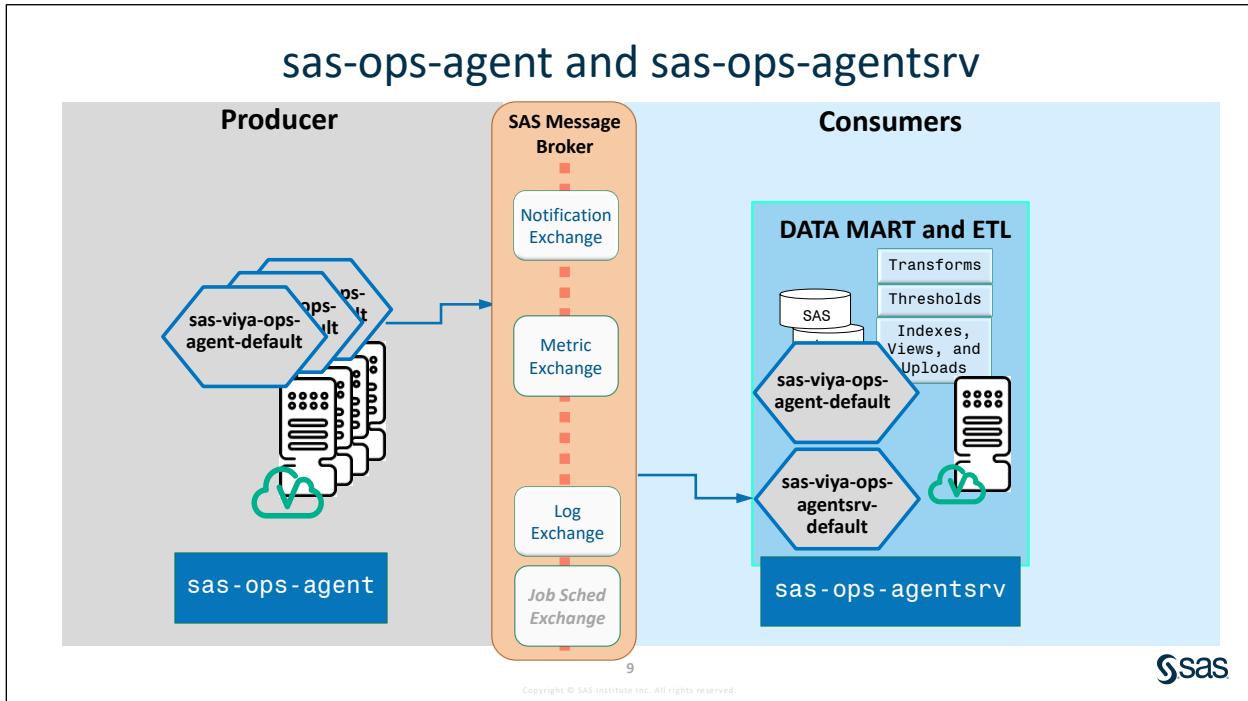
The services **sas-viya-alert-track-default**, **sas-viya-ops-agent-default**, and **sas-viya-watch-log-default** run on every machine in your deployment and use the producer commands to carry out operations. These services publish events to the SAS Message Broker.

Note: These services perform tasks that use the producer commands and are managed using **sas-viya-all-services**.



The sas-stream process performs the consumer role by collecting metric, log, and notification events that are written to the SAS Message Broker. Then, the stream process writes the data to tab-separated value (TSV) files.

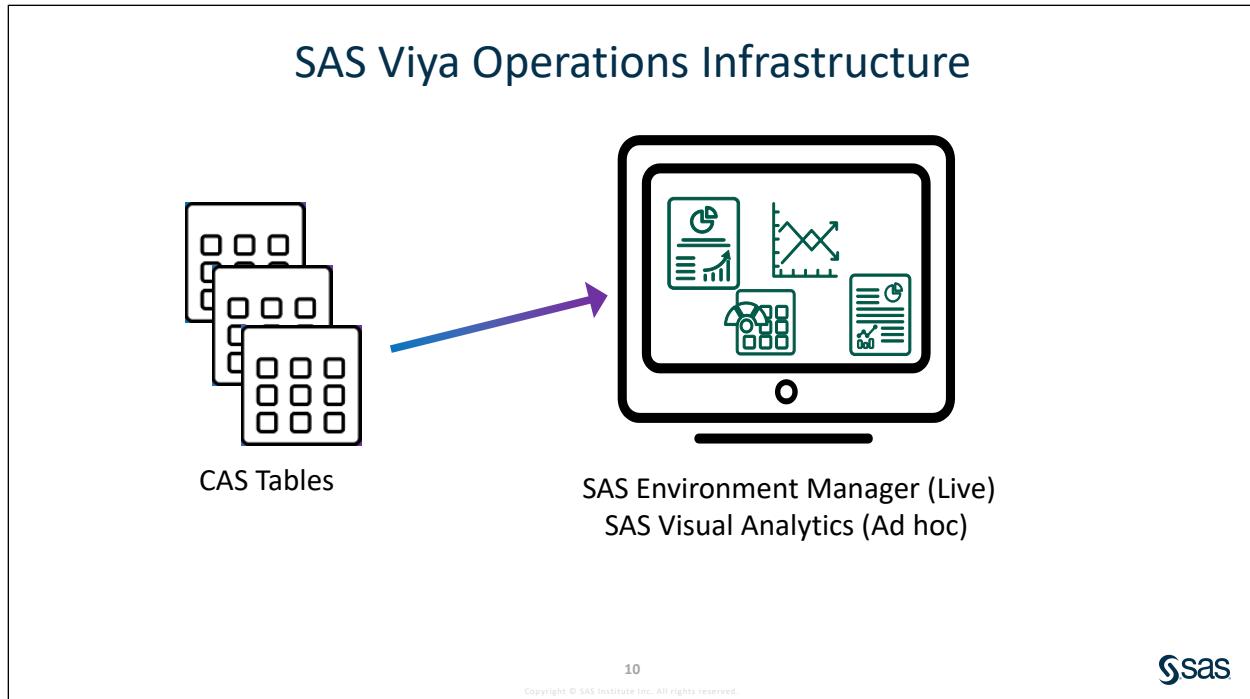
Every five minutes, the etl_driver.sas process runs and loads data from the data mart to the CAS server, where it is then surfaced in SAS Environment Manager. An example of this is that both the Logging view and the Machines view of SAS Environment Manager surface data that is collected through the operations infrastructure.



A sas-ops-agent is deployed to each machine in a SAS Viya deployment. The operations agent manages monitoring and operations activities on all machines.

Each agent is managed by the sas-ops-agent-default service. All instances of the sas-ops-agent run the same set of scheduled tasks that are published to the SAS Message Broker on a regular basis.

The consumer service sas-viya-ops-agentsrv-default runs only on the machine hosting the Environment Manager data mart. The machine is identified in the Operations host group in the inventory.ini file used during deployment. The sas-ops-agentsrv service runs a schedule of tasks that gather information from the SAS Message Broker and runs processes to organize the data in the data mart.



The components of the operations infrastructure are configured to run on an automatic schedule and the result of the processes is to create or produce metric and log data in CAS tables. SAS Environment Manager or SAS Visual Analytics can display or produce reports using the data from the CAS tables.



Exploring Machines Page in SAS Environment Manager

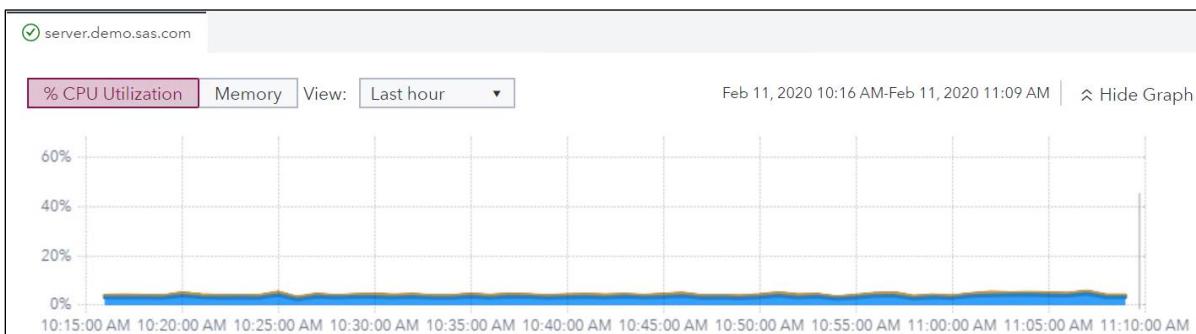
This demonstration explores the Machines page in Environment Manager.

1. Sign in to SAS Environment Manager as **Christine**, if not already signed in.
2. Select **Machines** from the left navigation menu to display the Machines page.

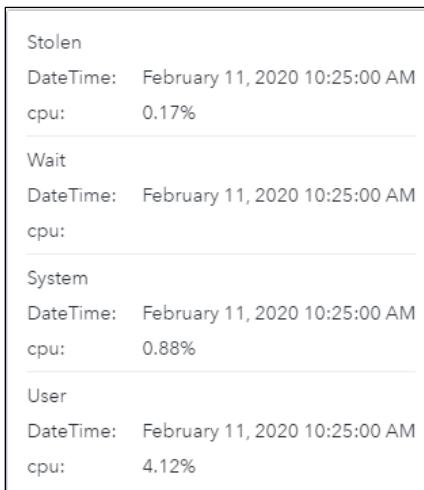


The Machines page will display a list of machines across the top of the page. SAS Viya is deployed on only one machine in our environment, and the check mark indicates the status of available.

By default, the chart on the Machines page displays the percentage of total CPU utilization over the last hour. You can change that to the last 6, 12, or 24 hours.

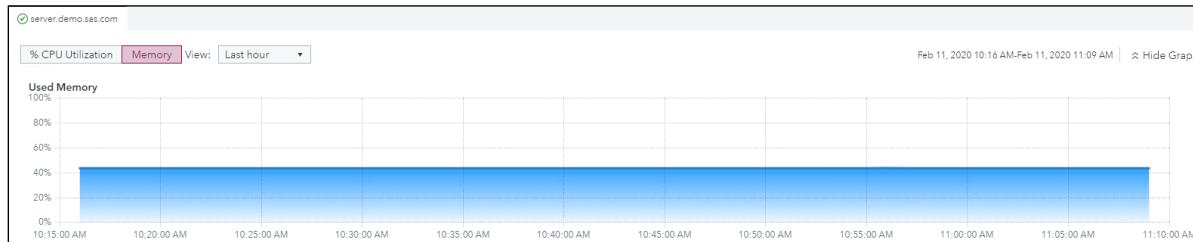


3. Place your pointer on a line on the graph to view detailed information about the CPU utilization, divided into User, System, Wait, and Stolen usage.



Note: The chart is updated every two minutes. The data that is displayed on the chart is updated every five minutes.

4. Click **Memory** above the chart to display the percentage of memory that is used over the selected time period. You can place your pointer on a line on the graph to view detailed information about memory usage.



The Machine Checks table displays the results of these predefined system checks that are performed on the machine:

- **Disk utilization of SAS Config filesystem:** The check passes if disk usage does not exceed 95%.
- **Memory percent free:** The check passes if memory usage does not exceed 95%.
- **Serf Health Status:** The check passes if the SAS Configuration Server is running.

The table is refreshed every 10 seconds.

Machine Checks		Date modified: February 11, 2020 11:18:15 AM	
Name	Status	Notes	
Disk utilization of SAS Config filesystem	✓	Enter a warning state if disk space utilization exceeds 95%	
Memory percent free	✓	Enter a warning state if memory utilization exceeds 95%	
Serf Health Status	✓		

The **Service Instances** table displays a list of the service instances that are running on the selected machine and the status, address, and port for each service instance. Again, data is refreshed every 10 seconds.

Service Instances					Date modified: March 15, 2018 10:39:06 AM
Service Name	Status	Address	Port	Description	
Home service	✓	10.96.14.88	36496	Supports the functionality of the ...	
SAS Backup Manager	✓	10.96.14.88	37409	All management of the backup ...	
SAS Data Studio	✓	10.96.14.88	40883	Provides a graphical interface to ...	
SAS Environment Manager	✓	10.96.14.88	41197	Enables administration, monitor...	

5. Click **Properties**  on the toolbar on the right. The Properties area displays information such as the host name, operating system, uptime, and total memory.

>>
Properties

Hostname:
server.demo.sas.com

Operating system:
linux

Architecture:
amd64

Total memory:
119.83 GB

Kernel release:
3.10.0-957.27.2.el7.x86_64

Kernel version:
#1 SMP Mon Jul 29 17:46:05 UTC 2019

Operating system release:
CentOS Linux release 7.6.1810 (Core)

6. Click **System Metrics**  on the toolbar on the right to display detailed information about memory usage and availability.

System Metrics

Datetime:
Feb 11, 2020 11:22 AM

Machine name:
server.demo.sas.com

Actual free memory:
66.85 GB

Actual used memory:
52.98 GB

Uptime:
0 Day(s) 17 Hour(s) 13 Minute(s) 52 Second(s)

% Memory used:
44.22%



7. Click **SAS Packages**  on the toolbar to display the name and version number of the packages that are installed on the machine.

SAS Packages	
sas-aacomp1:	01.20.00
	20191104.231512463969.x86_64
sas-aastatistics1:	03.21.00
	20191104.231512427032.x86_64
sas-accelmva1:	01.20.00
	20191104.231512465559.x86_64
sas-analyticccmn1:	03.21.00
	20191104.231512428828.x86_64
sas-analytics-services:	1.1.101
	20191107.1573086654892.x86_64



8. Click **Ulimit**  on the toolbar to display the System Limits area, which shows resource limits for users on the machine.

System Limits	
asHard:	unlimited
asSoft:	unlimited
coreHard:	unlimited
coreSoft:	0
cpuHard:	unlimited

End of Demonstration



Exploring SAS Viya Operations Infrastructure

1. SAS Environment Manager uses the collected data from the data mart that is part of the operations infrastructure. The components of the operations infrastructure are configured to run on an automatic schedule, but you can use the operations infrastructure commands at any time to acquire ad hoc information.

The operations infrastructure agent runs a specified set of tasks. Each task is specified as a combination of a command to execute and information about how to publish the output of the command. Most tasks invoke the sas-peek or sas-check components, and publish the output as an event to the SAS Message Broker.

Use the **sas** connection in mRemoteNg. Navigate to **/opt/sas/viya/home/bin**.

```
[sas@server ~]$ cd /opt/sas/viya/home/bin
```

2. Use the sas-peek command: **./sas-peek -help**
3. To see nicely formatted CAS Server metrics with a metric event detail level of 2, issue the following command: **./sas-peek cas -level 2 -format pretty**

```
[sas@server bin]$ ./sas-peek cas -level 2 -format pretty
{
  "version": 1,
  "collectorName": "sas-peek-cas",
  "collectorVersion": "1.4.26+9a8010b",
  "timeStamp": "2019-04-15T14:20:29.972216-04:00",
  "properties": {
    "consulNodeName": "server.demo.sas.com",
    "hostname": "server.demo.sas.com",
    "os": "linux_amd64"
  },
  "measurements": [
    {
      "resourceType": "cas_node",
      "resourceId": "6+god2RghUnnwBo5QvAbCg==",
      "properties": {
        "connected": "true",
        "httpPort": "8777",
        "httpProtocol": "https",
        "name": "server.demo.sas.com",
        "pid": "18406",
        "port": "44131",
        "resourceName": "server.demo.sas.com|server.demo.sas.com|44131|Controller",
        "serverType": "Controller",
        "uuid": "E2829120-C009-D642-8BB8-DEB3D6BD4309"
      },
      "metrics": [
        {
          "name": "cpuLoad",

```

4. Issue the following command: **./sas-ops tasks**

The operations agent (sas-ops-agent) runs a specified set of tasks to collect system metrics and to publish the metric data to the SAS Message Broker. Use the sas-ops tasks command to view a list of the tasks that are performed by the agent and the frequency of the task that is run.

Task Name	Description	Frequency
CASMetrics	CAS performance metrics (level=2)	1m0s
CheckCpu	Check CPU activity less than 95% busy	1m0s
CheckFileSystemLinux	Check file system space on Linux system less than 90% used	1m0s
CheckFileSystemWindows	Check file system space on Windows system is less than 90% used	1m0s
CheckMemory	Check memory less than 95% used	1m0s
EmiSweeper	Retry publishing any payloads that failed to publish earlier	1h0m0s
FileSystemMetrics	Host file system metrics (level=2)	1m0s
FlushReqTask	Flush task list to permanent storage on request	0s
HostEnvSnapshot	Host environment snapshot	02:25
LogFileArchive	Archive daily	04:00
NetworkInterfaceMetrics	Host network interface metrics (level=2)	1m0s
OpsAgentActivity	Internal sas-ops-agent activity monitor	2m0s
OpsAgentTaskStatistics	Internal sas-ops-agent task statistics activity monitor	4m0s
OpsArm	Runs Ops ARM	1h0m0s
OpsValidate	Perform system validation when requested	0s
PostgresMetrics	Postgres metrics (level=2)	1m0s
RabbitmqMetrics	RabbitMQ performance metrics (level=2)	1m0s
SpringBootMetrics	Spring Boot performance metrics (level=2)	1m0s
SpringBootMetricsLevel3	Spring Boot performance metrics (level=3)	4h0m0s
SystemMetrics	Host system metrics (level=2)	1m0s
TopProcessMetrics	Top CPU process consumers (level=2)	1m0s
registerOpsAgentsServiceTask	Register Ops-Agent service task	1h0m0s
registerOpsServiceTask	Register Ops service task	1h0m0s

5. Issue the following command: **./sas-ops tasks -name "ops-agentsrv"**

The ops-agentsrv runs a schedule of tasks that gather information from the SAS Message Broker and runs processes to organize data in the data mart.

Task Name	Description	Frequency
ARMEtl	Application Response Measurement (ARM) ETL task	01:18
DatamartEtl	Datamart incremental etl driver	5m0s
DatamartRollOff	Datamart daily rolloff task	02:18
DatamartzipTSV	Datamart daily ZIP TSV task	03:43
EmiSweeper	Retry publishing any payloads that failed to publish earlier	1h0m0s
FlushReqTask	Flush task list to permanent storage on request	0s
OpsAgentActivity	Internal sas-ops-agent activity monitor	2m0s
OpsAgentTaskStatistics	Internal sas-ops-agent task statistics activity monitor	4m0s
genAudit	Extract audit records. Generate a CSV files for given applications	2h0m0s
registerOpsAgentSvrServiceTask	Register Ops-AgentSvr service task	1h0m0s
updateInventory	Update inventory	01:23

6. Use the **sas-ops datamarts** command to display the status of the Environment Manager data mart management tasks. These recurring jobs update, manage, and maintain the Environment Manager data mart.

```
[sas@server bin]$ ./sas-ops datamarts
evdm
SASFormats : 28K
SASReports : 0K
application : 47649K
arm : 325146K
last-update : 2019-04-09T16:49:22.222254-04:00
lastvals : 2752K
log : 722509K
metric : 329661K
notification : 5K
subjects : 40920K
total : 1470486K
application
    notification : 4K
    resource : 30289K
    security : 17356K
arm
    arm : 325146K
log
    log : 722509K
metric
    cas : 1583K
    cas_node : 1497K
    cas_system : 1718K
    event : 7010K
    metric : 21546K
    postgres : 1330K
    postgres_table_size : 20541K
    rabbitmq : 1710K
    rabbitmq_exchange : 17720K
    rabbitmq_node : 1977K
    rabbitmq_vhost : 1281K
    springboot : 217435K
    springboot_counter : 3213K
    springboot_gauge : 3013K
    system : 2018K
```

The results include information about the three jobs that are used by the data mart:

etl-driver Job	Processes the metric data and the log data and loads the data into the data mart
casLogLoad_SYSCRC	Return code from SAS for loading the log data into CAS for the log phase of the ETL job
casLogSearchLoad_SYSCRC	Return code from SAS for updating the CAS search index for the log phase of the ETL job
casLogconnect_SYSCRC	Return code from SAS for connecting to CAS for the log phase of the ETL job
casMetricConnect_SYSCRC	Return code from SAS for connecting to CAS for the metric phase of the ETL job
casMetricLoad_SYSCRC	Return code from SAS for loading the metric data into CAS for the metric phase of the ETL job
endtime	End time of the ETL job
jobExitRC	Return code from the operating system that is written by ops-runsas
osLogRC	Maximum return code (either 0,1, or 2) from SAS for the log phase
osMetricRC	Maximum return code (either 0,1, or 2) from SAS for the metric phase

readMetricTransform_SYSCRC	Maximum return code from SAS for reading the raw TSV file for the metric phase
starttime	Start time of the ETL job
Status	Status message (ok, error, or warning) that is written by ops-runsas at the end of the job
statusRC	Maximum return code from SAS

Nightly rolloff job		Removes old data mart data from CAS
endtime	End time of the rolloff job	
jobExitRC	Return code from the operating system that is written by ops-runsas	
starttime	Start time of the rolloff job	
status	Status message (ok, error, or warning) that is written by ops-runsas at the end of the job	

Nightly ZIPTSV job		Archives old TSV files into ZIP format, removes old archive files, and updates the data mart inventory
deleteOldZips_SYSCRC		Return code from SAS for deleting old zipped TSV files
endtime	End time of the ZIPTSV job	
jobExitRC	Return code from the operating system, written by ops-runsas	
osZipTSVRC	Maximum return code (either 0,1, or 2) from SAS for archiving the TSV files	
starttime	Start time of the ZIPTSV job	
status	Status message (ok, error, or warning) that is written by ops-runsas at the end of the job	
statusRC	Maximum return code from SAS	
updateInventory_SYSCRC	Maximum return code from SAS for updating all inventory files (one per resource type)	
zipTSV_SYSCRC	Maximum return code from SAS to zip TSVs and delete old ZIP files, written by SAS	

End of Demonstration



Practice

1. Using the **sas-peek** Command

In this practice, you use the SAS Viya operation infrastructure commands to read metrics for system and service resources.

- Use the **sas** connection in MRemoteNG. Navigate to **/opt/sas/viya/home/bin**.

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

- Read metrics for system and service resources. Issue the **./sas-peek --help** command.

```
./sas-peek --help
```

- Issue the **./sas-peek cpu -pretty** command (to make the output more readable).

```
./sas-peek cpu -format pretty
```

- (Optional) Obtain CAS server metrics. Do not forget the **-format pretty** option.

- (Optional) Display the top five processes on this host. Do not forget **-n** option.

2. Using the **sas-check** Command

In this practice, you use the SAS Viya operation infrastructure commands that compare metrics for a specific resource with threshold values.

- Use the **sas** connection in MRemoteNG. Navigate to **/opt/sas/viya/home/bin**.

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

- Read metrics for system and service resources. Issue the **./sas-check --help** command.

```
./sas-check --help
```

- Use **sas-check** to display example WARNING and ALERT (critical) messages.

Issue following command: **./sas-check cpu -warning 1 -format line**

```
./sas-check cpu -warning 1 -format line
```

Issue the following command: **./sas-check cpu -warning 1 -critical 1 -format line**

```
./sas-check cpu -warning 1 -critical 1 -format line
```

3. Using the **sas-ops** Command

The capabilities of the operations infrastructure are also provided in command line interfaces, which gives administrators interested in more IT-related information the ability to customize the monitoring and logging information to meet their own needs.

One of the primary commands that surfaces information from the framework is **sas-ops**.

Operations Infrastructure CLI: sas-ops Command

alerts	Stream alerts or show the most recent alerts
satamarts	Display data mart information
env	Display summary of relevant environment information
info	Display properties of the components of the deployment
logs	Stream log events
metrics	Stream metric events
notifications	Stream notification events
notify	Publish a notification message
services	List services, service details, and health
tasks	List task defined for sas-ops-agent
validate	Perform validation of the deployment

- a. Use the **sas** connection in MRemoteNG. Navigate to **/opt/sas/viya/home/bin**.

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

- b. Issue the **./sas-ops --help** command.

```
./sas-ops --help
```

- c. View a list of the tasks that are performed by the agent and the frequency of the task that is run. Issue the **./sas-ops tasks** command.

```
./sas-ops tasks
```

- d. For validating system health, use the **validate** command: **./sas-ops validate --h**

```
./sas-ops validate --h
```

The **sas-ops validate** command is a valuable troubleshooting technique, especially for start-up issues. Even if the start-up process for a SAS Viya deployment has issues and SAS Environment Manager is inaccessible, the **sas-ops** command will still function and will provide health information to help identify where problems might have occurred.

- e. Use the **level 3** option or **verbose** option for more detail.

```
./sas-ops validate --level 3
```

End of Practices

6.2 Exploring System and Audit Reports

Audit Tables and Reports

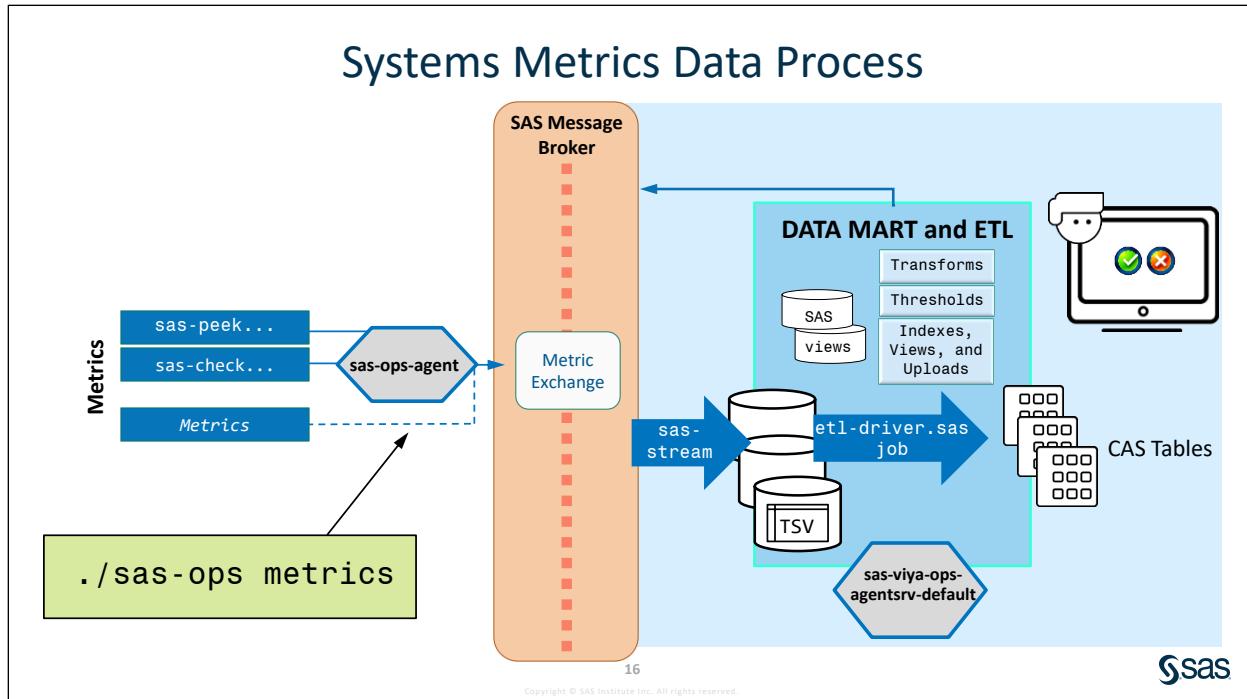
SAS Environment Manager (Live)
SAS Visual Analytics (Ad hoc)

EVDM Table (SystemData CAS Library)	Report
SPRINGBOOT	Application Activity
CAS, CAS_NODE, CAS_SYSTEM	CAS Activity
SYSTEM_FILESYSTEM	Disk Space
POSTGRES_TABLE_SIZE	Infrastructure Data Server Tables
RABBITMQ, RABBITMQ_EXCHANGE, RABBITMQ_NODE	Message Queue Activity
SYSTEM, SYSTEM_FILESYSTEM, SYSTEM_NETWORK_INTERFACE	System Activity
AUDIT	User Activity

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SAS Auditing is reporting based on historical data of your SAS Viya system. You can view trends of resource utilization and view user activity regarding reports, data, and applications that are most heavily used over time. The CAS tables with auditing information is part of the operations infrastructure that is event driven and configurable to meet specific needs. Additional reports can be created and made available.

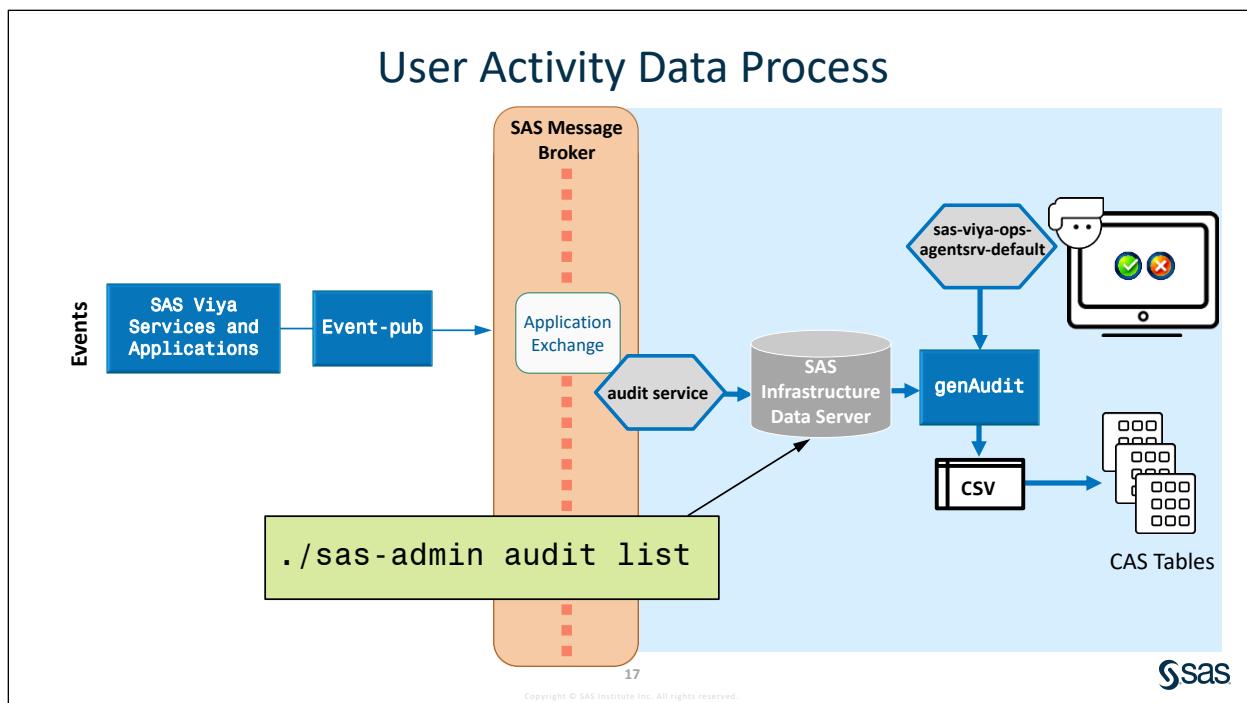
Note: Auditing is not designed for legal-quality auditing and currently is not capable of capturing every user action.



Data for the System Activity report is provided by the event-driven operations infrastructure. For system metrics, the information is pulled from the Metrics exchange and persisted in the data mart.

Administrators can run the `sas-ops metrics` command to see what information is flowing through the metrics exchange at any time.

The data for reports on system metrics is retained for three days by default.



An audit record is generated

- whenever an action is performed on a resource, such as a folder or a job. Actions include access to the resource and any changes made to the resource (updating, creation, or deletion).
- whenever a security-related action occurred, such as logging on to an application or changing an authorization rule.

The audit records are stored in the SAS Infrastructure Data Server and, by default, are retained for seven days. Records older than seven days can be archived to a local storage location.

You can view the audit records with the sas-admin audit command.

Considerations for Audit Configuration

Auditing every read action could create too much data.

Reset audit data if data is corrupt.

Focus on events that matter:
Did a log on fail?
Did someone try to access data or a report?

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Configuration decisions can affect disk usage. Depending on how auditing is configured, admins might see increased disk space requirements. For example, if all Read operations are requested, opening a simple report could generate many read records for items such as authorization rules, folders, data, and finally the report.

Note: If audit data is incorrect or corrupted:

- Delete files in `/opt/sas/viya/config/var/cache/auditcli` on the Operations host (where `sas-ops-agentsrv` is running)
- `genAudit` will re-create the files when it next runs

Note: Reset audit data if any of these services go down unexpectedly:

- `sas-ops-agent`
- `casManagement` service
- Audit service



Examining Operations Infrastructure Data and Reports

This demonstration examines the data that is created by the SAS Viya operations infrastructure processing and then introduces the reports created with it.

Viewing SystemData Tables

1. Sign in to SAS Environment Manager as **Christine**, if not already signed in.
2. Select the **Data** page.



3. Select **Data Sources** tab.
4. Expand **cas-shared-default** ⇒ **SystemData** caslib.

The operations infrastructure processes generate metric, audit, and log data and store that data in CAS tables. Applications such as SAS Environment Manager or SAS Visual Analytics can display or produce reports using the data from the CAS tables.

Table	Description
AUDIT	02/11/20 10:14 AM • sas.ops-agentsrv
CAS	02/11/20 11:11 AM • sas.ops-agentsrv
CAS_NODE	02/11/20 11:11 AM • sas.ops-agentsrv
CAS_SYSTEM	02/11/20 11:11 AM • sas.ops-agentsrv
POSTGRES	02/11/20 11:11 AM • sas.ops-agentsrv
POSTGRES_TABLE_SIZE	02/11/20 11:11 AM • sas.ops-agentsrv
RABBITMQ	02/11/20 11:11 AM • sas.ops-agentsrv
RABBITMQ_EXCHANGE	02/11/20 11:11 AM • sas.ops-agentsrv
RABBITMQ_NODE	02/11/20 11:11 AM • sas.ops-agentsrv
RABBITMQ_VHOST	02/11/20 11:11 AM • sas.ops-agentsrv
SPRINGBOOT	02/11/20 11:11 AM • sas.ops-agentsrv

SystemData

Name: SystemData

Description: Stores application generated data, used for general reporting.

Server: cas-shared-default

Source type: PATH

Personal: false

Path: /opt/sas/viya/config/data/cas/default/sysData/

Include subdirectories: false

5. Click the **SYSTEM_CPU_USAGE** table to view details of the table.

The screenshot shows the SAS Data Explorer interface with the following details:

- Title Bar:** SYSTEM_CPU_USAGE, 06/02/2012 12:03 PM • sas.ops-agentsrv
- Table View:**
 - Header: #, Name, Label, Type, Raw Le..., Format..., Format, Tags
 - Rows: 14
 - Sample Data: Available
 - Profile: Available
 - Filter: Filter
- Table Data:**

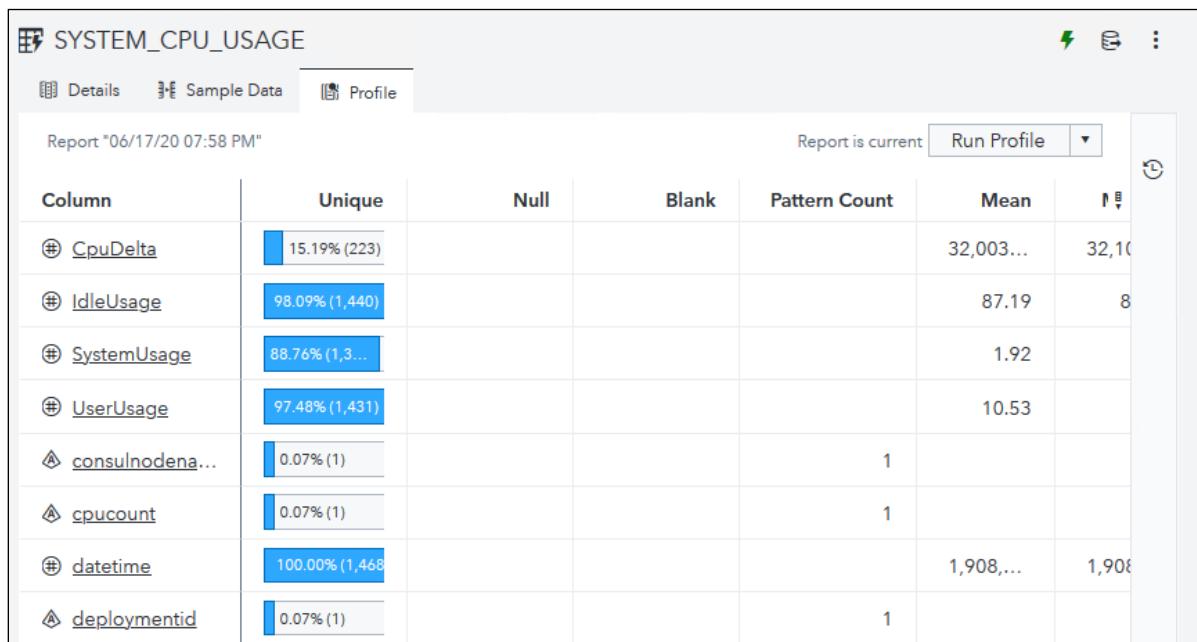
#	Name	Label	Type	Raw Le...	Format...	Format	Tags
1	datetime		double	8	22	DATET...	⌚
2	shift	Work Shift...	double	8	9	SHIFT...	⌚
3	tzoneoff		double	8	12		⌚
4	deploymentid		char	255	255		⌚
5	tenantid		char	255	255		⌚
6	machine		char	256	256		⌚
7	consulnodeidname		char	256	256		⌚
8	resourcetype		char	32	32		⌚
9	resourceid		char	500	500		⌚
10	CpuDelta		double	8	12		⌚
11	IdleUsage		double	8	12		⌚
12	SystemUsage		double	8	12		⌚
13	UserUsage		double	8	12		⌚
14	cpucount		char	6	6		⌚
- Table Metadata:**
 - Date profiled: (none)
 - Columns: 14
 - Rows: 1.1 K
 - Size: --
 - Label: (not available)
 - Location: cas-shared-default/SystemData
 - Date created: Feb 11, 2020 02:19 AM
 - Date modified: Feb 11, 2020 11:11 AM
 - Date last accessed: Feb 11, 2020 11:11 AM
 - Source table: (not available)
 - Source CAS Library: (not available)
 - Encoding: utf-8
 - Tags (0): No items have been added. ⌚

6. You can view sample data here or run a profile on the data. Click the **Profile** tab and select **Run Profile**.

The screenshot shows the SAS Data Explorer interface with the following details:

- Top Navigation:** Details, Sample Data, **Profile** (highlighted with a red box).
- Profile View:**
 - Icon: Bar chart, line graph, pie chart.
 - Text: NO PROFILES ARE AVAILABLE.
 - Text: To view profile information, run a profile job for this table.
 - Buttons: Run Profile (highlighted with a red box), Run Profile and Save.

7. After a moment, a report will populate on this page.



The screenshot shows a report titled "SYSTEM_CPU_USAGE" generated at "06/17/20 07:58 PM". The report is currently active. It displays a table with columns: Column, Unique, Null, Blank, Pattern Count, Mean, and N. The data includes:

Column	Unique	Null	Blank	Pattern Count	Mean	N
CpuDelta	15.19% (223)				32,003...	32,10
IdleUsage	98.09% (1,440)				87.19	8
SystemUsage	88.76% (1,3...				1.92	
UserUsage	97.48% (1,431)				10.53	
consulnodena...	0.07% (1)			1		
cpucount	0.07% (1)			1		
datetime	100.00% (1,468)				1,908,...	1,908
deploymentid	0.07% (1)			1		

Reviewing Dashboard Reports

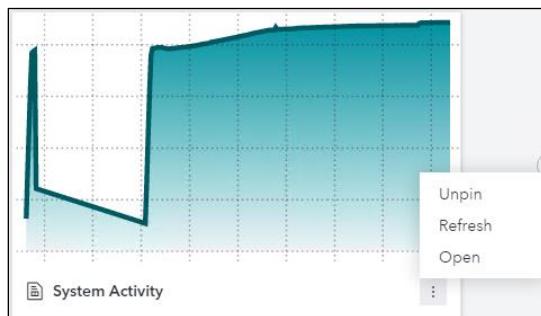
8. To view reports on the dashboard, navigate to the **Dashboard** page.



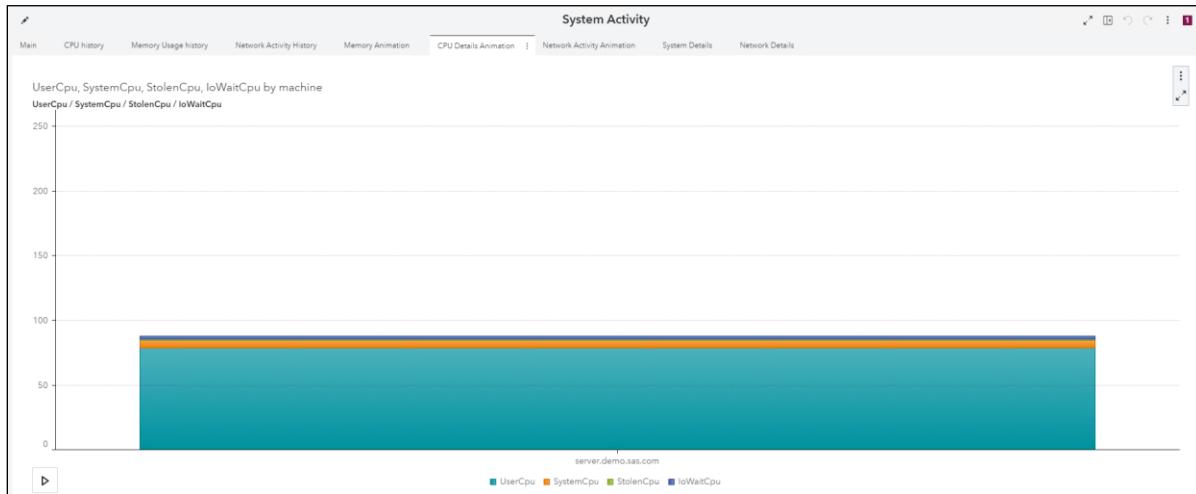
9. Click **Show Reports** at the top right of SAS Environment Manager if they are hidden.



10. The default reports are shown at the bottom of the dashboard. If necessary, scroll to the right until the System Activity report is visible. Click the **More options** menu and select **Open**.



11. The report opens in the SAS Report Viewer. Click the **CPU Details Animation** tab in the System Activity report and click the **Play** button at the bottom of the screen.



The reports on the dashboard are provided by SAS for the administrator's use. They are SAS Visual Analytics reports, so the data for them is loaded into CAS and is available for administrators to use to develop additional reports.

The reports on system resources activity are structured similarly:

- multiple pages across the top for different metrics
- a button selector to view data for specific machines
- a time-based slider that allows the viewer to limit the data shown in the graph

Using Auditing CLI Interfaces

The **ops-dm-admin** command will show information about the data mart. It is in the directory on the machine that hosts the data mart.

12. Using the **sas** connection in MRemoteNG, navigate to **/opt/sas/viya/home/bin**.

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

13. Enter this command:

```
./ops-dm-admin show
```

```
[sas@server bin]$ ./ops-dm-admin show
2019-04-10T10:18:53.056195-04:00 INFO [main.go:255] [ops-dm-admin] - Datamart show
config/ops/datamarts/evdm/ARM_SUBSYS=ARM_PROC
config/ops/datamarts/evdm/EMI_CAS_LOAD=Y
config/ops/datamarts/evdm/EMI_CAS_LOAD_LOGS=Y
config/ops/datamarts/evdm/EMI_CAS_LOAD_METRICS=Y
config/ops/datamarts/evdm/EMI_CAS_RETAIN_DAYS=3
config/ops/datamarts/evdm/EMI_DELETE_TSVZIP_DAYS=10
config/ops/datamarts/evdm/EMI_ZIP_TSV_DAYS=1
```

Property Values for the Data Mart Configuration

ARM_SUBSYS	Specifies the application response measurement (ARM) subsystem to use. Valid values are ARM_PROC or ARM_DSIO.
EMI_CAS_RETAIN_DAYS	Specifies the number of days that the metric and log data are retained in CAS. The default value is 3. Note: Do not set this value to be greater than the value of the EMI_DELETE_TSVZIP_DAYS property, because the metric and log data will be deleted before the EMI_CAS_RETAIN_DAYS limit is reached. For example, if you set EMI_CAS_RETAIN_DAYS to 30 and EMI_CAS_RETAIN_DAYS to 10, the data is deleted after 10 days, and no data is ever available for days 11 through 30.
EMI_DELETE_TSVZIP_DAYS	Specifies the number of days to keep the metric and log data on disk in the data mart. The default value is 10.
EMI_ZIP_TSV_DAYS	Specifies the number of days of data in the data mart to collect before raw TSV files are compressed into a ZIP file. It also applies to the number of days to keep SAS log files that are generated by standard data mart batch jobs. The default value is 1. Do not use a value lower than 1.

Note: TSV file logs are located in `/opt/sas/viya/config/var/lib/evmsvrops/evdm/log/log`.

14. To view the default auditing frequency, enter the following command:

```
./sas-ops tasks -name "ops-agentsrv"
```

The genAudit task is run every two hours.

Task Name	Description	Frequency
ARMEtl	Application Response Measurement (ARM) ETL task	01:18
DatamartEtl	Datamart incremental etl driver	5m0s
DatamartRollOff	Datamart daily rolloff task	02:18
DatamartzipTSV	Datamart daily ZIP TSV task	03:43
EmiSweeper	Retry publishing any payloads that failed to publish earlier	1h0m0s
FlushReqTask	Flush task list to permanent storage on request	0s
OpsAgentActivity	Internal sas-ops-agent activity monitor	2m0s
OpsAgentTaskStatistics	Internal sas-ops-agent task statistics activity monitor	4m0s
genAudit	Extract audit records. Generate a CSV files for given applications	2h0m0s
registerOpsAgentsrvServiceTask	Register Ops-Agentsrv service task	1h0m0s
updateInventory	Update inventory	01:23

For a summary of the operations infrastructure agent command line, see the Extended Learning page.

15. Enter the command `./sas-ops-agent list` to return a list of the tasks that are available and displays the frequency and a brief description for each task.

```
./sas-ops-agent list
```

```
[sas@server bin]$ ./sas-ops-agent list
2019-04-10T11:31:22.525106-04:00 INFO [xllogr.go:157] [ops-agent] - sas-ops-agent log started for server ops-agent version 1.4.62-samarium dat
18-06-21 19:43:43Z on host server.demo.sas.com
2019-04-10T11:31:22.525197-04:00 INFO [xmmain.go:304] [ops-agent] - Log started for ops-agent service type cluster on host system server.demo.
com
2019-04-10T11:31:22.525250-04:00 INFO [xmmain.go:345] [ops-agent] - Waiting for Consul and Rabbit access
2019-04-10T11:31:22.729312-04:00 INFO [xmmain.go:360] [ops-agent] - Using Consul base key config
2019-04-10T11:31:32.818505-04:00 INFO [xmconsul.go:113] [ops-agent] - getConsulLockName [lock:true error:<nil> name:ops-agent]
2019-04-10T11:31:33.021443-04:00 INFO [xmconsul.go:217] [ops-agent] - getConsulTaskListHeader [role:VIYA icount:1 host:server.demo.sas.com ser
e:cluster]
2019-04-10T11:31:33.105013-04:00 INFO [xmconsul.go:122] [ops-agent] - freeConsulLockName [name:ops-agent error:<nil>]
2019-04-10T11:31:33.105075-04:00 INFO [xmconsul.go:292] [ops-agent] - freeConsulLockName [error:<nil> name:ops-agent]
2019-04-10T11:31:33.105171-04:00 INFO [xmclist.go:31] [ops-agent] - Formatted task list:
Task name: CASMetrics
  Freq.....: 1m0s
  Description.: CAS performance metrics (level=2)
Task name: CheckCpu
  Freq.....: 1m0s
  Description.: Check CPU activity less than 95% busy
Task name: CheckFilesystemLinux
  Freq.....: 1m0s
```

16. Use the **sas-admin audit list** command to list all of the audit records that have been collected. Because the list of records that are returned can be long, you can use options to manage the records that are returned and more easily locate the records that you want to see.

```
./sas-admin audit list -h
```

```
[christine@server bin]$ ./sas-admin audit list -h
NAME:
  sas-audit list - List the records of audit entries.

USAGE:
  sas-audit list [command options] [arguments...]

COMMANDS:

OPTIONS:
  --action          Returns entries that are based on the specified action.
  --after           Returns entries that are created after the specified timestamp. For example: 2017-05-23 2017-05-23T18:15Z
  --application    Returns entries that are based on the specified application.
  --application-contains Returns entries whose application contains the specified pattern.
  --before          Returns entries that are created before the specified timestamp. For example: 2017-05-23 2017-05-23T18:15Z
  --csv             Directs the output as CSV of the specified file.
  --description    Returns entries that are based on the specified description.
  --description-contains Returns entries whose description contains the specified pattern.
  --details         Shows more detailed output, including the attributes: description, type, remoteAddress
  --help, -h        Shows help.
  --limit '50'      Maximum number of records of audit entries to return. The default is 50.
  --no-header       Excludes the header rows in the various output formats.
  --remote-address Returns entries that are based on the specified remote address.
  --remote-address-contains Returns entries whose remote address contains the specified pattern.
  --resolve-uri    Where applicable, an audit entry's URI is resolved to the content location of the audit entry's application. For
ample, the URI for a SAS Report would contain its name and folder.
  --sort-by         The sort criteria for the returned records of audit entries. By default, the list is sorted by ID. The valid val
are: id, timestamp, type, action, state, description, user, application, remoteAddress
  --start "0"       0-based offset of the first record of an audit entry to return. The default is 0.
  --state          Returns entries that are based on the specified state.
  --type            Returns entries based on the specified type.
  --user-id        Returns entries that are based on the specified user ID.
  --user-id-contains Returns entries whose user ID contains the specified pattern.
  --user-id-starts-with Returns entries whose user ID starts with the specified pattern.
```

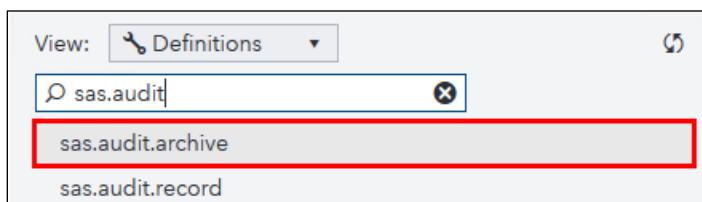
Configuring the Auditing Properties in SAS Environment Manager

17. Change the auditing configuration through SAS Environment Manager. Select the **Configuration** page.



18. In the **View** field, select **Definitions**.

19. Search **sas.audit.archive**.



20. Click the **Edit** icon beside Audit Service.



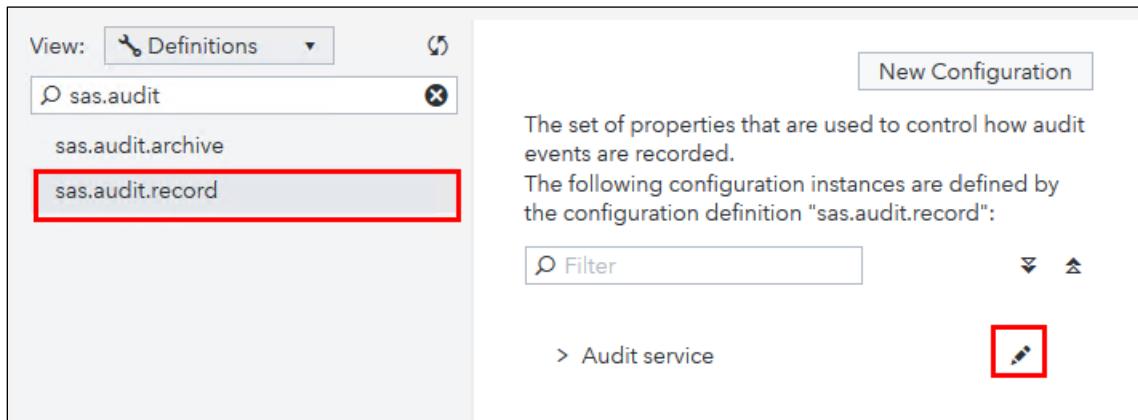
21. You can modify properties here that control the Audit Archive.

batchSize	The number of audit records to process in a single batch during an archive request.
enabled	Enables archiving of audit records.
localRetention	The retention period for persisting audit records within the service. This defaults to seven days.
scanSchedule	The schedule that determines when an archive request is initiated.
storage.local.destination	The file path to use when 'storageType' is set to 'local'.
storageType	The external storage mechanism to use for archiving audit records. Must be set to 'none' or 'local'.

22. Click **Cancel**.

23. In the **View: Definitions** field where you selected **sas.audit.archive**, open **sas.audit.record**.

24. Click the **Edit** icon beside Audit service.



25. You can modify properties here that control the Audit Record.

application	Customizable properties to control which application specific audit events are recorded.
type	Customizable properties to control which type of audit events are recorded.

Note: If the Audit Service Configurations are modified, the corresponding service must be restarted to pick up your changes.

End of Demonstration



Practice

4. Moving a Custom Report to the SAS Environment Manager Dashboard

A custom report was created using the **SYSTEM_NETWORK_INTERFACE** table from the operations infrastructure data mart and is saved to Christine's My Folder. In this practice, you pin the report to the dashboard in SAS Environment Manager.

Note: The steps that were taken to create the report can be found in the Solutions section.

- a. Log on as **christine** with the password **Student1** in SAS Environment Manager.
- b. Select the **Content** area.
- c. Open **My Folder**. Do you see the new Network Transmit and Receive report? Click the report and note the URI.
- d. Right-click on the report and select **Pin to dashboard**.
- e. On the Content page, navigate to **SAS Content** \Rightarrow **Users** \Rightarrow **christine** \Rightarrow **Application Data** \Rightarrow **SAS Environment Manager** \Rightarrow **Dashboard Items**.
- f. Click the **Network Transmit and Receive** reference. Is the URI the same as the URI in My Folders?
- g. Click **Dashboard** page.
- h. Click **Show Reports** at the top right of SAS Environment Manager.
- i. Click the arrow on the right of the reports view to see second page of reports. Do you see the Network Transmit and Receive report?

Note: By clicking the **More info** menu, you can unpin the report from the dashboard, refresh the report, or open the report.

- j. The reports viewed on the dashboard are managed in the SAS Environment Manager settings. Click **Christine** at the top right of the SAS Environment Manager window and select **Settings**.
- k. Click **My Dashboard Items** in the Settings window. The Network Transmit and Receive report is in the My Dashboard Items list.

5. Configuring an Event for Reading Reports

- a. Click **Configuration** in SAS Environment Manager.
- b. Select **All services** from the **View** drop-down menu.
- c. Select **Audit service**.
- d. Scroll to the **sas.audit.record** configuration and select **Edit** icon.

e. Select **Add property** under **application**.

Add the following events to the application section:

Name: **reports.action.read.enabled**

Value: **true**

Click **Save**.

The screenshot shows a modal dialog titled "Add Property". Inside, there are two input fields: "Name:" with the value "reports.action.read.enabled" and "Value:" with the value "true". At the bottom right are two buttons: "Save" and "Cancel".

f. Select **Add property** under **application**.

Add the following events to the application section:

Name: **reports.action.read.state**

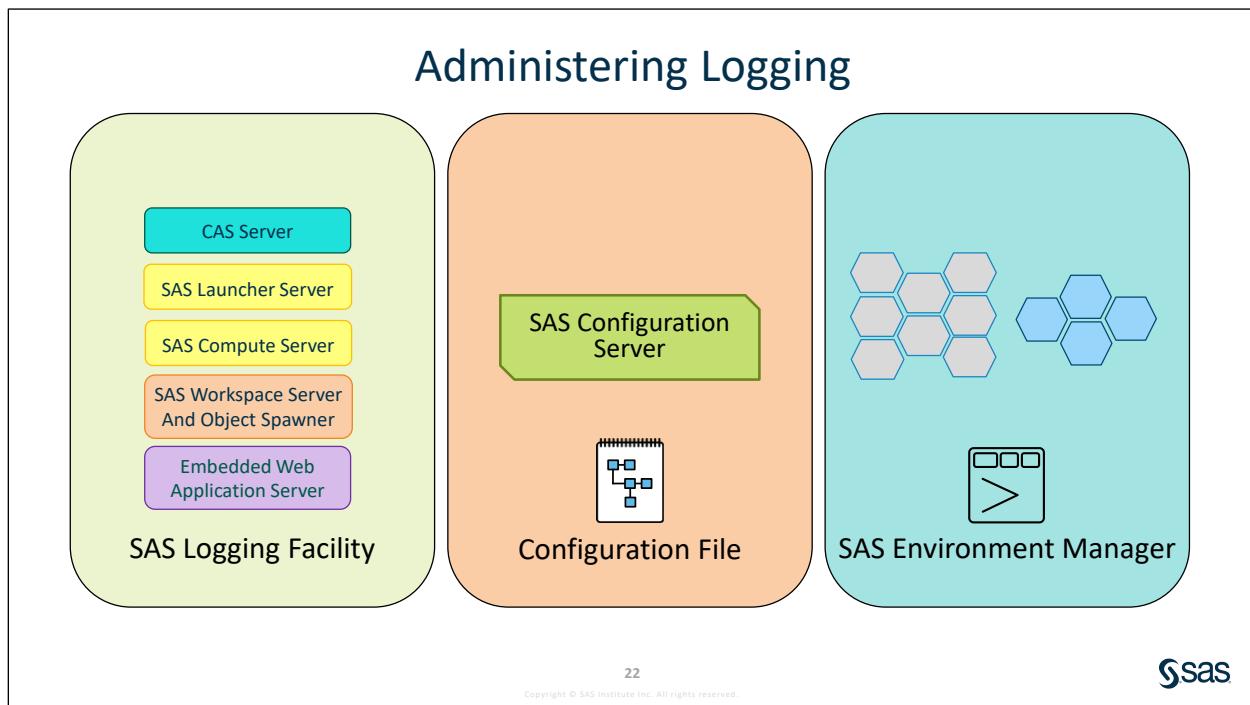
Value: **all**

You will need to open one or more reports to generate events that can be trapped. Open one or more of the auditing reports from your EV Dashboard gallery. You might need to wait a few minutes for the events to be detected and updated in the CAS table.

The easiest place to see whether your report read events are in place is to open the **User Activity** report from your EV Dashboard gallery and switch to the **Details** tab. Filter events for the reports application, read action, and if you want, a state of success.

End of Practices

6.3 SAS Viya Server Logging



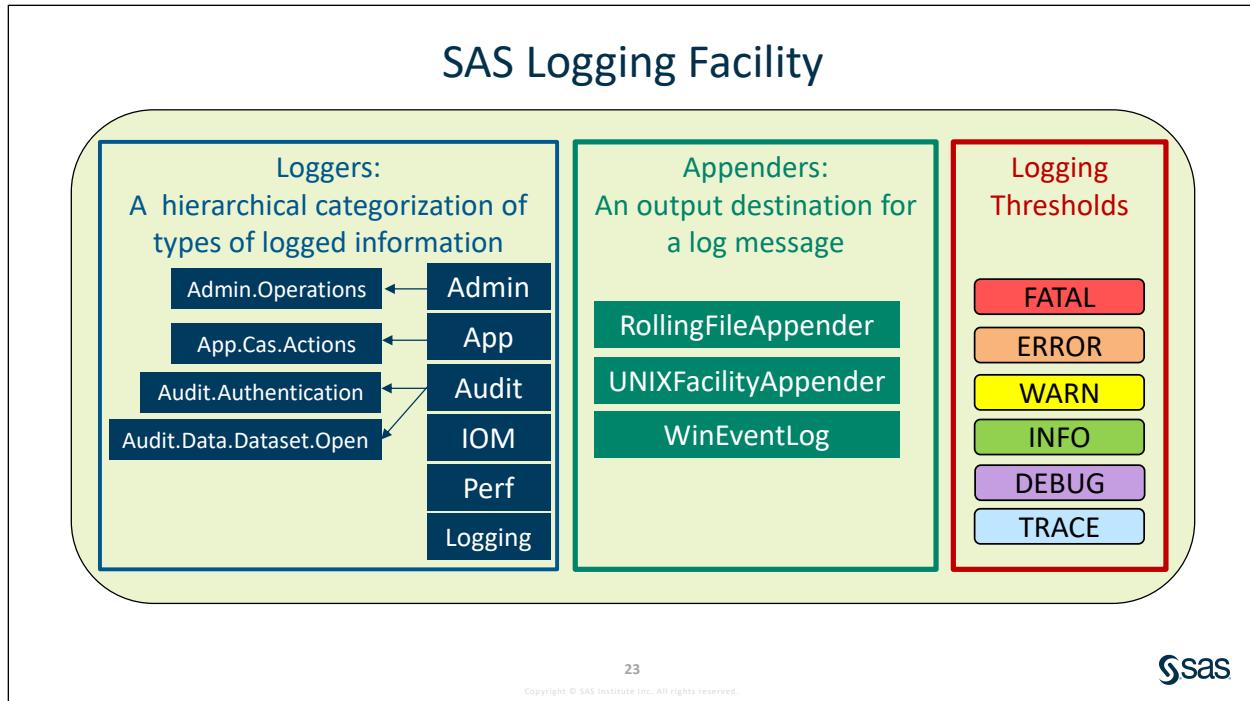
SAS Viya servers and services use different methods to control logging.

SAS Viya servers use the SAS logging facility to generate and process log messages.

SAS Configuration Server logging is controlled by a configuration file. The format of the configuration file and the logging process is different from SAS Viya servers.

Note: The workspace server default configuration does not generate a log, but it can be modified to create logs.

SAS Viya microservices and web applications logging is administered in SAS Environment Manager, where you set logging levels for each microservice and web application.



The SAS logging facility is used by most servers of SAS Viya, including the CAS server. It is a flexible, configurable framework that you can use to collect, categorize, and filter events and to write them to a variety of output devices.

Log events are categorized using a hierarchical naming system. These log event categories are called *loggers*. Loggers are organized hierarchically and inherit the attributes of their ancestor logger. Hierarchical logger names are separated by a period (.) (for example, Admin.Meta.Security). The root logger is the highest-level logger. All loggers inherit the root logger's attributes. The logging configuration file defines several message categories that are immediate descendants of the root logger. These high-level categories — Admin, App, Audit, IOM, and Perf — are used for SAS server logging and can be referenced by log events in SAS programs.

These log events can be directed to multiple output destinations, which are called appenders. You can specify the categories and levels of log events to report, the message layout, and filters based on criteria such as diagnostic levels and message content.

The logging configuration file sets a threshold for each logger. Messages at the threshold or higher level are processed by the logger, and messages that are lower than the threshold are ignored.

(Logging levels can be adjusted dynamically in SAS Environment Manager, without starting or stopping processes.)

The logging facility allows detailed changes to the logging configuration, including changes to message levels, output locations, and output format.

Logging Facility Definitions

Appender	An output destination for a log message.
Logger	A hierarchical categorization of types of logged information.
Diagnostic Level	The level that is associated with a log event. The levels are TRACE, DEBUG, INFO, WARN, ERROR, and FATAL.
Log Event	An occurrence that is reported by a program or server for possible inclusion in a log.
Filter	A set of character strings or thresholds. Events are compared to the filter to determine whether they should be processes.

Loggers

Admin	Processes administration events. The log messages are sent to the operating system log.
App	Processes events from applications.
App.cas.actions	Processes events from CAS actions.
Audit	Processes events used for auditing. These events include user authentication requests and administration of access controls.
IOM	For servers that use Integrated Object Model (IOM) workspace server interface.
Perf	Related to system performance.
Logging	Processes events from the logging system. Log messages are sent to the operating system log.

Here are some examples:

App.Program processes log events that are related to running a program using the SAS language.

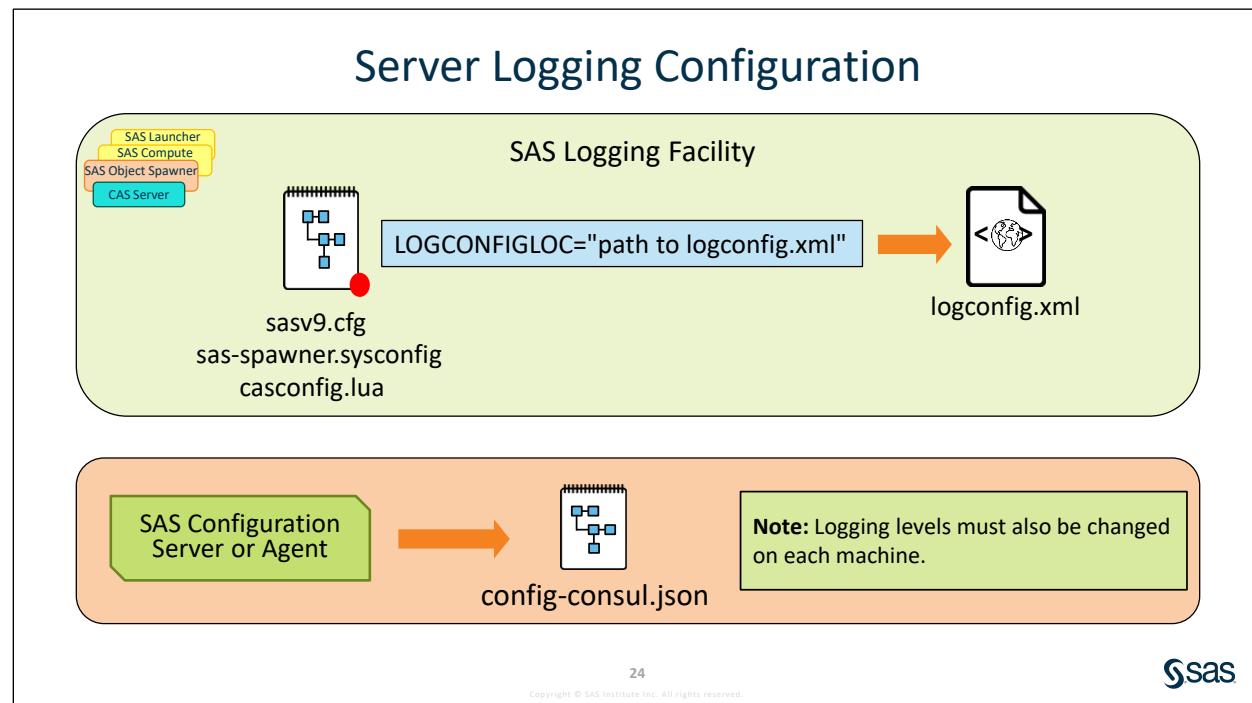
Audit.Authentication processes log events for server authentication requests.

Admin.Operations processes log events that are related to server operations, such as starting, pausing, and stopping an instance of a workspace server.

Audit.Data.Dataset.Open processes log events that are related to users' access to SAS libraries.

Appenders

<i>RollingFileAppender</i>	Writes log messages to a time-based rolling log file. By default, the file rolls over at midnight. By default, messages from the App, App.cas.actions, and Audit loggers are sent to this appender.
<i>UNIXFacilityAppender</i>	Writes log messages to the syslogd logging facility in the UNIX operating system. It discards messages that have already been logged by the appender. By default, messages from the Admin and Logging loggers are sent to this appender.
<i>WinEventLog</i>	Writes log messages to the Windows event viewer in the Windows operating system. By default, messages from the Admin and Logging loggers are sent to this appender.



Each SAS Viya server has an XML file that contains its logging configuration: what messages are captured and where they are sent, based on a diagnostic level filter. The LOGCONFIGLOC= option is specified in each server's configuration file, which points the server to this logconfig.xml file.

The logging configuration files are located under the server configuration directories:

- /opt/sas/spre/config/etc/server name
- /opt/sas/viya/config/etc/server name

Logging for the SAS Configuration Server is controlled by a JSON configuration file. The logging level for the SAS Configuration Server can be changed by editing the file **/opt/sas/deployment-name/config/etc/consul.d/config-consul.json**.

SAS Viya machines that do not host the SAS Configuration Server will host instead the SAS Configuration Server agent.

Note: The SAS Configuration Server must be restarted to complete the change to logging levels.

How Did the Message Make It to the Log?

logconfig.xml

```

<!-- Audit message logger -->
<logger name="Audit">
  <appender-ref ref="AuditTimeBasedRollingFile"/>
  <level value="Info"/>
</logger>

<appender class="RollingFileAppender" name="AuditTimeBasedRollingFile">
  <param name="Append" value="true"/>
  <param name="ImmediateFlush" value="true"/>
  <param name="Threshold" value="Info"/>
  ...
</appender>

```

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Thresholds are used to ***ignore*** log events that are *lower* than a particular level, or to ***include more detailed*** log events for debugging and problem resolution.

For example, the following thresholds cause the described responses:

- **ERROR** ignores any WARN, INFO, DEBUG, and TRACE messages, and shows only FATAL and ERROR.
- **INFO** ignores any DEBUG and TRACE messages and shows FATAL, ERROR, WARN, and INFO.

Pattern Layout: What Is Written to the Log

```
<param name="ConversionPattern" value="%d %-5p [%t]
%X{Client.ID} :%u - %m"/>
```

```
2017-04-10T16:18:51,622 INFO [00000008] :sas - Reserved IPv6
port 8591 for server listen (connection 1).
```

Pattern	Information	Value
%d	Event Date and Time	2017-04-10T16:18:51,622
%-5p	Logging Level	INFO
%t	Thread Identifier	[000000008]
%X{Client.ID}	Client ID	(blank in this message)
%u	User Identity	1221:sasadm@saspw
%m	Message	Reserved...

A pattern layout is a template that you create to format log messages for the appender classes in the SAS logging facility. The pattern layout that you define identifies the type of data, the order of the data, and the format of the data that is generated in a log event and that is delivered as output.

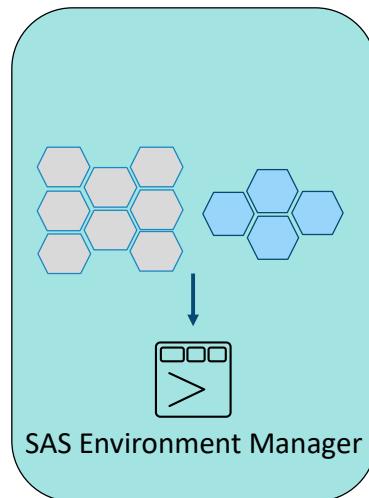
The pattern layout is referenced in an appender layout tag. For example:

```
<layout> <param name="HeaderPattern" value="DEFAULTHEADER"/>
<param name="ConversionPattern" value="DEFAULT"/>
```

The pattern layout is created by using a *conversion pattern*, which consists of literal text and format-control directives. Format-control directives are also called *conversion specifiers*.

For additional information, refer to "Pattern Layouts" on the Extended Learning page.

Microservices and Web Application Logging

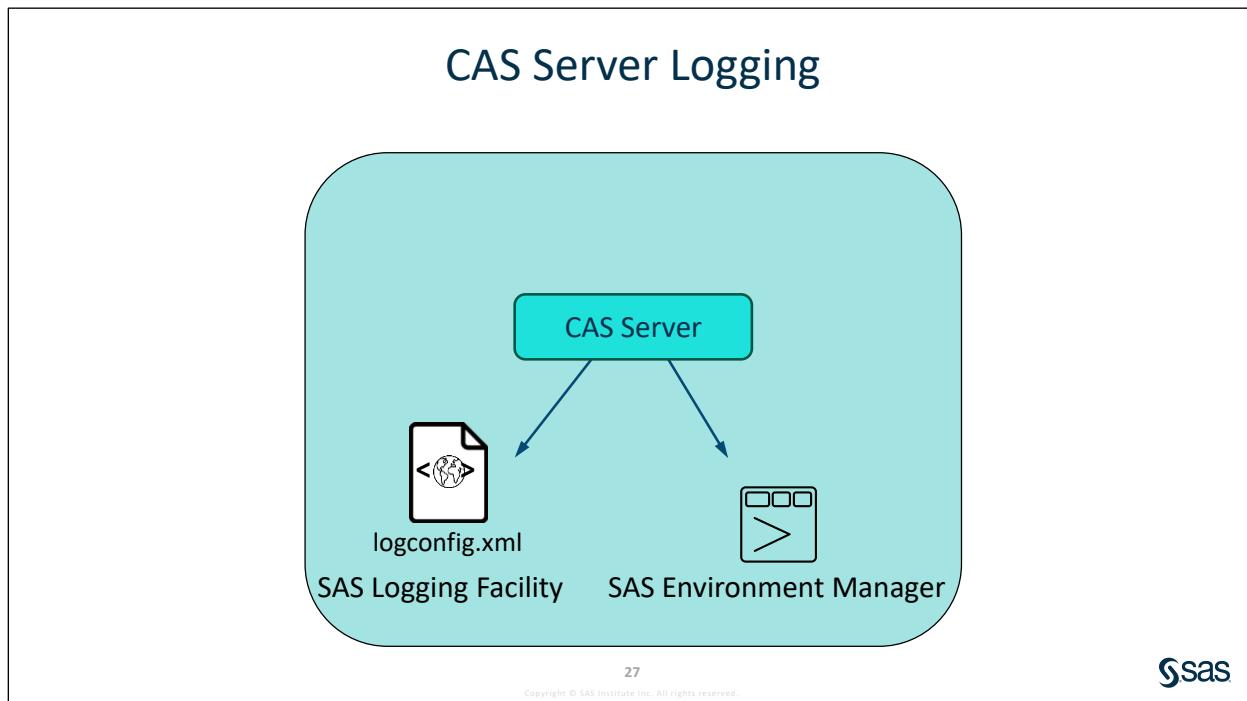


You use SAS Environment Manager to administer microservices and web applications logging. You can add a logger or change the level of a logger for microservices and web applications. However, SAS Environment Manager does ***not*** support deleting an existing definition. If you set a high level of logging in SAS Environment Manager, after problem resolution occurs, reduce the logging threshold to ensure that log volumes do not become too large.

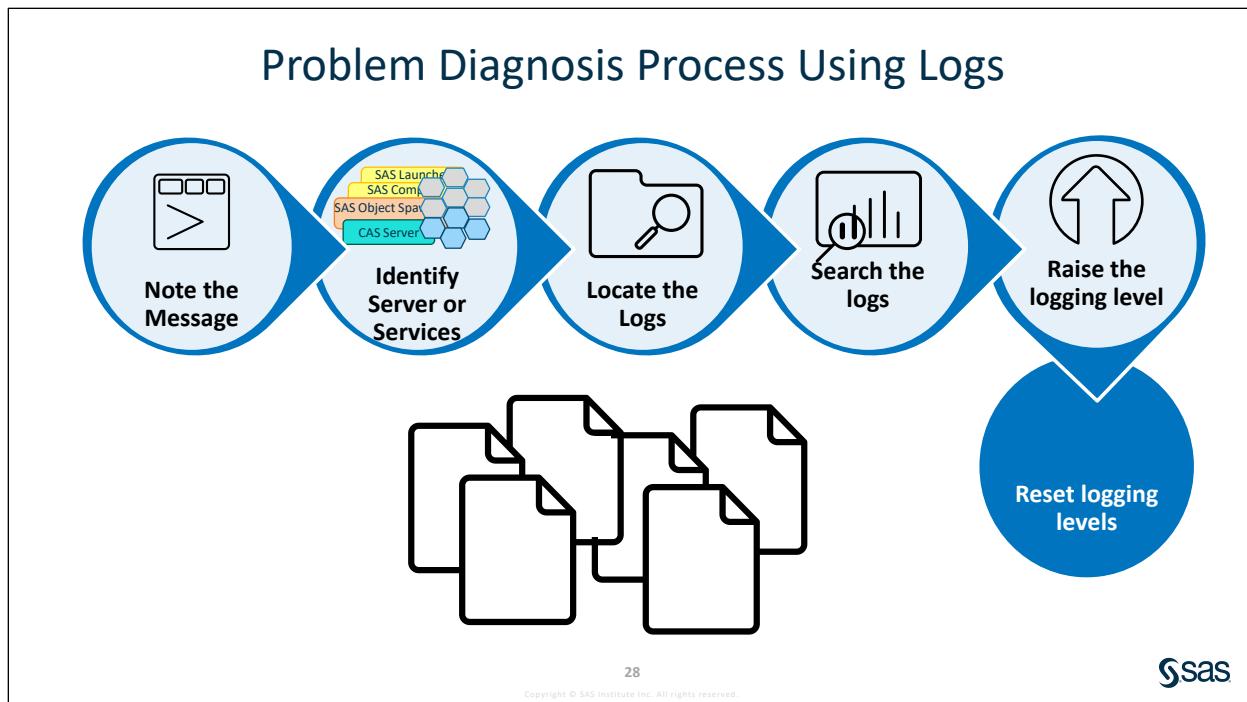
Note: For microservice and web application logs, you currently ***cannot*** do any of the following actions:

- change the format of the messages written to the log
- send the log to a different destination
- roll over the logs on a time-based schedule

Note: Microservices do not require a restart to pick up the changes to the logging configuration.

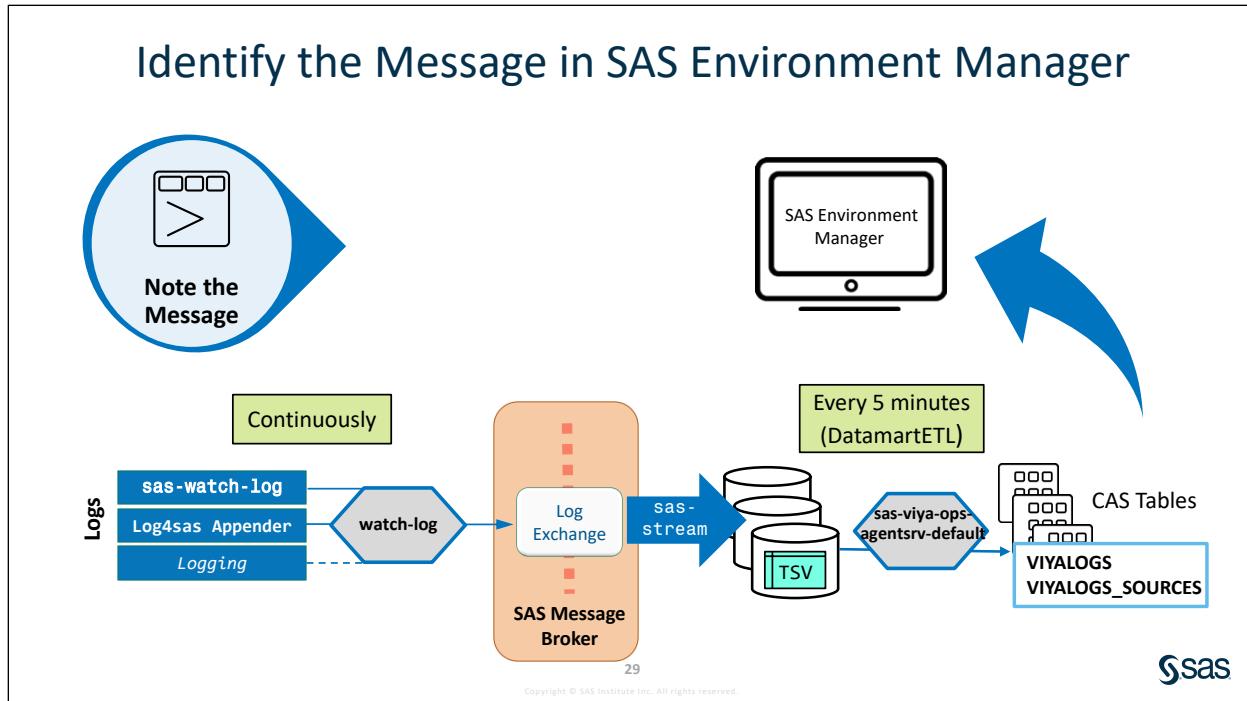


The logging for a CAS server is specified in the server's logging configuration file. This file specifies the loggers and logging thresholds that are used by the server. However, there might be instances, such as when working with SAS Technical Support, when you need to temporarily change the threshold level of a logger, add a logger, or delete a logger. You can use the **Servers** area in SAS Environment Manager to make these changes on a temporary basis. Any change that you make remains in effect until you restart the server. When you restart the server, the loggers and threshold levels are reset to the values that are specified in the logging configuration file.



The problem diagnosis process using logs:

1. **Note the message** from the interface and any relevant details.
2. **Identify the server or services** where the error occurs.
3. **Locate the logs** for the server or service based on the name of the service and what machines that service might run on.
4. **Search the logs** for errors or related messages.
5. If necessary, **raise the logging level** for the related services.
6. **Repeat** the process with the increased logging levels.
7. After problem resolution, **reset the logging levels to the defaults**.



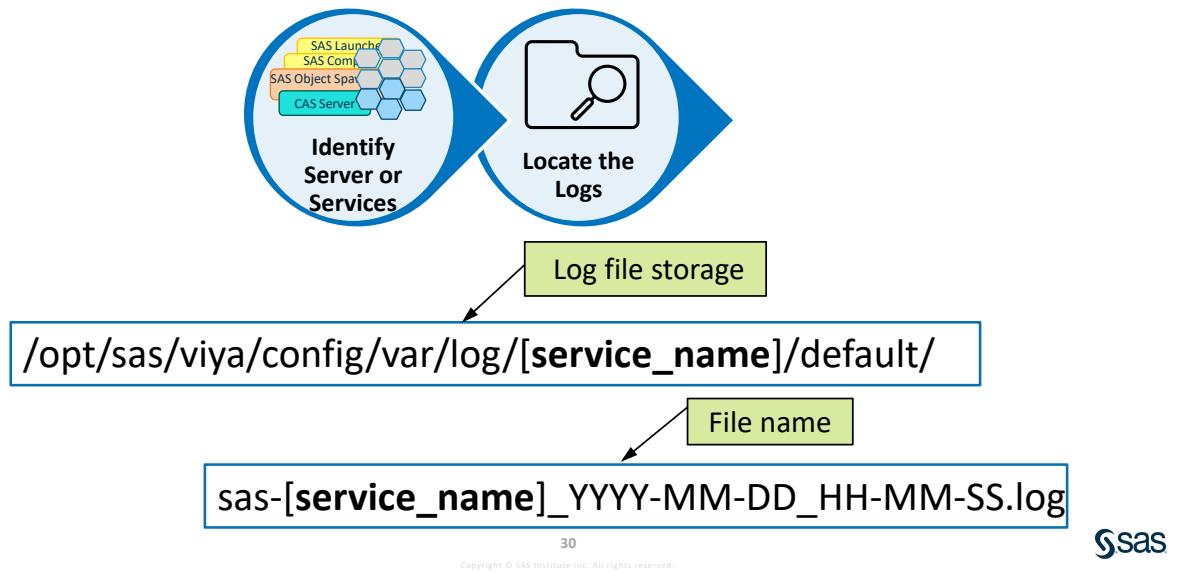
The operations infrastructure provides functions or tasks that are scheduled to collect and store log messages. These log messages can be viewed in SAS Environment Manager.

1. The **sas-watchlog** command continuously collects and sends log messages to the SAS Message Broker.
2. The **sas-stream** command pulls the messages from SAS Message Broker and writes them to disk as a tab-separated value (TSV) file.
3. Every five minutes, the **sas-ops-agentsrv** command runs the DatamartEtl task to extract log messages from the TSV file and load them into the **VIYALOGS** CAS-indexed search table.
4. SAS Environment Manager uses the information in the **VIYALOGS** table and the **VIYALOGS_SOURCES** table to display log messages and graphs that contain the frequency and trends of messages.

Note: The **VIYALOGS** and **VIYALOGS_SOURCES** tables are Search index tables. They cannot be read directly.

Note: It is possible to modify the frequency of this task by modifying the **sas-ops-agentsrv** DatamartEtl task definition.

Identify Where the Error Occurs and Locate the Logs



Each SAS Viya server, microservice, and web application creates a separate log in a separate directory. In addition, multiple services might contribute to a single problem, so it can be challenging to find the correct log.

Note: A symlink (**viya**) to this location is also created under the standard Linux logging directory **/var/log/sas**.

- spre -> /opt/sas/spre/config/var/log
- viya -> /opt/sas/viya/config/var/log

```
[lynn@server sas]$ pwd
/var/log/sas
[lynn@server sas]$ ls -li
total 0
2617339 lrwxrwxrwx 1 root root 28 Apr 25 09:01 viya -> /opt/sas/viya/config/var/log
```

Find Changed Logs

`sudo grep ERROR: /var/log/sas/viya/*/default/*`
 ⇒ Returns all logs with **ERROR** for services on the machine

`ls -ltr /* | grep "todays_date"`
 ⇒ Returns all logs that changed today



Search the logs

```
[christine@server default]$ sudo grep ERROR: /var/log/sas/viya/*/default/*
/var/log/sas/viya/cas/default/caslaunch_default_controller_daemon_2017-05-25_155235.err:2017-05-23T11:49:01
server:0: ERROR: Could not find the specified session.
/var/log/sas/viya/cas/default/caslaunch_default_controller_daemon_2017-05-25_155235.err:2017-05-23T12:04:59
server:0: ERROR: Could not find the specified session.
/var/log/sas/viya/cas/default/caslaunch_default_controller_daemon_2017-05-25_155235.err:2017-05-23T12:27:56
server:0: ERROR: Could not find the specified session.
/var/log/sas/viya/cas/default/caslaunch_default_controller_daemon_2017-05-25_155235.err:2017-05-24T13:20:18
server:0: ERROR: Could not find the specified session.
```

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You can use operating system commands to identify the log of interest.

Adjust Logging Levels

Servers

Adjust logging levels in logconfig.xml file which contains relevant loggers and appenders.

Services

Adjust using SAS Environment Manager:
Configuration ⇒ **Definitions** ⇒ **logging.level**

FATAL

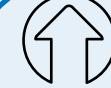
ERROR

WARN

INFO

DEBUG

TRACE



Raise the logging level

32

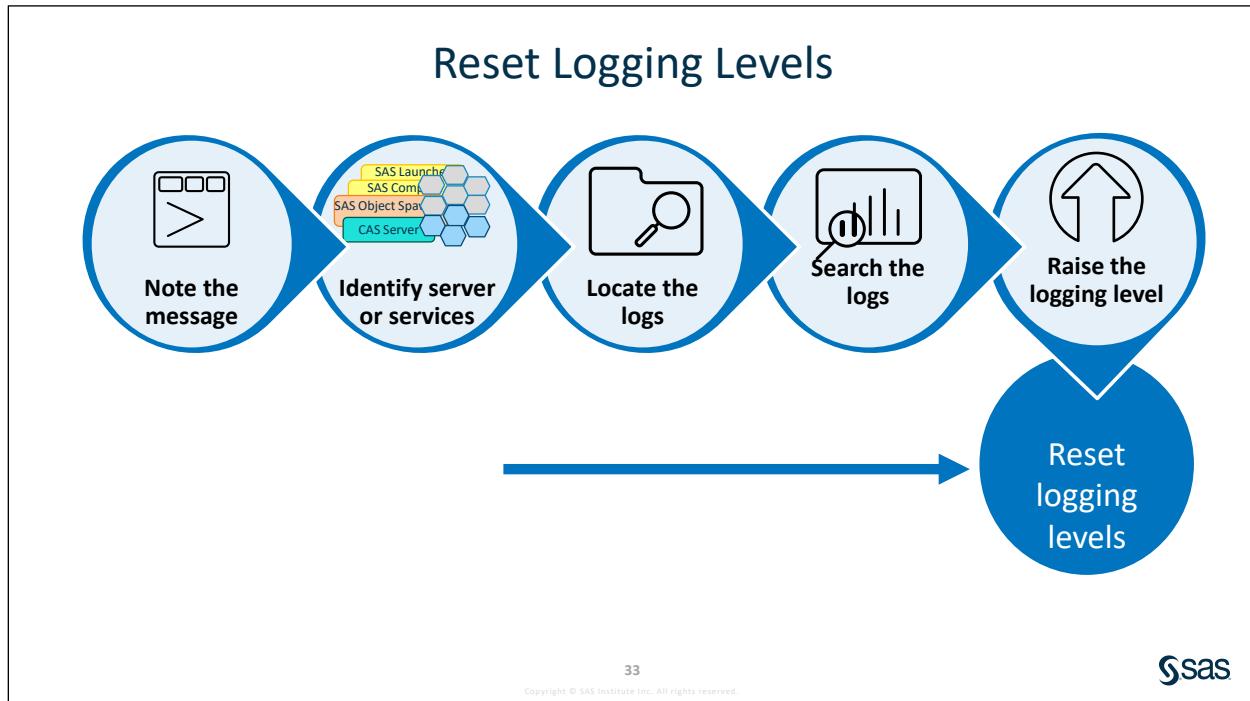
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If necessary, **raise the logging level** for the related servers or services as log messages are classified by their severity. You can adjust services logging levels using SAS Environment Manager. For SAS Viya servers, you need to modify the logconfig.xml and restart the server for the changes to be picked up.

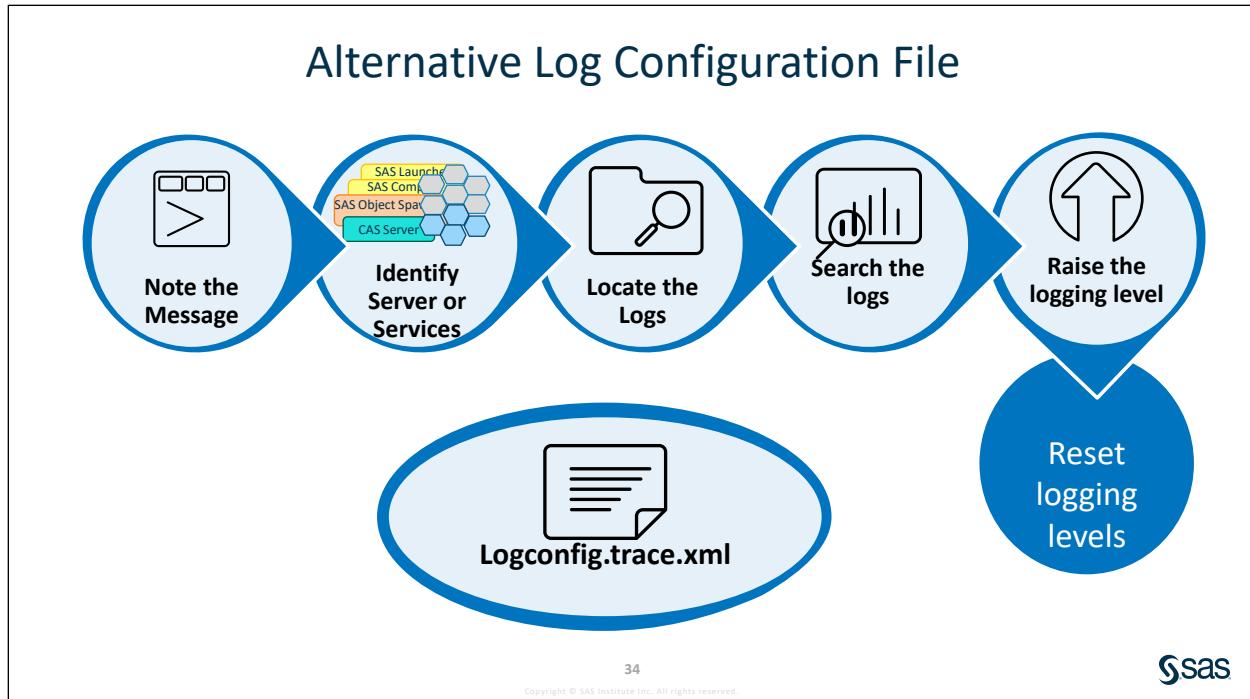
Repeat the process with the increased logging levels.

- Note:** Create a backup copy of logconfig.xml before editing the file.
- Note:** The service that collects log messages and stores them in a table for SAS Environment Manager parses the log messages to determine several fields for the message (including level). If that parsing algorithm cannot determine the level from the message, it is stored as NONE.
- Note:** In the case of the SAS Studio web application server, the default logging configuration file is **SASStudio-log4j.xml**. To increase the logging level, give that file a different name. Then rename the file **SASStudio-log4j.trace.xml** to **SASStudio-log4j.xml**.

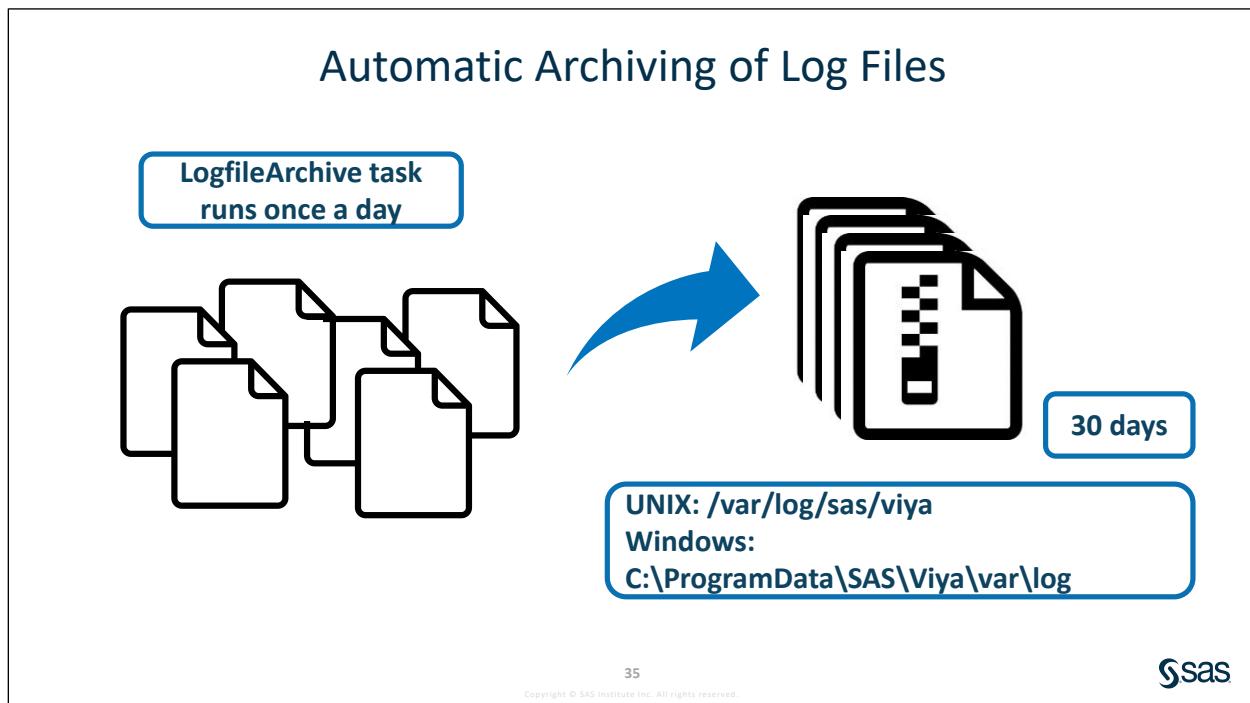


Be sure to reset logging levels to the defaults after problem resolution so as not to generate more logging than necessary, which could cause server performance issues. If it is a server log configuration file, a restart of the server is necessary.

- Note:** SAS Environment Manager supports adding a logger and changing a logger. You cannot delete an existing definition. If you set a high level of logging in SAS Environment Manager, after problem resolution occurs, reduce the logging threshold to ensure that log volumes do not become too large.
- Note:** For microservice and web application logs, you currently **cannot** perform any of the following actions:
- change the format of the messages written to the log
 - send the log to a different destination
 - roll over the logs on a time-based schedule
- Note:** Microservices do not require a restart to pick up the changes to the logging configuration.



You can also use an alternative logging configuration file is provided called **logconfig.trace.xml** or rename one of the alternative logging configuration files as **logconfig.xml**. This file raises the level of logging and might enable additional appenders.



These logs are not included in the archive process:

- all-services
- cas
- cas-consul-registration
- httpproxy
- rabbitmq-server
- vault
- watch-log

Note: This process does not allow the ZIP files to be saved anywhere other than the default location. You can develop your own process for moving the ZIP files to another directory in order to manage disk space and for managing the log files that are not included in the ZIP files.

In UNIX, to search in all the ZIP files for the log for a specific service, issue the following command from the **/var/log/sas/viya** directory (replace ‘transfer service’ with any service name that you are searching):

```
For f in `ls *.zip`; do echo "$f: "; unzip -l $f |grep transfer  
service; done
```

Note: Do not uncompress archived ZIP log files to their original location:
var/log/sas/viya/service_name/default for UNIX and
C:\ProgramData\SAS\Viya\var\log\service_name\default for Windows. Uncompressed files in these directories will be compressed again during the next compression operation, which results in an old log file that has a new date. The date mismatch makes it difficult to locate the log for the original date. Uncompress ZIP log files to a different directory and delete the uncompressed files when you are finished with them. The original ZIP files are retained. Deleting the uncompressed files saves disk space.



Viewing Log Messages and CAS Server Logging in SAS Environment Manager

This demonstration illustrates using SAS Environment Manager to view log messages and modify CAS server logging.

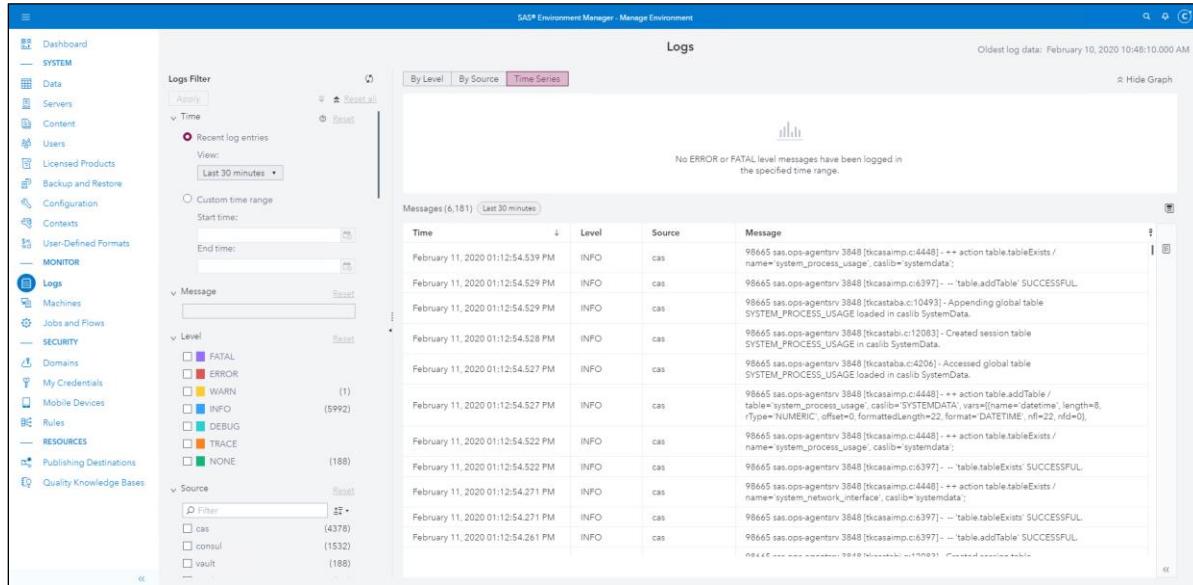
1. In SAS Environment Manager, select **Dashboard**. The Logged Issues tile displays a time series graph of the number of ERROR and FATAL level log messages captured by SAS Viya log files from the current top five applications over the past 30 mins.

(If there have been no ERROR or FATAL messages in the past 30 minutes, a message is displayed in place of the graph. This tile does not refresh automatically, but will be updated when you refresh the dashboard.)

The screenshot shows the SAS Environment Manager interface with the 'Logged Issues' tile highlighted. The tile displays a grid of green squares representing service instances. Below the grid, a message states: 'No ERROR or FATAL level messages have been logged in the past 30 minutes.' The left sidebar contains a vertical list of management icons, and the right sidebar has a search bar and a three-dot menu icon.

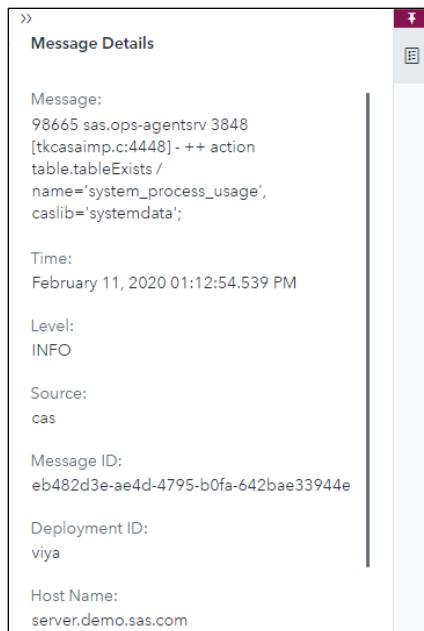
2. Click  and select **Open** to display the Logs page.

The Messages table displays log messages from SAS Viya components, subject to the specified filters and time constraints. By default, messages from the past 30 minutes are displayed. The table displays the first three lines of each log message.



Time	Level	Source	Message
February 11, 2020 01:12:54.539 PM	INFO	cas	98665 sas.ops-agentsrv 3848 [tkcasaimp.c:4448] - ++ action table.tableExists / name='system_process_usage', caslib='systemdata';
February 11, 2020 01:12:54.529 PM	INFO	cas	98665 sas.ops-agentsrv 3848 [tkcasaimp.c:397] - -- table.addTable' SUCCESSFUL.
February 11, 2020 01:12:54.529 PM	INFO	cas	98665 sas.ops-agentsrv 3848 [tkcasaimp.c:10493] - Appending global table SYSTEM_PROCESS_USAGE loaded in caslib SystemData.
February 11, 2020 01:12:54.528 PM	INFO	cas	98665 sas.ops-agentsrv 3848 [tkcasaimp.c:12083] - Created session table SYSTEM_PROCESS.
February 11, 2020 01:12:54.527 PM	INFO	cas	98665 sas.ops-agentsrv 3848 [tkcasaimp.c:206] - Accessed global table SYSTEM_PROCESS_USAGE loaded in caslib SystemData.
February 11, 2020 01:12:54.527 PM	INFO	cas	98665 sas.ops-agentsrv 3848 [tkcasaimp.c:4448] - ++ action table.addTable / table='system_process_usage', caslib='SYSTEMDATA', vars='{name='datetime', length=8, rtype='NUMERIC', offset=0, formattedLength=22, format='DATETIME', nf=22, nfd=0}.
February 11, 2020 01:12:54.522 PM	INFO	cas	98665 sas.ops-agentsrv 3848 [tkcasaimp.c:4448] - ++ action table.tableExists / name='system_process_usage', caslib='systemdata';
February 11, 2020 01:12:54.522 PM	INFO	cas	98665 sas.ops-agentsrv 3848 [tkcasaimp.c:397] - -- table.tableExists' SUCCESSFUL.
February 11, 2020 01:12:54.271 PM	INFO	cas	98665 sas.ops-agentsrv 3848 [tkcasaimp.c:4448] - ++ action table.tableExists / name='system_network_interface', caslib='systemdata';
February 11, 2020 01:12:54.271 PM	INFO	cas	98665 sas.ops-agentsrv 3848 [tkcasaimp.c:397] - -- table.tableExists' SUCCESSFUL.
February 11, 2020 01:12:54.261 PM	INFO	cas	98665 sas.ops-agentsrv 3848 [tkcasaimp.c:397] - -- table.addTable' SUCCESSFUL.

3. To view the full message, select the message and click **Properties**  to the right. You see detailed information of the logged message: time, message level, source (which application logged the message), message ID, deployment ID, and host name. These values are useful for locating the physical log file.



Message Details

Message:
98665 sas.ops-agentsrv 3848 [tkcasaimp.c:4448] - ++ action table.tableExists / name='system_process_usage', caslib='systemdata';

Time:
February 11, 2020 01:12:54.539 PM

Level:
INFO

Source:
cas

Message ID:
eb482d3e-ae4d-4795-b0fa-642bae33944e

Deployment ID:
viya

Host Name:
server.demo.sas.com

4. The chart on the Logs page displays a graph of log messages over the selected time range. The default is 30 minutes. You can choose from these graph types:

By Level

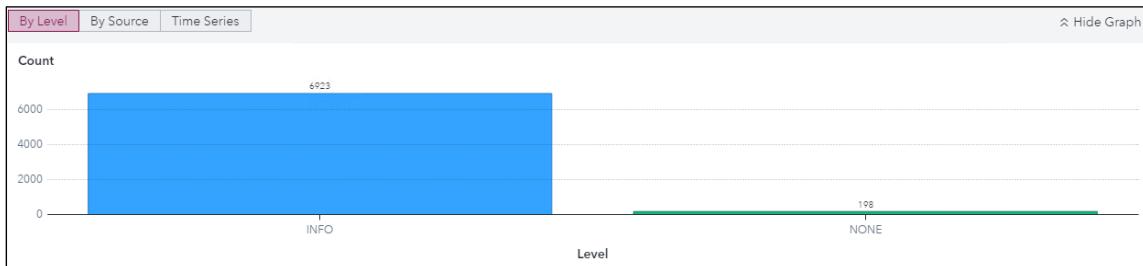
Number of messages grouped by logging level. Place your pointer over a bar to view the logging level and count. The information that is displayed in this chart is changed only by filtering based on a time range or message text. It does not change if you filter by source or level.

By Source

Number of messages grouped by source (the component or service that generated the message). Place your pointer over a bar to view the source and message count. The information that is displayed in this chart changes based on any filters that you select.

Time Series

Number of ERROR-level or FATAL-level messages, if any, for the current time period. (The default is 30 minutes.) Counts are displayed for the top five sources of these messages. If there were no ERROR-level or FATAL-level messages during the selected time period, the chart is replaced with the message **No information is available**. The information that is displayed in this chart can be changed by filtering based on a time range, message text, or sources.



5. The left side of the Logs page contains filtering option. You can filter the messages using these conditions:

- display messages from a specified time period
- display messages that contain specific messages or text in the message
- display messages that are at specified levels
- display messages from specified sources

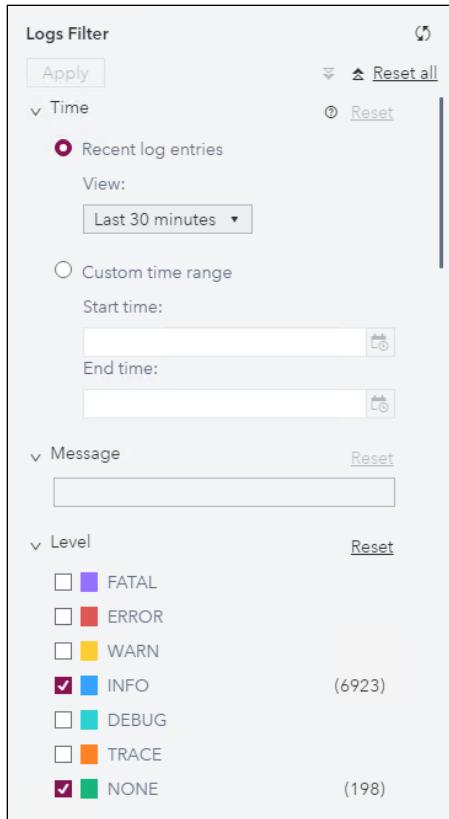
Apply these filters:

Recent log entries **Last hour**

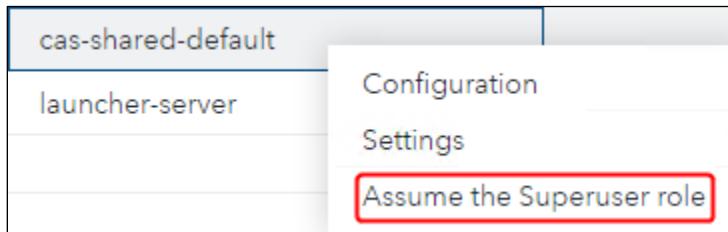
Message: blank

Level: **ERROR**

Source: **cas**



- Select the **Servers** area to manage CAS server logging. You can make changes to the threshold level of a logger, add a logger, or delete a logger on a temporary basis. Any changes that you make remain in effect until you restart the server. When you restart the server, the loggers and threshold levels are reset to the values that are specified in the logging configuration file.
- Right-click **cas-shared-default** and select **Assume the Superuser role**. (To modify, add, or delete a logger, you must assume the Superuser role.)



- Select **Settings**.

Note: When you are trying to isolate the cause of a problem, it can be useful to temporarily set the logging threshold to a lower level. Lowering the threshold adds more detailed messages to the log and can help you locate the actions that are causing a problem. However, you should change the level back to a higher level after fixing the problem so that your log does not fill up with unneeded messages.

Note: You can edit the configuration file directly, and that requires a restart of the CAS server. The logging threshold level is set to a default value of **INFO**, and it is specified in the configuration file `/opt/sas/deployment-name/config/etc/cas/default/logconfig.xml`.

9. Click the **Logging** tab. The Logging tab displays a list of the loggers that are specified for the selected server and the current threshold level for each logger.

Name	Level
Admin	Info
App	Info
App.cas.actions	Info
App.cas.actions.linecontrol	Info
App.tk.eam.rsa.Buffer	Fatal
App.tk.eam.rsa.pbe	Fatal
App.tk.eam.rsa.rsaopenssl102.Locks	Fatal
App.tk.eam.rsa.rsaopenssl110.Locks	Fatal
App.tk.eam.rsa.rsaopenssl111.Locks	Fatal
App.tk.eam.ssl.Buffer	Fatal
App.tk.eam.ssl.openssl102.Locks	Fatal
App.tk.eam.ssl.openssl102.Mem	Fatal
App.tk.eam.ssl.openssl110.Locks	Fatal
App.tk.eam.ssl.openssl110.Mem	Fatal
App.tk.eam.ssl.openssl111.Locks	Fatal
App.tk.eam.ssl.openssl111.Mem	Fatal
App.tk.http.server.access	Error

10. To change the threshold level for one or more loggers, select **Edit**.

Name	Level
Admin	Info
App	Info
App.cas.actions	Info
App.cas.actions.linecontrol	Info
App.tk.eam.rsa.Buffer	Fatal
App.tk.eam.rsa.pbe	Fatal
App.tk.eam.rsa.rsaopenssl102.Locks	Fatal
App.tk.eam.rsa.rsaopenssl110.Locks	Fatal
App.tk.eam.rsa.rsaopenssl111.Locks	Fatal
App.tk.eam.ssl.Buffer	Fatal
App.tk.eam.ssl.openssl102.Locks	Fatal
App.tk.eam.ssl.openssl102.Mem	Fatal
App.tk.eam.ssl.openssl110.Locks	Fatal
App.tk.eam.ssl.openssl110.Mem	Fatal
App.tk.eam.ssl.openssl111.Locks	Fatal
App.tk.eam.ssl.openssl111.Mem	Fatal
App.tk.http.server.access	Error

11. From the drop-down menu, select the threshold level that you want to use for each logger that you want to change.

12. To add a logger, select **Add Logger** . A blank entry appears in the table. Specify the name of the logger and the threshold level for the logger.

Name	↑	Level
<input type="text"/>		Info

13. To delete a logger, select the logger and select **Remove Logger** .

14. Click **Cancel**. Click **Close**.

15. For microservice logging, **Configuration** \Rightarrow **Definitions**.

16. Select **logging.level**.

17. Click the **Collapse All** icon next to the search filter. This set of properties is used to configure logging levels.



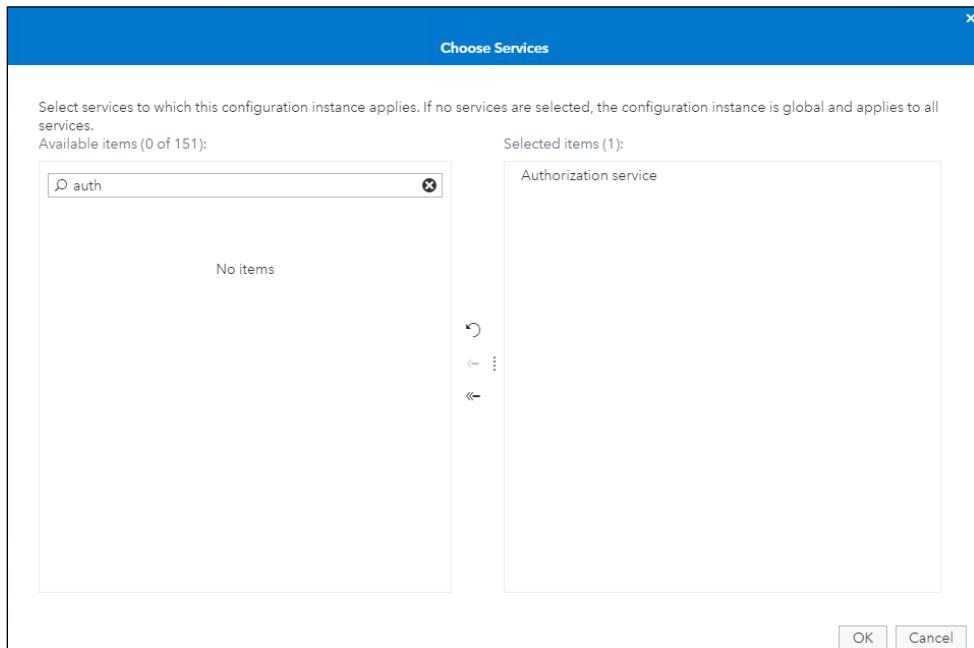
18. Click **New Configuration.**



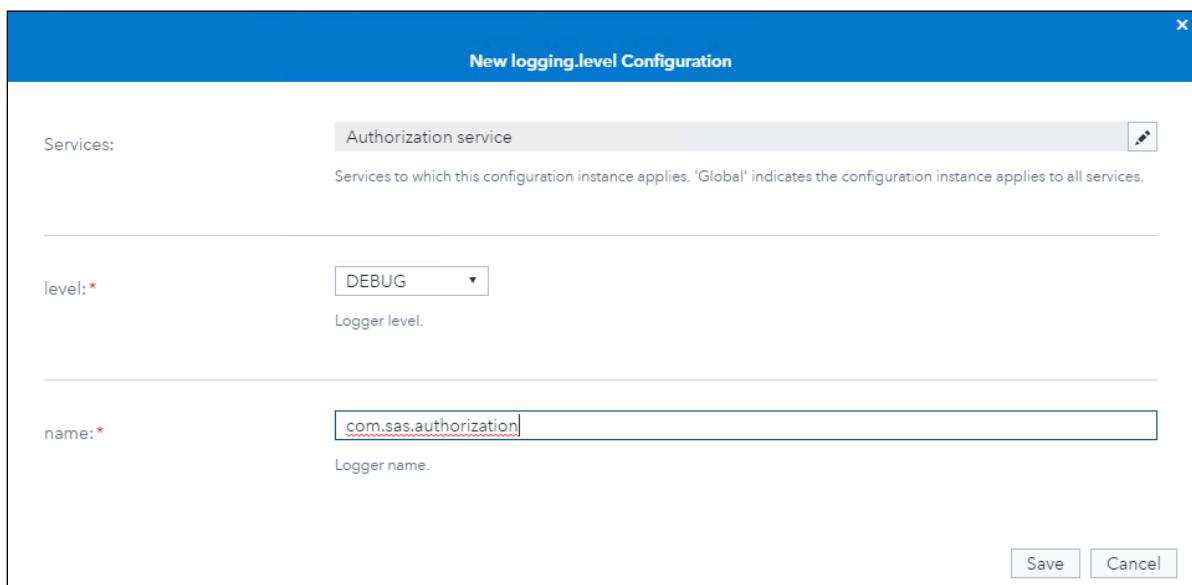
19. Click **Edit in the Services section.**



20. Search **Auth. Select **Authorization service** and click **Add** (the down arrow). Click **OK**.**



21. Select **DEBUG for the logger level and **com.sas.authorization** for the logger name. Click **Save**.**



22. Examine the authorization log. Verify that DEBUG messages are written to the log.

In mRemotNG, navigate to `/opt/sas/viya/config/var/log/authorization/default`. Look at the last log file. Verify that the log contains messages with a logging level of DEBUG.

```
[sas@server bin]$ cd /opt/sas/viya/config/var/log/authorization/default/
[sas@server default]$ ll
total 840
-rw-r--r--. 1 sas sas 61371 Jan 13 13:41 sas-authorization_2020-01-13_11-06-02.log
-rw-r--r--. 1 sas sas 61387 Jan 14 12:11 sas-authorization_2020-01-14_07-45-56.log
-rw-r--r--. 1 sas sas 61834 Jan 14 13:16 sas-authorization_2020-01-14_12-34-44.log
-rw-r--r--. 1 sas sas 67861 Jan 14 15:03 sas-authorization_2020-01-14_13-25-33.log
-rw-r--r--. 1 sas sas 65905 Jan 16 06:44 sas-authorization_2020-01-14_15-16-22.log
-rw-r--r--. 1 sas sas 61605 Jan 27 15:16 sas-authorization_2020-01-27_14-46-34.log
-rw-r--r--. 1 sas sas 66554 Jan 29 11:07 sas-authorization_2020-01-27_16-04-51.log
-rw-r--r--. 1 sas sas 64989 Jan 30 11:57 sas-authorization_2020-01-29_11-45-45.log
-rw-r--r--. 1 sas sas 66084 Jan 31 16:19 sas-authorization_2020-01-30_12-03-13.log
-rw-r--r--. 1 sas sas 61596 Feb 3 15:32 sas-authorization_2020-02-03_09-29-39.log
-rw-r--r--. 1 sas sas 61607 Feb 10 11:27 sas-authorization_2020-02-10_10-48-00.log
-rw-r--r--. 1 sas sas 86041 Feb 11 14:44 sas-authorization_2020-02-10_18-12-54.log
```

```
2020-02-11 14:44:36.339 DEBUG 45137 --- [0-auto-1-exec-5] c.s.a.service.util.RequestUtil : sas.search [00eed2
80359ba968] No permission found in context for evaluation, will infer permission using HTTP method
2020-02-11 14:44:36.340 DEBUG 45137 --- [0-auto-1-exec-5] c.s.a.service.util.RequestUtil : sas.search [00eed2
80359ba968] Inferred authorization permission DELETE from HTTP method DELETE
2020-02-11 14:44:36.344 DEBUG 45137 --- [0-auto-1-exec-5] c.s.a.s.h.FolderServiceHierarchy : sas.search [00eed2
80359ba968] Found no ancestors for /casManagement/servers/cas-shared-default/sessions/c4262322-ec1b-6140-bb5a-2c3949f7b38b. Caching result. Found in 4 ms.
2020-02-11 14:44:36.344 DEBUG 45137 --- [0-auto-1-exec-5] c.s.a.s.authorize.AuthorizationLogger : sas.search [00eed2
80359ba968] Found rules matching /casManagement/servers/cas-shared-default/sessions/c4262322-ec1b-6140-bb5a-2c3949f7b38b, none of which were denied and one of which was granted in 5 ms
2020-02-11 14:44:36.537 DEBUG 45137 --- [cTaskExecutor-2] c.s.a.s.h.FolderServiceHierarchy : service [b2063e193
405e665] Received resource event type: delete for /casManagement/servers/cas-shared-default/sessions/c4262322-ec1b-6140-
-bb5a-2c3949f7b38b
2020-02-11 14:44:36.538 DEBUG 45137 --- [cTaskExecutor-3] c.s.a.s.AuthorizationEventConsumer : service [4cc4bc755
a5ec8d0] Received resource event type: delete for /casManagement/servers/cas-shared-default/sessions/c4262322-ec1b-6140-
-bb5a-2c3949f7b38b
2020-02-11 14:44:36.538 DEBUG 45137 --- [cTaskExecutor-3] c.s.a.s.AuthorizationEventConsumer : service [4cc4bc755
a5ec8d0] Finding specific authorization rules for member /casManagement/servers/cas-shared-default/sessions/c4262322-ec1b-6140-
-bb5a-2c3949f7b38b
2020-02-11 14:44:36.540 DEBUG 45137 --- [cTaskExecutor-3] c.s.a.s.AuthorizationEventConsumer : service [4cc4bc755
a5ec8d0] Found specific rules to for uri /casManagement/servers/cas-shared-default/sessions/c4262322-ec1b-6140-bb5a-2c3949f7b38b: []
2020-02-11 14:44:36.540 DEBUG 45137 --- [cTaskExecutor-3] c.s.a.s.AuthorizationEventConsumer : service [4cc4bc755
a5ec8d0] Finding non-specific rules for uri /casManagement/servers/cas-shared-default/sessions/c4262322-ec1b-6140-bb5a-2c3949f7b38b
2020-02-11 14:44:36.540 DEBUG 45137 --- [cTaskExecutor-3] c.s.a.s.AuthorizationEventConsumer : service [4cc4bc755
a5ec8d0] Uri contains a resource id. Finding rules with object or container uris containing id: c4262322-ec1b-6140-bb5a-2c3949f7b38b
2020-02-11 14:44:36.541 DEBUG 45137 --- [cTaskExecutor-3] c.s.a.s.AuthorizationEventConsumer : service [4cc4bc755
a5ec8d0] Found rules containing resource id c4262322-ec1b-6140-bb5a-2c3949f7b38b: []
2020-02-11 14:44:58.752 DEBUG 45137 --- [0-auto-1-exec-5] c.s.a.s.rainbow.RainbowRuleServiceImpl : christine(63ce2e13
) [b8a6874a08446755] Adding backwards compatible fix for 'Administrators' group
2020-02-11 14:44:58.754 DEBUG 45137 --- [0-auto-1-exec-5] c.s.a.s.rainbow.RainbowRuleServiceImpl : christine(63ce2e13
) [b8a6874a08446755] Adding backwards compatible fix for 'Administrators' group
```



A log level of DEBUG produces detailed log messages. This level can be useful when you isolate the cause of a problem, but it produces too many messages for normal use. It is important to set the logging level to **INFO** after troubleshooting is completed.

23. Reset the logging level to **INFO**.

Return to SAS Environment Manager. Select **Configuration** ⇒ **Definitions** if you are not already at that location.

24. Select `logging.level` and search for `auth`.

The screenshot shows the SAS Configuration interface with the following details:

- View:** Definitions
- Search:** log
- Selected Item:** logging.level
- Configuration Definition:** logging.level
- Instance:** auth
- GUID:** 6a5eb1e7-0a63-44e3-bb7b-c17e121fb00c
- Services:** Authorization service
- level:** DEBUG
- name:** com.sas.authorization

25. Click (Edit) to edit the Authorization service, com.sas.authorization.

The screenshot shows the edit screen for the com.sas.authorization service:

- level:** INFO
- name:** com.sas.authorization

26. Change the logger level to **INFO and click **Save**.**

The screenshot shows the updated configuration for the com.sas.authorization service:

- level:** INFO
- name:** com.sas.authorization
- GUID:** c69e3068-57e4-4295-a6b5-3330c1e482d5
- Services:** Authorization service
- level:** INFO
- name:** com.sas.authorization

27. In WinSCP, navigate to `opt/sas/viya/config/etc/cas/default`.

28. Right-click **casconfig.lua** and select **Edit**. The **casconfig.lua** file contains the line **cas.logcfglog = config_loc ... '/logconfig.xml'**. This points the CAS server to the logging configuration file.

```
-- The 'logcfgloc' option is used to specify the Log configuration file
-- for the CAS server.
-----
cas.logcfgloc = config_loc .. 'logconfig.xml'
```

Scroll down further to here:

```
-- The 'onelog' option is used to direct all logging to the controller node
-- for the CAS server.
-- Default: false
-----
--cas.onelog = true
```

29. Close **casconfig.lua** without saving.

30. Right-click **logconfig.xml** and select **Edit**. Three appenders are defined, and loggers are defined at a higher level.

```
<!-- Rolling log file with default rollover of midnight -->
<appender class="RollingFileAppender" name="TimeBasedRollingFile">
  <param name="Append" value="false"/>
  <param name="Unique" value="true"/>
  <param name="ImmediateFlush" value="true"/>
  <param name="FilePermissions" value="A:u:r--,A:g:r--,A:o:---"/>
  <rollingPolicy class="TimeBasedRollingPolicy">
    <param name="FileNamePattern" value="%${OSENV.LOG_PATH}/cas_%d_%s{hostname}_%s{pid}.log"/>
  </rollingPolicy>
  <layout>
    <param name="HeaderPattern" value="Host: '%s{hostname}', OS: '%s{os_family}', Release: '%s{os_release}', Com
    <param name="ConversionPattern" value="%d %5p [%t] %u %%{Cas.ClientHostname|local} %%{Cas.ClientPid|MAIN} %
  </layout>
</appender>

<!-- Resource logging -->
<appender class="RollingFileAppender" name="ResourceFile">
  <param name="Append" value="false"/>
  <param name="Unique" value="true"/>
  <param name="ImmediateFlush" value="true"/>
  <param name="FilePermissions" value="A:u:r--,A:g:r--,A:o:---"/>
  <rollingPolicy class="TimeBasedRollingPolicy">
    <param name="FileNamePattern" value="%${OSENV.SAS_RESOURCE_LOG_PATH}/cas_%d_%s{hostname}_%s{pid}.log"/>
  </rollingPolicy>
  <layout>
    <param name="HeaderPattern" value="Host: '%s{hostname}', OS: '%s{os_family}', Release: '%s{os_release}', Com
    <param name="ConversionPattern" value="%d %5p [%t] %u %%{Cas.ClientHostname|local} %%{Cas.ClientPid|MAIN} %
  </layout>
</appender>

<!-- Unix System Facility Appender, writes to unix system log -->
<appender class="UNXFacilityAppender" name="UnixsysLog">
  <filter class="RepeatMatchFilter">
    <param name="AcceptOnMatch" value="false"/>
  </filter>
  <layout>
    <param name="ConversionPattern" value="%-5p [%t] %u %%{Cas.ClientHostname|local} %%{Cas.ClientPid|MAIN} %%{C
  </layout>
</appender>
```

CAS Loggers

Logger	Events
Cas.ClientIP	IP address of the machine where the message was originally logged
Cas.ClientUser	process ID of the process
Cas.ClientPid	From start-up of the CAS server
Cas.ClientHostname	Host name of the machine where the message was logged
Cas.SessionIndex	Identifies the distinct user session

Loggers are not defined by default.

Logger	Events
app.cas	From the CAS server
app.cas.actions. <i>actionset.action</i>	From a specified CAS action set and CAS action
app.cas.driver	From start-up of the CAS server
app.cas.tkcasa	From internal processes
app.cas.datastep	From DATA step PUT statements, as well as messages that are sent to the SAS log

End of Demonstration



Practice

6. Filtering Log Messages in SAS Environment Manager

- In SAS Environment Manager, select the **Logs** page.
- Apply the following filters:

Recent log entries **Last 12 hours**

Level: **ERROR**

Source: **cas**

Click **Apply**.

- Select one of the log messages on your display and examine the Message Details.

- Save the table of messages to your caslib. Click  at the top of the Messages table.
- Keep the library as **SystemData** and enter: **CASERRORS<date>** as the table name.

Note: Because of potentially sensitive data that might be in the log messages, you can save the log message table only to the CAS server and only to your personal library or the **SystemData** library. By default, the table is also loaded into memory when it is saved.

The screenshot shows the 'Save Table' dialog box. It has two main sections: 'CAS table' and 'CSV file'. Under 'CAS table', the 'Server' is set to 'cas-shared-default' and the 'Library' is set to 'SystemData'. The 'Table name' field contains 'CASERRORS_2_11_20'. A checked checkbox labeled 'Load table into memory' is present. Under 'CSV file', the 'File name' field contains 'LogMessages.csv'. At the bottom are 'Save' and 'Cancel' buttons.

- Click **Save**.
- Go to the **Data** page and click the **Available** tab to see the newly created table that is loaded in memory. (You might need to refresh the view.)
- Switch to the **sas** user and move to the log directory. Use WinSCP or mRemoteNG and navigate to **/opt/sas/viya/config/var/log/cas/default**.

i. mRemoteNG:

Use the following command to search for the latest log file name:

```
ls -lrt cas_*.log
```

Open the latest log file with vi or gedit (your date will be different than below).

```
[sas@server default]$ gedit cas_2019-06-19_server_6453.log
```

WinSCP:

- Use the datetime stamp.
- Search for the specific message in the opened log file. Copy the message from the SAS Environment Manager Logs page.

j. (Optional) Stream log messages to the console (you must run the sas-ops command as the **sas** account):

```
/opt/sas/viya/home/bin/sas-ops logs --h
```

```
/opt/sas/viya/home/bin/sas-ops logs
```

Note: Hold down the Ctrl key and click C to quit, as this could run for some time.

7. Changing Logging Configuration

- a. Navigate to `/opt/sas/viya/config/etc/cas/default/` and view the **casconfig.lua** file. Locate the options below and notice their values.

```
cd /opt/sas/viya/config/etc/cas/default
more casconfig.lua
```

```
-- Default Lua Configuration file for Cloud Analytic Services

-- IMPORTANT: This file is NOT intended to be modified by users.
-- Do NOT modify anything in this file.
-- User modifications are permitted within the files
-- casconfig_usermods.lua and node_usermods.lua.

-- Recommended / Required options

-- unique id for the deployment of SAS
sas_deployment_id = 'viya'
```

`cas.logcfgloc`: used to specify the Log configuration file

```
-- The 'logcfgloc' option is used to specify the Log configuration file
-- for the CAS server.

cas.logcfgloc = config_loc .. 'logconfig.xml'
```

`cas.onelog`: used to direct all logging to the controller node

```
-- The 'onelog' option is used to direct all logging to the controller node
-- for the CAS server.
-- Default: false
-----
--cas.onelog = true
```

Notice that this is an SMP deployment, with only a CAS controller node.

- Make a backup copy of the `logconfig.xml` file. (You need to use sudo.)

```
sudo cp logconfig.xml logconfig.xml.saved
```

```
[christine@server default]$ pwd
/opt/sas/viya/config/etc/cas/default
[christine@server default]$ ls -la
total 64
drwxr-xr-x 3 sas sas 4096 Jul 23 13:50 .
drwxr-xr-x 3 sas sas 4096 Apr 25 09:38 ..
-rw-r--r-- 1 sas sas 1077 Mar 9 08:35 casconfig_deployment.lua
-rw-r--r-- 1 sas sas 9555 Apr 25 11:18 casconfig.lua
-rw-r--r-- 1 sas sas 21 Apr 25 11:18 cas.hosts
-rw-r--r-- 1 root root 20 Mar 9 08:35 cas.hosts.21353.2017-04-25@09:39:02~
-rw----- 1 cas sas 990 Apr 25 09:39 keys.lua
-rw-r--r-- 1 sas sas 2929 Mar 9 08:35 logconfig.trace.xml
-rw-r--r-- 1 sas sas 2434 Jul 23 13:50 logconfig.xml
drwx----- 4 cas sas 4096 Jun 2 16:45 permstore
-rw----- 1 cas sas 7633 Mar 9 08:35 perms.xml
-rw-rw-r-- 1 sas sas 5809 Apr 25 09:39 SASViyaV0300_09KC9Q_Linux_x86-64.txt
[christine@server default]$ sudo cp logconfig.xml logconfig.xml.saved
```

- Edit the `logconfig.xml` file. Use the `sudo gedit ./logconfig.xml` command.

```
sudo gedit ./logconfig.xml
```

- Find the Application message logger and change the level value from **Info** to **Debug**.

```
<!-- Application message logger -->
<logger name="App">
    <level value="Debug"/>
</logger>
```

```

<!-- Administration message logger -->
<logger name="Admin">
  <level value="Info"/>
  <appender-ref ref="UnixSysLog"/>
</logger>

<!-- Application message logger -->
<logger name="App">
  <level value="Debug"/>  
</logger>

<!-- CAS Action message logger -->
<logger name="App.cas.actions">
  <level value="Info"/>
</logger>

<!-- HTTP server access logger -->
<logger name="App.tk.http.server.access">
  <level value="Error"/>
</logger>

```

e. Save your changes and exit your edit session.

f. Restart the CAS server. (You need to use sudo.)

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

g. Switch to the **sas** user and navigate to **/opt/sas/viya/config/var/log/cas/default/** and view the most recent log file.

```
cd /opt/sas/viya/config/var/log/cas/default
ls -la
more cas<date and time>_server_<process id>.log
```

Notice the following items:

- A new log file is generated with a new process ID (PID) in the name.
- The log now contains a finer level of detail, including DEBUG messages.

```
[christine@server default]$ cd /opt/sas/viya/config/var/log/cas/default
[christine@server default]$ ls -la
total 500
drwxr-xr-- 2 cas sas 4096 Jul 24 09:43 .
drwxr-xr-- 3 cas sas 4096 Apr 25 09:38 ..
-rw-r--r-- 1 cas sas 406123 Jul 24 09:42 cas_2017-07-24_server_25164.log
-rw-r--r-- 1 cas sas 85758 Jul 24 09:48 cas_2017-07-24_server_32484.log
-rw-r--r-- 1 cas sas 0 Jul 24 09:11 caslaunch_default_controller_daemon_2017-07-24_094320.err
-rw-r--r-- 1 cas sas 256 Jul 24 09:11 caslaunch_default_controller_daemon_2017-07-24_094320.log
-rw-r--r-- 1 cas sas 0 Jul 24 09:43 caslaunch_default_controller_daemon.err
-rw-r--r-- 1 cas sas 256 Jul 24 09:43 caslaunch_default_controller_daemon.log
[christine@server default]$ more cas_2017-07-24_server_32484.log
Host: 'server', OS: 'Linux X64', Release: '2.6.32-696.1.1.el6.x86_64', Command: '/opt/sas/viya/home/SASFoundation/utilities/bin/cas start -role controller -permstore /opt/sas/viya/config/etc/cas/default/permstore -userloc /opt/sas/viya/config/data/cas/default/casuserlibraries/#USER -cfg /opt/sas/viya/config/etc/cas/default/casconfig.lua -launcher /opt/sas/viya/home/SASFoundation/utilities/bin/caslaunch'
2017-07-24T09:43:20,167 INFO [00000003] cas local MAIN NoUser [tkcalsock.c:673] - The CAS server is listening on port 5570.
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1522] - 
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1522] - / \ / \ | / \ /
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1522] - / \ / \ | \ \
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1522] - \ / \ / \ | / \
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1522] - 
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1525] - SAS Cloud Analytic Services Version V.03.02MPO3082017
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1526] - Copyright © 2014-2017 SAS Institute Inc. All Rights Reserved.
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1533] - OS Name: Linux
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1534] - OS Family: Linux X64
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1535] - OS Release: 2.6.32-696.1.1.el6.x86_64
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1536] - OS Version: #1 SMP Tue Apr 11 17:13:24 UTC 2017
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1540] - Model Number: x86_64
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1567] - Starting Cloud Analytic Services driver, host=server.exnet.sas.com, id=0, role=main controller.
2017-07-24T09:43:20,174 INFO [00000003] cas local MAIN NoUser [cas.c:1787] - The list of machines in '/opt/sas/viya/home/SASFoundation/../../config/etc/cas/default/cas.hosts' will be ignored because the server is running in SMP mode.
2017-07-24T09:43:20,174 INFO [00000003] cas local MAIN NoUser [cas.c:1919] - All grid nodes have connected.
2017-07-24T09:43:20,176 INFO [00000003] cas local MAIN NoUser [tkhttpserver.c:1293] - Starting HTTP server 'localhost', minPort=8777, maxPort=8778
2017-07-24T09:43:20,176 INFO [00000003] cas local MAIN NoUser [tkhttpserver.c:1376] - HTTP Server 'localhost' listening on port 8777.
2017-07-24T09:43:20,177 INFO [00000003] cas local MAIN NoUser [cashttp.c:1718] - HTTP server is authenticating connections.
2017-07-24T09:43:20,177 INFO [00000003] cas local MAIN NoUser [cashttp.c:1761] - HTTP server listening on port 8777.
2017-07-24T09:43:49,641 INFO [00000003] cas local MAIN NoUser [tkcalsock.c:797] - New client connection accepted on port 5570. Client IP address and port are ::ffff:127.0.0.1:41302.
2017-07-24T09:43:49,646 INFO [00000016] sas.monitoring local MAIN NoUser [tkident.c:997] - User sas.monitoring successfully authenticated using the OAuth authentication provider.
2017-07-24T09:43:49,646 INFO [00000016] sas.monitoring local MAIN NoUser [tkcsesinst.c:672] - Successfully created session e276c3bb-8ab8-fe40-a173-d69c0f0e4159.
2017-07-24T09:43:49,664 INFO [00000016] sas.monitoring local MAIN NoUser [casgeneral.c:3084] - Launched session controller. Process ID is 32625.
2017-07-24T09:43:49,668 INFO [00000007] cas local 32625 cas 0 [cas.c:1567] - Starting Cloud Analytic Services driver, host=server, id=0, role=session controller.
2017-07-24T09:43:49,669 INFO [00000007] cas local 32625 sas.monitoring 0 [tkcsesinst.c:672] - Successfully created session e276c3bb-8ab8-fe40-a173-d69c0f0e4159.
2017-07-24T09:43:49,670 INFO [00000007] cas local 32625 sas.monitoring 0 [tkhttpserver.c:1293] - Starting HTTP server 'server', minPort=0 maxPort=0
2017-07-24T09:43:49,671 INFO [00000007] cas local 32625 sas.monitoring 0 [tkhttpserver.c:1376] - HTTP Server 'server' listening on port 39579.
2017-07-24T09:43:49,672 INFO [00000007] cas local 32625 sas.monitoring 0 [cashttp.c:1718] - HTTP server is authenticating connections.
2017-07-24T09:43:49,672 INFO [00000007] cas local 32625 sas.monitoring 0 [cashttp.c:1761] - HTTP server listening on port 39579.
2017-07-24T09:43:49,677 DEBUG [00000007] cas localhost 32625 sas.monitoring 0 [tkcasainmp.c:3906] - Synchronizing cas libs
2017-07-24T09:43:49,678 DEBUG [00000007] cas local 32625 sas.monitoring 0 [tkcasainmp.c:3909] - Synchronize complete
2017-07-24T09:43:49,678 INFO [00000007] cas local 32625 sas.monitoring 0 [tkcasainmp.c:7715] - Opening license file '/opt/sas/viya/home/SASFoundation/../../config/etc/cas/default/SASViyaV0300_09KC9g_Linux_x86-64.txt'.
2017-07-24T09:43:49,679 INFO [00000007] cas local 32625 sas.monitoring 0 [tkcasainmp.c:3317] - ++ action addFmtLib /fmtLibName='userformats1', name='userformats1.sashdat', caslib='FORMATS', promote=true, fmtSearch='NONE';
2017-07-24T09:43:49,679 DEBUG [00000007] cas local 32625 sas.monitoring 0 [tkcasainmp.c:4698] - Invoking action sessionProp.addFmtLib
2017-07-24T09:43:49,679 DEBUG [00000007] cas local 32625 sas.monitoring 0 [tkcasainmp.c:3911] - No Synchronize required
2017-07-24T09:43:49,680 INFO [00000007] cas local 32625 sas.monitoring 0 [tkcasainmp.c:3317] - ++ action tkcastab.loadable / path='userformats1.sashdat', readAhead=true, resident=false, caslib='FORMATS', singlePass=false, returnWhe reInfo=true;
2017-07-24T09:43:49,680 DEBUG [00000007] cas local 32625 sas.monitoring 0 [tkcasainmp.c:4698] - Invoking action table
```

- h.** Switch back to christine change the CAS logging configuration to its original state. Copy the saved log configuration file to the **logconfig.xml** file that is defined in the **casconfig.lua** file.

```
cd /opt/sas/viya/config/etc/cas/default
sudo cp logconfig.xml.saved logconfig.xml
```

```
[christine@server default]$ cd /opt/sas/viya/config/etc/cas/default
[christine@server default]$ sudo cp logconfig.xml.saved logconfig.xml
```

- i. Restart the CAS server. (You need to use sudo.)

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

```
[christine@server default]$ sudo service sas-viya-cascontroller-default stop
sas-viya-cascontroller-default is stopped
[christine@server default]$ sudo service sas-viya-cascontroller-default start
sas-viya-cascontroller-default is running
```

8. Changing Folder Service Logging to TRACE and Viewing Additional Detail in the Log

In this practice, you change the logging level for the folders microservice and view the resulting additional details in the logs. Change the Folder Service logging to TRACE.

- a. In SAS Environment Manager, select **Configuration** \Rightarrow **Definitions**.
- b. Select **logging.level** and click **New Configuration** to add a new logger.
- c. Click the **Edit** icon in the Services section.
- d. Enter **Fold** and highlight **Folders service**.
- e. Move it to the **Selected items** area and click **OK**.
- f. Enter **TRACE** for the level and **com.sas.folders** for the name.
- g. Click **Save**.

Where can you find the possible required values for **name** and **Logger level**?

Note: The level OFF (SAS Environment Manager loggers) is not a real level. It is used only to disable an existing configuration definition “logging.level.”

- h. Generate an event using a folder to verify the change in logging level. Select **Content** from the side menu.
- i. Click **New Folder** to add a new folder. Name the folder **test**.
- j. Verify the changes in the folders log file. In your mRemoteNG session, navigate to **/opt/sas/viya/config/var/log/folders/default/**.
- k. View the log to see DEBUG and TRACE information about the creation of a new folder:

Gedit name of log file

You can see that the TRACE-level logging generates a large volume of messages in the log.



Return to the logging definition for the folders server and reset the level to **INFO**. Save your changes.

- l. In SAS Environment Manager, change the logging level back to **INFO**. On the side menu, select **Configuration** \Rightarrow **Definitions**.
- m. On the right side of the window, search for **folders**. This search should return one item: **Folders service: com.sas.folders**.
- n. Modify the logger level to **INFO** by clicking the **Edit** icon next to the service.
- o. Change the logging level to **INFO** and click **Save**.

End of Practices

6.01 Multiple Choice Question

On each machine in the deployment, log files are stored in which configuration directory?

- a. /opt/sas/viya
- b. /opt/sas/viya/config
- c. /opt/sas/viya/config/var
- d. /opt/sas/viya/config/var/log

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6.02 Multiple Choice Question

In SAS Viya server logging, what is an output destination for a log message?

- a. logger
- b. appender
- c. diagnostic level
- d. filter

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6.03 Multiple Choice Question

Which configuration files govern CAS server logging?

- a. via the casconfig.json file and the logconfig.xml file
- b. via the casconfig.lua file and the logconfig.xml file
- c. via the logconfig.xml file and SAS Environment Manager
- d. via the logconfig.xml file and CAS Server Monitor

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6.04 Multiple Choice Question

Which type of file can you edit to change the logging level for the SAS Configuration Server?

- a. .xml
- b. .txt
- c. .json
- d. .sas7bdat

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6.05 Question

Microservices do not require a restart to pick up changes to the logging configuration.

- True
- False

6.4 Solutions

Solutions to Practices

1. Using the sas-peek Command

In this practice, you use the SAS Viya operation Infrastructure commands to read metrics for system and service resources.

- Use the **sas** connection in MRemoteNG. Navigate to **/opt/sas/viya/home/bin**.

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

- Read metrics for system and service resources. Issue the **./sas-peek --help** command.

```
./sas-peek --help
```

- Issue the **./sas-peek cpu -pretty** command (to make the output more readable).

```
./sas-peek cpu -format pretty
```

- (Optional) Obtain CAS server metrics. Do not forget the **-format pretty** option.

- (Optional) Display the top five processes on this host. Do not forget the **-n** option.

```
[sas@server bin]$ ./sas-peek top -n 5 -format pretty
{
  "version": 1,
  "collectorName": "sas-peek-top",
  "collectorVersion": "1.4.26+9a8010b",
  "timeStamp": "2019-04-25T13:59:02.177840-04:00",
  "properties": {
    "consulNodeName": "server.demo.sas.com",
    "hostname": "server.demo.sas.com",
    "os": "linux_amd64"
  },
  "measurements": [
    {
      "resourceType": "system_cpu_usage",
      "resourceId": "1rMPLp/asXIt82ilbM0nlw==",
      "properties": {
        "boottime": "2019-04-19T00:01:42.000000-04:00",
        "cpucount": "16",
        "resourceName": "server.demo.sas.com",
        "sample": "2s",
        "topN": "5"
      },
      "metrics": [
        {
          "name": "cpuDelta",
          "unit": "ms",
          "type": "gauge",
          "detailLevel": 1,
          "value": 32280
        },
        {
          "name": "systemUsage",
          "unit": "percent",
          "type": "gauge",
          "detailLevel": 1,
          "value": 2.0446096654275094
        },
        {
          "name": "userUsage",
          "unit": "percent",
          "type": "gauge",
          "detailLevel": 1,
          "value": 2.0446096654275094
        }
      ]
    }
  ]
}
```

2. Using the sas-check Command

In this practice, you use the SAS Viya operation infrastructure commands that compare metrics for a specific resource with threshold values.

- Use the **sas** connection in MRemoteNG. Navigate to **/opt/sas/viya/home/bin**.

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

- Read metrics for system and service resources. Issue the **./sas-peek --help** command.

```
./sas-check --help
```

```
[sas@server bin]$ ./sas-check --h
sas-check - Help

Common usage:
  sas-check
    < cpu | filesystem | http | memory | network | dns | process | help | version >
    [-critical <critical threshold value>]
    [-warning <warning threshold value>]
    [-name <test name>]
    [-test <logical test operator, LT LE GT GE COM INC EXC RXC>]
    [-metric <test metric name (see -dm)>]
    [-units <units keyword: percent s ms us>]
    [-format <json | pretty | line | block | event >]
    [-min-level < info | warn | alert >]
    [-help]
    [-quiet]
    [-dm]
    [-version]
    [-verbose]
    [-debug]

Commands:
  cpu:           check central processor metric
  filesystem:   check file system metric
  http:          check hyper text transport prorocol metric
  memory:        check system memory metric
  network:       check network metric
  dns:           check domain name service metric
  process:       check system process metric
  help:          display sas-check help information
  version:       display sas-check version

Notes:
  - Use sas-check help -verbose for extended information.
  - Use sas-check <cmd> -help for command specific information.
  - Use sas-check <cmd> -help -verbose for command specific information
    and examples.
  - Use sas-check <cmd> -dm to display metric name information for the
    specified command <cmd>.
```

- Use **sas-check** to display example WARNING and ALERT (critical) messages.

Issue following command: **./sas-check cpu -warning 1 -format line**

```
./sas-check cpu -warning 1 -format line
```

```
[sas@server bin]$ ./sas-check cpu -warning 1 -format line
WARN 2019-04-25T14:21:32.534-04:00 [ops] [server.demo.sas.com] One or more 'cpu' tests crossed warning threshold boundaries for metric 'percentCpuUsy' and 'cpu' ID(s) 'server.demo.sas.com'
```

Issue the following command: **./sas-check cpu -warning 1 -critical 1 -format line**

```
./sas-check cpu -warning 1 -critical 1 -format line
```

```
[sas@server bin]$ ./sas-check cpu -warning 1 -critical 1 -format line
INFO 2019-04-25T14:24:09.991-04:00 [ops] [server.demo.sas.com] cpu test of metric 'percentCpuBusy' passed for ID(s) 'server.demo.sas.com'
```

3. Using the sas-ops Command

The capabilities of the operations infrastructure are also provided in command line interfaces, which gives administrators interested in more IT-related information the ability to customize the monitoring and logging information to meet their own needs.

One of the primary commands that surfaces information from the framework is **sas-ops**.

Operations Infrastructure CLI: sas-ops Command

alerts	Stream alerts or show the most recent alerts
satamarts	Display data mart information
env	Display summary of relevant environment information
info	Display properties of the components of the deployment
logs	Stream log events
metrics	Stream metric events
notifications	Stream notification events
notify	Publish a notification message
services	List services, service details, and health
tasks	List task defined for sas-ops-agent
validate	Perform validation of the deployment

- a. Use the **sas** connection in MRemoteNG. Navigate to **/opt/sas/viya/home/bin**.

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

- b. Issue the **./sas-ops --help** command.

```
./sas-ops --help
```

Note: You will need to run the command as **sas**, the install account.

- c. View a list of the tasks that are performed by the agent and the frequency of the task that is run. Issue the **./sas-ops tasks** command.

```
./sas-ops tasks
```

[sas@server bin]\$./sas-ops tasks			
Task Name	Description		Frequency
-----	-----		-----
CASMetrics	CAS performance metrics (level=2)		1m0s
CheckCpu	Check CPU activity less than 95% busy		1m0s
CheckFileSystemLinux	Check file system space on Linux system less than 90% used		1m0s
CheckFileSystemWindows	Check file system space on Windows system is less than 90% used	1m0s	
CheckMemory	Check memory less than 95% used		1m0s
EmiSweeper	Retry publishing any payloads that failed to publish earlier		1h0m0s
FileSystemMetrics	Host file system metrics (level=2)		1m0s
FlushReqTask	Flush task list to permanent storage on request		0s
HostEnvSnapshot	Host environment snapshot		02:25
LogFileArchive	Archive daily		04:00
NetworkInterfaceMetrics	Host network interface metrics (level=2)		1m0s
OpsAgentActivity	Internal sas-ops-agent activity monitor		2m0s
OpsAgentTaskStatistics	Internal sas-ops-agent task statistics activity monitor		4m0s
OpsArm	Runs Ops ARM		1h0m0s
OpsValidate	Perform system validation when requested		0s
PostgresMetrics	Postgres metrics (level=2)		1m0s
RabbitmqMetrics	RabbitMQ performance metrics (level=2)		1m0s
SpringBootMetrics	Spring Boot performance metrics (level=2)		1m0s
SpringBootMetricsLevel3	Spring Boot performance metrics (level=3)		4h0m0s
SystemMetrics	Host system metrics (level=2)		1m0s
TopProcessMetrics	Top CPU process consumers (level=2)		1m0s
registerOpsAgentServiceTask	Register Ops-Agent service task		1h0m0s
registerOpsServiceTask	Register Ops service task		1h0m0s

- d. For validating system health, use the **validate** command: **./sas-ops validate --h**

```
./sas-ops validate --h
```

The **sas-ops validate** command is a valuable troubleshooting technique, especially for start-up issues. Even if the start-up process for a SAS Viya deployment has issues and SAS Environment Manager is inaccessible, the **sas-ops** command will still function and will provide health information to help identify where problems might have occurred.

```
[sas@server bin]$ ./sas-ops validate --h
NAME:
  sas-ops validate - Performs validation of the deployment

USAGE:
  sas-ops validate [command options] message

COMMANDS:
  No subcommands

OPTIONS:
  --json          Output validation results in JSON format
  --level level   level of validation to perform (1-3) (default 2)
  --tags string    Only run tests that match at least one of the given tags (local consul rabbit datamart http tls ops cas)
  --verbose        Enable verbose output
```

- e. Use the **level 3** option or **verbose** option for more detail.

```
./sas-ops validate --level 3
```

```
[sas@server bin]$ ./sas-ops validate --level 3
Wed, 24 Apr 2019 11:06:03 EDT - Validating deployment on server.demo.sas.com...
  Level 1 - [consul] Verify Consul connectivity...
  Level 1 - [rabbit] Verify RabbitMQ exchanges...
  Level 2 - [consul] Verify Consul services...
  Level 2 - [datamart] Verify operations datamart ETL status...
  Level 2 - [local] Verify local system...
  Level 2 - [ops] Verify status of operations services...
  Level 2 - [tls] Verify TLS...
  Level 3 - [cas] Verify status of CAS servers...
  Level 3 - [http] Verify HTTP connectivity...
  Level 3 - [http] Verify OAuth...

Validation test(s) completed with 1 error(s):
  ERROR evdm step resetdm_cas status is [Error]

Use --verbose for additional details
```

4. Moving a Custom Report to the SAS Environment Manager Dashboard

A custom report was created using the SYSTEM_NETWORK_INTERFACE table from the operations infrastructure data mart and is saved to Christine's My Folder. In this practice, you pin the report to the dashboard in SAS Environment Manager.

- Log on as **christine** with the password **Student1** in SAS Environment Manager.
- Select **Content** area.

- c. Open **My Folder**. Do you see the new Network Transmit and Receive report? **Yes** Click the report and note the URI.

Folders > My Folder

- My Snippets
- SAS Videos
- Demo Data Preparation Plan
- Network Transmit and Receive**

- d. Right-click on the report and select **Pin to dashboard**.

Network Transmit and Receive

- Delete
- Rename
- Add as shortcut
- Move to folder
- View authorization
- Edit authorization
- Export
- Pin to dashboard**

- e. On the Content page, navigate to **SAS Content** ⇒ **Users** ⇒ **christine** ⇒ **Application Data** ⇒ **SAS Environment Manager** ⇒ **Dashboard Items**.

Application Data > SAS Environment Manager > Dashboard Items

Network Transmit and Receive

- f. Click the **Network Transmit and Receive** reference. Is the URI the same as the URI in My Folders? **Yes**

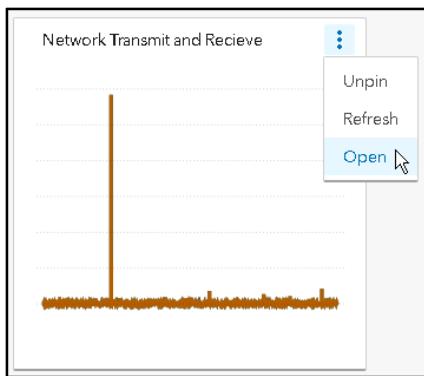
- g. Click **Dashboard** page.

Dashboard

- h. Click **Show Reports** at the top right of SAS Environment Manager.

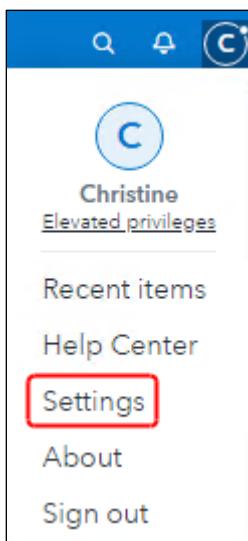
Show Reports

- i. Click the arrow on the right of the reports view to see second page of reports. Do you see the Network Transmit and Receive report? **Yes**

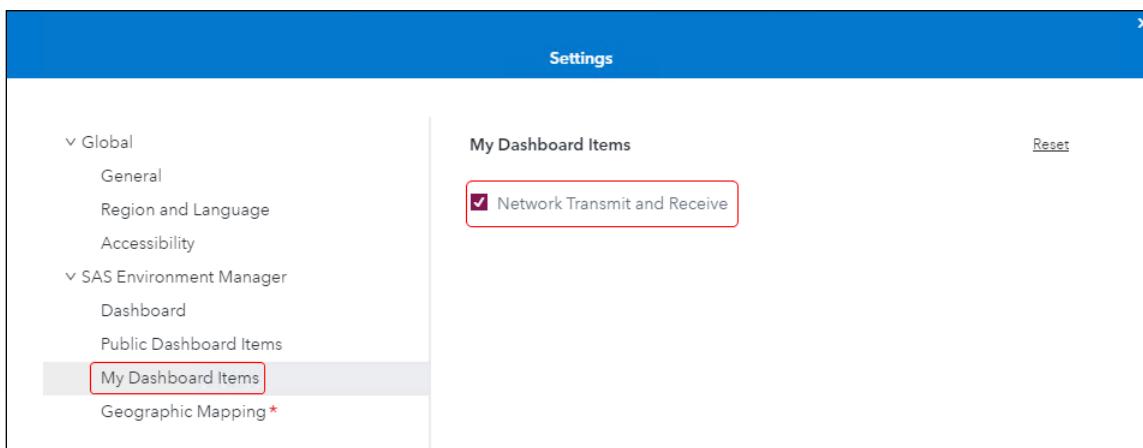


Note: By clicking the **More info** menu, you can unpin the report from the dashboard, refresh the report, or open the report.

- The reports viewed on the dashboard are managed in the SAS Environment Manager settings. Click **Christine** at the top right of the SAS Environment Manager window and select **Settings**.

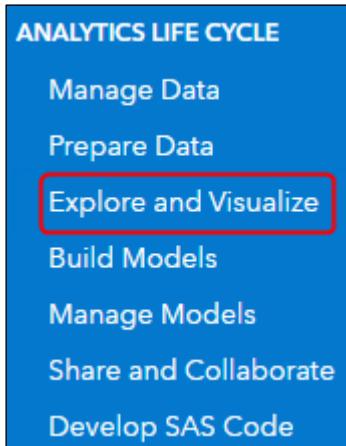


- Click **My Dashboard Items** in the Settings window. The Network Transmit and Receive report is in the My Dashboard Items list.

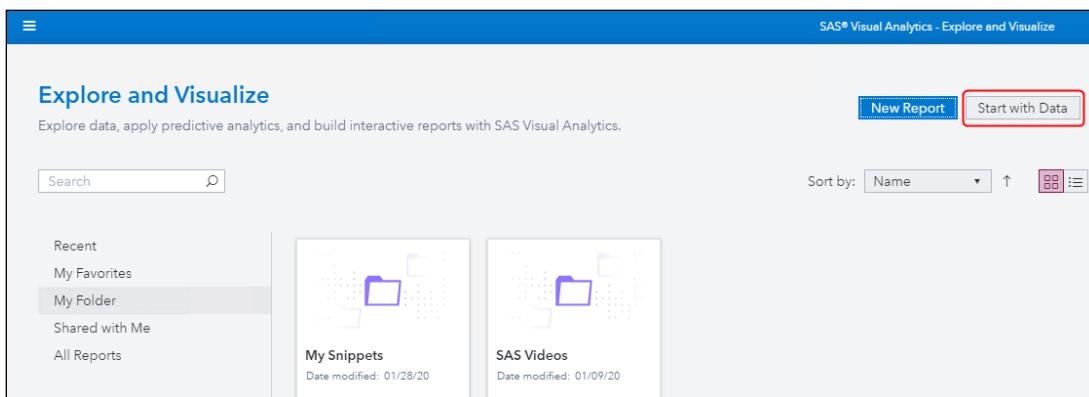


Steps to Create Custom Report

1. Sign in to SAS Drive as **christine** with the password **Student1**. Opt in to the SASAdministrators assumable group.
2. Select **Explore and Visualize Data** from the side menu.



3. Select **Start with Data** from the Welcome to SAS Visual Analytics window.



4. Select the **SYSTEM_NETWORK_INTERFACE** table in the Open Data Source window and click **OK**.

The screenshot shows the 'Choose Data' window with the 'Available' tab selected. On the left, a list of data sources is shown, including RABBITMQ_EXCHANGE, RABBITMQ_NODE, RABBITMQ_VHOST, SPRINGBOOT, SYSTEM, SYSTEM_CPU_USAGE, SYSTEM_FILESYSTEM, SYSTEM_NETWORK_INTERFACE, SYSTEM_PROCESS_USAGE, VIYALOGS, and VIYALOGS_SOURCES. The 'SYSTEM_NETWORK_INTERFACE' entry is highlighted with a red box. On the right, the details for this table are displayed in a grid format. The grid has columns for #, Name, Label, Type, Raw Len..., Format..., Format, Tags, and a toolbar at the top. Below the grid, there are sections for Date profiled, Columns, Rows, Size, Label, Location, Date created, Date modified, and Date last accessed. At the bottom right are 'OK' and 'Cancel' buttons.

5. You need to apply controls to the report to dynamically filter the data.

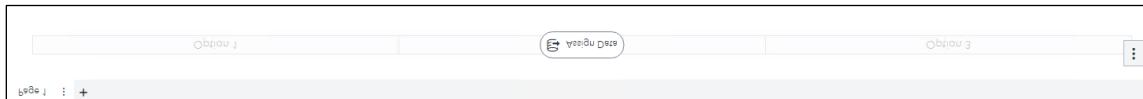
Click **Objects** on the left side of the report window.

6. Filter on **Button**.

The screenshot shows the 'Objects' panel with a search bar containing 'button'. Below it, there is a section titled 'Controls' which contains the 'Button bar' option, also highlighted with a red box.

7. Click **Button bar** and drag it to the report page.

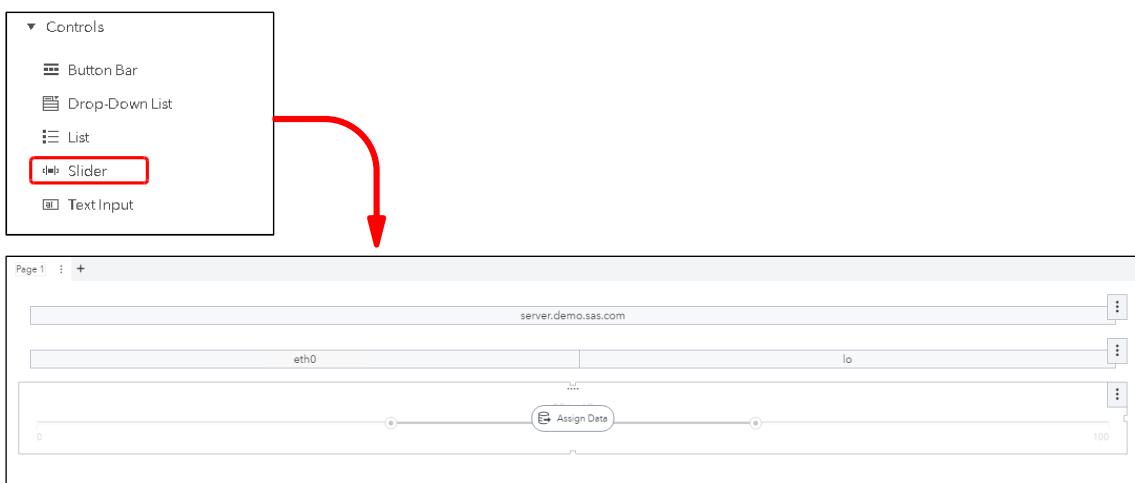
The screenshot shows the 'Controls' panel with the 'Button bar' option highlighted with a red box.



8. Variables must be assigned roles on the button bar to provide filtering of the data. Ensure that the new button bar in the report page is selected, and click **Roles** on the right side of the report window.

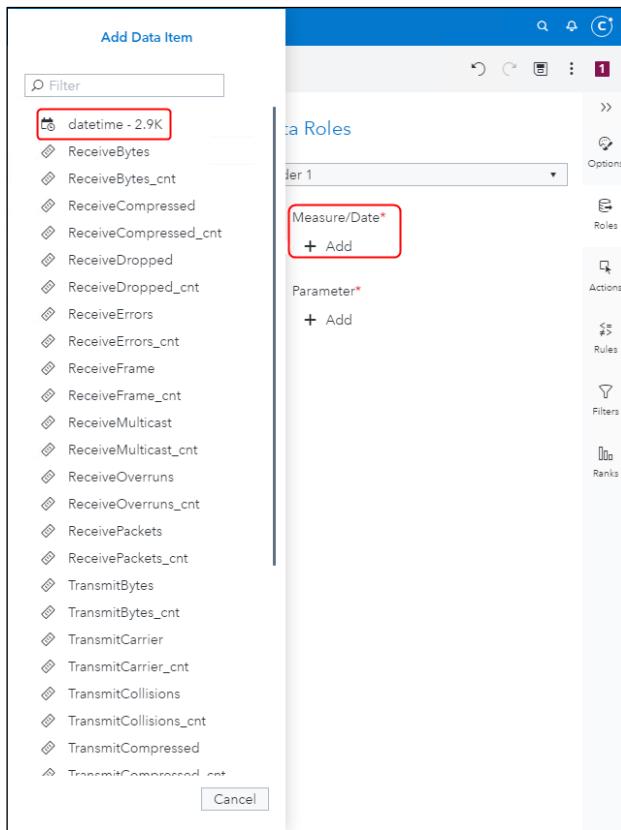
9. Click **Add** under **Category** and select **machine**.

10. Add another button bar. Click **Objects** on the left side of the report window.
 11. Click **Button bar** and drag it onto the report page.
 12. Ensure that the new button bar on the report page is selected and click **Roles** on the right side of the report window .
 13. Click **Add** under **Category** to add a category variable. From the Add Data Item list, select **interfaceName**.
- There are two network interfaces on this system. The button bar enables you to choose one of them to view data for that interface.
14. One more dynamic filter will be applied to the report. Click **Objects** on the left side of the report window.
 15. Filter on Slider. Click **Slider** and drag it onto the report page.



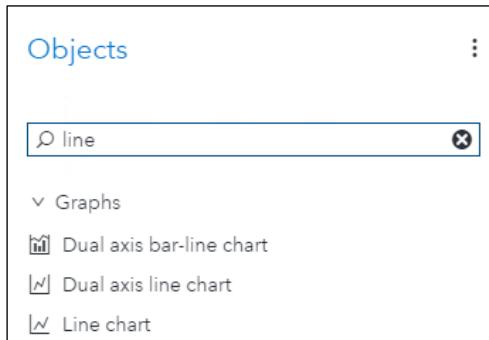
16. Click **Roles** on the right side of the report window, and click **Add** under **Measure/Date** to add a Measure/Date variable.

17. From the Add Data Item list, select **datetime**.



18. Click **Objects** on the left side of the report window.

19. Filter on **Line** and drag **Line Chart** to the report page.



20. Make sure that the new line chart is selected on the report page and click **Roles**. The **Category** and **Measure** variables from the data are required.

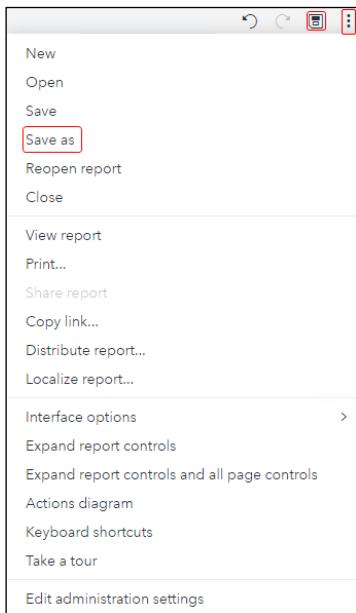
21. Click **Add** under **Category** and select **datetime**.

22. When the datetime variable was added, a Frequency measure was automatically added as a measure. You are charting different data. Click **Frequency** and select **ReceiveBytes** from the Replace Data Item list.

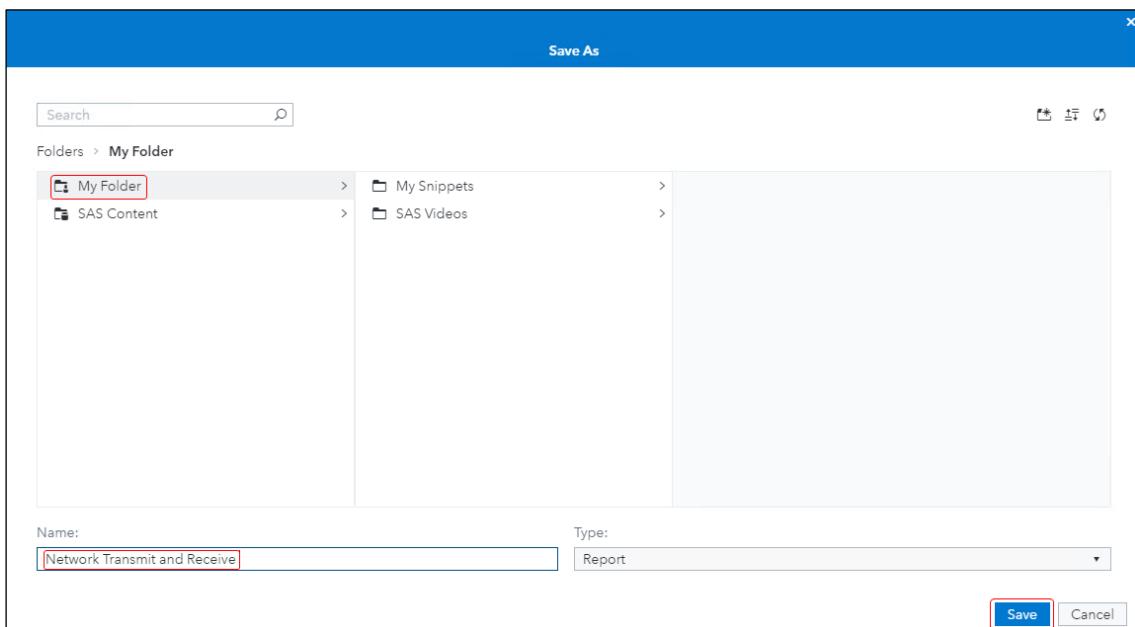
23. One more measure needs to be added. Click **Add** under **Measure** and select **TransmitBytes** from the Add Data Items list.

24. Click **OK** to save.

- 25.** Save the report by clicking the **disk** icon or the **More info** menu and selecting **Save as**.



- 26.** Select **My Folder** from the Save As window. Then enter **Network Transmit and Receive** in the **Name** field. Click **Save**.



5. Configure an Event for Reading Reports

- Click **Configuration** in SAS Environment Manager.
- Select **All services** from the **View** drop-down menu.

c. Select Audit service.

The screenshot shows the SAS Configuration interface. On the left, there is a sidebar with a tree view of various services. The 'Audit service' node is currently selected and highlighted in grey. The main panel is titled 'Configuration' and displays configuration instances for the 'Audit service'. It shows two sections: 'jvm' and 'sas.audit.archive'. Under 'jvm', there is a configuration instance with a GUID of '82f1af0a-88fb-40b1-91d9-c9ed26266be7'. Under 'sas.audit.archive', there is another configuration instance with a GUID of 'ebae90cd-b947-4b19-b247-f56e2b8960a0'. Both sections include descriptive text about the configuration instance and its scope.

d. Scroll to the `sas.audit.record` configuration and select **Edit icon.**



e. Select **Add property under **application**.**

Add the following events to the application section:

Name: **reports.action.read.enabled**

Value: **true**

Click **Save**.

The screenshot shows the 'Add Property' dialog box. It has a blue header bar with the title 'Add Property'. The main area contains two input fields: 'Name:' with the value 'reports.action.read.enabled' and 'Value:' with the value 'true'. At the bottom right, there are 'Save' and 'Cancel' buttons.

f. Select **Add property under **application**.**

Add the following events to the application section:

Name: **reports.action.read.state**

Value: **all**

You will need to open one or more reports to generate events that can be trapped. Open one or more of the auditing reports from your EV Dashboard gallery. You might need to wait a few minutes for the events to be detected and updated in the CAS table.

The easiest place to see whether your report read events are in place is to open the **User Activity** report from your EV Dashboard gallery and switch to the **Details** tab. Filter events for the reports application, read action, and if you want, a state of success.

6. Filtering Log Messages in SAS Environment Manager

- In SAS Environment Manager, select the **Logs** page.



- Apply the following filters:

Recent log entries **Last 12 hours**

Level: **ERROR**

Source: **cas**

Click **Apply**.

The screenshot shows the 'Logs' page with the following filter settings:

- Time:** Last 12 hours
- Level:** ERROR
- Source:** cas

The results table displays two log entries:

Time	Level	Source	Message
February 20, 2020 12:48:58.826 PM	ERROR	cas	MAIN NoUser MAIN [tkcsesinst.c:2109] - Could not find the specified session.
February 20, 2020 12:48:58.761 PM	ERROR	cas	MAIN NoUser MAIN [tkcsesinst.c:2109] - Could not find the specified session.

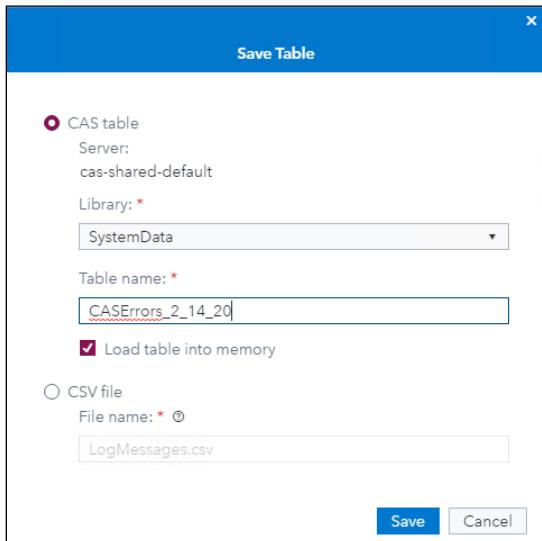
- Select one of the log messages on your display and examine the message details.
- Save the table of messages to your caslib. Click at the top of the Messages table.

The screenshot shows the 'Messages' table with the following data:

Time	Level	Source	Message
March 30, 2018 01:46:19.417 PM	ERROR	cas	httpProcessRequest: Could not read initial header line.
March 30, 2018 01:46:09.404 PM	ERROR	cas	httpProcessRequest: Could not read initial header line.

- e. Keep the library as **SystemData** and enter: **CASERRORS<date>** as the table name.

Note: Because of potentially sensitive data that might be in the log messages, you can save the log message table only to the CAS server and only to your personal library or the **SystemData** library. By default, the table is also loaded into memory when it is saved.



- f. Click **Save**.

- g. Go to the **Data** area and select **Loaded Tables** to see the newly created table that is loaded in memory. (You might need to refresh the view.)

- h. Move to the log directory. Use WinSCP or mRemoteNG and navigate to **/opt/sas/viya/config/var/log/cas/default**.

- i. mRemoteNG:

Use the following command to search for the latest log file name:

```
ls -lrt cas_*.log
```

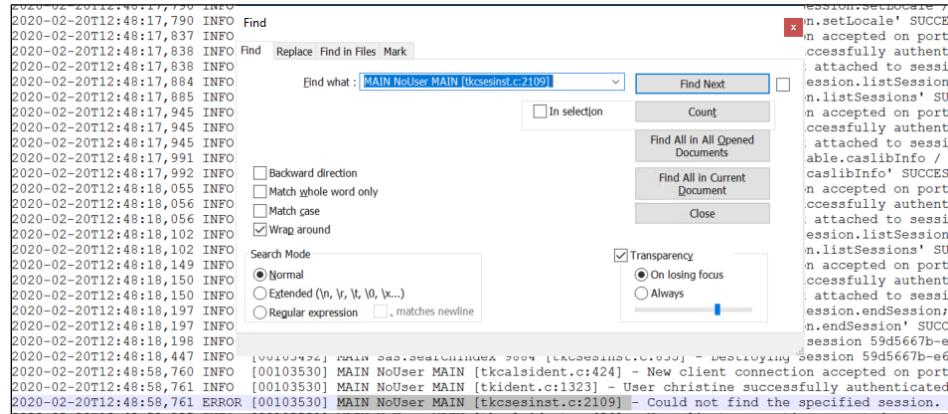
Open the latest log file with vi or gedit (your date will be different than below).

```
[sas@server default]$ vi cas_2020-02-20_server.demo.sas.com_32922.log
```

WinSCP:

- Use the datetime stamp.
- Search for the specific message in the opened log file. Copy the message from the SAS Environment Manager Logs page.

Message:
MAIN NoUser MAIN [tkcsesinst.c:2109] - Could not find the specified session.



- j. (Optional) Stream log messages to the console (you must run the sas-ops command as **sas** account):

```
/opt/sas/viya/home/bin/sas-ops logs --h
```

```
/opt/sas/viya/home/bin/sas-ops logs
```

Note: Hold down the Ctrl key and click C to quit, as this could run for some time.

```
[sas@server bin]$ ./sas-ops logs --h
NAME:
  sas-ops logs - Stream log events

USAGE:
  sas-ops logs [command options] [arguments]

COMMANDS:
  No subcommands

OPTIONS:
  --format format      Output format of log messages (json|pretty|line|file|term|plain|logfmt|template|event) (default "term")
  --match expression   Filter log messages by this regular expression
  --match-file file   file containing log message regular expression filters
  --min-level level   Minimum level of log messages (trace|debug|info|warn|error|fatal|none) (default "trace")
  --source source     Filter log messages by source
  --timeout duration  Exit after the specified duration

[sas@server bin]$ ./sas-ops logs
Listening for logs...CTRL+C to quit
```

7. Changing Logging Configuration

- a. Navigate to **/opt/sas/viya/config/etc/cas/default/** and view the **casconfig.lua** file. Locate the options below and notice their values.

```
cd /opt/sas/viya/config/etc/cas/default
more casconfig.lua
```

```
-- Default Lua Configuration file for Cloud Analytic Services

-- IMPORTANT: This file is NOT intended to be modified by users.
-- Do NOT modify anything in this file.
-- User modifications are permitted within the files
-- casconfig_usermods.lua and node_usermods.lua.

-- Recommended / Required options

-- unique id for the deployment of SAS
sas_deployment_id = 'viya'
```

`cas.logcfgloc`: used to specify the Log configuration file.

```
-- The 'logcfgloc' option is used to specify the Log configuration file
-- for the CAS server.

cas.logcfgloc = config_loc .. 'logconfig.xml'
```

`cas.onelog`: used to direct all logging to the controller node.

```
-- The 'onelog' option is used to direct all logging to the controller node
-- for the CAS server.
-- Default: false

--cas.onelog = true
```

Notice that this is an SMP deployment, with only a CAS controller node.

- b. Make a backup copy of the `logconfig.xml` file. (You need to use sudo.)

```
sudo cp logconfig.xml logconfig.xml.saved
```

```
[christine@server default]$ pwd
/opt/sas/viya/config/etc/cas/default
[christine@server default]$ ls -la
total 184
drwxr-xr-x. 5 sas sas 4096 Feb 18 13:54 .
drwxr-xr-x. 3 sas sas 53 Jan 7 12:35 ..
-rw-r--r--. 1 sas sas 2633 Jan 7 12:35 casconfig_deployment.lua
-rw-r--r--. 1 sas sas 1055 Jan 7 12:35 casconfig_deployment.lua_202001071235
-rw-r--r--. 1 sas sas 4352 Feb 18 13:54 casconfig_deployment.lua.ctmpl
-rw-r--r--. 1 sas sas 14015 Dec 4 17:48 casconfig.lua
-rw-r--r--. 1 sas sas 0 Jan 7 12:35 casconfig_usermods.lua
-rw-r--r--. 1 sas sas 31 Jan 7 12:35 cas.hosts
-rw-r--r--. 1 sas sas 20 Dec 4 17:48 cas.hosts_202001071235
-rw-r--r--. 1 sas sas 1166 Feb 18 13:54 cas_hosts.ctmpl
-rw-r--r--. 1 sas sas 630 Jan 7 12:35 cas.settings
-rw-r--r--. 1 sas sas 504 Jan 7 12:35 cas.settings_202001071235
-rw-r--r--. 1 sas sas 834 Feb 18 13:54 cas_settings.ctmpl
-r-----. 1 cas sas 1240 Jan 7 12:35 casstartup.lua
-r-----. 1 cas sas 0 Jan 7 12:35 casstartup_usermods.lua
-rw-r--r--. 1 sas sas 38009 Dec 4 17:48 cas-tls.lua
-rw-r--r--. 1 sas sas 125 Feb 18 13:54 cas_usermods.settings
-rw-r--r--. 1 sas sas 1776 Jan 7 12:35 cas.yml
drwxr-xr-x. 2 sas sas 6 Jan 7 12:35 conf.d
-rw-r--r--. 1 root root 37 Jan 7 12:35 consul_cas_hosts
-rw-----. 1 cas sas 398 Dec 4 17:48 keys.lua
-rw-r--r--. 1 sas sas 4374 Dec 4 17:48 logconfig.trace.xml
-rw-r--r--. 1 sas sas 3771 Dec 4 17:48 logconfig.xml
-rw-----. 1 cas sas 7947 Dec 4 17:48 node.lua
-rw-----. 1 cas sas 0 Jan 7 12:35 node_usermods.lua
drwx-----. 3 cas sas 33 Jan 7 12:35 permstore
-rw-----. 1 cas sas 12981 Dec 4 17:48 perms.xml
-rw-r--r--. 1 sas sas 1136 Feb 18 13:54 sas-cas-deployment.ctmpl
lrwxrwxrwx. 1 sas sas 82 Jan 7 12:35 sas_token.txt -> /opt/sas/viya/config/etc/cas/default/SASViyaV0300_70180938_Linux_x86-64.jwt
-rw-r--r--. 1 sas sas 21898 Jan 7 12:35 SASViyaV0300_09QBX6_70180938_Linux_x86-64.jwt
```

- c. Edit the **logconfig.xml** file. Use the **sudo gedit ./logconfig.xml** command.

```
sudo gedit ./logconfig.xml
```

- d. Find the Application message logger and change the level value from **Info** to **Debug**.

```
<!-- Application message logger -->
<logger name="App">
  <level value="Debug"/>
</logger>
```

```
<!-- Administration message logger -->
<logger name="Admin">
  <level value="Info"/>
  <appender-ref ref="UnixSysLog"/>
</logger>

<!-- Application message logger -->
<logger name="App">
  <level value="Debug"/> <!-- Application message logger -->
</logger>

<!-- CAS Action message logger -->
<logger name="App.cas.actions">
  <level value="Info"/>
</logger>

<!-- HTTP server access logger -->
<logger name="App.tk.http.server.access">
  <level value="Error"/>
</logger>
```

- e. Save your changes and exit your edit session.

- f. Restart the CAS server. (You need to use sudo.)

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

```
[christine@server default]$ sudo service sas-viya-cascontroller-default stop
sas-viya-cascontroller-default is stopped
[christine@server default]$ sudo service sas-viya-cascontroller-default start
sas-viya-cascontroller-default is running
[christine@server default]$
```

- g. Navigate to **/opt/sas/viya/config/var/log/cas/default/** and view the most recent log file.

```
cd /opt/sas/viya/config/var/log/cas/default
ls -la
more cas<date and time>_server_<process id>.log
```

Notice the following items:

- A new log file is generated with a new process ID (PID) in the name.
- The log now contains a finer level of detail, including DEBUG messages.

```
[christine@server default]$ cd /opt/sas/viya/config/var/log/cas/default
[christine@server default]$ ls -la
total 500
drwxr-xr-- 2 cas sas 4096 Jul 24 09:43 .
drwxr-xr-- 3 cas sas 4096 Apr 25 09:38 ..
-rw-r--r-- 1 cas sas 406123 Jul 24 09:42 cas_2017-07-24_server_25164.log
-rw-r--r-- 1 cas sas 85758 Jul 24 09:48 cas_2017-07-24_server_32484.log
-rw-r--r-- 1 cas sas 0 Jul 24 09:11 caslaunch_default_controller_daemon_2017-07-24_094320.err
-rw-r--r-- 1 cas sas 256 Jul 24 09:11 caslaunch_default_controller_daemon_2017-07-24_094320.log
-rw-r--r-- 1 cas sas 0 Jul 24 09:43 caslaunch_default_controller_daemon.err
-rw-r--r-- 1 cas sas 256 Jul 24 09:43 caslaunch_default_controller_daemon.log
[christine@server default]$ more cas_2017-07-24_server_32484.log
Host: 'server', OS: 'Linux X64', Release: '2.6.32-696.1.1.el6.x86_64', Command: '/opt/sas/viya/home/SASFoundation/utilities/bin/cas start -role controller -permstore /opt/sas/viya/config/etc/cas/default/permstore -userloc /opt/sas/viya/config/data/cas/default/casuserlibraries/#USER -cfg /opt/sas/viya/config/etc/cas/default/casconfig.lua -launcher /opt/sas/viya/home/SASFoundation/utilities/bin/caslaunch'
2017-07-24T09:43:20,167 INFO [00000003] cas local MAIN NoUser [tkcalsock.c:673] - The CAS server is listening on port 5570.
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1522] - 
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1522] - / \ / \ | / \ /
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1522] - / \ / \ | \ \
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1522] - \ / \ / \ | / \
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1522] - 
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1525] - SAS Cloud Analytic Services Version V.03.02MPO3082017
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1526] - Copyright © 2014-2017 SAS Institute Inc. All Rights Reserved.
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1533] - OS Name: Linux
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1534] - OS Family: Linux X64
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1535] - OS Release: 2.6.32-696.1.1.el6.x86_64
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1536] - OS Version: #1 SMP Tue Apr 11 17:13:24 UTC 2017
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1540] - Model Number: x86_64
2017-07-24T09:43:20,173 INFO [00000003] cas local MAIN NoUser [cas.c:1567] - Starting Cloud Analytic Services driver, host=server.exnet.sas.com, id=0, role=main controller.
2017-07-24T09:43:20,174 INFO [00000003] cas local MAIN NoUser [cas.c:1787] - The list of machines in '/opt/sas/viya/home/SASFoundation/../../config/etc/cas/default/cas.hosts' will be ignored because the server is running in SMP mode.
2017-07-24T09:43:20,174 INFO [00000003] cas local MAIN NoUser [cas.c:1919] - All grid nodes have connected.
2017-07-24T09:43:20,176 INFO [00000003] cas local MAIN NoUser [thtthtpserver.c:1293] - Starting HTTP server 'localhost', minPort=8777, maxPort=8778
2017-07-24T09:43:20,176 INFO [00000003] cas local MAIN NoUser [thtthtpserver.c:1376] - HTTP Server 'localhost' listening on port 8777.
2017-07-24T09:43:20,177 INFO [00000003] cas local MAIN NoUser [cashttp.c:1718] - HTTP server is authenticating connections.
2017-07-24T09:43:20,177 INFO [00000003] cas local MAIN NoUser [cashttp.c:1761] - HTTP server listening on port 8777.
2017-07-24T09:43:49,641 INFO [00000003] cas local MAIN NoUser [tkcalsock.c:797] - New client connection accepted on port 5570. Client IP address and port are ::ffff:127.0.0.1:41302.
2017-07-24T09:43:49,646 INFO [00000016] sas.monitoring local MAIN NoUser [tkident.c:997] - User sas.monitoring successfully authenticated using the OAuth authentication provider.
2017-07-24T09:43:49,646 INFO [00000016] sas.monitoring local MAIN NoUser [tkcsesinst.c:672] - Successfully created session e276c3bb-8ab8-fe40-a173-d69c0f0e4159.
2017-07-24T09:43:49,664 INFO [00000016] sas.monitoring local MAIN NoUser [casgeneral.c:3084] - Launched session controller. Process ID is 32625.
2017-07-24T09:43:49,668 INFO [00000007] cas local 32625 cas 0 [cas.c:1567] - Starting Cloud Analytic Services driver, host=server, id=0, role=session controller.
2017-07-24T09:43:49,669 INFO [00000007] cas local 32625 sas.monitoring 0 [tkcsesinst.c:672] - Successfully created session e276c3bb-8ab8-fe40-a173-d69c0f0e4159.
2017-07-24T09:43:49,670 INFO [00000007] cas local 32625 sas.monitoring 0 [tkhttpserver.c:1293] - Starting HTTP server 'server', minPort=0, maxPort=0
2017-07-24T09:43:49,671 INFO [00000007] cas local 32625 sas.monitoring 0 [tkhttpserver.c:1376] - HTTP Server 'server' listening on port 39579.
2017-07-24T09:43:49,672 INFO [00000007] cas local 32625 sas.monitoring 0 [cashttp.c:1718] - HTTP server is authenticating connections.
2017-07-24T09:43:49,672 INFO [00000007] cas local 32625 sas.monitoring 0 [cashttp.c:1761] - HTTP server listening on port 39579.
2017-07-24T09:43:49,677 DEBUG [00000007] cas localhost 32625 sas.monitoring 0 [tkcasainmp.c:3906] - Synchronizing cas libs
2017-07-24T09:43:49,678 DEBUG [00000007] cas local 32625 sas.monitoring 0 [tkcasainmp.c:3909] - Synchronize complete
2017-07-24T09:43:49,678 INFO [00000007] cas local 32625 sas.monitoring 0 [tkcasainmp.c:7715] - Opening license file '/opt/sas/viya/home/SASFoundation/../../config/etc/cas/default/SASViyaV0300_09KC9g_Linux_x86-64.txt'.
2017-07-24T09:43:49,679 INFO [00000007] cas local 32625 sas.monitoring 0 [tkcasainmp.c:3317] - ++ action addFmtLib /fmtLibName='userformats1', name='userformats1.sashdat', caslib='FORMATS', promote=true, fmtSearch='NONE';
2017-07-24T09:43:49,679 DEBUG [00000007] cas local 32625 sas.monitoring 0 [tkcasainmp.c:4698] - Invoking action sessionProp.addFmtLib
2017-07-24T09:43:49,679 DEBUG [00000007] cas local 32625 sas.monitoring 0 [tkcasainmp.c:3911] - No Synchronize required
2017-07-24T09:43:49,680 INFO [00000007] cas local 32625 sas.monitoring 0 [tkcasainmp.c:3317] - ++ action tkcastab.loadable / path='userformats1.sashdat', readAhead=true, resident=false, caslib='FORMATS', singlePass=false, returnWhe reInfo=true;
2017-07-24T09:43:49,680 DEBUG [00000007] cas local 32625 sas.monitoring 0 [tkcasainmp.c:4698] - Invoking action table
```

- h.** Change the CAS logging configuration to its original state. Copy the saved log configuration file to the **logconfig.xml** file that is defined in the **casconfig.lua** file.

```
cd /opt/sas/viya/config/etc/cas/default
sudo cp logconfig.xml.saved logconfig.xml
```

```
[christine@server default]$ cd /opt/sas/viya/config/etc/cas/default
[christine@server default]$ sudo cp logconfig.xml.saved logconfig.xml
```

- Restart the CAS server. (You need to use sudo.)

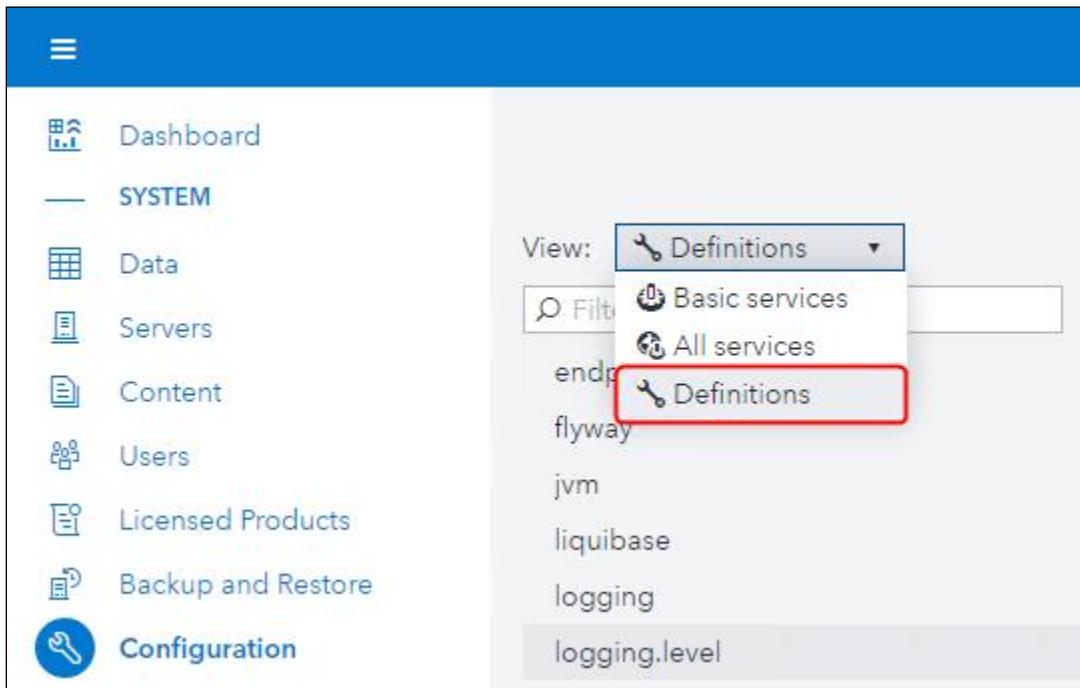
```
sudo systemctl stop sas-viya-cascontroller-default
sudo systemctl start sas-viya-cascontroller-default
```

```
[christine@server default]$ sudo service sas-viya-cascontroller-default stop
sas-viya-cascontroller-default is stopped
[christine@server default]$ sudo service sas-viya-cascontroller-default start
sas-viya-cascontroller-default is running
```

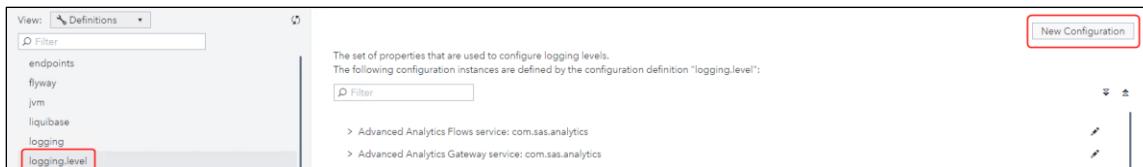
8. Changing the Folder Service Logging to TRACE and Viewing Additional Detail in the Log

In this practice, you change the logging level for the folders microservice and view the resulting additional details in the logs. Change the Folder Service logging to TRACE.

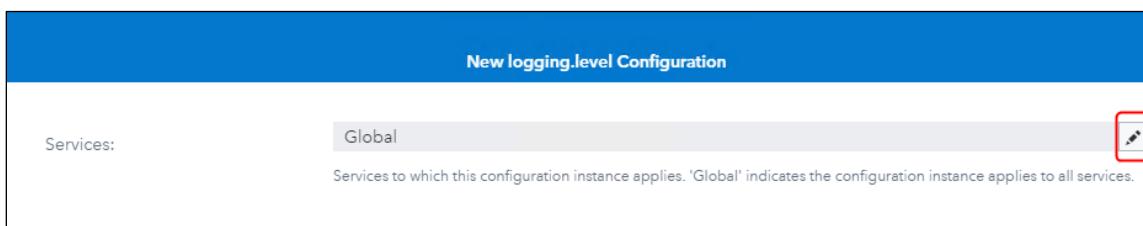
- In SAS Environment Manager, select **Configuration** \Rightarrow **Definitions**.



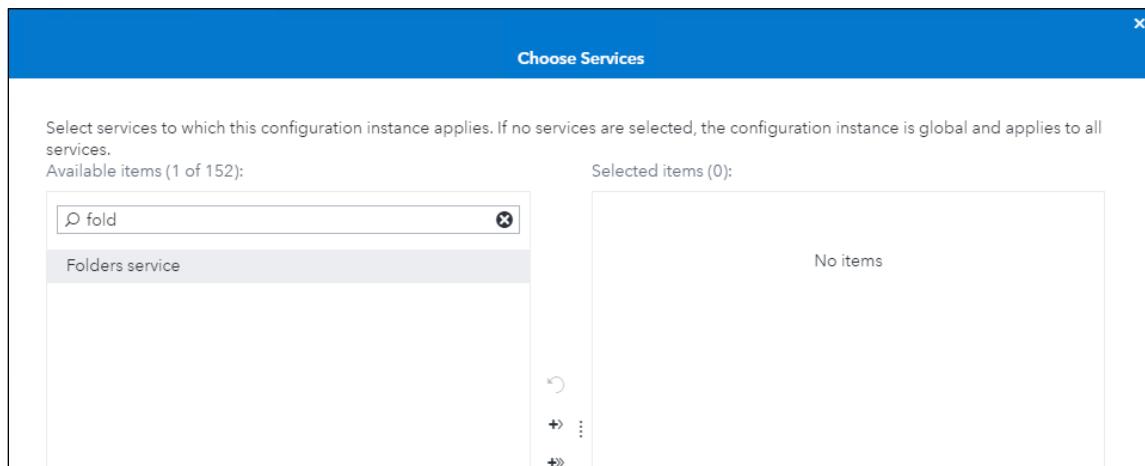
- Select **logging.level** and click **New Configuration** to add a new logger.



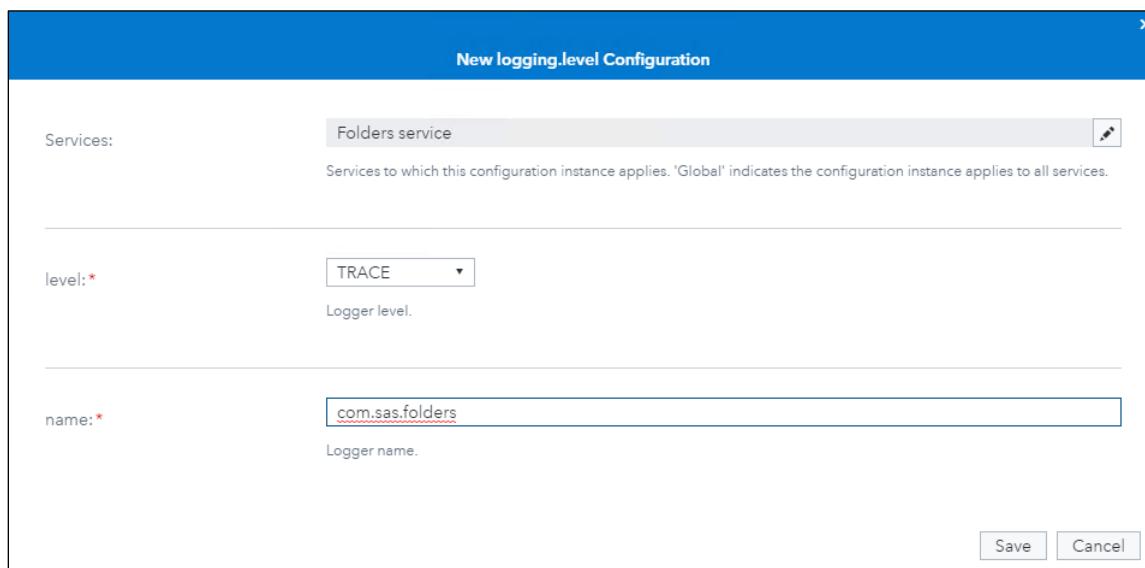
- Click the **Edit** icon in the Services section.



- d. Enter **Fold** and highlight **Folders service**.
- e. Move it to the **Selected items** area and click **OK**.



- f. Enter **TRACE** for the level and **com.sas.folders** for the name.



- g. Click **Save**.

Where can you find the possible required values for **name** and **Logger level**?

SAS Viya 3.5 Administration / Logging Documentation

Note: The level OFF (SAS Environment Manager loggers) is not a real level. It is used only to disable an existing configuration definition “logging.level.”

Microservice and Web Application Loggers		
These loggers are associated with SAS Viya microservices and web applications. Specify these loggers when you are creating a logging level definition. See Set the Threshold Level for Logs for more information.		
Service	Loggers	Usage
All	com.sas.authorization	Authorization decisions
All	com.sas.authorization.bootstrap	Authorization rule bootstrapping
All	com.sas.configuration.bootstrap	Configuration bootstrapping
All	com.sas.credentials.bootstrap	Credential domain bootstrapping
All	com.sas.event	Generated and received events
All	com.sas.folders.bootstrap	Folder definition bootstrapping
All	com.sas.security.oauth2	Authentication issues
All	com.sas.security.oauth2.bootstrap	Client token bootstrapping (allows services to talk to other services)
All	com.sas.typeregistry.bootstrap	Type definition bootstrapping
All	org.apache.http.header	Request and response headers
All	org.apache.http.wire	Full requests and responses
All	org.springframework.security	Authentication issues
appregistry	com.sas.appregistry	
appregistry	com.sas.homeshared	
audit	com.sas.audit	

- h. Generate an event using a folder to verify the change in logging level. Select **Content** from the side menu.

- i. Click **New Folder** to add a new folder. Name the folder **test**.

- j. Verify the changes in the folders log file. In your mRemoteNG session, navigate to `/opt/sas/viya/config/var/log/folders/default/`.

```
[sas@server default]$ pwd
/opt/sas/viya/config/var/log/folders/default
[sas@server default]$
```

- k. View the log to see DEBUG and TRACE information about the creation of a new folder:

Gedit name of log file

```
sas-folders_2018-03-20_10-51-12.log
a96cce31-288e-42b9-8353-26a6eceeaa352,type=application/
vnd.sas.authorization.rule,itemType=<null>,responseType=<null>,responseItemType=<null>,title=<null>,
com.sas.common.rest.representations.Link@3b88c3a5[method=PUT,rel=update,uri=/authorization/rules/
a96cce31-288e-42b9-8353-26a6eceeaa352,href=/authorization/rules/
a96cce31-288e-42b9-8353-26a6eceeaa352,type=application/
vnd.sas.authorization.rule,itemType=<null>,responseType=application/
vnd.sas.authorization.rule,responseItemType=<null>,title=<null>,
com.sas.common.rest.representations.Link@2fec6441[method=DELETE,rel=delete,uri=/authorization/rules/
a96cce31-288e-42b9-8353-26a6eceeaa352,href=/authorization/rules/
a96cce31-288e-42b9-8353-26a6eceeaa352,type=<null>,itemType=<null>,responseType=<null>,responseItemType=<null>,title=
matchParams=false]
2018-04-02 15:52:20.449 TRACE 25934 --- [o-auto-1-exec-7] com.sas.folders.Controller : christine
(fed506c4) [cd9ae1610ba5661b] Created folder test with id f876181d-2995-482b-888b-a30a297fd35d.
2018-04-02 15:52:20.451 DEBUG 25934 --- [enerContainer-3] com.sas.folders.FolderEventListener : service
[cd9ae1610ba5661b] Received resource event type: create for /folders/folders/f876181d-2995-482b-888b-a30a297fd35d
2018-04-02 15:52:20.451 TRACE 25934 --- [enerContainer-1] c.sas.folders.FolderCacheEventListener : service
[cd9ae1610ba5661b] Received resource event type: create for /folders/folders/f876181d-2995-482b-888b-a30a297fd35d
2018-04-02 15:52:20.451 DEBUG 25934 --- [enerContainer-1] c.sas.folders.FolderCacheEventListener : service
[cd9ae1610ba5661b] Clearing member cache.
2018-04-02 15:52:20.479 TRACE 25934 --- [o-auto-1-exec-6] com.sas.folders.Controller : christine
(fed506c4) [f75eb5dd6ef20c] Found 7 folders.
2018-04-02 15:52:20.572 DEBUG 25934 --- [o-auto-1-exec-3] com.sas.folders.Controller :
sas.searchIndex [cd9ae1610ba5661b] Getting folder f876181d-2995-482b-888b-a30a297fd35d.
2018-04-02 15:52:20.574 TRACE 25934 --- [o-auto-1-exec-3] com.sas.folders.Controller :
sas.searchIndex [cd9ae1610ba5661b] Found folder test.
2018-04-02 15:52:20.941 DEBUG 25934 --- [o-auto-1-exec-4] com.sas.folders.Controller : christine
(fed506c4) [feb9a361ef670891] Getting folder f876181d-2995-482b-888b-a30a297fd35d.
2018-04-02 15:52:20.942 TRACE 25934 --- [o-auto-1-exec-4] com.sas.folders.Controller : christine
(fed506c4) [feb9a361ef670891] Found folder test.
```

You can see that the TRACE-level logging generates a large volume of messages in the log.



Return to the logging definition for the folders server and reset the level to **INFO**. Save your changes.

- In SAS Environment Manager, change the logging level back to **INFO**. On the side menu, select **Configuration** \Rightarrow **Definitions**.
- On the right side of the window, search for **folders**. This search should return one item: **Folders service: com.sas.folders**.

Folders service: com.sas.folders	
GUID:	47006ed3-7e7a-4dd7-9e47-007e9f6a1ea
Services:	Folders service
level:	TRACE
name:	com.sas.folders

- n. Modify the logger level to **INFO** by clicking the **Edit** icon next to the service.

Folders service: com.sas.folders

GUID: 47006ed3-7e7a-4dd7-9e47-007e9f6aa1ea
The globally unique identifier for the configuration instance.

Services: Folders service
Services to which this configuration instance applies. 'Global' indicates the configuration instance applies to all services.

level: * TRACE
Logger level.

name: * com.sas.folders
Logger name.

- o. Change the logging level to **INFO** and click **Save**.

Edit logging.level Configuration

GUID: 47006ed3-7e7a-4dd7-9e47-007e9f6aa1ea
The globally unique identifier for the configuration instance.

Services: Folders service
Services to which this configuration instance applies. 'Global' indicates the configuration instance applies to all services.

level: * **INFO**
Logger level.

name: * com.sas.folders
Logger name.

Save Cancel

End of Solutions

Solutions to Activities and Questions

6.01 Multiple Choice Question – Correct Answer

On each machine in the deployment, log files are stored in which configuration directory?

- a. /opt/sas/viya
- b. /opt/sas/viya/config
- c. /opt/sas/viya/config/var
- d.** /opt/sas/viya/config/var/log

6.02 Multiple Choice Question – Correct Answer

In SAS Viya server logging, what is an output destination for a log message?

- a. logger
- b.** appender
- c. diagnostic level
- d. filter

6.03 Multiple Choice Question – Correct Answer

Which configuration files govern CAS server logging?

- a. via the casconfig.json file and the logconfig.xml file
- b. via the casconfig.lua file and the logconfig.xml file
- c. via the logconfig.xml file and SAS Environment Manager
- d. via the logconfig.xml file and CAS Server Monitor

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6.04 Multiple Choice Question – Correct Answer

Which type of file can you edit to change the logging level for the SAS Configuration Server?

- a. .xml
- b. .txt
- c. .json
- d. .sas7bdat

45

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6.05 Question – Correct Answer

Microservices do not require a restart to pick up changes to the logging configuration.

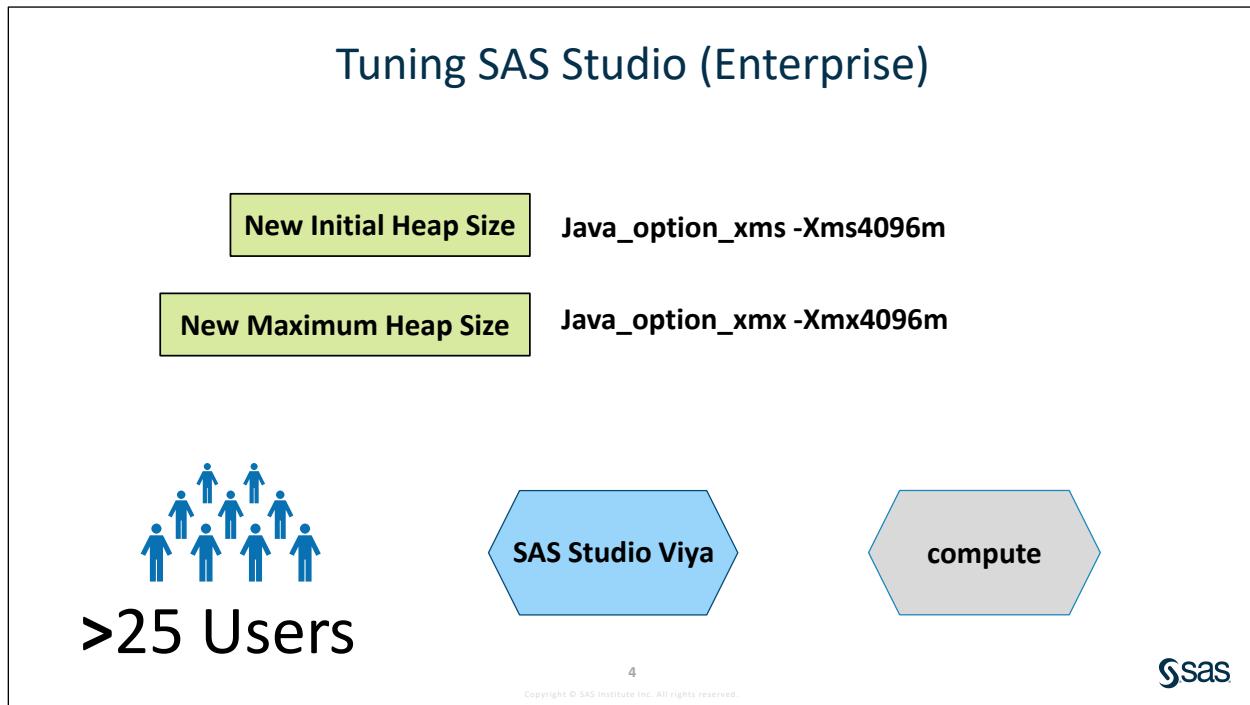
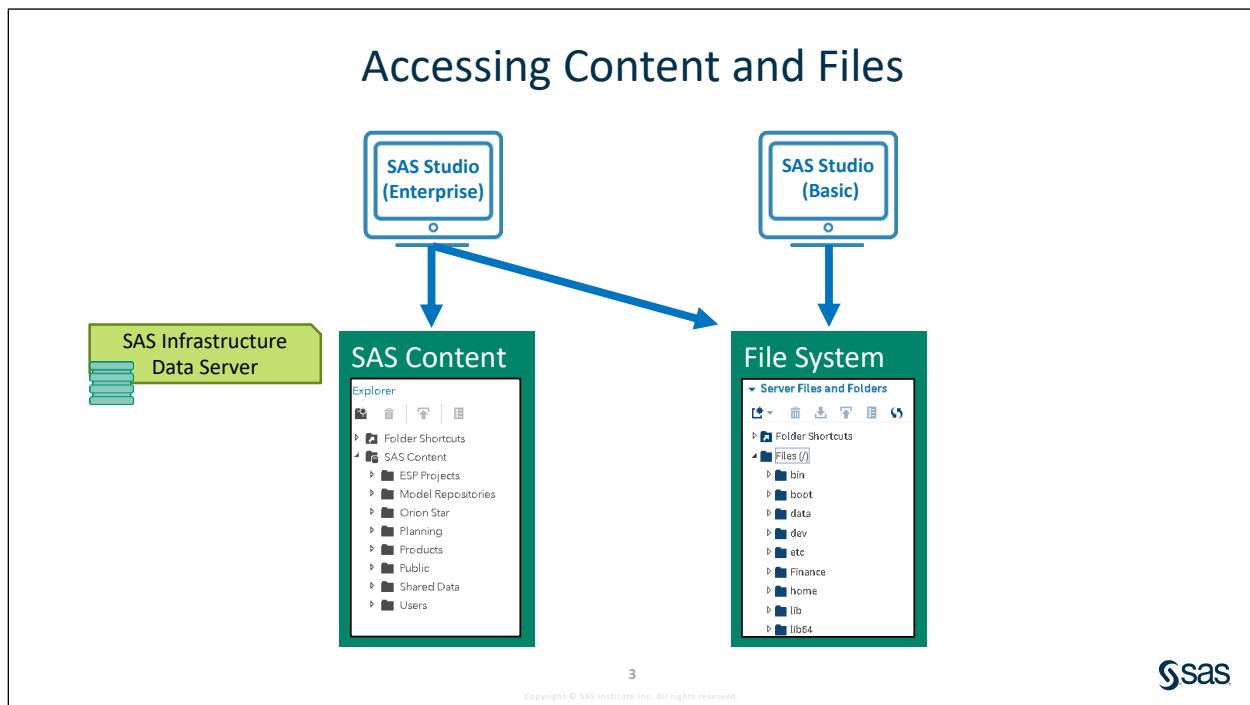
True

False

Lesson 7 Managing Content in SAS® Viya®

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	Practice.....	7-9
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	Solutions to Practices	7-45

7.1 Managing SAS Studio



SAS Studio is a development application for SAS that you access through your web browser. Heap size increases are recommended if you have more than 25 users accessing the SAS Studio (Enterprise) server.

It is recommended that you increase the initial heap size option (-Xms) and the maximum heap size option (-Xmx) for SAS Studio (Enterprise). The maximum heap size option also needs to be increased for SAS Compute Server.

Considerations for SAS Studio Users

Restrict programmer access to operating system commands and other resources.

-NOXCMD system option

LOCKDOWN system option

Consider disabling the X command:

- -NOXCMD system option specifies that the X command is not valid in the current SAS session
- Also controls use of FILENAME PIPE (a way to get results of arbitrary shell command back into SAS)

For more information, see the Extended Learning Page.

Consider using the LOCKDOWN system option and the LOCKDOWN statement. You can limit access to files and to specific SAS features in a SAS Compute Server session.

You can set these options

- in a configuration file
- In the SASV9_OPTIONS environment variable
- In the SAS command
- In an OPTIONS statement, either in a SAS program or an autoexec file. (An autoexec file contains SAS statements that are executed automatically when SAS is invoked. The autoexec file can be used to specify some SAS system options, as well as to assign librefs and filerefs to data sources that are used frequently.)

For more information, see the Extended Learning page.

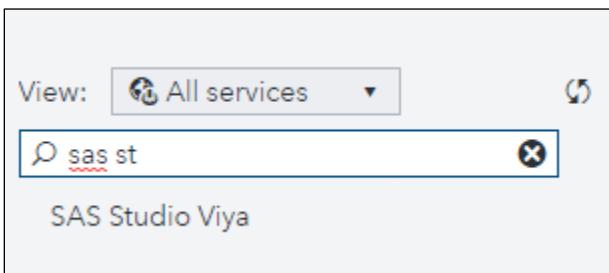


Configuring Heap Size for SAS Studio (Enterprise)

1. Use the Configuration area in SAS Environment Manager to increase initial heap size and maximum heap size options. Click the **Configuration** area.



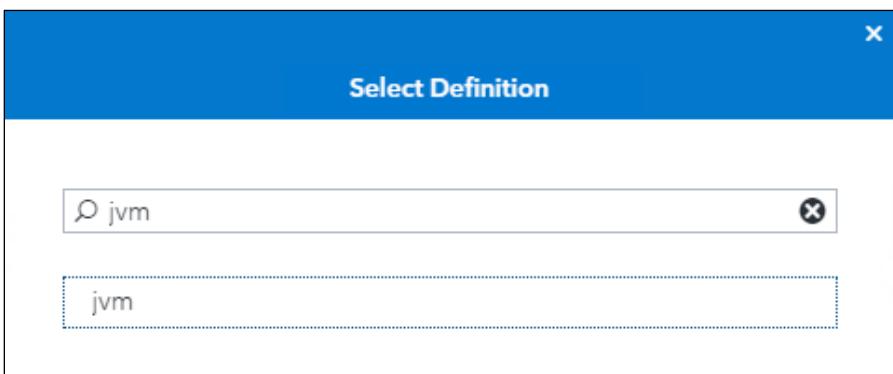
2. Navigate to the **All services** view and select **SAS Studio Viya**.



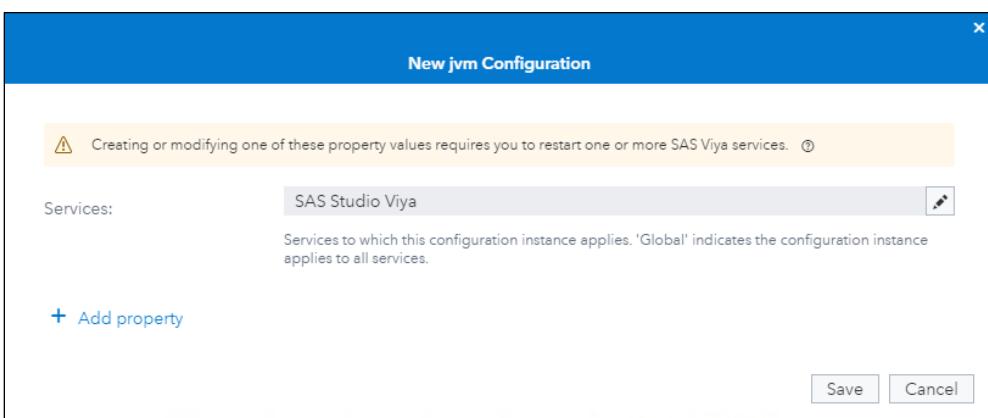
3. At the top of the content pane, click **New Configuration**.



4. In the **Select Definition** dialog box, select **jvm**.

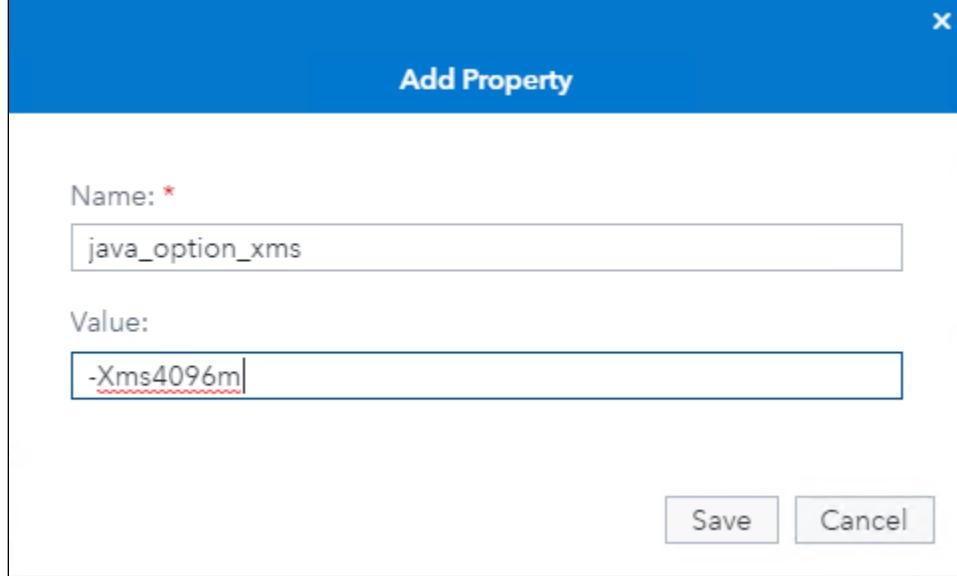


5. Click **+ Add property**.



6. In the Add Property window, specify the following to set the new initial heap size:

1. Name	java_option_xms
2. Value	-Xms4096m



The screenshot shows the 'Add Property' dialog box. At the top, it says 'Add Property'. Below that, there are two input fields: 'Name:' with the value 'java_option_xms' and 'Value:' with the value '-Xms4096m'. At the bottom right are 'Save' and 'Cancel' buttons.

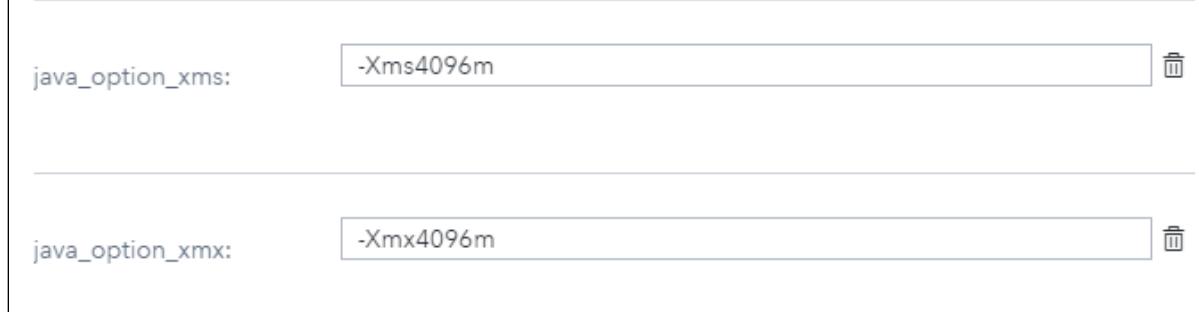
7. Click **Save**.
8. Add another property. Click **+ Add property**.



The screenshot shows a list of properties. The first item is 'java_option_xms: -Xms4096m'. Below it is a blue '+ Add property' button.

9. In the Add Property window, specify the new maximum heap size with the following:

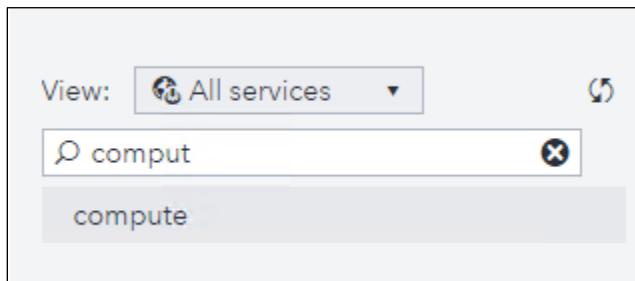
3. Name	java_option_xmx
4. Value	-Xmx4096m



The screenshot shows the properties list again. It now includes two items: 'java_option_xms: -Xms4096m' and 'java_option_xmx: -Xmx4096m'. Both items have a small trash can icon to their right.

10. Click **Save** twice.

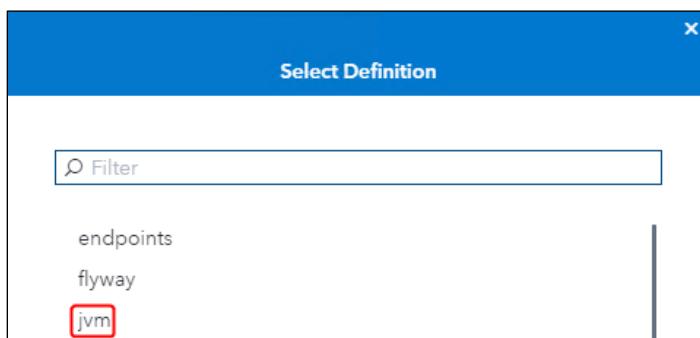
11. Configure maximum heap size for the SAS Compute Server as well. In the **All services** list, select the **compute** service.



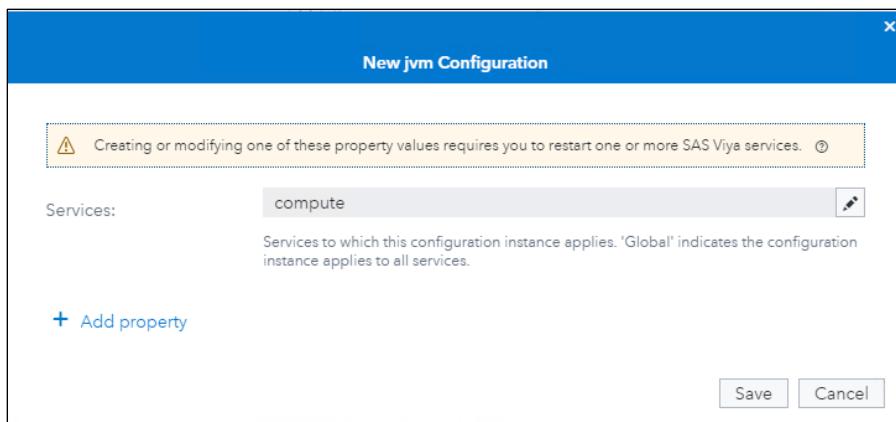
12. At the top of the content pane, click **New Configuration**.



13. In the **Select Definition** dialog box, select **jvm**.



14. Click **+ Add property**.



15. In the Add Property window, specify the following:

Name	java_option_xmx
Value	-Xmx1024m

java_option_xmx:	<input type="text" value="-Xmx1024m"/>	
------------------	--	---

16. Click **Save** twice.

x

Edit jvm Configuration

⚠ Creating or modifying one of these property values requires you to restart one or more SAS Viya services. [?](#)

GUID: 8c30e7b6-d932-4850-a37e-6c9e29131673
The globally unique identifier for the configuration instance.

Services: 

Services to which this configuration instance applies. 'Global' indicates the configuration instance applies to all services.

java_option_xmx: 

[+ Add property](#)

17. Restart the SAS Studio service and the SAS Compute service:

```
sudo systemctl restart sas-viya-sasstudiov-default
```

```
sudo systemctl restart sas-viya-compute-default
```

End of Demonstration



Practice

1. Set File Navigation Options for SAS Studio (Enterprise)

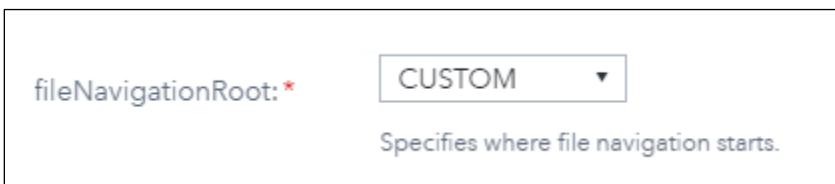
In this practice, you use SAS Environment Manager to configure the file system path for users of SAS Studio (Enterprise).

- Open **SAS Environment Manager**.
- As the **christine** user, opt into your assumable groups.
- Click the **Configuration** area.

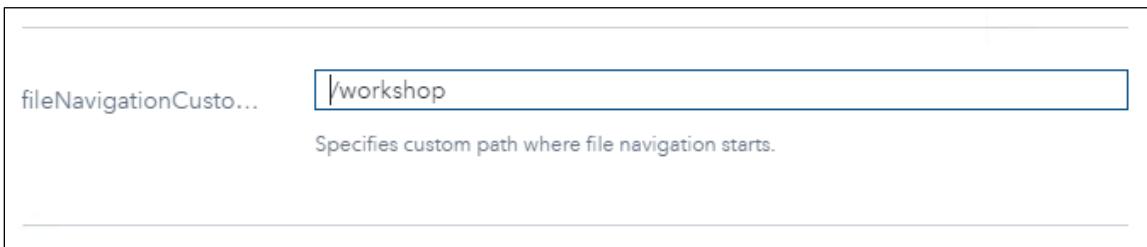


- Navigate to the **All services** view and select **SAS Studio Viya**.

- In the content pane, filter on **sas.studioviy**, and click the **Edit** button .
- Here you can view and set configuration for SAS Studio (Enterprise). Scroll down to the **fileNavigationRoot** property and notice the current value is set to **SYSTEM**. The other possible options include **CUSTOM** or **USER**.
- Set the **fileNavigationRoot** drop-down menu to **CUSTOM**.



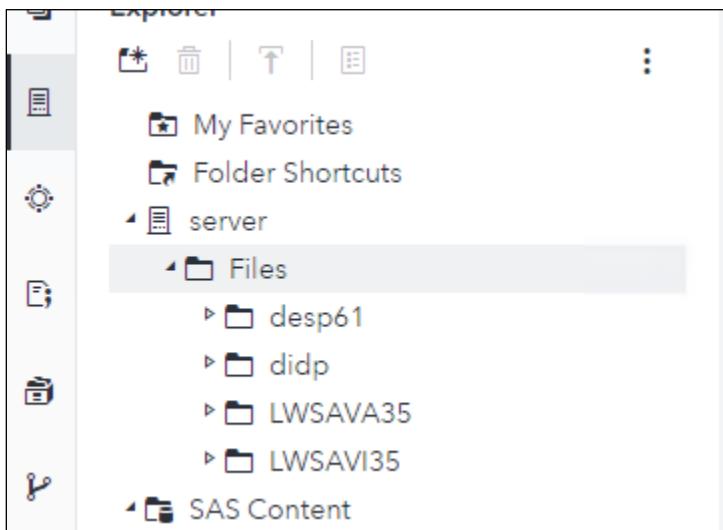
- Set the property **fileNavigationCustomRootPath** to the value: **/workshop**.



- Click **Save**.
- Restart SAS Studio service to pick up the change in mRemoteNG.

```
sudo systemctl restart sas-viya-sasstudioviy-default
```

- k. Verify the changes by launching SAS Studio (Enterprise) and expanding **Explorer** ⇒ **Server** ⇒ **Files** to see the LWSAVI35 and LWSAVA35 directories inside the /workshop directory.



2. Set File Navigation Options for SAS Studio (Basic)

In this practice, you edit **init_usermods.properties** to change the file system access in SAS Studio (Basic).

Use MRemoteNG or WinSCP to modify **init_usermods.properties**.

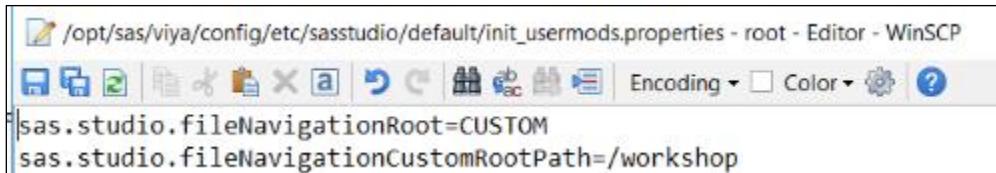
- a. Navigate to: **/opt/sas/viya/config/etc/sasstudio/default**

```
cd /opt/sas/viya/config/etc/sasstudio/default
```

- b. Open the file for editing. The current parameters set the file navigation path to the /workshop directory for this class.

Note: If you are using Christine's session in MRemoteNg, you will need sudo privileges to modify the file.

```
sudo gedit init_usermods.properties
```



- c. Modify the fileNavigationRoot property to point to the server root directory.

```
sas.studio.fileNavigationRoot=SYSTEM
```

- d. Delete the **sas.studio.fileNavigationCustomRootPath=/workshop** property.

- e. Save and close the file.

Note: Values that you specify in the **init_usermods.properties** file have precedence over corresponding values in other files. Values in the **init_usermods.properties** survive software upgrades.

- f. Restart SAS Studio service to pick up the change.

```
sudo systemctl restart sas-viya-sasstudio-default
```

- g. Sign on to **SAS Studio (Basic)** to confirm the modified file navigation path. (Use the shortcut on the bookmark bar.)

Note: The **sas.studio.fileNavigationRoot** property is set to **USER** by default. This maps the file navigation path to each users' \$HOME directory.

3. (Optional) Scheduling Programs in SAS Studio (Enterprise)

- Run the **Test Job Definition Code.sas** program in SAS Studio to test first before scheduling. The Job Execution service does not provide as detailed information about errors, and some errors do not register as an error (for example, incorrect *folderpath* or *filename*).
 - From the side menu in SAS Environment Manager, select **Develop SAS Code**.
 - In the navigation pane, click **Explorer** ⇒ expand **SAS Content** ⇒ expand **Public**.
 - Right-click **Test Job definition Code.sas** and select **Open**. (Or double-click the program to open the code in the Program Editor.)

The screenshot shows the SAS Studio Program Editor window with the title "Test Job Definition Code.sas". The toolbar includes "Run", "Cancel", "Copy to My Snippets", "Debug", and tabs for "Code" and "Log". The code area contains the following SAS code:

```

1  /*************************************************************************/
2  /*
3  /* Start a session named mySession using the existing CAS server connection */
4  /* while allowing override of caslib, timeout (in seconds), and locale */
5  /* defaults. */
6  /*
7  /*************************************************************************/
8
9  cas mySession host="server.demo.sas.com" port=5570 sessopts=(caslib=Public timeout=1800 locale="en_US");
10
11 filename myJob1 FILESRVC folderpath="/Public" filename="Generate CSV File Example.sas";
12 %include myJob1 / source;
13
14 filename myJob2 FILESRVC folderpath="/Public" filename="Load File to Memory Example.sas";
15 %include myJob2 / source;
16
17 cas mySession terminate;

```

- Submit the program (press the F3 key). This program connects to the CAS server session, includes two programs, **myJob1** and **myJob2**, to be submitted. Examine the log to verify that the program ran successfully.
 - Confirm that the **CARS_CSV** table was loaded to the **Public** caslib.
- From the side menu, select **Manage Environment** for SAS Environment Manager ⇒ select the **Data** area ⇒ click the **Data Sources** tab ⇒ expand **cas-shared-default** ⇒ expand **Public**.

Note: **CARS_CSV** should have a lightning bolt icon to show that it is loaded in-memory.

- c. Go back to SAS Studio and copy **Test Job Definition Code** from this code editor, so that you can paste it in a SAS Job Execution file.

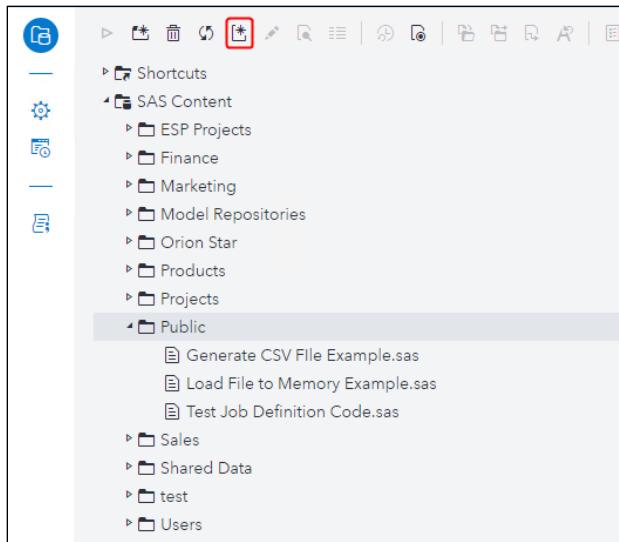
```

1  ****
2  /*
3  /* Start a session named mySession using the existing CAS server connection */
4  /* while allowing override of caslib, timeout (in seconds), and locale */
5  /* defaults. */
6  /*
7  ****
8
9  cas mySession host="server.demo.sas.com" port=5570 sessopts=(c
10
11 filename myJob1 FILESRVC folderpath="/Public" filename="General.sas";
12 %include myJob1 / source;
13
14 filename myJob2 FILESRVC folderpath="/Public" filename="Load File.sas";
15 %include myJob2 / source;
16
17 cas mySession terminate;

```

- d. Create and submit SAS Job Execution code.

- 1) Enter **http://server/SASJobExecution/** in the web browser.
- 2) Expand the **Public** folder and click **New File**.



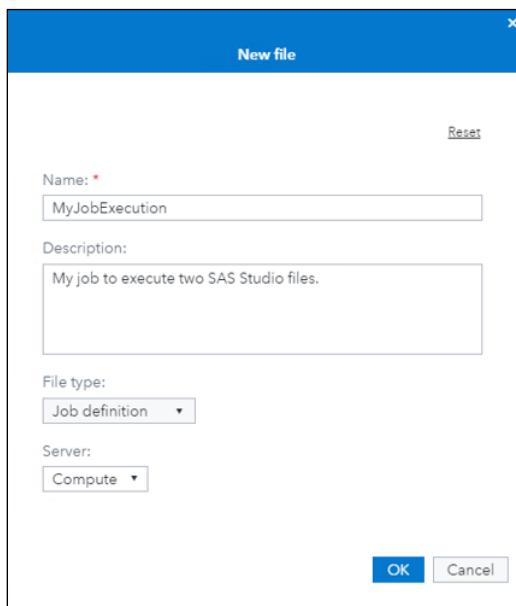
- 3) Enter:

Name: **MyJobExecution**

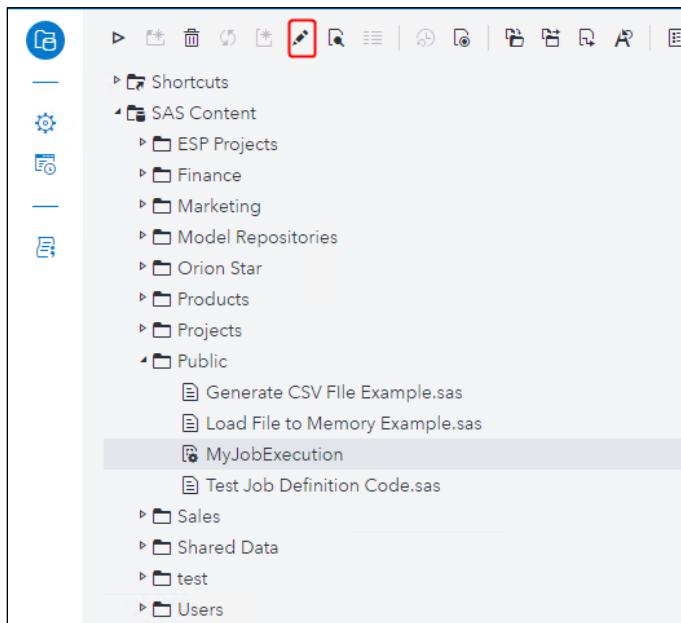
Description: **My job to execute two SAS Studio files.**

File type: **Job definition**

Click **OK**.

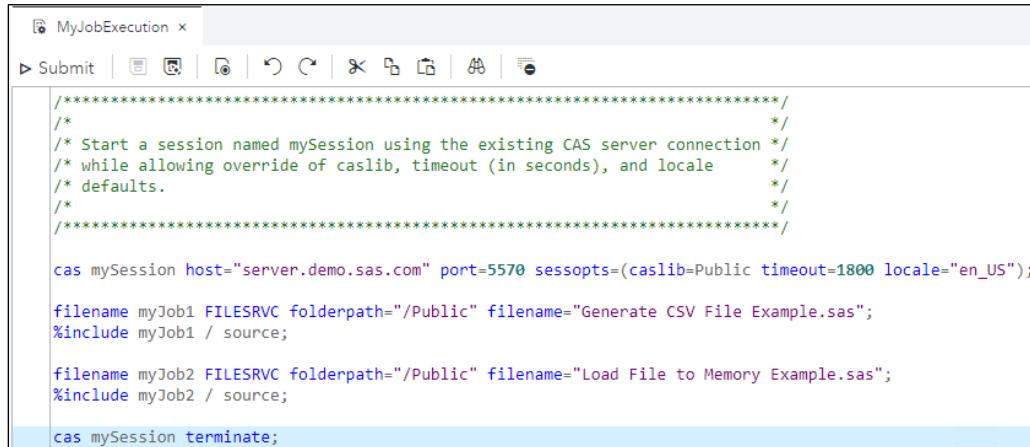


- 4) With the new file name selected, click **Edit file** to edit the contents of the file.



- 5) Paste the code that you copied previously from your SAS Studio test job.

Note: You must press and hold the Ctrl key and click V to paste the copied code.



```

*****;
/*
/* Start a session named mySession using the existing CAS server connection */
/* while allowing override of caslib, timeout (in seconds), and locale */
/* defaults.
*/
*****;

cas mySession host="server.demo.sas.com" port=5570 sessopts=(caslib=Public timeout=1800 locale="en_US");

filename myJob1 FILESRVC folderpath="/Public" filename="Generate CSV File Example.sas";
%include myJob1 / source;

filename myJob2 FILESRVC folderpath="/Public" filename="Load File to Memory Example.sas";
%include myJob2 / source;

cas mySession terminate;

```

- 6) Click **Save changes**.

- 7) Click **Submit**.

Submitting the job opens a SAS Output tab for the contents from the executable file. Because the job did not produce content, the tab is empty.

- 8) Close the **Output** tab.

- 9) Click the **X** on the MyJobExecution tab of the SAS Job Execution Application to close out of the program.



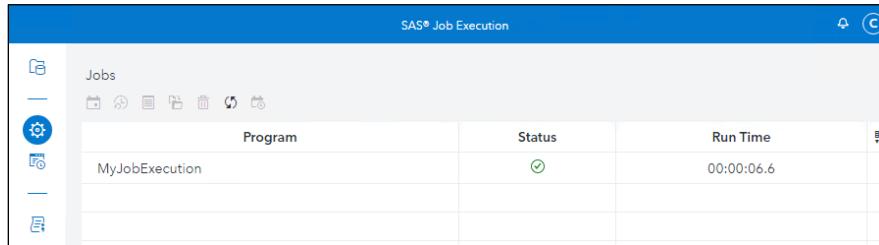
- 10) Select **Jobs** from the side navigation pane to confirm that the job that was just executed has a status of success, .

e. Add parameters to your **MyJobExecution** file.

- 1) Return to the **Contents**  area and highlight **MyJobExecution**. With the file highlighted, click **Job submit options**.
- 2) Enter the following parameter to eliminate the display of the SAS Output tab after submitting the job: `_output_type=none`
Check **Show log** to display the SAS Log when submitting the job.
- 3) Click **Close**.

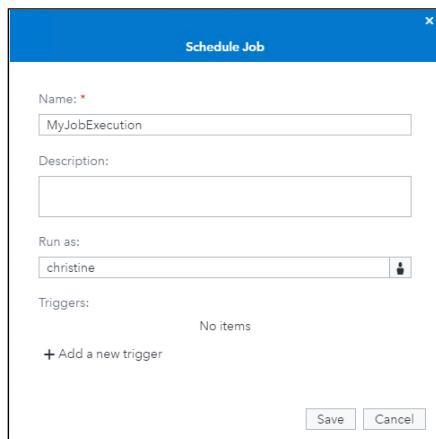
f. Schedule the job.

- 1) Return to **Jobs** area, highlight **MyJobExecution**, and click the **Schedule job icon** . This will add a job entry in the **Jobs** area of SAS Environment Manager and open the application.



The screenshot shows the 'SAS® Job Execution' interface. On the left, there's a sidebar with icons for Home, Jobs, Triggers, and Help. The main area is titled 'Jobs' and contains a table with three columns: 'Program', 'Status', and 'Run Time'. A single row is listed for 'MyJobExecution', which has a green checkmark in the 'Status' column and a run time of '00:00:06.6'.

- 2) Name the job.

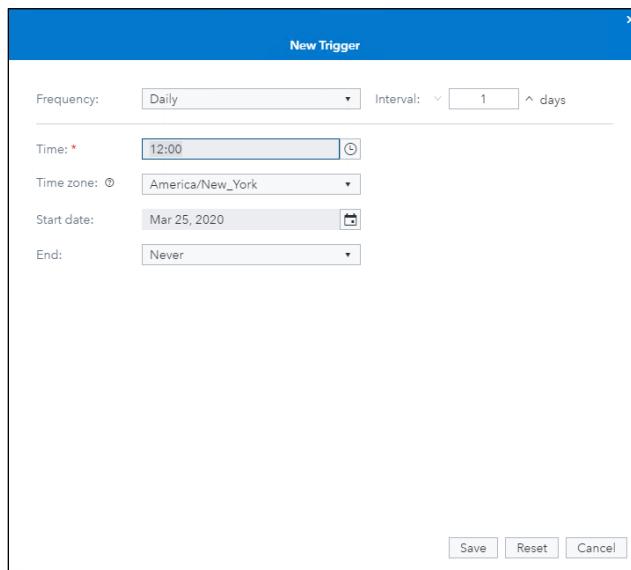


The 'Schedule Job' dialog box is open. It has fields for 'Name' (containing 'MyJobExecution'), 'Description', 'Run as' (containing 'christine'), and 'Triggers' (showing 'No items'). At the bottom are 'Save' and 'Cancel' buttons.

- 3) Click **Add a new trigger**.
- 4) Enter the following to have the job run every day at noon EST:

Time: **12:00**

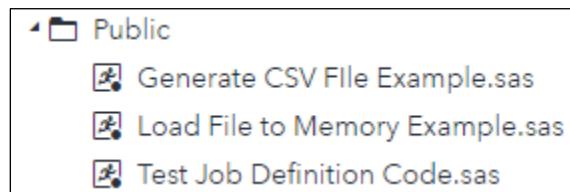
Click **Save**.



The 'New Trigger' dialog box is open. It has settings for 'Frequency' (set to 'Daily'), 'Interval' (set to '1 days'), 'Time' (set to '12:00'), 'Time zone' (set to 'America/New_York'), 'Start date' (set to 'Mar 25, 2020'), and 'End' (set to 'Never'). At the bottom are 'Save', 'Reset', and 'Cancel' buttons.

5) Run as **christine**. Click **Save**.

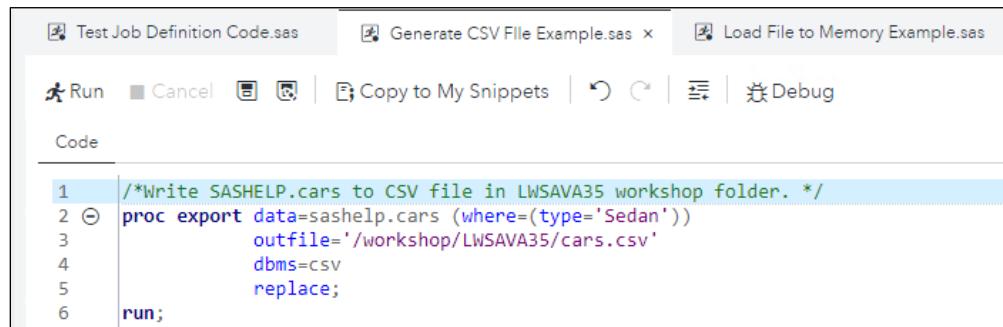
Note: Three SAS programs are in **SAS Content** \Rightarrow **Public**.



```

Public
  Generate CSV File Example.sas
  Load File to Memory Example.sas
  Test Job Definition Code.sas

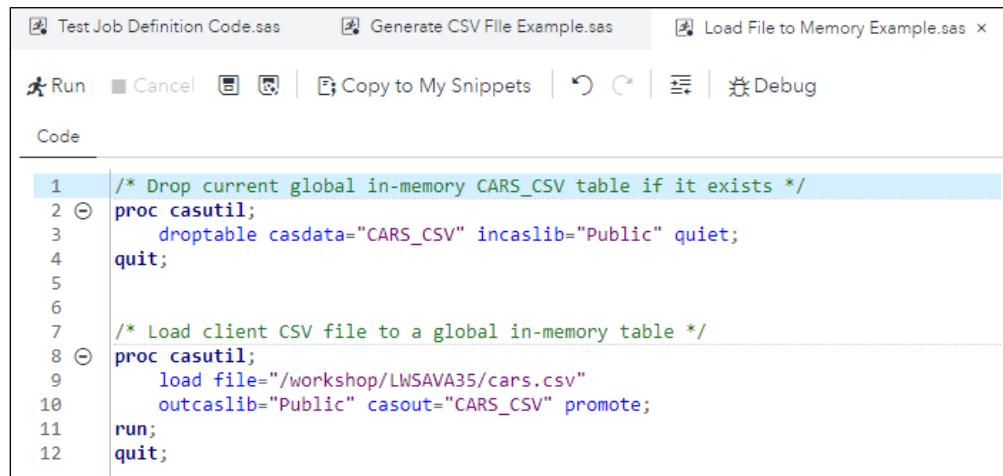
```



```

1 /*Write SASHelp.cars to CSV file in LWSAVA35 workshop folder. */
2 proc export data=sashelp.cars (where=(type='Sedan'))
3   outfile='/workshop/LWSAVA35/cars.csv'
4   dbms=csv
5   replace;
6 run;

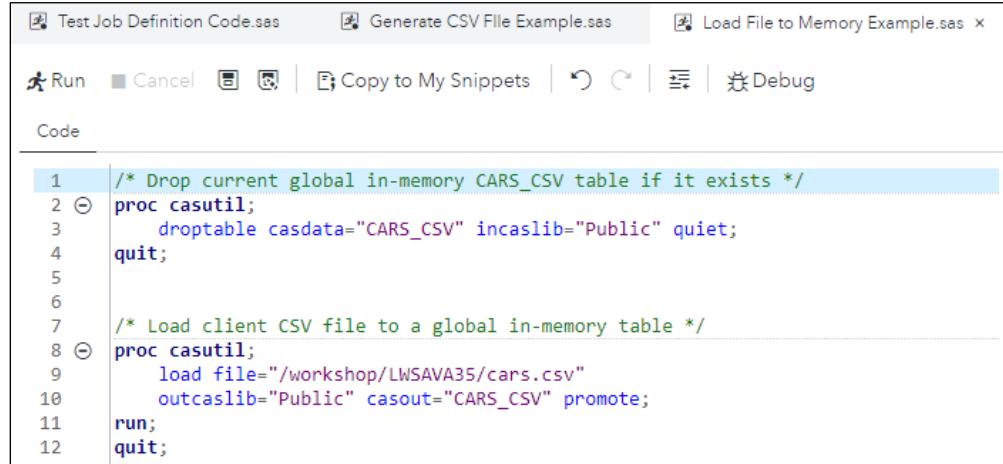
```



```

1 /* Drop current global in-memory CARS_CSV table if it exists */
2 proc casutil;
3   droptable casdata="CARS_CSV" incaslib="Public" quiet;
4 quit;
5
6
7 /* Load client CSV file to a global in-memory table */
8 proc casutil;
9   load file="/workshop/LWSAVA35/cars.csv"
10  outcaslib="Public" casout="CARS_CSV" promote;
11 run;
12 quit;

```



```

1 /* Drop current global in-memory CARS_CSV table if it exists */
2 proc casutil;
3   droptable casdata="CARS_CSV" incaslib="Public" quiet;
4 quit;
5
6
7 /* Load client CSV file to a global in-memory table */
8 proc casutil;
9   load file="/workshop/LWSAVA35/cars.csv"
10  outcaslib="Public" casout="CARS_CSV" promote;
11 run;
12 quit;

```

End of Practices

7.2 SAS Viya REST APIs

SAS Viya Administrator Tools

SAS Environment Manager



CLI (Command-Line Interfaces)

```
/opt/sas/viya/home/bin/sas-admin identities --output text  
list-members --group-id SASAdmins
```

9

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You can manage your environment with the visual interface SAS Environment Manager.

Or, because SAS Viya is built on REST architecture, SAS Viya contains administrative command-line interfaces (CLIs) to the SAS Viya REST services, where you enter commands on a command line and receive a response back from the system. You can use a CLI to interact directly with SAS Viya programmatically.

The sas-admin CLI acts as a wrapper. The individual plug-ins operate as interfaces to functionality from within sas-admin. In this example, you are using the identities interface to receive a list of members of the SAS Administrators group in text output.

SAS Viya Administrator Tools

SAS Environment Manager

CLI (Command-Line Interfaces)

```
/opt/sas/viya/home/bin/sas-admin identities --output text  
list-members --group-id SASAdmins
```

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In addition to the user-friendly CLI interface to make REST calls, you can access the capabilities of SAS Viya through REST APIs.

REST APIs

A RESTful API is an application program interface (API) that uses HTTP requests to GET, PUT, POST, and DELETE data.

Programming Languages: Perl, Python, R, Java, Lua, C, JavaScript, other

SAS Viya

CAS Server

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sas

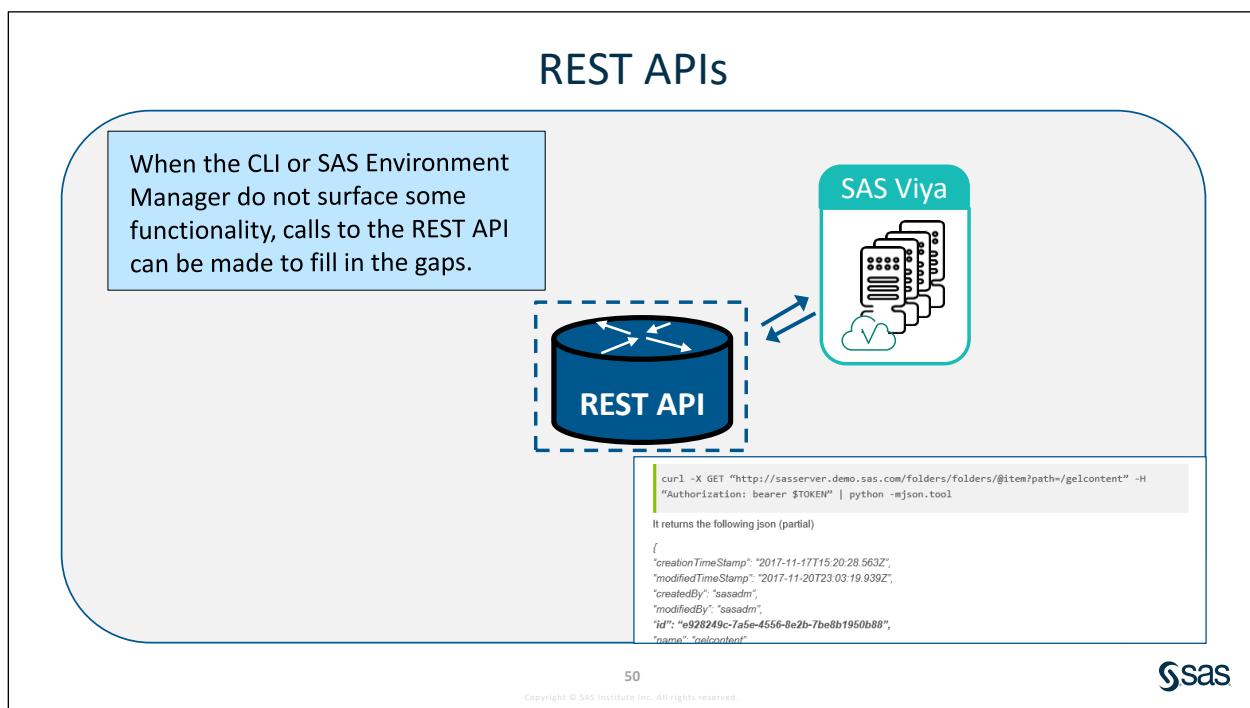
There are two sets of REST APIs:

- SAS Viya surfaces the full functionality available.
- CAS provides access to Cloud Analytics Services (CAS) server and the CAS grid. There are API operations for executing CAS actions, managing the CAS sessions, monitoring the system, and inspecting.

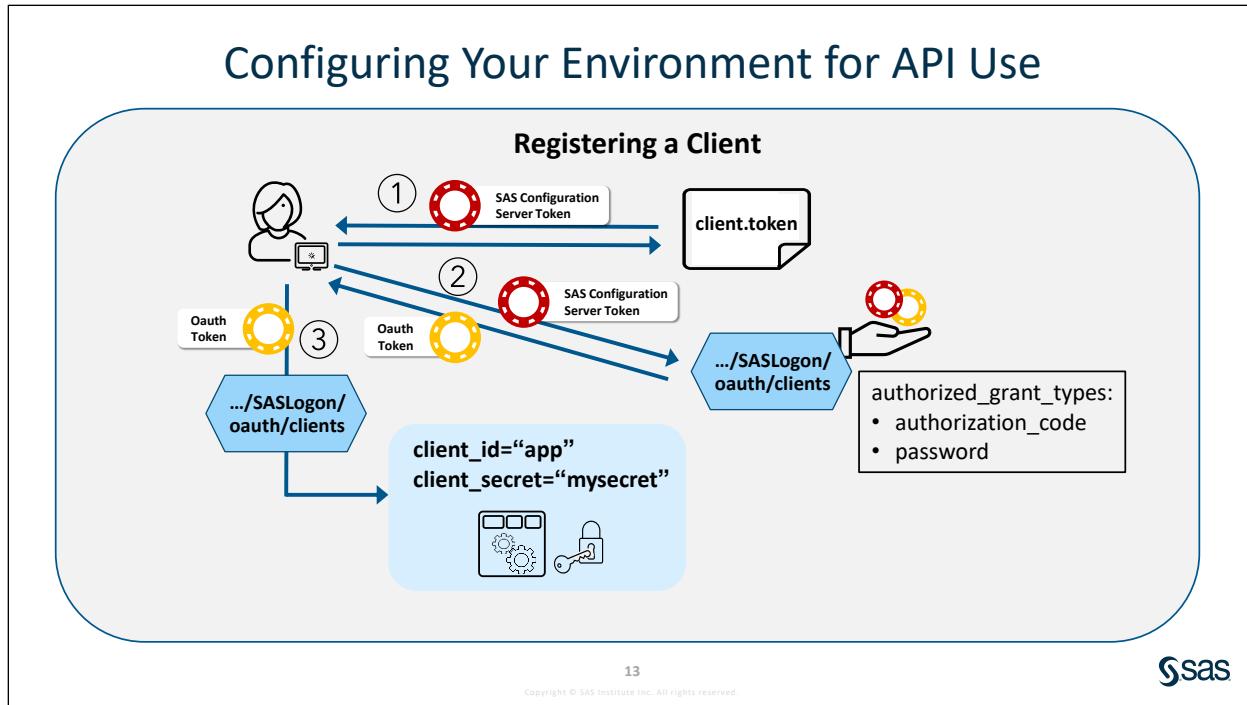
With SAS Viya REST APIs, you can create and access SAS resources using any client technology, making it easy to integrate the capabilities of SAS Viya into your business processes or to extend and customize SAS Viya to meet specific requirements.

A RESTful API -- also referred to as a RESTful web service -- is based on representational state transfer (REST) technology, an architectural style and approach to communications often used in web services development.

API (application programming interface) is a set of rules and mechanisms for programs/applications to talk to each other. It is a software architectural style consisting of a set of rules that leverages on web architecture. It uses HTTP methods like PUT, DELETE, POST, GET, and so on.



For SAS Viya Administrators, you can use calls to the REST API to perform tasks that the CLI or SAS Environment Manager cannot do. For example, you might want to run a more complex task from a single command. Or perhaps you just prefer Python code to interact with SAS Viya.

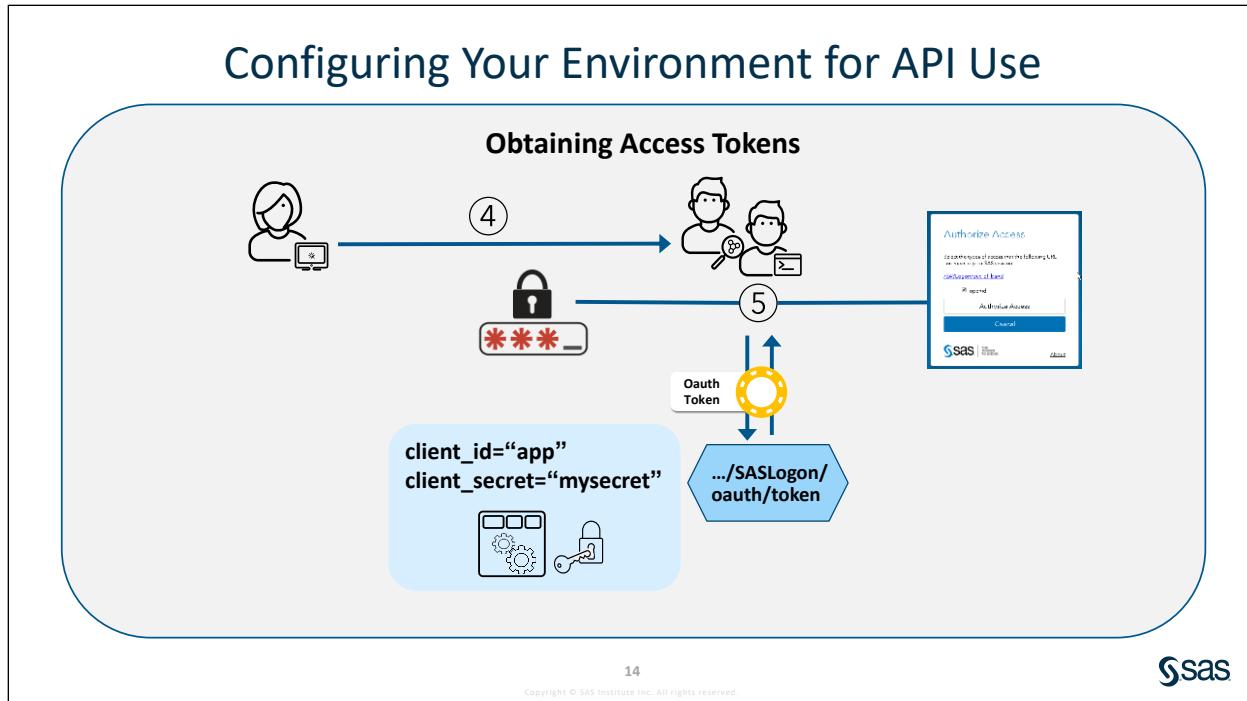


All applications and scripts that use the SAS Viya REST APIs must be registered with the SAS environment. In practice, this registration is handled by the SAS administrator properly configuring a client with the OAuth service in SAS Logon Manager.

To register a client:

1. Locate a valid SAS Configuration Server token. A SAS administrator can find a token in the **client.token** file at **/opt/sas/viya/config/etc/SASSecurityCertificateFramework/tokens/consul/default**.
2. Use the SAS Configuration Server token to request a valid OAuth access token to use on the registration call.
(The SAS Logon Manager has an endpoint that issues an OAuth access token to anyone who has a valid SAS Configuration Server token.)
3. Use the Access token to register the new client with a client ID and client secret. If the request is successful, the client is registered. A JSON response file is generated.

Note: You can register the client using an authorization code or using a password.

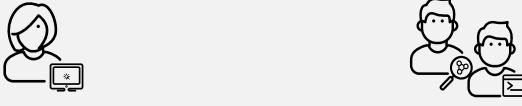


4. The SAS administrator provides the client identifier and client secret to developers to use as needed. If the client was registered with grant_type of authorization code, the administrator must also provide the URL to an end-user to generate the authorization code. If the client was registered with grant_type of password, the end-user will use his or her credentials when requesting an access token.
5. Registered clients can request an access token using the SAS Logon OAuth API. Access tokens are obtained when a client makes a request and authenticates to the /SASLogon/oauth/token endpoint and passes a form of authorization, either password or the authorization code that was generated from the Authorization Code display.

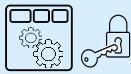
Note: An example is a developer who wants to access SAS Viya from their VB Script program to run code and pull data.

Configuring Your Environment for API Use

Making API Requests with Access Tokens



```
$ curl -k https://sasserver.demo.sas.com/folders/folders?filter=null(parent) -H "Authorization: Bearer $ACCESS_TOKEN"  
{"version":1,"links":[{"method":"GET","rel":"preferences","href":"/preferences/preferences/stpweb1","url":"/preferences/preferences"}]
```



client_id="app"
client_secret="mysecret"

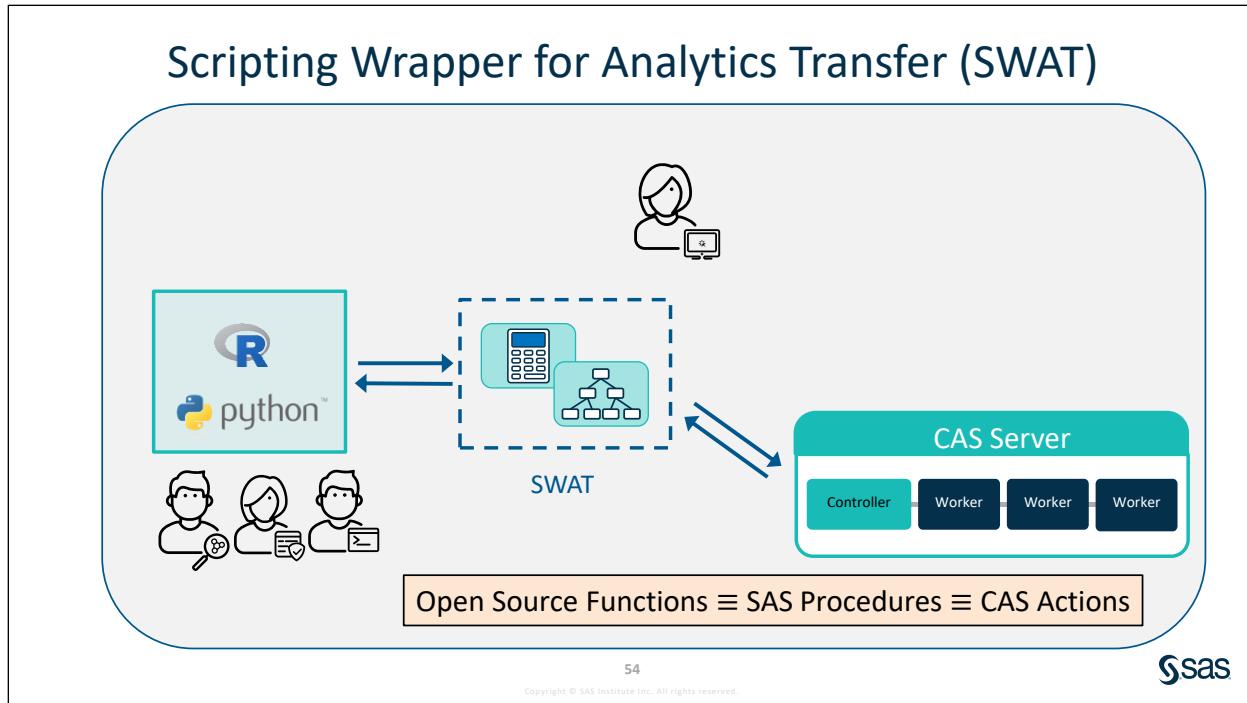
15
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When a client has a valid access token to use on behalf of a user, requests to SAS Viya REST APIs should use that token.

By default, a token is valid for 12 hours (or 43200 seconds). A refresh token is also generated when SAS Logon OAuth API returns an access token. A user can use the refresh token to get a new access token.

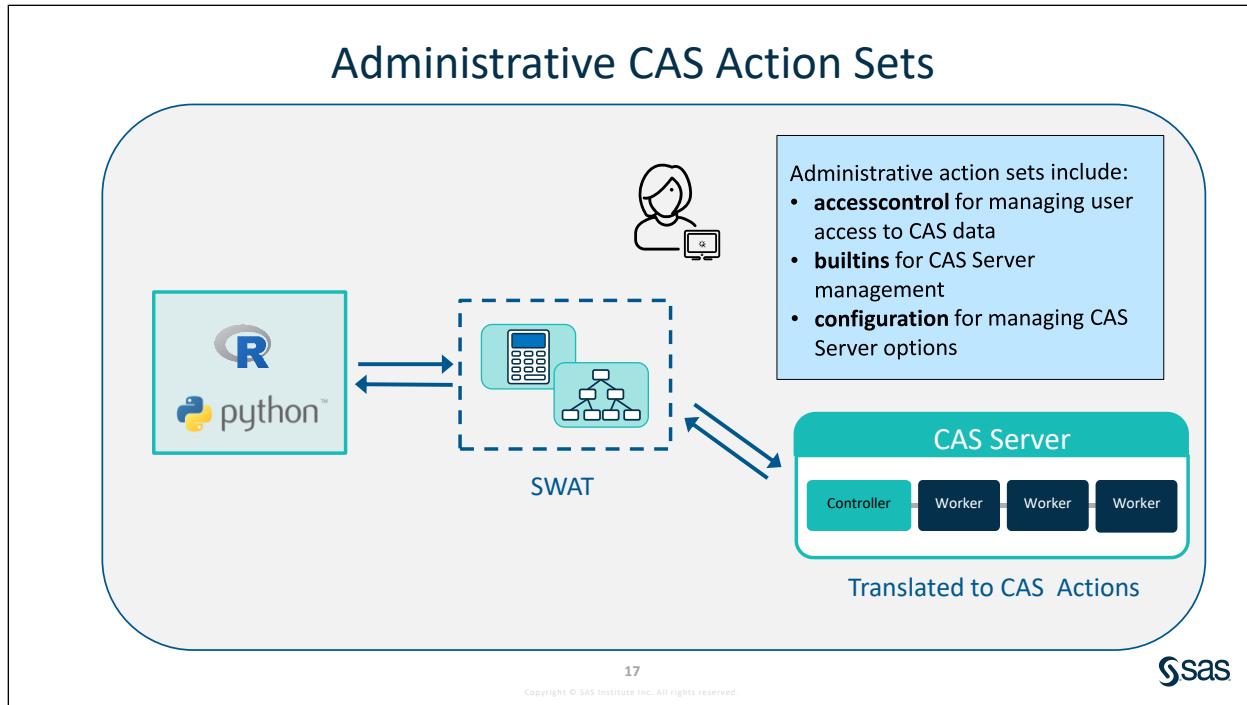
Note: The SAS Viya REST APIs rely on the OAuth2 features of SAS Logon Manager for all operations that require authentication.



You can write an R or Python program that connects to a CAS server, loads data into CAS, analyzes large in-memory data sets quickly and efficiently using CAS actions, and works with results of your analyses using familiar data preparation techniques in the open source language.

Regardless of the language in which the API call is issued, the underlying CAS action submitted to the CAS server is the same. For example, if you wanted to print the first ten observations of your CAS table, you would use the PRINT procedure in SAS, the head method in Python, and the head function in R.

The SWAT package provides functionality and syntax that have a look and feel of open source code but simply wrap up CAS actions.



If you would like to manage CAS data or the CAS Server through CAS language, there are administrative action sets.



Exploring SAS Developer Home

This demonstration explores the developer.sas.com website, which contains resources for integrating open source languages with the capabilities of SAS Analytics.

1. Navigate to **developer.sas.com** in a web browser.

2. Scroll down and click on **Open Source SAS** to show resources for integrating open source languages with SAS services.

3. Click **Python**. You can download the SAS Python Client Interface (Python SWAT) for SAS Viya, as well as access the documentation.

The screenshot shows the SAS Developer website with a blue header. The main content area has a large Python logo and the text "Integrate SAS with Python". Below this, there's a section titled "Getting started with SAS and Python integration" with a "Jump to a library" button. A text box explains that SAS integrates with Python through various code libraries and tools.

4. Click **Home**, and then click **SAS on GitHub** and click **github/sassoftware**.

The screenshot shows the SAS Software GitHub profile. It features the SAS logo, the text "SAS Software", and "Open Source from SAS Software". It includes location information ("Cary, North Carolina, USA"), a link to the website ("https://www.sas.com/"), an email address ("github@sas.com"), and a "Verified" badge.

5. Scroll down and click **pyviyatools**.

The screenshot shows the pyviyatools GitHub repository page. It displays the repository name, a brief description ("Python command-line tools that call the SAS Viya REST APIs - for SAS administrators."), and various metrics: Python, Apache-2.0, 6, 12, 10, 0, and "Updated 3 days ago".

6. The Python tools for SAS Viya are a set of command-line tools that call the SAS Viya REST APIs from Python. Right-click **INSTALL.md** and select **Open in New Tab**.

The screenshot shows a context menu for the "INSTALL.md" file in the GitHub repository. The menu options are "Open link in new tab", "Open link in new window", and "Open link in incognito window".

7. You will download these files in the practice and use the available Python scripts to access your SAS Viya environment.

The screenshot shows a GitHub repository page for the file `INSTALL.md` in the `pyviyatools` repository. The page includes a commit history, contributor information, file statistics, and a preview of the file's content. The content of the file discusses the `pyviyatools` package and provides installation instructions.

pyviyatools Install Instructions

The `pyviyatools` are a set of command-line tools that call the SAS Viya REST API's from python. The tools can be used to make direct calls to any rest-endpoint (like a CURL command) or to build additional tools that make multiple rest calls to provide more complex functionality.

INSTALL

The tools are a package of files and should be downloaded as such. The individual files are not useable without the package.

The tools should be installed on the same machine that hosts the Viya command-line interfaces(CLI). The following command will install a copy of the tools in a sub-directory(`pyviyatools`) of the current directory.

`git clone https://github.com/sassoftware/pyviyatools.git`

End of Demonstration



Practice

4. Using PYViyaTools

- In a web browser, enter the following URL: developer.sas.com
- Download the package to `/opt/sas` directory.

Using Christine's session in **mRemoteNG**, change the directory to `/opt/sas`.

```
cd /opt/sas
```

Issue the following command to install a copy of the tools in a subdirectory of `/opt/sas`:

```
sudo git clone https://github.com/sassoftware/pyviyatools
```

- Authenticate to SAS Viya.

The pyviya tools use the sas-admin auth CLI to authenticate to SAS Viya. To use the tool, you must have created a profile and generated a token for authentication. (The token will expire in 12 hours.) If you have not set up a profile and generated a token, issue the following script that includes the commands:

```
~/authLogin.sh
```

- Execute a test call.

- Change the directory to your install directory: `/opt/sas/pyviyatools`

```
cd /opt/sas/pyviyatools
```

- Run the following command to see options used on the `call_rest_api.py` script:

```
./call_rest_api.py -h
```

- Run the test command. (Returns JSON, but you might want to add `-t` for text output.)

```
./callrestapi.py -e /folders/folders -m get
```

- Test other Python scripts:

```
./callrestapi.py -e /identities/identities -m get
```

```
./callrestapi.py -e /identities/identities -m get > /workshop/identities.json
```

```
./callrestapi.py -e /identities/userCount -m get
```

```
./callrestapi.py -e /identities/cache/refreshes -m post
```

```
./getfolderid.py -f "/Orion Star"
```

```
./getconfigurationproperties.py -c sas.identities.providers.ldap.user -o simple
```

List of Additional Tools Available

Additional tools provide more complex functionality by combining multiple calls to the callrestapi function, and post-processing the output that is returned.

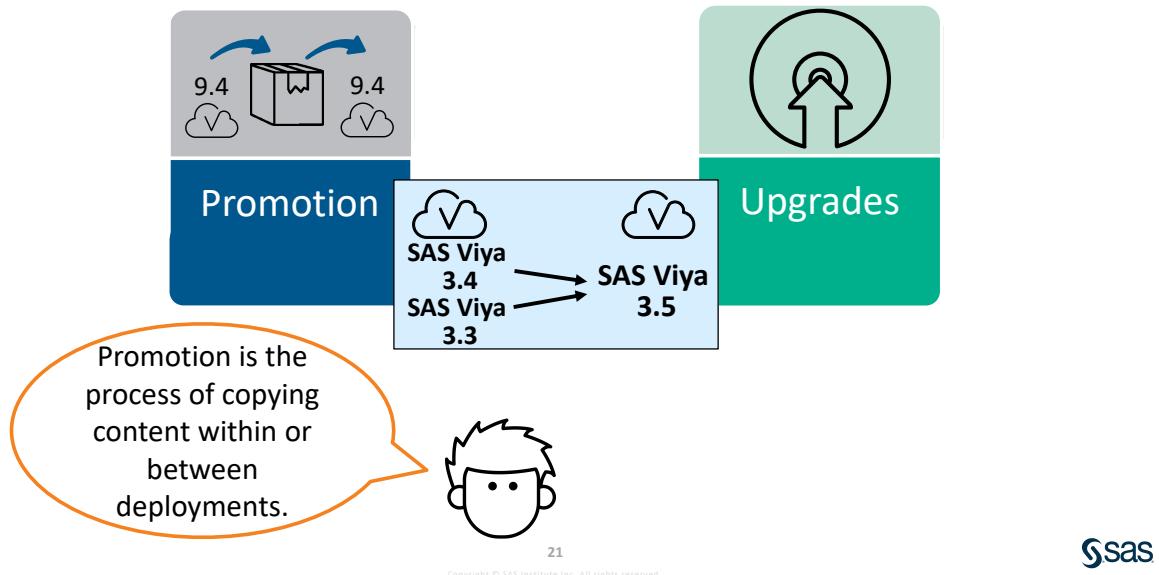
<i>getfolderid</i>	Returns the ID of the folder based on the full folder path.
<i>deletefolder</i>	Deletes a folder based on the full folder path.
<i>deletefolderandcontent</i>	Deletes a folder and any reports that are stored in the folder.
<i>movecontent</i>	Moves the content from a source to a target folder.
<i>getconfigurationproperties</i>	Lists the name/value pairs of a configuration.
<i>Testfolderaccess</i>	Tests if a user or group has access to a folder.
<i>createbinarybackup.py</i>	Creates a binary backup job.
<i>Createdomain.py</i>	Creates an authentication domain.
<i>Listrules.py</i>	Lists authorization rules subset on a principal and/or a uri.
<i>loginviaauthinfo.py</i>	Uses an authinfo file to authenticate to the CLI.
<i>updatepreferences.py</i>	Updates preferences for a user or group of users.
<i>updatedomain.py</i>	Loads a set of user IDs and passwords to a SAS Viya domain from a CSV file.
<i>createfolders.py</i>	Creates a set of SAS Viya folders from a CSV file.
<i>explainaccess.py</i>	Explains access for a folder, object, or service endpoint.

getpath.py	Returns path of folder, report, or other object in folder.
listmemberswithpath.py	Lists members of a folder, recursively if desired.
listcaslibs.py	Lists all CAS libraries on all servers.
listcastables.py	Lists all CAS tables in all CAS libraries on all servers.
listcaslibsandeffectiveaccess.py	Lists all effective access on all CAS libraries on all servers.
listcastablesandeffectiveaccess.py	Lists all effective access on all CAS tables in all CAS libraries on all servers.
listgroupsandmembers.py	Lists all groups and their members.

End of Practices

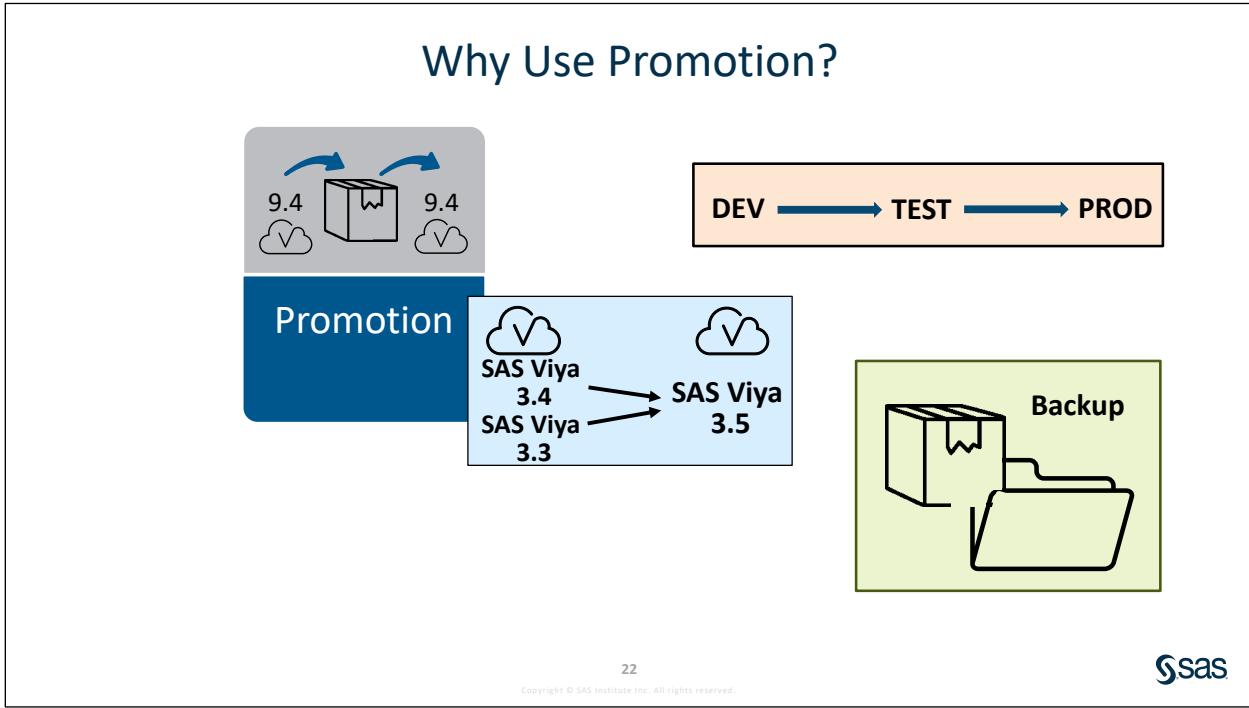
7.3 Promotion

Moving Content between SAS Viya Releases

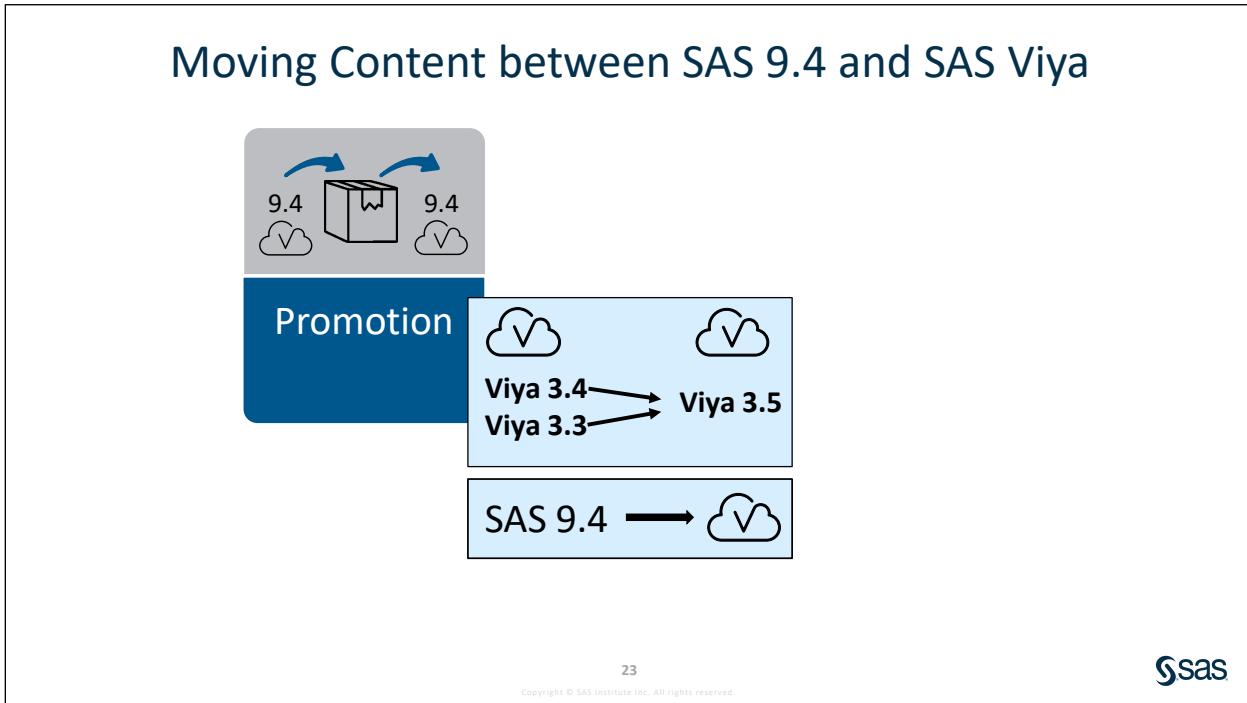


To transition from an earlier release to a newer release of SAS Viya and maintain the content that has been developed, you can use promotion tools or perform an upgrade.

Why Use Promotion?



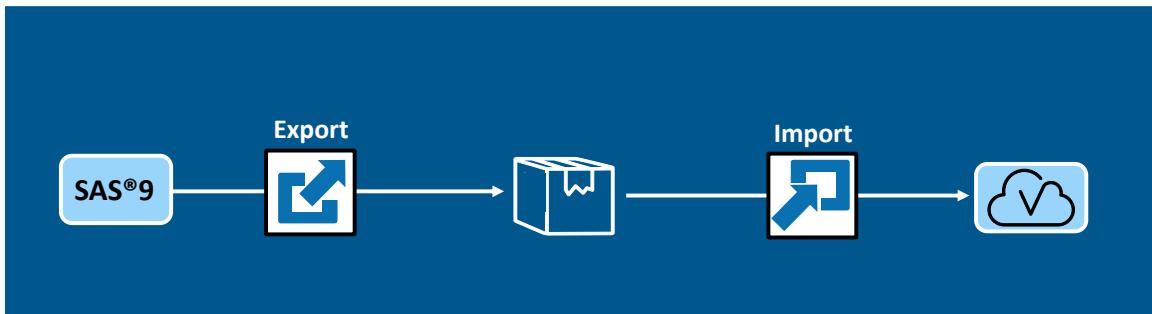
Promotion is also useful when moving from development to testing to production environments. And you can use promotion as a method of creating selective backups.



Promotion is the only option for moving content from SAS 9.4 to SAS Viya. When transitioning from 9.4 to SAS Viya, user content will not have to be re-created because you can promote much of the content from SAS 9.4.

Note: Promotion of reports and explorations from earlier releases of SAS Visual Analytics and SAS Visual Statistics can be attempted, but you might need to make post-promotion adjustments to content.

Promotion Tools: SAS®9 and SAS Viya



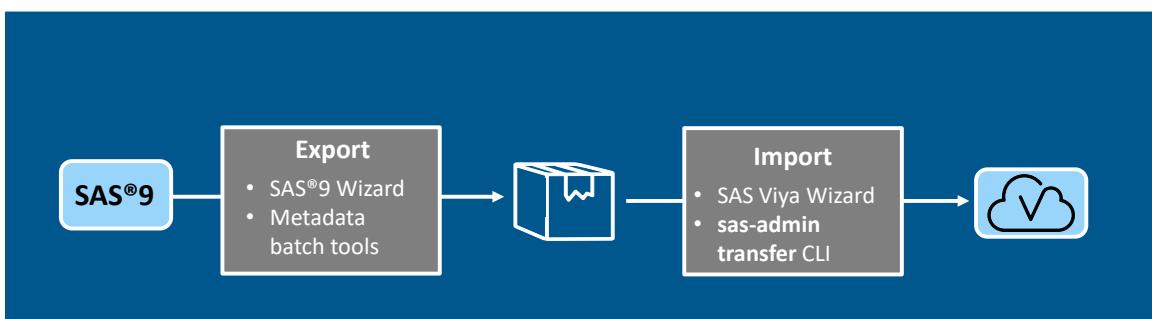
24

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The promotion process has two phases: export resources from the source environment and import resources to the target environment.

Promotion Tools: SAS®9 and SAS Viya



25

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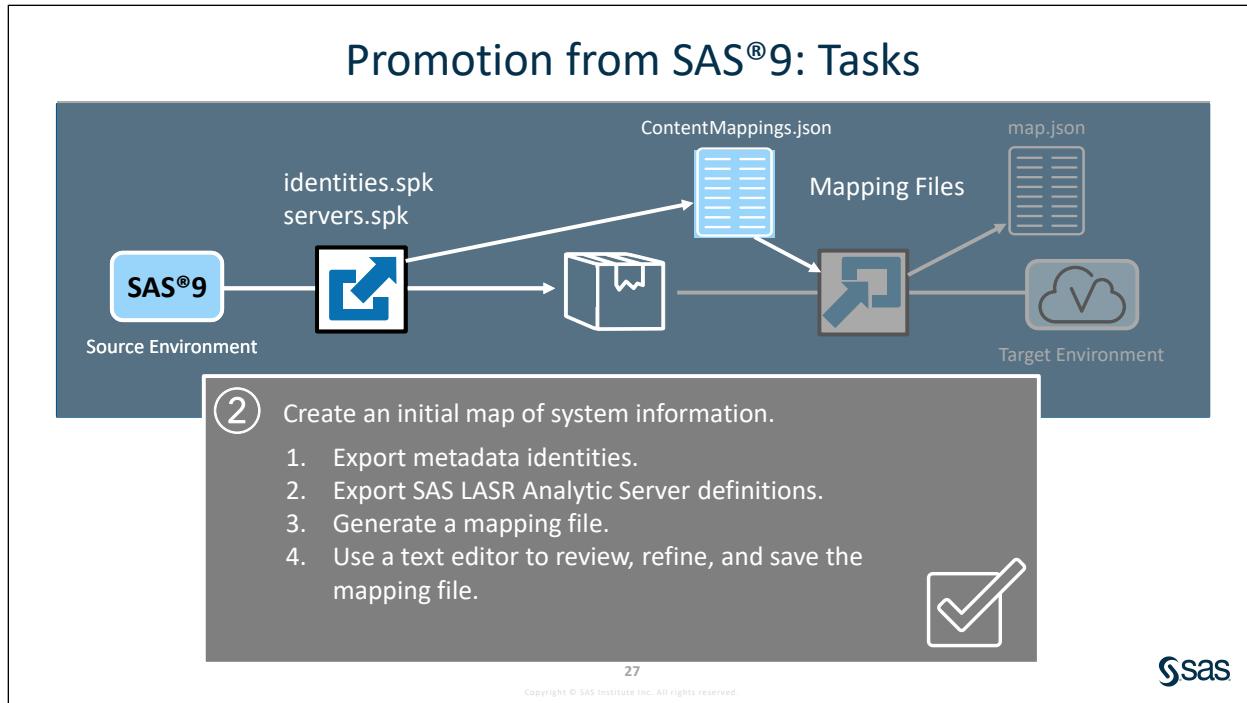
Both environments, SAS®9 and SAS Viya, offer graphical point and click interfaces, as well as batch tools to export and import packages.

What Can Be Promoted?

Environment	Release (SAS Visual Analytics and SAS Visual Statistics)	Participating Resources
SAS 9.4	7x	<p>Content: folders, reports, explorations</p> <p>Supporting resources: graph templates, images</p> <p>Data definitions: LASR and Base libraries and tables</p> <p>User groups: most metadata-only groups</p> <p>Authorizations: most explicit access control entries for promoted objects</p>
SAS Viya	8.x	<p>Content: folders, reports, data plans, statistical models, jobs (SAS Viya 3.3 and later)</p> <p>Supporting resources: graph templates, images, files, comments</p> <p>Data definitions: all types of caslibs and tables</p> <p>CAS authorization: all direct access controls for promoted objects</p> <p>General authorization: all direct rules for promoted objects</p>

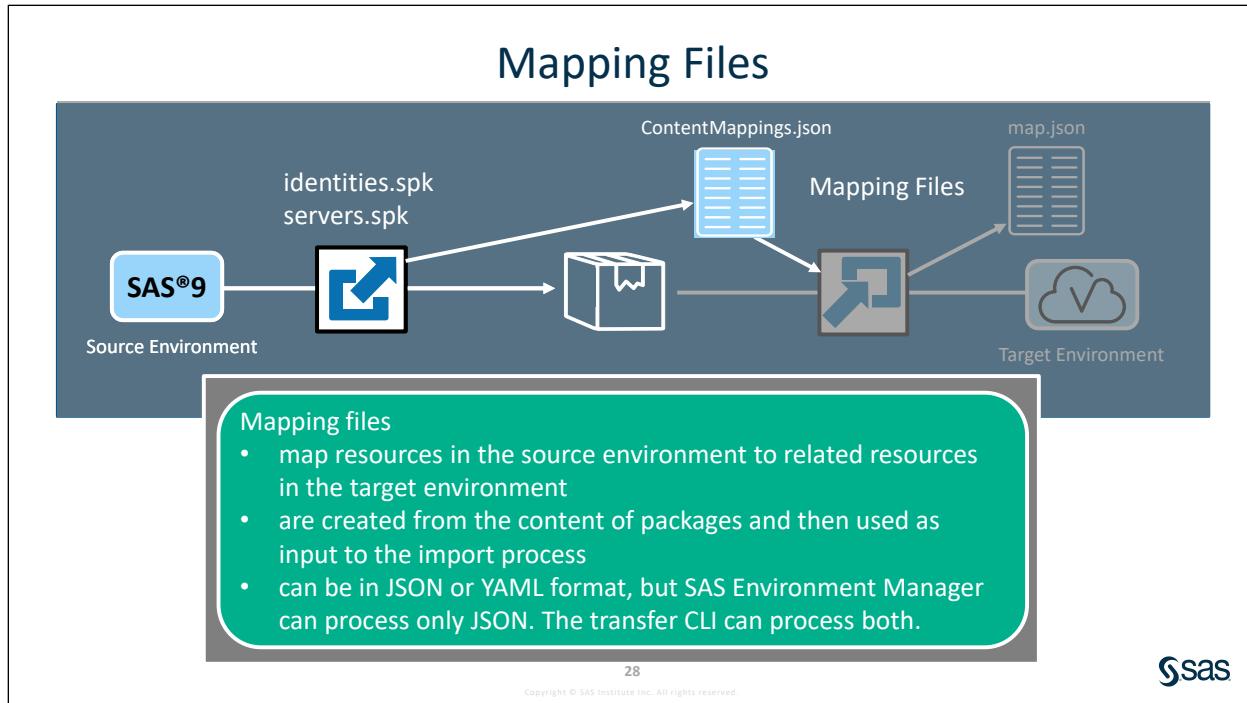


Before creating export packages, you need to examine your current SAS 9.4 environment.



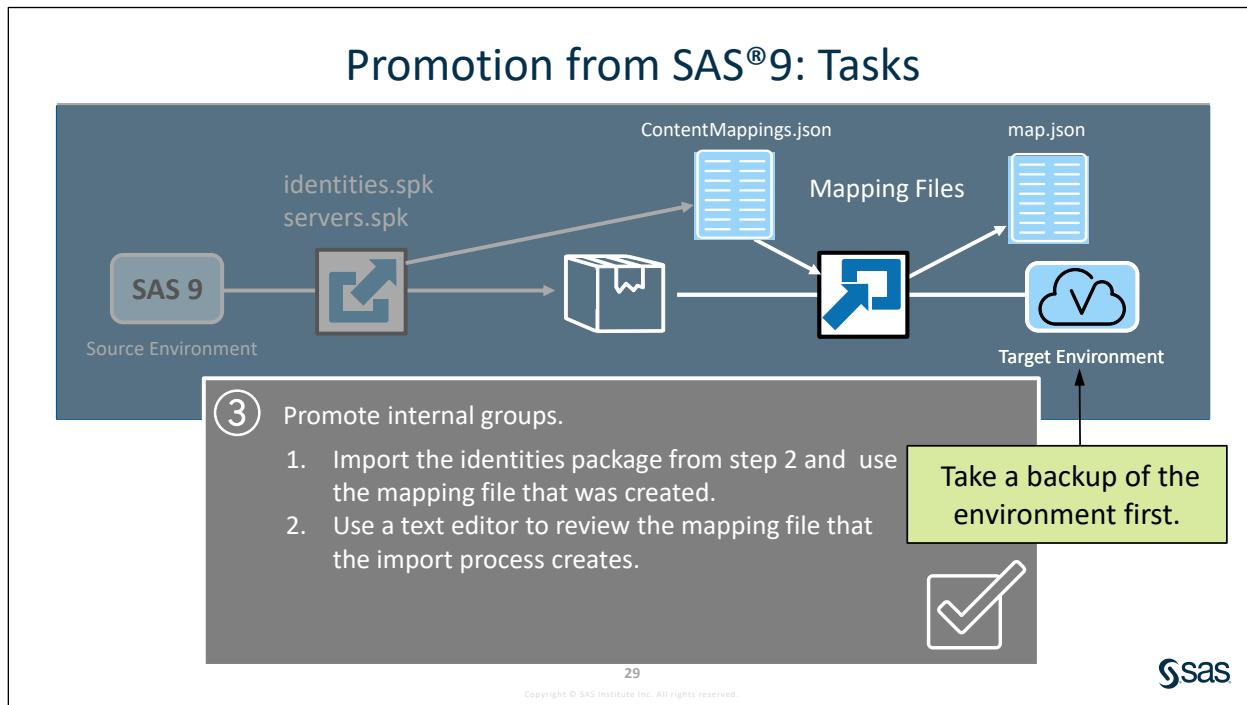
Secondly, you create a mapping file from your identities package. Your identities package should include only groups that you want in SAS Viya. For example, you do not want to include SAS Environment Manager groups. And you would exclude roles and Access control templates. Note that SAS Viya does not have internal users. Each user must exist in LDAP. (Any users who do not have an external identity value in the SAS®9 metadata are assumed to be internal (metadata-only users). Most SAS®9 internal (metadata-only) groups are converted to SAS Viya custom groups. In most cases, membership information is preserved for members that exist in LDAP. The SAS General Servers and SAS System Services groups are discarded.

You would export SAS LASR Analytic Server definitions if you want SAS Viya to access data through a SAS LASR Analytic Server. Note that you are not going to import the servers.spk package. Some server properties are added to the mapping file and can be used when you import LASR libraries, converting them to LASR caslibs.



Note: Mapping files are cumulative. Within a series of imports, each successive mapping file supplements and refines a previous mapping file. For that reason, you should use the same format (JSON or YAML) for all of your mapping files.

These tasks are organized by object type. For some usage patterns, a different workflow might be more efficient. For example, you might prefer to perform all exports first and then perform all imports. In any workflow, make sure that you import resources in the specified order.



Promotion from SAS®9: Tasks

SAS®9 Source Environment → **libraries.spk**, **tables.spk** → **ContentMappings.json** → **Mapping Files** (map.json) → **SAS Viya** Target Environment

④ Promote data definitions for LASR and base libraries and tables.

1. Export library definitions.
2. Export table definitions.
3. Import the packages.

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sas

Promotion from SAS®9: Tasks

SAS®9 Source Environment → **content.spk**, **content2.spk** → **ContentMappings.json** → **Mapping Files** (map.json) → **SAS Viya** Target Environment

⑤ Promote content.

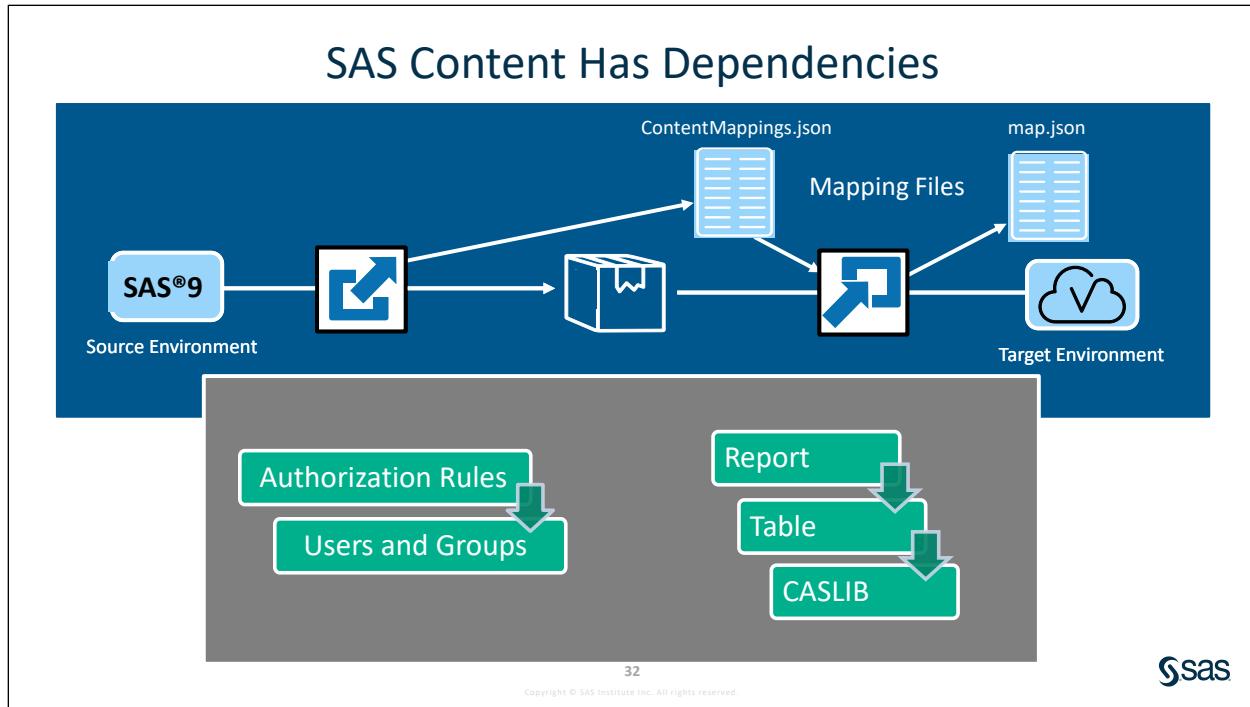
1. Export reports and explorations and supporting resources.
2. Import the packages into SAS Viya.

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sas

The reports are exported from the root of the content tree in SAS 9.4. This ensures that any authorizations on the folders will be promoted to SAS Viya. If you export lower down the tree, you will get the folders, but not the authorizations.

Note: The SAS Viya Administration documentation might not have all the information you need. You might have to go to individual product documentation.



- Reports depend on tables that depend on caslibs.
- Authorization rules depend on users and groups.





Practice

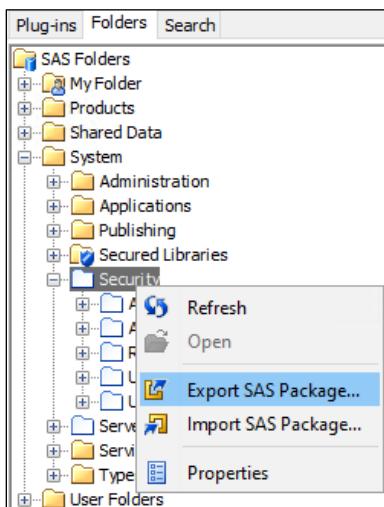
5. Promoting SAS 9.4 Groups into SAS Viya

In a SAS 9.4 environment, the Import/Export SAS Package Wizard in SAS Management Console enables content to be moved between deployments and releases. In this practice, you export Groups from a 9.4 environment and import them into SAS Viya.

- From the Start menu, launch SAS Management Console.

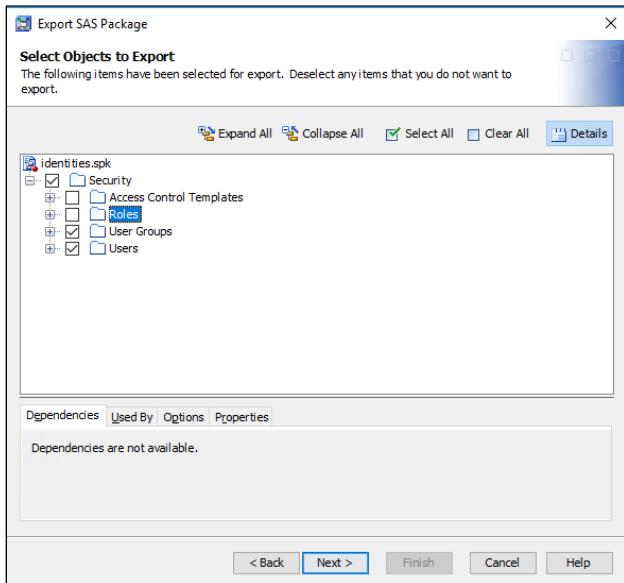


- Log in with the username **sasadm@saspw** and password of **Student1** if not automatically signed in.
- In SAS Management Console, navigate to the **Folders** and expand the **System** folder.
- Right-click **Security** and select **Export SAS Package**.

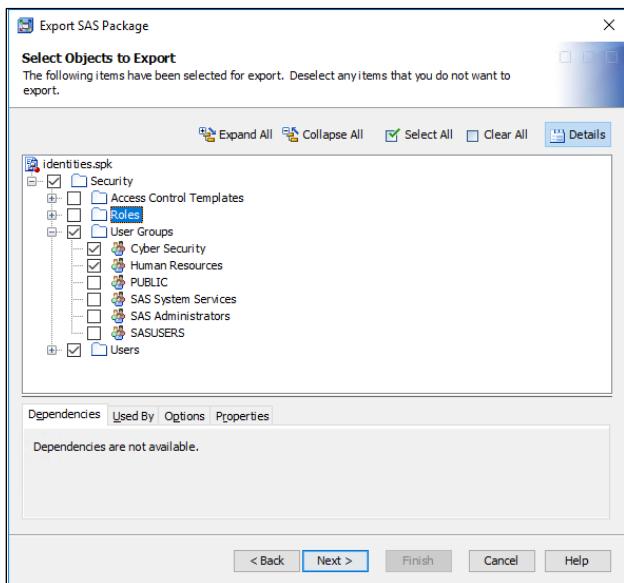


- Set the export package path to **D:\identities.spk**.
- Click **Next**.

- g. On the Select Objects to Export screen, deselect **Access Control Templates** and **Roles**.



- h. Expand **User Groups** and select which groups you would like to bring over to SAS Viya. Select **Cyber Security** and **Human Resources**.

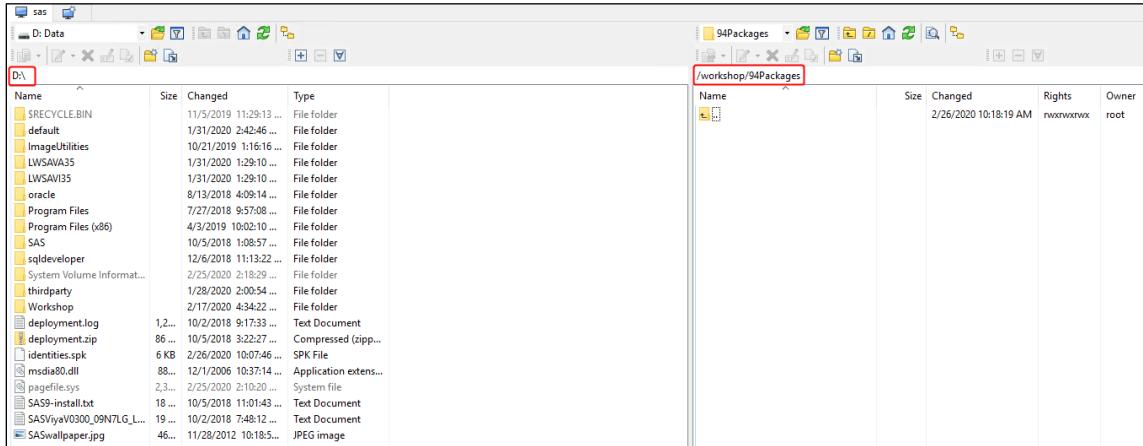


- i. Expand **Users** and select the users that you would like to promote to SAS Viya. Select **Bruno** and **Lynn**.

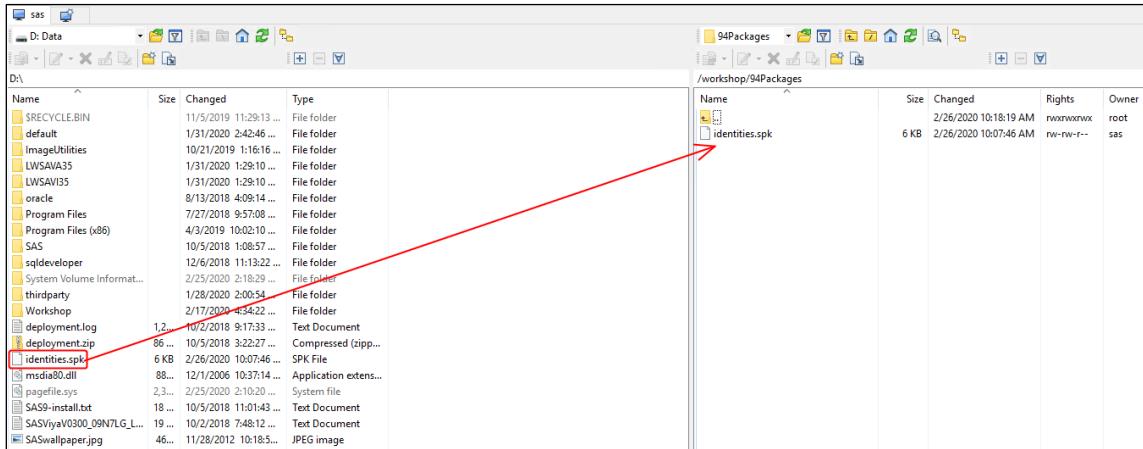


- j. Click **Next** twice.
k. Then click **Finish** on the Export Complete page.

- I. In WinSCP, connect as **sas**.
- m. On the left side, navigate to **D:**, and on the right side, navigate to **/workshop/94Packages**.



- n. Move **identities.spk** from **D:** over to **/workshop/94Packages**.



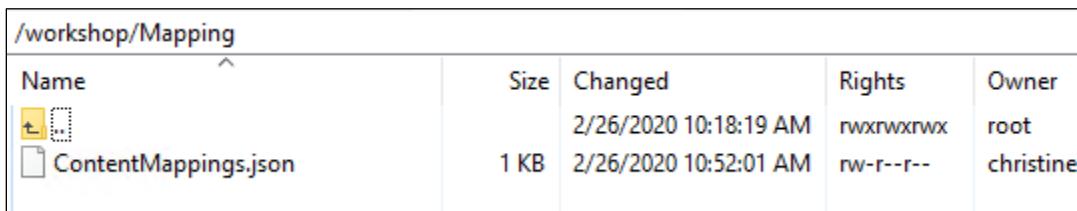
- o. Connect as **christine** in mRemoteNG and navigate to **/opt/sas/viya/home/bin**.

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

- p. Run the following command:

```
./sas-admin transfer generate-content-mapping --mapping
/workshop/Mapping --user-package
/workshop/94Packages/identities.spk --group-package
/workshop/94Packages/identities.spk
```

- q. In WinSCP, navigate to **/workshop/Mapping**. In the Mapping directory, you will see a **ContentMappings.json** file. You might need to refresh to see the file.



r. Copy the **ContentMappings.json** file over to D:\.

Name	Size	Changed	Type	Name	Size	Changed	Rights	Owner
\$RECYCLE.BIN		11/5/2019 11:29:13 ...	File folder	..				
ImageUtilities		1/31/2020 2:42:45 ...	File folder					
LWSAVA35		10/21/2019 1:16:16 ...	File folder					
LWSAVID5		1/31/2020 1:29:10 ...	File folder					
oracle		8/13/2018 4:09:14 ...	File folder					
Program Files		7/27/2018 9:57:08 ...	File folder					
Program Files (x86)		4/3/2018 10:02:10 ...	File folder					
SAS		10/5/2018 1:08:57 ...	File folder					
sqldeveloper		12/6/2018 11:13:22 ...	File folder					
System Volume Informat...		2/25/2020 2:10:29 ...	File folder					
thirdparty		1/28/2020 2:08:54 ...	File folder					
Workshop		2/17/2020 4:34:22 ...	File folder					
ContentMappings.json	1 KB	2/26/2020 10:52:01 ...	JSON File					
deployment.log	1,2...	10/2/2018 9:17:33 ...	Text Document					

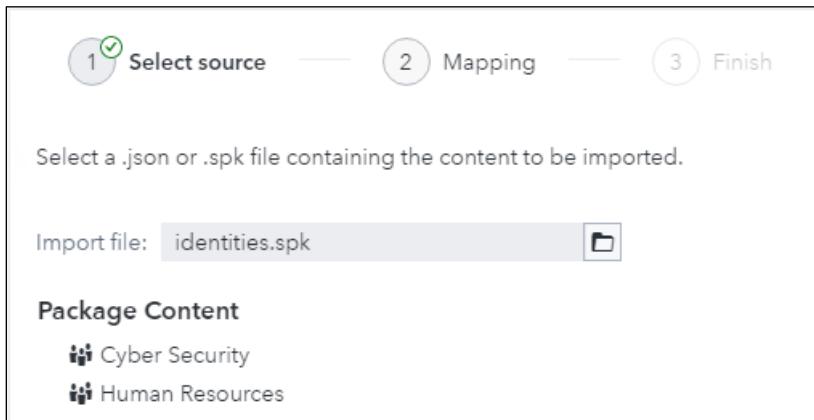
s. Open a web browser (Chrome or Firefox), and on the bookmark bar, select **SAS Environment Manager**.

t. Sign in as **christine** with password **Student1** and opt in to all assumable groups.

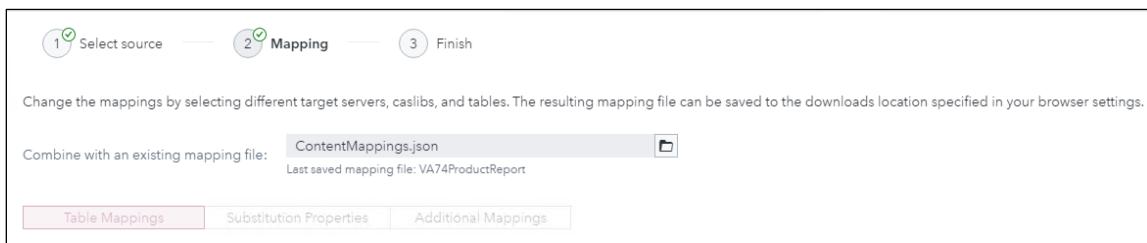
u. In Environment Manager, select **Content**.

v. In Content, select **Import**.

- w. On the Select source page, select the Import file by clicking the **folder** icon  and selecting **identities.spk**.



- x. Click the numeral **2** in the circle to go to Mapping. 
- y. In the **Combine with an existing mapping file** field, select the **Folder** icon  and select **ContentMapping.json**



- z. Click the numeral **3** to go to the Finish page. 
- aa. On the Finish page, select **Import**.



A successful import will generate the below:

Import Import Finish - Step 3 of 3						
Select the Import button to apply the mappings and import your source content.						
Mapping file: ContentMappings.json						
Total tasks: 2	Succeeded: 2	Failed: 0	Completed with errors: 0	Completed with warnings: 0	Skipped: 0	
Reminders Results						
Name	Status	Message	Path	Start Time	Completed Time	
Cyber Security		The resource was successfully promoted.	/identities/groups/Cyber Security	February 26, 2020 11:54:19 AM	February 26, 2020 11:54:20 AM	
Human Resources		The resource was successfully promoted.	/identities/groups/Human Resources	February 26, 2020 11:54:19 AM	February 26, 2020 11:54:20 AM	

- bb. Click **Close**.

- cc.** Navigate to **Users** ⇒ **Custom groups**. Verify that both Cyber Security and Human Resources were imported.
- dd.** If both groups were successfully imported, select **Cyber Security**. Verify that **Bruno** was placed as a member of the Cyber Security group.

The screenshot shows the SAS Viya interface with the following details:

- View:** Custom groups
- Filter:** (empty)
- Custom groups list:**
 - Application Administrators
 - Cyber Security** (selected)
 - Data Builders
 - Esri Users
 - Human Resources
 - Planning Administrators
 - Planning Users
 - SAS Administrators
 - SAS Score Users
- Cyber Security Group Details:**
 - Name:** Cyber Security
 - ID:** (empty)
 - Description:** Cyber Security
 - Icon:** User icon
 - Members:** (1) Bruno
 - Member Of:** (0)
 - Advanced:** (link)

End of Practices

7.4 Solutions

Solutions to Practices

1. Set File Navigation Options for SAS Studio (Enterprise)

In this practice, you use SAS Environment Manager to configure the file system path for users of SAS Studio (Enterprise).

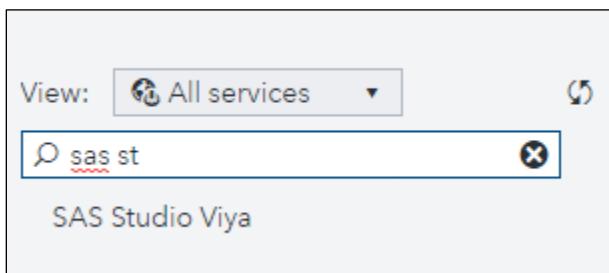
- Open **SAS Environment Manager**.
- As the **christine** user, opt in to your assumable groups.



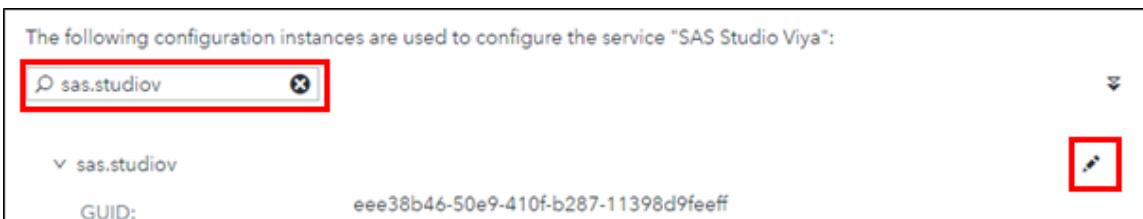
- Use the Configuration area in SAS Environment Manager to increase initial heap size and maximum heap size options. Click the **Configuration** area.



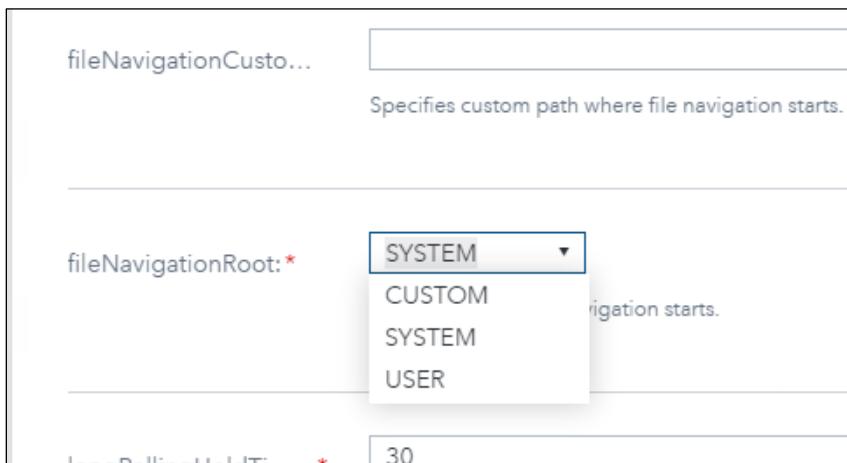
- Navigate to the **All services** view and select **SAS Studio Viya**.



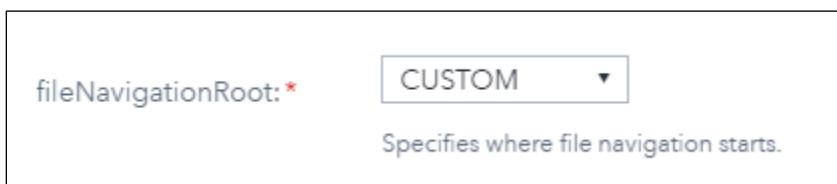
- In the content pane, filter on **sas.studiov**, and click the **Edit** button .



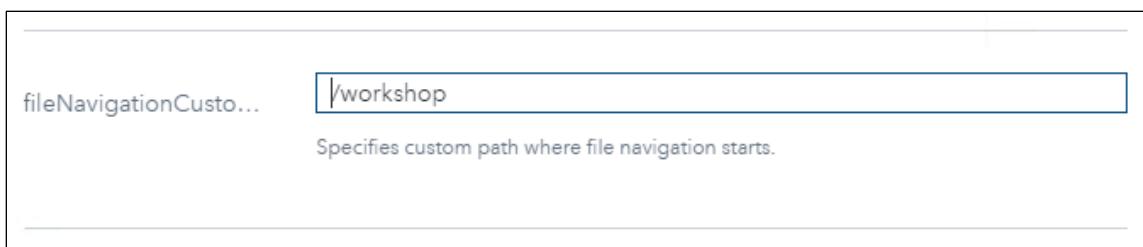
- f. Here you can view and set configuration for SAS Studio (Enterprise). Scroll down to the **fileNavigationRoot** property and notice the current value is set to **SYSTEM**. The other possible options include CUSTOM or USER.



- g. Set the **fileNavigationRoot** drop-down menu to **CUSTOM**.



- h. Set the property **fileNavigationCustomRootPath** to the value **/workshop**.



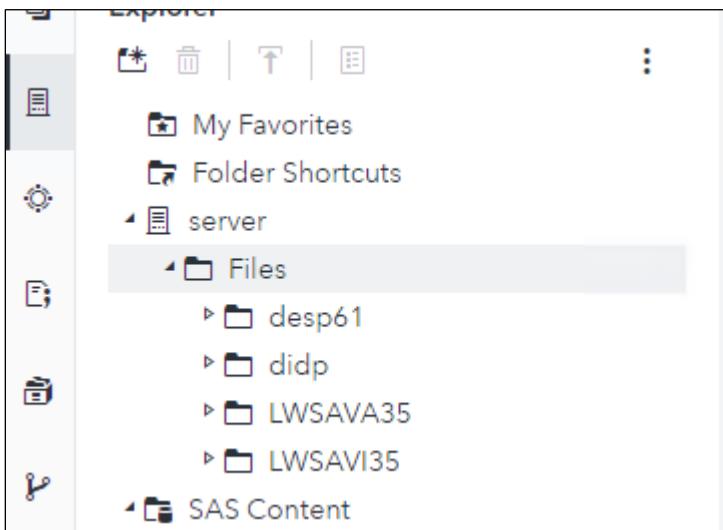
- i. Click **Save**.

- j. Restart SAS Studio service to pick up the change in mRemoteNG.

```
sudo systemctl restart sas-viya-sasstudio-default
```

```
[christine@server workshop]$ sudo systemctl restart sas-viya-sasstudio-default
```

- k. Verify the changes by launching SAS Studio (Enterprise) and expanding **Explorer** ⇒ **Server** ⇒ **Files** to see the LWSAVI35 and LWSAVA35 directories inside the /workshop directory.



2. Set File Navigation Options for SAS Studio (Basic)

In this practice, you edit **init_usermods.properties** to change the file system access in SAS Studio (Basic).

Use MRemoteNG or WinSCP to modify **init_usermods.properties**.

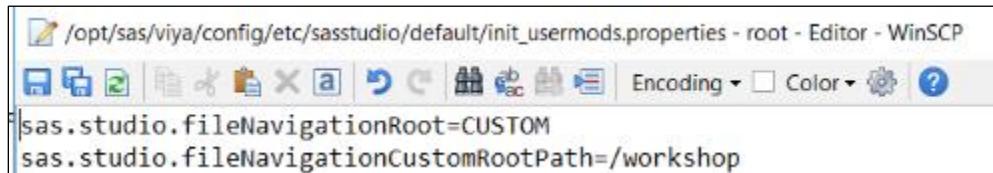
- a. Navigate to **/opt/sas/viya/config/etc/sasstudio/default**.

```
cd /opt/sas/viya/config/etc/sasstudio/default
```

- b. Open the file for editing. The current parameters set the file navigation path to the /workshop directory for this class.

Note: If you are using Christine's session in MRemoteNg, you will need sudo privileges to modify the file.

```
sudo gedit init_usermods.properties
```



- c. Modify the fileNavigationRoot property to point to the server root directory.

```
sas.studio.fileNavigationRoot=SYSTEM
```

- d. Delete the **sas.studio.fileNavigationCustomRootPath=/workshop** property.

- e. Save and close the file.

Note: Values that you specify in the **init_usermods.properties** file have precedence over corresponding values in other files. Values in the **init_usermods.properties** survive software upgrades.

- f. Restart SAS Studio service to pick up the change.

```
sudo systemctl restart sas-viya-sasstudio-default
```

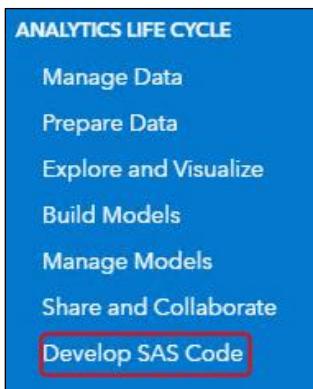
- g. Sign on to **SAS Studio (Basic)** to confirm the modified file navigation path. (Use the shortcut on the bookmark bar.)

Note: The **sas.studio.fileNavigationRoot** property is set to USER by default. This maps the file navigation path to each users' \$HOME directory.

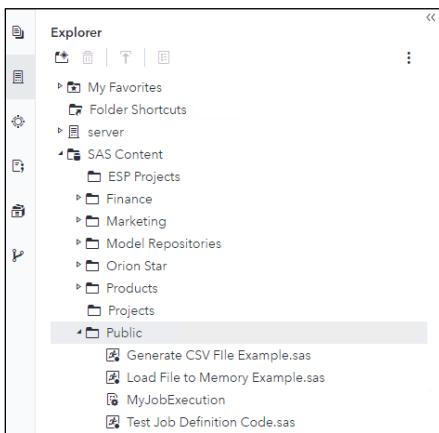
3. (Optional) Scheduling Programs in SAS Studio (Enterprise)

- a. Run the **Test Job Definition Code.sas** program in SAS Studio to test first before scheduling. The Job Execution service does not provide as detailed information about errors, and some errors do not register as an error (for example, incorrect *filepath* or *filename*).

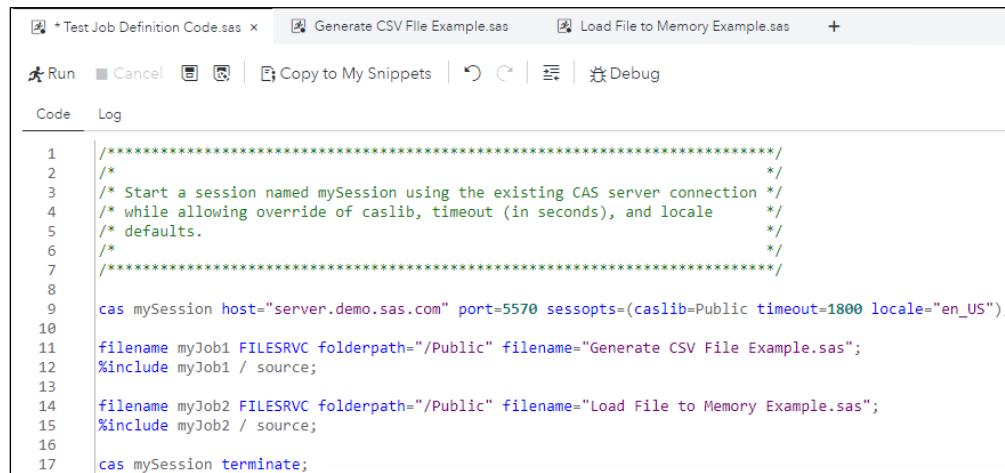
- 1) From the side menu in SAS Environment Manager, select **Develop SAS Code**.



- 2) In the navigation pane, click **Explorer** ⇨ expand **SAS Content** ⇨ expand **Public**.



- 3) Right-click **Test Job definition Code.sas** and select **Open**. (Or double-click the program to open the code in the Program Editor.)



```

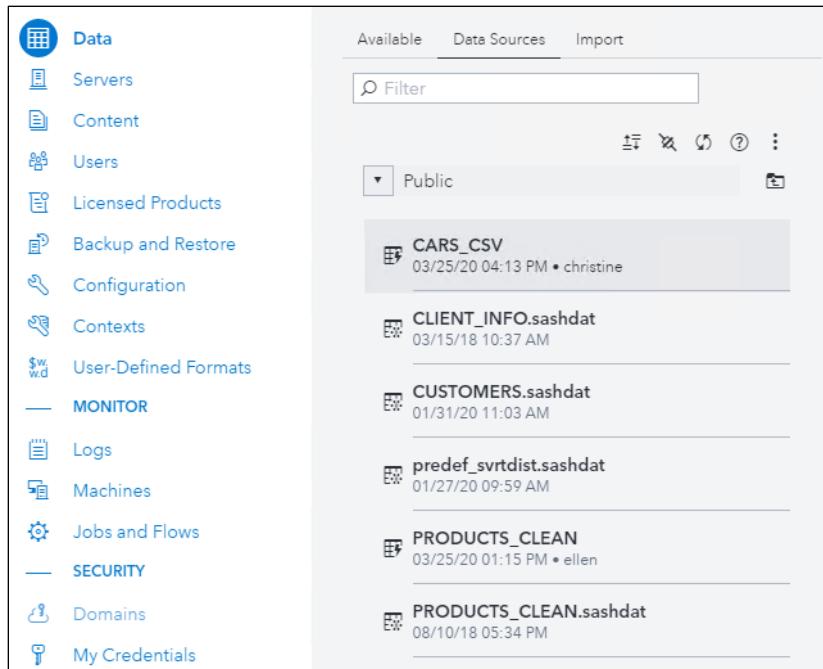
1  ****
2  /*
3  /* Start a session named mySession using the existing CAS server connection */
4  /* while allowing override of caslib, timeout (in seconds), and locale */
5  /* defaults. */
6  /*
7  ****
8
9  cas mySession host="server.demo.sas.com" port=5570 sessopts=(caslib=Public timeout=1800 locale="en_US");
10
11 filename myJob1 FILESRVC folderpath="/Public" filename="Generate CSV File Example.sas";
12 %include myJob1 / source;
13
14 filename myJob2 FILESRVC folderpath="/Public" filename="Load File to Memory Example.sas";
15 %include myJob2 / source;
16
17 cas mySession terminate;

```

- 4) Submit the program (press the F3 key). This program connects to the CAS server session and includes two programs to be submitted, **myJob1** and **myJob2**. Examine the log to verify that the program ran successfully.
- b. Confirm that the **CARS_CSV** table was loaded to the **Public** caslib.

From the side menu, select **Manage Environment** for SAS Environment Manager ⇒ select the **Data** area ⇒ click the **Data Sources** tab ⇒ expand **cas-shared-default** ⇒ expand **Public**.

Note: **CARS_CSV** should have a lightning bolt icon to show that it is loaded in-memory.



Available	Data Sources	Import												
	<input type="text" value="Filter"/> ✖️ ✖️ ✖️ ? ⋮													
	Public													
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;"> CARS_CSV</td> <td style="padding: 5px;">03/25/20 04:13 PM • christine</td> </tr> <tr> <td style="padding: 5px;"> CLIENT_INFO.sashdat</td> <td style="padding: 5px;">03/15/18 10:37 AM</td> </tr> <tr> <td style="padding: 5px;"> CUSTOMERS.sashdat</td> <td style="padding: 5px;">01/31/20 11:03 AM</td> </tr> <tr> <td style="padding: 5px;"> predef_svrdist.sashdat</td> <td style="padding: 5px;">01/27/20 09:59 AM</td> </tr> <tr> <td style="padding: 5px;"> PRODUCTS_CLEAN</td> <td style="padding: 5px;">03/25/20 01:15 PM • ellen</td> </tr> <tr> <td style="padding: 5px;"> PRODUCTS_CLEAN.sashdat</td> <td style="padding: 5px;">08/10/18 05:34 PM</td> </tr> </table>	CARS_CSV	03/25/20 04:13 PM • christine	CLIENT_INFO.sashdat	03/15/18 10:37 AM	CUSTOMERS.sashdat	01/31/20 11:03 AM	predef_svrdist.sashdat	01/27/20 09:59 AM	PRODUCTS_CLEAN	03/25/20 01:15 PM • ellen	PRODUCTS_CLEAN.sashdat	08/10/18 05:34 PM	
CARS_CSV	03/25/20 04:13 PM • christine													
CLIENT_INFO.sashdat	03/15/18 10:37 AM													
CUSTOMERS.sashdat	01/31/20 11:03 AM													
predef_svrdist.sashdat	01/27/20 09:59 AM													
PRODUCTS_CLEAN	03/25/20 01:15 PM • ellen													
PRODUCTS_CLEAN.sashdat	08/10/18 05:34 PM													

- c. Go back to SAS Studio and copy the **Test Job Definition Code** from this code editor, so that you can paste it in a SAS Job Execution file.

```

1  /*
2   * Start a session named mySession using the existing CAS server connection
3   * while allowing override of caslib, timeout (in seconds), and locale
4   * defaults.
5   */
6
7 ****
8
9 cas mySession host="server.demo.sas.com" port=5570 sessopts=(caslib="caslib")
10 filename myJob1 FILESRVC folderpath="/Public" filename="General";
11 %include myJob1 / source;
12
13 filename myJob2 FILESRVC folderpath="/Public" filename="Load F";
14 %include myJob2 / source;
15
16 cas mySession terminate;
17

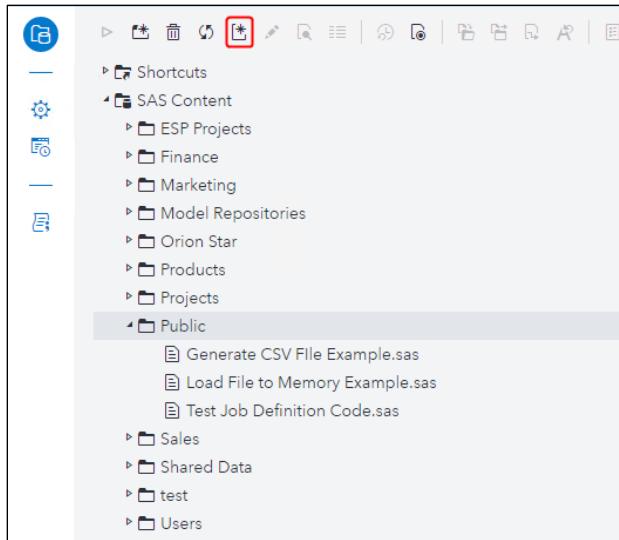
```

- d. Create and submit SAS Job Execution code.

- 1) Enter **http://server/SASJobExecution/** in the web browser.

<http://server/SASJobExecution/>

- 2) Expand the **Public** folder and click **New File**.



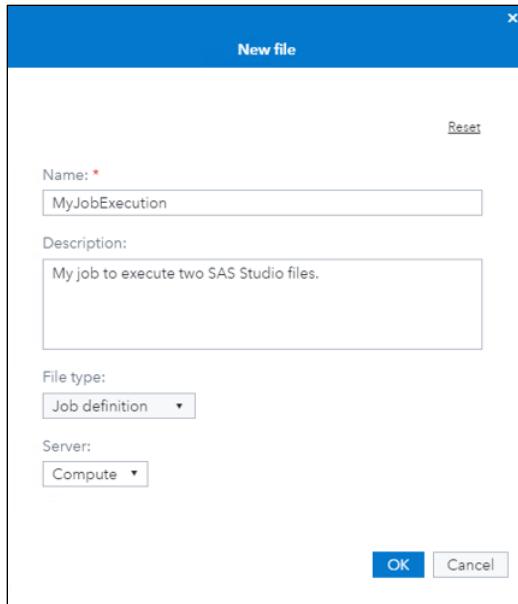
- 3) Enter:

Name: **MyJobExecution**

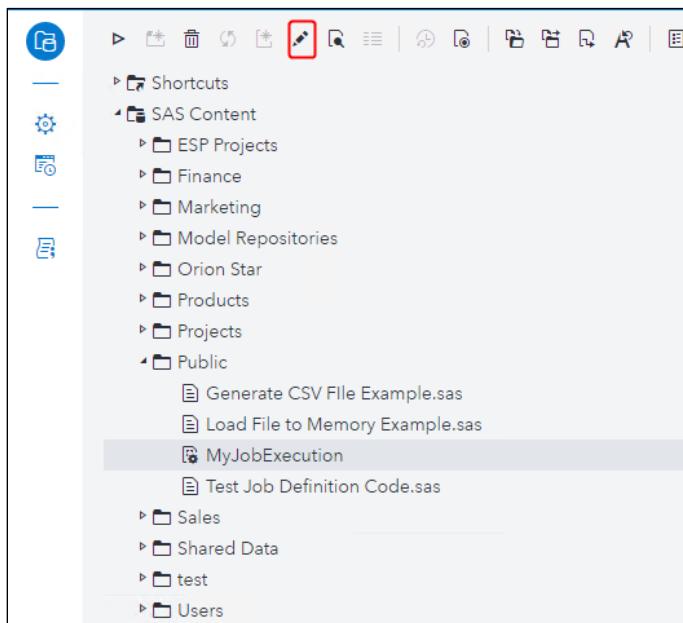
Description: **My job to execute two SAS Studio files.**

File type: **Job definition**

Click **OK**.

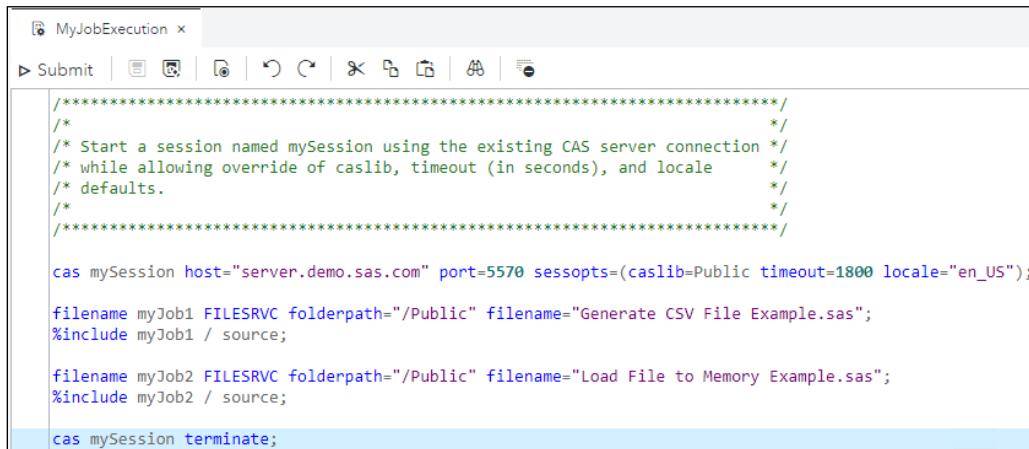


- 4) With the new file name selected, click **Edit file** to edit the contents of the file.



5) Paste the code that you copied previously from your SAS Studio test job.

Note: You must press and hold the Ctrl key and click V to paste the copied code.



```

MyJobExecution x
Submit | Run | Stop | Refresh | Back | Forward | Help | Exit

/*
 ****
 /* Start a session named mySession using the existing CAS server connection */
 /* while allowing override of caslib, timeout (in seconds), and locale */
 /* defaults.
 */
/*
 ****
cas mySession host="server.demo.sas.com" port=5570 sessopts=(caslib=Public timeout=1800 locale="en_US");

filename myJob1 FILESRVC folderpath="/Public" filename="Generate CSV File Example.sas";
%include myJob1 / source;

filename myJob2 FILESRVC folderpath="/Public" filename="Load File to Memory Example.sas";
%include myJob2 / source;

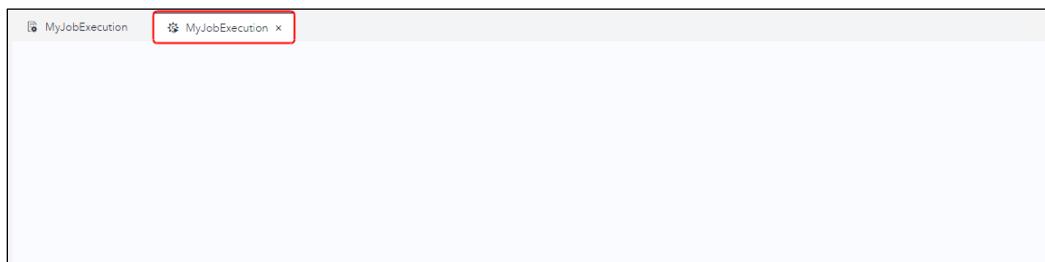
cas mySession terminate;

```

6) Click **Save changes** .

7) Click **Submit**. 

Submitting the job opens a SAS Output tab for the contents from the executable file. Because the job did not produce content, the tab is empty.



8) Close the **Output** tab.

9) Click the **X** on the MyJobExecution tab of the SAS Job Execution Application to close out of the program.



10) Select **Jobs** from the side navigation pane to confirm that the job that was just executed has a status of success, .



The screenshot shows the SAS Job Execution interface. On the left, there's a sidebar with icons for Jobs, Settings, and Help. The main area is titled 'Jobs' and contains a table with one row. The table has columns for 'Program' (containing 'MyJobExecution'), 'Status' (containing a green checkmark), and 'Run Time' (containing '00:00:06.6').

- e. Add parameters to your **MyJobExecution** file.

- 1) Return to the **Contents** area and highlight **MyJobExecution**. With the file highlighted, click **Job submit options**.

The screenshot shows the SAS Contents interface. On the left, there's a tree view under 'SAS Content' with categories like 'Shortcuts', 'SAS Content', 'ESP Projects', 'Finance', 'Marketing', 'Model Repositories', 'Orion Star', 'Products', 'Projects', and 'Public'. Under 'Public', there are two files: 'Generate CSV File Example.sas' and 'Load File to Memory Example.sas'. The file 'MyJobExecution' is highlighted with a gray background.

- 2) Enter the following parameter to eliminate the display of the SAS Output tab after submitting the job: **_output_type=none**

Check **Show log** to display the SAS log when submitting the job.

The screenshot shows the 'Job Submit Options' dialog box. It has a blue header bar with the title 'Job Submit Options'. Below the header, there's a 'Reset' link. The main area is labeled 'Parameters:' and contains a text input field with the value '_output_type=none'. There are also two checkboxes: one checked ('Show log') and one unchecked ('New window'). At the bottom right is a blue 'Close' button.

- 3) Click **Close**.

- f. Schedule the job.

- 1) Return to **Jobs** area, highlight **MyJobExecution** and click the **Schedule job icon** . This will add a job entry in the **Jobs** area of SAS Environment Manager and open the application.

Program	Status	Run Time
MyJobExecution	✓	00:00:06.9

- 2) Name the job.

Schedule Job

Name: *

Description:

Run as:

Triggers:

No items

+ Add a new trigger

Save **Cancel**

- 3) Click **Add a new trigger**.

+ Add a new trigger

- 4) Enter the following to have the job run every day at noon EST:

6. Time: **12:00**

7. Click **Save**.

New Trigger

Frequency: Interval: days

Time: * 

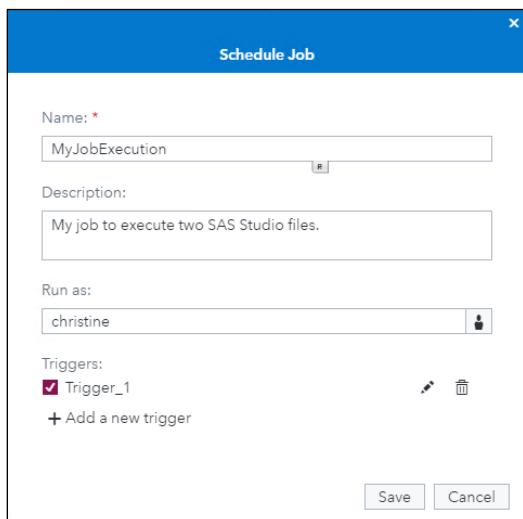
Time zone:

Start date: 

End:

Save **Reset** **Cancel**

5) Run as **christine**. Click **Save**.



Note: Three SAS programs are in **SAS Content ⇒ Public**.

The first screenshot shows the 'Public' folder containing three SAS programs: 'Generate CSV File Example.sas', 'Load File to Memory Example.sas', and 'Test Job Definition Code.sas'.

The second screenshot shows the 'Test Job Definition Code.sas' editor window. The code is:

```

1 /*Write SASHELP.cars to CSV file in LWSAVA35 workshop folder. */
2 proc export data=sashelp.cars (where=(type='Sedan'))
3   outfile='/workshop/LWSAVA35/cars.csv'
4   dbms=csv
5   replace;
6 run;

```

The third screenshot shows the 'Load File to Memory Example.sas' editor window. The code is:

```

1 /* Drop current global in-memory CARS_CSV table if it exists */
2 proc casutil;
3   droptable casdata="CARS_CSV" incaslib="Public" quiet;
4 quit;
5
6 /* Load client CSV file to a global in-memory table */
7 proc casutil;
8   load file="/workshop/LWSAVA35/cars.csv"
9   outcaslib="Public" casout="CARS_CSV" promote;
10 run;
11 quit;

```

The screenshot shows the SAS Studio interface with three tabs at the top: "Test Job Definition Code.sas", "Generate CSV File Example.sas", and "Load File to Memory Example.sas". The "Test Job Definition Code.sas" tab is active. Below the tabs is a toolbar with icons for Run, Cancel, Copy, Copy to My Snippets, Refresh, Stop, and Debug. The main area is titled "Code" and contains the following SAS code:

```

1 /* Drop current global in-memory CARS_CSV table if it exists */
2 proc casutil;
3   droptable casdata="CARS_CSV" incaslib="Public" quiet;
4 quit;
5
6
7 /* Load client CSV file to a global in-memory table */
8 proc casutil;
9   load file="/workshop/LWSAVA35/cars.csv"
10  outcaslib="Public" casout="CARS_CSV" promote;
11 run;
12 quit;

```

4. Using PYViyaTools

- In a web browser, enter the following URL: developer.sas.com
- Download the package to `/opt/sas` directory.
 - Using Christine's session in **mRemoteNG**, change directory to `/opt/sas`

```
cd /opt/sas
```
 - Issue the following command to install a copy of the tools in a subdirectory of `/opt/sas`:


```
sudo git clone https://github.com/sassoftware/pyviyatools
```

```
[christine@server opt]$ sudo git clone https://github.com/sassoftware/pyviyatools
Cloning into 'pyviyatools'...
remote: Enumerating objects: 26, done.
remote: Counting objects: 100% (26/26), done.
remote: Compressing objects: 100% (11/11), done.
remote: Total 95 (delta 16), reused 18 (delta 15), pack-reused 69
Unpacking objects: 100% (95/95), done.
```
- Authenticate to SAS Viya.

The pyviya tools use the sas-admin auth CLI to authenticate to SAS Viya. To use the tool, you must have created a profile and generate a token for authentication. (The token will expire in 12 hours.) If you have not set up a profile and generated a token, issue the following script that includes the commands:

```
~/authLogin.sh
```

- Execute a test call.
 - Change directory to your install directory: `/opt/sas/pyviyatools`

```
cd /opt/sas/pyviyatools
```
 - Run the following command to see options used on the `call_rest_api.py` script:


```
./call_rest_api.py -h
```

- 3) Run the following command again to see options used on the **call_rest_api.py** script:

```
./call_rest_api.py -h
```

```
[christine@server pyviyatools]$ ./call_rest_api.py -h
usage: call_rest_api.py [-h] -e ENDPOINT -m {get,put,post,delete}
                        [-i INPUTFILE] [-a ACCEPTTYPE] [-c CONTENTTYPE]
                        [-o {csv,json,simple}] [-t]

Call the Viya REST API

optional arguments:
  -h, --help            show this help message and exit
  -e ENDPOINT, --endpoint ENDPOINT
                        Enter the REST endpoint e.g. /folders/folders
  -m {get,put,post,delete}, --method {get,put,post,delete}
                        Enter the REST method.
  -i INPUTFILE, --inputfile INPUTFILE
                        Enter the full path to an input json file
  -a ACCEPTTYPE, --accepttype ACCEPTTYPE
                        Enter REST Content Type you want returned e.g.
                        application/vnd.sas.identity.basic+json
  -c CONTENTTYPE, --contenttype CONTENTTYPE
                        Enter REST Content Type for POST e.g
                        application/vnd.sas.identity.basic+json
  -o {csv,json,simple}, --output {csv,json,simple}
                        Output Style
  -t, --text             Display Simple Text Results.
```

- 4) Run the test command. (Returns JSON, but you might want to add **-t** for text output.)

```
./callrestapi.py -e /folders/folders -m get
```

```
{
  "count": 125,
  "name": "folders",
  "links": [
    {
      "href": "/folders/folders",
      "type": "application/vnd.sas.collection",
      "method": "GET",
      "rel": "collection",
      "uri": "/folders/folders"
    },
    {
      "href": "/folders/folders?start=0&limit=20",
      "type": "application/vnd.sas.collection",
      "method": "GET",
      "rel": "self",
      "uri": "/folders/folders?start=0&limit=20"
    }
  ]
}
```

- e. Test other Python scripts.

```
#return the json for all the identities
./callrestapi.py -e /identities/identities -m get
```

```
{
  "count": 40,
  "name": "identities",
  "links": [
    {
      "itemType": "application/vnd.sas.identity.group.summary application/vnd.sas.identity.user.summary",
      "uri": "/identities/identities",
      "href": "/identities/identities",
      "rel": "collection",
      "type": "application/vnd.sas.collection",
      "method": "GET"
    },
    {
      "itemType": "application/vnd.sas.identity.group.summary application/vnd.sas.identity.user.summary",
      "uri": "/identities/identities?start=0&limit=50",
      "href": "/identities/identities?start=0&limit=50",
      "rel": "self",
      "type": "application/vnd.sas.collection",
      "method": "GET"
    }
  ]
}
```

```
#return the json for all the identities output to a file
./callrestapi.py -e /identities/identities -m get >
identities.json
```

```
#refresh the identities cache
./callrestapi.py -e /identities/userCount -m get
./callrestapi.py -e /identities/cache/refreshes -m post
```

```
[christine@server pyviyatools]$ ./callrestapi.py -e /identities/userCount -m get
{
  "version": 1,
  "value": 29
}
[christine@server pyviyatools]$ ./callrestapi.py -e /identities/cache/refreshes -m post
{
  "state": "refreshing",
  "version": 1,
  "links": []
}
```

```
#pass the folder path and return the folder id and uri
./getfolderid.py -f "/Orion Star"
```

```
(christine@server pyviyatools)$ ./getfolderid.py -f "/Orion Star"
name ,memberCount ,type ,modifiedTimeStamp ,version ,modifiedBy ,createdBy ,creationTimeStamp ,id
"Orion Star","1","folder","2020-01-30T18:49:35.476Z","1","christine","christine","2020-01-30T18:49:26.084Z","0e7d225d-201d-40dd-81ab-8ba9187610df"
(christine@server pyviyatools)$
```

```
#return a set of configuration properties
./getconfigurationproperties.py -c
sas.identities.providers.ldap.user -o simple
```

```
[christine@server pyviyatools]$ ./getconfigurationproperties.py -c sas.identities.providers.ldap.user -o simple
====Item 0 ====
accountId = uid
address.country = co
address.locality = l
address.postalCode = postalCode
address.region = region
address.street = street
baseDN = ou=users,dc=viya,dc=com
createDate = createTimestamp
description = description
distinguishedName = none
emailAddress.other = otherMailbox
emailAddress.sms =
emailAddress.work = mail
id = 4c86b990-8563-4503-80c1-3a0e4b5f13b5
memberOf = memberOf
metadata = {u'mediaType': u'application/vnd.sas.configuration.config.sas.identities.providers.ldap.user+json;versi}
```

List of Additional Tools Available

Additional tools provide more complex functionality by combining multiple calls to the callrestapi function, and post-processing the output that is returned.

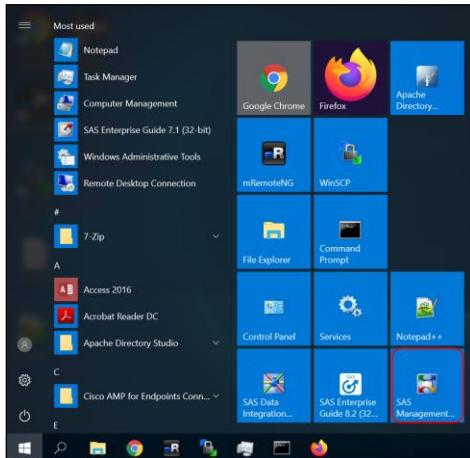
getfolderid	Returns the ID of the folder based on the full folder path.
deletefolder	Deletes a folder based on the full folder path.
deletefolderandcontent	Deletes a folder and any reports that are stored in the folder.
movecontent	Moves the content from a source to a target folder.
getconfigurationproperties	Lists the name/value pairs of a configuration.
Testfolderaccess	Tests if a user or group has access to a folder.
createbinarybackup.py	Creates a binary backup job.
Createdomain.py	Creates an authentication domain.
Listrules.py	Lists authorization rules subset on a principal and/or a uri.
loginviaauthinfo.py	Uses an authinfo file to authenticate to the CLI.
updatepreferences.py	Updates preferences for a user or group of users.
updatedomain.py	Loads a set of user IDs and passwords to a SAS Viya domain from a CSV file.
createfolders.py	Creates a set of SAS Viya folders from a CSV file.
explainaccess.py	Explains access for a folder, object, or service endpoint.
getpath.py	Returns path of folder, report, or other object in folder.
listmemberswithpath.py	Lists members of a folder, recursively if desired.
listcaslibs.py	List all CAS libraries on all servers.

listcastables.py	Lists all CAS tables in all CAS libraries on all servers.
listcaslibsandeffectiveaccess.py	Lists all effective access on all CAS libraries on all servers.
listcastablesandeffectiveaccess.py	Lists all effective access on all CAS tables in all CAS libraries on all servers.
listgroupsandmembers.py	Lists all groups and their members.

5. Promoting SAS 9.4 Groups into SAS Viya

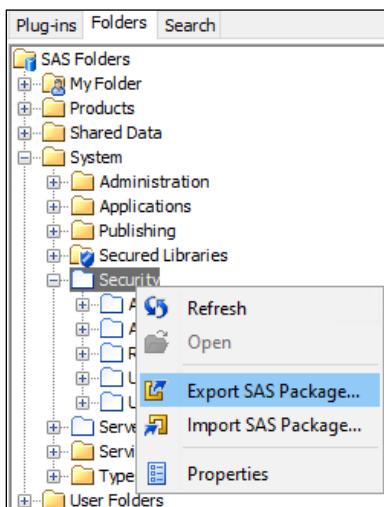
In a SAS 9.4 environment, the Import/Export SAS Package Wizard in SAS Management Console enables content to be moved between deployments and releases. In this practice, you export groups from a 9.4 environment and import them into SAS Viya.

- From the Start menu, launch SAS Management Console.



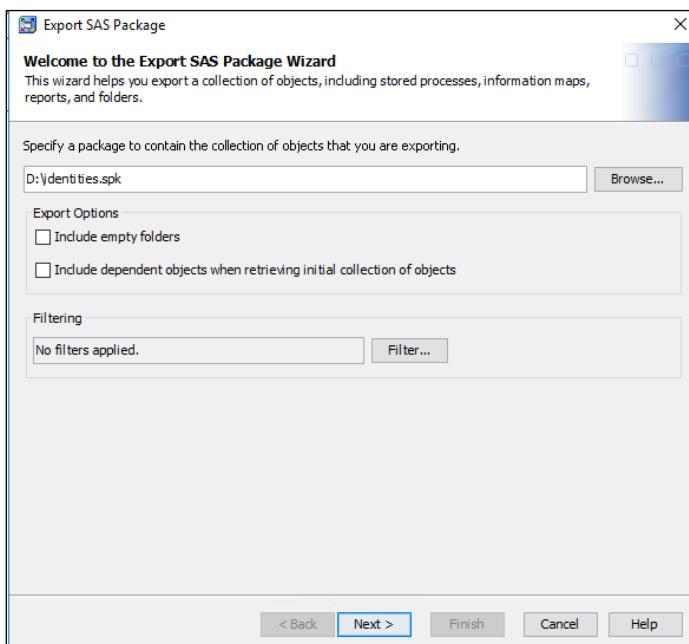
- Log in with the username **sasadm@saspw** and password of **Student1** if not automatically signed in.
- In SAS Management Console, navigate to the **Folders** tab and expand the **System** folder.

- d. Right-click **Security** and select **Export SAS Package**.

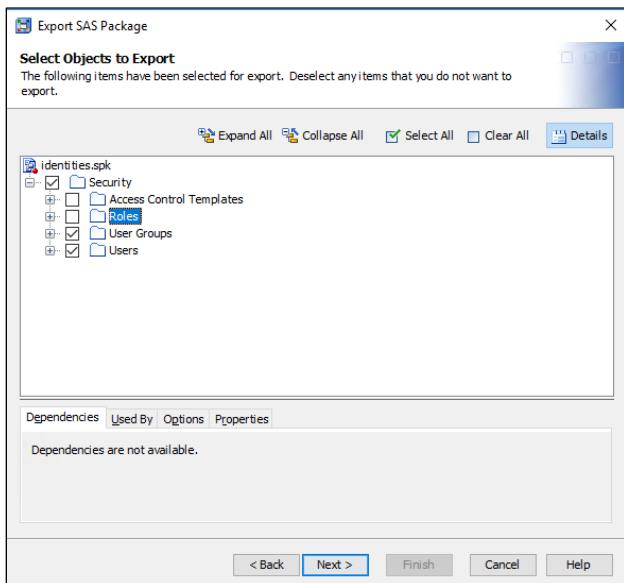


- e. Set the export package path to **D:\identities.spk**.

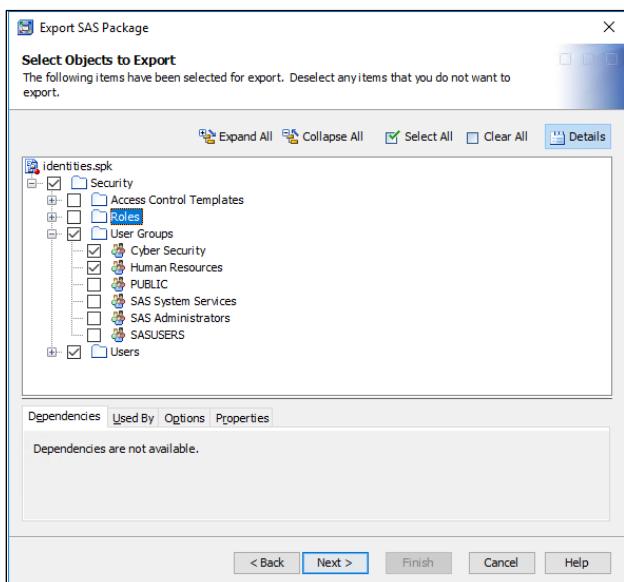
- f. Click **Next**.



- g. On the Select Objects to Export page, deselect **Access Control Templates** and **Roles**.



- h. Expand **User Groups** and select which groups you would like to bring over to SAS Viya. Select **Cyber Security** and **Human Resources**.

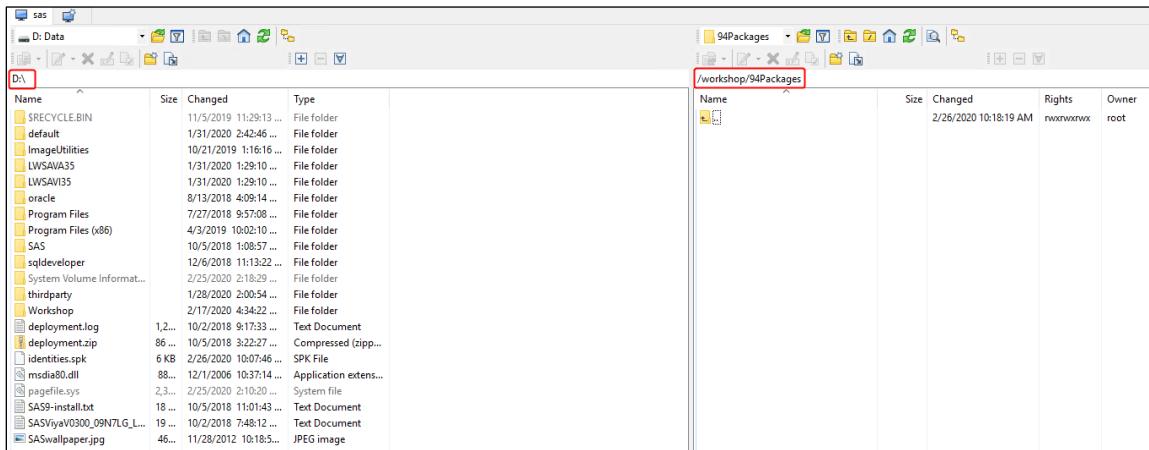


- i. Expand **Users** and select the users that you would like to promote to SAS Viya. Select **Bruno** and **Lynn**.

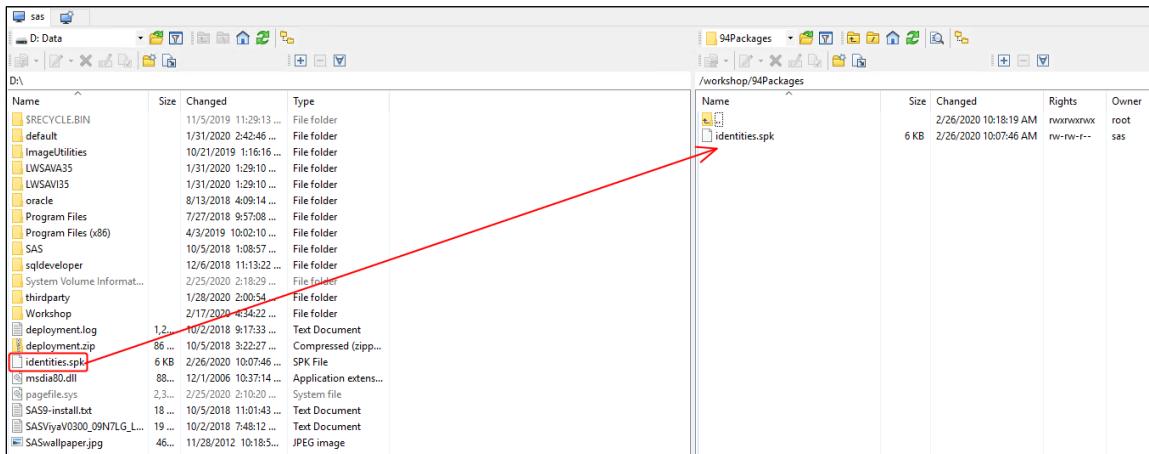


- j. Click **Next** twice.
k. Then click **Finish** on the Export Complete page.
l. In WinSCP, connect as **sas**.

- m. On the left side, navigate to D:\, and on the right side, navigate to /workshop/94Packages.



- n. Move identities.spk from D:\ over to /workshop/94Packages.



- o. Connect as christine in mRemoteNG and navigate to /opt/sas/viya/home/bin.

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

```
[christine@server /]$ cd /opt/sas/viya/home/bin
```

- p. Run the following command:

```
./sas-admin transfer generate-content-mapping --mapping
/workshop/Mapping --user-package
/workshop/94Packages/identities.spk --group-package
/workshop/94Packages/identities.spk
```

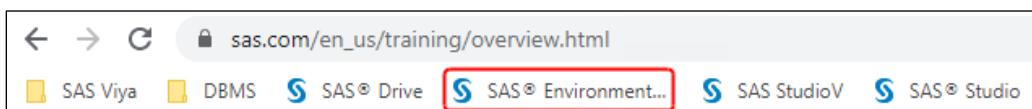
- q. In WinSCP, navigate to **/workshop/Mapping**. In the Mapping directory, you will see a **ContentMappings.json** file. You might need to refresh to see the file.

/workshop/Mapping					
Name	Size	Changed	Rights	Owner	
ContentMappings.json	1 KB	2/26/2020 10:52:01 AM	rw-r--r--	christine	

- r. Copy the **ContentMappings.json** file over to **D:**.

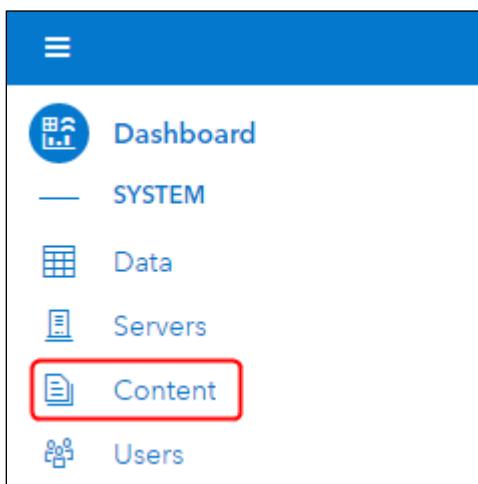
Name	Size	Changed	Type	Name	Size	Changed	Rights	Owner
\$RECYCLE.BIN		11/5/2019 11:29:13 ...	File folder					
default		1/31/2020 2:42:46 ...	File folder					
ImageUtilities		10/21/2019 1:16:16 ...	File folder					
LWSAVA35		1/31/2020 1:29:10 ...	File folder					
LWSAV35		1/31/2020 1:29:10 ...	File folder					
oracle		8/13/2018 4:09:14 ...	File folder					
Program Files		7/27/2018 9:57:08 ...	File folder					
Program Files (x86)		4/3/2019 10:02:10 ...	File folder					
SAS		10/5/2018 1:06:57 ...	File folder					
sqldesigner		12/6/2018 11:13:22 ...	File folder					
System Volume Informat...		2/25/2020 2:18:29 ...	File folder					
thirdparty		1/28/2020 2:00:54 ...	File folder					
Workshop		2/17/2020 4:34:22 ...	File folder					
ContentMappings.json	1 KB	2/26/2020 10:52:01 ...	JSON File					
deployment.log	1,2...	10/2/2018 9:17:33 ...	Text Document					

- s. Open a web browser (Chrome or Firefox), and on the bookmark bar, select **SAS Environment Manager**.

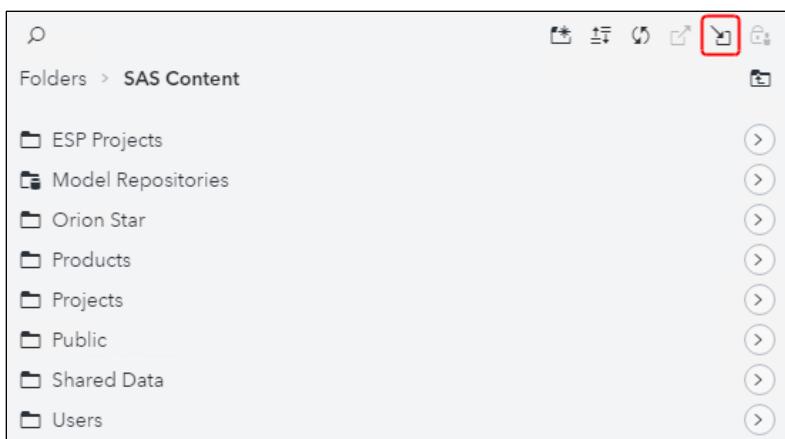


- t. Sign in as **christine** with password **Student1** and opt into all assumable groups.

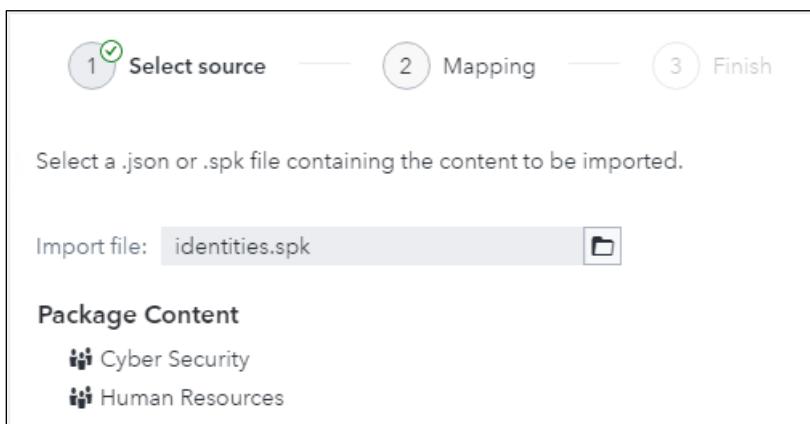
- u. In Environment Manager, select **Content**.



- v. In Content, select **Import**.

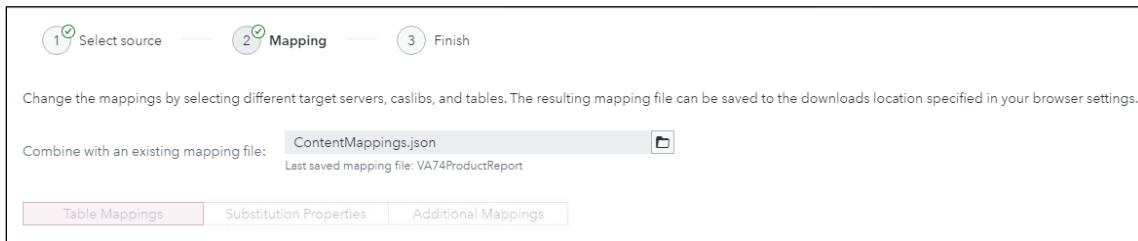


- w. On the Select source page, select the Import file by clicking the **folder** icon and select **identities.spk**.



- x. Click the numeral **2** in the circle to go to Mapping.

- y. In the **Combine with an existing mapping file** field, select the **folder** icon  and select **ContentMapping.json**

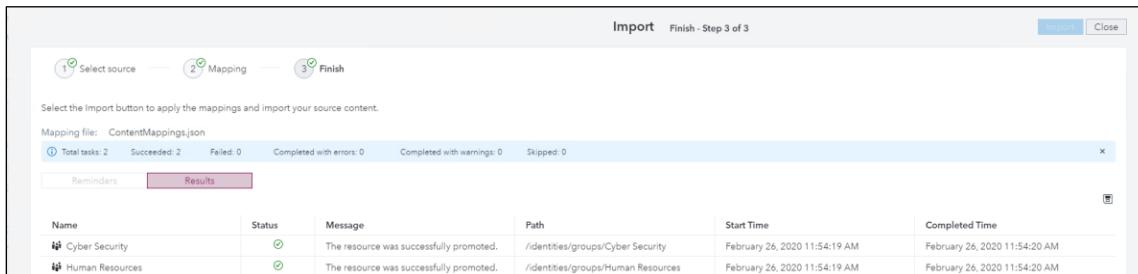


- z. Click the numeral **3** to go to the Finish page. 

- aa. On the Finish page, select **Import**.

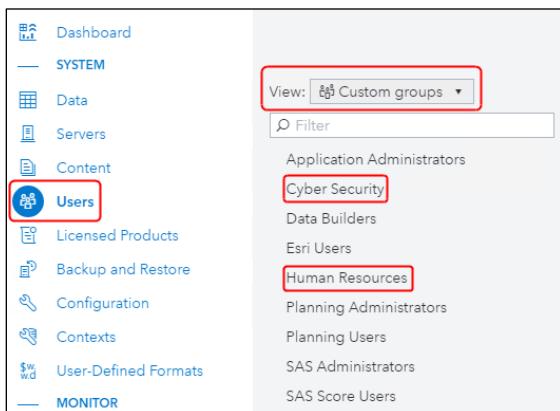


A successful import will generate the following:



- bb. Click **Close**.

- cc. Navigate to **Users** \Rightarrow **Custom groups**. Verify that both **Cyber Security** and **Human Resources** were imported.



- dd. If both groups were successfully imported, select **Cyber Security**. Verify that **Bruno** was placed as a member of the Cyber Security group.

The screenshot shows a software interface for managing groups. On the left, a sidebar lists several groups: Application Administrators, Cyber Security (which is selected and highlighted in grey), Data Builders, Esri Users, Human Resources, Planning Administrators, Planning Users, SAS Administrators, and SAS Score Users. At the top of this sidebar is a 'View:' dropdown set to 'Custom groups' and a 'Filter' input field. On the right, a detailed view of the 'Cyber Security' group is displayed. It shows the group's name, a blue circular icon with a person symbol, and fields for 'ID:' and 'Description:' which are both empty. Below these are tabs for 'Members (1)', 'Member Of (0)', and 'Advanced'. Under the 'Members (1)' tab, there is a list with one item: 'Bruno'.

End of Solutions

