

## Planning for Migration from SAS® 9.4 to SAS® Viya®

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### ABSTRACT

SAS® Viya® is the new Analytics architecture based on the Cloud Analytic Services (CAS) In-Memory Engine delivered by the SAS Institute Inc. SAS Viya brings a change in the fundamental methodology of installing SAS by moving away from SAS Software Depots and towards industry-standard software deployment methods. This paper will compare and contrast SAS 9.4 with SAS Viya in several key areas for Administrators including pre-install requirements, installation processes, administration tools and methods, and data source connectivity including library definitions. The paper will also discuss upgrade and migration planning.

### INTRODUCTION

Over the last year companies and universities have been installing SAS Viya. With our clients, it has not been a migration from SAS 9.4 Platform, SAS 9.4 Platform Grid, and SAS Visual Analytics to Viya, but rather integrating these existing installations with new deployments of SAS Viya. This paper will share with you our experiences installing, configuring, and validating SAS Viya installations as well as the process for upgrading SAS Viya.

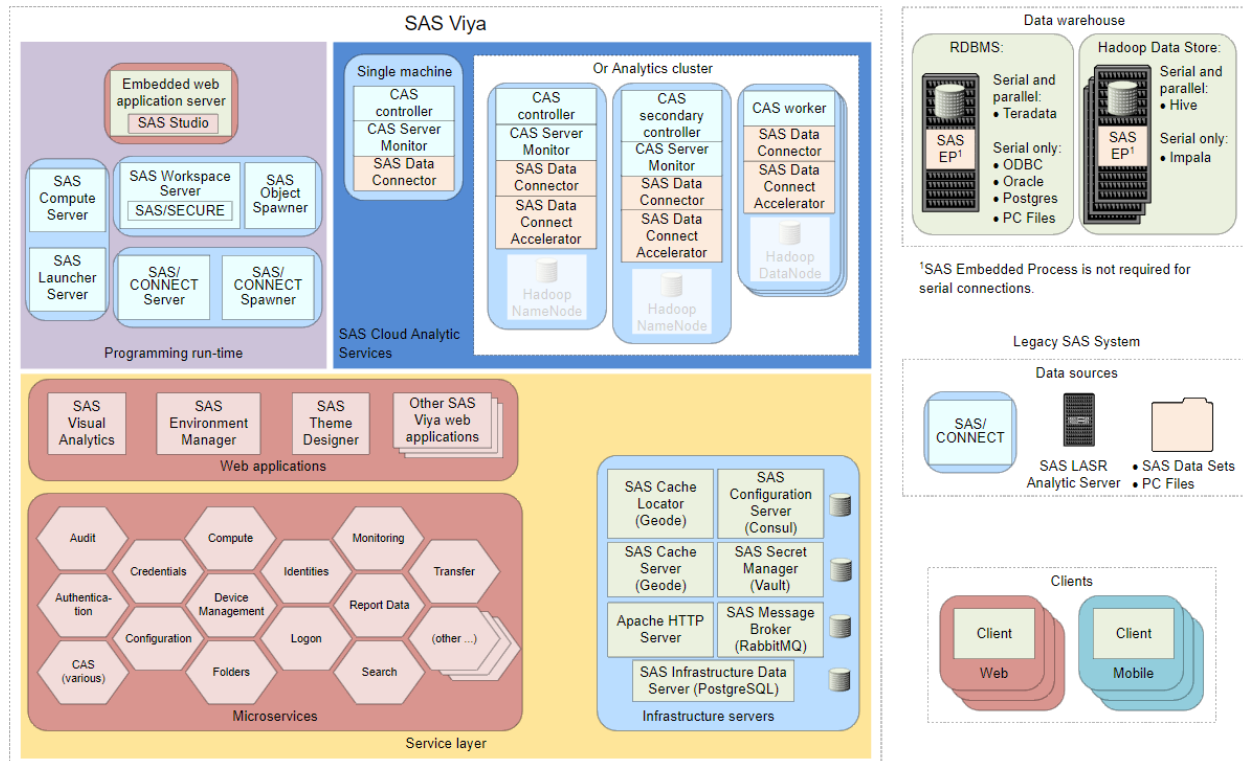
We will discuss the differences in installation, upgrade, and migration of SAS Viya versus the SAS 9.4 Platform. Our topics will include:

- Architecture
- Operating Systems
- Pre-Installation Requirements
- Installation Processes
- Administration Differences
- Required CAS Sessions, Libraries, & Data Loading
- Upgrade and Migration Planning

### ARCHITECTURE

The SAS 9.4 Platform supports both SMP (Symmetric Multiprocessing) and MPP (Massively Parallel Processing) architectures. SAS 9.4 can be installed as an all-in-one deployment where the Metadata, Compute, and Mid-Tier server components are all configured on one machine. The components may also be split apart for performance improvement by having the Metadata, Compute, and Mid-Tier servers each on separate machines. SAS Grid implements functionality to further improve parallel processing with multiple Compute Nodes, and SAS Visual Analytics (VA) may use the distributed LASR Analytic Server architecture to allow many blades/nodes to share cores and RAM.

SAS Viya 3.3 may also be used in both SMP and MPP architectures. The high-level components of the current SAS Viya server architecture are the Cloud Analytic Services (including Controller and Workers), the Services Layer (including Microservices, Web applications and Infrastructure servers), and the Programming run-time. Installation on an SMP system is called a Non-Distributed Installation, and installation on multiple servers (MPP) is called a Distributed Installation.



**Figure 1 Full Viya Deployment [1]**

When we install Non-Distributed SAS Viya on a single machine, this is like an all-in-one installation of SAS 9.4. Similarly, as in SAS 9.4 when we separate the components for additional performance, the Non-Distributed SAS Viya installation allows you split out the Services layer and Programming Run-Time to a different machine from the CAS Controller. This is called a Split Non-Distributed SAS Viya system. This may sound confusing. However, Non-Distributed and Distributed refer to the CAS (Cloud Analytics Services) components. Separating the Cloud Analytics Services away from the Services layer and Programming Run-Time is what is termed a “Split” system.

In the Distributed configuration of SAS Viya you have multiple machines configured for CAS. This allows for parallel processing of SAS operations across multiple CAS Worker Nodes.



**Figure 2 Distributed SAS Viya Installation [2]**

## OPERATING SYSTEMS

The SAS 9.4 Platform can be installed on numerous Operating Systems including Windows, Linux, Solaris, HP-UX, IBM-AIX, and zOS.

SAS Viya 3.3 is officially supported on:

- Red Hat Enterprise Linux 6.7 (64-bit) and later within 6.x
- Red Hat Enterprise Linux 7.1 and later within 7.x
- Oracle Linux 6.7 and later within 6.x
- Oracle Linux 7.1 and later within 7.x

SAS Viya 3.4 is *additionally* supported on:

- SUSE Linux Enterprise Server 12.2 and later [3]

## PRE-INSTALLATION REQUIREMENTS

### PLAN.XML VERSUS ANSIBLE PLAYBOOK

Installing SAS 9.4 usually requires a planned installation. A plan file is custom-built specifically for the installation and licensing for a customer. When we build the plan.xml file, a rich documentation set is generated with diagrams and the PIRD – Pre-Installation Requirements Document. We utilize these documents while working with the customer to identify all the ports, hosts, networks, Data Sources, and Lev numbers for the target environment. With this documentation, the plan.xml, the SAS Depot, and the other Pre-Installation requirements, we are ready to begin the SAS 9.4 installation.

To install SAS Viya, we follow the same Documentation process. To perform the actual installation we will use an Ansible playbook instead of the SAS Deployment Wizard with a plan.xml file. We will download and install Linux RPM packages instead of using a SAS Depot.

The recommended method for a full Non-Distributed SAS Viya installation is to use Ansible. SAS also provides support for installing the programming-only option of SAS Viya without using Ansible. This method is performed by executing a script that includes Yum commands and additional manual steps. However, the non-Ansible option does not include the complete suite of services. The only option available for a Distributed Installation of SAS Viya involving a CAS Controller and multiple CAS Workers is to use Ansible. [4]

For Ansible deployments, a Linux-based host to serve as the Ansible Control Machine is required. The Ansible Control Machine may be co-located with the SAS Viya installation in a Non-Distributed architecture. For larger Split and Distributed deployments, we recommend a separate Ansible Control Machine. Co-location of the Ansible Control Machine on a host with other Administrative services is a common choice.

### AUTHENTICATION AND AUTHORIZATION

In SAS 9.4 we use the SAS Metadata Server to authenticate users. The Metadata Server will generally pass the request to the computer's Operating System to validate that the user is authenticated and authorized to use SAS. The OS can validate a user identity in various ways, including /etc/passwd or using pam-based authentication. If configured, Metadata may also use LDAP or Active Directory directly to validate user identities.

With SAS Viya an external identity server must be configured for support of visual interfaces such as SAS Visual Analytics and SAS Environment Manager. Localhost /etc/passwd authorization is not sufficient for these services. This requirement can be problematic if you are installing for a standalone proof of concept, for example in a small Amazon AWS environment. You will have to first build and configure an OpenLDAP or Active Directory instance to satisfy this requirement. However, this should not frequently pose a problem when you are installing SAS Viya for a larger company, where there is typically central user management and SSO-Single Sign On infrastructure in place.

## INSTALLATION PROCESS

### SAS 9.4M5 DEPLOYMENT WIZARD

As a best practice we prefer to break our planned SAS 9.4 installations into stages. We first install the Binaries by unchecking the configuration button in the SAS Deployment Wizard. We also like to record our Deployment Wizard responses in a response file. Once this is done, we stop and create a fallback/checkpoint of the deployed software using an OS command such as tar or rsync. With the response file and the checkpoint created, we can always then fallback to the beginning or to the point of the Binary installation if issues arise.

Next we run the SAS Hot Fix and Deployment Tool (SASHFADD) to see if there are any new SAS Hot Fixes since our SAS Depot Download. We then create another failback/checkpoint. Finally we run the Configuration Phase. Once that is complete we do a final failback/checkpoint with the cold environment. (ALL SAS processes down).

## **RUNNING THE ANSIBLE PLAYBOOK**

For a SAS Viya deployment, once the software order has been processed, SAS Institute provides an SOE (Software Order Email), the RPM files, License (setinit) and an Ansible Playbook. If the IT administrative duties are separate, the SAS Viya installer will need to work with the Linux Administrator for root or sudo privileges to install, start, stop, and get a status on the Viya processes.

The SAS Viya installation process provides a nice built-in failback and restart capability. If you need to start over, you simply stop all SAS Viya processes, delete the directory structure that was installed, and then rerun the Ansible Playbook.

## **ADMINISTRATION DIFFERENCES**

### **SAS METADATA SERVER VERSUS MANAGING THE SAS VIYA ENVIRONMENT**

In SAS 9.4 we use the SAS Management Console and the Environment Manager to manage the metadata for Servers, Grid Nodes, users, groups, roles, etc. We have the sasadm@saspw unrestricted user, and we have administrator roles that can be granted to individual users.

In SAS Viya, we will typically be using native tools for LDAP or Active Directory to create the user access and configure groups. There are additional groups in Viya that may be created.

The administrator roles and identities in SAS Viya work a little differently than in SAS 9.4. We have the Viya SAS Administrator, the CAS Administrator, and the CAS Data Administrator. With SAS Viya, the Administrator roles can be “assumed” (or declined) at the time of login for authorized users, thereby allowing authorized users to choose to have their sessions behave as “Administrator” or “non-Administrator”. This capability can be very useful when trying to replicate user-issues that only occur when running as a non-Administrative user.

## **REQUIRED CAS SESSIONS, LIBRARIES, DATA LOADING**

### **LIBRARY DEFINITIONS: SAS 9 VERSUS SAS VIYA**

SAS has historically placed significant emphasis on the data. SAS has the ability to read and load most types of data and that continues to be the focus. With the SAS 9 Platform we use SAS Libraries to allow SAS access to various data as SAS datasets. These libraries may be built from Base SAS Datasets or from one of the many SAS Access Engines that provide connectivity to external data sources such as Teradata or Oracle. We use the LIBNAME statement to create these SAS Libraries.

In SAS Viya we are building CASLIBs or Cloud Analytic Server Libraries. While CAS is primarily designed for in-memory operations, CAS's File-Based Memory Mapped Data architecture allows us to process data that is larger than physical memory. This alleviates the issue of potentially failing to load a dataset that is larger than the amount of available memory. Processing is typically slower in this scenario than if the dataset resided entirely in RAM due to required memory page-ins.

To build the CAS data in-Memory, we must establish a CAS Server Connection, a Session, define a CASLIB, and load the data. Additional steps to authenticate users for a personal CAS Session or promote data to a Global CAS Session are part of the SAS Administrator, CAS Administrator, or CAS Data Administrator roles.

CAS Sessions can be created via SAS Studio or Command Line Interfaces (scripting). CAS Libraries can also be created using the SAS Viya Environment Manager and the CAS Server Monitor. We will discuss the methodology here using SAS Studio Snippets.

## EXAMPLE OF PROCESS TO CREATE CAS LIBRARY AND LOAD DATA

### Create a CAS Server Connection:

From SAS Studio > Snippets > SAS Viya Cloud Analytic Services > Create CAS Connection > Open, input the resolvable hostname for your "cas server name", as well as the port that your CAS server runs on:

```
/* ***** */
/* Set the options necessary for creating a connection to a CAS server.      */
/* Once the options are set, the cas command connects the default session   */
/* to the specified CAS server and CAS port, for example the default value  */
/* is 5570.                                                                    */
/* ***** */
options cashost="<cas server name>" casport=<port number>;
cas;
```

(Hit Running Man)

### Create a CAS Session:

From SAS Studio > Snippets > SAS Viya Cloud Analytic Services > New CAS Session > Open

```
/* ***** */
/* Start a session named mySession using the existing CAS server connection*/
/* while allowing override of caslib, timeout (in seconds), and locale      */
/* defaults.                                                                    */
/* ***** */
cas mySession sessopts=(caslib=casuser timeout=1800 locale="en_US");
```

(Hit Running Man)

### Define a CASLIB:

From SAS Studio > Snippets > SAS Viya Cloud Analytic Services > New caslib for Path > Open, input the filepath to the dataset you would like to load:

```
/* ***** */
/* Create a CAS library (myCaslib) for the specified path ("/filePath/")    */
/* and session (mySession). If "sessref=" is omitted, the caslib is         */
/* created and activated for the current session. Setting subdirs extends   */
/* the scope of myCaslib to subdirectories of "/filePath".                    */
/* ***** */
caslib myCaslib datasource=(srctype="path") path="/filePath/"
sessref=mySession subdirs;
libname myCaslib cas;
```

(Hit Running Man)

## Load Data to CASLIB:

From SAS Studio > Snippets > SAS Viya Cloud Analytic Services > Load data to caslib > Open

```
/* Choose only one of the following Methods - Comment out the other 2 */
/* Method 1 */
/*****
/* Load file from a client location ("pathToClientFile") into the specified*/
/* caslib ("myCaslib") and save it as "tableNameForLoadedFile". */
*****/

proc casutil;
load file="pathToClientFile"
outcaslib="myCaslib" casout="tableNameForLoadedFile";
run;

/* Method 2 */
/*****
/* Load SAS data set from a Base engine library (library.tableName) into */
/* the specified caslib ("myCaslib") and save as "targetTableName". */
*****/

proc casutil;
load data=library.tableName outcaslib="myCaslib"
casout="targetTableName";
run;

/* Method 3 */
/*****
/* Load a table ("sourceTableName") from the specified caslib */
/* ("sourceCaslib") to the target Caslib ("targetCaslib") and save it as */
/* "targetTableName". */
*****/

proc casutil;
load casdata="sourceTableName" incaslib="sourceCaslib"
outcaslib="targetCaslib" casout="targetTableName";
run;
```

(Hit Running Man)

## UPGRADE AND MIGRATION PLANNING

Since SAS 9.4 Platforms are clients to SAS Viya, we recommend you upgrade/migrate to the latest version of SAS, which is currently SAS 9.4M5 as of the writing of this paper. M5 has the capability built in to directly connect to SAS Viya. Earlier versions require SAS Connect. Much of the connection functionality in M5 is automated when using SAS Studio or Enterprise Guide.

SAS 9 ships with the migration utility in the SAS Depot. Often we have to determine if we are going to perform a migration, or a new installation that includes exporting and importing SAS Metadata. If we are staying with the same platform and operating system we can utilize the migration utility. Always run the migration utility to generate a detailed report of all the components available for migration. Remember data sources and SAS code that may be stored outside of the SAS Binary and Configuration directory structures.

For SAS Viya we recommend you upgrade to the latest version, which is Version 3.4 as of the writing of this paper. Migration or upgrading will use the same Ansible playbook if there are no new SAS Products added. For new SAS products you will need a new SOE, License file (setinit), and will need to blend your configuration settings in the Ansible .yaml variable file.

You will stop the sas-viya-\* processes as root or using sudo. Then backup (we use tar or rsync) the entire Viya home (Binaries) and Viya config directory structure. Then run your Ansible Playbook, and restart your environment.

Upgrades to individual microservices can be done on the fly. Stop the microservice sas-viya-service-name, install the new RPM, then restart the microservice as root.

As with any upgrade or migration, you must find all the custom data connections and custom SAS programs. Just remember to backup, backup, backup, and validate those backups. Always create failback/restart checkpoints in order to minimize the time needed to return to a valid and stable point-in-time.

With your CAS Controller and CAS Worker nodes you will need your Data Connectors. Each node must be able to connect to the data and data sources.

Sync up with your SAS representation or your SAS Partner! Plan. Plan. Plan.

## SAS VIYA 3.4 UPDATES

Version 3.4 of SAS Viya adds several new capabilities to the platform. Per the “What’s New in SAS® 9.4 and SAS® Viya® 3.4” document [5]:

- This release of SAS Viya is faster and smaller. SAS Viya 3.4 has streamlined services, better performance, and a smaller footprint.
- You can deploy SAS Viya 3.4 on SUSE Linux. You can also use the new Mirror Manager and upgrade in place.
- SAS Viya 3.4 provides more management tools in CAS resource management, SAS Environment Manager, CLIs, and promotion tools.
- SAS Viya 3.4 adds support for these data connectors: JDBC, MySQL, Spark, and Vertica.
- Integration with the Cloud has been improved with S3 caslibs, the S3 procedure, an enhancement to the Redshift integration, and a Quick Start for Amazon Web Services.
- SAS Viya 3.4 also supports Lineage and includes SAS Studio 5.1, which is written to use microservices.
- A new promotion wizard is available for importing content from SAS 9.x to SAS Viya 3.4 and SAS Viya 3.x to SAS Viya 3.4.
- SAS Viya now supports managing multiple Cloud Analytic Services (CAS) servers (controller+worker sets) under one Viya installation.
- CAS has extended support for resource management through policies for table quotas and CPU utilization.
- A new license file has been introduced in preparation for future billing enhancements.

## CONCLUSION

The migration from SAS 9.4 to SAS Viya is not really a migration to SAS Viya, but integration with SAS Viya. When we look at the Viya architecture diagram, we see that SAS 9.4 is one of the clients that can run code in SAS Viya and get results back. SAS Viya can access the same Data Connectors as SAS 9.4,



allowing direct access to the same data sources as our SAS 9.4 installations. SAS Viya enables access not only via traditional SAS code, but from other programming languages such as Python, LUA, Java, and also via REST API's.

When we consider Enterprise Analytics there continues to be a very significant need for solutions such as SAS Grid Manager that will be able to service thousands of small SAS user programs and still be able to reach out to the SAS Viya environment to run a Big Data In-Memory process.

The role of the SAS Platform Administrator is expanding to include SAS Viya Administration to best utilize the assets under their control. Taking the time to load data into SAS Viya when it could have already been executed on a SAS 9 Server will be a balancing act to determine how to best use the company's resources. Migration to the latest versions of SAS 9.4 and SAS Viya is highly recommended. As our technology is changing, SAS is constantly updating to stay in sync with the latest innovations. Migrations and upgrades should always be a normal part of the SAS Administrator's world.

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## RECOMMENDED READING

- SAS® Viya™ 3.3: *Overview*
- *Video: Overview of SAS® Viya™ Deployment Options*
- SAS® Viya® 3.4 for Linux: *Deployment Guide*



- *SAS Viya 3.4 Administration: Orientation*

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