

The impact of migrating to SAS Viya 202X (aka SAS Viya 4)

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ABSTRACT

Currently, most of the SAS-based Statistical Computing Environments (SCEs) are built on the SAS 9 version; some on SAS Viya 3. Recently, SAS Institute released its modern cloud-native, unified version with multi-lingual programming capabilities, SAS Viya 202X (Viya 4).

This journey to SAS Viya 4 brings specific challenges for GxP environments from a technical and change management point of view. Due to the compliance aspects, this transition can take from a couple of weeks up to 2 to 3 years, depending on the complexity of your overall statistical compute platform.

This proceeding aims to provide a bird's-eye view over the considerations to be made from different angles in order to adopt SAS Viya 4: the business and industry point of view; can SAS Viya 4 be a validated environment and how it can be qualified; the considerations towards planning and project management; and last but not the least, the scenarios made available by SAS Institute as solutions to such requirements, drafting their pros and cons.

INTRODUCTION

SAS Institute is a multinational vendor of different market solutions. They are the leading analytics vendor in many business sectors, having specialization in life sciences and pharmacology among other areas of business.

OCS Consulting is a Gold Partner of SAS Institute across Europe that provides services such as managed services and technology solutions, OCS Life Sciences is a specialist CRO whose focal point is in the life sciences industry for more than 20 years and is focused on: clinical and statistical programming, biostatistics, and CDISC data conversion.

This industry is highly regulated. Best practices (GxP) require the systems to be fully qualified and validated.

SAS Institute released a new architecture of the SAS software in late 2020. The new architecture is cloud-native and based on a new technology, Kubernetes. Given this technology of Kubernetes has been rarely qualified in the current scope of SAS software, the introduction of the new software raises questions: What are the risks in validation? What are the risks in regulatory compliance? What will be familiar? And, what is changing and how?

The analysis used to answer these questions are based on the differences in technology. It will focus on the concepts, ideas and the practical aspects towards the end-user and about how to handle them from a risk and compliance point of view, versus its more detailed technical aspects.

VALIDATION vs. QUALIFICATION

Validation	Qualification
Validation applies to entire processes or analytical methods [and includes the equipment and software of computer system(s)], and it must follow industry best practices (GCP, GMP, GLP, or GxP), regulatory standards, and defined processes.	Qualification is a component of the overall validation process and provides documented evidence that the hardware and software comprising the system was installed (IQ, Installation Qualification) correctly and operates (OQ, Operation Qualification) as defined by the vendor for the customer's intended use.

This paper is focussing on the qualification aspect.

Many technical details can be added as differences. This is being described in the documentation.sas.com and in other presentations, papers, and webinars. For the purpose of this paper, which is focused on the viability of qualifying SAS Viya, the most relevant aspects are described below.

ABOUT SAS VIYA

SAS Viya 4 is the envisioned version of SAS Viya, as envisioned by SAS Institute. There is a previous version, namely SAS Viya 3.x, which can be considered as an intermediate version. Therefore, we will be referring to SAS Viya 4 along this paper simply as SAS Viya, not SAS Viya 4 or SAS Viya 202X, unless stated otherwise for the sake of comparisons.

SAS Viya is an AI, analytic and data management platform that runs on a modern, scalable architecture. It is not a product on itself but an architecture, and all SAS solutions will be moved on this architecture, and users are still able to execute SAS 9 code on the SAS Viya architecture. SAS Viya is a modern architecture, cloud-native runtime on Kubernetes with multi-lingual programming capabilities. This offers a future-proof design, scalable, and updated to the technology offerings of nowadays.

SAS VIYA SOLUTIONS USED IN CLINICAL DEVELOPMENT

SAS LIFE SCIENCE ANALYTICS FRAMEWORK

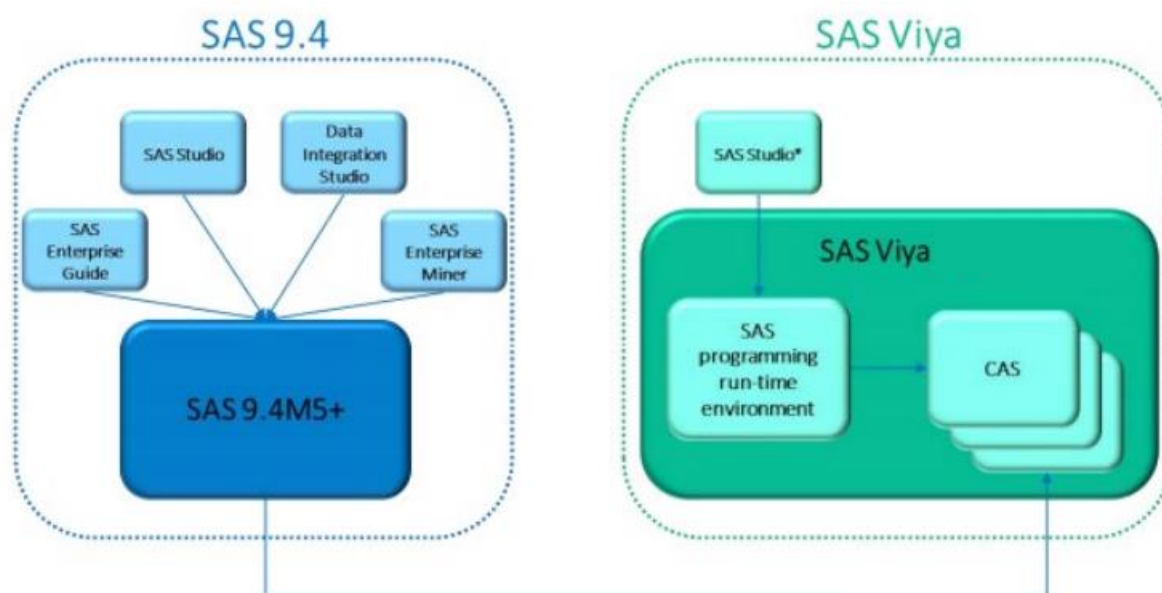
In addition to the technology approach for a GxP compliant statistical compute environment, SAS offers a tailor-made solution for Life Sciences Companies: SAS Life Science Analytics Framework (LSAF). Developed with all aspects of clinical development in mind, this SAS offering delivers a single, open, cloud-native statistical computing environment for clinical research with embedded analytic tools, support for data standards and optional integrated analytic applications. SAS' analytic foundation for clinical research helps customers modernize and deliver new therapies to market faster to improve health. However, this paper will be focussing on the SAS Viya (SAS technology) aspect.

SAS ANALYTICS PRO ON SAS VIYA

In 2021, SAS brought a new offering to market called SAS Analytics Pro on Viya. It is a cloud-ready, containerized version of SAS Analytics Pro, simplified version of SAS Viya, having SAS Studio, a basic login and the Computing engine. Other more complex elements such as the CAS engine, and other graphical applications (such as SAS Visual Analytics/Visual Statistics) and microservices have been removed from this version. This single container can run on any Docker or Kubernetes installation, including personal computers, assuming they have the required hardware resources.

DIFFERENCES BETWEEN TRADITIONAL SAS AND SAS VIYA

SAS Viya offers the traditional compute engine (formerly SAS Foundation or Base SAS, now SAS Compute engine) where the code and studies are commonly executed; it offers also an additional, in memory-based engine called Cloud Analytic Services (CAS), for multi-parallel processing (MPP), and Graphical Processing Units (GPUs), commonly used nowadays for neural networks, machine learning and artificial intelligence. In this sense, SAS Viya offers full support for all SAS workloads that have been running until now, and it supports new workloads and edge computing functionalities.



In the past, we had a whole set of heavy-client tools to work with SAS: SAS Display Manager, SAS Enterprise Guide, SAS Enterprise Miner, SAS Data Integration Studio, all of them requiring an installation and be qualified differently. SAS Viya has integrated all of them into a single web interface, SAS Studio, taking local installations as part of the requirements, and allowing more standard qualification and validations.

SAS 9		SAS Viya
SAS Data Integration Studio Jobs	→	SAS Studio flows
SAS Enterprise Guide Projects	→	SAS Studio flows
SAS OLAP Star Schema Cube	→	SAS Job Definition (to create a CAS table*)
SAS OLAP Detailed Cube (Single Table)	→	CAS table and SAS Visual Analytics data view
SAS Relational Information Map	→	SAS Job Definition (to create a CAS table)
SAS Stored Process	→	SAS Job Definition (to create the specified SAS code output, including and tables, graphs, and files)
SAS Visual Analytics Reports	→	Visual Analytics reports

SAS Studio has matured into a complete tool, able to work with all SAS code, able to import SAS Enterprise Guide projects and most of the SAS Data Integration jobs and flows, having both a coding and a visual interface. Any graphical interface will need to be validated manually as well as part of the Installation Qualification process, together with all above.

Therefore, until now, there are not many actual differences, towards the user, except the new CAS engine and SAS Studio. On the other hand, many companies work already with SAS Studio, and even with CAS if they started with SAS Viya 3. The usage, the validation and qualification remain the same as earlier.

The main differences come to the technical installation, qualification of the installation, and the operational maintenance activities of the system, which require additional technical know-how. SAS Viya is designed to run as cloud native application.

	SAS 9.4	SAS Viya 3	SAS Viya 4 (SAS Viya)
Requires	Windows/Linux	Windows/Linux (Less functionalities in Windows)	Kubernetes (Linux)
Sequence	Machine by machine	Parallel	Parallel
Steps in case of deployment issue	Wipe clean, restart from beginning	Re-try	Re-try
Human interaction during deployment, qualification and maintenance	Mostly manual (Many steps can be recorded in a configuration response file) No automated validation of requirements.	Less manual steps required SAS deployment can be scripted through Ansible playbook GitHub ARK project supports validation of requirements	Manual steps reduced to some post-configurations Infrastructure can be deployed as code (GitHub IaC project) SAS can be deployed using the Deployment Orchestrator GitHub ARK project supports validation of requirements
Recommended skills	Windows/Linux	Linux, YUM, Ansible	YAML, Kubernetes, Kustomize, containers
Permission levels	Root/Sudo (single step) Windows local admin	Root/Sudo (most steps)	Kubernetes Admin / Namespace admin

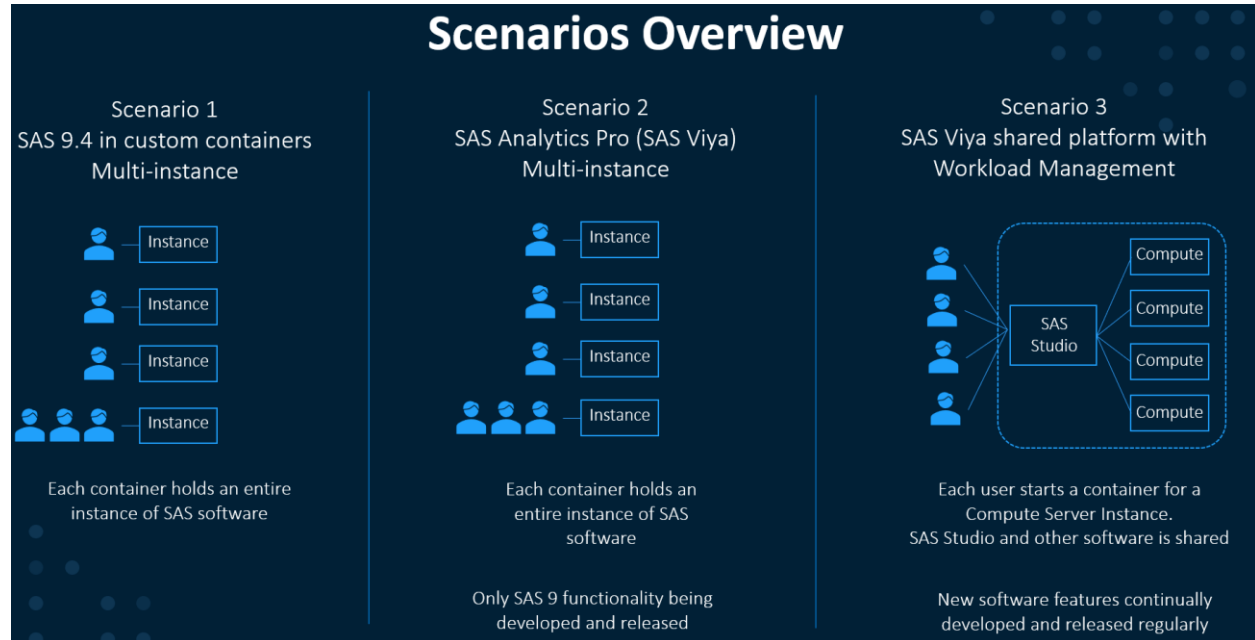
Therefore, while SAS Viya now requires additional Kubernetes knowledge, the fact that more phases can be automated with scripts, the activities to qualify and validate the system can be simplified, following governance and version control, bringing manual qualification and validation to a minimum.

DIFFERENT DEPLOYMENT OPTIONS FOR SAS VIYA

Traditionally speaking, SAS 9 offered the possibility to deploy the system for a single user on personal workstations, and for multiple users in a client-server design. When the concept of containers was introduced, it became possible as well to deploy SAS 9.4 on individual containers for single or multiple users.

Later on, with the introduction of SAS Viya 3, there was not really an option for single user, only an option for multiple users, although it was possible to choose between a flavour only for programming purposes (SAS Studio only), or the full-fledged deployment, where other products and solutions could be deployed as well.

Now, with the latest version of SAS Viya, it is possible again to offer a deployment for a single user and for multiple users.



For a single user, SAS Institute delivers a single Docker image having SAS Analytics Pro, which can be deployed as a container either on Docker or Kubernetes for a single user or even for multiple users. SAS Analytics Pro provides a simple SAS Viya environment, single instance, only with SAS Studio and the SAS 9 Compute Engine, without any of the other components that would add complexity to the system. It requires less infrastructure resources, making it more cost effective for environments focused only on programming and statistics.

For multiple users, SAS Analytics Pro could be an ideal option for programming-only purposes. When other products or solutions are needed, a full deployment of SAS Viya is required on a Kubernetes cluster. This has more requirements and complexity on infrastructure and design; however it offers more possibilities and solutions.

Therefore, the general architecture with a Kubernetes cluster offers the most options and solutions, however, it might not be needed for programming-only environments that don't require multi-parallel processing. For those purposes, SAS Analytics Pro might be sufficient. Otherwise, one of the SAS Viya solutions is best.

DIFFERENT OPERATIONAL AND MAINTENANCE OPTIONS: PROS AND CONS

SAS Viya can be deployed on the main Clouds (Microsoft Azure, Amazon AWS, Google Cloud Platform), and on-premises now as well. This is relevant as an introduction for the options for operations and maintenance. This means, leaving aside the need to have the infrastructure always qualified and validated, any system can be made available in any of these alternatives.

As such, the infrastructure and the SAS application, can be implemented and maintained by the organisation itself, fully outsource these activities, or any hybrid-model. This creates many options, and each of them they have their benefits and challenges. SAS Institute and their partners, including but not limited to OCS Consulting, offer a wide range of services to support their customers to help them succeed on their experiences, meeting the requirements and business expectations.

When any organisation decides to implement any system, not just SAS software, it is important to consider 3 main aspects:

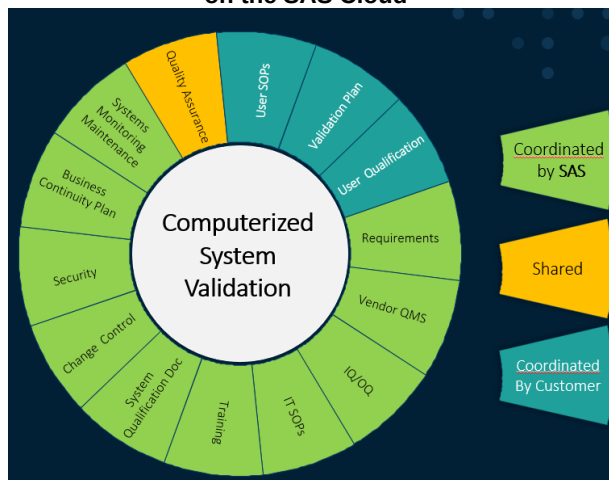
1. **the infrastructure:** on a public cloud, a private cloud/on-premises, the SAS cloud or LSAF as SaaS in SAS cloud.
2. **the installation, and validation/qualification:** SAS Consulting Services, OCS Consulting services, or any other qualified party.
3. **the maintenance,** which must follow GxP as well: SAS Consulting Services, OCS Consulting services, or any other qualified party.

Location	Supported	Kubernetes SME required 	Installation 	Validation	Maintenance 
On-premises	Red Hat OpenShift on VMWare	YES	Customer	Customer	Customer
Customer's Private Cloud	Azure, AWS, GCP	YES	Customer or SAS (Project)	Customer or SAS (Project)	Customer
SAS Cloud	Any of above	NO	SAS (in contract)	SAS (in contract)	SAS (in contract)
SAS LSAF	SAS Datacenter	NO	SAS (in contract)	SAS (in contract)	SAS (in contract)

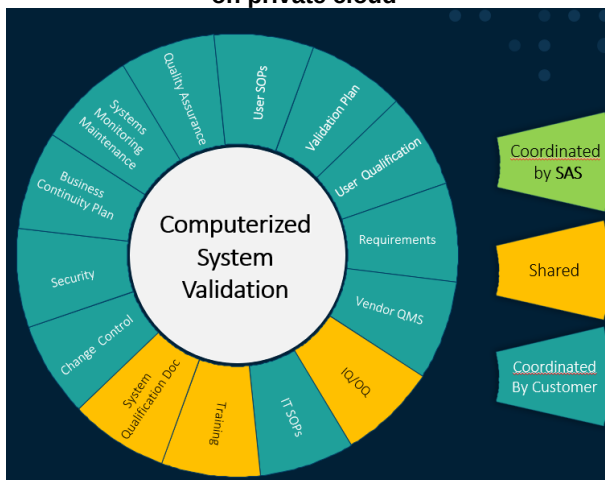
The SAS Cloud could be a good option to organizations who don't have yet experience with either SAS Viya, Kubernetes or the cloud infrastructure. This option, while adding some costs at first sight, would help minimise risks by handing over responsibilities to the SAS Cloud, and by doing so, increasing the chances to reduce costs in the medium-long term, increasing the Return of Investment (ROI).

The other main advantage of having the SAS environment on SAS Cloud is that the organisations will see themselves relieved from the responsibilities of the system itself, from the infrastructure validation to the SAS application implementation and validation. The main responsibility of the organisation will be the business flows and processes, allowing organisations to focus investment and resources on the business objectives.

Responsibilities of the organisation on the SAS Cloud



Responsibilities of the organisation on private cloud



SAS LSAF, mentioned earlier, is a solution that is only available in the SAS Cloud. Therefore, it will have the benefit of all the maintenance “pros” and allow SAS to alleviate the organisations from all the maintenance and system validation and qualification activities.

QUALIFYING SAS VIYA

The usage of this new technology provides many advantages, such as important improvements in scalability, cloud usage, REST-APIs, strong security, built-in high availability and failover. More specifically, towards qualification and validation, the possibility to deploy both the infrastructure and the SAS environment as code, which makes validation efforts more standard, version controlled, and reducing risks, making the overall process with SAS Viya more compliant.

GENERAL IDEA

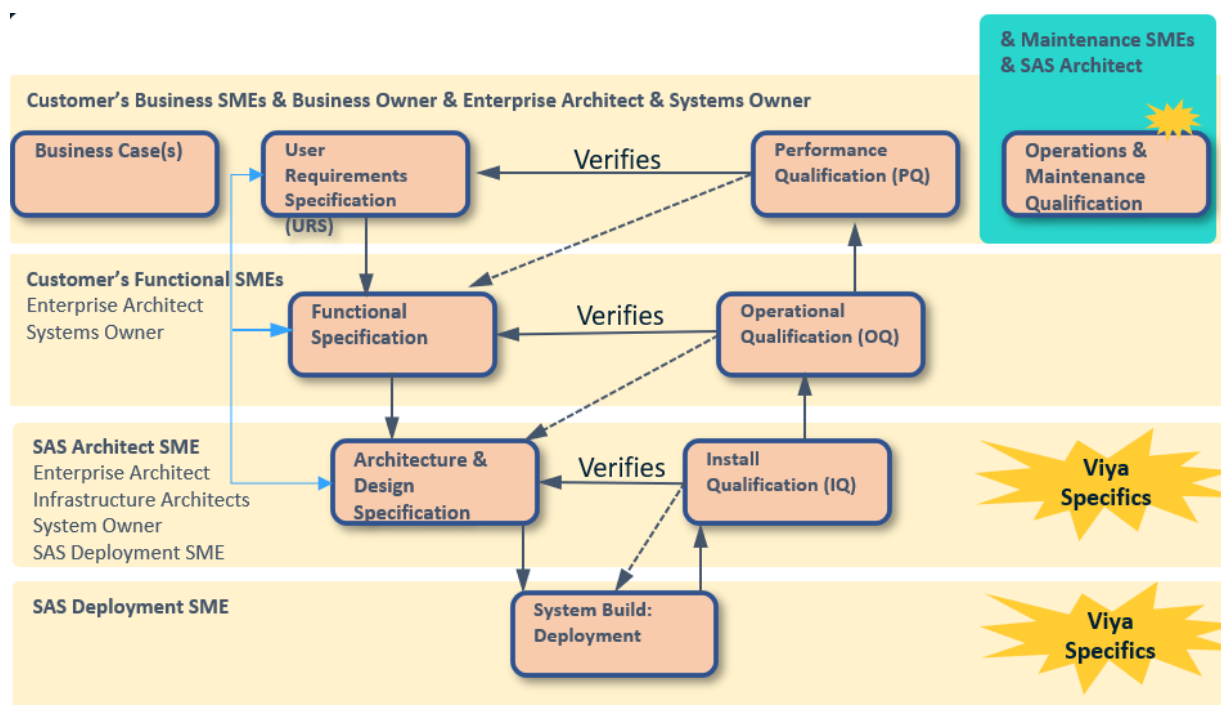
SAS Viya is not different than any other software. The process of validation and qualification of the environment will be exactly the same as any other statistical compute environment, no matter if it is based on SAS technology or any other provider. The main differences will appear on the more technical phases of the SAS Application itself. All the other steps will be exactly as usual.

The V-Model supports visually this concept.

In the figure below, all the main steps of the validation and qualification are represented, together with the main roles involved. Notice that the “Viya specifics” start symbol are present on 3 of the phases:

- Architecture & Design Specification and Install Qualification (IQ);
- System Build / Deployment;
- Operations and Maintenance Qualification.

Those 3 will be the phases that would require adjustments on the required knowledge and expertise (a Subject Matter Expert or SME), and some adjustments in the way the Qualification will be documented. Any other phase in the V-Model will follow the same validations as done previously.



In that sense, as it can be appreciated from the contents of this paper in further paragraphs, the System Qualification process will require Subject Matter Experts on Kubernetes and the chosen cloud infrastructure. This will be crucial for the success of the implementation/transition. On the other hand, thanks to this new technology, the documentation required during qualification will be reduced, standardised and made easier, thanks to the automation and standardisation capabilities of the Cloud and Kubernetes: the infrastructure can be deployed as code, SAS Viya can be deployed as code and SAS Viya is not installed anymore, it is delivered in non-mutable images (which can be considered as qualified and validated by SAS already).

The next paragraphs will go into details of the aspects that remain the same and what is changing and how, towards the Install Qualification (IQ) of the SAS Viya system.

SAS 9 COMPUTE ENGINE

This aspect remains similar as it was done with the traditional deployment of SAS 9.

GxP Operational Qualification (OQ) for SAS Viya is performed using a combination of automated and manual testing. The SAS OQ tool is used to perform OQ testing for SAS Compute (SAS 9 engine), whereas manual testing is used for the new CAS actions and the SAS Viya visual interfaces (SAS Drive, Environment Manager, etc.).

In terms of validation and qualification, the traditional computing engine (now named SAS 9 Compute Engine), will be qualified and validated exactly how it was done until now with SAS 9, and the SAS Operational Qualification scripts will remain available to validate the binaries and SAS licensed procedures (SAS PROCs). Hence, automated/scripted qualification is possible. This will be further discussed in the paragraph “VALIDATING SAS VIYA.”

The SAS OQ tool is available as a downloadable Docker container for use with SAS Viya and later deployments. Tests that are provided by SAS are included, and you can create and use custom tests.

- SAS OQ Container is delivered with the customer order;
- SAS OQ Container runs on client machines independent from the Viya Kubernetes Cloud environment;
- Customers can leverage and manage existing tests locally on any client machine.

The SAS OQ tool includes tests focused on the SAS Compute Engine, Base SAS, SAS/Stat, SAS/Graph, as well as the upper-level analytics such as OR, IML, and ETS. This is especially pertinent to Analytics Pro and Analytics Pro Advanced Programming.

```
NOTE: This session is executing on the X64_7PRO platform.

NOTE: Enhanced analytical products:
SAS/STAT 12.1, SAS/ETS 12.1, SAS/OR 12.1, SAS/IML 12.1, SAS/QC 12.1

NOTE: SAS initialization used:
      real time      0.10 seconds
      cpu time       0.09 seconds

NOTE: AUTOEXEC processing beginning; file is C:\oq93\ftt_20121129.000\autoexec.sas.

NOTE: AUTOEXEC processing completed.

1          /* ***** */
2          /* Report the operation qualification Tool results */
3          /* ***** */
4
5          /* close any open ods listing to free resources. */
6          ods listing close;
7
8          options orientation=landscape ls=132;
9          ods escapechar="^";
10         options formchar="|----|+|---+|=|<>";
11
12         /* add sasqstyle template to itemstore */
13         proc template;
14         define style styles.sasqstyle;
15         parent = styles.printer;
16
```

Pass/Fail			
Find fail			
Previous Next			
Component	Table	Test	Result
	tstor	tstnf01	Pass
	tstor	tstnlp01	Pass
	tstor	tstolp01	FAIL
	tstor	tstom01	FAIL
	tstor	tstopm01	Pass
	tstor	tstopm02	Pass
	tstor	tstopm03	Pass
	tstor	tstogp01	Pass
	tstor	tstpm01	Pass
	tstor	tsttr01	Pass
QC	tstqc	tstanm01	Pass
	tstqc	tstcap01	Pass
	tstqc	tstcus01	Pass

CAS CODING AND FUNCTIONALITY

SAS Institute is currently working on scripts to qualify all the CAS Actions, which are the “equivalent” to the SAS procedures, but for the CAS engine. For now, they need to be qualified manually, or automated by creating a custom CAS script.

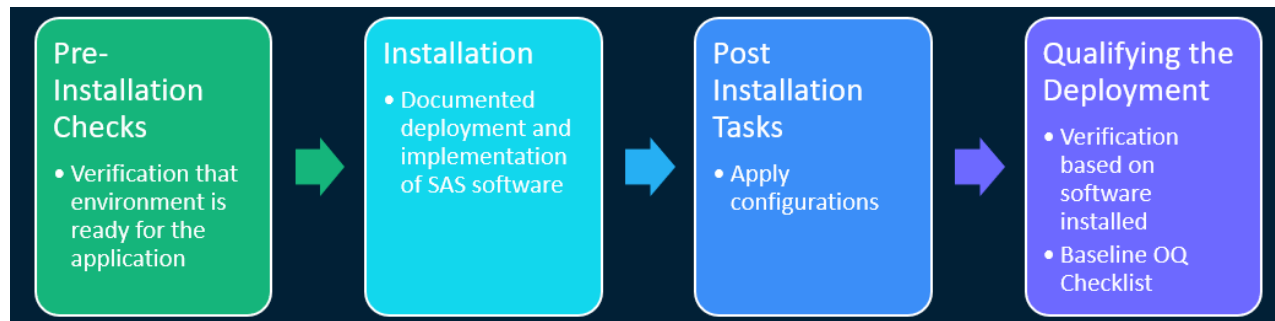
When it is required to include the CAS Actions in the Validation and Qualification plan for the Operation Qualification (OQ), at this moment, it will be required to be done manually, or for the organisation to develop custom scripts to qualify each of the CAS Actions.

INTERFACES

Any graphical interface, including but not limited to SAS Studio, will need to be validated manually as well as part of the Installation Qualification process, together with all above, on the same way as any visual interface from any system is qualified.

QUALIFYING DEPLOYMENT

The general process for IQ/OQ of the SAS software is represented on the following figure:



As quickly discussed earlier in this paper, to design, deploy and validate SAS Viya, it requires Kubernetes and cloud expertise. On the other hand, many tasks become more standard and adaptable to the validation and qualification process. More specifically:

- Immutable Docker images provided by SAS Institute;
- Scripted deployment of Cloud Infrastructure with Infrastructure as a Code (IaC) toolset;
- Scripted qualification of the Cloud infrastructure with the ARK scripts;
- Scripted deployment and qualification of SAS Viya into the Kubernetes cluster.

Some post-configurations and validations, earlier described, will need to be manually documented as usual.

Since the SAS software is not delivered in the flavour of Docker images that are not meant to be modified, the binaries, the installation on itself does not need to be validated, qualified, as this has been done thoroughly by the quality process by SAS Institute itself. As such, the images can be audited by the organisation, should this be required, but they don't need a qualification. The SAS IQ becomes "irrelevant" in that sense, within the process of the GxP Installation Qualification (IQ). SAS IQ is different from the GxP IQ, in the sense, the GxP IQ intends to qualify the complete deployment, whereas the traditional SAS IQ scripts would qualify only the binary files, if they match with the md5 hash.

The IaC scripts are example scripts developed by SAS individuals to support the description of automated provision of the infrastructure on the clouds (Azure, AWS, Google). Therefore, they are not officially supported by SAS Technical Support, since SAS is not responsible for the infrastructure. However, it is possible to contact the authors through the GitHub projects. These scripts will need to be adjusted with any parameter that will be defined as outcome of the Architecture and Design Specification Phase, and it requires Kubernetes and Cloud in-depth expertise.

The SAS Viya Administration Resource Kit (ARK) provides a suite of utilities to validate and administer the SAS Viya environment. Each version of the Resource Kit is available on the SAS Software GitHub repositories. The Viya ARK contains a script that generates a post-installation Deployment Report which is used as evidence for Installation Qualification, as it provides a basic proof of the successful deployment of the cloud provisioning and in detail proof, after the SAS Viya deployment is complete, with a SAS Viya installation report.


```
#!/bin/bash
touch /start
#####
echo "Starting with the installation of OPENLDAP. Check the openldap.log in the playbook directory for more information" &gt; /var/log/myScriptLog.txt
#####
# install openldap
cd /opt/sas/install/OpenLDAP
ansible-playbook openldapsetup.yml
if [ $? -ne 0 ]; then { echo "Failed the openldap setup, aborting." ; exit 1; } fi
cp ./sitedefault.yml /opt/sas/install/sas_viya_playbook/roles/consul/files/sitedefault.yml
if [ $? -ne 0 ]; then { echo "Failed to copy file, aborting." ; exit 1; } fi
#####
echo "Starting Viya installation" &gt;&gt; /var/log/myScriptLog.txt
#####
# install viya
cd /opt/sas/install/sas_viya_playbook
ansible-playbook site.yml
if [ $? -ne 0 ]; then { echo "Failed to install sas viya, aborting." ; exit 1; } fi
#####
echo "Starting jupyterhub installation" &gt;&gt; /var/log/myScriptLog.txt
#####
# install jupyterhub
cd /opt/sas/install/jupy-azure
ansible-playbook deploy_jupyter.yml
if [ $? -ne 0 ]; then { echo "Failed to install jupyterhub, aborting." ; exit 1; } fi
#####
touch /finish
#####
```

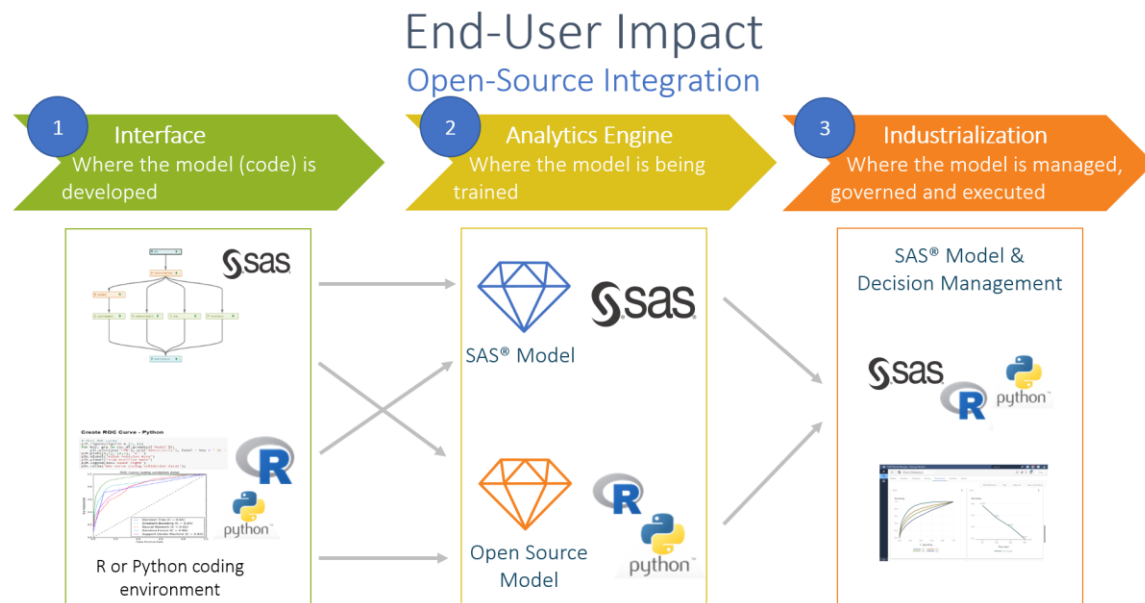
The SAS Viya 4 deployment GitHub project contains examples of the kustomize scripts to be used for the deployment of SAS Viya. Similar to the IaC scripts, they will need Kubernetes and cloud expertise, they will require as input a file generated with the IaC scripts, and they will need to be adjusted as determined during the Architecture and Design Specification phase. A report will be generated at their completion indicating the deployment was successful or failed.

SAS VIYA INTERFACES

OVERVIEW

SAS delivers an open analytics platform, built on the latest cloud technology and accessible from the interface or in the coding language of your choice, giving you the freedom to experiment and create.

Combining the power of SAS with open-source technologies, you can unify disparate tools and analytic assets into a streamlined, collaborative environment that fosters productivity, business agility and tangible results.



NEW WAYS TO OBTAIN RESULTS: CODING VS VISUAL

Building on the vision and commitment to democratize analytics, SAS Viya offers multiple ways to support non-programmers and empowers people with no programming skills to get up and running quickly and build machine learning models. In addition, SAS Viya also supports more advanced pipeline-based visual modelling via SAS Visual Data Mining and Machine Learning (VDMML). The combination of these different tools within SAS Viya supporting a low-code/no-code approach to modelling makes SAS Viya an incredibly flexible and powerful analytics platform that can help drive analytics usage and adoption throughout an organization.

MIGRATION CONSIDERATIONS

SAS CONTENT ASSESSMENT

In addition to the OQ scripts, SAS also provides customers the SAS Content Assessment. This offering is a collection of applications designed to examine the characteristics of your SAS 9 system. Each application examines your SAS 9 system for relevant information, gathers key details, and produces results from each part of the assessment and provides you with information around the compatibility of your existing SAS code in the Viya environment.



DATA

UTF-8 is the only SAS session encoding supported by SAS Viya. UTF-8 is a multi-byte encoding and part of the Unicode coded character set. UTF-8 is becoming the preferred and most-used encoding, and it is the recommended encoding for using Unicode with Linux-style operating systems.

UTF-8 is a variable-width multi-byte encoding, and the character codes 0x00 through 0x7F have the same meaning in ASCII. One UTF-8 character can be 1 byte, 2 bytes, 3 bytes, or even 4 bytes.

Because SAS Viya and SAS LSAF supports only the UTF-8 session encoding, you must be aware of the encoding of your legacy data sets. You might have SAS 9 data sets that are not in UTF-8 encoding. You therefore need to determine the encoding of your data and take steps to convert the data to UTF-8.

- Determine the encoding of your data set;
- Determine if CEDA is the appropriate conversion method;
- Determine if CVP (character variable padding) is an appropriate conversion method and if your data has space issues;
- Convert Indexes and Constraints to UTF-8;
- Convert Format Catalogues to UTF-8;
- Read external files;
- Functions like PRXPARSE and PRXMATCH are available, but only work with SBCS data.

In general, when working with MBCS or DBCS data, whether in PC SAS, LSAF or Viya, users should use functions that are I18N Level 2 compliant.

If users still have true single byte characters after converting to UTF-8 (for example, because the data was true ASCII or ISO 8859-1) the code will still work; however, if users have any multi-byte character data after the UTF-8 conversion, the original code may not work as expected. For example, the non-standard Microsoft characters (, curly quotes, ...) become multi-byte character data, so string functions on this data may not work anymore as expected.

WHAT'S NEXT

IMPACT OF CONTINUOUS IMPROVEMENT/DELIVERY (CI/CD), DEVOPS AND CADENCE

Continuous Integration/Continuous Delivery (CI/CD) is a philosophy wherein the steps involved in making changes to and then deploying code are streamlined so that they can be performed freely, continuously, and automatically. The CI/CD process allows customers to choose their release intervals, so they gain access to the latest product innovations the moment they are ready or can incorporate updates into their own change-management schedules.

SAS Viya is continuously delivered with updates coming every month. It is a standard practice in the SaaS / CD realm to number releases with the Year. # (e.g., 2020. #, 2021. #) so, you can quickly determine which version has the capability you need or are currently using.

There is more to this scheme, as the new SAS Viya has the concept of regular monthly releases and long-term support (LTS) releases.

SUPPORT LEVELS OF SAS

The most up-to-date support level of all SAS components are posted at: <https://support.sas.com/en/technical-support/support-levels.html>

SAS Viya has the concept of regular monthly (Stable) and long-term support (LTS) releases.

- **Stable** – ships as monthly version releases and has a support window of 4 months. Being the current Stable version and three previous versions
- **Long-Term Support (LTS)** – ships as 6 monthly version releases and has a support window of 2 years. Being the current LTS version and three previous versions.

LTS releases require a lower level of maintenance/updates on the system, therefore better suited for validated Production environments.

Single Versioning with Aligned Releases		
2 release cadences		
SAS Viya provides 2 release cadences: Stable Releases and Long-term Support (LTS). Use the information below to choose the best one that suits your business needs:		
	Stable Releases	Long-term support
How often?	Once a month	Every 6 months
What's included?	New features, changes to features, bug fixes, removal of features, etc.	Based on the stable release from 2 months prior.
Which support?	Current stable release plus 3 previous stable releases (or four months total)	Current LTS release plus 3 previous LTS releases. Note that customers must update at least once every 2 years.
Who is it for?	Users who are comfortable with CI/CD and want to stay up-to-date with SAS Viya technology.	User who are not comfortable with CI/CD yet and want to upgrade less frequently

AUDITING AND MONITORING

Since SAS Viya architecture is based on Kubernetes, this has an impact on the monitoring and auditing/logging aspects of SAS Viya.

Kubernetes

Search

Search for poac

Cluster

Namespaces

Nodes

Persistent Volumes

Roles

Storage Classes

Namespace

default

Overview

Workloads

Cron Jobs

Daemon Sets

Deployments

Jobs

Pods

Replica Sets

Replication Controllers

Stateful Sets

Discovery and Load Balancing

Ingresses

Services

Config and Storage

Config Maps

Persistent Volume Claims

Secrets

Deployments

Name	Labels	Pods	Age	Images
viya-poac-ps	app: viya-poac-ps component: viya-3.4_python-3.6_R-1.1.463 owner: demo type: Global	1 / 1	a month	nealtee/development:2019012902
viya-poac-scoring	app: viya-poac-scoring component: viya-3.4 owner: demo type: System	1 / 1	2 months	nealtee/development:2018120501
viya-poac-development-user2	app: viya-poac-development-user2 component: viya-3.3_python-2.7_R-1.1.463 owner: demo type: Personal	1 / 1	2 months	nealtee/development:2019012902
viya-poac-development-user1	app: viya-poac-development-user1 component: viya-3.4_python-3.6_R-1.1.463 owner: demo type: Personal	1 / 1	2 months	nealtee/development:2019012902
viya-poac-development	app: viya-poac-development component: viya-3.4_python-3.6_R-1.1.463 owner: demo type: Global	2 / 1	2 months	nealtee/development:2019030501

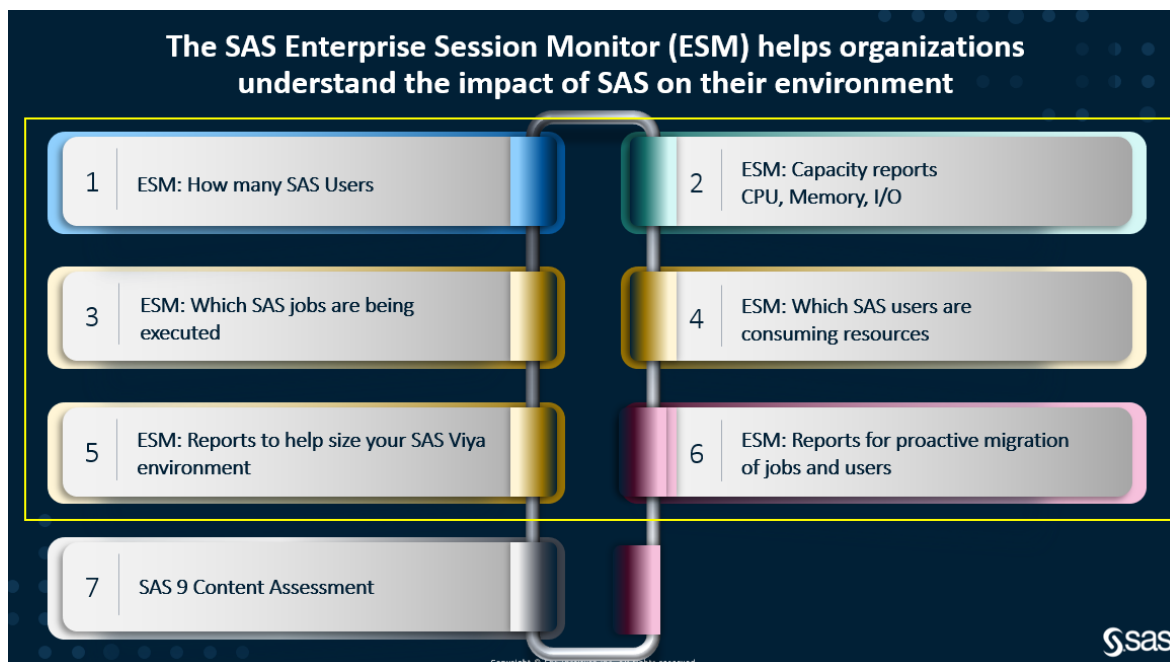
Pods

Name	Node	Status	Restarts	Age	CPU (cores)	Memory (bytes)
viya-poac-development-988d9989-lvlg6	aks-agentpool-20272703-4	Running	0	24 days	0.001	1.619 Gi
viya-poac-ps-5cd74bcd-n2mg	aks-agentpool-20272703-1	Running	0	a month	0.001	568.324 Mi
viya-poac-development-5895688585-ksbac	aks-agentpool-20272703-0	Running	0	a month	-	-
viya-poac-development-user2-7766786cb-4plgo	aks-agentpool-20272703-5	Running	0	a month	0.001	676.789 Mi
viya-poac-development-user1-844cbcb8d55-h8kkw	aks-agentpool-20272703-4	Running	0	a month	0.001	678.371 Mi
viya-poac-scoring-754557d5c4-7vrrp	aks-agentpool-20272703-5	Running	0	2 months	0.001	676.805 Mi

Anything that is related and generated by the code itself, it will remain the same in SAS Viya 4 as it was in SAS 9, and it can be managed by the users.

All that is related to the internal SAS system itself is different now, since Kubernetes writes all logs and outputs to stdout in Json format; meaning, they are not written in any storage. For this to happen, third party tools, based on Kubernetes, must be provisioned, such as Grafana, Kibana and Prometheus, as some examples. SAS provides a standard Kubernetes image that can be deployed together in a namespace together with SAS Viya, and be connected to SAS Viya's namespace in order to provide the auditing, logging and monitoring functionalities. However, they might not be enough for the organisation. When the organisation has already tools to monitor and keep a logging of Kubernetes application, it is recommended to keep using those and connect them to SAS Viya.

To obtain a snapshot of your current SAS environment, SAS offers Enterprise Session Monitor (ESM) for SAS 9 and for SAS Viya. Enterprise Session Monitor brings unparalleled visibility to complex analytic workloads allowing SAS developers and administrators to keep business critical SAS platforms and applications stable and performant, control Cloud costs, and enable optimal efficiency at scale.



CONCLUSION

SAS Viya 4 is a new architecture and concept for the SAS software, it is the way to go in the future. As any architecture change, it is a culture change as well. It holds some challenges, and it holds many advantages, especially towards the qualification and usage of the SAS System. While it is not urgent to move towards it at the moment, it is a healthy good idea to start the necessary processes to evaluate and to onboard the culture changes, as soon as possible.

We acknowledge it currently is a challenge to find individual or third parties capable of having enough Kubernetes and cloud expertise. For the organisations that lack expertise on all or any of those areas of knowledge/experience, or organisations who would like to be relieved of the weight to deploy and qualify the cloud infrastructure and/or SAS Viya, we recommend to consider the possibility to evaluate the services of the SAS Cloud (for a full service), or one of the several options at SAS and partners such as OCS, who can provide Managed Services and Consulting services.

REFERENCES

<https://github.com/sassoftware/viya4-orders-cli>

- Tool to manage the orders and get the items to download the SAS Viya images

<https://github.com/sassoftware/viya4-iac-azure>

- Example scripts to provision automatically the Azure infrastructure

<https://github.com/sassoftware/viya4-iac-aws>

- Example scripts to provision automatically the AWS infrastructure

<https://github.com/sassoftware/viya4-iac-gcp>

- Example scripts to provision automatically the GCP infrastructure

<https://github.com/sassoftware/viya4-iac-k8s>

- Example scripts to provision automatically the OpenShift (based on VMWare) infrastructure

<https://github.com/sassoftware/viya4-ark>

- Scripts to automatically run a basic qualification of the infrastructure

<https://github.com/sassoftware/viya4-deployment>

- Example scripts to deploy the SAS Viya images and to configure the SAS Viya system in Kubernetes

<https://github.com/sassoftware/viya4-monitoring-kubernetes>

- Example scripts to provision automatically the monitoring and logging functionality. If the organization already use their one, it is encouraged to use the ones currently managed instead

RECOMMENDED READING

“Moving your SCE to the Cloud” (Phuse Poster Oct 2021), by Martin Doughty (OCS Consulting),

https://www.lexjansen.com/phuse/2021/pp/POS_PP09.pdf

“Migrating Your Clinical Development Environment to the Cloud” (PhUSE Paper 2020), by Antoine Maison (Debiopharm) & Daniel Christen (SAS Institute)

https://www.lexjansen.com/phuse/2020/li/PRE_LI01.pdf

Migrating SAS Processes to VIYA (Article early 2022), by Richard Paterson (OCS Consulting)

<https://ocs-sasconsulting.com/migrating-sas-processes-to-viya-by-richard-paterson/>

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