



Migrating SAS Viya to the AWS Cloud

AWS Prescriptive Guidance



AWS Prescriptive Guidance: Migrating SAS Viya to the AWS Cloud

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Migrating SAS Viya to the AWS Cloud

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SAS Viya is a cloud-enabled, in-memory analytics engine that provides quick, accurate, and reliable analytical insights. It uses elastic, scalable, and fault-tolerant processing that addresses complex analytical challenges while scaling for future use cases. SAS Viya has the following benefits:

- Fast processing for large-scale data and complex analytics, which includes machine learning, deep learning, and artificial intelligence.
- A standardized code base that supports programming in SAS and other languages, such as Python, R, Java, and Lua.
- Support for cloud, on-site, and hybrid environments. SAS Viya deploys to any infrastructure or application ecosystem.

This guide describes how to migrate SAS Viya to Amazon Web Service (AWS) and modernize your SAS workloads by using Amazon Elastic Kubernetes Service (Amazon EKS). It also discusses other architectural and design considerations in terms of costs, licenses, and best practices. The guide is intended for IT professionals who have both SAS and AWS expertise.

SAS Viya migration at a glance

Category	Attribute	Value
Workload	Source workload	SAS Viya 3.x
	Source environment	Unix, Linux
		On-premises/colocation
	Destination workload	SAS Viya
	Destination environment	AWS
Migration	Migration strategy (7 Rs)	Refactor/rearchitect

	Is this a workload version upgrade?	Yes
	Migration duration	Varies by customer
Assumptions and prerequisites	System limitations (minimum/maximum requirements)	SAS System Requirements
	Service-level agreements (SLAs)	SAS Technical Support Services and Policies
	Recovery time objective (RTO)	Backup and Restore: Recover from a Disaster
	Recovery point objective (RPO)	
	Licensing and operating model for the target AWS account	Bring Your Own License (BYOL)
	Migration tools	<ul style="list-style-type: none"> • Full-System Migration and Content Migration • AWS Database Migration Service (AWS DMS)
	AWS services used	<ul style="list-style-type: none"> • Amazon Elastic Kubernetes Service (Amazon EKS) • Amazon Elastic File System (Amazon EFS) • Amazon Elastic Compute Cloud (Amazon EC2) • Amazon Virtual Private Cloud (Amazon VPC) • Amazon EC2 Auto Scaling • AWS Identity and Access Management (IAM)

	Benchmarks	Contact the SAS Enterprise Excellence Center for benchmark information relevant to your site.
Compliance	Security and compliance requirements	Security Administration
	AWS Compliance Programs	SAS Governance and Compliance Manager

Costs and licenses

The cost of migrating a SAS workload to AWS assumes that you establish a new environment on AWS. This includes accounting for personnel time and effort in addition to provisioning computing resources and licensing software for the new environment.

Costs

SAS Viya is a cloud-native analytics platform on which the latest software offerings from SAS are built and run. SAS Viya offerings are delivered as a set of container images that are deployed with Amazon EKS.

To most accurately estimate the costs of establishing a new SAS Viya environment on AWS, use the [AWS Pricing Calculator](#). The calculator helps you estimate the monthly cost of AWS services, based on your expected usage. It is continuously updated with the latest pricing for all AWS services in all Regions and includes support for most AWS services. You can include additional costs, such as inbound-data and outbound-data charges and retrieval fees. You can also select Amazon EC2 with various pricing models, such as On-Demand, Dedicated, and Reserved Instances. We recommend that you use the calculator with the following baseline requirements for a SAS Viya deployment.

Baseline resource recommendations

The following table provides baseline resource recommendations for SAS Viya product offerings. The estimates are derived from SAS performance testing and intended for medium-sized deployment, which is defined as 10 concurrent users that access SAS Viya user interfaces. In SAS testing simulations, users manipulated datasets of 10–30 GB. The Amazon EC2 virtual machine instances used an Intel Xeon Platinum 8000 series processor or better. On AWS, the number of vCPUs for an instance is indicated by a number in the instance type name (multiplied by four). For example, the m5n.2xlarge instance type provides 8 vCPUs, which is the equivalent of 4 physical CPU cores.

The following table provides baseline resource requirements per offering.

Offering	CAS node group	Default node group	Additional managed-node groups*
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SAS visual analytics and SAS data preparation	<ul style="list-style-type: none"> • RAM: 128 GB per instance • CPU: 16 vCPUs or 8 physical cores per instance • Example: r5dn.4xlarge • Recommended minimum for CAS disk cache: 150 GB; ephemeral storage • Example number of machines: 4 	<ul style="list-style-type: none"> • RAM: 64 GB • CPU: 8 vCPUs or 4 physical cores • Example: m5n.2xlarge • Example number of machines: 1 	<ul style="list-style-type: none"> • RAM: 64 GB per instance • CPU: 8 vCPUs or 4 physical cores per instance • Example: m5n.2xlarge • Recommended minimum ephemeral storage for selected applications: 60 GB • Example number of machines: 1 per node group
SAS visual machine learning	<ul style="list-style-type: none"> • RAM: 128 GB per instance • CPU: 16 vCPUs or 8 physical cores per instance • Example: r5dn.4xlarge • Recommended minimum for CAS disk cache: 600 GB; ephemeral storage • Example number of machines: 8 	<ul style="list-style-type: none"> • RAM: 64 GB • CPU: 8 vCPUs or 4 physical cores • Example: m5.2xlarge • Example number of machines: 1 	<ul style="list-style-type: none"> • RAM: 128 GB per instance • CPU: 16 vCPUs or 8 physical cores per instance • Example: r5dn.4xlarge • Minimum disk: 2 x 128 GB • Example number of machines: 1 per node group

SAS visual data science	<ul style="list-style-type: none"> • RAM: 384 GB per instance • CPU: 48 vCPUs or 24 physical cores per instance • Example: r5dn.12xlarge • Recommended minimum for CAS disk cache: 1200 GB • Example number of machines: 9 	<ul style="list-style-type: none"> • RAM: 64 GB • CPU: 8 vCPUs or 4 physical cores • Example: m5n.2xlarge • Example number of machines: 1 	<ul style="list-style-type: none"> • RAM: 128 GB per instance • CPU: 48 vCPUs or 24 physical cores • Example: r5dn.12xlarge • Minimum disk: 2 x 128 GB • Example number of machines: 1 per node group
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* In addition to the CAS node group, four managed node groups are recommended to host the remaining SAS Viya workload classes.

These guidelines do not attempt to account for all ordering scenarios but are instead intended to illustrate typical software orders. SAS recommends that you consult with a sizing expert to obtain an official hardware recommendation that is based on your requirements. To request sizing expertise, contact your SAS account representative. For help with finding your SAS account representative, contact SAS at contactcenter@sas.com.

Licenses

Although SAS 9 and SAS Viya 3.x licensing models are based primarily on capacity metrics (that is, the number of processing cores), SAS Viya licensing follows a cloud-native model that uses boundless scaling. Core-based licensing does not make sense in the context of a dynamic containerized architecture. In an elastic cloud architecture, customers need the flexibility to fit their supporting infrastructure to their analytic needs in real time. The number and size of containers vary because containers are regularly spun up and down in response to the volume of software use. This fundamental aspect of containerized cloud architectures means that licensing is unrelated to the number of SAS Cloud Analytic Services (CAS) and Programming Runtime Environment (SPRE) cores. But it is related to the number of users, types of users, and total revenue.

Pricing metrics depend on the SAS Viya license offer. Furthermore, SAS and ACCESS products are no longer licensed separately but are included in their respective offerings. For SAS Viya offerings that are priced by user type, authorized users are distinct: data scientists, power users, and viewers. Each user is licensed separately and has its own quantity and price so that the value of users is better aligned with tasks and how customers use the software.

Each licensed user must have a unique ID and authorization to access the software. Unlike the policy for total-user licensing, guest users are prohibited because they do not have authorized user IDs. Additionally, licenses for some user types do not apply to some offerings. The only SAS Viya offering that has a user minimum is SAS Model Manager (on SAS Viya), which requires a minimum of five authorized data scientists.

Assumptions and prerequisites

Knowledge requirements

The SAS Viya software uses containers to deploy to a Kubernetes cluster. The deployment is declarative and is based on a custom manifest that you create by using Kustomize. To deploy, update, and manage the SAS Viya software, you should have knowledge of the following:

- Experience with the cloud provider that your site uses to deploy SAS Viya.
- Kubernetes declarative deployments that use manifests and Kubectl.
- Kustomize and a kustomization file to customize your deployment.
- Kubectl commands to perform operations, such as `kubectl apply`, `kubectl taint`, `kubectl label`, and `kubectl logs`.

For more information, see the [Kubernetes documentation](#).

System requirements

There are many system requirements that are different from previous releases of SAS Viya. For example, SAS Viya requires Kubernetes to be deployed.

A shared file system is required for multiple purposes, including shared data storage and private user directories. A file server that uses the network file system (NFS) protocol is a minimum requirement. In an AWS environment, Amazon Elastic File System (Amazon EFS) performed well in SAS testing. The following options are recommended for Amazon EFS:

- Set the performance mode to the maximum I/O.
- Provision the throughput mode with 1,024 MiB/s or greater.

For more information, see [System Requirements for SAS Viya](#) in the SAS documentation.

It is also assumed that you are familiar with all of the system requirements needed for a successful deployment. For more information, see [System Requirements for SAS Viya](#).

Full-system migration and content migration

Content migration

Content migration is defined as moving content from one system to another. Note that the SAS 9 process for this is different from the SAS Viya process.

Full-system migration

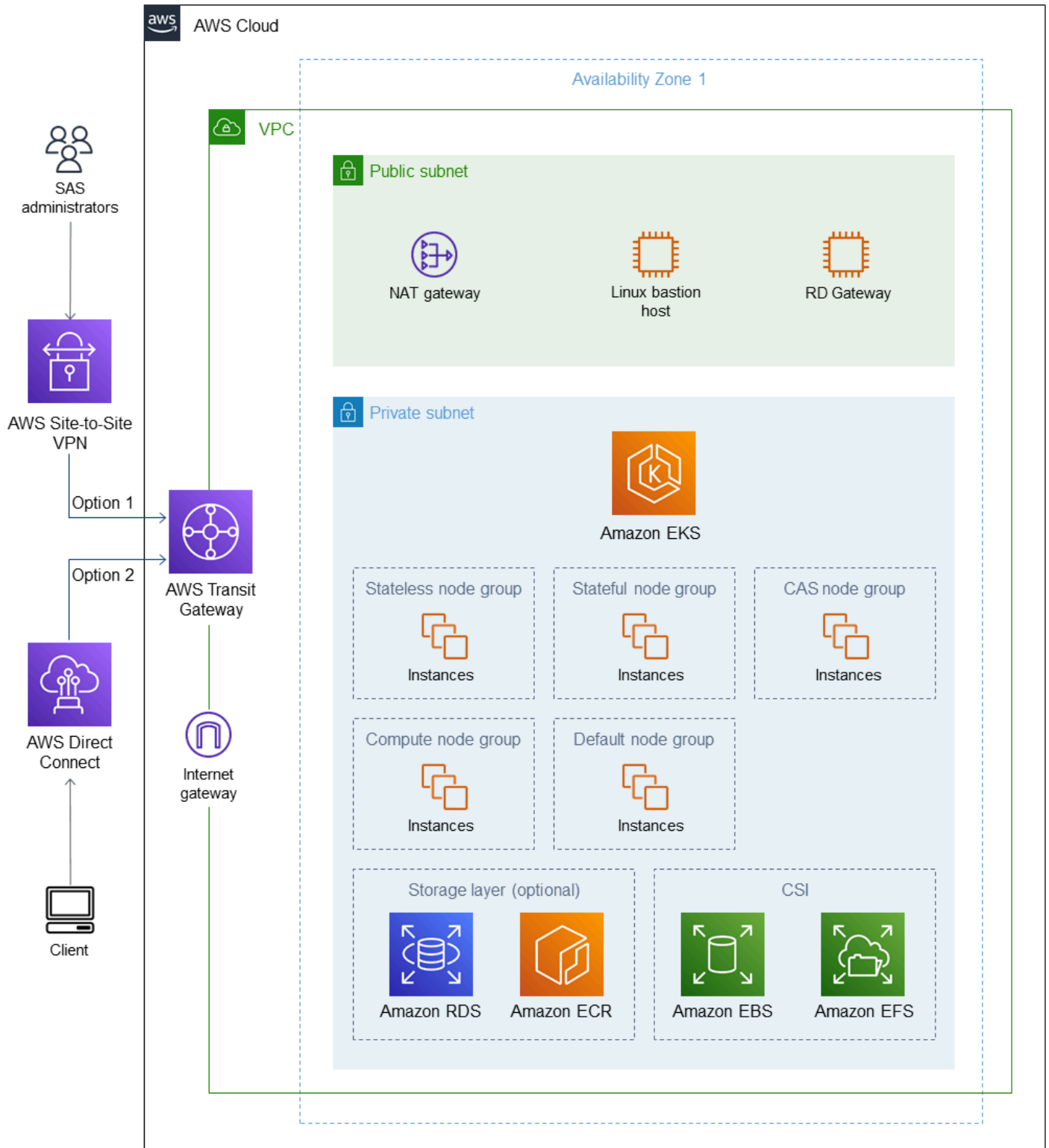
Full-system migration is defined as moving an entire SAS Viya system from one deployment to another. The target deployment can be either the same version or a more recent version of the software. You cannot migrate an entire SAS 9 system to SAS Viya. Instead, you must promote content from SAS 9 to SAS Viya.

If you move from SAS 9.4 to SAS Viya, you can migrate only content, which SAS considers a content migration. Migrating an entire system is considered a full-system migration. If you migrate from SAS Viya 3.x to SAS Viya, the entire system is backed up and restored, which is a full-system migration. Neither a content migration nor a full-system migration should be confused with an upgrade, which involves installing new releases of software on an existing system. Upgrade support is provided by SAS deployment tools, such as SAS Deployment Wizard, SAS Deployment Manager, and a SAS Viya playbook.

Architecture

Earlier SAS platforms, such as SAS 9.4 and SAS Grid Manager, run on AWS, and users can expect to see cost benefits and performance boosts depending on their selected compute and storage options. (Note that the Always-On Amazon EC2 instance-based system must provision itself for peak workloads.) The SAS Viya on Amazon EKS architecture illustrated in the following diagram not only helps with shifting workload demands but also provides the following benefits:

- Containerized microservices
- Support for continuous integration and continuous delivery (CI/CD)
- Small memory footprint
- Fast startup times
- Default multitenancy configuration
- Subscription-based pricing choices
- Overall reduced cost



The SAS Viya architecture contains the following components:

- AWS Site-to-Site VPN allows SAS users to securely connect from their on-premises network or branch office to SAS Viya deployed on a virtual private cloud (VPC).
- AWS Direct Connect allows users to connect to their SAS Viya VPC through a dedicated private network connection.
- AWS Transit Gateway connects VPCs and on-premises networks through a central hub. This simplifies your network and puts an end to complex peering relationships. It acts as a cloud router – each new connection is made only once.
- An internet gateway is attached to your VPC. By default, it comes with a security group that allows no inbound traffic and all outbound traffic to the internet.
- In the public subnet:
 - A NAT gateway allows for instances in the SAS Viya private subnet to connect to the internet.
 - A Linux bastion provides secure access to the SAS Viya instances located in both the public and private subnets.
 - A Remote Desktop (RD) Gateway instance provides remote administration. This gateway uses remote desktop protocol (RDP) over HTTPS to establish a secure, encrypted connection between remote users on the internet and Windows-based EC2 instances.
- In the private subnet:
 - Amazon EKS resource group with at least five node groups, identified by the work that they perform, optimizes the workload balance. These resource groups include stateless, stateful, cloud analytics services (CAS), compute, and default.
 - (Optional) A storage layer uses Amazon Relational Database Service (Amazon RDS) for PostgreSQL for the SAS Viya infrastructure data server and Amazon Elastic Container Registry (Amazon ECR) to store, manage, share, and deploy SAS Viya container images and artifacts anywhere.
 - Amazon Elastic Block Store (Amazon EBS) and/or Amazon EFS persist SAS datasets by using a container storage interface (CSI).

Configuration options

SAS CAS provides the run-time environment where data management and analytics take place. The CAS server can be deployed to a single node or across multiple nodes. Deploying the CAS server on a single node facilitates symmetric multi-processing (SMP) and performs serial loads of data into memory from supported data sources.

The in-memory analytic features of a distributed CAS server are available to the single-node CAS server. Distributing the CAS server across multiple nodes enables massively parallel processing (MPP). One advantage of MPP is that, when possible, data is loaded into memory in parallel, which provides faster load times.

Resource recommendations

There is no difference in the choice of instances between SAS 9.4 and SAS Grid Manager. That is, the deployment automatically selects EC2 instances that have good throughput, such as the I3e(n), M5(n), and R5(n) family of instances.

Use the following nodes according to their workload sizes and requirements:

- Single large deployment: 5 or more nodes
- Two or more large deployments: 7 or more nodes
- With Amazon EC2 Auto Scaling, use the following:
 - 2 or more nodes per node group
 - 1 node in the default node group

High-level, full-system migration steps

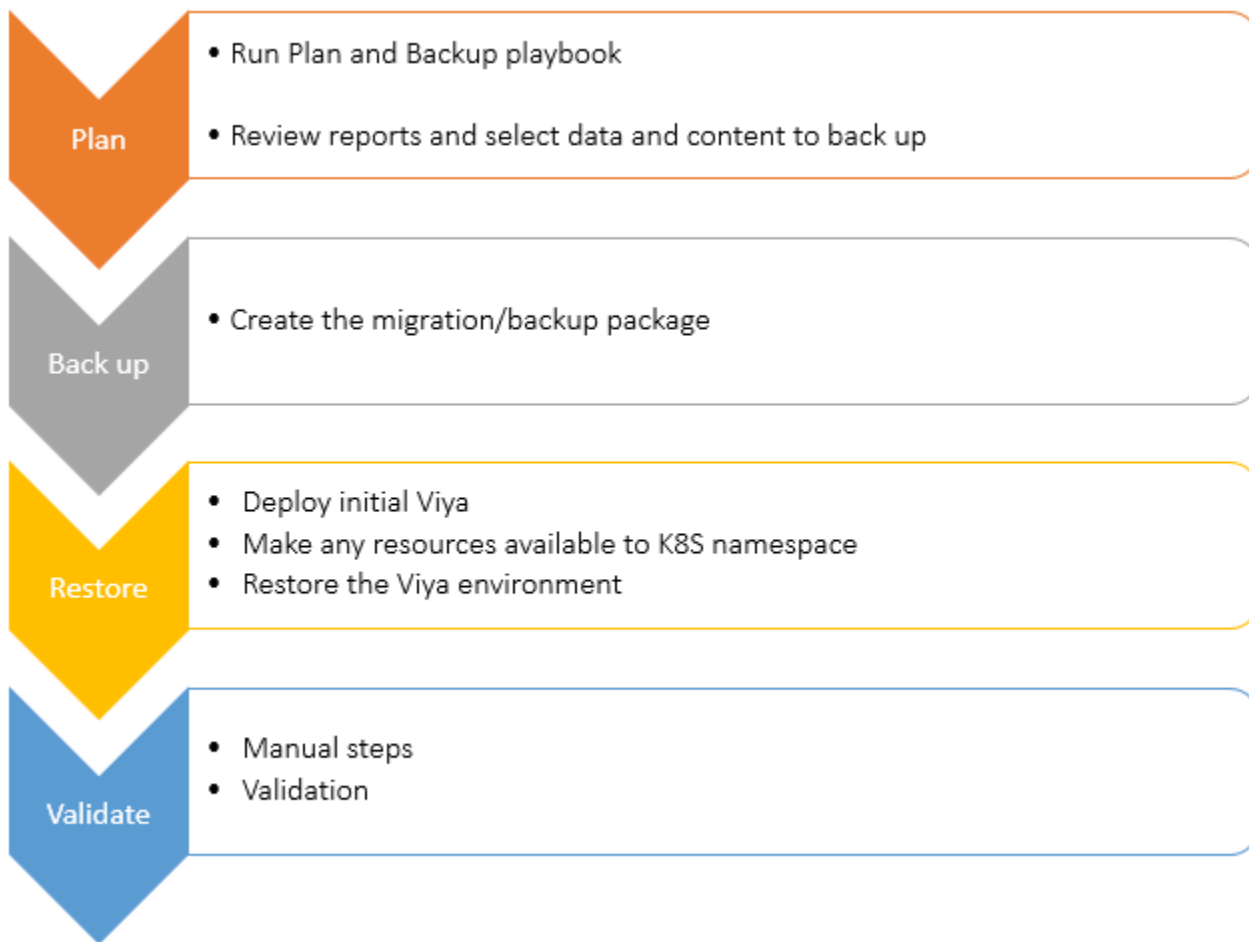
Note

This document is based on the 2020.1.5 stable release of SAS Viya 4. For more information, see [Full-System Migration and Content Migration](#) in the SAS documentation.

A full-system migration to SAS Viya 4 moves content and data from a specific version of a SAS Viya on-premises deployment (or from a SAS Viya deployment) in a hosting facility to a SAS Viya 4 cloud-based environment.

A full-system migration is a four-step process: plan, back up, restore, and validate. Although each step is independent, a successful full-system migration requires that you complete each step in order. An Ansible playbook lets you properly plan and back up your migration content so that you can curate what is migrated.

The following diagram illustrates the steps involved in migrating a Viya 3.x deployment to Viya4.



Supported scenarios for full-system migration

Full-system migration to SAS Viya 4 includes moving content and data from a single-tenant SAS Viya 3.4, a single-tenant SAS Viya 3.5, or from an existing SAS Viya 4 deployment. This document covers the following target SAS Viya 4 scenarios:

- Migrating to a private cloud
- Migrating to a public cloud

You cannot migrate from the following SAS Viya environments:

- SAS Viya 3.3 or earlier
- Multitenant environments
- Microsoft Windows environments

- PowerLinux (PLX) environments
- SAS Viya 3.x or SAS Viya 4 SMP environments to SAS Viya 4 MPP environments
- SAS Viya 3.x or SAS Viya 4 MPP environments to SAS Viya 4 SMP environments

Furthermore, you cannot migrate from SAS 9.x environments by using the same tools, processes, and steps that are used to migrate from SAS Viya, but content migration of SAS 9.x content is supported. For more information, see [Migration from SAS 9.4: Tasks](#) in the SAS documentation.

Using Ansible for full-system migration

Ansible is configuration-management software that provides a way to move to SAS Viya 4 by automating the commands for migrating and controlling content. SAS provides a playbook that facilitates this. For a list of supported versions, see [Ansible](#) in the *Support for Operating Systems and Environments in SAS Viya 3.5* documentation.

To use Ansible for migration, customize your environment's files, and run the migration commands according to the values in those files. The files, known collectively as the *Plan and Backup Ansible Playbook*, provide the instructions for which content is migrated to which machines.

The migration process includes a planning step that runs scans and publishes a report in addition to a step that backs up the SAS Viya 3.x environment. Each step involves running an Ansible command that evokes a play—specifically, a scan play and a backup play.

Use the inventory plugin of the SAS Viya command line interface (CLI) to generate the Plan and Backup Ansible Playbook.

SAS Viya 3.x deployment file used by full-system migration

The `inventory.ini` file that is created during the SAS Viya 3.x deployment is used by Ansible to migrate to SAS Viya. The `inventory.ini` file defines which machines (or hosts) the SAS Viya components reside on.

Step 1. Plan

You should understand the source environment and plan for what you want to migrate and what your target environment's characteristics are. The SAS administrator inventory CLI plays a key part in migration to Viya. The inventory CLI:

- Generates the Plan and Backup Ansible playbook.
- Delivers the SAS Viya inventory reports.
- Supports the system backup and user-created content of the migration package.

For more information, see [Step 1: Plan \(SAS Administrator\)](#) in the SAS documentation.

Step 2. Back up

You can use the Ansible playbook to create the migration backup package. The Ansible playbook uses the backup CLI to package the Viya system content and configuration.

Running the backup play of the Plan and Backup Ansible playbook does the following:

- Initiates another scan of the environment. If enough time has passed since you ran the scan play, this helps to ensure that any changes in the environment are also reflected in the scan.
- Creates the SAS Viya 3.x migration package.

For more information, see [Step 2: Back Up \(SAS Administrator\)](#) in the SAS documentation.

Step 3. Restore

The restore process creates a new Viya deployment and restores the content of an existing environment into it. This requires elevated privileges in the Kubernetes cluster and involves using Kubectl and Kustomize to modify the Kubernetes objects in the cluster to restore the content from the package to the new environment.

For more information, see [Step 3: Restore \(Cluster Administrator\)](#) in the SAS documentation.

Step 4. Validate

SAS Viya 4 provides the SAS Viya 4 inventory and SAS Viya comparison reports for comparing content between the source SAS Viya 3.x and target SAS Viya 4 environments. These reports and the associated SASVIYATYPES table are accessible through the SAS environment manager.

For more information, see [Step 5: Validate](#) in the SAS documentation.

Resources

SAS documentation and resources

- [A First Look at Migration from SAS Viya 3.x to SAS Viya](#)
- [SAS Viya Administration](#)
- [SAS Viya Operations](#)
- [SAS Viya 4 Infrastructure as Code \(Terraform scripts\)](#)
- [SAS Viya 4 Resource Guide](#)
- [SAS Viya 4 Deployment \(Ansible\)](#)
- [Demo: Migration to SAS Viya](#)

AWS documentation and resources

- [Getting started with Amazon EKS](#)
- [Getting started with Amazon EFS](#)

Kubernetes resources

- [Kubernetes documentation](#)

Document history

The following table describes significant changes to this guide.

Change	Description	Date
Initial publication	—	June 9, 2021