Migrating from SAS® 9.4 to SAS® Viya® 3.5

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ABSTRACT

SAS Viya brings with it a wealth of new analytic and data management capabilities, as well as a resilient, scalable, and open architecture. Users of SAS 9.4 need an easy path to migrate their workloads to SAS Viya in order to leverage these platform capabilities.

In this paper, we discuss your options for adopting SAS Viya to complement, and in some cases replace, a SAS 9.4 environment. The options fall into three general categories: interoperability, content promotion, and replacement. We discuss how SAS 9.4 clients can **interoperate with SAS Viya's analytic servers. Further, we describe how you can promote** content like library definitions and SAS Visual Analytics reports from SAS 9.4 to SAS Viya, all the while taking advantage of backward compatibility as you bring SAS programs forward. Finally, we cover scenarios in which you can completely replace SAS 9.4 workloads with equivalent SAS Viya product support.

Along the way, we highlight SAS tools that can ease the migration process. For example, the Content Assessment tool profiles your SAS 9.4 metadata and helps you determine which content is ready for promotion to SAS Viya. SAS Management Console creates packages **that feed into SAS Viya's transfer framework. And if you've already deployed SAS Viya, its** backup and restore utility supports migration from one SAS Viya environment to another.

INTRODUCTION

Since **SAS Viya's inception in 2016, users are finding an increasing number of reasons to** modernize their SAS 9.4 environments. Some of the more common motivators are described below.

OPEN-SOURCE LANGUAGES

Python and R are gaining popularity as languages of choice for data scientists. While some SAS 9.4 tools support limited integration for open-source model development, SAS Viya supports these languages as first-class citizens alongside the SAS programming language.

DEEP LEARNING

This advanced machine learning technique trains a computer to perform human-like tasks, such as speech recognition and image identification. Such training involves multiple layers of pattern-recognition processing with enormous amounts of unstructured data. This calls for the type of highly distributed, performant analytics engine provided by SAS Viya.

SPEED

SAS Viya's in-memory CAS server is specifically designed for analytic workloads, which benefit from divide-and-conquer approaches over large amounts of data. In addition, multi-user applications benefit from its shared memory capability and virtual memory approach to extend physical memory. Finally, data uploads can be accelerated through parallel connections directly to CAS server worker nodes.

CLOUD

Although many users install SAS 9.4 in public and private cloud environments, SAS Viya is uniquely architected to realize the benefits of moving workloads to the cloud, like quicker deployment and dynamic scalability.

HIGH AVAILABILITY

Keeping production systems operating 365/24/7 is a de facto requirement for most enterprise customers. SAS Viya provides a platform that can be deployed with no single points of failure, delivering this required high availability.

While these motivators are in many cases compelling, migrating SAS 9.4 workloads to SAS Viya is typically a gradual process, rather than an immediate wholesale adoption. Invariably, some customers choose to deploy SAS Viya side-by-side with SAS 9.4, and to incrementally transition workloads based on such factors as the following:

- End users becoming familiar with the new interfaces

- Business unit / departmental readiness

- Availability of target machines supporting SAS Viya

- Functional replacement value becoming available in SAS Viya

During this period of transition, you can take advantage of seamless interoperability between SAS 9.4 programming clients and SAS Viya CAS servers, as described in the next section.

In considering transitioning workloads to SAS Viya, the following definitions apply to terms used in this paper:

Migrate
To move a workload from one SAS environment to another. This frequently involves moving to a more recent software version, but can also apply when moving to different hardware, operating systems, cloud infrastructure, or geographic location. The differentiating characteristic is that processing of the workload ceases in the originating environment and resumes in the target environment. In many cases, migration implies deploying a new target environment.

Promote
To copy or move user content from one SAS environment to another. Examples of user content are models, reports, views, library definitions, formats, authorization settings, and data plans. You can selectively choose a subset of content to promote, allowing for incremental movement from one environment to another. In many cases, promotion implies that your target environment is already deployed and operational.

Update
To install, in-place, a new version of SAS software that does not require a new software order. Updates typically involve minor features and bug and security fixes.

Upgrade
To install, in-place, a new version of SAS software that requires a new order. The software components of your environment are replaced with the newer versions. Upgrades typically involve major new features.

Because SAS Viya represents a completely different architecture from SAS 9.4, transitioning to it implies either migration or promotion. You cannot update or upgrade-in-place to move from SAS 9.4 to SAS Viya.

INTEROPERABILITY

Some sites choose to perform a phased migration to a new release of SAS. For example, you might install SAS Viya in the same environment as SAS 9.4 and move your workload gradually rather than all at once. If you go this route, you might discover along the way that SAS 9.4 is so well integrated with SAS Viya that you can continue to run them as a single **deployment, a "SAS Platform." That's because, with SAS Viya 3.3 and later, base processing** functionality is shared between SAS 9.4 and SAS Viya. As a result, you can continue to use your existing SAS 9.4 projects and code while leveraging enhancements and features that are only available in SAS Viya.

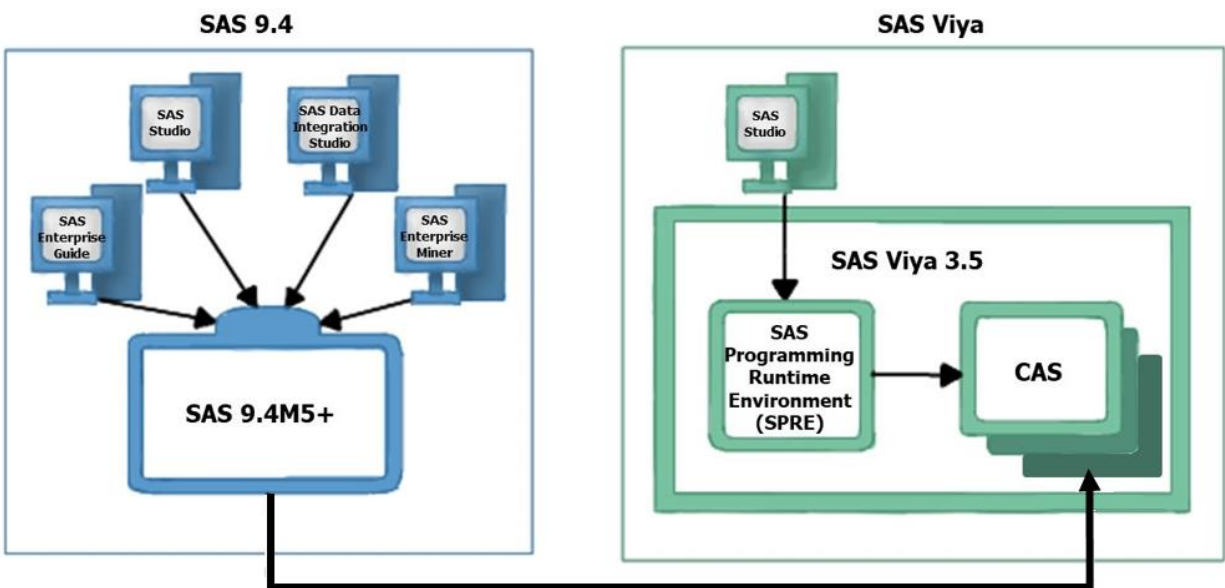**Here's an illustration** of interoperating SAS 9.4 and SAS Viya deployments:

Figure 1. SAS 9.4M5 (and later) and clients interoperate with SAS Viya

Users in your organization can continue to use tools such as SAS® Studio, SAS® Enterprise Guide, or SAS® Data Integration Studio to write and deploy programs that execute SAS 9.4 code and run SAS Viya procedures, transparently using both a SAS 9.4 server and a CAS server. All SAS programs are initially submitted to either the SAS 9.4 engine or SAS programming run-time environment engine, depending on the client and the program. The default engine in this type of hybrid deployment is the CAS server. Some of your 9.4 code might be CAS-enabled. If the associated source and target tables exist in CAS, the process runs in CAS. The SAS workspace server is there to pick up any code that is not CAS-enabled, or that does not have the required tables in CAS.

You can keep your SAS 9.4 products and also add newer SAS Viya products, gaining functionality without having to replace what you have. The only additional configuration that is required to enable the two environments to work together is related to security. Before you can submit programs to the CAS server from SAS 9.4, install security certificates and authorize clients to connect to the CAS server. The SAS Viya Administration documentation describes the required steps.

In establishing an environment in which SAS 9.4 and SAS Viya interoperate, your object should be to enable the powerful CAS server to access your SAS 9.4 data and reports. You have several options for achieving this goal:

- In SAS Visual Analytics for SAS Viya, use the self-service import feature.

- In SAS Environment Manager for SAS Viya, load data interactively.

- Move selected data into SAS Viya on the fly. Write code to load data into CAS, or just use the available SAS or CAS tasks. For example, SAS Enterprise Guide 7.1.3 and later offers the Upload to CAS task.

- Use SAS 9.4 components to move data into SAS Viya where CAS can access it. Both SAS Enterprise Guide and SAS Add-In for Microsoft Office enable you to move data from SAS 9.4 to CAS. The documentation for these products provides instructions.

- In any SAS programming client, write code to load data. Therefore, you can write code that enables CAS to load SAS 9.4 data. The SAS Viya Programming documentation contains more information.

- Use SAS/CONNECT to move and share data between SAS 9.4 and SAS Viya. SAS 9.4M4 and earlier require SAS/CONNECT to support SAS 9.4 programs running in SAS Viya. With SAS 9.4M5 and later, SAS/CONNECT provides add-on functionality but is no longer **required to support an integrated "SAS Platform."**

Your SAS 9.4 data inevitably resides on a real or virtual disk; however, SAS Viya processes data in parallel from CAS server memory. You can use SAS/CONNECT to retrieve data from your SAS 9.4 deployment and transfer it directly into memory in SAS Viya. SAS/CONNECT comprises tools that let you process data on a remote server, transfer SAS 9.4 data into CAS tables, perform backups, and automatically handle issues with data encoding incompatibilities. For more information, see the *SAS/CONNECT for **SAS Viya User's Guide***.

CHALLENGES OF AN INTEGRATED SAS PLATFORM

The requirement for dual maintenance is surely the most significant challenge to an integrated SAS 9.4 - SAS Viya environment. Another challenge can arise when administrators re-import SAS 9.4 content into SAS Viya to keep it up to date with the latest changes. SAS Environment Manager will warn you about imports that will overwrite preexisting content to avoid unintended updates. You can also use the sas-admin transfer command-line plug-in to import the SAS 9.4 content; however, the service does not provide these warnings.

You can install SAS 9.4 and SAS Viya on the same machine, but they require a lot of resources. Also, beware of port conflicts, especially for these components:

- SAS/CONNECT

- SAS Studio

- The object spawner

System requirements for SAS 9.4 and SAS Viya are different. SAS Viya supports different operating systems and a different version of the JRE. But the most significant differences between these platforms relate to user access and authentication. SAS Viya does not use the SAS 9.4 Metadata Server to store user identities and instead provides a service that draws information about users and groups from LDAP. In addition, SAS Viya requires two different, broad authorizations to be configured for users: authorization for access to folders and their contents, and authorization to access data in caslibs. By default, every user in your SAS 9.4 ecosystem is denied access to data, reports, and user interfaces in SAS Viya.

Although in most cases you can run existing SAS code in CAS, DATA step code often requires modification because CAS will execute it across multiple worker nodes, so some variables must be adapted for multithreaded execution.

CUSTOMER SCENARIOS: INTEROPERABILITY

One very large customer has been using SAS Enterprise Miner for over 25 years. They have recently deployed some new sensor technology that has resulted in an exponentially increased amount of data collection. In their highly regulated industry, they must use stringent security, which **has resulted in an unfortunate silo effect: the new sensor data isn't** easily accessible to SAS 9.4 because it requires a much higher-capacity storage environment. However, they would like to include the new data in models that analyze legacy data sets so that they can predict events and costs. Analysts and data scientists are widely distributed but ideally, they would all see the same data.

This customer found a sweet spot when they deployed SAS Viya 3.5 in addition to their SAS 9.4 solutions. The last thing they wanted to do was attempt to promote the many hundreds of tables and reports that they had created over decades of SAS usage. However, they recognized that SAS Viya offers some powerful analytical tools, such as machine-learning algorithms and streaming analytics, that would draw unique insights from their incoming sensor data in near real time. So they leveraged the granular permissions of caslibs to provide employees with access to data with pinpoint precision. Many of these employees are still using SAS 9.4 programs and reports, but now they can also use the CAS server to extend their reach and rapidly analyze incoming sensor data. With selective access to ultra-secure databases via caslib permissions, they can then incorporate the results into their SAS 9.4 models. Other employees are building new models to apply machine learning to the same data sets.

Many legacy SAS customers find that, by revising only a few lines of their code, their SAS 9.x programs can run in CAS, significantly increasing the speed of execution. As one example, a longtime customer in the health care sector installed SAS Viya and discovered that, by making minor updates to their Base SAS code, they could reduce the time required to run their quarterly reports from four weeks to one week. The code updates were trivial: changing the source and target tables in their DATA step processes from librefs to caslibs **and changing PROC SQL code to PROC FEDSQL. Now that they're using both SAS 9.4 and** SAS Viya 3.4, their reporting occurs monthly rather than quarterly. Yes, CAS is that fast.

CONTENT PROMOTION

Promoting SAS content lets you selectively move it from one environment to another, such as from a testing environment to a production environment. Content promotion is frequently required to make a transition from SAS 9.4 to SAS Viya. Content promotion also enables you to make a larger shift, such as moving your on-premises SAS resources to a cloud environment.

Promotion might also be a best practice if your organization has deployed SAS Viya, but multiple users are still actively running SAS 9.4 programs, deploying SAS 9.4 models, or accessing SAS 9.4 reports. In that scenario, promotion—copying content from SAS 9.4 to SAS Viya—will enable those users to take advantage of the more powerful CAS server and will provide greatly enhanced API interfaces. And gradually eliminating SAS 9.4 tools and programs will eventually reduce overhead for SAS administrators.

SAS product documentation covers the topics of migration and content promotion from an older version of SAS 9.x to SAS 9.4 very thoroughly. In this paper, we will focus on content promotion from SAS 9.4 to SAS Viya 3.4 or 3.5.

WHAT IS CONTENT PROMOTION?

Content promotion occurs in three phases: content assessment, content export, and content import. When you promote SAS 9.4 content to SAS Viya, you complete three basic steps:

1. Make your data available to the CAS server. (Data is not included in content promotion.)

    You can do that by copying it to the CAS server machine, or by granting the CAS server access to the data on another machine. SAS provides some utilities to help with the copying process, including SAS/CONNECT.

2. Export selected SAS 9.4 content into SAS package (SPK) files. That content might include SAS 9.4 reports, templates, models, authorization rules, and more. You are not required to promote all content.

3. Import your SAS 9.4 content, transforming it into a new format for SAS Viya.

    The transformation is performed automatically, based on *mappings*. You can edit your mapping files for additional control over the import process.

Any required content transformation only takes place during the import phase. The entire process relies on your intentional actions, and the exported content is unaltered.

In all cases, SAS recommends that you perform content promotion from a SAS deployment that is functioning well, into a SAS deployment that is also functioning well. Check your logs, and use SAS Environment Manager to assess the health of each environment before you start the promotion process.

WHAT CAN BE PROMOTED?

The following table summarizes the types of resources that you can promote from SAS 9.4 to SAS Viya, or from an earlier version of SAS Viya to the current version (3.5):

Platform Versions	Resources that Can Be Promoted
SAS 9.4 to SAS Viya 3.5	Content: folders, reports, and explorations Supporting resources: graph templates, themes, and images Data definitions: LASR and Base libraries and tables User groups: identities; most metadata-only groups Authorizations: most explicit access control entries (ACEs) for promoted objects
SAS Viya 3.3 or 3.4 to SAS Viya 3.5	Content: folders, reports, data plans, statistical models, themes, and job requests/definitions/schedules Supporting resources: graph templates, images, files, and comments CAS authorization: all direct access controls for promoted objects General authorization: all direct rules for promoted objects

Table 1. Resources supported for content promotion

Note that when you promote identities, you are actually preserving authorization settings that are associated with the promoted content. Users are not promoted. Where possible, some SAS 9.4 authorization objects, such as access control entries, are converted to rules in the SAS Viya authorization systems. For example, if such entries correspond to CAS access controls that can be applied directly to a caslib or a table, they are promoted. Any SAS 9.4 groups that also exist in LDAP are *not* promoted because SAS Viya uses LDAP directly instead of storing group objects; however, authorization settings associated with the groups *are* transferred to SAS Viya.

SAS never forces you to move your actual data. However, if your SAS 9.4 environment includes a SAS LASR Server, SAS Management Console can export LASR libraries into LASR-based caslibs, which load that data into the CAS server. Often, **it's easier just to leave the data where it is** and to create path-based caslibs that point to it.

PROMOTION TOOLS

SAS provides tools to help you at every phase of content promotion:

Assess: Use SAS Content Assessment, a CLI tool to help you plan for a migration. SAS Content Assessment analyzes existing SAS 9.4 content registered in the SAS Metadata Server, such as reports, custom graphs, configuration items, and even licenses, and publishes the results. It also scans the local file system and SAS Content Server for SAS content. Multiple filters help you evaluate the likely quality of SAS data once imported. And it creates data sets with all the SAS 9.4 configuration items that it has assessed. You can then use SAS Data Explorer to import the data sets into SAS Viya 3.4 or later for analysis using SAS Visual Analytics reports.

Export: In SAS Management Console, use the Export SAS Package Wizard, or use SAS 9.4 command-line tools. Then use the transfer plug-in to the sas-admin CLI (available in the SAS Viya Admin Tools package) to create content mappings.

Import: In SAS Environment Manager on SAS Viya, use the Import Wizard. The following diagram provides an overview of the export-map-import process:
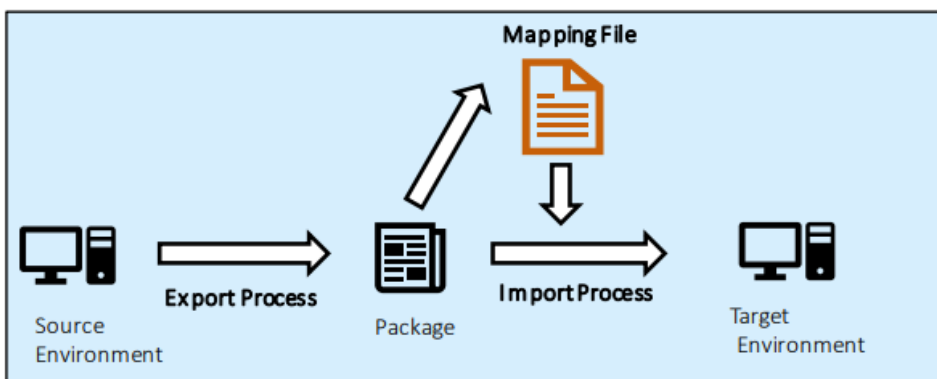

Figure 2. The export-import process

Another import option is to use the sas-admin transfer plug-in to upload SPK files to the SAS Viya environment. This method often requires manually merging the content mapping file with a second mapping file that is created by the content upload process. However, you can use the same transfer tool to import the content into SAS Viya while pointing to the merged mapping file.

You should plan to export SAS 9.4 content in separate packages, by type: identities; libraries; tables; and reports. Then when you import, keep in mind that in order to enable SAS 9.4 resources that have dependencies to function properly in SAS Viya, the resources

on which selected objects depend must already exist in the target environment. For example, if you want reports to function properly, the target environment must include all of the following:

- tables on which the reports depend

- caslibs that contain the tables

- identities that support user authorization to access the content

You probably don't know much about SAS content dependencies off the top of your head, and that's ok. SAS Content Assessment analyzes content and reports on all dependencies. **Here's an example of** a report from SAS Content Assessment:
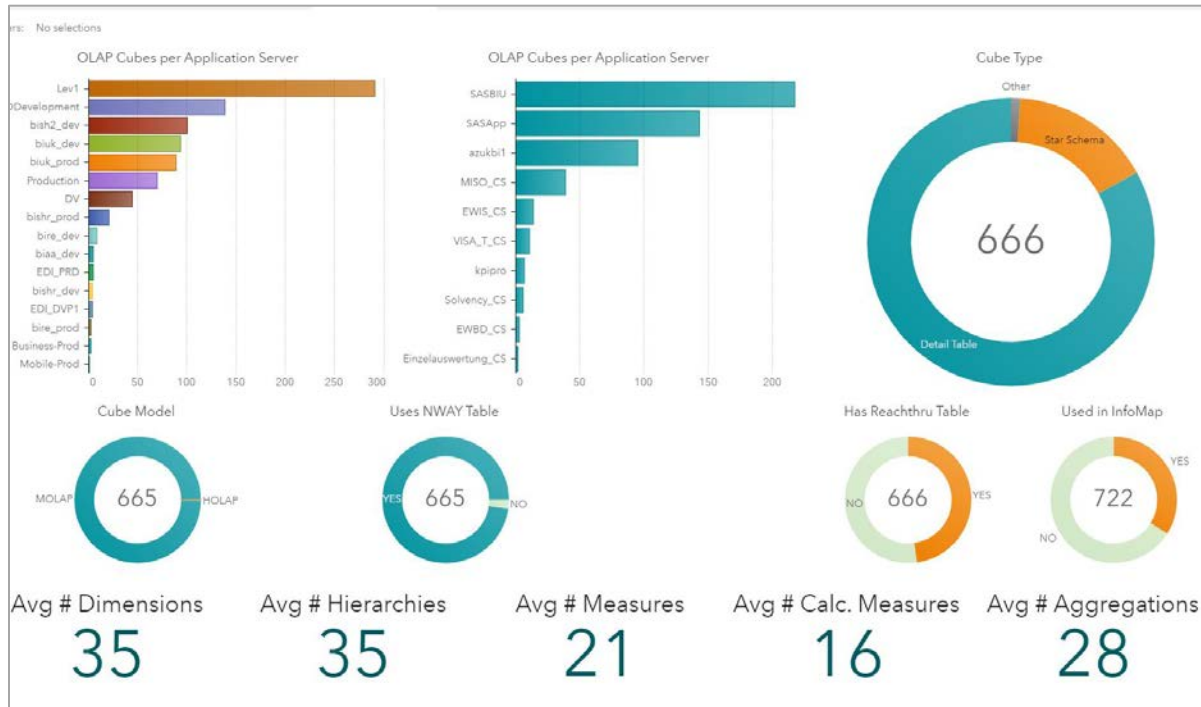

Figure 3. Report from SAS Content Assessment

When you are ready to import your SAS 9.4 SPKs, the first step is to examine and modify your mapping (JSON) file. Then you can use either the import wizard in SAS Environment Manager or the SAS Viya transfer plug-in to the sas-admin CLI to select source files, load them, and verify the completed environment.

BEST PRACTICES

It's a good idea to examine some SAS 9.4 reports before you embark on full-scale content assessment. SAS Environment Manager for SAS 9.4 offers Service Architecture reports that can reveal the types and locations of your SAS content, lists of users and groups, and your **SAS data libraries. You can run these reports to get a "lay of the land" before you even** install SAS Content Assessment. The SAS 9.4 Platform Object framework enables these reports and also supports other queries of your metadata, including relationships among objects in the folder tree, using the sas-relationship-reporter CLI tool.

Import SAS 9.4 content types into the SAS Viya environment in a specific order. Otherwise, the software might not make correct associations between dependent resources. For example, if the relevant caslib already exists in the target deployment, the promoted tables are accurately mapped to that caslib once you import them. The key to importing in the

correct order is ensuring that you export a separate package for each resource type. Here are some additional tips:

1. **Identities (users and groups).** Export them from the security folders in SAS 9.4 metadata to a separate export package.

   Exclude any groups that you do not need in SAS Viya.

2. **LASR libraries; Base SAS libraries; tables.** If you export these items directly from the library definition in metadata instead of from the folder tree, you can avoid creating unneeded folders in the target deployment. SAS Viya does not store these items in folders, yet it creates an empty folder for each folder object in your SPK.

   Export libraries in a separate package from tables. That way, you can import libraries before tables. Libraries can then be available for mapping to the tables when they are imported.

3. **Content and reports.** If you export them from the base of the folder tree, all access control lists (ACLs) that are associated with them are included in the SPK.

Prior to importing, make sure that users and groups are configured correctly in LDAP. And because physical data is not promoted, do some testing to ensure that required data and formats are accessible to the SAS Viya environment.

Import resources in the following order: first groups (identities), then libraries, then tables, and then reports (explorations).

Drawbacks of Content Promotion

At scale, content promotion simply takes longer and is less reliable than a traditional migration. For example, in order to promote content that is associated with data stored in libraries other than LASR and Base, you must first provide equivalent data in CAS libraries in your SAS Viya environment. Then you must make sure that your mappings include associations between the promoted content and the data in the new caslibs.

Because SAS Viya security mechanisms are so different from those in SAS 9.4, you can only promote users and user groups. You cannot promote other types of security objects, such as domains, roles, or access control templates. If you think it will be easier to start fresh in SAS Viya, you might consider not promoting any of your SAS 9.4 authorization settings. You would still have the option to use SAS 9.4 batch tools to translate selected SAS 9.4 permissions into SAS Viya permissions. Then you can use sas-admin command-line tools to apply these permissions.

Stored processes run only in SAS 9.x. You must therefore perform manual mapping steps to enable reports in SAS Viya to call stored processes in SAS 9.4. And each time the stored process is called, the user is asked to authenticate to SAS 9.4.

Finally, if you have user-defined formats, those objects are not included in the promotion and must be converted to a format that CAS can read. Custom themes require some manual configuration in SAS Visual Analytics for SAS Viya before they can be used by reports. And your SAS Visual Data Builder jobs cannot be promoted; however, the tables that they create can be used in SAS Viya.

EXAMPLE WORKFLOW: CONTENT PROMOTION

SAS consultants routinely urge legacy SAS 9.4 customers to use the promotion tools to make the move to SAS Viya because the results are predictable and reliable. An efficient workflow might resemble the following:

1. Deploy SAS Viya in your environment and start acclimating yourself and a few key users.

2. Run some of the SAS Environment Manager SAS 9.4 Service Architecture reports so that you can gauge the scope of the effort that will be required to promote SAS 9.4 content. These reports help you locate key SAS data libraries.

3. In SAS Viya, create caslibs that point to your SAS 9.4 data libraries.

4. Run SAS Content Assessment to create a full inventory of the SAS 9.4 content that you want to continue using in SAS Viya.

5. Use the data stores that SAS Content Assessment creates, or use the tools in SAS Management Console, to export content in separate SPK files per content type (identities, libraries, tables, and reports). If applicable, export LASR libraries to LASR-based caslibs.

6. Examine and, if necessary, update the mapping files that are created during the export process.

7. In SAS Viya, use the import wizard in SAS Environment Manager or the sas-admin transfer command-line tool to import the SPK files that you exported from SAS 9.4.

As you shift workloads over to SAS Viya, you can continue running your SAS 9.4 programs while simultaneously optimizing them to take advantage of the superior processing capabilities of SAS Viya. With a few minor changes, such as updates to file system paths or database parameters, your programs will continue to run using the SAS programming run-time environment delivered as a part of SAS Viya to support compatibility. Consult the SAS Programming documentation to see a list of SAS 9.4 procedures that are supported in SAS Viya. And then as desired, rewrite certain code to take advantage of features unique to SAS Viya. The **table that compares basic functions, "SAS Viya Foundation Procedures," in the** document titled *An Introduction to SAS Viya 3.5 Programming* provides an excellent starting place.

REPLACEMENT

As we mentioned previously, migration from SAS 9.4 to SAS Viya is typically a gradual process, involving a period of time where both environments are operational. Ultimately, once all SAS workloads are migrated from SAS 9.4 to SAS Viya, you can disable your SAS 9.4 environment. However, before doing so, you must consider several factors:

PRODUCT AVAILABILITY

While SAS has converted most products to leverage SAS Viya, some horizontal products and industry solutions are not yet available. One example is SAS Data Integration Studio.

SAS is constantly adding to its SAS Viya portfolio of products, so check with your account representative to determine the availability of products that correspond to your current licensed SAS 9.4 set. They can provide you with access to SAS Content Assessment, which we also mentioned previously. This tool scans SAS 9.4 environments for your content, including the contents of the Metadata Server, the SAS Content Server, and the filesystem. It also scans deployment and license information. SAS Content Assessment reports summarize the content that is promotable. You can then more easily gauge whether a comparable or superior replacement exists in the SAS Viya portfolio of products.

FUNCTIONAL REPLACEMENT VALUE

While the majority of SAS 9.4 functionality is available in a SAS Viya environment, not all products offer full functional replacement value. You should assess which features you are **using at SAS 9.4. Then you can check feature availability by consulting the "**[SAS 9.4 and SAS Viya Functional Comparison](#)**" technical paper. It covers capabilities across the platform,** data management, visualization, analytics, model management, and intelligent decisioning areas.

CAPACITY

You must allocate enough compute, storage, and I/O capacity in your SAS Viya environment to support the total of all SAS workloads. Your account representative can engage the SAS Enterprise Excellence Center to provide customized sizing recommendations.

DATA ACCESS

SAS Viya must have access to the data sources used by your SAS 9.4 workloads. You must have file system or network access to the underlying data as well as a SAS Viya license for any associated SAS Data Connectors (that is, those corresponding to SAS/ACCESS products used in SAS 9.4).

USER READINESS

SAS Viya has adopted a modern HTML5-based user interface for all its clients. In many cases, this is significantly different from the SAS 9.4 interface. As such, you should ensure that your users are comfortable with the new interface before disabling the old one.

One scenario in which a migration can achieve full replacement is with a SAS Visual Analytics (VA) deployment. Not only does SAS Visual Analytics on SAS Viya offer full functional replacement value for its SAS 9.4 counterpart, but you can promote your existing VA user content using the SAS Management Console export and SAS Environment Manager import capabilities that we described earlier. An additional convenience with such a migration is that SAS Viya allows you to connect directly to the LASR server used by SAS Visual Analytics in SAS 9.4. This allows you to set up CAS server libraries in SAS Viya that point directly to in-memory VA data in SAS 9.4 as you transition your data alongside your user content.

SAS VIYA TO SAS VIYA

While beyond the scope of this paper, it is important to note that SAS offers tools that help you migrate from one SAS Viya environment to another. In some cases, you migrate in order to move to a newly installed environment on different cloud or on-premises infrastructure. In other cases, you migrate to move to a more recent version of the software, but do not want to modify your existing environment with an upgrade or update in-place. In either case, the following tools come into play:

BACKUP AND RESTORE TOOLS

SAS Viya includes a Backup and Restore facility that's accessible either from the SAS Environment Manager user interface or via a CLI. It backs up user content from the SAS Infrastructure Data Server and environment configuration from the SAS Configuration Server. It also backs up CAS server access controls and global caslib definitions. You can run backups as regularly scheduled jobs or as ad-hoc manual submissions.

When restoring a SAS Viya backup, all contents are restored to the target environment. You cannot selectively restore a specific item or items. If you require selective restore, you

can either delete the extraneous content after restoring or restore to a temporary environment and then use **SAS Viya's promotion capability to transfer specific** items to the target environment.

INVENTORY TOOL

The SAS Viya inventory plug-in to the sas-admin CLI enumerates environment-specific configuration and content stored outside of the SAS Infrastructure Data Server and the SAS Configuration Server. Such content is not included by the SAS Viya Backup and Restore facility. However, you can use the inventory plug-in to scan the following types of content in your environment:

Services
All deployed services in your environment, including those that are not currently running.

Infrastructure
Files stored in the installation paths of the SAS Infrastructure Data Server and the SAS Configuration Server that reside outside of their respective data stores of PostgreSQL and Consul.

File System
SAS Viya user files stored directly in the file system, including transient analytics caslibs, ASTOREs written by SAS Model Manager, auditing information**, and SAS Viya "USERMODS"** files containing user modifications to configuration.

CAS Content
CASUSER caslib definitions for all users.

The SAS Viya inventory plug-in produces CSV and log files, which it can publish to files imported by SAS Environment Manager. You can then use the SAS Environment Manager built-in reports to view summaries of the above content.

SAS VIYA 4

SAS Viya 4 will use a completely containerized deployment approach, leveraging Kubernetes as the container orchestrator. As this represents a major architectural shift, SAS Viya 3.x customers will need to use the previously mentioned tools to move to SAS Viya 4. You will not be able to do an in-place upgrade from SAS Viya 3.x to SAS Viya 4. However, unlike a migration from SAS 9 to SAS Viya, all user content and configuration will be included.

CONCLUSION

There are many good reasons to move workloads from SAS 9 to SAS Viya. You might want to take advantage of open-source language support, advanced deep-learning techniques, or an architecture that provides high availability and superior distributed, in-memory performance.

Several migration approaches are available to help you adopt SAS Viya. Interoperability provides a way for SAS 9 clients to leverage SAS Viya servers while also allowing SAS Viya servers to directly access SAS 9 data sources. Promotion allows you to selectively move SAS 9 content to a SAS Viya environment, either as a one-time operation to permanently transition associated workloads, or as a continuous process to make content available to SAS Viya while maintaining the original source in SAS 9. Replacement is an option when **you've confirmed** that all the capabilities of the SAS 9 products you value are available in

SAS Viya; when **you've met the system requirements** for capacity and data access in the new environment; and when **your users are ready for SAS Viya's modernized look and feel.**

Inevitably, migrating from SAS 9 to SAS Viya is an incremental process. Using any or all of the described approaches is an intentional investment that requires careful planning. Success is typically achieved by prioritizing and staging your migration over time rather than attempting a single all-encompassing event. SAS provides tools to ease this migration, and continues to enhance these tools so that later stages of an incremental approach could benefit from usability improvements and additional types of supported content.

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