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SAS® Grid Manager and SAS® Viya®: A Strong Relationship

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ABSTRACT

SAS® Grid Manager and SAS® Viya® implement distributed computing according to different computational patterns. They complement each other in providing a highly available and scalable environment to process large volumes of data and produce rapid results. From finding the best way to allocate tens of jobs on multiple machines, to allocating huge amounts of data to quickly analyze in parallel, this paper shows how to architect and implement SAS Grid Manager and SAS Viya to effectively support your business.

INTRODUCTION

As SAS Viya adoption increases among customers, many discover that it fits perfectly alongside their existing SAS implementations, which can be integrated and kept running until major projects have been migrated over. Conversely, SAS Grid Manager has been deployed during the past years to countless production sites. Because SAS Viya provides distributed computing capabilities, customers wonder how it compares to SAS Grid Manager.

At a high level, the questions we get the most from SAS customers can be summarized in four categories:

- I have SAS Viya and SAS Grid Manager. How can I get the most value from using them together?
- I have SAS Viya. Can I get any additional benefits by also implementing SAS Grid Manager?
- I have SAS Grid Manager. Should I move to SAS Viya?
- I am starting a new project. Which platform should I use - SAS Viya or SAS Grid Manager?

The common answer to all these questions is that SAS Grid Manager and SAS Viya complement each other in providing a highly available and scalable environment.

The rest of this paper aims to help you understand how to get the most from both an architecture and an administration perspective.

If you are new to one or the other, you might benefit from a brief description of the two software solutions.

SAS GRID MANAGER

SAS Grid Manager is a multi-tier solution, based on SAS 9 technology, that enables multiple users to submit jobs to a grid of computers in centrally managed environment.

A grid control server continuously monitors grid nodes to register their computing capabilities (such as CPUs, RAM, and available resources) and to track the resource consumption of running jobs. This permits dynamic and advanced workload management capabilities.

Users can modify their code to enable parallel submission to the grid, leading to considerable gains in running time.

SAS Grid Manager also provides additional benefits such as higher availability, ease of maintenance, and the capability to quickly scale based on computing demand.

SAS Grid Manager is usually deployed as the enabling layer of many additional solutions, including SAS® Enterprise Miner™, SAS® Enterprise Guide®, SAS® Office Analytics, SAS® Data Integration Studio, and SAS® Data Quality.

Although SAS®9 solutions can include multiple runtime engines, such as LASR, ESP, and in-database, SAS Grid Manager is usually used with the traditional SAS MultiVendor Architecture™ runtime.

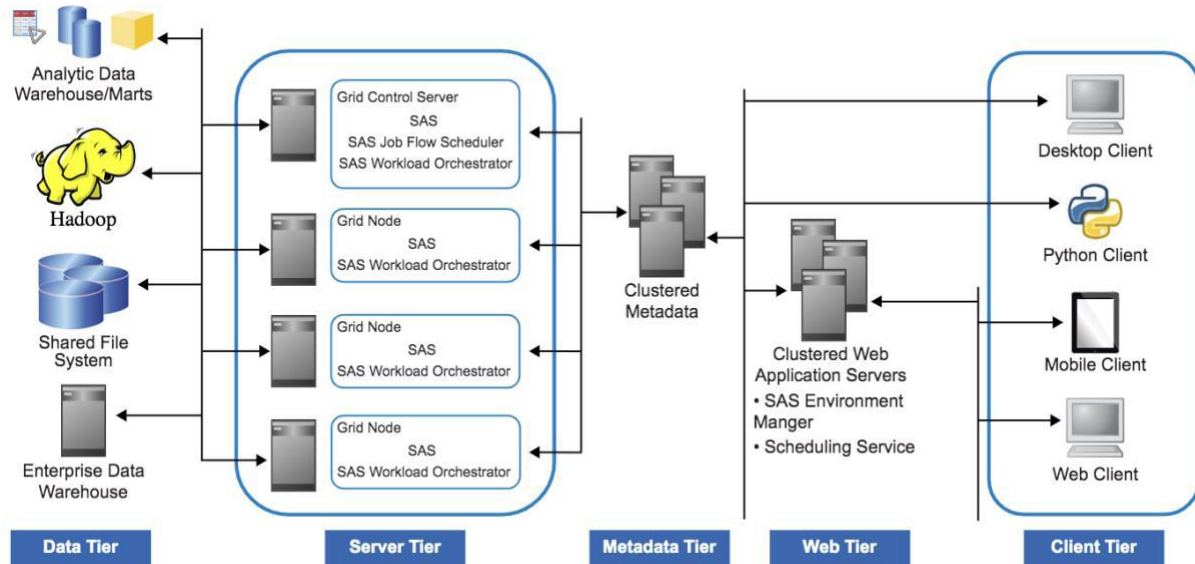


Figure 1 - SAS Grid Manager Architecture

SAS VIYA

SAS Viya is an in-memory platform designed to deliver the information that you need as quickly as possible. It is comprised of a modern, common set of services that enable reporting and analytical solutions, such as SAS® Visual Analytics or SAS® Visual Data Mining and Machine Learning.

SAS Viya services support clustering and are designed with scalable and fault-tolerant processing capabilities.

SAS Viya has the following benefits:

- SAS Viya provides distributed analytical in-memory calculations that are optimized for unconstrained environments and that automatically adjust in constrained environments.
- SAS Viya supports a standardized code base that enables programming in SAS and other languages such as Python, R, Java, and Lua.
- SAS Viya is highly available, providing distributed processing that can handle multiple users who are distributing operations either across the cores of a single server or across nodes of massive compute clusters.

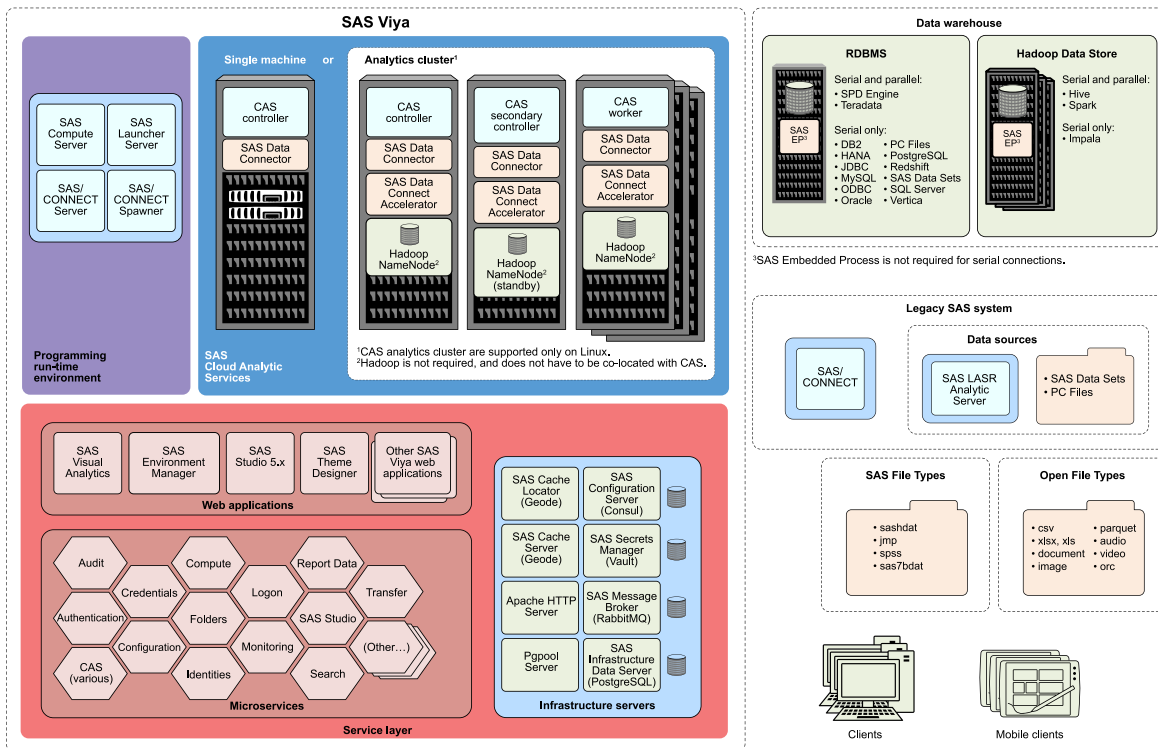


Figure 2 - SAS Viya Architecture

SAS Viya can leverage multiple compute engines such the following:

- SAS® Cloud Analytic Services (CAS)
- Traditional SAS (referred to as the SAS programming runtime environment, or SPRE)
- SAS® Micro Analytic Service
- SAS® Event Stream Processing
- In-Database engines

SAS Viya engines cannot be directly managed by SAS Grid Manager as native grid nodes to execute grid jobs, but there are multiple integration patterns described throughout this paper.

CAS

The CAS server is the SAS Viya run-time engine for analytics and data management. It is an in-memory server that can run on a single host to provide a symmetric multi-processing (SMP) CAS server instance or it can be scaled across multiple hosts to form a massively parallel processing (MPP) CAS cluster.

- In SMP mode, there is just one node running CAS. This allows a single node to take advantage of CAS without having to invest in a large cluster or a cloud environment. You get the advantage of running the analytics on multiple processors and the same functionality of an MPP system.
- In MPP mode, a single CAS server can span multiple hosts to help offload the analytics and spread the data out, which enables parallel processing on the multiple workers. MPP allows the user to create a session with as many worker nodes as

needed, up to the current number of workers available.

A distributed deployment can add or remove its underlying worker nodes to provide high availability and scaling up and down based on workload demands.

All data, tables, and objects are held in memory as long as required and for whomever is using them. Multiple users can explore and analyze the same data how and when they need to, interactively collaborating during the data discovery and model-building processes. Independent sessions ensure optimized processing for everyone.

INTEGRATION POINTS

Beginning with SAS 9.4M5, SAS Viya and SAS 9 solutions can play nicely together:

- Interfaces and integration points are built into SAS®9 to enable easy access to CAS.
- Integration capabilities with SAS Viya are available both in SAS® Foundation and in many clients (such as SAS Studio, SAS Enterprise Miner, SAS Enterprise Guide, and others).
- SAS/CONNECT® allows SAS®9 and SAS Viya to work together by exchanging data and by permitting remote code execution.

From a SAS session you can connect to a CAS server. After you connect to the server, you can load data to CAS server memory, submit DATA step code, and run SAS Viya analytic procedures, CAS server utility procedures, and Base SAS® procedures. Finally, you can save tables that are in CAS server memory or send back any result to the original SAS session.

Although it is also possible to use SAS/CONNECT, when licensed, to connect SAS grid sessions with the SAS programming and runtime environment in SAS Viya, it is more efficient to directly submit data and code to CAS from the SAS sessions.

In short, by using both SAS®9 and SAS Viya in parallel, you can continue to benefit from any investment in SAS®9 while making use of SAS Viya functionality and features. From within familiar SAS®9 interfaces, projects, and code, you can access the advanced analytics and performance enhancements that SAS Viya provides.

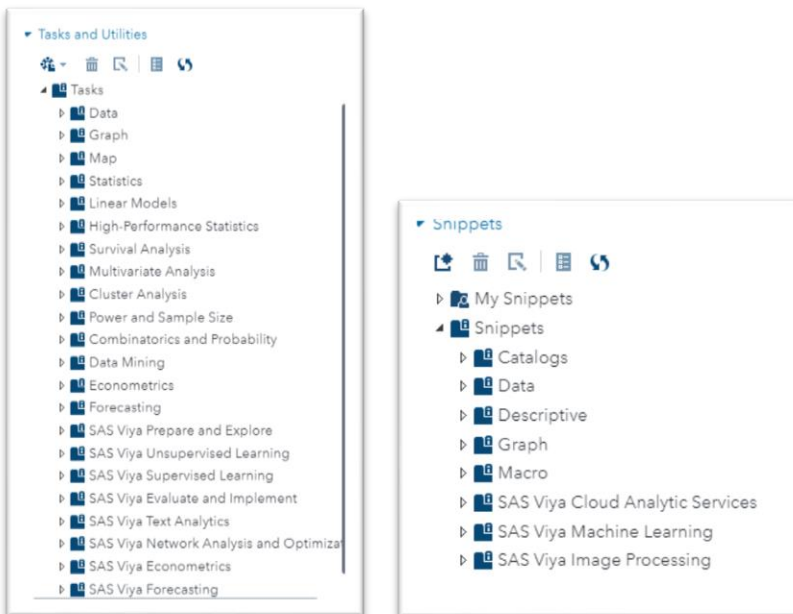


Figure 3 - SAS Studio 3.x (on SAS®9): Snippets and Tasks Include New Portions of Code to Interact with SAS Viya.

Now that the tight integration between SAS 9 and SAS Viya is clear, it is easy to understand how SAS Grid Manager can provide benefits to SAS Viya similar to those that a centrally managed environment brings to solutions traditionally running on SAS®9:

- SAS Grid Manager can run multiple SAS sessions in parallel that offload computing tasks to CAS, which increases overall utilization and keeps CAS CPUs full. Code can be submitted to both SMP or MPP CAS servers, and both can analyze data using CAS multi-threaded capabilities. In an MPP CAS environment, large analytic problems can be broken down into chunks that CAS simultaneously processes across many machines.
- SAS Grid Manager workload management capabilities can avoid resource contention and efficiently prioritize a diverse user base. SAS processes that spawn CAS sessions can be managed and prioritized.

To summarize, SAS Grid Manager can help to fully utilize CAS hardware resources while at the same time prevent over-saturating CAS nodes with too many sessions.

The left side of Figure 4 represents a job started on a grid node. The job code can connect to a CAS server and establish a new session. Execution is offloaded to CAS, which can accelerate the processing of steps within the job code by distributing the processing across multiple compute nodes on an MPP CAS server. On the CAS server, the CAS controller is responsible for managing a cluster of CAS workers. The controller distributes the data to the workers to load into their memory, submits processing tasks to CAS workers, and aggregates the results from the CAS workers when processing is complete.

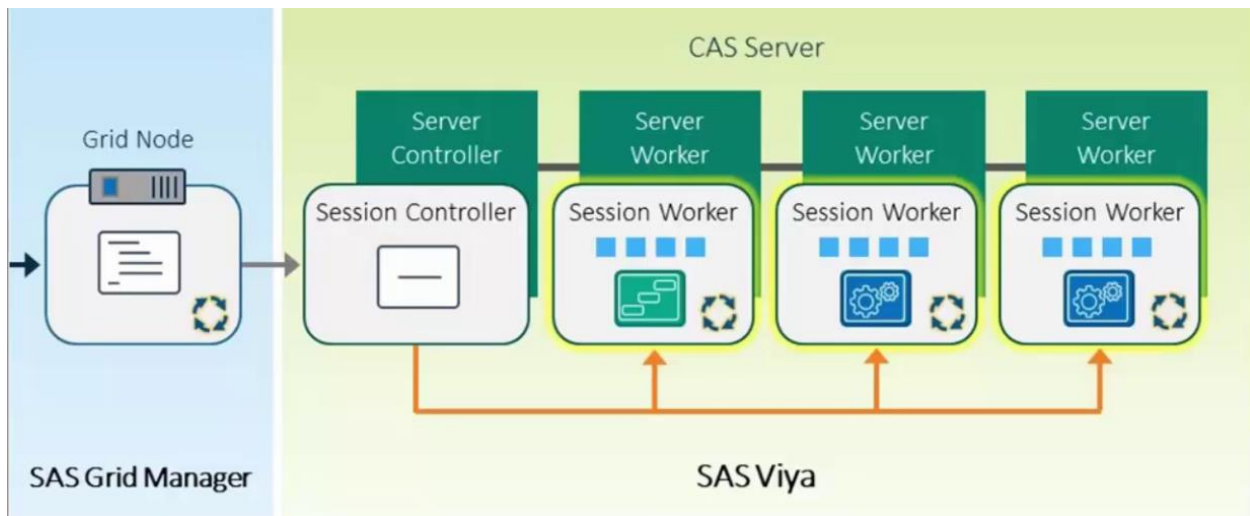


Figure 4 - A SAS Grid Manager Job Spawning CAS Parallel Processing

COMPARING BENEFITS

Both SAS Grid Manager and SAS Viya provide highly available and scalable computing with high levels of performance. How do they compare, complement, or differ in providing those capabilities?

WORKLOAD MANAGEMENT

SAS Grid Manager

When users submit new jobs, the grid control server initially holds them in multiple queues. At regular intervals, the grid control server then spawns the jobs by assigning them to the grid node with the best available resources at that moment in time.

Queues are used to assign different policies to jobs, such as priorities, resource requirements, and permissions.

When resources are constrained, jobs can be held in the queues in order to avoid overloading the execution hosts with too many competing jobs. As a result, the workload from multiple users is dynamically and efficiently managed.

SAS Viya

SAS Viya relies on the operating system for concurrent activity management. You can set options to set global limits on resource utilization for each CAS server instance (using the options `cas.MAXMEMORY`, `cas.MAXCORES`, and `cas.CPUSHARES`). Starting with SAS Viya 3.4, on Linux platforms, CAS has resource management capabilities that enable administrators to control CAS table size and CPU consumption. CAS relies on cgroups, which is the Linux kernel feature, to provide the CPU and memory consumption control.

Although these capabilities provide basic forms of prioritization and resource management, SAS Viya in the current release does not provide proper workload management.

Integration Point: SAS Grid Manager in Front of SAS Viya

SAS Grid Manager cannot manage SAS Viya, or more specifically, workloads running inside of CAS, as if they were native grid jobs. However, you can use SAS Grid Manager - with any of the available providers - to throttle the workload that gets submitted to CAS. For example, you could submit all jobs that access CAS to a common grid queue and limit that queue to five simultaneous jobs at any given time.

SCALABILITY

SAS Grid Manager

As the number of users or the number of running jobs increases, the available computing resources might not be enough to satisfy the increased demand. You can quickly and easily add new hosts to a SAS grid, which provides new capacity and maintains acceptable throughput levels. Using a shared filesystem greatly simplifies grid scalability.

Both batch jobs and load-balanced workspace servers can benefit by additional computing resources.

Infrastructure servers (such as the SAS® Metadata Server and the middle-tier servers) can be clustered to support an increased number of interactive users.

Grid deployments can scale on any supported operating system.

SAS Viya

SAS Viya on Linux (both on Intel and IBM Power architectures) supports scaling in multiple ways:

- Vertical scalability: CAS can benefit from additional RAM and CPU cores to support more user sessions and to load more or bigger tables in memory. Adding additional resources also enables some services (such as the SAS® Infrastructure Data Server) to be clustered on a single host.
- Horizontal scalability: With few exceptions, all SAS Viya servers and services can be clustered across multiple hosts. Services can also be split out on dedicated hosts. A single CAS MPP deployment can scale almost linearly with the number of additional worker nodes that are added.

- Using multi-tenancy, the system defines a separate CAS server (SMP or MPP) for each tenant. You can choose to have the servers on dedicated or shared host machines.
- In single-tenant deployments, you can install and configure multiple CAS servers (SMP or MPP), using dedicated host machines for each.

SAS Viya on Windows is supported on single-host deployments only. However, you can still scale vertically by adding more resources to the host, which provides the same benefits as on Linux.

EASE OF MAINTENANCE

SAS Grid Manager

SAS Grid Manager is easier to maintain than traditional SAS®9 computing platforms. Grid nodes can be taken offline for maintenance. The grid control server is aware of node availability and only dispatches jobs to online nodes. At the end of the planned maintenance, grid nodes can be added back and re-opened to accept new jobs.

SAS Viya

Nodes in a clustered SAS Viya deployment can be maintained similarly to SAS Grid Manager grid nodes. Clustered services keep running after a member of the cluster has been taken offline, and will automatically re-accept the node when it comes back online.

When an administrator closes a CAS worker host, CAS server re-shuffles the in-memory data among the remaining online workers. All of the running analysis and user sessions keep working unaffected.

When the host is brought back online, it is automatically used to load new data, but an administrator must manually re-shuffle the pre-existing tables to include the new node in the data distribution. Because actions only run on nodes that are hosting data, it is important to perform this re-shuffling to guarantee that the newly added worker is actually used.

AVAILABILITY

SAS Grid Manager

SAS Grid Manager can increase the overall availability of your environment at multiple levels.

- If grid node goes down, the remaining grid nodes are available to keep jobs running. Jobs that were executing on a failed node can be automatically resubmitted to other nodes.
- Essential services can be monitored, and the grid controller can react in case of failures by either restarting the failed services or initiating a failover procedure to restart them on another node.
- Batch jobs that are automatically resubmitted after an abnormal termination can resume from the last good checkpoint instead of from the beginning. This can save large amounts of time, because all steps that completed successfully do not have to be re-executed.

SAS Viya

The fault-tolerant design of SAS Viya automatically detects server failures, both in the services layer and across computing clusters.

SAS Viya servers and services can be clustered to increase their availability. With clustering, if a member of the cluster goes down, all the other members keep servicing client requests.

When CAS is deployed in an MPP cluster, processing is optimized and redistributed as needed. CAS manages several copies of data on the computing CAS cluster. If a node in the cluster becomes unavailable or fails, the other workers can recover the lost allocation of data from the block copies in their own cache. These self-healing mechanisms ensure high availability for uninterrupted processing and automated recovery.

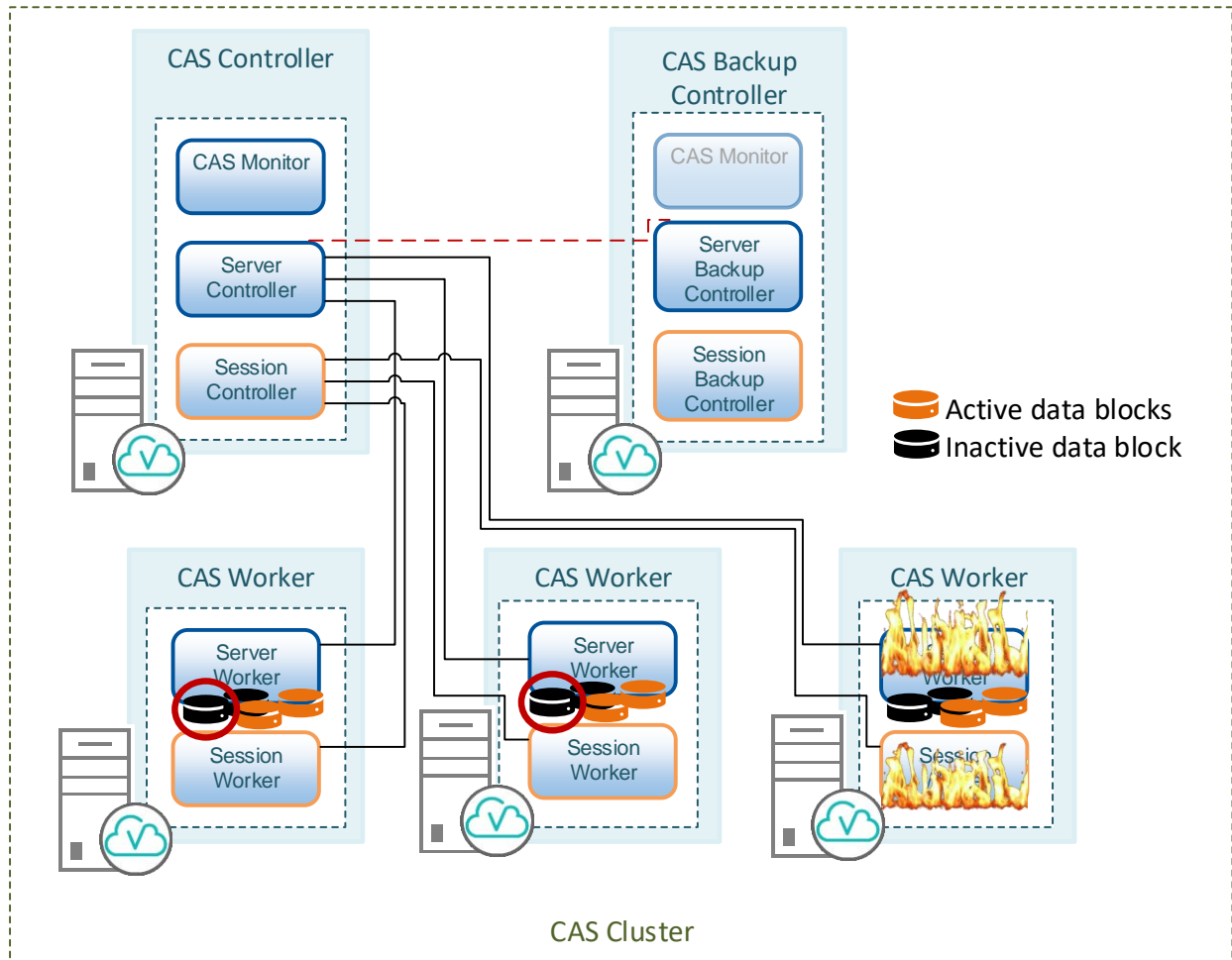


Figure 5 - CAS Data Blocks are Activated (Red Circle) on Surviving Workers After a Worker Failure.

PARALLELIZATION

SAS Grid Manager

Traditional SAS jobs that sequentially run multiple steps can be grid-enabled and converted to run independent steps in parallel on multiple grid nodes.

Some solutions, such as SAS Enterprise Miner or SAS Enterprise Guide, can automatically analyze the active project diagram and submit code to parallel independent code nodes.

Parallelization can lead to accelerated results due to the reduction of the overall execution time.

The left side of Figure 6 shows a serial sequence of steps. As an example, the steps could be a data step, three data preparation procedures, two analytical models, and finally a report with the results. On the right side of Figure 6, the same steps have been reorganized to highlight how some of them can run in parallel. When both flows are submitted to SAS Grid Manager, it runs as many steps as possible concurrently; the parallelized sequence might finish in a fraction of the time required for the original one.

SAS Viya

When a CAS server is installed in an MPP architecture, data is split evenly in chunks distributed across the cluster nodes. Large analytic problems can be spread by CAS simultaneously across many machines. Each node can produce results faster, because it has to analyze only a subset of the data. At the end, the CAS controller collects and summarizes all intermediate results before sending them back to the client. Splitting data into smaller chunks also enables parallelization of the data transfer phases to quickly move large volumes of data into or out from CAS.

The left side of Figure 7 shows a single host and the right shows a distributed CAS cluster with three workers. Each worker of the distributed cluster gets one-third of the data that the single host has to process. When the same process flow is run on both environments, the distributed CAS cluster can produce results faster.

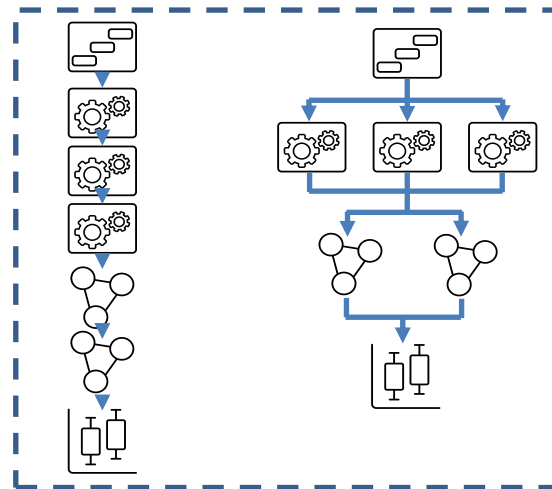


Figure 6 - Transforming the sequential steps of a job into parallel execution.

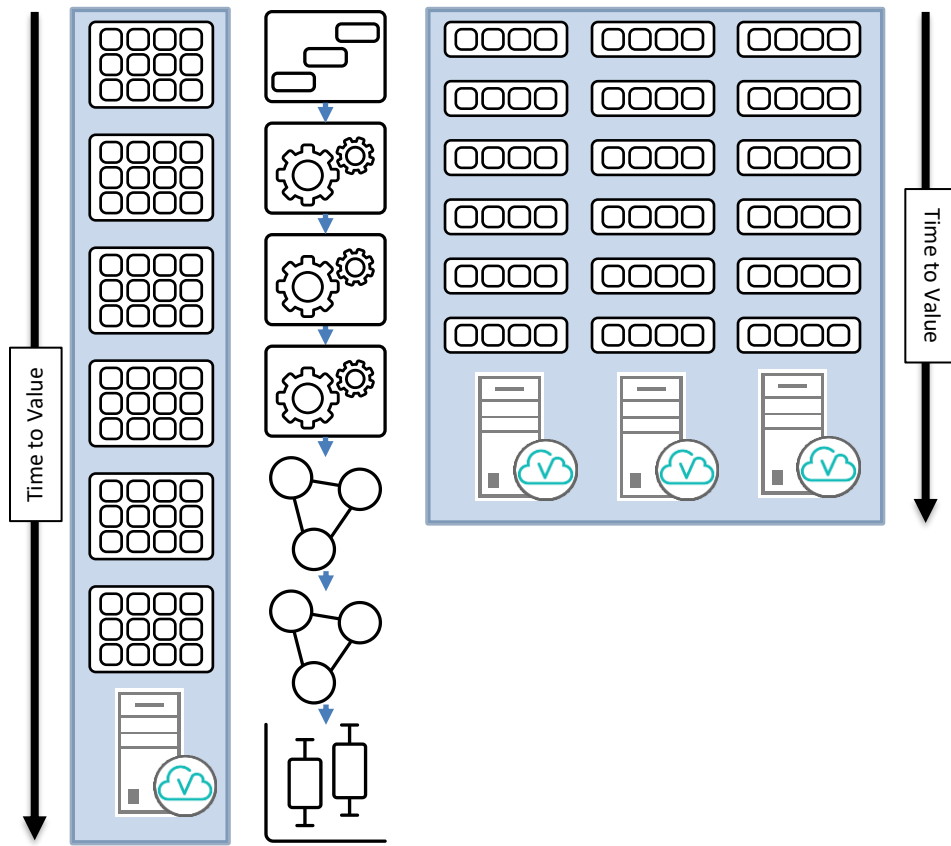


Figure 7 – CAS Server Data Parallelism

Figure 8 illustrates a similar comparison, by showing how the parallelization capabilities of a distributed CAS cluster can also be used to analyze bigger volumes of data without increasing the overall processing time.

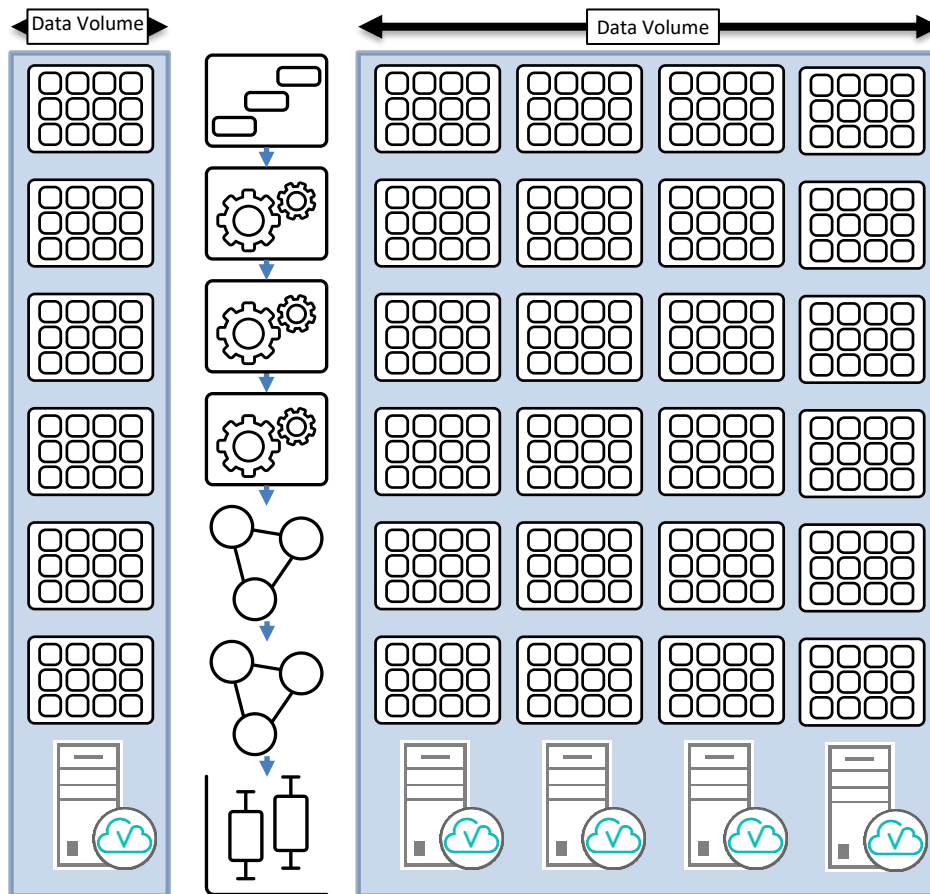


Figure 8 - CAS Server Scalability

Different Forms of Distributed Computing

You may have noted that SAS Viya and SAS Grid Manager implement parallelism using two complementary approaches. SAS Viya uses data parallelism, while SAS Grid Manager uses task parallelism.

Data Parallelism

Data parallelism is defined as concurrent execution of the same task on each multiple computing cores or hosts, and on different subsets of the data to be analyzed.

For example, suppose you want to sum the contents of an array of size N . In a sequential system, one computing unit **would simply sum the elements $[0] \dots [N - 1]$** . With two computing units, however, thread A, running on the first core or host, could sum the **elements $[0] \dots [N/2 - 1]$** while thread B, running on the second core or host, could sum the **elements $[N/2] \dots [N - 1]$** . Two threads would be running in parallel on separate computing units. A final step would sum the two partial results.

Task Parallelism

Task parallelism is defined as concurrent execution of different tasks on multiple computing cores or hosts.

Using the previous example, task parallelism might involve two threads, each performing a different and independent statistical operation on the array of elements. The threads are operating in parallel on separate computing cores or hosts, but each is performing a unique operation.

The key differences between data parallelism and task parallelism are illustrated in Table 1: Table 1

Data Parallelisms (CAS)	Task Parallelisms (Grid)
The same task is performed on different subsets of same data.	Different tasks are performed on the same or different data.
The computation is synchronous. All subtasks have to be completed before moving to the next step. If one computing unit takes longer, they all must wait until it finishes. This is the reason why CAS workers must be identical.	The computation is asynchronous. As soon as a task is done, the host is available to perform another one independently from what other hosts are doing.
The amount of parallelization is driven by how data is distributed between compute workers.	The amount of parallelization is proportional to the number of independent tasks that can be performed.
Optimum load balancing depends upon the algorithms used by the multiple parallel tasks to synchronize with the controller and between themselves.	Optimum load balancing depends upon the algorithms used to schedule the right jobs on the best available hosts, given the current available resources.

Table 1 – Comparison Between Data and Task Parallelism

Integration Point: SAS Grid Manager in Front of SAS Viya

SAS Grid Manager excels at using sophisticated and customizable resource management algorithms to allocate multiple jobs across a grid of machines. This capability maximizes the consumption of available resources.

CAS excels at breaking down individual jobs into steps that can run on subsets of data in parallel and in memory in order to provide maximum throughput.

Together, SAS Grid Manager and SAS Viya can provide an efficient and highly available environment that ensures rapid results. Multiple jobs started on grid nodes can connect to a CAS server and establish new sessions. Execution is offloaded to CAS, which can further accelerate the processing of steps within the job's code by distributing the processing across multiple compute nodes on an MPP CAS server.

ARCHITECTURAL CHOICES

DESIGN

When designing an environment to use both SAS Grid Manager and SAS Viya, the first choice is whether the two should be co-located on the same set of hardware or split over dedicated machines.

A key point is that the functionality from each of these products can place extreme demands on the underlying hardware. A simple approach can be to dedicate hardware to each one, but this could lead to increased hardware costs, underutilized computing power, increased environment management costs, and data replication. Sharing hardware can mitigate some

of these concerns, but it can lead to other considerations such as resource conflicts and complex deployment and administration. Table 2 compares benefits and possible issues of each approach.

Shared hardware	Dedicated hardware
Hardware cost savings	Potential duplication of hardware resources
Possible savings in project time to value (by avoiding the need to provision new hosts)	Additional hosts must be provided, although this can be mitigated using cloud infrastructure.
Potential resource conflicts. Co-location requires using proper resource management, such as Linux cgroups.	Dedicated hardware provides more consistent performance.
Increased deployment complexity	The deployment experience is streamlined. There is no overlap or confusion with system requirements and prerequisites.
Increased maintenance complexity	Fixes, configuration changes, and other maintenance activities can be performed independently.
Data and programs can be easily shared on the common filesystem.	SAS 9.4M5 (and later) capabilities can integrate with SAS Viya to communicate and share data.

Table 2 – Pros and Cons of Shared Hardware Versus Dedicated Hardware

In summary, in most cases it is preferred to dedicate different hosts to SAS Grid Manager and SAS Viya. Co-location is not suggested.

OPERATING SYSTEM CONSIDERATIONS

From an integration perspective, SAS Grid Manager and SAS Viya can run on different operating systems. In fact, as of SAS 9.4M5, you can access a CAS server from Linux, Solaris, AIX, or 64-bit Windows. The CAS server itself runs on Linux and Windows Server.

Crossing operating systems does not present a functional problem. However, it is important to remember that there are performance implications when processing data that is not native to the running session. You should carefully consider the performance implications of deploying in a heterogeneous topology before committing to a mixed environment.

FILE SYSTEM REQUIREMENTS

SAS Grid Manager requires high-performance, clustered storage, such as IBM Spectrum Scale (formerly known as GPFS), RedHat GFS2, Lustre, or others.

The same level of storage is not required for SAS Viya. CAS storage requirements are more similar to those for Hadoop than those for SAS Grid Manager. The CAS reference architecture is mainly a collection of nodes with local storage that allows SAS Viya to perform memory-mapping to disk. A shared file system is required only for specific areas, and only **when some components are configured for high availability (such as users' home**

directories for clustered SAS® Studio instances, or /opt/sas/viya/config/data/CAS to implement CAS controller high availability).

In addition, CAS has the ability to use a Network File System in a massively parallel way, using a parallel loading technology referred to as DNFS. This is a SAS specific acronym that references the generalized concept of a **“distributed network file system.”** With a supported file system mounted identically on each CAS node, CAS can access (both read and write) **the file system’s CSV and SASDAT files from every worker node in parallel.**

The shared file system that is part of an existing SAS Grid Manager environment could be further leveraged as a means to share data between the SAS Grid and SAS Viya environments.

The best value comes from environments built with a blend of storage solutions, including shared file systems for job concurrency and less expensive distributed storage for workloads that might not require concurrency (such as large machine learning and AI training problems). The latter is where SAS Viya shines.

SIZING

SAS Grid Manager can benefit from any node added to the grid, even if the nodes have different CPUs, memory, disks, and computing power. The grid control server is aware of **each node’s available resources and submits a** proportional amount of work to each one.

CAS requires equally sized nodes because computational tasks are evenly split across nodes. If a node were undersized compared to the others, the whole cluster would have to stop and wait on the slower node before the controller could summarize the results from the distributed computation.

SAS®9 workloads require hosts that supports heavy analytical processing and large sequential I/O. SAS Viya processes data in memory that can be mapped to disk if required. These behaviors should be taken into consideration when selecting the correct storage and file system type.

USE CASES

Customers adopting SAS solutions can be at different level of maturity in their journey to implement SAS technology. In this section you can find some use cases we have seen along the way. In each case, SAS Grid Manager and SAS Viya can both provide complimentary benefits.

THE EVOLUTION PATTERN

Customers with a large user base of SAS Enterprise Guide users, who use SAS Enterprise Guide mostly **for the “visual programming” aspects and not** as much as a code editor, might wonder how to evolve their environment.

SAS Viya is moving away from desktop clients and towards web-based interfaces. The natural evolution for SAS Enterprise Guide users is to migrate to SAS Studio. Although the current release of SAS Studio on SAS Viya is focused on providing interfaces for programmers, work is in progress to develop a visual perspective where users design the flow between nodes, similar to that used for SAS Enterprise Guide projects.

Many SAS Enterprise Guide costumers follow an evolution pattern that moves along the following phases:

(1) SAS Enterprise Guide connected to a departmental server running SAS®9 -> (2) SAS Enterprise Guide connected to a SAS®9 grid -> (3) SAS Enterprise Guide connected to a SAS®9 grid that submits code to CAS.

The initial phase is depicted in Figure 9, where some desktop clients running SAS Enterprise Guide sessions are connected to backend SAS workspace servers running on a central server.

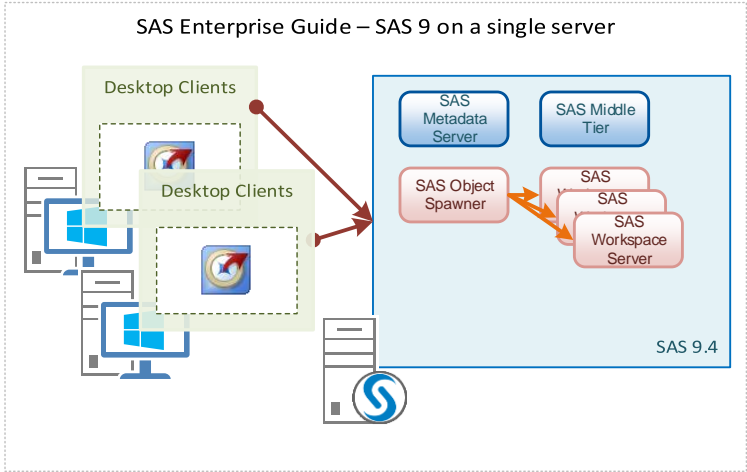


Figure 9 - SAS Enterprise Guide Using a Single Server

As the number of clients grows, it might become difficult to avoid resource contention and prioritize users of the shared environment. Figure 10 shows the second phase, where the single backend server is migrated to a SAS grid environment, which provides the required workload management capabilities.

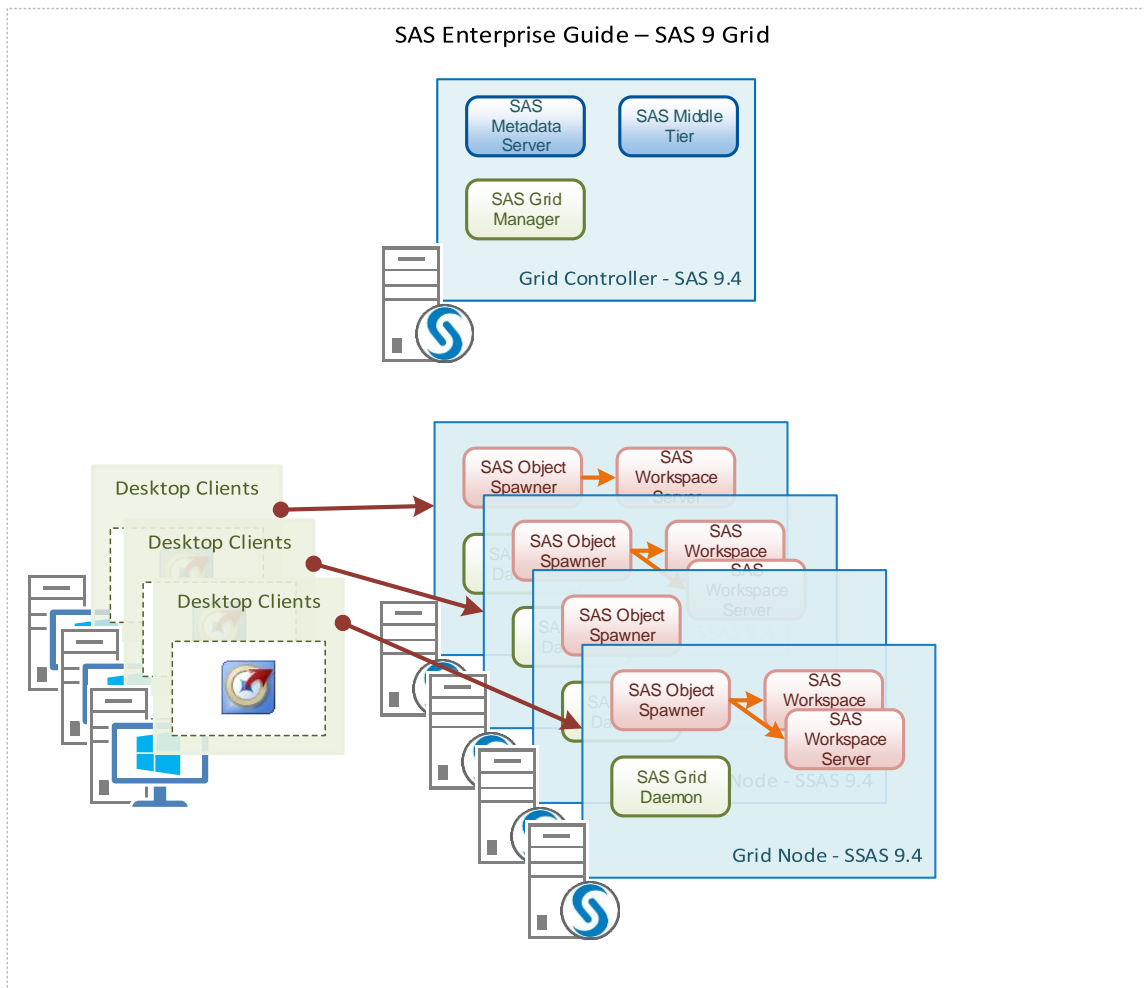


Figure 10 - SAS Enterprise Guide Leveraging a SAS Grid

Distributed in-memory capabilities are required to keep the pace with increasing amount of data to be consumed and analyzed. Figure 11 shows the third phase, which adds SAS Viya to the previous environment, bringing new advanced algorithms and CAS in-memory processing capability.

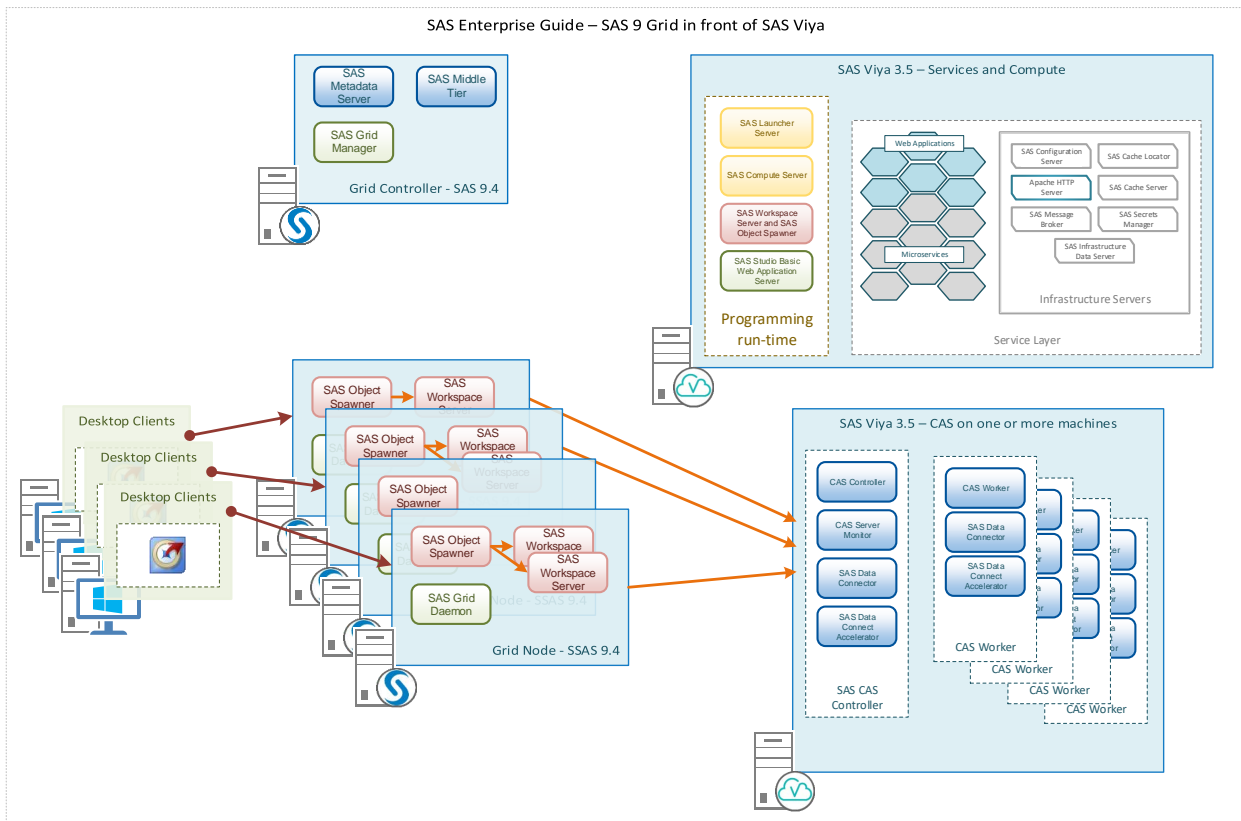


Figure 11 - SAS Enterprise Guide Leveraging a SAS Grid Integrated with SAS Viya

In this new environment SAS Enterprise Guide can even leverage SAS Studio tasks, which provides both native SAS Viya tasks that can be part of any project and traditional SAS Enterprise Guide tasks. These tasks, shown in Figure 12, generate code that can be spawned from a grid session to execute directly in CAS.

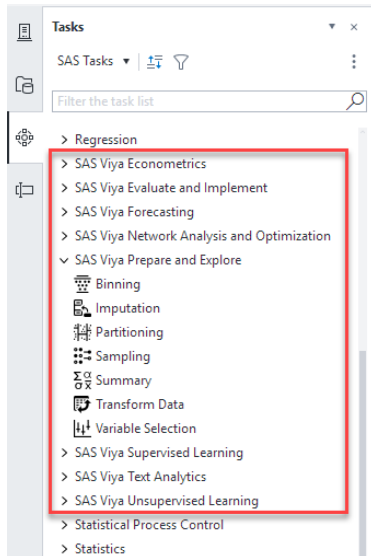


Figure 12 - SAS Studio SAS Viya Tasks Leveraged by SAS Enterprise Guide

This “evolutionary” approach can be also implemented for other SAS solutions. For example, customers currently using SAS Enterprise Miner in SAS 9, can leverage a SAS 9 grid environment to parallelize models execution and balance the workload between modelers; the addition of SAS Viya can bring new models, new algorithms, and in-memory, distributed

execution. SAS Viya models and procedures can be called directly from SAS Enterprise Miner, starting with release 14.2, by using the SAS Viya Code node.

A variation of this “phased evolution” approach can be created by implementing a SAS Grid Manager environment integrated with SAS Viya, and doing it all at once.

For example, a customer with an extremely overworked SAS®9 environment, whose users are mainly Base SAS® programmers using DATA step, SQL, and analytical procedures, might wonder whether to move into a grid environment or directly switch to SAS Viya. Are the growing number of technical and analytical capabilities in SAS Viya ousting the need to contemplate a SAS grid?

As we have explained above, implementing both SAS Grid Manager and SAS Viya can provide an efficient and highly available environment, in which they complement one another, and each uses its own strengths. SAS Grid Manager can provide the workload management capabilities required to avoid resource contention and to efficiently prioritize the diverse user base. SAS Viya can augment the analytical capabilities by providing advanced algorithms and accelerate the time to results, thanks to CAS distributed and in-memory processing.

THE PIPELINE MODEL

Different use cases can be implemented in environments where SAS Grid Manager and SAS Viya provide complementary services in different steps of a project.

SAS Viya Feeds into SAS Grid Manager

SAS Data preparation and SAS Visual Data Mining and Machine Learning, both of which are based on SAS Viya, can be used by analysts to prepare data and build models in development. They can benefit from large-scale data manipulation, interactive and scalable visualization, and advanced model training. When models are ready to be pushed as batch jobs running on the corporate data warehouse, SAS Grid Manager can be used to orchestrate their execution in production, which provides operational batch workload management.

SAS Grid Manager Feeds into SAS Viya

Analysts working in SAS Viya want to leverage advanced analytical capabilities on large amounts of data. Traditional ETL systems can lag in feeding the required data into their environment. In these cases, data quality and data preparation steps can be run in a SAS grid environment. The SAS Grid environment can leverage grid scaling and parallelization capabilities to perform parallel data manipulation for a lot of users, for a lot of applications, and on a lot of data. Grid jobs can include both traditional SAS 9 and CAS steps, integrated in a seamless flow.

MANAGED ANALYTICS

SAS Visual Analytics customers that have already embraced SAS Viya can benefit from SAS Grid Manager, too. They may face issues such as batch jobs or interactive, ad hoc sessions that connect to CAS and that exhaust resources. When that happens, online reporting might become sluggish, and reports might sometimes display quickly and sometimes seem strangely slow.

In this case, SAS Grid Manager can provide workload management capabilities. As we have seen previously, it is possible to create specific grid queues for SAS jobs that interact with CAS. Queue policies can set a fixed limit for the maximum number of concurrent jobs, which leaves enough resources on CAS workers for interactive SAS Visual Analytics users.

A more advanced integration can be obtained by creating custom metrics for SAS Grid Manager. For example, a custom script could monitor the CPU consumption of CAS workers

or the number of existing CAS user sessions. SAS Grid Manager could then be configured to use the custom script output to dynamically adjust the limits on grid queues based on these metrics.

A LOOK AT THE FUTURE

SAS Grid Manager capabilities have evolved and expanded over time. Will SAS Grid Manager be further integrated with SAS Viya? What is the vision of SAS?

To date, SAS Grid Manager has primarily served the needs of IT by enabling optimal utilization and centralized management of a fixed set of compute resources across the enterprise. But technology continues to advance, and cloud computing, together with the commoditization of compute resources, is changing the landscape entirely. The constraint of fixed compute resources is being replaced by an altogether different set of constraints. The era of cloud computing brings with it the reality of an elastic compute infrastructure and the ability to provision needed compute resources on demand. Rather than the constraint being the compute resources themselves, the constraints are now defined by the customer's desire to balance the ratio of performance and price.

Systems administrators will benefit from automated workload management, which offers replacement value for the queue management, prioritization, high availability, and scalability offered by SAS Grid Manager in SAS®9. This enables them to optimize the use of cloud resources to meet computing SLAs while containing cost.

This is the vision that SAS is pursuing while developing the next generation of SAS Grid Manager.

CONCLUSION

If you are a SAS customer who has business critical applications or batch jobs that are managed by SAS Grid Manager, then you can leverage the new functionalities that SAS Viya provides. You can use the two side by side without having to convert over your processes all at once.

If you are already using SAS Viya, you can benefit from SAS Grid Manager workload management capabilities.

In the end, you are free to choose the path that best meets your needs, using the best from both worlds.

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