



SAS® System 9 Architecture

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With the slow down of the global economy, profit margins are under pressure and market share is decreasing. Companies are demanding greater efficiency from their operations while the amount of data stored and analysed explodes due to faster hardware and cheaper storage. An increasing number of people in the enterprise need to interact with and make sense of the growing mountain of data and do it in a way that best suits their abilities and needs. The browser has revolutionised and enabled the democratisation of information delivery. It has also significantly increased expectations.

Faster, more in-depth intelligence is needed to drive changes in business strategy. SAS® System 9 provides a platform to meet these requirements.

The 4 cornerstones of SAS System 9 are **usability**, **scalability**, **manageability** and **interoperability**.

Usability: SAS System 9 provides a set of user-interfaces designed with the end-user in mind.

SAS Web Report Studio is aimed at Information Consumers and Decision Makers and is an easy to use web-based reporting tool. Whilst it can be used for ad-hoc report generation it also allows reports to be stored, shared and published.

SAS Report Studio is a full-client Windows application. It allows for more detailed and robust reports and report templates to be created and distributed throughout the enterprise.

SAS Office Integration enables widespread use of SAS Analytics within the comfort of MS Office products like Word and Excel.

Other existing products have also been enhanced to meet the aims of SAS System 9

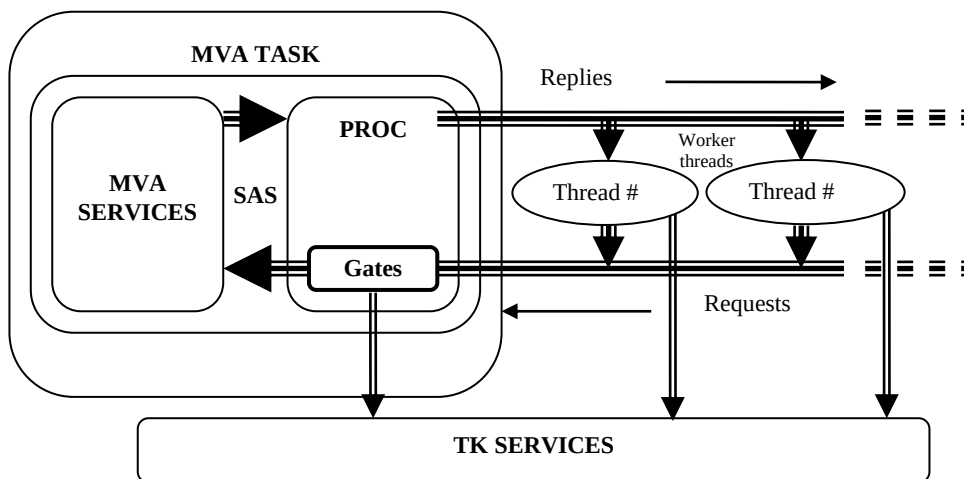
SAS Information Delivery Portal 2.0 has been rebuilt to make use of the Business Intelligence Platform and Open Metadata Architecture. This release of the ID Portal has a new user interface to surface information in a customized role-based fashion and enhances end user personalization. The installation procedure has been simplified through the addition of an InstallShield wizard.

SAS Enterprise Guide® 2.05 is the Windows-based point-and-click interface to the SAS System and is designed to simplify access to the power of SAS for statisticians, business analysts and programmers. This latest release includes new tasks for analytics like Generalized Linear Models and Mixed Models, improved control for building queries and support for the new graph styles. New extensibility features allow tailored add-in tasks to be used and an expanded automation interface lets Enterprise Guide be controlled via scripts. Enterprise Guide's role has also been further extended providing a wizard style interface to the deployment of code as Stored Processes which can then be surfaced to users via interfaces such as the SAS Information Delivery Portal and the SAS Office Integration.

New Components for SAS/GRAPH® includes 16 "Graph Styles" – similar in concept to the ODS styles these ensure a consistent look and feel to graphs generated in ODS.



Scalability: Since 1989 SAS has had in place Multi-Vendor Architecture which allows our software to run optimally on supported platforms whilst allowing 90% of the program code to be portable across platforms. SAS System 9 needed to go further to provide enterprise-level scalability and performance and to fully utilize the multi-CPU platforms. With these goals in mind SAS introduces the threaded kernel so that key SAS algorithms can benefit from multi-threading. The processes in these threads have access to all of the services traditionally available to MVA, thus preserving all existing functionality. Sorting, grouping and summarization will all greatly benefit from threading.



Making use of multiple CPUs is only part of the picture however. The Scalable Performance Data Engine provides parallel (or multi-threaded) I/O to greatly increase throughput of the SAS System. This technology allows a libname to be allocated to multiple partitioned data sets to enable threaded I/O to and from SAS. Consider this engine as taking the traditional SAS data set and index structure and mapping it into three separate structures: a metadata layer, the actual partitioned data values and a technology called hybrid indexing. SAS 8.2 provided *course-grain* parallelism through MP Connect (the ability to asynchronously execute multiple SAS sessions through program control); this has been further enhanced to incorporate the concept of pipeline parallelism. Pipeline parallelism enables socket communications between certain types of SAS program steps negating the need for intermediary datasets.

Together these technologies provide the SAS Scalable Architecture which in turn enables:

1. SAS threaded procedures

- PROC REG
- PROC GLM
- PROC LOESS
- PROC DMREG
- PROC DMINE
- PROC SORT
- PROC SUMMARY / MEANS
- PROC SQL

More procedures will begin to take advantage of the SAS Scalable Architecture over time.

2. Threaded Access Engines

Multi-threaded reads of the following databases will be supported under SAS System 9

- Oracle
- DB2 on Unix and PC
- ODBC on PC
- Sybase on PC and Unix
- Teradata on PC

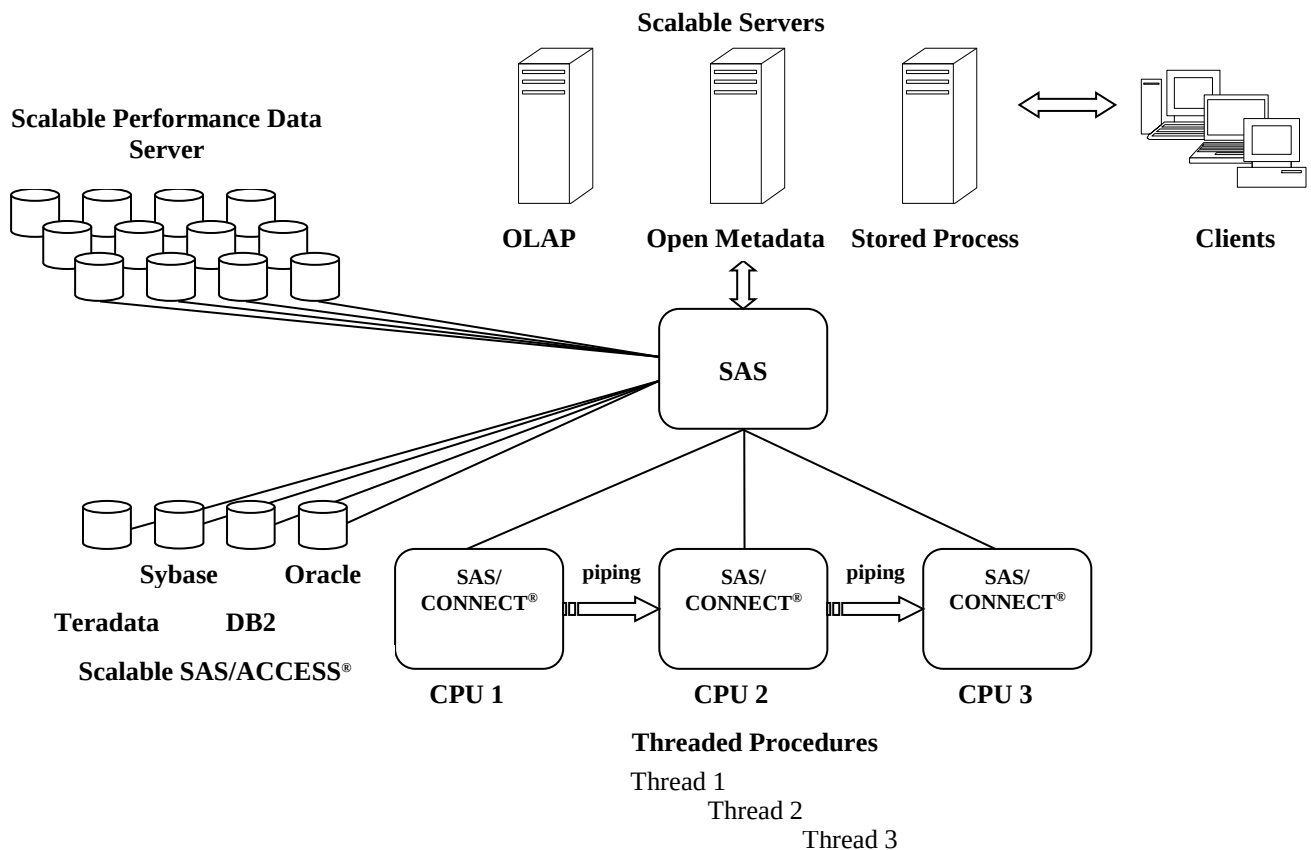
3. Threaded Distributed Technology

The IOM servers are threaded for client server applications

4. Threaded Server Technology

The Stored Process, Open Metadata and OLAP servers all make use of the Scalable Architecture.

The Power to Know.



Manageability: As decision-making moves closer to the operational-levels within an organization and the end-user population grows exponentially, a higher demand is placed on managing the information infrastructure. A completely new management framework is needed to support this fluid and demanding operational environment. It has to be flexible and provide a “central” point of administration. To address these demands, SAS System 9 contains the SAS Management Console. With it, IT can centrally manage SAS resources, no matter where they might reside.

The SAS Management Console framework consists of multiple management “plug-ins” that can be deployed including:

- Maintenance
 - License Management
 - Install Information
- Environment
 - Metadata
 - Servers
 - Applications
 - User Management
- Policy
 - Authorisation
 - Access Control
 - Resources
- Monitor
 - SAS Processes

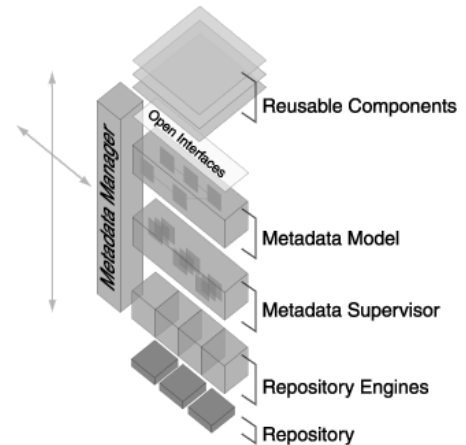
Included with this powerful toolkit will be the SAS Management Console Software Developers Kit to enable third party vendors or application programmers to create their own specialized plug-ins using standard JAVA mechanisms.



Interoperability: SAS System 9 will be the most open and interoperable platform SAS has ever delivered. It is designed and built with integration and open-standards in mind. These two factors are both important to the Information Technology world where integration into existing infrastructure is critical and also to 3rd-party developers who require access to the SAS platform in many different forms, whether they are SAS clients, web-based browsers or 3rd-party clients. SAS System 9 will contain a number of Java APIs that support interoperability and computing standards.

The Open Metadata Architecture, running on the SAS Open Metadata Server:

- supports open and secure access from any client
- supports open persistence allowing quick integration into existing storage infrastructures
- provides open interchange that allows quick integration with existing software infrastructures through adoption of the Common Warehouse MetaModel (CWM) industry standard.



The Extensible Markup Language (XML) is an application and machine independent transport mechanism that promotes interoperability and integration in many different areas. Within SAS XML is used as a persistence method in vertical applications, as a query protocol in SAS ETL Studio (the next generation replacement for Warehouse Administrator) and is further supported as an output format in ODS and as a data interchange mechanism within Base SAS with the Libname engine.

A new JAVA GUI has been provided so that XML can be better understood visually and to generate schemas and build XMLMaps to successfully import or export data.

These are not the only changes that can be expected in SAS System 9.

SAS Analytic Products

A number of SAS analytic products have also been enhanced such as:

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|-----------|---|
| SAS/IML® | Genetic Algorithms, new matrix sorting capabilities and by-group processing. |
| SAS/QC® | Support for split-plot designs in the ADX interface, PROC ANOM for simultaneously testing difference in quality outcomes |
| SAS/ETS® | PROC TIMESERIES which converts transactional data to time series format, PROC MDC for modeling a set of choices |
| SAS/STAT® | PROC MI and PROC MIANALYSE adjust for missing values via multiple imputation, SCORE and STRATA statements in PROC LOGISTICS allow conditional logistic regression and scoring, PROC ROBUSTREG now performs outlier detection. |

Shipping and Packaging

Rigorous research as to what customers receive and their experience of installing SAS has led to improvements in the shipping and packaging of the SAS System:

- CD Packaging separated into three tiers: Client, Mid-Tier and Server.
- Improved license distribution
- Quick Start Guides
- Improved configuration and installation instructions

Migration

The transition from older versions of SAS to SAS System 9 will be greatly assisted by a new MIGRATE procedure. This is particularly relevant with the 32 bit to 64 bit platform migration. PROC MIGRATE is similar to PROC COPY except its sole intent is to migrate data so it retains integrity constraints and takes on the data representation of the “out” library by default. Once migrated you will probably want to make use of an application that ships with SAS System 9 to validate both the installation integrity and data integrity.

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Base SAS®

Base SAS sees many new enhancements like long format names, in addition there will be new ODS Document destination and PERL regular expressions.

The output delivery system has been one of the most popular features amongst SAS users and SAS System 9 will allow output to be sent to the Document destination effectively allowing the data portion to be persisted. The output can be edited, viewed and rendered at will until it is deleted.

PERL regular expressions greatly simplify the manipulation of complex strings.

The new *anydt* informats make reading dates, times and date-time fields from raw data files much easier as it identifies and translates a whole range of date and time strings into SAS date or time numbers.

Summary

SAS System 9 offers toolkits to empower the decision makers in your organization to access and use the data that provides insights into the customers, suppliers or operational resources. These toolkits are supported by a scalable and secure architecture that makes best use of your hardware investments.