What’s New in SAS® 9.4 and SAS® Viya® 3.5
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Using This Book

Audience

This document describes the new features and enhancements for products during the SAS 9.4 life cycle and for products in SAS Viya 3.5. The functionality available at your site depends on what you have licensed and installed. See the product-specific documentation for your SAS products.
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SAS 9.4

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# Overview of SAS 9.4

## Initial Release of SAS 9.4

The initial release of SAS 9.4 was in 2013. SAS 9.4 includes features that are beneficial to all users at your site.

- For IT departments, SAS 9.4 provides a simplified architecture, increased security (including enhanced encryption algorithms), and deployment options that include running SAS on premises or on a cloud infrastructure.
- For SAS administrators, SAS 9.4 provides a broad suite of management capabilities that support management tasks, auditing, and software deployment and upgrades.

## Enhancing SAS 9.4 through Maintenance Releases

- For IT departments, SAS 9.4 provides a simplified architecture, increased security (including enhanced encryption algorithms), and deployment options that include running SAS on premises or on a cloud infrastructure.
- For SAS administrators, SAS 9.4 provides a broad suite of management capabilities that support management tasks, auditing, and software deployment and upgrades.
• For data administrators, the integration of the DataFlux products creates a more complete data management solution. Also, additional programming languages enable you to manipulate your data and access relational data from various data sources.
• For SAS programmers, high-performance analytics enable you to quickly analyze large amounts of data. Multi-threading capabilities enable you to perform analyses on single-machine deployments.
• For the business user, SAS 9.4 extends the options for mobile access and self-service options for data access, reporting, and exploration.

**Enhancing SAS 9.4 through Maintenance Releases**

Over the past several years, SAS 9.4 technology has advanced, and SAS has introduced SAS Viya. Both of these engines are part of one SAS platform.

During the SAS 9.4 life cycle, maintenance releases enable us to continue delivering new functionality to our users.

SAS 9.4M6 (November 2018) expands integration between SAS 9.4M6 and SAS Viya Cloud Analytic Services (CAS) engines. Security updates include upgrading to Java 8 runtime. This release includes programming and data access enhancements, new grid options for new customers, and accessibility enhancements.

Here are additional changes to the SAS Intelligence Platform:

• The SAS Web Server is now based on Apache Open Source HTTP server and it is completely built and packaged by SAS. It has also been upgraded from Apache HTTP server 2.2.34 to Apache HTTP server 2.4.34. As part of this upgrade, FIPS compliance is now supported.
• The SAS Web Application Server is updated from Pivotal tcServer 3.2.5 (or Tomcat 8.5.13) to Pivotal tcServer 3.2.11 (or Tomcat 8.5.32).
• The SAS Messaging Engine now uses ActiveMQ 5.15.5.
• The SAS Cache Locator now uses GemFire 8.2.7.
• SAS 9.4M6 includes support for preserving SSL for ActiveMQ during an update in place.
• SAS 9.4M6 includes support for preserving SSL for GemFire during an update in place.

SAS 9.4M5 (December 2017) provides greater integration with SAS Viya. This release includes several new and updated CAS-enabled procedures, new packages for accessing SAS Viya procedures, additional options for managing files in SAS Viya, and enhancements to DS2 actions and supported data types, and functions. SAS Studio 3.71 includes new tasks that support text analysis and forecasting in SAS Viya.


SAS 9.4M5 introduces procedures that can be used to connect to the CAS server, which is part of SAS Viya. Programmers can access CAS using familiar SAS programming interfaces, such as SAS Studio, SAS Enterprise Guide, SAS Enterprise Miner, and the SAS windowing environment. High-level changes also include security updates and integration between SAS 9.4 and SAS Viya.
SAS 9.4M4 (November 2016)
includes new releases of SAS Studio and the SAS analytical products, such as
SAS/ETS 14.2, and many more. This maintenance release also includes bridges to
SAS Viya.

SAS 9.4M3 (July 2015)
includes new releases of SAS Studio and the SAS analytical products, such as
SAS/STAT 14.1, SAS Enterprise Miner 14.1, SAS Contextual Analysis 14.1, and
SAS/ETS 14.1. This maintenance release also increases support for secure
configurations of SAS. Starting with this maintenance release, you also have the
ability to break up—or subset—your SAS software order. SAS is shipped with a
trusted CA certificate bundle, which makes the secure deployment of SAS easier.

SAS 9.4M2 (August 2014)
includes new releases of the SAS analytical products, such as SAS/STAT 13.2, SAS

SAS 9.4M1
includes 32-bit Windows support for a broader list of products.

New HTML 5 User Interfaces
Previously, many SAS applications and SAS solutions used the Adobe Flash Player to
provide interactive user interfaces. Adobe announced that it intends to end support for
Flash technology and will cease to update and distribute the Flash Player at the end of
2020. Browser vendors will disable Flash by default in 2019. For more information
about Adobe Flash end-of-life, see SAS Software and Its Use of the Adobe Flash Player.

Deploying and Administering SAS

Increasing Software Availability with More Deployment Options
To make SAS available to all users in your global organization, SAS 9.4 delivers tools
and technologies that support deploying, managing, and maintaining your software in
public and private cloud environments. To promote innovation, SAS provides a cloud
development platform. With a cloud environment, your IT department can quickly meet
the demands for increased computing capacity, which makes it easier for your software
to grow as your business grows.

In addition, SAS continues to support deploying SAS at your site and as hosted solutions
by using SAS Solutions OnDemand.

For more information, see SAS Product Support for Virtualization Environments.

Reducing the Cost and Complexity of SAS Deployments
SAS 9.4 includes an embedded middle-tier server called SAS Web Application Server
and an embedded Java Runtime Engine. In addition, a SAS Web Server is an optional
component of a SAS 9.4 middle-tier deployment. As a result, you do not need to spend
time or money acquiring, integrating, maintaining, and supporting third-party software.
The SAS Web Application Server simplifies IT management and supports deploying
SAS in a cloud environment.
SAS also delivers Java support as the SAS Private JRE. Quarterly security updates are provided.

**Subsetting SAS Software Orders**

Starting in SAS 9.4M3, the SAS Deployment Wizard enables you to break up—or subset—your SAS software order. Subsetting your order makes it easier to provision individual SAS clients and conserves download time and disk space. When you subset your depot, you are creating a copy of your original depot with only those products that you designate based on criteria such as operating system, product type, and language.

**Support for 32-Bit and 64-Bit Operating Environments**

SAS applications are typically used to process large data sets. This processing benefits from higher performance environments. SAS 9.4 takes advantage of the additional memory and processing capability of the 64-bit Windows operating environments. If a middle tier is part of your deployment, SAS requires a 64-bit operating environment.

Starting in SAS 9.4M1, SAS includes 32-bit Windows support for a broader list of products.

**Clustering the Metadata and Middle-Tier Servers to Improve Availability**

To make your software more available to users in your organization, SAS 9.4 supports clustering the metadata and middle-tier servers. A metadata server cluster is a group of three or more nodes that are configured as identical metadata servers. If the servers are clustered and each server manages copies of the same data, you drastically reduce the threat of data loss. If one node in the cluster fails, users can continue working on the remaining nodes, thus reducing potential system downtime. Finally, clustering helps distribute the workload, which can result in improved performance.

**Enhanced Management Capabilities for SAS Administrators with the SAS Environment Manager**

SAS administrators have access to enhanced management capabilities with SAS Environment Manager, a web-based monitoring solution for a SAS environment. SAS Environment Manager enables you to administer, monitor, and manage SAS resources, including administering the SAS Web Application Server and monitoring SAS foundation servers. The application collects and charts data on metrics for monitored resources, providing a comprehensive view of resource health and operation. It provides functions such as auto-discovery of resources, monitoring of log events, and reporting of alerts. The application also enables administrators to manage access for metadata objects.

**Increased Security**

Security “hardening” is an industry phrase that is growing in use. It is the process of securing a system by reducing its surfaces of vulnerability.

SAS follows coding standards and performs reviews and testing to continually improve SAS products. For more information, see [Security Assurances from SAS](#) and [SAS Software Security Framework: Engineering Secure Products](#).
For SAS software, security “hardening” includes upgrading third-party components, addressing vulnerabilities that have been flagged, closing loopholes, and ensuring that credential information is appropriately encrypted. Security “hardening” also includes single sign-on connections, setting minimum cipher levels for encrypted connections, and ensuring that secure connections do not interfere with system or administrative tasks.

In SAS 9.4M5, changes include updates to the SAS Security Framework, the JRE, and several third-party components. Customers can upgrade the underlying components of the Web Infrastructure Platform Data Server.

SAS 9.4M5 also introduces enhanced encryption algorithms and certificate handling.

In SAS 9.4M4, changes include updates to third-party components, incorporating hot fixes, and updating security-related documentation. For more information about changes in default settings and the available configuration options, see *Encryption in SAS*, *SAS Intelligence Platform: Security Administration Guide*, and *SAS Intelligence Platform: Middle-Tier Administration Guide*.

To help ensure that your system is protected from known vulnerabilities, SAS updates third-party components that are incorporated into SAS software with each maintenance release.

Starting in SAS 9.4M3, SAS is shipped with a trusted CA certificate bundle, which makes the secure deployment of SAS easier. Using this bundle simplifies the process for creating a secure deployment. After SAS installation, administrators can add and update trusted certificates by using the SAS Deployment Manager.

Starting in SAS 9.4, SAS/SECURE is shipped with Base SAS. You no longer need a separate license for SAS/SECURE. SAS/SECURE enables the protection of data and passwords with a range of encryption and encoding options.

As always, customers are encouraged to adopt processes that enable them to apply hot fixes and updates to SAS products on a regular basis. To stay current with information and updates, subscribe to the Hot Fix Announcements community and review Security Bulletins from SAS.

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**Accessing SAS from Mobile Devices**

SAS SDK for iOS and SAS SDK for Android are available for download from [http://developer.sas.com](http://developer.sas.com). The SAS SDKs enable all customers to create custom mobile apps that embed SAS Visual Analytics content. You start by creating a personalized app that simply takes the SAS Visual Analytics App and adds a corporate icon and app name. You can progress to creating completely customized mobile apps that bring together multiple capabilities. With the SAS SDKs, customers can build the mobile apps that they need.

Often, the consumers of SAS reports are high-level executives who are in meetings, traveling, or otherwise away from the office. To meet the demands of these business professionals, SAS reports are now available on devices. In the SAS Output Delivery System, the new ODS EPUB destination creates SAS reports as e-books that work optimally with the Apple iBooks e-book reader on the iPad, iPhone, or iPod.

ODS also supports output to HTML5 and Microsoft PowerPoint.

SAS Visual Analytics Apps for iOS for Android and Windows 10 are available for no additional fee from the Apple App Store, Google Play, and Microsoft Store. Through
these apps, you can subscribe to dashboards and reports on SAS Servers and interact with them through native apps on your mobile devices.

Using High-Performance Analytics

Analyzing Large Amounts of Data with High-Performance Analytics

If you are developing analytical models by using large amounts of data, SAS provides in-memory analytics that enable you to perform these analyses in a distributed environment. Because multiple nodes are working on the same tasks in parallel, in-memory analytics can provide significant gains in performance.

In SAS 9.4, five domain-specific high-performance analytics products are available:

- SAS High-Performance Statistics
- SAS High-Performance Data Mining
- SAS High-Performance Text Mining
- SAS High-Performance Econometrics
- SAS High-Performance Optimization

Using Multi-Threaded Capabilities on Single-Machine Deployments

In addition, the analytics procedures in these products are available from traditional SAS analytics products (such as SAS/STAT). Because these SAS High-Performance Analytics procedures are available from the traditional SAS analytics products, you can now run these high-performance analytics procedures on single-machine deployments.

- SAS Enterprise Miner
- SAS/ETS
- SAS Forecast Server
- SAS/OR
- SAS/STAT
- SAS Text Miner

Managing Your Data

Building an Integrated Information Management Platform

SAS has fully integrated the DataFlux suite of data quality, data integration, data governance, and master data management solutions. Incorporating the DataFlux brand into SAS helps customers build a more integrated information management approach that goes beyond data management and governance to support analytics and decision management.

Some DataFlux products have changed their names to SAS, and others will in the future. For example, DataFlux Federation Server is now SAS Federation Server. Instead of
being licensed separately, DataFlux products are now being combined with SAS software offerings that include other SAS products as well. Changes in offerings might affect your license renewals.

Performing Advanced Data Manipulation In-Database By Using DS2

DS2 is a SAS proprietary programming language that is appropriate for advanced data manipulation and applications. DS2 is included with Base SAS and is used in conjunction with the SAS DATA step. This language also includes additional data types, ANSI SQL types, programming structure elements, and user-defined methods and packages.

To allow SQL pre-processing on input tables, the SET statement for DS2 supports FedSQL syntax. The queries that are generated at run time can exchange data interactively between DS2 and any supported database. You can run your DS2 threaded packages on a database by using the SAS In-Database Code Accelerator.

Managing Relational Data Optimally By Using SAS FedSQL

SAS FedSQL enables you to access multiple data sources without performing a different SQL query for each data source. The same FedSQL query can be used on several data sources, and the results are presented in a single table. By using the FEDSQL procedure, you can submit FedSQL language statements in a Base SAS session.

SAS FedSQL is a SAS proprietary implementation of the ANSI SQL:1999 core standard. It provides support for new data types and other ANSI 1999 core compliance features and proprietary extensions. FedSQL provides data access technology that provides a scalable, threaded, high-performance way to access, manage, and share relational data in multiple data sources. When possible, FedSQL queries are optimized with multi-threaded algorithms to resolve large-scale operations.

Starting in SAS 9.4M5 (September 2017), FedSQL is a CAS-enabled procedure, which can be used to access SAS Viya resources that are licensed and accessible to a SAS 9 deployment.

Integration with SAS Viya

SAS 9.4M6 supports sessions between SAS and the SAS Viya CAS server. You can work with your SAS 9.4 and SAS Viya environments from the same familiar SAS interfaces, such as SAS Enterprise Guide, SAS Studio, and the SAS windowing environment.

Note: Your site must license and install both SAS Viya and SAS 9.4 to access the CAS functionality in a SAS 9.4M5 programming environment. The available procedures depend on the SAS Viya products licensed at your site. SAS 9.4M5 (September 2017) sites need to receive a new order to run these SAS Viya procedures. Packages are available for accessing SAS Viya procedures in a SAS 9.4M5 programming environment. Here are some of the available packages: SAS Visual Analytics procedures and SAS Viya procedures, SAS Econometrics procedures, SAS Optimization procedures, SAS Forecasting procedures, SAS Visual Data Mining and Machine Learning procedures, and SAS Statistics procedures.

- DATA step code can execute on a SAS 9.4 server and a CAS server. The new SAS Viya Analytic procedures execute only on the CAS server.
• The CAS LIBNAME engine enables you to load SAS data sets to a CAS table for processing on the CAS server using the DATA step and SAS Viya Analytic procedures.

• Several procedures can perform some processing on the CAS server: COPY, MEANS, REPORT, SUMMARY, TABULATE, and TRANSPOSE.

• In addition to processing NUMERIC and CHAR data, the CAS server supports the VARCHAR data type for DATA step processing.

• The CAS server processes only tables with an encoding of UTF-8. When SAS data sets are loaded to the CAS server, the data sets are automatically transcoded to UTF-8.

• You can use the CAS procedure and the CAS language (CASL) to program CAS actions.

• Many SAS language publications now include information that you need to process CAS tables. You will see both SAS 9.4 and SAS Viya documentation when it is appropriate to document how the language interacts with the CAS server.

Starting in SAS 9.4M5 (December 2017), several CAS-enabled procedures are available.
Chapter 2

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**SAS 9.4M6 Integration with SAS Viya**

SAS 9.4M6 provides further integration with SAS Viya 3.4, which shipped in July 2018.

**SAS 9.4M5 Integration with SAS Viya**

Beginning with SAS 9.4M5, you can submit code to SAS Viya 3.3 and later releases of Cloud Analytic Services (CAS).

In SAS Viya 3.3, new procedures are available. If you are currently running SAS 9.4M5, you need to order a new deployment to get these procedures. If you are getting SAS 9.4M5 for the first time, these procedures are automatically included.

- You can access the CAS server from all SAS programming environments, including SAS Studio, SAS Enterprise Guide, SAS Enterprise Miner, and SAS Display Manager.

  *Note:* To connect to the CAS server, a valid certificate must be in place. For information about obtaining and configuring certificates, see Configure SAS 9.4 Clients to Work with SAS Viya in *Encryption in SAS*.

- DATA step code and new SAS Viya procedures execute on the CAS server. There are a few DATA step statements that do not run on the CAS server. If it is determined that the DATA step has code that does not run on the CAS server, the DATA step runs in SAS.

- The CAS LIBNAME engine enables you to load SAS data sets to a CAS table for processing on the CAS server using the DATA step and SAS Viya procedures. You can also use the CAS LIBNAME engine to process CAS tables using SAS procedures that run only in SAS and not on the CAS server. For example, when PROC PRINT DATA= specifies a libref that is associated with the CAS engine, the CAS table is downloaded from the CAS server to SAS for PROC PRINT to process.

- Several procedures perform some processing on the CAS server: COPY, MEANS, REPORT, SUMMARY, TABULATE, and TRANSPOSE.

- In addition to processing NUMERIC and CHAR data, the CAS server supports the VARCHAR data type for DATA step processing. VARCHAR data is based on the number of characters for a variable as compared to CHAR, which is based on the number of bytes for a variable.

Several procedures can read and process VARCHAR variable data in CAS tables: CONTENTS, COPY, DATASETS COPY and CONTENTS statements, EXPORT,
IMPORT, PRINT, DOWNLOAD (SAS/CONNECT), and UPLOAD (SAS/CONNECT).

- The CAS server processes only tables with an encoding of UTF-8. When SAS data sets are loaded to the CAS server, the data sets are automatically transcoded to UTF-8. For DBCS data, SAS provides a CAS LIBNAME option and data set option, both with the name NCHARMULTIPLIER, and a system option, CASNCHARMULTIPLIER=, for you to specify a multiplier to increase byte size during transcoding.

- You can use the CAS procedure and the CAS language (CASL) to program using CAS actions.

- You can submit SAS DS2 language statements to the CAS server by using PROC DS2. Most of the functionality of the DS2 language is supported on the CAS server. You can submit a SAS FedSQL language statement to the CAS server by using PROC FEDSQL. FedSQL provides query and join functionality on the CAS server.

- Many SAS language publications now include information that you need to process CAS tables. You will see both SAS 9.4 and SAS Viya documentation when it is appropriate to document how the language interacts with the CAS server.

- SAS 9.4 and SAS Viya programming documentation appear in these document collections:
  - SAS 9.4 and SAS Viya Programming. For more information, see SAS Programming Documentation.

- Take some time to familiarize yourself with the contents. User feedback for the new look and feel of the SAS 9.4 programming documentation has been very positive—it just takes a little time to become used to it.

Cloud Analytic Services

Cloud Analytic Services describes the CAS server that is available in SAS Viya. The CAS statement, CAS system options, and CAS macros enable SAS 9.4M5 programmers to directly reference CAS server resources. Starting in SAS 9.4M6, you can specify the WHERE statement in a DATA step that is running CAS.

CAS Statement

SAS 9.4M5 shipped in September 2017 and has these new options for the CAS statement:

- You can specify the location of the authinfo file that contains your credentials using the AUTHDOMAIN= system option.
- The CASSERVERMD= option specifies the name of a server object registered on the SAS Metadata Server that associates SAS Cloud Analytic Services connection parameters with a server name.
**CAS System Options**

For SAS 9.4M5 (September 2017), these system options were added to SAS Cloud Analytic Services:

- Data transfer of CAS tables can impede system performance if the CAS table is very large. You can use the `CASDATALIMIT=` system option to limit the amount of data in a single CAS table that can be transferred from the CAS server to SAS.

- When SAS reads a data set to be loaded to the CAS server, SAS makes a best guess at the number of bytes that are needed to transcode the data to UTF-8. You can use the `CASNCHARMULTIPLIER` system option to replace the best guess with an explicit value of the byte multiplier when you know the number of bytes that are needed to represent the data in UTF-8.

- By default, the `DSCAS` system option is set so that the DATA step runs on your CAS server without specifying a session reference option in the DATA statement. If `NODSCAS` is set, the `SESSREF=` DATA statement option is required for the DATA step to run on the CAS server.

**CAS Functions**

For SAS 9.4M6 (November 2018), the new `SESSBUSY` function determines whether a CAS session is busy processing actions.

**CAS Macros**

User-defined formats are stored in a SAS catalog in SAS and a CAS library on the CAS server. To use your SAS user-defined formats on the CAS server, you can migrate them from SAS to the CAS server using the autocall macro `%UDFSEL`. This macro generates a `SELECT` statement that you can use with the `FORMAT` procedure to migrate only the user-defined formats that your data is using.

**Create and Run Python Objects in SAS**

In the May 2019 release of SAS 9.4M6, you can create a Python object to execute a Python function using `PROC FCMP`. You execute Python objects using `PROC FCMP` or the DATA step. You cannot submit Python objects to the CAS server.

For more information about the Python object, see “Using PROC FCMP Python Objects” in *SAS Component Objects: Reference*.

**DS2 Language**

**About the DS2 Language**

DS2 is a SAS proprietary programming language that is appropriate for advanced data manipulation and applications. DS2 is included with Base SAS and intersects with the SAS DATA step. DS2 also includes additional data types, ANSI SQL types, programming structure elements, and user-defined methods and packages. Several DS2 language elements accept embedded FedSQL syntax, and the run-time-generated queries can exchange data interactively between DS2 and any supported database. This action enables SQL preprocessing of input tables, which effectively combines the power of the two languages. The DS2 procedure enables you to submit DS2 language statements from a Base SAS session. In addition, by using the power of the SAS Embedded Process, the SAS In-Database Code Accelerator enables you to publish a DS2 thread program to the database and execute the thread program in parallel inside the database.
DS2 Language: SAS 9.4M6
Beginning in August 2019, PROC DS2 supports the Google BigQuery and Snowflake databases for SAS 9.4M6 and SAS Viya 3.4. Read and Write access is supported from a SAS library and from a CAS library. In CAS, DS2 creates in-memory tables from existing tables only. Appropriate SAS/ACCESS software must be installed.

In the April 2019 release of SAS 9.4M6, PROC DS2 includes connection options that enable you to connect to MongoDB and Salesforce databases.

SAS 9.4M6 (November 2018) has these changes and enhancements:

• PROC DS2 supports databases that are JDBC compliant as data sources.
• The SAS In-Database Code Accelerator can be executed on MapReduce or Spark.
• Character data can be written in a universally unique identifier (UUID) format.
• Inline declarations can be specified for DO loop counters.
• A RETAIN option has been added to the MERGE statement that produces a many-to-many match-merge that is similar to a DATA step merge.
• You can direct the PROC DSTODS2 output file to a directory using the OUTDIR= option.
• New functions are available: CMISS, LOGISTIC, SAVING, SHA256, and SYSGET.
• New methods for the DS2 HTTP package enhance security and a default character set.

DS2 Language: SAS 9.4M5
SAS 9.4M5 (September 2017) has these changes and enhancements:

• The new procedure DSTODS2 translates a subset of your SAS DATA step code into DS2 code.
• Methods in thread programs now allow packages to be passed in as parameters.
• DS2 can access the Amazon Redshift, Microsoft SQLServer, and Vertica data sources.
• You can use the new predefined packages, PCRXFIND and PCRXREPLACE, for regular expression matching and substitution. These packages are based on the PCRE 2 open-source regular expression library.
• When a variable is used but not declared, a warning is sent to the SAS log. The warning now indicates the data type, length, and, in some cases, precision, that are assigned to the undeclared variable.

DS2 Language: SAS 9.4M4
SAS 9.4M4 (November 2016) has these changes and enhancements:

• The private access modifier is now supported for attributes or methods that are intended for internal use within the package.
• Two new functions, DIF and LAG, enable you to access previous values of a variable or expression. These functions are useful for computing lags and differences of series.
• The DO statement now enables you to use multiple index variable clauses separated by commas.
• The new INTNEST function calculates the number of whole periods of the smaller interval that fits into the period of the larger interval.
Three new automatic variables, _HOSTNAME_, _NTHREADS_, and _THREADID_ enable you to subset a problem across a thread.

The TIME and TIMESTAMP precision is now preserved across a THREAD and DATA boundary.

**DS2 Language: SAS 9.4M3**

SAS 9.4M3 (July 2015) has these changes and enhancements:

- The SAS In-Database Code Accelerator supports reading multiple tables and embedded SQL by using the SET statement, reads and writes HDFS-SPD engine file formats, and links to the MapReduce job log from the SAS log to find error messages that are related to Hadoop. The SET statement supports multiple tables and embedded SQL.
- You can change several default behaviors of a DS2 program by using the DS2_OPTIONS statement.
- You can use the FMTINFO( ) function to determine whether you are using a format or informat and to obtain information about that format or informat. This function also returns the format or informat category, the description, format width values, and decimal place values.
- Three new SQLSTMT methods enable you to retrieve the number of columns, the name of a column by column number, and the type of column by column number.
- You can parse JSON text by using the JSON DS2 package.
- The D2TX package enables you to perform time zone processing.
- You can match-merge data by using the MERGE statement.
- The SELECT statement in embedded SQL text supports the PARTITION BY, ORDER BY, INDSNUM, and WHERE clauses.
- You can create a US-locale-based value regardless of the current locale by using the BESTDOTX. format.
- You can partition tables by using the DBCREATE_TABLE_OPTS table option.

**DS2 Language: February 2015 Release**

In the February 2015 release, the SAS In-Database Code Accelerator for Hadoop uses HCatalog to process complex, non-delimited files. Using HCatalog enables the SAS In-Database Code Accelerator for Hadoop to support Avro, ORC, RCFile, and Parquet file types. In addition, you can now use the DBCREATE_TABLE_OPTS table option to specify the output SerDe, the output delimiter of the Hive table, the output ESCAPED BY character, and any other CREATE TABLE syntax allowed by Hive.

**DS2 Language: SAS 9.4M2**

SAS 9.4M2 includes the following DS2 changes:

- The SAS In-Database Code Accelerator for Hadoop runs the DS2 data program as well as the thread program inside the database.
- A new predefined HTTP package enables you to construct an HTTP client to access web services.
- A new logger enables logging of HTTP traffic through the SAS Logging Facility.
- A connection string parameter is available when instantiating an SQLSTMT package.
DS2 Language: SAS 9.4M1
SAS 9.4M1 (December 2013) includes the following DS2 changes:

- The behavior for the SAS In-Database Code Accelerator has changed where the DS2 code is not executed inside the database, by default. An option must be set to send the DS2 code to the database.
- The SAS In-Database Code Accelerator for Teradata can now run the DS2 data program as well as the thread program inside the database.
- New DS2 configuration and run-time loggers have been added to the SAS Logging Facility.

Additional Information for DS2 Language
For more information, see SAS DS2 Language Reference and Base SAS Procedures Guide.

FedSQL Language

About FedSQL Language
SAS FedSQL is a SAS proprietary implementation of the ANSI SQL:1999 core standard. It provides support for new data types and other ANSI 1999 core compliance features and proprietary extensions. FedSQL provides data access technology that brings a scalable, threaded, high-performance way to access, manage, and share relational data in multiple data sources. When possible, FedSQL queries are optimized with multi-threaded algorithms in order to resolve large-scale operations. For applications, FedSQL provides a common SQL syntax across all data sources. That is, FedSQL is a vendor-neutral SQL dialect that accesses data from various data sources without submitting queries in the SQL dialect that is specific to the data source. In addition, a single FedSQL query can target data in several data sources and return a single result table. The FEDSQL procedure enables you to submit FedSQL language statements from a Base SAS session.

In its initial release, FedSQL provided access to the following data sources: SAS data sets, SAS Scalable Performance Data Engine (SPD Engine) data sets, and the following databases: Aster, DB2 for UNIX and PC operating environments, Greenplum, MySQL, Netezza, ODBC databases, Oracle, SAP (Read-only), Sybase IQ, and Teradata. Additional database support has been added in subsequent releases.

FedSQL Language: SAS 9.4M6
Beginning in August 2019, PROC FEDSQL supports the Google BigQuery and Snowflake databases for SAS 9.4M6 and SAS Viya 3.4. Read and Write access is supported from a SAS library and from a CAS library. In CAS, FedSQL creates in-memory tables from existing tables only. Appropriate SAS/ACCESS software must be installed.

In the April 2019 release of SAS 9.4M6, PROC FEDSQL includes connection options that enable you to connect to MongoDB and Salesforce databases.

SAS 9.4M6 (November 2018) has these changes and enhancements:

- PROC FEDSQL support for databases that are JDBC compliant as data sources.
- The FedSQL language creates VARCHAR columns that contain greater than 65,535 characters as type STRING in Hive.
FedSQL Language: SAS 9.4M5
SAS 9.4M5 shipped in September 2017 and has these FedSQL enhancements:

- This release supports Amazon Redshift, Microsoft SQL Server, and Vertica data sources.
- New table options for Hive allow additional database-specific options to be placed before and after the table name when you are creating a table.
- You can query SAS Cloud Analytic Services (CAS) tables.
- The ENCRYPT= table option supports stronger AES encryption for SAS data sets.
- SAS Scalable Performance Data (SPD) Server tables can now also be encrypted with ENCRYPT= option.
- You can now get information about views from DICTIONARY.COLUMNS queries.
- This release adds support for numerous functions.

FedSQL Language: SAS 9.4M4
SAS 9.4M4 (November 2016) has these FedSQL enhancements:

- support for reading and writing SAS Scalable Performance Data (SPD) Server tables
- a new DESCRIBE TABLE statement
- support for three-level names when creating and reading Hive tables
- support for several new functions

FedSQL Language: SAS 9.4M3
SAS 9.4M3 has these FedSQL enhancements:

- Support for HAWQ and Impala distributions of Hadoop; support for Impala includes bulk loading.
- You can specify DBMS-specific syntax to append to the CREATE TABLE statement by using the DBCREATE_TABLE_OPTS= table option.
- You can set the encoding for a SAS data set by using the ENCODING= table option.
- You can use the DECIMAL/NUMERIC(p,s) data type for data definition and for reading in HDMD.
- You can use the DECIMAL/NUMERIC(p,s) data type and the VARBINARY data type for data definition and for reading in Hive.
- The Hive ARRAY, MAP, STRUCT, and UNION complex types read from Hive.

FedSQL Language: SAS 9.4M2
SAS 9.4M2 (August 2014) has the following FedSQL enhancements:

- Support for Hive, HDMD, and PostgreSQL data sources. Not all FedSQL statements are supported for each data source. See the documentation for FedSQL statements to determine statement support.
- The CAST function for ODBC enables you to convert a value from one data type to another.
- DBMS-specific clauses can be added when indexes are created.
- SASHDAT files can be compressed.
FedSQL Language: SAS 9.4M1
SAS 9.4M1 (December 2013) adds support for Memory Data Store (MDS), SAP HANA, and SASHDAT data sources.

Additional Information for FedSQL Language
For more information, see SAS FedSQL Language Reference and Base SAS Procedures Guide.

Hadoop Support

Hadoop Support: SAS 9.4M6
SAS 9.4M6 (November 2018) has these changes and enhancements:

• Information about IBM Big Insights and Pivotal has been removed from the Hadoop Configuration Guide for Base SAS and SAS/ACCESS documentation. These Hadoop vendors have asked their customers to move to Hortonworks.

• If you are using Hortonworks version 3.0, select No Filter when using SAS Deployment Manager to collect the Hadoop JAR files. This selection ensures that the correct jline JAR files are obtained for running PROC HADOOP Pig jobs successfully.

Hadoop Support: SAS 9.4M4
Starting in SAS 9.4M4 (November 2016), the FILENAME statement, Hadoop access method now supports Knox security.

Hadoop Support: SAS 9.4M3
SAS 9.4M3 has these enhancements:

• Using the HADOOP procedure, you can now connect to a Hadoop cluster by copying the Hadoop configuration files to a physical location that is accessible to the SAS client machine, and then setting a SAS_HADOOP_CONFIG_PATH environment variable to the location of the configuration files. You can also request recursive action to execute the operation on the specified directory as well as subdirectories for several HDFS statement options. Support was added for BINARY and DECIMAL data types, and options were added to enhance automatic creation of generated SQL code and to control transcode errors.

For more information about the HADOOP procedure, see Base SAS Procedures Guide.

• New HDFS statement options display the contents of files, change file access permissions, and list HDFS files. In addition, you can submit a MapReduce program and Pig language code to a Hadoop cluster through the Apache Oozie RESTful API. For more information about HDFS commands, see FILENAME (Hadoop Access Method) in SAS Global Statements: Reference.

• In the SPD Engine, current access to data that is stored in HDFS is enhanced with a new distributed lock manager. Parallel processing is expanded to write data. SPD data sets can be read in HDFS through Hive. For more information, see SAS SPD Engine: Storing Data in the Hadoop Distributed File System.

• The SAS FedSQL language has enhanced support for these data types:
• The DECIMAL/NUMERIC(p,s) data type is supported for data definition and for reading in HDMD.

• The DECIMAL/NUMERIC(p,s) data type and the VARBINARY data type are supported for data definition and for reading in Hive.

• The Hive ARRAY, MAP, STRUCT, and UNION complex types read from Hive.

In addition, by using the SQOOP procedure, you can access Apache Sqoop within a SAS session to transfer data between a database and HDFS. For more information about the SQOOP procedure, see Base SAS Procedures Guide.

**Hadoop Support: SAS 9.4M2**

SAS 9.4M2 (August 2014) has the following enhancements:

• **SAS Hadoop Configuration Guide for Base SAS and SAS/ACCESS** is available from SAS 9.4 Guides, Papers, and Documentation for Hadoop on support.sas.com. This book explains how to configure SAS components so that you can use SAS technology to connect to Hadoop.

• SAS can write Hadoop MapReduce job information to the SAS log.

• The SPD Engine improves Hadoop performance.

• You can submit HDFS commands through WebHDFS.

**Hadoop Support: SAS 9.4M1**

SAS 9.4M1 (December 2013) enables you to use the SPD Engine to read, write, and update data in a Hadoop cluster through the HDFS. In addition, you can now use the HADOOP procedure to submit configuration properties to the Hadoop server.

**Additional Information about Hadoop Support**

For more information, see the following documentation:

• For an overview of SAS and Hadoop, see SAS and Hadoop Technology: Overview.

• To learn about common deployment scenarios, see SAS and Hadoop Technology: Deployment Scenarios.

• For more information about SAS/ACCESS Interface to Hadoop, see SAS/ACCESS for Relational Databases: Reference.

• For more information about support for Hadoop and a list of the supported Hadoop distributions, see SAS 9.4 Support for Hadoop and SAS 9.4 Guides, Papers, and Documentation for Hadoop.

**Execute the DATA Step in New Supported Environments**

In SAS 9.4M2 (August 2014), DATA step processing in Hadoop has moved from preproduction status to production status.

In SAS 9.4M1 (December 2013), the DATA step runs in-memory in the SAS LASR Analytic Server and inside Hadoop using SAS/ACCESS and the SAS Embedded Process, with limitations. Note that the DATA step processing in Hadoop is preproduction.

For more information, see SAS LASR Analytic Server: Reference Guide and SAS In-Database Products: User’s Guide.
**Improved Performance**

- SAS can process large amounts of data more efficiently by using new system options to align data and utility files on a page boundary and to set the page size for a SAS library to be the same size as a RAID stripe.
- Optimization processes to determine page size and the default size of a logical record length have been enhanced.
- The Scalable Performance Data Engine (SPD Engine) enables the caching of opened SPD Engine files.

In SAS 9.4M2 (August 2014), the SPD Engine enhances I/O control and efficiency, and improves Hadoop performance.

For more information, see *SAS System Options: Reference*, *SAS Language Reference: Concepts*, and *SAS Scalable Performance Data Engine: Reference*.

**Increased Security**

**Security Updates: SAS 9.4M6**

SAS 9.4M6 (November 2018) has these changes and enhancements:

- TLS is supported on Integrated Object Model (IOM) servers and server processes that provide IOM Bridge access. On all IOM servers, the NETENCRYPTALGORITHM system option is specified to enable TLS encryption on these servers:
  - SAS Metadata Server
  - SAS Workspace Server
  - SAS OLAP Server
  - SAS Stored Process Server
  - SAS Pooled Workspace Server
  - Object Spawner
- The SSLCACERTDIR system option specifies the location of the trusted certificate authorities (CA) found in OpenSSL format.

- PROC S3 has these enhancements:
  - supports encryption when working with the Amazon S3 or Amazon Redshift environment
  - the ENCKEY statement to register encryption keys
  - encryption is enabled with new options in the COPY, GET, GETDIR, INFO, PUT, and PUTDIR statements

**Security Updates: SAS 9.4M5**

SAS 9.4M5 (September 2017) includes these updates to encryption:

- New system options have been added for LINUX, UNIX, and z/OS:
  - SSLCACERTDATA specifies the trusted Certification Authority (CA) certificate in base64 encoded string.
  - SSLCIPHERLIST specifies a list of cipher suites to use.
• SSLSNIHOSTNAME enables the client to use Server Name Indication (SNI) in the TLS handshake to identify the server name that it is trying to connect to.

• SSLCACERTDIR specifies the location of the trusted Certification Authority (CA) certificates found in OpenSSL format.

• SSLMINPROTOCOL specifies the minimum TLS protocol that can be negotiated when using OpenSSL.

• New encoding type SAS005 uses AES encryption with a 256-bit fixed key and a 64-bit random salt value. SAS005 increases security for stored passwords by using the SHA-256 hashing algorithm and is hashed for additional iterations.

• For more security, you can use SHA256-10000 for internal account passwords used in metadata. SHA256-10000 is the same as SHA256, but is hashed for additional iterations.

• When encrypting data at rest, you can now specify data set option ENCRYPT=AES2. AES2 is another key generation algorithm for AES encryption.

• Beginning in the December 2017 release of SAS 9.4M5, on Linux, if the root CA is already in the OpenSSL trusted certificate store, Lua, Python, and SWAT clients should work without having to set the CAS_CLIENT_SSL_CA_LIST= environment variable.

Security Updates in SAS 9.4M3
In SAS 9.4M3 (July 2015), the SAS Deployment Wizard automates the process of updating the TLS certificates in UNIX and z/OS environments and for Java applications on Windows and UNIX. In UNIX and z/OS environments, the installation process lays down a Mozilla bundle of trusted CA certificates. The installation also includes the files that are used as the trusted list of certificates. In UNIX environments, trusted certificates are now located in the trusted CA bundle in $SAS-installation-directory/SASSecurityCertificateFramework/1.1/cacerts/trustedcerts.pem. During installation, the SAS Deployment Wizard sets the SSLCALISTLOC system option in the $SAS-installation-directory/sasv9.cfg file to point to the trustedcerts.pem file.

You can add certificates to and remove those certificates from the trusted bundle of certificates by using the SAS Deployment Manager. New environment variables enable you to specify the minimum TLS protocol for OpenSSL and to specify OpenSSL ciphers.

SAS provides OpenSSL versions of TLS on UNIX and z/OS. For the SAS 9.4 release and all maintenance releases of SAS 9.4, updated versions of OpenSSL are provided at the time of the software release and are kept up-to-date through hotfixes. For the latest information about OpenSSL security advisories under consideration for SAS components, see SAS Statement Regarding OpenSSL Security Advisories.

Security Updates in SAS 9.4M1
SAS 9.4M1 (December 2013) incorporates a new default location for the TLS Certificate Authority for UNIX and z/OS foundation servers, and support for Subject Alternative Names in TLS certificates on UNIX and z/OS clients and servers. Also new in this release, authorized users of metadata-bound libraries can access data without supplying the key-in code.

Security Updates in SAS 9.4
• SAS/SECURE is a product within SAS, and it is now included with Base SAS. In prior releases, SAS/SECURE was an add-on product that was licensed separately. A
separate license for SAS/SECURE is no longer required. This change makes strong encryption available in all deployments (except where prohibited by import restrictions).

- SAS/SECURE increases the security by using the industry standard Advanced Encryption Standard (AES) with 64-bit salt. The components of the SAS language that support security use the AES encryption to encrypt and secure SAS data.

- SAS supports mixed-case passwords and the IBM standard for password phrases up to 100 characters.

- SAS data sets can be better secured by placing them in a metadata-bound library, which is a physical library that is tied to a metadata object.

- The SAS logging facility supports SAS/CONNECT spawner and encryption activity, and the auditing of logging configuration changes, SAS data set access, and access to metadata-bound libraries. Logger activity and level settings can be made secure.

- Email security has been enhanced.

**Additional Information about Security**


**Enhance Your SAS Output**

**Output Enhancements: SAS 9.4M6**

Here are the new features and enhancements in SAS 9.4M6 (November 2018):

- The default style for HTML 5.0 output has changed from HTMLBlue to HTMLEncore.

- The ODS destination for Word is preproduction. The ODS destination for Word enables users to customize different aspects of the document, such as themes, tables of contents, and orientation.

- The method that is used to build and compress PDF files has been enhanced, resulting in smaller file sizes. This change affects all PDF files, including tagged PDF files.

For more information about the new features for accessibility, see “Creating Accessible Output: SAS 9.4M6” on page 28.

**Output Enhancements: SAS 9.4M5**

In the December 2017 release of SAS 9.4M5 and SAS Viya 3.3, you can enable wrapping text in a designated Excel worksheet area using the ODS EXCEL FLOW option.

SAS 9.4M5 (September 2017) includes these enhancements to output:

- Several new features support accessible graphs using ODS HTML5. For more information, see “Creating Accessible Output: SAS 9.4M5” on page 29.

- The ODS PDF statement ACCESSIBLE option that enables accessible PDF documents is now fully supported.

- Table of contents metadata can be included in the body file using the ODS HTML5 OUTLINE= option.
• ODS RTF output can split table rows using the TRKEEP option.

**Output Enhancements: SAS 9.4M4**

SAS 9.4M4 (November 2016) has these enhancements:

• The new HEADING statement has been added to the ODSTEXT procedure.

• The new DESCRIPTION= option has been added to these methods: IMAGE, LAYOUT_ABSOLUTE, LAYOUT_GRIDDED, REGION (absolute), REGION (gridded), and TABLE_START.

• The new DESCRIPTION= option specifies alternative text for layouts and layout regions. The DESCRIPTION= option is new for these statements: ODS LAYOUT ABSOLUTE, ODS LAYOUT GRIDDED, ODS REGION Statement, Absolute, and ODS Region Statement, Gridded.

• The ODS GRAPHICS statement supports these options:
  • NBINSMAX= specifies the maximum number of bins that are processed for histograms.
  • NXYBINSMAX= specifies the maximum number of bins that are processed for heat maps.

• The ODS HTML5 destination supports accessibility.
  • The new preproduction ACCESSIBLE_GRAPH option has been added to the ODS HTML5 statement. The ACCESSIBLE_GRAPH option adds accessibility metadata to graphs that are created by ODS Graphics.

  Users with visual impairments can access the graph using SAS Graphics Accelerator. The accelerator provides users with alternative presentations of SAS data visualizations that have been created with the metadata. For more information, see the software product page for [SAS Graphics Accelerator](#).

**Output Enhancements: SAS 9.4M3**

SAS 9.4M3 (July 2015) has these enhancements:

• Support for Microsoft Excel that uses the ODS EXCEL statement.

• A new procedure, MSCHART, creates charts that can be opened and manipulated in Microsoft Excel.

• The default EPUB version is EPUB3.

• In ODS EPUB3, embedded video, audio, and images are supported. This functionality is provided using the Report Writing Interface (RWI) and the Inline Formatting functions that are used with the ODS ESCAPECHAR statement.

• The ODS EPUB3 statement supports new EVENT= values for figures and custom entries in a table of contents.

• The ODS POWERPOINT statement now supports style options for the slide background. This statement also supports changes to the slide transitions and their effects.

• In ODS HTML5, embedded video and audio are supported. This functionality is provided using the Report Writing Interface.

**Output Enhancements: SAS 9.4M2**

SAS 9.4M2 (August 2014) has enhancements for the EPUB, EPUB3, and HTML5 destinations.
Output Enhancements: SAS 9.4M1
SAS 9.4M1 (December 2013) enables you to apply cascading style sheets and includes support for EPUB 3 standard.

Output Enhancements: SAS 9.4
- The Output Delivery System (ODS) Report Writing Interface (RWI) enables you to create and manipulate predefined ODS objects in a DATA step to create highly customized output.
- Using new ODS destinations, you can create EPUB, HTML5, and Microsoft PowerPoint files.
- You can now create text and list templates.
- You can arrange ODS output objects exactly where you want them on a page, or use dynamic placement of objects by using a grid structure.
- A new procedure creates table templates and binds them with input data set in one statement.
- You can animate multi-page GIF images and SVG files by setting system options.

Additional Information about SAS Output

Enhanced ODS Statistical Graphs

ODS Graphics in SAS 9.4M6
Starting in SAS 9.4M6 (November 2018), you can create pie charts and donut charts using the SGPIE procedure. This procedure is preproduction.

ODS Graphics in SAS 9.4M5
ODS Graphics provides enhanced support for vector graphics and now supports data tips and drill-down capability with HTML5 output. In addition, the ODS GRAPHICS statement provides a number of new features and options to control graphic output. Several of these options enable you to control the processing of large CAS in-memory tables. For example, the OBSMAX= option specifies the maximum number of observations that are processed.

For the SGPLOT and SGPANEL procedures, the new LEGENDITEM statement creates a legend item that can be included in the legend. For example, to display annotation text within the legend area, you can define a LEGENDITEM statement with TYPE=TEXT and specify the text in the TEXT= option.

Numerous plot and axis options were added to the SGPLOT and SGPANEL procedures to control and enhance the output of your graphs. These options affect a wide range of plot types. For example, you can display and change the appearance of line fill patterns in a number of plot types. This feature helps support accessibility. Graphs that use this feature do not rely on color alone to distinguish categories of data. Many other options were added to the procedures to facilitate enhanced output.

ODS Graphics in SAS 9.4M4
Starting in SAS 9.4M4 (November 2016), the following new functionality and enhancements are included:
• The ELLIPSE statement has been added to the SGPANEL procedure. The statement adds a confidence or prediction ellipse to another plot.

• A new ELLIPSEPARM statement has been added to the SGPlot and SGPANEL procedures. The ELLIPSEPARM statement plots an ellipse with specified axis lengths, a specified slope for the major axis, and the ellipse center. The ELLIPSEPARM statement does not perform computations on input data to derive the location and shape of the ellipse.

• The NBINSMAX and NXYBINSMAX options have been added to the ODS GRAPHICS statement. These options specify the maximum number of bins that are processed for histograms and heat maps, respectively.

• The LINEJOIN option has been added to the Graph Template Language SERIESPLOT statement. This option enables you to specify how to shape the vertices of the series line.

• The accessibility topic in SAS ODS Graphics: Procedures Guide is enhanced with information about the accessibility of the graphs that you create with the ODS Graphics procedures.

ODS Graphics in SAS 9.4M3
In SAS 9.4M3 (July 2015), ODS Graphics has several new plot statements and includes a wide range of enhancements to plots, legends, axes, axis tables, and attribute maps. The ODS Graphics Designer enables you to create more sophisticated graphs. The ODS Graphics Editor supports editing new plot types and annotating and editing some attributes of graphs that are generated by the SAS/QC procedures. The viewport function in the ODS Graphics Editor adjusts the view of 3-D graphs, and groups are supported in histograms and density plots. For all ODS Graphics, implementation of sub-pixel rendering results in clearer images.

ODS Graphics in SAS 9.4M2
In SAS 9.4M2 (August 2014), ODS Graphics has a new text plot and several enhancements to the graphics output.

ODS Graphics in SAS 9.4M1
In SAS 9.4M1 (December 2013), ODS Graphics has new and revised plots, charts, and panels.

ODS Graphics in SAS 9.4
• The ODS Graphics products provide several new plot types, including axis tables that create an axis-aligned row or column of textual data.

• Numerous plot layout, panel, and axis options have been added to control and enhance the output of your graphs. For example, you can now customize the appearance attributes for group values without changing the ODS style template. You can also now specify a color-priority rotation pattern for cycling graph data attributes.

• A new sub-pixel rendering feature provides smoother curves for line charts and more consistent spacing in bar charts.

• The ODS Graphics products provide more options for fitting or splitting data labels, curve labels, and axis tick values when there is not enough room to display the text normally. The data label positioning algorithm was improved to better position the data labels with their data markers. In addition, data markers can now be adjusted when multiple observations have the same response value.
• The ODS Graphics Designer introduces an Auto Charts feature that generates a variety of graphs automatically, based on your data.

• The ODS Graphics suite of products includes the Graph Template Language, ODS Graphics procedures, ODS Graphics Designer, and ODS Graphics Editor.

**Additional Information about ODS Graphics**


**Creating Accessible Output Using ODS and ODS Graphics**

**Creating Accessible Output: SAS 9.4M6**

These accessibility enhancements were added in SAS 9.4M6:

• New system options facilitate the creation of accessible content on a system-wide level. Here is a summary of the options:
  • The ACCESSIBLECHECK option checks your SAS programs for common violations of accessibility standards and writes messages to the SAS log if violations are found.
  • The ACCESSIBLEGRAPH option enables the ACCESSIBLE_GRAPH option in the ODS HTML5 destination by default.
  • The ACCESSIBLEPDF option enables the ACCESSIBLE option in the ODS PDF destination by default.
  • The ACCESSIBLETABLE option makes table captions visible and changes the layout of some tables to make them accessible. This option applies to tables that are generated by the PRINT, REPORT, and TABULATE procedures as well as the Report Writing Interface.
  • The CAPTION= option defines a visible table caption. The caption is displayed when the ACCESSIBLETABLE system option has been specified. This option applies to tables that are generated by the REPORT and TABULATE procedures as well as the Report Writing Interface.
  • Several enhancements affect PDF output.
    • The method that is used to build and compress PDF files has been enhanced, resulting in smaller file sizes. This change affects all PDF files including tagged PDF files.
    • You can specify the ACCESSIBLE_IDENTIFIER option in the ODS PDF statement to add an identifier to the metadata of the PDF file confirming that the PDF produced by SAS meets the PDF Matterhorn Protocol.
    • Support has been added for visual captions. The CAPTION= option, when used in the supported procedures, creates tables with captions that are visible and accessible in the PDF.
    • Alternative text for images that are created with the POSTIMAGE= and PREIMAGE= style options or with the Report Writing Interface IMAGE method appears in PDF output.
    • Images can be marked as artifacts in PDF output. For example, the following code creates an artifact: `preimage="file.jpg?desc="`
    • ATTRPRIORITY=NONE is now the default setting for the Daisy ODS style.
• The Daisy, HighContrast, and HighContrastLarge styles include an enhanced FOCUSLINK indicator.

Creating Accessible Output: SAS 9.4M5
These accessibility enhancements were added in SAS 9.4M5 (September 2017):

• Image maps are supported with SVG output using HTML5. However, image maps are supported only when the HTML5 SVG mode is INLINE (the default value).
• You can customize the appearance of focus indicators. A new FOCUSLINK style element is available to be used in a style template. Three new style attributes enable you to customize the focus outline pattern, width, and color.
• You can specify line fill patterns for supported plot types with all styles. Previously, fill patterns were available only when you used certain gray-scale styles. You can also change the appearance of the fill patterns.

Creating Maps Using ODS Graphics and Mapping Procedures
These enhancements were added in SAS 9.4M6 (November 2018):

• PROC GINSIDE, PROC GPROJECT, PROC GREDUCE, and PROC GREMOVE have moved from SAS/GRAPH to Base SAS and use ODS Graphics to create graphs. They are documented in SAS/GRAPH: Reference and SAS/GRAPH and Base SAS: Mapping Reference.
• The %CENTROID macro that supports the SGMAP procedure has moved from SAS/GRAPH to Base SAS and is now an autocall macro. Running the %ANNOMAC macro before using %CENTROID is no longer necessary.
• The SGMAP procedure has these enhancements:
  • You can use the NOAUTOLEGEND option on PROC SGMAP to suppress automatically creating a legend.
  • The SERIES statement and several of its options are added for plot creation. Examples of series plot lines are streets, railroads, and waterways.
  • The GRADLEGEND statement and several of its options are added for customizing legends with a numeric response variable. Only discrete key legends were created prior to SAS 9.4M6.
  • The PROC SGMAP CHOROMAP statement is at production level. The procedure now accepts numeric response values. Statement options DISCRETE and LINEATTRS= are new:
    • The DISCRETE option handles response variable values, and affects both the filled polygons and their respective legend entries.
    • The LINEATTRS= option on the CHOROMAP and SERIES statements enables the control of color, line style, and line thickness on polygon borders and series lines such as railroads, respectively.
  • The CHOROMAP statement now processes unprojected map coordinates (LAT, LATITUDE, LONG, LON, and LONGITUDE), in addition to the projected X and Y coordinates. Unprojected choromaps can be overlaid on Open Street Maps and Esri maps.
  • You can specify the percentage of transparency of a plot using the TRANSPARENCY option in the BUBBLE statement and in the CHOROMAP statement.
• In the BUBBLE statement, you can specify bubble sizes with the BRADIUSMIN and BRADIUSMAX options.

• The GROUP= option is added to the BUBBLE, SCATTER, and SERIES statements.

• The NOMISSINGGROUP option is added to the BUBBLE, SCATTER, and SERIES statements. This option enables the use of groups when plotting multiple items that might not be at the same data points, and the skipping of missing plot values when the plot is being drawn.

For the full list of new features and enhancements, see SAS/GRAPH and Base SAS: Mapping Reference.

These new features and enhancements were added in SAS 9.4M5 (September 2017):

• The new Base SAS SGMAP procedure uses the functionality of ODS Graphics to render maps. The SGMAP procedure works with map data sets prepared by a third party. It also works with map data sets prepared by the SAS/GRAPH procedures or by the GEOCODE and MAPIMPORT procedures that are now part of Base SAS.

• The maps data sets in the MAPSGFK library have been updated. The MAPSGFK= system option can now be updated using the APPEND= and INSERT= system options.

Locked-down State

In SAS 9.4M1 (December 2013), the SAS server administrator can create an environment where your SAS client has access to a specific set of directories and files if you are running in a client/server environment. All other directories and files would be inaccessible. When SAS is in a locked-down state, access to several SAS language elements is restricted.

In SAS 9.4M2 (August 2014), certain access methods and their related procedures are disabled, by default, when a SAS session is locked down.

For more information, see SAS Language Reference: Concepts. To determine whether your SAS product supports this functionality, see the Administrator’s Guide for your SAS product.

Scalable Performance Data Engine

The Scalable Performance Data Engine (SPD Engine) enables the caching of opened SPD Engine files. New SPD Engine data set options enable AES (Advanced Encryption Standard) encryption. For more information about updating data using the SPD Engine in a Hadoop environment, see “Hadoop Support” on page 12 and SAS Scalable Performance Data Engine: Reference.

Beginning in SAS 9.4M6 and SAS Viya 3.3, for both HDFS and non-HDFS file systems, access is expanded to the FEDSQL procedure, FedSQL language, DS2 procedure, and DS2 language.

SAS 9.4M5 has the following enhancement:

• The SPD engine supports cross-environment data access (CEDA) with additional restrictions. For more information, see “Accessing SPD Engine Files on Another Host” in SAS Scalable Performance Data Engine: Reference.
SAS 9.4M2 has the following changes and enhancements:

- SPD Engine does not support DLDMGACTION=NOINDEX, but does support ABORT, FAIL, PROMPT, and REPAIR.

- The new LIBNAME statement options enable you to do the following:
  - The IOBLOCKSIZE= option enables you to specify the size, in bytes, of a block of observations to be used in an I/O operation.
  - The COMPRESS= option enables you to compress an SPD Engine data set on disk as it is being created.

**Universal Printing**

In SAS 9.4M5 (September 2017), new AvenirNextforSAS and HelveticaNeueforSAS fonts replace the Avenir Next LT W04, Avenir NextCyr W04, and Helvetica LT Pro fonts. For more information, see “Printing with SAS” in *SAS Language Reference: Concepts*.

**Create Customized Attributes for Data Sets and Variables**

You can create attributes for data sets and variables to contain information that you supply by using extended attributes. Extended attributes are part of a data set and are managed with the DATASETS procedure. The procedures that process data sets, such as CPORT, DOWNLOAD, and SQL, support extended attributes. For more information, see *SAS Language Reference: Concepts*.

**Preserve the SAS Environment between SAS Sessions**

The Work library data sets and catalogs, and the values of global statements, macro variables, and system options can be preserved between SAS sessions. For more information, see *SAS Language Reference: Concepts*, *SAS System Options: Reference*, and *Base SAS Procedures Guide*.

**Write JavaScript Object Notation (JSON)**

SAS data sets can be written to an external file in JSON representation. In SAS 9.4M3 (July 2015), you can create and parse JSON text by using the DS2 JSON package.

In SAS 9.4M4 (November 2016), the JSON LIBNAME statement enables you to associate a libref with a JSON document. For more information, see the LIBNAME Statement, JSON Engine in *SAS Global Statements: Reference*.

For more information, see the DS2 Procedure in *Base SAS Procedures Guide*.

**View SAS Data Sets By Using JMP**

SAS data sets can be converted to JMP files to view them by using JMP applications such as the JMP Graph Builder iPad application. For more information, see *Base SAS Procedures Guide* and *SAS Global Statements: Reference*. 
Process Streamed Data

- SAS 9.4 processes arbitrary text that contains SAS macro specifications in an input stream. The macro code in the stream can be expanded and stored in a file.
- Stream-record format can be processed by the SFTP access method. Data is transferred in image (binary) mode.

For more information, see *Base SAS Procedures Guide* and *SAS Global Statements: Reference*.

Write to a SharePoint Document Library

You can use the WebDAV access method to write a file to a SharePoint document library, specify the name of an authentication domain metadata object, and create and delete a directory. For more information, see *SAS Global Statements: Reference*.

Read User Text

The DATAURL Access Method reads character and URL-encoded characters, and BASE64 data. For more information, see *SAS Global Statements: Reference*.

Read ZIP Files

The new ZIP Access Method reads ZIP files. Starting in SAS 9.4M5, SAS supports GZIP files. For more information, see *SAS Global Statements: Reference*.

Process Time and Datetime Values By Using Time Zones

The SAS language now supports time zones based on Universal Coordinate Time (UTC). Data sets and catalog time stamps can specify the time based on a specific time zone. You can specify a specific time zone, or you can specify an area of the world for SAS to determine the time for that area, taking into account Eastern Time.

SAS 9.4M2 (August 2014) includes several new time zone functions.


National Language Support

National Language Support in SAS 9.4M5

SAS 9.4M5 (September 2017) includes these enhancements:

- To avoid character truncation when you copy data to a new encoding, you can use the macro `%COPY_TO_NEW_ENCODING`.
- SAS supports the locale Tagalog-Philippines.
- Several new character string functions search for strings, return string positions, and count characters and substrings in character strings.

National Language Support in SAS 9.4

SAS 9.4 adds the following support:
After placing locale information in a data set, SAS can use the data set to configure SAS for a locale. A new SAS 9.4 procedure manages the data set and writes the locale information to the SAS registry.

Using system options, you can change the language of SAS output and the SAS log.

Additional Information for National Language Support
For more information, see SAS National Language Support (NLS): Reference Guide.

Audit and Report More about SAS and SAS Applications

New loggers audit logging configurations, access to SAS data sets, and metadata-bound libraries.

The ARM_DSIO subsystem has new ARM metrics that report data set information.

SAS 9.4M2 (August 2014) enables additional control over log file permissions and destinations.

For more information, see SAS Logging: Configuration and Programming Reference and SAS Interface to Application Response Measurement (ARM): Reference.

Metadata Enhancements

Metadata Updates: SAS 9.4M6
Database credentials that are specified in the PROC METALIB DBAUTH statement override any other predefined authentication types.

Metadata Updates: SAS 9.4M5
SAS 9.4M5 (September 2017) includes these enhancements:

Using the PROC AUTHLIB CREATE statement, you can use AES2 encryption for libraries and data sets that are bound using metadata objects.

PROC METALIB has changed how it handles case updates for DBMS columns. In previous releases, when a column name in a DBMS table’s metadata definition matches a column name in the data source but the column name has a different case (for example, lowercase instead of uppercase), the column definition was deleted and re-created to match the case of the column name in the data source. Starting in 9.4M5, PROC METALIB updates the existing column definition. The change preserves column mappings. Column definitions for SAS data sets are already updated instead of replaced.

Configuring Your SAS Metadata Server in SAS 9.4
The SAS Metadata Server can be configured as a clustered metadata server or as a single metadata server in SAS 9.4. For more information about enhancements that enable you to monitor and manage the cluster from SAS, see SAS Language Interfaces to Metadata.

Transporting SAS Files
These documentation enhancements were made in SAS 9.4M5 (September 2017):

Information was added to the document about changes to PROC CPORT and PROC CIMPORT starting in SAS 9.4 that require source and target sessions to be compatible encodings unless the encoding value of the data set is ASCIIANY.
Information was added to the document about migrating data to UTF-8 encoding in order to support multilingual data and SAS Viya. The section outlines the steps to take including how to determine the encoding of your data, storage issues, and whether CEDA is the appropriate conversion method; how to convert indexes, integrity constraints, and format catalogs; and how to read external files.

These new features were added in SAS 9.4M4 (November 2016):

- The %XPTCOMMN macro in the autocall library was updated so that when a data set conforms to the V5 specification and you use the %LOC2XPT macro to create a V5 or V6 transport file, PROC COPY and the XPORT engine can read this file.
- The %XPT2LOC macro in the autocall library was updated so that quotation marks are no longer part of the name in the transport file if a memname needs to be n-literalized. In addition, the n-literalization was changed to occur when generating DATA step code to convert to a local SAS data set.

Starting in SAS 9.4M3 (July 2015), PROC CIMPORT supports the ability to import data sets created in non-UTF-8 SAS sessions into UTF-8 SAS sessions.

Starting in SAS 9.4M2 (August 2014), you can read from and write to transport files in SAS Version 5 (V5) or SAS Version 8 (V8) formats by using autocall macros.

For more information, see *Moving and Accessing SAS Files*.

**General Enhancements to SAS Procedures**

**Procedure Enhancements: SAS 9.4M6**

In the May 2019 release of SAS 9.4M6 and SAS Viya 3.4, you can use PROC FCMP to create Python functions using the SAS Python component object. You execute these Python functions using PROC FCMP or the DATA step when you submit code to the SAS Workspace Server or the SAS Compute Server. You cannot submit Python functions using PROC FCMP or the DATA step to the CAS server. For more information, see *SAS Component Objects: Reference*.

- PROC FCMP has these option enhancements:
  - Use the OUTFILE= option to write referenced functions and the main program to a text file. Programs that have been parsed by PROC, including macro variables, can be exported.
  - The OUTITEMSTORE= option exports symbols, referenced functions, and the main program to the specified item store.

- PROC HDMD supports managed, external, and transactional tables for Hive 3.0. By default, a table is created as managed and transactional.

- When you invoke a web service using PROC HTTP, you can set SSL options using the new SSLPARMS statement. This statement is not valid in SAS Viya 3.4.

- The default behavior of the PROC HTTP DEBUG statement has changed. The HTTP request body and response body are now written as binary, instead of text. The DEBUG statement also has new options, in addition to Level=, to enable you to specify the parts of the HTTP request that you want to debug.

- Information about the scope of variables and other objects that are defined for PROC LUA is added to the documentation.

- When you use the PROC PROTO LINK statement to load modules that are written in C or C++, you can specify only load modules whose paths are registered by the administrator using the PROTOLIBS= system option.
• If you use the V9 engine to create a PROC SQL view that contains a USING clause, the view is not accessible in SAS 9.4M5 or earlier releases.

Procedure Enhancements: SAS 9.4M5
Starting in SAS 9.4M5 (December 2017), the TRANSPOSE procedure can summarize data using CAS server actions.

SAS 9.4M5 (September 2017) includes these enhancements:

• PROC AUTHLIB supports AES2 encryption.
• PROC COPY copies data using CAS server actions when the IN= option and the OUT= option are both set to the CAS engine libref. No data is transferred to SAS to copy in SAS.
• PROC DS2 and PROC FEDSQL support CAS tables, and Amazon Redshift, Microsoft SQL Server, and Vertica data sources. You must use the SESSREF= or SESSUUID= options to connect the procedure to a CAS session.

The procedures also support SAS Scalable Performance Data (SPD) Server connections using the NOLIBS= and CONN= options. PROC DS2 and PROC FEDSQL are available in both SAS 9.4 and SAS Viya.
• The new DSTODS2 procedure enables you to translate a subset of your SAS DATA step code into DS2 code.
• These procedures support CAS tables that have variables with a data type of VARCHAR: CONTENTS, COPY, DATASETS COPY and CONTENTS statements, EXPORT, IMPORT, and PRINT. PROC CONTENTS reports the number of characters or bytes for a variable.
• PROC supports dictionaries and Analytic Store scoring models.
• PROC HTTP adds a DEBUG statement, the TIMEOUT= procedure option, and response status macro variables.
• PROC REPORT, TABULATE, MEANS, and SUMMARY can summarize data using CAS server actions.
• PROC SQOOP supports workflows and Kerberos on Linux, and the WFHDFSPATH= option is now optional.

Note: You must license SAS/ACCESS Interface to Hadoop to run this procedure.

Procedure Enhancements: SAS 9.4M4
In SAS 9.4M4 (November 2016), PROC RANK and PROC SORT support the Hive database management system.

Procedure Enhancements: SAS 9.4M3
SAS 9.4M3 includes these enhancements:

• Using the LUA procedure, you can run LUA code within a SAS session. The LUA procedure also enables you to call SAS functions from within blocks of LUA code.

• The following procedures support the Impala, HAWQ, and SAP HANA database management systems:
  • DS2 procedure
  • FedSQL procedure
  • MEANS procedure
• RANK procedure
• REPORT procedure
• SORT procedure
• SUMMARY procedure
• TABULATE procedure

Procedure Enhancements: SAS 9.4M2
SAS 9.4M2 (August 2014) includes the following enhancements:

• In DS2 and FedSQL, you can control the behavior of the SAS session when an NLS transcoding failure occurs.
• You can control the sorting of imported files according to the destination collating sequence.
• Passwords are hidden in the SAS log.
• The REPORT procedure supports several statistical keywords.

Procedure Enhancements: SAS 9.4M1
In SAS 9.4M1 (December 2013), changes and enhancements to procedures enable you to determine the encoding of data sets in a transport file, transport data sets with time zone offsets, generate a one-time password from the metadata server to access the SAS Content Server, and support user identity authentication. A link and supporting text were added for Microsoft Excel functions.

Additional Information about SAS Procedures
For more information, see Base SAS Procedures Guide.

Enhancements to Base SAS Statistical Procedures

• The CORR procedure can now create an output data set that contains polychoric correlation statistics and an output data set that contains polyserial correlation statistics.
• The FREQ procedure now does the following:
  • supports Baker, exact mid-\( p \), likelihood ratio, and logit binomial confidence limits
  • provides score confidence limits for the odds ratio and relative risk and displays them in the corresponding plots
  • provides Mantel-Haenszel, stratified Newcombe, and summary score estimates of the common risk (proportion) difference, which can be displayed in the risk difference plot
  • produces mid \( p \)-values for exact tests
  • colors mosaic plot tiles according to the values of the Pearson residuals or the standardized residuals
  • displays the Pearson residuals in the CROSSLIST table
• The UNIVARIATE procedure now enables you to overlay histograms that are associated with different levels of a \CLASS\ variable onto a single plot, offers improved maximum likelihood estimation for Johnson \( S_\nu \) distribution parameters, and calculates the geometric means of analysis variables.
Data Set Options

Starting in SAS 9.4M5 (September 2017), the ENCRYPT= data set option supports AES2 encryption. For more information, see SAS Data Set Options: Reference.

Functions

Starting in SAS 9.4M6 (November 2018), you can manage a GIT repository using a set of new GIT functions.

Starting in the December 2017 release of SAS 9.4M5 and SAS Viya 3.3, you can set the working directory using the DLBCDIR function.

Starting in SAS 9.4M5 (September 2017), SAS supports three families of pseudorandom number generators: Mersenne twister generators, a permuted congruential generator (PCG), and two ThreeFry generators. New random-number generators (RNG) generate numbers in parallel and distributed environments. You can select from a number of algorithms using the CALL STREAMINIT and CALL STREAM routines. A new best practice for generating random numbers is to use these routines. SAS also supports a hardware-based RNG on certain chipsets.

For more information, see SAS Functions and CALL Routines: Reference.

Statements

In the May 2019 release of SAS 9.4M6 and SAS Viya 3.4, you can use the STATUS option in the INFILE statement to specify a variable whose value contains the return status code from a URL request.

These enhancements were added in SAS 9.4M5 (September 2017):

- The FILENAME statement, EMAIL (SMTP) access method supports GZIP files and attaching more than one file using multiple !EM_ATTACH! directives.
- The LIBNAME statement, JSON engine now supports an ALLDATA= "name" option. The ALLDATA= LIBNAME option enables you to specify a different name for the ALLDATA data set.

Macro Language

These enhancements were added in SAS 9.4M5 (September 2017):

- Several new automatic macro variables report device types, directory information, fileref and the %INCLUDE filename from a %INCLUDE file.
- The SYSMAXLONG automatic variable returns the maximum long integer value allowed under Linux.

For more information, see SAS Macro Language: Reference.
**XMLV2 Engine**

In SAS 9.4M6, two LIBNAME statement options expand column lengths to avoid truncation when importing XML data that contains double-byte character set (DBCS) or multi-byte character set (MBCS) data.

In SAS 9.4, XMLV2 engine functionality for the z/OS environment changed from preproduction to production. The engine is production in all SAS 9.4 operating environments.

**SAS under UNIX**

Starting in SAS 9.4M5 (September 2017), you can use the new environment variable AUTHINFO to specify the location of the authinfo file that you use to authenticate to a CAS server.

In SAS 9.4M4 (November 2016), the cleanwork utility has two new options, –V and –LOG.

In SAS 9.4M3 (July 2015), the CONTENTS procedure generates the size of file in KB, MB, or GB.

SAS 9.4M2 (August 2014) has the following enhancements:

- You can specify Read, Write, and Execute permissions for a fileref.
- The default for the MVARSIZE system option changed from 32000 to 65534.
- In a locked-down state, some FILENAME statement access methods are, by default, not available but can be re-enabled by the SAS server administrator. For more information, see “Locked-down State” on page 30.
- New information is available about UNIX environment variables.
- You can measure system performance.

In SAS 9.4M1 (December 2013), you can enable SAS programs to send messages to and receive messages from an ActiveMQ message broker and any JMS API-compliant message service in the UNIX environment.

For more information, see *SAS Companion for UNIX Environments*.

**SAS under Windows**


Starting in SAS 9.4M3 (July 2015), SAS deployments no longer require Windows 8.3 filename support. In previous releases, this filename convention had to be enabled before you could install SAS.

SAS 9.4M2 (August 2014) has the following enhancements:

- SAS provides a utility to clear temporary files.
- You can specify Read, Write, and Execute permissions for a fileref.
- In a locked-down state, some FILENAME statement access methods are, by default, not available but can be re-enabled by the SAS server administrator.
In SAS 9.4M1 (December 2013), details have been added in support of Windows 32-bit architecture.

For more information, see *SAS Companion for Windows*.

**SAS under z/OS**

In the May 2019 release of SAS 9.4M6, the FILE statement and the INFILE statement cannot modify or override the device type that was set by an earlier FILENAME statement.

Starting in SAS 9.4M6, the MSYMTABMAX= system option default value has changed from 1,048,576 bytes to 2,097,152 bytes.

SAS 9.4M5 (September 2017) has these enhancements:

- The FILEBUFNO system option specifies how many memory buffers to allocate for reading and writing.
- SAS supports eight-character TSO user IDs on z/OS V2R3.
- SAS supports the CSSTMP email server on z/OS V2R3.
- PROC RELEASE does not release unused space in a PDSE.

SAS 9.4M4 (November 2016) has these new features:

- The .spds9 file extension is supported.
- FILE/INFILE statement processing supports the BUFNO= SAS system option.
- SAS added support for the IBM z/OS V2R2 Extended Format Generation Data Group (GDG), which allows up to 999 generation data sets to be associated with the GDG.

SAS 9.4M2 (August 2014) has the following enhancements:

- Large block size support for SAS libraries on tape devices improves performance and efficiency.
- The LOCKDOWN feature is supported for foundation servers.
- SAS can generate TCW channel programs for Read operations on some direct access bound libraries, improving I/O performance.

For more information, see *SAS Companion for z/OS*.

**Additional Information**

For more information about changes from the previous release, see *Base SAS in SAS Guide to Software Updates and Product Changes*.

For more information, see these resources:

- What’s New in Base SAS 9.4: Details
- What’s New in Base SAS 9.4 Procedures in *Base SAS Procedures Guide*
- What’s New in Base SAS 9.4 Statistical Procedures in *Base SAS Procedures Guide: Statistical Procedures*
- What’s New in Base 9.4 System Options in *SAS System Options: Reference*
- What’s New in Encryption in SAS 9.4 in *Encryption in SAS*
- What’s New in the SAS 9.4 Logging Facility

What’s New in SAS/GRAPH and Base SAS 9.4: Mapping Reference

What’s New in SAS 9.4 Graph Template Language in *SAS Graph Template Language: Reference*


What’s New in SAS 9.4 Global Statements in *SAS Global Statements: Reference*

What’s New in SAS 9.4 Functions and CALL Routines in *SAS Functions and CALL Routines: Reference*


What’s New in SAS 9.4 Application Response Measurement in *SAS Interface to Application Response Measurement (ARM): Reference*

What’s New in SAS 9.4 Language Interfaces to Metadata in *SAS Language Interfaces to Metadata*

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**SAS/ACCESS**

**New Interfaces in SAS/ACCESS 9.4**

In SAS 9.4, there are several new SAS/ACCESS engines:

- SAS/ACCESS Interface to Amazon Redshift
- SAS/ACCESS Interface to Hadoop
- SAS/ACCESS Interface to HAWQ
- SAS/ACCESS Interface to Impala
- SAS/ACCESS Interface to Impala and the SAS/ACCESS Interface to PI System
- SAS/ACCESS Interface to PostgreSQL
- SAS/ACCESS Interface to SAP HANA
- SAS/ACCESS Interface to Vertica

Note: These products were added after the initial SAS 9.4 release.

- The SAS/ACCESS Interface to HAWQ was added in SAS 9.4M3 (July 2015). The SAS/ACCESS Interface to Amazon Redshift was added in April 2016.
- The SAS/ACCESS Interface to Impala and the SAS/ACCESS Interface to PI System were added in SAS 9.4M2 (August 2014).
- In April 2019, the SAS/ACCESS Interface to MongoDB and the SAS/ACCESS Interface to Salesforce were added to SAS 9.4M6.
• For the August 2019 release of SAS/ACCESS, support was added for the Google BigQuery LIBNAME engine and for the Snowflake LIBNAME engine. Both engines include a corresponding SAS Data Connector that enables data transfer between the DBMS and CAS.

These new engines provide direct, transparent access to the engine through LIBNAME statements and the SQL pass-through facility. You can use various LIBNAME statement options and data set options that the LIBNAME engine supports to control the data that is returned to SAS.


SAS/ACCESS 9.4 to Amazon Redshift

In SAS 9.4M6 (November 2018), support was added for the SUB_CHAR= LIBNAME option.

Starting in SAS 9.4M4 (November 2016), the name of the Amazon Redshift engine is redshift. Support for bulk loading has been added. Support for the SQLGENERATION system option has been added. Support for pushdown of these procedures to the database has been added: FREQ, MEANS, RANK, REPORT, SORT, SUMMARY, and TABULATE.

Starting in the April 2016 release of SAS/ACCESS 9.4, support was added for Amazon Redshift. This interface provides direct, transparent access to Amazon Redshift data through LIBNAME statements and through the SQL pass-through facility.

For more information, see SAS/ACCESS Interface to Amazon Redshift in SAS/ACCESS for Relational Databases: Reference.

SAS/ACCESS 9.4 Interface to Aster

In SAS 9.4M6 (November 2018), support was added for the CONOPTS= LIBNAME option and the SUB_CHAR= LIBNAME option.

SAS/ACCESS 9.4 Interface to DB2 under UNIX and PC Hosts

Starting in SAS 9.4M5 (September 2017), support has been added for these options:

• DBNULLWHERE= LIBNAME option and data set option
• DBCLIENT_MAX_BYTES LIBNAME= option and data set option

Starting in SAS 9.4M4 (November 2016), a new environment variable, SAS_DB2_TS_REDUCE_SCALE, has been added to maintain the numeric precision of the previous version of DB2 for TIMESTAMP values.

For more information, see SAS/ACCESS Interface to DB2 for UNIX and PC Hosts in SAS/ACCESS for Relational Databases: Reference.

SAS/ACCESS 9.4 Interface to Greenplum

In SAS 9.4M6 (November 2018), support was added for the CONOPTS= LIBNAME option and the SUB_CHAR= LIBNAME option.
SAS/ACCESS 9.4 Interface to Hadoop

In SAS 9.4M4 (November 2016), support was added for additional security features that use Knox, Kerberos, Sentry, or Record Service. Support was added for temporary tables. The ANALYZE= and SCRATCH_DB= LIBNAME options and data set options were added.

Starting in SAS 9.4M2 (August 2014), HiveServer2 is supported as the default Hive protocol. You can create and append to Hive tables by using the WebHDFS service. SAS supports Hive data types TIMESTAMP, DATE, and VARCHAR for Hive 0.12 and CHAR for Hive 0.13. Also, SAS supports Hive authorization and authentication by using IBM InfoSphere BigInsights 2.1. For more information, see “Hadoop Support” on page 20.

SAS/ACCESS 9.4 Interface to HAWQ

Starting in SAS 9.4M3 (July 2015), the SAS/ACCESS Interface to HAWQ is a new interface. This interface provides direct, transparent access to HAWQ through LIBNAME statements and the SQL pass-through facility.

For more information, see SAS/ACCESS Interface to HAWQ in SAS/ACCESS for Relational Databases: Reference.

SAS/ACCESS 9.4 Interface to Impala

In SAS 9.4M6 (November 2018), support was added for the CONOPTS= LIBNAME option and the SUB_CHAR= LIBNAME option.

SAS/ACCESS 9.4 Interface to JDBC

In SAS 9.4M6 (November 2018), support was added for customers who run only SAS 9.4.

SAS/ACCESS 9.4 Interface to Microsoft SQL Server

Starting in SAS 9.4M5 (September 2017), support has been added for the DBNULLWHERE= LIBNAME option and data set option.

Starting in SAS 9.4M3 (July 2015), the SAS/ACCESS Interface to Microsoft SQL Server supports the Microsoft Windows for x64 platform and the Microsoft Windows x86 platform.

SAS 9.4M4 (November 2016) adds support for these items:

- the Microsoft Azure SQL database
- the SQLGENERATION system option, which enables SAS to generate SQL code for in-database processing
- the ability to run these procedures in-database: FREQ, MEANS, RANK, REPORT, SORT, SUMMARY, and TABULATE

For more information, see SAS/ACCESS Interface to Microsoft SQL Server in SAS/ACCESS for Relational Databases: Reference.
SAS/ACCESS 9.4 Interface to MongoDB

In the April 2019 release of SAS 9.4M6, support was added for SAS/ACCESS Interface to MongoDB. MongoDB is a nonrelational database that stores data in documents. For more information, see SAS/ACCESS for Nonrelational Databases: Reference.

SAS/ACCESS 9.4 Interface to MySQL

In SAS 9.4M4 (November 2016), support was added for the SSL_CA=, SSL_CERT=, SSL_CIPHER=, and SSL_KEY data set options. For more information, see SAS/ACCESS Interface to MySQL in SAS/ACCESS for Relational Databases: Reference.

SAS/ACCESS 9.4 Interface to Netezza

In SAS 9.4M6 (November 2018), support was added for the CONOPTS= LIBNAME option and the SUB_CHAR= LIBNAME option.

In SAS 9.4M5 (September 2017), support was added for the BL_DEFAULT_DIR= data set option. Documentation no longer includes support for the DELETE_MULT_ROWS= or UPDATE_MULT_ROWS= LIBNAME options.

In SAS 9.4M4 (November 2016), support was added for the PRESERVE_USER= LIBNAME option and the corresponding environment variable, SAS_NETEZZA_PRESERVE_USER.

For more information, see SAS/ACCESS Interface to Netezza in SAS/ACCESS for Relational Databases: Reference.

SAS/ACCESS 9.4 Interface to ODBC

In SAS 9.4M5 (September 2017), support was added for the DBNULLWHERE= LIBNAME option and data set option.

For more information, see SAS/ACCESS Interface to ODBC in SAS/ACCESS for Relational Databases: Reference.

SAS/ACCESS 9.4 Interface to OLE DB

In SAS 9.4M4 (November 2016), support was added for the CHAR_AS_NCHAR=LIBNAME option. For more information, see SAS/ACCESS Interface to OLE DB in SAS/ACCESS for Relational Databases: Reference.

SAS/ACCESS 9.4 Interface to Oracle

Starting in SAS 9.4M5 (September 2017), support was added for these options:

- DBNULLWHERE= LIBNAME option and data set option
- POST_DML_STMT_OPTS= LIBNAME option and data set option

Starting in SAS 9.4M4 (November 2016), a new LIBNAME option, DBENCODIN, has been added so that you can change the encoding for a libref.
Starting in SAS 9.4M2 (August 2014), you can perform bulk loading by using the Oracle Direct Path API instead of the Oracle SQL*Loader utility. Starting with Oracle 12c, the default data type for SAS character variables in SAS output is either VARCHAR2 or CLOB, depending on the length of the variable.

For more information, see SAS/ACCESS Interface to Oracle in SAS/ACCESS for Relational Databases: Reference.

SAS/ACCESS 9.4 Interface to PC Files

SAS/ACCESS 9.4 Interface to PC Files enables you to exchange (import and export) PC files between the original source format and SAS data sets. Files are moved between the native PC format and SAS data sets by using the IMPORT and EXPORT procedures and wizards or by using LIBNAME statements.

SAS/ACCESS 9.4 has several enhancements to support Microsoft Excel XLSX files. For example, you can add a new Microsoft Excel XLSX worksheet to an existing workbook, and you can replace an existing worksheet in a workbook. You can export Excel XLSX files directly to UNIX. In this release, you can specify DBMS=XLSX to read and write to Excel workbooks under UNIX and Microsoft Windows directly without accessing the PC Files Server.

Certain statements used with the IMPORT and EXPORT procedures have been updated: RANGE=, SHEET=, GETNAMES=, GUESSINGROWS=. How RANGE= and SHEET= handle special characters in names has changed in Microsoft Excel XLSX files.

The EXPORT procedure supports the ENCRYPTKEY= option, which specifies the key value that is required for exporting an AES-encrypted SAS data set. Support for the Base SAS ENCRYPTKEY= data set option is also added.

SAS/ACCESS 9.4 imports data from JMP files saved with Version 7 or later formats, and exports SAS data to JMP files with Version 7 or later formats. Support for these newer file formats enables you to access JMP files from an application such as the JMP Graph Builder iPad. SAS/ACCESS 9.4 also supports importing and exporting JMP files with more than 32,767 variables. JMP variable names can be up to 255 characters in length.

Because you can use the Base SAS IMPORT and EXPORT procedures on JMP files without a SAS/ACCESS license, the preceding information applies to SAS 9.4 as well.

In earlier releases of SAS, the META statement was used for importing and exporting JMP files. In SAS 9.4, this statement is no longer supported. Instead, extended attributes are automatically used. If extended attributes are in a file, they are automatically transferred to the new file when that file is imported or exported. For example, when importing a JMP file with extended attributes, the attributes are automatically attached to the new SAS data set.

The ROWSTATE data type is generated by JMP and is used to store several row-level characteristics. If the JMP file contains row state information, PROC IMPORT stores this information as a new variable with the name _rowstate_. If the EXPORT procedure finds a column named _rowstate_, the procedure converts this column to the row state information in the output JMP file. For more information, see “JMP Data Types” in SAS/ACCESS Interface to PC Files: Reference.

Starting in SAS/ACCESS 9.4, when you import a Stata file, SAS can read multiple Stata missing values and map them to multiple SAS special missing values such as .a–.z or a single dot (.) for up to 27 missing values.
The PC Files Server can be operated as a Microsoft Windows service or as a Windows application on the 64-bit or 32-bit Windows operating system. Starting in SAS/ACCESS 9.4, if the machine does not have Microsoft Office or an ACE driver already installed on it, the 64-bit version of the SAS PC Files Server is the default. For more information, see SAS PC Files Server: Installation and Configuration Guide. (This document was first available in SAS 9.4M2 (August 2014).)

Here are the features and enhancements that were introduced in a maintenance release:

- **SAS/ACCESS 9.4M5 Interface to PC Files (September 2017)**
  - SAS/ACCESS Interface to PC Files has merged with SAS Viya 3.2 documentation. For example, the CAS engine is supported with the IMPORT and EXPORT procedures in SAS 9.4M5. VARCHAR data types imported from SPSS, Stata, JMP, and XLSX data files can be stored in CAS tables as VARCHAR. When used with CAS tables, PROC EXPORT can store VARCHARs in SPSS, Stata, JMP, and XLSX files.
  - The following functionality is not valid in SAS Viya: SAS PC File Server, IMPORT and EXPORT Wizards and EFI.
  - For the IMPORT procedure, the specification DBMS=XLSX now supports storing currency values using the NLMNY format, which formats the value according to the locale.

- **SAS/ACCESS 9.4M4 Interface to PC Files supports creation of Microsoft Excel files with the XLSX file format. This release shipped in November 2016.**

- **SAS/ACCESS 9.4M2 Interface to PC Files has added a new SAS LIBNAME engine called XLSX. It enables you to directly read and write data between Microsoft Excel XLSX files and SAS on Linux, UNIX, and Microsoft Windows operating environments.**

For more information, see What’s New in SAS/ACCESS 9.4 Interface to PC Files in SAS/ACCESS Interface to PC Files: Reference.

**SAS/ACCESS 9.4 Interface to the PI System**

SAS 9.4M4 (November 2016) includes these new features:

- Support was added for the Picom_Summary virtual table for summaries of sensor data over time. The CALCULATION_BASIS= and MEDIAN= data set options pertain to the Picomp_Summary table.
  - The MIXED= data set option enables you to merge data of different data types into the Picomp table.
  - Support for the SHOWINDEX= and TAGLIST_JOIN data set options was added.

In the February 2016 release of SAS/ACCESS Interface to the PI System, these features are new:

- Support has been added for the PI System Asset Framework. The Asset Framework adds hierarchical organization to time series data.
  - Support has been added for PI System event frames. An event frame tracks processing events that are important to your business.
  - SAS/ACCESS Interface to the PI System can now run in UNIX environments.

For more information, see What’s New in SAS/ACCESS for Nonrelational Databases in SAS/ACCESS for Nonrelational Databases: Reference.
SAS/ACCESS 9.4 Interface to PostgreSQL

In SAS 9.4M6 (November 2018), support was added for the CONOPTS= LIBNAME option and the SUB_CHAR= LIBNAME option.

In SAS 9.4M5 (September 2017), the default value for the DBINDEX= LIBNAME option and data set option has been corrected in the documentation. The default value for both is NO.

SAS 9.4M4 (November 2016) adds support for these items:

- the SQLGENERATION system option, which enables SAS to generate SQL code for in-database processing
- the ability to run these procedures in-database: FREQ, MEANS, RANK, REPORT, SORT, SUMMARY, and TABULATE

For more information, see SAS/ACCESS Interface to PostgreSQL in SAS/ACCESS for Relational Databases: Reference.

SAS/ACCESS 9.4 Interface to R/3

Starting in SAS 9.4M3 (July 2015), two new CALLRFC procedure options and LIBNAME options are available. Use the NETWEAVER option to specify that the engine uses the SAP NetWeaver RFC libraries. Use the CLASSIC option to specify that the engine uses the SAP classic RFC libraries.

For more information, see What’s New in SAS/ACCESS Interface to R/3 in SAS/ACCESS Interface to R/3: User’s Guide.

SAS/ACCESS 9.4 Interface to Salesforce

In the April 2019 release of SAS 9.4M6, support was added for SAS/ACCESS Interface to Salesforce. Salesforce is a customer relationship management platform (CRM). For more information, see SAS/ACCESS for Nonrelational Databases: Reference.

SAS/ACCESS 9.4 Interface to SAP ASE

Starting in SAS 9.4M4 (November 2016), the name of the Sybase product is SAP ASE. For more information, see SAS/ACCESS 9.4 Interface to SAP ASE in SAS/ACCESS for Relational Databases: Reference.

SAS/ACCESS 9.4 Interface to SAP HANA

In SAS 9.4M6 (November 2018), support was added for the CONOPTS= LIBNAME option and the SUB_CHAR= LIBNAME option.

Starting in SAS 9.4M5 (September 2017), support was added for the DBNULLWHERE= LIBNAME option and data set option.

SAS 9.4M3 (July 2015) includes these new features and enhancements:

- When using analytic views in SQL statements, the measures have to be aggregated. Starting in SAS 9.4M3 (July 2015), the SAS/ACCESS engine generates a default statement with aggregated measures based on the metadata about the analytic view.
• SAP HANA has new PARMSTRING= and PARMDEFAULT= LIBNAME data set options. The PARMSTRING= options specify a quoted string of variable name and value pairs. The PARMDEFAULT= options specify whether the SAP HANA engine should use the defaults for variables and parameters as specified in the metadata.

For more information, see SAS/ACCESS Interface to SAP HANA in SAS/ACCESS for Relational Databases: Reference.

SAS/ACCESS 9.4 Interface to SAP IQ

In SAS 9.4M6 (November 2018), support was added for the CONOPTS= LIBNAME option and the SUB_CHAR= LIBNAME option.

Starting in SAS 9.4M4 (November 2016), the name of the Sybase IQ product is SAP IQ. For more information, see SAS/ACCESS 9.4 Interface to SAP IQ in SAS/ACCESS for Relational Databases: Reference.

SAS/ACCESS 9.4 Interface to Teradata

Starting in SAS 9.4M4 (November 2016), support is added for single sign-on (SSO) with Kerberos.

Starting in SAS 9.4M3 (July 2015), these features are new or enhanced:
• SAS/ACCESS supports object names that contain up to 32 characters for users who use Teradata 14.10 or later.
• Support was added for the Teradata Wallet security feature.

For more information, see SAS/ACCESS Interface to Teradata in SAS/ACCESS for Relational Databases: Reference.

SAS/ACCESS 9.4 Interface to Vertica

In SAS 9.4M6 (November 2018), support was added for the CONOPTS= LIBNAME option and the SUB_CHAR= LIBNAME option.

SAS 9.4M4 (November 2016) adds support for these items:
• the SQLGENERATION system option, which enables SAS to generate SQL code for in-database processing
• the ability to run these procedures in-database: FREQ, MEANS, RANK, REPORT, SORT, SUMMARY, and TABULATE

For more information, see SAS/ACCESS Interface to Vertica in SAS/ACCESS for Relational Databases: Reference.

Additional Information

For more information about changes from the previous release, see SAS/ACCESS in SAS Guide to Software Updates and Product Changes.
SAS/CONNECT 9.4

SAS/CONNECT 9.4 offers enhanced tools for managing the SAS/CONNECT spawner, including new spawner start-up options, a new spawner interface, and a new spawner executable file that is the same for each operating environment. SAS/CONNECT also features enhanced logging and messaging support, enhanced data transfer of encoded data, support for several new Base SAS language elements, and support for the upload and download of extended attributes that use the UPLOAD and DOWNLOAD procedures.

These updates were made in a maintenance release:

- **SAS 9.4M5** (September 2017)
  - Support was added so that the user can supply credentials in an authinfo file instead of in a SIGNON statement. Use of an authinfo file is required if you want to connect to SAS Cloud Analytic Services.
  - The TCPPROXYLIST environment variable was added to support HTTP_CONNECT so that SAS clients outside of the cloud can sign on to SAS/CONNECT spawners. By setting the TCPPROXYLIST environment variable, you can connect to different clouds from the same client.
  - The default value for the TCPLISTENTIME option was changed to 300. Previously, the default value was 0, or no time limit. The TCPLISTENTIME option is the amount of time a SAS/CONNECT server listens for a SAS/CONNECT client to connect.
  - You no longer need to add the NOCLEARTEXT spawner option to increase security. The NOCLEARTEXT spawner option has been made the default value and is no longer valid as an option. The CLEARTEXT option has been added to be used only when absolutely necessary because credentials are transmitted unencoded.
  - Users who sign on from workspace servers that allow numeric session-ids now get an error message. The documentation has been updated to indicate that a server name must be eight characters or less and start with an alphabetic character.
  - The _USER_ option was added to the %SYSRPUT statement to enable user-defined macro variables to be pushed to the server.
  - Starting in SAS/CONNECT 9.4M2 (August 2014), you can now use the wildcard character to specify 0 or more characters anywhere in the filename. This new pattern-matching capability enables you to more efficiently transfer data comprised of multiple files to and from remote sessions.
  - In Base SAS 9.4M1 (December 2013), the LOCKDOWN statement and LOCKDOWN system option are new. With LOCKDOWN, the SAS server administrator can create a restricted environment in which the SAS/CONNECT client has limited access to a designated set of directories and files.

See these resources:

- For more information, see *What’s New in SAS/CONNECT 9.4* in *SAS/CONNECT User’s Guide*.
- For more information about changes from the previous release, see *SAS/CONNECT* in *SAS Guide to Software Updates and Product Changes*. 
SAS/GIS 9.4

SAS/GIS 9.4 expands its import capability to include the U.S. Census Bureau’s Topologically Integrated Geographic Encoding and Referencing (TIGER) shapefiles (.shp) that are dated 2007 to the present. You can now organize and analyze, either interactively or programmatically, the most current spatial data. You can also continue to work with TIGER Record Type (RT) files that are dated prior to 2007.

For more information, see What’s New in SAS/GIS 9.4 in SAS/GIS: Spatial Data and Procedure Guide.

SAS/GRAPH 9.4

SAS/GRAPH 9.4M6

Starting in SAS 9.4M6 (November 2018), note these changes:

- PROC GINSIDE, PROC GPROJECT, PROC GREDUCE, and PROC GREMOVE have moved from SAS/GRAPH to Base SAS.
- The %CENTROID macro that supports the SGMAP procedure has moved from SAS/GRAPH to Base SAS and is now an autocall macro. Running the %ANNOMAC macro before using %CENTROID is no longer necessary.

SAS/GRAPH 9.4M5

Starting in SAS 9.4M5 (September 2017), the following new functionality and enhancements are included:

- Mapping procedures GEOCODE and MAPIMPORT are moved from SAS/GRAPH to Base SAS. Mapping procedures GINSIDE, GMAP, GPROJECT, GREDUCE, and GREMOVE remain with SAS/GRAPH.
- SAS/GRAPH: Mapping Reference is moved to the Base SAS documentation library. It documents the existing mapping procedures plus the new ODS Graphics SGMAP procedure.
- The GCHART procedure provides new options:
  - The new GROUPREF option on the HBAR and VBAR statements provides the ability to draw a dividing line between bars or groups of bars. In addition, three new options enable you to manage the appearance of reference lines: option CGROUPREF manages line color, option LGROUPREF manages line type, and option WGROUPREF manages line width.
  - Four new options enable you to draw a reference line between the midpoints of bars or groups of bars. Option MIDPOINTREF on the HBAR and VBAR statements provides the ability to draw a dividing line between the midpoints of bars or groups of bars. Three additional options enable you to manage the appearance of the midpoint reference line: option CMIDPOINTREF manages line color, option LMIDPOINTREF manages line type, and option WMIDPOINTREF manages line width.
• The new frequency format option STATFMT= on the BLOCK, VBAR, VBAR3D, HBAR, HBAR3D, PIE, PIE3D, DONUT, and STAR statements applies a specified format to a calculated statistical value such as that specified with the frequency (FREQ=) option of the TYPE= option. This option overrides the GCHART procedure’s default format of the displayed statistical value. Use this option to change the default format that might contain decimal points, percentages, or commas. The STATFMT= option does not control the format of the response axis tick marks.

• The GBARLINE procedure provides a new frequency format option STATFMT= on its BAR and PLOT statements. This option applies a specified format to a calculated statistical value such as that specified with the frequency (FREQ=) option of the TYPE= option. The STATFMT= option overrides the GBARLINE procedure’s default format of the displayed statistical value. Use this option to change the default format that might contain decimal points, percentages, or commas. The STATFMT= option does not control the format of the response axis tick marks.

• The annotate IMAGE function STYLE= option provides a new value SINGLE that centers a single instance of an image on a specific coordinate.

• New graphics devices IMGPNG and IMGGIF provide improved graph-rendering performance over the PNG and GIF Universal Printer devices. The IMGPNG and IMGGIF devices can be used to improve the performance of SAS jobs that generate a large number of graphs in the PNG or GIF format.

Also starting in SAS 9.4M5, SAS/GRAPH Network Visualization Workshop is discontinued and no longer supported.

SAS/GRAPH 9.4M4

Starting in SAS 9.4M4, these SAS/GRAPH Mapping enhancements are included:

• For ease of use, the mapping functions are removed from SAS/GRAPH: Reference and placed in a new document, SAS/GRAPH: Mapping Reference. This new document includes the GEOCODE, GINSIDE, GMAP, GPROJECT, GREDUCE, GREMOVE, and MAPIMPORT procedures, and their supporting documentation

• Additional enhancements are made to street geocoding, including changing an example to show geocoding using the TYPE= option to create a custom GCTYPE lookup data set that contains an uncommon abbreviation for Boulevard. Street geocoding now obtains more accurate locations in areas where the U.S. Postal Service has reassigned local ZIP codes when modifying its delivery routes.

SAS/GRAPH 9.4M3

Starting in SAS 9.4M3 (July 2015), the following new functionality and enhancements are included:

• The CTEXT= option in the GPLOT procedure’s PLOT statement now affects the color of POINTLABEL symbols.

• The SYMBOL statement’s POINTLABEL COLOR= option is updated to show the sequential order of its color selection. The default color selection now aligns with the color that is specified for the axis label.

• The new GraphTitle1Text ODS style element is introduced. It controls and reduces the font size of the output of TITLE1 statements in order to improve graph title scaling.
• The maximum length for the annotate facility variables \texttt{XC=} and \texttt{YC=} is increased from 32 characters to 256 characters.

• Support is added for range geocoding with IPv6 addresses. A new version of the \texttt{%MAXMIND} autocall macro converts IPv6 geocoding data from MaxMind, Inc. to SAS data sets.

\textbf{SAS/GRAPH 9.4M2}

Starting in SAS 9.4M2 (August 2014), the following new functionality and enhancements are included:

• The GEOCODE procedure for city geocoding offers a new variable to handle nonstandard state values, changes requirements for the customized versions of the SASHELP.GCSTATE lookup data set, changes variable values within the SASHELP.GCSTATE lookup data set, allows non-abbreviated state names, and offers an improved \texttt{%TIGER2GEOCODE} import program.

• The GRADAR procedure offers a new parameter on the SPKLABEL= option.

• The PowerPoint destination supports both the JAVAIMG device and the ACTXIMG device. The ZPNG device is disabled. Also, new HTML attributes are added to the SVG, SVGT, and SVGView devices.

• The GTILE procedure now supports the NOLEGEND option.

\textbf{SAS/GRAPH 9.4M1}

Starting in SAS 9.4M1 (December 2013), the following new functionality and enhancements are included:

• The GEOCODE procedure for street geocoding offers a new variable to handle multiple street type abbreviations, changes requirements for data set indexes, clarifies the text string requirements for the DIRECTION variable, and adds four note value tokens. In addition, the GEOCODE procedure adds two variables to the SASHELP.ZIPCODE lookup data set to support city geocoding.

• The CHORO statement in the GMAP procedure supports a production level of the OSM (OpenStreetMap) option when displaying maps using a JAVA or JAVAIMG device.

• To see a brief description of any SAS data set in the SASHELP library, as well as output displaying the first five observations in each data set, see \texttt{SASHELP Data Sets}.

\textbf{SAS/GRAPH 9.4}

SAS/GRAPH 9.4 includes the following enhancements:

• The GEOCODE procedure now supports non-U.S. street geocoding. To support non-U.S. street geocoding, new lookup data sets are available, and the existing lookup data sets are reformatted. A new import macro program, \texttt{%GEOBASE2GEOCODE}, and an updated version of \texttt{%TIGER2GEOCODE} are available from the SAS Maps Online website. These macros create lookup data sets in the new format. The new DIRECTION= option enables you to specify an alternate data set of street direction names and abbreviations, such as northwest or NW. The new STATE= option enables you to specify an alternate data set that contains state or province character names.
rather than FIPS numeric codes. The STREET geocoding method now provides several new and changed values for the output variables _MATCHED_ and _NOTES_ to support U.S. and non-U.S. street geocoding.

- The map data sets in the MAPSGFK library have been updated.
- The GINSIDE procedure provides two new options to control whether to keep or drop map data set variables, KEEPMAPVARS and DROPMAPVARS.
- In the GMAP procedure, the new LATLON= option specifies that the unprojected LAT and LONG variables from the map data set are used for coordinate data instead of the Y and X variables. The new RESOLUTION= option specifies that the GMAP procedure use those map observations containing a resolution variable with a certain level (value). The new preproduction OSM option enables you to specify an OpenStreetMap style and project map data onto an OSM map.
- In the GPROJECT procedure, the LATLON= option specifies that the unprojected LAT and LONG variables from the map data set are used for coordinate data instead of the Y and X variables. The new FROM= and TO= options invoke the proj. 4projection and enable you to specify a coordinate system for the projection. These FROM= and TO= options can also be used together to reverse a projection.
- In the GREMOVE procedure, the new DROPVARS option drops all input data set variables from the output map data set.
- In the GPLOT procedure, the new CBASELINE= option specifies the color of the horizontal baseline for reference lines of a plot.
- The GCHART procedure provides new options. The PPERCENT= option modifies the font, height, and color of the percentages that are displayed in pie slice labels. When used with the PLABEL= option (which controls the text attributes of pie slice labels), you can easily differentiate between percentages and text labels. The EXPLODE=ALL option pulls all of the slices outward from the center of the pie.
- In the GKPI procedure, the FORMAT= option now accepts user-defined formats.
- The SVG and GIF devices now support animation. In addition, the GIF device now supports RGBA color mode (transparency) and anti-aliasing.
- The new TIFF and TIFFK devices produce TIFF images and support the RGBA and CMYK color modes, respectively.
- The new EMFDUAL device produces a graphics file that contains both EMF and EMF Plus records. It supports RGBA colors (transparency).
- The new %SHORTCUT autocall macro creates a shortcut device that is linked to the existing Universal Printers of the same name. It can also define a new Universal Printer and shortcut device and link the device to the Universal Printer.
- The Annotate Facility has several enhancements. The IMGPATH variable now accepts a URL location for graphics that are on web pages. The HTML= option enables you to animate text labels that are created with the LABEL function, and it has been added to the ARROW function. The %CENTROID macro has been enhanced to return more accurate centroid locations.
- The Tile Chart applet supports adding one or more custom menu items to the tile chart pop-up menu.
- The Treeview applet supports assigning multiple drill-down links for each node in the diagram.
- TITLE and FOOTNOTE statements now support the ALT= option, which specifies descriptive text for a URL to which a title or footnote links, or for the title or footnote itself.


Additional Information for SAS/GRAPH


For more information about changes from the previous release, see SAS/GRAPH in SAS Guide to Software Updates and Product Changes.

SAS Grid Manager

SAS Grid Manager 9.4M6

Starting in SAS 9.4M6 (November 2018), SAS Grid Manager includes these changes:

- SAS Grid Manager uses a new grid provider, which consists of SAS Workload Orchestrator and SAS Job Flow Scheduler. SAS Grid Manager uses queues, host parameters, and user-specified limits to distribute jobs among hosts in the grid. High availability is supported through failover capability for the master host and defined services. The grid is configured and managed through the SAS Workload Orchestrator web interface.

- The product name for a grid that uses Platform Suite for SAS has been changed to SAS Grid Manager for Platform.

- The existing SAS Grid Manager agent plug-in for SAS Environment Manager has been renamed to SAS Grid Manager for Platform agent plug-in.

- A new SAS Grid Manager agent plug-in for SAS Environment Manager has been added to support the new grid provider.

- The existing SAS Grid Manager Module for SAS Environment Manager has been renamed to SAS Grid Manager for Platform Module. The user interface has completely changed, although the functions provided remain the same.

Note: Starting in SAS 9.4M6, Grid Management Services (GMS) is not updated to work with the latest release of Load Sharing Facility. Therefore, the SAS Grid Manager plug-in for SAS Management Console is no longer supported. However, the plug-in is included with SAS 9.4M6 if you want to upgrade to SAS 9.4M6 without also upgrading Platform Suite for SAS.

See these resources:

- For more information about this release, see What’s New in SAS Grid Manager 9.4.
- For more information about changes from the previous release, see SAS Grid Manager in SAS Guide to Software Updates and Product Changes.

SAS Grid Manager 9.4M5

Starting in SAS 9.4M5 (September 2017), SAS Grid Manager includes these changes:

- An option has been added to the SAS Grid Manager Client Utility to submit a program that exists on a grid node, rather than being accessible to users on a client machine. The program is not copied to a grid share when it runs.
• Shortened option names are supported for the SAS Grid Manager Client Utility.

• The SAS Grid Manager Agent Plug-in for SAS Environment Manager provides metric data for grid queues.

• The SAS Grid Manager Module for SAS Environment Manager provides this functionality:
  • new affinity and dependency configuration options for high availability (HA) applications
  • the ability to reset the LSF password and to update the LSF license
  • functions to terminate jobs, requeue jobs, change the position of jobs within a queue, and switch an uncompleted job to a different queue

For more information about this release, see What’s New in SAS Grid Manager 9.4 in Grid Computing in SAS.

SAS Grid Manager 9.4M3

Starting in SAS 9.4M3, SAS Grid Manager 9.4 includes these changes:

• SAS Grid Manager for Hadoop has been added. SAS Grid Manager for Hadoop enables you to apply all of the advantages of a SAS grid, including workload management, accelerated processing, and scheduling, to a Hadoop environment. SAS server definitions and grid options sets provide the connection between SAS and Hadoop. Users of SAS will not notice any difference in their operations. They will continue to submit jobs as they normally would, but those jobs will be processed on the Hadoop grid.

• An agent plug-in and a management module have been added to SAS Environment Manager. If your grid uses Platform Suite for SAS, these components enable you to monitor and manage a SAS grid cluster. Together, the agent plug-in and the module provide some of the same functions as Platform RTM, so you can monitor and manage your grid by using the same application that you use to monitor your SAS environment. However, the plug-in and module have different purposes:

  Grid Manager Agent Plug-in
  uses continuously collected metric data to monitor the performance of the grid and grid servers, graph changing metric data, and generate alerts.

  Grid Manager Module
  configures and controls grid resources, views current performance data, and configures grid resources and high-availability applications.

  Note: The Grid Manager module replaces the Grid Manager server plug-in that was added to SAS Environment Manager in SAS 9.4M2.

  • New functions have been added to return a list of hosts that are available to run grid jobs and to return a list of valid options sets.
  • Support has been added for using an Oozie scheduling server. This server is used in a SAS Grid Manager for Hadoop environment.

SAS Grid Manager 9.4M2

Starting in SAS 9.4M2, a Grid Manager plug-in is available from SAS Environment Manager. This plug-in enables you to perform these tasks:

• view information about LSF clusters
• view information about and manage grid jobs, hosts on the grid, and queues
• view information about and manage high availability applications
• view audit records

**SAS Grid Manager 9.4**

SAS Grid Manager provides grid options sets and grid-launched workspace servers. A grid options set is a collection of grid options, SAS options, and required grid resources that can be assigned when a specified SAS application is used by a specified user or group. Using grid options sets enables you to map options for grid jobs to application users without creating a new SAS Application Server context for each option and without requiring input from the application users.

Using grid-launched workspace servers enables SAS Grid Manager to launch new workspace servers for load balancing. This capability enables the grid’s management and policies to be applied to the workspace server and simplifies how some SAS applications, such as SAS Enterprise Guide, send jobs to a SAS grid.

**SAS/SHARE 9.4**

SAS/SHARE 9.4 features enhanced security with metadata-bound library support and a new USETRUSTEDUSER procedure option, as well as support for extended attributes in SAS data sets and SAS libraries. Also, SAS/SHARE naming conventions for user IDs and passwords have been enhanced to allow longer names (up to 256 characters), mixed case, spaces, and punctuation.

These updates were made in a maintenance release:

• In SAS/SHARE 9.4M5 (September 2017), support was added so that the user can supply credentials in an Authinfo file instead of in a SIGNON statement.

• In SAS/SHARE 9.4M4 (August 2014), content from *Communication Access Methods for SAS/CONNECT and SAS/SHARE* relevant to SAS/SHARE software was moved to *SAS/SHARE User’s Guide*. Now, you have easier access to all information related to SAS/SHARE software.

See these resources:

• For more information about this release, see What’s New in SAS/SHARE 9.4 in *SAS/SHARE User’s Guide*.

• For more information about changes from the previous release, see SAS/SHARE in *SAS Guide to Software Updates and Product Changes*.

**SAS Scalable Performance Data Server**

**SAS Scalable Performance Data Server 5.4**

SAS Scalable Performance Data (SPD) Server 5.4 (September 2017) has internal modifications to ensure interoperability with SAS 9.4M5. You must have the 5.4 release
of both the server software and the SPD Server client software to be able to use SPD Server with SAS 9.4M5.

For more information, see What’s New in SAS Scalable Performance Data Server 5.4 in SAS Scalable Performance Data Server: User’s Guide.

SAS Scalable Performance Data Server 5.3

SPD Server 5.3 supports secure sockets communication via Transport Layer Security (TLS). This release also includes a new language driver that enables you to read and write SPD Server tables with the SAS DS2 language and the SAS FedSQL language. You submit DS2 language statements by using PROC DS2. You submit FedSQL language statements by using PROC FEDSQL. SAS Federation Server 4.2 also supports access to SPD Server tables.

SAS Scalable Performance Data Server 5.2

SPD Server 5.2 can read, write, and update tables in the Hadoop environment. SPD Server 5.2 supports WHERE-processing optimization in the Hadoop cluster using MapReduce. To support enterprise computing environments that have existing authentication processes and password management systems, SPD Server 5.2 provides support for performing non-native user authentication via the SAS Metadata Server.

SAS Scalable Performance Data Server 5.1

SAS 9.4 includes a new SAS Scalable Performance Data Server engine that can connect with the SPD Server. This enhances the SPD Server experience and offers expanded support for regulatory, IT, and end-user features, such as the following:

• enhanced (AES-256) encryption for data at rest

• support for the Windows 64-bit Server

• SQL performance enhancements

• new SPD Server cluster features, including online cluster management and distributed cluster tables

SAS Studio

SAS Studio 3.8


• This release includes experimental support for Git integration.

• The new SAS member name policy preference enables you to specify a set of rules for SAS data set names, SAS data view names, and item store names.

• In SAS Studio 3.8, FTP support is off by default. Administrators can turn on this functionality by using a new configuration property.

• You can now append new log information to the existing logs for programs and tasks. You can also automatically clear the log each time you submit code.

• This release also includes several new tasks:
• The Combine Tables task provides a variety of methods for combining two data tables.

• Several map tasks have been added: Bubble Map, Choropleth Map, Scatter Map, Series Map, and Text Map.

• New econometrics tasks, Severity Model task and Spatial Regression Models task, have been added.

• Finally, there are many new SAS Viya tasks.

See these resources:


• For more information about changes from the previous release, see SAS Studio in SAS Guide to Software Updates and Product Changes.

SAS Studio 3.71

SAS Studio 3.71 (December 2017) supports SAS 9.4M5. New tasks for text analysis and forecasting were added for this release. To run these tasks, you must license and install these SAS Viya products: SAS Text Analytics and SAS Visual Forecasting.

For more information, see What’s New in SAS Studio 3.71 in SAS Studio: User’s Guide.

SAS Studio 3.7

SAS Studio 3.7 (September 2017) supports SAS 9.4M5.

• New tasks and code snippets provide tighter integration with CAS in SAS Viya.

• You can open your existing SAS Enterprise Guide projects in SAS Studio. When opened, these SAS Enterprise Guide projects are converted to a process flow in SAS Studio.

• You can choose to display log updates as a procedure is processed. You can now see the progress of your SAS job without waiting for the procedure to complete.

• New SAS 9.4 tasks include Recode Values, Recode Ranges, Heat Map, Custom Tests for Power and Sample Size, and Equivalence Tests for Power and Sample Size. Also, the graph tasks (Bar Chart, Pie Chart, Scatter Plot, and so on) have been rewritten.

For more information, see What’s New in SAS Studio 3.7 in SAS Studio: User’s Guide.

SAS Studio 3.6

SAS Studio 3.6 includes these new features:

• You can now create a SAS program from a process flow.

• A new preference enables you to control the level of automatic refreshes that occur or to specify whether to refresh the file navigation tree manually.

• You can use the new Start-Up preferences to specify whether SAS Studio opens in the state that you closed it. For example, any tabs that you had open in a prior session will be open in the new session.

• For background submit jobs, you can now specify the location of the output and log files. You can also specify what action to take if an output or log file already exists.

• You can now generate HTML graphs in the SVG format.
• Many new analytical tasks for statistical process control, multivariate analysis, econometric analysis, and power and sample size are now available.
• This release includes new analytical tasks in these categories: power and sample size, cluster analysis, and network optimization.
• New code snippets and tasks enable you to connect to the SAS Viya environment and to use Cloud Analytic Services (CAS) tables.

For more information, see What’s New in SAS Studio 3.6 in SAS Studio: User’s Guide.

**SAS Studio 3.5**

SAS Studio 3.5 includes these new features:

• The new batch submit feature enables you to run a saved SAS program while you continue to use SAS Studio.
• Results include a table of contents that you can use to navigate to different sections in your results.
• A new Messages window displays information about the programs, tasks, queries, and process flows that you run.
• Additional keyboard shortcuts make it easier for you to add and insert code snippets.
• Many new analytical tasks for statistical process control, multivariate analysis, econometric analysis, and power and sample size are now available.
• For administrators, new global settings enable you to define folder shortcuts and repositories for all users at your site. The addition of repositories makes it easier for you to share tasks and snippets with other users.

For more information, see What’s New in SAS Studio 3.5 in SAS Studio: User’s Guide.

**SAS Studio 3.4**

SAS Studio 3.4 includes these new features:

• The new import data tool enables you to easily import your data from Microsoft Excel, delimited files (such as CVS), and other file types into SAS Studio.
• For server environments, the SAS Studio administrator can now control the starting point of the navigation tree.
• In the code editor, autocomplete is now available for librefs and table names.
• Several new analytical tasks enable you to prepare and explore your time series data and to perform modeling and forecasting.
• There are also enhancements to process flows.

For more information, see What’s New in SAS Studio 3.4 in SAS Studio: User’s Guide.

**SAS Studio 3.3**

SAS Studio 3.3 includes these new features:

• The Basic Edition of SAS Studio is now supported in Windows and UNIX operating environments.
• The new Visual Programmer perspective enables you to use process flows to organize and run your work.
• A new query feature enables you to extract data from one or more tables according to the criteria that you specify.

• SAS Studio 3.3 also includes several new tasks. The new Bubble Plot task enables you to explore the relationship between three or more variables. New analytical tasks include the Analysis of Covariance task, the Generalized Linear Models task, and the N-way ANOVA task. The new Combinatorics and Probability category includes a Combinations task, a Permutations task, two probability tasks, and two simulation tasks.

For more information about this release, see What’s New in SAS Studio 3.3 in SAS Studio: User’s Guide.

SAS Studio 3.2

SAS Studio 3.2 includes several new features for programmers.

• The SAS Program Package is a file that contains a snapshot of a SAS program along with its log and HTML results.

• The autosave functionality creates copies of each previously saved program so that you can recover files if your browser closes unexpectedly.

• You can create a summary page for code that you have written as well as for code that is automatically generated when you run a task.

• New code snippets show you how to use the SAS macro functionality.

Here are some of the additional new features in this release:

• In addition, you can now send a copy of your results, the associated code, and the log files to another user through email. You can also access files on an FTP server by creating a folder shortcut.

• Several new analytical tasks (Binary Logistic Regression, Linear Regression, and Predictive Regression Modeling) are available. The new Box Plot task enables you to easily create box plots, and the new Data Exploration task uses graphs to help you learn more about your data.

For more information, see What’s New in SAS Studio 3.2 in SAS Studio: User’s Guide.

SAS Studio 3.1

SAS Studio is a development application for SAS that you access through your web browser. With SAS Studio, you can access your data files, libraries, and existing programs, and you can write new programs. You can also use the predefined tasks in SAS Studio to generate SAS code. When you run a program or task, SAS Studio connects to a SAS server to process the SAS code. The SAS server can be a hosted server in a cloud environment, a server in your local environment, or a copy of SAS on your local machine. After the code is processed, the results are returned to SAS Studio in your browser.

SAS Studio supports multiple web browsers, such as Microsoft Internet Explorer, Apple Safari, Mozilla Firefox, and Google Chrome.

In addition to writing and running your own SAS programs, you can use the predefined tasks that are included with SAS Studio to analyze your data. The tasks are based on SAS System procedures and provide access to some of the most commonly used graph and analytical procedures. You can also use the default task template to write your own tasks.
Chapter 3

Analytical Products

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SAS Business Rules Manager 3.3


Starting with this release, the user interface has been rewritten in HTML5. Previously, many SAS applications and SAS solutions used the Adobe Flash Player to provide interactive user interfaces. Adobe announced that it intends to end support for Flash technology and will cease to update and distribute the Flash Player at the end of 2020. Browser vendors will disable Flash by default in 2019. For more information about Adobe Flash end-of-life, see SAS Software and Its Use of the Adobe Flash Player.

New features and enhancements in this release enable you to perform the following tasks:

- edit rules in an improved, simplified rule set editor.
- add a stand-alone assignment statement to a rule set.
- create, move, and rename folders in the Manage Folders window.

It is no longer possible to create data libraries or register tables from within SAS Business Rules Manager. You must use SAS Management Console to create data libraries and register tables.

For more information, see these resources:
SAS Business Rules Manager 3.2


SAS Business Rules Manager 3.2 provides new features and enhancements that enable you to perform these tasks:

• use data grid variables in rules
• generate DATA step (DS1) code for rule flows
• control the ability to import and export business rules content
• set Read-Only privileges for vocabularies and lookup tables
• define an administrator role for folders and set permissions on top-level folders
• set a default application server for testing rule flows
• delete published rule flows
• use Oracle Database 12c for the SAS Decision Manager database

See these resources:

• For more information, see What’s New in SAS Business Rules Manager 3.2 in SAS Business Rules Manager: User’s Guide.
• For more information about changes from the previous release, see SAS Business Rules Manager in SAS Guide to Software Updates and Product Changes.

SAS Business Rules Manager 3.1

SAS Business Rules Manager 3.1 runs on SAS 9.4M3.

SAS Business Rules Manager 3.1 provides new features and enhancements that enable you to perform the following tasks:

• view the relationships between data, rule flows, and the processes that consume the data and rules flows by using the features of SAS Lineage
• execute rule flows inside the Hadoop database
• lock rule set versions automatically when rule flows are published
• deploy rule flows dynamically so that SAS Data Integration Studio jobs always use the latest compatible version of a rule flow
• use the simplified list view in the rule set editor
• experience improved performance when generating rule-fired summary tables and generating rules from the New Discovery wizard
• use numeric lookup tables
• duplicate, delete, and move multiple folders, vocabularies, terms, lookup tables, rule sets, or rule flows at the same time
• use pre-existing vocabularies when you generate rules with rule discovery

**SAS Business Rules Manager 2.2**

SAS Business Rules Manager 2.2 runs on SAS 9.4M2. New features and enhancements in this release enable you to perform these tasks:

- create libraries and register tables in the SAS Metadata Repository
- send rule flows through approval workflows and track workflow tasks
- manage versions of rule sets and rule flows
- create rule flows as stored processes
- run a wizard to generate and import vocabularies, rule sets, and rule flows from an input data source by using the Decision Tree, Scorecard, Market Basket Analysis, or Recency Frequency Monetary discovery techniques
- execute rule flows inside the databases by using the SAS In-Database Code Accelerator for Teradata and Greenplum
- selectively include rule sets in a rule flow
- save rule flow tests and display the results of previous tests
- display the terms and lookup tables that are used in a rule set
- import terms from an input data table
- search for rule sets by term

For more information, see What’s New in SAS Business Rules Manager 2.2 in SAS Business Rules Manager: User’s Guide.

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**SAS Contextual Analysis**

**SAS Contextual Analysis 15.1**

SAS Contextual Analysis 15.1 shipped in November 2018 and runs on SAS 9.4M6 and later releases.

SAS Contextual Analysis 15.1 offers performance enhancements when creating projects, building models, and analyzing documents.

See these resources:

- For more information about this release, see What’s New in SAS Contextual Analysis 15.1 in SAS Contextual Analysis: User’s Guide.
- For more information about changes from the previous release, see SAS Contextual Analysis in SAS Guide to Software Updates and Product Changes.

**SAS Contextual Analysis 14.3**

SAS Contextual Analysis 14.3 shipped in September 2017. This release runs on SAS 9.4M5 with some new and enhanced features:
SAS Contextual Analysis 14.3 has added these languages to its support for project data:

- Arabic
- Croatian
- Czech
- Danish
- Farsi
- Greek
- Hebrew
- Hindi
- Hungarian
- Indonesian
- Norwegian
- Polish
- Romanian
- Slovak
- Slovene
- Thai
- Vietnamese

The sentiment analysis DS2 score code now includes information about product-level and feature-level sentiment. (Previous releases included document-level sentiment only).

For more information about this release, see What’s New in SAS Contextual Analysis 14.3 in SAS Contextual Analysis: User’s Guide.

SAS Contextual Analysis 14.2

SAS Contextual Analysis 14.2 runs on SAS 9.4M4 with some new and enhanced features.

- SAS Contextual Analysis 14.2 has added Swedish to its support for project data.
- SAS Contextual Analysis 14.2 User’s Guide includes values for predefined concepts in all supported languages.
- The CLASSIFIER concept rule type now includes an option that returns canonical (full) forms for matched strings, when available.
- You can use a new option in the category score code to remove the subcategories that are created from automatically generated rules.
- Data tables that are created in the SAS Contextual Analysis project libraries are now written in compressed format.
**SAS Contextual Analysis 14.1**

SAS Contextual Analysis 14.1 runs on SAS 9.4M3 and is a major product release with new and enhanced features. SAS Contextual Analysis 14.1 provides support for project data in 13 languages, including English. New project features enable you to import and export SAS Contextual Analysis project models and to share projects with other users.

The categories pane has been redesigned and now includes document frequency counts and a tree view where you can build rules. Concept and category rules can be tested interactively with sample text. Enhanced documentation for writing rules can be accessed through the online Help. New properties in the concept task enable you to apply priority and case sensitivity to concept rules. New properties in the topics task enable you to specify term density and number of topics generated.

Rules are now generated using the HPBOOLRULE procedure. Multiple cores are now accessed during project processing. The score code that is produced by SAS Contextual Analysis has been modified to include the SAS DS2 programming language so that threaded processing is enabled.

**SAS Contextual Analysis 13.2**

SAS Contextual Analysis 13.2 runs on SAS 9.4M2 and is a major product release with an enhanced user interface. SAS Contextual Analysis 13.2 combines more of the machine learning capabilities of SAS Text Miner with the rules-based linguistic methods for categorization and extraction in SAS Enterprise Content Categorization. It is now also possible to import SAS Enterprise Content Categorization projects and create custom concepts in SAS Contextual Analysis. Generated category rules follow the SAS Enterprise Content Categorization category rules format (MCAT) and are fully supported. Document-level sentiment scoring is now available. A feature for viewing and downloading score code for concepts, sentiment, and categories enables you to leverage your model to score external documents. In addition, the interfaces for document viewing, project creation and editing, and the Properties page have been enhanced.

**SAS Contextual Analysis 12.3**

New for SAS 9.4, SAS Contextual Analysis is a web-based categorization application that combines the powers of SAS Text Miner and SAS Enterprise Content Categorization into a single user interface. Using SAS Contextual Analysis, you can build models that automatically categorize a set of input documents, identify key textual data in your document collections, remove meaningless textual data, categorize that data, and customize your models in order to realize the value of your text-based data.

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**SAS Decision Manager**

**SAS Decision Manager 3.3**

SAS Decision Manager 3.3 runs on the June 2019 release of SAS 9.4M6. Starting with this release, the user interface has been rewritten in HTML5. Previously, many SAS applications and SAS solutions used the Adobe Flash Player to provide interactive user interfaces. Adobe has announced that it intends to end support for Flash technology and
will stop updating and distributing the Flash Player at the end of 2020. Browser vendors will disable Flash by default in 2019. For more information about Adobe Flash end-of-life, see SAS Software and Its Use of the Adobe Flash Player.

New features and enhancements in this release enable you to perform the following tasks:

- edit rules in an improved, simplified rule set editor.
- add a stand-alone assignment statement for a rule set.
- create and manage folders in the Manage Folders window. This window is available from the Actions menu in each category view except My Tasks, Data, and Decisions. The Manage Folders window replaces the New Folder window and the previous Actions menu in the Projects and Portfolios category views.
- work with models in the Models category view. The Models category view replaces the Inventory category view, and provides a way to import models into a folder, as well as export models and manage models in one place.

It is no longer possible to perform these tasks:

- create data libraries or register tables from within SAS Decision Manager. You must use SAS Management Console to create data libraries and register tables.
- add model keywords.
- filter items by date modified in the Models, Projects, and Portfolios category views.
- filter the list of models by keywords and user-defined properties in the Models category view.
- duplicate or move a model from one folder to another folder.

In the application bar, the name SAS Decision Manager has been changed to SAS Decision Management.

See these resources:

- For more information about this release, see What’s New in SAS Decision Manager 3.3 in SAS Intelligent Decisioning: What’s New.
- For more information about changes from the previous release, see SAS Decision Manager in SAS Guide to Software Updates and Product Changes.

**SAS Decision Manager 3.2**

SAS Decision Manager 3.2 runs on SAS 9.4M4. SAS Decision Manager 3.2M1 shipped in November 2018 and runs on SAS 9.4M6.

SAS Decision Manager 3.2 provides new features and enhancements that enable you to perform these tasks:

- use data grid variables in rules
- generate DATA step (DS1) code for rule flows
- control the ability to import and export business rules content
- set Read-Only privileges for vocabularies and lookup tables
- define an administrator role for folders and set permissions on top-level folders
- set a default application server for testing rule flows
- delete published rule flows
• use Oracle Database 12c for the SAS Decision Manager database
• duplicate decisions
• import SAS analytic store models
• publish, score, and run performance or reports for SAS analytic store models
• publish models to Hadoop and Teradata using single sign-on authentication by Kerberos
• score SAS Factory Miner models within a SAS Model Manager portfolio using macros
• publish SAS Factory Miner models from within a SAS Model Manager portfolio to a database or Hadoop using macros

For more information about this release, see What’s New in SAS Decision Manager 3.2 in SAS Intelligent Decisioning: User’s Guide

**SAS Decision Manager 3.1**

SAS Decision Manager 3.1 runs on SAS 9.4M3.

SAS Decision Manager 3.1 provides new features and enhancements that enable you to perform the following tasks:

• build decisions with the Decision Builder and deploy these decisions by using SAS Micro Analytic Web Service
• execute rule flows, models, and decisions inside the Hadoop database
• view the relationships between data, models, rule flows, and the processes that consume these data, models, and rule flows by using the features of SAS Lineage
• lock rule set versions automatically when rule flows are published
• deploy rule flows dynamically so that SAS Data Integration Studio jobs always use the latest compatible version of a rule flow
• use the simplified list view in the rule set editor
• use numeric lookup tables
• duplicate, delete, and move multiple folders, vocabularies, terms, lookup tables, rule sets, or rule flows at the same time
• use pre-existing vocabularies when you generate rules with rule discovery
• manage SAS Factory Miner models that are registered in the SAS Model Manager model repository
• manage model versions
• import, update, and export generic models at the folder level
• access the inventory of all models in the same category view
• add and edit model keywords
• add multiple user-defined properties to a model at one time
• search the model inventory with improved performance and also filter the search results by the date modified, model properties, and user-defined properties
SAS Decision Manager 2.2

SAS Decision Manager 2.2 runs on SAS 9.4M2. The full functionality of the SAS Model Manager Java Client application and the Workflow Console web-based application have been integrated into SAS Decision Manager 2.2.

New features and enhancements in this release enable you to perform these tasks:

• create libraries and register tables in the SAS Metadata Repository
• manage workflows and track workflow tasks
• manage versions of projects, rule sets, and rule flows
• publish models to Hadoop and SAP HANA
• create rule flows as stored processes
• run a wizard to generate and import vocabularies, rule sets, and rule flows from an input data source by using the Decision Tree, Scorecard, Market Basket Analysis, or Recency Frequency Monetary discovery techniques
• execute rule flows inside the databases by using the SAS In-Database Code Accelerator for Teradata and Greenplum
• selectively include rule sets in a rule flow
• save rule flow tests and display the results of previous tests
• display the terms and lookup tables that are used in a rule set
• import terms from an input data table
• search for rule sets by term

SAS Enterprise Miner

SAS Enterprise Miner 15.1


Here is an overview of the new features and enhancements for this release:

• In the Gradient Boosting Node, the default value of the Leaf Fraction property is now 0.001. (The previous default value was 0.1.)
• In the HP Text Miner Node:
  • Support was added for 18 additional languages: Arabic, Croatian, Czech, Danish, Farsi, Greek, Hindi, Hebrew, Hungarian, Indonesian, Norwegian, Polish, Romanian, Slovak, Slovene, Swedish, Thai, Vietnamese.
  • All languages except Hebrew and Norwegian now support the Find Entities property.
  • For UTF-8 installations, default stop lists are available for most languages.

See these resources:

• For more information about SAS Enterprise Miner 15.1, see the software product page for SAS Enterprise Miner.
• For more information about changes from the previous release, see SAS Enterprise Miner in SAS Guide to Software Updates and Product Changes.

**SAS Enterprise Miner 14.3**

SAS Enterprise Miner 14.3 (September 2017) runs on SAS 9.4M5. In this release, the SAS Viya Code node was rewritten to better support CAS.

**SAS Enterprise Miner 14.2**

SAS Enterprise Miner 14.2 (November 2016) now includes the SAS Viya Code node. The SAS Viya Code node enables you to submit SAS Viya and Cloud Analytic Services (CAS) code directly through SAS Enterprise Miner. The SAS Viya Code node is similar in usage to the SAS Code node. You write your own SAS Viya or CAS code in a code editor window and submit that code to a SAS Viya or CAS server in SAS Enterprise Miner.

**SAS Enterprise Miner 14.1**

SAS Enterprise Miner 14.1 (July 2015) runs on SAS 9.4M3. Here are the new features and enhancements for the SAS Enterprise Miner core user interface:

- SAS Enterprise Miner now supports PMML 4.2.
- The Incremental Response node includes a new property that enables you to specify whether node variable selection is performed using net information value scores or adjusted net information value scores.

Here are the new features and enhancements in the SAS Enterprise Miner High-Performance Data Mining node:

- A new HP Bayesian Network node is available.
- The HP Variable Selection node adds a new tree-based selection method.
- The HP Clustering node is enhanced to enable automatic selection of the number of clusters, via the ABC criterion.
- The HPSVM and HPForest nodes now support the creation of an analytic store. An analytic store is a portable format of the model that can be used to score observations within a database.
- The HPForest node also includes a new variable importance method that can be used to perform variable selection.

Here are some of the new features in the SAS Enterprise Miner high-performance procedures:

- The HP4SCORE procedure offers a variable importance method that is similar to Breiman's method and Strobl's method.
- The HPFOREST procedure can now handle large amounts of distributed data and includes new methods for selecting splitting variables.
- The HPSVM procedure now supports the TEST option in the PARTITION statement and the VALIDATESET option in the SELECT statement.
**SAS Enterprise Miner 13.2**


SAS Enterprise Miner 13.2 creates a metadcode.sas file that enables you to specify global metadata changes. Also, the **Model Regression** node provides a new Mining Function property that enables you to specify the type of model to register.

Here are the new features and enhancements in the SAS Enterprise Miner High-Performance Data Mining node:

- The **HP Regression** node produces a new variance inflation factor (VIF) table that can be used to detect multicollinearity.
- The **HP Forest** node adds support for a partitioned validation data.
- SAS Enterprise Miner 13.2 adds support for SAP HANA and Scalable Performance Data Engine (SPD Engine).

Here are some of the new features in the SAS Enterprise Miner high-performance procedures:

- The new HPTSDR procedure reduces the dimensionality of time series (in transposed, transactional, and columnwise formats), enabling you to take advantage of fewer dimensions to perform tasks such as similarity and clustering.
- The HPCLUS procedure now uses the $k$-modes algorithm for clustering nominal input variables and enables you to specify the imputation method for nominal variables and the distance measure for similarity in the $k$-modes algorithm for nominal input variables.
- The HPFOREST procedure now enables you to create an ODS table that contains a variety of fit statistics for each target variable and enables you to specify the cosine activation function for both hidden layer neurons and target layer neurons.
- The HPSVM procedure now supports cross validation for penalty selection, the ID statement, training output, and a new ODS table that contains penalties and their corresponding fit statistics.

**SAS Enterprise Miner 13.1**


Here are some of the new features and enhancements in the core user interface:

- The **Open Source** node enables users to integrate R language code inside a SAS Enterprise Miner process flow diagram.
- The **Save Data** node provides users with a simple way to save training, validation, test, score, or transaction data from a SAS Enterprise Miner path to a user-defined path, or a previously defined SAS library.
- The **Decision Tree** node enables users to import a previously created model and apply this model to new data.
- The **Time Series Dimension Reduction** node extracts features from each time series and reduces the dimension of time.
- The **Time Series Correlation** node helps users perform correlation and cross-correlation analyses. It calculates numerous auto-correlation and cross-correlation statistics on time series data.
• The **Time Series Decomposition** node enables you to perform seasonal decomposition of time series.

Here are some of the new features and enhancements in the SAS Enterprise Miner High-Performance Data Mining nodes:

• The **HP Cluster** node uses the high-performance HPCLUSTER procedure to perform $k$-means clustering analysis in distributed computing environments.

• The **HP Forest** node provides users with a choice of variable selection methods: Out-of-Bag (OOB) Average Error for interval targets, or OOB marginal reduction for class targets.

• The **HP GLM** node uses the high-performance HPGENSELECT procedure to fit a generalized linear model in a distributed computing environment.

• The **HP Neural** node now provides a User-Defined Architecture.

• The **HP Principal Components** node performs principal component analysis by using the high-performance HPPRINCOMP procedure.

• The **HP Support Vector Machine** node uses the newly developed high-performance HPSVM procedure for binary classification problems.

• The **HP Tree** node adds support for models that have interval targets.

Here are some of the new features and enhancements in the SAS Enterprise Miner high-performance procedures:

• The new HPBNET procedure learns a Bayesian network from an input data set to create a predictive model in supervised data mining.

• The new HPCLUS procedure enables you to read and write data in distributed form and to perform clustering and scoring in parallel.

• The new HPSVM procedure executes the support vector machine (SVM) algorithm in multiple threads.

• The HPFOREST procedure offers enhancements to enable the training algorithm to use multiple concurrent threads, to segregate data for pruning and early stopping, and to generate an observation ID in scored data.

• The HPNEURAL procedures now enables you to use an arbitrary number of hidden layers to support deep learning, to specify the Poisson and gamma error function and the exponential output layer activation function to support modeling of count data, and to specify an activation function for hidden layers and for the output layer.

**SAS Enterprise Miner 12.3**

SAS Enterprise Miner 12.3 (July 2013) is a new release that runs on SAS 9.4. This major release includes new tools and significant updates to existing tools to enhance your data mining experience. Improved scalability emphasizes the ability to train high-performance data mining nodes on complex data that is used by existing personal SAS workstations or SAS servers.

Key updates to the core data mining tools include the following:

• link analysis for the visualization of translational data as a network of interconnected, linked entities

• updated decision tree node
Data mining application extensions include the following:

- support for time varying covariates with the Survival Data Mining node. Users can also set left-truncation and censor dates.
- treatment level selection for the incremental response node.
- interval target including loss given default support for the interactive grouping node of SAS Credit Scoring for SAS Enterprise Miner.

All of the high-performance data mining nodes are now available (at no additional licensing fee) for threaded parallel processing on your existing SAS Enterprise Miner desktop or server. High-performance k-means clustering and decision tree nodes have been added to SAS High-Performance Data Mining.

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**SAS Energy Forecasting**

**SAS Energy Forecasting 4.1**

SAS Energy Forecasting 4.1 shipped in February 2018. Here are some of the new features in this release:

- To account for loads that are not influenced by temperature (such as some large industrial users), you can choose to remove the temperature effect from the model.
- You can select between multiple time intervals for a diagnose and forecast.
- You can run a diagnose or forecast for power (MW) or energy (MWh) data.
- You can choose to remove the trend from distribution phase-level forecasting to ensure that the phase does not diverge.
- The source file information that contains hierarchical information has been enhanced to enable you to define multiple hierarchies for the system.
- You can remove the economic trend from a medium-term or long-term forecast.
- You can perform a cross-hierarchy reconciliation between two different hierarchies.
- You can perform a temporal reconciliation.

See these resources:

- For more information about this release, see the software product page for *SAS Energy Forecasting*.
- For more information about changes from the previous release, see *SAS Energy Forecasting* in *SAS Guide to Software Updates and Product Changes*.

**SAS Energy Forecasting 3.2M1**

SAS Energy Forecasting 3.2M1 shipped in April 2017. Here are some of the new features in this release:

- New parameters for automated, event-triggered forecasting give you greater control when initiating a new forecast.
- A multi-zone diagnose instance significantly reduces the amount of processing time that is required when forecasting a large number of zones.
• You can choose to forecast using a model other than the best model from a diagnose instance.
• For a medium-term or long-term forecast, you can choose one or more specific economic scenarios instead of all economic scenarios.
• You can choose to delete the source data upon completion of the forecast. Deleting the source data reduces the accumulation of data.
• Report output includes more data so that you perform fewer calculations to produce a report.
• The Zones tab contains the hierarchy of all the zones in the input data. The Instances tab contains a list of all diagnose, reconciliation, and forecast instances that have been initiated.
• Batch API results appear in the user interface.

**SAS Energy Forecasting 3.2**

SAS Energy Forecasting 3.2 shipped in March 2016. Here are some of the new features in this release:

• backcasting, which is energy forecasting using actual weather data instead of predicted weather data
• point forecasting
• reconciliation of a geographical hierarchy
• performance-optimized forecasts
• sample reports for SAS Visual Analytics
• SAP HANA as an input data source

**SAS Energy Forecasting 3.1**

Leveraging the experience that SAS has with hundreds of utilities worldwide, SAS Energy Forecasting 3.1 improves forecast results by providing trustworthy, repeatable, and defensible energy forecasts for planning horizons ranging from very short-term (for example, an hour ahead) to very long-term (for example, 50 years ahead). It is designed to meet the energy forecasting needs of the entire enterprise by providing forecasts for Energy Trading, Marketing, Risk Management, Operations, Fuels, System Planning, Finance, and any other department that might have a need for an energy forecast.

SAS Energy Forecasting 3.1 runs on SAS 9.4M2 and later releases.

**SAS Event Stream Manager 5.2**

SAS Event Stream Manager 5.2 shipped in June 2018.

Here are some of the new features and enhancements in SAS Event Stream Manager 5.2:

• The look and feel of the user interface has been enhanced to improve the user experience. For example, the pages in the menu bar are listed in a different order, and the Jobs page has been renamed as the Log page.
• The user interface for filtering ESP servers has been enhanced.
- You can monitor ESP metering servers from within SAS Event Stream Manager, using a new page called **Metering**.

- When you reference a project in SAS Model Manager, it is now more obvious when an update to the model is available. In addition, you can now update the model in more than one project at a time.

- Project major version numbers that are set in SAS Event Stream Processing Studio are now reflected in SAS Event Stream Manager. In addition, if you update a project that references a project in SAS Model Manager, SAS Event Stream Manager increments your project’s minor version number.

- There are no new XML elements and attributes available for use in job templates. However, there are new variables for the project-version attribute.

For more information, see **SAS Event Stream Manager 5.2: What’s New**. For more information about changes from the previous release, see **SAS Event Stream Processing in SAS Guide to Software Updates and Product Changes**.

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**SAS Event Stream Processing**

**SAS Event Stream Processing 5.2**

SAS Event Stream Processing 5.2 shipped in June 2018. SAS Event Stream Processing is a stand-alone product that can coexist with SAS 9.4. You can also use SAS Event Stream Processing 5.2 with SAS Viya.

Here are some of the new features and enhancements in SAS Event Stream Processing 5.2:

- SAS Event Stream Processing 5.2 provides a set of JavaScript objects and methods that communicate with running ESP servers. Using the ESPJS API, you can create models and publish/subscribe operations in SAS Event Stream Processing from within web pages and across other platforms that support JavaScript.

- Beginning with release 5.2, SAS Event Stream Processing Analytics is supported on Microsoft Windows. Also new analytics algorithms are available.

- SAS Event Stream Processing 5.2 supports the use of graphical processing units (GPUs) to score streaming data with several neural networks.

- SAS Event Stream Processing now supports several new connectors and adapters.

For more information about changes from the previous release, see **SAS Event Stream Processing in SAS Guide to Software Updates and Product Changes**.

**SAS Event Stream Processing 5.1**

SAS Event Stream Processing 5.1 shipped in December 2017. SAS Event Stream Processing is a stand-alone product that can coexist with SAS 9.4. You can also use SAS Event Stream Processing 5.1 with SAS Viya.

Here are some of the new features and enhancements in SAS Event Stream Processing 5.1:

- A new metering server enables you to track ESP server usage data.

- Several new analytics algorithms (such as linear regression, logistic regression, and support vector machines) are available.
• This release includes several new and enhanced connectors and adapters. New features include an adapter connector that enables you to run an adapter in the same process space as the ESP server, a BACnet publisher connector and adapter, an OPC-UA connector and adapter, a URL connector, a UVC connector and adapter, and a WebSocket connector.

• SAS Event Stream Processing 5.1 enables any language that supports WebSockets to publish and subscribe to an event stream processing engine without requiring the use of client-side C++ classes.

• You can now import SAS Micro Analytic Service stores into SAS Event Stream Processing Studio directly from SAS Model Manager.

• Three new data types are available in events: BINARY (binary large object, or blob), RUTF8STR (reference-counted string, or rstring), and ARRAY (32-bit integers, 64-bit integers, double).

• Starting in SAS Event Stream Processing 5.1, there is a single port for all HTTP requests.

• Programming enhancements include a new retention type bytime_jumping_lookback, a new aggregate function ESP_aCAT, and server publish/subscribe support for using the project port without requiring the global port.

• You can now enable cluster redundancy by setting up spare engines. When an engine fails, the router automatically and transparently replaces it with the specified spare engine.

• You can now set up a cluster of Cluster Managers to enable Cluster Manager failover. The failover mechanism is implemented using the HTTP protocol and the existing HTTP port.

• You can now define a polyline in the Geofence window.

**SAS Event Stream Processing 4.3**

SAS Event Stream Processing 4.3 shipped in May 2017. SAS Event Stream Processing is a stand-alone product that can coexist with SAS 9.4. You can also use SAS Event Stream Processing 4.3 with SAS Viya.

SAS Event Stream Processing Analytics enables you to execute the analytics that are produced by various SAS products, such as SAS Visual Statistics. Based on feedback from users, changes have been made to SAS Event Stream Processing Studio to improve the user experience and to expand available functionality. SAS Event Stream Processing 4.3 now enables you to set up the event stream processing server to use explicit read/write permissions on engine, project, query, and window objects based on the user.

**SAS Event Stream Processing 4.2**

SAS Event Stream Processing 4.2 shipped in September 2016. SAS Event Stream Processing is a stand-alone product that can coexist with SAS 9.4. You can also use SAS Event Stream Processing 4.2 with SAS Viya.

The publish and subscribe clients, Camel clients, XML clients, adapters, and the adapter manager support authentication against a SASLogon service URL. And the HDFS adapter users can now authenticate against a Kerberized Hadoop grid using native Java Kerberos. SAS ESP adaptors and connectors now provide increased access to metadata and message-level logging information for increased administration. SAS Streamviewer has introduced a new geographic visualization component. The event stream processing...
server can now be configured to maintain a metering source window to track the number of events processed within a specified interval. A migration tool is also available to convert XML models from the 3.2 XML schema to the 4.2 XML schema. Enhancements to documentation and examples are also included in this latest release.

**SAS Event Stream Processing 4.1**

SAS Event Stream Processing 4.1 shipped in August 2016. SAS Event Stream Processing is a stand-alone product that can coexist with SAS 9.4.

SAS Event Stream Processing 4.1 provides the Adapter Manager for orchestration and grid publishing. This release is cloud-ready. SAS Event Stream Processing 4.1 also provides enhancements to SAS Event Stream Processing Studio, a number of new adapters and connectors, enhancements to existing adapters and connectors, changes and enhancements to the XML layer, an enhanced Streamviewer, a Python-based publish/subscribe APT, an Adobe Adapter NiFi ESP processor, and enhancements to window types.

**SAS Event Stream Processing 3.2**

SAS Event Stream Processing 3.2 shipped in November 2015 and runs on SAS 9.4M3. Starting with this release, input handlers can be written using DATA step statements. This release adds authentication and includes compression for pattern windows and changes to the HTTP API. SAS Event Stream Processing 3.2 also provides integration with Hadoop Yarn and new connectors and adapters.

**SAS Event Stream Processing 3.1**

SAS Event Stream Processing 3.1 (formerly known as SAS Event Stream Processing Engine) shipped in May 2015 and runs on SAS 9.4M2. This release provides a web-based client that enables you to create event stream processing models. The SAS Event Stream Processing Studio client generates XML code based on the models that you define in the user interface. SAS Event Stream Processing 3.1 now supports these connectors and adapters: Twitter, Sniffer, SOAP, Netezza, and REST. This release also includes a new integrated HTTP client driver.

**SAS Event Stream Processing Engine 2.3**

SAS Event Stream Processing Engine 2.3 includes a new Streamviewer tool that uses the HTTP protocol. The tool provides enhanced graphic and publishing capabilities. 1+N way failover has been enhanced to support the RabbitMQ messaging system. SAS Event Stream Processing Engine now enables expressions to access an event’s opcode or flags. This release also includes a new Project publish connector and a new RabbitMQ connector and adapter.

**SAS/ETS**

**SAS/ETS 15.1**

SAS/ETS 15.1 (November 2018) runs on SAS 9.4M6 and later releases. The SASEOECD interface engine has been added to the SAS/ETS software. This engine
enables you to retrieve time series data from the Organisation for Economic Co-operation and Development (OECD) website.

New features have been added to these procedures:

**AUTOREG**
- The CLASS statement is now production.
- You can now output the standard errors of prediction intervals by specifying the STDERR= and STDERRM= options in the OUTPUT statement.

**COUNTREG**
- The NOSPLITEFFECTS option for variable selection requests that effects that involve class variables not be split into individual effects that correspond to class levels.
- The RETAINEFFECT option for variable selection requests that the effects named within parentheses be retained during the variable selection process.

**COPULA**
- A SIMULATE statement can be used with a BY statement, provided that a FIT statement precedes the SIMULATE statement.
- Multiple FIT and SIMULATE statements can be used with a BY statement.

**SPATIALREG**
Taylor and Chebyshev approximation techniques were added for spatial error models and spatial Durbin error models.

**SSM**
You can now request that parameter estimation be based on a new type of likelihood called marginal likelihood. For some model types, parameter estimation that is based on marginal likelihood is preferred over parameter estimation that is based on diffuse likelihood, which is the default.

**TMODEL**
- Most features in the TMODEL procedure are now production. Only the RANDOM statement and the QUADHESS=ANALYTIC option remain experimental.
- The LUSOLVER= option has been added to provide better control over the solution of matrix equations that occur in FIT and SOLVE tasks.

**UCM**
- You can now add a transfer-function component in your model by using the new TF statement. A transfer-function component models the contribution of contemporaneous and lagged values of a predictor.
- You can now request that parameter estimation be based on a new type of likelihood called marginal likelihood. For some model types, parameter estimation that is based on marginal likelihood is preferred over parameter estimation that is based on diffuse likelihood, which is the default.

**VARMAX**
- Conditional forecasts and scenario analysis are supported for the vector autoregressive (VAR) model, Bayesian VAR model, vector error correction model (VECM), and Bayesian VECM, with or without exogenous variables. Conditional forecasts under both hard and soft conditions are supported. You can also obtain forecasts for different scenarios in only one call of PROC VARMAX. The simulated forecasts can be output to a data set for further analysis.
- You can now plot dynamic conditional covariances for DCC GARCH models by specifying PLOTS= CONDCORR.
• The OUTSTAT statement now includes the value of the log-likelihood function that is calculated at the parameter estimates.

See these resources:
• For more information about this release, see What’s New in SAS/ETS 15.1 in SAS/ETS 15.1 User’s Guide.
• For more information about changes from the previous release, see SAS/ETS in SAS Guide to Software Updates and Product Changes.

SAS/ETS 14.3

SAS/ETS 14.3 (September 2017) runs on SAS 9.4M5 and later releases.

These components have been added to SAS/ETS software:
• The SASEWBG0 interface engine enables SAS programmers to retrieve time series data from the World Bank Group Open (WBGO) data website, which is hosted by the World Bank Group.
• The TMODEL procedure is a new, experimental version of the MODEL procedure. The code that you use to perform nearly all analyses in PROC MODEL can be used without changes in PROC TMODEL. However, PROC TMODEL incorporates high-performance computational techniques and offers new features that enhance the functionality of PROC MODEL.

New features have been added to these SAS/ETS components:
• In the PANEL procedure, dynamic panel estimation is now easier through the addition of new options and features.
• The no-U turn sampler (NUTS) of the Hamiltonian algorithm has been added to the QLIM procedure.
• New features have been added to the SASEFAME interface engine to support remote access to MarketMap’s (FAME) master and MCADBS servers.
• For the SASEFRED interface engine, the USER= option is new.
• For the SASEQUAN interface engine, version 3 of the QUANDL API is now supported.
• In the SSM procedure, model-based temporal aggregation and temporal distribution are now possible for time series that have response variables of flow type. The BREAKPEAKS and ZSPARSE options in the PROC SSM statement are now production.
• In the UCM procedure, you can specify higher-order stochastic cycle components in your models.
• In the VARMAX procedure, confidence intervals and standard errors for impulse response functions of exogenous variables and for all impulse response functions of VARFIMA models now appear in corresponding plots and tables. The FI option is now production.

For more information about this release, see What’s New in SAS/ETS 14.3 in SAS/ETS 14.3 User’s Guide.

SAS/ETS 14.2

SAS/ETS 14.2 (November 2016) runs on SAS 9.4M4 and later releases.
These components have been added to SAS/ETS software:

- The SASENOAA interface engine enables SAS users to retrieve severe weather data from the National Oceanic and Atmospheric Administration (NOAA) Severe Weather Data Inventory (SWDI) web service.
- The SASERAIN interface engine enables SAS users to retrieve weather data from the World Weather Online website.
- The SPATIALREG procedure analyzes spatial econometric models for cross-sectional data where observations in the data are spatially referenced or georeferenced.

New features have been added to these SAS/ETS components:

- HPCDM procedure
- HPSEVERITY procedure
- QLIM procedure
- SASEFAME interface engine
- SASEFRED interface engine
- SASEQUAN interface engine
- SASEXFSD interface engine
- SEVERITY procedure
- SSM procedure
- TIMESERIES procedure
- VARMAX procedure

For more information, see What’s New in SAS/ETS 14.2 in SAS/ETS 14.2 User’s Guide.

SAS/ETS 14.1


Here are some of the new features and enhancements:

- The COUNTREG procedure adds the TEST statement, three statements that enable you to include spatial effects in a model, and more Bayesian analysis features.
- The HPCOUNTREG procedure adds the TEST statement and support for the Conway-Maxwell distribution.
- The HPPANEL procedure adds support for the between-groups estimator, between-time-periods estimator, and pooled OLS regression.
- The MODEL procedure adds the %EQAR and %EQMA macros.
- The PANEL procedure adds more general Hausman specification tests, comparison tables for multiple models, and Hausman and Taylor (1981) and Amemiya and MaCurdy (1986) estimators.
- The QLIM procedure adds the RANDOM statement, which enables you to estimate the random-intercept models, and more Bayesian analysis features.
- The SASEFRED interface engine supports Linux X64 (LAX) hosts; real-time periods for Federal Reserve Economic Data (FRED) data; logging of diagnostics in the SAS log; requests for useful information about categories, tags, groups, and releases; and use of blanks in pathnames in options.
• The SASEXFSD interface engine supports Linux X64 (LAX) hosts, logging of
diagnostics in the SAS log, the UNIVERSE= option on the ExtractFormulaHistory
factlet, and use of blanks in pathnames in options.
• The SASEQUAN interface engine supports Linux X64 (LAX) hosts, up to nine
Quandl codes, logging of diagnostics in the SAS log, and use of blanks in pathnames
in options. It also ensures unique names by appending the variable number to names.
• The SSM procedure adds the DEPLAG statement, which simplifies the specification
of models that have lagged values of response variables in the observation equation.
• The VARMAX procedure supports vector error correction models in ARMA-
GARCH form, linear equality and inequality constraints in vector error correction
models, covariance and standard errors of the parameter estimates of the adjustment
coefficient matrix, covariance matrix of innovations in vector error correction
models, outputs of parameter estimates of the long-run parameters and the error
correction trend parameters, Wald tests on any parameters in vector correction
models except the long-run parameters and the error correction trend parameters,
specification of initial values, and a new estimation method, the conditional
maximum likelihood (CML).
• The new X13 procedure incorporates the X12 procedure in response to the US
Census Bureau’s inclusion of the X-12-ARIMA methodology in the X-13ARIMA-
SEATS program. PROC X13 also adds numerous options, displays additional tables,
and changes the default value of the MAXITER= option to 1,500.

For more information, see What’s New in SAS/ETS 14.1 in SAS/ETS 14.1 User’s Guide.

SAS/ETS 13.2

SAS/ETS 13.2 (August 2014) runs on SAS 9.4M2 and later releases.

Here are some of the new features and enhancements:
• The new SASEQUAN interface engine enables you to retrieve economic data from
the Quandl website.
• The COUNTREG procedure now supports the following features:
  • A number of Bayesian estimation features are supported.
  • You can control the number of threads that are used during optimization.
  • You can store parameter estimates and other results on a per-BY-group basis in
    the item store so that they can be retrieved later for scoring the BY groups in
    another data set.
• The PANEL procedure now supports the following features:
  • first-differenced methods for one-way and two-way models
  • panel data cross-sectional dependence test
  • Lagrange multiplier (LM) test for cross-sectional and time effects
  • locally mean most powerful (LMPP) and standardized Lagrange multiplier
    (SLM) tests
  • Gourieroux, Holly, and Monfort Lagrange multiplier test
  • tests for serial correlation and cross-sectional effects
• The QLIM procedure has added an automated algorithm to monitor the quality of the
  posterior representation through MCMC methods. In doing so, this algorithm can
retune and/or reinitialize the MCMC methods until the posterior distribution representation is satisfactory.

- The SASEFRED interface engine now performs error checking to avoid incompatibility of various options.

- The SEVERITY procedure now supports the following features:
  - The CLASS statement is supported.
  - You can specify a wide variety of regression effects, such as singleton continuous effects, polynomial continuous effects, main CLASS variable effects, and more.
  - You can save estimation results in an item store and use them for parameter initialization in a subsequent run of the SEVERITY or HPSEVERITY procedure.
  - You can create scoring functions.
  - You can limit the number of observations that are used to prepare the empirical distribution function (EDF) estimates, enabling you to speed up the EDF estimation step for large data sets, especially when you specify censoring or truncation effects.

- The VARMAX procedure now supports the following features:
  - \( p \)-values for the Johansen cointegration rank test
  - multistep forecast for the multivariate GARCH model, enabling you to obtain the multistep forecast of conditional covariance matrices at any horizons ahead

- The X12 procedure now enables you to specify the following:
  - the size of forecast confidence limits
  - the difference in critical values for almost outliers
  - the alpha value for outlier detection
  - the method of calculating the critical value for outlier detection based on the alpha value and the number of observations in the span that is used for analysis
  - the number of level-shift outliers to consider for forming a temporary level shift
  - the method of adding outliers at each iteration of model estimation
  - the rate of decay for temporary change outliers
  - the moving average filter for each period

For more information, see What’s New in SAS/ETS 13.2 in SAS/ETS 13.2 User’s Guide.

Here are some new features in SAS/ETS 13.2 high-performance procedures:

- The HPCOUNTREG procedure now supports panel data analysis.

- The HPSEVERITY procedure now supports the following features:
  - The CLASS statement is supported.
  - You can specify a wide variety of regression effects, such as singleton continuous effects, polynomial continuous effects, main CLASS variable effects, and more.
  - You can save estimation results in an item store and use them for parameter initialization in a subsequent run of the SEVERITY or HPSEVERITY procedure.
  - You can create scoring functions.
  - PROC HPSEVERITY supports the following functions, which were previously available only in the SEVERITY procedure: You can request a variety of plots in single-machine mode; you can create a SAS data set in single-machine mode that
contains the EDF and CDF estimates of all distributions that do not fail to converge; you can specify the probability of observability; and you can specify the same options in the NLOPTIONS statement that you can specify in PROC SEVERITY.


**SAS/ETS 13.1**

SAS/ETS 13.1 (December 2013) runs on SAS 9.4M1 and later releases.

Here are some of the new features and enhancements:

- The AUTOREG procedure now enables you to estimate GARCH models without constraints on parameters.
- The COPULA procedure now supports tail dependence plots.
- The COUNTREG procedure now supports the following features:
  - The STORE statement enables you to save your model parameter estimates and other statistics in item stores.
  - New options in the CLASS statement enable you to control parameterization methods, reference levels, and sort order for classification variables.
- The SEVERITY procedure now supports the following features:
  - The scale regression model can include offset variables.
  - The new OUTSCORELIB statement creates scoring functions.
- The PANEL procedure now supports the Blundell and Bond system GMM estimator.
- The QLIM procedure now provides the following features:
  - Bayesian estimation is available for most of the multivariate models.
  - Endogeneity issues can now be addressed in most models.
  - Heckman’s two-step procedure now enables the model for the selected sample to be a discrete choice or limited dependent variable model.
- The SSM procedure now supports the following features:
  - A more general state-transition equation permits inclusion of regression effects.
  - You can now search for structural breaks in any model component.
- The UCM procedure now provides a bootstrap-based procedure for computing standard error of a series and component forecasts.
- The VARMAX procedure now supports the following features:
  - huge performance and scalability improvements for VARMAX and VARMAX-GARCH models that are estimated by maximum likelihood
  - inequality constraints on parameters
  - initial values for parameters
  - matrix expressions, operators, and functions in the BOUND, INITIAL, RESTRICT, and TEST statements
  - multivariate DCC GARCH models
• four new forms of univariate GARCH models: exponential GARCH (EGARCH), power GARCH (PGARCH), quadratic GARCH (QGARCH), and the threshold GARCH (TGARCH)

• concentrated likelihood estimation for CCC and DCC GARCH models

• The new SASEFRED interface engine enables you to retrieve economic data from the FRED website, which is hosted by the Economic Research Division of the Federal Reserve Bank of St. Louis.

• The SASECRSP interface engine supports Linux X64 (64-bit), Solaris Sun UltraSPARC, Solaris on Intel x86, and Windows.

• The new SASEXFSD interface engine enables you to access FactSet data that are provided by the FactSet FASTFetch web service.

Here are some of the new high-performance features and procedures in SAS/ETS 13.1:

• The experimental high-performance HPCDM procedure estimates a compound distribution model, which is the distribution of an aggregate loss that you expect to see in a given period of time.

• The new HPCOPULA procedure is a high-performance version of the COPULA procedure, which enables you to simulate realizations of multivariate distributions by using the copula approach.

• The new HPPANEL procedure is a high-performance version of the PANEL procedure, which analyzes a class of linear econometric panel data models.

• The HPCOUNTREG procedure now supports the BY statement.

• The HPQLIM procedure now supports discrete choice models and the BY statement.

• The HPSEVERITY procedure now supports the following features:
  • BY statement
  • offset variables in the scale regression model
  • a new OUTSCORELIB statement, which creates scoring functions

For more information, see What’s New in SAS/ETS 13.1 in SAS/ETS 13.1 User’s Guide.

SAS/ETS 12.3

SAS/ETS 12.3 is essentially a maintenance release of SAS/ETS software that runs on SAS 9.4.

In addition, the procedures that make up the SAS High-Performance Econometrics product are available with SAS/ETS for use in single-machine mode. Depending on data characteristics and model complexity, you might see performance improvements over comparable SAS/ETS functionality that is not multithreaded.

For more information, see Overview of SAS/ETS High-Performance Procedures in SAS/ETS User’s Guide: High-Performance Procedures.
SAS Factory Miner

About SAS Factory Miner

SAS Factory Miner is an easy-to-use application that enables you to build models to analyze data and examine results. You can build a model by creating a project, selecting data source configurations, choosing model templates, running your analysis, and viewing results.

You can use these models to analyze data in SAS Factory Miner:

- Bayesian Network model
- Decision Tree model
- Generalized Linear model
- Gradient Boosting model
- Neural Network model
- Random Forest model
- Regression model
- Support Vector Machine model

SAS Factory Miner helps you perform data mining model creation at a segment level. For example, you could use customer data to investigate which customers are most likely to respond to online offers. Furthermore, you could build separate models for each of the regions in which your clients live. You can run multiple models and examine results to determine which modeling algorithm was most effective for the data that you have and the goals of your investigation. Comparing modeling results can help you make more informed and effective business decisions.

SAS Factory Miner 14.1 runs on SAS 9.4M3 and later releases.

SAS Factory Miner 15.1

SAS Factory Miner 15.1 shipped in November 2018 and runs on SAS 9.4M6 and later releases.

See these resources:

- For more information about this release, see the software product page for SAS Enterprise Miner and SAS Factory Miner.
- For more information about changes from the previous release, see SAS Factory Miner in SAS Guide to Software Updates and Product Changes.

SAS Factory Miner 14.2

SAS Factory Miner includes a new REST endpoint that can be called to automatically retrain a project with new data and give you the option to register the new models with SAS Model Manager. This update includes a SAS code template that can be used to invoke the new endpoint and a UI component that enables you to download the SAS code template for a particular project. You can use this code template and use your
operating system’s scheduler to invoke the REST endpoint periodically in order to automatically retrain your models.

**SAS Forecast Server**

**SAS Forecast Server 15.1**

SAS Forecast Server 15.1 shipped in November 2018 and supports SAS 9.4M6 and later releases.

See these resources:

- For more information about SAS Forecast Server, see the software product page for SAS Forecast Server.
- For more information about changes from the previous release, see SAS Forecast Server in *SAS Guide to Software Updates and Product Changes*.

**SAS Forecast Server 14.3**


**SAS Forecast Server 14.2**

SAS Forecast Server 14.2 shipped in November 2016 and runs on SAS 9.4M4. This release includes several enhancements to the SAS Forecast Server procedures.

**SAS Forecast Server 14.1**

SAS Forecast Server 14.1 shipped in July 2015 and runs on SAS 9.4M3. This release includes the new SAS Forecast Server Client, which is a web-based interface that you can use to segment your time series data, create forecasts, and track the accuracy of your forecasts. With SAS Forecast Server Client, you have the option of writing custom code to segment and model your time series.

*Note:* The SAS Forecast Server Client is discontinued as of SAS Forecast Server 14.3.

**SAS Forecast Server 13.1**

SAS Forecast Server 13.1 shipped in December 2013 and runs on SAS 9.4M1. Here are some of the new features and enhancements in this release:

- support for Integrated Windows Authentication, clustered servers, and grid computing environments
- new options for changing the ODS format and execution server when running a report or stored process
- the ability to create a forecast data set for independent variables
**SAS Forecast Server 12.3**

SAS Forecast Server 12.3 runs on SAS 9.4 and includes updates to the web infrastructure. SAS Forecast Server is now integrated with SAS Time Series Studio, which is now production software. SAS Time Series Studio enables you to analyze and structure your time-stamped data. You can export data from SAS Time Series Studio and import it into SAS Forecast Studio.

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**SAS High-Performance Risk**

**SAS High-Performance Risk 4.2**

SAS High-Performance Risk 4.2 shipped in June 2019 and runs on SAS 9.4M6. This release provides these new features:

- ability to filter SubCubes of a comparison join independently
- ability to store one or more schema files as cube data files
- new QueryVal subroutines that enable you to iterate through scenarios
- support for aggregate and side-by-side joins of basecell result set cubes
- prompts to refresh the risk exploration if the data source has changed
- input methods during distribute tasks to update positions for stress
- ability to compute and display computed methods by scenario in a risk exploration

**SAS High-Performance Risk 4.1**

SAS High-Performance Risk 4.1 shipped in June 2018 and runs on SAS 9.4M5. This release provides these new features:

- a new user interface
- a new roll-up method
- new analytical features
- improvements to cube management

See these resources:

- For more information, see the software product page for SAS High-Performance Risk.
- For more information about changes from the previous release, see SAS High-Performance Risk in SAS Guide to Software Updates and Product Changes.

**SAS High-Performance Risk 3.9**

SAS High-Performance Risk 3.9 shipped in September 2017 and aligns with SAS 9.4M5.
**SAS High-Performance Risk 3.8**

SAS High-Performance Risk 3.8 shipped in June 2017 and runs on SAS 9.4M4. This release provides these new features:

- new computed roll-up methods and pre-query methods
- historical simulation and sensitivity analysis
- new cross-classification filters when you create a cube
- a new administrative tool that works across SAS risk solutions to set up risk work groups

**SAS High-Performance Risk 3.7**

SAS High-Performance Risk 3.7 shipped in November 2016 and runs on SAS 9.4M4. This release provides these new features:

- support for Delta-Normal analysis
- scenario cash flow and ValueData data sets
- transposed scenario analysis result set

**SAS High-Performance Risk 3.6**

SAS High-Performance Risk 3.6 runs on SAS 9.4M3. This release includes a bridge component that enables you to run programs that are not thread-safe and a preproduction custom file reader that enables you to directly access risk data in Hadoop MAPREDUCE jobs. This release also includes new SAS language elements.

**SAS High-Performance Risk 3.5**

SAS High-Performance Risk 3.5 runs on SAS 9.4M3. Starting with this release, scenario results can be stored in a risk cube. This release also includes enhancements to the user interface and new SAS language elements.

**SAS High-Performance Risk 3.4**

SAS High-Performance Risk 3.4 runs on SAS 9.4M2 and provides these new features:

- the capability to store risk cube data files in the Hadoop Distributed File System (HDFS) in distributed mode. The primary benefit of storing risk cubes in HDFS is an improved backup and restore process.
- the ability to define statistics and include them in a risk cube. You can also include distortion risk measures in a risk cube.
- the ability to plot risk factors in the Scenario Editor.
- new language elements.
SAS High-Performance Risk 3.3

SAS High-Performance Risk 3.3 runs on SAS 9.4M2 and provides the following features:

• enhancements to scenario creation and stress testing
• enhanced support for counterparty risk and credit value adjustment
• ability to price a portfolio by both positions and market states
• new SAS language statements

SAS High-Performance Risk 3.2

SAS High-Performance Risk 3.2 runs on SAS 9.4M1 and provides the following new features:

• access to SAS High-Performance Risk through the SAS Visual Analytics application bar
• ability to export risk explorations to a PDF file
• user interface enhancements
• ability to send data sets from grid nodes directly to a distributed data file system or to in-memory data
• ability to perturb instrument variables in a portfolio

SAS High-Performance Risk 3.1

SAS High-Performance Risk 3.1 runs on SAS 9.4 and includes these features:

• enhancements to risk analytics include netted and collateralized exposure calculations, portfolio stressing and filtering, and an enhanced scenario builder
• integration with Hadoop and SAS LASR
• enhancements to the user interface include enhanced sorting, the ability to export graphs to Microsoft Excel, the ability to drill down in bar charts, and enhancements to stress testing
• ability for high-performance sensitivity analysis
• improvements to performance

SAS/IML

SAS/IML 15.1

SAS/IML 15.1 shipped in November 2018 and runs on SAS 9.4M6 and later releases. Here are the new statements and functions:

• The CONTINUE statement stops the processing of the current iteration of a DO loop and resumes processing at the next iteration of the DO loop.
- The new digital filtering functions enable you to design digital filters and apply those filters to signals. Many of the digital filtering functions start with the 'DF' prefix. The new function and subroutines are CCEPSTRUM, DFCONV, DFDESIGN, DFFILT, DFFREQZ, DFFREQZZPK, DFMEDFILT, DFORDER, DFSOSFILT, DFSOSFREQZ, DFSOSFREQZZPK, ICCEPSTRUM, and RCEPSTRUM.
- The experimental KPCATRAIN subroutine computes a kernel principal component (kPCA) analysis from training data. The experimental KCPAScore function uses the kPCA model to score new data.
- The FEVAL function enables you to evaluate a function indirectly by specifying the name of the function and its arguments.
- The LEAVE statement exits the current DO loop and resumes processing at the statement that follows the DO loop.
- The MODULESTACK function returns the names of all modules in the module call stack.
- The SPECTROGRAM subroutine displays a spectrogram of a short-time Fourier transform of a time series signal.
- The TABLESORT subroutine sorts a table by one or more columns.

Several statements, functions, and subroutines have been enhanced.
- If the SAS VALIDVARNAME option is set to ANY, then you can use a name literal as the name of a SAS/IML symbol.
- The INV, ROOT, and SWEEP functions support multithreaded algorithms for large matrices.
- The CREATE FROM statement and the APPEND FROM statement accept multiple matrices, making it easier to write mixed data types to a SAS data set.
- The PRINT statement accepts numerical vectors for the ROWNAME= and COLNAME= options.
- The RANDGEN subroutine and RANDFUN function support new random number generators. You can use the RANDSEED subroutine to specify the following generators:
  - MTHYBRID
    - (Default) Hybrid 1998/2002 32-bit Mersenne twister
  - MT2002
    - 2002 32-bit Mersenne twister
  - MT64
    - 64-bit Mersenne twister
  - PCG
    - 64-bit permuted congruential generator
  - TF2
    - Threefry 2x64-bit counter-based RNG
  - TF4
    - Threefry 4x64-bit counter-based RNG
  - RDRAND
    - Intel hardware-based RdRand instructions
- The VARMASIM function enables you to use the INITIAL= option to specify a matrix that initializes a simulated VARMA time series.
See these resources:

- For more information about this release, see *What's New in SAS/IML 15.1*.
- For more information about changes from the previous release, see *SAS/IML in SAS Guide to Software Updates and Product Changes*.

**SAS/IML 14.3**

SAS/IML 14.3 shipped in September 2017 and runs on SAS 9.4M5 and later releases. Here are some of the new features and enhancements:

- The SAS/IML language supports new syntax for defining and manipulating lists. You can use square brackets to define a list, subscript notation to extract a sublist, a dollar sign ($) to extract an item from a list, and the concatenation operator (||) to concatenate lists.
- You can transfer data between SAS/IML tables and R data frames by using the ExportTableToR subroutine and the ImportTableFromR function.
- You can analyze complex-valued time series data by using several new functions for time-frequency analysis.


**SAS/IML 14.2**

SAS/IML 14.2 shipped in November 2016 and runs on SAS 9.4M4 and later releases. Here are some of the new features and enhancements:

- The fundamental data type in the IML procedure is the matrix. Prior to SAS/IML 14.2, every symbol in a PROC IML program represented a matrix. A new feature in SAS/IML 14.2 is support for new nonmatrix data types: tables and lists.
- The RANDGEN subroutine supports new distributions and enhancements to many existing distributions.
- At the time of its release, SAS/IML 14.2 interfaces correctly with the most recent version of R, which is 3.3.1. You can contact SAS Technical Support for the latest information about support for newer versions of R.
- SAS/IML 14.2 also introduces several enhancements to the SUBMIT statement. Global SAS statements that are executed inside a SUBMIT block now also affect the SAS/IML program after the SUBMIT block.


**SAS/IML 14.1**

SAS/IML 14.1 shipped in July 2015 and runs on SAS 9.4M3 and later releases. Here are some of the new features and enhancements:

- Large matrices (up to 231 – 1 elements, or more than 2 billion elements) are supported on the Windows operating system.
- The PACKAGE statement supports installing and using packages, which are ZIP files that contain source code, data sets, documentation, and sample programs. You
can share and download packages from the SAS/IML File Exchange in the SAS Support Communities on support.sas.com.

- Eigenvalue computations use vendor-supplied math libraries, if available.
- The RANDSEED subroutine uses a different initialization algorithm for certain seeds.


SAS/IML 13.2

SAS/IML 13.2 shipped in August 2014 and runs on SAS 9.4M2 and later releases.

Here are some of the new features and enhancements:

- The new experimental EXECUTEFILE subroutine executes SAS/IML statements that are contained in a text file.
- Although not formally a part of SAS/IML software, the new SAS/IML File Exchange in the SAS/IML Support Community enables you to share SAS/IML programs and download programs written by others. You can post SAS/IML functions, tag files, and rate files, and search for files by tags, content, or author.

For more information, see What’s New in SAS/IML 13.2 in SAS/IML 13.2: User’s Guide.

SAS/IML 13.1

SAS/IML 13.1 shipped in December 2013 and runs on SAS 9.4M1 and later releases.

Here are some of the new features and enhancements:

- enhancements to the SAS/IML language syntax:
  - The NEXT keyword now supports expressions.
  - The STOP and ABORT statements now accept a default message that is displayed in the SAS log.
  - The parentheses in the RETURN statement are now optional.
- new support of the Tweedie distribution by the RANDGEN subroutine
- new statistical functions, subroutines, and modules:
  - The CV function returns the sample coefficient of variation for each column of a matrix.
  - The HEATMAPCONT call creates a heat map of a matrix whose values are visualized by using a continuous color ramp.
  - The HEATMAPDISC call creates a heat map of a matrix whose values are visualized by using a discrete color ramp.
  - The KURTOSIS function returns the sample kurtosis for each column of a matrix.
  - The LOGABSDET function returns the logarithm of the absolute value of a matrix determinant.
  - The LPSOLVE call solves linear programming problems.
  - The MILPSOLVE call solves mixed-integer linear programming problems.
• The PALETTE function returns a discrete color palette that is suitable for
choropleth maps, heat maps, and other graphical visualizations that display a
relatively small number of discrete values.
• The PARENTNAME function returns the name of the matrix that was passed to a
module.
• The SKEWNESS function returns the sample skewness for each column of a
matrix.

For more information, see What’s New in SAS/IML 13.1 in SAS/IML 13.1: User’s
Guide.

SAS/IML 12.3

SAS/IML 12.3 is essentially a maintenance release of SAS/IML software that runs on
SAS 9.4.

For more information, see the software product page for SAS/IML.

SAS Model Manager

SAS Model Manager 14.3

SAS Model Manager 14.3 runs on the June 2019 release of SAS 9.4M6. Starting with
this release, the user interface has been rewritten in HTML5. Previously, many SAS
applications and SAS solutions used the Adobe Flash Player to provide interactive user
interfaces. Adobe has announced that it intends to end support for Flash technology and
will stop updating and distributing the Flash Player at the end of 2020. Browser vendors
will disable Flash by default in 2019. For more information about Adobe Flash end-of-
life, see SAS Software and Its Use of the Adobe Flash Player.

See these resources:
• For more information about this release, see What’s New in SAS Model Manager
• For more information about changes from the previous release, see SAS Model
  Manager in SAS Guide to Software Updates and Product Changes.

SAS Model Manager 14.2

SAS Model Manager 14.2 runs on SAS 9.4M4. SAS Model Manager 14.2M1 shipped in
November 2018 and runs on SAS 9.4M6 and later releases.

New features and enhancements in this release enable you to perform these tasks:
• import SAS analytic store models
• publish, score, monitor performance, or run reports for SAS analytic store models
• publish models to Hadoop and Teradata using single sign-on authentication by
  Kerberos
• run scoring tests in a High-Performance Analytics production environment
• score SAS Factory Miner models from within a SAS Model Manager portfolio by
  using macros
• publish SAS Factory Miner models from within a SAS Model Manager portfolio to a
database or Hadoop using macros

SAS Model Manager 14.2M1 on SAS 9.4M6 enables you to perform these tasks:
• compute the feature contribution indices for interval and nominal predictors using
the feature contribution index (FCI) program
• convert and export a model’s DS2 score code using the %MM_GetModelDS2Code
macro
• configure support for executable attachments

For more information about this release, see What’s New in SAS Model Manager 14.2 in

SAS Model Manager 14.1

SAS Model Manager 14.1 runs on SAS 9.4M3.

New features and enhancements in this release enable you to perform these tasks:
• manage SAS Factory Miner models that are registered in the SAS Model Manager
model repository
• add model dependencies and view the relationships by using SAS Lineage
• manage model versions
• import, update, and export generic models at the folder level
• access the inventory of all models in the same category view
• add and edit model keywords
• add multiple user-defined properties to a model at one time
• search the model inventory with improved performance and filter the search results
by the date modified, model properties, and user-defined properties

For more information, see What’s New in SAS Model Manager 14.1 in SAS Model
Manager: User’s Guide.

SAS Model Manager 13.1

SAS Model Manager 13.1 runs on SAS 9.4M2. The SAS Model Manager Java Client
application and the Workflow Console web-based application have been replaced with
an integrated web-based application. The SAS Model Manager Client installation is no
longer required on a user’s desktop. New features and enhancements in this release
enable you to perform the following tasks:
• create libraries and register tables in the SAS Metadata Repository
• manage workflows and track workflow tasks
• publish models to Hadoop and SAP HANA
• manage all versions within a project in one place
• schedule recurrent jobs
• retrain models based on the dashboard project status
• specify performance options for using dynamic data sources and generating
dashboard reports
• specify additional reporting options
• attach documents and add comments

For more information, see What’s New in SAS Model Manager 13.1 in SAS Model Manager: User’s Guide.

**SAS Model Manager 12.3**

SAS Model Manager 12.3 runs on SAS 9.4. Major themes for this release include the ability to manage projects collaboratively as one control group, to support additional model classes, and to perform more activities from within SAS Model Manager Workflow Console. New features and enhancements in this major release enable you to perform the following tasks:

• create and manage multiple projects in a control group
• monitor performance of champion models for all projects within a control group and publish the champion models to the SAS Metadata Repository
• schedule performance monitoring tasks.
• specify multiple data sources and collection dates when defining performance monitoring tasks.
• remove models that are published to a database.
• create folders, projects, and versions by using macros. You can also set project properties.
• create and view reports within a workflow activity.
• view the process flow diagram for a workflow.

In addition, SAS Model Manager 12.3 provides support for these areas:

• SAS Enterprise Miner Random Forest (HPFOREST), as well as the SAS/ETS COUNTREG and SEVERITY models
• multiple SAS application servers when scoring or retraining a model, and monitoring performance of champion and challenger models

For more information, see What’s New in SAS Model Manager 12.3 in SAS Model Manager: User’s Guide.

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**SAS/OR**

**SAS/OR 15.1**

SAS/OR 15.1 shipped in November 2018 and runs on SAS 9.4M6 and later releases. SAS/OR 15.1 includes improvements to its optimization procedures, solvers, and algorithms, along with interface and performance improvements to SAS Simulation Studio.

SAS Simulation Studio 15.1, a discrete-event simulation component of SAS/OR15.1 for Windows and Linux environments, extensively revises and enhances its graphical user interface, improves its performance, and streamlines authentication when executing simulation models in batch mode.
See these resources:

- For more information about this release, see What's New in SAS/OR 15.1. in SAS/OR 15.1 User’s Guide: Mathematical Programming.
- For more information about changes from the previous release, see SAS/OR in SAS Guide to Software Updates and Product Changes.

**SAS/OR 14.3**

SAS/OR 14.3 shipped in September 2017 and runs on SAS 9.4M5 and later releases.

Several optimization solvers have been updated in SAS/OR 14.3 and improve their performance. The LP, MILP, QP, and NLP solver algorithms all reduce the time they require to solve benchmark optimization problems. These improvements also include the decomposition (DECOMP) algorithm for LP and MILP.

SAS Simulation Studio 14.3, a component of SAS/OR 14.3 for Windows environments, adds Linux support (on an experimental basis) and also adds an alternative user interface design.

For more information, see What’s New in SAS/OR 14.3 in SAS/OR 14.3 User’s Guide: Mathematical Programming.

**SAS/OR 14.2**

SAS/OR 14.2 shipped in November 2016 and runs on SAS 9.4M4 and later releases.

SAS/OR 14.2 includes performance improvements in the LP, MILP, and NLP solvers.

SAS Simulation Studio, a component of SAS/OR 14.2 for Windows environments, now includes these modeling blocks:

- The new Caster block makes it easier to transfer complex objects (entities, observations, and so on) within a model.
- The Queue block adds extended queueing controls that you can use to help prevent a queue from becoming blocked.

For more information, see What’s New in SAS/OR 14.2 in SAS/OR 14.2 User’s Guide: Mathematical Programming.

**SAS/OR 14.1**

SAS/OR 14.1 shipped in July 2015 and runs on SAS 9.4M3 and later releases. It adds a number of new optimization capabilities that shorten optimization time, increase diagnostic capabilities, and make the software easier to use.

Here are some of the new features and enhancements:

- Several solvers improve their performance.
- The concurrent FOR loop (the COFOR loop) in PROC OPTMODEL can run in distributed mode.

  Note: Distributed mode requires SAS High-Performance Optimization.

- PROC OPTMODEL adds a profiler that tracks the amount of time spent in problem generation, presolve, and various stages of the solution process.
- PROC OPTNET enables parallel computing, provides faster graph data input, and adds enhancements to three of its algorithms.
• The quadratic and nonlinear solvers add irreducible infeasible set (IIS) diagnostics.
• The decomposition algorithm expands the range of constraint matrix structures that it can detect automatically.
• The CLP procedure adds more variable selection strategies.

SAS Simulation Studio 14.1, a component of SAS/OR 14.1 for Windows environments, adds features that improve the accuracy of your models and give you additional controls on model execution. Highlights include the following:
• controls on the order in which dynamically created data input and output ports on blocks execute during the run of a model
• centralized controls on the ranking of blocks in a model, which determines the order of execution for events that are scheduled for the same simulation clock time
• expanded and improved controls on the allocation of resource units among resource entities when there is a scheduled adjustment
• automatic launching of the SAS server on your local PC


SAS/OR 13.2

SAS/OR 13.2 shipped in August 2014 and runs on SAS 9.4M2 and later releases. Here are some of the new features and enhancements:
• Several optimization solvers improve their performance.
• PROC OPTMODEL adds the experimental constraint logic programming (CLP) solver.
• The nonlinear programming (NLP) solver adds output of the covariance matrix for the decision variables (parameter estimates).
• The decomposition (DECOMP) algorithm adds new block detection features.
• For the linear programming (LP) interior point solver, the crossover algorithm is applied by default.
• The network solver is now production.
• The parallel implementation of the mixed integer linear programming (MILP) solver is now production.
• SAS Simulation Studio 13.2 provides a new optional parallel mode that executes design points and replications simultaneously on multiple computational cores, a central facility in the new Data Trimmer block to control data collection, and added control on the precision of the numeric values that the Formula block produces.

For more information, see What’s New in SAS/OR 13.2 in SAS/OR 13.2 User’s Guide: Mathematical Programming.

SAS/OR 13.1

SAS/OR 13.1 shipped in December 2013 and runs on SAS 9.4M1 and later releases. It includes new features and enhancements to current features in optimization, discrete-event simulation, and constraint programming.
Here are some of the new features and enhancements:

- The OPTMODEL procedure now supports:
  - direct access to network optimization and analysis algorithms (Experimental)
  - parallel execution of solver invocations in a COFOR loop
  - support for function definition via PROC FCMP in Base SAS software
- The OPTLSO procedure now provides:
  - multiobjective optimization
  - support for the use of array-structured data in function definition (via PROC FCMP)
- The mixed integer linear programming (MILP) solver adds the option to execute in parallel on multiple computational cores. (Experimental)
- SAS Simulation Studio adds:
  - support for custom block icons
  - improvements to the simulation clock display
  - enhancements to the Submodel block interface
  - other interface improvements


SAS/OR 12.3

SAS/OR 12.3 is largely a maintenance release of SAS/OR software that runs on SAS 9.4. The most significant addition is PROC OPTLSO for parallel hybrid local search optimization. This procedure, formerly named PROC HPLSO, previously was included only in SAS High-Performance Optimization but is now available with SAS/OR for use in single-machine mode.

For more information, see the software product page for SAS/OR.

SAS/QC 15.1

SAS/QC 15.1 shipped in November 2018 and runs on SAS 9.4M6 and later releases.
Here are some of the new features and enhancements in this release:

- The harmonic mean is included in the summary statistics that the CAPABILITY procedure computes. It is included by default in the data set that is created in the OUTTABLE= option in the PROC CAPABILITY statement, and you can include it in data sets that are requested in the OUTPUT statement. You can also display the harmonic mean in graphical output by using the INSET statement.
- The RAREEVENTS procedure enables you to apply tests for special causes to rare events charts. These tests can improve the sensitivity of rare events charts by detecting patterns of measurements that might indicate unusual variation. The CHART statement supports new options related to tests for special causes. The
CHART and COMPARE statements support the new ENDOBS option, which specifies that the last observation in the input data set represents the interval between the most recent event and the end of data collection. This measurement is not used in distribution fitting, but it can be displayed on a comparison plot or rare events chart.

- The CCHART, NPCHART, PCHART, and UCHART statements in PROC SHEWHART support the new LANEY option, which computes control limits.
- The EWMACHART and MACHART statements in PROC MACONTROL support the new LABASYMPOTOTIC option, which labels varying control limits with asymptotic limit values.
- The SHEWHART, ANOM, CUSUM, and MACONTROL procedures recognize new macro variables that you can use to control details of ODS Graphics output more conveniently. Each chart statement in these procedures also supports the new QCSYMBOLS= option, which specifies a set of symbol markers to use to plot points on the charts.

See these resources:

- For more information about this release, see What's New in SAS/QC 15.1. in SAS/QC 15.1 User's Guide.
- For more information about changes from the previous release, see SAS/QC in SAS Guide to Software Updates and Product Changes.

SAS/QC 14.3

SAS/QC 14.3 shipped in September 2017 and runs on SAS 9.4M5 and later releases. In this release, the RAREEVENTS procedure can produce rare events charts with distinct sets of probability limits for different phases of observations.

For more information about this release, see What’s New in SAS/QC 14.3 in SAS/QC 14.3 User’s Guide.

SAS/QC 14.2

SAS/QC 14.2 shipped in November 2016 and runs on SAS 9.4M4 and later releases. SAS/QC 14.2 includes enhancements to the ANOM, CAPABILITY, CUSUM, MACONTROL, RAREEVENTS, and SHEWHART procedures.

For more information, see What’s New in SAS/QC 14.2 in SAS/QC 14.2 User’s Guide.

SAS/QC 14.1


Here are some of the new features and enhancements:

- The new, experimental RAREEVENTS procedure produces control charts for rare events. A rare event is one that occurs infrequently, with a low probability. A rare events chart is better suited than traditional control charts to detecting changes in the frequency of low-probability events.
- The ANOM, CUSUM, MACONTROL, and SHEWHART procedures are now capable of producing graphs that you can edit by using the ODS Graphics Editor.

**SAS/QC 13.2**

SAS/QC 13.2 shipped in August 2014 and runs on SAS 9.4M2 and later releases.

Here are some of the new features and enhancements:

- The ANOM, CUSUM, MACONTROL, and SHEWHART procedures now use templates that are written in the Graph Template Language to produce ODS Graphics.
- The CAPABILITY procedure now calculates the geometric means of analysis variables and can save them in an output data set or display them in a graph (or both).
- The MVPMONITOR procedure now includes an option that enables you to specify the distribution that is used to compute control limits.
- The RELIABILITY procedure can now produce confidence bands for stress-lifetime plots that are produced by the RELPLOT statement.

For more information, see What’s New in SAS/QC 13.2 in SAS/QC 13.2 User’s Guide.

**SAS/QC 13.1**

SAS/QC 13.1 shipped in December 2013 and runs on SAS 9.4M1 and later releases.

Here are some of the new features and enhancements:

- The CAPABILITY procedure now provides the following:
  - improved parameter estimation for the Johnson \(S_U\) distribution
  - support for the OVERLAY option, which overlays, onto a single plot, histograms that are associated with different levels of a CLASS variable
- The MVPMONITOR procedure supports the new SCORECHART statement, which produces control charts of principal component score.
- The RELIABILITY procedure now supports the following features:
  - horizontal plots of failure and censoring times for recurrent events data
  - parameter estimation and probability plotting for the Gompertz and Gompertz-Makeham distributions
- The SHEWHART procedure has several new options:
  - The ACTUALALPHA option displays the effective \(\alpha\) value, which might not be the same as the requested \(\alpha\) value, in the limits legend of an attribute chart. This option is available in the CCHART, NPCHART, PCHART, and UCHART statements.
  - The IDSYMBOLHEIGHT= option controls the size of the symbols that are used to plot outliers in box plots that are produced by the BOXCHART statement.
  - The PROBLIMITS=DISCRETE option requests discrete control limits for attribute charts. This option is available in the CCHART, NPCHART, PCHART, and UCHART statements.
  - The WESTGARD= option applies Westgard rules to a Shewhart chart for quality control in health care laboratories.
• The \texttt{WHISKERPERCENTILE=} option requests that the whiskers of the box plots that are produced by the \texttt{BOXCHART} statement be drawn to percentile values.

There are four new macros for measurement system analysis:

• The \texttt{%basicEMP} macro performs a basic evaluating-the-measurement-process (EMP) analysis.
• The \texttt{%shortEMP} macro performs the eight steps for characterizing relative utility.
• The \texttt{%gaugeRR} macro performs a traditional gauge repeatability and reproducibility analysis.
• The \texttt{%honestGaugeRR} macro creates an “honest” gauge repeatability and reproducibility report.

For more information, see \texttt{What’s New in SAS/QC 13.1} in \textit{SAS/QC 13.1 User’s Guide}.

\textbf{SAS/QC 12.3}

SAS/QC 12.3 is essentially a maintenance release of SAS/QC software that runs on SAS 9.4.

For more information, see the software product page for \texttt{SAS/QC}.

\textbf{SAS/STAT}

\textbf{SAS/STAT 15.1}

SAS/STAT 15.1 (November 2018) runs on SAS 9.4M6 and later releases.

• The new \texttt{BGLIMM} procedure provides full Bayesian inference for generalized linear mixed models (GLMMs). It models data from the exponential family distributions that have correlations or nonconstant variability.

• The new \texttt{CAUSALGRAPH} procedure examines the structure of graphical causal models and suggests statistical strategies that enable researchers to compute unbiased estimates of causal effects.

• The new \texttt{RMSTREG} procedure analyzes time-to-event data by using regression with respect to the restricted mean survival time (RMST), using specialized methods.

• In the \texttt{ANOV A} procedure, you can specify the \texttt{EFFECTSIZE} option in the \texttt{MODEL} statement to add measures of effect size to each analysis-of-variance table.

• The \texttt{CAUSALMED} procedure enables you to input observational weights in the \texttt{WEIGHT} statement and to input the standard deviations of continuous variables in the \texttt{STD} statement.

• The \texttt{FMM} procedure supports random starting values for maximum likelihood estimation.

• The \texttt{FREQ} and \texttt{SURVEYFREQ} procedures offer the \texttt{SENSPEC} option in the \texttt{TABLES} statement to provide estimates and confidence limits for sensitivity, specificity, positive predictive value, and negative predictive value.

• The \texttt{ICPHREG} procedure fits the semiparametric proportional hazards model to interval-censored data.
• The MCMC and NLMIXED procedures support a steady state option for one-, two-, and three-compartment models.

• The PSMATCH procedure provides a PSWEIGHT statement to compute weights for observations on the basis of propensity scores.

• The QUANTREG procedure enables you to perform observationwise conditional distribution analysis.

• The SURVEYFREQ, SURVEYLOGISTIC, SURVEYMEANS, and SURVEYREG procedures provide two methods of computing the deviations for the replication variance estimation methods.

• The TTEST procedure produces graphs of bootstrap distributions and confidence intervals.

See these resources:

• For more information about this release, see What's New in SAS/STAT 15.1.

• For more information about changes from the previous release, see SAS/STAT in SAS Guide to Software Updates and Product Changes.

**SAS/STAT 14.3**

SAS/STAT 14.3 (September 2017) runs on SAS 9.4M5 and later releases.

Here are some of the enhancements for this release:

• The new CAUSALMED procedure estimates causal mediation effects from observational data.

• The GAMPL procedure now supports the Tweedie distribution.

• In PROC FREQ, the COMMONRISKDIFF option in the TABLES statement provides estimates, confidence limits, and tests for the overall risk (proportion) difference for multiway tables.

• The IRT procedure now supports the nominal response model, which enables you to perform item analysis of nominal responses.

• The NLMIXED and MCMC procedures add a CMPTMODEL statement that fits compartment models in pharmacokinetic analysis.

• The PHREG procedure provides cause-specific proportional hazards analysis for competing-risks data.

• The QUANTREG and QUANTSELECT procedures provide fast quantile process regression.

• The VARMETHOD=BOOTSTRAP option provides variance estimation by the bootstrap method for the survey data analysis procedures.

• The TTEST procedure provides bootstrap standard error, bias estimates, and confidence limits.

See these resources:

• For more information about this release, see What’s New in SAS/STAT 14.3 in SAS/STAT 14.3: User’s Guide.

• For more information about changes from the previous release, see SAS/STAT in SAS Guide to Software Updates and Product Changes.
SAS/STAT 14.2

SAS/STAT 14.2 (November 2016) runs on SAS 9.4M4 and later releases.

This release contains two new procedures:

- The CAUSALTRT procedure estimates the average causal effect of a binary treatment variable T on a continuous or discrete outcome Y.
- The PSMATCH procedure provides a variety of tools for propensity score analysis, which is a general strategy for reducing the effects of confounding in observational studies, where the subjects are not randomly assigned to the treatment and control groups.

Here are some of the enhancements in this release:

- The FREQ and SURVEYFREQ procedures provide additional agreement statistics.
- The NLIN procedure now provides ESTIMATE and CONTRAST statements.
- The NLMIXED procedure supports multithreading in models that have more than one RANDOM statement.
- The PHREG procedure now provides time-dependent ROC analysis.
- The POWER procedure now provides extensions of existing power analyses that are applicable to various generalized linear models.
- The SURVEYIMPUTE procedure provides two-stage fully efficient fractional imputation and fractional hot-deck imputation.
- The SURVEYSELECT procedure now provides balanced bootstrap selection and sequential Poisson selection.

For more information, see What’s New in SAS/STAT 14.2 in SAS/STAT 14.2: User’s Guide.

SAS/STAT 14.1


Here are some of the new features and enhancements:

- The new GAMPL procedure is a high-performance procedure that fits generalized additive models by penalized likelihood estimation.
- The new SURVEYIMPUTE procedure imputes missing values of an item in a sample survey by replacing them with observed values from the same item. Imputation methods include single and multiple hot-deck imputation and fully efficient fractional imputation.
- The BCHOICE procedure allows varying numbers of alternatives in choice sets for logit models.
- Exact mid-p, likelihood ratio, and Wald modified confidence limits are available for the odds ratio produced by the FREQ procedure.
- The GLIMMIX procedure provides the multilevel adaptive Gaussian quadrature algorithm of Pinheiro and Chao (2006) for multilevel models, which can greatly reduce the computational and memory requirements for these models with many random effects.
- The GLMSELECT procedure supports the group LASSO method.
- The IRT procedure fits generalized partial credit models.
- The LIFETEST procedure performs nonparametric analysis of competing-risks data.
- The LOGISTIC procedure fits an adjacent-category logit model to ordinal response data.
- The MCMC procedure adds an ordinary differential equation (ODE) solver and a general integration function, enabling the procedure to fit models that contain differential equations (for example, PK models) or models that require integration (for example, marginal likelihood models).
- The NPARIWAY procedure performs stratified rank-based analysis for two-sample data.
- The POWER procedure supports Cox proportional hazards regression models.
- The HPSPLIT procedure for classification and regression trees has been updated to include the MODEL and CLASS statements and tree plots, cross validation plots, and ROCS curves.
- The HPGENSELECT procedure for model selection for generalized linear models now provides the LASSO method.

For more information, see What’s New in SAS/STAT 14.1 in SAS/STAT 14.1 User’s Guide.

SAS/STAT 13.2

SAS/STAT 13.2 (August 2014) and runs on SAS 9.4M2 and later releases.

Here are some of the new features and enhancements:

- The new ICPHREG procedure fits proportional hazards regression models to interval-censored data.
- The new SPP procedure analyzes spatial point patterns.
- The experimental GEE procedure fits generalized linear models for longitudinal data by using the generalized estimating equations (GEE) estimation method of Liang and Zeger (1986). It also provides weighted GEE analyses.
- The FACTOR procedure generates path diagrams.
- The FMM procedure fits multinomial models.
- The IRT procedure generates polychoric correlation matrices, item characteristic curves, and test information curve plots.
- The MCMC procedure supports a categorical distribution in the MODEL, RANDOM, and PRIOR statements.
- The NLMIXED procedure enables you to specify more than one RANDOM statement in order to fit hierarchical nonlinear mixed models.
- The SEQDESIGN procedure enables you to create a ceiling-adjusted design that corresponds to integer-valued sample sizes at the stages for nonsurvival data.
- The LOGISTIC procedure enables you to add or relax constraints on parameters in nominal response and partial proportional odds models.
- The FREQ procedure now provides score confidence limits for the odds ratio and the relative risk.
The GLMSELECT procedure enables you to apply safe screening and sure independence screening methods to reduce a large number of regressors to a smaller subset from which model selection is performed.

For more information, see What’s New in SAS/STAT 13.2 in SAS/STAT 13.2 User’s Guide.

SAS/STAT 13.1

SAS/STAT 13.1 (December 2013) runs on SAS 9.4M1 and later releases.

Here are some of the new features and enhancements:

- The experimental BCHOICE procedure performs Bayesian analysis for discrete choice models.
- The new ICLIFETEST procedure performs nonparametric survival analysis for interval-censored data.
- The experimental IRT procedure fits item response models.
- The MI procedure now provides the MNAR statement to facilitate sensitivity analysis.
- The Tweedie distribution is now supported by the GENMOD procedure.
- The competing risk model of Fine and Gray (1999) is available in the PHREG procedure.
- With the NLIN procedure, you can generate both bootstrap estimates of confidence intervals for the parameters and bootstrap estimates of the covariance matrix and correlation matrix of the parameter estimates.
- The MCMC procedure is now multithreaded.
- Path diagrams are available with the CALIS procedure.
- You can now compute power for PROC GLM-type MANOVA and repeated measurements with the GLMPOWER procedure.
- The SURVEYMEANS procedure produces domain quantile estimates.

Here are some new high-performance features and procedures in SAS/STAT:

- The new HPCANDISC procedure performs high-performance canonical discriminant analysis.
- The new HPFMM procedure performs high-performance finite mixture model analysis.
- The new HPPRINCOMP procedure performs high-performance principal component analysis.
- The SCREEN option in the SELECTION statement for the HPREG procedure requests screening stages that reduce a large number of regressors to a much smaller subset from which the final model is chosen.

For more information, see What’s New in SAS/STAT 13.1 in SAS/STAT 13.1 User’s Guide.

SAS/STAT 12.3

SAS/STAT 12.3 is essentially a maintenance release of SAS/STAT software that runs on SAS 9.4.
In addition, the procedures that make up the SAS High-Performance Statistics product are available with SAS/STAT for use in single-machine mode. Depending on data characteristics and model complexity, you might see performance improvements over comparable SAS/STAT functionality that is not multi-threaded. Also, these procedures provide some new features; for example, the HPGENSELECT procedure provides model selection for generalized linear models.

For more information, see Overview of SAS/STAT High-Performance Procedures in SAS/STAT User’s Guide: High-Performance Procedures.

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### SAS Text Miner

#### SAS Text Miner 15.1

SAS Text Miner 15.1 shipped in November 2018 and runs on SAS 9.4M6 and later releases. SAS Text Miner 15.1 offers performance enhancements when running text mining nodes and viewing results. In addition, new stop lists are available on WLATIN1 and UTF-8 installations from the SASHELP library. These stop lists can be specified using the Text Parsing node’s StopList property.

See these resources:

- For more information about the new features and enhancements in SAS Text Miner 15.1, see the software product page for SAS Text Miner.
- For more information about changes from the previous release, see SAS Text Miner in SAS Guide to Software Updates and Product Changes.

#### SAS Text Miner 14.3

SAS Text Miner 14.3 shipped in September 2017 and runs on SAS 9.4M5 and later releases. SAS Text Miner 14.3 offers performance enhancements when running text mining nodes and viewing results. It also offers improved parsing performance for these languages: Arabic, Czech, Danish, Greek, Hebrew, Hungarian, Indonesian, Norwegian, Polish, Romanian, Slovak, Swedish, Thai, and Vietnamese. These languages now use the HPTMINE procedure, which allows for multi-threaded parsing.

These languages continue to use the HPTMINE procedure: Chinese, Dutch, English, Finnish, French, German, Italian, Japanese, Korean, Portuguese, Russian, Spanish, and Turkish.

#### SAS Text Miner 14.2

SAS Text Miner 14.2 shipped in November 2016 and runs on SAS 9.4M4 and later releases. SAS Text Miner 14.2 offers performance enhancements when running nodes and viewing results. In addition, the high-performance HPTMINE procedure now enables you to parse text data in another language, Swedish.

#### SAS Text Miner 14.1

SAS Text Miner 14.1 shipped in July 2015 and runs on SAS 9.4M3 and later releases.
Here are some of the new features and enhancements in SAS Text Miner 14.1:

- A new HPBOOLRULE procedure replaces macros in the Text Rule Builder node.
- Enhancements to the HPTMINE procedure enable you to select or ignore parts of speech, attributes, and entities, as well as to build a search index.
- The HP Text Miner node now uses PROC HPTMINE to perform topic rotation and to create the topic table.
- Eleven parsing languages have been added to the Language property in the HP Text Miner node. The complete list of parsing languages includes Chinese, Dutch, English, Finnish, French, German, Italian, Japanese, Korean, Portuguese, Russian, Spanish, and Turkish.
- The new macro variable EM_TERM_LOC enables users to specify a location for SAS Text Miner nodes to write output data sets. These data sets are needed as input to SAS Text Miner score code.
- An _item_ variable with term | role information has been added to the transaction output that is exported from the Text Topic node and the Text Filter node. This variable is added to the transaction tables valid_trans and test_trans when a Data Partition node is used in a process flow diagram, such as Input Data node (for example, NEWS) > Data Partition node > Text Parsing node > Text Filter node.

One benefit of exporting term | role information in the transaction table is that the Association node shows this information in the rules that it generates if the node is used in a process flow diagram, such as Input data node (for example, ABSTRACT)> Text Parsing node > Text Filter node > Association node.

Here are some of the new features and enhancements in the high-performance procedures for SAS Text Miner:

- The new HPBOOLRULE procedure enables you to extract Boolean rules from large-scale transactional data. PROC HPBOOLRULE adds essential capability to high-performance text mining for supervised rule-based modeling. In the current release, you can use the HPBOOLRULE procedure to read data and extract rules only in single-machine mode. The HPBOOLRULE procedure can automatically generate a set of Boolean rules by analyzing a text corpus that has been processed by the HPTMINE procedure and represented in a transactional format.
- The HPTMINE procedure supports the following new languages, statement, and options:
  - You can parse text data in the following newly supported languages: Chinese, Dutch, Finnish, French, Italian, Japanese, Korean, Portuguese, Russian, Spanish, and Turkish.
  - You can use the HPTMINE procedure to generate a search index for a text corpus. Use the index in the TMUTIL procedure to query the text corpus.
  - You can use the new SELECT statement to specify the parts of speech, entities, or attributes that you want to include in or exclude from your analysis.
  - You can specify a terms table when running the HPTMINE procedure in SVD-only mode. The terms table is required by topic discovery.

**SAS Text Miner 13.2**

SAS Text Miner 13.2 shipped in August 2014 and runs on SAS 9.4M2.
Here are some of the new features and enhancements in the high-performance procedures for SAS Text Miner:

- The HPTMINE procedure supports the following new functionality:
  - You can parse text data in the German language, and you can specify which language is used in the input data set of documents.
  - You can parse documents that contain more than 32K characters.
  - You can run in SVD-only mode, which enables you to parse documents and compute the singular value decomposition (SVD) separately in two procedure calls when you want to try different parameters for SVD computation after document parsing.
  - You can discover topics that exist in your text corpus.
  - You can store the term-by-document matrix in the Base64-encoded sparse rows (BESR) format.
  - You can use either the default coordinate list (COO, or transactional) format or the Base64-encoded sparse rows (BESR) format to store the term-by-document matrix.
  - You can specify custom LITI files for custom entity and noun group extraction.
  - You can specify whether to include terms that have _keep=N in the OUTTERMS= data set and in the OUTFCHILD= data set.

- The HPTMSCORE procedure supports the following new functionality:
  - You can parse text data in the German language.
  - You can parse documents that contain more than 32K characters.
  - Custom LITI files for custom entity and noun group extraction are supported.

SAS Text Miner 13.1

SAS Text Miner 13.1 shipped in December 2013 and runs on SAS 9.4M1 and later releases. This release includes the new Text Profile node, enhancements to node performances and results, and an enhancement to the high-performance HPTMINE procedure.

- The new Text Profile node enables you to profile a target variable by using terms that are found in the documents.
- The Text Parsing node contains a new Select Languages property, which enables you to specify the languages to keep in the document collection.
- The results for the Text Topic node contain these new items:
  - a Terms table, which shows terms and their weights for each topic
  - a Topic Terms matrix graph, which shows the topic values across terms.
- The high-performance HPTMINE procedure now supports the NONORMDOC keyword in the OUTDOCPRO= option in the SVD statement to control whether document projections are normalized.
SAS Text Miner 12.3

SAS Text Miner 12.3 includes enhancements to node performance and results. When importing table information in various dialog boxes, the Import button has been replaced with the Replace Table and Add Table buttons. You can choose whether to replace the currently selected table or add to the currently selected table. Results for the Text Rule Builder node include a new Document Rules table and a Rule Success graph.

You can use SMP mode in SAS 9.4 on a properly enabled SAS Server to deploy the HP Text Miner node in a process flow diagram, and use the HPTMINE and HPTMSCORE procedures. Using the HP Text Miner node in a process flow diagram can lead to multi-threaded processing gains in many cases. For more information, see the HP Text Miner Node chapter in SAS Enterprise Miner High-Performance Data Mining Node Reference.
Chapter 4
In-Memory Analytics

SAS In-Memory Statistics provides a single, interactive programming environment for the entire analytical life cycle inside the Hadoop environment.

- Interactive programming enables you to move through the entire analytical life cycle in Hadoop with an extremely fast, multi-user environment.
- In-memory analytical processing enables you to get fast analytic computations that are optimized for multiple passes across distributed clusters.
- Because data is held in-memory, you can increase speed and reduce latency.
• Analytical data management enables you to prepare data for modeling with data integration, variable transformations and creation, and exploratory analysis.
• You can quickly create, evaluate, and compare multiple statistical models.
• With statistical algorithms and machine-learning techniques, you can uncover patterns and trends faster.
• You can analyze your unstructured and structured data by using a wide range of text analysis techniques.
• You receive personalized, meaningful recommendations in real time with a high level of customization.

SAS High-Performance Analytics Infrastructure

About the SAS High-Performance Analytics Infrastructure
The SAS High-Performance Analytics Infrastructure consists of these products:
• SAS High-Performance Computing Management Console
• SAS High-Performance Deployment of Hadoop
• SAS High-Performance Analytics environment

SAS High-Performance Analytics Infrastructure 3.7
SAS High-Performance Analytics Infrastructure 3.7 shipped in September 2017.
This release includes the following changes and enhancements:
• There is a new SAS Plug-in for Hadoop installation. The script automates tasks that in the past required manual steps.
• You can now use separate networks for internal and external communication.
For more information about changes from the previous release, see SAS High-Performance Analytics Infrastructure in SAS Guide to Software Updates and Product Changes.

SAS High-Performance Analytics Infrastructure 3.1
In release 3.1, the SAS High-Performance Analytics environment supports a remote parallel connection with MapR.

SAS High-Performance Analytics Infrastructure 2.94
The SAS High-Performance Analytics 2.94 environment supports reading and writing files by using AES encryption with 256-bit keys.

SAS High-Performance Analytics Infrastructure 2.91
SAS High-Performance Analytics Infrastructure 2.91 includes a new environment variable that helps you decide how much memory to request. During installation, you
can now specify whether the SAS High-Performance Analytics environment reads and writes MapR data directly. Finally, enhancements have been made to the prompts in the installation script for the SAS High-Performance of Hadoop.

**SAS High-Performance Analytics Infrastructure 2.8**

In this release, the SAS High-Performance Deployment of Hadoop has been upgraded to Apache Hadoop version 2.4.

The SAS High-Performance Analytics environment now supports Cloudera CDH 5 and IBM BigInsights as co-located data sources. The environment can also read data from SAP HANA in parallel. This environment also now includes a resource management template and support for YARN.

**SAS High-Performance Analytics Infrastructure 2.4**

In SAS High-Performance Computing Management Console 2.4, you can use the RPM installer to install the console into any directory that contains the `-prefix` option. SAS High-Performance Computing Management Console 2.4 also includes a tarball installer. Use this tarball installer when a non-RPM installer is desired or the RPM version on the machine is not compatible with the console.

In the SAS High-Performance Analytics environment, a new installation script supports the new word cloud feature in SAS Visual Analytics. Also, the simultaneous utilities commands (simcp and simsh) are installed with the SAS High-Performance Analytics environment.

**SAS High-Performance Analytics Infrastructure 2.1**

SAS High-Performance Analytics Infrastructure 2.1 supports Kerberos. This release also provides a way to configure SAS High-Performance Deployment of Hadoop with multiple data devices. Finally, SAS supplies a security wrapper that you can use to limit the use of sudo commands to specific directories.

**SAS High-Performance Computing Management Console**

**About SAS High-Performance Computing Management Console**

The console is a web application that is used by system administrators to manage high-performance computing environments that use SAS software. Maintaining high-performance computing (HPC) environments is challenging because of the large number of machines that are used in the distributed computing environment. The console eases this challenge by propagating changes, such as adding user IDs, to all the machines in the environment.

**SAS High-Performance Computing Management Console 2.4**

The installation process for the console is enhanced to support a relocatable RPM so that you can install the console in any directory that you choose. The console can also be
installed from a tarball (TAR file). This installation method also enables you to install
the console in any directory that you choose.

Other than the enhancements to the installation process, the console has no other
customer-visible features for the 2.4 release.

### SAS High-Performance Computing Management Console 2.1

The console is enhanced to support machine groups. It is now possible to perform
operations on groups of machines rather than all of the machines in the SAS High-
Performance Analytics environment. The simultaneous copy (**simcp**) command is
enhanced to support return codes. Return codes can be used to provide error checking in
scripts.

### SAS LASR Analytic Server

#### SAS LASR Analytic Server 2.82

SAS LASR Analytic Server 2.82 (November 2018) includes these changes:

- The **TAG=** option is added to the LASR procedure. When you load data and specify
  the ADD and DATA= options, you can also specify a **TAG=** option that sets the
  server tag for the in-memory table.

- For a distributed server, you can enable an option in the resources.settings that makes
  the server less vulnerable to failures introduced by network port scanning software.
  For more information, see Resource Management for the Analytics Environment in
  *SAS High-Performance Analytics Infrastructure: Installation and Configuration
  Guide*.

For more information, see the product documentation page for SAS LASR Analytic
Server and the software product page for SAS Visual Analytics.

#### SAS LASR Analytic Server 2.81

SAS LASR Analytic Server 2.81 (September 2017) includes these changes:

- Distributed servers can use separate networks for internal and external
  communication. This enhancement is provided by the SAS High-Performance
  Analytics Infrastructure that is used by the server.

- The **IMSTAT** procedure is enhanced to provide error messages when unsupported
  data set options are specified.

#### SAS LASR Analytic Server 2.8

SAS LASR Analytic Server 2.8 (November 2016) includes these changes:

- The **RECOMMEND** procedure is enhanced to support a **SIGNER=** statement option.

- A **FORCESIGNER=** option is added to **PROC LASR** and the SAS LASR Analytic
  Server engine **LIBNAME** statement.

- The SAS Plug-ins for Hadoop replace the delivery of the SAS High-Performance
  Deployment for Hadoop.
**SAS LASR Analytic Server 2.7**

SAS LASR Analytic Server 2.7 (March 2016) is enhanced to support additional languages for text analytics. The TEXTPARSE statement in the IMSTAT procedure is enhanced to support a LANGUAGE= option.

**SAS LASR Analytic Server 2.6**

SAS LASR Analytic Server 2.6 (May 2015) includes these changes:

- Encryption for SASHDAT tables.
- Enhancements to the IMSTAT procedure.
  - The HYPERGROUP statement can perform a number of analytics on data interpreted as a graph (vertices and edges). Features include several forms of structural analysis, the calculation of vertex centrality measures, and layout in 2-D or 3-D space.
  - The TRANSFORM statement can perform a variety of analytic data preparation tasks. The features include imputation, outlier treatment, functional transformation, binning, and output.
- Enhancement to distributed servers for high-volume access to smaller tables.
- Support for the MapR Distribution for Apache Hadoop.
- Support for Teradata with SAS In-Memory Statistics.

**SAS LASR Analytic Server 2.5**

SAS LASR Analytic Server 2.5 (November 2014) includes many updates, including the following:

- The server has two automatic tables that you can use to monitor server and table memory use. The two tables are named _T_LASRMEMORY and _T_TABLEMEMORY. The tables are automatically available in a SAS LASR Analytic Server library.
- The IMSTAT procedure is enhanced as follows:
  - The AGGREGATE statement is enhanced to support the KEEPRECORD option and the KEEP= option. The KEEPRECORD option is used to add an aggregated value for each input observation by aggregating the input observations with ID= values that are specified in the INTERVAL= option and the WINDOWINT= option. The KEEP= option is used to transfer variables from the active table to the ODS table output or temporary table.
  - The NEURAL statement is added to the IMSTAT procedure. The statement is used to train feed-forward artificial neural networks (ANN). The statement can also use the trained networks to score data sets.
  - The SAVE statement is enhanced to support a CSV option. This option enables saving in-memory tables to HDFS in comma-separated value format.
  - The SERVERPARM statement is enhanced to support the TABLECEILING option. This option enables an administrator to set a soft limit for memory use by tables.
The analytic statements that support generating SAS DATA step code with a CODE= option are enhanced. If the active table that is analyzed includes columns with special characters or international characters that require the name literal syntax for a column such as 'profit (%)', then the generated code also uses the name literal syntax. The enhancement applies to the following statements:

- CLUSTER
- DECISIONTREE
- GENMODEL
- GLM
- LOGISTIC
- NEURAL
- RANDOMWOODS

**SAS LASR Analytic Server 2.4**

SAS LASR Analytic Server 2.4 (August 2014) includes many updates, including the following:

- The server supports compressed in-memory tables. The SAS Data in HDFS engine also supports adding tables to HDFS in compressed form.
- The IMSTAT procedure is enhanced as follows:
  - The AGGREGATE statement is new. It is used to aggregate values of one or more variables. Many aggregation methods are available, including quartiles and distinct counts.
  - The FORECAST statement is enhanced to support goal-seeking analysis.
  - The DROPCOLUMN statement is added to remove a column that was added with the COMPUTE statement.
  - The RECOMMEND procedure is enhanced to support storing recommendations in a temporary in-memory table. The procedure is also enhanced to support reading transaction data from an in-memory table. This can be used for the ARM method to recommend new items based on recent activities.

**SAS LASR Analytic Server 2.3**

SAS LASR Analytic Server 2.3 (March 2014) includes many updates, including the following:

- The new RECOMMEND procedure enables you to develop a recommender system. A common goal for a recommender system is to make personalized recommendations.
- The IMSTAT procedure is enhanced to enable in-memory statistical programming. The procedure statements that enable statistical programming are licensed separately from the statements for data and server management. SAS In-Memory Statistics for Hadoop is an offering that includes the statistical statements.
- The TEXTPARSE statement is added to the IMSTAT procedure to support in-memory text analysis. This statement is licensed separately from the data and server management statements.
**SAS LASR Analytic Server 2.1 and 2.2**

SAS LASR Analytic Server functions as an analytic platform, providing speedy, secure, multi-user access to in-memory data. For smaller data sets, the server can be deployed on a single machine. For larger data volumes, the server can be deployed on a distributed computing environment.

In SAS LASR Analytic Server 2.1 (July 2013), the server is enhanced to offer administrators controls for enforcing memory utilization limits for distributed deployments. The IMSTAT procedure is enhanced to enable administrators to manage in-memory tables.

In SAS LASR Analytic Server 2.2 (December 2013), the IMSTAT procedure is enhanced to support joining in-memory tables in a simple star schema and appending the entire in-memory tables. The DATA step is enhanced to support running in-memory for scoring.
SAS Add-In for Microsoft Office

SAS Add-In 8.2 for Microsoft Office

SAS Add-In 8.2 for Microsoft Office shipped in November 2019 and supports SAS 9.4, 9.3, and 9.2. It also supports SAS Viya 3.4 and 3.5. Here are some of the new features in this release:
• integration with SAS Visual Analytics 8.5 and earlier releases

• ability to connect directly to workspace servers, including the workspace server on SAS Viya

• accessibility improvements such as the support for high contrast

For more information, see What’s New in SAS Add-In 8, 8.1, and 8.2 for Microsoft Office.

**SAS Add-In 8.1 for Microsoft Office**

SAS Add-In 8.1 for Microsoft Office shipped in June 2019 and supports SAS 9.4, 9.3, and 9.2. In this release, if your site does not have web access, you have the option of downloading the PDF files to your local computer or network and accessing them locally.

See these resources:

• For more information about this release, see What’s New in SAS Add-In 8.1 for Microsoft Office.

• For more information about changes from the previous release, see SAS Add-In for Microsoft Office.

**SAS Add-In 8 for Microsoft Office**

SAS Add-In 8 for Microsoft Office shipped in June 2018 and supports SAS 9.4, 9.3, and 9.2. This release includes a new user interface. From the SAS panel, you can quickly and easily access reports, data sources, SAS tasks, any generated results, and SAS programs. The SAS tab in the Ribbon has also been simplified. In addition, this release provides integration with SAS Visual Analytics 8.3 and earlier releases.

For more information about this release, see What’s New in SAS Add-In 8 for Microsoft Office.

**SAS Add-In 7.15 for Microsoft Office**

SAS Add-In 7.15 for Microsoft Office shipped in September 2017 and supports SAS 9.4, 9.3, and 9.2. This release provides integration with SAS Viya. SAS Add-In for Microsoft Office enables you to run SAS Viya tasks from SAS Studio. You can also submit Cloud Analytic Services (CAS) code from the program window. Starting in this release, you can also open data sets that are saved as a server file.

**SAS Add-In 7.14 for Microsoft Office**

SAS Add-In 7.14 for Microsoft Office shipped in April 2017. This release provides integration with SAS Visual Analytics 7.4 and 8.1. A new connections dialog box makes it easier for you to select an active SAS 9 metadata profile and to add connections to SAS Visual Analytics servers.
**SAS Add-In 7.13 for Microsoft Office**

SAS Add-In 7.13 for Microsoft Office shipped in November 2016 and includes these new features:

- You can submit SAS code directly from the Office document by using the SAS Program Editor. Using the Program Editor, you can define a LIBNAME, write a program, submit the code, and manage the results within the Microsoft Office document. You can also open an existing SAS program. When you run the SAS program, the results are added to the specified location in the Office document.

- You can upload your existing SAS 9.4 data to SAS Cloud Analytic Services (CAS) by using the new Upload to CAS task.

- Many accessibility enhancements improve the experience for users who depend on screen readers such as JAWS.

- Server file navigation now defaults to your `Documents` folder on Windows servers. In addition, the file navigation now contains folder shortcuts.

This release also includes several minor enhancements to the user interface. In the Manage Content dialog box, you can now delete multiple items at one time. In the Add Profile dialog box, you can specify whether to automatically connect to the server after you create or modify a profile. When you refresh SAS Visual Analytics reports that contain tables with additional rows and columns, these new rows and columns automatically inherit the Microsoft Excel format, alignment, and conditional formatting.

**SAS Add-In 7.12 for Microsoft Office**

SAS Add-In 7.12 for Microsoft Office adds support for Microsoft Office 2016. Starting with this release, SAS provides two add-ins for Microsoft Office: SAS Add-In for Microsoft Office and SAS Visual Analytics Add-In for Office. SAS Visual Analytics Add-In for Office enables you to open, interact, and refresh SAS Visual Analytics reports in Microsoft Excel and Microsoft PowerPoint. SAS Visual Analytics Add-In for Office is not available in Microsoft Word or Microsoft Outlook. This add-in works only with SAS Visual Analytics content.

This release of SAS Add-In for Microsoft Office also provides additional integration with SAS Visual Analytics 7.3.

- You can now refresh any SAS Visual Analytics reports that you send from SAS Enterprise Guide to a Microsoft Office document.

- You can specify whether to save the full report state within the Office document.

- Any exported data is automatically refreshed when the SAS Visual Analytics report is refreshed.

- When you refresh a SAS Visual Analytics report, you can reset all interactions so that the refreshed report displays the default values.
SAS Add-In 7.11 for Microsoft Office

SAS Add-In 7.11 for Microsoft Office shipped in May 2015. This release provides additional support for SAS Visual Analytics to include the 7.2 and 7.3 releases. Here are some of the new features and enhancements for this release:

- Better integration with SAS Visual Analytics results in the ability to remove and find report elements in your Microsoft Office document.
- Using the SAS add-in in Microsoft Outlook, you can export a SAS Visual Analytics report to PDF.
- If your SAS Visual Analytics report contains sparklines, these lines are available when you open the report in Microsoft Excel.
- You can enable SAS Add-In for Microsoft Office to automatically check for software updates.

SAS Add-In 7.1 for Microsoft Office


A key feature in this release is integration with SAS Visual Analytics 6.2, 6.3, 6.4, and 7.1.

- Starting with this release, SAS Add-In for Microsoft Office supports SAS Visual Analytics reports that enable you to brush, filter, drill, expand, and collapse elements. You can interact with this functionality in Microsoft Excel, Microsoft Word, Microsoft PowerPoint, and Microsoft Outlook.
- You can preview the contents of a SAS Visual Analytics report before inserting any objects into your Microsoft Office document. You can select the specific objects to include, or you can insert the entire report.
- You can specify whether to display any specified filters before an object in a SAS Visual Analytics report. If you are opening a crosstabulation report, the filter also includes any breadcrumbs.
- You can also view and add comments to a SAS Visual Analytics report. You can view the rules for conditional highlighting. (These rules were defined when the report was created in SAS Visual Analytics.) You can also view the aggregated data that was used to create a graph in a SAS Visual Analytics report.

Another key feature in this release is the new task interface and integration of tasks that are shipped with SAS Studio. The redesigned task interface displays your recent and favorite tasks. Categories, filters, and searching functionality enable you to quickly find the task that you need. From this interface, you can access SAS Add-In for Microsoft Office tasks and SAS Studio tasks.

Additional new features include the availability of SAS Central in Microsoft Excel, Microsoft Word, Microsoft PowerPoint, and Microsoft Outlook. Using SAS Central (a view similar to the Hub in SAS Visual Analytics), you can easily access your SAS Visual Analytics reports and SAS Stored Processes.

Also, SAS Add-In 7.1 for Microsoft Office includes the new Upload to LASR task that enables you to upload data to SAS LASR Analytic Server so that you can access the data in SAS Visual Analytics.
SAS Add-In 6.1 for Microsoft Office

SAS Add-In 6.1 for Microsoft Office provides integration with SAS Visual Analytics 6.1. (SAS Add-In 6.1M1 for Microsoft Office provides integration with SAS Visual Analytics 6.2 and 6.3.) Because of this integration, you can use the SAS add-in to open and refresh reports that were created using SAS Visual Analytics Designer and SAS Visual Analytics Explorer. You can access and manage favorites that were created in SAS Visual Analytics. In Microsoft Outlook, the SAS add-in also provides a view similar to the Hub in SAS Visual Analytics. This view enables you to easily access and comment on your favorite and recently opened SAS Visual Analytics reports.

A new stand-alone installer is also available for SAS Add-In for Microsoft Office. The new installer is much smaller, thereby making it easier to install over a distributed deployment, especially using provisioning tools such as Microsoft System Center Configuration Manager (SCCM). For more information, see SAS Deployment Wizard and SAS Deployment Manager 9.4: User’s Guide at http://support.sas.com/deploywizug94.html.

SAS Enterprise Guide

SAS Enterprise Guide 8.2

SAS Enterprise Guide 8.2 shipped in November 2019 and is supported on SAS 9.4, 9.3, and 9.2. It also supports SAS Viya 3.4 and 3.5.

SAS Enterprise Guide 8.2 includes these new features and enhancements:

• more robust integration with Git, including cloning, pulling, pushing, and branching
• ability to access and run tasks from SAS Studio 5.2
• support for connecting directly to a workspace server, including the workspace server on SAS Viya
• ability to manage keyboard shortcuts

For more information, see What’s New in SAS Enterprise Guide 8.2.

SAS Enterprise Guide 8.1

SAS Enterprise Guide 8.1 shipped in June 2019 and is supported on SAS 9.4, 9.3, and 9.2. SAS Enterprise Guide 8.1 has been redesigned to include a modern and flexible user interface with tab-based organization of content and flexible window management.

SAS Enterprise Guide 8.1 includes these new features and enhancements:

• an updated user interface. The new SAS Enterprise Guide user interface provides a more flexible space in which to write programs, build process flows, as well as access and browse your files and project. The navigation area includes the panes that you expect to see such as Project, Tasks, Servers, SAS Folders, and the Prompt Manager. There is also a new Open Items pane that enables you to view a list of all your currently open items.
• optional use of projects. SAS Enterprise Guide no longer requires you to use a project to manage all of your data, tasks, programs, and results. You can still use
projects, if you like, or you can use SAS Enterprise Guide as a tool to open and work on individual files.

- new appearance theme. SAS Enterprise Guide 8.1 enables you to choose between a light theme (Illuminate) and a dark theme (Ignite). SAS Enterprise Guide also honors the Windows High Contrast themes.

- a new documentation interface. All SAS Enterprise Guide documentation is now available in Help Center on support.sas.com. Sites without web access can download the documentation as PDF files and create a local help center for their site.

See these resources:

- For more information about this release, see What’s New in SAS Enterprise Guide 8.1.

- For more information about changes from the previous release, see SAS Enterprise Guide in SAS Guide to Software Updates and Product Changes.

**SAS Enterprise Guide 7.15**


SAS Enterprise Guide 7.15 includes these new features:

- integration with SAS Viya. SAS Enterprise Guide enables you to run SAS Viya tasks from SAS Studio. You can also submit Cloud Analytic Services (CAS) code.

- integration with SAS Visual Analytics 7.4.

- a new option that enables you to create accessible PDF files.

- the ability to open script files in the text editor.

- support for project log operations (such as clear, export, and send via email) using automation.

**SAS Enterprise Guide 7.13**


SAS Enterprise Guide 7.13 includes these new features:

- The new DATA Step Debugger is a tool that enables you to find logic errors in a DATA step program. With the DATA Step Debugger, you can watch the variable values in a program change as the program runs. You can execute the program line by line, and you can also set specific breakpoints in the program.

- You can now transfer files from your local computer to a SAS server or from a SAS server to your local computer by using the Copy Files task. The Copy Files task works in a similar way to an FTP application. However, this task relies on the SAS protocols to complete the file transfers and does not require an FTP server.

- You can upload your existing SAS 9.4 data to SAS Cloud Analytic Services (CAS) by using the new Upload to CAS task.

- Starting with this release, the default graph format is PNG. Use the new Graph Format for Built-in Graph Tasks option to set the default format for the graph tasks, such as Bar Chart, Line Chart, and Pie Chart.
• You can specify whether to continue executing a process flow if an error is encountered.
• Server file navigation now defaults to your Documents folder on Windows servers. In addition, the file navigation now contains folder shortcuts.

**SAS Enterprise Guide 7.12**

SAS Enterprise Guide 7.12 shipped in February 2016. Here are some of the new features and enhancements:

• The save functionality has been updated to include a new Save All option. The default behavior of the save option now saves the active item in the project.
• You can generate results in Microsoft Excel and Microsoft PowerPoint formats and specify options for those formats.
• You can zoom the contents of items in the workspace, such as programs, data, HTML results, and process flows.
• You can open externally referenced files in their default associated applications.
• You can open the file location of externally referenced files in Microsoft Windows Explorer.

**SAS Enterprise Guide 7.11**

SAS Enterprise Guide 7.11 shipped in May 2015. This release provides additional support for SAS Visual Analytics by including the 7.2 and 7.3 releases. Here are some of the new features and enhancements in this release:

• You can quickly filter your data by using a WHERE expression.
• You can enable SAS Enterprise Guide to automatically check for software updates.
• You can export a SAS Visual Analytics report to PDF.
• You can copy and paste prompts within the same project or into another SAS Enterprise Guide project.
• You can add data and reports to your list of favorites.
• You can create case-insensitive filters in the Query Builder or when you filter and sort your data by using the Filter and Sort task.

**SAS Enterprise Guide 7.1**

SAS Enterprise Guide 7.1 is supported on SAS 9.4, 9.3, and 9.2. Some of the new features and enhancements include the following:

• The new program history feature enables you to track the changes that you and other programmers make to programs in SAS Enterprise Guide.
• You can search your project for text that you specify.
• In the Tasks pane, you can now search for a task by name, SAS procedure, or keyword. You can filter the list of tasks by predefined categories or by SAS
procedure. You can also quickly access any tasks that you recently opened or that you marked as favorites.

- If you have SAS Studio and Microsoft Internet Explorer 11 (or later) installed on your machine, you can also run SAS Studio tasks in SAS Enterprise Guide.

- SAS Enterprise Guide 7.1 includes the new Upload to LASR task that enables you to upload data to SAS LASR Analytic Server so that you can access the data in SAS Visual Analytics.

- The new Project Log Summary window is displayed with the Project Log window and includes an aggregated list of all the messages that have been generated in the project log.

- The SAS Macro Variable Viewer enables you to view all of the SAS macro variables that are defined in your current SAS session. You can use this window to see changes to the macro variables while you work in SAS Enterprise Guide and to quickly evaluate a macro expression.

- The SAS System Options Viewer enables you to view all of the SAS system options that are defined for your current SAS session.

- Smart highlighting is available in the Program Editor. By default, when you select or search for a word in the Program Editor, all other occurrences of that word are also highlighted.

- You can now open the Query Builder with multiple tables selected. The Query Builder automatically joins the tables if the tables include columns with matching names and data types.

- You can now copy and paste process flows.

**SAS Enterprise Guide 6.1**

SAS Enterprise Guide 6.1 is supported on SAS 9.4, 9.3, and 9.2. Enhancements for this release include the following:

- integration with SAS high-performance tools with the addition of the High-Performance Logistic and High-Performance Linear Regression tasks.

- improved programmer productivity with the new Log Summary window, which lists all the errors, warnings, and notes that were generated when the program ran, as well as related line numbers and a sample of the affected code.

- the ability to analyze a SAS program to determine whether there are any possible internationalization issues. Internationalization is the process by which a program is optimized so that it can be adapted to any language and region without being rewritten. When you analyze a program for internationalization, SAS Enterprise Guide lists the lines of code that might be affected and suggests substitutions when possible.

- the ability to use notes to add information to a process flow or to specific objects in the process flow.

- administration enhancements, such as the new stand-alone installer and application streaming support. The new installer is much smaller, thereby making it easier to install over a distributed deployment, especially using provisioning tools such as System Center Configuration Manager (SCCM). For more information, see SAS Deployment Wizard and SAS Deployment Manager 9.4: User's Guide at [http://support.sas.com/deploywizug94.html](http://support.sas.com/deploywizug94.html).
SAS Enterprise Guide 6.1M1 (which shipped in December 2013) provides integration with SAS Visual Analytics 6.2 and 6.3. Because of this integration, you can open and refresh reports that were created using SAS Visual Analytics Designer and SAS Visual Analytics Explorer. You can also save a SAS Visual Analytics report with your SAS Enterprise Guide project.

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**SAS Visual Analytics App**

**About the SAS Visual Analytics App**

SAS SDK for iOS and SAS SDK for Android are available from developer.sas.com to allow customers to create custom mobile apps that embed SAS Visual Analytics content.

You can use the free SAS Visual Analytics Apps (previously called SAS Mobile BI) to view SAS Visual Analytics reports. The app is supported on these devices:

- Apple iPhones and iPads
- Android smartphones and tablets
- PCs and tablets running Microsoft Windows 10

For more information, see the SAS Visual Analytics Apps documentation.

**SAS Visual Analytics App 8.31 for iPad and iPhone**

SAS Visual Analytics App 8.31 for iPad and iPhone (August 2018) provides an enhancement to the tray feature in the report viewer when used on iPads. To learn how to use this new feature, see What’s New in Release 8.3.

You can download the free iPad and iPhone app from Apple iTunes store.

**SAS Visual Analytics App 8.3 for Android**

SAS Visual Analytics App 8.3 for Android (July 2018) provides these updates:

- new tray feature in the report viewer replaces the context menus and Information view
- new magnifier tool makes it easy to view data in a report
- new sample reports and sample reports server
- support for SAS Visual Analytics 8.3, 8.2, 8.1, 7.4, and 7.3 servers

To learn how to use these features, see What’s New in Release 8.3.

You can download the free Android app from Google Play.

**SAS Visual Analytics App 8.3 for Windows 10**

SAS Visual Analytics App 8.3 for Windows 10 (July 2018) provides these updates:

- new sample reports and sample reports server
- support for SAS Visual Analytics 8.2, 8.1, 7.4, and 7.3 servers

For more information, see What’s New in Release 8.3.
SAS 9.4 OLAP Server

The SAS 9.4 OLAP Server has several new features for 9.4:

- new OLAPCONTENTS procedure for generating reports of OLAP cube information
- new OLAPCONFIG method for setting SAS OLAP Server options in batch mode
- updated OLAPOPERATE procedure
- new MDX Case statement
- new VISUALTOTALS_BEHAVIOR option for calculated measures

In addition, properties for multilingual cubes are automatically updated in multiple languages when reports are generated. And, the SQLRC macro can be used with the SQL pass-through facility for OLAP.

In SAS 9.4M1 OLAP Server, these new features and enhancements were added:

- A new LOGICALSERVERNAME option was added to the OLAPOPERATE procedure.
- You can enable execution of user-defined (FORMAT procedure style) formats in the SPD Server. For more information, see *SAS 9.4 OLAP Server: User’s Guide*.
- A new INSTR MDX function was added. For more information, see *SAS OLAP Server: MDX Guide*.
- The LOCKDOWN option and statement are supported by the SAS OLAP Server.

In SAS 9.4M3, the *SAS 9.4 OLAP Server: User’s Guide* includes information about SAS OLAP variations, MDX function behavior and ragged or unbalanced hierarchies, and the new THREADPOOLQRY option.

- For more information about this release, see *What’s New in SAS 9.4 OLAP Server* in *SAS 9.4 OLAP Server: User’s Guide*.
- For more information about changes from the previous release, see *SAS OLAP Server* in *SAS Guide to Software Updates and Product Changes*.

SAS Web Parts 6.1 for Microsoft SharePoint

Web Parts are an integrated set of controls that enable you to provide customized, dynamic content on your website. By using Microsoft Windows SharePoint Services, you can add SAS content directly to your website.

In SAS Web Parts 6.1 for Microsoft SharePoint, administrators can create connection profiles for the SharePoint users at your site. Two SAS Web Parts are now available:

- The SAS Central Web Part lists any SAS Visual Analytics reports that you recently opened and any favorites that you have created. It also enables you to open additional reports. These reports open in a new web browser.
  
  **Note:** The SAS Central Web Part is available only if your site licenses SAS Visual Analytics.
• The SAS Content Viewer Web Part enables you to add SAS content such as reports, the results from a stored process, or a dashboard to your SharePoint site.

• For more information about this release, see *What’s New in SAS Web Parts 6.1 for Microsoft SharePoint* in the *SAS Web Parts for Microsoft SharePoint: User’s Guide*.

• For more information about changes from the previous release, see *SAS Web Parts for Microsoft SharePoint* in *SAS Guide to Software Updates and Product Changes*.

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**SAS Web Report Studio 4.4**

SAS Web Report Studio 4.4 provides enhanced totals and subtotals. It also supports several additional browsers.


• For more information about changes from the previous release, see *SAS Web Report Studio* in *SAS Guide to Software Updates and Product Changes*. 
Chapter 6
Data Management and Integration

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SAS Data Management Standard

Starting with SAS 9.4, the SAS Data Management Standard 2.41 (or later) offering replaces the SAS Enterprise Data Integration Server offering. The SAS Data Management Standard offering includes a mix of DataFlux products, such as DataFlux Data Management Studio, DataFlux Data Management Server, and DataFlux Authentication Server, as well as SAS products, such as SAS Data Integration Studio and SAS/ACCESS. For a list of the products in this offering and its Advanced version, see the software product page for SAS Data Management.

For a list of SAS support for DataFlux Data Management products, see SAS Note 51665.
DataFlux Authentication Server

DataFlux Authentication Server 4.1

The installation process for the UNIX and Linux operating environments now automates the configuration process for host authentication. In earlier releases, this configuration process occurred after installation. After installation, authentication can be reconfigured in any operating environment.

The configuration option AdminLoginManagementPolicy now defines an administrator's ability to add, modify, or delete users with the ASBATCH utility.

Starting with the first maintenance release, DataFlux Authentication Server 4.1 is required only by DataFlux Web Studio and DataFlux Web Studio Server.


See these resources:
- For more information, see the product documentation page for DataFlux Authentication Server
- For more information about changes from the previous release, see DataFlux Authentication Server

DataFlux Authentication Server 3.2

DataFlux Authentication Server supports authorization and authentication for the DataFlux Data Management products in certain SAS software offerings, such as the SAS Data Management offerings. Some components in the offerings are now configured by default to use a SAS Metadata Server instead of the Authentication Server. Other components, such as the optional SAS Federation Server, are required to use the DataFlux Authentication Server. For more information, see DataFlux Authentication Server: Administrator's Guide.

DataFlux Data Management Server

DataFlux Data Management Server 2.7

DataFlux Data Management Server 2.7 runs on SAS 9.4M3 and later releases.

Here are the primary enhancements in DataFlux Data Management Server 2.7:
- DataFlux Data Management Server 2.7 uses the SAS Metadata Server exclusively to support authentication and authorization. DataFlux Data Management Server 2.7 also includes support for accessing a clustered SAS Metadata Server.
- FIPS compliance for SOAP client connections is now available as a security enhancement for the DataFlux Data Management Server.
- SAS Data Management Server 2.7 also allows web service calls through a REST API for batch jobs, real-time data services, and process services.
See these resources:

- For more information, see the software product page for DataFlux Data Management Studio, DataFlux Data Management Server, and DataFlux Expression Language.
- For more information about changes from the previous release, see DataFlux Data Management Server in SAS Guide to Software Updates and Product Changes.

**DataFlux Data Management Server 2.6**

DataFlux Data Management Server 2.6 runs on SAS 9.4M1 and later releases. Here are the primary enhancements in DataFlux Data Management Server 2.6:

- When you import objects that replace existing objects, you can now apply the permissions from the existing object to the new object.
- Objects, jobs, and services receive a default access control list (ACL) when they are added to the DataFlux Data Management Server. In the 2.6 release, the default ACL contains ALLOW or DENY permissions for lists of users and groups.
- To make batch and profile job logs more accessible to administrators and to the SAS Job Monitor, you can now specify a separate storage location for those log files.
- When you run jobs with the `dmpexec` command, you can now configure the log files that are generated by those job runs.
- You can now enable the capture of log data for the SOAP packets that are received and transmitted by the DataFlux Data Management Server.
- You can now validate XML in output data from real-time services.

**DataFlux Data Management Server 2.5**

DataFlux Data Management Server runs jobs and real-time services in response to requests that are submitted by authorized SOAP/HTTP clients. DataFlux Data Management Server 2.5 runs on SAS 9.4. Here are the primary enhancements in DataFlux Data Management Server 2.5:

- The DataFlux Data Management Server has a new server configuration and security.
- The SAS Metadata Server is configured by default for security.
- The SAS Metadata Server provides configuration options when the server starts.
- SAS Job Monitor collects job status and statistics.

**DataFlux Data Management Studio**

**DataFlux Data Management Studio 2.7**

Here are the main enhancements for DataFlux Data Management Studio 2.7:

- This release includes several enhancements for customizing quality knowledge bases. You can now copy and paste regular expressions in the Regex Library Edition. You can import word, category, and likelihood values from external files in the
Vocabulary Editor. You can copy and paste rules and categories in the Grammar Editor.

- You must log on to a SAS Metadata Server when you need to access DataFlux Data Management Servers or SAS Federation Servers.
- Netezza 7.2.0.5 has been added to the list of supported databases for data storage in DataFlux Data Management Studio.

In the June 2017 release, additional databases are supported for data storage and DataFlux repositories.

See these resources:

- For more information, see the software product page for DataFlux Data Management Studio, DataFlux Data Management Server, and DataFlux Expression Language.
- For more information about changes from the previous release, see SAS Data Management Studio

**DataFlux Data Management Studio 2.6**

Here are the main enhancements for DataFlux Data Management Studio 2.6:

- enhanced interface for customizing quality knowledge bases
- new ODBC drivers for Apache Hive and Cloudera Impala
- changes to clustering
- support added for SAS Lineage Viewer
- support added for SAS Business Data Network

**DataFlux Data Management Studio 2.5**

Here are the main enhancements for DataFlux Data Management Studio 2.5:

- SAS Metadata Servers can now authenticate connections to DataFlux Data Management Servers.
- The job logs now provide run-time statistics for nodes within jobs.
- If your site has licensed SAS Environment Manager and SAS Job Monitor, then you can use a web browser to display run-time statistics for Data Management Studio jobs and the nodes within those jobs.

**DataFlux Secure**

**DataFlux Secure 2.7**

DataFlux Secure 2.7 runs on SAS 9.4M3 and later releases.

DataFlux Secure now offers FIPS compliance for SOAP client connections in DataFlux Data Management Server and DataFlux Data Management Studio.
See these resources:

- For more information about this release, see *DataFlux Secure: Administrator’s Guide* from the product documentation page for DataFlux Secure.
- For more information about changes from the previous release, see DataFlux Secure in *SAS Guide to Software Updates and Product Changes*.

**DataFlux Secure 2.5**

DataFlux Secure enables the enhancement of security for components in certain SAS software offerings, such as the Data Management offerings. The DataFlux Secure software is now installed by default, in a disabled state, together with these components. You can enable enhanced encryption, SSL/TLS protection, and FIPS compliance on your platform components. Starting with the May 2014 release, the keyconfig utility is available to assist with the configuration of SSL on the SAS Federation Server Manager.

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**SAS Business Data Network**

**SAS Business Data Network 3.3**

SAS Business Data Network 3.3 shipped in June 2019 and runs on SAS 9.4M6 and later.

Starting with this release, the user interface has been rewritten in HTML5. Previously, many SAS applications and SAS solutions used the Adobe Flash Player to provide interactive user interfaces. Adobe has announced that it intends to end support for Flash technology and will stop updating and distributing the Flash Player at the end of 2020. Browser vendors will disable Flash by default in 2019. For more information about Adobe Flash end-of-life, see *SAS Software and Its Use of the Adobe Flash Player*.

See these resources:

- For more information, see *What’s New in SAS Business Data Network 3.3*.
- For more information about changes from the previous release, see *SAS Business Data Network* in *SAS Guide to Software Updates and Product Changes*.

**SAS Business Data Network 3.2**

SAS Business Data Network 3.2 shipped in April 2017 and runs on SAS 9.4M4 and higher.

Here are some of the new features and enhancements in this release:

- You can now create a snapshot to save a read-only view of your data.
- The SAS Business Data Network Application Programming Interface (API) has been approved for public distribution.
- In the SAS Lineage 3.2 main window, you select the object to open in SAS Business Data Network.
- You can now import terms from CSV files.
- You can publish import results to a relationships service.
- URL, Date, and RTF are new attributes that are available for term types.
For more information, see What’s New in SAS Business Data Network 3.2.

**SAS Business Data Network 3.1**

A business data term list is an authoritative vocabulary that promotes a common understanding between stakeholders in an organization. SAS Business Data Network 3.1 is an application that enables you to manage a business data term list. It supports a collaborative approach to managing the following information:

- Descriptions of business terms, including their requirements and attributes
- Related source data and reference data
- Contacts (such as technical owners, business owners, and interested parties)
- Relationships between terms and processes (such as Data Management Studio jobs, services, and business rules)

By linking terms to business rules and data monitoring processes, SAS Business Data Network provides a single entry point for all data consumers to better understand their data. Data stewards, IT staff, and enterprise architects can use the terms to promote a common vocabulary across projects and business units. Permissions can be set to allow only specific users to access and control the data in SAS Business Data Network.

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**SAS Data Loader**

**SAS Data Loader 3.1**

SAS Data Loader 3.1 runs on SAS 9.4M4. SAS Data Loader 3.1M1 shipped in September 2017 and supports SAS 9.4M5.

Here are the main enhancements for this release:

- Multiuser web application is now based on the SAS Intelligence Architecture.
- Centralized administrative support now manages servers, access, directives, and QKB updates.
- New IT-friendly administrative deployment process uses SAS deployment tools.
- Additional connectivity options provide direct access to external data sources.
- Updated support enables the latest Hadoop technologies.
- Improved integration with SAS data management software enables remote directive execution.

See these resources:

- For more information about this release, see What’s New in SAS Data Loader 3.1 for Hadoop in SAS Data Loader for Hadoop: User’s Guide
- For more information about changes from the previous release, see SAS Data Loader in SAS Guide to Software Updates and Product Changes.
**SAS Data Loader 2.4 for Hadoop**

Here are the main enhancements for SAS Data Loader 2.4 for Hadoop:

- new trial version of SAS Data Loader for Hadoop is available.
- new Match-Merge Data directive enables you to combine columns from multiple source tables into a single target table. You can also merge data in specified columns when rows match in two or more source tables.
- new Chain Directives directive enables you to run two or more saved directives in series or in parallel.
- increased performance using Apache Spark and Cloudera Impala.
- support for the Hadoop distributions Pivotal HD and IBM Big Insights. New versions of Cloudera, Hortonworks, and MapR are supported. Kerberos is not supported in combination with MapR or IBM Big Insights.

**SAS Data Loader 2.3 for Hadoop**

Here are the main enhancements for SAS Data Loader 2.3 for Hadoop:

- support for importing delimited files into Hadoop.
- enhanced support for SAS LASR Analytic Server. The directive Load Data to LASR now supports symmetric multiprocessing (SMP) with the SASIOLA engine when loading data into non-grid configurations of the SAS LASR Analytic Server software.
- new features in data quality analysis now provide these transformations: Change Case, Gender Analysis, Pattern Analysis, and Field Extraction.
- enhanced support for Hadoop. New versions of Cloudera and Hortonworks are supported. Support for MapR has been added. Kerberos is not supported in combination with MapR.
- enhanced support for Apache Hive enables you to paste and edit existing Hive programs, and then run those programs in Hadoop.

**SAS Data Loader 2.2 for Hadoop**

SAS Data Loader for Hadoop provides self-service big data preparation, data quality, and data integration for business analysts and data scientists. The point-and-click user interface enables users to prepare, integrate, and cleanse big data faster and easier without writing code. In addition, power users can run SAS code and data quality functions faster on Hadoop for improved productivity and reduced data movement.

SAS Data Loader for Hadoop 2.2 runs on SAS 9.4M2. In this release, SAS Data Loader for Hadoop enables you to query, join, profile, and transform data on Hadoop. You can move relational data sources and SAS data sets to and from Hadoop. You can parse and standardize your data inside Hadoop. Using SAS Data Loader for Hadoop, you can load data into memory for visualization or analysis. You can also run SAS code and data quality functions in parallel on Hadoop.
SAS Data Integration Studio

SAS Data Integration Studio 4.904

SAS Data Integration Studio 4.904 (November 2018) runs on SAS 9.4M6. Here are the main enhancements in SAS Data Integration Studio 4.904:

• new GIT Version Control Plug-in
• new JDBC source designer
• support for Oracle Hints
• new options for the SCD Type 2 Transformation
• new option to generate macro variables for external files
• new LOAD statement option for the Cloud Analytic Services transformation
• macro variables as input for Amazon S3 transformation

See these resources:

• For more information about this release, see What’s New in SAS Data Integration Studio 4.904 in SAS Data Integration Studio: User’s Guide.
• For more information about changes from the previous release, see SAS Data Integration Studio in SAS Guide to Software Updates and Product Changes.

SAS Data Integration Studio 4.903

SAS Data Integration Studio 4.903 runs on SAS 9.4M5. Here are the main enhancements in SAS Data Integration Studio 4.903:

• new Cloud Analytic Services Table Loader transformation. This transformation replaces the Cloud Analytic Services Transfer transformation. Existing jobs that use the Cloud Analytic Services Transfer transformation should continue to work.
• new Table Maintenance transformation.
• support for K-functions in code generation.
• enhanced support for Hadoop code generation.
• enhanced support for Hive transformation.
• new parameter used by the Command Line Batch Deployment Tool.
• new option that generates JCL-friendly code on z/OS systems when using user-written code.
• new macro variables for generated transformations.

For more information about this release, see What’s New in SAS Data Integration Studio 4.903 in SAS Data Integration Studio: User’s Guide.
SAS Data Integration Studio 4.902

SAS Data Integration Studio 4.902 runs on SAS 9.4M4.

Here are the main enhancements in SAS Data Integration Studio 4.902:

• These new transformations are available: sFTP, Amazon S3, Cloud Analytic Services Transfer, and Data Loader Directive.

• A new RedShift source designer is supported.

• A new source designer in Data Integration Studio supports the new LIBNAME template that represents the Cloud Analytic Services engine (CAS Source Designer).

• The SCD Type 2 Loader transformation now supports a Netezza target for SQL pass-through.

• The Transpose transformation supports running an in-database version of PROC TRANSPOSE that can be executed inside HADOOP and TERADATA.

For more information, see What’s New in SAS Data Integration Studio 4.902 in SAS Data Integration Studio: User’s Guide.

SAS Data Integration Studio 4.901

SAS Data Integration Studio 4.901 runs on SAS 9.4M3.

Here are the main enhancements in SAS Data Integration Studio 4.901:

• Three new transformations are available: Fork, Fork End, and Wait For Completion nodes.

• This release includes updated support for the Hadoop (Hive), HAWQ, Impala, LASR, PI, and SASHDAT engines.

• The PI LIBNAME engine is supported.

• A new HAWQ source designer is available.

For more information, see What’s New in SAS Data Integration Studio 4.901 in SAS Data Integration Studio: User’s Guide.

SAS Data Integration Studio 4.9

SAS Data Integration Studio 4.9 runs on SAS 9.4M2.

Here are the main enhancements for SAS Data Integration Studio 4.9:

• A new source designer wizard is available for Cloudera Impala.

• The High-Performance Analytics Transformations and Enterprise Decision Management transformation are now production.

For more information, see What’s New in SAS Data Integration Studio 4.9 in SAS Data Integration Studio: User’s Guide.

SAS Data Integration Studio 4.8

SAS Data Integration Studio 4.8 runs on SAS 9.4M1.
Here are the main enhancements for SAS Data Integration Studio 4.8:

- new transformations that support conditional processing in jobs
- new source designer wizards for Vertica and SAP HANA
- a new, experimental transformation that incorporates SAS Decision Manager flows into jobs

**SAS Data Integration Studio 4.7**

SAS Data Integration Studio runs on SAS 9.4. Starting with this release, you can access third-party web clients from SAS Data Integration Studio jobs. This feature enables you to programmatically access the information from these clients and use it in your data integration projects. You can also deploy many jobs at once through a new command-line interface.

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**SAS Data Management Console**

SAS Data Management Console is a central, web-based environment that enables you to open data management and data governance products that are installed on your system. The console enables you to set preferences for these products and to view information from them. The console's home page displays SAS products, components, and features based on the roles and capabilities that are associated with your logon.

SAS Data Management Console is included in a number of SAS Data Management and SAS MDM offerings. For more information, see the product documentation page for SAS Data Management Console.

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**SAS Data Quality Accelerator for Teradata**

**SAS 9.4 Data Quality Accelerator for Teradata: November 2019 Release**

Beginning in SAS Viya 3.5 and the November 2019 release of SAS 9.4, the qkb_pack script that is used to package a QKB for deployment in the Teradata database for SAS Data Quality Accelerator for Teradata is available as a download. The download enables you to package a QKB on a computer other than the one on which SAS Data Quality Accelerator for Teradata is installed.

In addition, the documentation is updated to clarify the requirements for obtaining a QKB for use in SAS Viya. For more information, see “Obtaining and Deploying a QKB” in the “SAS Data Quality Accelerator for Teradata” chapter of “Administrator’s Guide for Teradata” in *SAS In-Database Products: Administrator’s Guide*.

**SAS 9.4 Data Quality Accelerator for Teradata**

SAS 9.4 Data Quality Accelerator for Teradata contains general fixes and enhancements to in-database data quality operations.

In addition, the release numbering of the SAS Data Quality Accelerator for Teradata product has changed from SAS Data Quality Accelerator 2.7 for Teradata to SAS 9.4...
Data Quality Accelerator for Teradata. The new numbering is a result of the company’s recent integration of DataFlux Data Management Studio into the SAS suite of data quality, data integration, data governance, and master data management solutions. In keeping with this change, SAS Data Quality Accelerator 2.7 for Teradata: User’s Guide has been retitled as SAS 9.4 Data Quality Accelerator for Teradata: User’s Guide.

See these resources:

- For more information about this release, see What’s New in SAS 9.4 Data Quality Accelerator for Teradata in SAS Data Quality Accelerator for Teradata: User’s Guide
- For more information about changes from the previous release, see SAS Data Quality Accelerator for Teradata in SAS Guide to Software Updates and Product Changes.

**SAS Data Quality Accelerator 2.7 for Teradata**

SAS Data Quality Accelerator 2.7 for Teradata includes enhancements that make it compatible with the most recent versions of underlying SAS in-database technologies. As a result, the way that the software is installed in the Teradata database has changed.


**SAS Data Quality Accelerator 2.6 for Teradata**

SAS Data Quality Accelerator 2.6 for Teradata includes internal enhancements that provide improved memory management and streamline the software infrastructure.

**SAS Data Quality Accelerator 2.5 for Teradata**

SAS Data Quality Accelerator 2.5 for Teradata includes new stored procedures and changes to existing stored procedures.

SAS Data Quality Accelerator 2.5 for Teradata expands its data quality offerings by adding parsed variants of the DQ_GENDER(), DQ_MATCH(), and DQ_STANDARDIZE() stored procedures. The new DQ_GENDER_PARSED(), DQ_MATCH_PARSED(), and DQ_STANDARDIZE_PARSED() stored procedures accept pre-parsed data as input instead of a single input string.

This release also adds pre-parsed support, informational, and session-management stored procedures.

- The pre-parsed support stored procedures create and manage token-to-column mappings that serve as input to the DQ_OPERATION_PARSED() stored procedures.
- The informational stored procedures list the locales and SAS Quality Knowledge Base definitions that are available to the SAS Data Quality Accelerator for Teradata session.
- The stored procedure for session management can cause the stored procedures to overwrite existing output tables instead of appending data to them.
SAS Data Quality Accelerator 2.4 for Teradata

SAS Data Quality Accelerator for Teradata is a new product that provides in-database data quality functionality. The data quality functionality is provided as Teradata stored procedures, which enable you to perform a number of tasks, such as parsing, analyzing patterns, and generating match codes. Executing data quality operations inside the database, rather than as a separate utility outside of the database, provides the following benefits: eliminates network I/O performance, leverages multi-node architectures for linear performance gains, and makes information more secure because it never leaves the database. This product includes a Quality Knowledge Base (QKB) and tools for transferring and deploying the QKB in the Teradata database.

SAS 9.4 Data Quality Server

SAS Data Quality Server consists of SAS language elements that perform data quality operations (matching, standardization, and so on), as well as elements that interoperate with the DataFlux Data Management Server. SAS Data Quality Server is delivered with a sample Quality Knowledge Base (QKB), which is available from SAS.

SAS 9.4 Data Quality Server communicates with components in certain SAS offerings, such as the SAS Data Management offerings, 2.41 and later, to provide an integrated system. SAS Data Quality Server is also a key component of the SAS Data Quality offerings.

SAS has shipped these maintenance releases:

- SAS 9.4M1 shipped in December 2013.
- SAS 9.4M2 shipped in August 2014.
- In SAS 9.4M3 (July 2015), the SAS Data Quality Server is enhanced with the DQLOCLST procedure. The DQLOCLST procedure creates a data set that includes the list of locales in the Quality Knowledge Base that is named by the SAS option DQSETUPLOC. Also, the SAS Data Quality Server is upgraded to synchronize results with DataFlux Data Management Studio 2.7.
- In SAS 9.4M4 (November 2016), SAS Data Quality Server interoperates with SSL-enabled DataFlux Data Management Server 2.1 and later. Relevant language elements in SAS Data Quality Server can now use HTTPS URLs to communicate with the secured server software to run jobs and services. Also, the DQLOCLIST procedure creates a data set that includes the list of locales in the SAS Quality Knowledge Base.
- The first release of SAS 9.4M5 shipped in September 2017.
- The second release of SAS 9.4M5 shipped in December 2017 along with SAS Viya 3.3. The documentation for SAS Data Quality 3.3 and SAS 9.4M5 Data Quality Server was combined into a single document.
  The new function DQLOCALESCORE returns an integer confidence score for a source string and a locale.
- SAS 9.4M6 shipped in November 2018.

See these resources:

- For more information about this release, see What’s New in SAS Data Quality in SAS Data Quality and SAS Data Quality Server: Language Reference.
For more information about changes from the previous release, see SAS Data Quality Server in SAS Guide to Software Updates and Product Changes.

SAS Data Remediation

SAS Data Remediation 2.4

Starting with this release, the user interface has been rewritten in HTML5. Previously, many SAS applications and SAS solutions used the Adobe Flash Player to provide interactive user interfaces. Adobe has announced that it intends to end support for Flash technology and will stop updating and distributing the Flash Player at the end of 2020. Browser vendors will disable Flash by default in 2019. For more information about Adobe Flash end-of-life, see SAS Software and Its Use of the Adobe Flash Player.

SAS Data Remediation 2.4 is no longer accessed from SAS Data Management Console. Instead, sign in to SAS Data Remediation directly.

Deep linking refers to constructing a URL (link) that, when initiated, takes a user directly to an issue in SAS Data Remediation rather than requiring the user to search for it. The URL syntax has changed in this release.

See these resources:

- For more information, see What’s New in SAS Data Remediation 2.4 in SAS Data Remediation: User’s Guide.
- For more information about changes from the previous release, see SAS Data Remediation in SAS Guide to Software Updates and Product Changes.

SAS Data Remediation 2.3

SAS Data Remediation 2.3 shipped in April 2017 and runs on SAS 9.4M4 and higher.

For more information, see What’s New in SAS Data Remediation 2.3 in SAS Data Remediation: User’s Guide

SAS Data Remediation 2.2

SAS Data Remediation 2.2 now includes a group-by functionality. There were enhancements to the remediation plug-in. SAS Data Remediation 2.2 includes a new overview portlet and the ability to view reports for SAS Visual Analytics. You can now save your preferences in SAS Data Remediation 2.2.

SAS Data Remediation 2.1

SAS Data Remediation enables users to manage and correct issues that are triggered by business rules in SAS MDM batch jobs and real-time processes. Data remediation allows user- or role-based access to data exceptions, which are categorized by application and subject area. Once data remediation issues have been reviewed, they can be corrected through the same application, eliminating the need for another user to complete the correction process.

SAS Data Remediation works in conjunction with SAS MDM, SAS Task Manager, and other SAS data management products.
SAS Data Surveyor for SAP

SAS Data Surveyor 5.1 for SAP includes new functions for semantically partitioned objects (SPOs) and InfoCubes that are optimized by SAP HANA.

SAS Data Surveyor 5.3 for SAP shipped in November 2016 and runs on SAS 9.4M4. For more information, see the software product page for SAS Data Surveyors.

SAS Federation Server

About SAS Federation Server

SAS Federation Server provides the business ability to quickly build virtual views of data from multiple sources, without moving or copying the data. It also supports data caching for frequently used data, which can result in improved query performance. The security features for SAS Federation Server include data masking, row-level security, and centralized access for improved governance.

SAS Federation Server 4.2

Here are the main enhancements for SAS Federation Server 4.2:

- SAS Metadata Server replaces DataFlux Authentication Server for authentication and persistence of users, groups, logins (for example, personal, group, and shared) and domains.
- New data masking rules provide additional encryption support.
- SAS Federation Server now supports the DATA Step 2 (DS2) language.
- The new data quality and cleansing functionality is implemented using SAS Quality Knowledge Base (QKB) with FedSQL and DS2.
- SAS Federation Server now has the capability of persisting a data cache in memory through the MDS data store.
- You can now use the SAS Federation Server Driver for Apache Hadoop for read/write access to Hadoop (HIVE).
- A new Federation Server driver enables you to share data sources across multiple SAS Federation Servers.

For more information, see What’s New in SAS Federation Server 4.2 in SAS Federation Server 4.2: Administrator’s Guide.

SAS Federation Server 4.1

Here are the main enhancements for SAS Federation Server 4.1:

- There are four new drivers:
  - SAS Federation Server Driver for SAP HANA
  - SAS Federation Server Driver for Netezza
• SAS Federation Server Driver for PostgreSQL
• SAS Federation Server SASHDAT Data Source Driver
• SAS Federation Server delivers a new data masking function as a method of ‘de-identifying’ sensitive information within data sources.
• The SQL language scripting capabilities handle administrative needs for start-up and shutdown events.
• New API (which is implemented as a REST interface) supports interacting with and managing SAS Federation Server.

For more information, see What’s New in SAS Federation Server 4.1 in SAS Federation Server 4.1: Administrator’s Guide.

SAS Federation Server 3.2

DataFlux Federation Server is now SAS Federation Server. This renaming is a result of the recent integration of DataFlux products into the SAS suite of data quality, data integration, data governance, and master data management solutions.

In-Memory Data Store (MDS) is a transactional in-memory data store that can be implemented on SAS Federation Server.

Privilege caching is offered as a tool for streamlining privilege determination, which results in improved performance.

For more information, see What’s New in SAS Federation Server 3.2 in SAS Federation Server 3.2: Administrator’s Guide.

SAS Job Monitor

SAS Job Monitor 2.2

Job Monitor 2.2 provides additional parameters to configure an environment locale.

The Job Monitor agent plug-in uses its language and country settings to parse the log for SAS Data Integration Studio. (The default values for the language and country settings come from the machine on which the agent is running.) The language and country settings have to match between the Job Monitor agent and SAS Data Integration Studio. To override the language, country, and variant used by the Job Monitor agent plug-in, new options were added to the user interface. These options override the agent plug-in’s settings for Data Integration Studio. In addition, an encoding option was added for both SAS Data Integration Studio and SAS Data Management Server jobs, to override the agent plug-in’s setting.

Job Monitor 2.2M1 shipped in April 2017 and runs on SAS 9.4M4 and later releases.

SAS Job Monitor 2.1

SAS Job Monitor is a plug-in for SAS Environment Manager that integrates information from SAS Data Integration Studio, DataFlux Data Management Server, and specific jobs from DataFlux Data Management Studio. Using SAS Job Monitor, you can oversee the state of jobs that are run from these applications.
SAS Job Monitor reads job logs at specified locations and displays run-time statistics from the logs, enabling you to monitor status information and performance statistics. Using the jobs table, you can view historical run times and also drill down to a job for details, trends, and status.

Help is available from within the product.

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**SAS Lineage**

**SAS Lineage 3.3**

Starting with this release, the user interface has been rewritten in HTML5. Previously, many SAS applications and SAS solutions used the Adobe Flash Player to provide interactive user interfaces. Adobe has announced that it intends to end support for Flash technology and will stop updating and distributing the Flash Player at the end of 2020. Browser vendors will disable Flash by default in 2019. For more information about Adobe Flash end-of-life, see [SAS Software and Its Use of the Adobe Flash Player](#).

The HTML5 interface for SAS Lineage is displayed in a window that contains these components:

- Diagram Pane
- Manage Views Pane
- Details Pane
- Filter Pane

See the resources:

- For more information, see the product documentation page for [SAS Lineage](#).
- For more information about changes from the previous release, see [SAS Lineage](#) in [SAS Guide to Software Updates and Product Changes](#).

**SAS Lineage 3.2**

SAS Lineage 3.2 shipped in April 2017 and runs on SAS 9.4M4 and higher. For this release, the main enhancement is the Open Link function. When you select an object and click [Open Link](#), the object is opened in SAS Business Data Network.

**SAS Lineage 3.1**

SAS Lineage 3.1 is a web-based diagram component for visualizing relationships between objects. It is used as a stand-alone lineage and relationship viewer that can be accessed by SAS database management and business intelligence applications. The component has two modes: first, a network diagram displays all relationships. Second, two left-to-right dependency diagrams are available: one that displays data governance information (governance) and another that displays parent and child relationships only (impact analysis). The relationship information displayed in these diagrams is drawn from the Relationship database that is a part of the Web Infrastructure Platform Data Server.
SAS Quality Knowledge Base

SAS Quality Knowledge Base for Contact Information

SAS Quality Knowledge Base for Contact Information 31
SAS QKB CI 31 includes updates for these locales and definitions:

Danish, Denmark; English, United States, French, France; German, Germany; and Italian, Italy
   Field Content identification analysis definition updated

English, United Kingdom and Norwegian, Norway
   Field Content identification analysis definition added

Japanese, Japan
   Address (Full) match definition updated

All locales
   These definitions have improved leap-year processing:
   • Date (DMY Validation - Numeric Only) identification analysis definition
   • Date (MDY Validation - Numeric Only) identification analysis definition
   • Date (YMD Validation - Numeric Only) identification analysis definition

Field Name identification analysis definition is now available for all locales:
   • Languages supported are English, Danish, French, German, Hebrew, and Chinese.
   • The identities were synchronized with the Identity names produced by the Field Content identification analysis definitions.

For more information, see the product documentation for SAS Quality Knowledge Base (QKB).

SAS Quality Knowledge Base for Contact Information 30
SAS QKB CI 30 includes updates for these locales and definitions:

Danish, Denmark
   • Field Content identification analysis definition

English, United States
   • Address match, parse, and standardize definitions
   • Field Content identification analysis definition

French, France
   • Country standardization definition
   • Field Content identification analysis definition

Japanese, Japan
   • Address (Full) parse and standardization definitions

All English locales plus Afrikaans, South Africa, and French, Canada
   • County standardization definition
   • County (Region) standardization definition
• Country (Sub-Region) standardization definition

All locales
• Country match definition
• Country (ISO 2 Char) standardization definition
• Country (ISO Number) standardization definition
• IBAN parse definition

SAS Quality Knowledge Base for Contact Information 29
SAS Quality Knowledge Base for Contact Information 29 introduces support for these definitions.

English, United States
• Address (PO Box only) match definition
• Address (Street only) match definition
• Field content identification analysis definition

French, Canada
• Country standardization definition

Danish, Denmark; French, France; German, Germany; Italian, Italy
• Field Content identification analysis definition

All locales
• HTML Character Reference Conversion standardization definition
• Symbol Removal standardization definition
• Symbol Space Replacement standardization definition

SAS Quality Knowledge Base for Contact Information 28
SAS Quality Knowledge Base for Contact Information 28 includes updates for these locales:

• English, Philippines
• English, United States

It also includes updates to these definitions in all locales:

• Country and Phone locale guess definitions
• Country match and standardization definitions
• Date match, parse, and standardization definitions
• Email identification analysis, match, parse, and standardization definitions

For more information, see the software product page for Quality Knowledge Base (QKB) for SAS and DataFlux.

SAS Quality Knowledge Base for Contact Information 27
SAS Quality Knowledge Base for Contact Information 27 includes updates for these locales:

• English, Philippines
• English, United States
• Portuguese, Brazil
• Spanish, Mexico
• Spanish, Spain

**SAS Quality Knowledge Base for Contact Information 26**
SAS Quality Knowledge Base for Contact Information 26 includes updates for these locales:
• English, Philippines
• Portuguese, Brazil
• Spanish, Mexico

New email identification, match, parse, and standardization definitions are available for all locales.

**SAS Quality Knowledge Base for Contact Information 25**
SAS Quality Knowledge Base for Contact Information 25 introduces support for the English, Philippines locale.

**SAS Quality Knowledge Base for Contact Information 24**
SAS Quality Knowledge Base for Contact Information 24 includes updates for these locales and definitions:
• Portuguese, Brazil
• Spanish, Mexico
• Spanish, Spain

**SAS Quality Knowledge Base for Contact Information 23**
SAS Quality Knowledge Base for Contact Information 23 introduces support for Hebrew, Israel Date definition.

This release also includes updates for these locales:
• Portuguese, Brazil
• Spanish, Mexico
• Turkish, Turkey

For all locales, these definitions are updated:
• **Address (Global)** parse definitions
• **E-mail** match definitions

SAS Quality Knowledge Base for Contact Information 23 also includes updates for Field Name identification analysis and match definitions for these locales:
• All English locales
• Chinese, China
• Danish, Denmark
• German, Germany
• French, France
• Hebrew, Israel
**SAS Quality Knowledge Base for Contact Information 22**
SAS Quality Knowledge Base for Contact Information 22 includes updates to the E-mail Parse and Standardization definitions for all locales.

In addition, these languages and locales have updates:
- English, New Zealand
- English, United States
- Danish, Denmark
- French, France
- Portuguese, Brazil

**Quality Knowledge Base for Contact Information 2013A**
Quality Knowledge Base for Contact Information 2013A introduces support for the Hebrew, Israel language and locale.

Support is updated for address-related definitions for the English, New Zealand language and locale.

**SAS Quality Knowledge Base for Product Data**

**SAS Quality Knowledge Base for Product Data 5**
SAS Quality Knowledge Base for Product Data contains extraction, parsing, standardization, and pattern analysis definitions for attributes in generic product data. This release also contains additional generic character-based standardization definitions.

**Quality Knowledge Base for Product Data 2013A**
Quality Knowledge Base for Product Data 2013A introduces support for the Italian, Italy language and locale.

Support is updated for the French and German Packaging/UOM Standardization definitions.

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**SAS MDM**

**SAS MDM 4.3**
SAS MDM 4.3 shipped in April 2017 and runs on SAS 9.4M4 (and earlier releases).
SAS MDM 4.3 includes new features and enhancements in these areas:
- support for SQL Server 2014
- configurable limits to the number of records presented when viewing clusters
- automated cleanup of remediation issues
- creation of new survivors when clusters change due to retirement
- control access to hierarchies
See these resources:

- For more information about this release, see the product documentation page for SAS MDM.
- For more information about changes from the previous release, see SAS MDM (Master Data Management) in SAS Guide to Software Updates and Product Changes.

**SAS MDM 4.2**

SAS MDM 4.2 includes new features and enhancements in these areas:

- reports for SAS Visual Analytics
- source system management functionality
- process control enhancements
- relationship type attributes
- cross-field clustering
- source system harmonization

**SAS MDM 4.1**

SAS MDM is a product that integrates master data management technologies with those in SAS 9.4. SAS MDM is a web-based application that provides a single, accurate, and unified view of corporate data, integrating information from various data sources into one master record. SAS enables you to develop master data management processes. SAS provides the technology required to analyze existing data resources, build a unified view of that information, and manage that master view of data over time. The latest release features performance enhancements and integration with SAS metadata.

SAS MDM works in conjunction with SAS Data Remediation, SAS Task Manager, SAS Visual Process Orchestration, and other SAS data management products.

**SAS Task Manager**

**SAS Task Manager 2.4**

SAS Task Manager 2.4 shipped in June 2019.

Starting with this release, the user interface has been rewritten in HTML5. Previously, many SAS applications and SAS solutions used the Adobe Flash Player to provide interactive user interfaces. Adobe announced that it intends to end support for Flash technology and will cease to update and distribute the Flash Player at the end of 2020. Browser vendors will disable Flash by default in 2019. For more information about Adobe Flash end-of-life, see SAS Software and Its Use of the Adobe Flash Player.

**SAS Task Manager 2.2**

The main enhancement for SAS Task Manager 2.2 is four new user preferences.
See these resources:

- For more information about this release, see What’s New in SAS Task Manager 2.2.
- For more information about changes from the previous release, see SAS Task Manager in SAS Guide to Software Updates and Product Changes.

**SAS Task Manager 2.1**

SAS Task Manager is a complementary application to others, such as SAS MDM, that integrates with SAS WorkFlow technologies. It gives users direct access to a workflow that might have been initiated from another SAS application. Users can start, stop, and transition workflows that have been uploaded to the SAS Workflow server environment.

SAS Task Manager works in conjunction with SAS MDM, SAS Data Remediation, and other SAS data management products.

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**SAS Visual Process Orchestration**

**SAS Visual Process Orchestration 2.2**

SAS Lineage is a web client that enables you to view the lineage of sources and targets in a job. If the SAS Relationship Content Service has been enabled, you can export lineage metadata from SAS Visual Process Orchestration to the service, where it can be accessed by SAS Lineage.

The documentation for SAS Visual Process Orchestration has been enhanced for these topics:

- logging on to SAS Data Management Console. The logon topic now describes a number of ways to access that application.
- configuring SAS Job Monitor for SAS Visual Process Orchestration jobs. If your site has licensed SAS Environment Manager and SAS Job Monitor, then you can use a web browser to display run-time statistics for SAS Visual Process Orchestration jobs. The topic for SAS Job Monitor now includes more details about configuring that application for Orchestration jobs.
- For more information about this release, see What’s New in SAS Visual Process Orchestration 2.2.
- For more information about changes from the previous release, see SAS Visual Process Orchestration in SAS Guide to Software Updates and Product Changes.

**SAS Visual Process Orchestration 2.1**

SAS Visual Process Orchestration is a web authoring environment that is launched from SAS Data Management Console. The authoring environment provides nodes that can be used to build orchestration jobs, which are process jobs that run other jobs.

An orchestration job can integrate executable files from various systems into a single process flow. A single orchestration job can run one or more executable files, such as SAS Data Integration Studio jobs, DataFlux Data Management Studio jobs, SAS code files, third-party programs, scripts, and web services. SAS Visual Process Orchestration can execute referenced jobs in parallel; apply control logic such as looping and IF/
THEN/ELSE handling; and handle events, error-checking, and run-time statistics for each node in the orchestration job.

SAS Visual Process Orchestration Server provides a Design Server and a Run-time Server to coordinate enterprise development and execution of orchestration jobs. The Design Server supports the development of orchestration jobs by using separate threads, file locking, and test execution. The Run-time Server triggers the execution of orchestration jobs in response to requests that are submitted by authorized SOAP/HTTP clients.
Chapter 7
SAS Customer Intelligence

SAS Marketing Automation

SAS Marketing Automation 6.4 has changes and enhancements in these areas:

• publishing campaigns
• refining output
• staging treatments
• additional supported databases

See these resources:
• For more information about this release, see the software product page for SAS Marketing Automation.
• For more information about changes from the previous release, see SAS Marketing Automation in SAS Guide to Software Updates and Product Changes.

Note: The documentation for SAS Marketing Automation is available only to customers who license this product.

SAS Marketing Automation 6.3

SAS Marketing Automation 6.3 has changes and enhancements in these areas:

• fault tolerance through middle-tier clustering
• multiple SAS Customer Intelligence Studio windows
• business context database upload options
• Reports workspace
• diagram nodes
• previewing export files
• generating diagram documents

SAS Marketing Optimization

SAS Marketing Optimization 6.4

SAS Marketing Optimization 6.4 has changes and enhancements in these areas:
• publication of solution tables to the SAS Marketing Optimization LASR Analytic Server
• editable pre-populated constraints
• score code generation for some types of scenarios
• optimization of prioritization scenarios
• improved implementation of the optimization algorithm

See these resources:
• For more information, see the software product page for SAS Marketing Optimization.
• For more information about changes from the previous release, see SAS Marketing Optimization in SAS Guide to Software Updates and Product Changes.

SAS Marketing Optimization 6.3

SAS Marketing Optimization 6.3 has changes and enhancements in these areas:
• double-byte character support for input data tables
• enhanced agent scalability option for scenarios
• enhanced reporting data output options
• consistent scaling for sensitivity analysis
• SAS Visual Analytics reporting services
**SAS Real-Time Decision Manager**

**SAS Real-Time Decision Manager 6.4**

SAS Real-Time Decision Manager 6.4 has changes and enhancements in these areas:

- campaign deployment
- configuration of run-time services
- documents and reporting
- treatments
- variables and custom processes

See these resources:

- For more information about this release, see the software product page for [SAS Real-Time Decision Manager](#).
- For more information about changes from the previous release, see [SAS Real-Time Decision Manager](#) in *SAS Guide to Software Updates and Product Changes*.

*Note:* The documentation for SAS Real-Time Decision Manager is available only to customers who license this product.

**SAS Real-Time Decision Manager 6.3**

SAS Real-Time Decision Manager 6.3 has changes and enhancements in these areas:

- fault tolerance through middle-tier clustering
- multiple SAS Customer Intelligence Studio windows
- diagram nodes
- campaigns
- treatments
- calculated variables
Chapter 8
SAS Financial Management

SAS Cost and Profitability Management

**SAS Cost and Profitability Management 8.4**


Many SAS applications and SAS solutions used the Adobe Flash Player to provide interactive user interfaces. Adobe has announced that it intends to end support for Flash technology and will stop updating and distributing the Flash Player at the end of 2020. Browser vendors will disable Flash by default in 2019. For more information about Adobe Flash end-of-life, see [SAS Software and Its Use of the Adobe Flash Player](#).

Because Adobe is discontinuing support for Flash Player, the Survey and What-If and Scenario Builder applications, which are based on Flash, have been removed from Cost and Profitability Management.

SAS Cost and Profitability Management supports more current versions of Red Hat Linux (RHEL) and Java.

- For RHEL 6.X: Up to RHEL 6.10 is tested and supported.
- For RHEL 7.X: Up to RHEL 7.6 is tested and supported.
- JAV A 8 is now supported.

See these resources:
- For more information about this release, see *What’s New in SAS Cost and Profitability Management 8.4* in *SAS Cost and Profitability Management: User’s Guide*. 
For more information about changes from the previous release, see SAS Cost and Profitability Management in SAS Guide to Software Updates and Product Changes.

**SAS Cost and Profitability Management 8.3**

SAS Cost and Profitability Management 8.3 shipped in May 2018. In this release, you can now export model data for various periods and scenarios to generate these reports:

- Destination Furthest
- Driver – Cost and Rate
- Multi-Level Contributions
- Resource Contributions
- Unassigned Costs
- Unit Cost
- Dimensional Attribute Cost

SAS Cost and Profitability Management contains a template for each report type. SAS Cost and Profitability Management exports the model data in a table in the database. Use the database tables to view, share, and analyze the report.

For more information, see What’s New in SAS Cost and Profitability Management 8.3 in SAS Cost and Profitability Management: User’s Guide

**SAS Cost and Profitability Management 8.1**

Here are some of the enhancements in SAS Cost and Profitability Management 8.1:

- Using memory-mapped files managed directly by the operating system rather than database tables managed by a database management system, the new architecture of SAS Cost and Profitability Management 8.1 performs calculations in a fraction of the time required by previous releases as well as significantly decreasing the time required for import and export.

- With SAS Cost and Profitability Management 8.1, you can push your model data and fact tables to the SAS LASR Analytic Server for viewing with SAS Visual Analytics. You are no longer limited to OLAP technology for the analysis of data but can avail yourself of the power of in-memory architecture to explore your data in real time.

- A new Web application allows you to take advantage of high performance calculation to explore the effect of modifying the value of selected variables on selected account measures. Use the SAS Cost and Profitability Management 8.1 client to mark variables (such as cost elements and numeric attributes) and accounts for analysis, and then use the new "What-If" Web application to explore the effect of changing the values of those variables on the selected accounts. When you change the value of a variable, fast calculation shows you the effect on the selected measures for the selected accounts.

- Rather than restricting users to the traditional ABC modules (Resource, Activity, Cost Object, and External Unit), SAS Cost and Profitability Management 8.1 allows you to create a model with anywhere from 2 to 10 modules with whatever name you choose. And, of course, you can still define stages within and across all those modules.
SAS Financial Management

SAS Financial Management 5.6


Starting with this release, the user interface has been rewritten in HTML5. Previously, many SAS applications and SAS solutions used the Adobe Flash Player to provide interactive user interfaces. Adobe has announced that it intends to end support for Flash technology and will stop updating and distributing the Flash Player at the end of 2020. Browser vendors will disable Flash by default in 2019. For more information about Adobe Flash end-of-life, see SAS Software and Its Use of the Adobe Flash Player.

You can now edit the form data only through SAS Financial Management Add-In for Microsoft Excel. You cannot edit the forms in the Forms workspace.

In the HTML5 user interface, the Administration and Processes Workspace is not provided. You can complete the tasks related to administration and business processes through SAS Financial Management Studio.

See these resources:

• For more information about this release, see What’s New in SAS Financial Management 5.6.

• For more information about changes from the previous release, see SAS Financial Management in SAS Guide to Software Updates and Product Changes.

SAS Financial Management 5.5

SAS Financial Management 5.5 includes several performance improvements, such as leveraging standby and failover support. This support is provided by the SAS Web Server to implement a high availability configuration.

SAS Financial Management 5.5 now includes SAS Visual Analytics Viewer from which you can launch your reports. Content promotion has been expanded to support the promotion of several new objects. This release includes enhancements to forecasting and expanded auto-allocation functionality.

For more information about this release, see What’s New in SAS Financial Management 5.5.

SAS Financial Management 5.4

SAS Financial Management 5.4 introduces process management support, data validation, and enhanced data entry and reporting options. Process Management is a new SAS Financial Management framework that enables administrators and users to perform these tasks

• define and manage company-specific business processes
• automate key Financial Management tasks
• view the status of processes and tasks, and identify and resolve delays and other problems
Process management also includes user notification at the business process and task levels, commenting, and audit history.
Chapter 9

SAS Fraud and Compliance Products

SAS Anti-Money Laundering

SAS Anti-Money Laundering 7.1 shipped in July 2016. In this release, scripts are provided so that you can quickly add new banks to the application. There is a separate schema for each bank as well as a separate alert generation process. The new and improved user interface enables you to triage Entities more efficiently and effectively. All alert types now roll up to an Entity. Triage is now performed at the Entity level while still providing granular level alert disposition. The Funds Tracker now provides a graphical view of the investigation.

SAS Anti-Money Laundering 6.3

SAS Anti-Money Laundering 6.3 includes SAS Visual Analytics Administrator and Reporting, which enables out-of-the-box reporting for alerts. Starting with this release, regulatory reports are pre-populated with subject information, and the process for electronically filing reports is automated. In addition, user interface enhancements enable you to page all data grids, export transactions to a CSV file, work with a redesigned interface for entering notes, and perform multi-column sorting. Also, the integration of Apache Solr enhances search capabilities.

In January 2016, SAS Anti-Money Laundering 6.3M1 shipped.
Here are some of the new features in this release:

- The new streamlined user interface called Entity Triage enables you to review and disposition alerts by entity.
- New Currency Transaction Reporting scenarios can be used in the alert generation process. These scenarios are for cash monitoring within a 24-hour period.
- You can create Currency Transaction Reporting reports and Designation of Exempt Person reports. Both reports support e-filing.
- The Regulatory Report 90D Review automatically creates a case for the mandatory continuous review after the initial filing of the Regulatory Report (after 90 days).
- Visual Scenario Designer is now integrated with SAS Anti-Money Laundering. You can develop and test scenarios in Visual Scenario Designer and then import these scenarios into SAS Anti-Money Laundering to be used in the alert generation process.

See these resources:

- For more information about this release, see the software product page for SAS Anti-Money Laundering.
- For more information about changes from the previous release, see SAS Anti-Money Laundering in SAS Guide to Software Updates and Product Changes.

Note: The documentation for SAS Anti-Money Laundering is available only to customers who license this product.

**SAS Anti-Money Laundering 6.2**

SAS Anti-Money Laundering 6.2 has new sample scenarios for Correspondent Banking to take advantage of the enhancements to the SAS Anti-Money Laundering data model. This release also includes a new relationship grid to quickly assess details about parties that are associated with the Correspondent Banking behavior.

**SAS Anti-Money Laundering 6.1**

SAS Anti-Money Laundering 6.1 runs on SAS 9.4 and has these new features:

- streamlined user interface to provide consistent user experience throughout the portfolio and improved integration among the applications.
- scenario promotion that enables the user to export and import scenarios and associated headers, to download .spk (SAS package) files to a local machine, and to import to a separate system.
- configurable workflow that displays a task list with available transitions and a visual diagram of the workflow states and transitions. The workflow also provides task lists that are shown on the Investigator and Manager Home screens and a completion report that indicates which rules were updated and created.
- Related Entities Visualization that enables additional regulatory reporting support for select forms within the FinCEN, FinTRAC, and AUSTRAC regulatory agencies.
- integration with the SAS Customer Due Diligence solution. This feature provides transparency between an institution’s SAS Anti-Money Laundering and Customer Due Diligence activities.
SAS Customer Due Diligence

**SAS Customer Due Diligence 6.3**

SAS Customer Due Diligence 6.3 includes a new strategy rule to incorporate the scoring of regulatory reports. The integration of Apache Solr enhances search capabilities. In addition, user interface enhancements enable you to page all data grids, export transactions to a CSV file, work with a redesigned interface for entering notes, and perform multi-column sorting.

SAS Customer Due Diligence 6.3M1 includes an enhanced user interface.

See these resources:

- For more information about this release, see the software product page for SAS Customer Due Diligence.
- For more information about changes from the previous release, see SAS Customer Due Diligence

*Note:* The documentation for SAS Customer Due Diligence is available only to customers who license the product.

**SAS Customer Due Diligence 6.2**

SAS Customer Due Diligence 6.2 includes a new strategy rule to incorporate the scoring of new customers. This release also includes an improved manual case creation process and case links to previously created parties.

**SAS Customer Due Diligence 6.1**

SAS Customer Due Diligence enables you to understand a customer’s profile and to establish an expectation about the customer’s behavior. SAS Customer Due Diligence collects data and performs risk rating and profiling on customers who are at risk to be involved in fraud, money laundering, or other illegal activities. Risk rating helps financial institutions meet the compliance requirements that are set by government and regulatory organizations.

**SAS Peer Group Analysis 6.1**

SAS Peer Group Analysis compares an entity’s (account or party) current behavior with that of its historical behavior and also its peers’ behavior. SAS Peer Group Analysis provides a process to build a prep data set, which can be used by SAS Peer Group Analysis headers and scenarios. Alerts that are generated by SAS Peer Group Analysis scenarios can be displayed in the user interface and can include fields that are specific to SAS Peer Group Analysis in the alert details screen.

SAS Peer Group Analysis is an add-on to SAS High-Performance Anti-Money Laundering.

For more information, see the software product page for SAS Anti-Money Laundering.
SAS Social Network Analysis Server 6.2

SAS Social Network Analysis Server 6.2 includes performance enhancements and updates. Here are some of the updates in this release:

- performance enhancements to the social network analysis diagram
- administrator-enabled network legend for the social network analysis diagram

SAS Social Network Analysis Server 6.2M1 includes the addition of an export feature that enables users to export alerts and designated columns directly from the Alerts window.

This release also includes expanded development and configuration features for analysts, administrators, and installers. Here are some of those features:

- a new method of plug-in development
- integration with SAS Management Console Configuration Manager and SAS Preferences to promote ease of configuration and management, and the addition of new configuration parameters to control the user experience
- streamlined post-installation and configuration process

In SAS Social Network Analysis Server 6.2M1, you can now use a custom URL to direct users to a specific Alert Details window within a defined alert series.

SAS Social Network Analysis Server 6.2M2 includes these enhancements and operational changes:

- You can easily adjust the column widths for all of the table data.
- In the Alerts window, you can save multiple custom views that are related to a specific alert series. You can also manage the views through the solution interface.
- The Export feature now includes alert details.

See these resources:

- For more information about this release, see the software product page for SAS Social Network Analysis.
- For more information about changes from the previous release, see SAS Social Network Analysis Server in SAS Guide to Software Updates and Product Changes.

Note: The documentation for SAS Social Network Analysis is available only to customers who license this product.
November 2018 Release: SAS 9.4M6

These features or changes were added in SAS 9.4M6 (November 2018):

- The delivery, installation, and deployment process for the SAS Embedded Process has changed. The SAS Embedded Process is now being delivered using a link in your Software Order Email (SOE) and the deployment process is the same for both SAS 9.4 and SAS Viya. When you license a SAS product that requires the SAS Embedded Process, you will receive two SOEs:
  - One email is for your SAS 9.4 or SAS Viya software offering.
  - A second email is for the SAS Embedded Process.

The SAS Embedded Process is delivered from a SAS Viya repository whether your software order includes SAS 9.4 or SAS Viya. Prior to this release, the SAS Embedded Process for SAS 9.4 software was delivered from the SAS 9.4 Software Depot. For SAS Viya, the SAS Embedded Process was delivered from a SAS Viya repository.

- Due to changes to the deployment of the SAS Embedded Process, install scripts for SAS Data Quality Accelerator for Teradata stored processes and the script to deploy SAS Contextual Analysis text analytics models to the Hadoop nodes are delivered in a different location.

- The SAS Embedded Process is now installed on all YARN Node Manager nodes.
The sasep-admin.sh script to manually install the SAS Embedded Process has several new options (-yarnnodes, -yarnrm, and -nohostcheck) and several options have been removed (-x, -epconfig, -linklib, and -unlinklib). The -maxscp option has changed to -maxparallel. In addition, you no longer need sudo access to run the script.

The SAS Deployment Manager is no longer used to deploy the SAS Embedded Process for Hadoop. The SAS Embedded Process files are delivered using RPM files.

Any program that uses the SAS Embedded Process, such as the SAS Scoring Accelerator, can be executed as either a MapReduce job or as a Spark application. A new system option, HADOOPPLATFORM, determines which execution platform is used. However, note that the HADOOPPLATFORM=SPARK option is not supported on the Windows operating system with the SAS In-Database Code Accelerator.

In-database scoring for the SAS Scalable Performance Data Server is no longer supported.

Information about IBM BigInsights and Pivotal has been removed from the documentation. These Hadoop vendors have asked their customers to move to Hortonworks.

The following enhancements were made to the SAS In-Database Code Accelerator:

- CEDA processing of SPD Engine input files is supported by the SAS In-Database Code Accelerator for Hadoop. Previously, only SPD Engine data sets whose architectures matched the architecture of the Hadoop cluster (that is, 64-bit Solaris or Linux) ran inside the database.

- The SAS In-Database Code Accelerator for Hadoop supports the SCRATCH_DB option for a Hive database that is used when a temporary table is created.

- SQL queries using a WHERE IN clause are now supported by the SAS In-Database Code Accelerator for Hadoop.

- The SAS In-Database Code Accelerator for Hadoop supports the SCRATCH_DB option for a Hive database that is used when a temporary table is created.

- The scoring functions and user-defined format functions for Teradata are now deterministic.

The following changes have been made to the SAS Deployment Manager when you configure Base SAS and SAS/ACCESS for Hadoop:

- If your Hive service is enabled with both Kerberos and TLS, the SAS Deployment Manager cannot validate the SAS/ACCESS configuration. The LIBNAME connection test fails. Deselect the validation box and click Next to collect the JAR and configuration files without validation. You have to validate the SAS/ACCESS configuration manually after the SAS Deployment Manager steps are complete.

- If you are using Hortonworks version 3.0, select No Filter. This selection ensures that the correct jline JAR files are obtained for running PROC HADOOP Pig jobs successfully.

- If you are using Advanced Encryption Standard (AES) encryption with Kerberos, you are no longer required to manually copy the Java Cryptography Extension local_policy.jar file or the US_export_policy.jar file to your JAVA home directory.
See these resources:

- For more information about this release, see What’s New in the SAS 9.4 In-Database Products in SAS In-Database Products: User’s Guide.
- For more information about changes from the previous release, see SAS In-Database Technologies in SAS Guide to Software Updates and Product Changes.

**December 2017 Release: SAS 9.4M5**

These features were added in SAS 9.4M5 (December 2017):

- The SAS In-Database Code Accelerator now honors the ACCESS LIBNAME and data set option, SCRATCH_DB, for a Hive database that is used when a temporary table is created.

- The SAS In-Database Code Accelerator for Hadoop now supports the SCRATCH_DB option for a Hive database that is used when a temporary table is created.

- The RETAIN statement is now supported when processing DATA step programs in Hadoop. Variable lists in the RETAIN statement have limited support.

For more information about this release, see What’s New in the SAS 9.4 In-Database Products in SAS In-Database Products: User’s Guide.

**September 2017 Release: SAS 9.4M5**

Starting in SAS 9.4M5 (September 2017), these features are new:

- The SAS Deployment Manager can now be run if the cluster manager is enabled with Transport Layer Security (TLS). The SAS Deployment Manager validates if the Certificate of Authority (CA) exists for the host that you are trying to access. If the CA does not exist, a warning message is issued and asks to run another SAS Deployment Manager task to add the CA.

  **Note:** All discussion of TLS is also applicable to the predecessor protocol, Secure Sockets Layer (SSL).

- You now have the option of manually collecting the JAR and configuration files with the Hadoop tracer script while using the SAS Deployment Manager.

- Three new options have been added to the hadooptracer.py script. One option collects the correct files when running the Hadoop tracer script from a Windows client. The second new option produces version and debug logging information. Postprocess, the third new option, removes version numbers from any configuration files that are collected.

- The SAS In-Database Scoring Accelerator for Hadoop now supports a cluster that has Sentry RecordService enabled. Apache Sentry is a system for enforcing fine-grained role-based authorization to data and metadata stored on a Hadoop cluster. RecordService is a core security layer that centrally enforces fine-grained access control policy. The combination allows security administrators to deliver unified row-based and column-based security, and dynamic data masking.

- If you license SAS Data Loader for Hadoop, you can now deploy the SAS Embedded Process and the SAS Data Quality Accelerator, the SAS Data Loader for Hadoop Spark Engine, and the SAS Quality Knowledge Base individually, all together, or in any combination at one time.
November 2016 Release: SAS 9.4M4

Starting in SAS 9.4M4, these features are new:

• The SAS Deployment Manager can now be used to pull Hadoop JAR and configuration files when configuring Base SAS and the SPD Engine for use with Hadoop. Previously, pulling these files was a manual process.

• The installation and configuration of the SAS Embedded Process for Aster, DB2, Greenplum, SAP Hana, Oracle, and Netezza has been improved and simplified. The in-database deployment package is delivered to the client from the SAS Install Depot in a ZIP file. The new process has a smaller client footprint and is a faster installation process.

• If you license SAS Data Loader for Hadoop, SAS Data Quality Accelerator for Teradata, or SAS Contextual Analysis In-Database Scoring for Hadoop, these components are included in the in-database deployment package for Hadoop and Teradata, respectively.

• The Base SAS procedures that are enhanced for in-database processing can now be run inside PostgreSQL, Redshift, and Microsoft SQL Server.

• PROC RANK and PROC SORT now support in-database processing on Hadoop with Hive .13 or later.

• If you use the SAS In-Database Code Accelerator for Hadoop, the SPD Engine SerDe can be used to access Hive tables.

• Several new configuration properties that enable you to adjust performance have been added for SAS Embedded Process.

• For SAS Embedded Process, the number of JAR files that are installed during deployment has been reduced from six to one.

• SAS in-database processing supports single sign-on to Teradata with Kerberos authentication.

July 2015 Release

In the July 2015 release, the SAS In-Database Scoring Accelerator for Hadoop now supports the SPD Engine HDFS file format. All of the SAS In-Database Code Accelerators support a SET statement with embedded SQL, a SET statement with multiple input tables, and a MERGE statement. The run and publish model macros for the SAS Scoring Accelerator for Hadoop now support the SAS_HADOOP_CONFIG_PATH environment variable. This support eliminates the need for a merged configuration file. The SAS Scoring Accelerator for Hadoop, SAP HANA, and Teradata supports model scoring by using item stores.

The installation and configuration of the SAS Embedded Process for Hadoop has been improved and simplified:

• For Cloudera and Hortonworks, Cloudera Manager and Ambari are used to install the SAS Embedded Process and the SAS Hadoop MapReduce JAR files.

• For IBM BigInsights, MapR, and Pivotal HD, the in-database deployment package is delivered to the client from the SAS Install Depot.
In addition, the SAS Embedded Process and the SAS Hadoop MapReduce JAR files are installed with one script instead of two separate scripts. The new process has a smaller client footprint and is a faster installation.

The SAS Embedded Process for Hadoop has been rewritten and no longer runs as a Linux service. The SAS Embedded Process for Hadoop now supports IBM BigInsights, MapR, and Pivotal HD Hadoop distributions. The installation and configuration of the SAS Embedded Process for Teradata has been improved and simplified. The in-database deployment package is delivered to the client from the SAS Install Depot. The new process has a smaller client footprint and is a faster installation.

**February 2015 Release**

In the February 2015 release, the SAS In-Database Code Accelerator for Hadoop uses HCatalog to process complex, non-delimited files. Using HCatalog enables the SAS In-Database Code Accelerator for Hadoop to support Avro, ORC, RCFile, and Parquet file types. In addition, you can now use the DBCREATE_TABLE_OPTS table option to specify the output SerDe, the output delimiter of the Hive table, the output ESCAPED BY character, and any other CREATE TABLE syntax allowed by Hive.

**August 2014 Release**

In the August 2014 release, the SAS Scoring Accelerator for SAP HANA is now available, and running limited DATA step scoring programs in Hadoop is now production. Also, numerous changes were made to the installation and configuration script for the SAS Embedded Process for Hadoop.

**December 2013 Release**

In the December 2013 release, the SAS In-Database Code Accelerator for Teradata now can run the DS2 data program as well as the thread program inside the database. Also, for the SAS In-Database Code Accelerator, the default behavior has changed from the 9.4 release. DS2 code no longer executes inside the database by default. The DS2ACCEL system option and the PROC DS2 DS2ACCEL option control this behavior. DATA step processing in Hadoop is now preproduction, so limited DATA step programs can be run inside Hadoop for scoring.

**September 2013 Release**

In the September 2013 release, in-database processing for Hadoop was enhanced by the addition of the SAS Scoring Accelerator for Hadoop. Also, in the September 2013 release, the autocall macros that initialized the publishing macros are no longer needed for any DBMS. However, the autocall macros are still supported.

**July 2013 Release**

In the July 2013 release, in-database scoring is supported for the SAS Scalable Performance Data Server.

**SAS 9.4**

Starting in SAS 9.4, in-database processing has been enhanced by the addition of the SAS In-Database Code Accelerator. The SAS In-Database Code Accelerator enables you
to publish a DS2 thread program to the database and execute the thread program in parallel inside the database.

In-database scoring for Netezza has been enhanced by the addition of the SAS Embedded Process. The SAS Embedded Process is a SAS server process that runs within Netezza to read and write data.
Chapter 11
SAS Integration Technologies

SAS 9.4 Integration Technologies

SAS Integration Technologies includes the following enhancements:

- SAS Stored Processes introduces new features for the STP procedure and the SAS Stored Process Web Application, as well as general enhancements. For more information, see *SAS Stored Processes: Developer’s Guide*.

- SAS BI Web Services includes an update for RESTful web services.

- SAS Publishing Framework has added support for circular integrity constraints and extended attributes. If you are publishing to SharePoint or WebDAV, SSL setup can be done using TKESSL. In addition, event publishing is obsolete, and the event publishing documentation has been removed.

- Directory Services includes new TLS_MODE_ON and TLS_MODE_OFF options for the LDAPS_OPEN CALL routine.

  In SAS 9.4M1 Integration Technologies, the new PagedResults argument for the LDAPS_SEARCH CALL routine can be used to specify the number of results on a page of output.

  In SAS 9.4M5 Integration Technologies, the LDAPS_SEARCH_PAGE CALL routine is new. The LDAPS_SEARCH_PAGE CALL routine enables you to search and retrieve paged information from the specified LDAP directory.

- Application messaging provides a new ACTIVEMQ file access method and two new arguments for the CLOSEQUEUE CALL routine.

- In SAS Foundation Services, the Event Broker Service is no longer available.

See these resources:

- For more information about this release, see the software product page for SAS Integration Technologies.

- For more information about changes from the previous release, see SAS Integration Technologies in *SAS Guide to Software Updates and Product Changes*. 
SAS Workflow Studio 1.3 has the following enhancements:

- support for SAS Web Infrastructure Platform privileges and roles and for web-layer permissions. Run-time access control is no longer dependent on SAS metadata and has been updated to support more granular privileges.
- a new dialog box that enables workflow template owners to specify permissions for individual templates.
- improved workflow template validation, such as verification of mandatory policy properties.
- a new dialog box that displays the workflow tree for two versions of a template side-by-side. This dialog box enables you to easily evaluate the differences between the two versions of the template.
- a new policy, Submit a JES Job, that enables you to execute code that has been registered with the SAS Job Execution Service.
- a new policy action, Invoke REST Web Service.
- two new properties, Error Code and Error Message, for the Invoke Web Service policy, which supports business logic based on potential error conditions.
- support for Date data objects in timer expressions. Using Date data objects allows the dynamic use of datetime values at run time. Also, with Date data objects, you can now enter negative relative offsets, which trigger actions prior to the date that was specified by the data object.
- support for a new TODAY function in decision gateway expressions. This function retrieves the current datetime system value, which enables you to specify a specific date offset from the current date.
SAS Environment Manager

About SAS Environment Manager

SAS Environment Manager is a monitoring and management system for SAS deployments. Features include automatic resource discovery, monitoring of remote systems, personal and role-based dashboards, alerting, and visualization. The application provides web-based management, operation, and proactive monitoring of servers on both the middle tier and the SAS server tier. SAS Environment Manager incorporates some of VMware's Hyperic technology in order to offer enterprise-class operational features.
SAS Environment Manager 2.6

Starting in the May 2019 update to SAS 9.4M6, the 2.6 release of SAS Environment Manager Administration is available.

This release provides an updated interface and incorporates features that were previously in SAS Visual Analytics Administrator.

For more information, see What’s New in SAS Environment Manager Administration.

SAS Environment Manager 2.5

Starting in SAS 9.4M5, SAS Environment Manager requires less manual configuration for HTTPS. For more information, see SAS Intelligence Platform: Middle-Tier Administration Guide.

SAS Environment Manager 2.5 runs on SAS 9.4M3 and later releases. SAS Environment Manager 2.5M1 was shipped in November 2016 and runs on SAS 9.4M4.

Here are some of the new features and enhancements for this release:

• Support has been added in SAS Environment Manager Administration for managing metadata definitions for SAS users, servers, and libraries. User definitions can be viewed, created, and edited. Server and library definitions can be viewed, and SAS LASR libraries and servers and Base SAS libraries can be created and edited.

• The stored process reports in the Report Center have been replaced with stored process prompts. Using stored processes enables you to generate reports based on criteria that you select, and provides for greater customization of the report parameters.

• The SAS Environment Management Data Mart now supports a federated data mart. A federated data mart enables you to collect metric data in data marts for several SAS deployments, copy that data to a single collector deployment, and view the collected metric data in one place.

• Log collection and discovery has been improved. Rather than relying on log locations that are stored in metadata, the ETL processes look through the directory structure of a SAS deployment to find log files.

• Support has been added for collecting metric data from a SAS grid. Metric data is collected and reported upon for the grid and for individual grid nodes.

• The new SAS Backup Manager is available on the Administration tab. For more information, see “Backup Tools” on page 178.

See these resources:

• For more information about this release, see What’s New in SAS Environment Manager 2.5 in SAS Environment Manager: User’s Guide.

• For more information about changes from the previous release, see SAS Environment Manager in SAS Guide to Software Updates and Product Changes.

SAS Environment Manager 2.4

SAS Environment Manager 2.4 runs on SAS 9.4M2 and later releases.
Here are some of the new features and enhancements for this release:

- The SAS Environment Manager Service Management Architecture provides functions and capabilities that enable SAS Environment Manager to fit into a service-oriented architecture (SOA). These functions include SAS Environment Manager Extended Monitoring, Audit, Performance, and Measurement (APM) ETL; Agent-Collected Metric (ACM) ETL; and a solution kit framework.
- SAS Environment Manager provides services that enable you to import and export event data.
- Environment Snapshot contains a comprehensive list of the system information in the SAS Environment Manager database. This snapshot provides you with valuable information about your system.
- SAS Environment Manager 2.4 also includes a facility that enables you to manage user definitions in SAS metadata. The user administration features in SAS Environment Manager enable you to create and maintain users, groups, and roles. You can also manage memberships, logins, and internal accounts.

For more information, see What’s New in SAS Environment Manager 2.4 in SAS Environment Manager: User’s Guide.

SAS Environment Manager 2.3

In SAS 9.4M1, SAS Environment Manager includes the ability to manage folders and to view and change authorization settings in SAS metadata.

In SAS 9.4M2, SAS Environment Manager includes the ability to create and update access control templates (ACTs). ACTs enable you to avoid repeatedly adding the same explicit controls for the same identities on multiple objects. When you apply an ACT to an object, the pattern settings in an ACT are added to the direct controls of an object.

For more information, see What’s New in SAS Environment Manager 2.3 in SAS Environment Manager: User’s Guide.

SAS 9.4 Intelligence Platform

Security Enhancements

SAS 9.4M6
SAS 9.4M6 continues to deliver security updates for SAS code and for third-party components. The SAS Private JRE is updated to a Java 8 baseline.

SAS 9.4M5
New encoding type SAS005 uses AES encryption with a 256-bit fixed key and a 64-bit random salt value. SAS005 increases security for stored passwords by using the SHA-256 hashing algorithm and is hashed for additional iterations. You can configure the metadata server to store any new or updated passwords using SAS005.

SAS 9.4M4
This release provides these enhancements:
- enhanced Webseal information
- certificate management
- new default minimum encryption levels with TLS configurations
SAS 9.4M3
This release provides these enhancements:

• the ability to audit internal accounts on the middle tier
• the ability to specify a whitelist of sites that are allowed to link to SAS web applications
• improved Transport Layer Security
• Windows Challenge/Response (NTLM) support for proxy authentication

SAS 9.4M2
In SAS 9.4M2, Integrated Windows Authentication on Linux systems no longer requires the use of Quest Authentication Services. SAS can leverage the libraries that are shipped with the supported operating system or that are provided in most third-party authentication solutions.

SAS 9.4M1
SAS 9.4M1 provides the ability to put a SAS server in a locked-down state, ensuring that the process can access only designated resources in the host operating environment. For more information, see “Locked-down State” on page 30.

SAS 9.4
You can now use either SAS Management Console or the AUTHLIB procedure to bind SAS data to metadata. All access from SAS to metadata-bound data is subject to metadata-layer permissions.

For more information, see “Audit and Report More about SAS and SAS Applications” on page 33.

**SAS Web Server and SAS Web Application Server**

Starting in SAS 9.4, the middle-tier software includes SAS Web Server for use as an HTTP server and SAS Web Application Server, so that a third-party web application server is no longer needed. SAS Web Application Server is a lightweight server that provides enterprise-class features for running SAS web applications. The SAS deployment tools can configure these servers automatically. The tools simplify the configuration of vertical and horizontal clustering as well as HTTP load balancing.

• In SAS 9.4M5, the version of SAS Web Application Server used in the middle-tier environment has been upgraded. It is now based on Apache Tomcat version 8.5.13.
• In SAS 9.4M3, SAS has made changes that are expected to result in a 40% to 50% decrease in start-up time for SAS Web Application Server.

**Metadata Server Clustering**

The metadata server clustering feature provides redundancy and high availability of the metadata server, which is a core component of the SAS infrastructure. Clustering ensures that the server continues to operate if a server host machine fails.

Effective with SAS 9.4M2, metadata server clustering is supported on z/OS. In previous SAS 9.4 releases, it is supported only on UNIX and Windows.

**Backup Tools**

The Deployment Backup and Recovery tool provides an integrated method for backing up and recovering SAS content across multiple tiers and machines.
SAS 9.4M3 includes SAS Backup Manager, which is an easy-to-use interface for scheduling, configuring, monitoring, and performing integrated backups. The interface incorporates most of the functions of the Deployment Backup and Recovery tool’s batch commands. SAS Backup Manager can be accessed from the Administration tab of SAS Environment Manager.

**Batch Tools for Relationship Reporting**

- SAS 9.4M3 includes a new batch command that enables you to use SAS Metadata Bridges to load third-party lineage information to the SAS Relationship Service.
- SAS 9.4M2 includes a new batch command that you can use to run the metadata analyze and repair tools that are available in SAS Management Console.
- SAS 9.4M1 includes new batch tools for relationship reporting. You can use these tools to identify relationships among the content objects in the SAS Folder tree.

**Smaller WAR Files for SAS Web Applications**

Starting in SAS 9.4M3, some SAS web applications no longer include JAR files, which makes the corresponding WAR files smaller. The web applications that support this feature now load the common JAR files from a central repository in the SASHome directory instead of including copies of the files in the WAR file. This change results in a smaller configuration area.

**DataFlux Integration**

Beginning in 2012, SAS has fully integrated the DataFlux suite of data quality, data integration, data governance, and master data management solutions. SAS data management offerings now include products with the DataFlux name, such as Data Management Studio, as well as other SAS products, including Base SAS, SAS/ACCESS interfaces, and the SAS Metadata Server.

When SAS integrated the DataFlux product line into SAS offerings, some products such as SAS MDM and SAS Federation Server were enhanced and rebranded. Other products have retained the DataFlux name but continue to be enhanced and adapted to SAS. Support for SAS Metadata Server has been added to DataFlux Data Management Studio on an incremental basis. For example, DataFlux Data Management Studio 2.5 and 2.6 can use either DataFlux Authentication Server or SAS Metadata Server for user authentication.

New SAS offerings, including the comprehensive SAS Data Management Advanced and Standard offerings, replace offerings such as SAS Enterprise Data Integration Server. These offerings enable customers to choose from a broader array of data management products and enable them to add SAS products such as SAS LASR Analytic Server and SAS Visual Analytics Administration and Reporting.

**Changes to Migration and Deployment**

SAS 9.4M4

A new migration utility property enables you to increase the Java heap size for the SAS Content Server repository. This utility also preserves the customizations for your TLS configurations.
SAS 9.4M3
In SAS 9.4M3, several features have been added to the SAS Deployment Wizard:

• If the wizard is interrupted and then restarted during the installation phase, it will install only those SAS products that it has not already installed.

• The wizard enables you to reduce the number of password prompts for required SAS internal accounts, metadata-based server accounts, and SAS Web Infrastructure Data Server accounts.

Support has also been added for compressing and validating SAS Software Depots. In addition, the SAS Migration Utility has been enhanced to protect passwords in the migration package from being exposed.

SAS 9.4M2
The SAS Deployment Wizard enables you to specify the size of your web application based on the number of users and workload. In addition, the SAS Deployment Wizard provides an option to install only the newly released documentation.

SAS 9.4M1
A feature has been added that identifies those versions of SAS offerings that are unable to be migrated directly to SAS 9.4 with the SAS Migration Utility. The Migration Utility Analysis Report identifies which products to update in order to prepare them for migration.

Processing the Configuration Folders
Starting in SAS 9.4M4, you can use the new USERCONFIG system option to specify whether to process the .sasv9.cfg and sasv9.cfg configuration files in a user’s home directory.

General Enhancements

• In SAS 9.4, users can view some SAS Web Report Studio relational reports on mobile devices with SAS Visual Analytics Apps. In addition, users can manage mobile access permissions through the use of whitelisting and blacklisting devices.

• Beginning in October 2014, new roles and capabilities are available for SAS Add-In 7.1 for Microsoft Office and SAS Enterprise Guide 7.1.

• Starting in SAS 9.4M3 and the release of SAS Visual Analytics 7.2, Visual Analytics Hub is a sibling of Visual Analytics, immediately below SAS Application Infrastructure. This adjustment to the software architecture is reflected on the Plug-ins tab in SAS Management Console.

• In SAS 9.4M6, support has been added for a new scheduler named the SAS Job Flow Scheduler. SAS Job Flow Scheduler is a component of SAS Grid Manager.

Additional Information
For more information about changes from the previous release, see SAS Intelligence Platform in SAS Guide to Software Updates and Product Changes.

For more information, see these What’s New topics:

• What’s New in Installation and Configuration for the SAS 9.4 Intelligence Platform in the SAS Intelligence Platform: Installation and Configuration Guide
SAS Information Retrieval Studio 1.53

SAS Information Retrieval Studio 1.53 provides SSL support for search.

For more information, see “Updates to SAS Information Retrieval Studio for SSL” in SAS Intelligence Platform: Middle-Tier Administration Guide.

SAS Theme Designer 5.1

SAS Theme Designer 5.1 shipped in May 2019. Here are the new features:

- For application themes, the Pin the pane and Unpin the pane options enable you to pin or unpin the side pane in the Preview pane.
- When editing an application theme in context, you can save a theme without publishing it.
- The primary color is used for application themes only. It is not used in report themes.
- If you import a SAS theme and a theme with the same name already exists, you can choose to overwrite the current theme or create a second theme.

SAS Theme Designer for Flex

SAS Theme Designer 4.7 for Flex

You can now access SAS Theme Designer 4.7 for Flex from a new Sign-In Screen. When accessing SAS Theme Designer 4.7 for Flex from the SAS Visual Analytics 7.2
Home page, the Home banner enables you to select the SAS Theme Designer (Classic) option. When you select this option, the SAS Theme Designer for Flex opens.

**SAS Theme Designer 4.2 for Flex**

The User Interface Components pane and the Properties pane have been combined into a single pane for SAS Theme Designer 4.2 for Flex. The User Interface Components pane now contains all components to create or modify a theme. In addition, you can now customize the font style for a theme. In the User Interface Components pane, the Global Settings option now contains a setting for Font.

The name for a theme is now assigned when you are saving or saving and deploying a theme. And, when a theme is deployed, undeployed, or deleted in SAS Theme Designer 4.2 for Flex, the list of available themes is immediately updated in applications that use Flex themes.

For more information, see What’s New in SAS Theme Designer 4.2 for Flex in SAS Theme Designer for Flex: User’s Guide.

**SAS Theme Designer 4.1 for Flex**

For SAS Theme Designer 4.1 for Flex, the SAS Corporate theme is now the default theme, which has been updated with a new color palette that is based on a navy blue palette.

You can now access SAS Theme Designer for Flex from the SAS Visual Analytics Hub to create custom themes. In addition, report themes are now automatically created when a custom application theme is created in SAS Theme Designer for Flex. These custom report themes can then be used in SAS Visual Analytics reports.
Chapter 13
SAS IT Resource Management

SAS IT Resource Management

SAS IT Resource Management 3.10
SAS IT Resource Management 3.10 became available in June 2019 and runs on SAS 9.4M6. This release includes these new features and enhancements:

• a simplified web application for the IT Resource Management Report Center
• updates to the VMware vCenter Adapter for the vCenter Server Application
  vPostgres database
• updates to the Adapter for MXG 36.36

See the resources:

• For more information about this release, see the product documentation page for SAS IT Resource Management.

SAS IT Resource Management 3.9
SAS IT Resource Management 3.9 became available in May 2018 and runs on SAS 9.4M5. New in this release are updates to adapters based on MXG software for MXG 36.01. Additional updates include Amazon CloudWatch, System Activity Report (SAR), Microsoft System Center Operations Manager for Windows Server Operating System 2003/2008 R2/2012/2012 R2, Windows Server Operating System 2016, and updates to SQL Server Memory metrics.
SAS IT Resource Management 3.8
SAS IT Resource Management 3.8 became available in February 2017 and runs on SAS 9.4M4. In this release, a new feature allows MXG software tables and columns that are not natively supported by the solution to be added to IT Resource Management metadata and staging jobs. Also new in this release are updates to adapters based on MXG software for MXG 34.08 and VMware vCenter adapter updates for VMware 6.5. In addition, packages that contain the Visual Analytics reports for VMware vCenter described in Appendix 14 of *SAS IT Resource Management: Administrator’s Guide* are provided.

SAS IT Resource Management 3.7
SAS IT Resource Management 3.7 became available in February 2016. In this release, two new adapters are provided: Amazon CloudWatch and Ganglia. As with earlier releases, there are also multiple adapter updates.

SAS IT Resource Management 3.6
SAS IT Resource Management 3.6 became available in May 2015. In this release, two new adapters are provided: SAS Environment Manager and ASG TMONDB2 V5. As with earlier releases, there are also multiple adapter updates. In addition, the copy function of ITRM Report Center is enhanced.

SAS IT Resource Management 3.5
SAS IT Resource Management 3.5 became available in September 2014. In this release, upon request, SAS Visual Analytics and the in-memory SAS LASR Analytic Server can be included with the solution. Reference documentation about installing and configuring SAS IT Resource Management without the SAS middle tier is available in *Guide to Operating SAS IT Resource Management 3.5 without a Middle Tier*. Version updates as well as enhanced support capabilities are provided for multiple adapters with this release. As is true for all releases, there are also multiple adapter updates.

SAS IT Resource Management 3.4
SAS IT Resource Management 3.4 became available in December 2013. In this release, you can use exception analysis processing to define, evaluate, detect, and report on exceptional conditions in IT data marts. Also new in this release is the ITRM Report Center web application used to view, organize, filter, and share SAS IT Resource Management performance and exception reports. Integration with SAS Visual Analytics was added through macros that enable you to load and update ITRM tables into the SAS LASR Analytic Server. There is a new wizard to add domain categories to an existing staging transformation. As is true for all releases, there are also multiple adapter updates.
Chapter 14
SAS Risk Management

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SAS Enterprise GRC 6.1

SAS shipped SAS Enterprise GRC 6.1 in October 2014.

This release has added several new features, which include, but are not limited to the following:

- The procedure to install SAS Enterprise GRC and its dependent products has been simplified.
- SAS Enterprise GRC 6.1 now integrates with SAS Visual Analytics. Users can now shift between the SAS Enterprise GRC and SAS Visual Analytics user interfaces for managing and running reports. In addition, two new SAS Visual Analytics reports are provided by default.
- New security features have been added to protect the server from malicious web traffic.
- Attachments can now be filtered by name and file type.
- Updates have been made to screen definitions and workflows to improve usability and performance.
- Several new data loaders have been added.

See these resources:

- For more information, see the software product page for SAS Enterprise GRC.
- For more information about changes from the previous release, see SAS Enterprise GRC

Note: The documentation for SAS Enterprise GRC is available only to customers who license this product.

SAS Firmwide Risk for Solvency II

About SAS Firmwide Risk for Solvency II

SAS Firmwide Risk for Solvency II performs risk analysis and risk-based capital calculations for insurers. With a data management and reporting platform that includes an insurance-specific data model, you can implement the Solvency II standard model approach for calculating risk-based capital. The solution has as its foundation an extendible risk analytics framework to support other regulatory regimes. It also supports an internal model approach for risk analysis, providing insurance companies with additional business benefit. SAS Firmwide Risk for Solvency II is designed to perform risk analysis and risk-based capital calculations for all insurance companies. It supports the standard model approach for Solvency II compliance at solo entity and insurance group levels.

SAS Firmwide Risk for Solvency II also performs these tasks:

- stress testing and scenario analysis
- calculation of risk margins
• aggregation of risk capital charges
• calculation of solvency capital requirements (SCR) and minimum capital requirements (MCR)
• regulatory and internal risk reporting

The current release of SAS Firmwide Risk for Solvency II is 3.2.

SAS Firmwide for Solvency II Content Releases

The SAS Firmwide Risk for Solvency II solution is delivered as a content release that runs on the SAS Infrastructure for Risk Management platform. Solutions that are based on SAS Infrastructure for Risk Management share the same architecture and layout. The difference between the solutions is the calculation content that is delivered in a solution’s content release. After installing SAS Infrastructure for Risk Management, you must separately download and install the SAS Firmwide Risk for Solvency II content release to complete the installation.

See these resources:
• For more information about new features and enhancements in the latest SAS Firmwide for Solvency II content release, see the SAS Firmwide Risk for Solvency II product page.
• For more information about changes from the previous release, see SAS Firmwide Risk for Solvency II

Note: The documentation for SAS Firmwide Risk for Solvency II is available only to customers who license this product.

SAS Market Risk Management for Insurance

About SAS Market Risk Management for Insurance

SAS Market Risk Management for Insurance enables insurance companies to perform asset valuation, portfolio allocation, and risk management analysis in a flexible, configurable, and high-performance environment. You can integrate, manage, and analyze data, run multiple models, and quantify the risks underlying your market portfolio.

SAS Market Risk Management for Insurance is designed for IT managers to govern the enterprise risk data management process; risk analysts to quantify the risk exposure and perform simulations and what-if analysis; and senior managers to monitor risk level and make risk-based strategic business decisions.

The solution provides these features:
• flexible risk analysis framework
• risk data management and governance
• market risk assessment and monitoring
• financial instrument modeling
• stress testing and what-if analysis
• visualization and reporting
• high-performance capabilities

The current release of SAS Market Risk Management for Insurance is 7.2.

SAS Market Risk Management for Insurance Content Releases

The SAS Market Risk Management for Insurance solution is delivered as a content release that runs on the SAS Infrastructure for Risk Management platform. Solutions that are based on SAS Infrastructure for Risk Management share the same architecture and layout. The difference between the solutions is the calculation content that is delivered in a solution's content release. After installing SAS Infrastructure for Risk Management, you must separately download and install the SAS Market Risk Management for Insurance content release to complete the installation.

For more information about new features and enhancements in the latest SAS Market Risk Management for Insurance content release, see the SAS Market Risk Management for Insurance product page.

Note: The documentation for SAS Market Risk Management for Insurance is available only to customers who license this product.

SAS Model Implementation Platform

About SAS Model Implementation Platform

SAS Model Implementation Platform is a robust software platform that is built to handle the diverse challenges that institutions face when implementing and executing systems of credit risk models.

SAS Model Implementation Platform is designed for model developers, model implementation teams, and analysts who are responsible for models that support activities such as forecasting, stress testing (CCAR and DFAST), reserving, calculating expected credit loss (IFRS 9 and CECL), and loan valuation.

SAS Model Implementation Platform performs the following actions:

• streamlines the pipeline between estimating models and implementing those models into an integrated system
• provides a controlled, transparent, and replicable model execution environment
• improves auditability with a searchable, centralized model repository
• provides pre-built modeling templates to simplify the setup of new modeling frameworks such as the Cox proportional hazards model, the Monte Carlo state-transitions model, and the Markov chain transitions model
• enables thread-safe parallelization without the need to write any distributed processing code
• uses scalable, in-memory technology to quickly process complex loan-level modeling systems for all portfolios across the enterprise
• provides the ability to aggregate model results for millions of loans, and enables visual exploration and drill-down through those results
• provides built-in tools for backtesting, model sensitivity analysis, and attribution analysis
For more information, see the software product page for SAS Model Implementation Platform.

Note: The documentation for SAS Model Implementation Platform is available only to customers who license this product.

**SAS Model Implementation Platform 3.2**

SAS shipped SAS Model Implementation Platform 3.2 in June 2019. This release includes SAS 9.4M6 and SAS High-Performance Risk 4.2.

Here are some of the new actions that you can perform in this release:

- execute a scenario run and a portfolio cube run in a single analysis run
- submit a new originations run, which includes both existing portfolio data and synthetic new originations in the analysis
- execute model unit tests
- create an editable copy of a modeling system so that you can perform what-if analysis
- use SAS Code Debugger to debug the code that is generated for analysis runs and model unit tests
- generate the $\chi^2$ data for each model variable and horizon combination that is included in an analysis run or a model unit test
- customize the HPEXPORT procedure for analysis runs
- implement Python models (preproduction)
- implement analytic store models (preproduction)
- explore and decompose attribution analysis results by different cross-classification variables
- enable job queuing so that administrators can limit job throughput and assign users a priority
- use system-supplied macros to call the SAS Model Implementation Platform REST API so that you can submit an analysis run, replace a model in a model group, or publish a run to a modeling system

**SAS Model Implementation Platform 3.1**

SAS shipped SAS Model Implementation Platform 3.1 in June 2018. This release includes SAS 9.4M5 and SAS High-Performance Risk 4.1.

Here are some of the new actions that you can perform in this release:

- perform attribution analyses to analyze differences between two analysis runs
- use the SAS Risk Model Editor component to publish models to SAS Model Implementation Platform
- define your own backtesting metrics, or use the built-in backtesting metrics
- publish the backtesting-metrics data to SAS Model Risk Management
- define custom librefs to expand the input and output data locations
- display a graph of the economic scenarios in the user interface
• remove an object and simultaneously remove all of its dependent objects
• analyze cash flow legs, and use time bucket schemes to group the results
• define multiple shocks within a single scenario in a scenario run with model sensitivity analysis
• specify multiple derived-from variables for the variable definitions in an atomic model
• use the SAS Risk Work Groups component to register and manage work groups for SAS Model Implementation Platform

SAS Model Implementation Platform 2.4

SAS shipped SAS Model Implementation Platform 2.4 in June 2017. This release includes SAS 9.4M4 and SAS High-Performance Risk 3.8.

Here are some of the new actions that you can perform in this release:

• explore the effect of perturbing portfolio or economic inputs on the results of your model
• encrypt a model group’s user-defined logic and model methods
• add computed methods, computed roll-up methods, function sets, and risk data objects to analysis runs
• provide dynamic model overrides
• use the following new model forms: transitionMatrix, custom, and code
• cancel an in-progress run (best effort), and force delete a run even though one or more of its artifacts cannot be deleted

SAS also shipped SAS Model Implementation Platform 2.4 in September 2017. This release includes SAS 9.4M5 and SAS High-Performance Risk 3.9.

Here are some of the new actions that you can perform in this release:

• debug the models, model groups, and PostProcess methods that are included in an analysis run that contains computed methods
• use the syntax `package_name.function_name` to call a function in the user-defined logic and methods that are included in an analysis run

SAS Model Implementation Platform 2.3

SAS shipped SAS Model Implementation Platform 2.3 in November 2016. This release includes SAS 9.4M4 and SAS High-Performance Risk 3.7.

Here are some of the new actions that you can perform in this release:

• publish collections of portfolio analysis objects (execution logic) together as a single, versioned system
• implement a formal approval process for your models and modeling systems
• use the following new model forms: pdCurves and emModel
• use work groups in Windows environments
• delete multiple analysis runs simultaneously
• replace models in a model group
create and manage templates for user-defined logic
• customize the SAS Risk Dimensions environment for analysis runs
• offset exposures in a portfolio data set

SAS Model Risk Management

About SAS Model Risk Management

SAS Model Risk Management runs on SAS 9.4M2. It is a user-friendly, web-based application that facilitates the capture and life cycle management of statistical model-related information. That information is then used to conduct all aspects of model risk management, including governance. Specifically, SAS Model Risk Management facilitates the entry, collection, transfer, storage, tracking, and reporting of models that are drawn from multiple lines of business across an organization. It also integrates with other SAS products, including the SAS Workflow Engine and SAS Visual Analytics.

SAS Model Risk Management enables you to perform the following activities:
• create, update, and track your model inventory across the model life cycle
• conduct model reviews, including full scope validation and other types of reviews
• perform assessments of model candidates
• create and track findings (effective challenges) and develop action plans
• conduct change management related to all aspects of the model life cycle
• conduct model usage tracking
• measure, manage, and monitor model risk assessment
• retire models
• initiate and manage "in system" ad hoc communication
• manage documents and workflows
• create and manage model governance policies
• enhance and extend all functional capabilities provided with the solution
• access an aggregated view of models through interactive dashboards
• generate reports based on entered and collected data

Each of these activities can be tied to other activities in the system. Therefore, the SAS Model Risk Management application provides an integrated and centralized framework for collecting, managing, and storing model information, while capturing all changes, communication, and interactions across the model life cycle.

The SAS Model Risk Management system also provides the ability to extensively customize the user interface and add new fields, links, and user interface elements; rename windows and labels; add new screens; and so on.

SAS Model Risk Management 7.3

SAS shipped SAS Model Risk Management 7.3 in December 2017. This release runs on SAS 9.4M5.
Here are some of the new features and enhancements in this release:

- model performance tracking with Model Monitoring
- the ability to manage a targeted review of internal models (TRIM)
- support for the bulk approval of model risk management business objects
- support for additional custom business objects
- support for Rich Text formatting in additional fields

For more information, see the software product page for SAS Model Risk Management.

**SAS Model Risk Management 7.2**

SAS shipped SAS Model Risk Management 7.2 in November 2016. This release runs on SAS 9.4M4.

Here are some of the new features and enhancements in this release:

- the ability to integrate model metadata with SAS Model Implementation Platform for the storage and classification of model-related information
- the ability to export models for import and use in SAS Model Implementation Platform
- significant improvements to search capabilities, including the ability to conduct searches across all business objects
- support for rich text formatting of fields (for example, the Comments field)
- a built-in Groovy editor for programming new functions and components
- updates to email notification templates
- performance improvements for business objects that contain a large number of custom fields or links
- the ability to select models and download attachments for those models to a user’s PC
- updates to screen definitions
- reporting improvements

**SAS Model Risk Management 7.1**

SAS shipped SAS Model Risk Management 7.1 in July 2016. This release runs on SAS 9.4M3. Here are some of the new features and improvements in this release:

- completely redesigned user interface with improved navigation and usability
- a significant content update that includes these features:
  - the addition of the model risk assessment feature
  - the addition of the inventory attestation feature
  - the addition of the data sources feature
  - an overhaul of the model inventory, model review, findings, and action plans features
  - significant reporting improvements, including a set of new reports and integration with Microsoft Office
• intelligent provisioning of defaults for business objects
• support for up to 25 custom business objects
• improved automation and support for migration
• a rich and extensive set of options to support relationships between models (upstream/downstream, parent/child, prior versions, and so on)
• improvements to search capabilities

SAS OpRisk VaR 6.1

SAS OpRisk VaR 6.1 enables you to perform incremental data load, incremental VaR calculation, and reporting using web services rather than the user interface. New reports in this release include FFIEC – Schedule 5 and COREP – Operational Risk.

Here are the enhanced analytics in this release:

• the ability to compute the effect of one additional large loss on VaR
• the ability to model the severity of your losses by combining two lognormal distributions

SAS OpRisk VaR 6.1M2 shipped in May 2015 and runs on SAS 9.4M3. Here are some of the new features and enhancements in this release:

• Custom scaling enables you to define your own scale factors for internal data.
• Single loss approximation to VaR enables you to quickly learn how different modeling choices affect the VaR.
• Additional dependence structure options provide you with increased flexibility in specifying the dependence structure for a simulation.

See these resources:

• For more information about this release, see the software product page for SAS OpRisk VaR.
• For more information about changes from the previous release, see SAS OpRisk VaR in SAS Guide to Software Updates and Product Changes.

SAS Risk and Finance Workbench

About SAS Risk and Finance Workbench

SAS Risk and Finance Workbench provides an efficient and collaborative environment for regulatory risk and finance projects that involve classification, measurement, and reporting activities. The following regulations and standards are typical subjects of such projects:

• IFRS 9 Financial Instruments (IFRS 9)
• Current Expected Credit Loss (CECL) model
• Dodd-Frank Act Stress Testing (DFAST)
SAS Risk and Finance Workbench 3.2

SAS shipped SAS Risk and Finance Workbench 3.2 in July 2018. This release runs on SAS 9.4M6. The following list provides some of the new features and enhancements:

- support for new data load formats and file types
- additional roles and capabilities to enable more flexible user management schemes
- usability improvements to project and worksheet features
- enhanced style support for notifications
- expanded support for formulas in worksheets
- enhancements to the SAS Risk and Finance Workbench API

See these resources:

- For more information about this release, see the software product page for SAS Risk and Finance Workbench.
- For more information about changes from the previous release, see SAS Risk and Finance Workbench in SAS Guide to Software Updates and Product Changes.

SAS Risk and Finance Workbench 3.1

SAS shipped SAS Risk and Finance Workbench 3.1 in December 2017. This release runs on SAS 9.4M5. The following list provides some of the new features and enhancements:

- full support for dimensions
- configuration archives to manage projects and model groups
- the ability to send notifications from a project on an ad hoc basis
- expanded support in process definitions for custom notifications and task groups
- improvements to user management and access with risk work groups
- the ability to run sensitivity analyses with model groups
- enhanced parameter definition for scripts

See these resources:

- For more information about this release, see the software product page for SAS Risk and Finance Workbench.
- For more information about changes from the previous release, see SAS Risk and Finance Workbench in SAS Guide to Software Updates and Product Changes.

Note: The documentation for SAS Risk and Finance Workbench is available only to customers who license this product.
SAS Risk and Finance Workbench 2.3

SAS shipped SAS Risk and Finance Workbench 2.3 in November 2016. This release runs on SAS 9.4M4. The following list provides some of the new features and enhancements:

- object security with work groups
- allocation of aggregated data values to details
- drill-down support for aggregated data
- ability to launch SAS scripts from task actions
- versioning support
- ability to lock projects
- enhanced log information
- selection of worksheet templates for projects
- enhancements to the SAS Risk and Finance Workbench API

SAS Risk Dimensions

SAS Risk Dimensions 6.X runs on SAS 9.4. Here are some highlights for these releases:

  This release includes infrastructure changes to support SAS High-Performance Risk 3.1 and SAS Risk Management for Banking 3.2. These statements were also added to the RISK procedure: NLOPT, DRIVER, READSCENARIOS, and WRITESCENARIOS.
  In this release, the ANALYSISGROUP argument was added to the READSCENARIOS statement for the RISK procedure.
- SAS Risk Dimensions 6.5 shipped in October 2015 and supports SAS 9.4M3.
  This release includes infrastructure changes to support SAS High-Performance Risk 3.5 and SAS Model Implementation Platform 2.1.
- SAS Risk Dimensions 6.6 shipped in April 2016 and supports SAS 9.4M3.
  This release includes changes to support SAS High-Performance Risk 3.6 and SAS Risk Management for Banking 3.4. Also, in this release, GBM (Geometric Brownian motion) was added as a new value to the MLEVEL argument in the DECLARE statement for the RISK procedure.
- SAS Risk Dimension 6.8 shipped in June 2017 and supports SAS 9.4M4.

SAS Risk Dimensions now provides a way to apply pre-computed values for Deltas, Gammas, and the base case value to a sensitivity analysis or a DeltaNormal analysis.
You specify these values in a Sensitivities data set, and register them for use in the MARKETDATA statement of SAS Risk Dimensions.

- SAS Risk Dimensions 6.9 shipped in September 2017 and supports SAS 9.4M5.

The latest release is SAS Risk Dimensions 6.11.

See these resources:

- For more information about this release, see the software product page for SAS Risk Dimensions.
- For more information about changes from the previous release, see SAS Risk Dimensions in SAS Guide to Software Updates and Product Changes.

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**SAS Risk Management for Banking**

**SAS Risk Management for Banking 3.4**

SAS Risk Management for Banking 3.4 shipped in July 2016. In this release, the regulatory reporting regime for European Banking Authority (EBA) is supported for Taxonomy 2.4.1.1.

See these resources:

- For more information about this release, see the software product page for SAS Risk Management for Banking.
- For more information about changes from the previous release, see SAS Risk Management for Banking in SAS Guide to Software Updates and Product Changes.

*Note:* The documentation for SAS Risk Management for Banking is available only to customers who license this product.

**SAS Risk Management for Banking 3.3**

SAS Risk Management for Banking 3.3 extends the bank’s capability to assess, monitor, optimize, and create regulatory reports for financial risks. The various analyses within SAS Risk Management for Banking can be run on SAS High-Performance Risk in addition to SAS Risk Dimensions. Running calculations of large portfolios in a distributed environment on SAS High-Performance Risk has substantial performance benefits. The multithreading capabilities of SAS High-Performance Risk also mean that performance is enhanced even in solo mode.

New Monte Carlo simulation methods are offered for several of the analysis tasks.

The regulatory Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR) calculations are extended in the areas of classification of contingent cash flows and in accounting for collateral. The collateral management tools enable you to perform these tasks:

- estimate collateral shortfalls
- predict the impact of the downgrading of collateral assets
- predict the impact of the downgrading of the bank
predict the impact of derivative volatilities

SAS Underwriting Risk Management for P&C Insurance

About SAS Underwriting Risk Management for P&C Insurance

SAS Underwriting Risk Management for P&C Insurance enables insurance companies to perform loss estimation, reserving and risk management analysis within a single, flexible and high-performance analytics environment. Analysts can blend actuarial and financial techniques to value P&C insurance liabilities using an internal model approach.

SAS Underwriting Risk Management for P&C Insurance is designed to be used by actuarial and investment analysts, risk analysts and managers, IT managers and senior management at P&C insurance companies.

The solution provides the following features:

- integrated data management
- blend of actuarial and financial techniques for valuing P&C insurance liabilities on both an accident- and underwriting-year basis
- flexible risk analysis and reporting framework
- high-performance capabilities

The current release of SAS Underwriting Risk Management for P&C Insurance is 3.2.

SAS Underwriting Risk Management for P&C Insurance Content Releases

The SAS Underwriting Risk Management for P&C Insurance solution is delivered as a content release that runs on the SAS Infrastructure for Risk Management platform. Solutions that are based on SAS Infrastructure for Risk Management share the same architecture and layout. The difference between the solutions is the calculation content that is delivered in a solution’s content release. After installing SAS Infrastructure for Risk Management, you must separately download and install the SAS Underwriting Risk Management for P&C Insurance content release to complete the installation.

For more information about new features and enhancements in the latest SAS Underwriting Risk Management for P&C Insurance content release, see the SAS Underwriting Risk Management for P&C Insurance product page.

Note: The documentation for SAS Underwriting Risk Management for P&C Insurance is available only to customers who license this product.
Chapter 15
SAS Visual Analytics

SAS Visual Analytics

About SAS Visual Analytics

SAS Visual Analytics is a web-based product that uses SAS high-performance analytic technologies to explore huge volumes of data quickly in order to see patterns and trends.

SAS Visual Analytics 7.5

SAS Visual Analytics 7.5 shipped in May 2019 and supports SAS 9.4M6 and later releases.

Here are some of the general enhancements in this release:

- The user interface has been rewritten in HTML5. Previously, many SAS applications and SAS solutions used the Adobe Flash Player to provide interactive user interfaces. Adobe has announced that it intends to end support for Flash technology and will stop updating and distributing the Flash Player at the end of 2020. Browser vendors will disable Flash by default in 2019. For more information about Adobe Flash end-of-life, see SAS Software and Its Use of the Adobe Flash Player.

- The SAS Visual Analytics Explorer (the explorer) and the SAS Visual Analytics Designer (the designer) interfaces have been combined into a single interface.
There are new side panes. For example, the new **Outline** pane provides you with a convenient way to work with pages and objects in your report.

The existing side panes have been updated. For example, you can right-click a data item in the **Data** pane to add the item as either a report control or a page control.

New objects have been added. For example, the new key value object can be used to highlight numeric and categorical values in an infographic.

Existing objects have been improved. For example, the pop-up menus now enable you to move objects; sort, replace, or remove data items; and print or share an object.

New features are available for geo maps. For example, geo maps support animation for all map types.

There are enhanced parameters. For example, you can have parameters based on date and datetime formats.

Accessibility has been enhanced. SAS Visual Analytics is now accessible via the keyboard. Some graphs have integration with SAS Graphics Accelerator.

Functionality that was previously in SAS Visual Analytics Administrator is now incorporated in SAS Environment Manager Administration. For more information, see [What’s New in Administration of SAS Visual Analytics](#).

SAS Visual Data Builder 7.5 has these new features and enhancements:

- The user interface has been rewritten in HTML5. Previously, many SAS applications and SAS solutions used the Adobe Flash Player to provide interactive user interfaces. Adobe has announced that it intends to end support for Flash technology and will stop updating and distributing the Flash Player at the end of 2020. Browser vendors will disable Flash by default in 2019. For more information about Adobe Flash end-of-life, see [SAS Software and Its Use of the Adobe Flash Player](#).

- The interface for maintaining data queries has been modernized, but the steps for creating and maintaining queries are basically the same.

- The expression builder enables you to create calculated columns, WHERE clauses, and HAVING clauses for data queries. This window has been enhanced for 7.5. Among other improvements, the expression builder enables you to select more functions for analyzing and processing data.

- The scheduling interface for queries has been simplified for 7.5. You can select **Unschedule** to stop the execution of a scheduled query. The query is saved automatically after scheduling.

- Hadoop data sources now have a separate section in the **Import** window.

See these resources:

- For more information about this release, see [What’s New in SAS Visual Analytics 7.5: Details](#) and [What’s New in SAS Visual Data Builder 7.5](#).

- For more information about changes from the previous release, see [SAS Visual Analytics](#) in [SAS Guide to Software Updates and Product Changes](#).

**SAS Visual Analytics 7.4**

SAS Visual Analytics 7.4 shipped in April 2017 and supports SAS 9.4M4 and later releases.
Here are some of the general enhancements in this release:

- SAS Visual Analytics Designer (the designer) has dynamic text, improved calculations, as well as enhanced prompted filter controls, parameters, report links, and section links.

- The modern SAS Visual Analytics Viewer (the viewer) now contains most of the features that the classic viewer had, which enables many users to switch to the modern viewer.

- Enhanced printing features enable you to have page breaks in the PDF for list tables and to show the filter context for filter controls. Another new feature enables the same footer to be printed on every page of a report. For example, you could have the same legal statement on each page in all of your company’s reports. The customized footer is also displayed in reports that are distributed using the designer. (This feature must be enabled by a SAS administrator using SAS Management Console.) For more information, see What’s New in SAS Visual Analytics Administration 7.4 in SAS Visual Analytics 7.4: Administrator’s Guide.

- Importing data from Teradata no longer requires a user name and password.

### SAS Visual Analytics 7.3

SAS Visual Analytics 7.3 shipped in August 2015 and supports SAS 9.4M3. SAS Visual Analytics 7.3 contains these updates:

- Samples tables, sample reports, and a sample exploration (if you have SAS Visual Analytics Explorer) are now available. When the samples are installed, you can access them from SAS Home (the home page).

- You can now import data from a Pivotal HAWQ database.

- SAS Visual Analytics Designer has a new **Expand clipped content** option, which is available for printing to PDF. This option enables you to print the entire content of tables, crosstabs, gauges, and containers with content that is only partially available in the layout of the report section.

- SAS Visual Analytics Viewer has a new appearance called modern, which is the default. You can use preferences to specify the default appearance of the viewer as modern or classic. The modern appearance includes a **Report Refresh** setting, which lets you specify how many minutes to wait between update checks.

For more information, see What’s New in SAS Visual Analytics 7.3 in SAS Visual Analytics 7.3: User’s Guide.

### SAS Visual Analytics 7.2

SAS Visual Analytics 7.2 shipped in May 2015 and supports SAS 9.4M2. SAS Visual Analytics 7.2 contains many updates, including the following:


- Decision tree visualizations include an icicle plot of the nodes in the tree.

- You can import data from Google Analytics, Facebook, and MapR. You can import a ZIP file that contains a single spreadsheet or delimited text file.
A new report theme, SAS Snow, provides a clean, uncluttered default appearance for your reports.

When you print a report to PDF, new options are available (for example, you can add page numbers).

When you send a report by email, you can attach a PDF of the report.

Calculated data items and grouped category data items can be changed into geographic data items and used in geo maps.

In URLs that link to reports in the designer or viewer, you can include parameter-value pairs. For example:


For more information, see What’s New in SAS Visual Analytics 7.2 in SAS Visual Analytics 7.2: User’s Guide.

SAS Visual Analytics 7.1

SAS Visual Analytics 7.1 shipped in October 2014 and supports SAS 9.4M2. SAS Visual Analytics 7.1 contains many updates, including the following:

- Importing data from Pivotal HD and Cloudera Impala is supported.
- A new Sankey diagram visualization enables you to perform path analytics. Path analytics displays flows of data from one event (value) to another as a series of paths.
- With goal seeking, you can specify a target value for the forecast measure, and then determine the values of the underlying factors that would be required to achieve the target value.
- Text analytics in a word cloud visualization enables you to analyze the sentiment of documents in your document collection. It also enables you to explore a selection of specific documents as a new visualization.
- Parameters are supported for report controls, and can be used in calculations, filters, ranks, and display rules.
- New options for printing to PDF are available for reports. You can use category data items, calculated items that are categories, and custom categories in custom sorts. You can distribute reports to other users based on a schedule. Report designers can localize (or translate) the labels, tooltips, and other descriptive text that are part of reports.
- A predefined report provides insight into how your site uses SAS Visual Analytics. The report is populated after you enable auditing, and is visible only to administrators.


SAS Visual Analytics 6.4

SAS Visual Analytics 6.4 shipped in March 2014 and supports SAS 9.4M1. SAS Visual Analytics 6.4 contains many updates, including the following:

- You can now import data from these third-party vendor database servers:
  - Aster
• BigInsights
• Cloudera
• DB2
• Greenplum
• Hortonworks
• MySQL
• Netezza
• ODBC
• Oracle
• PostgreSQL
• Salesforce
• SAP HANA
• SQL Server
• Teradata
• Vertica

• Importing data from massively parallel processing databases has been enhanced.
• Working with visualizations usability is improved.
• Designing reports usability is improved.


SAS Visual Analytics 6.3

SAS Visual Analytics 6.3 shipped in December 2013 and supports SAS 9.4M1. SAS Visual Analytics 6.3 contains many new features, including the following:

• Simplified self-service capabilities enable users to quickly and easily load their own data, whether the users are exploring data or designing a report.
• You can use Esri mapping technology when exploring data and designing reports.
• Network diagrams enable you to see the relationships and contributions between elements with nodes on a chart and across a geo map.
• Alerts that are based on expressions notify report subscribers when metrics reach specific values.
• You can create custom graph templates for reports.
• Guest access, which does not require a login ID or password, is available for viewing explorations, reports, and dashboards.
• New text analysis capabilities enable you to understand the most common terms and topics discussed in your Twitter streams or other text fields such as "customer comments."

Integration with SAS Office Analytics enables customers to display SAS Visual Analytics content in Microsoft Excel, PowerPoint, Word, Outlook, and SharePoint.

Here are some of the updates in SAS Visual Analytics 6.2:

- The SAS Visual Analytics home page now displays tables, and the search has been enhanced to include any registered SAS types, not only reports, explorations, and stored processes.

- SAS Visual Data Builder now supports input tables from the SAS LASR Analytic Server and has improved performance with the Greenplum Data Computing Appliance.

- In SAS Visual Analytics Explorer, forecasting has been enhanced to support underlying factors and scenario analysis. You can now create aggregated measures and perform decision tree analysis. You can also rank your data based on the greatest and least aggregated values.

- SAS Visual Analytics Designer has been enhanced to give you the ability to create new aggregated calculated items for tables and graphs, filter or rank your data based on the top or bottom values, and change the report theme. You can add links to a specific section in a target report or add links from a report object, text, or image to another report. You can group more than five gauges in a report.

- Using SAS Visual Analytics Administrator, you can define permission conditions in an interactive editor. You can use either blacklisting or whitelisting to manage mobile devices. You can register tables.


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SAS Visual Statistics

About SAS Visual Statistics

SAS Visual Statistics uses the in-memory capabilities of SAS LASR Analytic Server to create and compare powerful statistical models in an easy-to-use, web-based interface. SAS Visual Statistics extends the capabilities of SAS Visual Analytics by creating, testing, and comparing models on the basis of the patterns discovered in SAS Visual Analytics. SAS Visual Statistics enables you to export model score code in order to apply your model to new data.

SAS Visual Statistics is integrated with SAS Visual Analytics in order to provide a seamless transition between the two solutions. Documentation for SAS Visual Statistics 7.2 and later is included in the documentation for SAS Visual Analytics.

For more information, see the product documentation page for SAS Visual Statistics.

SAS Visual Statistics 7.5

SAS Visual Statistics 7.5 shipped in May 2019 and runs on SAS 9.4M6. Here are some of the general enhancements in this release:

- The user interface has been rewritten in HTML5. Previously, many SAS applications and SAS solutions used the Adobe Flash Player to provide interactive user interfaces. Adobe announced that it intends to end support for Flash technology and will cease
to update and distribute the Flash Player at the end of 2020. Browser vendors will disable Flash by default in 2019. For more information about Adobe Flash end-of-life, see SAS Software and Its Use of the Adobe Flash Player.

- The SAS Visual Analytics Explorer (the explorer) and the SAS Visual Analytics Designer (the designer) interfaces have been combined into a single interface.
- You can select **Duplicate as** to duplicate an object and change its type at the same time.
- You can create new objects from data items that are selected in other objects.
- You can export the score code of the champion model.
- New detail tables relating to model information, lift, ROC, and assessment statistics are available.
- Model comparison objects are saved in the reports.
- New settings and style options are available.

For more information about this release, see SAS Visual Statistics 7.5: What’s New.
Part 2

SAS Viya 3.5

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Highlights of New Features in SAS Viya 3.5

- The new SAS Job Flow Scheduler includes the Job Flow Editor that enables the graphical editing and management of complex job flows.
- Support is added for IBM Power9 and Linux on Power with the POWER9 chip.
- Stored processes, visual data builder queries, and some OLAP cube structures can be migrated from a SAS 9 environment to corresponding objects in SAS Viya.
- SAS Studio adds the ability to create job definitions with prompting.
- SAS Infrastructure Data Server is updated to use PostgreSQL version 11.
- SAS Cloud Analytic Services adds support for Apache Parquet data files. The server must use Linux. The files can be loaded and saved with Path, DNFS, or Amazon Web Services S3 caslibs.
- SAS Cloud Analytic Services adds support for Hadoop distributions built on Apache Hadoop version 3.
- SAS Viya can be deployed on machines that have multiple network interface cards (NICs). When you install a deployment, you can specify the NIC for SAS to use on each machine.
• SAS Cloud Analytic Services has the following enhancements for caslib data sources:

• The server supports adding a caslib to Azure Data Lake Storage Gen2 for data access. The ADLS caslib type supports loading and saving delimited files (CSV files) and Optimized Row Columnar (ORC) files.

• The server can assign caslibs to remote HDFS clusters on a caslib-by-caslib basis. Each remote HDFS cluster must be configured for SASHDAT access with the SAS Plug-ins for Hadoop. In earlier releases, the server could access either a single co-located cluster or a single remote cluster for use with HDFS caslibs.

For information about specifying NICs, see “Installation” in *SAS Viya for Linux: Deployment Guide*.

For information about using CAS with Hadoop version 3, see Configuring CAS SASHDAT Access to HDFS.

### About SAS Viya

Here are the key software components in SAS Viya.

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>The analytics engine to SAS Viya</td>
<td>In SAS Viya, the SAS High-Performance Architecture and SAS LASR Analytic Server from SAS 9 are replaced by a unified third-generation high-performance analytics engine.</td>
</tr>
<tr>
<td></td>
<td>• SAS Cloud Analytic Services (CAS) is a server that is suitable for both on-premises and cloud deployments. The server provides the run-time environment for data management and analytics. By run-time environment, we refer to the combination of hardware and software where data management and analytics take place.</td>
</tr>
<tr>
<td></td>
<td>• The server can run on a single machine or as a distributed server on multiple machines. The distributed server consists of one controller, an optional backup controller, and one or more workers. This architecture is often referred to as a massively parallel processing architecture. For both architectures, the server is multi-threaded for high-performance analytics.</td>
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<td></td>
<td>• The distributed server has a communication layer that supports fault tolerance. A distributed server can continue processing requests even after losing connectivity to some nodes. The communication layer also enables you to remove or add worker nodes from a server while it is running.</td>
</tr>
<tr>
<td>Component</td>
<td>Description</td>
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</tr>
<tr>
<td>A modular set of supporting services</td>
<td>SAS Viya contains several services often referred to as microservices. A <em>microservice</em> is a small service that runs in its own process and communicates with a lightweight mechanism (HTTP). Some of the services in SAS Viya are Authorization, Backup, and CAS Management. Use SAS Environment Manager to see the complete list of SAS Viya services.</td>
</tr>
<tr>
<td>A web application for basic administration</td>
<td>CAS Server Monitor is a web application that you use to monitor your CAS server and to perform some administration tasks.</td>
</tr>
<tr>
<td>A web application for enterprise administration</td>
<td>SAS Environment Manager is a web application for managing a SAS Viya environment. It includes a dashboard, which provides an at-a-glance view of your environment’s health and status, as well as detailed views that enable you to examine and manage your environment in detail.</td>
</tr>
<tr>
<td>A web application for writing and submitting code</td>
<td>SAS Studio is a tool that you can use to write and run SAS code through your web browser. With SAS Studio, you can access your data files, libraries, and existing programs and write new programs.</td>
</tr>
<tr>
<td>A web application for visual reporting, exploration, and modeling</td>
<td>SAS Visual Analytics uses SAS high-performance analytic technologies and empowers organizations to explore huge volumes of data quickly to identify patterns, trends, and opportunities for further analysis. The highly visual, drag-and-drop data interface of SAS Visual Analytics, combined with the speed of SAS Cloud Analytic Services (CAS), accelerate analytic computations and enable organizations to derive value from massive amounts of data. This power creates an unprecedented ability to solve difficult problems, improve business performance, predict future performance, and mitigate risk rapidly and confidently. Users can quickly create reports or dashboards, which can be viewed on a mobile device or on the web.</td>
</tr>
<tr>
<td>Component</td>
<td>Description</td>
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<td>-----------</td>
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</tr>
<tr>
<td>Multiple application programming interfaces</td>
<td>SAS Viya uses PROC CAS to run CAS actions in SAS Cloud Analytic Services. You can use the REST APIs for any client language to access SAS analytics, data, and services. You can also use programming interfaces for Python, Java, and Lua to access this CAS functionality. In addition, you can continue to submit SAS code in batch mode. For more information, see SAS for Developers.</td>
</tr>
</tbody>
</table>

For more information, see *SAS Cloud Analytic Services: Fundamentals*.

**Cumulative Functionality**

Among some of the products in SAS Viya, available functionality is cumulative.

- SAS Visual Analytics provides baseline functionality, including reporting and basic analytics.
- SAS Visual Statistics provides an additional set of advanced analytic functions.
- SAS Visual Data Mining and Machine Learning provides a second additional set of advanced analytic functions.

**Comparing SAS 9 and SAS Viya**

<table>
<thead>
<tr>
<th>Item for Comparison</th>
<th>SAS 9</th>
<th>SAS Viya</th>
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<tr>
<td>Servers</td>
<td>SAS 9 contains these servers:</td>
<td>SAS Viya contains these servers:</td>
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<td>-------------------------</td>
<td>---------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------</td>
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<td></td>
<td>• SAS Metadata Server</td>
<td>• SAS Cloud Analytic Services</td>
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<td></td>
<td>• SAS Workspace Server</td>
<td>• SAS Workspace Server and Object Spawner</td>
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<td></td>
<td>• SAS Pooled Workspace Server</td>
<td>• SAS Infrastructure Data Server</td>
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<td></td>
<td>• SAS Stored Process Server</td>
<td>• SAS Configuration Server</td>
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<td></td>
<td>• SAS OLAP Server</td>
<td>• SAS Message Broker</td>
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<tr>
<td></td>
<td>• SAS Web Infrastructure Platform Data Server</td>
<td>• SAS/CONNECT Server and Spawner</td>
</tr>
<tr>
<td></td>
<td>• SAS/CONNECT Server and Spawner</td>
<td>• embedded web application server</td>
</tr>
<tr>
<td></td>
<td>• SAS Content Server</td>
<td></td>
</tr>
<tr>
<td>Data Location</td>
<td>SAS 9 uses LIBNAME engines and librefs to refer to directories of SAS data sets, database servers, and so on. SAS reads the data before running the analysis or DATA step. Many data sources enable you to run summary procedures and functions in-database. You must aggregate the data in some way before running the analysis or DATA step.</td>
<td>SAS Viya still uses LIBNAME engines and librefs for traditional workloads. CAS adds caslibs, which is a server-side data access strategy. A caslib includes a data source such as a directory of files or a database server. When you access data from the caslib, the CAS server performs the data access rather than SAS. Starting in SAS Viya 3.3, in-database support is available using SAS Scoring Accelerator. In SAS Viya, SAS/ACCESS is available for the Hadoop and PC Files LIBNAME engines. For additional data sources, data connectors are available. For example, if you order the SAS/ACCESS interface to Oracle, you receive the data connector to Oracle. For distributed servers, your data can be distributed across various worker nodes, and the processing of that data occurs on that node. For massive parallel processing, CAS uses parallel file storage in HDFS, but also supports parallel file storage via network file systems. As a result, Hadoop is no longer a requirement.</td>
</tr>
<tr>
<td>Management Tools</td>
<td>SAS 9 uses a variety of management tools such as SAS Management Console and SAS Deployment Manager.</td>
<td>SAS Viya consolidates administrative tasks into a completely rewritten SAS Environment Manager. CAS Server Monitor is also available for a programming-only deployment.</td>
</tr>
<tr>
<td>Installation, Configuration, and Maintenance</td>
<td>SAS 9 uses SAS proprietary tools such as SAS Deployment Wizard and SAS Deployment Manager. To apply updates and maintenance releases to your SAS 9 environment, you must take your system offline for a period of time.</td>
<td>SAS Viya uses industry-standard tools, such as Ansible, for installation and configuration. SAS uses RPM packages to deliver the software. At installation, these packages are downloaded either from an internet repository or a mirror of this repository at your site.</td>
</tr>
</tbody>
</table>
Backups

In SAS 9, backups are created using SAS Environment Manager or SAS Management Console.

In SAS Viya, backups are performed using CAS actions and REST APIs. In this release, the backup service does not include a scheduling feature or an email alert feature.

Availability

In SAS 9, a failed LASR node or job could potentially impact everyone on that server.

In SAS Viya, CAS server processes and CAS session processes are independent of each other.

Interfaces

In SAS 9, analytics procedures are accessed through SAS interfaces and REST-based services.

SAS Viya provides an open user experience. You can use your existing skill sets in SAS, Python, Lua, Java, or REST to access SAS analytics.

Relationship between SAS 9.4 and SAS Viya

**SAS Viya Augments SAS 9**

SAS 9 and SAS Viya are two run-time environments built for different use cases. However, these environments share some functionality. For example, SAS 9 uses the SAS programming language, and SAS Viya uses the next generation of SAS programming with the new CAS programming language. The CAS language is very similar to the SAS language. Some procedures are available in both SAS 9 and SAS Viya, so some existing SAS code can be run in SAS Viya. However, SAS Viya also contains new procedures that take advantage of the open, distributed environment. As a result, some SAS 9 procedures do not exist in SAS Viya.

Because of the advancement in technology and infrastructure since SAS 9 was released, the technology of SAS Viya is very different from SAS 9. Here are some examples:

- **SAS Cloud Analytic Services**, delivered in SAS Viya, is the third generation of in-memory services from SAS. It replaces SAS LASR Analytic Server and the SAS High-Performance Analytics engine in SAS 9.

- For functionality other than CAS, the SAS 9 concept of governing roles and capabilities has been replaced with rules that target a service, a service endpoint, a media type, or a pseudo URL.

- Instead of metadata-based authorization, SAS Viya maintains data access authorizations within SAS Cloud Analytic Services.

- In SAS Viya, CAS uses a VARBINARY data type that enables image analysis. The CAS server supports the VARCHAR data type, which uses character semantics and varying length variables.
SAS Viya Interoperates with SAS 9.4

- You can make your SAS 9.4 data available to SAS Viya.
- You can migrate your user-defined format catalogs.
- You can remotely submit SAS 9 code to run in SAS Viya. You can include CAS-enabled procedures in SAS 9 code and run that code in SAS Viya, if it is available.

SAS Viya is designed to coexist with SAS 9.4 solutions and the SAS 9 environment. For a list of procedures that can run CAS actions, see SAS Procedures That Can Run CAS Actions in Base SAS Procedures Guide.

See Also
SAS Viya: Overview

Differences in Programming

UTF-8 Session Encoding

In SAS Viya, UTF-8 is the only available session encoding. UTF-8 is a variable-width multi-byte encoding that encompasses most character sets.

If SAS Viya can determine the data encoding, it automatically transcodes non-UTF-8 encodings to UTF-8 when it reads data. If a data set character encoding does not match the SAS session encoding, the data set must be transcoded to UTF-8 before it can be used in SAS Viya. If the encoding cannot be determined, data sets must be transcoded programmatically. Caution is necessary to ensure that columns are wide enough for UTF-8 encodings. If the columns are not wide enough, data truncation might occur. You can use the CVP engine to enlarge character columns.

See Also
Migrating Data to UTF-8 for SAS Viya

SAS Cloud Analytic Services (CAS)

SAS Cloud Analytic Services, the CAS server, is the next step for SAS in the evolution of SAS Analytics high-performance distributed processing on single or multiple machines.

The following list highlights how the CAS server is different from SAS LASR Analytic Server:

- Fault tolerance on the CAS server detects when a node no longer operates and distributes that node’s work to other nodes.
- Processing occurs in CAS server sessions and not in server processes, enabling CAS session monitoring, resource tracking, and resource management.
- In-memory tables can have local (session) or global scope.
- The CAS server can process tables when memory capacity is exceeded.
- The CAS server interfaces with third-party software such as Python, Lua, Java, and REST APIs.
• All table operations are performed in a caslib. A caslib is an in-memory space to hold tables, access control lists, and access data source information.

• PROC CASUTIL is a new procedure to manage CAS server tables, including loading and saving tables. Data in tables can be loaded serially or in parallel.

• The CHARACTER data type in SAS 9 uses byte semantics and supports fixed widths. The CAS server supports the VARCHAR data type, which uses character semantics and varying length variables.

• Similar to SAS LASR Analytic Server, the basic unit of work is an action, which performs a single task. You submit actions to the CAS server either by using PROC CAS and the CAS language (CASL), or by using third-party software.

• The SAS Analytic procedures and the DATA step have been rewritten for parallel processing in multiple cores or server nodes. The DATA step has some language element restrictions.

• DS2 and FedSQL run on the CAS server. FedSQL has some restrictions.

• Catalogs are not supported on the CAS server. To support user-defined formats, format libraries are associated with caslibs.

• Some utility procedures, such as the PRINT procedure, pull data from the CAS server to process but run on the SAS Workspace Server.

See Also

• An Introduction to SAS Viya Programming

• SAS Cloud Analytic Services: Fundamentals

SAS Programming Interfaces

SAS Studio is the SAS language code editor in SAS Viya. The SAS windowing environment and SAS Enterprise Guide are not available in SAS Viya. However, you can use these interfaces to submit code to a CAS server when the SAS 9 environment has access to a SAS Viya environment. You can also submit SAS code by using batch mode or line mode processing. Python, Lua, and Java programmers can submit code to the CAS server using their respective programming environments.

In addition to the procedures that are introduced for SAS Viya, programmers can run the CAS actions that underpin many of the procedures. Running CAS actions is supported from these programming languages:

• CASL – SAS Studio provides the CAS procedure and the CAS language.

• Python 2.7+, Python 3.4+ – SAS provides the SAS wrapper for analytics transfer (SWAT) that enables Python to communicate with CAS and run actions.

• Lua 5.2+, 5.3+ – Similar to Python, SAS provides a SWAT library that enables Lua to communicate with CAS and run actions.

• Java 8 – SAS provides a client JAR file that enables any environment that is Java 8 compliant to communicate with CAS and run actions.

• REST – CAS offers an embedded HTTP server that can be accessed for running actions.
SAS Analytic Procedure Results

The SAS Analytic procedures create in-memory output tables that contain the procedure results. Some of these tables are used as input for scoring, and some are the results of scoring. Several of these procedures save their models as an analytic store, which is a binary object that contains that procedure’s state after the procedure completes the training phase of data analysis. You use an analytic store as input to the ASTORE procedure to score data at a later time.

You can save in-memory tables to disk in a path-based caslib. By default, the suffix is .sashdat. For smaller in-memory tables, you can also use a DATA step to save data as a client-side data set in a physical location that is associated with a libref. If you specify a .csv suffix, a CSV file is saved. In-memory tables persist until they are dropped.
Chapter 17
SAS Viya Administration

New Features and Enhancements for SAS Viya 3.5

Here are some of the key administrative features in SAS Viya 3.5:

• Reduced footprint. The disk and memory footprint of SAS Viya has been reduced. Much of this has been achieved by combining microservices. In certain SAS Environment Manager views, you will see a shorter list of services.

• Promoting content from SAS Viya to SAS Viya is enhanced with a new inventory plug-in to the sas-admin command-line interface.

• A new health check service (healthcheck) is provided as a sas-admin plug-in.

• Licensed users can use the Job Flow Scheduler in the Jobs and Flows section of SAS Environment Manager to create complex flows. The entry Jobs in SAS Environment Manager becomes Jobs and Flows if you have a SAS Job Flow Scheduler license.

• Jobs for scheduling or including in a flow can be created from a SAS DATA step program.

• The contents of the Application Menu on the left have been significantly improved.

• SAS Studio has two flavors: SAS Studio (Basic) and SAS Studio (Enterprise). SAS Studio (Basic) is used in a programming-only environment and SAS Studio (Enterprise) is used in a full environment.

See Also

SAS Viya Administration: What’s New
Working with Backups

- Use the following command to cancel a backup:

\[\text{sas-admin backup cancel -i=<backup-job-id>}\]

A cancel is an asynchronous operation. It returns the current state of the backup. The user can execute the SHOW command to determine whether the backup was canceled.

- All SAS Message Broker exchanges, queues, bindings, users, virtual hosts, permissions, and parameters are backed up. Actual messages are not backed up.

- The backups are retained for a period that is set by an administrator. The default value for the retentionPeriod property is 30 days. The retentionPeriod property can be modified by selecting **Backup service** on the Configuration page in SAS Environment Manager. Click **New Configuration**, and then select **sas.deploymentbackup**.

SAS Data Preparation

**SAS Data Explorer 2.5**

SAS Data Explorer 2.5 shipped in November 2019 and runs on SAS Viya 3.5. Here are some of the new features and enhancements:

- You can now define connections to these data sources: S3 (Simple Storage Services of Amazon Web Services), ADLS (Azure Data Lake Storage Gen2), and Snowflake, MongoDB, Google BigQuery, and Salesforce databases.

- You can now load an imported table into memory without saving a physical copy of the table to the target destination. This feature offers a significant performance gain for small tables.

- Several new import options enable you to copy content from multiple tables or files and load it to an in-memory table for analysis.

- You can copy a source table to a target table in a different format. For example, you can copy a SAS table to a Parquet table.

- You can add a user-defined connection to a project on a SAS Event Stream Processing Server.

- If you license SAS Data Preparation, you can use the **dataexplorer** command-line interface (CLI) to automate data management. Support for generic data connectors is new for this release.

For more information, see **What’s New in SAS Data Explorer 2.5**.

**SAS Data Studio 2.5**

Here are some of the new features in SAS Data Studio 2.5:
• You can select a format when you save target tables. The available formats depend on the library where the table is saved.

• You can set the data type of the cluster ID generated by the Match and Cluster transform. The available options are **Double** (8 bytes) and **Char** (12 bytes).

• You can now remove all but one row from a set of rows that have identical values in a list of user-specified fields.

• You can load a table to memory without saving a physical copy of the table to the target destination. This option can provide a significant performance boost for small tables.

• The Simple Random partitioning method has been added to the Analytical Partitioning transform.

• The Suggestions feature uses machine learning to analyze your data and suggest transforms and actions that you can add to your SAS Data Studio plans.

For more information, see *What’s New in SAS Data Studio 2.5*. 
Chapter 18
SAS Cloud Analytic Services

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Enhancements to the CAS Procedure

**New CASL Functions**

The following CASL functions are new:

- The ACTIONQ function displays the action queue.
- The EXECUTE function compiles and executes the code that is provided as an argument to the EXECUTE function.

**New Common Functions**

The following common functions are new for the CAS procedure:

- The RAND function generates random numbers from a distribution that you specify.
- The CALL STREAMINIT function specifies a random-number generator and seed value for generating random numbers.

**See Also**

*SAS Cloud Analytic Services: CASL Reference*

Enhancements to SAS Deep Learning

**SAS Deep Learning Toolkit on SAS Viya 3.5**

*Note:* You must have SAS Visual Data Mining and Machine Learning licensed and installed to use these action sets.

The SAS Deep Learning toolkit is a growing set of cloud-enabled deep neural networking CAS actions, most recently released with SAS Viya 3.5. The actions are delivered as part of SAS Visual Data Mining and Machine Learning (VDML) 8.5. The new SAS Deep Learning toolkit includes the Python open-source utility SAS DLPy, as well as these Deep Learning key features:

- supports Windows 64-bit operating environments on a single GPU.
- supports the Linux on Power platform with SMP, MPP, and GPUs. SAS Deep Learning and SAS Viya 3.5 specifically support models using the POWER9 chip.
- the SAS Deep Learning tools provide GPU performance improvements on processing speed and memory utilization.
- supports Mask R-CNN for instance segmentation.
- supports a new RoI Alignment layer.
- supports Layer Normalization.
- supports a new embedding loss layer to train Siamese, triplet, and quartet networks.
• supports a Survival layer type for the addLayer action (in the deepLearning action set) in order to create deep survival analysis analytic models.

• supports the Cosine Margin Softmax loss function. For more information, see Embedding with Cosine Margin Softmax Loss in the SAS Deep Learning technical documentation for the Output layer.

• supports CNN layers in RNN models. For more information, see Requirements for Mixing Sequential and Fixed-Dimension Layers in the RNN model technical documentation.

• supports transfer learning with Transformer-based NLP architectures (such as BERT) on CPU. Here the base architecture is fixed (not trainable), whereas the task-specific terminating layers are fully trainable.

• supports multi-head attention with the Multi-Head Attention layer.

• supports GPU scoring for CPU-trained RNN and LSTM models, and vice versa. For more information, see the technical documentation on RNN Model Portability.

• supports the robust TRish optimization algorithm. For more information, see TRish with Momentum in the model optimization technical documentation.

• supports the Layer-wise Adaptive Rate Scaling (LARS) algorithm for distributed training with large batch-size.

• supports custom FCMP functions that you can use to define early stopping criteria during training.

• supports data augmentations (such as cropping, mutating, and flipping) for object detection and segmentation tasks.

• supports deep clustering unsupervised learning applications.

• supports computing more model metrics for model classification and segmentation tasks. For more information and usage details, see the Evaluating Segmentation Models example for the SAS deepLearn action set.

• the dlTrain, dnnTrain, and rnnTrain actions now support the options freezeLayers and freezeLayerTo as part of the optimizer. These options enable you to freeze one or more layers in a deep network.

• the addLayer action of the SAS deepLearn action set now supports a sharingWeights option. You use the sharingWeights option to share variable weights between model layers.

• supports a Split Layer to split features into multiple branches in CNN.

• includes updated tools, libraries, and examples in the SAS DLPy utility.

See Also

Enhancements to SAS Visual Text Analytics Action Sets

Overview

SAS Visual Text Analytics 8.5 includes the ability to use the Sampling and Partitioning action set, a redesigned action, new action examples, new action parameters, the ability to search for special missing values, improved concept scoring in the Korean language, improvements to extraction of predefined concepts in the Danish language, improved coverage of predefined concepts in the Spanish language, and performance enhancements.

Enhanced Functionality

SAS Visual Text Analytics is a text analytics framework that combines text mining, contextual extraction, categorization, sentiment analysis, and search.

Note: You must have SAS Visual Text Analytics licensed and installed to use these action sets.

• SAS Visual Text Analytics 8.5 includes improved text processing.
• The SAS Visual Text Analytics 8.5 license includes the ability to use the Sampling and Partitioning action set.
• The ruleGen action has been redesigned in SAS Visual Text Analytics 8.5 to generate LITI concept and fact rules that might be useful in your analysis.
• You can now use the appendIndex and searchIndex actions in the Search action set to search for special missing values.
• Capabilities for morphological expansion in the Korean language have been enhanced. Terms used in CONCEPT, C_CONCEPT, CONCEPT_RULE, SEQUENCE, PREDICATE_RULE, REMOVE_ITEM and NO_BREAK rules are now automatically expanded to include inflectional forms. When scoring these rules with the applyConcept action, the inflectional forms will match in addition to the term in the rule. In other words, if the stem of a word (for example, "하다") is in a CONCEPT rule, inflectional forms in the dictionary (such as "했다", "하면서", or "하시면") in a document will be matched.
• Extraction of predefined concepts in the Danish language has been enhanced. The ability to extract predefined concepts (including terms that denote a place, organization, person, or date) has been improved in the Danish language in SAS Visual Text Analytics 8.5. These improvements also include the ability to identify time expressions and percent value in documents, as well as improved accuracy in identifying part-of-speech tags.
• Coverage of predefined concepts in the Spanish language has been enhanced. The coverage of the predefined concepts nlpTime, nlpDate, nlpMoney, and nlpCurrency has been extended for the Spanish language. In addition, fully elaborated combined date-and-time spans such as "21 agosto a las 16:00" are now recognized in their entirety as nlpTime.
New Action Parameters

- SAS Visual Text Analytics 8.5 includes the following new action parameters in the Search action set:
  - You can now use the casOut parameter in the searchAggregate action to write results to a CAS table.
  - You can now use the casOut parameter in the valueCount action to write results to a CAS table.
  - You can now use the trim parameter in the valueCount action to specify whether to trim the padding spaces of a JavaScript Object Notation (JSON) report.

- SAS Visual Text Analytics 8.5 includes the new action parameter exclude in the ruleGen action in the Text Analytics Rule Development action set. The exclude parameter specifies an input table that contains the concept rules that you want to exclude from your analysis.

- SAS Visual Text Analytics 8.5 includes the new option outputTableAnalysisLevel for the build parameter for the exportTextModel action in the Text Analytics Rule Development action set. The outputTableAnalysisLevel option enables you to specify which output tables are generated when exporting a sentiment astore model. A value of All for this option generates all output tables, and a value of DOCUMENT generates only a document-level sentiment output table. If you want to score a sentiment astore model using a Micro Analytic Service (MAS) or the SAS Embedded Process (EP), you should use the DOCUMENT value because MAS and EP support only one output table.

See Also

- SAS Visual Text Analytics: Programming Guide
- SAS Visual Analytics: Programming Guide

Enhancements to SAS Visual Data Mining and Machine Learning 8.5 Action Sets

New Kernel Principal Component Analysis (kernelPCA) Action Set

The Kernel Principal Component Analysis (kernelPCA) action set was added in SAS Visual Data Mining and Machine Learning 8.5 (November 2019 release of SAS Viya 3.5).

KPCA is a nonlinear extension to the widely used linear dimensionality reduction technique principal component analysis (PCA). KPCA exploits the “kernel trick” to implicitly map the original data to certain high-dimensional RKHS (reproducing kernel Hilbert space) and implement PCA in that space. The resulting projections onto the kernel principal components extract the nonlinear pattern in the data.

The kernelPCA action in this action set also features fast training and fast scoring methods, which greatly alleviate the computational and memory burden that is associated with ordinary KPCA while achieving comparable accuracy. These methods are based on low-rank matrix approximation coupled with $k$-means clustering as a
sampling scheme. Thanks to this approximation, the kernelPCA action is capable of handling large data tables efficiently. The kernelPCA action can be applied in many areas, including nonlinear dimensionality reduction, nonlinear data visualization, kernel principal component regression, image denoising, novelty detection, and so on.

For more information, see Kernel Principal Component Analysis Action Set in SAS Visual Data Mining and Machine Learning: Programmer’s Guide.

**New Reinforcement Learning Action Set**

Along with supervised learning and unsupervised learning, reinforcement learning is one of the major branches of machine learning. Each branch of machine learning differs in the manner of feedback the model receives during training.

- Supervised learning methods require data to be labeled so that the model can compare its output to the target output and can determine how the model should change to improve. Supervised learning models are often used for predictive or classification tasks.

- Unsupervised learning techniques do not require data to be labeled. Instead of comparing model output to a target, unsupervised learning methods compare the data to itself to find useful patterns or groupings within it.

- Reinforcement learning methods rely on a reward signal for training feedback. The reward signal is a scalar function that indicates the goodness or badness of the agent’s decisions. Reinforcement learning models attempt to learn a policy that maximizes this reward signal over some sequence of time steps.

For more information about reinforcement learning, see SAS Visual Data Mining and Machine Learning: Reinforcement Learning Programming Guide

**Enhanced Action Sets**

These action sets were enhanced in SAS Visual Data Mining and Machine Learning 8.5 (November 2019 release of SAS Viya 3.5):

- Analytic Store Scoring action set
  - This action set now supports varbinary data type in the Embedded Process (EP) code and for SAS Event Stream Processing.
  - The action set now supports multiple output tables and multiple output rows per input row for SAS Event Stream Processing.
  - The action set now supports the Hidden Markov Model action set, the Kernel Principal Component Analysis action set, the Mixed Modeling action set, the Reinforcement Learning action set, and the gamSelect action in the Generalized Additive Models action set.

- Autotune action set
  - These actions are new:
    - The tuneDeepForest action automatically adjusts deep forest parameters to tune a model for minimum error.
    - The tuneGlm action automatically adjusts linear regression parameters to tune a model for minimum error.
    - The tuneLabelSpread action automatically adjusts label spreading technique parameters to tune for minimum loss function value.
• The tuneLogistic action automatically adjusts logistic regression parameters to tune a model for minimum error.

• The relative importance of each hyperparameter based on all configurations evaluated is now reported in a new results table.

• The action set now supports the creation of a CAS table from the evaluation history of all model configurations that have been evaluated. This history table can be created in real time while the tuning action is running, allowing dashboarding of the autotune data. It can also be fed back into subsequent autotune executions as a lookup table to initialize to a previous best point and avoid duplicate evaluations.

• The tuneDecisionTree, tuneForest, and tuneGradientBoostTree actions can now optionally tune the leafSize parameter.

• The tuneForest action now supports tuning of the nBins parameters.

• BioMedImage action set

• The processBioMedImages action enables users to filter ROIs by their display color in the DICOMRT_SPECIFIC substep of the ROI2MASK step. Accordingly, if the DICOM-RT data contain contours for multiple organs, each with a different value of the ROI Display Color DICOM attribute, the user can select a single organ for the action to generate segmentation images.

• The processBioMedImages action incorporates a new step called BINARY_OPERATION, which supports operations on pairs of biomedical images. The step currently includes one substep called MASK_SPECIFIC, which can be used to mask one image with another.

• The processBioMedImages action includes a new step called HISTOGRAM_EQUALIZATION, which enhances the contrast of biomedical images. This step consists of the BASIC substep, which considers the histogram of the entire image, and the ADAPTIVE substep, which uses the histogram of a chosen image window.

• Data Science Pilot action set

• The new detectInteractions action searches for interactions among pairs of predictor variables in a regression or classification data table. The action generates an output CAS table that contains the candidate interactions ranked according to their interaction strength. The action implements an efficient and scalable algorithm to handle data tables that contain a large number of predictor variables as well as a large number of observations.

• The new generateShadowFeatures action generates new random features by a scalable, random permutation of the input features. These randomly permuted features, usually referred to as shadow features, can be used for all relevant feature selection.

• The featureMachine action has several new parameters and updates. The rankPolicy parameter specifies the ranking policy to apply to the generated features; the interaction parameter controls the generation of interaction features; and features now come with autogenerated labels that describe the transformations.

• The dsAutoML action has several new parameters. These include an expanded saveState parameter to support the generation of analytic score objects for both the feature generation and the top-k models; generalized linear model (GLM) and logistic model types; and an hpOptimizer parameter to specify the hyperparameter optimizer to use for model hyperparameter tuning.
Explain Model action set

- A new shapleyExplainer action quickly gives accurate Shapley value estimates by using the HyperSHAP method invented by SAS.
- The partialDependence action now supports a second analysis variable and more analysis variable parameters, including using missing values as a valid level and reading in user-defined levels.
- The linearExplainer action now supports more parameters for training regression models and supports including missing values in the analysis.
- All actions in the action set now support the use of DS2 code to accompany an analytic store model, as well as multiple analytic stores as part of a full model.
- The Factorization Machine (factmac) action set now accepts data that contain missing values without issuing an error. Observations that have missing values are excluded from the analysis.
- In the Graph-Based Semisupervised Learning action set, a loss function was added to demonstrate the computation results based on graph prediction.

Image action set

- The condenseImages action generates encoded or decoded image tables, depending on the value of the new decode parameter. Most common photographic image formats, such as JPG and PNG, are supported for the encoding.
- The RESIZE step in the processImages action now supports preserving the aspect ratio of images during resizing by using the new type parameter.
- The MUTATIONS step in the processImages action has a new parameter called angle. You can use the angle parameter with the ROTATE_LEFT and ROTATE_RIGHT values of the type parameter to rotate images by arbitrary angles.
- The MUTATIONS step in the processImages action now supports perspective transformations of images. You can perform a perspective transformation by specifying the WARP_PERSPECTIVE value of the type parameter and the values of the homography matrix in the new homographyValues parameter.

Network action set

- The internalFormat parameter has been deprecated. The best underlying internal structures are chosen for the requested algorithm.
- For algorithms that support multilinks, the default value of the multiLinks parameter is True. Previously, this default was determined by the value of the internalFormat parameter.
- The loadGraph action enables you to load graph input data tables and build in-memory data structures for subsequent analyses.
- The unloadGraph action enables you to delete in-memory data structures that have been loaded with the loadGraph action.
- You can now find network projections by using the new projection action, which creates a single-partition graph from a multiple-partition graph.
- New features have been added to the community, cycle, nodeSimilarity, patternMatch, and summary actions.
In the Support Vector Machine action set, the earlyStop parameter is new. If this parameter is set to True and the partition parameter is specified, the action uses the validation data to determine whether to stop the iterations early.

For more information about these action sets, see SAS Visual Data Mining and Machine Learning: Programming Guide.

SAS Visual Statistics 8.5 Action Sets

New Action Sets

These action sets are new for SAS Visual Statistics 8.5 (November 2019 release of SAS Viya 3.5):

- The Distribution System Simulation (simSystem) action set simulates continuous univariate data from distributions in the Pearson and Johnson systems.
- The Nonlinear Models (nonlinear) action set performs nonlinear model fitting.
- The Nonnegative Matrix Factorization (nmf) action set performs nonnegative matrix factorization.
- The Sparse Regression (sandwich) action set analyzes linear models by using the classical robust sandwich variance estimator.

New Actions

These actions are new for SAS Visual Statistics 8.5 (November 2019 release of SAS Viya 3.5):

- The gamSelect action in the gam action set fits and performs model selection on generalized additive models.
- The logisticLackfit action in the regression action set performs the Hosmer-Lemeshow goodness-of-fit test for binary and polytomous response models by using a model that was previously fit and stored by the logistic action and a (possibly new) data table.
- The logisticOddsRatio action in the regression action set performs odds ratios for effects from a model that was previously fit and stored by the logistic action.
- The nlmol action in the nonlinear action set performs nonlinear model fitting by using the maximum likelihood or nonlinear least squares method. You can define the nonlinear models either by using standard distributions or by specifying a general likelihood function.
- The nmf action in the nmf action set performs nonnegative matrix factorization, which seeks to approximately decompose a nonnegative data matrix into two low-rank nonnegative factor matrices.
- The simsk action in the simSystem action set uses the Pearson and Johnson systems to simulate continuous univariate data for any given feasible values of mean, standard deviation, skewness, and kurtosis.
- The sparseReg action in the sandwich action set analyzes linear models by using the classical robust sandwich variance estimator.
Enhanced Actions

These actions were enhanced in SAS Visual Statistics 8.5 (November 2019 release of SAS Viya 3.5):

- In the glm action, the new ELASTICNET value of the method subparameter in the selection parameter specifies the elastic net method, an extension of LASSO that estimates parameters by using a version of ordinary least squares in which both the sum of the absolute regression coefficients and the sum of the squared regression coefficients are constrained. If the model contains classification variables, then these corresponding effects can be split.

- genmod action
  - The new inParmEst parameter enables you to input starting values for the optimizations.
  - The new maxResponseLevels parameter enables you to specify the maximum number of allowed response levels.
  - The new useLastIter parameter requests that the action continue its computations even when the optimization fails.

- logistic action
  - The new inParmEst parameter enables you to input starting values for the optimizations.
  - The new maxResponseLevels parameter enables you to specify the maximum number of allowed response levels.
  - The new lackfit parameter performs the Hosmer-Lemeshow goodness-of-fit test for binary and polytomous response models.
  - The new useLastIter parameter requests that the action continue its computations even when the optimization fails.

- In the mbcFit action, the covStruct parameter now provides eight new covariance structures for fitting parsimonious Gaussian mixture models (PGMMs).

- In the mixed action, the new store parameter saves a model containing both fixed and random effects and the results of the statistical analysis to a binary compressed file. This stored model can then be used by the ASTORE procedure to score a new data set.

- The stratified action in the sampling action set now supports segment-stratified sampling for each target.

Differences from the Previous Release

- In the genmod action, the maximum number of response levels allowed is now 100 when the value of the dist parameter is MULTINOMIAL. You can change this value by specifying the maxResponseLevels parameter. This limit is added to prevent you from accidentally trying to use these models to fit a continuous response variable.

- In the logistic action, the maximum number of response levels allowed for polytomous response variables is now 100. You can change this value by specifying the maxResponseLevels parameter. This limit is added to prevent you from accidentally trying to use these models to fit a continuous response variable.
Enhancements to Data Quality Action Sets

Enhancements to Actions

- The Data Discovery action set has a list of values and the data type for the collected column, which is Row ID 1001.
- The Data Discovery action set does not include the output from certain metrics when the threshold for a field is reached to avoid displaying invalid data. Here are the metrics:
  - 1004 Frequency distribution (High)
  - 1005 Frequency distribution (Low)
  - 1006 Maximum value
  - 1009 Median
  - 1010 Minimum value
  - 1012 Mode
  - 1016 Outlier high values
  - 1017 Outlier low values
  - 1018 Pattern frequency distribution (High)
  - 1019 Pattern frequency distribution (Low)
  - 1020 Unique patterns
  - 1021 Primary Key candidate
  - 1025 Unique count
  - 1026 Unique pct
  - 1027 Pattern unique pct
  - 1041 Unique percentage
  - 1042 Pattern unique percentage
- The entityRes.match action has a new parameter named ClusterIDType. You can choose from CHAR, DOUBLE, INT, and it defaults to DOUBLE.

See Also

SAS Data Quality: CAS Action Programming Guide

Enhancements to SAS Econometrics Action Sets

New Action Sets for SAS Econometrics

In SAS Econometrics 8.5, the new Time Series Information Analysis (tsInfo) action set evaluates a variable in an input data table for its suitability as a time ID variable in SAS.
procedures, CAS action sets, and solutions that are used for time series analysis. The tsInfo action set is intended for use as a tool to either identify the time interval of a variable or prepare problematic data sets for use in subsequent time series analyses.

**Enhanced Action Sets**

These action sets were enhanced in SAS Econometrics 8.5 (November 2019 release of SAS Viya 3.5):

- In the Aggregate Loss Modeling action set, the cdm action has been enhanced. The output style as it relates to adjusted severity symbols is now consistent whether you specify one or more adjusted severity symbol in the adjustedSeverity parameter. In previous releases, the output style with one adjusted severity symbol differed from the output style with more than one adjusted severity symbol. To revert to the older style for the case of one adjusted severity symbol, you can use the new backwardCompatibleOutput subparameter of the adjustedSeverity parameter.

- In the Copula Modeling (copula) action set, the following enhancements have been made:
  - In both the copulaFit and copulaSimulate actions, the new plot parameter has been added to request ODS tables that can be used to visualize correlation plots.
  - In the copulaFit action, the new margApproxOpts parameter has been added. This parameter supports a more accurate algorithm for computing the cumulative distribution function for variables in large data tables and for variables that have nonsmooth distributions and extreme values.
  - A new Simulation Summary table has been added to describe results of the copulaSimulate action.

- In the Hidden Markov Model (hmm) action set, state-independent parameter estimation and analytic store technology are now supported.

- In the Panel Data Regression Modeling (panel) action set, these estimators are now supported:
  - heteroscedasticity-corrected standard error estimator (HCCME)
  - cross-sectional-correlation-corrected (CLUSTER) standard error estimator
  - heteroscedasticity- and autocorrelation-consistent (HAC) standard error estimator

- In the Qualitative and Limited Dependent Variable Modeling (qlim) action set, the Bayesian estimation of most univariate models is now supported.

- In the Severity Distribution Modeling (severity) action set, the parameter estimation phase now balances the available work in each BY group equitably among all available threads of computation. This new default behavior can lead to significantly faster estimation times, but it can also cause the numeric results to differ from those in previous releases. To revert to the numeric results of older releases, you can use the new balanceThreads parameter.
Enhancements to SAS Optimization Action Sets

**OptNetwork Action Set Enhancements**

The following list highlights changes that are related to graph handling for all algorithms:

- The `internalFormat` parameter has been deprecated. The best underlying internal structures are chosen for the requested algorithm.

- For algorithms that support multilinks, the default value of the `multiLinks` parameter is `True`. Previously, this default was determined by the value of the `internalFormat` parameter.

- The `loadGraph` action enables you to load graph input data tables and build in-memory data structures for subsequent analyses.

- The `unloadGraph` action enables you to delete in-memory data structures that have been loaded with the `loadGraph` action.

The following actions have been enhanced:

- In the cycle action, you can now specify the `outCyclesLinks` parameter to produce an output table that contains the sequence of links for each cycle that the action finds.

- In the linearAssignment action, the linear assignment problem solver now includes the `maxTime` parameter, which enables you to specify the maximum amount of time to spend on the algorithm.

- In the minCut action, the minimum cut algorithm now includes the `source` and `sink` parameters, which you can use to find a minimum source-sink cut.

- In the summary action, you can now add the triangle count for undirected graphs to the graph summary output by specifying the `clusteringCoefficient` parameter.

**Optimization Action Set Enhancements**

The following actions have been enhanced:

- The `runOptmodel` action supports the use of the COFOR loop with distributed execution. A COFOR loop is a FOR loop in which solver invocations are executed in parallel with other statements inside the loop.

- The `runOptmodel` action also adds support for BY-group processing, which provides a new and highly efficient means for solving multiple optimization problems by a single action call. This method is far more efficient than embedding a SOLVE statement within a loop in OPTMODEL code, and it enables you to solve a large number of problems more easily.

- The new `solveBlackbox` action calls the black-box solver, which uses innovative methods to find solutions to some of the most challenging optimization problems.

- For the `solveNlp` action, the new `iis` parameter enables (TRUE) or disables (FALSE) IIS analysis. The default value is `FALSE`.
Enhancements to SAS Visual Analytics Action Sets

Enhancement to SAS Cloud Analytic Services

- The server adds support for Linux on Power for the POWER9 chip.
- The server supports reading and writing files in the Apache Parquet file format. Support is available for single-machine and distributed servers that run Linux or Linux on Power. Apache Parquet files can be used with Path, DNFS, and Amazon Web Services S3 caslib types.
- The HDFS caslib type is enhanced to support data access to a remote HDFS cluster. The Hadoop cluster must be configured to enable SASHDAT access to HDFS. For deployment information, see SAS Viya for Linux: Deployment Guide.
- The server supports adding a caslib to Azure Data Lake Storage Gen 2 for data access. The ADLS caslib type supports loading and saving delimited files (CSV files) and Optimized Row Columnar (ORC) files.
- The following enhancements related to Amazon S3 are added:
  - The server has improved performance for loading and saving files with Amazon S3. The data transfer for load and save uses multiple threads to transfer data in parallel. The performance improvement is most noticeable with large files.
  - Support for server-side encryption (SSE) is added. The settings can be specified when you add a caslib.
  - Support for adding caslibs that use Identity and Access Management (IAM) roles is added. The settings can be specified when adding a caslib or loading a table.
  - For actions that generate in-memory tables, a new parameter is available for the output table. You can specify the lifetime parameter. The lifetime parameter sets the number of seconds for the table to remain in memory after it is last accessed. When the table has not been accessed in the specified number of seconds, the server drops the table.

New Action Sets

- The new Duplicate Management (deduplication) action set provides the deduplicate action for managing rows within groups.
- The SAS Embedded Process for Spark (sparkEmbeddedProcess) action set is new. The action set provides actions for interacting with the SAS Embedded Process for Spark continuous session.
**New Actions**

These actions are new for SAS Visual Analytics 8.5:

- The new `session.listactionq` action enables you to see what, if any, actions are currently queued for execution in a session identified by its UUID.
- The new `table.addCaslibSubdir` action creates a subdirectory in an existing caslib.
- The new `table.deleteRows` action deletes matching rows from a table.
- The new `table.describeView` action provides the definition of the view, such as caslib, table names, keys, and so on.
- The new `builtins.getCascheInfo` action retrieves information about CAS_DISK_CACHE usage on session worker nodes.
- The new `simple.compare` action compares the index and frequency of each group within each input CAS table, as well as the index of each record within each group of the input CAS tables.

**Enhancements to Actions**

The following actions are enhanced for SAS Viya 3.5:

- The `table.loadTable` action is enhanced to support loading a directory of CSV files into a single in-memory table. For more information, see multifile CSV import.
- The `table.fetch` action is enhanced to support the `sortBy` parameter when fetching rows from a view.
- The `table.tableInfo` action is enhanced to support the `%` and `_` characters as wildcard characters.
- The `table.save` action is enhanced to change how the number of copies (replicate HDFS blocks) is determined when a table is saved to HDFS.
- The `threadBlockSize` parameter is new for the `datastep.runCodeTable` action. The `threadBlockSize` parameter specifies the number of bytes to use for blocks in the output table.
- The `dynamicCardinality` parameter is new for the `fesSql/execDirect` action. When `dynamicCardinality` is set to True, the FedSQL query planner performs cardinality estimations of the input data.
- The `sessionProp.setSessOpt` action is enhanced to support the following new parameters:
  - `azureTenantId`
  - `dataStepMergeNoBy`
  - `debugopt`
  - `useGpu`
- The `tag` parameter is new for the `session.flushresult` action. The `tag` parameter specifies the results TAG.
- The `fcmpact.runProgram` action is enhanced to support the following new parameters:
  - `debughost`
The configuration.setServOpt action is enhanced to support the following new parameters:

- addNodeCancelTimeout
- addNodeKillTimeout
- azureTenantId
- azureAuthCacheLoc
- casuserencr
- dataStepMergeNoBy
- debugopt
- dcextport
- dcport
- encryptfips
- exthostknownby
- useGpu

The following parameters are new in the transform action in the Data Preprocess action set:

- topKSave
- separateRank
- topKInteractions
- rareThreshold
- slice
- noTable
- adjustMisraGries
- label
- lifetime

The following parameters are new in the hypergroup action in the Hypergroup action set:

- The directed parameter is used to specify whether a graph is directed and has a default value of False.
- The shortestPathStart parameter specifies that either vertex=, vertexNumber=, or vertexNumeric= is the start of the shortest path when the value of the directed parameter is set to True. The default value for shortestPathStart is False.
- The degree parameter specifies whether to generate vertice degrees. If a graph is directed, both in-degree and out-degree are generated. The default value for degree is False.

In the percentile.assess action, the following parameters are new:

- The new method option enables users to specify the algorithm used for percentile analysis.
The new userCutoff parameter is used to generate a confusion matrix and associated metrics based on the user-defined threshold. It is especially useful for rare event classification where the cutoff would be significantly less than 0.5.

In the percentile.boxplot action, the new method option parameter enables users to specify the algorithm used for percentile analysis.

In the search.valueCount action, the new trim parameter specifies whether to trim the padding spaces of a JavaScript Object Notation (JSON) report.

In the simple.groupByInfo action set, the following parameters are new:
- nSubGroupVars
- keyModify
- inputRegEx
- divider
- minGroupsLL
- sparse

See Also
- SAS Viya: System Programming Guide
- SAS Visual Analytics: Programming Guide

New IML Action Set

The iml action set enables you to run SAS/IML programs in SAS Viya. The action supports most of the statements and functions in the SAS/IML language. In addition, the iml action supports new functionality that enables you to take advantage of the distributed computational resources in SAS Viya. In particular, you can use the iml action to implement custom parallel algorithms that use multiple nodes and threads on a cluster of machines.

The SAS/IML language is a high-level matrix-vector language that supports a rich library of functions in statistics, data analysis, matrix computations, numerical analysis, simulation, and optimization. A primary goal of SAS/IML software is to enable programmers to extend the capabilities of SAS software.

See Also
- SAS IML: Programming Guide

CAS Session Options

These CAS session options are new in SAS Viya 3.5:
- The USEGPU session option specifies whether work is offloaded to the Graphics Processing Unit (GPU), if it is available.
• The DEBUGOPT session option specifies the host and port for the SAS Code Debugger in a session.

• The AZURETENANTID session option specifies the tenant ID for connecting to a Microsoft Azure storage system in a session.

See Also

SAS Cloud Analytic Services: User's Guide

Enhancements to the CASUTIL Procedure

Here are the new parameters and options in the CASUTIL procedure.

• The ALTERTABLE statement enables you to change your table, such as renaming the table.

• The INDEX statement enables you to create indexes on one or more table variables.

• The LOAD statement now supports reading data from an external file using a fileref.

• The LOAD statement now supports the WRITETRANSFERSIZE= option, which specifies the maximum number of bytes that the CAS engine writes when transferring data to the CAS server.

• The PARTITION statement enables you to partition a table.

• The PROMOTE statement now supports the QUIET option, which does not return a message with status and severity.

• The UPDATE statement enables you to update rows in a table.

See Also

SAS Cloud Analytic Services: User’s Guide
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SAS Viya Foundation

SAS Viya supports the Apache ORC (Optimized Row Columnar) open-source file format. You use a SAS LIBNAME engine in the SAS Viya programming environment to read and write ORC tables. For more information, see *SAS Viya Engines for Open-Source File Formats: Reference*. The Apache ORC Data Connector is available for SAS Cloud Analytic Services (CAS). For more information, see *SAS Cloud Analytic Services: User's Guide*. Apache ORC is an open-source file format that was created for use with Apache Hive.

Base SAS

For more information, see *Details about the New Features in Base SAS 9.4 and SAS Viya*.

Create and Run Python Objects in SAS

In SAS Viya 3.5 and the November 2019 release of SAS 9.4M6, you can submit to the CAS server Python objects using PROC FCMP or the DATA step.

Platform Data Sources

In SAS Viya 3.5, support was added for the USEIAMROLE= option for the S3 platform data source. This option enables you to use the credentials that are defined for your EC2 instance on S3.

Data Connectors

These data connectors are new in SAS Viya 3.5:

- SAS Data Connector to MongoDB
- SAS Data Connector to Salesforce
- SAS Data Connector to ORC

These data connector enhancements have been made in SAS Viya 3.5:

- Amazon Redshift: bulk unloading (data retrieval). Bulk-unloading support includes the new BULKUNLOAD= data connector option.
- PostgreSQL: bulk unloading (data retrieval). Bulk-unloading support includes these new data connector options: BULKUNLOAD=, BLDELDATFILE=,
Teradata: support for the NUMBER data type.

**SAS LIBNAME Engine for SAS Federation Server**

In SAS Viya 3.5, the behavior of two LIBNAME options and their respective data set options have changed:

- The IGNORE_READ_ONLY_COLUMNS= LIBNAME option and data set option affect columns that are Read-only and have unique values. In SAS 9.4 and earlier releases of SAS Viya, the options affect columns whose data types are Read-only.

- The READBUFF= LIBNAME option and data set option use a default block size of 64K to read data if the underlying database supports extended Fetch. The default number of rows is determined by dividing 64K with the width of a row. In SAS 9.4 and earlier releases of SAS Viya, the options perform single-row Fetch by default.

The DBMS option is removed from the SPOOL= LIBNAME option documentation. It is not supported in SAS 9.4 or SAS Viya.

**Debugging SAS Code**

SAS Viya 3.5 has two new debugging environments.

- In SAS Studio 5.2, use the SAS DATA Step Debugger to debug a DATA step.
- You can use the SAS Code Debugger to debug a subset of DATA step programming and Base SAS procedures, as well as some analytical procedures.

**Output Delivery System (ODS)**

In SAS Viya 3.5, ODS has these enhancements:

- The ODS Destination for Microsoft Word supports these new features:
  - The COLUMNS= option specifies the number of columns to place across each page of output.
  - The SUBJECT= option inserts the text string that you specify as the subject into the metadata of a file.
  - You can standardize Word-specific styles using the SAS Registry.
  - SVG is a supported file type.
- The ODS Destination for Excel supports the SUBJECT= option.
- The ODS Destination for PowerPoint supports the SUBJECT= option.

**ODS Graphics Procedures**

SAS Viya 3.5 has these enhancements:

- These changes apply to the SGPLOT and SGPANEL procedures:
  - The NOLIMITCAPS option was added to the DOT, HLINE, and VLINE statements. This option suppresses the serif cap on limit lines.
In the fit plots (LOESS, REG, and PBSPLINE), the FILL | NOFILL and OUTLINE | NOOUTLINE suboptions were added to the CLIATTRS= option and the CLMATTRS= option. These suboptions give you more control over the display of confidence band features. You can now easily specify fills, outlines, and their attributes.

The STATFMT= option was added to the PIE and DONUT statements in the SGPIE procedure. This option specifies the format of the displayed statistical value in the pie or donut chart.

**Creating Maps Using ODS Graphics and Mapping Procedures**

SAS Viya 3.5 has these enhancements for the SGMAP procedure:

- The STYLEATTRS statement enables you to specify color, marker, and other attributes for a graph. You no longer have to change the ODS style template to accomplish this.

- These are the general enhancements for the PROC SGMAP statement:
  - The CYCLEATTRS and NOCYCLEATTRS options specify whether plots are drawn with unique attributes in the graph. Automatic cycling of attributes is allowed.
  - The DATRTRMAP= option and the RATTRMAP= option specify the discrete attribute map data set or the range attribute map data set, respectively, that you want to use with the SGMAP procedure. Use these options in conjunction with overlay map or the plot statement’s options ATTRID= and RATTRID=, respectively. These attribute ID options specify the value of the ID variable that is contained in the discrete or range attribute map data set.
  - You can specify coordinate system references directly in the PROC SGMAP statement with the MAPCS= and the PLOTCS= options. This enhancement negates the need to run PROC GPROJECT on a map data set to project the coordinates before using the projected data in the SGMAP procedure.
  - PROC SGMAP has several new options for map, legend, and plot overlay statements.
  - Automatic legends are created differently now when the CHOROMAP statement is used.

**SAS Engines for Open-Source File Formats**

Beginning in SAS Viya 3.5, SAS supports Apache ORC tables by using the SAS ORC engine.

The SAS ORC engine can create or access an ORC table that is stored in one of the following storage systems:

- Microsoft Azure Data Lake Storage Gen2
- Linux for x64 distributions that are supported by SAS

**Scalable Performance Data Engine**

In SAS Viya 3.5, you can override and change the encoding when reading or writing SAS data sets by using the INENCODING= LIBNAME statement option.
National Language Support (NLS)

SAS Viya 3.5 has these changes and enhancements.

- Aliases and POSIX numbers are updated for these locales:
  - Chinese_China
  - Chinese_HongKong
  - Chinese_Macau
  - Chinese_Singapore
  - Chinese_Taiwan
  - Serbian_Serbia
  - SerbianLatin_Serbia

- These formats are new:
  - NLTIMEL converts a SAS time value to the time value of the specified locale, and then writes the value as a time value in a long-uniform pattern.
  - NLTIMEM converts a SAS time value to the time value of the specified locale, and then writes the value as a time value in a medium-uniform pattern.
  - NLTIMES converts a SAS time value to the time value of the specified locale, and then writes the value as a time value in a short-uniform pattern.

- These formats have been restored to SAS Viya 3.5:
  - JNENGO writes SAS date values as Japanese dates as reign, year, month, and day.
  - JNENGOT writes SAS datetime values as Japanese datetimes as reign, year, month, day, hour, and minute, and with narrow character numbers.
  - JNENGOTW writes SAS datetime values as Japanese datetimes as reign, year, month, day, hour, and minute, and with wide character numbers.
  - JNENGOW writes SAS date values as Japanese dates as reign, year, month, and day, and with wide character numbers.

- The JNENGO informat has been restored to SAS Viya 3.5. The JNENGO informat reads Japanese kanji date values.

- These functions have been enhanced:
  - You can modify the functionality of the KCOMPARE function by using modifiers.
  - The KPROPDATA function PUNC option converts commonly used 8-bit punctuation.

- These LIBNAME statement options are new:
  - You can exclude variables for data processing by using the CVPEXCLUDE statement option.
  - You can include variables for data processing by using the CVPINCLUDE statement option.
Procedures

For a list of SAS Foundation procedures that are available for sites with only SAS Viya and SAS Visual Analytics installed, see SAS Viya Foundation Procedures in An Introduction to SAS Viya Programming.

SAS Viya 3.5 has these changes and enhancements:

- The CIMPORT procedure has these enhancements:
  - PROC CIMPORT can be used to import a file that was created in UTF-8 encoding into non-UTF-8 SAS sessions and output corresponding data sets.
  - When a transport file is imported, the original string variable length might not be large enough for the transcoded strings. To ensure that your destination buffer size is sufficient for transcoded data, specify the EXTENDVAR= and EXTENDFORMAT = options in the PROC CIMPORT statement.

- In the COPY procedure, the APPEND procedure supports appending data that includes VARCHAR columns if the VARCHAR column attributes match.

- In the DATASETS procedure, the DATASETS APPEND statement supports appending data that includes VARCHAR columns if the VARCHAR column attributes match.

- In the DS2 procedure, the following enhancements have been made:
  - Beginning in November 2019 on SAS 9.4M6 and with SAS Viya 3.5, Write access is available for MongoDB and Salesforce data sources. The Write support is available through a SAS library and a CAS library. Appropriate SAS/ACCESS software must be installed.
  - The VARBINARY data type is supported for DS2 programming in CAS.
  - A DBMAX_TEXT= connection option is available for connecting to Hive and Spark with the NOLIBS and CONN= procedure options. The NOLIBS and CONN= options enable you to connect to a SAS library by specifying a connection string, instead of using the active librefs. Appropriate SAS/ACCESS software must be installed.
  - New USER= and PASSWORD= aliases are supported for connecting to data sources with the NOLIBS and CONN= procedure options. You can connect to any data source with any of the aliases.
  - Support for Spark is clarified.

- The EXPORT procedure supports all access types that are available in the FILENAME statement.

- In the FedSQL procedure, the following enhancements have been made:
  - Beginning in November 2019 on SAS 9.4M6 and with SAS Viya 3.5, Write access is available for MongoDB and Salesforce data sources. The Write support is available through a SAS library and a CAS library. Appropriate SAS/ACCESS software must be installed.
  - Use of the UNION set operator is supported for FedSQL programming in CAS.
  - The VARBINARY data type is supported for FedSQL programming in CAS.
  - There are several new options for optimizing FedSQL performance on the CAS server. They are specified in the CNTL= procedure option.
• The output of the _METHOD procedure option has changed. This procedure option no longer returns the stage query and number of threads used by a FedSQL query plan in its textual description of the plan.

• There is a new CNTL= option, showStages, which returns the information previously printed by the _METHOD procedure option. In addition, showStages returns query execution details such as whether the tables in a query were partitioned, the number of rows and columns processed by each stage of the query, and the elapsed time for each processing stage.

• A DBMAX_TEXT= connection option is available for connecting to Hive and Spark with the NOLIBS and CONN= procedure options. The NOLIBS and CONN= options enable you to connect to a SAS library by specifying a connection string instead of using the active librefs. Appropriate SAS/ACCESS software must be installed.

• New USER= and PASSWORD= aliases are supported for connecting to data sources with the NOLIBS and CONN= procedure options. You can connect to any data source with any of the aliases.

• Support for Spark is clarified.

• The IMPORT procedure supports all access types that are available in the FILENAME statement.

• In PROC S3, you can save LIST output to an external file by using the OUT= option.

• The SCOREACCEL procedure adds support for publishing a model to a global model table:
  • You publish a model to a global model table by using the PUBLISHGLOBAL= option in the PUBLISHMODEL statement.
  • You delete a model from a global model table by using the DELETEGLOBAL= option in the DELETEMODEL statement.

• PROC SQOOP support was added for the HIVE_SERVER= option to connect to the Hive server and port and for the HIVE_URI= option to specify the JDBC URI. The HIVE_URI= option is required when connecting to a Kerberized HDP 3.1 cluster when the hive-site.xml file does not contain the Zookeeper service.

Functions

In SAS Viya 3.5, here are the changes and enhancements:

• There are several new Git functions and the Git functions that began with GITFN_ have been deprecated and replaced with functions that begin with GIT_.

• The COMPSRV_OV AL function returns the original, possibly unsafe, value of an input parameter or global macro variable passed into the compute server.

• The COMPSRV_UNQUOTE2 function unmasks matched pairs of quotation mark characters in an input parameter or global macro variable.

Statements

SAS Viya 3.5 has these changes and enhancements:

• The DESCENDING option in the BY statement is now supported for a DATA step that is running in CAS. The option is supported only for the second and subsequent variables in a CAS DATA step and not for the first variable in a BY statement.
The FILENAME statement Azure access method enables access to data in Microsoft Azure Data Lake Storage Gen2.

The FILENAME statement S3 access method enables access to data in Amazon S3 files.

**System Options**

These are the new features for SAS Viya 3.5:

- The AZUREAUTHCACHELOC system option specifies the location of a file that contains login information for connecting to a Microsoft Azure storage system.
- The AZURETENANTID system option specifies the tenant ID for connecting to a Microsoft Azure storage system.
- The DEBUGOPT system option specifies the host and port where debugging SAS languages occurs.

**Macros**

To use your SAS user-defined formats on the CAS server, you can migrate them from a SAS catalog to the CAS server using the autocall macro %UDFSEL. This macro generates a SELECT statement that you can use with the FORMAT procedure to migrate only the user-defined formats that your data is using. User-defined formats are stored in a CAS library on the CAS server.

**SAS DS2**

The SAS Viya 3.5 release has the following new features and enhancements:

- The ability to read and write to MongoDB and Salesforce nonrelational databases with DS2 when appropriate SAS/ACCESS software is installed. The functionality is available when accessing the databases through a SAS library. It is also available when accessing the databases through a CAS library.
- Support for the VARBINARY data type when reading and writing to CAS tables
- There are improvements to data type support for various third-party relational databases when appropriate SAS/ACCESS software is installed. The features are available when the databases are accessed through a SAS library.
  - DS2 now creates VARCHAR columns that contain more than 65,535 characters as type STRING in Hive.
  - DS2 now reads and writes Teradata NUMBER columns.
  - DS2 now reads JSON columns in MySQL.
- The documentation about the scope of package instances has been updated. The THIS and package-instance arguments of the NEW operator have been deprecated and are removed from the _NEW_ operator for packages. The lifetime of a package instance now depends on whether a DS2 package variable references it. The lifetime of a package instance can extend beyond the scope in which the instance itself was created.
- Some DS2 error messages that are written to the SAS log now contain an internal error code. If you need to contact Technical Support, these internal error codes can
help SAS more quickly determine the source of the problem. An appendix has been added to the documentation that provides more information about these error codes.

- A DS2 program that runs in CAS can create a column with a VARBINARY data type, read a VARBINARY column from a CAS table, and write a VARBINARY column to a CAS table. In addition, a DS2 program that runs in CAS can create a column with a BINARY data type. However, a DS2 program cannot read a BINARY data column from a CAS table or write a BINARY column to a CAS table.

- If you use in-database processing with the SAS Embedded Process on Teradata, the SASTransform table function has been deprecated. The SASTblOp table operator should be used with Teradata version 14.10 or later.

**SAS FedSQL**

The SAS FedSQL language has the following new functionality in SAS Viya 3.5:

- The ability to read and write to MongoDB and Salesforce nonrelational databases with FedSQL when appropriate SAS/ACCESS software is installed. The functionality is available when accessing the databases through a SAS library. It is also available when accessing the databases through a CAS library.

- Support for the VARBINARY data type when reading and writing to CAS tables

- There are improvements to data type support for various third-party relational databases when appropriate SAS/ACCESS software is installed. The features are available when the databases are accessed through a SAS library.
  - FedSQL now creates VARCHAR columns that contain more than 65,535 characters as type STRING in Hive.
  - FedSQL now reads and writes Teradata NUMBER columns.
  - FedSQL now reads JSON columns in MySQL.
  - The COMPRESS function supports a Modifier argument.

- There are four new instructions for the Cntl option in FedSQL for CAS:
  - An optional dynamicCardinality instruction for the Cntl option directs the FedSQL query planner to perform a cardinality estimation before creating a query plan.
  - An optional optimizeVarbinaryPrecision instruction for the Cntl option optimizes VARBINARY precision by using a precision that is appropriate to the actual data, instead of the declared precision for VARBINARY columns.
  - An optional optimizeVarcharPrecision instruction for the Cntl option optimizes VARCHAR precision by using a precision that is appropriate to the actual data, instead of the declared precision for VARCHAR columns.
  - An optional showStages instruction for the Cntl option returns FedSQL query execution details, including times for intermediate stages, along with the FedSQL query plan.

- The new CAST function converts a column from one data type to another and also enables you to change the column’s length.

- The new UNION set operator combines the result sets of two SELECT queries and returns unique rows from both result sets. Columns are combined by position by default. An optional CORRESPONDING keyword enables you to combine columns based on column name instead. An optional BY keyword enables you to submit a column list to the CORRESPONDING keyword.
In earlier versions of SAS Viya, the DROP TABLE statement and REPLACE= table option considered global tables when enforcing name uniqueness rules and would drop and replace a table that was previously promoted. Beginning in SAS Viya 3.5, the DROP TABLE statement and REPLACE= table option operate exclusively on CAS session tables.

In previous versions of SAS Viya, the fedSql.execDirect action serialized many operations on one worker. Beginning with SAS Viya 3.5, the action partitions operations that have computed columns by creating temporary intermediate tables. The following operations, which were previously serialized on one worker, can now be performed on multiple workers:

- FULL outer joins, except full outer joins where the join condition is an inequality condition (t1.x <> t2.x) or an equality condition where one side of the equation contains column references from more than one table (t1.x + t2.y = 7).
- GROUP BY aggregations where one or more group expressions are computed columns
- Joins on columns that use different SAS formats.
- SELECT DISTINCT with computed columns.

LIMIT and OFFSET operations are still serialized on one worker.

Some FedSQL error messages that are written to the SAS log now contain an internal error code. If you need to contact Technical Support, these internal error codes can help SAS more quickly determine the source of the problem.

SAS/ACCESS Interface to Snowflake

In SAS Viya 3.5, support was added for the 64-bit Microsoft Windows platform.

SAS Drive 2.2

SAS Drive 2.2 shipped in November 2019 and runs on SAS Viya 3.5. Here are the new features and enhancements in this release:

- Performance has been improved for the SAS Drive user interface. For example, tabs display their contents more quickly.
- The Quick Access bar has a new button to add recommended items.
- On the SAS Viya side menu, the SAS Drive application is now labeled Share and Collaborate.

For more information, see What’s New in SAS Drive 2.2.
SAS Econometrics

About SAS Econometrics

SAS Econometrics runs in SAS Viya. It provides a new, resilient, distributed, and scriptable method of conducting advanced econometric modeling and time series analysis. It also provides a programming entry point for econometricians in government, academics, and industry (especially banking, insurance, and other financial services). SAS Econometrics leverages the speed, scalability, and elasticity of the SAS in-memory environment.

SAS Econometrics requires SAS Visual Analytics.

SAS Econometrics 8.5

SAS Econometrics 8.5 (November 2019 release of SAS Viya 3.5) includes these new features and enhancements:

- The new SASEMOOD interface engine enables SAS users to retrieve time series data from the Moody’s Analytics Data Buffet (Economy.com) website.

- The new TSINFO procedure evaluates a variable in an input data table for its suitability as a time ID variable in SAS procedures and solutions that are used for time series analysis. PROC TSINFO assesses how well a time interval specification fits SAS date values, SAS datetime values, or observation numbers that are used to index a time series.

PROC TSINFO is intended for use as a tool to either identify the time interval of a variable or prepare problematic data sets for use in subsequent time series analyses. In particular, this procedure can be used to investigate inconsistencies between time ID values and the ID statement options that are used in other SAS procedures and solutions.

- The CCDM procedure has been enhanced. The output style as it relates to adjusted severity symbols is now consistent whether you specify one or more adjusted severity symbol in the ADJUSTEDSEVERITY= option. In previous releases, the output style with one adjusted severity symbol differed from the output style with more than one adjusted severity symbol. To revert to the older style for the case of one adjusted severity symbol, you can specify the new ONEADJSEVCOMPAT option in the PROC CCDM statement.

- CCOPULA procedure
  - The new PLOTS= option has been added to request correlation plots for pairs of variables in the DATA= data table for the FIT statement. Both the original data and their transformed uniform values can be plotted. The PLOTS= option is also available to plot the correlations between variables generated by the SIMULATE statement.
  - Additional options are available in the MARGINALS=EMPIRICAL option in the FIT statement. These options support a more accurate algorithm for computing the cumulative distribution function for variables in large data tables and for variables that have nonsmooth distributions and extreme values.
  - A new SimulateModelSummary ODS table has been added to describe results of the SIMULATE statement.
• The CPANEL procedure now supports these estimators:
  • heteroscedasticity-corrected standard error estimator (HCCME)
  • cross-sectional-correlation-corrected (CLUSTER) standard error estimator
  • heteroscedasticity- and autocorrelation-consistent (HAC) standard error estimator
• In the HMM procedure, state-independent parameter estimation and analytic store technology are now supported.
• In the SEVSELECT procedure, the parameter estimation phase now balances the available work in each BY group equitably among all available threads of computation. This new default behavior can lead to significantly faster estimation times, but it can also cause the numeric results to differ from those in previous releases. To revert to the numeric results of older releases, you can specify the new NOBALANCETHREADS option in the PROC SEVSELECT statement.

For information about the new and enhanced action sets in SAS Econometrics, see “Enhancements to SAS Econometrics Action Sets” on page 233.

For more information, see these resources on the product documentation page for SAS Econometrics:
• SAS Econometrics 8.5: Programming Guide
• SAS Econometrics 8.5: Econometrics Procedures

SAS Event Stream Manager 6.2

SAS Event Stream Manager 6.2 (November 2019 release of SAS Viya 3.5) includes these new features and enhancements:
• SAS Event Stream Manager can be deployed on a Kubernetes cluster.
• SAS Event Stream Manager can deploy projects to a Kubernetes cluster.
• The ESP server log is visible in SAS Event Stream Manager.
• The user interface has been enhanced. For example, the color scheme has been updated and windows have a new style.
• SAS Event Stream Manager documentation has been merged with the SAS Event Stream Processing documentation in the SAS Event Stream Processing Help Center.

For more information, see SAS Event Stream Manager 6.2: What’s New.

SAS Event Stream Processing 6.2

SAS Event Stream Processing 6.2 (November 2019 release of SAS Viya 3.5) includes these new features and enhancements:
• new cloud-native capabilities with pre-built Docker images
• enhancements to SAS Event Stream Processing Studio, including an improved test mode and expression validation
• enhancements to SAS Event Stream Processing Streamviewer, including new and easier-to-understand icons
new and improved adapters, including the new OPC-DA adapter
enhancements to ESPPy, including support for a group of windows that connect in a specific way as templates, which can then be reused within a Python program
new ESP Server Connection API that uses the WebSocket protocol that enables ESP functions to operate with minimal system resources
improvements to the Image Processing Algorithm to support more flexible image processing
expanded support for Deep Learning functionality that is available from SAS Visual Data Mining and Machine Learning
enhanced Analytical support, including the new online models Kalman Filter, Slice Operations, and Smoothing, and expanded ASTORE support
new capability to start and stop event stream processing projects on Kubernetes clusters using SAS Event Stream Manager

For more information, see SAS Event Stream Processing 6.2: What’s New.

SAS Intelligent Decisioning 5.4

SAS Intelligent Decisioning 5.4 (November 2019 release of SAS Viya 3.5) includes new features and enhancements that enable you to perform these tasks:

• add Equals, Range, and LIKE multi-branch nodes to a decision. With Equals and LIKE branches, you can also combine branch paths using the OR operator.
• enable performance logging for decisions that are run on the Micro Analytic Score service by setting the includeLoggingInGeneratedCode configuration property.
• trace how variable values change as a decision executes. The Enable value tracing option for decision tests enables you to capture the values of decision variables as they change while the decision executes.
• use a subdecision to score the rows in a data grid. The Score rows in this data grid option is available when you are mapping variables for a subdecision.
• copy and paste the content of specific versions of decisions, rule sets, lookup tables, treatments, and treatment groups.
• delete specific versions of decisions, rule sets, and lookup tables.
• control whether published rule sets and decisions use updated versions of lookup tables without republishing rule sets or decisions. The lookupStaticBinding configuration option enables you to specify whether published content uses new versions of lookup tables.
• update the version of a rule set or subdecision that is used in a decision.
• generate PDF documentation for decisions, rule sets, lookup tables, and treatment groups. For decisions, you can choose to include the decision diagram and the code for custom code nodes. You can also choose to download additional documents for any rule sets, treatment groups, and subdecisions used in the decision.
• view, edit, and manage custom code files from the Code Files category view.
• use custom code files to submit SQL queries to a Google BigQuery database.
• build custom SQL query files in SAS Studio.
• validate SQL and DS2 code files.
• use macro variables in data query files in SAS Studio to pass input data to a decision node.
• edit the description of code file nodes in a decision.
• publish a decision with the new %DCM_PUBLISH_DECISION macro.
• add data quality functions to rule expressions.
• copy rules between rule sets.
• duplicate variables in a rule set or decision.
• duplicate treatment attributes.
• add treatment attributes from another treatment.

For more information, see SAS Intelligent Decisioning 5.4: What’s New.

SAS Model Manager 15.3

SAS Model Manager 15.3 (November 2019 release on SAS Viya 3.5) has new features and enhancements that enable you to perform these tasks:
• compute partial model performance monitoring based on the input data
• generate DS2 score code from Python code
• import and export analytic score models
• perform an advanced search for models and projects
• publish open-source models such as Python and R to container publishing destinations
• compute the feature combination index (FCI) to measure the relationships between input and output variables
• view published history for models within a project

For more information, see SAS Model Manager 15.3: What’s New.

SAS Studio 5.2

New Features and Enhancements

For SAS Viya 3.5, SAS Studio has two flavors: SAS Studio (Basic) and SAS Studio (Enterprise). SAS Studio (Basic) is used in a programming-only environment and SAS Studio (Enterprise) is used in a full environment.

Here are some of the new features and enhancements in this release:
• Using the Query tool, you can create a query to extract data from one or more tables according to criteria that you specify. You can generate your query using either SQL or FedSQL query code.
• With Git integration, you can clone repositories, stage changes and create commits, create, merge, and rebase branches, and resolve merge conflicts from within SAS Studio.

• Using the import tool, you can import several basic file types into data sets.

• You can now access files and folders on both the SAS Content server and your server file system from the Explorer section in the navigation pane.

• You can use the new DATA Step Debugger to find logic errors in a DATA step program.

• You can run and create SAS Viya jobs.

• You can run a saved program as a background job.

• You can use the new command line interface to access SAS Studio by using the keyboard.

• You can create a filter based on a single column by right-clicking the column heading in the table viewer and selecting Quick Filter.

• You can send a copy of your results and the associated code and log files by email. Files that you can send include results in HTML5, RTF, and PDF formats as well as the code and log files that are associated with the results.

• You can now specify custom SAS code to run before or after the code for programs, tasks, queries, and imports. This code persists between SAS Studio sessions.

• You can now customize some keyboard shortcuts.

• SAS Studio includes many new tasks for Cloud Analytic Services, Machine Learning, and Time Series Modeling.

• The common task model (CTM) was enhanced to support dynamic and cascading prompts.

For more information, see What’s New in SAS Studio 5.2.

Differences between SAS Studio in SAS 9.4 and SAS Viya

If you are a current SAS Studio user, here are some differences between SAS Studio 3.8 (which runs on SAS 9.4) and SAS Studio 5.2 (which runs in SAS Viya):

• The Standard and Interactive perspectives are available in SAS Studio 5.2.

• The lists of tasks and snippets differ.

In addition, SAS Studio 5.2 does not support this functionality:

• process flows

• SAS Studio repositories

• the ability to export tables

• the ODS Graphics Designer and the ODS Graphics Editor

• FTP shortcuts

• extended attributes in the SAS Table Properties and Column Properties windows
SAS Visual Analytics 8.5

SAS Visual Analytics 8.5 (November 2019 release of SAS Viya 3.5) includes these new features and enhancements:

- The user interface has been enhanced. For example, there are new page templates.
- A new automated prediction object has been added.
- New geo maps objects have been added and existing geo map features have been enhanced. For example, geo maps now support multiple data layers.
- Existing objects have been improved. For example, crosstabs now display sparse values with a horizontal line (−).
- Accessibility has been enhanced. SAS Visual Analytics now produces accessible PDF files.

For more information, see What’s New in SAS Visual Analytics 8.5.

SAS Visual Statistics 8.5

SAS Visual Statistics 8.5 (November 2019 release of SAS Viya 3.5) includes these new features and enhancements to the user interface:

- A confusion matrix that displays the classification results for categorical response models is available.
- Several new assessment statistics are available for all models.
- You can now derive predicted items from generalized additive models and nonparametric logistic regression models.
- You can now export and save generalized additive models and nonparametric logistic regression models.
- In the Cluster object, a details table has been added for the Parallel Coordinates plot.
- The Bin method property that specifies the way that measure predictors are binned has been added to the Decision tree object.
- There is a new option for autotuning decision tree models: Leaf size.
- In the settings, you can now specify to automatically convert measure variables with two levels to a category when a data set is first opened in SAS Visual Analytics.
- In the settings, you can now set a default assessment statistic to use in all models.

For more information, see What’s New in SAS Visual Statistics 8.5.

SAS Visual Statistics 8.5 (November 2019 release of SAS Viya 3.5) includes these new programming features and enhancements:

- The new GAMSELECT procedure fits and performs model selection on generalized additive models. PROC GAMSELECT supports model selection by componentwise functional gradient descent (Friedman 2001; Bühlmann and Hothorn 2007) and the shrinkage method by using the penalized likelihood with sparsity-inducing penalties (Meier, Van de Geer, and Bühlmann 2009).
The new NMF procedure performs nonnegative matrix factorization, which seeks to approximately decompose a nonnegative data matrix into two low-rank nonnegative factor matrices. The procedure produces output data tables that contain the two low-rank factor matrices. You can use nonnegative matrix factorization for dimension reduction, feature identification, and feature extraction in applications in many different fields, such as image processing, text mining, bioinformatics, and spectral data analysis.

The new SANDWICH procedure analyzes linear models by using a robust sandwich estimate of the parameter covariance. It uses distributed computing and efficient sparse algorithms to handle models with a large number of clusters and models with large and sparse design matrices.

The new SIMSYSTEM procedure simulates continuous univariate data from distributions in the Pearson and Johnson systems. You request these distributions by directly specifying their measures of skewness and kurtosis rather than their mathematical parameters. This makes it convenient to simulate data from a series of distributions whose degrees of asymmetry and tail weight vary over a grid of skewness-kurtosis combinations.

In the ASSESS procedure, the new METHOD= option enables you to apply a new efficient algorithm for computing exact quantiles for quantile binning in the lift analysis. This method uses smart technology to perform an exact count to compute the percentile without global sorting in the distributed environment.

**BINNING procedure**
- The new RAW= option in the PROC statement specifies whether to process variables by using their raw values or formatted values.
- The new Variable Mapping Information ODS table displays how each binning variable name is mapped to each result variable name.

In the FREQTAB procedure, the new ONEWAY option in the TABLES statement provides additional statistics and display options for one-way frequency tables. The new PLOTVAR= and SCALEx plot options for PLOTS=DEVIATIONPLOT specify the residual statistic to display in one-way deviation plots. The FORMAT= option for frequencies is now available for one-way, LIST, and CROSSTLIST crosstabulation tables (in addition to default crosstabulation tables).

**GENSELECT procedure**
- The new INPARMEST= option enables you to input starting values for the optimizations.
- The new MAXRESPONSELEVELS= option enables you to specify the maximum number of allowed response levels.
- The new STORE statement saves a model and the results of the statistical analysis to a binary compressed file. This stored model can then be used by the ASTORE procedure and the logisticScore action from the regression action set to score a new data set. This stored model can also be read by many other actions in the regression action set.
- The new USELASTITER option requests that the procedure continue its computations even when the optimization fails.
- The new STORE statement saves a model containing both fixed and random effects and the results of the statistical analysis to a binary compressed file. This stored model can then be used by the ASTORE procedure to score a new data set.

**LOGSELECT procedure**
The new INPARMEST= option enables you to input starting values for the optimizations.

The new LACKFIT option performs the Hosmer-Lemeshow goodness-of-fit test for binary and polytomous response models.

The new MAXRESPONSELEVELS= option enables you to specify the maximum number of allowed response levels.

The new STORE statement saves a model and the results of the statistical analysis to a binary compressed file. This stored model can then be used by the ASTORE procedure and the logisticScore action from the regression action set to score a new data set. This stored model can also be read by many other actions in the regression action set.

The new USELASTITER option requests that the procedure continue its computations even when the optimization fails.

In the MBC procedure, the COVSTRUCT= option now provides eight new covariance structures for fitting parsimonious Gaussian mixture models (PGMMs).

In the PARTITION procedure, the TARGET statement now supports segment-stratified sampling for each target.

In the REGSELECT procedure, the new METHOD=ELASTICNET option in the SELECTION statement specifies the elastic net method, an extension of LASSO that estimates parameters by using a version of ordinary least squares in which both the sum of the absolute regression coefficients and the sum of the squared regression coefficients are constrained. If the model contains classification variables, then these corresponding effects can be split.

Here are two changes from the previous release:

In the GENSELECT procedure, the maximum number of response levels allowed when DIST=MULTINOMIAL is now 100. You can change this value with the MAXRESPONSELEVELS= option. This limit is added to prevent you from accidentally trying to use these models to fit continuous response variable.

In the LOGSELECT procedure, the maximum number of response levels allowed for polytomous response variables is now 100. You can change this value by specifying the MAXRESPONSELEVELS= option. This limit is added to prevent you from accidentally trying to use these models to fit a continuous response variable.

SAS Visual Data Mining and Machine Learning 8.5 (November 2019 release of SAS Viya 3.5) includes these new features and enhancements:

The new KPCA procedure performs kernel principal component analysis (KPCA). KPCA is a nonlinear extension to the widely used principal component analysis (PCA). It uses the “kernel trick” to implicitly map the original data to some high-dimensional RKHS (reproducing kernel Hilbert space) and implement PCA in that space. The resulting projections onto the kernel principal components can capture nonlinear patterns in the data. The KPCA procedure features fast training and fast scoring methods, which greatly alleviate the computation and memory burden.
associated with ordinary KPCA. These methods are based on low-rank matrix approximation coupled with $k$-means clustering as a sampling scheme. Thanks to this approximation algorithm, the KPCA procedure is capable of handling large data sets efficiently.

- The new SPARSEML procedure was designed for machine learning with sparse input data set. It currently implements the support vector machines (SVM) algorithm in SAS Viya for binary classification. By using the parallel coordinate descent optimization method, the SPARSEML procedure can train large data sets that can be both wide and deep. Like many other predictive modeling tools, the SPARSEML procedure uses input data to train a model and generates an analytic store that can be deployed through the ASTORE procedure. It can load data from multiple nodes and perform computations in parallel.

- The AUTOTUNE procedure now supports a hyperparameter importance ODS table, more options, saving the configuration history, and including warm start.

- The FACTMAC procedure now accepts data with missing values without issuing an error. Observations with missing values are excluded from the analysis.

- FOREST procedure
  - The NUMBIN= and MINLEAFSIZE= options can now be set by autotuning.
  - The default value of the NUMBIN= option is now 50 instead of 20, and the default value of the BINMETHOD= option is QUANTILE instead of BUCKET.
  - For isolation forests, the TARGET statement is no longer required, and fit statistics including variable importance are no longer computed.

- GRADBOOST procedure
  - The MINLEAFSIZE= option can now be set by autotuning.
  - The default value of some options have changed: the NUMBIN= option default is now 50 instead of 20; the MAXDEPT= option default is now 4 instead of 5; the RIDGE= option default is now 1 instead of 0; and the BINMETHOD= option default is now QUANTILE instead of BUCKET.

- The SEMISUPLEARN procedure now supports the AUTOTUNE statement.

- In the SVMACHINE procedure, the EARLYSTOP option is new. If the option is specified and the PARTITION statement is also specified, then the generated model is based on the validation accuracy.

For more information about the action sets and actions for SAS Visual Data Mining and Machine Learning, see “Enhancements to SAS Visual Data Mining and Machine Learning 8.5 Action Sets” on page 227.

For more information, see these resources on the product documentation page for SAS Visual Data Mining and Machine Learning:

- SAS Data Mining and Machine Learning 8.5: Programming Guide
- SAS Visual Data Mining and Machine Learning 8.5: The NETWORK Procedure
- SAS Visual Data Mining and Machine Learning 8.5: Procedures Guide
SAS Visual Forecasting

About SAS Visual Forecasting

SAS Visual Forecasting runs in SAS Viya. It provides a new, resilient, distributed time series analysis and scripting environment for cloud computing. It provides automatic forecast model generation, automatic variable and event selection, and automatic model selection. It provides advanced support for time series analysis (time domain and frequency domain), time series decomposition, time series modeling, signal analysis and anomaly detection (for IoT), and temporal data mining. It provides a programming entry point for forecast analysts and data scientists. SAS Visual Forecasting leverages the speed, scalability, and elasticity of the SAS in-memory environment.


SAS Visual Forecasting 8.5

SAS Visual Forecasting 8.5 includes these new programming features and enhancements:

- The new DFIL procedure enables you to design a digital infinite impulse response (IIR) filter of any type, to visualize the frequency response of the designed filter, to visualize the zero-pole plot of the designed filter for stability analysis, and to filter any input data by using the designed digital filter.

- In the ARIMA statement of the SMSPEC procedure, the new P= and Q= options enable you to specify a custom range for the moving average (MA) and autoregressive (AR) orders of the ARIMA model specification.

- The new External Languages (EXTLANG) package enables you to integrate external-language code written in Python and R into your SAS program. The package supports various versions of the Python 2, Python 3, and R languages.

- The new Time Series Dimension Reduction (TDR) package enables you to reduce the dimensionality of time series. The dimension reduction technique includes piecewise aggregate approximation, symbolic aggregate approximation, discrete Fourier transformation, discrete wavelet transformation, random projection, and singular value decomposition.

- The Automatic Time Series Modeling (ATSM) package has been enhanced.

- The new EventGroup method of the EVENT object enables you to specify a group event definition that is stored in the EVENT object.

- The new 'CHOOSE' argument of the FORENG object enables you to specify the name of the winning forecast model.

- The new 'ENDZEROS.MAXNUM', 'ENDZEROS.MAXPCT', and 'ENDZEROS.MINOBS' arguments of the FORENG object enable you to configure the _ZERO_ model test, which determines whether the FORENG object produces an all-zero forecast when trailing zeros are present in the dependent series.

- The new 'ZEROMISS' options of the TSDF.AddSeries, TSDF.AddX, and TSDF.AddY methods enable you to specify how to interpret beginning and
ending zero values in the ancillary, independent, and dependent series that you provide for the generation of forecast models

For more information, see these resources on the product documentation page for SAS Visual Forecasting:

- SAS Visual Forecasting 8.5: Programming Guide
- SAS Visual Forecasting 8.5: Forecasting Procedures
- SAS Visual Forecasting 8.5: Time Series Packages

SAS Visual Investigator 10.6

SAS Visual Investigator 10.6 shipped in November 2019 and runs on SAS Viya 3.5. Here are the new key features:

- administration enhancements, including extended support for the CLOB data type, new time zone configurations, and new entity security rules and configuration options
- workflow enhancements, including the ability to send email notifications and call services requiring authorization
- search enhancements, including phonetic searching and synonym searching
- the ability to score entities without creating an alert for each object
- the ability to track the alerting activity that caused a case to be created
- scenario administration enhancements, including improved filtering of scenarios and flows, flow locking to prevent conflicts, the ability to view data related to the score and triggering values on an alert, and the ability to see which sources are loaded and which are no longer useful
- the ability to select and delete multiple child objects simultaneously
- the ability to share links to objects within SAS Visual Investigator
- the ability to configure node and link styles based on the conditions of the data
- the ability to design page templates to dynamically change based on conditions
- the ability to configure hierarchical reference data
- the ability to refresh the page displayed for an object without having to refresh the browser
- page layout enhancements and the ability to copy and paste Page Builder controls to the clipboard
- the ability for indexing to be performed on separate hardware from the data hub
- a reduction of the impact experienced by users while indexing occurs
- an increase in parallelization options due to multiple instances of the indexing service
- SAS Mobile Investigator enhancements, including the ability to view attributes of a relationship, support for image and number controls on mobile page templates, filtering of search results, and the ability to retry or cancel attachment uploads
SAS Adaptive Learning and Intelligent Agent System enhancements, including the ability to train a model using unsupervised and supervised learning, a reduction in the potential for model bias, the creation of a new model based on another model version, and enhancements to job monitoring capabilities. For more information, see SAS Visual Investigator 10.6: What’s New.

SAS Visual Text Analytics 8.5

SAS Visual Text Analytics 8.5 (November 2019 release of SAS Viya 3.5) includes these new features and enhancements:

- Use stratified sampling when automatically generating categories for large data sets to reduce pipeline run time.
- Filter matches in the rule editor of the Edit Concept and Sandbox tabs by using the _SELF_ keyword in conjunction with REMOVE_ITEM and NO_BREAK rules.
- Generate output data from a Concepts node and export it to SAS Visual Analytics for further analysis and visualization.
- Use a report template in SAS Visual Analytics to quickly create reports from Concepts and Categories output data.
- The autocomplete feature of the code editor in the interactive windows for the Concepts and Categories nodes is case sensitive, preventing accidental automatic completion of a key word as an operator.
- Add a pipeline template to a new or existing project in The Exchange.

For more information, see http://documentation.sas.com/?activeCdc=ctxtcdc&cdcId=capcdc&cdcVersion=8.5&docsetId=ctxtaug&docsetTarget=p0r4sjo27jrqrn1khklf58fsidy.htm

SAS Visual Text Analytics 8.5 includes these new programming features and enhancements:

- the ability to use the Sampling and Partitioning action set
- a redesigned rule generation action
- new action parameters in the Search action set, the ruleGen action, and the exportTextModel action
- the ability to search for special missing values
- improved capabilities for morphological expansion in the Korean language
- improvements to extraction of predefined concepts in the Danish language
- improved coverage of predefined concepts in the Spanish language

For more information, see What’s New in SAS Visual Text Analytics 8.5.

SAS Workflow Manager 2.3

Key features in SAS Workflow Manager 2.3 enable you to perform these tasks:

- workflow administrators can create and manage business calendars to exclude specific days of the week, dates, or both for timer events.
• users can add business calendars to boundary timer events.
• configure a default workflow administrator account for users who can administer SAS Workflow definitions.
• manage administrative failure notifications for additional service task and timer failures.
• add users or groups to an Excluded Owner role. Using excluded owners ensures that the same person does not review the task twice and can increase the transparency of an organization’s processes.
• workflow administrators can customize performance parameters.
• use transient variables with service tasks to store values that are required for the next step in the workflow.
• save REST Service Tasks as custom task templates. Task templates can be selected for use in other workflow definitions.

For more information, see What’s New in SAS Workflow Manager 2.3.
Part 3

Appendix

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Appendix 1

Documentation Enhancements

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Overview

The What's New documentation is cumulative and is updated whenever there is an update to a SAS product. The following topics will help you determine what changes were made after the initial release of SAS 9.4, which shipped in July 2013.

November 2019 (SAS 9.4, Rev. 940_19w47 and SAS Viya 3.5)

SAS Viya 3.5 shipped in November 2019. For more information about this release, see these topics:

- Chapter 16, “Introduction to SAS Viya,” on page 209
- Chapter 17, “SAS Viya Administration,” on page 219
- Chapter 18, “SAS Cloud Analytic Services,” on page 223
- Chapter 19, “SAS Viya Products,” on page 241

In addition, these products are new:
SAS Data Quality Accelerator for Teradata was enhanced. For more information, see “SAS 9.4 Data Quality Accelerator for Teradata: November 2019 Release” on page 141.

August 2019 (SAS 9.4, Rev. 940_19w34 and SAS Viya 3.4)

Beginning in August 2019, PROC DS2 and PROC FedSQL support the Google BigQuery and Snowflake databases for SAS 9.4M6 and SAS Viya 3.4.

For the August 2019 release of SAS/ACCESS, support was added for the Google BigQuery LIBNAME engine and for the Snowflake LIBNAME engine. Both engines include a corresponding SAS Data Connector that enables data transfer between the DBMS and CAS.

SAS Visual Analytics 8.4 shipped.

June 2019 (SAS 9.4, Rev. 940_19w25 and SAS Viya 3.4)

These products shipped a new release:

- “SAS Add-In 8.2 for Microsoft Office” on page 119
- “SAS Enterprise Guide 8.2” on page 123

SAS Add-In 8.2 for Microsoft Office and SAS Enterprise Guide 8.2 were enhanced.

SAS Data Quality Accelerator for Teradata was enhanced. For more information, see “SAS 9.4 Data Quality Accelerator for Teradata: November 2019 Release” on page 141.

- “SAS Add-In 8.1 for Microsoft Office” on page 120
- “SAS Business Data Network 3.3” on page 136
- “SAS Cost and Profitability Management 8.4” on page 159
- “SAS Decision Manager 3.3” on page 67
- “SAS Data Remediation 2.4” on page 144
- “SAS IT Resource Management 3.10” on page 183
- “SAS Enterprise Guide 8.1” on page 123
- “SAS Financial Management 5.6” on page 161
- “SAS High-Performance Risk 4.2” on page 88
- “SAS Lineage 3.3” on page 147
- “SAS Model Implementation Platform 3.2” on page 189
- “SAS Model Manager 14.3” on page 94
- “SAS Quality Knowledge Base for Contact Information 31” on page 148
May 2019 (SAS 9.4, Rev. 940_19w21 and SAS Viya 3.4)

The SAS 9.4M6 updates in this release are available only in orders placed after the May 2019 update. To receive these product updates, contact your SAS representative about placing an order. After you receive the new order, you can perform an upgrade in place for an existing environment.

Previously, many SAS applications and SAS solutions used the Adobe Flash Player to provide interactive user interfaces. Adobe announced that it intends to end support for Flash technology and will cease to update and distribute the Flash Player at the end of 2020. Browser vendors will disable Flash by default in 2019. For more information about Adobe Flash end-of-life, see SAS Software and Its Use of the Adobe Flash Player.

April 2019 (SAS 9.4, Rev. 940_19w17 and SAS Viya 3.4)

This release includes two new SAS/ACCESS engines: SAS/ACCESS Interface to MongoDB and SAS/ACCESS Interface to Salesforce.

For more information, see these resources:
- “SAS/ACCESS 9.4 Interface to MongoDB” on page 43
- “SAS/ACCESS 9.4 Interface to Salesforce” on page 46
- “DS2 Language: SAS 9.4M6” on page 16
- “FedSQL Language: SAS 9.4M6” on page 18

April 2019 (SAS 9.4, Rev. 940_19w14 and SAS Viya 3.4)

The April 2019 update of SAS Viya 3.4 includes these changes and enhancements:
- security updates to administrative and core microservices
- support for LDAP referrals
- bug fixes and improvements to performance in multi-tenant configurations, promotion of SAS 9 content, and authorization management

November 2018 (SAS 9.4, Rev. 940_18w47)

These products shipped a new release:
- “SAS Contextual Analysis 15.1” on page 65
October 2018 (SAS 940_18w39 and SAS Viya 3.4)

Accessibility was enhanced in SAS Visual Analytics 8.3, which is available in the SAS Viya 3.4 environment.

July 2018 (SAS 9.4, Rev. 940_18w30 and SAS Viya 3.4)

In the SAS 9.4 environment, these products shipped a new release:

• “SAS Add-In 8 for Microsoft Office” on page 120
SAS Viya 3.4 shipped. For more information, see https://documentation.sas.com/?cdcId=pgmsascdc&cdcVersion=9.4_3.4&docsetId=whatsnew&docsetTarget=titlepage.htm

June 2018 (SAS 9.4, Rev. 940_18w25)

These products shipped a new release:

- “SAS High-Performance Risk 4.1” on page 88
- “SAS Model Implementation Platform 3.1” on page 189
- “SAS Risk Dimensions” on page 195

May 2018 (SAS 9.4, Rev. 940_18w21)

SAS IT Resource Management 3.9 is new. For more information, see “SAS IT Resource Management 3.9” on page 183.

February 2018 (SAS 9.4, Rev. 940_18w08)

SAS Energy Forecasting 4.1 shipped a new release. For more information, see “SAS Energy Forecasting 4.1” on page 74.

December 2017 (SAS 9.4, Rev. 940_17w47 and SAS Viya 3.3)

The SAS platform consists of two environments: SAS 9.4 and SAS Viya. In December 2017, SAS shipped SAS 9.4M5 (Rev. 940_17w47) and SAS Viya 3.3. This document includes the new features for both of these environments.

These products were updated in SAS 9.4M5.

Note: If you installed the September 2017 release of SAS 9.4M5, you must request a new order of SAS 9.4M5 to get this functionality.

These products shipped a new release:

- “SAS Event Stream Processing 5.1” on page 76
- “SAS Model Risk Management 7.3” on page 191
- “SAS Risk and Finance Workbench 3.1” on page 194

These products shipped as part of the SAS 9.4M5 release:

- “Base SAS 9.4” on page 13
To learn about the new features in SAS Viya 3.3, see What’s New in SAS 9.4 and SAS Viya 3.3.

September 2017 (SAS 9.4, Rev. 940_17w38)

These products shipped a new release:

- “SAS Add-In 7.15 for Microsoft Office” on page 120
- “SAS Contextual Analysis 14.3” on page 65
- “SAS Data Integration Studio 4.903” on page 139
- “SAS Enterprise Guide 7.15” on page 124
- “SAS Enterprise Miner 14.3” on page 71
- “SAS/ETS 14.3” on page 80
- “SAS Forecast Server 14.3” on page 87
- “SAS High-Performance Analytics Infrastructure 3.7” on page 112
- “SAS High-Performance Risk 3.9” on page 88
- “SAS/IML 14.3” on page 92
- “SAS/OR 14.3” on page 97
- “SAS/QC 14.3” on page 100
- “SAS Quality Knowledge Base for Contact Information 28” on page 149
- SAS Risk Dimensions 6.9. For more information, see “SAS Risk Dimensions” on page 195.
- “SAS/STAT 14.3” on page 103
- “SAS Studio 3.7” on page 57
- “SAS Text Miner 14.3” on page 107

These products shipped as part of SAS 9.4M5:

- “Base SAS 9.4” on page 13
- “SAS/ACCESS” on page 40
- “SAS/CONNECT 9.4” on page 48
- “SAS 9.4 Data Quality Server” on page 143
- “SAS/GRAPH 9.4” on page 49
- “SAS 9.4 Integration Technologies” on page 173
- “SAS 9.4 Intelligence Platform” on page 177
- “SAS 9.4 In-Database Products” on page 167
- “SAS/SHARE 9.4” on page 55

SAS Data Loader 3.1M1 also shipped. For more information, see “SAS Data Loader 3.1” on page 137.
June 2017 (SAS 9.4, Rev. 940_17w25)

These products shipped a new release:

- SAS High-Performance Risk 3.8. For more information, see “SAS High-Performance Risk” on page 88.
- SAS Model Implementation Platform 2.4. For more information, see “SAS Model Implementation Platform” on page 188.
- SAS Risk Dimensions 6.8. For more information, see “SAS Risk Dimensions” on page 195.

DataFlux Data Management Studio 2.7 supports additional databases for data storage and DataFlux repositories. For more information, see “DataFlux Data Management Studio 2.7” on page 134.

May 2017 (SAS 9.4, Rev. 940_17w21)

SAS Event Stream Processing 4.3 shipped. For more information, see “SAS Event Stream Processing 4.3” on page 77.

April 2017 (SAS 9.4, Rev. 940_17w16)

These products shipped a new release:

- “SAS Add-In 7.14 for Microsoft Office” on page 120
- “SAS Business Data Network 3.2” on page 136
- “SAS Data Remediation 2.3” on page 144
- “SAS Lineage 3.2” on page 147
- “SAS MDM 4.3” on page 151
- “SAS Visual Analytics 7.4” on page 200

These products shipped a maintenance release:

- “SAS Energy Forecasting 3.2M1” on page 74
- SAS Job Monitor 2.2M1. For more information, see “SAS Job Monitor 2.2” on page 146.

February 2017 (SAS 9.4, Rev. 940_17w08)

SAS shipped SAS IT Resource Management 3.8. For more information, see “SAS IT Resource Management 3.8” on page 184.
These products shipped a new release:

- “SAS Add-In 7.13 for Microsoft Office” on page 121
- “SAS Business Rules Manager 3.2” on page 64
- “SAS Contextual Analysis 14.2” on page 66
- “SAS Data Loader 3.1” on page 137
- “SAS Data Integration Studio 4.902” on page 140
- “SAS Decision Manager 3.2” on page 68
- “SAS Enterprise Guide 7.13” on page 124
- “SAS Enterprise Miner 14.2” on page 71
- “SAS/ETS 14.2” on page 80
- “SAS Factory Miner 14.2” on page 86
- “SAS High-Performance Risk 3.7” on page 89
- “SAS/IML 14.2” on page 92
- “SAS Model Manager 14.2” on page 94
- “SAS Model Risk Management 7.2” on page 192
- “SAS/OR 14.2” on page 97
- “SAS/QC 14.2” on page 100
- “SAS Risk and Finance Workbench” on page 193
- SAS Risk Dimensions 6.7. For more information, see “SAS Risk Dimensions” on page 195.
- “SAS/STAT 14.2” on page 104
- “SAS Studio 3.6” on page 57
- “SAS Text Miner 14.2” on page 107

These products shipped as part of SAS 9.4M4:

- “Base SAS 9.4” on page 13
- “SAS/ACCESS” on page 40
- “SAS 9.4 Data Quality Accelerator for Teradata” on page 141
- “SAS 9.4 Data Quality Server” on page 143
- “SAS/GRAPH 9.4” on page 49
- “SAS 9.4 Intelligence Platform” on page 177
- “SAS 9.4 OLAP Server” on page 128
August 2016 (SAS 9.4, Rev. 940_16w33)

SAS shipped SAS Event Stream Processing 4.1. For more information, see “SAS Event Stream Processing 4.1” on page 78.

July 2016 (SAS 9.4, Rev. 940_16w30)

These products shipped a new release:
- “SAS Anti-Money Laundering 7.1” on page 163
- “SAS Model Risk Management 7.1” on page 192
- “SAS Risk Management for Banking 3.4” on page 196

April 2016 (SAS 9.4, Rev. 940_16w17)

SAS/ACCESS 9.4 for Amazon Redshift is new for this release. For more information, see “SAS/ACCESS 9.4 to Amazon Redshift” on page 41.

These products shipped a new release:
- “SAS High-Performance Risk 3.6” on page 89
- “SAS Quality Knowledge Base for Contact Information 27” on page 149
- SAS Risk Dimensions 6.6. For more information, see “SAS Risk Dimensions” on page 195.

February 2016 (SAS 9.4, Rev. 940_16w08)

These products shipped a new release:
- “SAS/ACCESS 9.4 Interface to the PI System” on page 45
- “SAS Add-In 7.12 for Microsoft Office” on page 121
- “SAS Enterprise Guide 7.12” on page 125
- “SAS IT Resource Management 3.7” on page 184
- “SAS Studio 3.5” on page 58

January 2016 (SAS 9.4, Rev. 940_16w04)

These products shipped a new release:
These products shipped a maintenance release:

- DataFlux Authentication Server 4.1M1. For more information, see “DataFlux Authentication Server 4.1” on page 133.
- SAS Anti-Money Laundering 6.3M1. For more information, see “SAS Anti-Money Laundering 6.3” on page 163.
- SAS Customer Due Diligence 6.3M1. For more information, see “SAS Customer Due Diligence 6.3” on page 165.

November 2015 (SAS 9.4, Rev. 940_15w47)

SAS Event Stream Processing 3.2 is now available. For more information, see “SAS Event Stream Processing 3.2” on page 78.

SAS Contextual Analysis 14.1M1 is now available. For more information, see “SAS Contextual Analysis 14.1” on page 67.

October 2015 (SAS 9.4, Rev. 940_15w42)

These products shipped a new release:

- “SAS High-Performance Risk 3.5” on page 89
- “SAS Risk Dimensions” on page 195

Social Network Analysis Server 6.2M2 is now available. For more information, see “SAS Social Network Analysis Server 6.2” on page 166.

August 2015 (SAS 9.4, Rev. 940_15w33)

These products shipped a new release:

- “SAS Quality Knowledge Base for Contact Information 26” on page 150
- “SAS Visual Analytics 7.3” on page 201

July 2015 (SAS 9.4, Rev. 940_15w31)

SAS Data Loader 2.3 for Hadoop is now available. For more information, see “SAS Data Loader 2.3 for Hadoop” on page 138.
July 2015 (SAS 9.4, Rev. 940_15w29)

SAS Factory Miner 14.1 is a new product. For more information, see “SAS Factory Miner” on page 86.

These products shipped a new release:

• “SAS Business Rules Manager 3.1” on page 64
• “SAS Contextual Analysis 14.1” on page 67
• “SAS Data Integration Studio 4.901” on page 140
• “SAS Decision Manager 3.1” on page 69
• “SAS Enterprise Miner 14.1” on page 71
• “SAS Environment Manager 2.5” on page 176
• “SAS/ETS 14.1” on page 81
• “SAS Forecast Server 14.1” on page 87
• “SAS High-Performance Analytics Infrastructure 3.1” on page 112
• “SAS/IML 14.1” on page 92
• “SAS 9.4 In-Database Products” on page 167
• “SAS Model Manager 14.1” on page 95
• “SAS/OR 14.1” on page 97
• “SAS/QC 14.1” on page 100
• “SAS/STAT 14.1” on page 104
• “SAS Studio 3.4” on page 58
• “SAS Text Miner 14.1” on page 107
• “SAS Theme Designer 4.7 for Flex” on page 181

These products were updated as part of SAS 9.4M3:

• “Base SAS 9.4” on page 13
• “SAS/ACCESS” on page 40
• “SAS 9.4 Data Quality Server” on page 143
• “SAS/GRAPH 9.4” on page 49
• “SAS Grid Manager” on page 53
• “SAS 9.4 Intelligence Platform” on page 177
• “SAS 9.4 OLAP Server” on page 128

May 2015 (SAS 9.4, Rev. 940_15w20)

SAS Model Risk Management is a new product. For more information, see “SAS Model Risk Management” on page 191.
These products shipped a new release:

- “SAS Add-In 7.11 for Microsoft Office” on page 122
- “SAS Enterprise Guide 7.11” on page 125
- “SAS Event Stream Processing 3.1” on page 78
- “SAS High-Performance Analytics Infrastructure 2.94” on page 112
- “SAS High-Performance Risk 3.4” on page 89
- “SAS IT Resource Management 3.6” on page 184
- “SAS Risk Management for Banking 3.3” on page 196
- “SAS Visual Analytics 7.2” on page 201

April 2015 (SAS 9.4, Rev. 940_15w16)

SAS Scalable Performance Data Server 5.2 is now available. For more information, see “SAS Scalable Performance Data Server 5.2” on page 56.

March 2015 (SAS 9.4, Rev. 940_15w12)

These products are new:

- SAS Data Loader for Hadoop. For more information, see “SAS Data Loader” on page 137.
- SAS Energy Forecasting. For more information, see “SAS Energy Forecasting 3.1” on page 75.

These products shipped a new release:

- “SAS Data Remediation 2.2” on page 144
- “SAS Job Monitor 2.2” on page 146
- “SAS Marketing Automation 6.4” on page 155
- “SAS Marketing Optimization 6.4” on page 156
- “SAS MDM 4.2” on page 152
- “SAS Real-Time Decision Manager 6.4” on page 157
- “SAS Task Manager 2.2” on page 152
- “SAS Visual Process Orchestration 2.2” on page 153

February 2015 (SAS 9.4, Rev. 940_15w08)

These products shipped a new release:

- “SAS Data Quality Accelerator 2.6 for Teradata” on page 142
- “SAS Quality Knowledge Base for Contact Information 25” on page 150
These products were enhanced:

- the DS2 language. The SAS In-Database Code Accelerator for Hadoop now uses HCatalog to process complex, non-delimited files. For more information, see “DS2 Language” on page 15.
- SAS 9.4 In-Database Code Accelerator for Hadoop. For more information, see “SAS 9.4 In-Database Products” on page 167.

January 2015 (SAS 9.4, Rev. 940_15w04)

These products shipped a new release:

- “SAS Anti-Money Laundering 6.3” on page 163
- “SAS Customer Due Diligence 6.3” on page 165
- “SAS Financial Management 5.5” on page 161

SAS Social Network Analysis Server 6.2M1 shipped. For more information, see “SAS Social Network Analysis Server 6.2” on page 166.

November 2014 (SAS 9.4, Rev. 940_14w47)

These products are new:

- “SAS Business Data Network 3.1” on page 137
- “SAS Lineage 3.1” on page 147

These products shipped a new release:

- “DataFlux Data Management Server 2.6” on page 134
- “SAS Event Stream Processing Engine 2.3” on page 78
- “SAS High-Performance Analytics Infrastructure 2.91” on page 112
- “SAS High-Performance Risk 3.3” on page 90
- “SAS LASR Analytic Server 2.5” on page 115
- “SAS Quality Knowledge Base for Contact Information 24” on page 150
- “SAS Quality Knowledge Base for Product Data 5” on page 151

October 2014 (SAS 9.4, Rev. 940_14w41)

These products shipped a new release:

- “DataFlux Data Management Studio 2.6” on page 135
- “SAS Add-In 7.1 for Microsoft Office” on page 122
- “SAS Enterprise GRC 6.1” on page 186
September 2014 (SAS 9.4, Rev. 940_14w36)

SAS IT Resource Management 3.5 is a new release. For more information, see “SAS IT Resource Management 3.5” on page 184.

August 2014 (SAS 9.4, Rev. 940_14w32)

These products shipped a new release:

• “SAS Contextual Analysis 12.3” on page 67
• “SAS Business Rules Manager 2.2” on page 65
• “SAS Data Integration Studio 4.9” on page 140
• “SAS Decision Manager 2.2” on page 70
• “SAS Environment Manager” on page 175
• “SAS Enterprise Miner 13.2” on page 72
• “SAS/ETS 13.2” on page 82
• “SAS/IML 13.2” on page 93
• “SAS Model Manager 13.1” on page 95
• “SAS/OR 13.2” on page 98
• “SAS/QC 13.2” on page 101
• “SAS/STAT 13.2” on page 105
• “SAS Studio 3.2” on page 59
• “SAS Text Miner 13.2” on page 108

These products are new:

• SAS/ACCESS Interface to Impala
• SAS/ACCESS Interface to the PI System

These products shipped as part of SAS 9.4M2:

• “Base SAS 9.4” on page 13
• “SAS/ACCESS 9.4 Interface to Hadoop” on page 42
• “SAS/ACCESS 9.4 Interface to Oracle” on page 43
• “SAS/ACCESS 9.4 Interface to PC Files” on page 44
• “SAS/CONNECT 9.4” on page 48
• “SAS/GRAPH 9.4” on page 49
June 2014 (SAS 9.4, Rev. 940_14w23)

These products shipped a new release:
- “SAS OpRisk VaR 6.1” on page 193
- “SAS Quality Knowledge Base for Contact Information 23” on page 150

May 2014 (SAS 9.4, Rev. 940_14w19)

These products shipped a new release:
- “DataFlux Authentication Server 4.1” on page 133
- “SAS Federation Server 4.1” on page 145
SAS DataFlux Secure 2.5 was updated. For more information, see “DataFlux Secure 2.7” on page 135.

April 2014 (SAS 9.4, Rev. 940_14w14)

These products shipped a new release:
- “SAS Anti-Money Laundering 6.2” on page 164
- “SAS Data Quality Accelerator 2.5 for Teradata” on page 142
These products shipped a maintenance release:
- “SAS Data Remediation 2.1” on page 144
- “SAS MDM 4.1” on page 152
- “SAS Task Manager 2.1” on page 153

March 2014 (SAS 9.4, Rev. 940_14w11)

These products are new:
- “SAS In-Memory Statistics” on page 111
- “SAS Studio 3.1” on page 59
These products shipped a new release:

• “SAS LASR Analytic Server 2.3” on page 116
• “SAS Visual Analytics 6.4” on page 202

The documentation was updated for SAS Data Surveyor 5.1 for SAP. For more information, see “SAS Data Surveyor for SAP” on page 145.

December 2013 (SAS 9.4, Rev. 940_13w51)

SAS 9.4M1 shipped in December 2013. Several products were updated in this maintenance release.

• “SAS/ACCESS 9.4 Interface to PC Files” on page 44
• “Base SAS 9.4” on page 13
• “SAS/CONNECT 9.4” on page 48
• “SAS 9.4 In-Database Products” on page 167
• “SAS 9.4 Integration Technologies” on page 173
• “SAS 9.4 Intelligence Platform” on page 177
• “SAS 9.4 OLAP Server” on page 128

These products shipped a new release:

• “SAS Data Integration Studio 4.8” on page 140
• “SAS Enterprise Miner 13.1” on page 72
• “SAS/ETS 13.1” on page 84
• “SAS Financial Management 5.4” on page 161
• “SAS Forecast Server 13.1” on page 87
• “SAS High-Performance Computing Management Console 2.4” on page 113
• “SAS High-Performance Risk 3.2” on page 90
• “SAS/IML 13.1” on page 93
• “SAS LASR Analytic Server 2.1 and 2.2” on page 117
• “SAS/OR” on page 96
• “SAS/QC” on page 99
• “SAS/STAT 13.1” on page 106
• “SAS Theme Designer 4.2 for Flex” on page 182
• “SAS Text Miner 13.1” on page 109
• “SAS Visual Analytics 6.3” on page 203

These products shipped a maintenance release:

• SAS Add-In 6.1M1 for Microsoft Office is available. For more information, see “SAS Add-In 6.1 for Microsoft Office” on page 123.
• SAS Enterprise Guide 6.1M1 is available. For more information, see “SAS Enterprise Guide 6.1” on page 126.
November 2013 (SAS 9.4, Rev. 940_13w45)

These products shipped a new release:
• “SAS Anti-Money Laundering 6.1” on page 164
• “SAS Quality Knowledge Base for Contact Information 22” on page 151

These products are new:
• “SAS Customer Due Diligence 6.1” on page 165
• “SAS Peer Group Analysis 6.1” on page 165

October 2013 (SAS 9.4, Rev. 940_13w40)

These products are new:
• “DataFlux Data Management Server 2.5” on page 134
• “DataFlux Data Management Studio 2.5” on page 135
• “SAS Contextual Analysis 12.3” on page 67
• “SAS Data Management Console” on page 141
• “SAS Data Remediation 2.1” on page 144
• “SAS Job Monitor 2.1” on page 146
• “SAS MDM 4.1” on page 152
• “SAS Visual Process Orchestration 2.1” on page 153

These products shipped a new release:
• “DataFlux Authentication Server 3.2” on page 133
• “DataFlux Secure 2.5” on page 136
• “SAS Data Quality Accelerator 2.4 for Teradata” on page 143

September 2013 (SAS 9.4, Rev. 940_13w36)

SAS Data Quality Accelerator for Teradata 2.4 is a new product. For more information, see “SAS Data Quality Accelerator 2.4 for Teradata” on page 143.

July 2013 (SAS 9.4, Rev. 940_13w30)

The SAS In-Database products were updated. For more information, see “SAS 9.4 In-Database Products” on page 167.
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