What’s New in Base SAS® 9.4
Details
Contents

Chapter 1 • Details about the New Features in Base SAS 9.4 .............................................. 1
  DS2 Language .................................................................................................................. 2
  FedSQL Language ......................................................................................................... 3
  Hadoop Support ............................................................................................................... 4
  Execute the DATA Step in New Supported Environments ........................................... 6
  Output Delivery System (ODS) ..................................................................................... 6
  ODS Statistical Graphics .............................................................................................. 9
  Performance .................................................................................................................... 11
  Extended Variable and Data Set Attributes .................................................................. 12
  Locked-Down State ....................................................................................................... 12
  Preserving the SAS Environment .................................................................................. 13
  JSON Support ................................................................................................................ 13
  Saving Macro Code from an Input Stream ..................................................................... 13
  Transporting SAS Files ................................................................................................. 13
  Universal Printing .......................................................................................................... 13
  Encryption ....................................................................................................................... 14
  Scalable Performance Data Engine ............................................................................... 15
  National Language Support (NLS) ............................................................................... 16
  Metadata ......................................................................................................................... 18
  SAS Logging Facility ..................................................................................................... 19
  Application Response Measurement (ARM) ................................................................. 19
  E-Mail .............................................................................................................................. 20
  Procedures ...................................................................................................................... 20
  DATA Step Language Elements ................................................................................... 23
  SAS Macro Facility ......................................................................................................... 27
  SAS under UNIX ............................................................................................................ 28
  SAS under Windows ....................................................................................................... 29
  SAS under z/OS .............................................................................................................. 30
  Additional Information ................................................................................................. 31
# Chapter 1
Details about the New Features in Base SAS 9.4

<table>
<thead>
<tr>
<th>Feature</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS2 Language</td>
<td>2</td>
</tr>
<tr>
<td>FedSQL Language</td>
<td>3</td>
</tr>
<tr>
<td>Hadoop Support</td>
<td>4</td>
</tr>
<tr>
<td>Execute the DATA Step in New Supported Environments</td>
<td>6</td>
</tr>
<tr>
<td>Output Delivery System (ODS)</td>
<td>6</td>
</tr>
<tr>
<td>ODS Statistical Graphics</td>
<td>9</td>
</tr>
<tr>
<td>General Enhancements</td>
<td>9</td>
</tr>
<tr>
<td>SGPANEL and SGPLOT Statements</td>
<td>9</td>
</tr>
<tr>
<td>ODS Graphics Designer</td>
<td>10</td>
</tr>
<tr>
<td>ODS Graphics Editor</td>
<td>11</td>
</tr>
<tr>
<td>SAS Graph Template Language</td>
<td>11</td>
</tr>
<tr>
<td>Performance</td>
<td>11</td>
</tr>
<tr>
<td>Extended Variable and Data Set Attributes</td>
<td>12</td>
</tr>
<tr>
<td>Locked-Down State</td>
<td>12</td>
</tr>
<tr>
<td>Preserving the SAS Environment</td>
<td>13</td>
</tr>
<tr>
<td>JSON Support</td>
<td>13</td>
</tr>
<tr>
<td>Saving Macro Code from an Input Stream</td>
<td>13</td>
</tr>
<tr>
<td>Transporting SAS Files</td>
<td>13</td>
</tr>
<tr>
<td>Universal Printing</td>
<td>13</td>
</tr>
<tr>
<td>Encryption</td>
<td>14</td>
</tr>
<tr>
<td>Scalable Performance Data Engine</td>
<td>15</td>
</tr>
<tr>
<td>National Language Support (NLS)</td>
<td>16</td>
</tr>
<tr>
<td>Metadata</td>
<td>18</td>
</tr>
<tr>
<td>SAS Logging Facility</td>
<td>19</td>
</tr>
<tr>
<td>Application Response Measurement (ARM)</td>
<td>19</td>
</tr>
<tr>
<td>E-Mail</td>
<td>20</td>
</tr>
<tr>
<td>Procedures</td>
<td>20</td>
</tr>
<tr>
<td>DATA Step Language Elements</td>
<td>23</td>
</tr>
<tr>
<td>SAS Macro Facility</td>
<td>27</td>
</tr>
</tbody>
</table>
DS2 is a new 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. It 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.

The first maintenance release for SAS 9.4 has the following changes and enhancements:

• The PROC DS2 INDB= option has changed its name to DS2ACCEL. INDB= is still supported as an alias. However, the default value for the option has changed from YES to NO, which prevents DS2 code from executing in the database.

• The default behavior for the SAS In-Database Code Accelerator has changed. DS2 code is not executed inside the database by default. You must set either the new DS2ACCEL system option or the PROC DS2 DS2ACCEL option to ANY to enable DS2 code to run inside the database.

• The SAS In-Database Code Accelerator for Teradata now runs the DS2 data program as well as the thread program inside the database.

• Five new DS2 configuration and run-time loggers have been added to the SAS Logging Facility.

• You can use formatted log messages.

The second maintenance release for SAS 9.4 has the following changes and enhancements:

• The SAS In-Database Code Accelerator for Hadoop runs the DS2 data program as well as the thread program inside the database.

• Nine new functions have been added.

• A new predefined HTTP package enables you to construct an HTTP client to access web services.

• A new logger, App.TableServices.d2pkg.HTTP, enables logging of HTTP traffic through the SAS logging facility.

• A connection string parameter is available when instantiating an SQLSTMT package.

• The Getting Started section has been rewritten and contains new examples.

The third maintenance release for SAS 9.4 has the following changes and enhancements:

• SAS In-Database Code Accelerator has these enhancements:
• The SET statement supports multiple tables and embedded SQL.
• The Code Accelerator reads and writes HDFS-SPD Engine file formats.
• The SAS log links to the MapReduce job log to find error messages when a Hadoop data or thread program fails.

You can change the default behavior of a DS2 program by using the DS2_OPTIONS statement:
• Specify how DS2 processes a division by zero operation.
• Specify to write a note instead of an error message to the SAS log when an invalid function argument generates a missing value.
• Specify how non-existent values are processed as ANSI SQL null values.
• Specify to create a trace of executed statements.

You can override the default data source connection with the specified data source connection string by using the NOLIBS CONN= option in the PROC DS2 statement.

You can obtain information about a format or informat by using the FMTINFO( ) function. The function can return the format or informat category, whether it is a format or informat, 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 compare two character strings including and excluding trailing blanks, respectively, by using the CMP and CMPT functions.

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.

Create a value based on US locales regardless of the current locale by using the BESTDOTX. format.

Partition tables by using the DBCREATE_TABLE_OPTS table option.

**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.
The first maintenance release for SAS 9.4 has the following enhancements:

- support for Memory Data Store (MDS), SAP HANA, and SASHDAT data sources
- rename table and rename column functionality in the ALTER TABLE statement
- several new functions

The second maintenance release for SAS 9.4 has the following enhancements:

- Support for Hive, HDMD, and PostgreSQL data sources is new. 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.
- The DBCREATE_INDEX_OPTS= table option for SASHDAT enables you to add DBMS-specific clauses to the end of the CREATE INDEX statement.
- The SQUEEZE= table option enables you to write the SASHDAT file in compressed format.

The third maintenance release for SAS 9.4 has the following 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.
- Set the encoding for a SAS data set by using the ENCODING= table option.
- Use the DECIMAL/NUMERIC(p,s) data type for data definition and for reading in HDMD.
- 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.

Hadoop Support

The first maintenance release for SAS 9.4 has the following enhancements:

- The HADOOP procedure now provides the PROPERTIES statement to submit configuration properties to the Hadoop server.
- You can now specify the NOWARN option in the PROC HADOOP HDFS statement to suppress the warning message when there is an attempt to delete a file that does not exist.
- The SPD Engine is enhanced to read, write, and update data in a Hadoop cluster through the HDFS.
- The FILENAME Hadoop Access Method statement, which enables you to access files on an HDFS, has been enhanced. A new option, NEW, is used in output mode in conjunction with the DIR option to create the directory that is specified in the FILENAME Hadoop statement.

The second maintenance release for SAS 9.4 has the following enhancements:

- **SAS Hadoop Configuration Guide for Base SAS and SAS/ACCESS** is available from the support.sas.com third-party site for Hadoop.

  *SAS Hadoop Configuration Guide for Base SAS and SAS/ACCESS* explains how to configure SAS components so that you can use SAS technology to connect to Hadoop. Specific instructions are provided for the HADOOP procedure, the FILENAME statement Hadoop access method, the SAS Scalable Performance Data (SPD) Engine, and the SAS/ACCESS Interface to Hadoop.

- If `MSGLEVEL=I`, SAS writes Hadoop MapReduce job information to the SAS log.

In the second maintenance release for SAS 9.4, the SPD Engine improves Hadoop performance in these ways:

- Creating a large SAS index for a data set in HDFS is much faster because the index is partitioned.

- The scope of the SPD Engine I/O block size is expanded; the default block size is 1 megabyte. The block size affects compressed, uncompressed, and encrypted data sets. The block size influences the size of I/O operations when reading all data sets and writing compressed data sets.

- Expanded support for parallel processing enables you to request parallel processing for all Read operations of data stored in HDFS. Use the `SPDEPARALLELREAD=` system option, the `PARALLELREAD=` LIBNAME statement option, or the `PARALLELREAD=` data set option.

- You can optimize the performance of WHERE processing by requesting that the subsetting of the data be performed in the Hadoop cluster. This takes advantage of the filtering and ordering capabilities of the MapReduce framework. Use the `ACCELWHERE=` LIBNAME statement option or the `ACCELWHERE=` data set option.

- You can control the number of MapReduce tasks when writing data in HDFS. The new `NUMTASKS=` LIBNAME statement option controls parallel processing on the Hadoop cluster when writing output from a SAS High-Performance Analytics procedure. For more information, see “Controlling Tasks When Writing Data in HDFS” in *SAS SPD Engine: Storing Data in the Hadoop Distributed File System*.

The third maintenance release for SAS 9.4 has the following enhancements:

- You can use the `SQOOP procedure` to access Apache Sqoop from a SAS session to transfer data between a database and HDFS.

- **PROC HADOOP**
  
  - 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 use wildcard characters when specifying HDFS files for several HDFS statement options.
  
  - You can request recursive action to execute the operation on the specified directory as well as subdirectories for several HDFS statement options.
  
  - New HDFS statement options display the contents of files (`CAT=`), change file access permissions (`CHMOD=`, `CHMOD=`), and list HDFS files (`LS=`).
  
  - You can submit a MapReduce program and Pig language code to a Hadoop cluster through the Apache Oozie RESTful API.
• FILENAME, Hadoop access method
  • The Hadoop access method supports the SAS_HADOOP_CONFIG_PATH environment variable. You no longer have to merge properties from multiple Hadoop configuration files into a single configuration file and specify the CFG= option.
  • The CONCAT and DIR Hadoop options are now mutually exclusive because the SAS_HADOOP_CONFIG_PATH environment variable is available.

• SAS 9.4 SPD Engine: Storing Data in the Hadoop Distributed File System
  • WHERE processing is optimized for MapReduce to support more WHERE expression conditions.
  • Concurrent access to data 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.

• The SAS FedSQL language has enhanced support for 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.

• 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*.

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

In the first maintenance release for SAS 9.4, the DATA step can run in these environments, with limitations:

• in-memory, in the SAS LASR Analytic Server
• SAS Embedded Process for Hadoop (Preproduction)

In the second maintenance release for SAS 9.4, DATA step processing in Hadoop is fully supported.

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

**Output Delivery System (ODS)**

The Report Writing Interface (RWI) enables you to create and manipulate predefined ODS objects in a DATA step to create highly customized output.
There are four new ODS destinations, EPUB, EPUB3, HTML5, and the ODS destination for PowerPoint:

- The **ODS EPUB** statement creates e-books with the .epub extension. E-books that use the .epub format can be read by a wide variety of e-book readers.
- In the first maintenance release for SAS 9.4, the **ODS EPUB3** statement supports HTML5, CSS2, CSS3, SVG, and user-specified audio and video. Any e-book reader that supports EPUB3 supports ODS EPUB3 audio and video.
- The **ODS HTML5** statement creates HTML output by using the 5.0 version of HTML.
- The **ODS POWERPOINT** statement creates PowerPoint slides. Slides can contain text, graphics, and tables.

There are three new procedures:

- The **ODSLIST** procedure creates lists that can be customized and nested.
- The **ODSTABLE** procedure creates table templates and binds them with the input data set in one statement. You can also name your templates and store them in a template store.
- The **ODSTEXT** procedure creates lists and paragraphs for your output.

You can arrange output on a page by using the ODS LAYOUT statement. Output can be arranged in an absolute location (absolute), or it can be arranged dynamically (gridded). **Absolute layout** enables you to specify an exact page location by using x and y coordinates. **Gridded layout** enables you to arrange output in a two-dimensional grid structure. Absolute layout is limited to one page and is supported by PRINTER destinations (PDF, PS, and PCL). Gridded layout is supported for HTML, POWERPOINT, and PRINTER destinations (PDF, PS, and PCL).

The default style for all Printer family destinations (PDF, PS, and PCL) has changed from Printer to **Pearl**.

The default HTML style for batch output on all hosts has changed from Default to **HTMLBlue**.

The **ODS GRAPHICS** statement now supports the ATTRPRIORITY= option and the DRILLTARGET= option. The default for the ANTIALIASMAX= option has changed from 600 to 4000. In the first maintenance release for SAS 9.4, the DATASKINMAX= option specifies the maximum number of skinned graphical elements. Also, in the first maintenance release for SAS 9.4, the ODS GRAPHICS statement supports the BYLINE= option and the LOESSMAXOBS= options.

The default device driver for the **RTF** and **TAGSETS.RTF** destination has changed to EMF.


In the first maintenance release for SAS 9.4, the following options are new for the EPUB, MARKUP family, PRINTER family, and RTF ODS destinations:

- The **DOM** option specifies that the ODS document object model is written to the SAS log or an external file.
- The **CSSSTYIE=** option specifies a cascading style sheet to apply to your output.
In the first maintenance release for SAS 9.4, you can apply cascading style sheets (CSS) to many types of ODS output.

The second maintenance release for SAS 9.4 has the following changes and enhancements:

- For the ODS EPUB and ODS EPUB3 statements, the ODS ESCAPECHAR statement now supports these functions: BOLD, EMPHASIS, ITALIC, PDF, and STRONG.
- The ODS HTML5 statement supports these new options:
  The SHOW_GRAPH_STYLES= option specifies whether the output contains elements from the graph style that is specified.  
  The USE_CSS_RESET= option turns off the default CSS styles information.
- The following ODS tagsets have been deprecated: DOCBOOK, HTMLCSS, IMODE, MVSHtml, PYX, SASREPORT family of tagsets, TPL_STYLE_LIST, TRPL_STYLE_MAP, WML, WMLLIST, and XHTML.
- The SAS Output Delivery System: User's Guide has been divided into three documents:
  SAS Output Delivery System: Procedures Guide. Syntax and information about ODS procedures that were previously documented in SAS Output Delivery System: User's Guide are now documented here.
  SAS Output Delivery System: Advanced Topics. Advanced topics, such as the report writing interface and cascading style sheets, that were previously documented in SAS Output Delivery System: User's Guide are now documented here.
  SAS Output Delivery System: User's Guide. In addition to the document's restructuring, the section "ODS Styles Reference" has been added. This section is intended to help you find ODS style-related information. The Style Templates chapter contains a table of the recommended and default styles for each destination. This chapter also contains a gallery with examples of each style and a program that enables you to create a gallery of your own. The Style Elements chapter contains a table of all available style elements. The Style Attributes chapter contains a table of all available style attributes and their full descriptions.

The third maintenance release for SAS 9.4 has these enhancements:

- You can use the ODS EXCEL statement to create output for native Microsoft Excel files in the SpreadsheetML format.
- A new procedure, MSCHART (preproduction), creates charts that can be opened and manipulated in Microsoft Excel.
- The ODS POWERPOINT statement supports background color or images, several options to customize transitions between slides, and the dynamic or explicit population of gridded layouts by groups, tables, pages, or procedures.
- The default EPUB version is EPUB3.
- The ODS EPUB3 statement supports new EVENT= values for figures and custom entries in a table of contents.
- The ODS ESCAPECHAR statement supports new functions for use with the ODS EPUB3 statement:
  - Images and captions can be embedded in an EPUB3 e-book chapter. Audio and video are supported using the AUDIO and VIDEO functions, respectively.
• You can include accessibility features for MathML by using the MATHML function.

• You can create pop-up footnotes by using the NOTEREF function.

• The ODS EPUB and ODS EPUB3 statements no longer support the ENCODING= option. ODS uses the encoding that is specified in the SAS Registry. For more information, see “Changing the ODS EPUB and EPUB3 Encoding Settings” in SAS Output Delivery System: User’s Guide.

• The ODS GRAPHICS statement has these enhancements:
  • You can reset options to their default value by using the RESET option.
  • Two options have new names, LEGENDAREAMAX= and LOESSOBSMAX=. The original names, MAXLEGENDAREA= and LOESSMAXOBS= respectively, continue to be supported.
  • You can push and pop ODS GRAPHICS settings to a stack by using the PUSH or POP options. To specify the maximum stack depth, use the STACKDEPTHMAX= option.
  • To write the current ODS GRAPHICS setting to the SAS log, use the SHOW option.
  • Audio and video are supported in HTML5 and EPUB output when you use the Report Writing Interface.

### ODS Statistical Graphics

#### General Enhancements

**HTMLBlue** is the default style for the ODS HTML destination when you use SAS in the windowing environment and in batch mode. Previously, HTMLBlue was the default style only when you used SAS in the windowing environment.

A new **ATTRPRIORITY=** option for the ODS GRAPHICS statement specifies a priority for the cycling of attributes for group values. The **DRILLTARGET=** option enables you to specify the window where the drill-down output is displayed.

#### SGPANEL and SGPLOT Statements

The SGPANEL and SGPLOT procedures have new statements:

• The new **INSET** statement in the SGPANEL procedure adds a text box to each panel cell of the graph.

• The new **BLOCK** statement creates a plot that highlights ranges and creates rectangular blocks that contain text values.

• The new **STYLEATTRS** statement specifies group attributes for a graph.

• Two new statements in the SGPLOT procedure create an axis-aligned row or column of textual data. The **XAXISTABLE** and the **YAXISTABLE** statements place data values at specific locations inside or outside the axis.

The following SGPANEL and SGPLOT procedure enhancements have been added to the first maintenance release for SAS 9.4:
• The FRINGE statement creates a fringe plot on the X or X2 axis of a plot.
• DROPLINE creates one or more drop lines from data point or data points to one or both axes. The lines can be horizontal, vertical, or both.
• POLYGON creates a polygon plot from data that is stored in a data set.
• You can define your own marker symbols to be used in plots that contain markers. The SYMBOLCHAR statement defines a marker symbol by using a Unicode character. The SYMBOLIMAGE statement defines a marker symbol by using an image that exists in the local file system.
• You can use annotation macros within a DATA step to simplify the process of creating annotation observations.

In the second maintenance release for SAS 9.4, the ODS Graphics procedures have a new text plot, a new gradient legend, and several new options for controlling legends, axis tables, and graphical output. For more information, see “What's New in SAS ODS Graphics Procedures 9.4” in SAS ODS Graphics: Procedures Guide.

The following SGPANEL and SGPLOT procedure enhancements have been added to the third maintenance release for SAS 9.4:
• Five new plot statements enable heat maps, spline plots, and bar charts that are compatible with all basic plots.
• The attribute mapping feature maps ranges of continuous numeric values to graphical properties.
• A wide range of new options apply to plots, legends, axes, axis tables, and discrete attribute maps. These options enhance the ability to produce sophisticated graphs.

For a complete description of all enhancements, see the SAS ODS Graphics: Procedures Guide.

**ODS Graphics Designer**

The ODS Graphics Designer has these changes and enhancements:
• The new Auto Charts feature enables you to create a group of graphs dynamically with a single click.
• Axis tables create plots of input data along the vertical or horizontal axis, placing data values at specific locations inside the axis.
• High-low charts create a display of floating vertical or horizontal lines or bars that represent high and low values.
• There are several updates to enhance graphs, plots, charts, and the appearance of axes.
• New ODS styles have been added: HTMLBlue, Dove, Pearl, and Raven.
• To change the default appearance of graphs, you can specify attributes for group values.
• You can change the attribute priority that determines the rotation pattern that is used for group values.

The following SAS ODS Graphics Designer enhancements have been added to the first maintenance release for SAS 9.4:
• When working with automatically generated graphs, you can save the graphs as images or in other formats, including an ODS Graphics Designer file that you can later edit.
• For charts, such as bar charts, that enable you to specify a statistic, the default statistic is now MEAN. Previously, the default was SUM.
• You can save a graph to and open a graph from a remote server location.

The following SAS ODS Graphics Designer enhancements have been added to the third maintenance release for SAS 9.4:
• Subpixel rendering has been implemented, resulting in clearer images.
• Enhancements to individual plots enable you to create more sophisticated graphs.

For more information, see *SAS ODS Graphics Designer: User's Guide*.

**ODS Graphics Editor**

The ODS Graphics Editor has these changes and enhancements:
• New ODS styles have been added: HTMLBlue, Dove, Pearl, and Raven.
• To change the default appearance of graphs, you can specify attributes for group values.
• You can change the attribute priority that determines the rotation pattern that is used for group values.

Starting with the first maintenance release for SAS 9.4, you can do the following:
• Modify several attributes and properties of a PATHDIAGRAM plot’s graphical elements.
• Change all of the attributes and properties of the plot and axes of a LINECHART plot in the Plot Properties dialog box. In prior releases, you could edit only the general properties.

These enhancements are available in the third maintenance release for SAS 9.4:
• You can edit Textplot plot properties.
• Groups are supported in Histograms.
• Subpixel rendering results in clearer images.
• With some limitations, you can adjust the viewport and view 3-D graph parameters.

For more information, see *SAS ODS Graphics Editor: User's Guide*.

**SAS Graph Template Language**

The SAS Graph Template Language has numerous changes to enhance graphs in SAS 9.4, and in the first, second, and third maintenance releases for SAS 9.4. For more information, see “What’s New in SAS 9.4 Graph Template Language” in *SAS Graph Template Language: Reference*.

**Performance**

On host platforms other than z/OS, SAS is more efficient in writing output data, especially large amounts of data, when the data is aligned on a page boundary. You can use the `ALIGNSASIOFILES` system option to align output data on a page boundary.
The optimization processes that determine the page size for SAS data sets and utility files have been enhanced. If the optimization processes are not ideal for your SAS session, you can revert to optimization processes that were in place prior to SAS 9.4 by using the DATAPAGESIZE= system option.

I/O between SAS and RAID devices improves when you use the STRIPESIZE= system option to set the page size for a SAS library to be the same size as the RAID stripe.

SAS uses temporary utility files for processing SAS data sets. I/O performance improves when the page size of the utility files is compatible with the page size for the data set. Two new system options, UBUFNO= and UBUFSIZE=, enable you to configure buffers for utility files.

Processing a SAS view is improved using the VBUFSIZE= system option to set the size of the view buffer that holds output observations.

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### Extended Variable and Data Set Attributes

You can create custom attributes for variables and data sets by using extended attributes. You manage extended attributes by using the DATASETS procedure.

In addition to the DATASETS procedure, these procedures support extended attributes:

- APPEND
- CIMPORT
- CONTENTS
- COPY
- CPORT
- DOWNLOAD
- MIGRATE
- SQL
- UPLOAD

---

### Locked-Down State

In the first maintenance release for SAS 9.4, if you are running SAS in a client/server environment (for example, SAS Enterprise Guide), the SAS server administrator can create an environment where your SAS client has access to a set of directories and files. 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 the second maintenance release for SAS 9.4, the LOCKDOWN statement is enhanced so that certain access methods and their related procedures are disabled by default when a SAS session is locked down. However, the SAS server administrator can re-enable one or more of these access methods. For a list of the default locked-down restrictions, see “SAS Processing Restrictions for Servers in a Locked-Down State” in SAS Language Reference: Concepts.
Preserving the SAS Environment

When the `PRESENV=` system option is set, the Work library data sets and catalogs, and the values of global statements, macro variables, and system options can be preserved between SAS sessions. You use the `PRESENV` procedure to package the data to be used in another SAS session.

JSON Support

The `JSON` procedure reads data from a SAS data set and writes the data to an external file in JSON representation.

In the third maintenance release for SAS 9.4, you can create and parse JSON text by using the DS2 JSON package.

Saving Macro Code from an Input Stream

The new `STREAM` procedure enables you to process arbitrary text that contains SAS macro specifications in an input stream. The procedure can expand macro code and store it in a file.

Transporting SAS Files

Moving and Accessing SAS Files has been updated to include information about the following changes:

- The CPORT and CIMPORT procedures now support the Extended Attributes feature.
- The CPORT and CIMPORT procedures do not transfer data mining database catalog entries from SAS 9.3 or earlier versions of SAS.

In the second maintenance release for SAS 9.4, autocall macros have been added to read from or write to transport files in SAS Version 5 (V5) or SAS Version 8 (V8) formats. These are the macros:

- `%LOC2XPT`
- `%XPT2LOC`

For more information, see “What's New in Moving and Accessing SAS 9.4 Files” in Moving and Accessing SAS Files.

Universal Printing

SAS now creates TIFF images and the EMFPlus and EMFDual metafile formats.
Transparency is supported for EMF Universal Printers and GIF images within PostScript files.

You can add a printer’s mark that is not visible in Universal Printing output by using the COLOPHON= system option.

You can animate multi-page GIF images and SVG files by setting these system options: ANIMATION=, ANIMDURATION=, ANIMLOOP=, ANIMOVERLAY, SVGAUTOPLAY, SVGFADEIN=, SVGFADEMODE=, and SVGFADEOUT=.

SVG documents can be magnified by setting the SVGMagnifyButton system option. SAS embeds a magnify tool in the document when the SVG document is created.

SAS supports the following new font replacements:

- The Monotype Sans WT (J,K,SC,TC) fonts are replaced by the new Arial Unicode MS font.
- The Thorndale Duospace WT (J,K,SC,TC) fonts are replaced by the new Times New Roman Uni font.
- Sim Hei, SimSun, and NSimSun are replaced by CSongGB18030C-Light, CSongGB18030C-LightHWL, MYingHei_18030_C-Medium, and MYingHei_18030_C-MediumHWL.

In the second maintenance release for SAS 9.4, if you specify italic or bold style on a universal printer font that does not have an italic or bold style, the font is now displayed as italic or bold. For more information, see “Slanting and Emboldening Fonts” in SAS Language Reference: Concepts.

In the third maintenance release for SAS 9.4, Universal Printing supports Avenir Next TrueType fonts.

Encryption

SAS/SECURE is a product within the SAS System. SAS/SECURE 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 of stored passwords by using SAS004 encoding. SAS004 encoding uses Advanced Encryption Standard (AES) with 64-bit salt.

You can now use AES to encrypt SAS data sets. AES-encrypted data files are supported using these SAS language elements:

- SPD Engine ENCRYPT= and ENCRYPTKEY= data set options
- data set options ENCRYPT=AES and ENCRYPTKEY= to specify the encryption key
- APPEND procedure
- CONTENTS procedure
- COPY procedure
- SASFILE statement ENCRYPTKEY= option

The SAS Logging Facility now supports full logging and debugging of encryption activity.
On a Windows server or client, the user can import digital certificates to a Machine Store as well as to a Personal Store.

In the first maintenance release for SAS 9.4, the following enhancements were made:

- The default location for the TLS Certificate Authority (CA) changed for the UNIX and z/OS foundation servers. The default location is specified by the SSLOCALISTLOC= option in configuration files.

- Subject Alternative Names (SAN) in TLS certificates are supported. Server Name Indications (SNI) in the TLS handshake between clients and servers are supported. These are now supported on UNIX and z/OS clients and servers.

- Environment variables SSL_CERT_DIR and SSLCACERTDIR can now be used to point to the location of certificates. These environment variables are supported on UNIX and z/OS servers.

- An administrator can store an AES encryption key for the metadata-bound library so that a user with access authorization can access the metadata-bound data set without supplying the key-in code.

In the second maintenance release for SAS 9.4 on UNIX and z/OS, SAS now supports OpenSSL 1.0.1h, which provides support for SSL 3.0 and TLS versions 1.0, 1.1, and 1.2. SSL 2.0 is no longer supported.

In the third maintenance release for SAS 9.4, these are the encryption enhancements:

- The SAS Deployment Wizard automates the process of updating the TLS certificates on UNIX servers. At installation, a list of CA certificates that are distributed with Mozilla software products (Mozilla CA bundle) is used as the site-signed list. You can then use the SAS Deployment Wizard to add your own trusted certificates. The combination generates a new trusted CA list.

- The 1.0.1 and 0.9.8 versions of OpenSSL have been updated under UNIX and z/OS.

- TLS versions 1.0, 1.1, and 1.2 are supported.

- You specify the minimum TLS or SSL protocol that can be negotiated when using OpenSSL by using the SAS_SSL_MIN_PROTOCOL environment variable.

- You specify the ciphers that can be used for OpenSSL under UNIX and z/OS by using the SAS_SSL_CIPHER_LIST environment variable.

- Certificates are now located in the trustedcerts.pem file. The location of the file is automatically specified during installation by using the SSLOCALISTLOC= system option.

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**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 4 and *SAS Scalable Performance Data Engine: Reference*.

The second maintenance release for SAS 9.4 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.

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**National Language Support (NLS)**

You can create a data set that contains information about a locale. The data in the data set is used by SAS to process locale information. You use the `LOCALEDATA` procedure to manage and view the data, and to save the data to the SAS registry. You specify the name of the locale data set by using the `LOCALEDATA=` system option.

SAS can now process data by using a time zone other than your local time zone. You use the `TIMEZONE=` system option to specify a time zone. New time zone formats use the ISO 8601 standard to format dates, times, and datetime values by using Universal Coordinate Time (UTC). New time zone functions enable you to determine time zones and time zone offsets, and to convert datetime values between SAS and UTC. A new SAS datetime constant enables a SAS datetime value to have a time zone offset.

In addition to the time zone functions, there are new functions for these tasks:

- converting characters to base characters by using the `BASECHAR` function
- removing leading and trailing blanks from a character string by using the `KSTRIP` function
- specifying the locale keys for the current SAS session by using the `SETLOCALE` function

You can specify a translation table to transcode parts of SAS between EBCDIC and ASCII by using the `MAPEBCDIC2ASCII=` system option.

To keep the language of the SAS log as English, set the `ODSLANGCHANGE` and `LOGLANGCHG` system options.

Set the language for international date formats and informatas to the locale that is specified by the `LOCALE=` system option. To do this, specify the `LOCALE` argument for the `DFLANG=` system option.

SAS uses the value of the `LOCALE=` system option to set the `PAPERSIZE=` option to either LETTER or A4 when you specify the `LOCALE` argument for the `PAPERSIZE=` system option.

SAS now supports the English_Malta (en_MT), Greek_Cyprus (el_CY), and Irish_Ireland (ga_IE) locales.

ISO-8859–13 (Latin 7) and ISO-8859–15 (Latin 10) are new encodings that SAS supports.

The second maintenance release for SAS 9.4 has the following changes and enhancements:

- A new chapter was added to define time zones and to explain how SAS processes them.
- Formats:
The new BESTDOTX format specifies that SAS choose the best notation and use a dot as a decimal separator.

The country Latvia is added to these formats: NLMNIEUR and NLMNLEUR.

• Functions:
  The new KUPDATES function inserts, deletes, and replaces character value contents.
  The new TZONEDSTNAME function returns a daylight saving time name.
  The new TZONEDSTOFF function returns the timezone offset value for the specified daylight saving time.
  The new TzonesSTNAME function returns a standard timezone name.
  The new TzonesSTOFF function returns the timezone offset value for the specified standard time.
  The KCVT function was updated with DBCS, SBCS, and MBCS information, and references to DBCSLANG and DBCSTYPE were removed.
  The KUPDATE function NLSCOMPATMODE option was removed.

• Informat:
  The country Latvia is added to the NLMNIEUR and NLMNLEUR informat.
  The new NLDATEW informat reads the date value in the specified locale, and then converts the date value to the local SAS date and the day of the week.
  The new NLDATMW informat reads the date value in the specified locale, and then converts the date value to the local SAS day of the week and the datetime.
  The new NLDATMAP informat reads the date value in the specified locale, and then converts the date value to the local SAS datetime with a.m. or p.m.
  Aliases were added to the NLDAT , NLTIME , and NLDATM informat.

• System options:
  The new NLDECSEPARATOR system option specifies whether SAS produces locale-sensitive numeric output for the decimal separator or continues to format numbers with U.S. English preferences.
  The DFLANG system option was enhanced to support the locale option.
  The NLSCOMPATMODE system option is removed from the document.

The third maintenance release for SAS 9.4 has these enhancements:

• New locales are Kazakh_Kazakhstan (kk_KZ) and Basque_Spain (eu_ES).
• The ManxGaelic_UnitedKingdom (gv_GB) locale is deprecated.
• The KINDEXB function searches a character expression for a string of characters.
• The KINDEXCB function searches a character expression for a character string as a pattern for languages that use DBCS.
• The I18N level changed for numerous functions. For more information, see “Internationalization Compatibility for SAS String Functions” in SAS National Language Support (NLS): Reference Guide.

• Sorting by the SORT and SQL procedures is based on the session locale when the SORTSEQ= system option is set to LINGUISTIC.
Metadata

SAS data can be bound to metadata and subject to metadata layer permissions. A metadata-bound library is a physical library that is tied to a corresponding metadata object. You use the AUTHLIB procedure to manage metadata-bound libraries.

In the first maintenance release for SAS 9.4, an administrator can use the AUTHLIB procedure to require that all data sets in a metadata-bound library be automatically encrypted using the REQUIRE_ENCRYPTION=YES option in the CREATE or MODIFY statements.

The metadata server connection system options support use of a system connection profile to connect to the SAS Metadata Server.

The METAOPERATE procedure and the METADATA procedure have been enhanced to operate in a clustered SAS Metadata Server configuration and in a single SAS Metadata Server configuration.

The Metadata LIBNAME Engine supports extended attributes on SAS data sets and libraries.

A new metadata DATA step function, METADATA_APPPROP, returns the value of a specified property for a specified SoftwareComponent or DeployedComponent.

Processing of the METAAUTORESOURCES system option has changed. Now, library assignments that are stored in metadata are always applied before library assignments in the AUTOEXEC file.

The second maintenance release for SAS 9.4 has the following changes and enhancements:

- The METALIB procedure checks for and updates a table definition’s library ownership if the table definition being updated is using a different library definition than the one with which it was created. This is useful when importing and exporting data.
- The SAS Metadata Server sends alert email reminder messages after the initial notification of the alert condition “journal commit task stopped running.” The server terminates itself if the alert condition is not addressed within a configured period of time.

The third maintenance release for SAS 9.4 has the following changes and enhancements:

- The METADATA procedure supports the <CLUSTER/> XML element, which can be used to direct the METHOD=STATUS query in the IN= argument to the metadata server cluster’s master node without knowing or specifying its connection parameters.
- Cluster synchronization checking is available in the SAS Management Console Metadata Manager Analyze/Repair wizard and the sas-analyze-metadata batch tool. For more information, see SAS Intelligence Platform: System Administration Guide.
- The METALIB procedure statement, DBAUTH, enables you to specify database authentication credentials for libraries that have an authentication type of Prompt in their server definition, directly in the PROC METALIB request.
- The metadata engine enables you to specify database authentication credentials directly in the LIBNAME statement by using the DBUSER= and DBPASSWORD= LIBNAME options.
The DATA step function, **METADATA_GETURI**, constructs a URL for SAS web applications by using information from the SAS Metadata Repository.

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**SAS Logging Facility**

The SAS Logging facility uses the **ConsoleAppender** to write messages to z/OS system consoles.

You can specify whether a logger’s additivity and level settings are permanent or can be modified programmatically by setting a logger’s IMMUTABILITY setting.

Three new loggers support auditing logging configurations.

Two new loggers support auditing access to SAS data sets.

Two new loggers support auditing access to metadata-bound libraries.

You can specify the client ID in the DEFAULT and TRACE conversion patterns.

The second maintenance release for SAS 9.4 has the following changes and enhancements:

- **ConsoleAppender** has the following new parameters:
  - The ImmediateFlush parameter enables you to force messages to be written to the console immediately as they are received.
  - The Target parameter enables you to write messages to the console’s standard error stream instead of the standard output stream. This parameter is valid only for Windows and UNIX environments.
- The new FilePermissions parameter of **FileAppender** and **RollingFileAppender** enables you to set permissions on log files.
- The default level for the root logger is INFO.

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**Application Response Measurement (ARM)**

When you have an ARM appender that is defined in the XML configuration file, you no longer need to set the ARMAGENT=LOG4SAS system option. ARM sets ARMAGENT to LOG4SAS internally.

There are three new ARM metrics for the ARM_DSIO subsystem:

- **NOBS** reports the number of observations in the file.
- **NVAR** reports the number of variables in the file.
- **NOBSREAD** reports the number of observations read.
**E-Mail**

When you send email by using SAS and an SMTP server, you can use the `EMAILACKWAIT=` system option to set the number of seconds to wait for an acknowledgment from the SMTP server.

The new `EMAILHOST=` system option arguments PORT, SSL, STARTTLS, USERID, PWD, and AUTH enhance email security.

**Procedures**

The `DELETE` procedure has been reinstated.

The International Components for Unicode (ICU) version is used to sort data sets with a linguistic collating sequence. The `CONTENTS` procedure or `DATASETS` procedure `CONTENTS` statement output shows the ICU version number of a data set that is linguistically sorted. With the `COPY` or `MIGRATE` procedure, if a data set's ICU version number differs from the current SAS session, the data set retains its sort order in the `OUT=` destination library, but the sort indicator is removed.

JMP files that you specify in the `IMPORT` or `EXPORT` procedure, or in a `LIBNAME` statement, must be Version 7 or later. This enables you to export SAS data sets to JMP files for viewing in a variety of ways, such as with the JMP Graph Builder iPad application.

With the `FORMAT` procedure, a month can be formatted using a shortened version by specifying the number of characters to use in the `%nB` directive. The range to specify a default length of an informat, picture, or format is 1–32767.

With the `OPTIONS` procedure, you can list options that can be saved using the `OPTSAVE` procedure or the `DMOPTSAVE` command.

The `PRINT` procedure enables you to specify labels for the sums and grand totals. For the `PROC PRINT` statement `STYLE=` option, style attributes for the `HEADER` location no longer affect the `Obs` column heading. You specify style attributes for the `Obs` column heading by using the `OBSHEADER` location.

The `PRINTTO` `PRINT=` statement opens the `LISTING` destination. You no longer need to specify the `ODS LISTING` statement before you use the `PRINTTO` procedure.

The `QDEVICE` procedure enables you to specify additional device libraries and catalogs. The `NAMETYPE` variable has been renamed to `TYPE`. The General and Font reports include new information. Character variable lengths in report output data sets have a fixed length of 128 characters. The `LENGTH` statement is no longer required when reports are merged or concatenated.

The `SQL` `IPONEATTEMPT` option enables the termination of an SQL query if implicit pass-through fails. The `BUFFERSIZE` option for the `PROC SQL` statement has been replaced with the `UBUFSIZE` option. The `BUFFERSIZE` option that was used before SAS 9.4 is the same as the `UBUFSIZE` option and is still supported. As of SAS 9.4, `UBUFSIZE` is the preferred option.

The `XSL` procedure now enables the `PARAMETER` statement to pass a parameter value to an XSL style sheet.
The following enhancements have been made 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 Blaker, 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
  - 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
  - provides Mantel-Haenszel, stratified Newcombe, and summary score estimates of the common risk (proportion) difference, which can be displayed in the risk difference plot

- 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 SU distribution parameters, and calculates the geometric means of analysis variables.

In the first maintenance release for SAS 9.4, the following enhancements were made:

- The CIMPORT procedure provides the ability to determine the encoding of data sets in a transport file through the ENCODINGINFO= option. The encoding information is output to the SAS log.

- The CIMPORT and CPORT procedures now transport data sets with timezone offsets. PROC CPORT must specify the DATECOPY option.

- A link and supporting text were added for Microsoft Excel functions that are available to PROC FCMP.

- The HTTP procedure now allows the HTTP_TOKENAUTH option to generate a one-time password from the metadata server to access the SAS Content Server, and supports user identity authentication. If the server that you are connecting to supports the NTLM (for Windows only) or the Kerberos authentication protocols, then you do not need to specify a user name and password. As long as your current user identity has permissions, authentication is established.

The second maintenance release for SAS 9.4 has the following changes and enhancements:

- The CIMPORT procedure SORT option causes the data set that is being imported to be re-sorted according to the destination operating system’s collating sequence.

- The DS2 procedure XCODE= option controls the behavior of the SAS session when an NLS transcoding failure occurs. In addition, the SYSCC macro variable now contains the current SAS condition code that is returned to your operating environment.

- The FEDSQL procedure XCODE= option controls the behavior of the SAS session when an NLS transcoding failure occurs.
The **FONTREG** procedure **OPENTYPE** statement specifies one or more directories to be searched for valid OpenType font files. The ability to use a fileref was added. This ability enables you to use the **FILENAME** statement and its features.

The **OPTIONS** procedure **LISTOPTSAVE** option lists the system options that can be saved by using the **OPTSAVE** procedure or the **DMOPTSAVE** command. The **OPTIONS** procedure now displays passwords in the SAS log as 8 Xs, regardless of the actual password length.

The **REPORT** procedure now supports statistical keywords P20, P30, P40, P60, P70, and P80. A new section was added to describe the use of ODS Styles with **PROC REPORT**.

When SAS is in a locked-down state, the **SOAP** procedure is not available.

The third maintenance release for SAS 9.4 has these changes and enhancements:

- The **AUTHLIB** procedure **PURGE** statement removes any retained metadata-bound library credentials older than a given date of replacement. The MODIFY statement **PURGE** option can be used to remove all retained metadata-bound library credentials if all tables in the library are successfully modified to the newer credentials.

- The **DATEKEYS** procedure provides a way to create and manage date keys that are associated with time computations. A SAS date key is used to describe a date or time interval that is associated with special events such as holidays and sale periods.

- You can use the **PROC FCMP** **STATIC** statement to retain a variable’s value from a previous call until the variable is reassigned.

- **PROC HADOOP**
  - You can use wildcards in syntax in several HDFS statement commands such as **COPYTOLOCAL**.
  - You can request recursive action in an HDFS statement operation that executes the operation on the specified directory as well as subsequent directories.
  - There are new HDFS statement commands to list files (LS), list contents of files (CAT), and change permissions (CHMOD).
  - An alternate method to specify the location of the Hadoop configuration file is to specify the location by using the **SAS_HADOOP_CONFIG_PATH** environment variable.
  - You can submit a MapReduce program and Pig language code to a Hadoop cluster through the Apache Oozie RESTful API.

- **PROC HTTP**
  - Expands method support to include all methods that support the HTTP/1.1 standard and are supported by the target server.
  - Custom request headers can be specified as name=value pairs in a **HEADERS** statement or by submitting a fully formatted input file from a fileref.
  - Input data can be specified in a quoted string or submitted from a fileref.
  - For web servers that support it, the procedure uses connection caching and cookie caching by default. You can toggle the behavior of both types of caching and clear the caches within the procedure by specifying procedure arguments. Or you can turn cookie caching off by using a macro variable.

- The documentation for the HDMD procedures has moved from **SAS/ACCESS for Relational Databases: Reference** to **Base SAS Procedures Guide**.
• 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.

• For the **MIGRATE** procedure, the default value of BUFSIZE has changed. The new default is the buffer page size of the current session. To continue using the previous behavior, which is to clone the page size of the members from the source library, specify BUFSIZE=KEEPSIZE.

• The **PRINTTO** procedure enables you to restore the previous location of the SAS log and LISTING output files. SAS saves the path of the SAS log and LISTING output files in automatic macro variables.

• The **PRODUCT-STATUS** procedure returns a list of the SAS Foundation products that are installed on your system, along with the version numbers of those products.

• **PROC SQL** supports linguistic collation with the SORTSEQ statement option.

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

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**DATA Step Language Elements**

In the first maintenance release for SAS 9.4, you can save either column labels or column names for the data set that you are viewing in VIEWTABLE.

In addition to the language elements that are mentioned in other sections of this overview, these language elements are new or enhanced:

**Data Set Options**

In SAS 9.4, you can use the EXTENDOBSCOUNTER= system option to extend the observation count for the SAS session. The default value of the EXTENDOBSCOUNTER= data set option has been changed to YES.

*Note:* A SAS data set that is created with EXTENDOBSCOUNTER=YES is incompatible with releases prior to SAS 9.3.

**Component Objects**

Use the **keysum** argument tag in the **DECLARE** statement or _NEW_ operator to specify the name of a variable that tracks the key summary for all keys.

Use the **DO_OVER** method in an iterative DO loop to traverse the duplicate keys.

**Formats and Informats**

New ISO 8601 formats, **B8601DX**, **B8601LX**, **B8601TX**, **E8601DX**, **E8601LX**, and **E8601TX** can be used to format dates, times, and datetime values for time zones by using Universal Coordinate Time (UTC).
Some format values might differ slightly when the DECIMALCONV= system option is set to STDIEEE.

In the second maintenance release for SAS 9.4, new aliases were added for some time zone informats. For more information, see “Enhancements to Existing Informats” in SAS Formats and Informats: Reference.

Functions
SAS has several new functions:

- **COT** returns the cotangent.
- **CSC** returns the cosecant.
- **DOSUBL** imports macro variables from the calling environment, and exports macro variables back to the calling environment after the function invokes the SAS code in the text string.
- **FCOPY** copies a record from one fileref to another fileref, and returns a value that indicates whether the record was successfully copied.
- **SEC** returns the secant.

The **CALL IS8601_CONVERT** routine allows the year, month, day, hour, minutes, and seconds to have missing values.

The **PUTC** and **PUTN** functions can override the justification of your output. You can center, right-align, or left-align the output that you create.

If the **SCAN** or **KSCAN** function returns a value to a variable that has not yet been given a length, then that variable is given the length of the first argument.

The **DATE**, **DATETIME**, **TIME**, and **TODAY** functions return date and time values for the time zone that is specified by the TIMEZONE= system option.

In the Normal Mixture distribution for the **CDF**, **PDF**, **SDF**, **LOGCDF**, **LOGPDF**, **LOGSDF**, **QUANTILE**, and **SQUANTILE** functions, weights must be nonnegative. If the sum of the weights does not equal 1, they are treated as relative weights and adjusted so that the sum equals 1.

In the third maintenance release for SAS 9.4, these functions are new or enhanced:

- To determine the category of a format or informat, or to query decimal and width ranges for format or informat values, use the **FMTINFO()** function.
- The **HOLIDAY** functions are no longer experimental:
  - **HOLIDAYCK** returns the number of occurrences of the holiday value between two dates.
  - **HOLIDAYCOUNT** returns the number of holidays defined for a SAS date value.
  - **HOLIDAYNAME** returns the name of the holiday that corresponds to the SAS date or a blank string if a holiday is not defined for the SAS date.
  - **HOLIDAYNX** returns the $n$th occurrence of the holiday relative to the date argument.
  - **HOLIDAYNY** returns the $n$th occurrence of the holiday for the year.
  - **HOLIDAYTEST** returns 1 if the holiday occurs on the SAS date value.

The **SHA256HMACHEX** function returns the result of the message digest of a specified string by using the HMAC algorithm.
Statements

**FILENAME Statement, DATAURL Access Method** enables you to read data from user-specified text.

You can use the **FILENAME Statement, Hadoop Access Method** to create a directory.

Stream-record format has been added to the **RECFM=** option for the FILENAME Statement, SFTP Access Method. Data is transferred in image (binary) mode.

The **FILENAME Statement, URL Access Method** has new options to specify an Accept: header and to create connections when accessing a URL through a proxy.

You can use the **FILENAME Statement, 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.

The **FILENAME Statement, ZIP Access Method** enables you to access ZIP files.

The **LOCK** statement **NOMSG** option disables errors and warnings to the SAS log.

The **MODIFY and SET** statement option **CUROBS** creates and names a variable that contains the observation number that was just read from the data set. A new option, **KEYRESET**, controls whether a **KEY=** search should begin at the top of the index for the data set that is being read.

The second maintenance release for SAS 9.4 has the following changes and enhancements:

- The following SAS statements have been enhanced:
  - Using the **FILENAME Statement, EMAIL (SMTP) Access Method**, you can embed attachments in an email by using HTML. In addition, you can now specify a message/rfc822 content type.
  - Using the **FILENAME Statement, Hadoop Access Method**, you can now submit HDFS commands through WebHDFS. The new SAS environment variable **SAS_HADOOP_RESTFUL** must be defined and set to the value 1. In addition, the Hadoop configuration file must include the properties for the WebHDFS location.
  - For more information, see “Enhanced SAS Statements” in **SAS Statements: Reference**.

- The following FILENAME statement access methods are not available when SAS is in a locked-down state: EMAIL (SMTP), FTP, Hadoop, SOCKET (TCPIP), and URL (HTTP). However, the SAS server administrator can re-enable one or more of these access methods.

The third maintenance release for SAS 9.4 has the following changes and enhancements:

- **FILENAME, FTP access method**
  - Filenames can contain UTF-8 characters. Only hosts whose FTP servers support the **OPTS UTF8 ON** or **OPTS UTF-8 ON** FTP protocol commands can read these filenames.
  - The FTP access method supports Secure FTP by using Transport Layer Security (TLS). Three new statement options, **AUTHTLS**, **PBSZ**, and **PROT**, enable you to issue the FTP **AUTH TLS** command, specify the FTP Data Channel Protection Buffer Size, and specify the FTP Data Channel security command, respectively. A new environment variable, **SAS_FTP_AUTHTLS**, lets you specify how TLS authentication is enabled.
FILENAME, Hadoop access method

- The Hadoop access method supports the SAS_HADOOP_CONFIG_PATH environment variable. You no longer have to merge properties from multiple Hadoop configuration files into a single configuration file and specify the CFG= option.
- The CONCAT and DIR Hadoop options are now mutually exclusive because the SAS_HADOOP_CONFIG_PATH environment variable is available.

FILENAME, ZIP access method

- You can specify an encoding for ZIP file entry names and comments that are different from the current session encoding by using the NAMEENCODING= option.
- Wildcards (*) are supported in the MEMBER= syntax for reading or checking the existence of entries in the ZIP file.

System Options

The default values of these system options have changed:

- The default value of the CPUCOUNT= system option is ACTUAL or 4 for systems that have more than four processors.
- The default value of the DMSOUTSIZE= system option is 2147483647.
- The default value of the LRECL= system option is 32767.
- The default value of the YEARCUTOFF= system option is 1926.

You can specify the SAS Clinical Standards Toolkit global standards library by using the CSTGLOBALLIB= option. Use the CSTSAMPLELIB= option to specify the sample library.

The DECIMALCONV= system option enables you to process floating-point numbers that follow the IEEE Standard for Floating-Point Arithmetic 754–2008.

You can use the EXTENDOBSCOUNTER= system option to extend the observation count in 32-bit SAS data files.

In the LOGPARM= system option, the file that is specified by the SYSIN option can be used in the log name by using the %P directive. ROLLOVER=n is not supported for logs in z/OS data sets.

The SQLIPONEATTEMPT= system option enables the termination of an SQL query if implicit pass-through fails.

Instead of a note, you can specify whether to issue a warning message or an error message to the SAS log when a variable is not initialized. You can also specify not to issue a note. You use the VARINITCHK= system option to specify what is written to the SAS log.

In the first maintenance release for SAS 9.4, the following enhancements were made:

- The OPTMODEL procedure can now use the SAS language compiler for nonlinear statistical modeling or optimization in the CMPLIB= system option.
- The DSACCEL= system option enables you to specify whether a DATA step is enabled for parallel processing in supported environments. The DATA step can run, with limitation, in the SAS LASR Analytic Server and Hadoop environments.
- The DS2ACCEL system option specifies whether DS2 code is enabled for parallel processing in supported environments that use the SAS In-Database Code Accelerator.
In the second maintenance release for SAS 9.4, the following enhancements were made:

- If `MSGLEVEL=I`, then SAS writes Hadoop MapReduce job information to the SAS log.
- On host platforms other than z/OS, the `UTILLOC=` system option accepts a filename as an argument. The file contains a list of directories that SAS can use to select the location for utility files. Allowing SAS to select utility file locations can help balance server I/O workloads.
- The `OPTIONS` procedure displays passwords in the SAS log as 8 Xs, regardless of the actual password length.

In the third maintenance release for SAS 9.4, the following enhancements were made:

- You can control the locations of the SAS/IML package collections by using the `IMLPACKAGEPRIVATE=`, `IMLPACKAGEPUBLIC=`, and `IMLPACKAGESYSTEM=` system options.
- The `UBUFNO=`, `UBUFSIZE=`, and `VBUFSIZE=` options are included in the `PERFORMANCE` Proc Options Group. The `FONTSLOC=` option is included in the `ODSPRINT=` Proc Options Group.

### SAS Macro Facility

These automatic macro variables are new:

- `SYSDATASTEPHASE` ensures that the macro is being executed as part of the proper phase of a DATA step. The value indicates the current active phase of the DATA step.
- `SYHOSTINFOLOGLONG` contains the operating environment information that is displayed when the `HOSTINFOLOGLONG` option is specified.
- `SYSPROCESSMODE` contains the name of the current SAS session run mode or server type.
- `SYSTIMEZONE` contains the time zone name based on the current value of the `TIMEZONE` option.
- `SYSTIMEZONEIDENT` contains the time zone ID based on the current value of the `TIMEZONE` option.
- `SYSTIMEZONEOFFSET` contains the time zone offset based on the current value of the `TIMEZONE` option.

In the second maintenance release for SAS 9.4, two new options were added to the `%PUT` statement:

- The `_READONLY_` option lists all user-defined read-only macro variables, regardless of scope.
- The `_WRITABLE_` option lists all user-defined read and write macro variables, regardless of scope.

In December 2014, a new appendix lists all SAS macro error and warning messages, causes, and solutions.
In the third maintenance release for SAS 9.4, the MVARSIZE system option now has a default value of 65,534.

**SAS under UNIX**

You can set the number of seconds that SAS waits for a locked file to become available by setting the `FILELOCKWAIT=` system option.

The `HOSTINFOFOLONG` system option writes additional operating environment information to the SAS log when SAS starts.

When the `RTRACE` system option argument `VER` is set, SAS writes the version number and other trace information for each module that SAS loads.

The `X` command now supports the `SETENV | UNSETENV` commands to set or delete the environment.

In the first maintenance release for SAS 9.4, the following access methods are new:

- **ACTIVEMQ** enables SAS programs to send messages to and receive messages from an ActiveMQ message broker through the HTTP protocol.
- **JMS** enables SAS programs to send messages to and receive messages from any JMS API-compliant message service.

The second maintenance release for SAS 9.4 has the following changes and enhancements:

- The BMDP procedure has been deprecated. If you call the BMDP procedure, SAS does not attempt to run BMDP software. However, the BMDP engine, which enables SAS to convert to and from BMDP files, is still available.
- The new `PERMISSION=` option for the `FILE` and `FILENAME` statements enables you to specify Read, Write, and Execute permissions for the specified fileref. You also specify whether the permissions that you set apply to you, to the group owner of the file, or to other users.
- The following `FILENAME` statement access methods are not available when SAS is in a locked-down state: EMAIL, FTP, Hadoop, SOCKET, and URL. However, the SAS server administrator can re-enable one or more of these access methods.
- The `OPLIST` system option automatically masks any password values that are specified when invoking SAS. Only the masked values appear in the SAS log.
- You can expand the filename that is generated by the `RTRACELOC` system option to include the process ID, date, and system time. Include `%p`, `%d`, or `%t`, respectively, to include these values in the filename. Here is an example:

  `mytrace.%d.%t.%p`

- A new chapter was added to explain environment variables that are used under UNIX environments.
- Any path that you provide in a SAS program must include characters that are recognized by both the `PATHENCODING` environment variable and the SAS session encoding. Specifically, to specify a `PATHENCODING` value of UTF-8 in a SAS session that uses English (LANG=EN), you must specify a session encoding of UTF-8 or SAS_U8.
For more information, see “What’s New in the SAS 9.4 Companion for UNIX Environments” in *SAS Companion for UNIX Environments*.

The third maintenance release for SAS 9.4 has the following enhancements:

- The default value for the MV ARSIZE system option has changed from 32K to 65,534.
- You can run external Lua files from the command line by invoking the –SYSIN option. You can also run an external Lua file from within SAS by using an %INCLUDE statement.
- A new chapter has been added to the SAS 9.4 Companion for UNIX Environments that describes useful utilities that are available for system administrators.
- When you use the X command with the SETENV command to create an environment variable, the value of the environment variable is fully expanded before the environment variable is created.

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**SAS under Windows**

Beginning with SAS 9.4, Windows XP, Windows Server 2003, and Windows Vista are no longer supported.

Additional operating environment information can be written to the SAS log when the HOSTINFOLONG system option is set.

You can set the number of seconds that SAS waits for a locked file to become available by setting the FILELOCKWAIT= system option.

JRE 1.6.0_23 was replaced with JRE 1.6.0_24.

In the SAS Help and Documentation, accessibility to many equations is improved. These equations are encoded using mathML. Screen readers can easily read equations, and low-vision users can enlarge equations.

In the first maintenance release for SAS 9.4, the following changes were made:

- Details were added in support of the Windows 32-bit architecture.
- The accessibility topic was removed. An accessibility topic is available from the Base product documentation page.

In the second maintenance release for SAS 9.4, the following changes were made:

- The Cleanwork Utility, cleanwork.exe, is now a console-based application and is installed as part of Base SAS in the SASROOT directory.
- The new PERMISSION= option for the FILE and FILENAME statements enables you to specify Read, Write, and Execute permissions for the specified fileref. You also specify whether the permissions that you set apply to you, to the groups that you are a member of, or to all users.
- The following FILENAME statement access methods are not available when SAS is in a locked-down state: EMAIL, FTP, Hadoop, SOCKET, and URL. However, the SAS server administrator can re-enable one or more of these access methods.
- You can expand the filename that is generated by the RTRACELOC system option to include the process ID, date, and system time. Include %p, %d, or %t, respectively, to include these values in the filename. Here is an example:

```
mytrace.%d.%t.%p
```
SAS under z/OS

These SAS language elements are new:

- The **ZDSRATT** function returns RACF security attributes for a z/OS data set name or returns UNIX security attributes (including ACL definitions) for a UFS file or directory.
- The **HOSTINFO LONG** system option specifies to print additional operating environment information in the SAS log when SAS starts.
- The **SORTCUT** system option specifies a cutoff value that is the number of observations in a data set for which SAS sorts the data. If the number of observations is greater than the value of the SORTCUT system option, the host sort performs the sort.

These SAS language elements have been enhanced:

- The **ZDSSLIST** function supports the specification of up to 30 path components in a UFS directory path.
- The **FILENAME** statement supports the DATAURL, EMAIL, WebDAV, and ZIP device types.
- The default value of the **CARDIMAGE** system option is NOCARDIMAGE.

The following system options have been deprecated:

- **AUTHENCR**
- **AUTHPROVIDERDOMAIN**
- **HELPCASE**

The **USEREXIT** option specifies the name of the exec that the **SASRX exit** calls as a user exit instead of executing **SASCP**.

Diagnostic messages can be created when a utility file is closed if you set the **TKOPT_TKIOP_DIAG_SPACE** option in the **TKMVSENV** file. These messages detail the space allocation that is associated with the utility file allocation and the amount of space that the utility file actually used.

In the second maintenance release for SAS 9.4, the following changes were made:

- Large block size support for SAS Libraries on tape devices improves performance and efficiency. To enable this capability for a particular library, specify **DLLBI=YES** in the **LIBNAME** statement. To enable this capability for all sequential libraries on tape, specify the **DLLBI** system option.
- The **LOCKDOWN** feature is supported for foundation servers. This allows the server administrator to specify a restricted set of z/OS data sets and UFS paths that are available to clients of the server. When SAS is in the locked-down state, access to certain system interfaces is also disabled.
- If the zHPF facility is available and enabled on the processor, the disk device, and the channels that connect them, then SAS generates TCW channel programs (which execute in transport mode) when reading direct access bound libraries residing in **DSORG=PS** data sets. This style of channel program can perform I/O in less elapsed time than the CCW channel programs (command mode) that are traditionally used by
SAS. CCW channel programs are still used for Write operations, and they are also used for read processing if zHPF is not available or is disabled.

For more information, see “What's New in SAS 9.4 Companion for z/OS” in SAS Companion for z/OS.
• SAS Statements: Reference
• SAS System Options: Reference
• SAS SPD Engine: Storing Data in the Hadoop Distributed File System
• SAS Intelligence Platform: Security Administration Guide
• SAS Intelligence Platform: Application Server Administration Guide
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