

SAS 9.4 - 5 Top Migration Updates For Programmers

SESUG Mobile
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Charu Shankar
SAS Education



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About your presenter

SAS Senior Technical Training Specialist, Charu Shankar teaches by engaging with logic, visuals and analogies to spark critical thinking. She interviews clients to recommend the right SAS training. She is a frequent blogger for the [SAS Training Post](#).

When she's not teaching technology, she is passionate about helping people come alive with yoga and is a food blogger. www.charuyoga.com

Charu has presented at over 100 SAS international user group conferences on topics related to SAS programming, SQL , DS2 programming, tips and tricks with coding, new features of SAS and SAS Enterprise Guide.

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AGENDA

1. [New Clients](#)
2. [New Languages](#)
3. [New Interfaces](#)
4. [New Macro Variables](#)
5. [Enhancements](#)/changes to general sas products
6. [New Statements](#)
7. [New Procedures](#)
8. [New Platform](#)
9. [New Servers](#)
10. Handy Links



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1 New SAS Clients



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New SAS clients

	Ship Date	RUNS ON
Enterprise Guide 8.3	August 2020	SAS® 9.4, 9.3, and 9.2. It also supports SAS® Viya® 3.4 and 3.5.
SAS Studio 3.81	August 2020	SAS 9.4M7 and later releases
SAS Add In For Microsoft Office 8.3	August 2020	SAS 9.4, 9.3, and 9.2. It also supports SAS Viya 3.4 and 3.5.



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2 New Language - DS2 Advanced Data Manipulation



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BASE SAS 9.4 (all maintenance releases) DS2 and FedSQL

- DS2 new SAS proprietary programming language
- FedSQL is a SAS proprietary implementation of ANSI SQL:1999 core standard



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What is DS2?

- New SAS proprietary 4 GL programming language
- Advanced data manipulation
- Object-based syntax – user-defined methods and packages
- ANSI SQL data type support
- Embedded FedSQL in the SET statement
- DS2 is the intersection of SAS Data Step and ANSI SQL:1999
- Runs anywhere – Base, In-Database (via SAS Code Accelerator), HPA (via HPDS2)
- The SAS Code Accelerator enables you to run your DS2 thread packages in database.

**DS2, the last language
you will ever learn**



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DS2 Procedure

Sample Syntax

```
proc ds2;  
  data _null_;  
    method init();  
      dcl varchar(16) str;  
      str = 'Hello World!';  
      put str;  
    end;  
  enddata;  
run;  
quit;
```

The DS2 procedure enables you to submit DS2 language statements from a Base SAS session.

Highlighted statements represent elements of DS2.



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OOP! DS2 Object oriented programming - methods & packages

```
PROC DS2;  
data _null_;  
  method c2f(double Tc) returns double;  
    /* Celsius to Fahrenheit */  
    return (((Tc*9)/5)+32);  
  end;  
  method init();  
    dcl double DegC DegF;  
    do DegC=0 to 30 by 15;  
      DegF=c2f(DegC);  
      PUT DegC= DegF=;  
    end;  
  end;  
enddata;  
run;  
quit;
```



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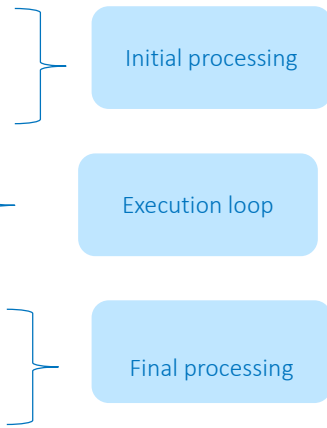


DS2 processing methods

```

PROC DS2;
data _null_;
  method init();
    dcl varchar(20) foo;
    foo = '**> Starting';
    put foo;
  end;
  method run();
    set ds2_sas.banks;
    put _all_;
  end;
  method term();
    dcl char(11) bar;
    bar = '**> I quit!';
    put bar;
  end;
enddata;
run;
quit;

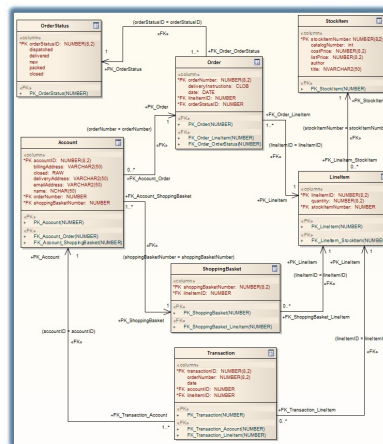
```



Ansi SQL Support Extended Data Types

The syntax of the DS2 language intersects with the SAS DATA step but also includes additional data types, ANSI SQL types, programming structure elements, and user-defined methods and packages

- BIGINT
- BINARY(n)
- CHAR(n)
- DATE
- DOUBLE
- FLOAT(p)
- INTEGER
- NCHAR(n)



- NVARCHAR(n)
- REAL
- SMALLINT
- TIME(p)
- TIMESTAMP(p)
- TINYINT
- VARBINARY(n)
- VARCHAR(n)

DS2 Is Not A Data Step Replacement

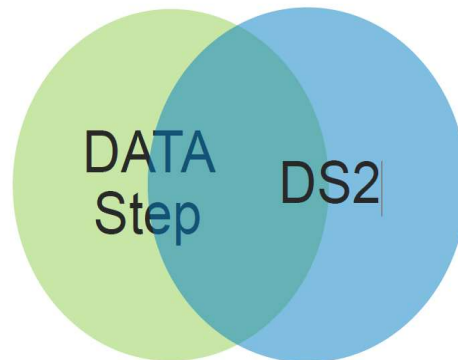
DS2 Complements the DATA Step

DS2 has

- DATA and SET statements
- IF..THEN..ELSE, DO loops
- Expressions and Functions
- Future: Debugger

DS2 does not have

- INFILE and INPUT statement
- MERGE, UPDATE
- MODIFY / REPLACE
- POINT=

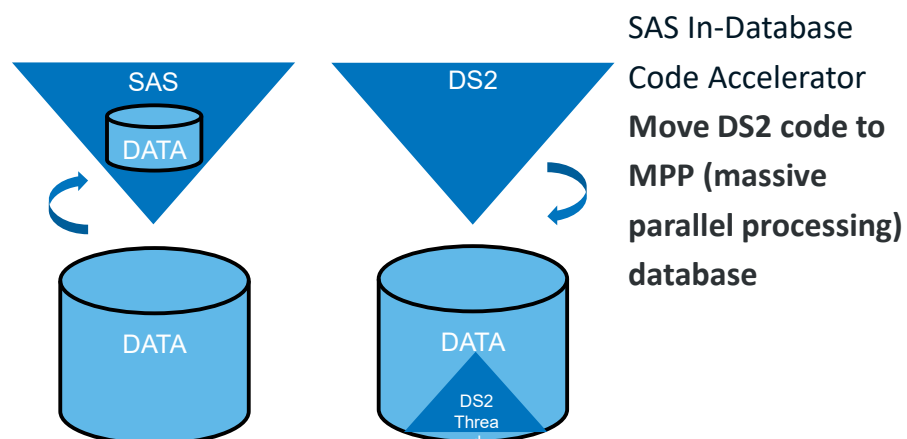


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DS2 Runs Anywhere

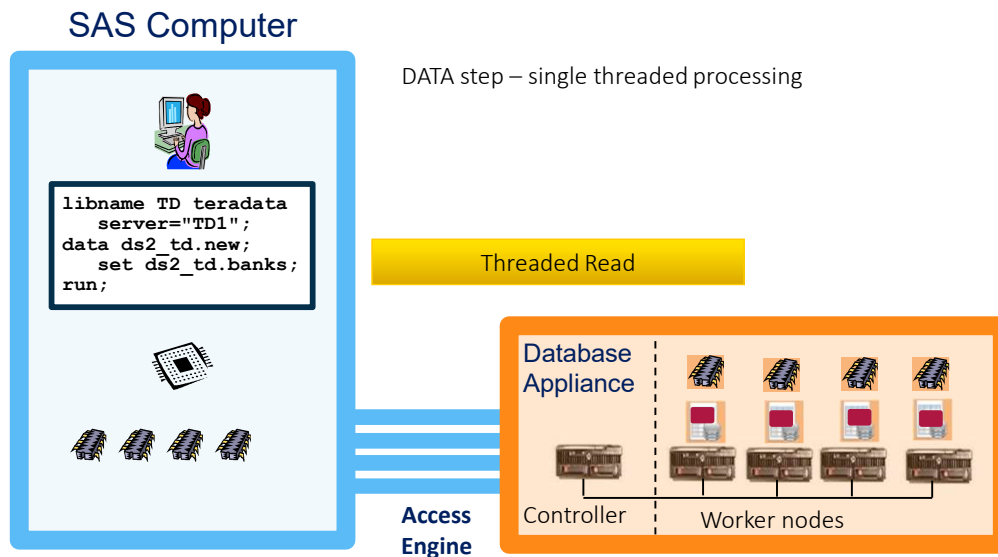


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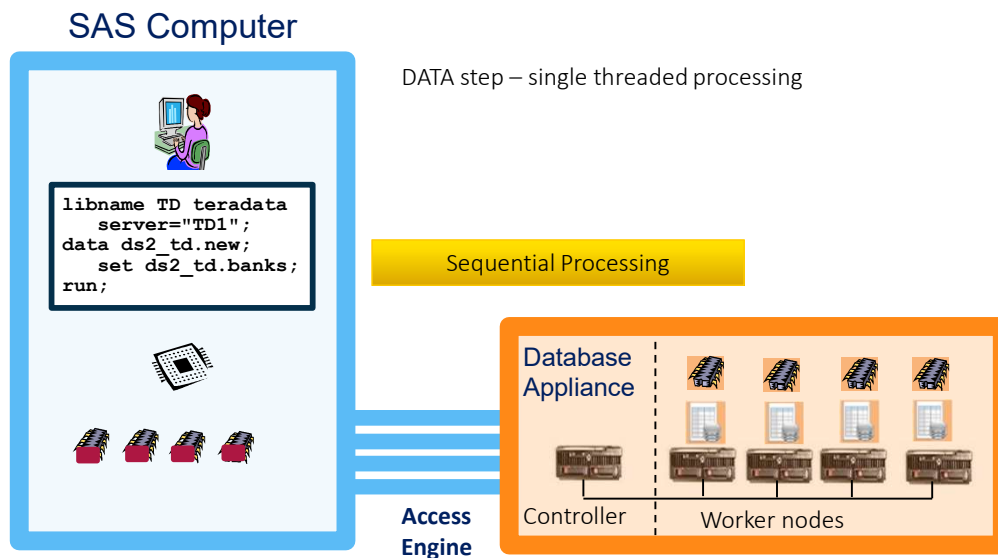
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Traditional DATA Step With SAS/ACCESS



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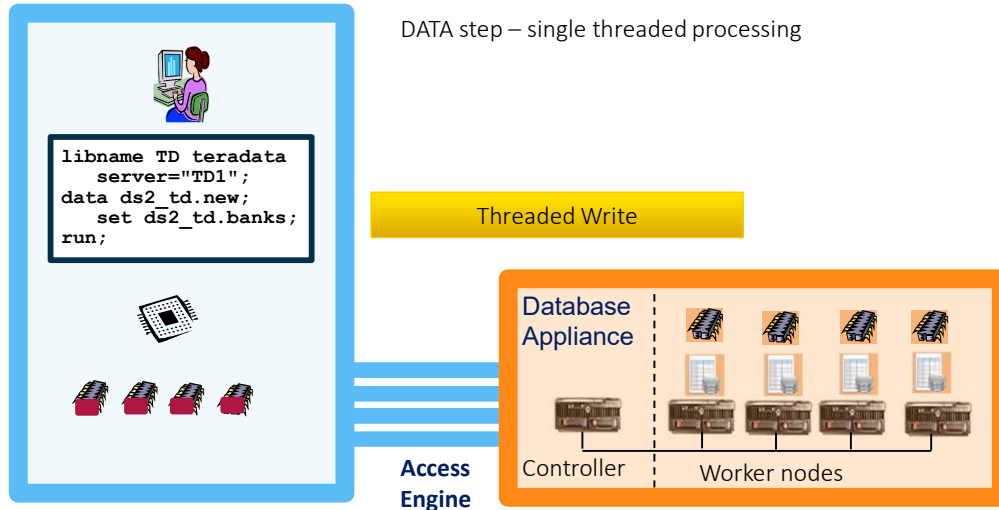
DATA Step With SAS/ACCESS



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DATA Step with SAS/ACCESS

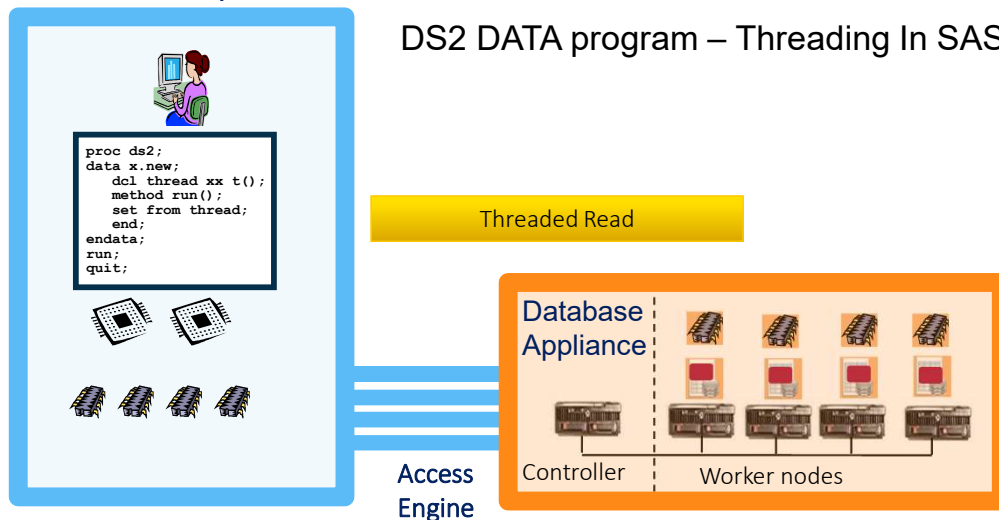
SAS Computer



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DS2 Threads With SAS/ACCESS

SAS Computer

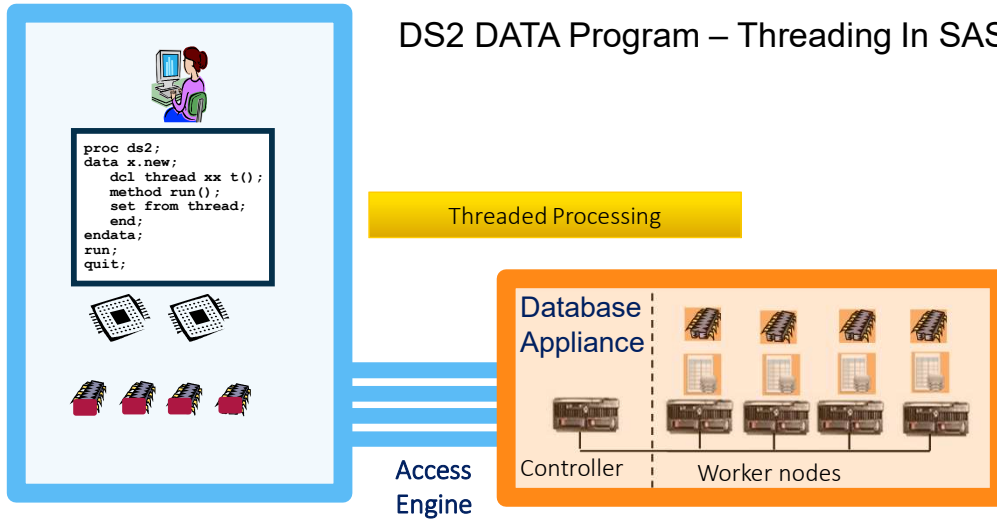


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DS2 Threads With SAS/ACCESS

SAS Computer

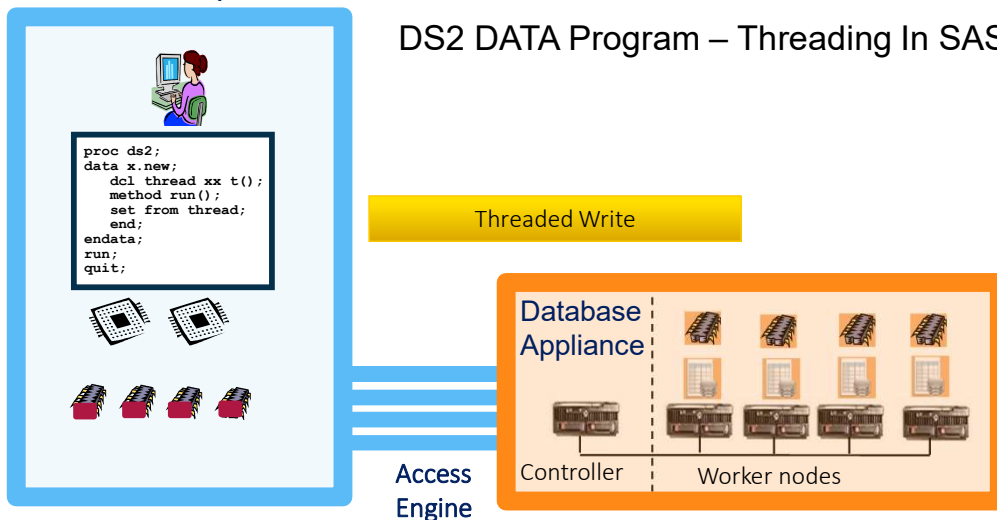
DS2 DATA Program – Threading In SAS



DS2 Threads with SAS/ACCESS

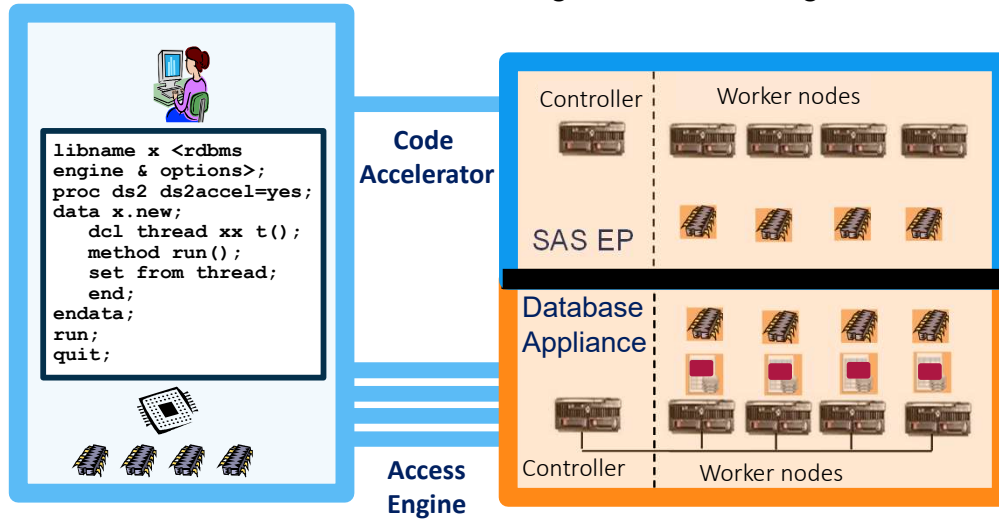
SAS Computer

DS2 DATA Program – Threading In SAS



SAS In-Database Code Accelerator

SAS Computer DS2 DATA Program – Threading In-Database



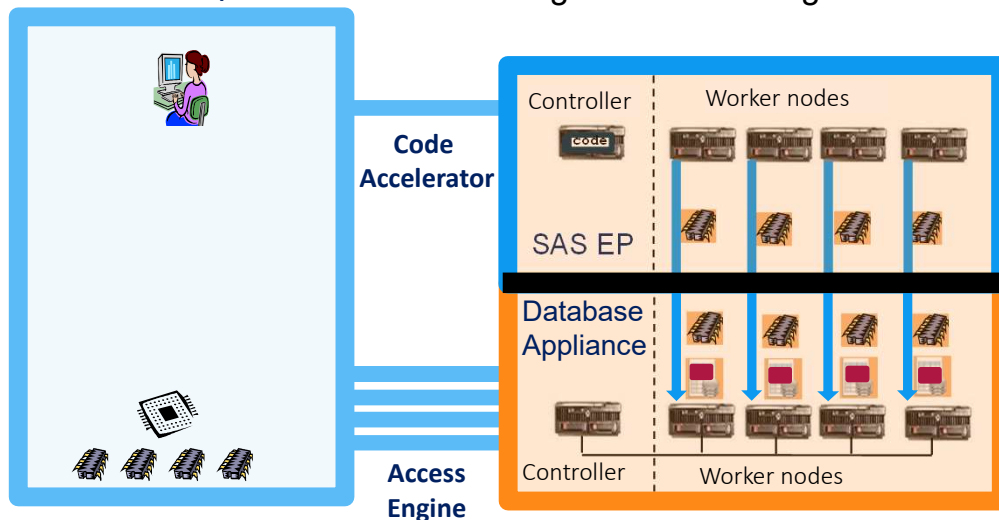
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SAS In-Database Code Accelerator

SAS Computer DS2 DATA Program – Threading In-Database



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What's New BASE SAS 9.4 FedSQL

FedSQL is a SAS proprietary implementation of the ANSI SQL:1999 core standard. It is a vendor-neutral SQL dialect that provides:

- A scalable, threaded, high-performance way to access, manage, and share relational data in multiple data sources.
- A common SQL syntax across all data sources.
- Support for new data types.
- SQL pre-processing on input tables, the SET statement for DS2 supports FedSQL syntax.



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FedSQL and DS2 Example

```
method run();  
  set {select * from work.titles natural join work.price  
      order by publisher};  
  by publisher;  
  ... DS2 statements ...  
end;
```

FedSQL is often used in combination with DS2 in order to generate query results at runtime. The highlighted portions represent the FedSQL query.



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Embedded FEDSQL in DS2

```
proc ds2;
data sales (overwrite=YES);
  keep Customer_ID Total;
  method run();
    set {select c.Customer_ID
          ,Total_Retail_Price
        from ds2_sas.order_fact f
        full join
          ds2_sas.customer_dim c
        on f.Customer_ID=c.Customer_ID
        order by 1};
  by customer_id;
  if first.customer_id then Total=0;
  Total+total_retail_price;
  if last.customer_id then output;
end;
enddata;
run;
quit;
```

Returns SQL
result set as
input stream

BY group
processing on
results

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Base SAS 9.4 M5 - FedSQL Language

- Support for Microsoft SQL Server
- 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 now get information about views from DICTIONARY.COLUMNS queries.

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DS2 : why use it?

You will see the most benefit from DS2

- In using extended data types
- In complex processes that could benefit from structured code.
- In computationally intense processes which can utilize parallel processing.
- In processes that require large data movement.
- take advantage of threaded processing



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3 New Interface - SAS Studio



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New Programming interface - SAS Studio

- Access programs, data files, and libraries
- When you run a program or task, SAS Studio connects to a SAS environment in order to process generated SAS code
- The SAS environment can be a hosted server in a cloud environment, it can be a server in your local environment, or it can be a local desktop.
- After the code is processed, program and task results are returned to SAS Studio



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New Programming interface - SAS Studio

The MEANS		
Continent Name	N Obs	Analysis Var
Africa	770	
Asia	1110	
Europe	653684	
North America	235708	
Oceania	60397	9045263.93 149.7637951

SAS Studio

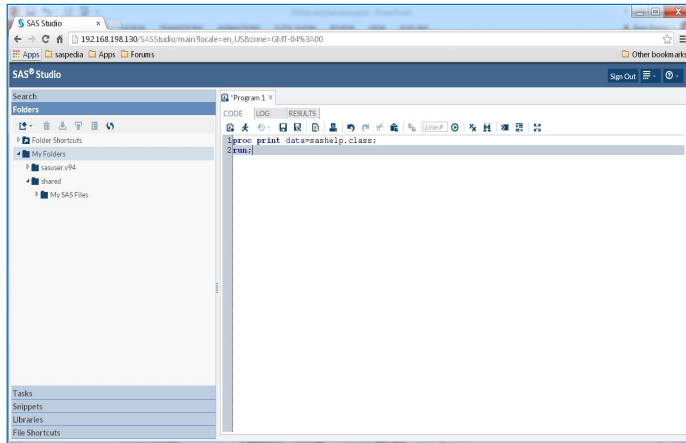
- web-based application
- write new programs
- access data and programs
- store code for common actions
- generate code with tasks



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SAS Studio

Available through all modern web browsers



Windows:

- Internet Explorer (IE) 9+

Windows & MAC (OS X):

- Firefox
- Chrome 15+
- Safari 6+

Mobile/Tablet (iOS) - Beta



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SAS Studio

is this true that SAS studio runs on browser on any machine??

single user scenario	If all you have is SAS on Windows desktop, your browser has to be on the same machine as SAS.
basic server scenario	Step up – SAS on a server, you get basic multi-user access. You can point Studio on your browser (on any machine) to SAS running on a server. You must have credentials to log into server machine. You have access to whatever folders the operating system allows you to.
enterprise scenario	Step up from that - if you have licensed Integration Technologies, you get our full enterprise with all its goodness (security & access control provided via SAS Metadata Server, monitoring & management of SAS & its middle tier, auditing & governance, etc.).

S

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SAS Studio

- Color-coded editor
- Auto-complete
- Pop-up syntax help

Programming interface

The screenshot shows the SAS Studio programming interface. The main window displays a PROC PRINT statement with several syntax errors highlighted in red. A pop-up window provides syntax help for the PRINT procedure, listing options like <option(s)>, <DESCENDING> variable-1, <DESCENDING> variable-2, PAGEBY BY-variable, and SUMBY BY-variable.

```

1      OPTIONS NONOTES NOSTIMER NOSOURCE NOSYNTAXCHECK;
42     ;
43     proc print data=sashelp.class noooops;
           22
           202
ERROR 22-322: Syntax error, expecting one of the following: ;, (, BLANKLINE, CONTENTS, DATA, DOUBLE, GRANDTOTAL_LABEL, GRANDTOT_LABEL, GRAND_LABEL, GTOTAL_LABEL, GTOT_LABEL, HEADING, LABEL, N, NOOBS, NSTYLE, SUMLABEL, UNIFORM, WIDTH.
ERROR 202-322: The option or parameter is not recognized and will be ignored.
    
```

- Color-coded log navigator
- Categorized alerts:
 - Errors
 - Warnings
 - Notes
- Easily save or share logs

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SAS Studio

Table viewer

- Sort or filter a table
- View or copy the generated SQL

The screenshot shows the SAS Studio table viewer. The table displays 10 rows of data from the SASHELP.CLASS table, filtered by Age=11 OR Age=12 OR Age=13. The columns are Name, Sex, Age, and Height. Below the table, the generated SQL code is shown in a text box.

Name	Sex	Age	Height	
1	Thomas	M	11	57.5
2	Robert	M	12	64.8
3	Louise	F	12	56.3
4	Joyce	F	11	51.3
5	John	M	12	59
6	Jeffrey	M	13	62.5
7	Jane	F	12	59.8
8	James	M	12	57.3
9	Barbara	F	13	65.3
10	Alice	F	13	56.5

```

PROC SQL ;
CREATE TABLE WORK.query AS SELECT "Name"n, "Sex"n, "Age"n, "Height"n FROM
SASHELP.CLASS WHERE Age=11 OR Age=12 OR Age=13 ORDER BY Name DESCENDING;
RUN;
QUIT;
    
```

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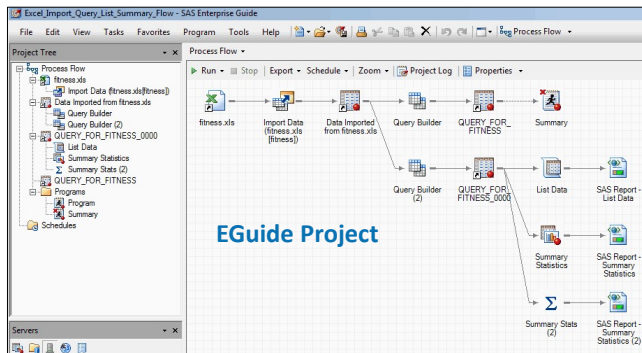
34



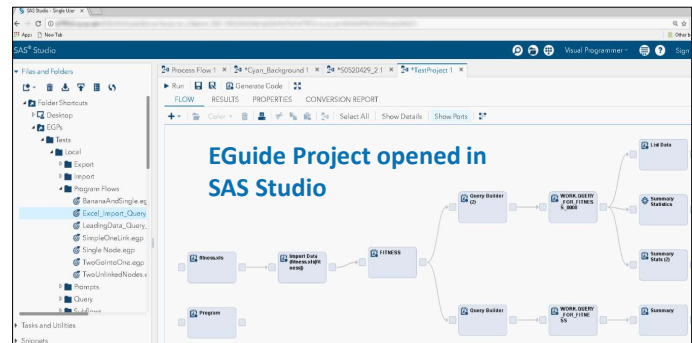
SAS Studio 3.7

Ability to open a SAS Enterprise Guide project in SAS Studio

SAS Enterprise Guide



SAS Studio



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Converting SAS Enterprise Guide Projects to SAS Studio Process Flows

- This functionality is available only if your site administrator has set the **webdms.allowEGPOpen** property to true.
- When you open a SAS Enterprise Guide project in SAS Studio, the process flows in the project are extracted and converted to process flows in SAS Studio.
- Any elements from the SAS Enterprise Guide project that are not supported by SAS Studio are either converted to different node types or are omitted from the process flow.
- SAS Studio creates a conversion report that lists the status of each node in the SAS Enterprise Guide process flow.



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SAS Studio - New Tasks

Custom Tests	calculates power or sample size for test statistics from the chi-square, Pearson correlation, normal, F, and t distributions task
Equivalence Tests	performs power analysis and sample size determination for equivalence tests of one-sample, paired, and two-sample means and mean ratios, & one proportion.
Heat Map	displays the magnitude of the response based on two variables. The response is represented as a color value from a color gradient.
Recode Values	change the values of character and numeric variables. With this task, you can specify single values to be recoded as other values that you specify
Recode Ranges	specify a range of numeric values and change all values in the range to another value. E.g, you could replace test scores from 90 to 100 with a letter grade of "A," scores from 80 to 89 with a grade of "B," and so on..
Severity Models	Estimates parameters of any arbitrary continuous probability distribution that is used to model the magnitude (severity) of a continuous-valued event of interest



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4 New Automatic Macro Variables



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Automatic Macro variables SAS 9.4

Macro	Contains
SYSINCLUDEFILENAME	contains the filename of the current %INCLUDE file.
SYSINCLUDEFILEDEVICE	contains the device type of the current %INCLUDE file.
SYSINCLUDEFILEDIR	contains the directory where the current %INCLUDE file was found.
SYSMAXLONG	returns the maximum long integer value allowed under Linux.
SYSINCLUDEFILEFILEREFS	contains the fileref that is associated with the current %INCLUDE file or blank.
SYSDATASTEPPHASE	ensures macro being executed as part of proper phase of DATA step
SYSHOSTINFOLONG	contains operating environment information that is displayed when the HOSTINFOLONG option is specified
SYSPROCESSMODE	contains name of current SAS session run mode or server type
SYSTIMEZONE	contains time zone name based on current value of TIMEZONE option
SYSTIMEZONEIDENT	contains time zone ID based on current value of TIMEZONE option
SYSTIMEZONEOFFSET	contains time zone offset based on current value of TIMEZONE option

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New Macro Options SAS 9.4

- The new [READONLY](#) option for the %GLOBAL statement creates a new read-only global macro variable.
- The new [READONLY](#) option for the %LOCAL statement creates a new read-only local macro variable.
- In the second maintenance release of 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.

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New Macro Options SAS 9.4

```
%if &sysday=Thursday %then %do;  
proc print data=sashelp.class;  
run;  
%end;
```

```
%else %do;  
proc means data=sashelp.cars;  
run;  
%end;
```

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5 Enhancements & Changes to General SAS Products

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SAS Enterprise Guide

- New *Create accessible PDF* option to add accessibility metadata to your PDF results. The metadata enables the file to be accessed by assistive technology such as a screen reader.
- Support for project log operations (such as clear, export, and send via email) using automation.



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SAS Enterprise Guide

- *Catalog and Formats Explorer* is now available.
With the Catalog and Formats Explorer, you can explore SAS libraries and the catalogs in those libraries. You can view the metadata (name, description, created and modified dates) for every catalog entry, view contents of some entry types, such as SOURCE entries and format entries, and delete entries.
- In Query Builder, you can now move selected variables to the top or bottom of the list (rather than up or down one position at a time).



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6 New Statements

Output Delivery System Statements

- The ODS EXCEL statement option `SHEET_INTERVAL= "NOW"` to open, manage, or close ODS destinations for Excel.
- The ODS HTML5 statement `OUTLINE=` option specifies whether metadata in the table of contents is included in the body file.
- The ODS PDF statement `ACCESSIBLE` option is fully supported.
- The ODS RTF statement now supports a `NOTRKEEP` option to control whether table rows can be split by a page break.

Global Statements

- **FILENAME, ZIP Access Method**
You can use the *GZIP* option to specify an external GZIP file.
- **FILENAME, EMAIL (SMTP) Access Method**
In SAS 9.4M5, you can attach more than one file to an email using multiple *!EM_ATTACH!* directives.



7 New Procedures



PROC GCHART

- The GCHART procedure provides new options:
 - **GROUPEF** option on HBAR and VBAR provides ability to draw a dividing line between bars or groups of bars.
 - Three new options enable you to manage the appearance of reference lines:
 - CGROUPEF** manages line color
 - LGROUPEF** manages line type
 - WGROUPEF** manages line width.



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PROC SGMAP

- The new Base SAS **SGMAP** procedure merges the functionality of ODS Graphics with the map manipulation capabilities of existing procedures.
- These procedures include:
 - Base SAS GEOCODE and MAPIMPORT
 - SAS/GRAPH procedures
- 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.



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National Language Support

- 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.



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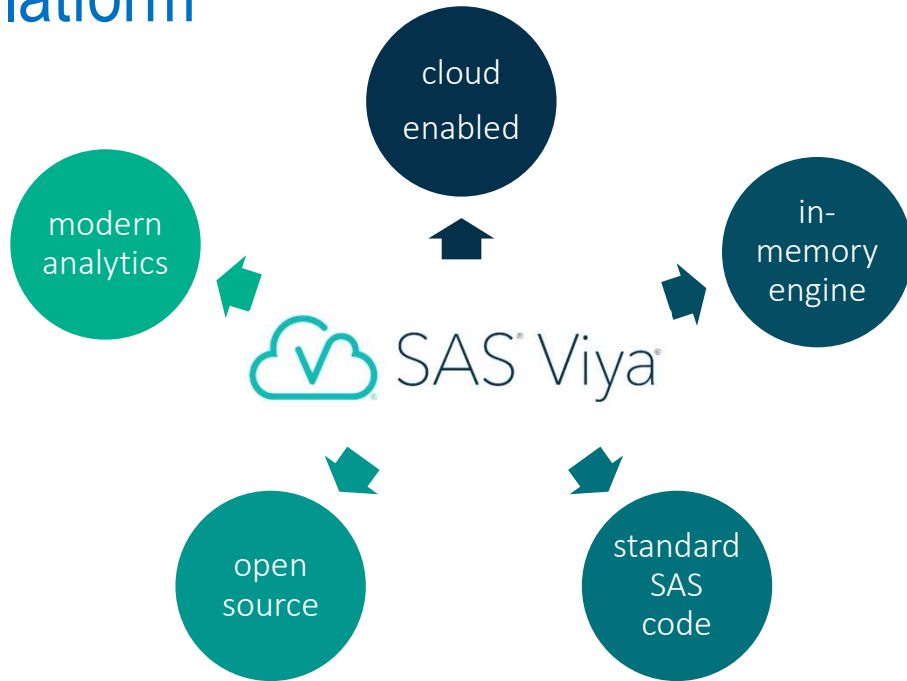
8 New Platform



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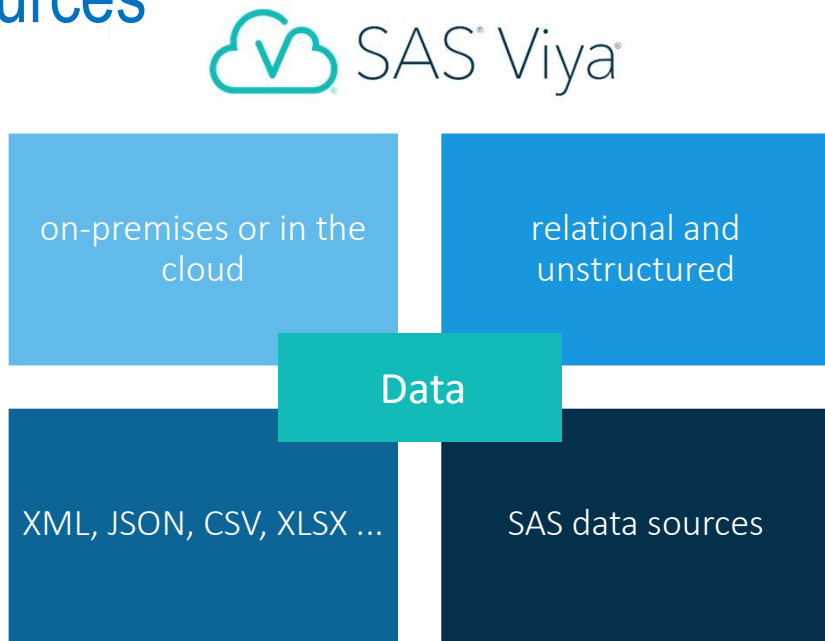
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New Platform



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Data Sources



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Applications



Applications

SAS Visual Analytics



SAS Visual Data Mining and Machine Learning



Open Source

Open-Source Applications

- Jupyter Notebook
- R Studio

SAS®9 Applications

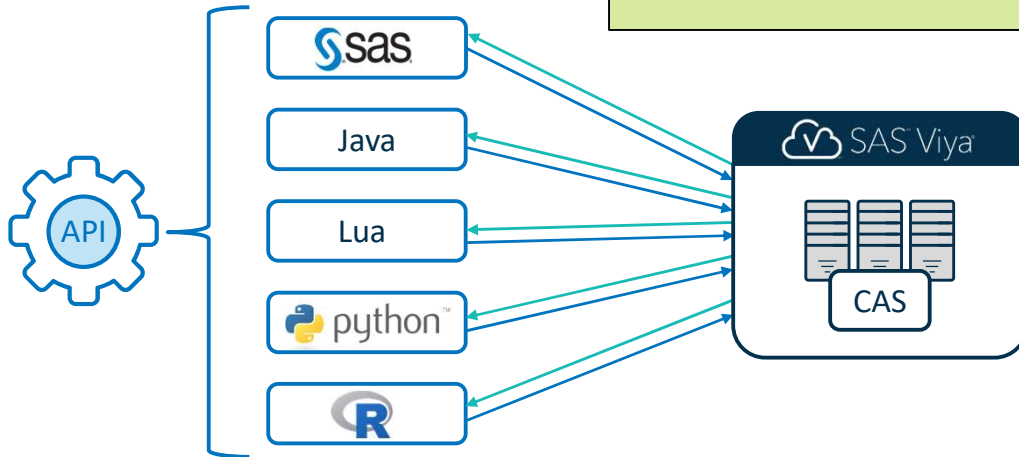
- SAS Studio (3.x)
- SAS Enterprise Guide
- SAS windowing environment

Other applications can be used to develop and submit code to SAS Viya.

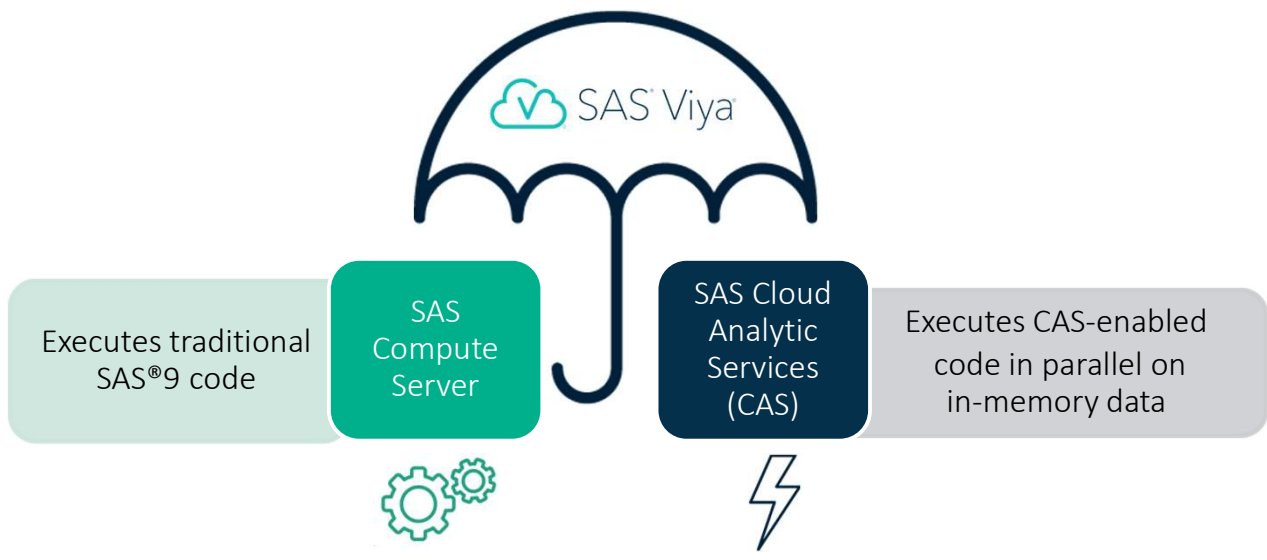


Open Source

Open-source languages can call CAS actions to process data in CAS.



SAS Viya Servers and Processing Environments



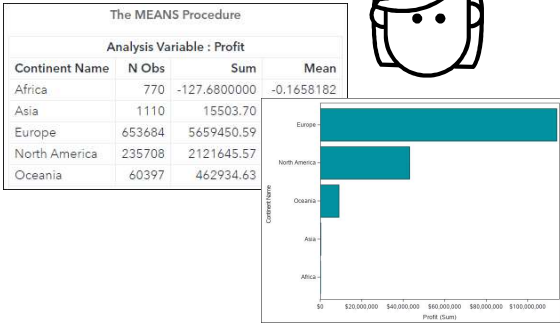
SAS
Compute
Server

```
libname pvbase "&path/data";

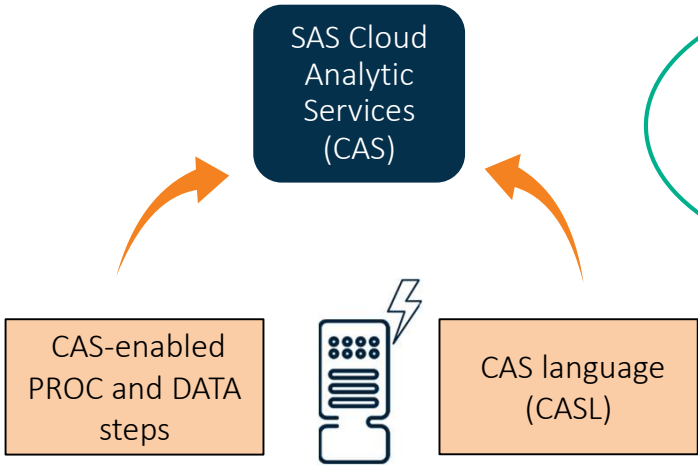
data profit;
  set pvbase.orders;
  ...
run;

proc means data=profit;
  ...
run;
```

Standard SAS code executes on the SAS Compute Server.



The CAS Language and CAS Actions



There are different ways to execute code in CAS.

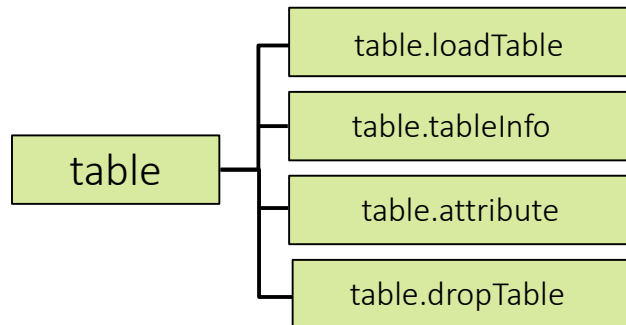


The CAS Language and CAS Actions

CASL can be used to call CAS actions.



- An action performs a single task.
- Actions are grouped into action sets.
- Action sets are based on functionality.
- Use *action-set.action*.



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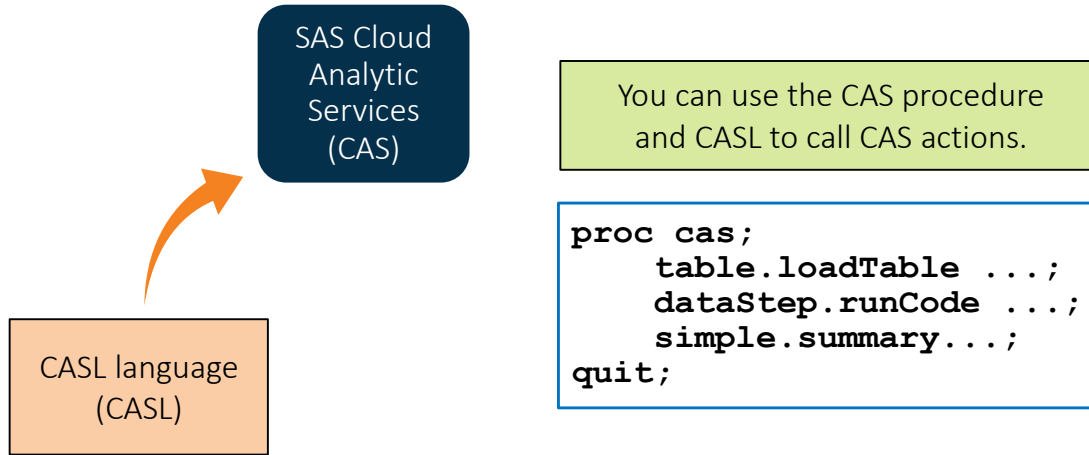
The CAS Language and CAS Actions

CASL and CAS actions execute only in CAS.

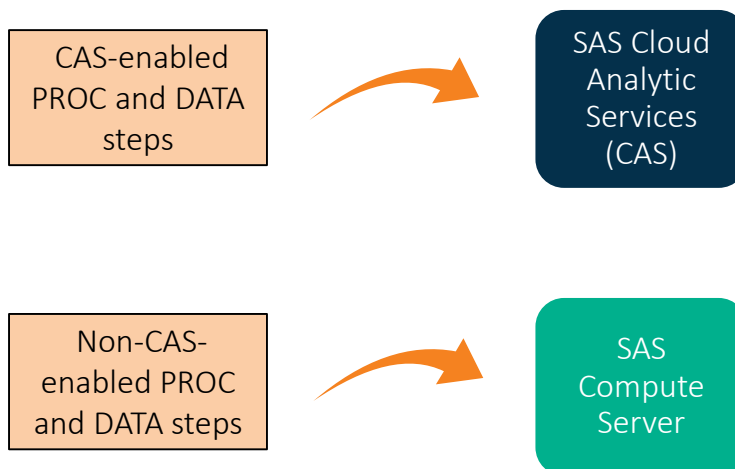


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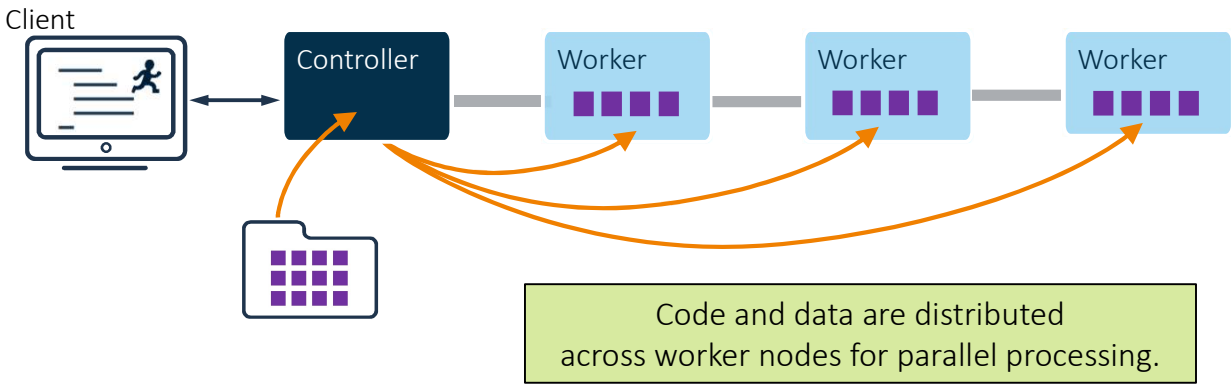
The CAS Language and CAS Actions



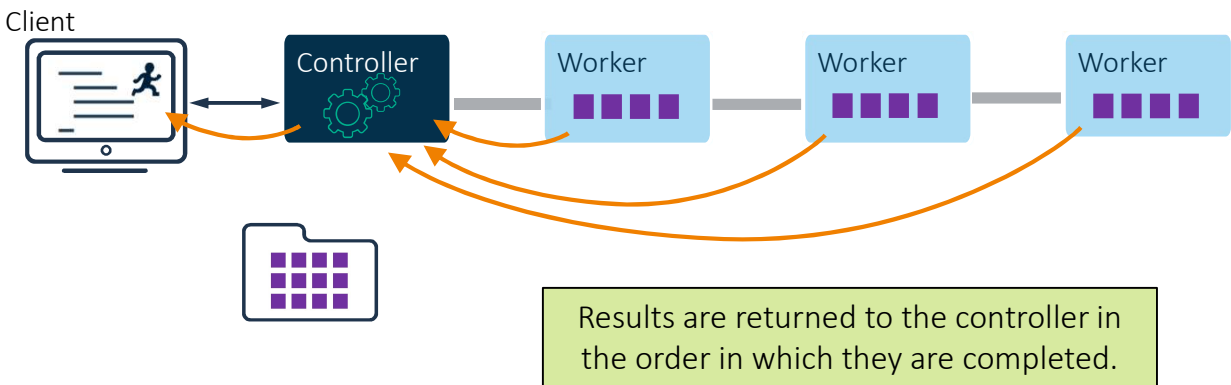
The CAS Language and CAS Actions



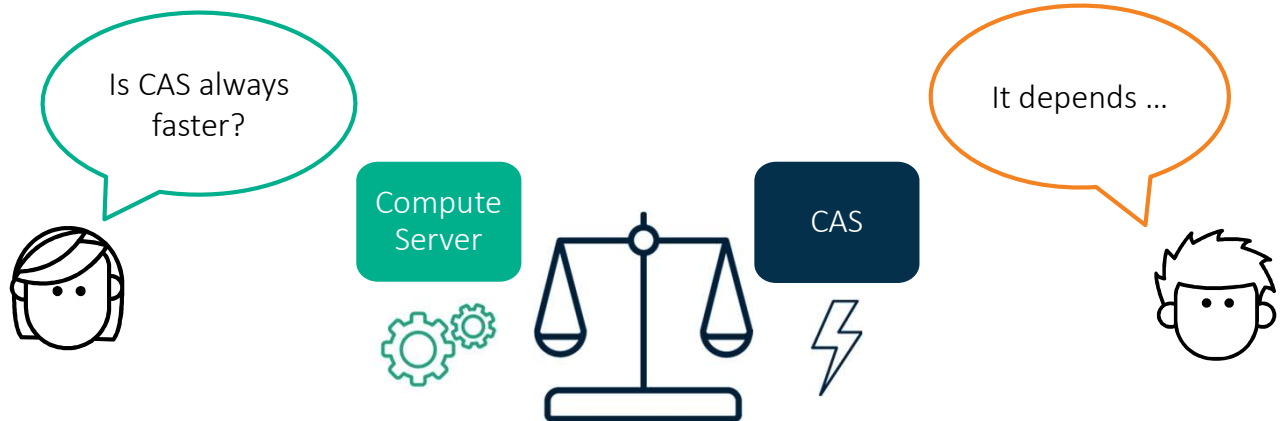
Parallel Processing in CAS



Parallel Processing in CAS



CAS Compute Server or CAS



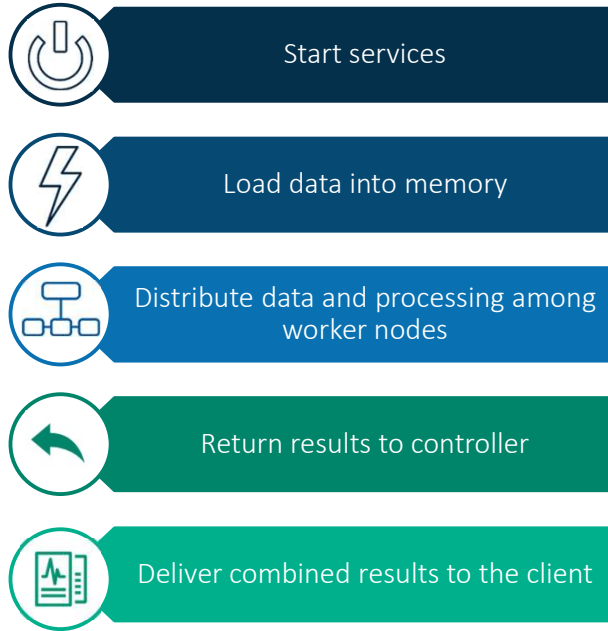
The CAS Language and CAS Actions

```
libname pvbase "&path/data";  
  
data profit;  
    set pvbase.orders;  
    ...  
run;  
  
proc means data=profit;  
    ...  
run;
```

```
proc casutil;  
    ...  
quit;  
  
data casuser.profit;  
    set casuser.orders;  
    ...  
run;  
  
proc means data=casuser.profit;  
    ...  
run;
```

SAS
Compute
Server

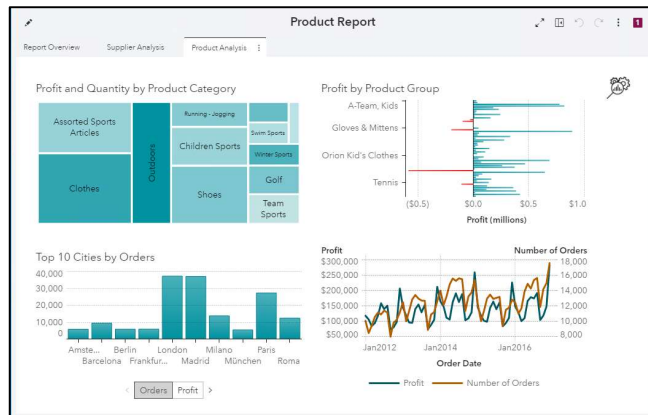
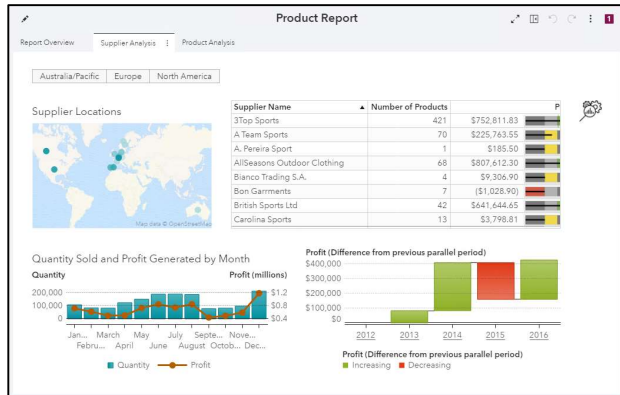
SAS Cloud
Analytic
Services
(CAS)



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Server Strengths

All visual interfaces in Viya use CAS behind the scenes.



- SAS Visual Analytics
- SAS Visual Statistics
- SAS Visual Data Mining and Machine Learning



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CAS procedures work directly with in-memory tables, ensuring full use of parallel processing.

- FREQ
- LOGISTIC
- MIXED



Foundation PROCs

CAS PROCs

- FREQTAB
- LOGSELECT
- LMIXED



Which steps should I modify to run in CAS?



steps using data sources larger than 50 GB



long-running steps (30 minutes+)

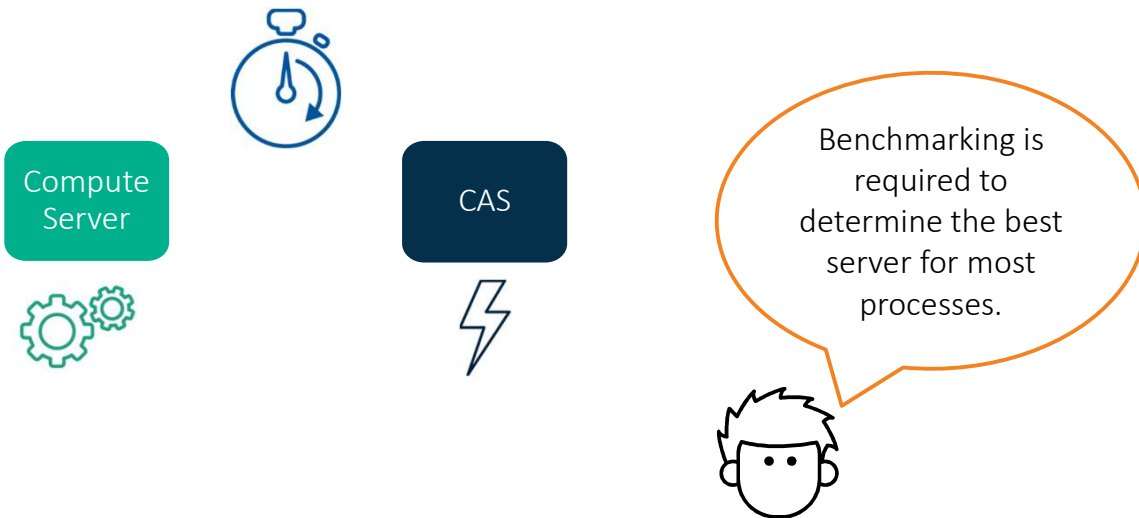


computationally demanding PROCs



DATA steps with many computations, functions, or conditional logic





Handy Links

Products shipped as part of SAS 9.4M5:

[Base SAS 9.4](#)

[SAS/ACCESS](#)

[SAS/CONNECT 9.4](#)

[SAS 9.4 Data Quality Server](#)

[SAS/GRAPH 9.4](#)

[SAS 9.4 Integration Technologies](#)

[SAS 9.4 Intelligence Platform](#)

[SAS 9.4 In-Database Products](#)

[SAS/SHARE 9.4](#)

[New macro options SAS 9.4](#)

Thank you

Charu Shankar
SAS Institute Toronto

EMAIL Charu.shankar@sas.com
BLOG <https://blogs.sas.com/content/author/charushankar/>
TWITTER [CharuYogaCan](#)
LINKEDIN <https://www.linkedin.com/in/charushankar/>

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