

# The SAS® Ecosystem – A Programmer’s Perspective

Thomas E. Billings, MUGF Union Bank, N.A.,  
San Francisco, California  
Version 2.0, Sept. 2016

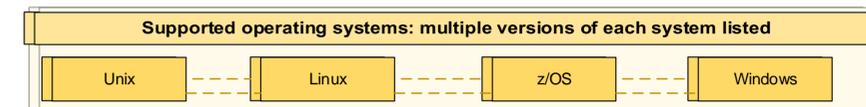
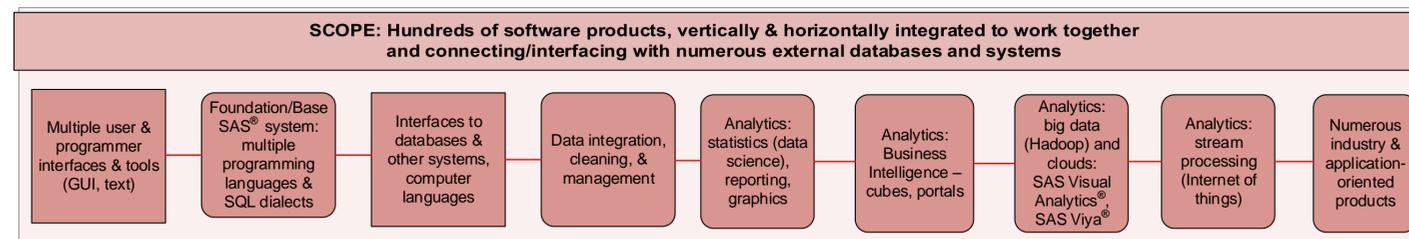
This work by Thomas E. Billings is licensed (2016) under a  
[Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/).



## Abstract

You may encounter people who used SAS® long ago (perhaps in university) or through very limited use in a job. Some of these people with limited knowledge/experience think that the SAS system is “just a statistics package” or “just a GUI”, the latter usually a reference to SAS® Enterprise Guide® or if a dated reference, to (legacy) SAS/AF® or SAS/FSP® applications. The reality is that the modern SAS system is a very large, complex ecosystem, with hundreds of software products and a diversity of tools for programmers and users. This poster provides a set of diagrams and tables that illustrate the complexity of the SAS system, from the perspective of a programmer. Diagrams/illustrations that are provided here include: the functional scope and operating systems in the ecosystem; different environments that program code can run in; cross-environment interactions and related tools; SAS Grid: parallel processing; SAS can run with data in memory – the legacy SASFILE statement and big data/Hadoop; some code can run in-database. We end with a tabulation of the many programming languages and SQL dialects that are directly or indirectly supported within SAS. Hopefully the content of this poster will inform those who think that SAS is an old, dated statistics package or just a simple GUI.

Synopsis: a 1-sheet description of the SAS system, for programmers



## SAS Ecosystem Languages:

DATA step procedural language

Analogue of DATA step language for user-defined functions in PROC FCMP and other select procedures

DS2, an object-oriented language (PROC DS2)

SAS Macro language operating on SAS code

SAS Macro language operating on arbitrary text via PROC STREAM

Perl regular expressions

Lua scripting language via PROC LUA

Groovy language plus some Java, via PROC GROOVY

Java classes (precompiled) can be used in SAS DATA steps

C, C++ functions (precompiled) can be used if registered using PROC PROTO

GTL: Graph Template Language, for graphics using PROC TEMPLATE and SAS procedures

SAS/IML: a matrix & vector language

MDDB for cubes via SAS/MDDB Server product

## SQL dialects:

2 Native SAS SQL dialects that work with SAS files and/or RDBMS tables:

- PROC SQL
- PROC FEDSQL

Direct pass-through of RDBMS-dialect SQL code (as-written, no change) to supported RDBMS systems.

Implicit pass-through of SQL: write native SAS SQL; the SAS system divides the work into tasks that can be done on the database vs. by SAS, and then performs the requested processing

Supported databases and interfaces include:

- Oracle
- DB2
- Greenplum
- Teradata
- Hadoop
- Sybase
- Microsoft SQL Server
- MySQL
- ODBC
- and many others.

## Legacy SAS languages:

SCL: SAS Component Language; object-oriented and runs via the SAS/AF product

## Interfaces with other languages and external tools:

- R
- Python
- Java
- Lua
- REST API (via PROC HTTP in Base SAS; also SAS Viya product)
- Jupyter Notebook

SAS X command provides an interface to external systems and programs

## Acknowledgements:

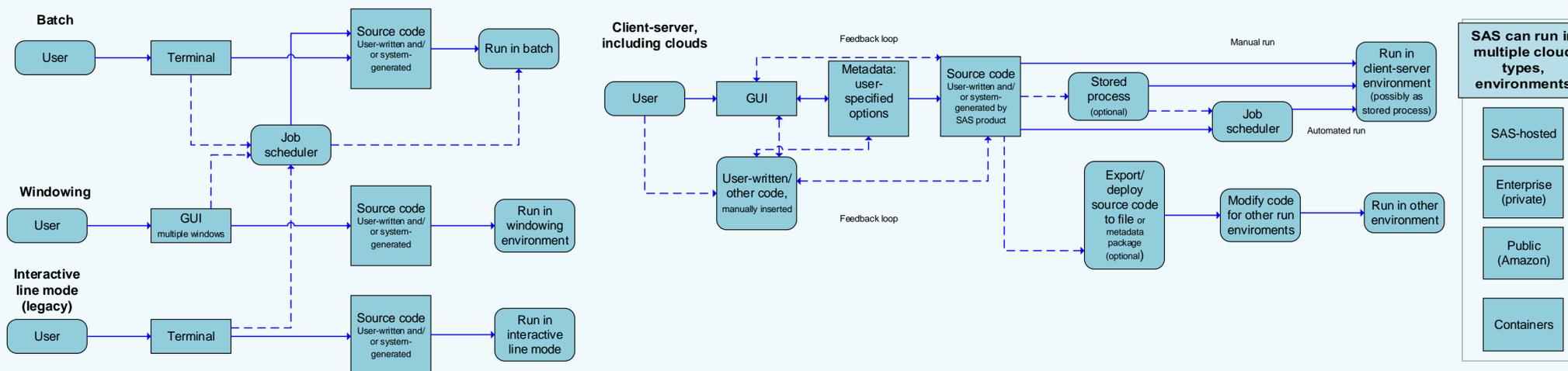
Thanks to  
 • Viraj Kumbhakama (MUGF Union Bank, N.A.),  
 • Suman Misra (SAS Institute, Inc.)  
 • Chris Hemedinger (SAS Institute, Inc.)  
 for valuable suggestions. Any errors herein are solely the responsibility of the author.

**Creative Commons Copyright:**  
 This poster may be freely reused and distributed, simply by complying with the license terms (details via link at top of poster). A link to the author’s presentation page on sascommunity.org would be appreciated: <http://goo.gl/uocYnc>

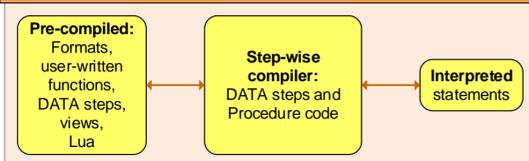
**Trademark notice:**  
 SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc. in the USA and other countries. ® indicates USA registration.

Other brand and product names are trademarks of their respective companies.

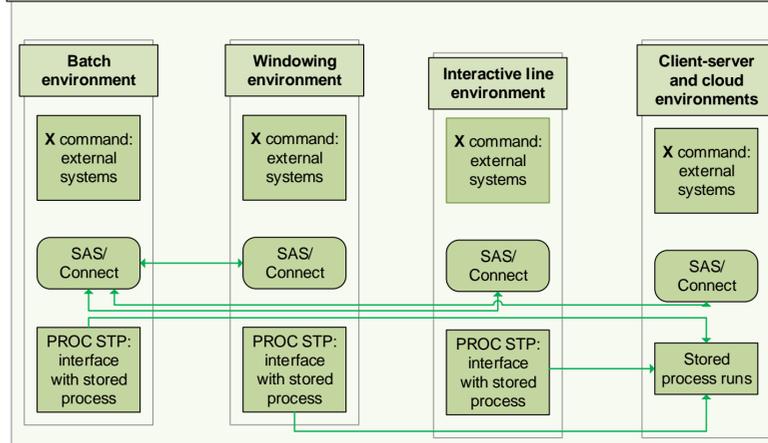
## SAS can run in multiple modes and environments, including client-server and clouds



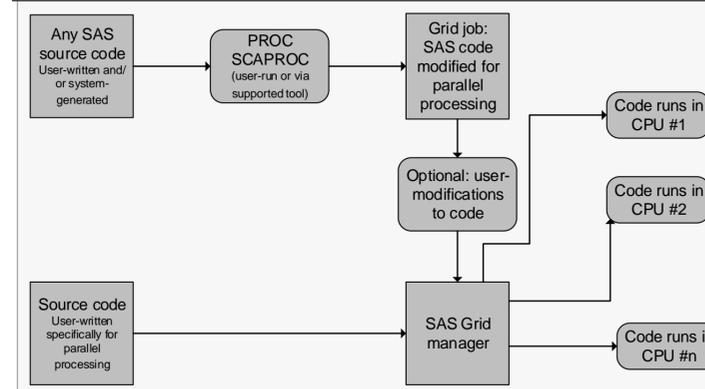
## SAS programs are a combination of 3 main types of processes



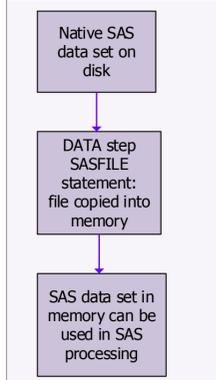
## SAS programs can communicate across SAS environments and with external systems



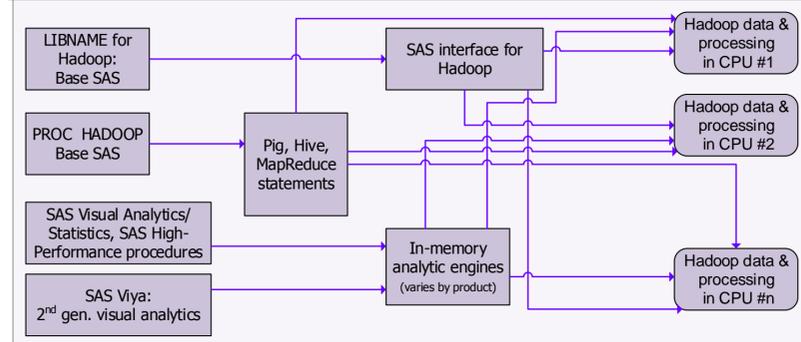
## SAS can run programs in parallel, in multi-processor systems (SAS Grid)



## SAS can process data sets in memory (legacy)



## SAS supports “big data” and Hadoop



## SAS supports in-database processing for select databases and SAS products (also see Hadoop diagram)

