



# The Missing Semicolon™

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## Overview of the SAS Business Intelligence Platform

The SAS BI platform becomes more widely used each year, and the tools tied to this framework grow more useful and powerful. This article will help demystify the BI platform and bring some clarity to those who have not yet adopted this technology.

The SAS BI platform is comprised of 4 tiers:

- Metadata tier
- Application tier
- Client tier
- Mid-tier

These logical components can all reside on a single physical machine or be distributed with each component on its own machine. Deployments may also go one step further and distribute one tier across multiple physical machines to improve performance through load balancing.

SAS Integration Technologies is the set of underlying protocols which enable communication between the different tiers using SAS' proprietary client-server technology. It also encompasses standard protocols like LDAP for directory access, CORBA & COM/DCOM for inter-application communication, and messaging like Microsoft Message Queuing or IBM WebSphere MQ to ensure that SAS can easily integrate with other applications.

The metadata tier contains the metadata repository. This repository contains rules and definitions for all aspects of your SAS solution. Applications servers are defined to execute your processes. Libraries are defined which provide access to databases and SAS datasets. Security is managed by creating metadata identities and groups which can be granted privileges to other metadata objects. One can also manage job schedules and foundation services. Business rules can be managed via custom plug-ins available within SAS industry solutions. The metadata repository is the central point for administering your entire software solution. And the SAS Management

Console is the client application which provides the interface to do it.

The SAS application tier is where all SAS processes will be executed. These processes may get called from a variety of sources. There are client applications, such as Enterprise Guide or the SAS Add-in for Microsoft Office, and web applications, such as Web Report Studio, which connect indirectly through the mid-tier. Custom web applications and services can also be built to meet very specific needs. Each of these client applications will contact the application tier using integration technologies. This contact will define a SAS process in the metadata which will services its needs.

The mid-tier serves as your web application server. This is an optional component that is needed if you will be using web tools such as Web Report Studio or Information Delivery Portal. SAS industry solutions all require a mid-tier in order to host the client applications.

Once this foundation is in place, a variety of client applications can be leveraged to suit the wide range of users and their needs. As previously mentioned, the SAS Management Console is the administrative tool used to manage all of the metadata which defines the environment. The user interface organizes all of the administrative functions into an intuitive tree structure. Easy to use wizards are available to create all of the metadata you need to establish your environment.

*Continued on page 3*

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## Letter From the Editor



Dear User,

It is only 1 week past Labor Day, and it is already a busy Fall. As everyone, we have been adapting to an ever-changing business environment. At the same time, we have also been focusing on what has made us a success in the past.

SAS and the SAS User Community are both constantly offering opportunities to keep up with changing techniques and technologies. At the 2010 SAS Global Forum, I learned about the new functionality of Enterprise Guide 4.3 (details on page 6). At our local Wisconsin User Group, Jeff Stander, from SAS, wowed the crowd with an impressive demonstration of SAS Data Integration Studio. Between user groups, we have been attending training and webinars from SAS (including SAS's free SAS Talks webinar series). All of these have been great opportunities to see the results of SAS's heavy investment into Research and Development and how we can constantly integrate them into the work we do.

As we have been keeping up with new technologies, we have been applying that learning to our tried and true business practices. This means that we are focusing our project work on good, reliable, documented SAS systems. We have also been focusing on quality SAS training that takes into account practical business applications and real time problem solving skills for users.

But of course the most enjoyable part of our business has always been just getting out and talking to our customers. It is our customers' business issues that define the purpose of our work, and these strong relationships are how we measure success. We have been continuing to do that through our newsletter, presentations at user groups, and visits to client sites.

So, we move forward for the rest of 2010 with confidence in our employees, our customers, and in SAS. And we are very excited about what's to come.

Thanks for Reading!



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# Overview of the SAS BI Platform

CONTINUED FROM PAGE 1

For developers, there are sophisticated data management tools, such as DI Studio (requires Data Integration Server package). This software simplifies creating and maintaining your ETL processes. DI Studio allows you to build common routines using wizards or by dragging and dropping functions into process workflow. This will generate all the SAS code that is needed. This code can be executed within the client application, or the SAS code can be generated and run simply using base SAS. There are a few other software packages that have some similar functionality, but what sets this software apart is its flexibility in managing performance. One advanced option allows segments of your system to be processed in parallel using SAS MPConnect. Another option allows you to push your transforms down into the database for improved performance, taking advantage of pass-through SQL and/or database specific utilities (supported DBMS's: DB2, Neoview, Netezza, ODBC, OLE DB, Oracle, Sybase, Teradata). In addition to performance optimization features, this software also assists in documentation, impact analysis of planned changes, debugging, and process restartability. For information see the Data Integration Studio User's Guide: <http://support.sas.com/documentation/cdl/en/etlug/62233/HTML/default/titlepage.htm>

SAS Enterprise Guide is a versatile tool for developers. It has a few features that DI Studio has, such as using wizards to join, summarize, and analyze data. It can also be a tool for your power users and analysts, providing them with an interface for creating their own queries and reports. These may be ad hoc off tasks or may evolve further into production systems. In either case, this becomes a great productivity tool that enables end users and frees up valuable IT resources for more complex tasks.

Users less familiar with SAS can leverage the power of SAS via the SAS Add-In for Microsoft Office. This add-in brings a new tool bar and additional menus to the already familiar Microsoft Office suite. With the prevalence of Microsoft Excel as an end user tool, it is almost certain that end users in organizations are analyzing SAS data in Excel. So, this marriage of technology will be an enormous time saver.

Non-technical, business users who need real-time data access can also accomplish this through Web Report Studio. It is centrally managed and deployed, so business users can receive accurate, consistent data. But its web interface is so intuitive, that a novice user can quickly become proficient.

SAS Information Delivery Portal provides a single point of entry for access to business intelligence. The customizable portal may contain dashboards that provide critical data at a glance, up to date reports, an interface to execute stored processes, or access to information maps for surfacing OLAP cubes.

The SAS BI platform expands the breadth of capabilities that SAS can provide, allowing it to be your sole business intelligence software. This is primarily enabled by SAS Integration Technologies, a variety of new tools, and a central metadata repository which contains object definitions, security, and information and business rules. Hopefully this overview helps illuminate this technology and how it can be used to help meet an organization's goals. In future issues, we will cover more details of the different tiers, client tools, and industry/vertical solutions.



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- Identify components of SAS
- Code and run SAS programs
- Build SAS datasets from raw input files
- Use SAS pre-written procedures (PROCs)
- Sort data
- Compute simple statistics
- Summarize data values
- Identify and correct common mistakes
- Write data step formulas, select rows and columns, and do accumulations
- Format SAS data values
- Produce reports using PROC PRINT and DATA step
- Process dates and times
- Merge, interleave, subset, and concatenate SAS datasets
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# I Know There Is An Error: How Do I Fix It?

Writing our programs is usually the easy part. Getting them to successfully execute can be the hard part. Often I've spent what feels like hours trying to figure out a bug in my program. After getting thoroughly frustrated, a co-worker will take a look at the program for less than a minute and tell me, 'Oh, it is right here. You just need....' Debugging programs is never easy, although, SAS is easier to debug than many other programming languages, and as new versions of SAS are released, improvements continue to be made to the messages displayed within the log. However, even with the improvements, there are some errors where the log message still leaves us scratching our head and asking the question, 'What the heck does that message mean?'

Sometimes we get lucky, and our problem is a simple misspelling of a keyword. In these instances SAS will often let us get away with the mistake and just give us a warning.

```
PROC PRINT DTA=SOFTSALE;
RUN;
WARNING 1-322: Assuming the symbol DATA was
misspelled as dta.
```

SAS isn't always so forgiving, but often the error message for a misspelled word can be fairly obvious. For instance, if we misspell a procedure name or specify a name for a non-existent procedure SAS will return the following error message:

```
ERROR: Procedure PRNT not found.
```

Another obvious error message is if we have unbalanced parentheses in a calculation.

```
aftertax = sales - (expense + (.05 * sales);
-
79
ERROR 79-322: Expecting a ).
```

At times like this, SAS is nice enough to let us know what is missing and where it thinks we should add the appropriate parentheses.

Sometimes the error is as simple as a missing semicolon, but the error message is not that obvious. Take for instance, the following data step and error message:

```
DATA SOFTSALE
  INFILE RAWIN;
  INPUT @1  NAME      $10.
        @12 DIVISION $1.
        @15 YEARS    2.
        @19 SALES     7.2
        @28 EXPENSE   7.2
        @36 STATE     $2.;
RUN;

ERROR: No DATALINES or INFILE statement.
```

When we look at the log in this instance, our first reaction is often, "Of course I have an INFILE statement. I see it right there in the second line of the data step." Upon closer inspection of our code though, we see our DATA statement does not have a semicolon to end the statement. Therefore, what we see as the INFILE statement, SAS sees as two more data sets on the DATA statement. Because of the missing semicolon, SAS does not see INFILE as a keyword to begin the statement, and it does not know where to go to read the input data.

A common error message that often leaves programmers wondering what they did wrong is the following error message:

```
ERROR 180-322: Statement is not valid or it
is used out of proper order.
```

Numerous errors result in this message. For instance, all of the following examples result in this same error message appearing in the log:

- Forgetting the equal (=) sign in an assignment statement in the data step
- Using a statement not allowed for a particular procedure, such as:
  - Using a CLASS statement on a procedure such as PRINT or FREQ
  - Using a VAR statement on the FREQ procedure
- Beginning a statement with an invalid keyword

For example, coding:

```
OUT=SUMDATA N(DIVISION)=COUNT;
```

Rather than:

```
OUTPUT OUT=SUMDATA N(DIVISION)=COUNT;)
```

Trying to resolve these errors can be problematic if you are not familiar with the syntax of a particular procedure or statement. Since SAS has narrowed down the location of the error to the statement, the first step is to use SAS Help or Online Documentation to look up the exact syntax of the statement. If everything is correct within the statement, Help or Online Documentation will verify the statement is allowed within a specific procedure, often resolving the issue.

*Continued on next page*

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Another common error message that can be vague in its description is the following:

```
ERROR 22-322: Syntax error, expecting one of
the following:
```

Typically this message will then contain a list of various symbols and words. Usually when this message is seen it is the result of one of the following:

1. Misspelling an option on a statement

```
PROC MEANS DATA=SOFTSALE MEANS;
-----
                22
ERROR 22-322: Syntax error, expecting one of
the following: ;, (, ALPHA, CHARTYPE,
CLASSDATA, CLM, COMPLETETYPES, CSS, CV, DATA,
DESCEND, DESCENDING, DESCENDTYPES, EXCLNPWGT,
EXCLNPWGTS, EXCLUSIVE, FW, IDMIN, KURTOSIS,
LCLM, MAX, MAXDEC, MEAN, MEDIAN, MIN, MISSING,
MODE, N, NDEC, NMISS, NOLABELS, NONOBS,
NOPRINT, NOTHEADS, NOTRAP, NWAY, ORDER, P1,
P10, P25, P5, P50, P75, P90, P95, P99, PCTLDEF,
PRINT, PRINTALL, PRINTALLTYPES, PRINTIDS,
PRINTIDVARS, PROBT, Q1, Q3, QMARKERS, QMETHOD,
QNTLDEF, QRANGE, RANGE, SKEWNESS, STDDEV,
STDERR, SUM, SUMSIZE, SUMWGT, T, THREADS, UCLM,
USS, VAR, VARDEF.
```

2. Missing the type of pointer on a formatted INPUT statement

```
$ INPUT 1 NAME 10. @12 DIVISION $1.;
-
                22
ERROR 22-322: Syntax error, expecting one of
the following: a name, #, +, @.
```

3. Missing expected options on a statement

```
PROC FREQ DATA=SOFTSALE;

TABLE DIVISION \;
-----
                22
ERROR 22-322: Syntax error, expecting one of
the following: a name, ;, (, *, -, /, :, _ALL_,
_CHARACTER_, _CHAR_, _NUMERIC_.
```

Debugging programs can often be challenging. While there is not a published document by SAS outlining the various error messages and possible causes of the error, there are tools to assist us in getting our programs to successfully execute. SAS Help and Online Documentation should be the first place to look to verify syntax, allowable statements, keywords, and options. In addition, a search of support.sas.com using the error message or a portion of the message can often turn up at least a few examples of code which caused the message.



## QUICK TIP

When you think of the rounding function the normal decimal or dollar scenarios come to mind but have you ever consider using it to round time?

```
Data _null_;
  format startTime startime2 startime3
         startime4 startime5 datetime.;

  salary=40000;
  totalHours = 80*26;

  hourlyWageDec = Round(salary/totalHours,.01);
                /* Nearest Decimal */

  hourlyWageDol = Round(salary/totalHours,1);
                /* Nearest Dollar */

  startTime = dhms('01Jan2008'd,07,43,00);
                /* Create a datetime of 7:43am */
  startime2 = round(startTime,hms(1,00,00));
                /* round to the nearest hour */
  startime3 = round(startTime,hms(0,15,00));
                /* round to the nearest 15 minutes */
  startime4 = round(startTime,hms(0,10,30));
                /* round to the nearest 10 1/2 minutes*/
  startime5 = round(startTime,hms(0,0,10));
                /* round to the nearest 10 seconds */

Put _all_;
run;

salary=40000
totalHours=2080
hourlyWageDec=19.23
hourlyWageDol=19

startTime =01JAN08:07:43:00
startime2=01JAN08:08:00:00
startime3=01JAN08:07:45:00
startime4=01JAN08:07:46:30
```



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## Evolution of a SAS User and a Software

I have worked for Systems Seminar Consultants for over 10 years. When I started, programming was a very small part of my job because I had to fit it in between running an office. So, I never had the time to really learn SAS end to end and practice it daily. This meant that whenever I needed any SAS work, I had to rely on another programmer. Relying on someone else can be problematic because you have to fit into their schedule and go back to them with any little changes you have. On a good day, maybe I could change my own attributes of a where clause, but more often than not, I would get confused with character versus numeric data or forget a semicolon (not to mention the time I overwrote a production dataset within a data step). So, needless to say, I was thrilled when I discovered SAS Enterprise Guide which allows you to do SAS analysis and reporting, all with wizards. I could easily query data, occasionally join a few datasets, and that worked great for 99% of what I was doing.

But then I started to think more like a programmer. I was excited about many things that I could now do in SAS (instead of manually doing in Excel), and I became greedy about the custom reports and analysis I was now able to complete independently. I began to want functionality that I couldn't always figure out with SAS Enterprise Guide's wizards. When I would ask for help at my office, often I would get a programmer's coding answer, when I wanted a simple SAS Enterprise Guide wizard answer.

For example, I had a report with a date field. I wanted to sort this date field in ascending order, with the missing values at the bottom of the report. Because of how SAS interprets the missing dates, it put the missing values at the top of my report. When I asked for programming help, I was told that I can sort this the way I want it. I just had to create a format and apply it to my date values. Then I could use PROC Report with the following options: use date as an

order variable, use the order=formatted option, point to my format, and specify to PROC Report to include the missing values in the report. As much as I wanted to, I could not incorporate all of these options within the wizards (although SAS is constantly adding new features and options to Enterprise Guide wizards).

I began integrating the programming answers and adding code to my Enterprise Guide projects. With mixed success, I entered into a weird limbo between point-and-click interfaces and programming. I began to understand the SQL queries that Enterprise Guide was building behind the scenes, and I became good at debugging my code by using the log. But I still am not at heart a programmer. I am a business user. I don't have time to learn and remember the syntax for every PROC I need, much less all of the different functions. So, when I heard about the new version of SAS Enterprise Guide, 4.3, I was absolutely giddy. For me, this new version of software has become the next perfect step in my personal evolution as a data analyst and SAS programmer.

One of the best enhancements in Enterprise Guide 4.3 is the new Syntax Suggestion. With this new feature, as you are typing a SAS keyword, SAS will display a list of potential keywords that you can click on to use in your code. My other favorite addition to the new software is the Integrated Syntax Help. This feature is available simply by mouse-over or clicking F1 over a SAS keyword. A box appears which offers the syntax for the keyword, as well as a brief description of the keyword. Both of these features mean that I can continue to improve my SAS coding abilities and take advantage of new options, functions, etc., all without needing to remember the syntax for every keyword. This new feature is sure to change the programming experience of every programmer, from novice to expert.

Enterprise Guide 4.3 has many more exciting new features as well, including displaying libraries and data members, parentheses matching, program formatting, and more. You can find more details in *SAS Programmer's Paradise: New Goodies in SAS Enterprise Guide 4.3* (Bang, Hemedinger, and Slocum) at <http://support.sas.com/resources/papers/proceedings10/137-2010.pdf>. As I have used Enterprise Guide more and more, and as I have seen enhancements to new versions, I have talked about it more and more. I have talked with co-workers, customers, and other SAS users. Everyone who sees a demonstration of the product or has a chance to use it finds something in it to get really excited about. Some people are interested in the ease with which you can create graphs, while others are intrigued that they can create a PROC Tabulate by drag and drop, instead of having to code it. Whatever your level of SAS programming experience and application of SAS, I encourage you to take a closer look at SAS Enterprise Guide. It truly does have something for everyone.

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