

Paper 246-30

End-to-End Web Reporting Using SAS[®] Enterprise Guide[®] 3.0:

Who does What and When

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ABSTRACT

SAS[®] 9 and SAS[®] Enterprise Guide[®] 3.0 provide an array of powerful tools for analyzing data and generating the information that organizations demand to address their business needs. However, to exploit the new architecture, more functional roles need to be involved in the development process, which means that a clear understanding of the different roles and responsibilities at each stage of the process is required. This scenario-based tutorial takes you through the different stages of the process (security control via the SAS[®] Management Console, SAS[®] Enterprise Guide[®] report development and deployment, end user access via the SAS[®] Information Delivery Portal, SAS[®] Web Report Studio, and Microsoft Office). The report(s) produced will be simple ones as the emphasis here is on the process and responsibilities involved.

INTRODUCTION

This paper focuses on the power of Enterprise Guide to provide information in both web and non web environments. To help the audience understand the pros and cons of differing approaches, we first review 3 classic approaches to a specific reporting task.

It is assumed that the SAS[®] Enterprise BI Server has been installed and configured. Only additional steps needed to perform the tasks discussed in the paper will be covered.

Many organizations require that reporting be published in formats such as HTML or Excel. While HTML reports are widely accessible, they are typically static and thus not as informative as supplying underlying data with full “slice and dice” and “reach through” capabilities. Building greater capability into SAS-produced HTML reports required considerable programmer effort and intervention in the pre – EG 3.0 world. Excel is a popular format for reports that enable the user to further manipulate the data, but the analytic capabilities of Excel are restricted by the available data, expertise of the user, and Excel limitations. When Excel is used for further analysis, it opens the door to differing results and “many versions of the truth” (for example, calculating averages by using the AVERAGE function or dividing the sum by the number of rows gives different results if there are missing values). As these calculations are hidden as formulae in Excel, there are also audit and replication issues.

Following a brief review of the SAS-based approach to producing reports in HTML and Excel format, we step through the benefits and processes for using Enterprise Guide 3.0 for end-to-end reporting. The **live presentation** of this paper includes a demonstration and explanation of the steps involved in *preparing the environment* (including the Management Console and Metadata Repository) and *defining stored processes*.

EXAMPLE REPORT

To illustrate a range of reporting capabilities that can easily be replicated by the audience, SAS sample data sets are used for examples. The first example is based on the sample CRIME data set supplied with SAS software, which provides crime rates for the 50 US states on auto theft, murder, larceny, burglary, and other crimes. A look-up table is used to classify the states by region and Coordinating Department, producing a high level summary with underlying region and state detail available. To replicate results, use the program in Appendix A to create the lookup table.

It is desired to produce a regional summary of the data including both a tabular and graphical display.

US Crime Rates by Region

	Number of States	Average Robbery Rate	Average Rape Rate	Average Murder Rate	Average Larceny Rate	Average Burglary Rate	Average Auto Theft Rate	Average Assault Rate
Region								
NorthCentral	16	96.5	21.0	5.6	2,527.6	1,001.6	309.7	155.7
NorthEast	11	155.5	19.8	4.9	2,609.9	1,375.9	528.7	190.6
Other	2	112.4	38.6	9.0	3,645.1	1,621.6	621.4	174.1
SouthCentral	8	117.3	28.5	11.6	2,223.0	1,232.4	297.5	229.3
SouthEast	6	105.0	26.2	9.9	2,375.6	1,260.4	246.1	294.3
West	7	165.3	38.8	8.3	3,583.7	1,824.4	429.3	289.7

“STATIC HTML” APPROACH TO REPORTING

Beginning with SAS Version 6.12, HTML output can be easily produced using ODS and SAS Procedures. To produce the desired summary table and chart as a static web page, appropriate PROC TABULATE and PROC GCHART output is routed to an ODS destination.

The user would get the desired result, but could they make any alterations or drill down to investigate the data?

“EXPORT TO EXCEL” APPROACH TO REPORTING

For users who prefer to view and manipulate their report in Excel, there are many possible approaches for building the report. One approach would be to use the Export Wizard, or PROC EXPORT to copy the data to Excel and then generate the summary report using Excel tools. Another approach, especially when working with massive quantities of data, would be to produce the summarization with SAS tools and then export the results to Excel. Beginning in Version 8, many SAS users take advantage of ODS features to output their reports to Excel and include appropriate styles and other features.

“DYNAMIC WEB-BASED” APPROACH TO REPORTING

To accomplish a more dynamic solution, the developer would have to either use SAS/IntrNet[®] to write a SAS program that passes parameters from an HTML form to a SAS program via the broker (CGI program), or develop an application using SAS[®] AppDev Studio[®].

ADVANTAGES AND DISADVANTAGES OF CLASSIC APPROACHES

While each of the above approaches produces the tabular and graphic summaries that are desired, they vary in complexity of development and usefulness of results.

Development efforts

- The HTML and Export to Excel approaches are both relatively simple from a “SAS skills” perspective. If you know exactly what the final report needs to look like, you can use base SAS to write the code.
- Deployment of HTML is straightforward – simply place it on the web server and add links to it.
- Deployment of Excel files is more complex, either a copy has to be sent to each potential user or the file has to be placed on a central server, which can cause further complications (concurrent access, possible data corruption if users have update access, etc.)
- The App Dev Studio approach requires more specialized skills and would be more complex to update
- Writing SAS programs that are invoked through CGI to create dynamic web reports, requires considerable knowledge beyond simple SAS skills.

Results

- Static means, “What you see is what you get”. If the developer did not properly anticipate the user’s needs, additional reporting will be required. How often do you look at a report and see all the answers you need?
- Excel reports are often desired for their flexibility, but automatically producing a multi-sheet report with stylized formatting is not easy. Exporting results to Excel gives the user a “starting point” from which they can further explore the data or produce additional summaries using Excel. This, however, creates further potential problems:
 - Excel has a maximum of 65536 rows of data, which restricts the amount of data that can be processed. If the original data exceeds this, either the user has to request subsets of the data to work with or the data must be summarized before exporting it from the source system.
 - Different users may perform their analyses in different ways resulting in different versions of the truth (sometimes referred to as “dueling spreadsheets”)
 - Data has to be sent to each potential user either as a data file to be imported into Excel or as a starter spreadsheet.
 - The analytical capabilities of Excel are not as extensive as those available within SAS.
- Dynamic web-based reports provide flexibility in both the format and content that are possible.

ENTERPRISE GUIDE APPROACH TO REPORTING

Enterprise Guide 3.0 provides a powerful environment and toolset for end-to-end reporting.

Some key concepts we will reference in our discussion of EG 3.0 are:

- **METADATA SERVER**
The SAS® Metadata Server stores information about servers, users, and stored processes to provide to client applications. The information is stored in Metadata Repositories.
- **STORED PROCESS**
A stored process is simply a set of SAS code that is available for execution by client applications.
- **WORKSPACE SERVER**
A SAS Workspace Server surfaces the SAS programming environment to client applications.
- **STORED PROCESS SERVER**
A Stored Process Server executes Stored Processes for client applications.

For the example under consideration, EG 3.0 can produce the desired tabular and graphical report with the following advantages over the other 3 approaches:

Results

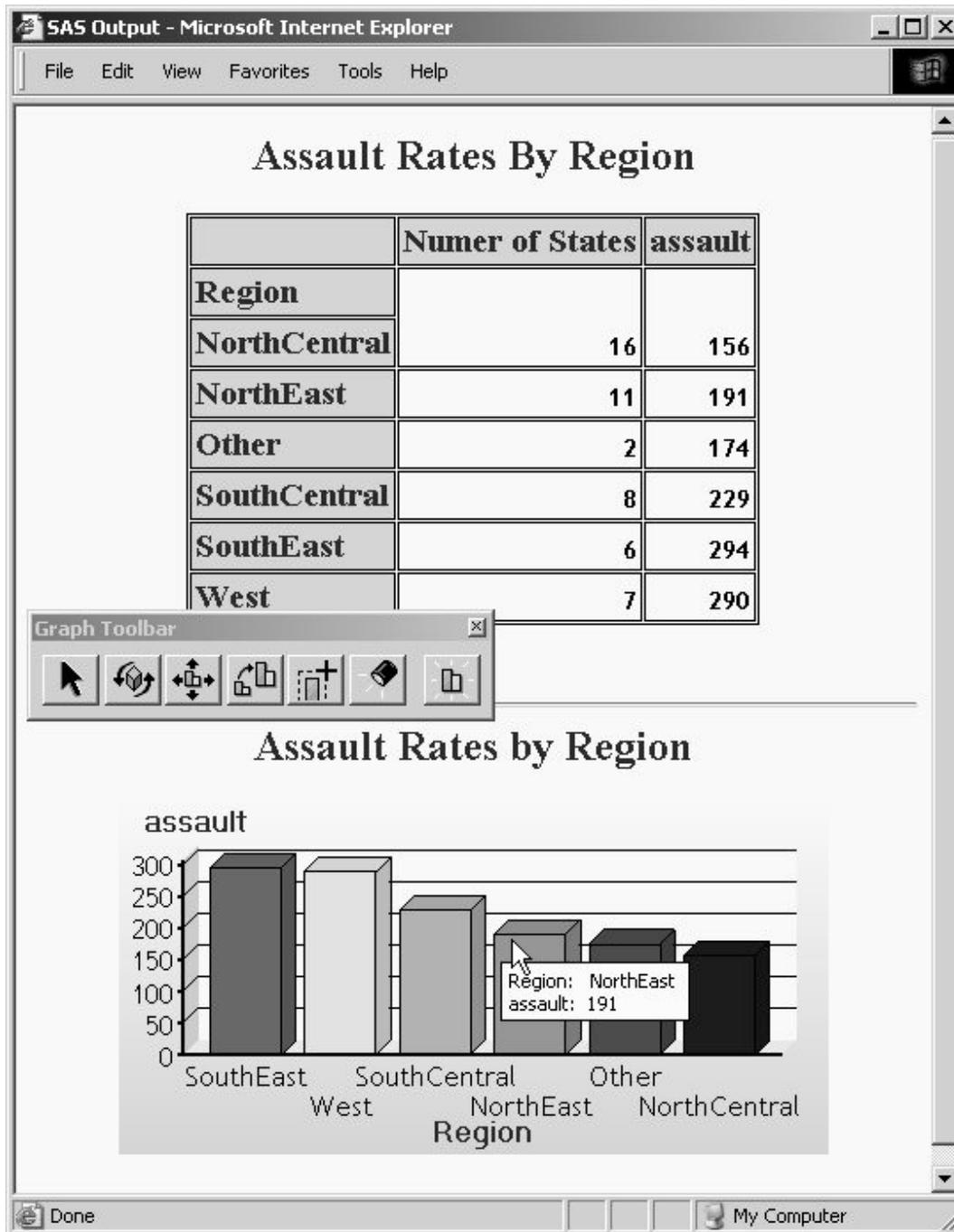
- The report can be produced in a variety of formats depending on requirements
 - Static reports
 - Parameter driven reports
 - Drillable reports.
- Reports can be viewed
 - As standard HTML (**Static only**)
 - Via Microsoft Office products (Word, Excel) using the SAS Add-In for Microsoft Office
 - Via the SAS Information Delivery Portal
 - Via SAS Web Report Studio.
- Report deployment is handled simply within Enterprise Guide to the appropriate people.
- Since the underlying data are available to the application, the user can further explore the results with the power of SAS analytical tools. Example: is there a correlation between murder and burglary? A couple of clicks runs PROC CORR!

Development Efforts

- Report generation falls into two categories which need to be considered
 - Environment preparation
Although this may seem to add complexity to the process, typically, most of the effort will only be expended once for a set of related projects as they are likely to use the same resources and environment. Benefits of this approach include control of access to the corporate data and computing resources.

- Appropriate access to the data and servers needs to be granted to both the developer and the end user
- Appropriate servers (Stored Process and Workspace) may need to be created
- Metadata for the source data needs to be set up in the Metadata server
- Application Development
 - Static reports can generally be created using the task wizards within Enterprise Guide
 - Parameter-driven and drillable reports require basic coding skills (ability to create macro variables) .

SAMPLE REPORT USING ENTERPRISE GUIDE



GETTING STARTED WITH ENTERPRISE GUIDE 3.0

It is easy to send a report to someone, when requested, but deploying information to an entire organization benefits from up-front planning, including

- Report requirements – determine requirements such as
 - Source data
 - Segmentation or summary levels
 - Granularity, for investigative purposes
 - Further tools required to explore the data
 - Deployment requirements – which delivery methods are to be used? (HTML, Web Report Studio, SAS Information Delivery Portal, etc.).
- Development requirements
 - Source data format, location, and access
 - Metadata
 - Execution location.
- Security Requirements
 - Who requires access to top-level reports?
 - Which users are permitted access to more granular data, for further exploration?

For ease of explanation, this paper focuses on 4 different phases involved in developing end-to-end reporting with Enterprise Guide:

REPORT REQUIREMENTS PHASE

In this phase, the report requirements including source data, report content, and delivery method are defined:

- Specification of the data to be used including sources and granularity
- Definition of the reporting requirements (Content, Graphs, Summary / Drill levels)
- Specification of the delivery method (Web, Excel, Word).

SAS ADMINISTRATOR ROLE: METADATA AND STORED PROCESS SERVERS

The SAS Administrator

- Prepares the environment in Management Console
 - Defines the location for Stored processes to run
 - Adds the source data libraries
 - Imports the appropriate table metadata
 - Assigns the source data to the Metadata Server
 - Grants appropriate permissions for the Programmer and End User
- Defines the Metadata Repository In the Enterprise Guide Administrator.

PROGRAMMER ROLE: REPORTING VIA EG

The Programmer's role will be similar to their role in preparing standard reporting. However, a portion of the efforts will focus on the extensibility of the reporting. For example, the stored processes will enable the user to produce further analyses and reports, beyond those originally provided

- Performs any necessary data manipulation (e.g. Joins)
- Generates reports & Graphs in Enterprise Guide
- Creates Stored Process to be used by the end user
- Defines reporting styles to be used.

END USER: ACCESSING REPORTING

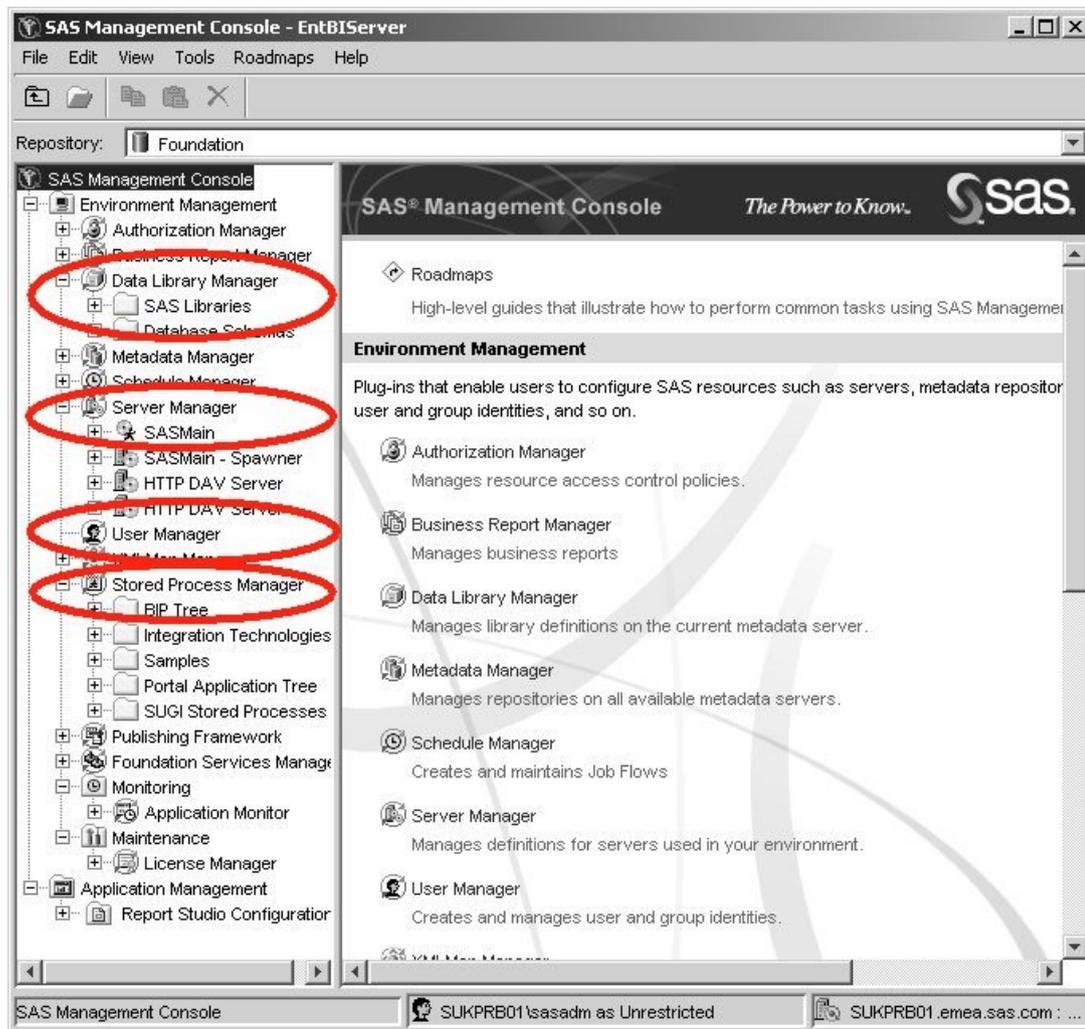
The user will enjoy a more flexible and responsive reporting environment including:

- Access Stored Processes in Excel / Word via the SAS Add-In for Microsoft Office.
 - Since the processing is done by the Stored Process, consistent answers are provided to all users.
 - Parameter Driven Stored processes allow powerful and flexible drill down capabilities
 - Since the Stored Process uses the original external data, the user is not limited to the 65536 rows in Excel
- The user can perform ad hoc analyses against the data, using many of the SAS analytical functions while working in Excel or Word.
- Using the SAS Information Delivery Portal, all users can access and use the same Stored Processes.
- Using Web Report Studio the user can produce reports against a standardized business view of the corporate data.

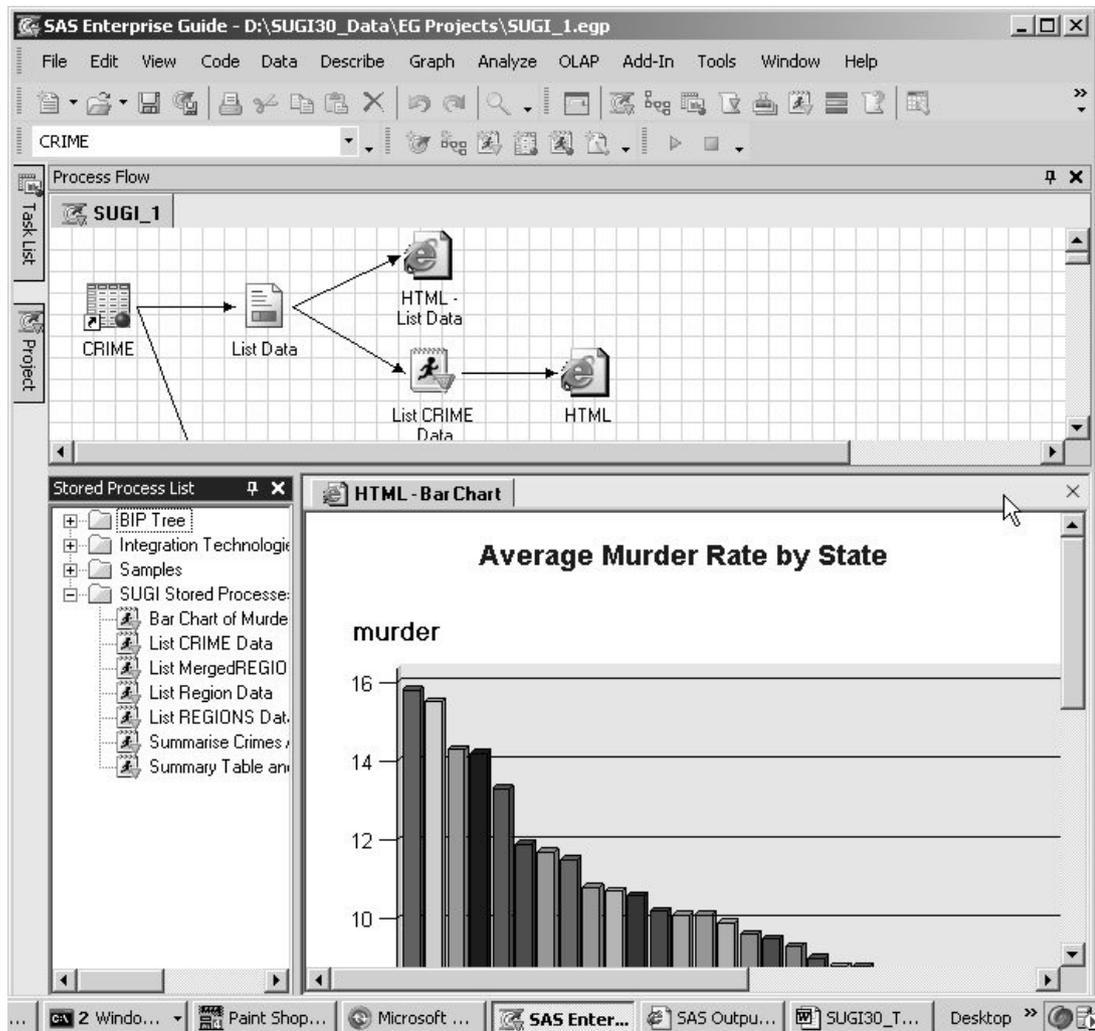
EXAMPLE 1:

To illustrate the basic steps involved in producing web-based reporting using the CRIME data, let's step through the roles.

- Requirements gathering
 - Identifies the data sources as: CRIME data and corresponding Coordinator / Region assignments
 - Determines that summary text and graphic reports are required at the Region and Coordinator levels
 - Determines that reporting should be surfaced on the web, and that the user should be able to produce additional analyses and view further summaries and details.
- SAS Administrator
 - Using the SAS Management Console, prepare the environment including data sources, permissions, etc.



- SAS Programmer
 - Specifies required data manipulation, such as the Join of Crime and Regions
 - Generates the summary and graphical reports using Enterprise Guide
 - Sets up Stored Process to be used by the end user
 - Defines reporting styles to be used.



- End-User
 - Accesses the static reports via a web browser
 - as a standard URL
 - using the SAS Information Delivery Portal.
 - Runs prepared Stored Processes in
 - Microsoft Excel or Word
 - The SAS Information Delivery Portal
 - SAS Web Report Studio.

SAS Output - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address <D:\Temp\0aa61c9b-e45f-401c-b600-a81c1690040b\result.html> Go

US Crime Rates By Region

	Numer of States	Average Robbery Rate	Average Rape Rate	Average Murder Rate	Average Larceny Rate	Average Burglary Rate	Average Auto Theft Rate	Average Assault Rate
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Done My Computer

EXAMPLE 2

More flexible reporting functionality can be added with minimal additional effort. Macro variables enable flexibility so that not all aspects of the reporting are fixed. Minor alterations to the SAS program give maximum benefit.

The screenshot shows two windows from the SAS software. The top window is titled "Summary Table and Graph with Selectable Dimensions" and has a "General" tab. It contains two dropdown menus: "Select Crime to Analyze" set to "Robbery" and "Select Summary Level" set to "Coordinator". A list box below the second dropdown shows "Coordinator", "Region", and "State". Below these is a status bar that says "Begins execution of stored process." and buttons for "Run" and "Cancel".

The bottom window is titled "SAS Output - Microsoft Internet Explorer" and displays the results. It features a table titled "Robbery Rates By Coordinator" and a 3D bar chart with the same title. The table data is as follows:

	Numer of States	robbery
Coordinator		
C1	25	131
C2	25	117

The 3D bar chart shows two bars for coordinators C1 and C2. The vertical axis is labeled "robbery" and ranges from 0 to 140. A context menu is open over the chart, showing options for "Horizontal Bar", "Vertical Bar", "Pie", "Plot", and "Area". A "Graph Properties" menu is also visible, with "Chart Type" expanded to show "Pie" selected. A "Graph Toolbar" is located at the bottom left of the chart area.

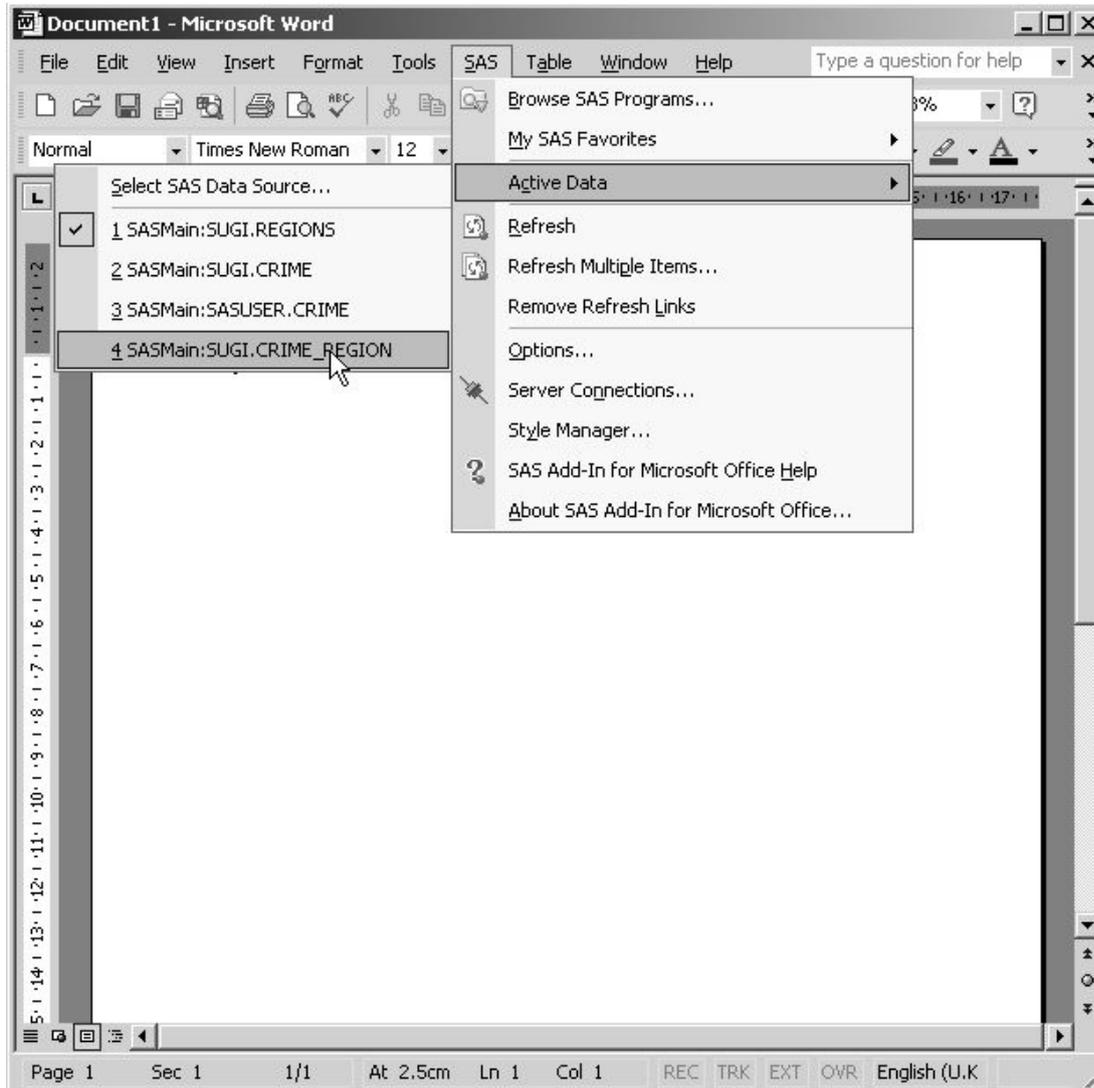
In this example, the user can

- Choose the Crime to analyze
- Choose the summary level (Coordinator, Region or State)
- Interact with the resulting graph to change the chart type, perspective, size, and much more.

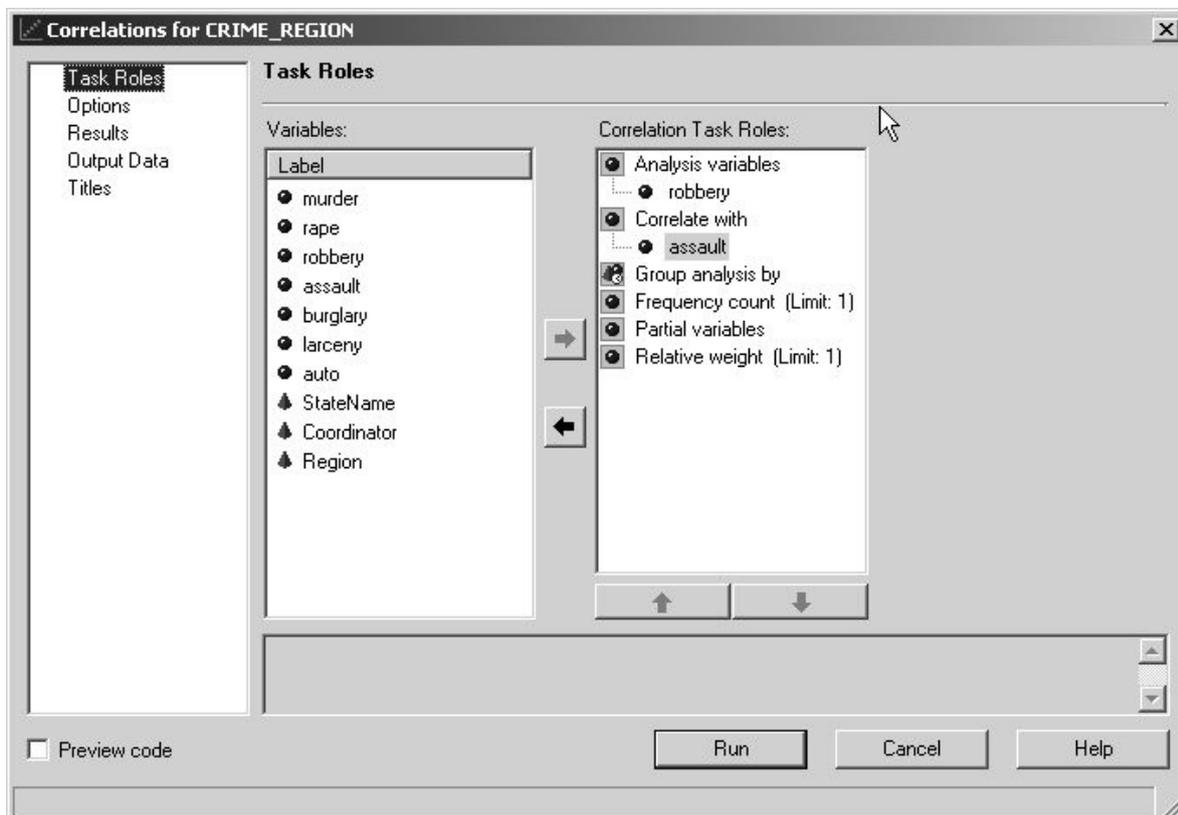
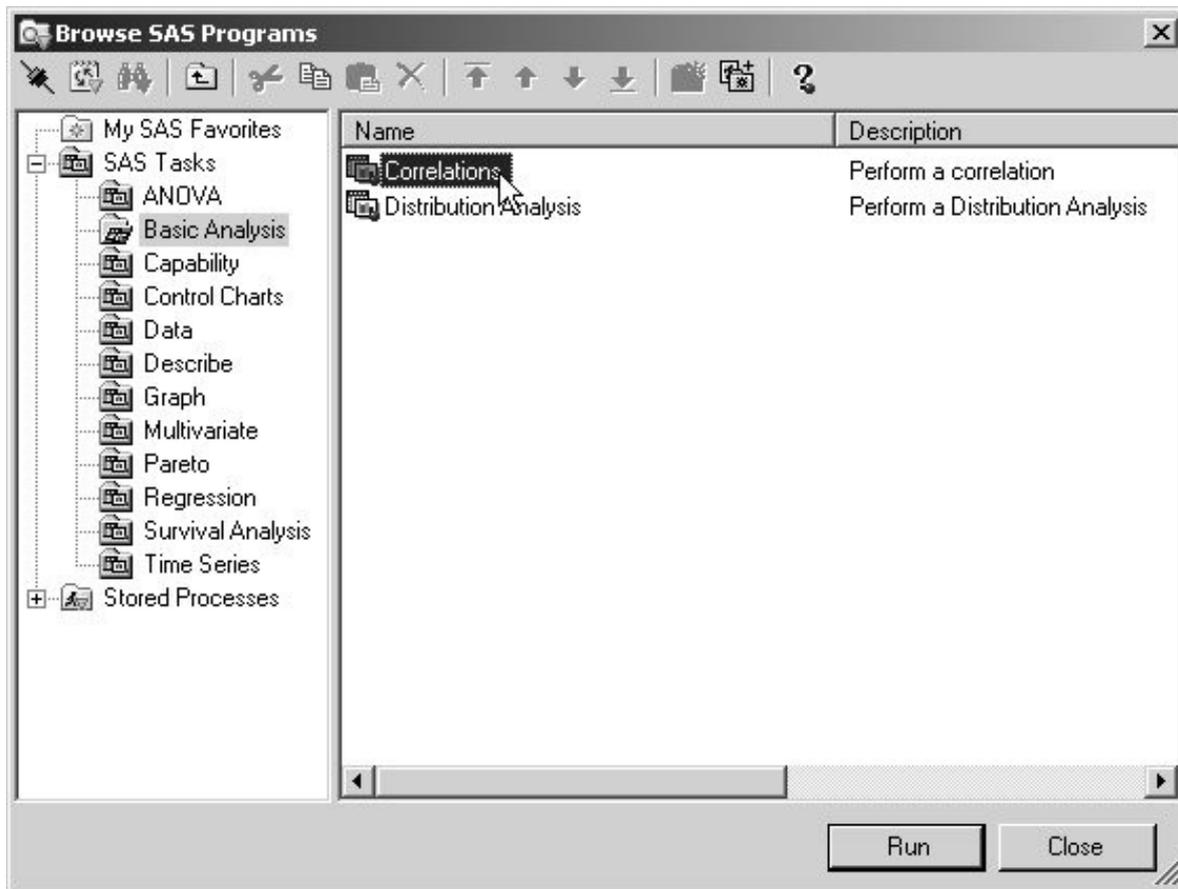
EXAMPLE 3

Having viewed the report, the user may wish to further analyze the data. Using the SAS Add-In for Microsoft Office, you can use the analytical features of the SAS System directly from Word or Excel.

The user first specifies the data source and then selects from the available SAS programs.



After selecting the desired program, additional information is requested including variables to analyze, output format, statistical options, etc.



Results (via SAS Add-In for Microsoft Office):

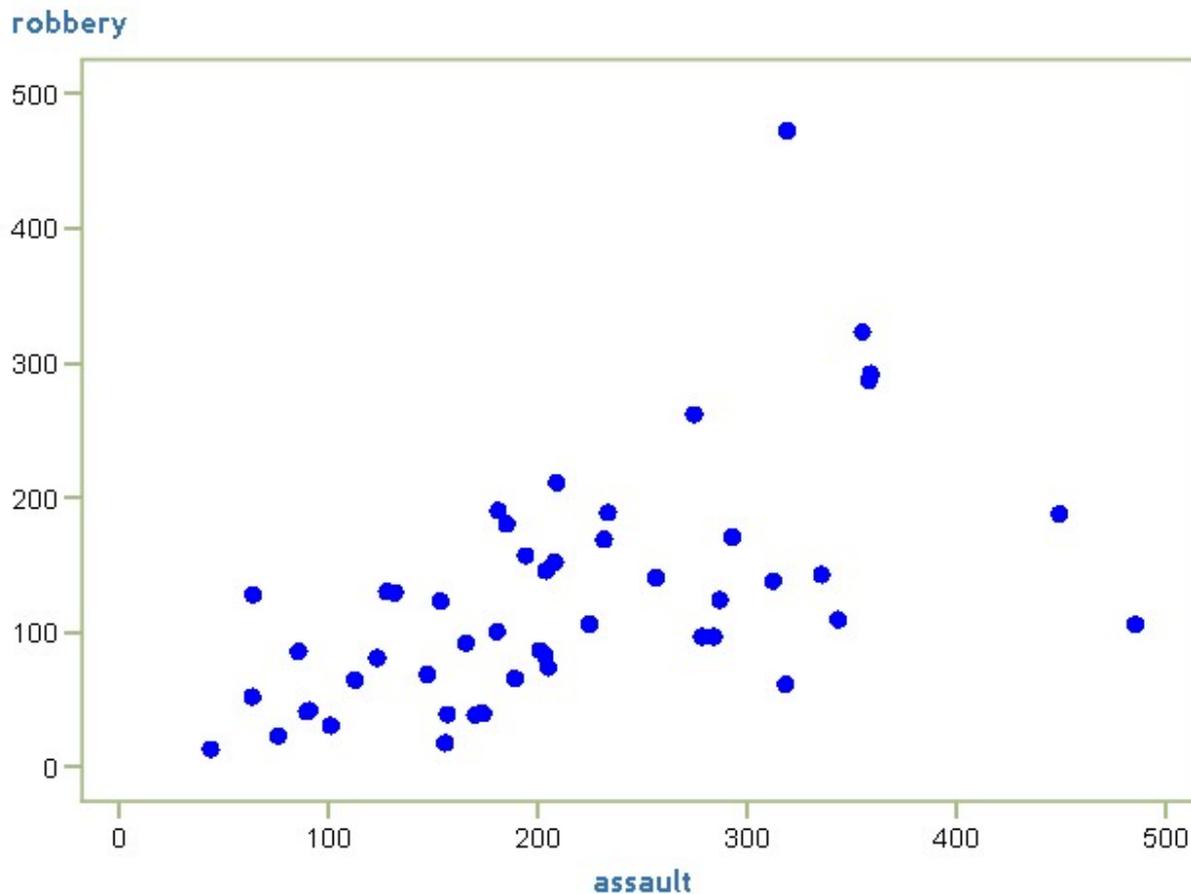
Correlation Analysis
The CORR Procedure

1 With Variables:	assault
1 Variables:	robbery

Simple Statistics						
Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
assault	50	211.30000	100.25305	10565	43.80000	485.30000
robbery	50	124.09200	88.34857	6205	13.30000	472.60000

Pearson Correlation Coefficients, N = 50	
Prob > r under H0: Rho=0	
	robbery
assault	0.55708 <.0001

Correlations Plots
Scatter plot of robbery by assault



SOFTWARE REQUIREMENTS

The examples and features discussed in this paper used the SAS software as supplied in the SAS Enterprise BI Server Technology Solution.

CONCLUSION

Enterprise Guide 3.0 provides a powerful environment and toolset for end-to-end reporting. As demonstrated in this paper, efforts expended during development and setup enable flexible reporting and analytics to meet your organization's business needs.

ACKNOWLEDGMENTS

The authors appreciate the review and suggestions provided by Harry Droogendyk, Stratia Consulting Inc.

RECOMMENDED READING

To gain a more complete understanding of Enterprise Guide 3.0, the authors recommend the following publications and web links.

- Getting Started with SAS Enterprise Guide – free learning tutorial available from http://www.sas.com/apps/elearning/elearning_details.jsp?pubcode_=59271
- Other (chargeable) e-learning on Enterprise Guide from http://www.sas.com/apps/elearning/elearning_courses.jsp?cat=SAS+for+Non-Programmers
- Further information on the SAS® Enterprise BI Server: <http://www.sas.com/technologies/bi/entbiserver/index.html>

CONTACT INFORMATION

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APPENDIX A

CODE TO CREATE SAMPLE DATASETS

```

libname SUGI 'd:\SUGI30_Data';

data SUGI.CRIME(drop=Coordinator StateName Region)
      SUGI.REGIONS(keep=Coordinator StateName Region);
  length      StateName $ 15
              Coordinator $ 2
              Region $ 12;
  set sasuser.crime;
  StateName = staten;
  if StateName in("Florida","Georgia","South Carolina","North Carolina",
                 "Virginia","West Virginia") then do;
      Region="SouthEast";
      Coordinator="C1";
  end;
  else if StateName in("Delaware","New Jersey","Pennsylvania","New York",
                      "Massachusetts","Rhode Island","Connecticut","Maine",
                      "Maryland","Vermont","New Hampshire") then do;
      Region="NorthEast";
      Coordinator="C1";
  end;
  else if StateName in("California","Washington","Oregon","Nevada",
                      "Arizona","New Mexico","Utah") then do;
      Region="West";
      Coordinator="C2";
  end;
  else if StateName in("Louisiana","Texas","Arkansas","Alabama",
                      "Tennessee","Kentucky","Colorado","Mississippi")
      then do;
      Region="SouthCentral";
      Coordinator="C1";
  end;
  else if StateName in("Illinois","Ohio","Indiana","Idaho","Iowa",
                      "Kansas","Michigan","Minnesota","Montana",
                      "Missouri","Nebraska","Wyoming","Wisconsin",
                      "North Dakota","South Dakota","Oklahoma")
      then do;
      Region="NorthCentral";
      Coordinator="C2";
  end;
  else if StateName in("Hawaii","Alaska") then do;
      Region="Other";
      Coordinator="C2";
  end;

RUN;

```