SAS/EIS®: SPRINTing to the Rescue

SPRINT INTERNATIONAL Global Voice Engineering Executive Information System

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Abstract
This paper describes our adventures installing a multi-featured SAS Executive Information System (EIS) for SPRINT INTERNATIONAL Global Voice Engineering. We cover the capabilities and limitations of SAS/EIS and demonstrate graphical examples.

SPRINT INTERNATIONAL handles millions of international phone calls each month from countries such as Australia, France, Germany, Ireland, New Zealand, and United Kingdom (UK), to more than 200 countries including the US. As SPRINT INTERNATIONAL expands, it continuously aims to improve its worldwide service. To track and summarize call setup time, holding, and duration, we installed a powerful Executive Information System (EIS) using SAS/EIS for Windows on a Dell Pentium desktop computer. The EIS takes advantage of many SAS/EIS capabilities. To use those capabilities, however, we had to overcome numerous EIS limitations.

What is an EIS?
An EIS is a computer system designed to summarize and display data in the form of graphs and tables, to enable managers quickly to see status and trends without requiring them to do any programming.

Key features of an EIS include:
• **DRILL DOWN**: To make a graph or table, to select one row of data, and to expand that row to a new graph or table
• **TRANSFORM**: To flip a chart into a table or vice-versa, without re-selecting data
• **OBJECTS**: To use menus (DESKTOPs) to list options, each with its own push-button (ICON), to allow you to call other objects, such as other DESKTOPs; graphics (CHARTs); variance reports or tables (VARREPs); calls to non-EIS SAS programs (EXECUTEs) for canned reports and macro definitions; and EXITS, to allow you to return from sub-menus

SPRINT INTERNATIONAL's Requirements
We designed our EIS to fulfill these key requirements:
• Read data about millions of calls each month, from incoming switches (telephone relays) into SAS datasets
• Select data by country
• Select by summary type, e.g., from where the call originated or to where the call terminated
• Select by time period, e.g., most recent month, by hour; most recent month, by day; most recent week; five most recent weeks; previous month
• Drill down or transform graphs to tables at any time
• Select how to represent variables with various formats
• Display data on graphs, tables, and other EIS tools
• Produce “canned” reports, written using base SAS code

Installing SPRINT INTERNATIONAL's EIS
To install the EIS, we executed the following steps:
• Installed SAS/EIS from the SAS distribution diskettes
• Wrote a program to read a month of UK hourly data, store it by hour, split it into five individual weeks, and to summarize hourly data by day
• Used SAS/EIS METALIST tool to “register” the UK hourly dataset into EIS
• Used SAS/EIS METABASE tool to register all UK hourly variables into EIS
• Used SAS/EIS BUILD tool to write a DESKTOP object to select time period, e.g., Hourly, Daily, or Week 1/23/45
• Developed various SAS/EIS data analysis objects:
  -- HBAR (horizontal bar chart)
  -- VBAR (vertical bar chart)
  -- PIE chart
  -- VARREP (columnar report)
  -- EXPANDER (expandable line report)
  -- MULTCOL (multiple-column report)
  -- Calls to “canned” external SAS programs
• Wrote a DESKTOP object to select a data analysis object
• Wrote programs similar to UK’s to read and store data from Australia, France, Germany, Ireland, and New Zealand
• Built a DESKTOP object to select country: Australia, France, Germany, Ireland, New Zealand, or UK.
• Added macro variables to “canned” reports, driven by push-buttons, to put these reports under complete EIS control

Enhancing the EIS
Switching among countries, we discovered that the SAS/EIS LIBNAME object had an “unwanted feature,” a warning that would not go away. So instead, we used SAS/EIS EXECUTE objects to run macros to reassign the active LIBNAME, for example:

```sas
%LET SWITCH=IRELAND;
%LET PERIOD=HOURLY;
LIBNAME DATA "\&SWITCH\&PERIOD";
```

Since each country’s dataset for hourly, daily, and week 1/23/45 were of identical structure, we only registered one standard dataset (UK/hourly) in the metadata. By using macros to assign a directory to LIBNAME DATA, we solved the problem of multiple datasets elegantly.

Next, we wished to control the title bar at the top of EIS screens to remind you what dataset you have selected. We used the following Screen Control Language (SCL) program:

```
INIT:
  SWITCH=SYMGET('SWITCH');
  PERIOD=SYMGET('PERIOD');
  CALL EXECUTE('SETWNAME "Data for \&SWITCH\&PERIOD"');
RETURN;
```
Enhancing the EIS (continued)

We found that by default, VARREP displays five columns: an ID, plus columns for budget, actual, variance, and percent. Since we wished to display only the ID variable and one numeric (summarization) variable, we tricked VARREP not to display certain columns by using a length of 1 and a BLANK format:

PROC FORMAT; VALUE BLANK OTHER=’ ’;

We further tricked VARREP to display certain columns as hundreds of minutes by using a HUNDS format:

PROC FORMAT; PICTURE HUNDS
OTHER=’0000009.999’ (MULT=10);

We enhanced EIS drill-down features by adding a WHERE-clause tool in the dataset selection menu and in the canned reports. Using the WHERE clause tool, you can select a data subset on the fly, rather than using the entire time period of data for the selected country. Your WHERE clause selection remains in effect until you select another time period or country.

We improved both performance and capability when we moved to a network environment. We were able to store far larger datasets and keep back months of data. We were also able to support multiple EIS users simultaneously. We learned, however, that when one user was updating the EIS, such as adding a new tool, other users were locked out of the EIS. We also learned that all users needed consistent AUTOEXEC.SAS and Windows icons with properties to call the EIS.

Another benefit of moving to the network was fast turnaround on new data. Originally, we downloaded each month's data onto our PC from a mainframe computer. Once we moved to a wide-area network, switches could send their data each day to a file server. We were thus able to convert daily data into SAS and use it in the EIS almost immediately. Using Windows NT, we were also able to load incoming data from several incoming switches into corresponding SAS datasets, all at the same time in several SAS windows.

- **EIS Data Structure**
  - **Our EIS variables fall into two groups:**
    - **ANALYSIS VARIABLES:**
      - Attempted Calls (ATTEMPTS)
      - Completed Calls (COMPLETE)
      - Call DURATION seconds or minutes
      - Call HOLDING seconds or minutes
      - Call SETUP seconds or minutes
    - **CLASS (DRILL-DOWN) VARIABLES:**
      - Originating Country (SWITCH)
      - Destination Country (DESTCNTY)
      - Destination Region (REGION)
      - Trunk Line (TERMTRNK)
      - Trunk Carrier (CARRIER)
      - Trunk Route (ROUTE)
      - Year (YEAR)
      - Date (CALLDATE)
      - Date Week Ended (SUNDAY)
      - Day of the Week (DAY)
      - Hour of the Day (CALLHOUR)
      - Day and Hour (DAYHOUR)

- **EIS Menu Structure**
  - **When you use the EIS, you see a series of menus:**
    - *Select trunk type: originating or terminating*
    - *Select a switch (country): Australia; France; Germany; Ireland, New Zealand; UK*
    - *Select a time period: month by hour; month by day; week 1/2/3/4/5, by hour; previous months*
    - *Select how to format TERMTRNK: Carrier; Media; Product; Overflow; Route; Description; Size; Use*
    - *Select a Custom (EIS) or Canned (base SAS) Report*

- **EIS Reports**
  - You can then select a Custom Report:
    - **Horizontal Bars**
    - **Pie Charts**
    - **Aggregate Tables**
    - **Expandable Tables**
    - **Multi-Column Tables**
  - In general, SAS/EIS tools display values in the order they are found in the data. If UK appears before Germany and Australia, EIS tools list UK first, then Germany and Australia.

  To overcome this limitation of SAS/EIS and expand its capabilities, you can select a Canned Report. The EIS asks you to select values for macro variables to shape the canned report, then calls an EIS EXECUTE object to run the report on your screen. Among reports in SPRINT INTERNATIONAL's EIS are three generic reports any SAS system might want:
    - **Custom Column** enables you to select one class variable and one analysis variable. The EIS then uses PROC SUMMARY and PROC PRINT to produce a report summarizing the analysis variable for each value of the class variable, listed alphabetically rather than in dataset order.
    - **Custom Bar Chart** produces a horizontal bar chart for each value of the class variable, alphabetically.
    - **Custom Crosstab** enables you to select two class variables and an analysis variable. The EIS then uses PROC SUMMARY, PROC TRANSPOSE, and PROC PRINT to produce a report summarizing the analysis variable in a two-way matrix, for each value of each of the two class variables, listed alphabetically. The report is not limited to 16-characters as is PROC FREQ.

  The EIS canned reports also enable you to call the SAST0123 macro to create comma-separated-variable (CSV) files for input into Lotus 1-2-3 or Microsoft Excel.

- **Conclusion**
  SPRINT INTERNATIONAL uses SAS/EIS to provide its users powerful data selection and analytic tools. SAS/EIS offered a broad baseline of tools; we then added canned tools using base SAS to boost capabilities and overcome limitations.

  For more information about our EIS, please contact:
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  The following pages illustrate the EIS.
Figure 1. Main Menu

Figure 2. Trunk Type Menu
Please select a switch

- France
- Germany
- UK
- Ireland
- Sydney
- Melbourne
- Auckland

All Switches (takes longer)
Goback

Figure 3. Switch Menu

Please select a time period

- Hourly Detail
- Daily Summary
- Previous Month

Week 1 Hourly
Week 2 Hourly
Week 3 Hourly
Week 4 Hourly
Week 5 Hourly
Goback

Figure 4. Time Period Menu
Figure 5. Trunk Formatting Menu

Figure 6. Custom Report Menu
Figure 7. Sample Vertical Bar Chart, by Date

Figure 8. Sample Drill/Down on One Date, by Hour
Please select a summary report

- Attempts
- Complete
- Holding
- Setup

Duration (min)
Duration (sec)

Go Back

Figure 9. Summary Report Menu

Please select a canned report

- Country*Trunk
- Treatmnt*Trunk
- List Dates
- Month Summary
- Busy Hour

1. DESTONLY
2. Top 100%
3. Top 99%
- Make PRN
- Make CSV

1. TERMTRNK
2. Top 99%
3. Top 90%
- No PRN
- No CSV

3. Dur/Hold Ranking

Go Back

Figure 10. Canned Reports Menu