

USING SAS® TO LOAD A DATA WAREHOUSE, WRITE HTML, AND SEND ANALYSES TO THE WORLD-WIDE WEB – ALL IN REAL TIME

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Abstract

GlobalOne Voice Network Planning (formerly Sprint International) carries several million international phone calls each month. Traffic managers in eight countries need to know call volumes and forecasts as soon as possible, to plan how to allocate equipment to maximize performance.

GlobalOne's Offshore Traffic Analysis Management System (OTAMS) receives 24 hourly data files each day. A SAS program, looping endlessly, tests whether new hourly data has arrived from any of the eight countries. If so, the program warehouses the new data in a SAS library. A SAS/EIS application summarizes the real-time data, appends it to a summary file, and produces bar charts, time-series plots, forecasts, data extracts, and printed reports. The EIS automatically uploads its outputs to our Intranet Web Site - virtually in real time.

This paper illustrates the system and explains how we built it using SAS software.

Requirements

At SESUG'95, our paper "SAS/EIS - Sprinting to the Rescue" described GlobalOne's requirements for OTAMS:

- Summarize data on millions of calls each month
- Select data by country, time period, and other variables
- Visualize data using both SAS/EIS tools (graphs, charts, drill-downs) and external "canned" SAS reports

Since last year, GlobalOne added new requirements:

- Gather and store hourly call data as soon as it appears
- Warehouse the data for each individual call
- Widen the spectrum of SAS/EIS tools and canned reports
- Send tables and graphics to GlobalOne's Intranet Site

To fulfill these requirements, we made significant strides:

- Added new EIS objects and canned reports
- Built management tools, including transaction back-out
- Developed a program to read and warehouse incoming data virtually in real time
- Developed GlobalOne's OTAMS Intranet Web Site
- Created SAS/EIS tools to create data extracts and graphics image files (GIFs) on the fly and send them directly to the Web Site

Some SAS/EIS Features

Before examining our SAS/EIS application, it is useful to define the key SAS/EIS features:

- You can **REGISTER** any SAS **DATASET** and its **VARIABLES** in a **METALIST**
- You can **REGISTER** response (dependent) variables as **ANALYSIS** variables and predictor (independent) variables as **CLASS** variables in a **METABASE**
- You can **REGISTER** a **DRILL-DOWN** sequence of your **CLASS** variables
- You can **BUILD** graphical menus called **DESKTOPs**
- You can add **BUTTONs** (**ICONs**) to **DESKTOPs**
- You can associate an **OBJECT** with each **BUTTON**. When you click the **BUTTON**, you execute the **OBJECT**. **OBJECTs** can be **DESKTOPs**, **graphics**, or **EXECUTES** that call canned reports
- Some **OBJECTs** allow you to **TRANSFORM** from horizontal to vertical bar charts or from charts to tables

Warehousing Detail Data

Each hour, each originating country sends its data files to an international wide-area network. We developed Real Time Management System (RTMS.SAS) to process these data files as they arrive. First, RTMS extracts the DOS directory for an originating country with the command:

```
X "DIR H:\&SW\*.CDR >>O:\OTAMS\RTMS.DIR";
```

where &SW represents the originating country

RTMS.SAS then compares that list of files to a list previously stored. If a new file has arrived, RTMS.SAS reads it into SAS, stores it in the warehouse, and adds an observation to a tracking file. Since data from each of the eight countries arrives in very different formats, RTMS.SAS %includes the program CONVERT.SAS to read each of the differently-formatted files into a common data structure:

- **CALL DETAIL VARIABLES:**
 - SWITCH - Originating country
 - TOPHONE - Destination phone number
 - TERMTTK - Trunk line
 - CALDATE - Date the call started
 - CALLTIME - Time the call started
 - DURATION - Billable seconds or minutes
 - INFILE - DOS name of hourly data file

Creating An Audit Trail

Each incoming file has a unique name. For instance, the file 96102700.CDR contains calls that end between midnight and 12:59 am on October 27, 1996. From this DOS file, CONVERT.SAS creates the dataset Y6102708.SD2, since SAS datasets must start A-Z or “_”. Subsequent hourly and daily summary files inherit the value of INFILE, enabling us to refer to warehoused hourly files in case of problems later.

By minimizing the number of variables in the warehoused detail data, we conserve space. Space is a vital concern, because about 5,760 hourly files a month (24 hours/day/switch x 30 days/month x 8 originating countries).

RTMS.SAS runs endlessly. Once it processes all new files for the first originating country, Australia, it proceeds to each of the other countries in turn: France, Germany, Guam, Ireland, New Zealand, Russia, and United Kingdom. Once RTMS.SAS cycles through all originating countries, it starts over with Australia. The process takes one hour per country.

Summarizing Data

The next step in RTMS.SAS is to summarize the individual-call detail data by hour. RTMS.SAS %includes the program SUMARIZE.SAS to summarize the data by hour. SUMARIZE.SAS also uses CALLDATE, CALLTIME, and DURATION to derive several analysis variables and TOPHONE to derive several class variables:

- **ANALYSIS VARIABLES:**
 - ATTEMPTS - Attempted calls
 - COMPLETE - Completed calls
 - DURATION - Billable seconds or minutes
 - HOLDING - Non-billable waiting time
 - SETUP- - Non-billable set-up time
- **CLASS (DRILL-DOWN) VARIABLES:**
 - SWITCH - Originating country
 - DESTCNTY - Destination country
 - REGION - Destination region
 - GIREGION - GlobalOne region
 - TERMTRNK - Trunk line
 - CARRIER - Trunk carrier
 - ROUTE - Trunk route
 - CALLDATE - Date the call started
 - CALLHOUR - Hour of the day
 - DAYHOUR - Day and hour
 - MONTH - Month and year
 - SUNDAY - Date week ended
 - DAY - Day of the week
 - INFILE - DOS name of hourly data file

Appending the Summarized Data

Finally, RTMS.SAS %includes the program APPEND.SAS to add the newly-summarized data into the SAS/EIS database for the current month. APPEND.SAS also computes daily summaries. We keep each month's hourly and daily summaries for a year, although our SAS/EIS application points only to the current and previous three months.

Review: Building our SAS/EIS

Our SESUG'95 paper reviewed how we built OTAMS:

- Installed SAS/EIS from the SAS distribution diskettes
- Used SAS/EIS METALIST to register a sample dataset
- Used SAS/EIS METABASE to register all variables
- Used SAS/EIS BUILD to write a Main Menu DESKTOP
- Developed various SAS/EIS data analysis objects:
 - HBAR and VBAR (horizontal and vertical bar chart)
 - PIE chart
 - VARREP (column report)
 - EXPANDER (expandable line report)
 - MULTCOL (multiple-column report)
 - Calls to canned SAS programs

Data Visualization Using SAS/EIS Tools

OTAMS takes advantage of many SAS/EIS tools for data visualization. The exhibits at the end of this paper illustrate HBAR, VBAR, and VARREP. On these tools, you can click on the drill-down variable to see a menu of other variables.

From our Custom Reports Desktop, you can select:

- | | |
|---------------------|-----------------------|
| • Horizontal Bars | • Vertical Bars |
| • Pie Charts | • Forecasts (plots) |
| • Aggregate Tables | • Ratio Tables |
| • Expandable Tables | • Multi-Column Tables |

Data Visualization Using Canned Reports

From our Canned Reports Desktop, you can select non-EIS SAS programs. Each Canned Report has its own DESKTOP menu to allow you specify axis variables and other parameters. The buttons on these menus define values of macro variables for the canned programs. Canned programs do not support drill-downs or graphical transformations, but overcome some limits of SAS/EIS tools:

- Canned reports permit up to 10 TITLE lines; SAS/EIS tools permit only one TITLE line
- Canned reports can sort data in any order; SAS/EIS tools display values in order of appearance
- Canned reports can include calculated columns and rows; SAS/EIS tools can show only variables in the dataset

EIS Menu Structure

When you use the OTAMS, you see a series of menus:

- Select switch (country): Australia; France; Germany, Guam, Ireland, New Zealand, Russia, UK
- Select time period: hourly summary, daily summary, current or previous months
- Select originating or terminating trunks
- Select how to format TERMTRNK: Carrier, Media; Product; Overflow; Route; Description; Size; Use
- Select Custom or Canned Reports

Among reports in OTAMS are three generic reports:

- Custom Column enables you to select one class variable and one analysis variable. OTAMS then uses PROC SUMMARY and PROC PRINT to produce a report summarizing the analysis variable for each value of the class variable, listed alphabetically
- 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. OTAMS 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.

Each text-based canned report calls the SASTO123 macro to create a comma-separated-variable (CSV) file for input into Lotus 1-2-3 or Microsoft Excel. Each graphical canned report send its results both to the Windows screen and to GIF output files. To create GIF output, OTAMS executes this code:

```
FILENAME GSASFILE
  "H:\INTRANET\&SW\&REPORT..GIF";
GOPTIONS DEVICE=IMGGIF
  GSFNAME=GSASFILE GSFMODE=REPLACE
  GSFLN=80 GACCESS=GSASFILE;
```

where &SW represents the originating country
and &REPORT represents the Canned Report number

Canned reports can also automatically update text files containing HyperText Markup Language (HTML) identifying the current status of data loading or the list of currently-valid switch-trunk or switch-route combinations. These text and graphical outputs go directly to the worldwide wide-area network drive where GlobalOne's Intranet site is stored.

BIGREPT Canned Report

Once we defined a set of canned reports and publicized them within our user community, users all across the worldwide wide-area network asked to see them immediately upon their completion.

To make the process of producing canned reports fully automatic, we built a BIGREPT canned report that provides default parameters to every canned report, runs it, and sends its text and graphical output to the Intranet site network drive where GlobalOne's Intranet site is stored. Thus, with one button click, the entire month's text reports and graphics, for all switches, go on-line to the worldwide user community.

OTAMS Web Site

The OTAMS on the Intranet features a home page and several subsidiary pages, illustrated at the end of this paper. If you click on a data file, the home page downloads the CSV to your PC; if you configure Excel as your viewer for CSV files, you automatically open the data file as a spreadsheet. If you click on a graphic, you immediately see the GIF image.

We update the reports daily using BIGREPT. With this tool, we generate traffic reports by Originating and Terminating trunk groups in the form of CSV files, organized by switch name and originating and terminating trunk groups. Another tool plots trend lines to indicate how the routes are doing in terms of traffic by various analysis variables. In addition, we generate capacity analysis graphs to show which routes need additional resources to accommodate traffic.

Conclusion

The following pages illustrate the EIS.

GlobalOne uses SAS/EIS to provide its users powerful data selection and analytic tools. We have harnessed SAS/EIS to offered a broad baseline of tools; we then added canned tools using base SAS to boost capabilities and overcome limitations. Using SAS, we made the processes of loading data, displaying it, and sending it to our Web site automatic and continuous.

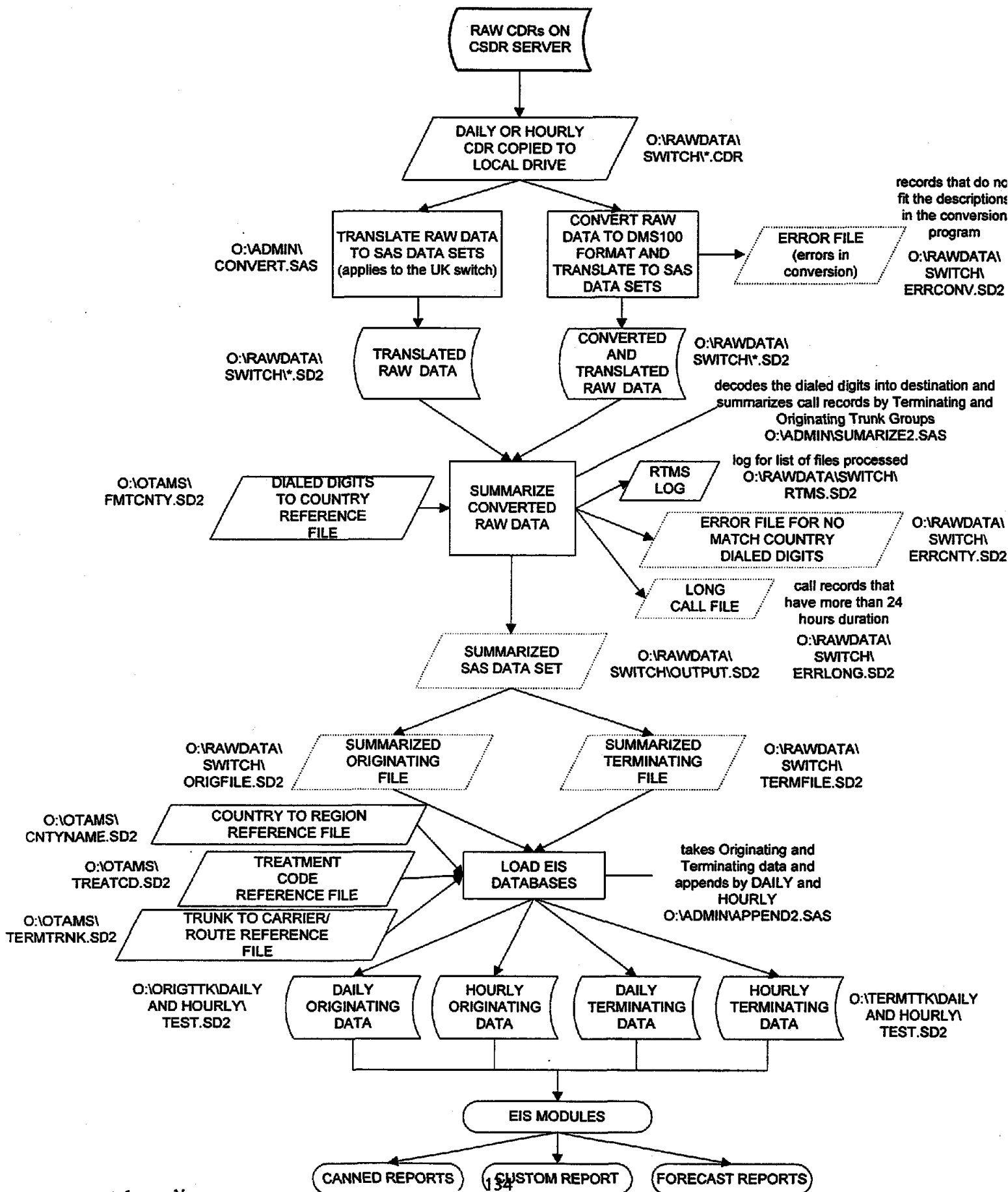
For more information about our EIS, please contact:

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GLOBALONE VOICE NETWORK PLANNING

CDR PROCESSING



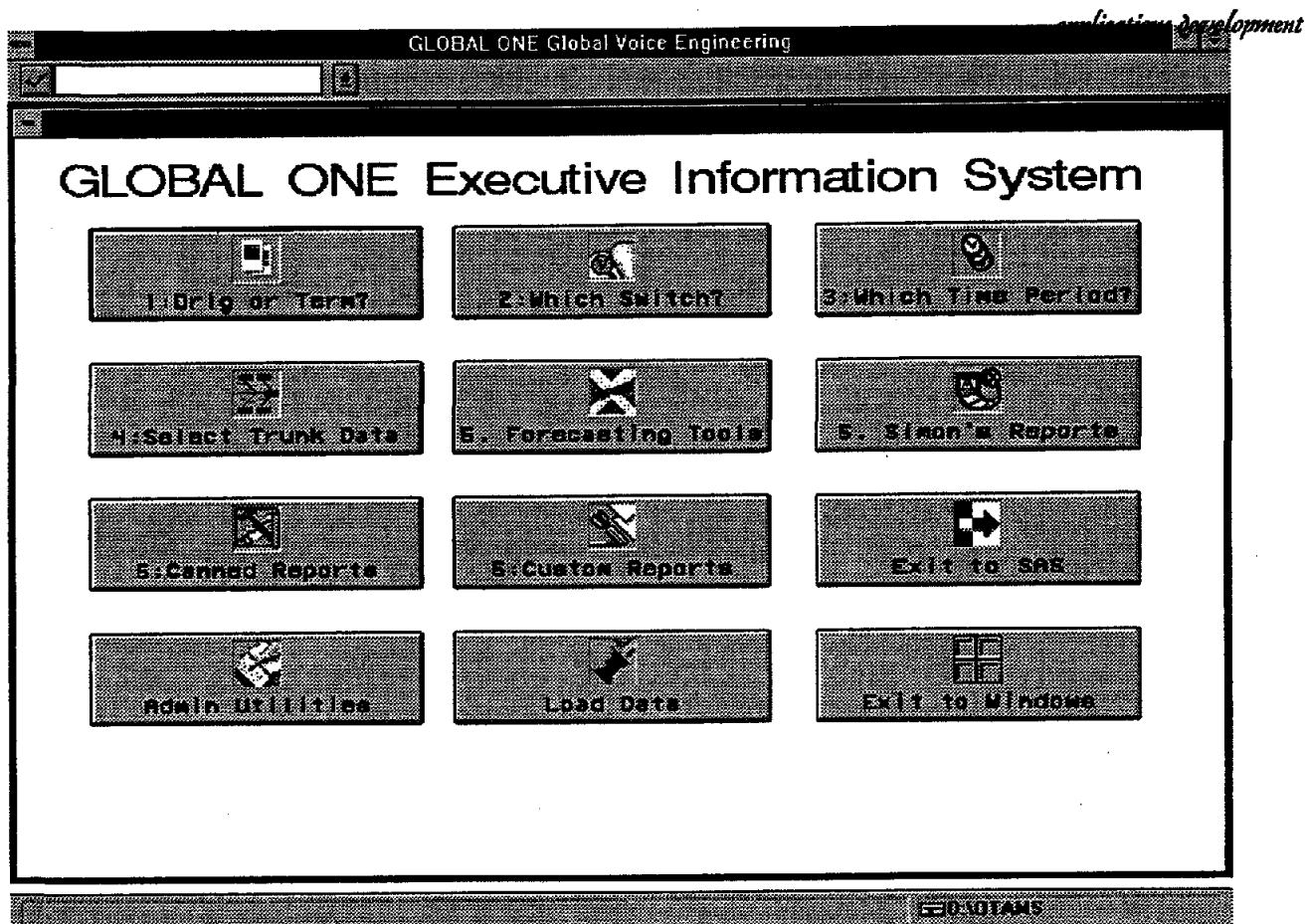


Figure 1. Main Menu

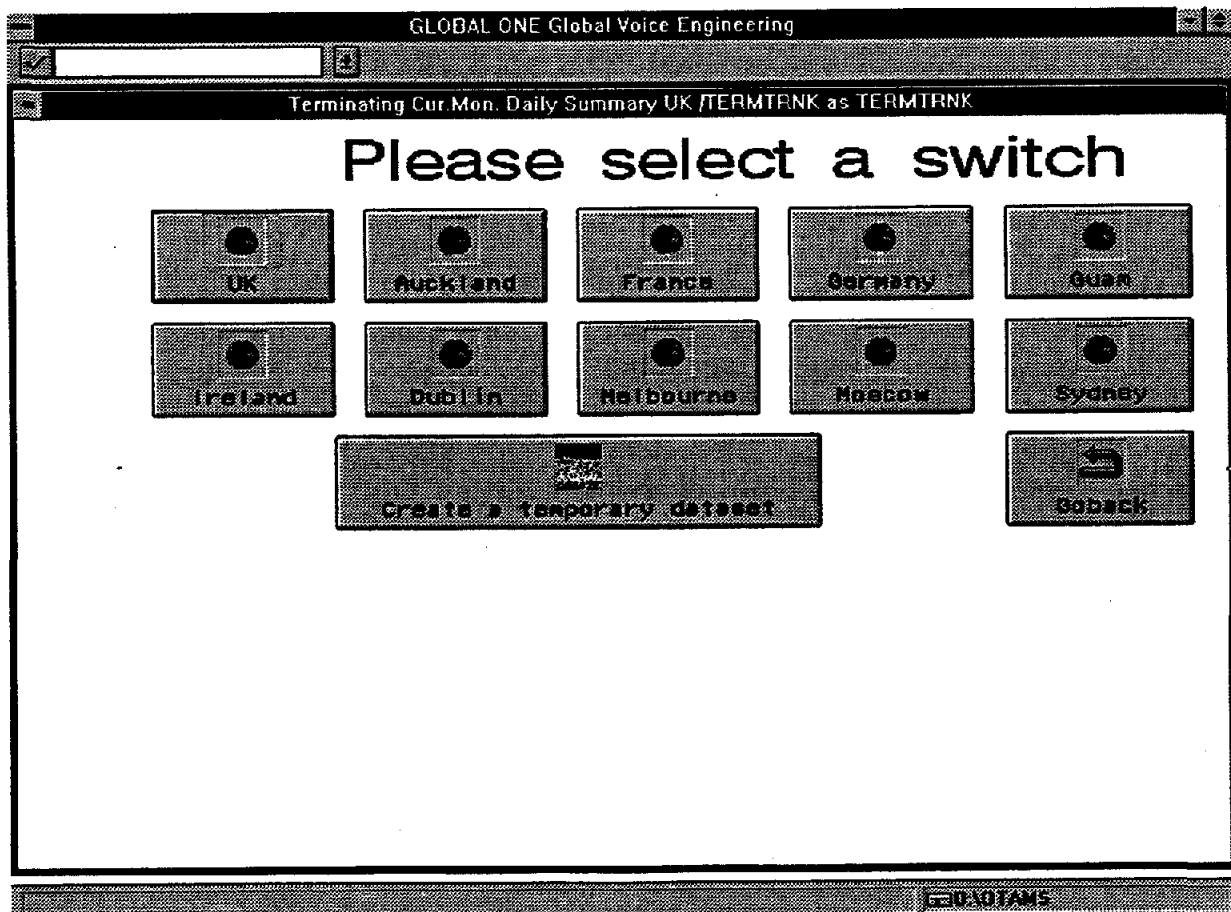


Figure 2. Switch Menu

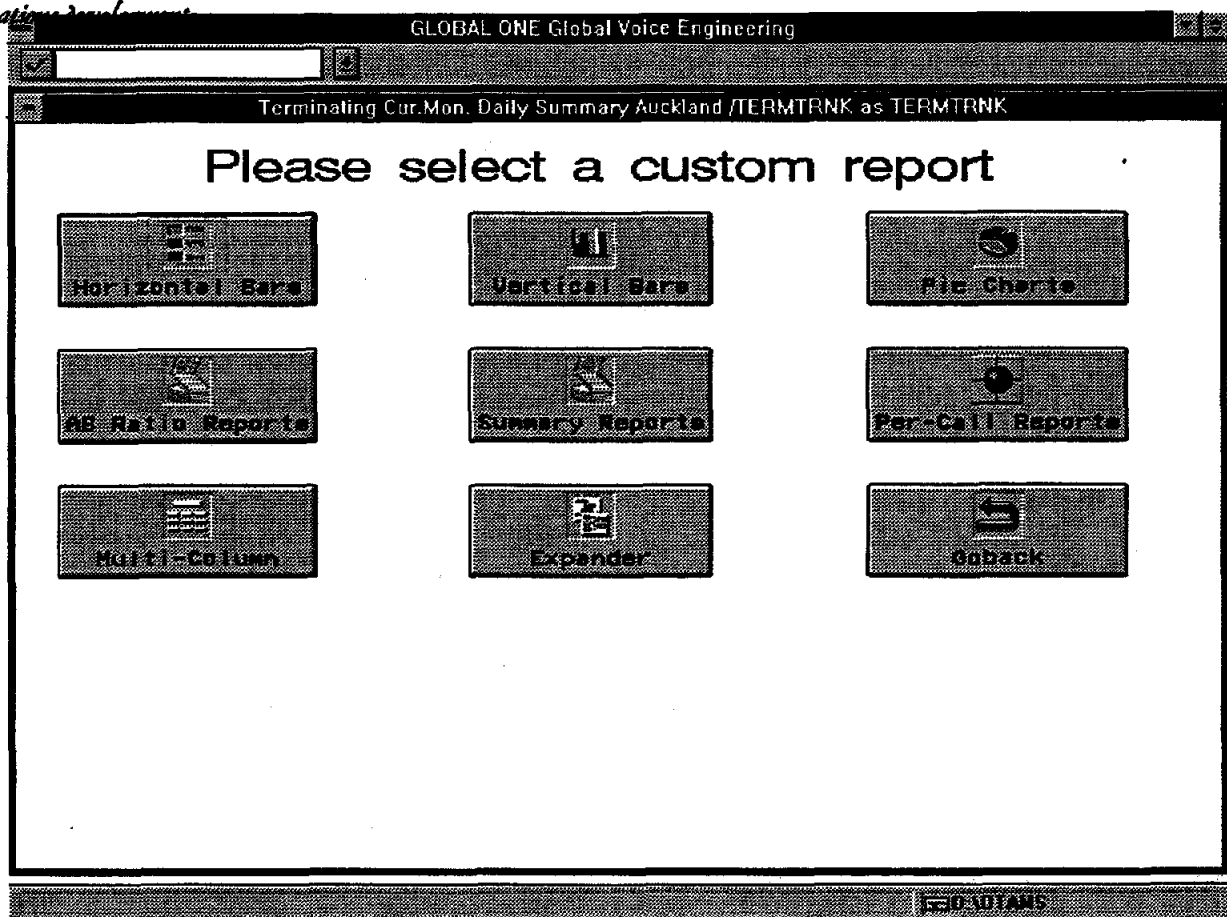


Figure 3. Custom Report Menu

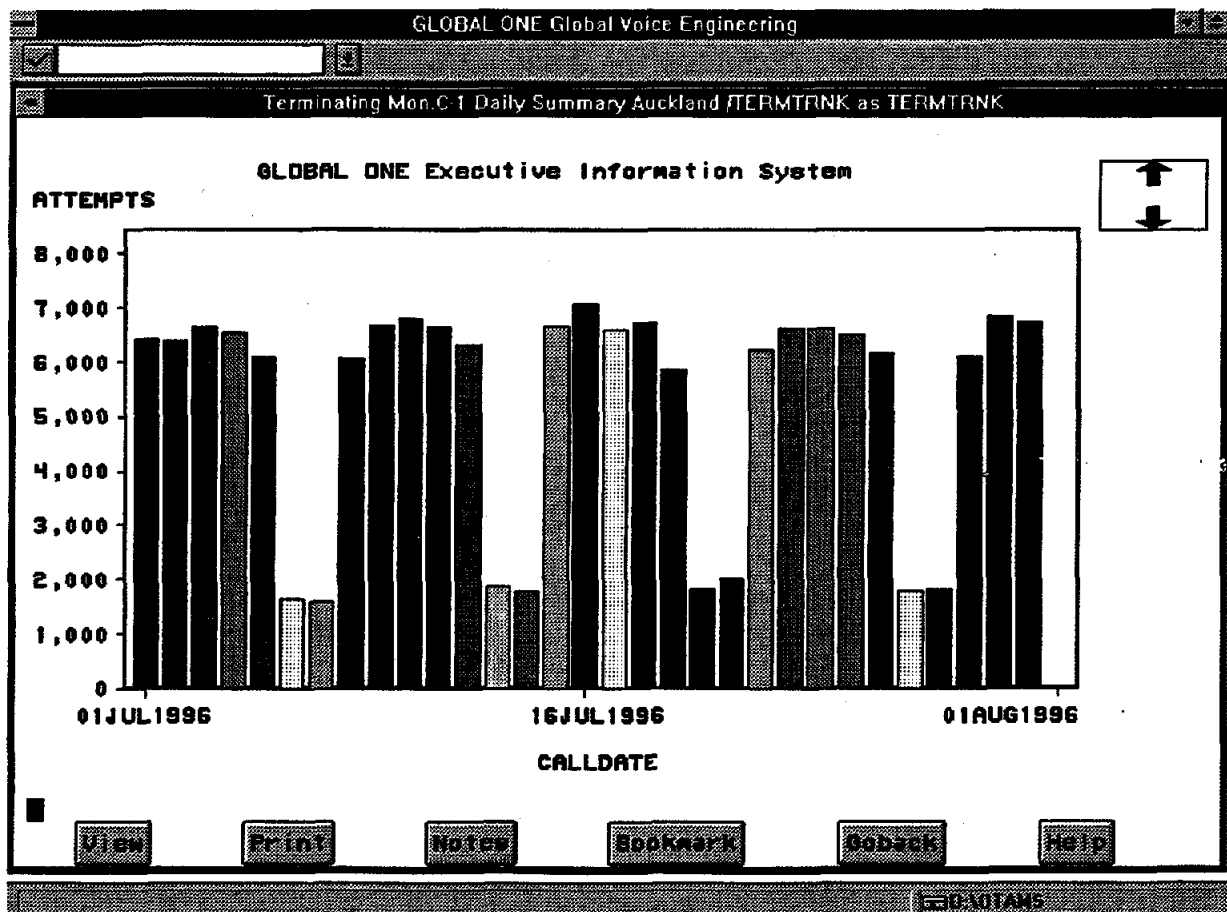
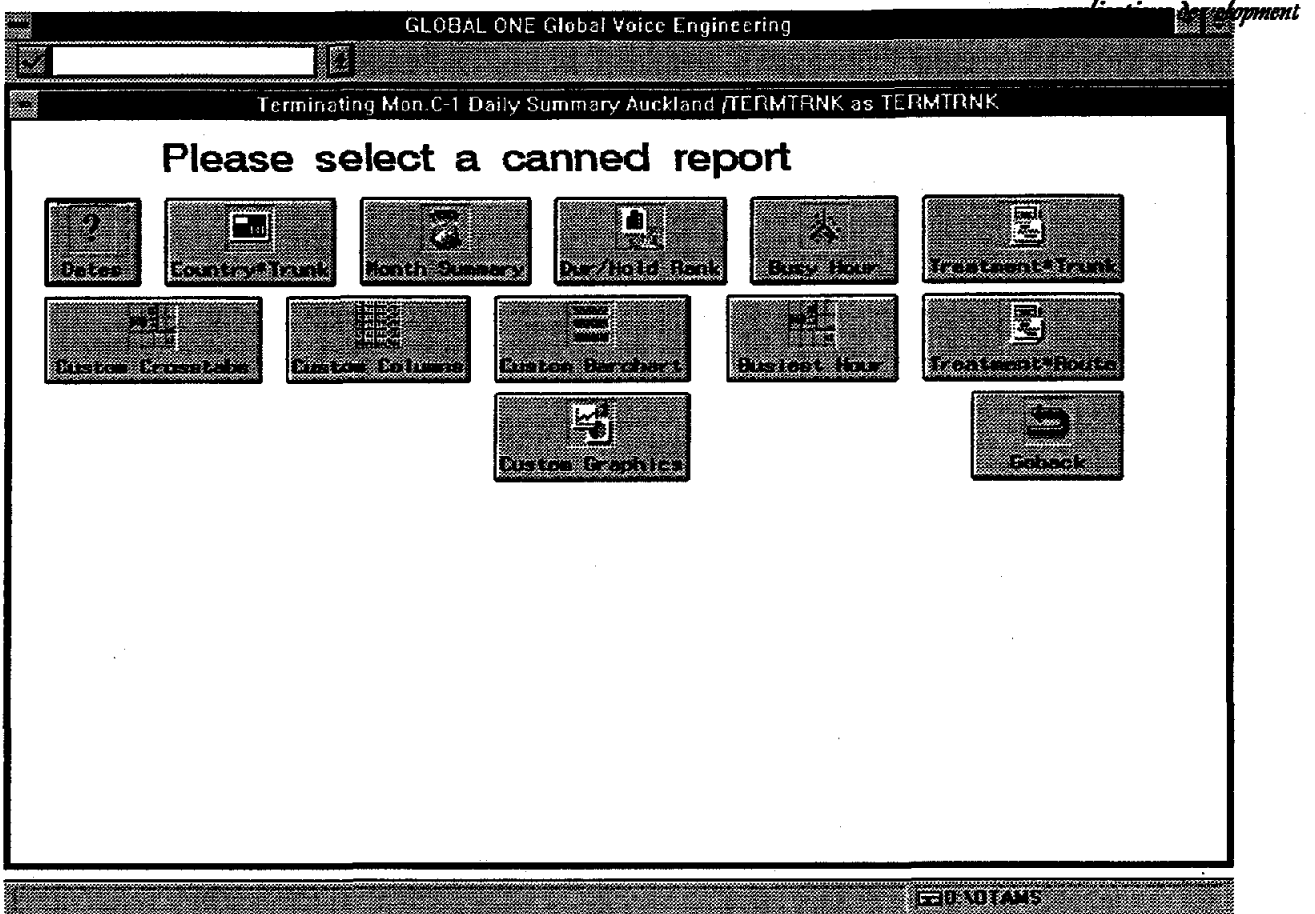


Figure 4. A Sample VBAR Chart



GLOBAL ONE Global Voice Engineering

OUTPUT - (Untitled)

GLOBAL ONE Global Voice Engineering
Terminating Trunks for Mon.C-1 Daily Summary Auckland, 07/01/96-07/31/96
Crosstabulation of ATTEMPTS by DAY vs. REGION

To GOBACK, please press the <F3> key.
Detail Table of REGION (across) vs. DAY (down)

TABLE OF DAY BY REGION

DAY	REGION					
Frequency	AMERICAS	ASIA/PAC	EEMEA	US/CAN	W.EUROPE	Total
1 Monday	149	26608	253	2592	1820	31422
2 Tuesday	154	27163	278	3949	2006	33550
3 Wednesday	158	27080	216	3881	2005	33340
4 Thursday	135	21382	246	3010	1593	26366
5 Friday	109	19825	202	2672	1611	24419
6 Saturday	20	5997	59	774	261	7111
7 Sunday	11	6111	32	755	241	7150
Total	736	134166	1286	17633	9537	163358

Figure 6. Sample Custom Crosstabs Report



Welcome!

You Have Entered

OTAMS PAGE 1

Traffic Information Delivery System

Offshore Traffic Analysis & Management System
Created: March, 1996. Revised: March, 1996
Credits: Claude Griffith - Manager, Selam Ellison

Before you get too deep into OTAMS reports
"Learn what OTAMS can do for you" **"CLICK HERE"**

OTAMS 

Global One Network Diagram



Global One Voice Network December 1997



Definitions /abbreviations

1996 Backbone circuits Actual/Planned

Country Codes (with Dial Digits)

For most recent MONTH OTAMS reports "Select a SWITCH":



AUCKLAND



IRELAND



SYDNEY



GUAM



MELBOURNE



UK



MOSCOW

Previous Months Reports for OTAMS By SWITCH are in the **MUSEUM**



Looking for TROUBLE ??



Select to view longcalls, Errors, Treatment Codes etc.



Jump to the top of page Top



You Have Entered

OTAMS " United Kingdom " REPORTS PAGE!

Created: March, 1996. Revised: April, 1996

UK Routes Trend

- | | | | |
|---|---|--|--|
| ☐ <u>UK - NEW YORK</u> | ☐ <u>UK - BT NATIONAL</u> | ☐ <u>UK - MERCURY</u> | ☐ <u>UK - FTELECOM</u> |
| ☐ <u>UK - STOCKTON</u> | ☐ <u>UK - BT LONDON</u> | ☐ <u>UK - TELIA</u> | ☐ <u>UK - FRANCE</u> |
| ☐ <u>UK - CANADA</u> | ☐ <u>UK - BT INTERNATIONAL</u> | ☐ <u>UK - ESPRIT</u> | ☐ <u>UK - BT WORLD EXCHANGE</u> |
| ☐ <u>UK - UK COLT</u> | ☐ <u>UK - NEW YORK VPN</u> | ☐ <u>UK - TELECEL</u> | ☐ <u>UK - MFS</u> |
| ☐ <u>UK - BTFNET</u> | ☐ <u>UK - TELSTRA</u> | ☐ <u>UK - ACC</u> | |

UK ErlangB Graphs

- | | | | |
|---|---|--|---|
| ☐ <u>UK - NEW YORK</u> | ☐ <u>UK - BT NATIONAL</u> | ☐ <u>UK - AMSTERDAM</u> | ☐ <u>UK - FRANCE</u> |
| ☐ <u>UK - STOCKTON</u> | ☐ <u>UK - BT LONDON</u> | ☐ <u>UK - TELIA</u> | ☐ <u>UK - MERCURY</u> |
| ☐ <u>UK - CANADA</u> | ☐ <u>UK - BT INTERNATIONAL</u> | ☐ <u>UK - ESPRIT</u> | ☐ <u>UK - FTELECOM</u> |
| ☐ <u>UK - UK COLT</u> | ☐ <u>UK - NEW YORK VPN</u> | ☐ <u>UK - TELECEL</u> | ☐ <u>UK - MFS</u> |
| ☐ <u>UK - BTFNET</u> | ☐ <u>UK - TELSTRA</u> | ☐ <u>UK - ACC</u> | |

- ☐ UK Switch Traffic Configuration
- ☐ Outbound Traffic Billable Minutes by Terminating Trunk Groups
- ☐ Outbound Traffic Billable Minutes by Originating Trunk Groups

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HOME PAGE

Cur.Mon. Hourly Detail UK

Where ROUTE=UK-NYC

Busiest Hour Each Day for ATTEMPTS

