OS/390 DASD I/O Drill Down Computer Performance Chart
Using ODS SAS/GRAPH & MXG® Software

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ABSTRACT

This paper displays a user example of an OS/390 Drill Down computer performance chart. The chart was output directly from a SAS/GRAPH® batch job to the OS/390 Webserver. A test MXG® Computer Performance Database was used for input data.

The Drill Down SAS/GRAPH® chart displayed was produced on an OS/390 Version 2.6 system using SAS/GRAPH® Version 8.1 with the Output Delivery System – ODS and the SAS/Graph® GIF driver. The WEB GIFS and HTML reports are updated daily on the mainframe intranet Webserver for viewing via a WEB browser.

OS/390® mainframe computer performance data is collected using IBM System Management Facilities (SMF) and Resource Measurement Facility (RMF) data. The raw SMF/RMF data is processed with MXG® and SAS® software into an easily usable SAS® format.

INTRODUCTION

The SAS/MXG software processes the OS/390 SMF/RMF performance data into daily, weekly and monthly MXG® Computer Performance Databases.

These databases contain numerous SAS® datasets. Each SAS® dataset contains performance variables in a SAS® readable format. The advantage of using MXG® software is that it converts raw performance data from IBM and third party computer vendors into SAS® readable format for processing by SAS® jobs.

MXG® provides numerous examples of SAS® analyze examples and plots, from utilizing SAS/BASE to using SAS/GRAPH®.

PREPARATION

The Drill Down SAS/GRAPH® chart is output directly to a path to the OS/390 Webserver. Of course you must first check with your Webserver technician(s) that the path exists and additionally that the path can also be accessed via your intranet web browser. The usual path for initial testing is often /u/xxxxxxx where xxxxxxx is your userid. The OS/390 TSO command panel can be used with the “ISH” or “OMVS” command to initially work on the Webserver path. Setting up the Webserver to create or access the path isn’t part of this paper.

A macro was used to write the daily chart to a path with the day in the name. For this example, the path used is /sas/mxg/ddd. Were ddd is the day sun, mon…sat.

The SMF/RMF data was dumped at midnight by a SMFDUMP job submitted by the mainframe automated operations software.

Figure #1  OS/390  SAS JCL

```
//****************************************************
//*DOC:DAILY CHART DASD IO RATE
//****************************************************
//V8IORATE EXEC SASV8,
//  OPTIONS='SOURCE  NOMEMRPT MACRO',
//  WORK='400,200'
//INSTREAM DD UNIT=SYSDA,SPACE=(TRK,(1,1)),
//            DISP=(,PASS)
//LIBRARY  DD DSN=MXG.FORMATS,DISP=SHR
//SOURCLIB DD DSN=MXG.USER.SOURCLIB,DISP=SHR
//         DD DSN=MXG.SOURCLIB,DISP=SHR
//PDB      DD DSN=MXG.PDB.DAILY(0),DISP=SHR
//SYSIN DD DSN=MXG.USERGIF.SOURCLIB(V8IORATE),DISP=SHR
```

MXG® also provides SAS/GRAPH® charts and plots with some of the MXG® DOCGRAF and GRAFXXXX examples as source code.
Figure #2  OS/390 CHART DASD IORATE PER SECOND

The SAS/GRAPH® VBAR3D chart displayed above (Figure #2) was created using the SAS Version 8 Output Delivery System ODS and PROC GCHART. A test MXG® PDB was used for input data.

The chart displays the OS/390 DASD I/O Rate for each hour of the day. The OS/390 values for the computer system id and the date are taken from the input data and displayed in the chart title by using #BYVALS.

This drill-down chart is viewed with a web browser. By using a mouse to click on a bar more detail can be viewed via the html drill down link for each hourly bar.

The SAS® code to create the chart is displayed in Figure #4. ODS produced the HTML body with the name of “drill_down_dasdioratehour.html.” This html file displays the chart as a GIF file and includes Java script to reference the drill-down html link for each bar.

The VBAR3D statement option HTML=variablename is used to create drill-down links. In this example the code HTML=IODRILLDOWNLINKS is used. The variable name ‘IODRILLDOWNLINKS’ was assigned a different value for each hour in the DATA step.

The GCHART program in this example creates links, but doesn’t create the actual drill-down file for each hour.
Drill Down Details

The sio74cnt for DASD I/O counts for each DASD volser is in the MXG TYPE74 dataset. This information is taken from the RMF type74 record on I/O activity.

The above display and html file was produced from the SAS® code in Figure #6. The previous GCHART program example created the VBAR3D chart, the BODY html with the drill-down links, but did not create the actual twenty-four hourly drill-down files.

When you click on a bar on the chart, you will drill down to the respective html file if it exists.

The SAS code created twenty-four hourly html drill-down files ‘dasdioprint00.html’ to ‘dasdioprint23.html’ for the daily chart. This was accomplished by using macro’s and ODS to create twenty-four (24) separate HTML files.

This report included the DASD volser, I/O count, I/O rate, I/O response time, and additional metrics in the type74 dataset including the duration or time interval.

You have numerous options of what you want to include in each drill down report and the format of the report.
The following SAS® code is used to create the VBAR3D Drill Down chart as a GIF named “v8iorate.gif.”

**CHART DAILY DASD HOURLY IORATE**
**JOB RUNS DAILY AND CREATES HTML AND GIF**
**MEMBER=V8IORATE**

```sas
OPTIONS NODATE NONUMBER NOBYLINE LABEL;

%INCLUDE SOURCLIB(V8MACROS);

FILENAME ODSOUT _DAY; /* Path for ODS */

DATA IOCOUNT;
  FORMAT IODRILLDOWNLINKS $VARYING100.;
  SET PDB.RMFINTRV;
  IF SYSTEM NE 'SYS7' THEN DELETE; /* SYS7*/
  IF DATE NE ZDATE-1  THEN DELETE;
  /* CREATE A DRILL DOWN LINK FOR THE HOUR */
  /* ie. HREF=/sas/mxg/mon/dasdioprint00.html */
  /* to */
  /* ie. HREF=/sas/mxg/mon/dasdioprint23.html */
  /* day part of link changes daily via macro */
  IODRILLDOWNLINKS = 'HREF=' || _DAY || '/dasdioprint' || PUT(HOUR,Z2.0) || '.html';
RUN;

/* COMPUTE HOURLY DASD I/O ACTIVITY RATE */
PROC MEANS NOPRINT DATA=IOCOUNT;
  VAR SIO74CNT DURATM;
  BY SYSTEM DATE HOUR IODRILLDOWNLINKS;
  OUTPUT OUT=DASDOUT SUM=SIO74CNT DURATM;
DATA DASDCHRT;
  SET DASDOUT ;
  IORATE=SIO74CNT/DURATM;
RUN;

ODS LISTING CLOSE;

ODS HTML PATH=ODSOUT;
  BODY='drill_down_dasdioratehour.html'
  (TITLE='SAS/MXG DASD I/O DRILL DOWN CHART');

OPTIONS RESET=GLOBAL DEVICE=GIF GUNIT=PCT
  XMAX=7.0IN YMAX=4.0IN  FTEXT=SWISSB
  CTEXT=MAGENTA  HTEXT=2.0  CBACK=CXFFFF00 ;

PROC GCHART DATA=DASDCHRT; BY SYSTEM DATE;
  FORMAT DATE WEEKDATE29.;
  FORMAT IORATE 5.0;
  TITLE1 HEIGHT=3.9 C=BLACK
    'OS/390 COMPUTER SYSTEM = #BYVAL1';
  TITLE2 HEIGHT=3.8 C=BLACK
    'DASD I/O ACTIVITY RATE PER SECOND';
  TITLE3 HEIGHT=3.8 C=RED ' #BYVAL2';
AXIS1 WIDTH=4 C=BLUE
  LABEL=(HEIGHT=3.0 C=VIB) /*HORIZ HOUR AXIS */
  VALUE=(HEIGHT=2.5 C=BROWN);

AXIS2 WIDTH=4 C=BLACK /*RESPONSE IO AXIS */
  LABEL=(HEIGHT=2.4 COLOR=RED
    ROTATE=90 ANGLE=-90 ' DASD*I/O*PER*SEC')
  MAJOR=(HEIGHT=2 COLOR=GREEN)

PROC GCHART DATA=DASDCHRT; BY SYSTEM DATE;
  FORMAT DATE WEEKDATE29.;
  FORMAT IORATE 5.0;
  TITLE1 HEIGHT=3.9 C=BLACK
    'OS/390 COMPUTER SYSTEM = #BYVAL1';
  TITLE2 HEIGHT=3.8 C=BLACK
    'DASD I/O ACTIVITY RATE PER SECOND';
  TITLE3 HEIGHT=3.8 C=RED ' #BYVAL2';
AXIS1 WIDTH=4 C=BLUE
  LABEL=(HEIGHT=3.0 C=VIB) /*HORIZ HOUR AXIS */
  VALUE=(HEIGHT=2.5 C=BROWN);

AXIS2 WIDTH=4 C=BLACK /*RESPONSE IO AXIS */
  LABEL=(HEIGHT=2.4 COLOR=RED
    ROTATE=90 ANGLE=-90 ' DASD*I/O*PER*SEC')
  MAJOR=(HEIGHT=2 COLOR=GREEN)

RUN;

/* DISPLAY IORATE ON BAR */
/* SHOW Bars */
/* OUTLINE */
/* COLOR */
/* MAXIS */
/* RAXIS */
RUN;
```

The “PICKPATH” macro is one of several user macro’s in my sourclib member “V8MACROS.” The “PICKPATH” macro creates a _DAY macro that appends the lowercase value of the day to the path.

**CHART DAILY DASD HOURLY IORATE**
**JOB RUNS DAILY AND CREATES HTML AND GIF**
**MEMBER=V8IORATE**

```sas
%MACRO PICKPATH ;
  /* USE DATA _NULL_ TO DEFINE _DAY MACRO */
  DATA _NULL_;
  FORMAT WEBSERVER_PATH $CHAR50.;
  TODAY=TODAY();
  YESTERDAY=TODAY-1;
  /* DAY TAKES YESTERDAY VALUE MON, TUE...*/
  DAY= LOWCASE(PUT(YESTERDAY,WEEKDATE3.));
  WEBSERVER_PATH = '/sas/mxg/' || DAY ;
  /* put path in quotes & Delete blanks */
  WEBSERVER_PATH = QUOTE(TRIM(WEBSERVER_PATH));
  /* _DAY MACRO POINTS TO PATH AND DAY */
  FILE INSTREAM RECFM=F8 LRECL=80 BLKSIZE=800;
  PUT @1  'MACRO _DAY ' @12  WEBSERVER_PATH @63  '%' ;
RUN;
%INCLUDE INSTREAM;
%MEND PICKPATH;
```

Figure #5 PICKPATH SAS Macro
Create twenty-four (24) hourly drill-down HTML files named “dasdioprint00.html” to “dasdioprint23.html.” Each HTML file is an hourly printed detail report.

Figure #6  ODS & PROC PRINT OUTPUT.

```sas
/** PRINT DAILY DASD IO BY HOUR - 24HR */
/** JOB RUNS DAILY AND CREATES HTML */
/** HTML REPORTS REFERENCED BY DRILL CHART */
/** MEMBER=V8DASDPR DETAILED DASD IO */
OPTIONS NODATE NONUMBER LABEL ;
%INCLUDE SOURCLIB(V8MACROS);
%PICKPATH;
FILENAME ODSOUT _DAY;
%MACRO PRINT_HOURLY (HOURPRT, DRILLHTML, HEADING);
ODS LISTING CLOSE;
PROC SORT DATA=IOHOUR
OUT =SORTOUT (WHERE=(HOUR=&HOURPRT));
BY SYSTEM DATE HOUR DESCENDING SIO74CNT;
RUN;
ODS HTML PATH=ODSOUT STYLE=BROWN
BODY=&DRILLHTML (TITLE=&HEADING);
/* PRINT HOURLY DATA ON TOP 5 DASD VOLSERS */
PROC PRINT SPLIT="*" DATA=SORTOUT(OBS=5) ;
BY SYSTEM DATE HOUR;
FORMAT SIO74CNT COMMA10.0;
FORMAT DURATM TIME8.0;
TITLE1 COLOR=BLUE BCOLOR=YELLOW BOX=4
'OS/390 -TOP 5 DASD - DRILL DOWN DETAILS';
VAR VOLSER SIO74CNT IORATE LCU AVGRSPMS DURATM;
RUN;
ODS HTML CLOSE;
RUN;
%MEND PRINT_HOURLY; /* END MACRO */
/* PRINT HOURLY DATA ON TOP 5 DASD VOLSERS */
%MACRO PRINT_FOR_THE_DAY;
%LET QMRK=%STR(%');
%DO I=0 %TO 23 %BY 1;
%LET PATT=dasdioprint00.html;
%LET &I=%STR(%QMRK%SUBSTR(&PATT,1,12)&I%SUBSTR(&PATT,14,5)&QMRK);
%LET PRHTML = &QMRK%SUBSTR(&PATT,1,12) &I%SUBSTR(&PATT,14,5) &QMRK;
%ELSE %LET PRHTML = &QMRK%SUBSTR(&PATT,1,11) &I%SUBSTR(&PATT,14,5) &QMRK;
%LET PRHTML = %UNQUOTE(&PRHTML);
/* PRHTML IS BODY WHERE THE PRINT IS AT */
%LET TOP=SAS/MXG DASD I/O DETAILS AT HOUR = &I;
%LET TOP=%QMRK%TOP%QMRK;
%LET TOP=%UNQUOTE(&TOP);
%PRINT_HOURLY (&I, &PRHTML, &TOP);
%END;
%MEND PRINT_FOR_THE_DAY;
/* END OF MACRO DEFINITIONS */
DATA IOCOUNT;
FORMAT DATE WEEKDATE29.;
SET PDB.TYPE74;
IF SYSTEM NE 'SYS7' THEN DELETE; /* SYS7*/
DATE = DATEPART(STARTIME);
TIME = TIMEPART(STARTIME);
HOUR = HOUR(TIMEPART(STARTIME));
IOTIME = AVGRSPMS*SIO74CNT;
/* IOTIME IN MS for the HOUR */
IF DATE NE ZDATE-1 THEN DELETE;
RUN;
/** COMBINE 15 MINUTE INTERVALS INTO HOUR **/
PROC SORT DATA=IOCOUNT ;
BY SYSTEM DATE HOUR VOLSER LCU ;
PROC MEANS NOPRINT DATA=IOCOUNT;
VAR
SIO74CNT DURATM IOTIME;
BY SYSTEM DATE HOUR VOLSER LCU ;
OUTPUT OUT=DASDOUT
SUM= SIO74CNT DURATM IOTIME;
DATA IOHOUR;
SET DASDOUT;
FORMAT IORATE 9.1;
LABEL IORATE='IO*PER*SECOND';
FORMAT AVGRSPMS 5.1;
LABEL AVGRSPMS='AVG*RESPONSE*MS';
IORATE = SIO74CNT/DURATM;
AVGRSPMS = IOTIME/SIO74CNT;
/* average response time for hour*/
%PRINT_FOR_THE_DAY;
RUN;
ODS HTML CLOSE;
RUN;

Again as in the previous code, the pickpath macro was utilized to define a _DAY macro. This permits all of yesterday’s charts, html and gifs to be written to a day of the week path, i.e., /sas/mxg/sun, /sas/mxg/mon, etc.

Daily MXG® pdb.type74 data was used for input to the program. Detailed I/O activity on each DASD volser is recorded in the OS/390 RMF type74 record. The dumped OS/390 SMF/RMF data is processed and stored in SAS® format in the daily MXG® PDB via the daily MXG PDB build process.

Another useful feature of SAS ODS is adding a title to the body html. In this example code, the hour is placed in the ODS body by using the title suboption. This title displays in the upper left of the screen display.
CONCLUSION

The updated daily SAS/GRAPH® Drill Down GIFS and Base SAS® HTML reports from the MXG® computer performance database improved the ease of use for managers and technicians to review daily performance activity.

The Drill Down feature also provides more interactive feedback with the data, which is appealing to many users and management. The results can be easily interpreted by tactical performance technicians for investigating “bottlenecks” or by management to review for overall system performance and trends.

Providing SAS/GRAPH® charts and BASE SAS® HTML reports from the SAS® Print procedures via the intranet also increased productivity of the staff by eliminating searches for lost or miss-routed printed reports.

REFERENCES

IBM OS/390 - MVS System Management Facilities (SMF) - GC28-1783-05


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A modified test MXG/PDB was used for the I/O rates and DASD volser names displayed. The computer system id, date, I/O rates and DASD volser names, etc, were changed from actual values for security reasons – not to provide actual values of detailed computer performance data in the paper.

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