PLOTTING MULTIPLE GRAPHS USING STANDARD M IN DHCP

David R. Hoak B.S. M.T. and Frank Stalling Jr. M.S. M.T.
Dallas Information Systems Center
Dept. of Veterans Affairs
1901 N. Hwy. 360
Grand Prairie, TX 75050

Abstract

This abstract describes a system capable of plotting laboratory test data using conventional DHCP hardware and software.
Using the advances in Kernel 7, we developed a system that will plot up to four graphs on a conventional terminal. A secondary screen permits the user to expand each graph in turn. The expanded display also includes patient demographics and test reference values.
After the user views the expansion screen, the primary screen is refreshed and the user can choose another graph. This system allows a clinician to view test data instantaneously using a few keystrokes. Because this program requires no special hardware, it can be used in any DHCP environment that supports Kernel 7.

Introduction

Since its implementation during the last decade VA DHCP (Decentralized Hospital Computer Program) has served 172 Medical centers and clinics in the VA Health Care System. However, lack of graphics capability has been a major shortcoming. Kernel 7 allows programmers to produce elegant graphs using conventional DHCP hardware and software. We chose the laboratory package of DHCP to demonstrate this. A brief description follows.

System Environment

We developed this program on VAX VMS system in a conventional DHCP, Kernel 7 environment using standard M. For most of this work we used a VT 100 compatible terminal.

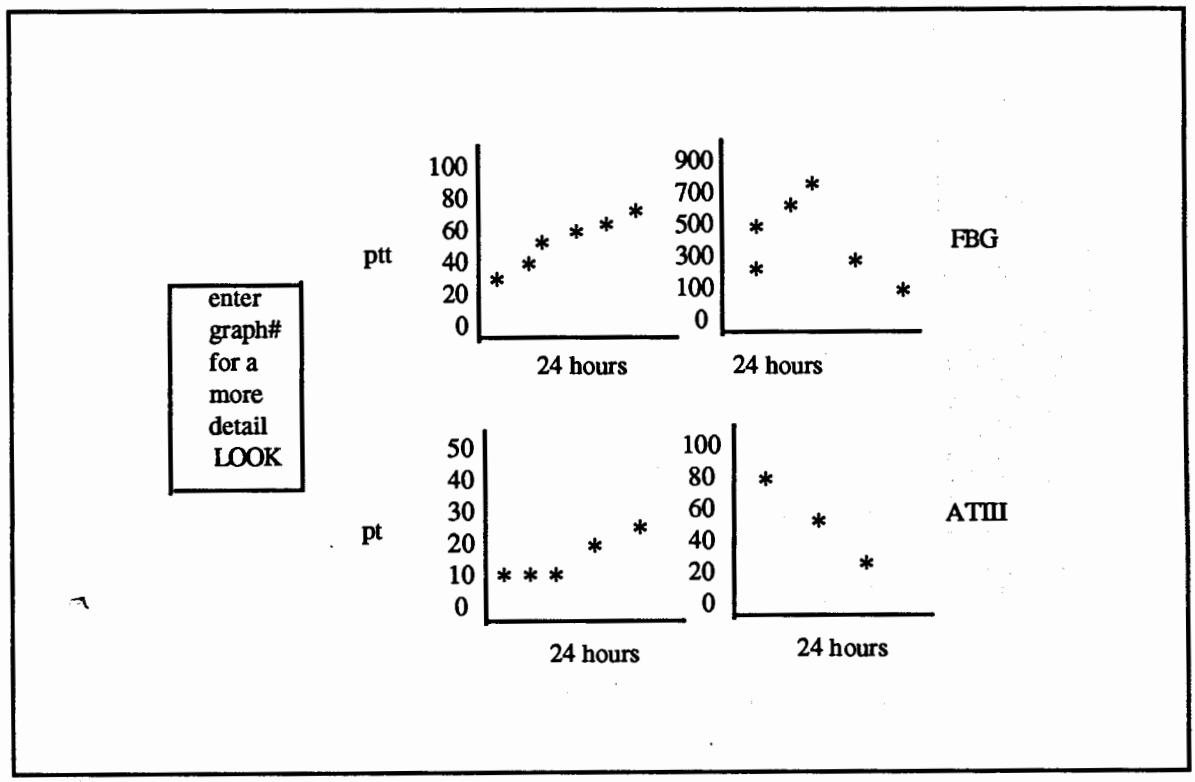
Data Input

After a clinician signs on, the program prompts for patient name, date range, and test selection. The user can select up to four laboratory tests.

Kernel Commands

GSET^%ZISS and W IOG1 turn on the graphics functions and W IOG0 and GKILL^%ZISS turns them off. Setting DX and DY and the executing IOXY position data on the screen.

Figure 1. Screen I Display



Screen 1

The program plots test results on the ordinate (y axis) and the time the test was ordered the abscissa (x axis). The vertical axis on the standard screen is only 24 characters high. We made each character the equivalent of 10 units so that the ordinate could accomodate a wide range of test results. Using a forward and reverse bubble sort, we determined the Max. (y) and the Min.(y) respectively. The program rounds decimal values greater than or equal to 0.49 up to the next whole number and rounds values less than 0.49 down. Each data point was made relative to Max. (y) by the equation:

(1) Y(i)=[Y(i)/Max. (y)]*10

Where: Y(i) is the test result,
Max. (y) is the maximum test value,
and 10 is the size of the total ordinate.

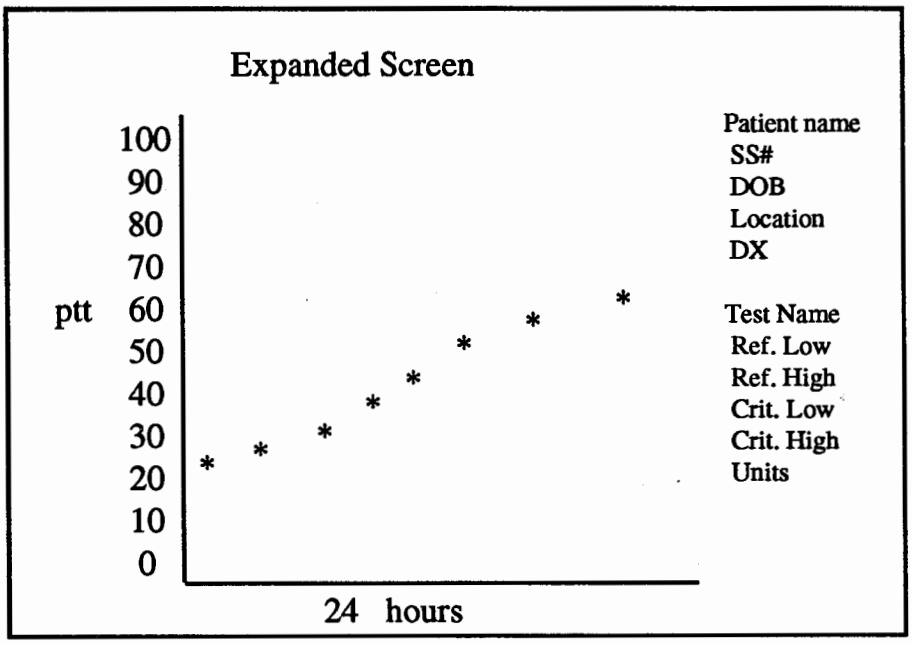
The abscissa represents the time when the test was ordered. These times are stored in inverse order date form. The $Order functio was used to find those dates with corresponding results. By subtracting the inverse date from 9999999, a readable date is created. Hours are rounded off as previously described using 29 minutes as the cut off point. These values make up X(i). The variables DYF(I) and DXF(I) were assigned the values of Y(i) and X((i) respectively. The following M code shows the actual plotting function of the program:

```
PLOT   ;
       F I=1:1:CNT-1 D
       .S DY=$$YPOS(DYF(I))
       .S DX=SP+DXF(I)
       .X IOXY W "*"
       Q       .
       .
YPOS(CONC)   ;
       S Y=+$J(MAXY-
       ((CONC/MAXY*10))+$G(AC),1,0)
       Q Y
```

Screen II

Screen II relies on the same routines used to create screen I; but we doubled the ordinate and the abscissa. In addition we used VADPT to display patient demographics and lab file 60 to show test reference ranges.

Figure 2. Screen II Display



Discussion

Tests physicians use to monitor effectiveness of anticoagulant therapy, such as comedian and heparin, lend themselves to graphical analysis because trends over time are of interest. Four of these tests include Prothrombin Time (PT), Activated Partial Thromboplastin Time (PTT), Fibrinogen concentration, and Antithrombin III activity. We used our system to plot the results of these tests on a single screen. Data is plotted in the conventional manner where the ordinate displays the test result and the abscissa the time when the test was ordered. The user can invoke a second screen to expand the graph and display additional information about the patient and the test. A carriage return takes the user back to the original screen where another selection can be made. Using simple M routines in a Kernel 7 environment we created a system to graph DHCP data. This gives health care providers a powerful tool for evaluation of clinical data.

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References

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