Administrative Information for the UNIX Graphics Package

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1. INTRODUCTION

This document is a reference guide for system administrators who are using or establishing a Graphics facility [1] on a UNIX† system. It contains information about directory structure, installation, makefiles, hardware requirements, and miscellaneous facilities of the Graphics Package.

2. GRAPHICS STRUCTURE

Figure 1 contains a graphical representation of the directory structure of Graphics. In this paper, the shell variable SRC will represent the parent node for Graphics source and is usually set **/usr/src/cmd**.

The *graphics* command (see *graphics*(1G)) resides in **/usr/bin**. All other Graphics executables are located in **/usr/bin/graf**; the **/usr/lib/graf** directory contains text for *whatis* documentation (see *gutil*(1G)) and editor scripts for *ttoc* (see *toc*(1G)).

Graphics source resides below the directory **$SRC/graf**; **$SRC/graf** is broken into the following subdirectories:

- **include** — contains the following header files: **debug.h, errpr.h, gsl.h, gpl.h, setopt.h,** and **util.h**.
- **src** — contains source code partitioned into subdirectories by subsystem. Each subdirectory contains its own *Makefile* (or *Install* file for **whatis.d**).

    - **glib.d** — contains source used to build the graphical subroutine library, **$SRC/graf/lib/glib.a**.
    - **stat.d** — contains source for numerical manipulation and plotting routines.
    - **dev.d** — contains source code for device filters partitioned into subdirectories.

        - **lolib** and **uplib** — contain source used to create device independent libraries.
        - **hp7220.d** — contains source for *hpd* (a Hewlett-Packard Plotter display function).
        - **tek4000.d** — contains source for *ged* (the graphical editor), *td* (a Tektronix display function), and other Tektronix dependent routines.

    - **gutil.d** — contains source for utility programs.
    - **toc.d** — contains source for table of contents drawing routines.
    - **whatis.d** — contains *nroff* files and the installation routine for on-line documentation.

- **lib** — contains **glib.a** which contains commonly used graphical subroutines.

UNIX User's Manual entries for Graphics consist of the following: *gdev*(1G), *ged*(1G), *graphics*(1G), *gutil*(1G), *stat*(1G), *toc*(1G), and *gps*(5).

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Figure 1.   Graphics Directory Structure
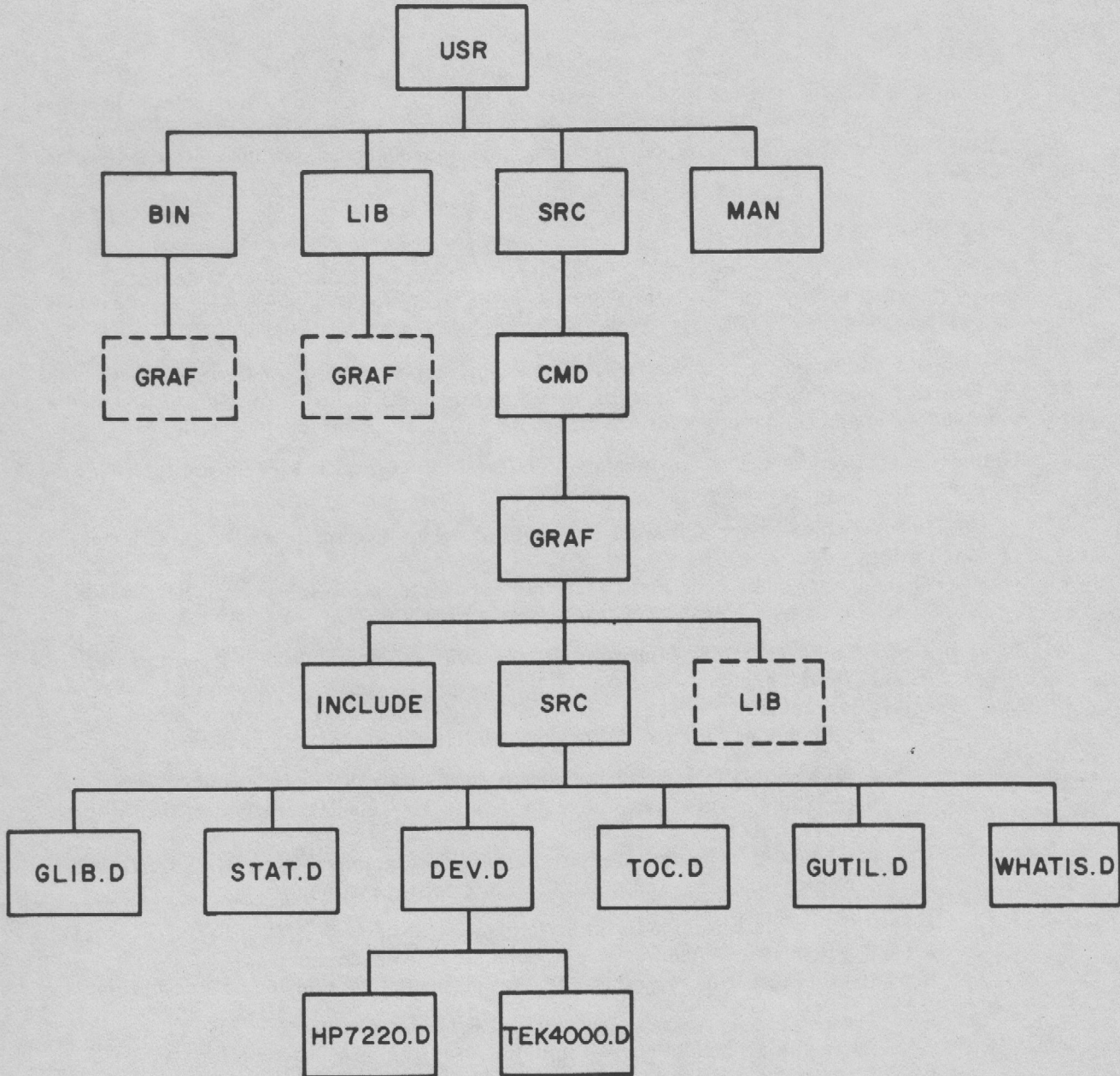
3. INSTALLING GRAPHICS

Procedures for installing Graphics:

— To build the entire Graphics package, execute (as super-user):

    /usr/src/:mkcmd graf

— To build a particular graphics subsystem use the shell variable ARGS:

    ARGS=*subsystem* /usr/src/:mkcmd graf

A *subsystem* is either **glib, stat, dev, toc, gutil**, or **whatis**. **Glib** must exist before other subsystems can be built. Write permission in **/usr/bin** and **/usr/lib** is needed, and the following libraries are assumed to exist:

/lib/libc.a	Standard C library, used by all subsystems.
/lib/libm.a	Math library, used by all subsystems.
/usr/lib/macros/mm[nt]	Memorandum macros for [*nt*]*roff*, used by the *whatis* subsystem.

The complete build process takes approximately two hours of system time. If the build must be stopped, it is a good idea to restart from the beginning. Upon completion, the following things will be created and owned by **bin**:

/usr/lib/graf	A directory for data and editor scripts.
/usr/bin/graf	A directory for executables.
/usr/bin/graphics	Command entry point for Graphics.

*Makefile*s use executable shell procedures *cco* and *cca*. *Cco* is used to compile C source and install load modules in **/usr/bin/graf**. The *cca* command compiles C programs and loads object code into archive files.

Whatis.d contains source files for *whatis* and the executable command *Install*.

    Install command-name

calls *nroff* to produce *whatis* documentation for *command-name* in **/usr/lib/graf**. To install the entire *whatis* subsystem, use *:mkcmd* as described above.

3.1 Makefile Parameters

*Makefile*s use various macro parameters, some of which can be specified on the command line to redirect outputs or inputs. Parameters specified in higher level *Makefile*s are passed to lower levels. Below is a list of specifiable parameters for *Makefile*s followed by their default values in parentheses and an explanation of their usage:

— $SRC/graf/graf.mk:

BIN (/usr/bin)	installation directory for the *graphics* command.
BIN (/usr/bin/graf)	installation directory for other graphic commands.
SRC (/usr/src/cmd)	parent directory for source code.

— $SRC/graf/src/Makefile

BIN1 (/usr/bin)	installation directory for the *graphics* command.
BIN2 (/usr/bin/graf)	installation directory for other graphic commands.
LIB (/usr/lib/graf)	installation directory for *whatis* documentation.

— $SRC/graf/src/stat.d/Makefile:

BIN (../../bin)	installation directory for executable commands.

— $SRC/graf/src/toc.d/Makefile:

   BIN (../../bin)   installation directory for executable commands.

— $SRC/graf/src/dev.d/Makefile:

   BIN (../../bin)   installation directory for executable commands.

— $SRC/graf/src/dev.d/hp7220.d/Makefile:

   BIN (../../../bin)   installation directory for executable commands.

— $SRC/graf/src/dev.d/tek4000.d/Makefile:

   BIN (../../../bin)   installation directory for executable commands.

— $SRC/graf/src/gutil.d/Makefile:

   BIN (../../bin)   installation directory for executable commands.

The following example will make a new version of the graphical editor, *ged*, installing it in **/a1/pmt/dp/bin**:

```
cd $SRC/graf/src/dev.d/tek4000.d
make BIN=/a1/pmt/dp/bin ged
```

(This assumes, of course, that necessary libraries were previously built.)

4. HEWLETT-PACKARD PLOTTER

The Graphics display function *hpd* uses the Hewlett-Packard 7221A Graphics Plotter. The HP plotter can be connected to the computer in series with a terminal via a dedicated or dial-up line. This arrangement allows the plotter to intercept plotting instructions while passing other data to the terminal unaltered and thus providing for normal terminal operation. Plotter switch settings should match those of the terminal. See the plotter operating manual for a more complete discussion [3].

5. TEKTRONIX TERMINAL

The Graphics display function *td* and the graphical editor *ged* both use Tektronix Series 4010 storage tubes. Below is a list of device considerations necessary for Graphics operation.

5.1 Inittab Entry

When a Tektronix 4010 series terminal is connected to UNIX via a dedicated 4800 or 9600 baud line, /etc/inittab should reference speed table entry **6** (may vary locally) of *getty*. Speed table entry **6** is designed specifically for the Tektronix 4014 and, among other things, sets a form-feed delay so that the screen may be cleared without losing information and clears the screen before prompting for a login. See *stty*(1), *inittab*(5) and *getty*(8) for more information.

5.2 Strap Options

The standard strap options as listed below should be used (see the Reference Manual for the Tektronix 4014 [2]):

— LF effect — LF causes line-feed only.
— CR effect — CR causes carriage return only.
— DEL implies loy — DEL key is interpreted as low-order y value.
— Graphics Input terminators — None.

5.3 Enhanced Graphics Module

The Enhanced Graphics Module (EGM) for Tektronix terminals is required for Graphics. The EGM provides different line styles (solid, dotted, dot-dashed, dashed, and long-dashed), right and left margin cursor location, and 12-bit cursor addressing (4096 by 4096 screen points).

6. MISCELLANEOUS INFORMATION

6.1 Announcements

The *graphics* command provides a means of printing out announcements to users. To set up an announcement facility, create a readable text file containing the announcements named **announce**. Also in **/usr/bin/graphics** redefine the shell variable GRAF to be the directory path name of the file **announce**.

6.2 Uselog

The *graphics* command also provides a means of monitoring its use by listing users in a file. To set up a usage logging facility, create a writable file named **.uselog** (in the same directory as **announce** if announcements are being used) and redefine the shell variable GRAF within **/usr/bin/graphics** to specify the directory location. Each time a user executes *graphics*, an entry of the login name, terminal number, and system date are recorded in **.uselog**.

6.3 Restricted Environments

Restricted environments can be used to limit access to the system (see $sh(1)$). A restricted environment for Graphics can be set up by creating the directories **/rbin** and **/usr/rbin** and populating them with restricted versions of regular UNIX commands, so that the environment cannot be compromised. In particular, $ed(1)$, $mv(1)$, $rm(1)$, and $sh(1)$ require restricted interface programs that do not allow users to move or remove files whose names begin with ".". [4].

To create a restricted environment for Graphics:

— Create a restricted *ged* command in **/usr/rbin** as follows:

    exec /usr/bin/graf/ged −R

— Create restricted logins for users or create a community login with a working directory (reached through **.profile**) set up for each user. A restricted login specifies **/bin/rsh** as the terminal interface program and is created by adding **/bin/rsh** to the end of the **/etc/passwd** file entry for that login.

— Call **graphics −r** from **.profile**.

The execution of **graphics −r** changes $PATH to look for commands in **/rbin** and **/usr/rbin** before **/bin** and **/usr/bin** and executes a restricted shell. The −Roptionisappended to the *ged* command so that the escape from *ged* to UNIX (*!command*) will also use a restricted shell.

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REFERENCES

[1]   A. R. Feuer. *UNIX Graphics Overview*, Bell Laboratories (1979).

[2]   *User's Manual for 4014 and 4014-1 Display Terminal*, Tektronix (July 1974).

[3]   *7221A Graphics Plotter Operating and Programming Manual*, Hewlett-Packard (Nov. 1977).

[4]   T. A. Dolotta, S. B. Olsson, and A. G. Petruccelli (eds.). *UNIX User's Manual* — Release 3.0, Bell Laboratories (June 1980).

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