

S
y
s
t
m

A
d
m
i
n
i
s
t
r
a
t
i
o
n

The X Window System

U n I X

The X Window System

*"X and Motif are the reasons that UNIX deserves to die."
—Larry Kaplan*

"X: The First Fully Modular Software Disaster"

"... what better way is there to force users to upgrade their hardware than to give them X, where a single application can bog down the client, the server and the network between them, simultaneously!"

"How to make a 50-MIPS Workstation Run Like a 4.77MHz IBM PC

If the designers of X-Windows built cars, there would be no fewer than five steering wheels hidden about the cockpit, none of which followed the same principles—but you'd be able to shift gears with your car stereo. Useful feature, that.

—Marus J. Ranum, Digital Equipment Corporation"

X

⌘ a network transparent window system which runs on a wide range of computing and graphics machines

☒ *"X Window System servers run on computers with bitmap displays. The server distributes user input to and accepts output requests from various client programs through a variety of different interprocess communication channels."*

'[Footnote: We have tried to avoid paragraph-length footnotes in this book, but X has defeated us by switching the meaning of client and server. In all other client/server relationships, the server is the remote machine that runs the application (i.e., the server provides services, such as database service or computational service). For some perverse reason that's better left to the imagination, X insists on calling the program running on the remote machine "the client." This program displays its windows on the "window server." We're going to follow X terminology when discussing graphical client/servers. So when you see "client" think "the remote machine where the application is running," and when you see "Server" think "the local machine that displays output and accepts user input.]"

XFree86 Installation

⌘ Xconfigurator

- ☒ sets up the necessary configuration files and links to use XFree86

⌘ main configuration file is `/etc/X11/XF86Config`

- ☒ divided into various sections, each handling one aspect of X configuration and device handling

- ☒ *Files*
- ☒ *ServerFlags*
- ☒ *Keyboard*
- ☒ *Pointer*
- ☒ *Monitor*
- ☒ *Device*
- ☒ *Screen*

- ☒ care is needed when editing this file

- ☒ *can blow up a monitor!*

```

# excerpted /etc/X11/XF86Config...
Section "Files"
    RgbPath      "/usr/X11R6/lib/X11/rgb"
    FontPath     "/usr/X11R6/lib/X11/fonts/75dpi/"
[snip...]
EndSection
Section "Pointer"
    Protocol     "PS/2"
    Device       "/dev/mouse"
    Emulate3Buttons
    Emulate3Timeout    100
EndSection
Section "Monitor"
    Identifier   "Sony Multiscan 15sf"
    VendorName   "Unknown"
    ModelName    "Unknown"
    HorizSync    31.5-64
    VertRefresh  50-120
    Modeline     "640x400"    25.175 640 664 760 800 400 409 411 450
    Modeline     "640x480"    25.175 640 664 760 800 480 491 493 525
    Modeline     "800x600"    36      800 824 896 1024 600 601 603 625
[snip...]
EndSection
Section "Screen"
    Driver       "vga16"
    Device       "Generic VGA"
    Monitor      "Sony Multiscan 15sf"
    Subsection "Display"
        Modes     "640x480" "800x600"
        ViewPort   0 0
        Virtual    800 600
    EndSubsection
EndSection
  
```

User Environment

⌘ complex; difficult to set up

☒ DISPLAY

☒ *environment variable tells the server where the associated client is (host:display.screen)*

```
# setenv DISPLAY mac:0.0
```

☒ startup scripts

☒ .xsession

- shell script to run to start up initial clients (such as terminal emulators, clocks, a window manager, user settings for things like the background, the speed of the pointer, etc.)

☒ .xinitrc

- performs a similar function when X is being started from the command line by xinit, rather than via xdm

☒ .xserverrc

- used to establish an X server appropriate to the actual display hardware

☒ .Xdefaults, .Xdefaults-hostname

- user-specific resource customizations

☒ .Xauthority

- authorization information defining hosts/servers that can talk to the client the user is running

More User Environment

☒ *.Xclients*

- similar to .xsession

☒ system-wide defaults are set in /etc/X11/xinit/Xclients and /etc/X11/xinit/xinitrc

\$v@t@n

AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPpQqRrSsTtUuVvWwXxYyZz

UNIX

X Servers

- ⌘ handles device management, geometry management, access control, fonts, keyboards, pointing devices and many of the other infrastructural issues associated with providing a GUI
 - ☒ servers are contained in /usr/X11R6/bin
 - ☒ *many specialised varieties, each concerned with a given type of display*
 - /usr/X11R6/bin/XF86_SVGA
 - ☒ which server to use is defined within the XF86Config file
- ⌘ also deals with the issues of protocol management for local and remote clients

Window Managers

- ⌘ the layout of windows and other GUI elements on the screen is controlled by programs called window managers
- ⌘ window managers are regular (albeit complex) client programs
 - ⌘ a variety of different user interfaces can be built
 - ⌘ "mechanism, not policy"
- ⌘ the X distribution comes with a window manager named twm
 - ⌘ supports overlapping windows, popup menus, point-and-click or click-to-type input models, title bars, nice icons, etc.
- ⌘ *many other managers*
 - ⌘ fvwm, olwm, mwm, Afterstep, Enlightenment, Gnome, Lesstif, etc.
 - ⌘ IRIX allows multiple virtual (and real) displays and each can have a different window manager!
 - ⌘ YUK!
- ⌘ active manager established in /etc/X11/xinit/XClients

Security Issues

⌘ access control

- ⌘ per-host, per-user and per-protocol restrictions possible
- ⌘ based around \$HOME/.Xauthority
 - ⌘ *data stored in this file is used to generate the correct authorization information to pass along to an X server at connection setup*

⌘ xhost

- ⌘ used to add and delete host names or user names to the list allowed to make connections to the X server
- ⌘ provides a rudimentary form of privacy control and security sufficient for a workstation environment
 - ⌘ *limits the worst abuses*
 - those that are the most fun!

```
% xhost +redhat -aunty
```

⌘ xauth

- ⌘ edits and displays authorization information used when a client connects to an X server
- ⌘ manipulates the .Xauthority file
 - ⌘ *generally you don't need this...*

X Display Manager (xdm)

- ⌘ provides services similar to those provided by init, getty and login on character terminals: prompting for login name and password, authenticating the user, and running a "session."

- ☑ handles network requests using XDMCP (XDM Control Protocol)

- ⌘ designed to be simple to use and easy to customize

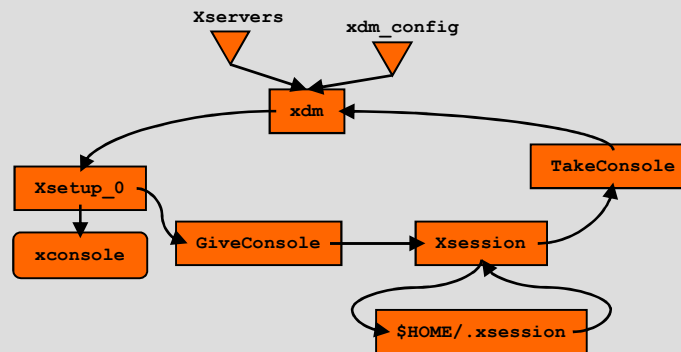
- ☑ looks in /etc/X11/xdm for configuration information

```
# ls /etc/X11/xdm
GiveConsole*  Xaccess      Xservers      Xsetup_0*     chooser*
TakeConsole*  Xresources   Xsession*     authdir/       xdm-config
```

- ⌘ should be started by init via /etc/inittab

```
x:5:respawn:/usr/bin/X11/xdm -nodaemon
```

- ⌘ goes through a series of initialization steps at login



Fonts

- ⌘ one of the most common X administrative tasks is to deal with fonts
- ⌘ most X servers support both scalable and bitmapped fonts
 - ☐ postscript type 1 fonts are supported
 - ☐ not truetype
- ⌘ an X server can obtain fonts from individual files stored in directories in the file system, or from one or more font servers, or from a mixtures of directories and font servers
 - ☐ the list of places the server looks when trying to find a font is controlled by its font search path

☐ *default search path is configured in /etc/X11/XF86Config*

```
FontPath    "/usr/X11R6/lib/X11/fonts/75dpi/"
FontPath    "/usr/X11R6/lib/X11/fonts/misc/"
FontPath    "/usr/X11R6/lib/X11/fonts/Type1/"
FontPath    "/usr/X11R6/lib/X11/fonts/Speedo/"
```

☐ *users can add their own private fonts*

```
% cp newfont.pcf ~/myfonts
% mkfontdir ~/myfonts
% xset fp rehash
```

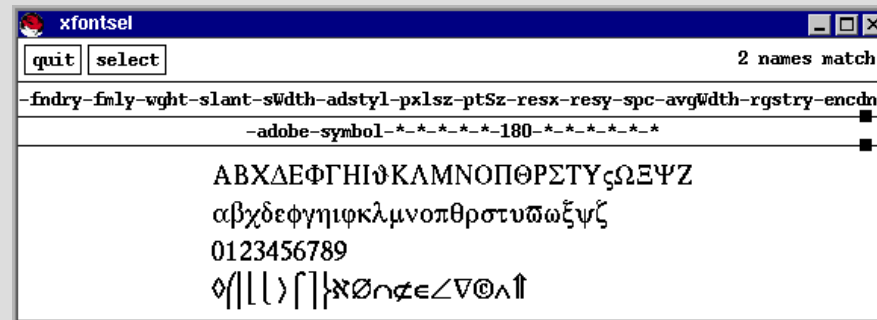
Font Specifications

- font specifications tend to be fairly long as they contain all of the information needed to uniquely identify individual fonts
- X servers support 'wildcarding' of font names, so the following are equivalent:

```
-adobe-courier-medium-r-normal--10-100-75-75-m-60-iso8859-1
--courier-medium-r-normal--*-100-*-*-*-*iso8859-1
```

- because the shell has special meanings for * and ?, wildcarded font names should be quoted:

```
% xlsfonts -fn '-*-courier-medium-r-normal--*-100-*-*-*-*'
-adobe-courier-medium-r-normal--10-100-75-75-m-0-iso8859-1
-adobe-courier-medium-r-normal--10-100-75-75-m-0-iso8859-1
-adobe-courier-medium-r-normal--10-100-75-75-m-60-iso8859-1
-bitstream-courier-medium-r-normal--10-100-75-75-m-0-iso8859-1
-bitstream-courier-medium-r-normal--10-100-75-75-m-0-iso8859-1
```



Font Servers

⌘ xfs

- ☒ supplies fonts to X servers
 - ☒ *can be configured as master and alternate servers*
- ☒ ensures that a common set of fonts are available across a network
- ☒ usually started at system boot time via the normal mechanism
- ☒ configured by /etc/X11/fs/config
- ☒ capable of dealing with many protocols
 - ☒ *advertises a catalogue*

```
tcp/18.30.0.212:7101/all
```

```
# allow a max of 10 clients to connect to this font server
client-limit = 10

# alternate font servers for clients to use
alternate-servers = hansen:7101,hansen:7102

# where to look for fonts
# the first is a set of Speedo outlines, the second is
# a set of misc bitmaps and the last is a set of
# 100dpi bitmaps
catalogue = /usr/X11R6/lib/X11/fonts/speedo,
            /usr/X11R6/lib/X11/fonts/misc,
            /usr/X11R6/lib/X11/fonts/100dpi/

# in 12 points, decipoints
default-point-size = 120

# 100 x 100 and 75 x 75
default-resolutions = 100,100,75,75
use-syslog = off
```

X Resources

⌘ most applications provide tailoring mechanisms, either through resources or command line arguments

☒ resources can be thought of as stored settings, c.f. Windows' registry

⌘ mechanism/description language is flexible enough to specify the colour of an individual widget, or the background of a whole class of widgets

☒ thus it is rather complex:

☒ *manipulating application classes*

- the foreground colour of all VT100 widgets, wherever they are used

```
*VT100.Foreground: SteelBlue
```

☒ *changing instance defaults*

- show the scrollbar of the xterm application

```
xterm.vt100.scrollbar: true
```

☒ standard resource sets are held in /usr/X11R6/lib/X11/app-defaults

☒ shouldn't be changed...allow users to set their own

- may need to supply a standard .Xdefaults file when creating a user account

A Default Resource File

```
% cat /usr/X11R6/lib/X11/app-defaults/XConsole
! $XConsortium: XConsole.ad,v 1.3 94/02/09 19:44:01 gildea Exp $
*allowShellResize:                true
XConsole.translations:             #override\
    <MapNotify>:                   Deiconified() \n\
    <UnmapNotify>:                 Iconified() \n\
    <Message>WM_PROTOCOLS:         Quit()
XConsole.baseTranslations:         #override\
    <MapNotify>:                   Deiconified() \n\
    <UnmapNotify>:                 Iconified() \n\
    <Message>WM_PROTOCOLS:         Quit()
*text.translations:                #override\
    Ctrl<KeyPress>>C:              Clear() \n\
    <KeyPress>Clear:               Clear()
*text.baseTranslations:            #override\
    Ctrl<KeyPress>>C:              Clear() \n\
    <KeyPress>Clear:               Clear()
*text.scrollVertical:              whenNeeded
*text.scrollHorizontal:            whenNeeded
*text.width:                       400
*text.height:                      70
*text.allowResize:                 true
*editType:                         read
%
```

More X Resources, etc.

⌘ xrb

☒ manipulate the current server's resource database

☒ *load, merge, remove, etc.*

☒ *typically run from within a user's .xinit or .xsession file*

- uses a user's \$HOME/.Xdefaults

```
% xrb -merge ~/.Xdefaults
```

⌘ command-line options

```
% xterm -fg yellow -bg goldenrod -display redhat:0.0 -geometry 80x25-16+16
```

☒ -display

☒ *same as the DISPLAY environment variable*

☒ - geometry

☒ *widthxheight[+-]xoffset[+-]yoffset*

