LynxOS Installation Guide

LynxOS Version 2.5

DOC-0164

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Printed in the United States of America.

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Preface

Welcome to LynxOS 2.5, the real-time development operating system from Lynx Real-Time Systems. LynxOS offers the following major benefits for real-time applications: UNIX compatibility integrated into an efficient real-time kernel; unsurpassed worst-case task response time; compatibility with BSD 4.3 UNIX; and compliance with IEEE POSIX 1003.1, 1003.1b and 1003.4a Draft 14 standards.

Conventions Used in This Guide

This Preface shows the typographical conventions used in this guide. All references to file names and commands are case sensitive and should be typed exactly as shown.

Fonts

The typefaces in this guide are used to emphasize important concepts. These are described below.

Description	Example
`Courier` font denotes commands, programs, file names, and words that would appear on your computer screen.	`myprog.c` Enter `ls` on the command line
`Bold Courier` font indicates words that you have typed on your computer.	`login:` **`myname`** **`cd /usr/home`**
Words that you must replace with a real name or value appear in *italics*.	`cat` *filename* `mv` *file1 file2*
New terms, book titles, and emphasized words appear in *italics*.	Refer to the *LynxOS Reference Manuals.*

Special Notes

The following notations highlight key points and cautionary notes in this guide.

NOTE: *These callouts note important points in the text.*

CAUTION! *This symbol stresses information that is critical to the integrity or continuity of an operation.*

Technical Support

Lynx Technical Support is available to answer your questions about LynxOS. Please feel free to contact us Monday–Friday (holidays excluded) between 8:00 AM and 5:00 PM Pacific Time (Lynx U.S. Headquarters) or between 9:00 AM and 6:00 PM Central European Time (Lynx Europe).

In addition, browse our World Wide Web home page for additional information about Lynx products, Frequently Asked Questions (FAQs), and Lynx newsgroups.

World Wide Web

http://www.lynx.com

Lynx U.S. Headquarters

Internet: support@lynx.com
Phone: (408) 879-3940
Fax: (408) 879-3945

Lynx Europe

Internet: tech_europe@lynx.com
Phone: (+33) 1 30 85 06 00
Fax: (+33) 1 30 85 06 06

CHAPTER 1

Installing LynxOS

This chapter describes how to install LynxOS on your system using the automated utility, `installit`.

Before You Begin

Verifying System Requirements

See the *LynxOS Hardware Support* for a detailed list by platform of hardware supported in this LynxOS release.

Backing Up Existing Data

If you have a previous version of LynxOS on your disk, Lynx recommends that you back up all user and data files before proceeding with an installation onto that disk.

CAUTION! *LynxOS 2.5 does not support "update installations." Any existing data on the installation partition will be overwritten. Please backup important data files before installing this release.*

Use the `tar` command to back up your important data files. The media that you use will depend on your system and the amount of data you plan to back up. For example, if your "home" directory is `/usr/home/mystuff` and you want to back up its contents to a tape device with SCSI ID 4, use the following command at the shell prompt:

tar –cvf /dev/*rawdevice* **/usr/home/mystuff**

The `cvf` arguments direct `tar` to (`c`) create a new tar archive, (`v`) be verbose, and (`f`) direct the output to a file (in this case, the tape device *rawdevice*). For this example, if you have an x86 system with an Adaptec 1542 SCSI controller, *rawdevice* is `rst1542.4`. On PowerPC, 68k, and SPARC systems, *rawdevice* is `rtape4`.

New Media Formats in this Release

By default, LynxOS ships on CD-ROM media for all supported hardware. PowerPC, 68k, and SPARC systems can boot LynxOS directly from this CD-ROM, while x86 systems must boot LynxOS first from the provided boot floppy. These steps are discussed in "Starting the Installation" on page 7.

Using the CD-ROM, you can create alternate installation media, such as cartridge tapes. For example, if you have one machine with a CD-ROM reader and many machines with tape drives, you can duplicate the installation media on tapes.

If you do not have any CD-ROM readers available in your workplace, contact Lynx to have another media format sent to you.

Overview of the CD-ROM Contents

The CD-ROM media contains both a complete ISO9660 file system and compressed `gnutar` images of the distribution. The CD-ROM itself can be mounted on any machine that supports ISO9660. From this mounted CD-ROM, you can extract the compressed `gnutar` images and put them on another media format.

The product images are located in `/tar_images` on the CD-ROM. (If you are familiar with previous releases of LynxOS, these `gnutar` images correspond to the individual release tapes.)

Creating Alternate Installation Media

Please see the README file in `/tar_images` for more details. You can also use the basic steps below to create tape media from CD-ROM.

1. Mount the CD-ROM on a LynxOS 2.5 or other UNIX machine that has the utilities `gunzip` and `dd`.
2. Uncompress the image with `gunzip` and use `dd` to write to the tape.

```
gunzip -c tar_images/file.gz \
| dd of=tape_device ibs=32k obs=32k
```

The LynxOS installation utility, if unloading from tape, expects an uncompressed `gnutar` image as input.

NOTE: *The* **`ibs=32k`** *and* **`obs=32k`** *options are very important—without them, the write to tape can take up to 50 times longer!*

Creating Installation Checklists

The tables in this section list the hardware configuration information, with examples, that you should gather before installing LynxOS. Consult your system administrator if you are unsure of your configuration.

Table 1-1: Example Installation Checklist for x86 Systems

Hardware Parameter	Example
Disk Adapter Type	SCSI
Disk Adapter Name (if SCSI)	Adaptec 2940
CD-ROM ID	6
Disk ID	0
Partition to Install	a
Network Interface Card	SMC EtherPower PCI
Memory (RAM)	16
Hostname	shark
IP Address	192.1.1.1
Graphics Card	Diamond Stealth 64
Monitor	Generic 1024x768 @ 75 Hz 17 inch
Mouse Type	Logitech Mouse Man, 3 buttons, connected to COM1

Table 1-2: Example Installation Checklist for PowerPC Systems

Hardware Parameter	Example
Disk Type	SCSI
CD-ROM ID	6
Disk ID	0
Partition on Disk for Installation	a
Network Interface Card Name	DEC21040 on-board Ethernet
Memory (RAM)	16
Hostname	shark
IP Address	192.1.1.1
Graphics Card	Cirrus Logic 5434
Monitor	Generic 1024x768 @ 75 Hz 17 inch
Mouse Type	Logitech Mouse Man, 3 buttons, connected to COM1

Table 1-3: Example Installation Checklist for 68k Systems

Hardware Parameter	Example
Disk Type	SCSI
Disk ID	0
Partition to Install	a
Network Interface Card	On-board LAN
Memory (RAM)	16
Hostname	shark
IP Address	192.1.1.1

Table 1-4: Example Installation Checklist for SPARC Systems

Hardware Parameter	Example
Disk Type	SCSI
Disk ID	0
Partition to Install	a
Network Interface Card	On-board LAN
Memory (RAM)	16
Hostname	shark
IP Address	192.1.1.1

Enabling Real-Time Clocks on MVME Boards (PowerPC and 68k)

Since we have observed that the real-time clock is disabled on new MVME boards, if you have a new board, you must first enable the real-time clock before installing LynxOS. Use the `set` command at the VMEbug prompt to set the time, thus enabling the clock (note that the VMEbug prompt reflects the MVME platform):

```
xxxx-Bug> SET <MMDDYYhhmm>
```

Also, before loading the boot media, clear the BBRAM area by using the **BF** command at the VMEbug prompt:

```
xxxx-Bug> BF FFFC0000 FFFC0040 0
```

NOTE: *You need to enable the real-time clock only once on any given MVME board. However, the BBRAM area may get corrupted over time and should be cleared before installing LynxOS.*

Starting the Installation

During the installation process, `installit` gathers information about your hardware and software configuration by presenting several menus for you to complete. You may quit the installation at any time by selecting '`Q`' in any of the menus or by typing '`^C`' (Control-C). However, if the installation is interrupted before successful completion, you will need to type `installit` at the command line to begin the installation again.

Since the initial power up of a LynxOS system is closely coupled with the underlying hardware, this section is organized by hardware type. After your system loads the boot media, you just need to type `installit` at the command prompt to begin the menu-driven installation utility.

Installing on X86 Systems

1. Insert the Installation Boot Disk into your boot floppy drive and power up your computer.
2. After LynxOS boots, remove the Boot Disk and insert the Utilities Disk.
3. Insert the CD-ROM distribution media.
4. Start the installation utility by typing `installit` at the prompt.
5. Navigate through the menus and change the settings to match your hardware configuration. Some screens have help topics that can provide additional information about the available options.

Installing on PowerPC Systems

1. Insert the CD-ROM into the drive and power up the computer.
2. Press the **Break** or **Esc** key to enable the VMEbug monitor.

3. Assuming that the CD-ROM device is at SCSI ID 6, enter the following at the PPC1-Bug prompt:

   `pboot 0 60 0`

   If the CD-ROM device is at another SCSI ID, use the `ioi` command to determine the correct arguments for pboot. Consult your PPC-Bug documentation for more information.

4. After LynxOS boots, start the installation utility by typing `installit` at the prompt.

5. Navigate through the menus and change the settings to match your hardware configuration. Some screens have help topics that can provide additional information about the available options.

Installing on 68K Systems

1. Insert the CD-ROM into the drive and power up the computer.

2. Press the **Break** or **Esc** key to enable the VMEbug monitor.

3. Assuming that the CD-ROM device is at SCSI ID 6, enter the following at the VMEbug prompt:

   `bo 00 60`

   Consult your VMEbug documentation for instructions on how to boot from a device that is set to another SCSI ID.

4. After LynxOS boots, start the installation utility by typing `installit` at the prompt.

5. Navigate through the menus and change the settings to match your hardware configuration. Some screens have help topics that can provide additional information about the available options.

Installing on SPARC Systems

1. Insert the LynxOS 2.5 CD-ROM into the CD-ROM drive and power up your computer.
2. Assuming that the CD-ROM device is at SCSI ID 6, enter the following at the Open Boot prompt:

   `boot cdrom`

   Consult your OBP documentation for instructions on how to boot from a device that is set to another SCSI ID.
3. After LynxOS boots, start the installation utility by typing `installit` at the prompt.
4. Navigate through the menus and change the settings to match your hardware configuration. Some screens have help topics that can provide additional information about the available options.

CHAPTER 2

Installing X and Motif

The X and Motif Development Package provides the graphic user interface to LynxOS. The X and Motif Development Package installation script, `Install.XM`, provides a similar organization as the LynxOS installation script. It presents several menu screens from which you can configure the installation of X and Motif Development Package from the product media.

After installing the X and Motif Development Package, the X server configuration utility, `configX`, will begin on systems that support a X server. This chapter also contains information about using `configX`.

Before You Begin

You must have root user privileges to install and configure the X and Motif Development Package.

Removing Existing Software

If you are updating from a previous version of the X and Motif Development Package, you must remove any existing X and Motif files before installing the new release. Use the `Uninstall.XM` script to do this.

```
/usr/bin/Uninstall.XM
```

Choosing the Installation Directory

The distribution may be installed into any directory or file system as required. However, Lynx recommends that you install the X and Motif Development Package distribution into your root (/) directory.

The file system where you install the X and Motif Development Package should have enough additional disk space for future expansion. Motif must be installed in the same file system and directory as X.

Installing with Install.XM

Start the installation utility `Install.XM` from any directory on the system.

```
/usr/bin/Install.XM
```

The Main installation menu will be displayed. The options are similar to the LynxOS installation utility, `installit`. Answer the questions about your hardware and software configuration.

You can quit the installation at any time with the *Quit Installation* option.

Configuring X with ConfigX Utility

Once you've installed the X and Motif Development Package, you must configure the X server. At a minimum, you need to select the graphics adapter and monitor from lists provided on the screen.

NOTE: *On 68k and SPARC systems, the X and Motif Development Package only supports X clients. The X server is only supported on x86 and PowerPC systems.*

Other steps, which are covered later in this chapter, may be required based upon the special features, options, and/or configuration requirements of your system.

Starting the Configuration Utility

By default, `configX` automatically runs after the X and Motif Development Package is successfully installed. However, you also can start `configX` from any directory by typing the following at the prompt:

```
/usr/bin/X11/configX
```

`configX` is a graphical utility that is most easily navigated by using a pointing device, such as a mouse. However, if you did not install mouse support before running `configX`, you can use special keys to move around the screens and to make your selections during the initial configuration process. These special keys are described in Table 2-1.

Table 2-1: Function of Special Keys

Key	Function
Tab	Moves you forward from field to field.
Shift-Tab	Moves you backward from field to field.
↑ ↓ ← →	Changes the value in the current field.

Table 2-1: Function of Special Keys

Key	Function
Enter	Sets/unsets a toggle button.
Page Down	Switches to the next configuration page.
Page Up	Switches to the previous configuration page.
Esc	Cancels you out of the current screen or pop-up.
Alt-F	Jumps you to the *File* pull-down menu.
Alt-S	Jumps you to the *Screen* pull-down menu.
Alt-C	Jumps you to the *Configuration* pull-down menu.

Configuring the Monitor, Mouse, and Keyboard

The first configuration page controls the mouse, keyboard, and monitor.

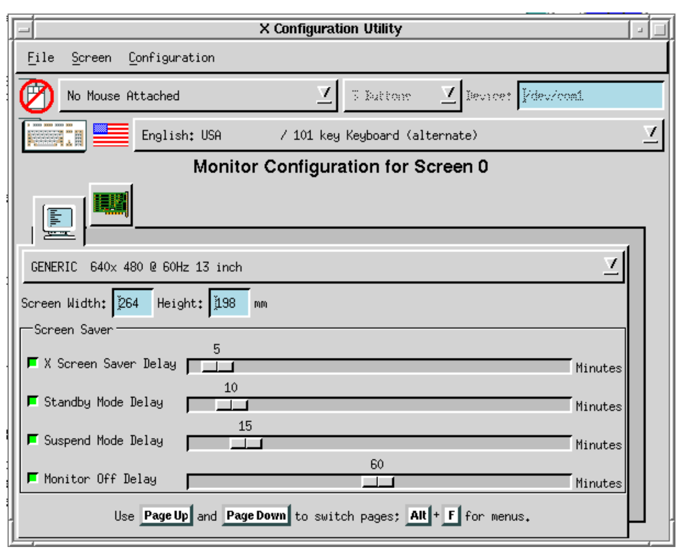


Figure 2-1: Monitor Configuration Page

Mouse

1. The default mouse setting is *No Mouse*.
2. Press ↓ to display the list of mice.
3. Press ↑ or ↓ to scroll to your mouse entry, then press Enter to select it.
4. Press Tab to move to the next field.
5. Press ↓ to display the list of mouse buttons. (The default entry is based on your mouse selection, and is usually the appropriate choice.)
6. Press ↑ or ↓ to scroll to your button entry, then press Enter to select it.
7. Press Tab to move to the next field.
8. If you need to change the path for your mouse device, edit it here.
9. Press Tab to move to the next field.

Keyboard

The X server includes international keyboard support, allowing you to select the keyboard appropriate for your language and country. Also, there are two separate mappings, US 101 and US 101 alternate, provided to cater to the various types of US 101 keyboards available, apart from the default console mapping. Select the one that works the best when using a US 101 type keyboard.

1. Press ↓ to display the list of keyboards.
2. Press ↑ or ↓ to scroll to your keyboard entry, then press Enter to select it.
3. Press Tab to move to the next field.

Monitor

1. The default monitor setting is *Generic 640x480 @ 60Hz 13 inch*.
2. Press ↓ to display the list of monitors.
3. Press ↑ or ↓ to scroll to your monitor entry, then press Enter to select it.
4. Press Tab to move to the next field.
5. If you need to change the screen width (mm), edit it here.
6. Press Tab to move to the next field.
7. If you need to change the screen height (mm), edit it here.
8. Press Tab to move to the next field.

Screen Saver

Some graphics cards and monitors support the Display Power Management System (DPMS), which minimizes the power used by the monitor when user input ceases. If your hardware has this feature, the phases of DPMS can be controlled in this section. The typical DPMS setup has a cascade effect, with the various phases being activated in succession with your choice of delay times between each.

- **X Screen Saver**–Preliminary phase to DPMS, which blanks the screen but provides no power reduction.
- **Standby Mode**–First phase of DPMS, which provides moderate power reduction by disabling the horizontal sync signal to the monitor.
- **Suspend Mode**–Second phase of DPMS, which provides significant power reduction by disabling the vertical sync signal to the monitor.
- **Monitor Off**–Final phase of DPMS, which provides maximum power reduction by disabling both the horizontal and vertical sync signals to the monitor.

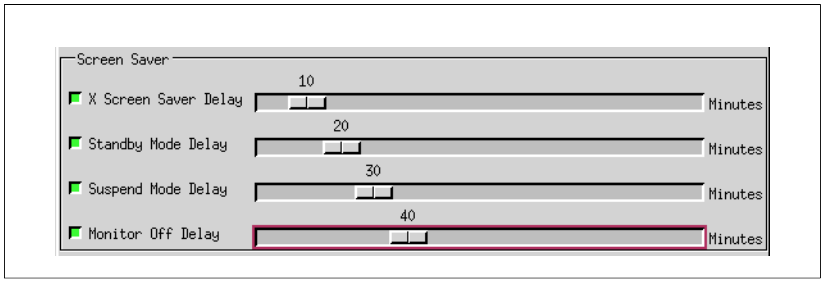


Figure 2-2: Screen Saver Configuration

1. In the *X Screen Saver Delay* field, press Enter to toggle this option on or off.
2. If toggled on, press Tab to move to the *Minutes* field, then use ← or → to set the value.
3. Press Tab to move to the next field.
4. In the *Standby Mode Delay* field, press Enter to toggle this option on or off.
5. If toggled on, press Tab to move to the *Minutes* field, then use ← or → to set the value.
6. Press Tab to move to the next field.
7. In the *Suspend Mode Delay* field, press Enter to toggle this option on or off.
8. If toggled on, press Tab to move to the *Minutes* field, then use ← or → to set the value.
9. Press Tab to move to the next field.
10. In the *Monitor Off Delay* field, press Enter to toggle this option on or off.
11. If toggled on, press Tab to move to the *Minutes* field, then use ← or → to set the value.

Configuring the Graphics Card

Press Page Down to move to the second configuration screen, which controls the graphics card, the number of colors, the virtual resolution, and the physical resolution.

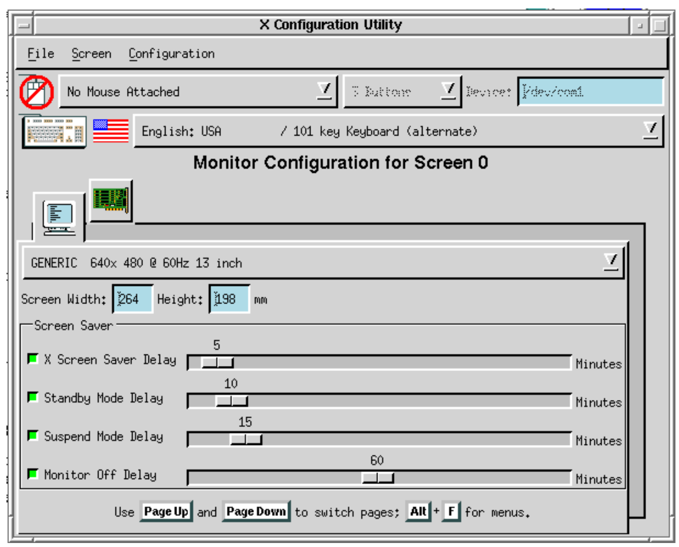


Figure 2-3: Graphics Card Configuration Page

Each graphics card configuration consists of five elements:

- The graphics card (make and model).
- The number of colors supported on screen simultaneously (color depth).
- The virtual resolution of the screen (width x height).
- The physical resolution of the screen (width x height).
- The screen refresh rate (Hz).

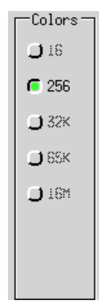
Refresh rates which are labeled “Interlaced” do not give as good of a screen appearance as non-interlaced modes. The highest refresh rate that your monitor supports will give the best image. At higher screen resolutions, a higher refresh rate will help prevent the screen from visibly flickering. The highest refresh rate supported by the selected monitor is automatically displayed.

Graphics Card

1. The default graphics card setting is *IBM VGA*.
2. Press ↓ to display the list of graphics cards. You can also quickly access a card setting by pressing Shift and the first letter of the card name. For example, press Shift–M to access the Matrox card settings.
3. Press ↑ or ↓ to scroll to your graphics card entry, then press Enter to select it.
4. Press Tab to move to the next field.

Colors

Not all graphics cards can support all color depths (number of colors). Only the options for the color depths supported by your card will be sensitive in this field. The other options will be greyed out.



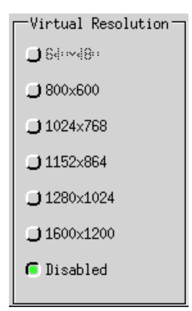
1. Only *one* color option can be selected (due to design limitations of X).
2. In some cases the color options available will be limited by the physical resolution(s) you choose, based on the capabilities of your graphics card. Not all color depths are available at high resolutions.

3. The default setting is at the lowest value for your card.
4. Decide which available color setting you want to use.
5. Press Tab to move to that color setting, then press Enter to select it. (The previous setting will be cancelled.)
6. Press Tab to move to the next field.

Virtual Resolution

The *Virtual Resolution* setting allows you to have an on-screen work area that is actually larger than your physical screen. Windows can extend beyond the screen's physical boundaries and are viewed by scrolling into the extended areas. Only the options for the virtual resolutions supported by your card will be sensitive in this field. The other options will be greyed out. If you don't want to use this feature, select the *Disabled* option.

- Only *one* virtual resolution can be selected.
- In some cases the virtual-resolution options available will be limited by the physical resolution(s) you choose, since the virtual resolution must always be greater than the highest physical resolution.

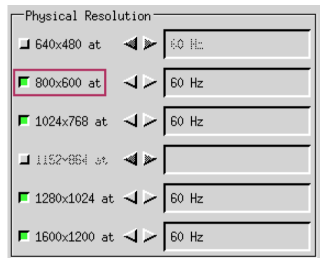


1. The default setting for virtual resolution is *Disabled*.
2. Decide which available virtual resolution you want to use.
3. Press Tab to move to that setting, then press Enter to select it. (The previous setting will be cancelled.)
4. Press Tab to move to the next field.

Physical Resolution

Not all graphics cards and monitors can support all physical resolutions. Only the options for the resolutions supported by your hardware will be sensitive in this field. The other options will be greyed out.

- **Multiple** physical resolutions can be selected. You can switch between these resolutions while running X by pressing a hot-key combination:
  - Press Ctrl-Alt-+ to change to the next resolution.
  - Press Ctrl-Alt-– to change to the previous resolution.
- If you want only **one** resolution, make sure only one *Physical Resolution* toggle button is selected.
- In some cases the physical resolution(s) you choose may limit the selections you can make in *Colors* and *Virtual Resolution*, depending on the capabilities of your graphics card.



1. The default setting is at the lowest value for your card.
2. Decide which available resolution(s) you want to use.
3. Press Tab to move to the setting, then press Enter to select it.
4. Press Tab to move to the corresponding field to set the screen refresh rate (Hz) for that resolution, then use ← or → to select a value from the Hz options available. The default setting is the highest frequency your monitor supports, and is usually the appropriate choice.
5. Repeat this procedure for each physical resolution you want to set.

NOTE: *On x86 systems, some adapters, like Western Digital WD90C3x and Diamond Viper, do not support dynamic switching of resolutions. For these only the highest resolution selected will be the one actually saved by the* `configX` *utility.*

Configuring Multiple-Screens

X supports up to four screens that can all be controlled simultaneously with a single keyboard and mouse. This allows you to run more applications without overlapping windows, and is particularly useful for image-processing work.

For each screen used, a separate configuration must be created for that screen's monitor and graphics card.

Adding a Screen

X defaults to a single-screen setup. The first screen configured is labeled *Screen 0*. When you add a second screen, all of its configuration default settings will duplicate the current settings of Screen 0. So if your hardware is the same on all screens, you can save time by configuring Screen 0 before adding the other screens. Similarly, as more screens are added, the settings of whichever one is currently active when you add another screen will determine the default settings of the new screen.

1. Press Alt-S to display the *Screen* pull-down menu.
2. Type *A* for *Add*.
3. The *Monitor* and *Graphics Card* icons for Screen 0 become outlines, and two full-color icons appear for Screen 1.
4. Refer to the procedures described earlier in this chapter if any changes need to be made to the new screen's configuration.
5. Use the Page Down and Page Up keys to move to the configuration pages of each screen.

Deleting a Screen

When a screen is deleted, all screens with higher screen numbers immediately drop down one slot. For instance: You currently have screens 0, 1, and 2 configured and you delete screen 1. That screen and all of its configuration information disappears. Screen 2 then becomes screen 1, but retains its own configuration. You are left with screens 0 and 1.

1. Use the Page Down or Page Up key to activate the set of icons for the screen you want to delete.
2. Press Alt-S to display the *Screen* pull-down menu.

3. Type *D* for *Delete*.
4. One set of *Monitor* and *Graphics Card* icons disappears. Higher-numbered screens (if any) immediately fill the gap of the deleted screen.

Screen Layout

The *Screen Layout* page lets you specify how the multiple screens are arranged on your desktop so that mouse movement from screen to screen will be appropriate.

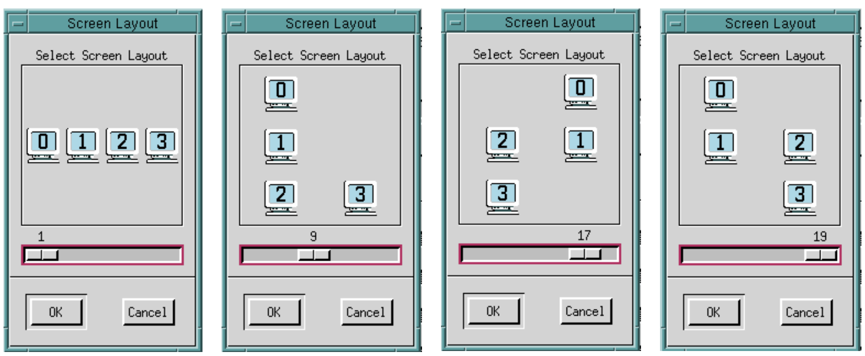


Figure 2-4: Several Screen Layout Windows

1. Press Alt-S to display the *Screen* pull-down menu.
2. Type *L* for *Layout*.
3. The *Screen Layout* window appears.
4. Press ← and → to view the various layout combinations for your number of screens.
5. When the layout you want is displayed, press Enter to select it.

Changing the Font Path

If needed, you can edit your font path from within `configX`. This will be necessary if you are using a font server instead of or in addition to your existing fonts.

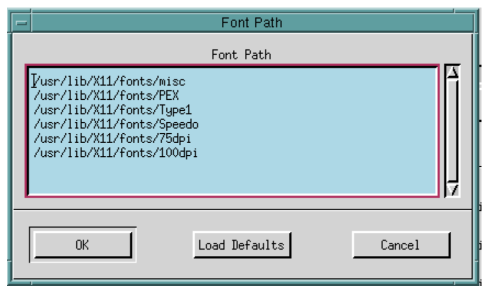


Figure 2-5: Font Path Window

1. Press Alt-C to display the *Configuration* pull-down menu, then press Enter.
2. The *Font Path* window appears.
3. Edit the file as necessary for your system. Metro-X looks for fonts in the order in which the directories are listed in this file.

   If you are using a font server, enter this as the first line:

   ```
   tcp/<fontserver machine>:7000
   ```

   If your port number is not the default `7000`, change it to the appropriate port number for your system.
4. Press Tab to move to and amongst the bottom buttons, then press Enter to select one. If the information is correct, select the *OK* button. If you want to disregard the changes you've made, select the *Cancel* button. If you've edited your font path and want to go back to the original settings, select the *Load Defaults* button.

Exiting configX

Saving Configuration

1. Press Alt-F to display the *File* pull-down menu.
2. Type *S* for *Save and Exit*.
3. Your changes are saved, the X Configuration Utility closes, and your system ready to run X!

Exiting Without Saving

1. Press Alt-F to display the *File* pull-down menu.
2. Type *Q* for *Quit*.
3. A precautionary dialog box appears: *Save current configuration before exiting?*
4. Press Tab to move to the *No* button, then press Enter to confirm that you want to exit the X Configuration Utility without saving your changes.

The bottom portion of the screen displays the *X Main Configuration Menu*. This menu gives you access to all configuration options.

Starting X

To start the X and Motif Development Package, type one of the following commands at the command line prompt: `xinit`, `startx` or `xdm` (if configured).

CHAPTER 3

Using X Windows on LynxOS

Lynx has made the X distribution as standard as possible. The goal was to lessen both the time required to port X applications and the time required for someone who is already familiar with the standard X environment to learn about X on LynxOS. The following notes deal with topics you need to be aware of to get the best use out of the X environment on LynxOS.

General Notes

X and Motif Libraries in /usr/lib

The X and Motif libraries are found in their standard location in `/usr/lib`. Some LynxOS compiler/linker combinations do not, by default, look in `/usr/lib` for libraries. You may need to use the **`-L`** option or set the `LIBPATH` environment variable. Please refer to the man page of the compiler and linker that you are using (e.g., `cc`, `gcc`, `ld`) to see what the appropriate way is to set the library search path for your system.

Default Configuration Files

Default files /.xinitrc, /.xsession, /.mwmrc and /.Xdefaults are provided as part of the X distribution. These can be used as provided or as examples. A default resource file is provided as well.

Unsupported Programs

Certain parts of the X distribution, as distributed by MIT, are neither supported nor supplied by Lynx. The contrib directory is neither supported nor supplied.

Some standard MIT X clients are not supported on LynxOS because the underlying kernel or utility support does not exist. Some of the unsupported clients are xload, xmh, and xconsole.

Saving Errors

The X server creates an error file Xerrors, in the /usr/lib/X11/Metro directory. In case of server problems please examine this file for clues to help in diagnosing the problem.

Audio Bell

The default bell tone may be changed by using xset.

Switching Display Modes

If you have selected more than one screen resolution. A hot-key combination lets you change the resolution on the fly. When using the X and Motif Development Package, press Ctrl-Alt-+ to change to a higher resolution, or Ctrl-Alt-– to change to a lower resolution.

Potential Problems

- Does your monitor support the resolution and refresh rate that you have chosen?

  Many older monitors cannot support the high resolutions and frequencies that the latest graphics cards can produce. If you don't have technical data on the monitor, pick a low resolution and work your way up to verify the monitor's capabilities.
- Did you find a configuration for your specific card?

  If not, try other configurations for the same chipset. Most cards that use the same chipsets are very similar, and if one configuration is not quite right, another may work.
- If you have a Logitech mouse or trackball and the Logitech Mouse Man option does not work, try the Logitech C7 and Microsoft options also.
- Read the server's output messages for clues or descriptions of problems encountered. Also check the file `/usr/lib/X11/Metro/Xerrors` for error output information.

Improving Performance

Modifying Disk Cache Blocks

The performance of an application which uses the disk subsystem can be greatly affected by the size of the Disk Buffer Cache which resides in kernel memory. The disk buffer cache is used to cache disk blocks to increase the performance of the operating system. The default value the operating system uses is configured with an orientation towards small embedded systems. X windows files tend to be large in size and will quickly consume the disk buffer cache.

Lynx recommends that the buffer cache be increased to at least 1024 blocks. Disk caches with a size of 2048 to 4096 blocks are common on systems which heavily use X and/or the file system. The default entry for the buffer cache is provided below. This entry from the kernel configuration file `<param.h>` will need to be modified to an appropriate value for the specific system configuration. See the LynxOS *LynxOS User's Guide* for more information.

```
/* number of cache memory blocks */
#define CACHEBLKS 202
```

Configuring Hardware

The configuration of your hardware system can have a significant impact on the performance of the operating system and X windows. Many computer systems have user configurable parameters which are used by the BIOS to control the hardware system. It is important that the hardware system be tuned for optimal performance. Consult the hardware documentation for your system for more information about configuring the hardware system.

Real-time Priorities and X

By default, the X server and initial clients run at the priority of the process which started them; i.e., they do not adjust their priority. You may find that raising the priority of the server and window manager above that of your other applications, shells, and X clients may improve your interaction to the window system.

If demand-paged virtual memory is active on your system, you will probably want to allow the X programs to be swapped because they use so much memory. To do this, make sure that `vmstart` (usually run from `/bin/rc`) is run at a higher priority than the priorities you choose for the X programs that you wish to swap.

Communication Port Requirements

ATC Virtual Consoles

X must have at least one free ATC virtual console for its use. The installation scripts will disable the login for the 4th virtual console `/dev/atc3`.

Serial Printers

If your printer is configured to use COM1 (`/dev/com1`) and your mouse is also using this same port, you may experience abnormal operations if the printer is left configured. You should disable the serial printer port by editing the `/etc/printcap` file.

SKDB and X

While running X, the Lynx Simple Kernel Debugger (SKDB) can only be run from COM2 and cannot be run from the console. Refer to the *LynxOS User's Guide*, provided with LynxOS distribution, on how to configure SKDB on COM2.

Xconsole and newconsole

LynxOS provides a similar facility to `xconsole` to change the console. See the man page for `newconsole(1)` in the *LynxOS Reference Manuals*. Simply execute `newconsole` in an `xterm` window. You must have root privileges to change the console.

CAUTION! *If you change the console to the pseudo-tty associated with an* `xterm`*, you must keep the* `xterm` *and pseudo-tty active; i.e., do not close the* `xterm` *window. Otherwise, console messages may fill up the* `pty` *queue and cause your computer to lock up. If you do wish to close that* `xterm`*, or exit X, run* `newconsole` *to set the console to another device, e.g.,* `/dev/atc0` *before exiting.*

Window Managers

Window Managers

You cannot have more than one window manager running on an X display simultaneously.

Limited Colors

If you use a limited color server, be aware that some window managers allocate many colors by default. You may not have many colors left for your applications, unless you reconfigure your window manager to use fewer colors. Refer to your window manager man page for more information.

APPENDIX A

Booting LynxOS

This appendix describes some platform-specific details of booting LynxOS. It also answers some commonly asked questions about booting.

Working with BIOS and Firmware

PowerPC Systems

After rebooting a Motorola PowerPC system, use the PPCbug `pboot` command to specify the device logical unit number (DLUN) of the hard disk on which you installed LynxOS. (You can find the DLUN of all the devices on your system with the `ioi` command.)

For example, if you have installed LynxOS on `sd1`, enter the following to boot LynxOS (the DLUN of `sd1` is `10`):

```
PPC1-Bug> pboot 0 10 0
```

Consult your PPCbug documentation for more information on the `pboot` and `ioi` commands.

68K Systems

After rebooting a Motorola 68k system, use the VMEbug `bo` to specify the device logical unit number (DLUN) of the hard disk on which you installed LynxOS.

Assuming that the SCSI ID of the hard disk on which you installed LynxOS is 0, type the following command.

```
xxxx-Bug> bo 00 00
```

Consult your VMEbug documentation for instructions on how to boot from a hard disk device that is set to another SCSI ID.

SPARC Systems

After the machine reboots, you should set the OBP environment variables so that the LynxOS kernel is automatically loaded. Type the following at the OBP prompt:

```
ok setenv boot-device diskN
ok setenv boot-file lynx.os
ok setenv auto-boot? true
ok setenv diag-switch? false
ok boot diskN
```

For the boot-device, *N* corresponds to the SCSI ID of the disk on which you installed LynxOS. For example, if you installed LynxOS on disk with SCSI ID 2, the value for boot device would be `disk2`.

LynxOS Preboot Utility

`preboot` is a kernel loader that provides the user interface prior to kernel boot-up. This utility supports loading any LynxOS kernel located on any partition or disk. With `preboot`, you can also load kernels that are on non-bootable disks.

NOTE: `preboot` *is now supported on all LynxOS platforms.*

Major and Minor Device Numbers

The LynxOS kernel identifies each device driver in the system with a unique pair of numbers, referred to as the major and minor device numbers.

X86 Systems

The default major device numbers are shown in Table A-1.

Table A-1: Default Major Numbers for Disk Devices (x86)

ID	Description
0	IDE/EIDE
1	Floppy 0-3
2	Adaptec 1522 SCSI
3	Adaptec 1542 SCSI
4	Adaptec 1742 SCSI
5	Adaptec 2742 SCSI
6	Adaptec 2940 SCSI

The default minor device numbers are shown in Table A-2.

Table A-2: Default Minor Numbers Disk Devices (x86)

<table>
<tr><th colspan="2">Type</th><th>ID</th><th>Whole Disk</th><th>Partition a</th><th>Partition b</th><th>Partition c</th><th>Partition d</th></tr>
<tr><td rowspan="7">SCSI</td><td rowspan="4">IDE</td><td>0</td><td>0</td><td>16</td><td>32</td><td>48</td><td>64</td></tr>
<tr><td>1</td><td>1</td><td>17</td><td>33</td><td>49</td><td>65</td></tr>
<tr><td>2</td><td>2</td><td>18</td><td>34</td><td>50</td><td>66</td></tr>
<tr><td>3</td><td>3</td><td>19</td><td>35</td><td>51</td><td>67</td></tr>
<tr><td></td><td>4</td><td>4</td><td>20</td><td>36</td><td>52</td><td>68</td></tr>
<tr><td></td><td>5</td><td>5</td><td>21</td><td>37</td><td>53</td><td>69</td></tr>
<tr><td></td><td>6</td><td>6</td><td>22</td><td>38</td><td>54</td><td>70</td></tr>
</table>

PowerPC Systems

The default major device numbers are shown in Table A-3.

Table A-3: Default Major Numbers for Disk Devices (PowerPC)

ID	Description
0	RAM disk
1	Floppy 0-3
2	SCSI disk (includes CD-ROM)
3	SCSI tape

The default minor numbers are the same as on x86 systems (seeTable A-2 on page 36).

68K and SPARC Systems

On LynxOS 68k and SPARC systems, the major number is 0 for all SCSI devices.

The default minor device numbers are shown in Table A-4.

Table A-4: Default Minor Numbers for SCSI Disk Devices (68k)

SCSI ID	Partition a	Partition b	Partition c	Partition d
0	16	32	48	64
1	17	33	49	65
2	18	34	50	66
3	19	35	51	67
4	20	36	52	68
5	21	37	53	69
6	22	38	54	70

Setting the Root Device

The root device is the location of a LynxOS file system. With the major and minor number of the device, you can set the root device using `preboot`.

X86 and PowerPC Systems

To display the current default root device, enter the following at the `preboot` prompt:

```
R ?
```

To set the root device to something other than the default:

R *major minor*

To set the root device for partition B of an Adaptec 1522 SCSI disk at ID 2, enter the following at the `preboot` prompt:

R 2 34

68K Systems

To display the current default root device, enter the following at the `preboot` prompt:

R ?

Note that on 68k systems, `preboot` displays the value of the root device hexadecimal notation.

To set the root device to something other than the default:

R *major minor*

For example, to set the root device for a disk with SCSI ID 2 and partition B, type the following at the `preboot` prompt:

R 0 34

SPARC Systems

To display the current default root device, enter the following at the `preboot` prompt:

r ?

To set the root device to something other than the default, use:

r *major minor*

Setting the Boot Device

The boot device is the location of the LynxOS kernel that will be booted.

X86 and PowerPC Systems

To set the boot device to partition B of a SCSI device at ID 2, enter the following at the `preboot` prompt:

```
b s2b
```

68K

To set the boot device to partition B of a SCSI device at ID 2, enter the following at the `preboot` prompt:

```
B s2b
```

Compatibility Issues on PowerPC

The `preboot` utility is a new feature on PowerPC platforms. As such, you cannot use `preboot` to boot a pre-2.5 kernel. Instead, you must use the facilities of the PPCbug.

For example, assume that a SCSI disk (on one machine) at ID 0 is configured as follows:

Partition B LynxOS 2.4.0	Partition C LynxOS 2.5.0 (with preboot)

In this example, `preboot` on Partition C has been made bootable with the `makeboot` utility (see `makeboot(1)` for more information).

To boot the LynxOS 2.5 kernel `/lynx.os` on partition C:

1. Boot preboot from the PPC Bug.

```
Bug> pboot 0 0
```

2. Press **Enter** at the `preboot` prompt.

To boot the LynxOS 2.4 kernel `/lynx.os` on partition B of a SCSI disk at ID 0:

1. From PPC Bug, set the major device number (in hexadecimal) of the root device.

```
Bug> mm 80000074; B
80000074 10 ? 15
80000075 10 ? 00
80000076 10 ?
80000077 02 ? 0          major number in hex
80000078 10 ? .
```

2. Set the minor device number (in hexadecimal) of the root device.

```
Bug> mm 80000074; B
80000074 10 ? 14
80000075 10 ? 00
80000076 10 ?
80000077 20 ? 20         minor number in hex
80000078 10 ? .
```

3. Boot `preboot`.

```
Bug> pboot 0 0
```

4. At the `preboot` prompt, boot the LynxOS 2.4 kernel.

```
b s0b /lynx.os
```

Troubleshooting

All Platforms

1. When I boot a kernel, the message "main file device not present" is printed to the screen.

This error message indicates that `preboot` can't access the root file system. You may see this message if you have specified incorrect major or minor device numbers for the root file system.

2. I made a new kernel and now it won't boot. How can I boot LynxOS?

This answer assumes that your system had a booting kernel at one time and that currently `preboot` boots successfully. When a making a new kernel, (`make install` in `/sys/lynx.os`), the old kernel is moved to `/lynx.os.old` and the new kernel becomes `/lynx.os`. Try to boot the old kernel (`/lynx.os.old`) from the `preboot` command prompt. If this works, determine what changes you made to the new kernel that may have caused it not to boot.

If you have tried the above and it didn't work, observe what is happening with the kernel:

- Did it display the LynxOS message when it tried to boot? If the message did not appear, it is probably a driver issue. Drivers are installed before the message is displayed for the kernel. If a new driver was added, it is crashing the kernel.
- Did the message come up and then nothing appeared on the screen? If so, see question 6 on page 42.
- Did the message "main file system not present" appear on the screen. If so, see question 1 on page 41.

3. Preboot hangs when I try to boot a kernel.

Ensure that the boot devices are set to `preboot` default values. If you have made your own bootable disk device, `preboot` will not contain the driver needed to boot the kernel. You need to obtain the `preboot` source code and add your driver into `preboot`.

4. How do I boot from a different partition than the one specified in preboot?

See section “Setting the Boot Device” on page 39.

5. Is there a limit on how big the kernel can be for booting?

The boot size limit, if using `preboot`, is 16 MB (the current kernel size limit). However, booting the kernel directly is restricted to less than 512 KB on x86 systems. ROM kernels are limited to 8 MB.

6. My kernel prints the banner message, does some disk activity, then hangs. What’s wrong?

The kernel prints a banner message when it first comes up then `/init` is executed. Before `init` creates the login shell, it runs the script `/bin/rc`. All output is displayed on `/dev/atc0`. If the internal device number for `/dev/atc0` and the major number of `/dev/atc0` do not match, no output will be displayed on the screen.

To fix this problem, reboot your system and specify the old kernel `/lynx.os.old` at the preboot command prompt. Rebuild the device nodes using the following steps:

```
cd /dev
mknod -a /etc/nodetab
reboot -a
```

If you do not have a backup kernel, you can use the LynxOS installation media to access the kernel and make the device nodes.

- Boot the installation media. Ignore the message about the `installit` utility.
- Mount the device that contains the problem kernel onto the directory `/mnt`.
- Change to the device node directory in `/mnt`.

  `cd /mnt/dev`
- Make the nodes.

  `/mnt/bin/mknod -a /mnt/etc/nodetab`

X86 Specific

7. How do I boot LynxOS from a removable disk drive?

A removable media device must be recognized by the system BIOS in order to boot. Adaptec BIOS, for example, has an option to “Support Removable Disks as Fixed Disk”. This option should be set to “All devices” so all removable media drives will be treated as fixed disks and can be used as boot devices.

8. I moved my disk from an Adaptec 1542 SCSI controller to an Adaptec 2742 SCSI controller. Now, preboot won’t load the kernel. Why?

The major device used by `preboot` is incorrect for the current controller. Refer to “Setting the Root Device” on page 37 for details on getting the new kernel to boot. Once LynxOS is booted, type the following:

`makeboot /preboot`

This command updates the major number in `preboot`.

9. The SCSI controller on my PCI system works with DOS but not LynxOS.

There are usually two buses on PCI-based systems: the ISA bus and the PCI bus. PCI devices on the system communicate with the PCI bus about interrupts, DMA channels, etc., so that the PCI bus knows how to assign resources. The ISA devices do not communicate this information to the PCI bus and resource conflicts may result. To fix this problem, use the PCI BIOS setup utility to enable the ISA cards on your system. See your hardware documentation for specific instructions for your system's BIOS.

10. Why must preboot be used to boot a LynxOS kernel that is greater than 512 KB?

The Lynx secondary boot loader begins in real-mode and is currently limited to the first 640 KB of memory. The boot loading code must be less than 512 KB to safely load in this memory region.