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LynxOS Installation Guide

LynxOS Release 4

DOC 0405-00 C

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Preface

This document provides detailed installation instructions for LynxOS for various configurations. This document includes topics on:

- Cross-development installations
- Native development installations for x86 and PowerPC platforms
- The LynuxWorks **`installit`** installation utility
- Booting LynxOS
- X & Motif Installation instructions
- X & Motif Configuration options

For More Information

For more information on the features of LynxOS, refer to the following printed and online documentation.

- *Release Notes*

  This printed document contains late-breaking information about the current release.

- *LynxOS User's Guide*

  This document contains information about basic system administration and kernel-level specifics of LynxOS. It contains a "Quick Starting" chapter and covers a range of topics, including tuning system performance and creating kernel images for embedded applications.

- Online information

  Refer to the LynxOS Documentation CD-ROM for PDF and HTML-formatted versions of important LynxOS documents. Additionally,

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Information about commands and utilities is provided online in text format through the **man** command. For example, a user wanting information about the GNU compiler would use the following syntax, where **gcc** is the argument for information about the GNU compiler:

```
man gcc
```

More recent versions of the documentation listed here may also be found online.

Typographical Conventions

The typefaces used in this manual, summarized below, emphasize important concepts. All references to file names and commands are case sensitive and should be typed accurately.

Kind of Text	Examples
Body text; *italicized* for emphasis, new terms, and book titles	Refer to the *LynxOS User's Guide.*

Environment variables, file names, functions, methods, options, parameter names, path names, commands, and computer data
Commands that need to be highlighted within body text, or commands that must be typed as is by the user are **bolded**.
	`ls`
	`-l`
	`myprog.c`
	`/dev/null`
	`login: myname`
	`# cd /usr/home`

Text that represents a variable, such as a file name or a value that must be entered by the user	`cat filename` `mv file1 file2`

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Kind of Text	Examples

Blocks of text that appear on the display screen after entering instructions or commands	`Loading file /tftpboot/shell.kdi into 0x4000`
	`.....`
	`File loaded. Size is 1314816`
	`Copyright 2000 LynuxWorks, Inc.`
	`All rights reserved.`
	
	`LynxOS (ppc) created Mon Jul 17 17:50:22 GMT 2000`
	`user name:`

Keyboard options, button names, and menu sequences	**Enter**, **Ctrl-C**

Special Notes

The following notations highlight any key points and cautionary notes that may appear in this manual.

NOTE: These callouts note important or useful points in the text.

CAUTION! Used for situations that present minor hazards that may interfere with or threaten equipment/performance.

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Technical Support

LynuxWorks Technical Support is available Monday through Friday (holidays excluded) between 8:00 AM and 5:00 PM Pacific Time (U.S. Headquarters) or between 9:00 AM and 6:00 PM Central European Time (Europe).

The LynuxWorks World Wide Web home page provides additional information about our products, Frequently Asked Questions (FAQs), and LynuxWorks news groups.

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CHAPTER 1 *Introduction*

LynxOS Overview

The LynxOS product family is comprised of many tools and features that collectively form a state-of-the-art development environment for writing, debugging, and deploying real-time embedded applications.

The center of the product line is the real-time, scalable, LynxOS kernel. The kernel is provided in two forms:

- A bootable, prebuilt kernel that can be loaded onto a target and executed as a full-featured development Operating System.
- A set of kernel libraries, scripts, and Makefiles that can be used to create custom kernels to match the needs of users' applications.

Libraries, compilers, linkers, debuggers, and other tools are provided in the LynxOS development environment for developing kernels and user applications.

Application and kernel development can take place in a supported *cross development environment*, with tools installed on a host system running Windows, Sun Solaris, or Linux

Applications and kernels compiled on a cross development environment generates code that can be downloaded and executed on a LynxOS target system.

NOTE: For the latest versions of host operating systems supported, please see the *LynxOS Release Notes*.

LynuxWorks provides a full set of tools that run natively on the target CPU, so that compilation, linking, debugging, and execution of the user's application occurs seamlessly on a single LynxOS target. This is called a *native development* environment.

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User applications and LynxOS kernels can be bound together into a single downloadable and bootable file called a Kernel Downloadable Image (KDI) using the **`mkimage`** tool.

Open Development Environment (ODE) Overview

The base LynxOS development package is called the Open Development Environment (ODE). This environment contains all necessary components needed to develop LynxOS kernels and user applications in both native and cross development environments. The ODE includes tools, libraries, and utilities in addition to Board Support Packages (BSP) for specific target boards.

The three system components that users must consider when selecting a specific ODE package are as follows:

- The type of processor (x86, PowerPC/PowerQUICC)
- The type of target Board Support Package (such as PC-AT, VME-based PowerPC products, and CPCI based PowerPC products.)
- The type of host system used in cross development systems

The LynxOS Open Development Environment packages for cross development hosts are listed below. Each of these ODE packages contains the LynxOS native development system and the cross development system. These are targeted at specific boards.

- ODEC - Open Development Environment for *SunOS* and *Solaris* Hosts
- ODEW - Open Development Environment for *Windows* Hosts
- ODEL - Open Development Environment for *Red Hat Linux* Hosts

The installation procedures for *X11 and Motif* libraries, servers, and tools are described in Chapter 7, “X & Motif Installation Instructions”.

Other tools and products, such as the TotalView debugger, SpyKer kernel event trace analyzer, and LynxInsure++ code quality tools, are sold separately and include their own installation manuals.

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LynxOS Distribution Overview

The LynxOS package consists of several ISO9660 CD-ROMs, described below:

- The *Cross Development Kit* - contains the cross development software (including the GNU compiler and debugger) appropriate for the cross development host.
- The *Open Development Environment (ODE)* - contains the native LynxOS BSP and system files for installing LynxOS on the target and host system.
- The *X Windows/Motif/ Posix Desktop* - contains the native LynxOS X & Motif system files. This CD also includes the LynxOS PosixWorks Desktop.

  The following table lists the CD-ROMs included with each development environment.

Table 1-1: LynxOS Development Environment CD-ROMs

Development Environment	Included CD-ROMs
ODEW (Windows Open Development Environment)	• Windows Cross Development Kit • Open Development Environment • X Windows/Motif/POSIX Desktop Development Package
ODEL (Linux Open Development Environment)	• Linux Cross Development Kit • Open Development Environment • X Windows/Motif/POSIX Desktop Development Package
ODEC (Solaris Open Development Environment)	• Solaris Cross Development Kit • Open Development Environment • X Windows/Motif/POSIX Desktop Development Package

NOTE: The x86 DRM and non-DRM ODEs are available as separate CD-ROMs.

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Cross Development and Native Development

LynxOS applications and kernels can be developed in two ways:

- Native Development

  Native development is the process of developing an application or kernel on the LynxOS system where the application is to be deployed. Native development provides users the ability to create, compile, and debug applications on the target board.

- Cross Development

  Cross development is the process of developing an application or kernel on a host system that uses a different configuration than the target system where the application is to be deployed.

  The LynxOS cross development environment includes LynxOS-specific compilers, linkers, libraries, and other development tools. The cross development environment provides developers the flexibility of creating LynxOS applications and kernels from a variety of platforms.

Native Development Installation Overview

For x86 hardware, LynxOS provides El Torito bootable CD-ROM support. Insert the ODE CD-ROM, power-up the system, and allow the system to boot to the `preboot` prompt. PowerPC systems can be booted directly from the LynxOS ODE CD-ROM.

LynxOS and the reference BSPs are installed from the LynxOS ODE CD-ROM. Use the **`installit`** utility to install LynxOS. After completing the installation, X Windows and Motif can be installed using the **`Install.XM`** script; refer to the Chapter 7, “X & Motif Installation Instructions” for details.

Cross Development System Installation Overview

LynxOS cross development hosts can be either UNIX- or Windows-based. While the installation procedure differs for each kind of host, there are general principles common to both.

For general information on both UNIX- and Windows-hosted cross development systems installation, see “Installing LynxOS Cross Development Systems” on page 11.

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UNIX-Hosted Cross Development Installation Overview

To install the Cross Development Kit (CDK) for UNIX and Linux-based hosts, use the CDK CD-ROM. The LynxOS CDK CD-ROM contains the CDKs for all supported processor families (x86, PowerPC and PowerQUICC). Go to the directory on the CD-ROM containing the LynxOS target processor tar files and extract them. To install the LynxOS files on the host, insert the ODE CD-ROM and extract the LynxOS tar files.

NOTE: While the CDK CD-ROM contains files for multiple target CPUs, LynxOS licenses only one CPU target architecture at a time.

For specific information on UNIX-hosted cross development systems installation, see “UNIX Cross Development Installation” on page 13.

Windows-Hosted Cross Development Installation Overview

Install the Cross Development Kit (CDK) for Windows-based systems using the CDK CD-ROM. The CDK for Windows hosts contains the CDK *only* for the specific development system’s target board. After inserting the CDK CD-ROM, the InstallShield installation wizard guides the user through the installation process.

NOTE: The CDK CD-ROM for Windows contains both the CDK development tools *and* the ODE LynxOS files.

For specific information on Windows-hosted cross development systems installation, see “Windows Cross Development Installation” on page 18.

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Before Installing

Review and complete the following sections before proceeding with the installation of LynxOS.

System Requirements

The following hardware requirements must be met before installing LynxOS on a system.

Table 1-2: System Requirements for LynxOS

Component	Requirement	
RAM (all platforms)	8 MB minimum 16 MB minimum for development systems 32 MB minimum for X & Motif 64 MB recommended for full development suite	
Hard Disk Space (x86)	LynxOS X Motif PosixWorks Desktop	127 MB 65 MB 35 MB 12 MB
Hard Disk Space (PowerPC)	LynxOS X Motif PosixWorks Desktop	167 MB 137 MB 179 MB 37 MB

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Hardware Checklist

Fill in the following table with your system's hardware before beginning the LynxOS installation:

Table 1-3: System Hardware Checklist

System Information	**Example**	
Processor Type	400 mhz. Pentium 2	
RAM	128 MB	
Hard Disk Information		
Bus Type (SCSI/IDE)	IDE	
Adapter Name	motherboard IDE Bus	
ID & Installation Partition	Master, IDE bus 1, partition a	
Networking Information		
Ethernet Adapter	Intel Pro100b	
IP Address	192.168.0.1	
Hostname	elmer	
Video Information		
Graphics Adapter	Diamond Stealth 64	
Monitor Max Resolution & Refresh Rate	1024x768@75hz	
Mouse Information		
Mouse Port	PS2	
Mouse Type	Logitech Mouseman	

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Basic Installation Overview

Use the following table to for basic installation steps. Refer to the relevant sections in this installation guide for detailed installation information.

Table 1-4: Overview of Installing & Starting LynxOS

Step	Procedure	for Native Development	for UNIX-hosted Cross Development	for Windows-hosted Cross Development
1	Determine Installation Type	Native	Cross, Unix hosts (Linux or Solaris)	Cross, Windows hosts
2	Locate Installation Media:	ODE for x86 or ODE for ppc	CDK & ODE for Linux, or CDK & ODE for Solaris	CDK for Windows (Contains both ODE and CDK components for Windows)
3	Begin Installation	1. Boot CD-ROM 2. Run **`installit`**	1. Untar CDK tar file 2. Untar ODE tar file	Double-Click **Setup.exe**, Select install options.

4	Start using LynxOS	Reboot system, Log in	1. Change to the LynxOS installation directory
			`$ cd \ /usr/lynx/4.0.0/<cpu>`
			where <*cpu*> is x86 or ppc
			2. Start the LynxOS environment:
			`$ . SETUP.bash`
				1. Open DOS prompt
				2. Start bash
				`C:\> bash`
				3. Change to the LynxOS installation directory
				`$ cd \ /lynx/4p0p0/usr/lynx/ \ 4.0.0/<cpu>`
				where <*cpu*> is x86 or ppc
				4. Start the LynxOS environment:
				`$ . SETUP.bash`

For detailed installation information, see		**x86** "LynxOS Native Development on x86 Systems" on page 21 **ppc** "LynxOS Native Development on PowerPC Systems" on page 25	**Linux/Solaris** "UNIX Cross Development Installation" on page 13	**Windows** "Windows Cross Development Installation" on page 18

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CHAPTER 2 *Installing LynxOS Cross Development Systems*

Introduction

This chapter details how to install the LynxOS cross development system software components.

A cross development system consists of a *host* computer, where the LynxOS cross development software components are installed for target system development. The target system is where the software is deployed.

The LynxOS cross development software can be installed on the following host operating systems:

- Sun/Solaris
- Linux
- Windows

NOTE: In this installation guide, the following terminology is used:

- *Windows* is used to collectively indicate all supported versions of Windows.
- *UNIX* is used to collectively indicate all supported versions of Sun/Solaris and Linux.

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Cross Development Core Software Components

The two core LynxOS cross development software components are:

- The LynxOS Cross Development Kit (CDK) - includes the GNU toolchain and all other development tools.
- The LynxOS Open Development Environment (ODE) - includes the LynxOS system files.

Installation of both core components is required for the LynxOS cross development system. Additional components can also be added to increase feature functionality.

For UNIX cross development hosts, the LynxOS CDK component must be installed *first*, followed by the ODE component.

This is important to note because installation of these components is different on Windows hosts:

- For UNIX cross development systems, the CDK and the ODE software components are installed from two separate CD-ROMs.
- For Windows cross development systems, both the CDK and the ODE software components are installed simultaneously from the same CD-ROM.

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Host/Target Matrix

LynxOS cross development software components are designed for use within the following host/target system matrix:

Table 2-1: Host/Target Matrix

Development Host	LynxOS Targets		
	x86	PowerPC	Power QUICC
Solaris	yes	yes	yes
Windows	yes	yes	yes
Linux	yes	yes	yes

UNIX Cross Development Installation

Use the following instructions to install the LynxOS cross development environment on the host. Installing the LynxOS CDK requires root privileges.

It is important to note that the LynxOS CDK package *must* be installed before the LynxOS ODE package. Failure to install these components in the correct order can result in problems with LynxOS.

1. Create a directory for LynxOS. Enter the following command on the host system:

   ```
   # mkdir /usr/lynx/release_num/target
   ```

   Where *release_num* is the LynxOS product release number and *target* is one of the following options: `x86` or `ppc`.

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For example, a user installing LynxOS 4.0 on an x86 platform would create the following directory:

```
/usr/lynx/4.0.0/x86
```

NOTE: If it is not possible to install the LynxOS CDK directly into this directory, install it in another directory, then link that directory to a directory with the same name as the directory above:

This can be done using the **`ln -s`** command. For example:

```
# ln -s /home/lynx/release_num/target /usr/lynx/release_num/target
```

The LynxOS CDK tools look for all libraries and tools under the directory `/usr/lynx/release_num/target`.

2. Insert the LynxOS CDK CD-ROM into the CD-ROM drive and mount it.

   To mount the CD-ROM to an available mount point, (`/mnt/cdrom` in this example) use the **`mount`** command.

   ```
   # mount /dev/cdrom /mnt/cdrom
   ```

   Where */dev/cdrom* is the CD-ROM device node name. Refer to the `mount` man page for additional usage options.

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3. Extract the LynxOS CDK tar files using **gnutar**. Enter the following commands to move to the installation directory and extract the tar files:

   ```
   # cd /usr/lynx/release_num/target
   ```

   ```
   # gnutar -xvzpf \
    /mnt/cdrom/tar_images/target/*.cdkhost.tar.gz ./
   ```

   In the command above, *release_num* represents LynxOS product release number and *host* is one of the following, depending on the host system:

   - SunOS/Solaris host- `sol1`
   - Linux host - `linux`

   The LynxOS CDK components are now installed.

NOTE: The **gnutar** utility is provided on the LynxOS CDK CD-ROM:

`/mnt/cdrom/target/cdk/host-objform-target/bin/gnutar`

`gnutar` can be copied from the LynxOS CDK CD-ROM to a cross development system with the `cp` command. For example,

```
# cd /mnt/cdrom/x86/cdk/sunos-coff-x86/bin
# cp gnutar /usr/bin/gnutar
```

---

4. Unmount the LynxOS CDK and remove it from the CD-ROM drive.
5. Insert the LynxOS ODE CD-ROM into the CD-ROM drive and mount it.
6. Change directory to the LynxOS installation directory:

   ```
   # cd /usr/lynx/release_num/target
   ```

   Where *release_num* represents the LynxOS product release number and *target* is one of the following: `x86` or `ppc`).

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7. Extract the ODE images by entering the following commands (assuming the CD-ROM mount point is `/mnt/cdrom`):

   ```
   # gnutar –xvzpf \
   /mnt/cdrom/tar_images/media_num.devos.tar.gz
   ```

   ```
   # gnutar -xvzpf \
   /mnt/cdrom/tar_images/media_num.bsp_bsp_name.tar.gz
   ```

   Where *media_num* is a LynuxWorks-assigned unique number, and *bsp_name* is the BSP name. Refer to *LynxOS Release Notes* for BSP names.

   The LynxOS ODE software component for UNIX-hosted cross development systems is now installed.

8. Unmount and remove the CD-ROM.

Once installed, the LynxOS ODE for UNIX-hosted cross development systems provides users with the LynxOS libraries, utilities, kernel objects, and other files necessary for developing LynxOS applications. See the chapter entitled “Quick Starting” in the *LynxOS User’s Guide* for information on using LynxOS.

This completes the LynxOS core installation for UNIX cross hosts.

The host system is now ready to develop target applications. However, several optional software components are available to enhance target application development. To install these onto the host system, refer to “Optional Software Installation for UNIX” on page 16.

Optional Software Installation for UNIX

The following sections outline optional LynxOS software installation:

- “Demo Files and KDI Files Installation on UNIX” on page 17
- “PosixWorks Desktop Installation for Solaris” on page 17

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Demo Files and KDI Files Installation on UNIX

Additional software components, such as demo files and Kernel Downloadable Image (KDI) files can also be installed. The following files are required:

media_num.kdi.tar.gz

media_num.demo_*bsp_name*.tar.gz

In the example above, *media_num* is replaced by a LynuxWorks-assigned numeric string, and *bsp_name* is replaced by the LynuxWorks-assigned BSP name; please refer to *LynxOS Release Notes* for BSP names.

PosixWorks Desktop Installation for Solaris

The PosixWorks Desktop is available for use with SunOS/Solaris hosted LynxOS systems. To install this components, use the following instructions:

1. Mount the CDK CD-ROM.
2. Enter the following command:

   ```
   # cd /usr/lynx/release_num
   ```

   where *release_num* represents the LynxOS product release number.
3. From this directory, extract the bundled component and mount it by entering the following command:

   ```
   # gnutar -xvzpf \
   /mnt/cdrom/tar_images/*.pw_cdkhost.tar.gz
   ```

   In the command above, the *host* variable is one of the following, depending on the host system:

- SunOS/Solaris hosts- `sol1`
- Linux hosts - `linux`

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Windows Cross Development Installation

The LynxOS cross development kit for Windows contains both the CDK and ODE software components on the same CD-ROM. These components are installed at the same time during the InstallShield installation.

NOTE: The LynxOS CDK/ODE CD-ROM for Windows is simply imprinted with the title “LynxOS CDK for Windows.”

In addition to the cross development software, the Windows CDK also contains the LynxOS BSP and system files.

Windows CDK/ODE Installation

The LynxOS CDK CD-ROM for Windows contains all components necessary for setting up a cross development host, including both CDK and ODE components.

To install these components, use the following instructions.

1. Close all programs.
2. Insert the LynxOS CDK CD-ROM into the CD-ROM drive.
3. When InstallShield starts, follow the instructions as appropriate.

   If Windows Autorun is not enabled, users can start the setup process by double-clicking on the **setup.exe** icon in the CD-ROM directory.

   Install Shield displays the following installation options:

   ```
   Win32 LynxOS release_num target CDK
   LynxOS release_num target X11
   LynxOS release_num target Motif
   LynxOS release_num target kdi
   VisualLynx
   ```

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4. Select the appropriate option and proceed through the installation as instructed by the Installshield process.

NOTE: The `Win32 LynxOS release_num target CDK` selection contains *both* the CDK and the ODE LynxOS components. This option must be installed first.

VisualLynux is an Integrated Development Environment that allows developers to build applications using the LynxOS Windows CDK. VisualLynux requires Microsoft Visual Studio to be installed on the host system. It also requires at least 1300 MB of disk space. InstallShield may require up to 50 percent additional disk space to unpack the cabinet files. For additional information, please refer to *VisualLynux Release Notes*.

Adding a Shortcut to the Desktop

Users can create a shortcut on the desktop that starts the bash prompt, changes to the LynxOS directory and starts the LynxOS environment. Use the following instructions to create a shortcut.

1. Right-click on desktop and select **New -> Shortcut**.
2. Type in the path to the `bash.exe` executable in the **Location of item** field. For example,

   ```
   C:\4p0p0\bin\bash.exe.
   ```

   When finished, click **Next**.
3. Type in a name for the shortcut, **LynxOS CDK**, for example, and click **finish**.
4. Right-click on the **LynxOS CDK** shortcut and select **Properties**.
5. In the **Shortcut** tab, modify the **Target** field to automatically execute the `SETUP.bash` or `SETUP.csh` script:

   ```
   C:\4p0p0\bin\bash.exe -rcfile SETUP.bash
   ```
6. Modify the **Start in** path to the LynxOS installation directory. For example,

   ```
   C:\4p0p0\usr\lynx\4.0.0\x86
   ```

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CHAPTER 3 *LynxOS Native Development on x86 Systems*

Introduction

This chapter provides details about installing LynxOS for native development on x86 systems.

The term *native development* describes a scenario in which the LynxOS host system hardware configuration is the same as that of the target system.

The LynxOS ODE installation CD-ROM is ISO9660-based and can be mounted on any machine that supports the ISO9660 format.

NOTE: El Torito bootable CD-ROM is available for LynxOS x86 installations.

LynxOS native installations use the provided **`installit`** utility to configure the LynxOS installation to the hardware configurations of the system.

Additionally, the ODE CD–ROM contains tar images in `/tar_images`. From this mounted CD-ROM, users can extract the compressed images. Each tar file corresponds to an installation component.

Before Installation

Review the system requirements before beginning the installation (see “System Requirements” on page 7). Additionally, review the Hardware Support Guide (available from http://www.lynuxworks.com and the LynxOS Documentation CD-ROM) for a complete list of supported hardware.

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Any existing data on the installation partition is overwritten during installation. Back up important files before installing LynxOS; see “Backing Up Existing Data” on page 23 for further information.

CAUTION! LynxOS does not support upgrade installations.

LynxOS overwrites the contents of the disk (or partition) when installed. Any existing data on the installation space will be permanently lost.

Also see “Planning Hard Disk Partitions” below for more on hard disk partitioning as it pertains to LynxOS.

LynxOS must be configured to the target system hardware. Before installing LynxOS, the user needs to draw up a list of installed hardware; see Table 1-3 on page 8 for further information.

Since the LynxOS installation process supports both serial terminals and graphical consoles, the installation process is text-based only; see “Installing a LynxOS x86 Native Development System” on page 23 for additional information.

Planning Hard Disk Partitions

For most installations, there are no requirements for a hard disk to be partitioned. LynxOS allows partitions and file systems to span an entire IDE or SCSI hard disk. However, partitioning does provide a form of disk management and crash recovery by assigning different applications/subsystems to different partitions. In this way, applications and/or subsystems do not compete for space in the same file system.

Although LynxOS does not require partitioning, certain BIOS limitations may require a maximum size allocatable to a partition. For hard disk sizes greater than this limit, a separate boot partition may need to be at the start of the hard disk. The remainder of the disk may be partitioned into one or more partitions. Consult the BIOS documentation for additional information.

To allow a partition to be bootable on an IDE drive, the following rules must be followed:

- On new disks, if the BIOS permits it, set the hard disk translation mode to `large` or `extended` before installation.
- On disks where another operating system has been installed, and LBA translation mode is enabled; or on new disks where the BIOS does not support hard disk translation mode, use the LynxOS **`mkpart`** command to

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force the LynxOS boot code to use LBA translation mode. LBA translation mode is enabled by entering the **`l`** command at the **`mkpart`** command prompt; this command toggles LBA translation mode between `enabled` and `disabled`.

For additional information on using `mkpart`, see "mkpart(1) man page" on page 123.

Backing Up Existing Data

LynxOS does not support upgrade installations; any installation of LynxOS overwrites data in the space in which it is installed. It is recommended that all existing data and files be backed up before performing installation. Refer to the LynxOS User's Guide for information on using `tar` to back up important data.

Installing a LynxOS x86 Native Development System

Use the following procedure to install LynxOS onto an x86 system for native development:

1. Insert the LynxOS ODE CD-ROM into the CD-ROM drive, and power-up the machine.

   The computer starts the LynxOS **`preboot`** utility, used to boot LynxOS from the CD-ROM drive. A boot prompt is displayed on the screen. If, after 10 seconds, no command is entered, `preboot` starts LynxOS from the CD-ROM.

2. Once LynxOS starts, run the installation utility by entering **`installit`** at the command prompt.

   ```
   # installit
   ```

   See Chapter 5, "Using installit" for step-by-step detailed instructions on how to use **`installit`**.

   During the installation process, the **`installit`** script allows the user to configure information about the target system. Users can select the components to install and the hardware available on the system.

   Quit the installation at any time by selecting **`Q`** or by typing **Ctrl–C**. If the installation is interrupted before successful completion, the user must enter the **`installit`** command to begin the installation again.

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CHAPTER 4 *LynxOS Native Development on PowerPC Systems*

Starting Installation

To install LynxOS onto a hard disk, it must first be booted from the ODE CD-ROM.

NOTE: Force PowerPC VME and CPCi boards do *not* support bootable CD-ROMs. Users installing LynxOS natively onto these types of Force boards must boot either through the system's network or use the **`x-dev`** command.

After LynxOS is booted, the **`installit`** script must be executed by entering `installit` at the command prompt.

During the installation process, the `installit` script gathers information about the installation system hardware and software by presenting several menus for the user to respond to. The user may quit the installation at any time by selecting **`Q`** in any of the menus, or by typing **Ctrl–C** on the keyboard. However, if the installation is interrupted before successful completion, the installer must enter the `installit` command and begin the installation again.

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Installing a LynxOS PowerPC Native Development System

CAUTION! Any existing data on the installation partition is overwritten during installation. On PowerPC systems, LynxOS always uses partition **a** as the installation partition. Please back up important information before installation; see the LynxOS User's Guide for additional information on using `tar` to backup important data.

LynxOS supports more than one type of PowerPC processor. Each CPU / board has its own firmware prompt. The differences in the installation procedure for LynxOS are described in the board-specific sections of this chapter.

For locating information that details installation for a specific board, see Table 4-1:

Table 4-1: Installing on Specific Manufacturer Boards

Manufacturer	Reference
Motorola PrPMC800 boards	See "Installing onto Motorola PrPMC800 Boards" on page 27
Motorola MVME products	See "Installing onto Motorola MVME Boards" on page 30.
Motorola MBX860 boards	See the *LynxOS Board Support Guide for MBX860/821*.
Motorola FADS8xx boards	See the *LynxOS Board Support Guide for MPC8xx FADS*.
Motorola VADS8260 boards	See the *LynxOS Board Support Guide for MPC8260 VADS*.
Cetia VMPCxx boards	See the section "Installing onto Cetia VMPCxx Boards" on page 32.
Cetia CVME boards	See the section "Installing onto Cetia CVME Boards" on page 34.
Force PMC/860 boards	See the *LynxOS Board Support Guide for Force Computers PMC/860* for instructions.

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Default Console

A PowerPC system needs either a VGA terminal connected to a video port or a terminal connected to the serial (`COM1`) port to serve as the console. By default, LynxOS performs an auto-detection test for the VGA terminal at boot time. If a VGA terminal is not found, the `COM1` port becomes the console.

NOTE: The auto-detection test is valid only if the VGA chip is present and the keyboard is connected.

By default, the console type is "dumb" when it comes up. However, it can be set to the appropriate type using an **`export`** command or by modifying the `/etc/ttys` file.

For example, type the following to use the **`export`** command:

```
export TERM=vt100at
```

This assumes the user has a `vt100` terminal. The user can also enter this command in the startup file.

To modify `/etc/ttys` for the same terminal type as the console, use a text editor to make the following changes:

```
# default for console
# /dev/con:0:default96:dumb:/bin/login
# change console to have no logins and set correct type
/dev/con:0:default96:vt100at:/bin/login
/dev/com1:0:default96:wyse50:/bin/login
/dev/com2:0:default96:wyse50:/bin/login
# enable logins on the VGA port
/dev/atc0:1:default:vt100at:/bin/login
```

Installing onto Motorola PrPMC800 Boards

The PrPMC800 processor board is a PMC card that connects to a PPMCBASE board,deriving its clock from the PPMCBASE board. The PrPMC800 board operates in Monarch or non-Monarch mode, depending on the PMC slot of the PPMCBASE board it is connected to. When connected to the Monarch slot, the board can access the PCI bus and can be booted from the network, disk, flash or cPCI backplane. When connected to the non-Monarch slot, the board can only be booted from either flash or a KDI download from the Monarch board.

This section contains the steps for installing and booting the PrPMC800 BSP. Before proceeding with the installation, the user must have a LynxOS cross development host system with which to create a bootable image.

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Once the PrPMC800 card is booted with this image, a LynxOS image can be copied to disk if there is one connected to the second PMC slot. The board can then boot directly from the disk.

Alternatively, abootable disk can be created by copying the LynxOS image and BSP to any PRePpartitioned disk, and connecting that disk to the base board.

Cross Development Kit installation

Users do not need to build separate kernels or KDIs for Monarch and non-Monarch operations of the board. The BSP is source and binary compatible for either mode.

Installing the PrPMC800 BSP

Insert the PrPM800 BSP CD in the cross development system. Untar the LynxOS and PrPMC800 bsp images in the same directory where the cross development system is installed.

The example in the *LynxOS Installation guide* uses the directory `/usr/lynx/`<*release_num*>`/`<*target*>, where <*release_num*> is the release number of LynxOS, and <*target*> is the target processor of the host.

The following example provides command line installation instructions for a a Linux Cross development System:

```
# mount /dev/cdrom /cdrom
# cd /usr/lynx/4.0.0/ppc/
# gnutar –xvzpf
 /cdrom/tar_images/<media_num>.devos.tar.gz
# gnutar –xvzpf
 /cdrom/tar_images/<media_num>.bsp.pmc800_drm.tar.gz
```

This extracts the complete LynxOS environment and the BSP specific files to the cross development directory.

Creating a Kernel downloadable Image (KDI)

Refer to the *LynxOS User's Guide* for instructions on how to create a Kernel Downloadable Image. No special steps are required for making KDIs for the PrPMC800 board.

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The PrPMC800 board can boot the same KDI in both Monarch and non-Monarch modes.

Booting the KDI using TFTP boot

The following steps are for booting a LynxOS KDI using PrPMC800's PPCBUG firmware:

Copy the KDI to default `tftpboot` location on the TFTP server machine. On the PPCBUG prompt of the PrPMC800 board, use the following command:

```
PPCBUG> nbo  0  0 172.17.3.15  172.17.3.14 \ pmc800.kdi
```

The CLUN and DLUN (0 0) above refer to the DEC ethernet controller on the PPMCBASE board. 172.17.3.15 is the IP address used for the PrPMC800 board. 172.17.3.14 is the IP address for the TFTP server.

Booting PrPMC800 in non-Monarch mode from flash

The following steps can be used to burn a KDI image on to the flash on PrPMC800 board and then using this image to boot the card in non-Monarch mode.

1. Put the PrPMC800 board in Monarch slot of the PPMCBASE board.
2. Type the following command:

   ```
   PPCBUG > nbo  0  0 172.17.3.15 \ 172.17.3.14
   pmc800.kdi

   PPCBUG> pflash 1F0000:<KDI size> F0200000
   ```

   (Be sure not to use the address range 0xF0000000 to 0xF0200000, because this is where the PPCBUG resides on PrPMC800. Also this command line assumes that tftpboot dumps the KDI at address 0x1F0000, if this address is different then supply the same in the above command line).
3. Take the card out from the Monarch slot and put it in the non-Monarch slot.
4. Type the following command:

   ```
   PPCBUG> g F0200020
   ```

   (This boots the KDI in non-Monarch mode).

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Uninstallation

To uninstall the build environment, delete the BSP directory.

Limitations

- ThePrPMC800 has only one COM port. The serial console, SKDB and kernel debug messages all share the same port.
- In non-Monarch mode the board cannot access any PCI devices.
- The PrPMC800 board does not have a real time clock. The user must use a network-based protocol for setting the correct time of day.

Installing onto Motorola MVME Boards

The real-time clock is disabled on new Motorola MVME boards. If the user has a new board, the real-time clock must be enabled before installing LynxOS. To enable the Motorola real-time clock, use the following instructions:

1. Use the **`set`** command at the **`PPC1-Bug`** (firmware) prompt to set the time, enabling the clock (Note that the `PPC1-Bug` prompt reflects the MVME platform.):

   ```
   PPC1-Bug> SET MMDDYYhhmm
   ```

2. Clear the BBRAM area by using the **`BF`** command at the `PPC1-Bug` prompt:

   ```
   PPC1-Bug> BF FFFC0000 FFFC0040 0
   ```

NOTE: The user needs to enable the real-time clock only once on any given MVME board. However, the BBRAM area can get corrupted over time and should be cleared before installing LynxOS.

The following commands assume that the CD-ROM device is at SCSI ID 6:

3. Insert the CD-ROM and power up the computer.
4. Press the **Break** or **Esc** key to enable the PPC1-Bug monitor.

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5. Enter the following command at the `PPC1-Bug` prompt:

   `pboot 0 60`

   where **`0`** is the **`CLUN`** and **`60`** is the **`DLUN`**

   If the CD-ROM device is at another SCSI ID, use the **`ioi`** command to determine the correct arguments for **`pboot`**. Consult the Motorola PPC1-Bug documentation for more information.

NOTE: At this time, the preboot prompt is displayed on the console. For more information on the **`preboot`** command, see Chapter 6, "Booting LynxOS" on page 79.

---

6. To boot LynxOS from a CD-ROM with SCSI ID 6, use the **`b`** command as follows:

   `Command?` **`b s6`**

   If the SCSI ID is not 6, change the `root` file system using the **`R`** command, and boot with the correct SCSI ID. For example:

   `Command?` **`R 1`** *`SCSI_ID`*

   `Command?` **`b s`***`SCSI_ID`*

   In the example above, *`SCSI_ID`* is the SCSI ID of the CD-ROM.

7. After LynxOS boots, start the installation utility by entering the **`installit`** command at the root (#) prompt.

8. Navigate through the menus and change the settings to match the hardware configuration. Some screens have help topics that provide additional information about available options; refer to "Using installit" on page 37 for more information.

9. The installed system must be rebooted. If the firmware is set to autoboot from the disk where LynxOS is installed, then the secondary installation starts. Otherwise, the user must use the appropriate boot command to boot from the disk.

   For example, assuming that LynxOS is installed on the hard disk with SCSI ID **`0`** and partition **`b`**, the following commands should be used to reboot (note that the first command is a firmware command, and the second is a preboot command):

   `PPC1-Bug>` **`pboot 0 0`**

   `Command?` **`b s0b`**

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Installing onto Cetia VMPCxx Boards

The following commands assume that the CD-ROM device is at SCSI ID 6.

1. Insert the CD-ROM and power up the computer.
2. Press any key to stop autoboot and enter the firmware.
3. Boot VMPCxx from the CD-ROM as follows:

   ```
   COMMAND> bop 60,c
   ```

   If the CD-ROM device is at another SCSI ID, use this command:

   ```
   COMMAND> bop SCSI_ID0, c
   ```

   where *SCSI_ID* is the SCSI ID of the CD-ROM.

NOTE: At this time, the preboot prompt is displayed on the console. For more information on the **preboot** command, see Chapter 6, “Booting LynxOS” on page 79.

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4. To boot LynxOS from the CD-ROM, enter the following command:

   ```
   COMMAND? b s6
   ```

   If the SCSI ID is *not* **6**, use the **R** command to set the root file system, and boot from the proper SCSI ID.

   ```
   COMMAND? R 1 SCSI_ID
   ```

   ```
   COMMAND? b sSCSI_ID
   ```

   where *SCSI_ID* is the SCSI ID of the CD–ROM.

5. After LynxOS boots, start the installation utility by entering the command **installit** at the prompt.
6. Navigate through the menus and change the settings to match the hardware configuration. Some screens have help topics that provide additional information about the available options. See Chapter 5, “Using installit” for further information.
7. The installed system must be rebooted. If the firmware is set to autoboot from the disk where LynxOS is installed, then the secondary installation starts. Otherwise, the user must use the appropriate boot command to boot from the disk.

   For example, assuming that LynxOS is installed on a hard disk with SCSI ID **0** and partition **b**, the following commands are used (Note that the first

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command is a firmware command, and the second is a preboot command.):

```
COMMAND> bop 0,c
Command? b s0b
```

Installing onto Cetia CVME Boards

The following commands assume that the CD-ROM device is at SCSI ID 6.

1. Insert the CD-ROM and power up the computer.
2. Press any key to stop autoboot and enter the firmware.
3. The installer has to initialize two firmware PReP boot selections:
   - Boot from the SCSI CD-ROM drive
   - Boot from the SCSI hard drive with the chosen SCSI ID

   For more details on the firmware commands, please refer to the *CVME Boot Firmware User Manual*.
4. To boot from a CD-ROM, the firmware must be configured as follows:
   - Run setup
   - Manage startup
   - Add a boot selection
   - Select type of boot required: **`PReP OS`**
   - New system partition
   - CD-ROM
   - Enter SCSI ID: **`6`**
   - Enter a name for this boot selection: **`PReP OS CD-ROM 6`**

     (The name chosen above is just a label with no significance.)
5. Since a disk boot is needed as soon as the CD-ROM installation is over, it should be configured at the same time as the CD-ROM boot. Assuming SCSI ID 0 is used:
   - Run setup
   - Manage startup

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- Add a boot selection
- Select type of boot required: **`PReP OS`**
- New system partition
- SCSI Hard Disk
- Enter SCSI ID: **`0`**
- Enter partition: **`0`**
- Enter a name for this boot selection: **`PReP OS disk 0`**

6. To boot from the CD-ROM, select the associated boot. At this time, the preboot prompt is displayed on the console.
7. To boot LynxOS from the CD-ROM, specify the **`LUN`** (Logical Unit Number) to the preboot utility, then boot from SCSI ID 6:

```
Command? C 10
Command? b s6
```

If the SCSI ID is not 6, use the **`R`** command to set the root file system and boot from the proper SCSI ID:

```
Command? R 1 SCSI_ID
Command? b sSCSI_ID
```

In the example above, *`SCSI_ID`* is the SCSI ID of the CD-ROM. A LynxOS kernel and minimum file system are copied into memory. This takes some time to complete, depending on the speed of the CD-ROM drive.

8. After LynxOS boots, start the installation utility by entering the **`installit`** command at the prompt.
9. Navigate through the menus and change the settings to match the hardware configuration. Some screens have help topics that provide additional information about available options; refer to “Using installit” on page 37 for more information.
10. The installed system must be rebooted. If the firmware is set to autoboot from the disk where LynxOS is installed, secondary installation will start. Otherwise, the user has to use the appropriate boot command to boot from the disk; refer to the *CVME Boot Firmware User Manual* for details. To boot from the disk, select the associated boot device.

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CHAPTER 5 *Using installit*

Introduction

This chapter provides instructions on using **`installit`** (the LynxOS native development installation utility) to install LynxOS onto native development system hard disks (including removable hard disks). `installit` in included on the LynxOS ODE CD-ROM.

Before running `installit`, complete the appropriate installation checklist for the type of system on which LynxOS is to be installed (see "Basic Installation Overview" on page 8).

The `installit` utility follows these four stages:

1. Selection of installation parameters, such as the location of the installation medium, the hard disk partition onto which LynxOS is to be installed (*destination* media), networking, and other parameters
2. Selection of the development modules from which to install LynxOS
3. Installation of LynxOS onto the development system's hard disk
4. Reconfiguration of LynxOS boot parameters from the development system's hard disk

After reconfiguring LynxOS to boot from the development system's hard disk, `installit` automatically reboots the system. After the system reboots, LynxOS is ready for application development, or installation of additional components.

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Backing Up Important Data

LynxOS installation overwrites existing data on disk onto which it is installed. Whether performing a new installation or an upgrade, be sure to back up important data.

If upgrading LynxOS to a newer version, LynuxWorks recommends that the following files be backed up:

- `/etc/passwd`
- `/etc/hosts`
- `/etc/fstab`
- `/etc/resolv.conf`
- `/net/rc.network`
- `/sys/cfg/pty.cfg`
- `/sys/lynx.os/CONFIG.TBL`
- `/sys/lynx.os/uparam.h`
- Any custom files under `/sys/dheaders/`
- Any custom files under `/sys/drivers/`

installit Interface, Restart and Quit Commands

Because LynxOS is designed to be installed on a wide range of systems, `installit` does not assume that a mouse is available. All `installit` menus are text-based menus, assuming that a monitor and a keyboard are always available on the development system.

For ease of use, `installit` is *case insensitive*, accepting either lower case or upper case commands. To select a particular menu item, simply type in the item number or first letter of that item, then hit **Enter**.

When waiting for a menu selection to be made, `installit` displays the default action for the particular menu in square brackets, for example: `[1]`. To select the default action, simply press the **Enter** key.

`installit` menus are designed so that after selecting an item, the user is presented with a new menu of increasingly detailed information. The user may return to a previous or parent menu by keying in the **R** command and pressing **Enter**. On returning to a previous menu, `installit` automatically selects the next menu item as the default option. In this manner, it is possible to navigate the entire `installit` menu tree.

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Typing **Q** and then pressing **Enter** in most `installit` menus causes the utility to quit without installing any files. `installit` prints the following message:

```
******** Aborting Installation ********
```

`installit` can be restarted at any time by quitting, and then typing the **`installit`** command at the root prompt.

Running installit

Welcome Message

After inserting the LynxOS ODE CD-ROM into the CD-ROM drive and booting the system, run **`installit`** by simply entering the command **`installit`** at the command prompt, then press **Enter**. On startup, `installit` displays the following message for all products:

```
Welcome to the LynxOS Installation Utility!
This script gathers all of the information needed to install LynxOS on
your particular hardware. It obtains this information by presenting
several menus for you to complete. If you are unsure about a menu
option, please refer to the Installation Guide or choose the help option
if one is available.
You may quit the installation by selecting 'Q' during any of
the menus or by typing '<Control>-<C>' at any time. If installit is
interrupted before successful completion, you will need to run it again.

IMPORTANT NOTE: Before proceeding with this installation, you should
backup all user and data files on your system. If you
have a previous version of LynxOS, refer to the Installation
Guide for a list of some important files that should be backed up.
Would you like to proceed with the installation? (y/n) [y]
```

Figure 5-1: Welcome Message

To terminate the installation, type the letter **n** then press the **Enter** key. Otherwise, simply press **Enter** to proceed with the installation.

NOTE: The initial screen is displayed on all LynxOS native development systems *except* PowerPC; see “First PowerPC Menu/Screen” below.

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First PowerPC Menu/Screen

On PowerPC systems *only*, the **Terminal Type Selection** Menu (shown below) is the first screen displayed after running `installit`.

```
        *** Terminal Type Selection Menu ***

        Current terminal type: dumb

        0) dumb terminal (dumb)
        1) vt100 console (vt100at)
        2) Wyse serial terminal (wyse50)
        3) vt100 serial terminal
        4) xterm (default mode of HyperTerm)
        5) linux (default mode of MiniCom)
        6) sun (default mode of TIP)

        C)ontinue installation

        Q)uit Installation

    Enter option or new terminal type: [1]
```

Figure 5-2: PowerPC Terminal Type Selection

`installit` supports installation via a serial line console. The following terminal emulator programs can be used with `installit`:

- TIP for SunOS (Solaris) hosts
- MiniCom for Linux hosts
- HyperTerm for Windows hosts

Terminal emulator programs must be configured to use the serial connection in the 9600/N81 mode. The 9600/N81 mode assumes the following settings:

baud rate	9600
parity	No
data bits	8
stop bit	1

Select the terminal and then enter option **C** to continue installation.

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Main Menu

The `installit` **Main Menu** displays the following options:

```
         *** Main Menu ***

         1) Modify Default Values
         2) Choose Products to Install

         Please make sure the Default Values and Products to
         install are correct before Beginning the Installation.

         B)egin Installation
         Q)uit Installation

     Enter Option: [1]
```

Figure 5-3: Main Menu

For a typical installation, the user must verify that all default installation values are correct and choose the products to install before continuing. As such, it is best to navigate through all of the menus.

Selecting the Distribution Media

The **Modify Default Values Menu**, shown below, allows the user to select the appropriate LynxOS installation media options. For instance, a CD-ROM drive can be connected to the system either through an IDE or SCSI interface.

```
         *** Modify Default Values Menu ***

         1) Install From:                IDE CD-ROM (ide.1)
         2) Install To:                  IDE Hard Disk (ide.0a)
         3) System Parameters:           default
         4) Virtual Memory:              no
            Swapfile name / size:        N/A / N/A
         5) Device Drivers and
            Driver Related Features
         6) Date, Time and Time Zone

         Q)uit Installation
         R)eturn to Previous Menu

     Enter option: [1]
```

Figure 5-4: Modify Default Values Menu

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The installation device for LynxOS is the IDE CD-ROM indicated by **`ide.1`** above. If this is correct, press **Enter**, and continue with selecting the **Install To**: device. If unsure, select 1 to view the **Install Media Selection Menu**, shown below.

```
        *** Install Media Selection Menu ***

        Installing LynxOS from: IDE CD-ROM (ide.1)

        1) SCSI Tape
        2) SCSI CD-ROM
        3) IDE CD-ROM

        Q)uit Installation
        R)eturn to Previous Menu

    Enter Option: [3]
```

Figure 5-5: Installation Media Selection Menu

Enter the option that is correct for the device from which LynxOS is being installed.

There are also several parameters that need to be entered for each LynxOS installation device.

Installing from a SCSI Tape Device

After entering option **1** (SCSI Tape) from the **Install Media Selection Menu**, the **SCSI Device Selection Menu** displays the following options:

```
        *** SCSI Device Selection Menu ***

        SCSI Tape attached to ISA Adaptec AHA 1520/1522 (st1522.4)

        1) Select SCSI Adapter:  st1522.4 (ISA Adaptec AHA 1520/1522)
        2) Select SCSI ID:       4
           Select Partition:     N/A

        Q)uit Installation
        R)eturn to Previous Menu

    Enter Option: [1]
```

Figure 5-6: SCSI Device Selection Menu

Enter the correct values and options for the LynxOS installation medium.

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Changing SCSI Adapter for x86 Systems

After entering **2** (SCSI CD-ROM) from the **Install Media Selection Menu**, the **SCSI Device Selection Menu** is displayed.

```
        *** SCSI Device Selection Menu ***

        SCSI CD-ROM attached to ISA  Adaptec AHA1540/1542 (sd1542.6)

        1) Select SCSI Adapter:     sd1542. (ISA  Adaptec AHA1540/1542)
        2) Select SCSI ID:          6
           Select Partition:        N/A

        Q)uit Installation
        R)eturn to Previous Menu

    Enter option: [1]
```

Figure 5-7: SCSI Device Selection Menu (x86)

Enter option **1** to view or change SCSI Adapter settings. The **SCSI Adapter Selection Menu** displays the following options:

```
        *** SCSI Adapter Selection Menu ***

        Current SCSI adapter for SCSI CD-ROM: sd1542. (sd1542.6)
           ISA  Adaptec AHA1540/1542

           ISA  Adaptec AHA1520/1522 (does not support CD-ROMs)
        2) ISA  Adaptec AHA1540/1542
        3) PCI  Adaptec AHA2940/2940W
        4) PCI  NCR 810/825

        Q)uit Installation
        R)eturn to Previous Menu

    Enter option: [2]
```

Figure 5-8: SCSI Adapter Settings (x86)

Enter the correct values and options on this screen.

draft

Changing SCSI Adapter for PowerPC Systems

After entering **2** from the **Install Media Selection Menu**, the **SCSI Device Selection Menu** is displayed the following options:

```
         *** SCSI Device Selection Menu ***

         SCSI CD-ROM attached to on-board SCSI (sdncr.6)

         1) Select SCSI Adapter:     sdncr. (on-board SCSI)
         2) Select SCSI ID:          6
            Select Partition:        N/A

         Q)uit Installation
         R)eturn to Previous Menu

      Enter Option: [1]
```

Figure 5-9: SCSI Device Selection Menu (PPC)

Enter option **1** to view or change SCSI Adapter settings; doing so displays the **SCSI Adapter Selection Menu** as follows:

```
         *** SCSI Adapter Selection Menu ***

         Current SCSI adapter for SCSI CD-ROM: sdncr. (sdncr.6)
            on board SCSI

         1) on board SCSI

         Q)uit Installation
         R)eturn to Previous Menu

      Enter option: [1]
```

Figure 5-10: SCSI Adapter Settings (PPC)

Enter the correct values and options on this screen, then return to the **SCSI Device Selection Menu**.

Once this is done, go to the section “Selecting ID for SCSI CD-ROM” on page 45 and continue.

draft

Selecting ID for SCSI CD-ROM

Enter option **2** from the **SCSI Device Selection Menu** to view the **SCSI ID Selection Menu**, shown below.

```
        *** SCSI ID Selection Menu ***

        Current SCSI ID of SCSI CD-ROM connected to
        PCI NCR 810/825: 6 (sdncr.6)

        0) SCSI ID 0
        1) SCSI ID 1
        2) SCSI ID 2
        3) SCSI ID 3
        4) SCSI ID 4
        5) SCSI ID 5
        6) SCSI ID 6

        Q)uit Installation
        R)eturn to Previous Menu

    Enter Option: [6]
```

Figure 5-11: SCSI ID Selection Menu

Enter the device ID of the SCSI CD-ROM drive. Now that the correct settings have been entered, return to the **Modify Default Values Menu**.

Installing from IDE CD-ROM

After entering option **3** (IDE CD-ROM) from the **Install Media Selection Menu**, the **IDE Device Selection Menu** displays the following options:

```
        *** IDE Device Selection Menu ***

        IDE CD-ROM attached to (E)IDE controller (ide.1)

        1) Select IDE Adapter:      ide. ((E)IDE controller)
        2) Select IDE ID:           1
           Select Partition:        N/A

        Q)uit Installation
        R)eturn to Previous Menu

    Enter Option: [1]
```

Figure 5-12: SCSI ID Selection Menu

draft

Selecting IDE Adapter

Enter option **1** tin the **IDE Device Selection Menu** to view or change the IDE Adapter settings on the **IDE Adapter Selection Menu**, which follows.

```
        *** IDE Adapter Selection Menu ***

        Current Adapter for IDE-CDROM: (ide.0) (E)IDE controller

        1) (E)IDE controller

        Q)uit Installation
        R)eturn to Previous Menu

    Enter Option: [1]
```

Figure 5-13: IDE Adapter Selection

`installit` supports only one IDE adapter.

Selecting IDE Device ID

Choose option **2** from the **IDE Device Selection Menu** to enter the IDE device ID from the **IDE ID Selection Menu**, shown below.

```
        *** IDE ID Selection Menu ***

        Current ID of IDE CD-ROM connected to (E)IDE controller: 0 (ide.0)

        0) Primary IDE controller, Master drive
        1) Primary IDE controller, Slave drive
        2) Secondary IDE controller, Master drive
        3) Secondary IDE controller, Slave drive

        Q)uit Installation
        R)eturn to Previous Menu

     Enter option: [0]
```

Figure 5-14: IDE Selection Menu

IDE IDs `0` and `1` refer to the primary IDE adapter master and slave devices, respectively. IDE IDs `2` and `3` refer to the secondary IDE adapter (not present on all systems) master and slave devices, respectively.

Now that the correct CD-ROM IDE settings have been entered or verified, return to the **Modify Default Values Menu** on the development system, then see “Selecting the Destination Media” on page 47.

draft

Selecting the Destination Media

Selecting the LynxOS destination media is similar to selecting the LynxOS installation device. Return to the **Modify Default Values Menu**, shown below, and enter option **2**.

```
        *** Modify Default Values Menu ***

        1) Install From:                IDE CD-ROM (ide.1)
        2) Install To:                  IDE Hard Disk (ide.0a)
        3) System Parameters:           default
        4) Virtual Memory:              no
           Swapfile name / size:        N/A / N/A
        5) Device Drivers and
           Driver Related Features
        6) Date, Time and Time Zone

        Q)uit Installation
        R)eturn to Previous Menu

     Enter option: [2]
```

Figure 5-15: Modify Default Values Menu

After entering option **2**, the **Installation Target Selection Menu** is displayed.

```
        *** Installation Target Selection Menu ***

        Installing LynxOS to:   IDE Hard Disk (ide.0a)
        1) SCSI Hard Disk
        2) IDE Hard Disk

        Q)uit Installation
        R)eturn to Previous Menu

     Enter Option: [2]
```

Figure 5-16: Installation Target Selection Menu

Enter the option that is correct for the development system upon which LynxOS is to be installed. There are two installation media options:

- *SCSI Hard Disk*: go to “Installing onto SCSI Hard Disk for x86” on page 48 and “Installing onto SCSI Hard Disk for PPC” on page 49 for more information.
- *IDE Hard Disk*: go to “Installing onto IDE Disk” on page 53 for more information.

draft

Installing onto SCSI Hard Disk for x86

After entering **1** from the **Installation Target Selection Menu**, the **SCSI Device Selection Menu** displays the following options:

```
        *** SCSI Device Selection Menu ***

        SCSI Hard Disk attached to on-board SCSI (sdncr.0a)

        1) Select SCSI Adapter:  sdncr. (PCI NCR 810/825)
        2) Select SCSI ID:       0
        3) Select Partition:     a

        Q)uit Installation
        R)eturn to Previous Menu

    Enter Option: [1]
```

Figure 5-17: SCSI Device Selection Menu (x86)

Enter option **1** in the **SCSI Device Selection Menu** to view or change SCSI Adapter settings on the **SCSI Adapter Selection Menu**, shown below.

```
        *** SCSI Adapter Selection Menu ***

        Current SCSI adapter for SCSI Hard Disk: sd1522. (sd1522.0a)
            ISA  Adaptec AHA1520/1522

        1) ISA  Adaptec AHA1520/1522
        2) ISA  Adaptec AHA1540/1542
        3) PCI  Adaptec AHA2940/2940W
        4) PCI  NCR 810/825

        Q)uit Installation
        R)eturn to Previous Menu

     Enter option: [1]
```

Figure 5-18: SCSI Adapter Selection Menu (x86)

The user must enter the correct values and options for the LynxOS destination hard disk, and then return to the **SCSI Device Selection Menu**.

draft

Enter option **2** on the **SCSI Device Selection Menu** to view the **SCSI ID Selection Menu**, shown below.

```
        *** SCSI ID Selection Menu ***

        Current SCSI ID of SCSI Hard Disk connected to
             PCI NCR 810/825: 0 (sdncr.0a)

        0) SCSI ID 0
        1) SCSI ID 1
        2) SCSI ID 2
        3) SCSI ID 3
        4) SCSI ID 4
        5) SCSI ID 5
        6) SCSI ID 6

        Q)uit Installation
        R)eturn to Previous Menu

    Enter Option: [0]
```

Figure 5-19: SCSI ID Selection Menu (x86)

Enter the destination SCSI hard disk's ID, then return to the **SCSI Device Selection Menu**.

Installing onto SCSI Hard Disk for PPC

After entering **1** from the **Installation Target Selection Menu**, the **SCSI Device Selection Menu** displays the following:

```
        *** SCSI Device Selection Menu ***

        SCSI Hard Disk attached to on-board SCSI (sdncr.0b)

        1) Select SCSI Adapter:   sdncr. (On-board SCSI)
        2) Select SCSI ID:        0
        3) Select Partition:      b

        Q)uit Installation
        R)eturn to Previous Menu

    Enter Option: [1]
```

Figure 5-20: SCSI Device Selection Menu (PPC)

draft

Enter option **1** in the **Installation Target Selection Menu** to view or change SCSI Adapter settings on the **SCSI Adapter Selection Menu**, shown below.

```
        *** SCSI Adapter Selection Menu ***

        Current SCSI Adapter for SCSI Hard Disk: sdncr. (sdncr.0b)
            On-board SCSI

        1) On-board SCSI

        Q)uit Installation
        R)eturn to Previous Menu

    Enter Option: [1]
```

Figure 5-21: SCSI ID Selection Menu (PPC)

The user needs to enter the correct values and options for the LynxOS destination device, then return to the **SCSI Device Selection Menu**.

Enter option **2** to view the **SCSI ID Selection Menu**, shown below.

```
        *** SCSI ID Selection Menu ***

        Current SCSI ID of SCSI Hard Disk connected to
            On-board SCSI: 0 (sdncr.0b)

        0) SCSI ID 0
        1) SCSI ID 1
        2) SCSI ID 2
        3) SCSI ID 3
        4) SCSI ID 4
        5) SCSI ID 5
        6) SCSI ID 6

        Q)uit Installation
        R)eturn to Previous Menu

    Enter Option: [0]
```

Figure 5-22: SCSI ID Selection Menu (PPC)

Enter the destination hard disk's SCSI ID, then return to the **SCSI Device Selection Menu**.

draft

Partitioning SCSI Devices (x86 or PPC)

Enter option **3** in the **SCSI Device Selection Menu** to view partitions. If the entered disk exists and partitions have already been created, the **Partition Configuration Menu** displays the following:

```
      *** Partition Configuration Menu ***

      Current partition: 2 (b) (sdncr.2b)

      0) Partition Info
         Partition 1 (a) (This partition is reserved for booting)
      2) Partition 2 (b)       9) Partition  9 (i)
      3) Partition 3 (c)      10) Partition 10 (j)
      4) Partition 4 (d)      11) Partition 11 (k)
      5) Partition 5 (e)      12) Partition 12 (l)
      6) Partition 6 (f)      13) Partition 13 (m)
      7) Partition 7 (g)      14) Partition 14 (n)
      8) Partition 8 (h)      15) Partition 15 (o)
     16) Create/Modify Disk Partitions

      Q)uit Installation
      R)eturn to Previous Menu

   Enter option: [2]
```

Figure 5-23: Partition Configuration Menu

If the selected disk exists, users can view the partition info by selecting option **0**. For instance:

```
   Current partitions:
   Space Available       total blocks (mb)   largest hole blocks (mb)
   base partitions:            336 (   0.16)          336 (   0.16)
   extended partition d:         0 (   0.00)            0 (   0.00)
   Partition   Boot       Megabytes      Id  Symbolic Name
       a        *            0.07        65  (PowerPC boot partition)
       b                   999.98        64  (LynxOS)
       c                  1000.00        64  (LynxOS)
       d                  6748.00*        5  (DOS Extended)
       e                   499.98        64  (LynxOS)
       f                   499.98        64  (LynxOS)
       g                   499.98        64  (LynxOS)
       h                   499.98        64  (LynxOS)
       i                   499.98        64  (LynxOS)
       j                   499.98        64  (LynxOS)
       k                   499.98        64  (LynxOS)
       l                   499.98        64  (LynxOS)
       m                   499.98        64  (LynxOS)
       n                   499.98        64  (LynxOS)
       o                  1747.98        64  (LynxOS)

   Press <Enter> to continue:
```

Figure 5-24: Partition Information

draft

NOTE: On the PowerPC, partition 1 (a) is reserved for booting.

To create or modify a disk partition, select option **16**.

```
        *** Disk Partitioning Menu ***

        Modify partitions on SCSI Hard Disk (sdncr.0)

        DISK PARTITIONING DESTROYS ALL DATA ON THE MODIFIED PARTITIONS!

        1) Modify current partitioning (using mkpart)
        2) Use default partitioning
        partition 1 (a): entire disk

        H)elp
        Q)uit Installation
        R)eturn to Previous Menu

    Enter Option: [R]
```

Figure 5-25: Disk Partition Menu

If the user enters option **1** to modify or create new partitions, `installit` invokes **`mkpart`**. For additional information on using `mkpart`, see “mkpart(1) man page” on page 123.

NOTE: The boot partition on SCSI disks cannot be greater than 1 GB. If your SCSI hard disk is greater than 1 GB, it must be divided into two or more partitions.

Now that the correct partition settings have been entered or verified, return to the **Modify Default Values Menu** on the development system, then see “Setting System Parameters” on page 57.

draft

Installing onto IDE Disk

After entering option **2** from the **Installation Target Selection Menu**, the **IDE Device Selection Menu** displays the following options:

```
        *** IDE Device Selection Menu ***

        IDE Hard Disk attached to (E)IDE controller (ide.0a)

        1) Select IDE Adapter:    ide. ((E)IDE controller)
        2) Select IDE ID:         0
        3) Select Partition:      a

        Q)uit Installation
        R)eturn to Previous Menu

    Enter Option: [1]
```

Figure 5-26: IDE Device Selection Menu

Changing IDE Adapter

Enter option **1** on the **IDE Device Selection Menu** to view or change IDE Adapter settings. The **IDE Adapter Selection Menu** appears, as shown below, confirming the selection.

```
        *** IDE Adapter Selection Menu ***

        Current Adapter for IDE-CDROM:(ide.0) (E)IDE controller

        1) (E)IDE controller

        Q)uit Installation
        R)eturn to Previous Menu

    Enter Option: [1]
```

Figure 5-27: IDE Adapter Selection Menu

`installit` supports only one IDE adapter; press the **Enter** key to select option **1**.

draft

IDE Device ID

Select **2** from the **IDE Device Selection Menu** to display the **IDE ID Selection Menu**, shown below.

the **IDE Device Selection Menu** to select the IDE device ID.

```
         *** IDE ID Selection Menu ***

         Current ID of IDE Hard Disk connected to (E)IDE controller: 0
             (ide.0a)

         0) Primary IDE controller, Master drive
         1) Primary IDE controller, Slave drive
         2) Secondary IDE controller, Master drive
         3) Secondary IDE controller, Slave drive

         Q)uit Installation
         R)eturn to Previous Menu

     Enter option: [0]
```

Figure 5-28: IDE Selection Menu

Device IDs **0** and **1** refer to the primary IDE adapter master and slave devices, respectively. Device IDs **2** and **3** refer to the secondary IDE adapter (not present on all systems) master and slave devices, respectively.

Enter the device ID of the destination hard disk.

draft

Partitioning IDE Disk

Return to the **IDE Device Selection Menu** and enter option **3** to view partitions.

If the entered disk exists and partitions have already been created, the **Partition Configuration Menu** displays partition information, as shown below.

```
        *** Partition Configuration Menu ***

        Current partition: 1 (a) (ide.0a)

        0) Partition Info
        1) Partition 1 (a)
        2) Partition 2 (b)       9) Partition  9 (i)
        3) Partition 3 (c)      10) Partition 10 (j)
        4) Partition 4 (d)      11) Partition 11 (k)
        5) Partition 5 (e)      12) Partition 12 (l)
        6) Partition 6 (f)      13) Partition 13 (m)
        7) Partition 7 (g)      14) Partition 14 (n)
        8) Partition 8 (h)      15) Partition 15 (o)
        16) Create/Modify Disk Partitions

        Q)uit Installation
        R)eturn to Previous Menu

    Enter option: [1]
```

Figure 5-29: IDE Partition Configuration Menu

If the selected disk exists, users can view its partition info by selecting option **0**. For instance:

```
    Current partitions:
    Space Available     total blocks (mb)   largest hole blocks (mb)
    base partitions:      10080 (   4.92)           10080 (   4.92)
    Partition   Boot        Megabytes     Id  Symbolic Name
        a        *          7000.84       64  (LynxOS)
        b                   7000.88       64  (LynxOS)
        c                   5551.88       64  (LynxOS)
        d                   15.75         64  (LynxOS)

    Press <Enter> to continue:
```

Figure 5-30: IDE Partition Information

draft

Selecting option **16** from the **Partition Configuration Menu** will display the **Disk Partitioning Menu**.

```
        *** Disk Partitioning Menu ***

        Modify partitions on IDE Hard Disk (ide.0)

        DISK PARTITIONING DESTROYS ALL DATA ON THE MODIFIED PARTITIONS!

        1) Modify current partitioning (using mkpart)
        2) Use default partitioning
           partition 1 (a): entire disk

        H)elp
        Q)uit Installation
        R)eturn to Previous Menu

    Enter option: [R]
```

Figure 5-31: IDE Disk Partitioning Menu

Enter option **1** to modify or create new partitions. `installit` invokes **`mkpart`**. For additional information on using `mkpart`, see “mkpart(1) man page” on page 123.

NOTE: The boot partition on IDE disks must be located starting in the first 8 GB (0 to 8 GB) of storage space in the hard disk.

Now that the correct partition settings have been entered or verified, return to the **Modify Default Values Menu** on the development system, and see “Setting System Parameters” on page 57.

draft

Setting System Parameters

To set the system parameters, return to the **Modify Default Values Menu**, shown below, and enter option **3**.

```
         *** Modify Default Values Menu ***

         1) Install From:                IDE CD-ROM (ide.1)
         2) Install To:                  IDE Hard Disk (ide.0a)
         3) System Parameters:           default
         4) Virtual Memory:              no
            Swapfile name / size:        N/A / N/A
         5) Device Drivers and
            Driver Related Features
         6) Date, Time and Time Zone

         Q)uit Installation
         R)eturn to Previous Menu

      Enter option: [3]
```

Figure 5-32: Modify Default Values Menu

After entering **3**, the **System Parameter Configuration Menu** displays the following:

```
         *** System Parameter Configuration Menu ***

         Current System Parameters: default

         1) Default values
         2) Development System Values (requires at least 10MB RAM)

         Q)uit Installation
         R)eturn to Previous Menu

      Enter Option: [1]
```

Figure 5-33: System Parameter Configuration Menu

The **Default values** are recommended for most LynxOS installations. If LynxOS is going to be used for software development and debugging, the **Development Systems Values** option is recommended. As noted in the menu, the development system values require at least 16 MB of memory (RAM).

draft

Setting Virtual Memory Options

To set or verify the virtual memory (swap file system) options, the user must return to the **Modify Default Values Menu**, shown below.

```
        *** Modify Default Values Menu ***

        1) Install From:                IDE CD-ROM (ide.1)
        2) Install To:                  IDE Hard Disk (ide.0a)
        3) System Parameters:           default
        4) Virtual Memory:              no
           Swapfile name / size:        N/A / N/A
        5) Device Drivers and
           Driver Related Features
        6) Date, Time and Time Zone

        Q)uit Installation
        R)eturn to Previous Menu

     Enter option: [4]
```

Figure 5-34: Modify Default Values Menu

All LynxOS processes and threads run in virtual memory, that is, addressing is virtual and is mapped to the underlying physical RAM by the system's memory management unit (MMU). LynxOS also supports demand-paged virtual memory (sometimes just called "virtual memory"). When demand-paging is not enabled, the number of simultaneously executable processes is limited by the amount of available physical RAM. When demand-paging is enabled, LynxOS (as needed and on demand) clears up physical RAM to make room for more processes. To do this, LynxOS copies pages of RAM to the *swapfile* residing on a hard disk or any other mass storage device. When these pages are needed again, LynxOS makes space for them in physical RAM (by *paging out* other pages) and *paging in* the needed pages.

For most embedded applications, demand-paging *should not* be enabled. The main reason for this is to avoid performance penalties associated with paging in and paging out of required pages of memory. Demand paging is *disabled by default*.

draft

To enable or disable demand-paging, enter option **4** from the **Modify Default Values Menu**, which displays the **Virtual Memory Configuration Menu** as follows:

```
         *** Virtual Memory Configuration Menu ***

         1) Install Virtual Memory:       no
            Swapfile type:                N/A
            Swapfile name:                N/A
            Size:                         N/A

         Q)uit Installation
         R)eturn to Previous Menu

      Enter option: [1]
```

Figure 5-35: Virtual Memory Configuration Menu, disabled

To enable demand paging, enter option **1**.

NOTE: The swapfile type, swapfile name, and size *cannot* be modified until demand paging is enabled.

Entering **1** on the **Virtual Memory Configuration Menu**, shown below, toggles demand-paged virtual memory. When it is enabled, the menu allows the user to select virtual memory type, name, and size parameters.

```
         *** Virtual Memory Configuration Menu ***

         1) Install Virtual Memory:        yes
            Swapfile type:                 Contiguous File
            Swapfile name:                 /.swap
            Size:                          32M

         Q)uit Installation
         R)eturn to Previous Menu

      Enter option: [1]
```

Figure 5-36: Virtual Memory Configuration Menu, enabled

There are two swapfile types supported by LynxOS:

- A contiguous file created in the root filesystem - To select this option, enter **1** on the **Swapfile Type Menu**.
- A separate disk partition that is used *only* for swapping (paging) pages in and out. To select this option, enter **2** on the **Swapfile Type Menu**.

draft

Virtual Memory Contiguous File Settings

To change the swapfile name, enter option **3** in the **Virtual Memory Configuration** Menu. The following is displayed:

```
        *** Swapfile Name Menu ***

        Current Swapfile Name: /.swap

        Q)uit Installation
        R)eturn to Previous Menu

    Enter option or New Swapfile Name: [/.swap]
```

Figure 5-37: Swapfile Name Menu

To change the name of the file, simply key in the new swapfile name in the `Enter option or New Swapfile Name:` field.

To change the swapfile size, enter option **4** from the **Virtual Memory Configuration Menu**. Doing this displays the **Swapfile Size Configuration Menu**, shown below.

```
        *** Swapfile Size Configuration Menu ***

        Current Swapfile Size: 32M

        H)elp
        Q)uit Installation
        R)eturn to Previous Menu

    Enter option or Swapfile size: [32M]
```

Figure 5-38: Swapfile Size Configuration Menu

To change the swapfile size, simply enter the new Swapfile size at the `Enter option or Swapfile size:` prompt. For help on this topic, enter the **H** option. In most cases, setting the swapfile size to twice the amount of physical RAM provides optimal performance. For systems running large applications, such as X Windows-based applications, additional swap space may be required.

Return to the **Modify Default Values Menu** on the development system, and see “Configuring Device Driver Parameters” on page 62.

draft

Virtual Memory Raw Partition Settings

After selecting raw swapfile type from the **Swapfile Type Menu**, the **Virtual Memory Configuration Menu** displays the following information:

```
        *** Virtual Memory Configuration Menu ***

        1) Install Virtual Memory:       yes
        2) Swapfile type:                Raw Partition
        3) Swapfile device:              ide.0b
            Size:                         N/A
        Q)uit Installation
        R)eturn to Previous Menu

    Enter Option: [3]
```

Figure 5-39: Virtual Memory Configuration Menu

The swapfile partition must not be the same as the LynxOS installation partition. To change the swapfile partition, enter option **3** the **Virtual Memory Configuration Menu**. Doing this displays the **Swap Partition Menu**, as shown below.

```
        *** Swap Partition Menu ***

        Current Swap Partition: IDE Hard Disk (ide.0b)
        1) SCSI Hard Disk
        2) IDE Hard Disk

        Q)uit Installation
        R)eturn to Previous Menu

    Enter Option: [2]
```

Figure 5-40: Swap Partition Menu

Selecting swap partition is identical to selecting the installation partition; see the following sections depending on the development system: “Installing onto SCSI Hard Disk for x86” on page 48, “Installing onto SCSI Hard Disk for PPC” on page 49, “Installing onto IDE Disk” on page 53.

Return to the **Modify Default Values Menu** on the development system, then see “Configuring Device Driver Parameters” below.

draft

Configuring Device Driver Parameters

To configure device driver parameters, enter option **5** on the **Modify Default Values Menu**:

```
        *** Modify Default Values Menu ***

        1) Install From:                IDE CD-ROM (ide.1)
        2) Install To:                  IDE Hard Disk (ide.0a)
        3) System Parameters:           default
        4) Virtual Memory:              no
           Swapfile name / size:        N/A / N/A
        5) Device Drivers and
           Driver Related Features
        6) Date, Time and Time Zone

        Q)uit Installation
        R)eturn to Previous Menu

    Enter option: [5]
```

Figure 5-41: Modify Default Values Menu

After entering option **5**, the **Modify Device Driver/Driver Related Features Menu** displays the following:

```
        *** Modify Device Driver / Driver Related Features Menu ***

        1) Networking
        2) PS2 Compatible Mouse Driver: no

        Q)uit Installation
        R)eturn to Previous Menu

    Enter Option: [1]
```

Figure 5-42: Modify Device Driver/Driver Related Features Menu

To install a PS2 compatible mouse, enter option **2**; see “Selecting a PS2 Mouse” on page 67. If networking parameters need to be configured, see “Configuring Networking Parameters” below.

Configuring Networking Parameters

To configure networking parameters, enter option **1** from the **Modify Device Driver/ Driver Related Features Menu**.

draft

`installit` allows the primary ethernet interface to be chosen, the IP address to be configured, the host name to be set, and provides the option to install NFS.

NOTE: The default options are *not* suitable; at a minimum the IP address needs to be changed. In addition, the default Ethernet device may not be correct.

The second and subsequent network devices (or devices not shown here) cannot be configured from `installit` and must be added after installation, either by running the `/usr/bin/Install.tcpip` script, or manually, after the addition of appropriate device drivers.

After entering **1** from the **Modify Device Driver/Driver Related Features Menu**, the **Modify Networking Default Values Menu** displays the following:

```
        *** Modify Networking Default Values Menu ***

        1) Network Interfaces
           Ethernet Card:              SMC EtherPower (smc0)
        2) TCP/IP:                     yes
           Hostname / IP Address:      lynxdemo / 10.0.0.1
        3) NFS:                        yes
           NFS Server / File Locking:  yes / yes
           NFS Client / Client Cache:  yes / yes

        Q)uit Installation
        R)eturn to Previous Menu

    Enter Option: [1]
```

Figure 5-43: Modify Networking Default Values Menu

To select a network interface card, enter option **1**; see “Selecting an Ethernet Card (x86)” on page 64.

To enable/disable TCP/IP, or to change the host name or IP address, enter option **2**; see “Configuring TCP/IP” on page 65.

To enable/disable NFS and to change NFS parameters, enter option **3**; see “Configuring NFS” on page 67.

draft

Selecting an Ethernet Card (x86)

To select an Ethernet card on x86 development systems, enter option **1** on the **Ethernet Adapter Selection Menu**.

```
         *** Ethernet Adapter Selection Menu ***

         Current ethernet adapter: SMC EtherPower (smc0)

         0) None
         1) WD/SMC Elite
         2) SMC Elite Ultra
         3) 3Com 3C509
         4) 3Com 3C579
         5) SMC EtherPower
         6) AMD Am79C970A
         7) SMC EtherPower II
         8) NE2000 compatible
         9) Intel 82558 Pro
        10) 3Com 3C900,3C905,3C905B
        11) 3Com 3C589

         Q)uit Installation
         R)eturn to Previous Menu

     Enter option: [5]
```

Figure 5-44: Ethernet Adapter Selection Menu (x86)

Enter the appropriate Ethernet adapter, then return to the **Modify Networking Default Values Menu** on the development system to continue configuring the appropriate network parameters.

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Selecting an Ethernet Card (PPC)

To select an Ethernet card on PPC development systems, enter option **1** on the **Ethernet Adapter Selection Menu**.

```
        *** Ethernet Adapter Selection Menu ***

        Current ethernet adapter: dec21040 / SMC EtherPower (dec0)

        0) None
        1) dec21040 / SMC EtherPower
        2) Am79c970 / AMD Am79C970A
        3) PowerQUICC SCC1 (821/860 only)
        4) Intel 82558 Pro

        Q)uit Installation
        R)eturn to Previous Menu

    Enter option: [1]
```

Figure 5-45: Ethernet Adapter Selection Menu

Enter the appropriate Ethernet adapter, then return to the **Modify Networking Default Values Menu** on the development system to continue configuring network parameters as appropriate.

Configuring TCP/IP

To configure TCP/IP parameters, enter option **2** on the **Modify Networking Default Values Menu**. This displays the **TCP/IP Configuration Menu** as follows:

```
        *** TCP/IP Configuration Menu ***

        1) Install TCP/IP:            yes
        2) Hostname:                  lynxdemo
        3) IP Address:                10.0.0.1

        Q)uit Installation
        R)eturn to Previous Menu

    Enter Option: [2]
```

Figure 5-46: TCP/IP Configuration Menu

TCP/IP is enabled by default. To toggle TCP/IP, enter option **1**.

NOTE: Changing the host name or the IP address is not permitted by `installit` unless TCP/IP is enabled.

---

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Setting Host Name

To change the host name, enter option **2** on the **TCP/IP Configuration Menu**. Doing this displays the **Hostname Configuration Menu** as follows:

```
        *** Hostname Configuration Menu ***

        Current Hostname: lynxdemo

        H)elp
        Q)uit Installation
        R)eturn to Previous Menu

    Enter option or new Hostname: [lynxdemo]
```

Figure 5-47: Hostname Configuration Menu

To change the host name, key in the name, then press **Enter**.

Configuring IP Address

After entering the host name, return to the **TCP/IP Configuration Menu** and enter option **3**. Doing this displays the **IP Address Configuration Menu**, shown below.

```
        *** IP Address Configuration Menu ***

        Current IP Address: 10.0.0.1

        H)elp
        Q)uit Installation
        R)eturn to Previous Menu

    Enter option or new IP address: [10.0.0.1]
```

Figure 5-48: IP Address Configuration Menu

To change the IP address, simply type the new IP address and press **Enter**.

After completing the TCP/IP configuration, return to the **Modify Networking Default Values Menu**.

NOTE: Any special netmask requirements must be added after installation.This is typically done by creating a `/net/rc.local` file and inserting appropriate `ifconfig` commands into it.

---

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Configuring NFS

To configure NFS, enter option **3**, which brings up the **NFS Configuration Menu**, as shown below.

```
        *** NFS Configuration Menu ***

        1) Install NFS:               yes
        2) Enable Server:             yes
        3) Enable Client:             yes
        4) Enable Client Cache:       yes
        5) Enable File Locking:       yes

        Q)uit Installation
        R)eturn to Previous Menu

    Enter Option: [2]
```

Figure 5-49: NFS Configuration Menu

NFS installation is *enabled by default*. To enable or disable NFS, enter option **1**. If NFS installation is disabled, `installit` does not permit the other NFS parameters to be changed. To enable or disable any of the other parameters (assuming NFS is enabled), simply enter the appropriate option and press **Enter**.

If `Enable Server` and `Enable Client` are both disabled, `installit` automatically disables `Install NFS:`.

Selecting a PS2 Mouse

To select a PS2 mouse, choose option **2** from the **Modify Device Driver/Drive Related Features Menu**.

```
        **** Modify Device Driver/ Driver Related Features Menu ****

        1) Networking
        2) PS2 compatible Mouse Driver: yes

        Q)uit Installation
        R)eturn to Previous Menu

    Enter Option [R].
```

Figure 5-50: Modify Device Driver/Driver Related Features Menu

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Setting Date, Time and Time Zone

To set or verify the date, time and time zone values, return to the **Modify Default Values Menu** and select option **6**.

```
        *** Modify Default Values Menu ***

        1) Install From:                IDE CD-ROM (ide.1)
        2) Install To:                  IDE Hard Disk (ide.0a)
        3) System Parameters:           default
        4) Virtual Memory:              no
           Swapfile name / size:        N/A / N/A
        5) Device Drivers and
           Driver Related Features
        6) Date, Time and Time Zone

        Q)uit Installation
        R)eturn to Previous Menu

    Enter option: [6]
```

Figure 5-51: Modify Default Values Menu

The following menu is displayed.

```
        *** Modify Date, Time and Time Zone Menu ***

        1) Date:                        2001/10/31
        2) Time:                        05:28:40
        3) Use TZ environment variable: no
        4) Time Zone:                   480 minutes east(-)/west(+) of
    Greenwich
        5) Daylight Savings Type:       1 (USA)

        Q)uit Installation
        R)eturn to Previous Menu

    Enter option: [1]
```

Figure 5-52: Modify Date, Time, and Time Zone Menu

Enter option **1** to modify the date.

```
        *** Modify Date Menu ***

        Current date: 2001/10/31

        Q)uit Installation
        R)eturn to the previous menu

    Enter a new date: [2001/10/31]
```

Figure 5-53: Modify Date Menu

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After changing the date, return to the **Modify Date, Time and Time Zone Menu** and select option **2** to enter a new time.

```
*** Modify Time Menu ***

    Current time: 05:44:48

    Q)uit Installation
    R)eturn to Previous Menu

Enter a new time: [05:44:48]
```

Figure 5-54: Modify Time Menu

There are two ways to set a time zone. One way (default) is to use a value of minutes east (-) or west (+) of Greenwich Mean Time and setting a daylight savings type. The second way is to use the TZ environment variable. To enable or disable use of the TZ environment variable, select option **3** from the **Modify Date, Time and Time Zone Menu**. The **Modify Date, Time and Time Zone Menu** changes appropriately.

```
 *** Modify Date, Time and Time Zone Menu ***

   1) Date:                       2001/10/31
   2) Time:                       06:42:53
   3) Use TZ environment variable: yes
   4) TZ environment variable:    PST8PDT9,M4.1.0/02:00:00,M10.5.0/02:00:00

    Q)uit Installation
    R)eturn to Previous Menu

Enter option: [4]
```

Figure 5-55: Modify Date, Time and Time Zone Menu, TZ enabled

.

```
*** Modify Date, Time and Time Zone Menu ***

    1) Date:                        2001/10/31
    2) Time:                        05:28:40
    3) Use TZ environment variable: no
    4) Time Zone:                   480 minutes east(-)/west(+) of
Greenwich
    5) Daylight Savings Type:       1 (USA)

    Q)uit Installation
    R)eturn to Previous Menu

Enter option: [4]
```

Figure 5-56: Modify Date, Time and Time Zone Menu, GMT enabled

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To set the time zone using the default way, select option **4** from the **Modify Date, Time and Time Zone Menu** when use of the TZ environment variable is turned off. The following menu is displayed.

```
      *** Modify Time Zone Menu ***

         Current time zone: 480 Minutes east (-) or west (+) of Greenwich
          1)  720 KJT (Kwajalein Is.)              18) -180 MSK/MSD (Asia: W Russia)
          2)  660 SST (Samoa)                      19) -210 IT (Iran)
          3)  600 HST (US Hawaii)                  20) -240 SMT (Asia: Seychelles)
          4)  540 AKST/AKDT (US Alaska)            21) -270 AFT (Afghanistan)
          5)  480 PST/PDT (US Pacific)             22) -300 PKT (Asia: Pakistan)
          6)  420 MST/MDT (US Mountain)            23) -330 IST (India)
          7)  360 CST/CDT (US Central)             24) -345 NPT (Nepal)
          8)  300 EST/EDT (US Eastern)             25) -360 NSK/NSD (Asia:Bangladesh)
          9)  240 AST/ADT (Atlantic)               26) -390 BMT (Burma)
         10)  210 NST (Newfoundland)               27) -420 ISK/ISD (Asia: China)
         11)  180 WGT/WGT DST (Western Greenland)  28) -480 WST (Western Australia)
         12)  120 MGT/MGT DST (Middle Greenland)   29) -540 JST (Asia: Japan)
         13)   60 EGT/EGT DST (Eastern Greenland)  31) -570 CST (Central Australia)
         14)    0 WET/WET DST (Western Europe)     32) -600 EST (Eastern Australia)
         16)  -60 MET/MET DST (Middle Europe)      33) -660 PSK/PSD (Asia: E Russia)
         17) -120 EET/EET DST (Eastern Europe)     34) -720 NZST/NZDT (New Zealand)

          Q)uit Installation
          R)eturn to Previous Menu

      Enter option or new time zone as minutes east(-)/west(+) of Greenwich:
      [480]
```

Figure 5-57: Modify Time Zone Menu

After changing the time zone, return to the **Modify Date, Time and Time Zone Menu** and select option **5** to select daylight savings type. The **Modify Daylight Savings Type Menu** is shown.

```
      *** Modify Daylight Savings Type Menu ***

         Current daylight savings type: 1 (USA)

         0) None
         1) USA
         2) Australia
         3) Eastern Europe
         4) Central Europe
         5) Western Europe

         Q)uit Installation
         R)eturn to Previous Menu

      Enter option: [1]
```

Figure 5-58: Modify Daylight Savings Type Menu

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To set the time zone using the TZ environment variable, select option **4** from the **Modify Date, Time and Time Zone Menu** when the TZ environment variable is enabled.

```
          *** Modify Date, Time and Time Zone Menu ***

        1) Date:                        2001/10/31
        2) Time:                        06:42:53
        3) Use TZ environment variable: yes
        4) TZ environment variable:     PST8PDT9,
    M4.1.0/02:00:00,M10.5.0/02:00:00

        Q)uit Installation
        R)eturn to Previous Menu

    Enter option: [4]
```

Figure 5-59: Modify Date, Time and Time Zone Menu, TZ enabled

The following menu is used to configure the TZ environment variable.

```
        *** Modify TZ Environment Variable Menu ***

        Current TZ variable: PST8PDT9,M4.1.0/02:00:00,M10.5.0/02:00:00

        0) Select from predefined TZ variables
        1) Standard Time Zone Name:             PST
        2) Standard Offset from GMT:            8
        3) Daylight Savings Time Zone Name:     PDT
        4) Daylight Savings Offset From GMT:    9
        5) Start Date:                          M4.1.0 (first Sunday in
    April)
        6) Start Time:                          02:00:00
        7) End Date:                            M10.5.0 (last Sunday in
    October)
        8) End Time:                            02:00:00

        H)elp
        Q)uit Installation
        R)eturn to Previous Menu

    Enter option: [0]
```

Figure 5-60: Modify TZ Environment Variable

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To select from predefined TZ variables, select option **0** from the **Modify TZ Environment Variable Menu**.

```
        *** Select Predefined TZ Environment Variable ***

      Current TZ area:      US (Pacific)
      Current TZ variable:  PST8PDT9,M4.1.0/02:00:00,M10.5.0/02:00:00

 1) US (Hawaii)       14) Russia (Kaliningrad)   27) Australia(Western)
 2) US (Alaska)       15) Russia (Moscow)        28) Australia(Central)
 3) US (Pacific)      16) Russia (Samara)        29) Australia(Eastern)
 4) US (Mountain)     17) Russia (Yekaterinburg) 30) Asia (Japan)
 5) US (Central)      18) Russia (Omsk)          31) Asia (China)
 6) US (Indiana)      19) Russia (Novosibirsk)   32) Asia (Hong Kong)
 7) US (Eastern)      20) Russia (Krasnoyarsk)   33) Asia (Korea)
 8) UK (London)       21) Russia (Irkutsk)       34) Asia (India)
 9) UK (Belfast)      22) Russia (Yakutsk)
10) UK (Dublin)       23) Russia (Vladivostok)
11) Europe (Western)  24) Russia (Magadan)
12) Europe (Central)  25) Russia (Kamchatka)
13) Europe (Eastern)  26) Russia (Anadyr)

     Q)uit Installation
     R)eturn to Previous Menu

 Enter option: [R]
```

Figure 5-61: Select Predefined TZ Environment Variable

To set the standard time zone name, select option **1** from the **Modify TZ Environment Variable Menu**.

```
          *** Set Time Zone Name Menu ***

        Current standard time zone name: PST
        Current TZ variable: PST8PDT9,M4.1.0/02:00:00,M10.5.0/02:00:00

        H)elp
        Q)uit Installation
        R)eturn to Previous Menu

    Enter new time zone name: [PST]
```

Figure 5-62: Select Time Zone Menu

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To set the standard offset from GMT, select option **2** from the **Modify TZ Environment Variable Menu**.

```
          *** Set Time Zone Offset Menu ***

          Current standard time zone offset: 8
          Current TZ variable: PST8PDT9,M4.1.0/02:00:00,M10.5.0/02:00:00

          H)elp
          Q)uit Installation
          R)eturn to Previous Menu

      Enter new time zone offset: [-3]
```

Figure 5-63: Set Time Zone Offset

To set the daylight savings time zone name, select option **3** from the **Modify TZ Environment Variable Menu**.

```
          *** Set Time Zone Name Menu ***

          Current daylight savings time zone name: PDT
          Current TZ variable: PST8PDT9,M4.1.0/02:00:00,M10.5.0/02:00:00

          H)elp
          Q)uit Installation
          R)eturn to Previous Menu

      Enter new time zone name: [MSD]
```

Figure 5-64: Set Time Zone Name Menu

To set the daylight savings offset from GMT, select option **4** from the **Modify TZ Environment Variable Menu**.

```
          *** Set Time Zone Offset Menu ***

          Current daylight savings time zone offset: 9
          Current TZ variable: PST8PDT9,M4.1.0/02:00:00,M10.5.0/02:00:00

          H)elp
          Q)uit Installation
          R)eturn to Previous Menu

      Enter new time zone offset: [-2]
```

Figure 5-65: Set Time Zone Offset Menu

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To set the time zone start date, select option **5** from the **Modify TZ Environment Variable Menu**.

```
        *** Set Time Zone Date Menu ***

        Current time zone start date: M4.1.0 (first Sunday in April)
        Current TZ variable: PST8PDT9,M4.1.0/02:00:00,M10.5.0/02:00:00

        H)elp
        Q)uit Installation
        R)eturn to Previous Menu

    Enter new time zone date: [M3.5.0]
```

Figure 5-66: Set Time Zone Date Menu (start date)

To set the time zone start time, select option **6** from the **Modify TZ Environment Variable Menu**.

```
        *** Set Time Zone Time Menu ***

        Current time zone start time: 02:00:00
        Current TZ variable: PST8PDT9,M4.1.0/02:00:00,M10.5.0/02:00:00

        H)elp
        Q)uit Installation
        R)eturn to Previous Menu

    Enter new time zone time: [02:00:00]
```

Figure 5-67: Set Time Zone Date Menu (start time)

To set the time zone end date, select option **7** from the **Modify TZ Environment Variable Menu**.

```
        *** Set Time Zone Date Menu ***

        Current time zone end date: M10.5.0 (last Sunday in October)
        Current TZ variable: PST8PDT9,M4.1.0/02:00:00,M10.5.0/02:00:00

        H)elp
        Q)uit Installation
        R)eturn to Previous Menu

    Enter new time zone date: [M10.5.0]
```

Figure 5-68: Set Time Zone Date Menu (end date)

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To set the time zone end time, select option **8** from the **Modify TZ Environment Variable Menu**.

```
          *** Set Time Zone Time Menu ***

          Current time zone end time: 02:00:00
          Current TZ variable:  PST8PDT9,M4.1.0/02:00:00,M10.5.0/02:00:00

          H)elp
          Q)uit Installation
          R)eturn to Previous Menu

      Enter new time zone time: [02:00:00]
```

Figure 5-69: Set Time Zone Date Menu (end time)

Choose Products to Install

Enter option **2** to choose products to install. The following menu appears:

```
      *** Product Installation Menu ***

          1) Development OS:                    yes

          Q)uit Installation
          R)eturn to Previous Menu
      Enter Option: [R]
```

Figure 5-70: Product Installation Menu

To choose an item for installation enter the appropriate option. Return to the **Main** Menu when all desired products are enabled.

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Completing the LynxOS Installation

After configuring the development system, begin the installation. This installs LynxOS onto the development system. To run `installit`, return to the **Main Menu**, shown below, and enter option **B**:

```
        *** Main Menu ***

        1) Modify Default Values
        2) Choose Products to Install

        B)egin Installation
        Q)uit Installation

    Enter Option: [B]
```

Figure 5-71: Main Menu

`installit` displays the **Final Installation Menu** as follows:

```
        *** Final Installation Menu ***

        Continuing now will result in the loss
        of all data on the IDE Hard Disk (ide.0a)!

        C)ontinue installation

        Q)uit Installation
        R)eturn to Previous Menu
    Enter Option [R]
```

Figure 5-72: Final Installation Menu

NOTE: If the wrong CD-ROM option is entered, `installit` prints the message shown below:

```
Please make sure that the Distribution CD-ROM is in
the IDE drive (/dev/ide.0)
Press <Enter> to continue.
```

Enter the command **C** to continue. `installit` immediately begins installing LynxOS. This process includes first removing any existing data on the destination hard disk partition. During the installation process, `installit` displays status information, including the names of files as they are being copied to the hard disk.

After running `installit` to install LynxOS, the development system needs to be rebooted for the installation to take effect.

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Rebooting

At the end of the installation, `installit` configures a LynxOS kernel to boot from the hard disk. A reboot message is printed by `installit`, prompting the user to remove the media and reboot the system.

Secondary Installation Configurations

After rebooting, the installation procedure starts the secondary installation installation process. This includes changing LynxOS configuration files and rebuilding the kernel, if needed. The following message is printed during the secondary installation:

```
LynxOS secondary configuration started.....................
DONE

Press <Enter> to reboot your system...
```

Reboot the system again to complete the LynxOS installation.

Users new to LynxOS should read the Quick Start chapter of the *LynxOS User's Guide* to familiarize themselves with the basics of LynxOS.

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CHAPTER 6 *Booting LynxOS*

Introduction

This chapter provides instructions for booting LynxOS, platform-specific details, and troubleshooting solutions.

Before booting LynxOS from the hard disk for the first time, it may be necessary to set up the development system's BIOS or hardware for LynxOS operation; see "Working with BIOS" on page 79 for more information.

The LynxOS boot process starts with **`preboot`** (the LynxOS preboot utility), that allows the user to select the hard disk, partition, and file to boot from. `preboot` uses built-in defaults that are set with the **`makeboot`** command. The default settings of `preboot` boot LynxOS from the same hard disk and partition from where `preboot` was loaded.

Once `preboot` is running, the user can change the root and boot devices, and boot LynxOS. Typically, both the root device and the boot device are the same and are the defaults. The `preboot` utility can boot from the default devices; see "LynxOS preboot Utility" on page 80 for details.

If LynxOS fails to boot successfully, some problems are due to minor BIOS and/or hardware variations. For further information, see "Troubleshooting Booting" on page 85.

Working with BIOS

LynuxWorks regularly installs and boots LynxOS on PCs from various vendors using a variety of different x86-compatible processors and BIOSs. However, due to the large number of PC vendors and rapid changes and upgrades in PC models, it is not possible to test LynxOS on all commercially available PCs. For up-to-date

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information on supported hardware, see the Hardware Support Guide at www.lynuxworks.com and on the LynxOS Documentation CD-ROM.

LynxOS also requires the BIOS to set up the serial ports, parallel ports, and IDE channels. Setting `Disable PnP OS` and setting these devices to `not autodetect` in the BIOS ensures that these devices can be setup in the BIOS as required by LynxOS.

On PCI systems, if an ISA ethernet adapter is used, allocate IRQ 5 (or the adapter's chosen IRQ) to `Legacy ISA` mode from within the BIOS. When IRQ 5 is used for an ISA ethernet device, the on-board audio port should be disabled (if present) to prevent IRQ overlap. In general, ISA interrupts cannot be shared.

If an SMC EtherEZ/Ultra/Elite series Ethernet adapter is used, the memory range `CC000-CFFFF` (or the adapter's RAM region) should be allocated as ISA RAM space. Shadowing for this RAM segment should be disabled.

If a PC has multiple ethernet adapters, only one of the ethernet cards can be chosen during installation. All other interfaces should be disconnected from the network. Once LynxOS is installed, multiple network adapters can be configured.

NOTE: LynxOS supports some PC Card (PCMCIA) devices and drivers in certain configurations. Please contact LynuxWorks for more information.

The BIOS in many x86 development systems includes an option called `LFB SIZE` and a start address. In some development systems, this memory range is write-protected used by system components such as `himem.sys`. This feature should be disabled when running LynxOS. If not, LynxOS may not recognize memory above this reserved write-protected region.

See the *LynxOS User's Guide* for default x86 DMA channels and IRQ allocations.

LynxOS preboot Utility

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

`preboot` defines two different devices for booting LynxOS: the *root* device and the *boot* device. The root device is where the LynxOS root file system is located. The boot device is the LynxOS image used to boot the system. In many cases, the

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boot device is the same as the root device; these two devices are discussed in detail in “Setting the Root Device” on page 83 and “Setting the Boot Device” on page 84.

Major and Minor Device Numbers

Both `preboot` and LynxOS identify each device driver in the development system with a unique pair of numbers: the major and minor device numbers. The major device number defines the device controller/adapter (such as IDE or SCSI) that a given device is attached to. The minor device number defines the logical unit (or, in some cases, a software defined subunit such as a disk partition) of a given device. For example, on x86 development systems all IDE drives on the primary bus have a major number of `0` to indicate that the drive is accessed through the IDE controller.

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x86 Device Numbers

The default major device numbers are shown in Table 6-1 below.

Table 6-1: Default Major Numbers for Disk Devices (x86)

Major Number	Description
0	Primary and Secondary IDE/EIDE
1	Floppy
2	Adaptec 1522 SCSI
3	Adaptec 1542 SCSI
4	Adaptec 2940 SCSI
5	SimBios 8xx

The default minor device numbers for x86 systems are shown in Table 6-2.

Table 6-2: Default Minor Numbers for Disk Devices (x86)

Type		Device ID	Minor Numbers				
SCSI	IDE		Disk	Partition A	Partition B	Partition C	Partition D
		0	0	16	32	48	64
		1	1	17	33	49	65
		2	2	18	34	50	66
		3	3	19	35	51	67
		4	4	20	36	52	68
		5	5	21	37	53	69
		6	6	22	38	54	70

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To determine the device ID for an IDE disk, refer to Table 6-3.

Table 6-3: Device IDs for IDE Disks

IDE Disk Device	Device ID
Primary Master	0
Primary Slave	1
Secondary Master	2
Secondary Slave	3

PowerPC Device Numbers

The default major device numbers are shown in Table 6-4.

Table 6-4: Default Major Numbers for Disks (PowerPC)

Major Number	Description
0	RAM disk
1	SCSI devices including hard disk, CD-ROM, and tape
2	IDE Primary and Secondary

The default minor device numbers are the same as on x86 development systems; see Table 6-2 on page 82.

Setting the Root Device

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

On x86 and PowerPC Systems

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

```
Command? R ?
```

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To set the root device to something other than the default, enter the following at the `preboot` prompt:

```
Command? R major minor
```

To set the root device for partition **b** of an Adaptec 1542 SCSI disk at ID 2, enter the following at the `preboot` prompt:

```
Command? R 3 34
```

Setting the Boot Device

The boot device is the location of the LynxOS kernel that is to be booted. In most cases, `preboot` automatically detects and selects the correct boot device. The preboot `boot` command is used to determine the boot device. The `boot` command has the following syntax:

```
Command? b <controller>.<device_id> <boot_dev_args> \
<root_dev_args> <boot_file>
```

In the example above, *<controller>* is one of the following: `ide`, `sd1542`, `sd2940`, or `sdncr`. *<device_id>* is the desired drive's ID. *<boot_file>* is the name of the file on the selected drive to boot (normally `/lynx.os`). The *<boot_dev_args>* and *<root_dev_args>* for ISA devices is a 16-bit I/O address of a specific ISA card. For PCI devices the argument is two 8-bit numbers, *PCIBus* and *PCIDev*, representing a specific PCI device. If one PCI or ISA card is present, the arguments are redundant.

For example, to set the boot device to partition **b** of a SCSI (1542 Adaptec) device at ID 3, enter the following at the `preboot` prompt:

```
Command? b sd1542.3b
```

To set the boot device to partition **c** of an IDE secondary slave device, enter the following at the `preboot` prompt:

```
Command? b ide.3c h3c
```

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Troubleshooting Booting

The following table provides solutions to problems with booting.

Table 6-5: Problems and Solutions: All Platforms

Problem	Solution
When I boot a kernel, the message `"main file device not present"` is printed.	This error message indicates that `preboot` cannot access the root file system. The message may appear if incorrect major or minor device numbers for the root file system are specified.
I made a new kernel and now it won't boot. How can I boot LynxOS?	This answer assumes that the development system had a bootable kernel at one time and that currently `preboot` boots successfully. When 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 were made to the new kernel that may have caused it not to boot. If the above procedure has not been effective, 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 has been added, that is what is crashing the kernel. • Did the message come up and then nothing appeared on the screen? If so, see "My kernel prints the banner message..." on the following page. • Did the `"main file system not present"` message appear on the screen? If so, see above.
`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. The `preboot` source code and must be obtained and the driver added to `preboot`.
How do I boot from a different partition from the one specified in `preboot`?	See "Setting the Boot Device" on page 84.

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Table 6-5: Problems and Solutions: All Platforms (Continued)

Problem	Solution
Is there a limit on kernel size for booting?	The boot size limit, if using `preboot`, is 8 MB on the PowerPC and unlimited on the x86. However, when booting directly, the x86 image is limited to 512K.

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 is displayed on the screen.
	
	To fix this problem, reboot the development system and specify the old kernel `/lynx.os.old` at the `preboot` command prompt. Rebuild the device nodes as follows:
	`# cd /dev`
	`# rm *`
	`# mknod -a /etc/nodetab`
	`# reboot -a`
	If there is no backup kernel, use the LynxOS installation media to access the kernel and make the device nodes.
	• Boot the installation CD-ROM/disk. 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`

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The following troubleshooting table is specific to x86 platforms.

Table 6-6: Problems & Solutions: x86 Specific

Problem	Solution
I have successfully booted LynxOS, but can't access all of the available memory. Why?	In some instances, BIOS has allocated memory regions that LynxOS cannot access. From the BIOS setup, delete these memory allocations.
How do I boot LynxOS from a removable disk drive?	A removable device must be recognized by the development system BIOS in order to boot. The 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 drives will be treated as fixed disks and can be used as boot devices.
I moved my disk from an Adaptec 1542 SCSI controller to an Adaptec 2742/2940 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 83 for details on getting the new kernel to boot. Once LynxOS boots, type the following: `makeboot /preboot` This command updates the major number in `preboot`.
The SCSI controller on the 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, and the like, 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 the development system. See BIOS documentation.
Why must `preboot` be used to boot a LynxOS kernel that is greater than 512 KB?	The LynuxWorks 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.

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Unless otherwise specified, these apply for both CVME and VMPCxx.

Table 6-7: Problems & Solutions: Cetia PowerPC Specific

Problem	Solution

I can't boot LynxOS from a CD-ROM on a CVME development system.
 	
Error message:
`CetiaOpenAndRead: unable to open device`
	Work around (at the `preboot` prompt).
	To boot LynxOS from the CD-ROM, specify the `LUN` to the `preboot` utility, then boot from SCSI ID 6 as follows:
	
	`Command? C 10`
	
	`Command? b s6 /lynx.os`

PS2 Mouse:	The mouse driver from LynuxWorks is not compatible with CETIA cards. A compatible mouse driver is available from Cetia in the Powerline Standard Package.
Xserver:	The Xserver from LynuxWorks is not compatible with the CPCIGx card. A compatible Xserver for the CPCIGx graphics card is available from Cetia.

Partitioning the hard drive:	If the hard drive has LynxOS 2.5 or lower already installed on it, it must be repartitioned before a newer version of LynxOS can be installed. Be aware that repartitioning the hard drive destroys any data currently on the hard drive. Back up any needed data before repartitioning.
	To repartition the hard drive, the existing partitions must first be deleted using the **d** command of `mkpart`, as in the following:
	
	`d a`
	`d b`
	`d c`
	
	To repartition later on, use the `mkpart` command as follows:
	
	`m /65 size [size...]`
	
	For additional information on using `mkpart`, see "mkpart(1) man page" on page 123.

SCSIMGR:	The new enhanced SCSI driver does not support the CETIA PCI interface.

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CHAPTER 7 *X & Motif Installation Instructions*

This section provides detailed installation instructions for the X & Motif Development Package for x86 and the Power PC (PPC) platforms.

NOTE: The X & Motif Development Package may not be included in all LynxOS ODE packages. Check to see if your LynxOS ODE package supports X & Motif before installing.

Overview

The installation process for the X & Motif Development Package involves the following steps:

1. Review system requirements
2. Remove any previous X server installation
3. Run the installation script **`Install.XM`**
4. Configure the X Server with **`configX`**

The following sections describe these steps in full detail. The **`configX`** utility is described in Chapter 8, “X Server Configuration” on page 101.

Before Installing

Before proceeding with the actual installation of the X & Motif Development Package, check that the following system requirements are met:

- The complete installation of the X & Motif Development Package requires 316 MB of free disk space on the system.

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- The system should have a minimum of 16MB of RAM, however, 32MB is recommended. Users can take advantage of Virtual Memory before running X. Refer to the "Setting Virtual Memory Options" on page 58 for instructions on how to configure the system to use virtual memory.
- The system must include a supported monitor, graphics adapter and pointing device.

These requirements are discussed in more detail in the following sections.

Disk Space Requirements

The X & Motif Development Package requires approximately 316 MB of free disk space for installation (137MB for X, 179MB for Motif.)

Graphics Adapter Requirements

Supported x86 Graphics Adapters

The X & Motif Development Package supports a wide array of graphics adapters for the x86 platform. Please see the *LynxOS Hardware Support Guide* (on the LynxOS Documentation CD-ROM or from www.lynuxworks.com) for the complete list of supported graphics cards.

Supported PPC Graphics Chipsets

The X & Motif Development Package supports Cirrus Logic 5434, 5436 and 5446 chipsets with 256 colors on the Power PC.

Monitor Requirements

The X & Motif Development Package requires a video monitor that is compatible with the system's video graphics adapter and capable of supporting the desired display resolution. Consult the manufacturer's documentation of the video graphics adapter for specific monitor requirements.

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Supported Mice

The X & Motif Development Package provides support for the following pointing devices and their compatibles:

- Alps GlidePoint Serial, PS/2
- Logitech Mouse Man Serial, Track Man, Track Man C7, Track Man Marble, C7 Serial
- Microsoft Serial, PS/2 Intellimouse, Serial Intellimouse
- Kensington Serial Thinking Mouse, PS/2 Thinking Mouse
- Genius PS/2 NetMouse, PS/2 NetScroll
- Generic PS/2
- Mouse Systems Serial
- Elo TouchSystems IntelliTouch Serial, AccuTouch Serial
- Carroll SFP1 Touch Screen, SFP2 Touch Screen
- Citron CTS Serial Touch Screen
- Lucas/Deeco Serial Touch Screen
- Microtouch Serial Touch Screen

NOTE: Bus mice are not supported.

Installing the PS/2 Mouse Driver

If the PS/2 mouse driver was not installed during the LynxOS installation, the **`Install.ps2mouse`** installation script can be used to install a PS/2 mouse driver. Use the following instructions to install the PS/2 mouse driver.

1. Run the `Install.ps2mouse` script by entering the following command:

   ```
   # /usr/bin/Install.ps2mouse
   ```

   This script adds the PS/2 mouse driver to the system and rebuilds the kernel.

2. Reboot the system by entering the following command:

   ```
   # reboot -aN
   ```

   The system boots with the PS/2 mouse driver support.

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Removing Previous X Server Installation

To upgrade an X server installation, the previous version of X must be removed.

The **`Uninstall.XM`** script can be used to remove any existing X and Motif distributions. Type the following command to remove a previous X server installation.

```
# /usr/bin/X11/Uninstall.XM
```

To manually remove an X server installation, follow the steps below.

NOTE: `root` access is required to complete these steps.

For example, to remove all of the X and Motif files from under the `/usr/bin/X11` directory, use the following instructions:

1. Change to the X server directory:

   ```
   # cd /usr/bin/X11
   ```

2. Remove all files in the current directory:

   ```
   # rm -rf *
   ```

NOTE: It is recommended that users check the directory before running the **`rm`** command. **`rm -rf`** deletes the current directory, and all subdirectories. Verify the current directory by typing **`pwd`** at the command line *before* running `rm`.

Repeat the same instructions for these directories:

- `/usr/bin/X11`
- `/usr/lib/X11`
- `/usr/include/X11`
- `/usr/include/Xm`
- `/usr/include/Mrm`
- `/usr/include/uil`

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Installing X with the Install.XM Utility

Before installing X & Motif, users must select the destination directory, specific components to be installed, and where the X & Motif distribution is located. A provided installation script, **`Install.XM`** must be run to set the options and install X and Motif. Use the following instruction to setup the installation options and start the installation.

Log in to the system as `root` and type the following command:

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

The following sections describe the X and Motif installation menu options.

X and Motif Installation Main Menu

After running **`Install.XM`**, the main menu is displayed:

```
        ******* Main Menu ******
        X and Motif Installation
        ************************

        1) Modify Default Values
        2) Choose Products to Install

        Please make sure the Default Values and Products to Install
        are correct before Beginning the Installation.

        B) Begin Installation
        Q)uit Installation

    Enter Option: [1]
```

Figure 7-1: X & Motif Installation Main Menu

The **Main Menu** options provide the following options:

- **Modify Default Values**--Allows the selection of various parameters related to hardware.
- **Choose Products to Install**--Allows selections of the products to be installed.
- **Begin Installation**--Use this option to start the automated installation process using the current configuration.
- **Quit Installation**--Use this option to exit the installation utility.

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These menu options are described in more detail in the following sections.

After X is installed, the **`Install.XM`** utility provides an additional option for use in administrative configuration tasks:

- **Miscellaneous Admin** --This option includes mouse configuration in **`configx`**, and **`xdm`** management. For more information, see "Miscellaneous Admin Menu Options" on page 97.

Modify Default Values

The Modify Default Values opens the **Hardware Configuration Menu**:

```
        *** Hardware Configuration Menu ***

        1) Install Directory                : /
        2) Installation Media               : /dev/ide.1
        3) Select Mouse Type for configx    : No Mouse Attached

        Q)uit Installation
        R)eturn to Previous Menu

     Enter Option: [R]
```

Figure 7-2: Hardware Configuration Menu

Hardware Configuration Menu Options

The **Hardware Configuration Menu** options are as follows:

- **Install Directory**--Use this option to specify the absolute path name of the base installation directory. The default base installation directory is `/`.

NOTE: LynuxWorks recommends that the X & Motif Development Package be installed in the root (/) directory. The distribution can be installed in any directory or file system as required. The file system where the X & Motif Development Package is installed should have enough disk space for future expansion. Motif must be installed in the same file system and directory as X.

- **Installation Media**--Use this option to specify the name of the media device that contains the product distribution. The default device is an IDE CD-ROM (`/dev/ide).` For more information about device naming in LynxOS, see the *LynxOS User's Guide.* This opens the **Installation Media Menu**.

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- **Select Mouse Type for configX**--This option selects the mouse type and interface for the system. This allows the mouse to be used in the X configuration utility **`configX`**.

```
      *** Installation Media Selection Menu ***

      Installing From: /dev/ide.0

      1) SCSI Tape
      2) SCSI CD-ROM
      3) IDE CD-ROM (x86 & PowerPC only)
      4) 1.44MB Floppy Disk (x86 only)
      5) Other SCSI Devices

      6) From distribution tar files
      7) Install pre-extracted distribution

      Q)uit Installation
      R)eturn to Previous Menu

Enter Option: [R]
```

Figure 7-3: Installation Media Selection Menu

The **Installation Media Selection Menu** selects the device that contains the X and Motif distribution media.

- **From distribution tar files**--X and Motif can be installed from a tar archive of the distribution by choosing option 6 (`From distribution tar files`). This option can be used to install X and Motif from an NFS-mounted directory.
- **Install pre-extracted distribution**--X and Motif tar files are included on the CD-ROM in the `tar_images` directory. The following command (assuming the distribution CDROM has been mounted on the `/mnt` directory) extracts the X or Motif distribution into the current directory.

  ```
  # tar xvfz /mnt/tar_images/filename.tar.gz
  ```

  Where *`filename`* is the name of the tar file archive.

  Next, execute the **`Install.XM`** script and make all the appropriate selections in the various menus. In the **Installation Media Selection Menu**, select Option 7, **Install pre-extracted distribution**.

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Choose Products to Install

Option 2 from the **Main Menu**, **Choose Products to Install** opens the **Software Configuration Menu**.

```
        *** Software Configuration Menu ***

        1) Install X (y/n)               :y
        2) Install Motif (y/n)           :y
        3) PosixWorks Desk               :y
             Selecting (y) will cause the PosixWorks Desk
             environment to be run by default. Selecting (n)
             will result in a basic mwm or twm environment
             to be run instead.

        4) Advanced Installation options

        Q)uit Installation
        R)eturn to Previous Menu

    Enter Option [R]:
```

Figure 7-4: Software Configuration Menu

Software Configuration Menu Options

The **Software Configuration Menu** options are as follows:

- **Install X**--Use this option to toggle the install state for the X components of the X & Motif Development Package.
- **Install Motif**--Use this option to toggle the install state for the Motif components of the X & Motif Development Package.
- **POSIX WORKS Desk**--Use this option to toggle the install state for the LynuxWorks POSIX WORKS Desktop to be used with the X product.
- **Advanced Installation Options**--Use this option to rebuild the LynxOS kernel after the X installation (recommended). This option also sets **`configX`** to run after the X install.

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Miscellaneous Admin Menu Options

Once the X installation is complete, the **Main Menu** includes a new option: **Miscellaneous Admin**. Selecting this option opens the **Miscellaneous Admin Menu** screen.

```
NOTE: These options are provided for tuning the X product AFTER
it has been installed. DO NOT use these, if installing X
for the first time.

     *** Miscellaneous Admin Menu ***

     1) Change Mouse selection for use with ConfigX utility
     2) Install Posix Works Desktop as default desktop
     3) De-Install Posix Works Desktop as default desktop
     4) Change X settings to enable automatic start on system reboot
     5) Change X settings to disable automatic start on system reboot

     Q)uit Installation
     R)eturn to Previous Menu

Enter Option: [R]
```

Figure 7-5: Miscellaneous Admin Menu

- **Change Mouse selection for use with configX utility** -- If the mouse selected earlier during the installation does not work properly within the **`configX`** utility, then this option can be used to select a different mouse.
- **Install POSIX WORKS Desktop as default desktop --** This option installs and configures the LynuxWorks POSIX WORKS desktop environment to be automatically displayed whenever the X session is started.
- **De-install POSIX WORKS Desktop as default desktop** -- This changes the X startup configuration so the POSIX WORKS desktop environment is no longer brought by default when X is started. Instead, a more generic display consisting of xterms is opened.
- **Change X settings to enable automatic start on system reboot --**Configures the system to start a local **`xdm`** session when the system boots. Refer to “X Display Manager (xdm)” on page 98.
- **Change X settings to disable automatic start on system reboot --**Configures the system to disable any automatic start of X on system boot. To start X, users must run **`xinit`**, **`startx`**, or **`xdm`**.

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X Display Manager (xdm)

The X Display Manager (**xdm**) manages X sessions for local and remote hosts. The following sections describe how to setup and configure **xdm** for LynxOS.

Configuring xdm for Local Systems

For a local display, the X installation script can set the xdm (X display Manager) utility to start the X session automatically. This selection can be changed at any time using the **Install.XM** script. See “Miscellaneous Admin Menu Options” on page 97.

Configuring xdm for Remote Systems

To configure a display on a remote system, the remote sysetm must have an X server running, and must be able to communicate with the LynxOS host system via TCP/IP.

The LynxOS system can force the connection between itself and the target system. Start the X server on the target and make sure that it can accept connections from the LynxOS system. If the target is also a LynxOS system, start the X server with this command:

```
# X -ac
```

This starts the X server and awaits connections from the host LynxOS system.

On the host LynxOS system, edit the /usr/lib/X11/xdm/Xservers file and add the line:

```
target_hostname:0 foreign
```

where *target_hostname* is replaced with the hostname of the target system running the X server. Next, start the xdm daemon by typing:

```
# /usr/bin/X11/xdm
```

followed by a **Return**. The xdm-errors file created in /usr/lib/X11/xdm directory can be viewed for any errors.

Alternatively, the chooser utility can be used to select between a number of hosts with which to establish a connection. On the LynxOS host system, comment out all entries in the /usr/lib/X11/xdm/Xservers file and start the xdm daemon by typing:

```
# /usr/bin/X11/xdm
```

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If the target system is also running LynxOS, type in the following on the target system:

```
# /usr/bin/X11/X -indirect host_hostname
```

This starts the X server and opens the chooser window, showing all the systems on the network that can establish a connection. Select the appropriate host to start the session.

Once a session has been established, the `xdm` login window appears. To abort the session press **Ctrl-R**.

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CHAPTER 8 X Server Configuration

This chapter explains how to use the **`configX`** utility to configure the X server.

Overview

After installing X on the system, the X server must be configured. The minimal steps required to configure the X server include:

- Select the pointing device.
- Select the monitor.
- Select the graphics adapter.

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

NOTE: `root` privileges are required to configure X.

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X Server Configuration

This section describes how to use the automated configuration utility, **configX**, to configure the X server on the system. Additionally, configuration files can be manually edited. This chapter shows only usage of the **configX** utility.

Starting the Configuration Utility

The **configX** utility is installed in the /usr/bin/X11 directory. To start **configX**, use the following instructions:

1. Login as root and type the following command:

   # **/usr/bin/X11/configX**

   The explanation of special keys appears. (This message only appears prior to the initial configuration of X when no XMetroconfig file exists.)

2. Press **Enter** to continue.

Using a Mouse or Special Keys

The **configX** utility is a graphical program that can be navigated with a mouse. However, users can also use the keyboard to move through the various menu options. This section describes how to add mouse support to **configX**, and provides a list of navigation keys to move about the different fields.

Using a Mouse in configX

To use a mouse with **configX**, it must be configured before running the utility. During the X & Motif installation, a pointing device can be selected to be used with **configX**. If no pointing device is selected, use the following instructions to add mouse support to **configX**.

NOTE: The mouse configuration shown in this section allows for use of a mouse in the **configX** utility only. The configuration of the mouse to use with the X server is shown in subsequent sections.

---

1. Start **Install.XM** from the command line:

   # **/usr/bin/Install.XM**

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2. If X is already installed on the system, the **`Install.XM`** script adds a third option in the **Main Menu**, **Miscellaneous Admin**. Select option 3, **Miscellaneous Admin**.
3. Select Option 1, **Change Mouse selection for use with configX utility** and follow the prompts.
4. Once the new mouse is configured, the **`Install.XM`** script exits.
5. Restart **`configX`**:

```
# /usr/bin/configX
```

This procedure can be repeated until the mouse is properly configured.

NOTE: For instructions on installing PS/2 drivers for a mouse, see “Installing the PS/2 Mouse Driver” on page 91.

Using the Keyboard in configX

The keyboard can be used to navigate through the **`configX`** menus. These keys are described in the following table.

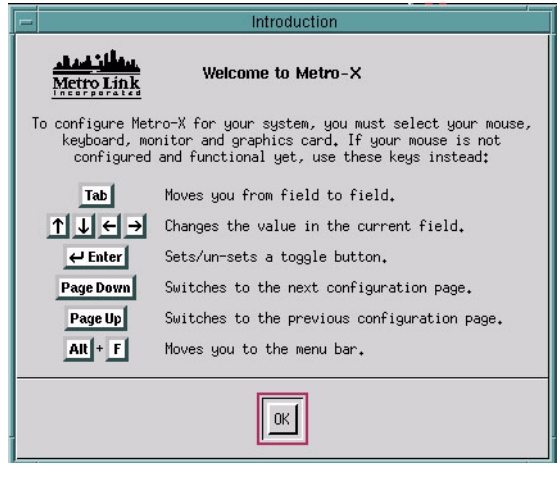

Figure 8-1: Introduction Screen

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Table 8-1: Function of Special Keys

Key	Function
Tab	Moves forward from field to field.
Shift-Tab	Moves backward from field to field.
Left arrow, **Right arrow,** **Up arrow,** **Down arrow**	Changes the value in the current field.
Enter	Sets/unsets a toggle button.
Pg Down	Switches to the next configuration page.
Pg Up	Switches to the previous configuration page.
Esc	Cancels out of the current screen or pop-up.
Alt-f	Opens the **File** pull-down menu.
Alt-s	Opens the **Screen** pull-down menu.
Alt-c	Opens the **Configuration** pull-down menu.

Mouse Configuration

If the default mouse is not correct for the system, change the configuration with the following instructions.

1. Press **Down arrow** to display the list of mice.
2. Press **Up arrow** or **Down arrow** to scroll to a mouse type, and press **Enter**.
3. Press **Tab** to move to the next field.
4. Press **Down arrow** to display the list of mouse buttons. (The default entry is based on the selected mouse.)
5. Press **Up arrow** or **Down arrow** to scroll to the button entry press **Enter**.
6. Press **Tab** to move to the next field.
7. To change the path for the mouse device, edit it here.
8. Press **Tab** to move to the next field.

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To use a touch screen instead of a mouse, refer to “Configuring a Touch Screen” on page 116, for set-up and calibration instructions.

For a PS/2 type mouse, select one of the PS/2 mouse specific entries, for example, Microsoft PS/2 Intellimouse or PS/2 Compatible.

Keyboard Selection

X includes international keyboard support, which allows users to select the keyboard appropriate for a language and country.

Figure 8-2: Keyboard Selection Menu

The initial keyboard setting is **Default: Use default console mapping**, which works with most keyboards. To select a keyboard, use the following instructions.

1. Press **Down arrow** to display the list of keyboards.
2. Press **Up arrow** or **Down arrow** to scroll to the keyboard entry and press **Enter**.
3. Press **Tab** to move to the next field.

Descriptions of English USA Keyboards

There are four US keyboards listed in **`configX`**. If using a US English keyboard, select the right one for the system:

- **English: USA / Standard PC keyboard**--This is a standard 102-key U.S. English keyboard. (This is equivalent to the English: Canada keyboard type.)
- **English: USA / Microsoft keyboard**--If a keyboard has the extra **Windows** and **Menu** keys on the bottom, choosing this keyboard allows these keys to be used in X programs. While X programs are not typically set up to use these keys by default, the Xt translation table feature can be used to customize the keyboard commands in most X programs. The **Windows** key is bound to the `Meta` modifier, and the **Menu** key uses the key symbol `Menu`.

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- **English: USA / Keytronic FlexPro keyboard**--Use this setting only if you have a Keytronic FlexPro keyboard.
- **English: USA / with ISO9995-3** -- This keyboard type allows users to type special characters used by non-English languages from a US English keyboard. When this keyboard type is selected, the right **Alt** key becomes a “mode switch” key. Holding down this key while typing other keys on the keyboard creates special characters.

Monitor Configuration

Use the Monitor Configuration page to configure monitor settings, adjust the image (after editing and saving the configuration), and set the timing of the screen saver.

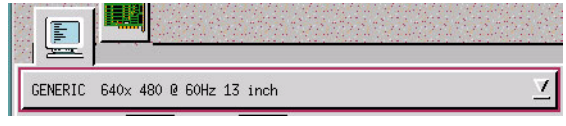

Figure 8-3: Monitor Configuration Screen

Use the following instructions to change the default monitor:

1. Press **Down arrow** to display the list of monitors.
2. Press **Up arrow** or **Down arrow** to scroll to your monitor entry, then press **Enter** to select it. If the monitor is not listed, use the generic entry that best matches the monitor’s capabilities.
3. Press **Tab** twice to move to the **Screen Width** field. (Bypass the **Adjust Image** button until after configuring the monitor. See “Adjust Image (Timing Editor)” on page 120.
4. To change the screen width (mm), edit it here.
5. Press **Tab** to move to the next field.
6. To change the screen height (mm), edit it here.
7. Press **Tab** to move to the next field.

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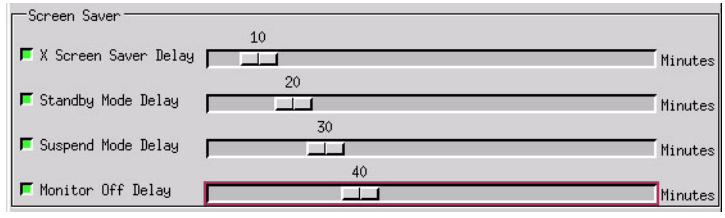

Figure 8-4: Screen Saver Panel

Some graphics cards and monitors support the Display Power Management System (DPMS), minimizing power consumption. If the hardware supports 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 a 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.

To set the screen saver, use the following instructions:

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 **Left arrow** or **Right arrow** 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, and use **Left arrow** or **Right arrow** to set the value.
6. Press **Tab** to move to the next field.

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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, use **Left arrow** or **Right arrow** 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 **Left arrow** or **Right arrow** to set the value.

Graphics Card Configuration

Press **Pg 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 8-5: Graphics Card Configuration Panel

Each graphics card configuration consists of six elements:

- The graphics card make and model. (The chipset used by the card is listed to the right of the card name.)
- The memory available on the graphics card.
- 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).

Non-interlaced mode provides a better screen appearance than interlaced refresh rates. The highest refresh rate that a monitor supports provides the best image. At higher screen resolutions a higher refresh rate is particularly important to prevent the screen from visibly flickering.

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A refresh rate of 60 Hz is selected by default. This can be increased if the graphics card and monitor support it.

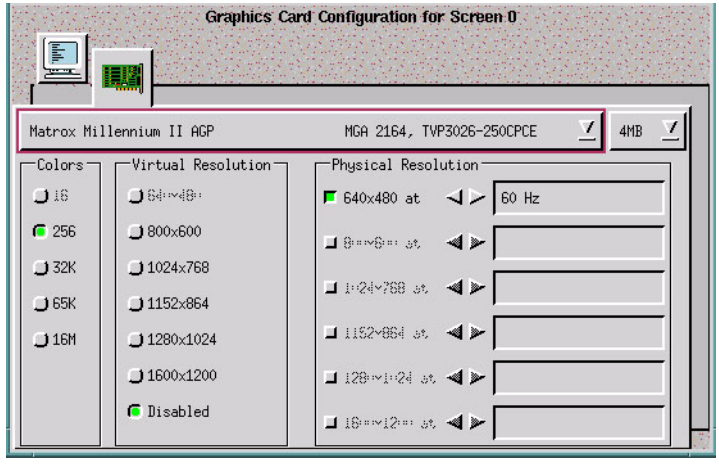

Figure 8-6: Graphics Card Configuration for Screen 0

The default graphics card setting is **IBM VGA**. To configure the graphics card, use the following instructions:

1. Press **Down arrow** to display the list of graphics cards.
2. Press **Up arrow** or **Down arrow** to scroll to the graphics card entry, and press **Enter**.Only models specifically listed are officially supported by Metro-X. If your graphics card model is not listed, select one of the generic entries with similar components (graphics chipset and ramdac).
3. Press **Tab** to move to the next field.

Memory Selection

To select memory, use the following instructions.

1. Scroll through the pull-down list of memory amounts and select the amount of memory on the graphics card in use (memory affects the availability of colors and resolutions.)
2. Press **Tab** to move to the next field.

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Color Selection

Not all graphics cards can support all color depths (number of colors). Only the options for the color depths supported by the card are included. Other options are grayed out.

Only *one* color option can be selected (due to design limitations of X).

Color options available are limited by the physical resolution(s) chosen. Not all color depths are available at high resolutions. The default setting is the lowest value for the graphics card. To select a color setting, use the following instructions.

1. Press **Tab** to move through the color settings, and press **Enter** to select one. (The previous settings are cancelled.)
2. Press **Tab** to move to the next field.

Figure 8-7: Color Setting Example

Virtual Resolution Selection

The **Virtual Resolution** setting provides a work area larger than the 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 the graphics card are provided in this field. Other options are grayed out. Select the **Disabled** option to disable this feature.

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

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The default setting for virtual resolution is **Disabled**. Use the following instructions to select a virtual resolution:

1. Press **Tab** to move to the appropriate setting, then press **Enter** to select it. (The previous settings are cancelled.)
2. Press **Tab** to move to the next field.

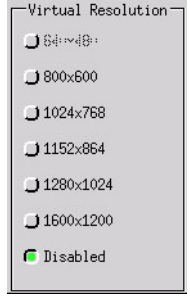

Figure 8-8: Virtual Resolution Setting Example

Physical Resolution

Not all graphics cards and monitors can support all physical resolutions. Only the options for the resolutions supported by your hardware are provided in this field. The other options are grayed out.

Multiple physical resolutions can be selected. Users can switch between these resolutions while running by pressing a hot-key combination:

- Press **Ctrl-Alt-+** to change to the next resolution.
- Press **Ctrl-Alt--** (minus) to change to the previous resolution.

NOTE: Use the **+** and **-** keys located on the numeric keypad.

For only one resolution, select the **Physical Resolution** button.

The physical resolution(s) choosen may limit the selections in **Colors and Virtual Resolution**, depending on the capabilities of the graphics card.

If the word “Custom” appears after the frequency, the timing editor is used to modify a mode. See “Adjust Image (Timing Editor)” on page 120. Changing the

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graphics card or monitor invalidates the custom modes, and the “Custom” tag no longer appears in the frequency box.

The default setting is the lowest value for the card. To enable a resolution, use the following instructions:

1. Press **Tab** to move to the setting, and press **Enter**.
2. Press **Tab** to move to the corresponding field to set the screen refresh rate (Hz) for that resolution.
3. Then use **Left arrow** or **Right arrow** to select a value from the frequency options available.

   The default setting is the highest frequency supported by the monitor.

Repeat this procedure for each physical resolution to set.

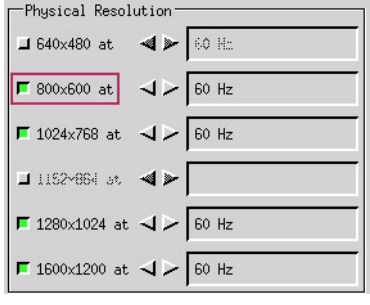

Figure 8-9: Physical Resolution Setting Example

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Font Path

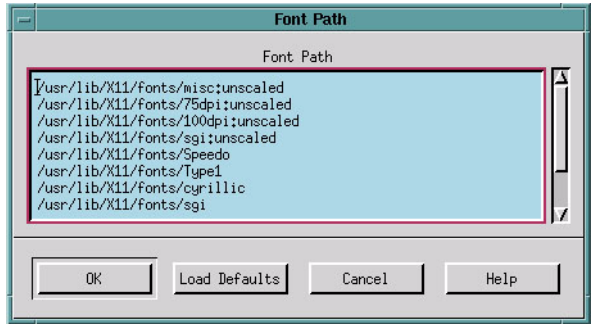

Figure 8-10: Font Path Screen

To use a font server instead of, or in addition to existing fonts, the font path within the Metro-X Configuration Utility must be updated. Use the following procedure to update the font path:

1. Press **Alt-c** to display the **Configuration** pull-down menu and press **Enter**.
2. The **Font Path** window appears. Edit paths as necessary for the system. Metro-X searches for fonts in the order in which the directories are listed in this file.
3. If a font server is used, enter the following as the first line:

   `tcp/`*`fontserver`*`:7000`

   Where *`fontserver`* is the name or IP address of the system. If the port number is not the default 7000, change it to the appropriate port number.
4. Press **Tab** to move through the buttons, and press **Enter** to select one.

   If the information is correct, select the **OK** button. To disregard the changes, select the **Cancel** button.

   Select the **Load Defaults** button to revert to the original settings.

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Multiple Screen Configuration (x86 only)

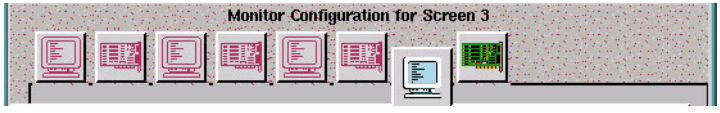

Figure 8-11: x86 Monitor Configuration

Metro-X supports up to 16 screens, all of which can be controlled simultaneously with a single keyboard and mouse. This allows users to run many applications without overlapping windows, and is particularly useful for large scale image-processing work. For users with 4 screens or less, **`configX`** can be used to configure the settings. For users with 5 to 16 screens, contact LynuxWorks technical support for specific instructions.

For each screen used, a separate configuration must be created for that screen's monitor and graphics card. The Matrox G100 Productiva Multi-Monitor is the only supported card.

Adding a Screen

Metro-X defaults to a single-screen setup. The first screen configured is labeled Screen 0. When adding a second screen, all of the configuration default settings are duplicated from the settings of Screen 0. If the hardware is the same on all screens, configuring Screen 0 before adding the other screens simplifies the setup and configuration. Similarly, as more screens are added, the settings of the currently active screen is used to set the default settings of the new screen.

When using multiple screens, the order in which the cards are probed on the motherboard (PCI/AGP bus) must match the order in which they are configured in **`configX`**.

To add a screen, use the following instructions:

1. Press **Alt-s** to display the **Screen** pull-down menu.
2. Type **A** for **Add**.

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3. The **Monitor** and **Graphics Card** icons for **Screen 0** become outlines, and two full-color icons appear for **Screen 1**.Refer to the procedures described earlier in this chapter if any changes need to be made to the new screen's configuration.
4. Use the **Pg down** and **Pg 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 example, Screens 0, 1, and 2 are currently configured and Screen 1 is deleted. Screen 2 then becomes Screen 1, but retains its own configuration. Screens 0 and 1 are the only remaining screens.

To delete a screen, use the following instructions:

1. Use the **Pg down** or **Pg up** key to activate the set of icons for the screen 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

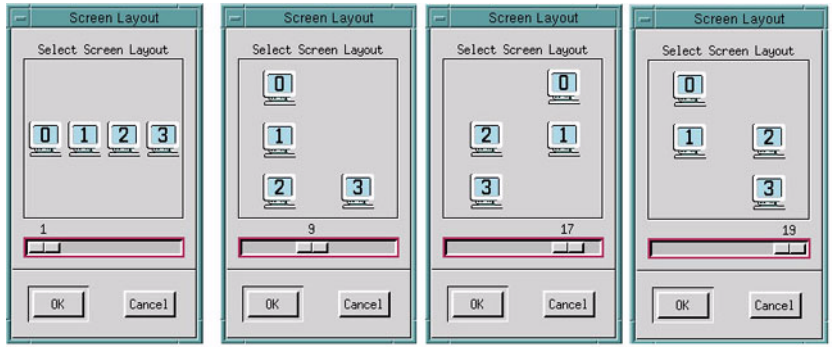

Figure 8-12: Screen Layout Windows

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The **Screen Layout** window lets users specify the arrangement of multiple screens in workspaces for screen-to-screen mouse movement. To arrange multiple screens, use the following instructions.

1. Press **Alt-s** to display the **Screen** pull-down menu.
2. Type **L** for **Layout**.
3. The **Screen Layout** window appears.
4. Press **Left arrow** or **Right arrow** to view the various layout combinations for the number of screens.
5. When the correct layout is displayed, press **Enter** to select it.

Configuring a Touch Screen

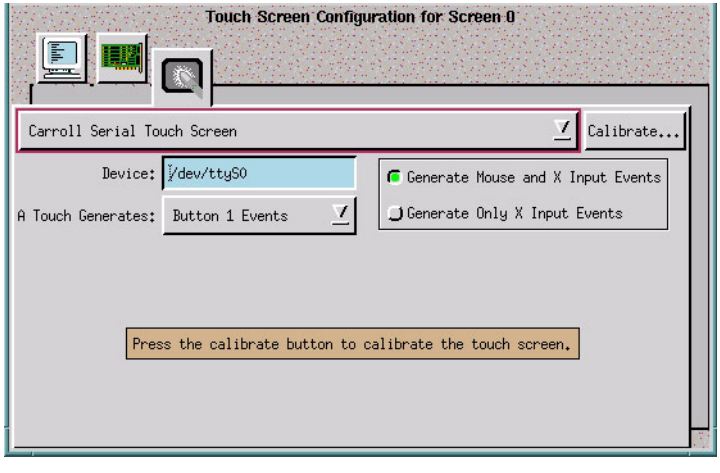

Figure 8-13: Touch Screen Configuration

Users can add one touch screen for every monitor (screens 0 - 3) displayed in **`configX`**. Each touch screen is associated with one monitor and one graphics card.

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To configure touch screens, use the following instructions:

1. Select the monitor icon with which the touch screen should be associated. (The active icon is in color; inactive icons appear as maroon outlines.)
2. Press **Alt-t** to display the **Touch Screen** pull-down menu.
3. Type **A** for **Add**. The **Touch Screen Configuration** page appears.
4. Press **Down arro**w to display the list of touch screens.
5. Press **Up arrow** or **Down arrow** to scroll to the touch screen, and press **Enter** to select it.
6. Press **Tab twice** to move to the next field. (Bypass the **Calibrate** button until the touch screen configuration is complete.)
7. In the **Device** field, enter the name of the serial device to which your touch screen is attached.
8. Press **Tab** to move to the next field.
9. Select to generate either Mouse and X Input events, or X Input events only.
10. Press **Tab** to move to the next field.
11. In **A Touch Generates**, press **Down arrow** to display the list of events.
12. Press **Up arrow** or **Down arrow** to scroll to the type of button event the touch should generate, and press **Enter**.

The touch screen is ready to be calibrated. See the next section for details.

Touch Screen Calibration

All touch screens must be calibrated to match the display. Some touch screens are pressure sensitive, so the calibration process uses variations in pressure to distinguish between a button click or a simple move. Since touch screens vary, the calibration process must be set individually for each. To calibrate a touch screen, use the following instructions:

1. Press **Tab** to move to the **Calibrate** button on the **Touch Screen Configuration** page then press **Enter**.
2. A pop-up window appears with instructions and a flashing target appears in the upper-left corner of the screen.

   Touch the center of the target.

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3. A flashing target appears in the lower-right corner of the screen.

   Touch the center of the target.

4. A **Calibration Test** pop-up window appears with a flashing target above it.

   Touch this target and drag it around the screen to verify the calibration settings.

   The icon on the pop-up window shows what is being recorded (no touch, a touch, or a click).

5. If the touch screen is pressure sensitive, use the slider bar to adjust the click threshold.

   Any touch pressure higher than the click threshold is reported as a button click.

6. To re-calibrate your touch screen, click on the **Re-calibrate** button.

7. If the calibration is correct, click **OK**.

Deleting a Touch Screen

To delete a touch screen, use the following instructions:

1. In **`configX`**, select the icon of the touch screen to delete.
2. Press **Alt-t** to display the **Touch Screen** pull-down menu.
3. Type **D** to **Delete** the touch screen.

   The **Touch Screen Configuration** page is removed.

Touch Screen Setup with No Mouse Attached

To configure a touch screen when a mouse is not attached, use the following instructions:

1. Run **`configX`** from the command line.
2. Configure the touch screen per the instructions provided in “Configuring a Touch Screen” on page 116, but in the **Mouse** section, select **No Mouse Attached**.

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3. Save and exit from **`configX`** (see instructions in “Save and Exit” on page 119).
4. Edit the `.xinitrc` file in your home directory and add the following lines:

   ```
   twm &
   configX
   ```

5. Run `xinit`.
6. This opens **`configX`** in the mode selected.
7. Add the touch screen and perform the calibration.

Save and Exit

To save current settings and exit the program, use the following instructions:

1. Press **Alt-F** to display the **File** pull-down menu.
2. Type **s** to **Save and Exit**.

   The changes are saved and the Metro-X Configuration Utility closes. The system is now ready to run Metro-X.

Quit Without Saving

To quit without saving the current settings, use the following instructions:

1. Press **Alt-F** to display the **File** pull-down menu.
2. Type **q** to **Quit**.

   A precautionary dialog box appears:

   ```
   Save current configuration before exiting?
   ```

3. Press **Tab** to move to the **No** button, then press **Enter** to confirm exiting the Metro-X Configuration Utility without saving changes.

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Adjust Image (Timing Editor)

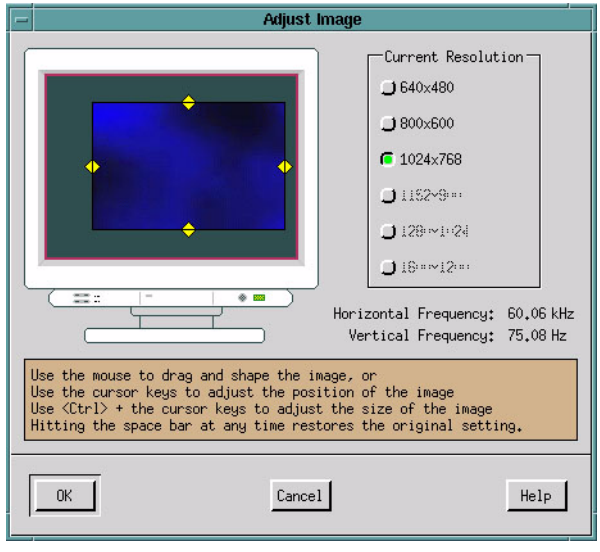

Figure 8-14: Adjust Image Screen

The **Adjust Image** pop-up window provides users the ability to change the size and position of the image display in the monitor. This is also known as a timing editor. Adjust the image for each of the physical resolutions previously selected in **`configX`**.

NOTE: Before adjusting the image, users must first configure the system, and restart the server. Run **`configX`** again and select **Adjust Image**.

Adjusting the Image

In the **Adjust Image** pop-up window is a picture of a monitor. The blue box on the monitor's screen represents the image displayed on your own screen at the current resolution. The yellow diamonds on each side of the blue box are handles which you can use to adjust the image.

- Use the mouse to drag the image to a new position.
- Use the mouse on the handles to stretch the image to a new size.

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- Use the cursor keys to move the image to a new position.
- Use **Ctrl** with the cursor keys to adjust the size of the image.

NOTE: Pressing the **Spacebar** at any time restores the image to its original setting.

To adjust the image, use the following instructions:

1. Activate a resolution toggle button to make it the current resolution (the screen automatically changes resolutions), and adjust the image for the current setting.
2. Repeat the procedure for each resolution to use.
3. Press **Tab** to move through the bottom buttons and press **Enter** to select one.

   If the adjusted image is correct, select the **OK** button, or to disregard the changes made, select the **Cancel** button.

   Save and exit from **configX** (see "Save and Exit" on page 119").

Starting X

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

```
# startx
```

PS/2 Mouse Support

If selecting a PS/2 mouse, select the appropriate mouse name (for example: `Intellimouse PS/2` or `PS/2 compatible` in the **configX** utility and select the mouse port `/dev/mouse`. Note that the PS/2 mouse driver must be installed in LynxOS before it is available to **configX** (see "Installing the PS/2 Mouse Driver" on page 91 in Chapter 7, "X & Motif Installation Instructions").

Audio Bell

The default bell tone can be changed with **xset**.

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Default Configuration Files

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

Switching Between Resolutions

If more than one screen resolution is available, users can use a hot-key combination to change the resolution on the fly:

- **Ctrl-Alt-+** increases the resolution, or
- **Ctrl-Alt--** (minus) reduces the resolution.

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APPENDIX A *mkpart(1) man page*

NAME

`mkpart` - An interactive utility to modify partitions

SYNOPSIS

`mkpart <device_name>`

DESCRIPTION

`mkpart` is an interactive utility that modifies the partitions of a disk. `mkpart` will work with all types of hard disks and devices that emulate hard disks (flash, magneto optical drives, ram disks, etc...) `mkpart` works on devices with non 512 byte block sizes, it will determine the physical block size of the device and get the data to the right spot on the device. Beware though, booting of greater than 512 byte physical devices with BIOS on the x86 is likely to fail. mkpart will not work on read-only devices, for good reason. The argument to mkpart is the raw device that corresponds to the whole disk. e.g. `/dev/rhd0`, `/dev/rsd2940.0`, `/dev/rsd3`.

The commands available for `mkpart` are:

- **`a`** - set active partition, `s` partition-letter. Only the base partitions may be selected for booting. An extended partition cannot be made bootable.
- **`c`** - clear all in memory partitions
- **`d`** - delete a partition,

  `d` *<partition_letter>*

  This command will delete the partition letters specified.
- **`e`** - save changes then exit

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- **h** or **?** - print instructions
- **m** - make a partition:

  m [*l*] **size**[*/type*]
- **p** - print partition information
- **q** - exit and do not save changes
- **v** - verbose, toggles the information level, off by default
- **r** - reload partitions from disk
- **s** - set partition.

  s <*partition_letter*> <*partition_type*>
- **G** - specify drive geometry. This command will be rarely needed. In some cases a user may want to specify the physical geometry of the disk.
- **command ?** - Gives a mini help screen detailing how to use the command. e.g. The command **m ?** gives help on the m command.

A partition is a contiguous set of blocks that is pointed to by the partition pointer. The **mkpart** utility manipulates the partition pointers. The partition pointers can be located in block 0 of the disk or within an extended partition. The **m** command is used to create a base partition pointer or a logical partition pointer. The size of the partition with the m command is always given in megabytes. The partition's actual size will be rounded up to the next cylinder boundary so the size of a partition might not exactly be the size given.

For example, to make a 100 megabyte base partition:

```
m 100
```

The m command can be used to create partitions without excessive typing by:

```
m 10 20 30 40
```

This will create 4 base partitions of 10, 20, 30 and 40 megabytes assuming of course you have 4 free base partitions and you have 100 megabytes available on the device. If you want to use the last available chunk of space on the device then the "all" size can be used for the last partition size given.

```
m 10 20 30
```

all will create a 10, 20 and 30 megabyte partition and a fourth partition with the remaining space available. Since partitions are rounded up to cylinder boundaries there can be disks that have less then a cylinders worth of blocks left. This space

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cannot be claimed by mkpart and will go unused. This is typically less then 1 megabyte though.

The default partition type is 64. This indicates a LynxOS partition. To create a partition of a different type use the `/` option with the `m` command.

```
m 100/20
```

This creates a 100 megabyte partition of type 20.

If you want more then 4 partitions then an extended partition must be used. One of the base partition pointers must be an extended partition type. The extended partition type is 5. The command

```
m 400/5
```

creates a 400 megabyte extended partition. As mentioned in the definitions the extended partition contains partition pointers and partitions.

NOTE: If the extended partition is written to as a block or raw device the logical partitions within the extended partitions will be lost.

Once the extended partition has been created the `l` option of the `m` command can be used. This says to create a logical partition within the extended partition. Given an extended partition the command

```
m l 30 40 50
```

would create 3 logical partitions of 30, 40 and 50 megabytes within the extended partition. Logical partitions can be of various types as well, just specify the /partition-type option after the size to override the default type.

NOTE: DOS® `fdisk` will not display non DOS logical partition types. You can either guess the correct DOS logical partition type for logical partitions intended to be used by DOS or just create all extended partitions with DOS fdisk then run mkpart and change the logical partition types to LynxOS types for use with LynxOS.

The base partitions are named `a`, `b`, `c` and `d`. The extended partitions start with letter `e` and proceed through letter `o`. Partition `o` is the limit because there are 4 bits available in the minor number allocated to the partitions. This means there are 14 usable (mountable) partitions. 0 is allocated to the entire disk and one of the base partitions is used up by pointing to an extended partition, leaving 14.

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For all partition types except type 65 a size must be specified. The type 65 partition is reserved to represent a PowerPC boot partition. The 1st partition created must be a type 65 in order to have that disk be able to boot on the PowerPC. **`m /65`** will create a 0 length type 65 partition. This partition uses up a base partition pointer.

NOTE: If `makeboot` is run on a PowerPC this partition will become non 0 in size. This is ok. What happened is that makeboot modified the type 65 partition to point to a contiguous file that looks like a bootable partition. This contiguous file is located within another partition.

Upon executing the **`exit`** command, `mkpart` will modify the 0 block of each partition displayed by `mkpart`. So experimenting and exiting with `mkpart` will result in various blocks on the device being written.

The **`d`** command is used to delete partitions. Just type **`d`** *`partition_letter`* to delete the partition. To delete lots of partitions at once, specify more partition-letters after the `d` command. When deleting logical partitions beware of partition jumbling. When logical partitions are created physical space is reserved. This space could contain important data like filesystems and cannot be moved around. When a logical partition is deleted the physical space pointed to by the logical partition pointer is still there but it is available for use by the m command. This space is referred to as a hole. Adjacent holes are automatically coalesced.

The **`s`** command is used to change the partition type. There are various reasonable restrictions placed on the s command like:

- An extended partition containing logical partitions cannot be changed from an extended partition type.
- A PowerPC boot partition type cannot be changed.
- A bootable partition cannot have its type changed to an extended partition.

When **`mkpart`** is first run it reads the labels on the disk and loads the internal partition tables with that data. After some modification it may be desirable to reload this information. The r command accomplishes this. Quitting then restarting mkpart accomplished the same thing.

The **`c`** command will clear the internal partition tables. Think of it as a lets start fresh command.

When verbose mode is enabled, the starting block, end block, and number of blocks allocated for the partition is also displayed.

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The **p** command prints the partition information. With extended partitions the number of lines can be excessive so the p command takes an optional integer argument that can limit the number of lines displayed e.g. **p 20**, would print 20 lines of information.

The **a** command is used to set an active partition. Only the x86 and PowerPC platforms need to have an active partition for booting. The makeboot command for the x86 and PowerPC will also set the active partition when they are run. This command is most useful when bootinganother operating system on a different partition.

Definitions

- **hole** - A set of contiguous blocks that had previously been allocated as a partition and is now available for use by the **m** command.
- **partition jumbling** - A side effect of deleting logical partitions. If a logical partition is deleted then all logical partitions located after the deleted logical partition will get a new letter assignment. This could adversely effect which disks get automatically mounted in `/etc/fstab`. partition jumbling never occurs for base partitions.
- **extended partition** - A partition, of type 5, that is used to provide more then 4 partitions. There are only 4 base partitions available in the 0 block of the disk limiting the number of partitions available without the extended partition to 4. The extended partition contains partition pointers and partitions that allow the number of partitions to be more then 4.
- **partition type** - A number in the range 0 - 255 that is associated with a partition. Different partitions can be of different types.
- **partition-letter** - A letter in the range a-zz. a, ab, cf, yy, b, and zz are examples of legal partition-letters.
- **logical partition** - A partition located within the extended partition.
- **partition pointer** - information to locate the start and size of a partition.
- **base partition** - A partition pointed to by a partition pointer located in the 0 block of the disk. There are only 4 base partitions pointers available which means only 4 base partitions are available.
- **0 block** - The 1st block for the given device. For example the 0 block of device /dev/rhd0 is the 1st block of the entire disk and is referred to as the 0 block of the disk, where the 0 block of `/dev/rhd0a` is the 1st block of partition a and is referred to as the 0 block of the partition.

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- **physical block** - The number of bytes that make up a block on the device. This is usually 512 bytes for hard disks and 2048 bytes for CD-ROM and MO drives.
- **logical block** - The number of bytes in each block of the filesystem. The logical blocks must be a multiple of the physical block of the device.
- **start block** - The physical starting block where the partition begins
- **partition size** - The number of contiguous physical blocks that are dedicated to the partition.
- **bootable partition** - The partition that firmware will boot from. This only applies to the x86 and PowerPC. x86 BIOS and PowerPC bug look for an active partition to boot.
- **CHS** - Cylinder head sector. This term is used to describe the geometry of the disk. The geometry of the disk is used by mkpart to calculate how many blocks are in a cylinder.

SEE ALSO

Utility Program - `setactive(1)`

draft

Index

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