Home

OS-9® for RPX Lite Board Guide

Version 4.7

RadiSys
THE POWER OF WE

www.radisys.com
Revision A • July 2006

Copyright and publication information

Disclaimer

The information contained herein is believed to be accurate as of the date of publication. However, RadiSys Corporation will not be liable for any damages including indirect or consequential, from use of the OS-9 operating system, Microware-provided software, or reliance on the accuracy of this documentation. The information contained herein is subject to change without notice.

Reproduction notice

The software described in this document is intended to be used on a single computer system. RadiSys Corporation expressly prohibits any reproduction of the software on tape, disk, or any other medium except for backup purposes. Distribution of this software, in part or whole, to any other party or on any other system may constitute copyright infringements and misappropriation of trade secrets and confidential processes which are the property of RadiSys Corporation and/or other parties. Unauthorized distribution of software may cause damages far in excess of the value of the copies involved.

Table of Contents

Chapter 1: Installing and Configuring OS-9® 5

6 Development Environment Overview
7 Requirements and Compatibility
7 Host Hardware Requirements (PC Compatible)
7 Host Software Requirements (PC Compatible)
8 Target Hardware Requirements
9 Target Hardware Setup
10 Connecting the Target to the Host
13 Building the OS-9 ROM Image
13 Coreboot
13 Bootfile
14 Starting the Configuration Wizard
16 Creating and Configuring the ROM Image
17 Select System Type
17 Configure Coreboot Options
20 Configure System Options
22 Network Configuration
28 Disk Configuration
30 Build Image
33 Transferring the ROM Image to the Target
34 Configuring TFTPServer32 on the Host
35 Configuring EEPROM on the Target
37 Loading the OS-9 ROM Image into RAM
39 Programing the OS-9 ROM Image into Flash
41 Autobooting OS-9
42 Optional Procedures
42 Preliminary Testing

Chapter 2: Board Specific Reference 45

46 Boot Menu Options
48 Runtime Information and Configuration Options
48 Sample Bootfile Images
48 OS-9 Vector Mapping
52 Dual-port RAM Mapping
53 Flash Memory Usage

Appendix A: Board Specific Modules 55

56 Low-Level System Modules
56 System Modules
56 Configuration Modules
56 Debugging Modules
56 Timer Modules
57 Console Drivers
57 Ethernet Driver
58 High-Level System Modules
58 Real Time Clock Driver
58 Ticker
58 Shared Libraries
59 Serial and Console Drivers
60 Common System Modules List

Chapter 1: Installing and Configuring OS-9®

This chapter describes installing and configuring OS-9® on the RPX Lite target board. It includes the following sections:

- **Development Environment Overview**
- **Requirements and Compatibility**
- **Target Hardware Setup**
- **Connecting the Target to the Host**
- **Building the OS-9 ROM Image**
- **Transferring the ROM Image to the Target**
- **Optional Procedures**

For More Information

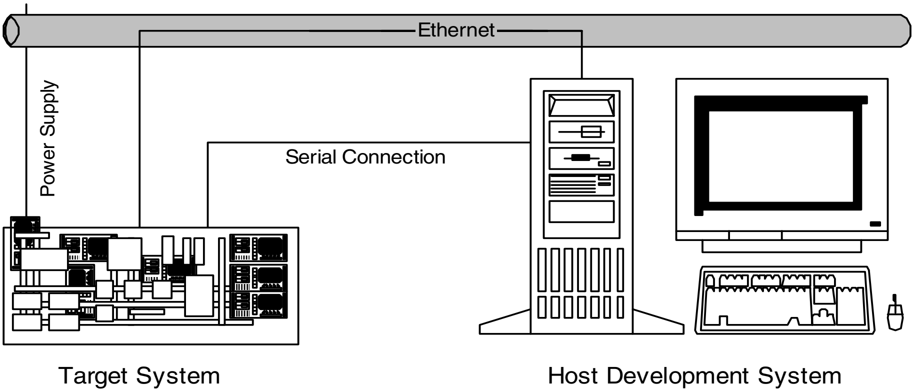
You can find hardware documentation at the following URL:

http://www.embeddedplanet.com/documentation_and_manuals.htm#RPX Lite (RPXL)

Development Environment Overview

Fig. 1-1 shows a typical development environment for the RPX Lite board. The components shown include the minimum required to enable OS-9 to run on the board.

Figure 1-1 RPX Development Environment



Requirements and Compatibility

Host Hardware Requirements (PC Compatible)

Your host PC must meet the following minimum requirements:

- Windows 95, 98, ME, 2000, or NT
- 300-400 MB of free disk space
    - an additional 235MB of free disk space is required to run PersonalJava™ for OS-9
    - the RPX Lite Board Level Support package requires about 100 MB of free disk space
- 16MB of RAM (64MB recommended)
- Serial port

Host Software Requirements (PC Compatible)

Your host PC must have the following applications:

- Microware OS-9 for PowerPC
- A terminal emulation program (such as `Hyperterminal` that comes with Microsoft Windows 95, Windows 98, and Windows NT 4.0).

Target Hardware Requirements

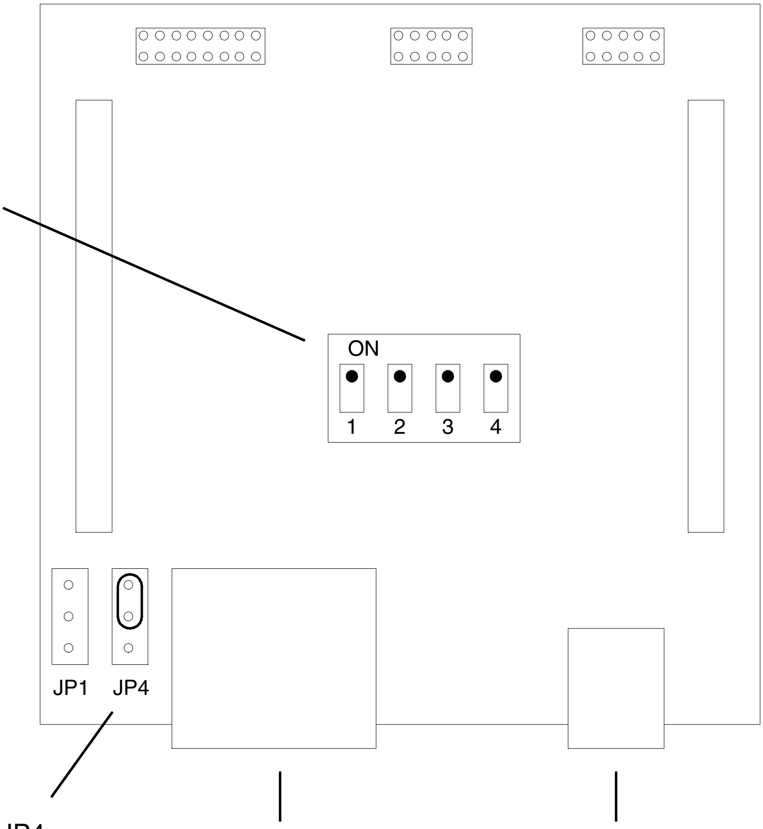
Your target system requires the following hardware:

- Power supply
- Ethernet 10BaseT and connecting cables
- RS-232 serial connectors and cables
- minimum of 4MB DRAM/2MB Flash

Target Hardware Setup

This section describes any switch settings that must be made on the target board. Figure 1-2 shows a properly configured RPX Lite target board.

Figure 1-2 Target Board Switch Settings



Set DIP switches as shown. For autobooting the OS-9 ROM image, DIP switches 3 and 4 are set to Off.

Set jumper JP4 as shown

Network/Serial Connection

Power Supply

Connecting the Target to the Host

This section describes connecting the target board to the Host PC via serial and Ethernet connections. It also describes using a terminal emulation program for the target.

Note

Your development system must have the following basic elements to complete this procedure:

- serial connection between the Host PC and the Target
- Ethernet connection from your Host and Target to a network
- terminal emulation program (for example `Hyperterminal`)
- appropriate power supply to the Target

Complete the following steps to connect the target to the host:

Step 1. Connect the target's RS-232 COM port to an unused RS-232 COM port on your Host PC using a serial cable.

Note

The RS232 COM port is marked MON on the RPX Lite board.

Step 2. Connect the target board to an Ethernet network. Your Host PC must also be connected to a network. You will use TFTP later in this procedure to move the ROM image from the Host to the target.

Step 3. Start Hyperterminal on the Host PC by selecting `Start -> Programs -> Accessories -> Hyperterminal`.

Step 4. Enter a name for your Hyperterminal session.

Step 5. Select an icon for the new Hyperterminal session. A new icon will be created with the name of your session associated with it.

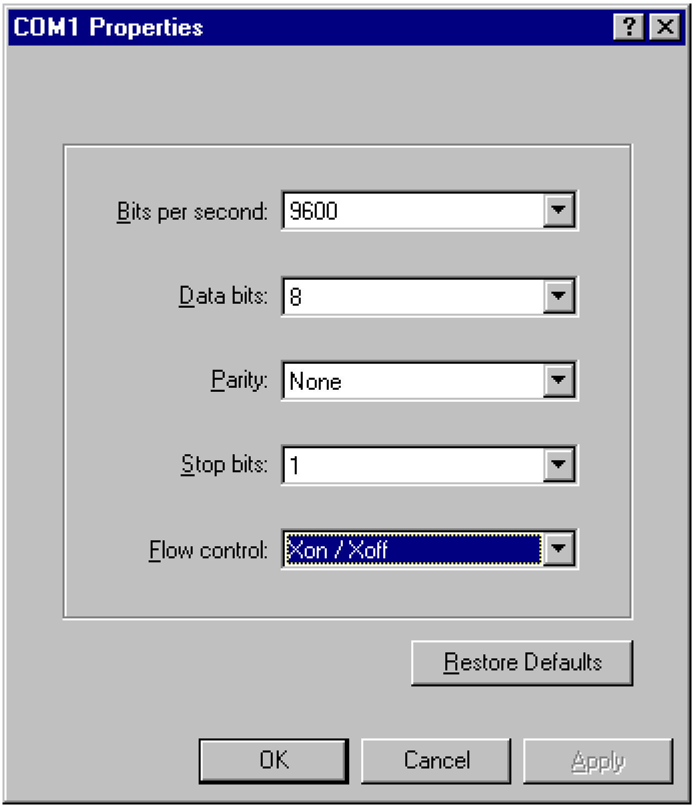
Step 6. Click `OK`.

Step 7. In the `Connect To` dialog box, go to the `Connect using` pull-down menu and enter the communications port to be used to connect to the target system.

Step 8. Click `OK`.

Step 9. Configure the `Port Settings` tab, as shown in **Figure 1-3**.

Figure 1-3 COM Port Settings



COM1 Properties

Bits per second: 9600

Data bits: 8

Parity: None

Stop bits: 1

Flow control: Xon / Xoff

Step 10. Click `OK`.

Step 11. In the Hyperterminal window, select `File/Properties`. Click on the `Settings` tab and select the following:

```
Terminal Keys

Emulation = Auto Detect

Backscroll Buffer Lines = 500
```

Step 12. Click `OK`.

Step 13. Go to the Hyperterminal menu and select `Call/Connect` from the pull-down menu to establish your terminal session with the Target. If you are connected, the bottom left corner of your Hyperterminal screen will display the word *connected*.

Step 14. Leave the Hyperterminal window open on your desktop (or minimized); you will use the window again later in this procedure.

Building the OS-9 ROM Image

The OS-9 ROM Image is a set of files and modules that collectively make up the OS-9 operating system. The specific ROM Image contents can vary from system to system depending on hardware capabilities and user requirements.

To simplify the process of loading and testing OS-9, the ROM Image is generally divided into two parts: the low-level image, called `coreboot`, and the high-level image, called `bootfile`.

Coreboot

The coreboot image is generally responsible for initializing hardware devices and locating the high-level (or bootfile) image as specified by its configuration. For example from a FLASH part, a harddisk, or Ethernet. It is also responsible for building basic structures based on the image it finds and passing control to the kernel to bring up the OS-9 system.

Bootfile

The bootfile image contains the kernel and other high-level modules (initialization module, file managers, drivers, descriptors, applications). The image is loaded into memory based on the device you select from the boot menu. The bootfile image normally brings up an OS-9 shell prompt, but can be configured to automatically start an application.

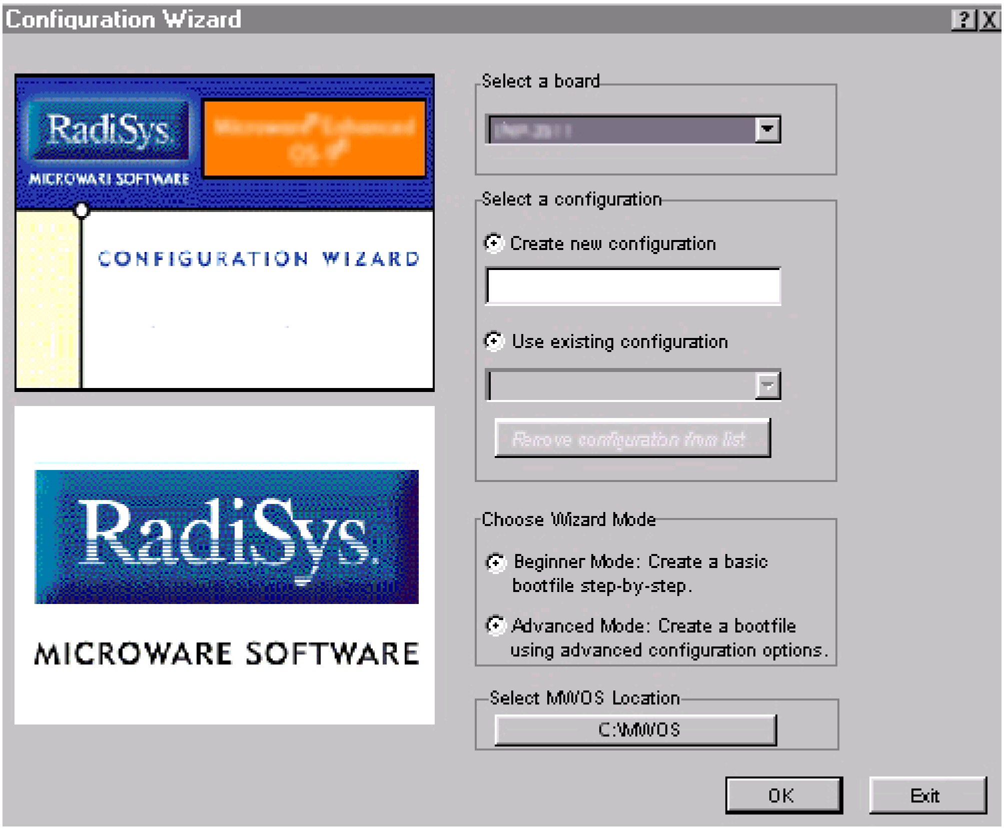
Microware provides a Configuration Wizard to create a coreboot image, a bootfile image, or an entire OS-9 ROM Image. The wizard can also be used to modify an existing image. The Configuration Wizard is automatically installed on your host PC during the OS-9 installation process.

Starting the Configuration Wizard

The Configuration Wizard is the application used to build the coreboot, bootfile, or ROM image. To start the Configuration Wizard, perform the following steps:

Step 1. From the Windows desktop, select `Start` -> `RadiSys` -> `Microware OS-9 for <product>` -> `Configuration Wizard`. You should see the following opening screen:

Figure 1-4 Configuration Wizard Opening Screen

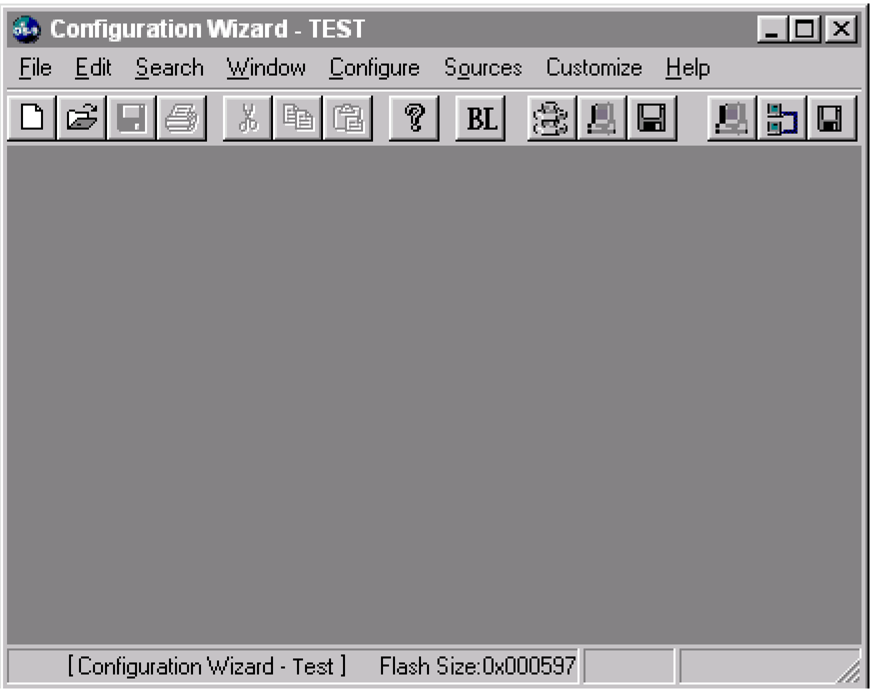

Configuration Wizard
? X
RadiSys
MICROWARE SOFTWARE
CONFIGURATION WIZARD
RadiSys.
MICROWARE SOFTWARE
Select a board
Select a configuration
○ Create new configuration
○ Use existing configuration
Remove configuration from list
Choose Wizard Mode
○ Beginner Mode: Create a basic bootfile step-by-step.
○ Advanced Mode: Create a bootfile using advanced configuration options.
Select MWOS Location
C:\MWOS
OK
Exit

Step 2. Select your target board from the **Select a board** pull-down menu.

Step 3. Select the `Create new configuration` radio button from the **Select a configuration** menu and type in the name you want to give your ROM image in the supplied text box. This names your new configuration, which can later be accessed by selecting the **Use existing configuration** pull down menu.

Step 4. Select the `Advanced Mode` radio button from the **Choose Wizard Mode** field and click `OK`. The Wizard's main window is displayed. This is the dialog from which you will proceed to build your image. An example is shown in **Figure 1-5**.

Figure 1-5 Configuration Wizard Main Window



Creating and Configuring the ROM Image

This section describes how to use the Configuration Wizard to create and configure your OS-9 ROM image.

Note

The OS-9 ROM image comprises two files--`coreboot.s` and `bootfile.s`. For the RPX Lite target board, these two files are built and transferred from the host PC to the target board separately.

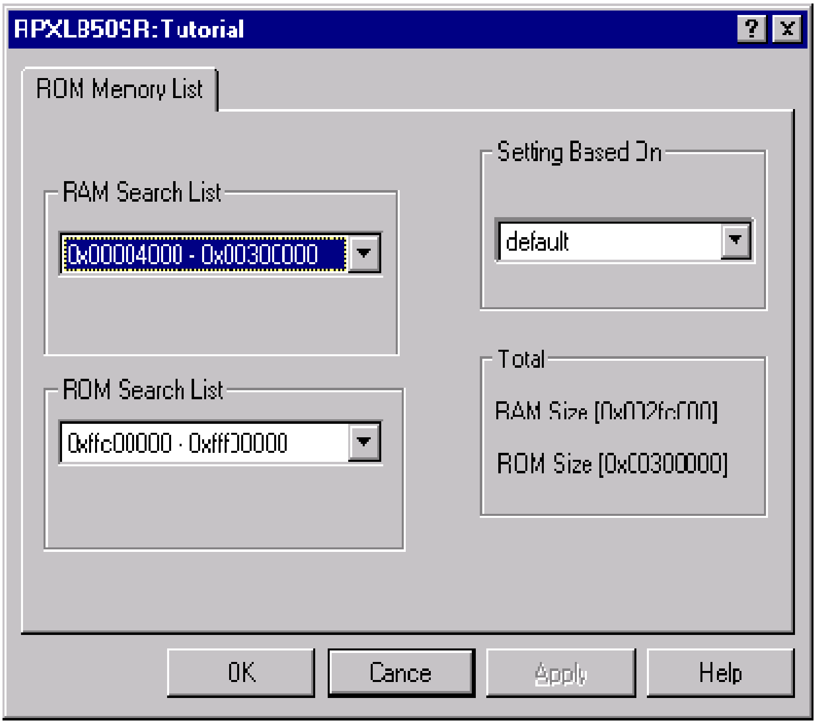
Note

This section provides an example of an OS-9 ROM image successfully built on a host PC and transferred to an RPX Lite target board. You may have to modify your selections depending on your application.

Select System Type

Configure system type options by selecting `Configure` -> `Sys` -> `Select System Type` from the Main Configuration window. **Figure 1-6** shows the proper settings.

Figure 1-6 System Type Settings



RPXL850SR:Tutorial

ROM Memory List

RAM Search List: 0x00004000 - 0x0030C000

ROM Search List: 0xffc00000 - 0xfff00000

Setting Based On: default

Total

RAM Size [0x002fc000]

ROM Size [0x00300000]

Select appropriate settings

Configure Coreboot Options

To configure your coreboot options, complete the following steps:

Step 1. From the Main Configuration window, select `Configure` -> `Coreboot` -> `Main configuration`.

Step 2. Select the **Debugger** tab.

Step 3. Under **Select Debugger**, select `RomBug`. This sets Ethernet as the method for user state debugging. Select `None` if you do not want to debug your program.

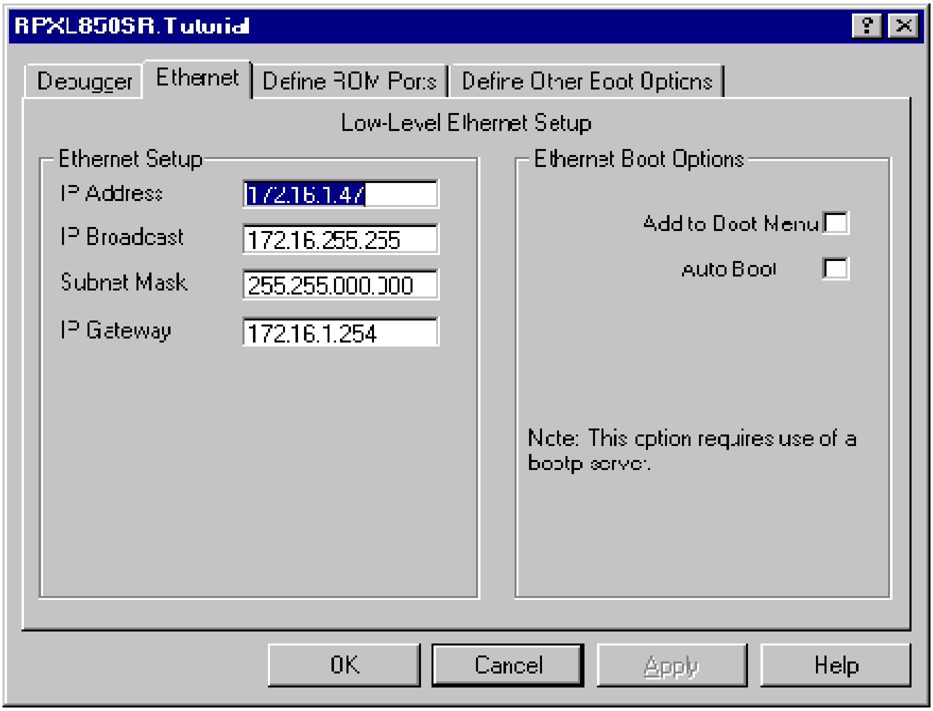
Note

To perform system state debugging, select `Ethernet` under **Remote Debug Connection**. If you set Ethernet as the method for system state debugging, you will not be able to perform user state debugging via Ethernet.

For system state debugging, you must also set the parameters in the **Ethernet** tab of the coreboot configuration.

Step 4. Select the **Ethernet** tab. The following window is displayed.

Figure 1-7 Coreboot Configuration—Ethernet Tab



Low-Level Ethernet Setup

Ethernet Setup

IP Address: 172.16.1.47

IP Broadcast: 172.16.255.255

Subnet Mask: 255.255.000.000

IP Gateway: 172.16.1.254

Ethernet Boot Options

Add to Boot Menu ☐

Auto Boot ☐

Note: This option requires use of a bootp server.

Step 5. Enter the appropriate Ethernet setup information.

Note

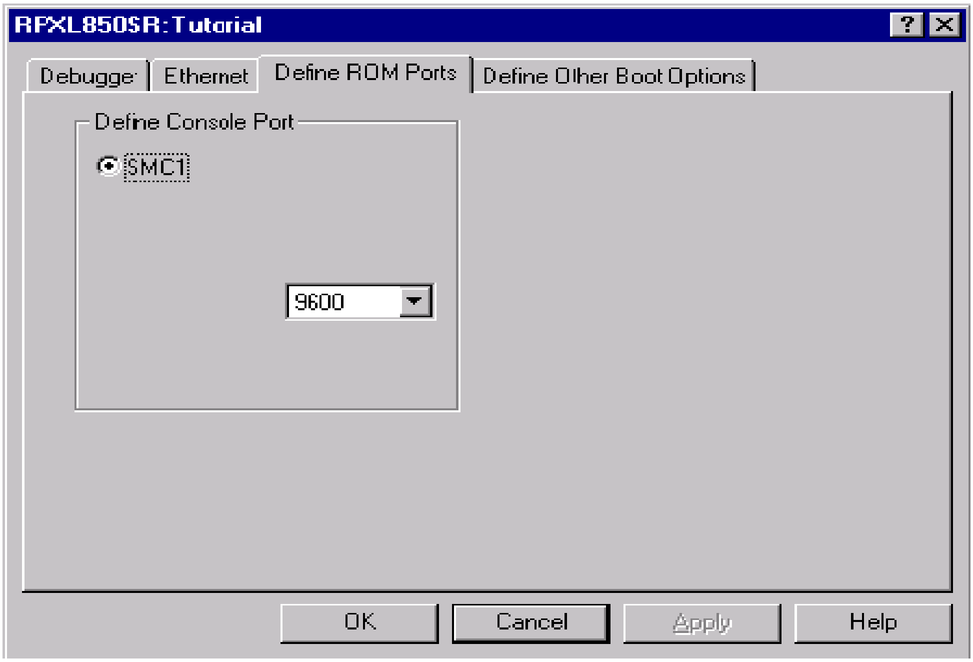
Complete the Ethernet setup information only if you intend to boot your system over a network or if you plan to use system state debugging.

Note

The addresses shown in **Figure 1-8** are for demonstration only. Contact your network administrator to obtain your Ethernet Setup information.

Step 6. Select the **Define ROM Ports** tab. The following window is displayed.

Figure 1-8 Coreboot Configuration—Define ROM Ports Tab



Define Console Port

● SMC1

9600

Step 7. Select Define Other Boot Options.

Step 8. Click OK and return to the **Main Configuration** window.

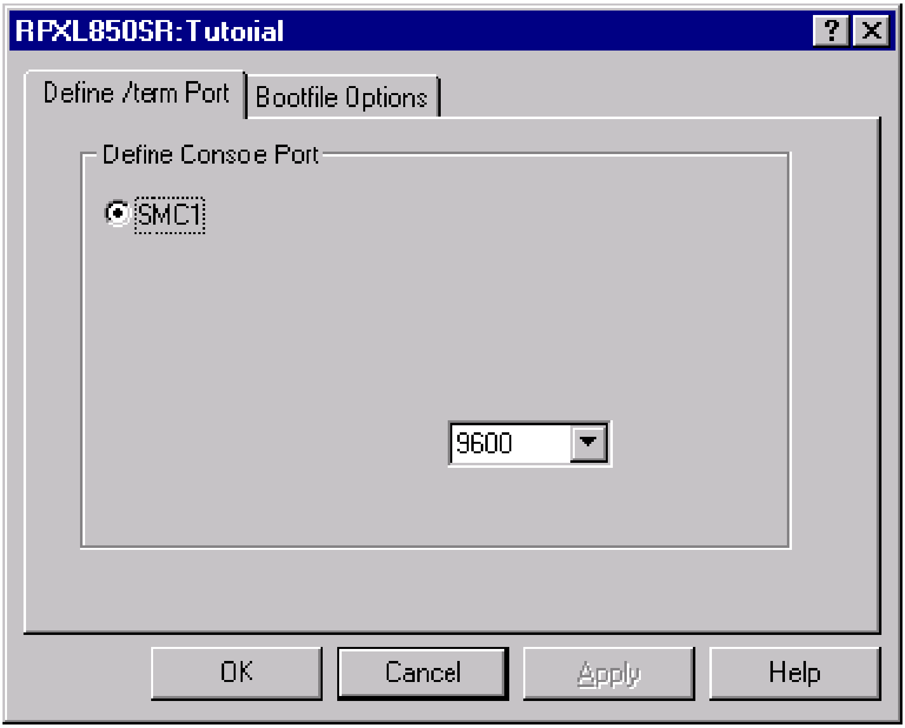
Configure System Options

Complete the following steps to configure your system options:

Step 1. From the **Main Configuration** window, select Configure -> Bootfile -> Configure System Options.

Step 2. Select the Define /term Port tab. The following window is displayed.

Figure 1-9 Bootfile Configuration—Define /term Port Tab



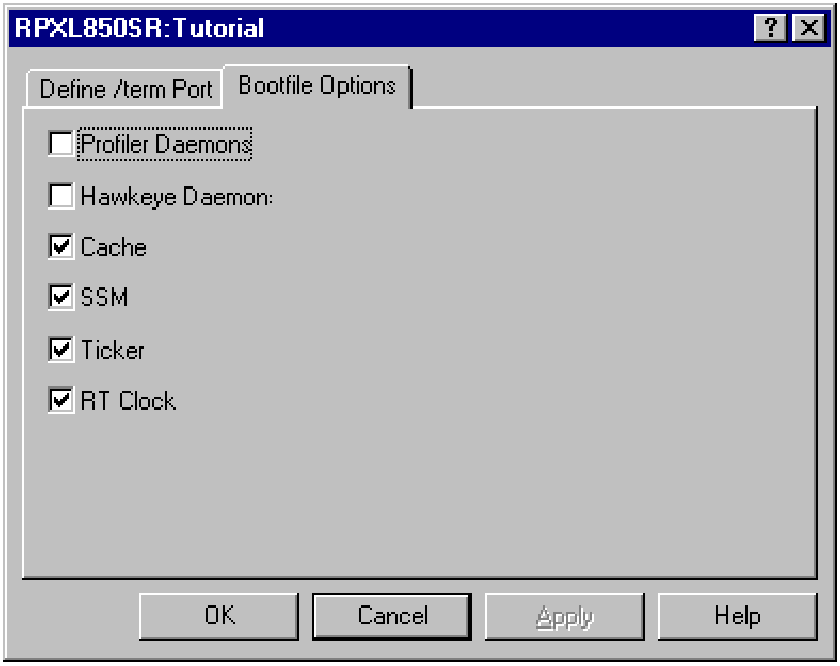
Define Consoe Port

● SMC1

9600

Step 3. Select the **Bootfile Options** tab. The following window is displayed.

Figure 1-10 Bootfile Configuration—Bootfile Options Tab



☐ Profiler Daemons

☐ Hawkeye Daemon:

☑ Cache

☑ SSM

☑ Ticker

☑ RT Clock

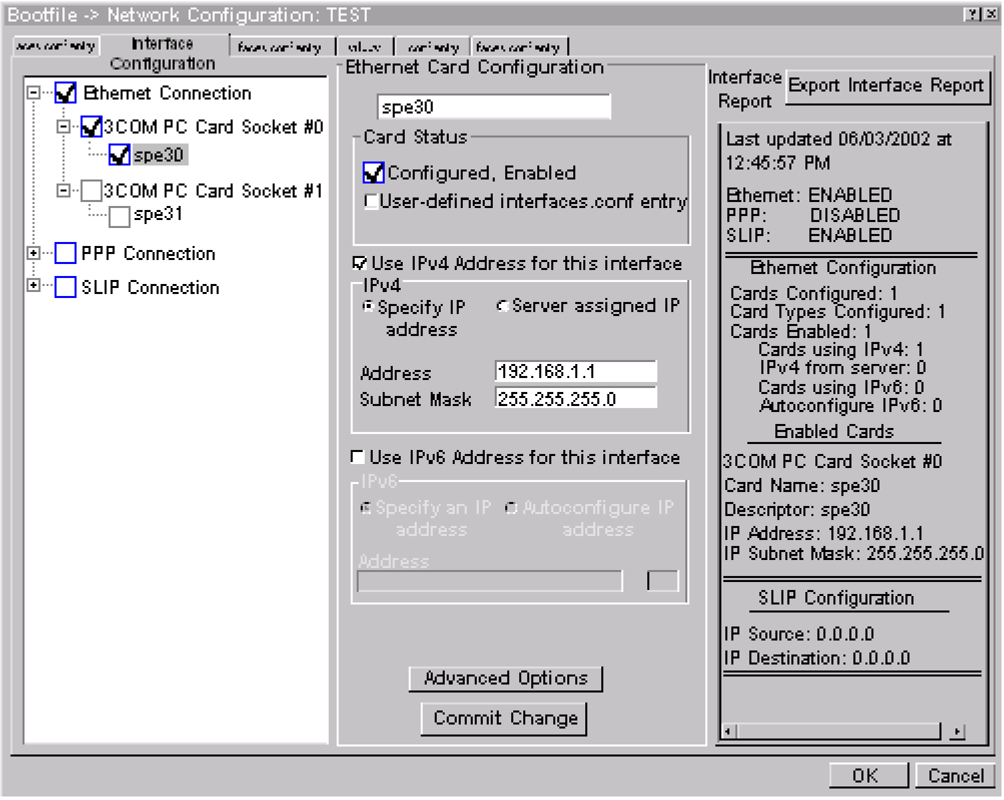
Network Configuration

To use the target board across a network--once the target is booted--complete the following steps:

Step 1. If you want to use the target board across a network, you will need to configure the Ethernet settings within the Configuration Wizard. To do this, select `Configure -> Bootfile -> Network Configuration` from the Wizard's main menu.

Step 2. From the **Network Configuration** dialog, select the `Interface Configuration` tab. From here you can select and enable the interface. For example, you can select the appropriate Ethernet card from the list of options on the left and specify whether you would like to enable IPv4 or IPv6 addressing. **Figure 1-11** shows an example of the **Interface Configuration** tab.

Figure 1-11 Bootfile -> Network Configuration -> Interface Configuration



Bootfile -> Network Configuration: TEST

- ☑ Ethemet Connection
  - ☑ 3COM PC Card Socket #0
    - ☑ spe30
  - □ 3COM PC Card Socket #1
    - □ spe31
- □ PPP Connection
- □ SLIP Connection

Ethernet Card Configuration

spe30

Card Status

☑ Configured, Enabled

□ User-defined interfaces.conf entry

☑ Use IPv4 Address for this interface

IPv4

● Specify IP address ○ Server assigned IP

Address 192.168.1.1

Subnet Mask 255.255.255.0

□ Use IPv6 Address for this interface

IPv6

● Specify an IP address ○ Autoconfigure IP address

Address

Interface Report

Last updated 06/03/2002 at 12:45:57 PM

Ethemet: ENABLED
PPP: DISABLED
SLIP: ENABLED

Ethemet Configuration

Cards Configured: 1
Card Types Configured: 1
Cards Enabled: 1
Cards using IPv4: 1
IPv4 from server: 0
Cards using IPv6: 0
Autoconfigure IPv6: 0

Enabled Cards

3COM PC Card Socket #0
Card Name: spe30
Descriptor: spe30
IP Address: 192.168.1.1
IP Subnet Mask: 255.255.255.0

SLIP Configuration

IP Source: 0.0.0.0
IP Destination: 0.0.0.0

For More Information

To learn more about IPv4 and IPv6 functionalities, refer to the ***Using LAN Communications*** manual, included with this product CD.

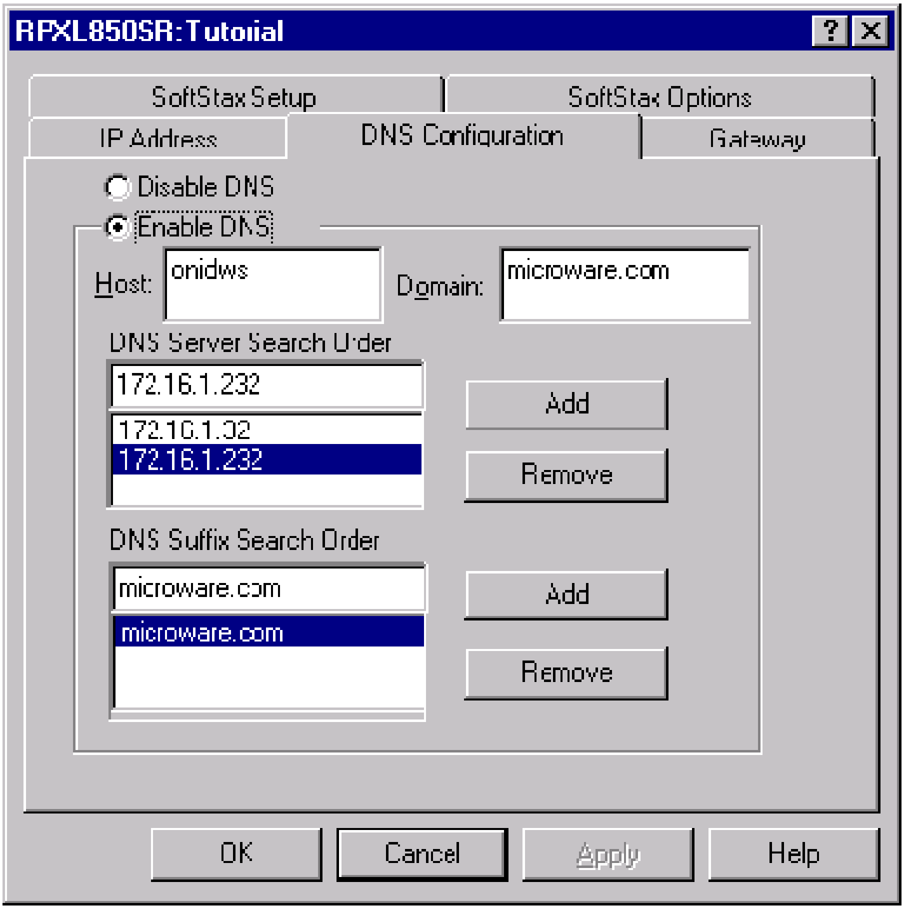
For More Information

Contact your system administrator if you do not know the network values for your board.

Step 3. Once you have made your settings in the **Network Configuration** dialog, click `OK`.

Step 4. Select the DNS Configuration tab. The following window is displayed:

Figure 1-12 Bootfile Configuration--DNS Configuration Tab



○ Disable DNS

● Enable DNS

Host: onidws

Domain: microware.com

DNS Server Search U'der

172.16.1.232

172.16.1.32
172.16.1.232

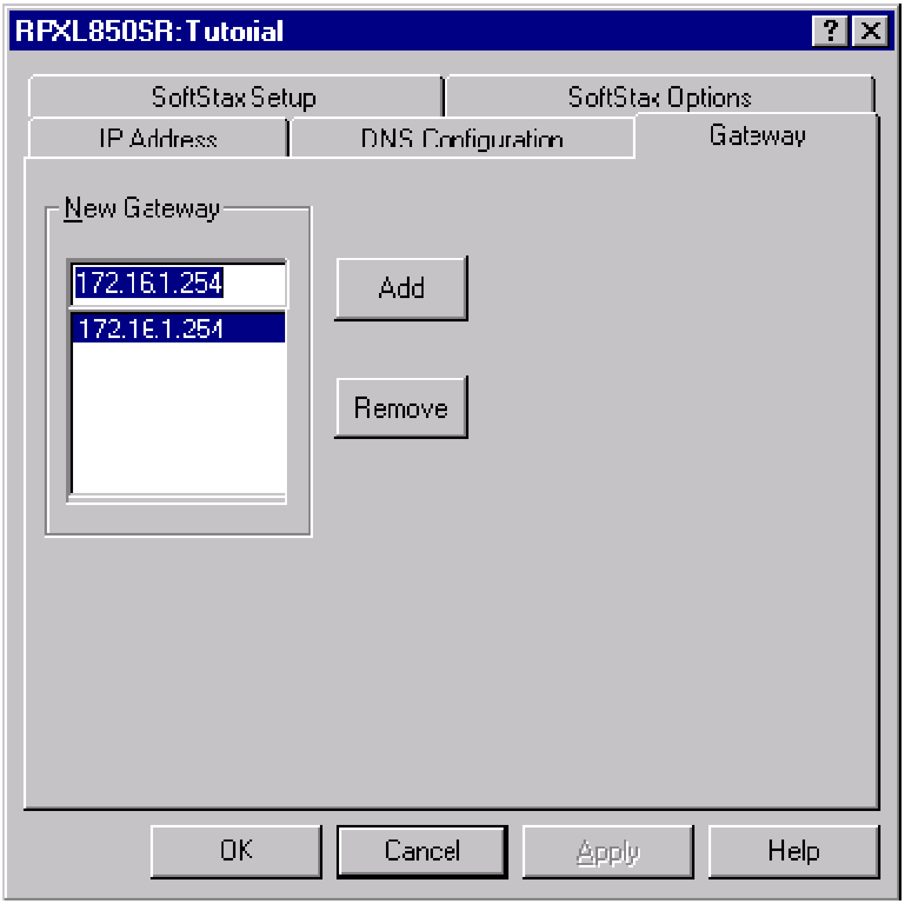
DNS Suffix Search Order

microware.com

microware.com

Step 5. Select the `Gateway` tab. The following window is displayed:

Figure 1-13 Bootfile Configuration--Gateway Tab

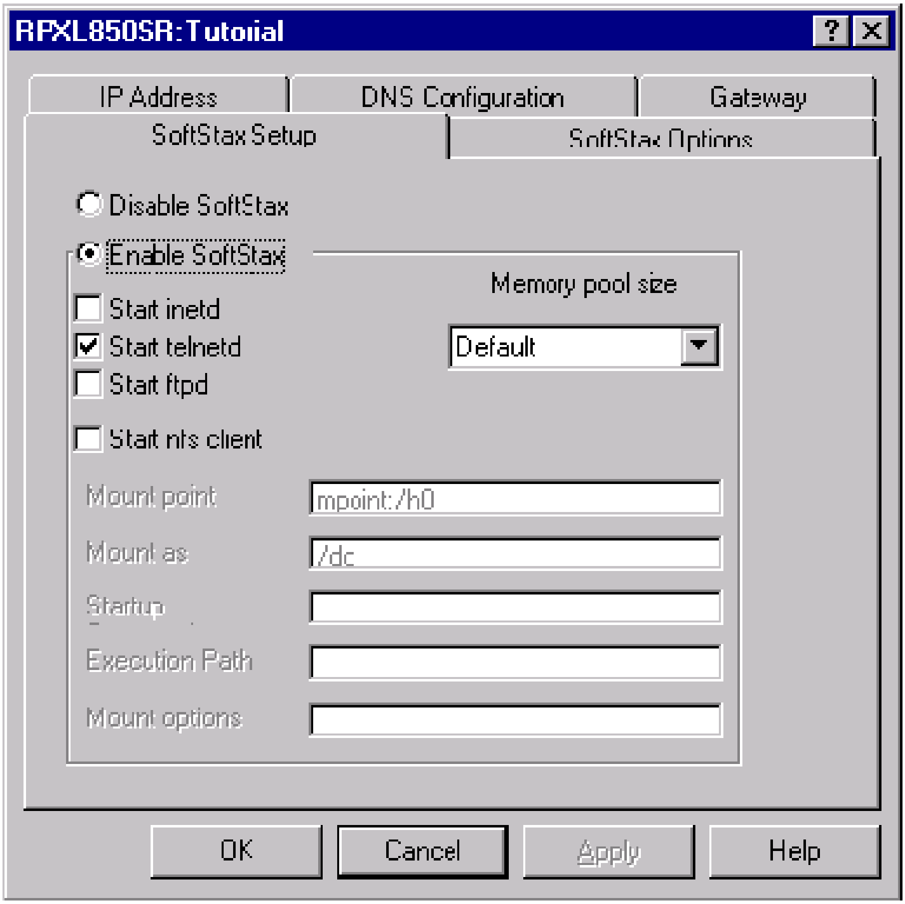


New Gateway: 172.16.1.254

172.16.1.254

Step 6. Select the SoftStax® Setup tab. The following window is displayed:

Figure 1-14 Bootfile Configuration--SoftStax Setup Tab



○ Disable SoftStax

● Enable SoftStax

□ Start inetd

☑ Start telnetd

□ Start ftpd

□ Start nfs client

Memory pool size: Default

Mount point: mpoint:/h0

Mount as: /dc

Startup:

Execution Path:

Mount options:

Note

This configuration is set for user state debugging on the target board. For system state debugging, select Disable SoftStax.

Step 7. Select the SoftStax Options tab.

Note
Using LAN Communications has more information about setting your network configuration.

Disk Configuration

Complete the following steps to complete disk configuration:

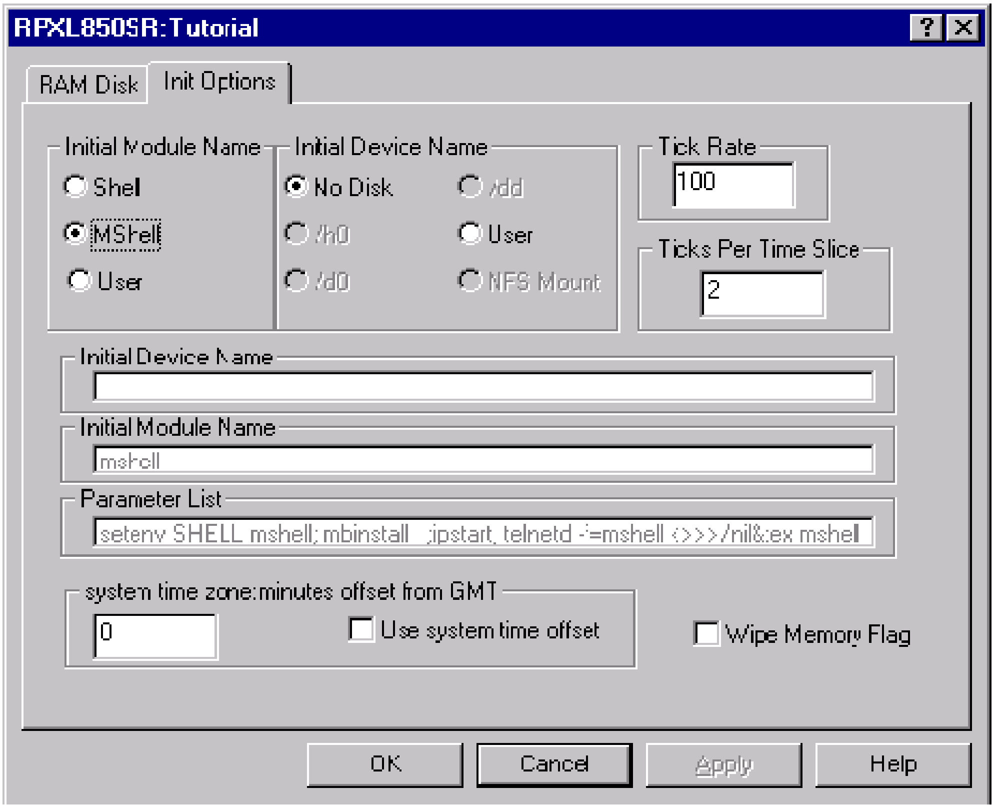
Step 1. From the main configuration window, select `Configure` -> `Bootfile` -> `Disk Configuration`.

The Disk Configuration options include the following tabs:

- The **RAM Disk** tab enables you to create a RAM disk of any size for loading modules onto the target.
- The **IDE Configuration** tab enables you to configure IDE drives for the target.

Step 2. Select the **Init Options** tab. The following window is displayed.

Figure 1-15 Bootfile Configuration—Init Options Tab



RPXL850SR:Tutorial

RAM Disk | Init Options

Initial Module Name: ○ Shell ● MShell ○ User

Initial Device Name: ● No Disk ○ /dd ○ /h0 ○ User ○ /d0 ○ NFS Mount

Tick Rate: 100

Ticks Per Time Slice: 2

Initial Device Name:

Initial Module Name: mshell

Parameter List: setenv SHELL mshell; mbinstall ;ipstart; telnetd -'=mshell <>>>/nil&;ex mshel

system time zone:minutes offset from GMT: 0

□ Use system time offset

□ Wipe Memory Flag

Step 3. Select the `Mshell` option for the initial module name. This causes OS-9 to start a console shell usable from your terminal window. Initial Device Name should be selected as `No Disk`.

The tick rate is `100` and ticks per timeslice is set to `2`. If you look at the **Parameter List** box, you see the commands that OS-9 executes upon system start-up.

Step 4. Click `OK` to return to the **Main Configuration** window.

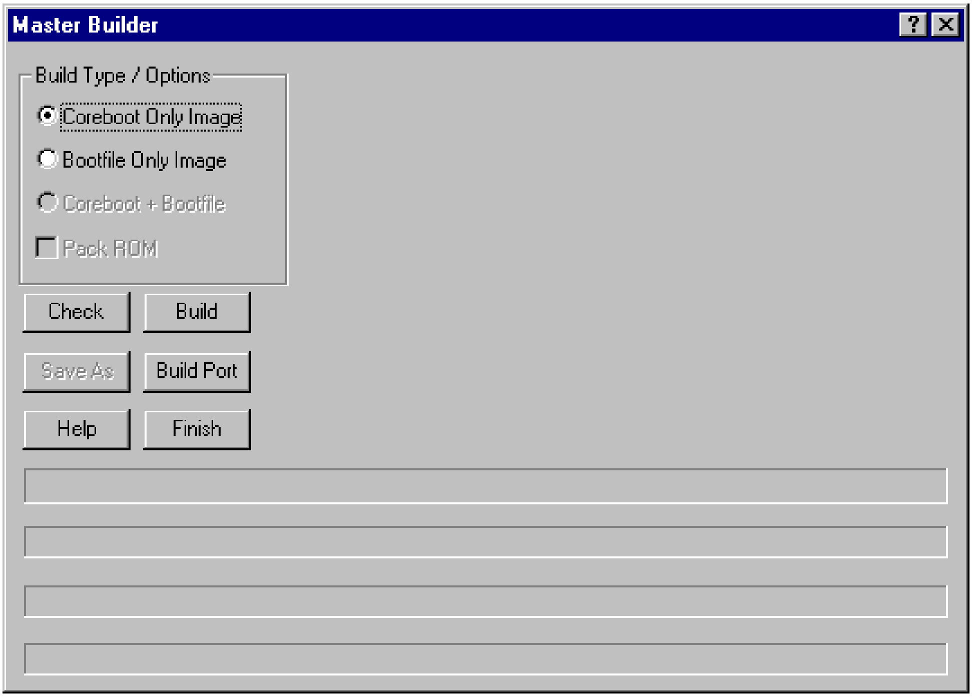
Build Image

For the RPX Lite target board, the Build Image section of the Wizard requires two separate operations for building the `coreboot.s` and `bootfile.s` images.

The build process creates and stores two files—`coreboot.s` and `bootfile.s`—in the following directory on your host system:

```
/mwos/OS9000/821/PORTS/RPXL850SR/BOOTS/INSTALL/PORTBOOT/
```

Step 1. Build the `coreboot` image by selecting `Configure -> Build Image` from the Main Configuration window. The following window is displayed.



Master Builder

Build Type / Options

● Coreboot Only Image

○ Bootfile Only Image

○ Coreboot + Bootfile

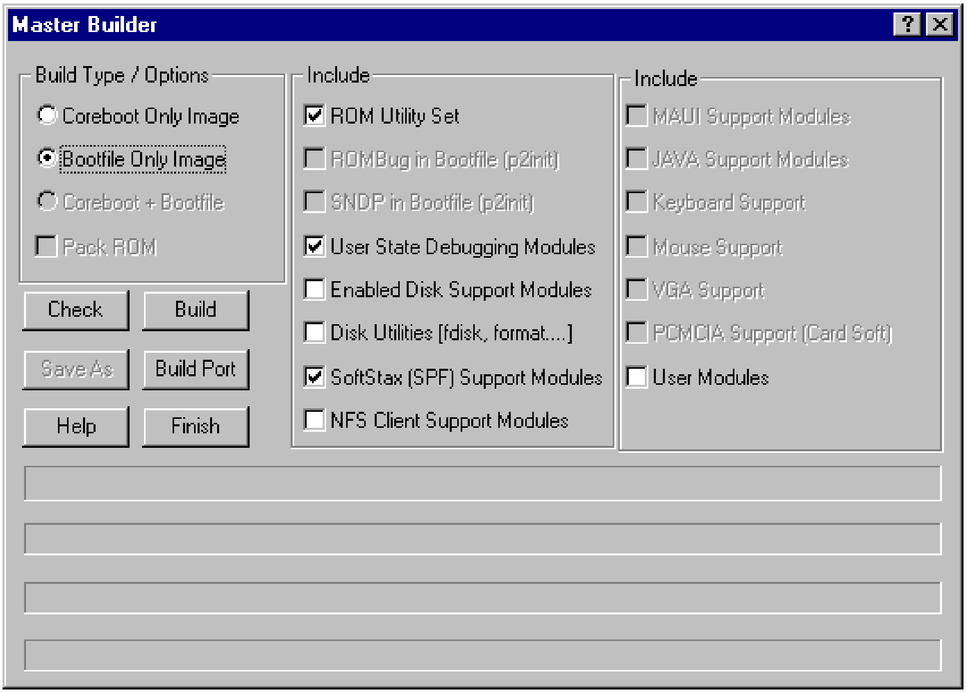
□ Pack ROM

Step 2. Select the `Coreboot Only Image` radio button.

Step 3. Click on the `Build` button.

After the image is built, click on the `Finish` button.

Step 4. Build the bootfile.s image by selecting Configure -> Build Image from the Main Configuration window. The following window is displayed.



Build Type / Options

○ Coreboot Only Image
● Bootfile Only Image
○ Coreboot + Bootfile
□ Pack ROM

Include

☑ ROM Utility Set
□ ROMBug in Bootfile (p2init)
□ SNDP in Bootfile (p2init)
☑ User State Debugging Modules
□ Enabled Disk Support Modules
□ Disk Utilities [fdisk, format....]
☑ SoftStax (SPF) Support Modules
□ NFS Client Support Modules

Include

□ MAUI Support Modules
□ JAVA Support Modules
□ Keyboard Support
□ Mouse Support
□ VGA Support
□ PCMCIA Support (Card Soft)
□ User Modules

Note

This configuration is set for user state debugging on the Target board. For system state debugging, select ROMBug in Bootfile (p2init) and deselect User State Debugging Modules under the Include section.

You must also complete the coreboot Ethernet information for system state debugging.

Step 5. Select the Bootfile Only Image radio button.

Step 6. Click on the Build button.

After the image is built, click on the Finish button.

Note

After the coreboot.s and bootfile.s images are built and you are returned to the Main Configuration window, you can select File -> Save Settings before exiting the Wizard. This saves the settings for your particular configuration.

Transferring the ROM Image to the Target

This section describes how to load the OS-9 ROM image from the Host PC to the Target board's RAM. From there, the OS-9 ROM image can be moved into Flash and set up for autobooting. Transferring the ROM image to the Target board includes the following basic tasks:

- **Configuring TFTPServer32 on the Host**
- **Configuring EEPROM on the Target**
- **Loading the OS-9 ROM Image into RAM**
- **Programing the OS-9 ROM Image into Flash**
- **Autobooting OS-9**

Configuring TFTPServer32 on the Host

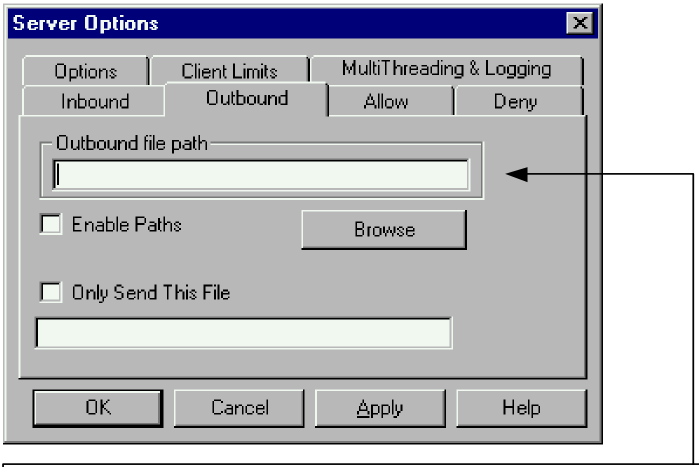
TFTPServer32 is the Trivial File Transfer Protocol (TFTP) server utility that must be installed on your host PC during installation. This software tool must be configured properly on the Host in order to transfer the ROM image to the target.

Step 1. On the Host PC, start TFTPServer32, by clicking the `Start` button on the Windows desktop.

Step 2. Select `Programs` --> `TFTPServer` --> `TFTPServer32`.

Step 3. In the TFTP application, go to the menu and select `System` --> `Setup` and click the `Outbound` tab. The path to where the ROM image is located must be shown in the **Outbound File Path** box.

Figure 1-16 TFTP Server Options Window



The Outbound file path is:

`/mwos/OS9000/821/PORTS/RPXL850SR/BOOTS/INSTALL/PORTBOOT/`

TFTPServer finds the ROM image in this directory and downloads it to the target machine.

All other tab options use the default settings.

Step 4. Click `OK` to apply the changes and exit the **Server Options** window.

Step 5. Leave TFTPServer32 running (or minimized) on your desktop.

Configuring EEPROM on the Target

EEPROM is part of the utility software provided on the RPX Lite target board. EEPROM must be configured properly on the target in order to transfer the ROM image from the host.

For More Information

This process uses the resident software on the target from Embedded Planet. For more information about the resident software, refer to the ***RPX Lite User's Manual***.

Step 1. Confirm that the reference board is connected to your host PC via the serial and Ethernet connections described in the **Connecting the Target to the Host** section.

Step 2. Reboot the target board by disconnecting and reconnecting the power supply. The following text should appear in your Hyperterminal window.

Note

This is the window on your Host PC desktop described on the page 12.

```
DRAM1:wwwwwvvvvvCCCCCVVVVV CaV NVRAM: CaV
--------------------------------------------------
RPX utility program, Copyright (C) 1998-1999, RPCg LLC, All Rights Reserved.
  Reset(0100): ExHard ExSoft ChkStop, TESR:0000 Core.Pv/Cp=2100.0050/0065
  BCSR : OK
  RTC  : OK, battery LOW or absent, tics/sec=1, time = 3 sec
  SPI  : OK, I2C: OK, STTM: OK, 29.5c, EEcfg: OK, 256b, cs:2301
  ENET : [zero], 0010EC000CD1, INET: AC10012C
  FLASH: OK, 8 Mb(32x8), id=01:49, cs:274E es:274E OK (FFF00000:FFF3C528)
  NVRAM: OK, 0 Kb, NVR battery GOOD
  DRAM : OK, 16 Mb, 10 columns
===> RPX Main
     RPX-Lite BW 850SR 50Mhz/8Mhz Ic ~Dc RPXU v1.40
  1  test BCSR                     A  Add-on board tests
  2  test dip switches             B  rpxBug command line (ctrl-B)
  3  test LEDs                     C  Configure EEPROM
  4  test SPI I2C STTM EEPR,CFG    L  Load RAM
  5  test FLASH firmware chksum    O  On-board I/O tests
  6  test NVRAM/SRAM               P  Program FLASH
  7  test DRAM (destructive)       R  hard Reset
  8                                S  Scan FLASH for executables
  9  run all tests                 T  display Time & Temperature
RPX Main menu: press 123456789 or ABCLOPRST key : <?> :
```

Step 3. Enter `C` (Configure EEPROM) in the RPX Main menu in your Hyperterminal window. This takes you to the RPX Configure menu.

Step 4. Enter `7` (Modify parameters of system configuration keys) in the RPX Configure menu.

Step 5. Change the following values in the Configure EEPROM dialog:

- IP address (IP address of the target board)
- AutoBoot name (must be set to `@FFF80EE1`)
- TFTP IP address (IP address of the Host PC)

Note

The IP address and TFTP IP address must be typed in hexadecimal format. For example, 172.16.4.163 becomes AC1004A3.

172 = AC; 16 = 10; 4 = 04; 163 = A3

Note

For the values not being changed in the Configure EEPROM dialog, press <ENTER> to proceed to the next field.

Step 6. Return to the **RPX Configure** menu and select 9 (Write parameters to EEPROM). When prompted, type YES.

Step 7. Return to the **RPX Configure** menu by pressing <ENTER>.

Step 8. Return to the **RPX Main** menu by pressing <Esc> and typing YES to reset the target.

Loading the OS-9 ROM Image into RAM

Load the OS-9 ROM image via TFTP Boot into RAM. The RPX Lite utility software has TFTP software that loads a specified S-Record into RAM. To load the ROM image, complete the following steps:

Step 1. From the **RPX Main** menu, type L (Load RAM) and then type 7 (Load using TFTP via Ethernet). The following will display on your screen:

```
Load using tftp via Ethernet
Enter server IP address <AC1004A3> : <ENTER>
Enter server filename   <coreboot.s> : coreboot.s
Enter address offset  : <00000000 hex> : 0
Starting tftp download:
inetARP(): OK
.1.2.4.8.16.32.64.128.256.512.1024.2048.4096
load_tftp(): OK
503852 data bytes, 6299 S-records, 985 tftp blocks, 0 repeated blocks
start address = 00000000
```

Step 2. Return to the **RPX Load** menu.

Note

The coreboot file is loaded into memory address 0x00100000

Step 3. From the **RPX Load** menu, type 7 (Load using TFTP via Ethernet). The following will display on your screen:

```
Enter server IP address <AC1004A3> : <ENTER>
Enter server filename   <coreboot.s> : bootfile.s
Enter address offset   : <00000000 hex> : <ENTER>
Starting tftp download:
inetARP(): OK
.1.2.4.8.16.32.64.128.256.512.1024.2048.4096.8192.16384.32768
load_tftp(): OK
2847900 data bytes, 35600 S-records, 5563 tftp blocks, 0 repeated blocks
start address = 00000000
```

Step 4. Return to the **RPX Main** menu by typing <Esc> and <Enter>.

Note

The bootfile is loaded into memory starting at address 0x00200000.

Note

You may receive “Timed Out” error messages in the Hyperterminal window during the loading process. This is usually caused by network traffic on large and busy networks.

If you receive a “Timed Out” message, connect the host and target directly with your Ethernet cable, bypassing the network. After making these connections, try the loading process again.

Programing the OS-9 ROM Image into Flash

Programming the RPX Lite Flash memory includes erasing specific regions of Flash and loading files from RAM into Flash. Complete the following steps to program the RPX Lite Flash.

Step 1. Type `P` (Program Flash) from the **RPX Main** menu.

Step 2. Type `2` (Erase section) from the **RPX Flash** menu. Enter the following addresses—one at a time—into the dialog. You are required to type <`ENTER`> and `YES` to confirm each operation.

- FFF80000—area for coreboot
- FFC00000—area for bootfile
- FFC40000—area for bootfile
- FFC80000—area for bootfile
- FFCC0000—area for bootfile
- FFD00000—area for bootfile

WARNING

Do not erase ALL regions of Flash memory. Do not erase section fff00000 of Flash Memory. Either or both of these operations will erase the RPX Lite utility software.

Note

You may need to erase more sections from Flash and increase the number of bytes to program if your bootfile exceeds 1 MB. The correct size of `bootfile` can be obtained by looking at the size of `/mwos/OS9000/821/PORTS/RPXL850SR/BOOTS/INSTALL/PORTBOOT/bootfile.`

Step 3. Return to the **RPX Flash** menu.

Step 4. Program `coreboot` into Flash by typing `9` (Program from Buffer) and entering the following into the dialog:

> program: Enter target address: <hex>: `fff80000` <`ENTER`>
>
> program: Enter source address: <hex>: `00100000` <`ENTER`>
>
> program: Enter number of bytes: <hex>: `00040000` <`ENTER`>

Step 5. Program `bootfile` into Flash by typing `9` (Program from Buffer) and entering the following into the dialog:

> program: Enter target address: <hex>: `ffc00000` <`ENTER`>
>
> program: Enter source address: <hex>: `00200000` <`ENTER`>
>
> program: Enter number of bytes: <hex>: `00140000` <`ENTER`>

Step 6. Return to the **RPX Main** menu by typing <`Esc`> and <`ENTER`>.

Step 7. Scan for Flash Executables by selecting `s` from the **RPX Main** menu. The following should appear on your screen:

```
Scanning for program signatures: ...............OK
01:[@FFF31278] RPXsignature=1.0 NAME=RPXBOOT START=FFF00100 Version=1.40
02:[@FFF80EE1] RPXsignature=1.0 NAME=OS9BOOT START=FFF80000
===> Select an item : <none> :
```

When prompted, type `2` <`ENTER`> and type `YES`. OS-9 will boot on the target.

Autobooting OS-9

You can configure your target system to autoboot OS-9 upon startup by completing the following steps.

Step 1. Remove power to the board.

Step 2. Set dip switches 3 and 4 to off.

Step 3. Restore power to the board. Your screen will display the following:

```
DRAM1:wwwwwvvvvvCCCCCVVVVV CaV NVRAM: CaV
--------------------------------------------------
RPX utility program, Copyright (C) 1998-1999, RPCg LLC, All Rights Reserved.
Autoboot: @FFF80EE1 @FFF80EE1 points to a signature
Autoboot: executing...
SigExec(): start addr = FFF80000
SigExec(): transferring control to program

OS-9000 Bootstrap for the PowerPC(tm)

Now trying to Override autobooters.
Now trying to Copy embedded OS-9000 to RAM and boot.
Now searching memory ($ffc00000 - $ffefffff) for an OS-9000 Kernel...

An OS-9000 kernel was found at $ffc00000
A valid OS-9000 bootfile was found.
$
```

Optional Procedures

The following section provides optional procedures you can perform after installing and configuring OS-9 on your board.

Preliminary Testing

Once you have established an OS-9 prompt on your target system, you can perform the following procedures to test your system:

Step 1. Type `mdir` at the prompt.

`mdir` displays all the modules in memory. You may have to hit the space bar to scroll the output.

Step 2. Type `procs` at the prompt.

`procs` displays the processes currently running in the system.

Step 3. Test the networking on your system.

Select a host on the Ethernet network and run the `ping` utility. The following display shows a successful `ping` to a machine called solkanar.

```
$ ping solkanar
PING solkanar.microware.com (172.16.2.51): 56 data bytes
64 bytes from 172.16.2.51: ttl=128 time=0 ms
```

Step 4. Test `telnet`.

Select a host machine that allows telnet access and try the OS-9 `telnet` utility. The following display shows a successful `telnet` to a machine called delta.

```
$ telnet delta
Trying 172.16.1.40...Connected to delta.microware.com.
Escape character is '^]'.
capture closed.

OS-9/68K V3.0.3 Delta VME177 - 68060 98/12/24 14:41:51
User name?: curt
```

```
Password:
Process #101 logged on 98/12/24 14:41:56
Welcome!
***********************************************************
*      WELCOME TO DELTA - THE :OS-9 68K: MACHINE *
```

Step 5. Test telnet from your host PC to the reference board.

From the Windows Start menu, select Run and type `telnet` <`hostname`> and click `OK`. A telnet window should display with a `$` prompt. Type `mdir` from the prompt. You should see the same module listing as on the serial console port.

You have now created your OS-9 ROM image, loaded the ROM image to the target, and established network connectivity with the target.

Chapter 2: Board Specific Reference

This chapter contains information that is specific to the RPX Lite reference board from Embedded Planet. It contains the following sections:

- **Boot Menu Options**
- **Runtime Information and Configuration Options**

Note

This document describes using the RPX Lite with the Motorola MPC850SR processor.

For More Information

For general information on porting OS-9, see the ***OS-9 Porting Guide***.

Boot Menu Options

You select your boot device menu options using the configuration wizard. For each boot device option, you can select whether you want it to be displayed on a boot menu, set up to autoboot, or both. The autoboot option enables the device selected to automatically boot up the high-level bootfile, bypassing the boot device menu.

Note

When using the configuration wizard, you should select only one device for autoboot on your system.

Following is an example of the Boot Menu displayed in the terminal emulation window (using `Hyperterminal`):

```
OS-9000 Bootstrap for the PowerPC(tm)

Now trying to Override autobooters.

BOOTING PROCEDURES AVAILABLE ----- <INPUT>

Scan SCSI devices ---------------- <ioi>
Boot FDC floppy ------------------ <fd>
Boot from PC-Floppy -------------- <pf>
Boot from Teac SCSI floppy drive - <fs>
Boot from SCSI PC-Floppy --------- <pfs>
Boot from Viper tape drive ------- <vs>
Boot over Ethernet --------------- <eb>
Boot from SCSI(SCCS) hard drive -- <hs>
Boot embedded OS-9000 in-place --- <bo>
Enter system debugger ------------ <break>
Restart the System --------------- <q>

Select a boot method from the above menu:
```

What you select for boot options in the configuration wizard determines what modules are included in the coreboot image. Table 2-1 lists some of the supported boot devices for OS-9:

Table 2-1 Supported Boot Methods

Type of Boot	Description
Boot from RBF hard disk	Boot from a standard SCSI hard disk (`hs`).
Floppy Disk	Boot from floppy disk. You must select if the floppy is controlled by a Random Block File System (RBF) (`fd` or `fs`) or PC File System (`pf` or `pfs`).
Boot embedded OS-9 in-place	Boot OS-9 from FLASH (`bo`).
Copy embedded OS-9 to RAM and Boot	Copy OS-9 from FLASH (if stored there) to RAM and boot (`lr`).
Boot using bootp over Ethernet	OS-9 is downloaded via TFTP from a server system.

Runtime Information and Configuration Options

Sample Bootfile Images

The sample bootfile images provided in this package offer a variety of configurations for high-level OS-9 bootfiles on the RPX Lite target platform from Embedded Planet.

Sample bootfile images are located in the following directory:

```
<MWOS>/OS9000/821/PORTS/RPX850SR/BOOTS/SYSTEMS/PORTBOOT
```

OS-9 Vector Mapping

This section contains the vector mappings and dual-port RAM mappings for the MPC850SR processor.

The system modules `siuirq` and `cpicirq` map interrupts coming from the SIU and CPM into the OS-9 vector table according to the following mappings.

SIU (System Interface Unit) vectors are mapped starting at vector 0x40 as shown in **Table 2-2**.

Table 2-2 System Interface Unit Vectors

Vector	Source
0x40	IRQ0
0x41	Level 0
0x42	IRQ1
0x43	Level 1

Table 2-2 System Interface Unit Vectors (continued)

Vector	Source
0x44	IRQ2
0x45	Level 2
0x46	IRQ3
0x47	Level 3
0x48	IRQ4
0x49	Level 4 (CPIC)
0x4a	IRQ5
0x4b	Level 5
0x4c	IRQ6
0x4d	Level 6
0x4e	IRQ7
0x4f	Level 7

CPM (Communications Processor Module) vectors are mapped starting at vector 0x50 as shown in **Table 2-3**.

Table 2-3 Communications Processor Module Vectors

Vector	Source
0x50	Error
0x51	Parallel I/O—PC4
0x52	Parallel I/O—PC5
0x53	SMC2/PIP
0x54	SMC1
0x55	SPI
0x56	Parallel I/O—PC6
0x57	Timer 4
0x58	Reserved
0x59	Parallel I/O—PC7
0x5a	Parallel I/O—PC8
0x5b	Parallel I/O—PC9
0x5c	Timer 3
0x5d	Reserved
0x5e	Parallel I/O—PC10
0x5f	Parallel I/O—PC11

Table 2-3 Communications Processor Module Vectors (continued)

Vector	Source
0x60	I2C
0x61	RISC Timer Table
0x62	Timer 2
0x63	Reserved
0x64	IDMA2
0x65	IDMA1
0x66	SDMA Channel Bus Error
0x67	Parallel I/O—PC12
0x68	Parallel I/O—PC13
0x69	Timer 1
0x6a	Parallel I/O—PC14
0x6b	SCC4
0x6c	SCC3
0x6d	SCC2
0x6e	SCC1
0x6f	Parallel I/O—PC15

Dual-port RAM Mapping

The MPC850SR processor includes 5120 bytes of dual-port RAM for buffer descriptor and microcode use. Since the high- and low-level drivers both use this area, its usage must be coordinated. Table 2-4 lists reserved locations and their uses.

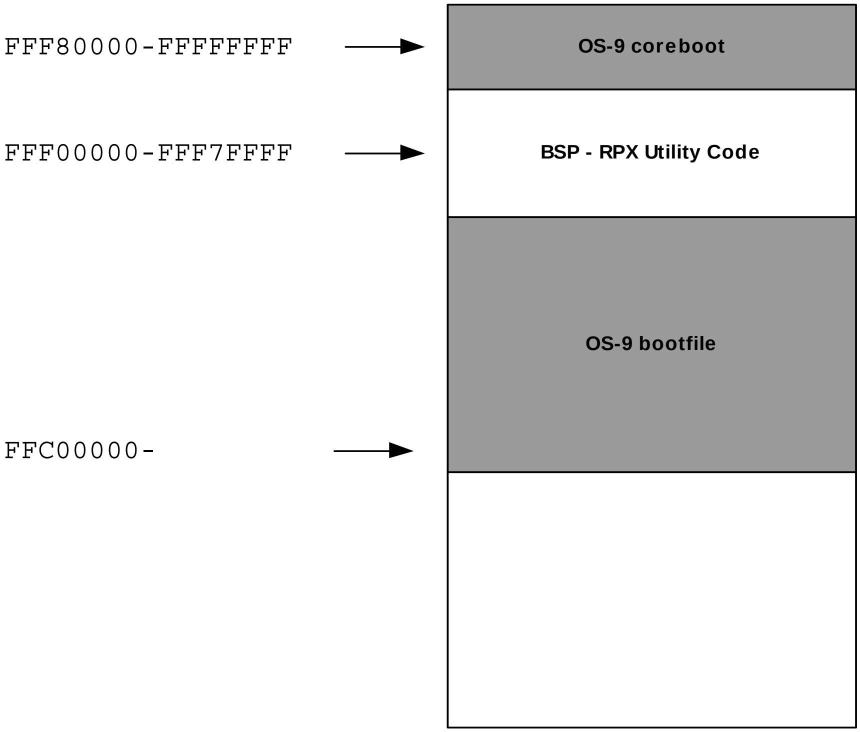
Table 2-4 Dual Port RAM Use Map

Offset into DPRAM	Use
0x0 - 0x0f	SCC1
0x10 - 0x1f	SCC2
0x20 - 0x2f	SCC3
0x30 - 0x3f	SCC4
0x40 - 0x4f	SMC1
0x50 - 0x5f	SMC2
0x60 - 0xff	reserved
0x100 - 0x17f	Ethernet
0x180 - 0x200	reserved

Flash Memory Usage

Figure 2-1 describes the various locations and contents of Flash memory on the RPX Lite target system running OS-9.

Figure 2-1 Flash Memory Usage



For More Information

Refer to the ***RPX Lite Programmer's Manual*** for a complete description of Flash memory in the RPX Lite target system.

Appendix A: Board Specific Modules

This appendix contains lists of high and low-level modules. The following sections are included:

- **Low-Level System Modules**
- **High-Level System Modules**
- **Common System Modules List**

Low-Level System Modules

The following low-level system modules are tailored specifically for the RPX Lite target platform. These modules can be found in the following directory:

```
MWOS/OS9000/821/PORTS/RPXL850SR/CMDS/BOOTOBJS/ROM
```

System Modules

`portmenu` retrieves a list of configured booter names from the ROM `cnfgdata` module.

`romcore` provides bootstrap code.

Configuration Modules

`cnfgdata` provides low-level configuration data including configuration of a serial console.

`cnfgfunc` retrieves configuration parameters from the `cnfgdata` module.

`conscnfg` retrieves the name of the low-level console driver from the `cnfgdata` module.

Debugging Modules

`usedebug` is a debugger configuration module.

Timer Modules

`tbtimer` provides polling timer services using the `tblo` and `tbhi` registers in the MPC850SR processor.

Console Drivers

`iosmc` provides console services for the SMC UART on the MPC850SR.

Ethernet Driver

`llquicc` provides network driver services for the MPC850SR Ethernet port.

High-Level System Modules

The following OS-9 system modules are tailored specifically for the MPX Lite target platform from Embedded Planet. Unless otherwise specified, each module can be found in a file of the same name in the following directory:

```
<MWOS>/OS9000/821/PORTS/RPXL850SR/CMDS/BOOTOBJS
```

Real Time Clock Driver

`rtc821` provides OS-9 access to the real time clock. In this release, `rtc821` is the name of the ticker regardless of the CPU in use on your platform.

Ticker

`tk821pit` provides the system ticker based on the SIU periodic interrupt timer.

`tkcpm` provides the system ticker based on the CPM general purpose timer.

`tkdec` provides the system ticker based on the PowerPC decrementer.

Shared Libraries

`picsub` provides interrupt enable and disable routines to handle platform specific interrupt controller issues for device drivers. This module is called by all drivers, and should be included in your bootfile.

Serial and Console Drivers

`sccpm` provides support for the CPM SMC and SCC UARTS serial port.

The descriptors provided for this driver are named `t0` and `term_t0`, and are located in the following directory:
`<MWOS>/OS9000/821/PORTS/RPXL850SR/CMDS/BOOTOBJS/DESC/SCCPM`

Common System Modules List

The following low-level system modules provide generic services for OS9000 modular ROM. They are located in the following directory:

```
MWOS/OS9000/PPC/CMDS/BOOTOBJS/ROM
```

Table 2-5 Common System Modules List

Module	Description
`bootsys`	provides booter services.
`console`	provides high-level I/O hooks into low-level console serial driver.
`dbgentry`	provides hooks to low-level debugger server.
`dbgserv`	is a debugger server module.
`excption`	is a service module.
`fdc765`	provides PC style floppy support.
`fdman`	is a target-independent booter support module providing general booting services for RBF file systems.
`flboot`	is a SCSI floptical drive disk booter.
`flshcach`	provides the cache flushing routine.
`fsboot`	is a SCSI TEAC floppy disk drive booter.
`hlproto`	allows user-state debugging.
`hsboot`	is a SCSI hard disk driver booter.

Table 2-5 Common System Modules List (continued)

Module	Description
`ide`	provides target-specific standard IDE support, including PCMCIA ATA PC cards.
`iovcons`	is a hardware independent virtual console driver that provides a telnetd-like interface to the low-level system console.
`llbootp`	is a target-independent BOOTP protocol booter module.
`llip`	is a target-independent internet protocol module.
`llkermit`	is a kermit booter (serial down loader).
`llslip`	is a target-independent serial line internet protocol module. This modules uses the auxiliary communications port driver to perform serial I/O
`lltcp`	is a target-independent transmission control protocol module.
`lludp`	is a target-independent user datagram protocol modules.
`notify`	coordinates use of low-level I/O drivers in system and user-state debugging.
`override`	enables overriding of the autobooter. If the space bar is pressed within three seconds after booting the target, a boot menu is displayed. Otherwise, booting proceeds with the first autobooter.
`parser`	parses key fields from the `cnfgdata` module and the user parameter fields.

Table 2-5 Common System Modules List (continued)

Module	Description
`pcman`	is a target-independent booter support module providing general booting services for PCF file systems (PC FAT file systems).
`protoman`	is a target-independent protocol module manager. This module provides the initial communication entry points into the protocol module stack.
`restart`	restarts boot process.
`romboot`	locates the OS-9 bootfile in ROM, FLASH, NVRAM.
`rombreak`	enables break option from the boot menu.
`rombug`	is a debugger client module.
`scsiman`	is a target-independent booter support module that provides general SCSI command protocol services
`sndp`	is a target-independent system-state network debugging protocol module. This module acts as a debugging client on the target, invoking the services of dbgserv to perform debug tasks.
`srecord`	receives a Motorola S-record format file from the communications port and loads it into memory.
`swtimer`	is a software timer.
`tsboot`	is a SCSI TEAC tape drive booter.
`type41`	is a primary partition type.

Table 2-5 Common System Modules List (continued)

Module	Description
`vcons`	is the console terminal pathlist.
`vsboot`	is a SCSI archive viper tape drive booter.