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OS-9® for Assabet/Neponset Board Guide

Version 4.7

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Chapter 1: Installing and Configuring OS-9®

This chapter describes installing and configuring OS-9® on the Intel SA-1110 Microprocessor Reference Platform (Assabet) and the Intel SA-1111 daughter card (Neponset). It includes the following sections:

Note
This description does not require that the Neponset daughter card be part of your development system. Neponset-specific modules and descriptors are noted.

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Requirements and Compatibility

Note

Before you begin, install the ***Microware OS-9 for StrongARM*** CD-ROM on your host PC.

Host Hardware Requirements (PC Compatible)

Your host PC should have the following:

- a minimum of 200 MB of free disk space (an additional 235MB of free disk space is required to run PersonalJava™ Solution for OS-9)
- an Ethernet network card
- a PCMCIA card reader/writer
- at least 16MB of RAM

Note

If you are a PersonalJava™ Solution for OS-9 licensee and you plan to use the Java JCC to pre-load your Java classes, you may need as much as 64MB of RAM. Refer to the document ***Using JavaCodeCompact*** for a complete discussion of using the JCC.

Host Software Requirements (PC Compatible)

Your host PC should have the following:

- Windows 95, 98, ME, 2000, or NT 4.0
- A terminal emulation program (such as Hyperterminal)

Target Hardware Requirements

For More Information

Refer to the ***Intel StrongARM SA-1110 Microprocessor Development Board User's Guide*** and the ***Intel StrongARM SA-1111 Microprocessor Development Module User's Guide*** for Assabet and Neponset hardware requirements, respectively.

Also refer to these manuals for information on hardware preparation and installation, operating instructions, and functional descriptions prior to installing and configuring OS-9.

Intel documenatation is provided online in PDF format at `www.intel.com`.

Java Hardware Requirements

PersonalJava™ Solution for OS-9 requires the following features:

- 16MB of RAM
- 4MB of Flash (Boot)
- LCD Display

Target Hardware Setup

Microware OS-9 for StrongARM provides the necessary software to run the Assabet development board, with or without the Neponset daughter card. There are no OS-9 -specific hardware considerations.

WARNING

If the Neponset daughter card is attached to the Assabet development board, do not insert a PCMCIA card into the Assabet's PCMCIA port. Use the Neponset's PCMCIA port instead.

Note

When the Neponset daughter card is used, the outer PCMCIA slot is slot #0 and the inner PCMCIA slot is slot #1.

For More Information

Refer to the ***Intel StrongARM SA-1110 Microprocessor Development Board User's Guide*** and the ***Intel StrongARM SA-1111 Microprocessor Development Module User's Guide*** for Assabet and Neponset hardware setup procedures, respectively.

Intel documenatation is provided online in PDF format at `www.intel.com`.

Connecting the Target to the Host

Connect an RS-232 null modem cable from the Target board to the serial port of a Windows host system.

Step 1. Connect the serial cable to the J10 connector (or the DB9 connector that connects to J10) on the Target board. The J10 connector is the SA1110 serial port 1 (SP1).

Step 2. Connect the other end of the serial cable to the Host PC.

Step 3. On the Windows desktop, click on the `Start` button and select `Programs -> Accessories -> Hyperterminal`.

Step 4. Once Hyperterminal is open, enter a name for your Hyperterminal session.

Step 5. Select an icon for the new Hyperterminal session. A new icon is created with the name of your session. Click `OK`.

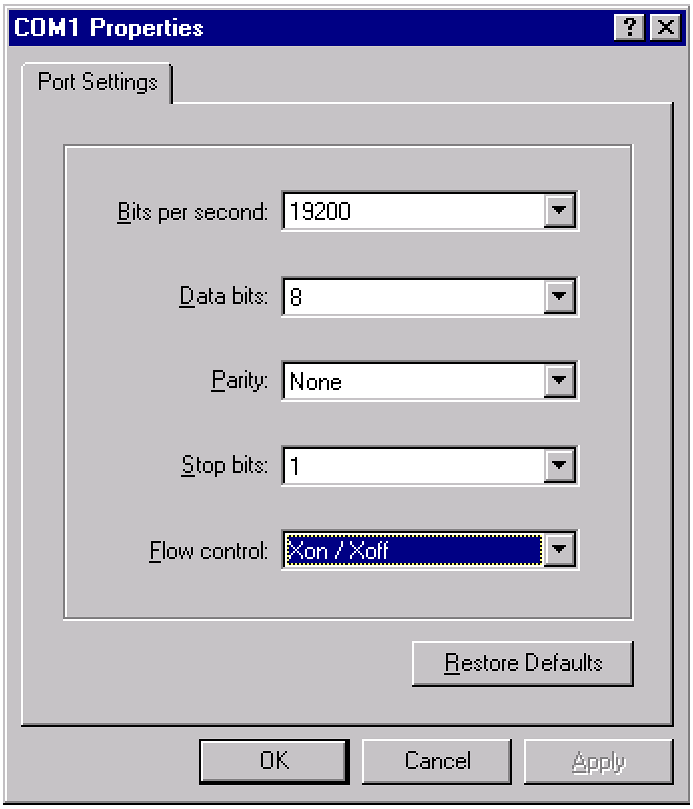
Step 6. In the **Phone Number** dialog, go to the **Connect Using** box and select the communications port to be used to connect to the reference board.

The port selected is the same port that you connected to the serial cable from the reference board. Click `OK`.

Step 7. In the **Port Settings** tab, enter the following settings:

```
Bits per second = 19200

Data Bits = 8

Parity = None

Stop bits = 1

Flow control = XOn/XOff
```

Figure 1-1 Port Settings



Bits per second: 19200

Data bits: 8

Parity: None

Stop bits: 1

Flow control: Xon / Xoff

Step 8. Click `OK`. A connection should be established.

Note

If the word connected does not appear in the lower left corner of the window, click `Call -> Connect` to establish the connection.

Building the OS-9 ROM Image

Overview

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.

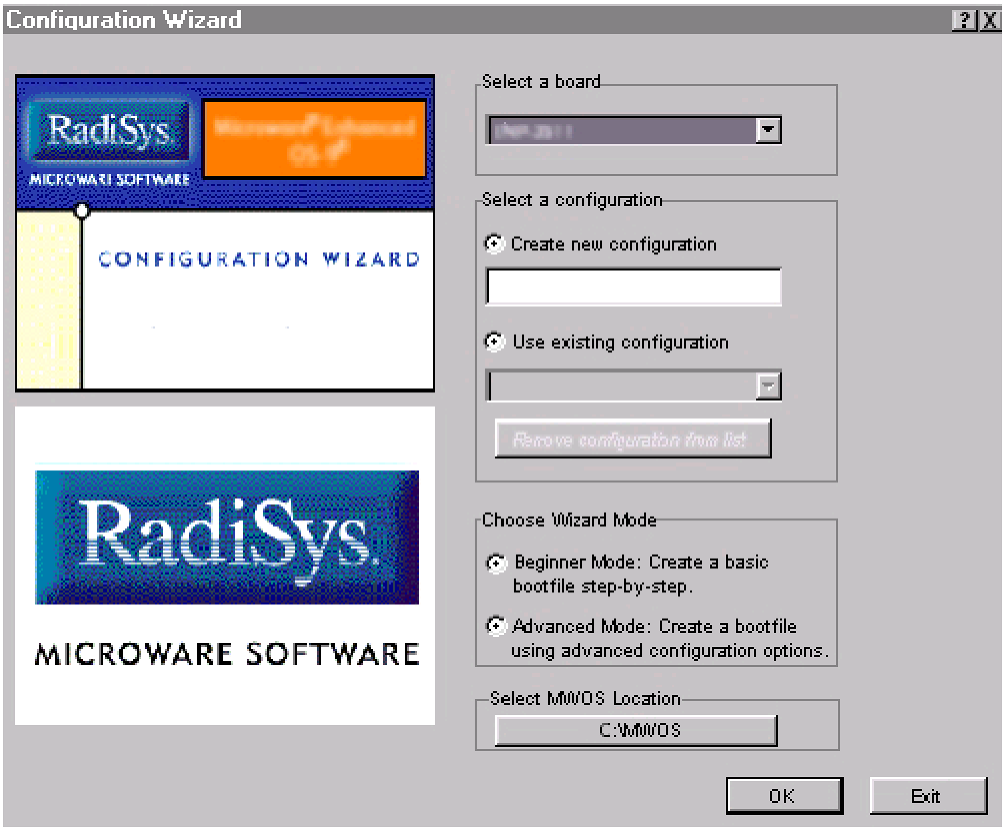
Microware provides a Configuration Wizard to create a coreboot image, a bootfile image, or an entire OS-9 ROM Image. The wizard can also be used to modify an existing image. The Configuration Wizard is automatically installed on your host PC during the OS-9 installation process.

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` -> `Programs` -> `RadiSys` -> `Microware OS-9 for <product>` -> `Configuration Wizard`. You should see the following opening screen:

Figure 1-2 Configuration Wizard Opening Screen

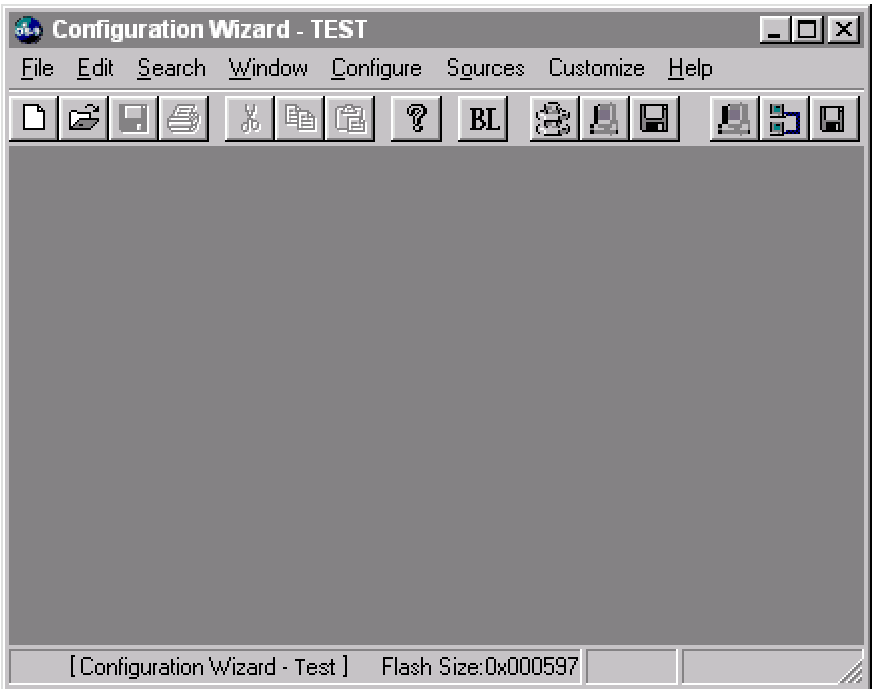


Step 2. Select your target board from the **Select a board** pull-down menu.

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 1-3**.

Figure 1-3 Configuration Wizard Main Window



[Configuration Wizard - Test]   Flash Size:0x000597

Booting from the On-Board Flash

The on-board Flash part provided with the board must be reprogrammed with an OS-9 bootfile containing the necessary low-level modules to boot from Flash, ATA, or using bootp.

For More Information

Refer to the **Creating a new OS-9 Coreboot Image or ROM Image in Flash Memory** section for this procedure.

Note

When configuring your system to boot from the on-board Flash, it is recommended that you obtain and use a separate Flash part for this procedure. The original Flash part should be removed and saved.

Booting from an ATA Flash Card or Using bootp

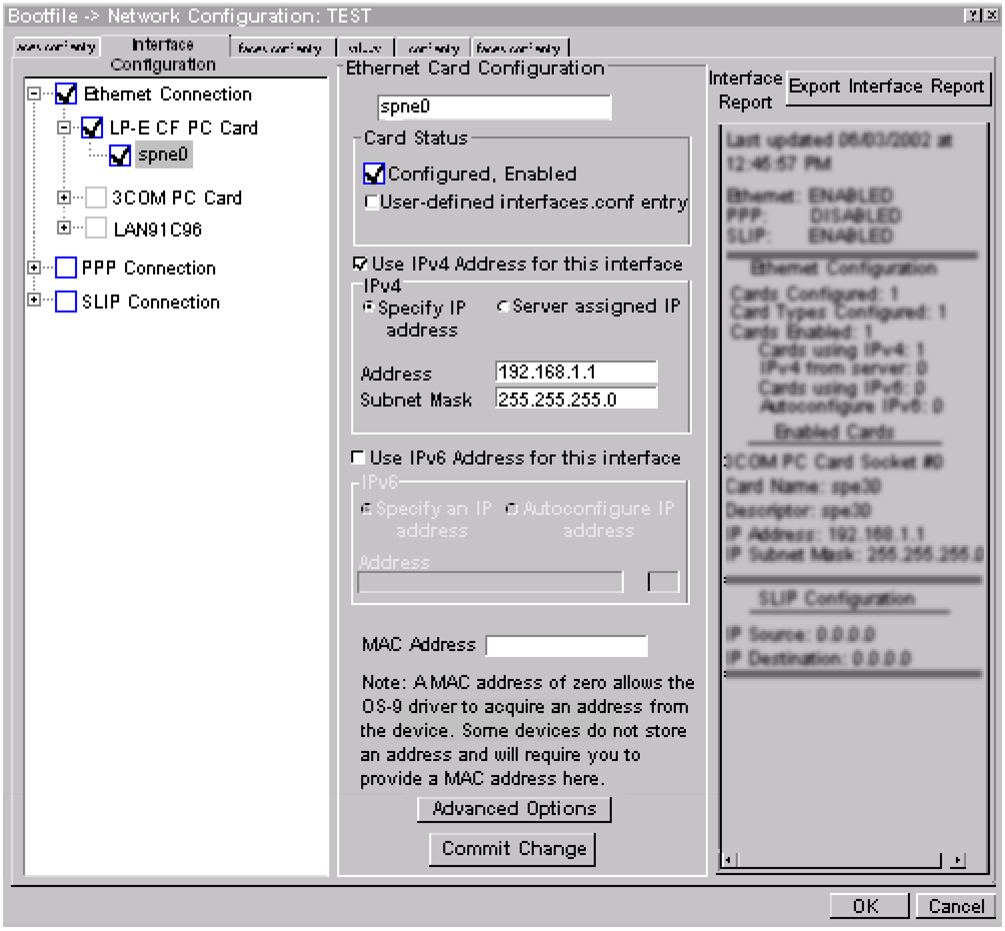
This section describes how to use the Configuration Wizard to create a `bootfile` suitable for loading into memory from a PCMCIA ATA card or over the network using a bootp server (not provided).

Step 1. Start the Configuration Wizard, bringing it to the main configuration window as outlined previously.

Step 2. 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 3. 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 1-4** shows an example of the **Interface Configuration** tab.

Figure 1-4 Bootfile -> Network Configuration -> Interface Configuration



Ethernet Card Configuration

spne0

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

MAC Address

Note: A MAC address of zero allows the OS-9 driver to acquire an address from the device. Some devices do not store an address and will require you to provide a MAC address here.

Interface Report

```
Last updated 06/03/2002 at
12:46:57 PM

Ethernet:  ENABLED
PPP:       DISABLED
SLIP:      ENABLED

  Ethernet 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*** 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 4. Once you have made your settings in the **Network Configuration** dialog, click `OK`.

Step 5. Select `Configure -> Bootfile -> Disk Configuration`.

Step 6. On the **RAM Disk** tab, make sure that both check boxes are checked.

Select an appropriate size from the pulldown for a RAM disk. (512K should be sufficient.)

Step 7. On the **IDE Configuration** tab, select the **Enable IDE disk** check box.

Make sure that the Socket #0 radio button is selected.

Step 8. From the **Init Options** tab complete the following tasks:

1. Select MShell under Initial Module Name.
2. Select `/dd` under **Initial Device Name**. Then select `User`.
3. Edit the Parameter List field and delete the following portions of text:

```
ipstart;
inetd <>>>/nil &;
> rtsol enet0
```

This text should only be present if networking was enabled.

Step 9. Click `OK`.

Step 10. Select `Configure -> Build Image`.

Step 11. Under **Build Type/Options** select the **Bootfile Only Image** radio button.

Step 12. Make sure that the following radio buttons are checked:

- ROM Utility Set
- Disk Support
- Disk Utilities

Step 13. If networking is desired, make sure that the following radio buttons are checked:

- SoftStax® (SPF) Support
- User State Debugging Modules

Step 14. Click on the **Build** button.

When the build is complete the bootfile can be found in the following location:

```
%MWOS%\OS9000\ARMV4\PORTS\ASSABET\BOOTS\INSTALL\PORTBOOT\os9kboot
```

If you are booting using a bootp server skip to Step 18.

Step 15. If the image is to be placed on a PCMCIA ATA card complete the following tasks:

1. Insert the PCMCIA ATA card into the PCMCIA slot of your host computer.
2. Click Save As to save the file os9kboot to the root directory of the PCMCIA ATA card.
3. Turn off the power to the target board.
4. Remove the PCMCIA ATA card from the computer and insert it into the socket on the target board.
5. Apply power to the board.
6. When prompted to “Press the spacebar for a booter menu", press the spacebar. If you miss it, simply power-cycle the target board.
7. Enter `ide0` and return. You should see the following screen:

```
Press the spacebar for a booter menu

BOOTING PROCEDURES AVAILABLE ---------- <INPUT>
Boot embedded OS-9 in-place ----------- <bo>
Copy embedded OS-9 to RAM and boot ---- <lr>
Boot from PCMCIA-1 IDE ---------------- <ide1>
Boot from PCMCIA-0 IDE ---------------- <ide0>
Boot over Ethernet (NE2000) ----------- <eb>
Load bootfile via kermit Download ----- <ker>
Enter system debugger ----------------- <break>
Restart the System -------------------- <q>

Select a boot method from the above menu: ide0
Wait for IDE drive ready......ready.
IDE Model                  : Hitachi CV 6.1.2
Number Heads               : 0x0004
Total Cylinders            : 0x00f6
Sectors Per Track          : 0x0020

Checking Partitions        : 0
Fat Type                   : 0x12
File Name                  : OS9KBOOT
File Size                  : 0x002b5844
Start Cluster              : 0x0000053d
Reading Bootfile....
Boot Address               : 0xc002c860
Boot Size                  : 0x002b5844

OS-9 kernel was found.
A valid OS-9000 bootfile was found.
$
```

Step 16. If the image is to be loaded from a bootp server (not provided), complete the following tasks:

1. Set up the bootp server such that it will serve the created image in response to a request from the given Ethernet card (which is identified by the Ethernet or MAC address -- this can be found by going through the following steps once before setting up the server).
2. Copy the os9kboot image from the following location to the location required by your server.

   ```
   %MWOS%\OS9000\ARMV4\PORTS\ASSABET\BOOTS\INSTALL\PORTBOOT\os9kboot
   ```

3. Turn off the power to the target board.
4. Insert the PCMCIA networking card into the slot on the board; connect it to the Ethernet.
5. Apply power to the board.
6. When prompted to "Press the spacebar for a booter menu", press the spacebar. If you miss it, simply power-cycle the target board.
7. Enter `eb` and return.

You can also specify the bootfile name using eb `bootfile=os9kboot`:

Note

The first line of output from the booter shows the Ethernet address of the given card.

```
Press the spacebar for a booter menu

BOOTING PROCEDURES AVAILABLE ---------- <INPUT>

Boot embedded OS-9 in-place ----------- <bo>
Copy embedded OS-9 to RAM and boot ---- <lr>
Boot from PCMCIA-1 IDE ---------------- <ide1>
Boot from PCMCIA-0 IDE ---------------- <ide0>
Boot over Ethernet (NE2000) ----------- <eb>
Load bootfile via kermit Download ----- <ker>
Enter system debugger ----------------- <break>
Restart the System -------------------- <q>

Select a boot method from the above menu: eb bootfile=os9kboot

bootp: 00:c0:1b:00:b5:d0 broadcasting for server...try 1/8
bootp: Got Response from server: 172.16.1.6
bootp: My IP Address will be: 172.16.3.197
bootp: My Bootfile is: /h0/TFTPBOOT/os9kboot
bootp: My bootfile size is: 00001629 (512-byte) blocks
bootp: My subnet mask is: 255.255.0.0
bootp: <<no timeoffset tag>>
tftp: Starting tftp transfer...
tftp: received file with 002c516c bytes

Bootfile received from server 172.16.1.6
Now searching for an OS-9000 Kernel...
A valid OS-9 bootfile was found.
$
```

If the bootfile was loaded using the bootp server, proceed directly to step 18. Otherwise, proceed to step 17.

Step 17. In order to use networking after booting off of the PCMCIA ATA Flash card, do the following:

- Deinitialize the PCMCIA slot:

  ```
  $ pcmcia -d
  ```

- Remove the PCMCIA Flash card from the slot. Slide the PCMCIA networking card into the slot.

- Initialize the PCMCIA slot:

```
$ pcmcia -i
```

  PCMCIA Ethernet card found in socket #0

Note

It is not possible to swap the networking card out for the Flash card.

WARNING

Damage may occur to the PCMCIA card if it is inserted or removed improperly.

Step 18. Networking can be started by executing the following steps. These steps could have been executed automatically at startup for the bootp case.

```
$ ipstart
$ inetd <>>>/nil &
```

Step 19. Test the Ethernet connections by pinging the target board.

If the ping operation fails, evaluate the following scenarios:

- Is the board connected to a live Ethernet port?
- Is the Ethernet cable defective?
- Are the network settings for the target board correct?

Pinging the Target Board

Windows 95, Windows 98, and Windows NT include a Ping command that can be used to test the Ethernet connection for the Target board.

Step 1. Go to the DOS prompt.

Step 2. Type `ping <IP Address>`.

The IP Address is the address you assigned to the evaluation board in either the Coreboot module or the Bootfile module. The address is typed without the <> brackets.

If the ping was successful, you will see the following response:

```
Reply from <IP Address>: bytes=xx time =xms TTL= xx
```

If the ping was unsuccessful, you will see the following response:

```
Request timed out.
```

Note

Windows 95, 98, and NT do not support IPv6.

Creating a Startup File

When the Configuration Wizard is set to use a hard drive or another fixed drive such as a PC Flash Card, as the default device, it automatically sets up the init module to call the `startup` file in the `SYS` directory in the target (For example: `/h0/SYS/startup`, `/mhc1/SYS/startup`). However, this directory and file will not exist until you create it. To create the startup file, complete the following steps:

Step 1. Create a `SYS` directory on the target machine where the `startup` file will reside (for example: `makdir /h0/SYS`, `makdir /dd/SYS`).

Step 2. On the host machine, navigate to the following directory:

```
MWOS/OS9000/SRC/SYS
```

In this directory, you will see several files. The files related to this section are listed below:

- `motd`: Message of the day file
- `password`: User/password file
- `termcap`: Terminal description file
- `startup`: Startup file

Step 3. Transfer all files to the newly created `SYS` directory on the target machine. (You can use Kermit, or FTP in ASCII mode to transfer these files.)

Step 4. Since the files are still in DOS format, you will be required to convert them into the OS-9 format with the `cudo` utility. The following command is an example:

```
cudo -cdo password
```

This will convert the `password` file from DOS to OS-9 format.

For More Information

For a complete description of all the `cudo` command options, refer to the ***Utilities Reference Manual*** located on the Microware OS-9 CD.

Step 5. Since the command lines in the startup file are system-dependent, it may be necessary to modify this file to fit your system configuration. It is recommended that you modify the file before transferring it to the target machine.

Example Startup File

Below is the example startup file as it appears in the `MWOS/OS9000/SRC/SYS` directory:

```
-tnxnp
tmode -w=1 nopause
*
*OS-9 - Version 4.1
*Copyright 2002 by Microware Systems Corporation
*The commands in this file are highly system dependent and
*should be modified by the user.
*
*setime </term                ;* start system clock
setime -s                     ;* start system clock
link mshell csl               ;* make "mshell" and "csl" stay in memory
* iniz r0 h0 d0 t1 p1 term    ;* initialize devices
* load utils                  ;* make some utilities stay in memory
* tsmon /term /t1 &           ;* start other terminals
list sys/motd
setenv TERM vt100
tmode -w=1 pause
mshell<>>>/term -l&
```

For More Information

Refer to the **Making a Startup File** section in Chapter 9 of the ***Using OS-9*** manual for more information on startup files.

Optional Procedures

Creating a new OS-9 Coreboot Image or ROM Image in Flash Memory

If you want to boot and run OS-9 from the on-board Flash part, or if you want to use ROM Ethernet services such as system state debugging, you must create a new coreboot file and possibly a new bootfile.

The coreboot image that was shipped with the target board does not allow you to perform system state debugging because the IP address in the Flash ROM is set to 0.0.0.0. You can create a new image for your Flash part by using an EPROM programmer or by using Intel's Jflash utility.

Note

Recreating the Coreboot Image is required only when system state debugging is desired.

Making a Coreboot Image with an EPROM programmer or Intel’s JFlash Utility

This section describes creating a new Flash image. When you are done creating your image you can either use your EPROM programmer to load the image or use Intel's JFlash utility.

For More Information

Please see your EPROM programmer's instructions for a description of how to load the image via your programmer. See Intel's website for information about the JFlash utility.

`http://developer.intel.com`

Note

The shipping OS-9 systems have been tested with the following two Flash parts: FlashFile28F160S3's and StrataFlash E28F128J3.

Larger sizes can be chosen from the Configuration Wizard by selecting `Select System Type` and selecting the `Setting based on` pull down menu.

Note

When using Intel’s JFlash utility, make sure you program the entire Flash part (select no when asked by the utility if you wish to save time by programming only part of the Flash).

Note

You can also create and load a new ROM image into EPROM.

To make a coreboot image with an EPROM programmer, complete the following step:

Step 1. From the Windows desktop, select `Start` -> `Programs` -> `RadiSys` -> `Microware OS-9 for StrongARM <ver>` -> `Configuration Wizard`.

Step 2. Name the boot image in the **Configuration Name** field.

Step 3. Select `Expert Mode` and click `OK`. The Main Configuration window is displayed.

Step 4. Make any necessary changes to the coreboot settings and possibly to the bootfile settings. These procedures are described in the **Building the OS-9 ROM Image** section.

Step 5. Select `Configure` -> `Build Image` to display the Master Builder screen.

Step 6. Select the `Coreboot Only Image` setting and click `Build`.

Step 7. Click `Save As` to save the Coreboot image to a directory of your choice. If you do not have that directory on the drive, you can create it.

Note

If you are creating a new ROM Image instead of a Coreboot Image only, follow the steps described above and return to the Master Builder window. Select the `ROM Image` radio button and click `Build`.

This step creates a ROM image suitable for use with your binary ROM burner.

Step 8. Transfer the Coreboot Image (or ROM Image) to the EPROM with the EPROM programmer. You will need to follow the documentation for the EPROM programmer to complete this step.

Compressing the Bootfile Image

OS-9 bootfiles can be compressed to allow more modules to be loaded into a bootfile; this can be useful if you plan on storing your image on a small FLASH part or a floppy disk.

Note

The bootfile compression utility performs the compression at approximately a 2.5:1 ratio.

Complete the following steps to compress your image:

Step 1. Verify that your coreboot contains the uncompress module. This module can be found in the pre-built ROM and coreboot images that were shipped with your Microware OS-9 product.

Note

The uncompress module must be included in order for the compression to execute properly.

Step 2. Open the Configuration Wizard and select `Configure -> Coreboot -> Main Configuration` from the main menu.

Step 3. Select the `Bootfile Compression` tab. Verify that the **Include bootfile uncompress module** box is checked and select OK.

Step 4. When you are ready to build the image, open the **Master Builder** dialog. Verify that the **Compress Bootfile** box is checked and then press `Build` to begin the installing the image.

Chapter 2: Board-Specific Reference

This chapter contains information that is specific to the Intel StrongARM SA-1110 Microprocessor development board (Assabet) and the Intel StrongARM SA-1111 Microprocessor development module (Neponset). It includes the following sections:

- **Boot Options**
- **The Fastboot Enhancement**
- **OS-9 Vector Mappings**
- **Assabet GPIO Usage**
- **Board-Specific Register Access Functions**
- **Port Specific Utilities**

For More Information

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

Boot Options

Following are the default boot options for the reference board. You can select these by hitting the space bar when the `Now Trying to Override Autobooters` message appears on the console port when booting.

You can configure these booters by altering the `default.des` file at the following location:

```
MWOS/OS9000/ARMV4/PORTS/ASSABET/ROM
```

Booters can be configured to be either menu or auto booters. The auto booters automatically attempt to boot in order from each entry in the auto booter array. Menu booters from the defined menu booter array are chosen interactively from the console command line after the boot menu is displayed.

Booting from Flash

When the `romcnfg.h` has a ROM search list defined the options `bo` and `lr` appear in the boot menu. If no search list is defined N/A appears in the boot menu. If an OS-9 bootfile is programmed into Flash in the address range defined in the `default.des` file, the system can boot and run from Flash.

`bo`	ROM boot—the system runs from the Flash bank.
`lr`	load to RAM—the system copies the Flash image into ram and runs from there.

Booting from PCMCIA ATA Card

The system can boot from a PC formatted PCMCIA hard card, which resides in the PCMCIA slot.

`ide0`	The file `os9kboot` is searched for in slot 0. If found it is copied to system RAM and runs from there.

Booting from PCMCIA Ethernet Card

The system can boot using the bootp protocol using an Ethernet card and `eb` option.

`eb`	Ethernet boot—a PCMCIA card that supports Ethernet will use the bootp protocol to transfer a bootfile into RAM and the system runs from there.

Booting over Serial Communications Port via Kermit

The system can download a bootfile in binary form over its serial communication port at 115200 using the kermit protocol. The speed of this transfer depends of the size of the bootfile, but expect at least a 3 minute wait, dots will show the progress of the download. The communications port is located at header J14 and uses the SA1110's SP3 UART.

`ker`	kermit boot—The `os9kboot` file is sent via the kermit protocol into system RAM and runs from there.

Restart Booter

The restart booter enables a way to restart the bootstrap sequence.

`q`	quit—quit and attempt to restart the booting process.

Break Booter

The break booter allows entry to the system level debugger (if one exists). If the debugger is not in the system the system will reset.

`break`	break—break and enter the system level debugger rombug.

Example boot session and message.

```
OS-9 Bootstrap for the ARM

ATA IDE disk found in socket 00
Now trying to Override autobooters.

BOOTING PROCEDURES AVAILABLE ------------- <INPUT>

Boot embedded OS-9 in-place -------------- <N/A>
Copy embedded OS-9 to RAM and boot ------- <N/A>
Boot from PCMCIA-1 IDE ------------------- <ide1>
Boot from PCMCIA-0 IDE ------------------- <ide0>
Load bootfile via kermit Download -------- <ker>
Restart the System ----------------------- <q>
Enter system debugger -------------------- <break>

Select a boot method from the above menu: ide0


Wait for IDE drive ready.
IDE Model                  :       ATA_FLASH
Number Heads               : 0x0002
Total Cylinders            : 0x03d8
Sectors Per Track          : 0x0020

Checking Partitions        : 0
Fat Type                   : 0x16
File Name                  : OS9KBOOT
File Size                  : 0x000fdeb0
```

```
Start Cluster               : 0x00003a57
Reading Bootfile....

Boot Address                : 0xc002c850
Boot Size                   : 0x000fdeb0

OS-9 kernel was found.
A valid OS-9 bootfile was found.
$
```

The Fastboot Enhancement

The Fastboot enhancements to OS-9 provide faster system bootstrap performance to embedded systems. The normal bootstrap performance of OS-9 is attributable to its flexibility. OS-9 handles many different runtime configurations to which it dynamically adjusts during the bootstrap process.

The Fastboot concept consists of informing OS-9 that the defined configuration is static and valid. These assumptions eliminate the dynamic searching OS-9 normally performs during the bootstrap process and enables the system to perform a minimal amount of runtime configuration. As a result, a significant increase in bootstrap speed is achieved.

Overview

The Fastboot enhancement consists of a set of flags that control the bootstrap process. Each flag informs some portion of the bootstrap code that a particular assumption can be made and that the associated bootstrap functionality should be omitted.

The Fastboot enhancement enables control flags to be statically defined when the embedded system is initially configured as well as dynamically altered during the bootstrap process itself. For example, the bootstrap code could be configured to query dip switch settings, respond to device interrupts, or respond to the presence of specific resources which would indicate different bootstrap requirements.

In addition, the Fastboot enhancement's versatility allows for special considerations under certain circumstances. This versatility is useful in a system where all resources are known, static, and functional, but additional validation is required during bootstrap for a particular instance, such as a resource failure. The low-level bootstrap code may respond to some form of user input that would inform it that additional checking and system verification is desired.

Implementation Overview

The Fastboot configuration flags have been implemented as a set of bit fields. An entire 32-bit field has been dedicated for bootstrap configuration. This four-byte field is contained within the set of data structures shared by the ModRom sub-components and the kernel. Hence, the field is available for modification and inspection by the entire set of system modules (high-level and low-level). Currently, there are six bit flags defined with eight bits reserved for user-definable bootstrap functionality. The reserved user-definable bits are the high-order eight bits (31-24). This leaves bits available for future enhancements. The currently defined bits and their associated bootstrap functionality are listed below:

B_QUICKVAL

The `B_QUICKVAL` bit indicates that only the module headers of modules in ROM are to be validated during the memory module search phase. This causes the CRC check on modules to be omitted. This option is a potential time saver, due to the complexity and expense of CRC generation. If a system has many modules in ROM, where access time is typically longer than RAM, omitting the CRC check on the modules will drastically decrease the bootstrap time. It is rare that corruption of data will ever occur in ROM. Therefore, omitting CRC checking is usually a safe option.

B_OKRAM

The `B_OKRAM` bit informs both the low-level and high-level systems that they should accept their respective RAM definitions without verification. Normally, the system probes memory during bootstrap based on the defined RAM parameters. This allows system designers to specify a possible RAM range, which the system validates upon startup. Thus, the system can accommodate varying amounts of RAM. In an embedded system where the RAM limits are usually statically defined and presumed to be functional, however, there is no need to validate the defined RAM list. Bootstrap time is saved by assuming that the RAM definition is accurate.

B_OKROM

The `B_OKROM` bit causes acceptance of the ROM definition without probing for ROM. This configuration option behaves like the `B_OKRAM` option, except that it applies to the acceptance of the ROM definition.

B_1STINIT

The `B_1STINIT` bit causes acceptance of the first `init` module found during cold-start. By default, the kernel searches the entire ROM list passed up by the `ModRom` for `init` modules before it accepts and uses the `init` module with the highest revision number. In a statically defined system, time is saved by using this option to omit the extended `init` module search.

B_NOIRQMASK

The `B_NOIRQMASK` bit informs the entire bootstrap system that it should not mask interrupts for the duration of the bootstrap process. Normally, the `ModRom` code and the kernel cold-start mask interrupts for the duration of the system startup. However, some systems that have a well defined interrupt system (i.e. completely calmed by the `sysinit` hardware initialization code) and also have a requirement to respond to an installed interrupt handler during system startup can enable this option to prevent the ModRom and the kernel cold-start from disabling interrupts. This is particularly useful in power-sensitive systems that need to respond to “power-failure” oriented interrupts.

Note

Some portions of the system may still mask interrupts for short periods during the execution of critical sections.

B_NOPARITY

If the RAM probing operation has not been omitted, the `B_NOPARITY` bit causes the system to not perform parity initialization of the RAM. Parity initialization occurs during the RAM probe phase. The `B_NOPARITY` option is useful for systems that either require no parity initialization at all or systems that only require it for “power-on” reset conditions. Systems that only require parity initialization for initial “power-on” reset conditions can dynamically use this option to prevent parity initialization for subsequent “non-power-on” reset conditions.

Implementation Details

This section describes the compile-time and runtime methods by which the bootstrap speed of the system can be controlled.

Compile-time Configuration

The compile-time configuration of the bootstrap is provided by a pre-defined macro (`BOOT_CONFIG`), which is used to set the initial bit-field values of the bootstrap flags. You can redefine the macro for recompilation to create a new bootstrap configuration. The new over-riding value of the macro should be established by redefining the macro in the `rom_config.h` header file or as a macro definition parameter in the compilation command.

The `rom_config.h` header file is one of the main files used to configure the ModRom system. It contains many of the specific configuration details of the low-level system. Below is an example of how you can redefine the bootstrap configuration of the system using the `BOOT_CONFIG` macro in the `rom_config.h` header file:

```
#define BOOT_CONFIG (B_OKRAM + B_OKROM + B_QUICKVAL)
```

Below is an alternate example showing the default definition as a compile switch in the compilation command in the makefile:

```
SPEC_COPTS = -dNEWINFO -dNOPARITYINIT -dBOOT_CONFIG=0x7
```

This redefinition of the BOOT_CONFIG macro results in a bootstrap method that accepts the RAM and ROM definitions without verification, and also validates modules solely on the correctness of their module headers.

Runtime Configuration

The default bootstrap configuration can be overridden at runtime by changing the rinf->os->boot_config variable from either a low-level P2 module or from the sysinit2() function of the sysinit.c file. The runtime code can query jumper or other hardware settings to determine what user-defined bootstrap procedure should be used. An example P2 module is shown below.

Note

If the override is performed in the sysinit2() function, the effect is not realized until after the low-level system memory searches have been performed. This means that any runtime override of the default settings pertaining to the memory search must be done from the code in the P2 module code.

```
#define NEWINFO
#include <rom.h>
#include <types.h>
#include <const.h>
#include <errno.h>
#include <romerrno.h>
#include <p2lib.h>

error_code p2start(Rominfo rinf, u_char *glbls)
{
    /* if switch or jumper setting is set… */
    if (switch_or_jumper == SET) {
        /* force checking of ROM and RAM lists */
        rinf->os->boot_config &= ~(B_OKROM+B_OKRAM);
    }
    return SUCCESS;
}
```

OS-9 Vector Mappings

This section contains the OS-9 vector mappings for the Intel SA1110 Assabet and the Intel SA1111 Neponset platforms.

The ARM standard defines exceptions 0x0-0x8. The OS-9 system maps these 1-1. External interrupts from vector 0x6 are expanded to the virtual vector rage shown below by the irq1110 and irq11x1 modules.

Note

Vectors can be virtually remapped from a ROM at physical address 0, into DRAM at virtual address 0. This speeds up interrupt response time and is enabled by defining the first cache list entry as a sub 1 Meg size.

For More Information

Refer to the ***Intel StrongARM SA-1110 Microprocessor Development Board User's Guide*** and the ***Intel StrongARM SA-1111 Microprocessor Development Module User's Guide*** for Assabet and Neponset hardware specifications, respectively.

Intel documenatation is provided online in PDF format at `www.intel.com`.

Table 2-1 shows the OS-9 IRQ assignment for the Assabet SA1110/SA1111 board.

Table 2-1 OS-9 IRQ Assignment for the SA1110/SA1111 Assabet/Neponset Boards

OS-9 IRQ #	ARM Function
0x0	Processor Reset
0x1	Undefined Instruction
0x2	Software Interrupt
0x3	Abort on Instruction Prefetch
0x4	Abort on Data Access
0x5	Unassigned/Reserved
0x6	External Interrupt
0x7	Fast Interrupt
0x8	Alignment error

Table 2-2 shows the OS-9 SA1110 Specific Functions.

Table 2-2 SA1110 Specific Functions

OS-9 IRQ #	SA1110 Specific Functions
0x40	GPIO[0] Edge Detect
0x41	GPIO[1] Edge Detect
0x42	GPIO[2] Edge Detect

Table 2-2 SA1110 Specific Functions (continued)

OS-9 IRQ #	SA1110 Specific Functions
0x43	GPIO[3] Edge Detect
0x44	GPIO[4] Edge Detect
0x45	GPIO[5] Edge Detect
0x46	GPIO[6] Edge Detect
0x47	GPIO[7] Edge Detect
0x48	GPIO[8] Edge Detect
0x49	GPIO[9] Edge Detect
0x4a	GPIO[10] Edge Detect
0x4b	OR of GPIO edge detects 27 - 11
0x4c	LCD controller service request
0x4d	UDC service request (0)
0x4e	SDLC service request (1a)
0x4f	UART service request (1b)
0x50	UART/HSSP service request (2)
0x51	UART service request (3)
0x52	MCP service request (4a)
0x53	SSP service request (4b)

Table 2-2 SA1110 Specific Functions (continued)

OS-9 IRQ #	SA1110 Specific Functions
0x54	DMA controller channel 0
0x55	DMA controller channel 1
0x56	DMA controller channel 2
0x57	DMA controller channel 3
0x58	DMA controller channel 4
0x59	DMA controller channel 5
0x5a	OS timer 0
0x5b	OS timer 1
0x5c	OS timer 2
0x5d	OS timer 3
0x5e	One Hz clock tick
0x5f	RTC als alarm register
0x60	GPIO[11] Edge Detect (The 0x4b OR is broken out here)
0x61	GPIO[12] Edge Detect (to make each one distinct)
0x62	GPIO[13] Edge Detect
0x63	GPIO[14] Edge Detect
0x64	GPIO[15] Edge Detect

Table 2-2 SA1110 Specific Functions (continued)

OS-9 IRQ #	SA1110 Specific Functions
0x65	GPIO[16] Edge Detect
0x66	GPIO[17] Edge Detect
0x67	GPIO[18] Edge Detect
0x68	GPIO[19] Edge Detect
0x69	GPIO[20] Edge Detect
0x6a	GPIO[21] Edge Detect (Assabet CF irq)
0x6b	GPIO[22] Edge Detect
0x6c	GPIO[23] Edge Detect (Assabet UCB1300 irq)
0x6d	GPIO[24] Edge Detect (Assabet GFX irqs)
0x6e	GPIO[25] Edge Detect (Assabet 11x1 irqs)
0x6f	GPIO[26] Edge Detect
0x70	GPIO[27] Edge Detect

Table 2-3 shows the OS-9 SA1111 Specific functions.

Table 2-3 SA1111 Specific Functions

OS-9 IRQ #	SA1111 Specific Function
0x71	GPIOA[0] (GPIOA)
0x72	GPI0A[1] (GPIOA)

Table 2-3 SA1111 Specific Functions (continued)

OS-9 IRQ #	SA1111 Specific Function
0x73	GPIOA[2] (GPIOA)
0x74	GPIOA[3] (GPIOA)
0x75	GPIOB[0] (GPIOB)
0x76	GPIOB[1] (GPIOB)
0x77	GPIOB[2] (GPIOB)
0x78	GPIOB[3] (GPIOB)
0x79	GPIOB[4] (GPIOB)
0x7a	GPIOB[5] (GPIOB)
0x7b	GPIOC[0] (GPIOC)
0x7c	GPIOC[1] (GPIOC)
0x7d	GPIOC[2] (GPIOC)
0x7e	GPIOC[3] (GPIOC)
0x7f	GPIOC[4] (GPIOC)
0x80	GPIOC[5] (GPIOC)
0x81	GPIOC[6] (GPIOC)
0x82	GPIOC[7] (GPIOC)
0x83	MsTxint (PS2 Mouse)

Table 2-3 SA1111 Specific Functions (continued)

OS-9 IRQ #	SA1111 Specific Function
0x84	MsRxint (PS2 Mouse)
0x85	MsStopErrint (PS2 Mouse)
0x86	TpxInt (PS2 Trackpad)
0x87	TpRxInt (PS2 Trackpad)
0x88	TpStopErrint (PS2 Trackpad)
0x89	SspXmitint (SSP)
0x8a	SspRcvint (SSP)
0x8b	SspROR (SSP)
0x8c	reserved
0x8d	reserved
0x8e	reserved
0x8f	reserved
0x90	reserved
0x91	AudXmtDmaDoneA (AUDIO)
0x92	AudRcvDmaDoneA (AUDIO)
0x93	AudXmtDmaDoneB (AUDIO)
0x94	AudRcvDmaDoneB (AUDIO)

Table 2-3 SA1111 Specific Functions (continued)

OS-9 IRQ #	SA1111 Specific Function
0x95	AudTFSR (AUDIO)
0x96	AudRFSR (AUDIO)
0x97	AudTUR (AUDIO)
0x98	AudROR (AUDIO)
0x99	AudDTS (AUDIO)
0x9a	AudRDD (AUDIO)
0x9b	AudSTO (AUDIO)
0x9c	USBPwr (AUDIO)
0x9d	nIrqHciM (USB)
0x9e	IrqHciBuffAcc (USB)
0x9f	IrqHciRmtWkp (USB)
0xa0	nHciMFClr (USB)
0xa1	USB port resume (USB)
0xa2	S0Readynint (PCMCIA)
0xa3	S1Readynint (PCMCIA)
0xa4	S0CDValid (PCMCIA)
0xa5	S1CDValid (PCMCIA)

Table 2-3 SA1111 Specific Functions (continued)

OS-9 IRQ #	SA1111 Specific Function
0xa6	S0_Bvd1Stschg (PCMCIA)
0xa7	S1_Bvd1Stschg (PCMCIA)
0xa8	reserved
0xa9	reserved
0xaa	reserved
0xab	reserved
0xac	reserved
0xad	reserved
0xae	reserved
0xaf	reserved
0xb0	reserved

Table 2-4 shows the Neponset Specific Functions.

Table 2-4 Neponset Specific Functions

OS-9 IRQ #	Neponset Specific Function
0xb1	Ethernet Irq
0xb2	USAR Irq

Assabet GPIO Usage

For More Information

See the Intel ***Assabet User's Manual*** for alternate pin functions.

Table 2-5 shows GPIO usage of the Assabet board as used by OS-9.

Table 2-5 GPIO Usage of the Assabet Board

GPIO	Signal Name	Direct	Description
GPIO0	`ON_OFF_SW1`	Input	Switch 1 (Abort Switch for OS-9)
GPIO1	`ON_OFF_SW2_FIQ`	Input	Switch 2
GPIO2	`LCD_D8_CNFG0`	Output	LCD Green bit 3 in 16 bit color mode
GPIO3	`LCD_D9_CNFG1`	Output	LCD Green bit 4 in 16 bit color mode
GPIO4	`LCD_D10_CNFG2`	Output	LCD Green bit 5 in 16 bit color mode
GPIO5	`LCD_D11_CNFG3`	Output	LCD Red bit 0 in 16 bit color mode
GPIO6	`LCD_D12_CNFG4`	Output	LCD Red bit 1 in 16 bit color mode
GPIO7	`LCD_D13_CNFG5`	Output	LCD Red bit 2 in 16 bit color mode
GPIO8	`LCD_D14_CNFG6`	Output	LCD Red bit 3 in 16 bit color mode
GPIO9	`LCD_D15_CNFG7`	Output	LCD Red bit 4 in 16 bit color mode
GPIO10	`SSP_UDA134_TXD`	Output	SSP Port transmit

Table 2-5 GPIO Usage of the Assabet Board (continued)

GPIO	Signal Name	Direct	Description
GPIO11	`SSP_UDA134_RXD`	Input	SSP Port Receive
GPIO12	`SSP_UDA134_SCLK`	Output	SSP Port Clock
GPIO13	`SSP_UDA134_SFRM`	Output	SSP Port Frame
GPIO14	`RADIO_IRQ`	Input	Radio IRQ input
GPIO15	`L3_I2C_SDA`	Output	Data line for shared I2C/L3 serial bus
GPIO16	`PS_MODE_SYNC`	Input	Power Mode switch input
GPIO17	`L3_MODE`	Output	L3 control bus signal
GPIO18	`L3_I2C_SCL`	Output	Clock line for shared I2C/L3 serial bus
GPIO19	`STERO_64FS_CLK`	Input	External Input clock for SSP
GPIO20	`UART3_CLK`	Input	External Input clock for SP3
GPIO21	`nMBGNT_CF_IRQ`	Input	ARM Bus grant/Assabet Compact Flash IRQ
GPIO22	`nMBREQ_CF_CARDDET`	In/Out	ARM Bus request/Assabet CF Card Detect
GPIO23	`UCB1300_IRQ`	Input	UCB 1300 Irq
GPIO24	`GFX_IRQ_CFBVD2 Irq`	Input	Graphics development board IRQ (MQ200)
GPIO25	`SA111_IRQ_CF_BVD1`	Input	1111 Development board Irq (Neponset)

Table 2-5 GPIO Usage of the Assabet Board (continued)

GPIO	Signal Name	Direct	Description
GPIO26	`VBAD_LOW/RCLK`	Input	Battery Low/Ref clk out.
GPIO27	`3.68M_32K`	Output	3.68Mhz output clock.

GPIO Interrupt Polarity

When GPIOs are used as interrupt sources, the `_PIC_ENABLE()` function will set default polarity based on settings in `systype.h` along with enabling the interrupt at the SA1110 PIC. If the opposite edge is required, software must assert/negate the appropriate bits in the GFER/GRER (if no edge defines were in `systype.h`, the pic code will default to rising edge).

Board-Specific Register Access Functions

A board-specific global storage area has been defined for the Assabet due to the board's use of the write-only register (BCR) in a variety of Assabet board functions.

For More Information

Refer to the ***Intel StrongARM SA-1110 Microprocessor Development Board User's Guide*** and the ***Intel StrongARM SA-1111 Microprocessor Development Module User's Guide*** for further information on the BCR.

In order to guarantee the coherency of the BCR value, several functions have been defined to give access to the global storage area. These functions provide atomic updates for bit or register operations and can be used by system state code by linking to the library `hwlib.l`, which is found at in the following location:

`/MWOS/os9000/armv4/ports/assabet/lib.`

The provided OS-9 drivers all link against this library to access BCR values. Bit defines for the BCR can be found in the ports `systype.h` file. A brief description of the access functions is provided below.

The global area is allocated at boot time by the `oemglobal` module and its access pointer is contained within the OS-9 rominfo structure (RINF).

The global area consists of an array of 8 four byte values.

- `hardware_shadow_globals[0]` - BCR value (read/write address).
- `hardware_shadow_globals[1]` - SCR value (probed value)
- `hardware_shadow_globals[2]` - Boot Code revision
- `hardware_shadow_globals[3-7]` - Reserved.

The following functions are used to access or update any of the globals and their associated hardware shadows. The use of the bit operations is preferred.

- `clear_oem_reg_bit()` - Clears a bit to 0.
- `set_oem_reg_bit()` - Sets a bit to a 1.
- `get_oem_reg_bit()` - Returns the value of 1 or 0 for a bit.
- `set_oem_reg()` - Sets the 32bit value of an array entry.
- `get_oem_reg()` - Returns the 32bit value of an array entry.

All the global access functions take the `rinf` as a parameter. In boot modules prior to the kernel (system call ability) the `rinf` is passed as a parameter to each ROM p2module. After the kernel is up the `rinf` can be obtained with the `os_getrinf()` function (see example below).

```
void clear_oem_reg_bit(u_int32 regoffset, u_int32 bitnum, Rominfo 
rinf)
void set_oem_reg_bit(u_int32 regoffset, u_int32 bitnum, Rominfo rinf)
u_int32 get_oem_reg_bit(u_int32 regoffset, u_int32 bitnum, Rominfo 
rinf)
```

`regoffset` is the offset to the array entry to access.

`bitnum` is the bit number to access.

`rinf` is a pointer to the rom information structure.

```
get_oem_reg_bit() returns the value of the referenced bit (0 or 1)
u_int32 get_oem_reg(u_int32 regoffset, Rominfo rinf)
```

`regoffset` is the offset to the array entry to access.

`rinf` is a pointer to the rom information structure.

`get_oem_reg` returns the 32 bit value of the selected array entry on success, or -1 on error if a bad rinf is passed.

```
error_code set_oem_reg(u_int32 regoffset, u_int32 new_value, u_int32 
                    *old_value, Rominfo rinf);
```

`regoffset` is the offset to the array entry to access.

`new_value` is the value to be set the array entry.

`old_value` is a pointer to the preious value of the seleted OEM reg (obtained by `get_oem_reg()`).

`set_oem_reg` returns `SUCCESS` if the operation succeeded. If the operation failed because the `old_value` is different than current value, a `-1` is returned. If the operation failed due to a bad `rinf`, `EOS_ILLPRM` is returned.

Note

`get_oem_reg()` must be called before a call to `set_oem_reg()`, this insures that the associated array entry has not asynchronously changed from another context. The `set_oem_reg()` call should be in a loop with `get_oem_reg()` until `SUCCESS` is reached (this will almost always be on the first attempt).

Example

```
#include <systype.h>   /* get BCR/SCR def's /mwos/.../assabet */
#include <rom.h>       /* get rinf defs, /mwos/src/defs/rom */
#include <p2lib.h>     /* get os_getrinf protos /mwos/src/defs/rom */

/* Power up the local Assabet LCD */
static void _lcdOn()
{
  Rominfo rinf;/* allocate local pointer for rinf */

  os_getrinf(&rinf); /* get global rom structure pointer */

  /* Power up local LCD if NO external GFX board preset*/
  if(get_oem_reg_bit(A_SCR_OFFSET, GFXDB, rinf))
  {
    set_oem_reg_bit(A_BCR_OFFSET,LCDON, rinf);   /* Enable power to LCD 
panel */
    clear_oem_reg_bit(A_BCR_OFFSET,LCD12_16, rinf); /* Set to RGB444 */
    set_oem_reg_bit(A_BCR_OFFSET,LIGHT, rinf);      /* BackLight on if 
there */
  }
  return;
}
```

Port Specific Utilities

The following port specific utilities are included:

- `pcmcia`
- `touch_cal`
- `ucbtouch`

pcmcia

Syntax

```
pcmcia [<opts>]
```

options

`-s=`	socket: socket [default all sockets]
`-d`	de-iniz socket(s)
`-i`	iniz socket(s)
`-v`	verbose mode
`-x`	dump CIS/Config information
`-?`	Print this help message

Description

`pcmcia` provides the ability to initilize or deinitilize a PCMCIA card after the system has booted. It also displays a PCMCIA cards CIS structure.

Example

```
$ pcmcia -x -s=0
ATA IDE disk found in socket0
Dump CIS Window for Socket #0
  Addr     0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F  0 2 4 6 8 A C E
--------  -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
-----------------
28000000  01 03 d9 01 ff 1c 04 03 d9 01 ff 18 02 df 01 20
...............
28000020  04 01 4e 00 01 15 2b 04 01 56 49 4b 49 4e 47 20
..N...+..VIKING
28000040  43 4f 4d 50 4f 4e 45 4e 54 53 20 20 20 20 20 20  COMPONENTS
28000060  20 20 00 43 46 20 41 54 41 20 00 56 2e 31 30 32  .CF ATA
.V.102
28000080  00 ff 21 02 04 01 22 02 01 01 22 03 02 04 5f 1a
..!..."..."..._.
280000a0  05 01 03 00 02 0f 1b 09 c0 40 a1 21 55 55 08 00
.........@.!UU..
280000c0  22 1b 06 00 01 21 b5 1e 35 1b 0b c1 41 99 21 55
"....!..5...A.!U
280000e0  55 64 f0 ff ff 22 1b 06 01 01 21 b5 1e 35 1b 0d
Ud..."....!..5..
28000100  82 41 98 ea 61 f0 01 07 f6 03 01 ee 22 1b 06 02
.A..a......."...
28000120  01 21 b5 1e 35 1b 0d 83 41 98 ea 61 70 01 07 76
.!..5...A..ap..v
28000140  03 01 ee 22 1b 06 03 01 21 b5 1e 35 14 00 ff ff
..."....!..5....
28000160  ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
................
28000180  ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
................
280001a0  ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
................
280001c0  ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
................
280001e0  ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
................
Dump Config Window for Socket #0
  Addr     0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F  0 2 4 6 8 A C E
--------  -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
-----------------
28000200  43 00 02 00 00 00 00 00 00 00 00 00 00 00 00 00
C...............
28000220  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
...............
```

```
28000240  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
................
28000260  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
................
28000280  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
................
280002a0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
................
280002c0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
................
280002e0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
................
28000300  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
................
28000320  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
................
28000340  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
................
28000360  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
................
28000380  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
................
280003a0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
................
280003c0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
................
280003e0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
................
```

touch_cal — Touchscreen Calibration Program

Syntax

```
touch_cal <options>
```

Options

`-f[=]<name>`	Output filename
`-c`	Only run calibration if output filename does not exist
`-m[=]<font_module>`	Use given UCM font module to display text

Description

The `touch_cal` utility will present a text message on the LCD screen as well as points for the user to press. After the points are pressed, the protocol module `mp_ucb1200` will be updated with the new calibration information.

Example

```
$ touch_cal
Found touch screen device '/ucb_touch/mp_ucb1200'
```

ucbtouch

Syntax

```
ucbtouch <>
```

Description

The `ucbtouch` utility prints the raw x,y and pressure values at a set sample rate.

Press the touch screen and observe the output on your console. The utility is helpful in determining whether your touch screen is connected properly.

Example

```
$ ucbtouch
Touch[00000]: Touch=0x30c3 X1=00328 Y1=00321 P= 28 X=329 Y=322
Touch[00001]: Touch=0x30c3 X1=00329 Y1=00325 P= 28 X=330 Y=326
Touch[00002]: Touch=0x30c3 X1=00329 Y1=00321 P= 28 X=330 Y=322
Touch[00003]: Touch=0x30c3 X1=00329 Y1=00321 P= 29 X=330 Y=322
Touch[00004]: Touch=0x30c3 X1=00329 Y1=00319 P= 29 X=330 Y=320
Touch[00005]: Touch=0x30c3 X1=00329 Y1=00321 P= 28 X=330 Y=322
Touch[00006]: Touch=0x30c3 X1=00329 Y1=00327 P= 28 X=330 Y=328
Touch[00007]: Touch=0x30c3 X1=00329 Y1=00321 P= 28 X=330 Y=322
Touch[00008]: Touch=0x30c3 X1=00329 Y1=00321 P= 29 X=330 Y=322
Touch[00009]: Touch=0x30c3 X1=00329 Y1=00322 P= 28 X=330 Y=323
Touch[00010]: Touch=0x30c3 X1=00329 Y1=00319 P= 28 X=0 Y=0
Touch[00011]: Touch=0x30c3 X1=00328 Y1=00321 P= 28 X=-1 Y=2
Touch[00012]: Touch=0x30c3 X1=00329 Y1=00315 P= 28 X=0 Y=-4
Touch[00013]: Touch=0x30c3 X1=00329 Y1=00322 P= 29 X=0 Y=3
```

Appendix A: Board-Specific Modules

This chapter describes the modules specifically written for the target board. It includes the following sections:

- **Low-Level System Modules**
- **High-Level System Modules**

Low-Level System Modules

For More Information

For a complete list of OS-9 modules common to all boards, see the ***OS-9 Device Descriptor and Configuration Module Reference*** manual.

The following low-level system modules are tailored specifically for the Intel SA1110 Assabet platform. The functionality of these modules can be altered through changes to the configuration data module (`cnfgdata`). **Table A-1** provides a list and brief description of the modules.

These modules can be found in the following directory:

```
MWOS/OS9000/ARMV4/PORTS/ASSABET/CMDS/BOOTOBJS/ROM
```

Table A-1 Assabet-Specific Low-Level System Modules

Module Name	Description
`cnfgdata`	Contains the low-level configuration data.
`cnfgfunc`	Provides access services to cnfgdata data.
`commcnfg`	Inits communication port defined in cnfgdata.
`conscnfg`	Inits console port defined in cnfgdata.
`ide`	IDE boot support module. PCMCIA compatible.
`io1100`	Provides polled serial driver support for the low-level system.

Table A-1 Assabet-Specific Low-Level System Modules (continued)

Module Name	Description
`ll91c94`	Provides low-level Ethernet services.
`llcis`	Inits the PCMCIA interface including cards.
`llne2000`	Provides low-level Ethernet services via SOCKET-LPE PCMCIA card.
`lle509`	Provides low-level Ethernet services via 3COM PCMCIA card.
`lle509_pcm`	Provides low-level Ethernet services.
`portmenu`	Inits booters defined in the cnfgdata.
`romcore`	Board specific initialization code.
`splash`	Provides way to init LCD screen with a compressed image.
`oemglob`	Creates a shared variable area for high/low level system interactions.
`dbinit`	Initilizes any daughter boards present.
`tmr1_1100`	Provides low-level timer services via time base register.
`usedebug`	Inits low-level debug interface to RomBug, SNDP, or none.

The following low-level system modules provide generic services for OS9000 Modular ROM. Table A-2 provides a list and brief description of the modules.

These modules can be found in the following directory:

`MWOS/OS9000/ARMV4/CMDS/BOOTOBJS/ROM`

Table A-2 Generic Services Low-Level System Modules

Module Name	Description
`bootsys`	Booter registration service module.
`console`	Provides console services.
`dbgentry`	Inits debugger entry point for system use.
`dbgserv`	Provides debugger services.
`excption`	Provides low-level exception services.
`flshcach`	Provides low-level cache management services.
`hlproto`	Provides user level code access to protoman.
`llbootp`	Booter which provides bootp services.
`llip`	Provides low-level IP services.
`llslip`	Provides low-level SLIP services.
`lltcp`	Provides low-level TCP services.
`lludp`	Provides low-level UDP services.
`llkermit`	Booter which uses kermit protocol.

Table A-2 Generic Services Low-Level System Modules (continued)

Module Name	Description
`notify`	Provides state change information for use with LL and HL drivers.
`override`	Booter which allows choice between menu and auto booters.
`parser`	Provides argument parsing services.
`pcman`	Booter which reads MS-DOS file system.
`protoman`	Protocol management module.
`restart`	Booter which cause a soft reboot of system.
`romboot`	Booter which allows booting from ROM.
`rombreak`	Booter which calls the installed debugger.
`rombug`	Low-level system debugger.
`sndp`	Provides low-level system debug protocol.
`srecord`	Booter which accepts S-Records.
`swtimer`	Provides timer services via software loops.

High-Level System Modules

The following OS-9 system modules are tailored specifically for your Intel SA1110 Assabet board and peripherals. Unless otherwise specified, each module is located in a file of the same name in the following directory:

`MWOS/OS9000/ARMV4/PORTS/ASSABET/CMDS/BOOTOBJS`

CPU Support Modules

These files are located in the following directory:

`MWOS/OS9000/ARMV4/CMDS/BOOTOBJS`

`kernel`	The kernel provides all basic services for the OS-9 system.
`cache`	Provides cache control for the CPU cache hardware. The cache module is in the file `cach1100`.
`fpu`	Provides software emulation for floating point instructions.
`ssm`	The System Security Module provides support for the Memory Management Unit (MMU) on the CPU.
`vectors`	Provides interrupt service entry and exit code. The vectors module is found in the file `vect110`.

System Configuration Module

These files are located in the following directory:

`MWOS/OS9000/ARMV4/PORTS/ASSABET/CMDS/BOOTOBJS/INITS`

`init`	Descriptor module with high level system initialization information.
`nodisk`	Same as init, but used in a disk-less system.

Power Management Support Modules

These modules provide an interface to control the power states of the Assabet device

The supported SA1110 CPU power states are `RUN`, `IDLE` and `SLEEP`.

`pwrman`	P2module which provides generic power management functions.
`pwrplcy`	P2module which provides power state control functions.
`sysif`	P2module which provides SA1100 CPU power state control.

Interrupt Controller Support

This module provides extensions to the vectors module by mapping the single interrupt generated by an interrupt controller into a range of pseudo vectors which are recognized by OS-9 as extensions to the base CPU exception vectors.

For More Information

The mappings are described in **Chapter 2**.

`irq1100`	P2module that provides interrupt acknowledge and dispatching support for the SA1100 pic.
`irq1111`	P2module which provides interrupt acknowledge and dispatching support for the SA1111 pic (vector range 0x71-0xB2).

Real Time Clock

`rtc1100`	Driver that provides OS-9 access to the SA1110 on-board real time clock.

Ticker

`tk1100`	Driver that provides the system ticker based on the SA1110 Operating System Timer.

Abort Handler

`abort`	P2module which provides a way to enter the system-state debugger via vector 0xb40 interrupt triggered by Assabet button at S1.

Generic IO Support modules (File Managers)

These files are located in the following directory:

`MWOS/OS9000/ARMV3/CMDS/BOOTOBJS`

`ioman`	Provides generic IO support for all IO device types.
`scf`	Provides generic character device management functions.

`rbf`	Provides generic block device management functions for OS-9 specific format.
`pcf`	Provides generic block device management functions for MS-DOS FAT format.
`spf`	Provides generic protocol device management function support.
`mfm`	Provides generic graphics device support for MAUI®.
`pipeman`	Provides a memory FIFO buffer for communication.

Pipe Descriptor

This file is located in the following directory:

`MWOS/OS9000/ARMV4/PORTS/ASSABET/CMDS/BOOTOBJS/DESC`

`pipe`	Pipeman descriptor that provides a RAM based FIFO that can be used for process communication.

RAM Disk Support

`ram`	RBF driver that provides a RAM based virtual block device.

Descriptors for Use with RAM

These files are located in the following directory:

`MWOS/OS9000/ARMV4/PORTS/ASSABET/CMDS/BOOTOBJS/DESC/RAM`

`r0`	RBF descriptor that provides access to a ram disk.
`r0.dd`	Same as `r0` except with module name dd (for use as the default device).

Serial and Console Devices

`sc1100`	SCF driver that provides serial support the SA1110's SP1 and SP3 ports when configured as UARTS.

Descriptors for Use with sc1100

`term1/t1` Descriptor modules for use with sc1100 and SP1 (default term).

Assabet Board header:	J10
Default Baud Rate:	19200
Default Parity:	None
Default Data Bits:	8
Default Handshake:	Software

`term3/t3` Descriptor modules for use with sc1100 and SP3.

Assabet Board header:	J14
Default Baud Rate:	115200
Default Parity:	None
Default Data Bits:	8
Default Handshake:	Software

`sc1101`	SCF driver that provides serial support for the SA1111.

Descriptors for use with sc1101

`m1`	Descriptor module used with the sc1101 and SP1.
`m2`	Descriptor module used with the sc1101 and SP2.

`sc16550`	SCF driver that provides serial support for PCMCIA modem cards.

Descriptors for use with sc16550

`t0m` Descriptor modules for use with PCMCIA modem cards.

Assabet Board header:	J6
Default Baud Rate:	9600
Default Parity:	None
Default Data Bits:	8
Default Handshake:	Software

`scllio`	SCF driver that provides serial support via the polled low-level serial driver.

Descriptors for Use with scllio

`vcons/term` Descriptor modules for use with scllio in conjunction with a low-level serial driver. Port configuration and set up follows what is configured in `cnfgdata` for the console port. It is possible for `scllio` to communicate with a true low-level serial device driver like `io1100`, or with an emulated serial interface provided by `iovcons`.

For More Information

See the OEM manual for more information.

PCMCIA Support for IDE Type Devices

`rb1003`	RBF/PCF driver that provides driver support for IDE/EIDE devices. This driver is used to provide disk support for PCMCIA ATA FLASH.

Descriptors for Use with rb1003

`hc1, hc1fmt, hc1.dd`

RBF Descriptor modules for use with PCMCIA slot #0

Assabet Board header:	J6
hc1fmt:	format enabled
hc1.dd:	module name of dd

`mhc1, mhc1fmt, mhc1fmt.dd mhc1.dd`

PCF Descriptor modules for use with PCMCIA slot #0 on the Assabet

Assabet Board header:	J6
mhc1fmt:	format enabled
mhc1fmt.dd	format enabled
mhc1.dd:	module name of dd

`mhc1_d, mhc1_dfmt, mhc1_dfmt.dd mhc1_d.dd`

PCF Descriptor modules for use with PCMCIA slot #0 on the Neponset

Neponset Board header:	J23
mhc1_dfmt:	format enabled
mhc1_dfmt.dd	format enabled
mhc1_d.dd:	module name of dd

PCF Descriptor modules for use with PCMCIA slot #1 on the Neponset
Descriptor modules

Board header:	J23
mhe1fmt:	format enabled
mhe1fmt.dd	format enabled
mhe1.dd:	module name of dd

PCMCIA Support for Socket-LPE Ethernet Card (NE2000 Compatible)

These files are located in the following directory:

`MWOS/OS9000/ARMV4/PORTS/ASSABET/CMDS/BOOTOBJS/SPF`

`spne2000`	SPF driver to support ethernet for a Socket-LPE CF card.

Descriptors for Use with spne2000

`spne0`	SPF descriptor module for use with PCMCIA slot #0 (bottom J6)
`spne1`	SPF descriptor module for use with PCMCIA slot #1 (J23, Neponset)

PCMCIA Support for 3COM Ethernet Card

These files are found in the following directory:

`MWOS/OS9000/ARMV4/PORTS/ASSABET/CMDS/BOOTOBJS/SPF`

`spe509_pcm`	SPF driver to support ethernet for a 3COM EtherLink III PCMCIA card.

spe509_pcm Descriptors

`spe30`	SPF descriptor module for use with PCMCIA slot #0 (J6).
`spe31`	SPF descriptor module for use with PCMCIA slot #1 (J23, Neponset).

SMC91C94 Ethernet Support

These files are located in the following directory:

`MWOS/OS9000/ARMV4/PORTS/ASSABET/CMDS/BOOTOBJS/SPF`

`sp91c94`	SPF driver to support ethernet for the SMC91C94 chip (on Neponset).

Descriptor for Use with sp91c94

`spsm0`	SPF descriptor module for use with SMC91C94 at U2 (on Neponset).

Network Configuration Modules

`inetdb/inetdb2/rpcdb`

UCB1300 Support Modules

Note
These drivers and descriptors work with UCB1100/1200/1300).

These files are located in the following directory:

`MWOS/OS9000/ARMV4/PORTS/ASSABET/CMDS/BOOTOBJS/SPF`

`spucb1200`	SPF driver that supports the on-board Phillips UCB1200 chip. This device communicates to the SA1100 over SP4 using MCP.

Descriptors for Use with spucb1200

`ucb`	SPF descriptor module that provides access to UCB1200.
`ucb_touch`	SPF descriptor module used with the touch screen.

Maui Graphical Support Modules

These files are located in the following directory:

`MWOS/OS9000/ARMV4/PORTS/ASSABET/CMDS/BOOTOBJS/MAUI`

`gx_sa1100`	MFM MAUI driver module with support for the Assabet LCD panel.

Descriptors for Use with gx_sa1100

`gfx`	MFM MAUI descriptor module for Assabet LCD.

`sd_ucb1200`	MFM MAUI driver module that provides PCM/mu-law sound support via the ucb1300. The UDA1341 must be configured to pass through UCB1300 signals.

Descriptors for Use with sd_ucb1200

`snd`	MFM MAUI descriptor module for UCB1200 sound functions.

MAUI configuration modules

`cdb`	MAUI configuration data base module.
`cdb_ptr`	Serial mouse configuration data base module.
`cdb_touch`	Touch screen configuration data base module.

MAUI protocol modules

`mp_kybrd`	Keyboard protocol module.
`mp_msptr`	Serial mouse protocol module.
`mp_ucb1200`	ucb1200 protocol module.

For More Information

The MAUI drivers are described in more detail in Appendix B: MAUI Driver Descriptions.

Appendix B: MAUI Driver Descriptions

This chapter provides MAUI driver descriptions. It includes the following sections:

Assabet Objects

This package provides object-level support for the Intel Assabet reference board. The port directory is at the following location:

`MWOS/OS9000/ARMV4/PORTS/ASSABET`

MAUI objects

`cdb`	Lists the devices on the system.
`mp_msptr`	Serial mouse protocol module.
`mp_ucb1200`	Touch screen protocol module for the UCB1200.
`gfx` and `gx_sa1100`	LCD graphics descriptor and driver.

GX_SA1100 LCD Graphic Driver Specification

This section describes the hardware specification of the StrongARM SA1110 LCD driver (named gx_sa1100) and descriptor (named gfx). The hardware sub-type defines the board configuration. This specification should be used with the MAUI Graphics Device API.

Board Ports

This driver is used in the following example board StrongArm ports.

The GraphicsClient board uses a Sharp LQ64D341 18 bpp color (16 used), TFT, with a resolution of 640x480 single panel. This panel is connected to the GraphicsClient with one of several possible cables:

- 8 bpp - most common to date
- RGB 565 - next most common
- RGB 655
- RGB 556

The SideArm board can support an LCD panel, but does not typically ship with one. For this reason the SideArm port does not build this driver. If the user did connect a LCD panel to this board, simply copy the makefiles from one of the other ports into the SideArm port.

The Assabet board uses a Sharp LQ039Q2DS01, TFT, with a resolution of 320x240 single panel. This panel is connected to the Assabet with one of several possible cables:

- 8 bpp - most common to date
- RGB 565 - next most common

Device Capabilities

Information about the hardware capabilities is determined by calling `gfx_get_dev_cap()`. The hardware sub-type defines the board configuration. This function returns a data structure formatted as shown in **Table B-1**. See `GFX_DEV_CAP` for more information about this data structure.

Table B-1 gfx_get_dev_cap() Data Structure

Member Name	Description	Value
`hw_type`	Hardware type (embedded in driver)	SA1100 LCD Controller
`hw_subtype`	Hardware subtype (embedded in descriptor)	Assabet 8 bit color LCD, or Assabet 16 bit color LCD
`sup_vpmix`	Supports viewport mixing	FALSE
`sup_extvid`	Supports external video as a backup	FALSE
`sup_bkcol`	Supports background color	FALSE
`sup_vptrans`	Supports viewport transparency	FALSE
`sup_vpinten`	Supports viewport intensity	FALSE
`sup_sync`	Supports retrace synchronization	FALSE

Table B-1 gfx_get_dev_cap() Data Structure (continued)

Member Name	Description	Value
`num_res`	Number of display resolutions	1
`res_info`	Array of display resolution information	See Display Resolution table
`dac_depth`	Depth of the DAC in bits	12
`num_cm`	Number of coding methods	1
`cm_info`	Array of coding method information	See Coding Methods table
`sup_viddecode`	Supports video decoding into a drawmap	FALSE

Display Resolution

The display resolution is configured by the descriptor and can be changed to support LCD panels of different sizes. The driver is only designed to support one resolution at a time. That resolution is specified by the descriptor. Modify the `DEFAULT_RES` macro in `mfm_desc.h` to change the resolution. If you change the resolution, you must also change all of the LCD timing fields as well.

Table B-2 Display Specifications

Board	Width	Height	Refresh Rate	Interlace Mode	Aspect Ratio X:Y
Graphics-Client	640	480	0*	`GFX_INTL_OFF`	1:1

*Refresh rate is determined by timing specified in descriptor. The devcap is not automatically update to reflect this.

Coding Methods

The coding method is also configured by the descriptor and can be changed to support b/w and color LCD panels. The coding method can be selected in the descriptor by simply specifying the coding method in the `DEFAULT_CM` macro in `mfm_desc.h`.

This driver was verified on the Assabet board with both a 8-bit and 565 cables. The maximal coding method supported by SA1100 LCD Controller is 16 bpp.

Table B-3 Coding Method Description

Board	Coding Method	CLUT Based	X,Y Multipliers	Palette Color Types
Graphics-Client w/8 bit cable	`GFX_CM_8BIT`	TRUE	1,1	GFX_COLOR_RGB
Graphics-Client w/16 bit cable	`GFX_CM_565`, `GFX_CM_655`, or `GFX_CM_556`	FALSE	1,1	NA
No current hardware implementati on available	`GFX_CM_4BIT`	TRUE	1,1	GFX_COLOR_RGB

Viewport Complexity

The driver supports one active viewport at a time. The application can create multiple viewports and stack them. The viewport must be aligned with, and the same size as the display. Display drawmaps must be the same size as the viewport.

Memory

Applications are expected to request graphics memory from the driver. The driver allocates memory from the system as needed. It requests this memory from color 0x80. This memory (specified in the init module) is located at the bottom of 16/32 MB DRAM address space and is marked as non cached.

Location

This driver's source is located in:

`SRC/DPIO/MFM/DRVR/GX_SA1100`

This driver's makefiles are located in:

`OS9000/ARMV4/PORTS/ASSABET/MAUI/GX_SA1100`

This directory contains the makefiles and descriptor header file to build the descriptor(s) and driver(s) (not all packages include driver source) for the StrongARM reference platform. This directory contains:

`makefile`	Calls each of the other makefiles in this directory
`drvr.mak`	Builds the driver
`desc.mak`	Builds the descriptor(s)
`mfm_desc.h`	Defines values for all modifiable fields of the descriptor(s)

Build the Driver

The driver source is located in `SRC/DPIO/MFM/DRVR/GX_SA1100`. To build the driver, use the following commands:

```
cd OS9000/ARMV4/PORTS/ASSABET/MAUI/GX_SA1100
os9make -f drvr.mak
```

Build the Descriptor

To build a new descriptor, modify `mfm_desc.h`, and use the following commands to compile:

```
cd OS9000/ARMV4/PORTS/ASSABET/MAUI/GX_SA1100
os9make -f desc.mak
```

To build both the driver and the descriptor you can specify `os9make` with no parameters.

SD_UCB1200 Sound Driver Specification

This section describes the hardware specifications for the Philips UCB1200 driver `sd_ucb1200`. The hardware sub-type defines the board configuration. This specification should be used in conjunction with the MAUI Sound Driver Interface.

This driver works in conjunction with the spucb1200 driver.

Device Capabilities

Information about the hardware capabilities is determined by calling `_os_gs_snd_devcap()`. This function returns a data structure formatted as in the following table. See `SND_DEV_CAP` for more information about this data structure.

Table B-4 Data Returned in SND_DEV_CAP

Member Name	Value	Description
`hw_type`	"CS4231	"Hardware type
`hw_subtype`	"CS4231A	"Hardware sub-type
`sup_triggers`	`SND_TRIG_ANY`	Supported triggers
`play_lines`	`SND_LINE_SPEAKER`	Play gain/mix lines
`record_lines`	`SND_LINE_MIC`	Record gain/mix lines
`sup_gain_cmds`	`SND_GAIN_CMD_MONO`	Mask of supported gain commands
`num_gain_caps`	2	Number of `SND_GAIN_CAPs`

Table B-4 Data Returned in SND_DEV_CAP (continued)

Member Name	Value	Description
`gain_caps`	See Gain Capabilities Array	Pointer to `SND_GAIN_CAP` array
`num_rates`	30	Number of sample rates
`sample_rates`	See Sample Rates	Pointer to sample rate array
`num_chan_info`	1	Number of channel info entries
`channel_info`	See Number of Channels	Pointer to channel info array
`num_cm`	3	Number of coding methods
`cm_info`	See Encoding and Decoding Formats	Pointer to coding method array

Gain Capabilities Array

The following tables show the various gain capabilities for the Philips UCB1200. This information is pointed to by the gain_cap member of the SND_DEV_CAP data structure. See SND_GAIN_CAP for more information about this data structure. This driver allows control of following individual physical gain controls:

Table B-5 Individual Gain Controls

`SND LINE SPEAKER`	Output Attenuation
`SND LINE MIC`	Microphone Gain

The following tables detail the various individual gain capabilities:

Table B-6 Speaker Gain Enable

Member Name	Value	Step	HW	Level	Comments
lines	`SND_LINE_SPEAKER`	0-3	31	-69 dB	default_level
`sup_mute`	`TRUE`	4-7	30	-66.8 dB	
`default_type`	`SND_GAIN_CMD_MONO`	8-11	29	-64.7 dB	
`default_level`	`SND_LEVEL_MAX`	12-15	28	-62.5 dB	
`zero_level`	`SND_LEVEL_MIN`	...	...	...	
`num_steps`	`32`	112-115	3	-6.5 dB	
`step_size`	`216`	116-119	2	-4.3 dB	
mindb	`-6900`	120-123	1	-2.2 dB	
maxdb	`0`	124-127	0	0.0 dB	zero_level

Table B-7 Mic Gain Enable

Member Name	Value	Step	HW	Level	Comments
lines	`SND_LINE_MIC`	0-3	0	0 dB	zero_level
`sup_mute`	`FALSE`	4-7	1	0.7 dB	
`default_type`	`SND_GAIN_CMD_MONO`	...	...	...	...
`default_level`	`SND_LEVEL_MAX`	64-67	16	11.3 dB	default_leve l
`zero_level`	`SND_LEVEL_MIN`	...	...	...	...
`num_steps`	32	112-115		20.4 dB	
`step_size`	70	116-119	29	21.1 dB	
mindb	0	120-123	30	21.8 dB	
maxdb	2250	124-127	31	22.5 dB	

Sample Rates

Following is an abbreviated list of the supported sample rates for the UCB1200. Below is a formula to derive valid sample rates:

sample_rate = 11981000/(32 * i), where $8 < i < 128$

This information is pointed to by the `sample_rates` member of the `SND_DEV_CAP` data structure.

Table B-8 Sample Rate (Hz)

2948	3941	4926	5942	6933
7966	8914	9852	10697	11700
12910	13866	14976	15600	17828
18720	19705	20800	22023	23400
24960	26743	28800	31200	34036
37440	41600	46801	53486	62401

Number of Channels

The following table shows the different supported number of channels for the Philips UCB1200. The first entry in the table is the default number of channels. This information is pointed to by the `channel_info` member of the `SND_DEV_CAP` data structure.

Table B-9 Number of Channels

Channels	Description
1	Mono

Encoding and Decoding Formats

The following table shows the supported encoding and decoding formats for the Philips UCB1200. The first entry in the table is the default format. This information is pointed to by the `cm_info` member of the `SND_DEV_CAP` data structure.

Table B-10 Encoding and Decoding Formats

Coding Method	Sample Size	Boundary Size	Description
`SND_CM_PCM_ULAW`	8	2	8 bit u-Law commanded
`SND_CM_PCM_SLINEAR` `SND_CM_LSBYTE1ST`	16	4	16 bit Linear (two's complement) little-endian
`SND_CM_PCM_SLINEAR`	16	4	16 bit Linear signed (two's complement) big-endian

SPUCB1200 driver for the UCB1200 Codec

This document describes the hardware specifications for the Philips UCB1200 driver. This is an SPF driver.

Capabilities

The UCB1200 is capable of controlling a microphone/speaker, input/output telecommunications lines, resistive style touch screen, and 16 General Purpose Input/Output lines. This driver currently can only control the touch screen, and general purpose input/output lines. The microphone/speaker can be controlled with a MAUI Sound driver called `sd_ucb1200`. No driver has been written for the telecommunications part of the UCB1200.

Descriptors

Table B-11 lists the UCB1200 descriptors.

Table B-11

Name	Function
`ucb`	UCB1200 Chip Initialization
`ucb_audio`	Not Implemented
`ucb_touch`	Touch Screen
`ucb_gpio`	Control GPIO Lines
`ucb_telecom`	Not Implemented

UCB

Opening the /ucb device will perform basic chip initialization. Normally this is not necessary, unless another driver is written to control part of the UCB1200 functions. This is the case for audio. The MAUI Sound driver `sd_ucb1200` will open /ucb to perform chip initialization. In this way, the MAUI Sound driver play audio and this driver can control the touch screen at the same time.

Audio

This portion of the driver is not implemented since the MAUI Sound driver `sd_ucb1200` already exists. `sd_ucb1200` and this driver can co-exist.

Touch Screen

This portion of the driver controls the touch screen operation. When pressure is applied to the touch screen, a hardware interrupt is raised, and this driver's interrupt service routine will execute. A system state alarm, then, will fire at regular intervals to sample data from the touch screen. When pressure is removed, the alarm stops. This mechanism leaves the UCB1200 in a low power state until the user presses the touch screen. The alarm rate can be controlled in the `ucb_touch` descriptor.

Each sample contains an x, y coordinate as well as pressure information. The data is formatted into a six byte packet as defined in the table below. Each packet contains 10 bits of x, 10 bits of y, and 8 bits of pressure information.

Table B-12 Touch Screen Descriptor Data

Byte number	Description
0	sync code - 0x80
1	header: bit 1: pendown bit 2: penup bit 3: penmove (may occur with pendown or penup)
2	bits 0..2: high 3 bits of x bits 3..6: high 4 bits of pressure bit 7: 0
3	bits 0..6: low 7 bits of x bit 7: 0
4	bits 0..2: high 3 bits of y bits 3..6: low 4 bits of pressure
5	bits 0..6: low bits of y bit 7: 0

GPIO

This section of the driver has basic GPIO line control, where lines 0..9 are connected to a 7 segment display or LED. Each line can be controlled with an `_os_write()` call. (Refer to the UCBHEX program in the TEST directory.)

Telecom

This portion of the driver is not implemented.

Supporting Modules

Before this driver can be used, the following modules must be in memory: `spf`, `sysmbuf`, `mbinstall`. `mbinstall` must also be run before use.

MP_UCB1200 MAUI Touch screen Protocol Module

This document describes the function of the `mp_ucb1200` protocol module, as well as a high level discussion of the touch screen driver and calibration application.

Overview

The protocol module converts the driver raw data into a `MAUI_MSG` structure. In this way, applications can remain somewhat ignorant of the details of the hardware since it deals with the MAUI Input layer. In this protocol module, the raw hardware data is converted into screen coordinates. In addition, some data filtering occurs to reduce the amount of erroneous data that the touch screen hardware can produce.

Data Format

The touch screen driver sends a 6 byte packet that contains x, y, and pressure information. The exact format of this packet is described in the spucb1200 driver.

Data Filter

This protocol module filters the data coming from the hardware in an attempt to reduce erroneous data. Two methods are implemented: data point averaging and low pressure point removal. The first method will average the last two points received from the driver. The data point will lag slightly behind the current position, then, but the average will reduce erroneous data points produced by the hardware. The second method throw out data points where the pressure below a certain threshold. It seems that extremely light touches will cause the data to become erratic, although the exact pressure threshold is hardware dependent.

Raw Mode

An application can put this protocol module in a "raw" mode where data points are not filtered, averaged, or converted to screen coordinates. That is, the data from the hardware is passed directly up to the application.

The application can put this protocol module in a "raw" mode by calling: `inp_set_sim_meth(inpdev,RAW_MODE)`. After calibration, the program will need to put the protocol module back in NATIVE mode by calling: `inp_set_sim_meth(inpdev,DEFAULT_SIM_METH)`. There is a sample touch screen Calibration Application in the `TOUCH_CAL` directory.

When the protocol module is taken out of "raw" mode, it will try to read new calibration data points from the ucb1200.dat data module. After the data is read from the module, it is no longer needed.

cdb.touch

The touch screen can be registered with MAUI by loading the `cdb.touch` module in memory before any programs using input are started. This will specify the `spucb1200` as the driver, `cdb.touch` as the descriptor, and `mp_ucb1200` as the protocol module.

Compile Time Options

Table B-13 shows compile time options used to control the default calibration settings and also the screen size. These options can be specified with a value in the `mp_ucb1200` makefile to modify the defaults.

Table B-13 Compile Time Options

Name	Purpose
`SCREEN_WIDTH`	Screen Width in Pixels
`SCREEN_HEIGHT`	Screen Weight in Pixels
`DEFAULT_CALIBRATION_X`	Left Calibration Hardware Point
`DEFAULT_CALIBRATION_Y`	Top Calibration Hardware Point
`DEFAULT_CALIBRATION_WIDTH`	Width of Screen In Hardware Points
`DEFAULT_CALIBRATION_HEIGHT`	Height of Screen In Hardware Points
`JITTER_THRESHOLD`	Minimum Pixel Change Required Before Points are Reported to the Application.
`NUM_PTS`	This allows you to choose how many successive data points to average in order to produce less erroneous screen coordinate data to the application. The default is 2, and valid choices are 1, 2, 4, 8, 16.
`MIN_PRESSURE`	Any pressure point less than this value will be ignored. This is another way to reduce erroneous data. This represents the 8 bit pressure value we get from the driver. The default is 40.

Calibration Application

There is a sample calibration application located in the `$(MWOS)/SRC/MAUI/MP/MP_UCB1200/TOUCH_CAL` directory. This application, called `touch_cal`, will present a text message on the screen as well as points for the user to press. After the points are pressed, the protocol module `mp_ucb1200` will be updated with the new calibration information.

Assumptions/Dependencies

1. A Window Manager must be running before this application will operate.
2. A font module must be present to run the demo. `default.fnt` is the default module, or you can specify one on the command line.
3. `touch_cal` will open the first `CDB_TYPE_REMOTE` device in the cdb.

Command Line Options

`-f[=]<outfile>`	Specifies the file name of the calibration information module. This program will write the calibration information to this file name if it is specified. The file contains the calibration information as a data module, thus allowing the information to be stored on disk, nv RAM, flash, etc. for use the next time the hardware is rebooted.
`-c`	This option only works if `-f` is specified. This will cause the calibration program to run only if the filename specified with `-f` is not present.
`-m=<font module>`	Specifies the font module to use for displaying the text message on the screen.

Coordination with Protocol Module

The protocol module `mp_ucb1200` and the touch screen application `touch_cal` work together to provide the calibration functionality. `touch_cal` must first open the touch screen device, and then must set it into Raw Mode. After the user selects each calibration point, `touch_cal` computes the average of them. These averaged hardware points (as well as the screen resolution) are then stored in a data module called `ucb1200.dat.` When the input device is taken out of Raw Mode, the protocol module will link to `ucb1200.dat` and update itself with the new calibration information.

Compiling

The makefile for touch_cal exists in the `$(PORT)/MAUI/MP_UCB1200/TOUCH_CAL` directory.