Getting Started Guide for MIPS SEAD-3

Timesys

Contents

1 Introduction

This document will describe in detail the procedures for booting a Linux kernel image and mounting a root file system over nfs on the MIPS SEAD-3.

2 Prerequisites

2.1 Host Requirements

To properly boot a board using software from Timesys, your host machine must meet the following requirements:

- Modern GNU/Linux Distribution. Timesys recommends one of the following distributions:

    - Ubuntu 8.04, 8.10, 9.04, 9.10
    - Fedora 9, 10, 11

- An internet connection on the Development Host.

- Root or sudo permission on the Development Host.

- A copy of the Linux Kernel (vmlinux.srec) and Root File System (rootfs.tar.gz) for the Target Board downloaded from Factory. These are found in the output directory of your online build, or in the directory *build_ mipsisa32r2-timesys-linux-<libc>/images/* on the command line.

- If you are booting your root file system over the network, you will need two network cards installed and configured in the Development Host. One to communicate normally with your LAN/WAN while installing host packages, the other to communicate solely with the target board.

- An available serial port on your Development Host.

2.2   Target Requirements

To boot the MIPS SEAD-3, you will need the following items:

- MIPS SEAD-3 Board

- Serial NULL Modem Cable

- Ethernet Crossover Cable **or** Ethernet hub/switch and Ethernet Patch Cables

Once you have all of the necessary components, you should perform the following steps:

1. Connect the debug port of the board to the serial port of your workstation using the null modem cable.

2. If you are using a cross-over cable, connect the Ethernet port of the board to the second Ethernet port of your workstation.

3. If you are using an Ethernet hub or switch, connect the board to the hub with a straight-through Ethernet cable, then connect the hub to the second Ethernet port of your workstation.

4. Connect the power supply to your board.

3   Preparing the Target

3.1   Configuring Serial Communication

The SEAD-3 uses a serial debug port to communicate with the host machine.

3.1.1   Using Minicom

1. Start minicom in configuration mode as root:

   ```
   # minicom -o -s -w
   ```

2. A menu of configuration should appear. Use the Down-arrow key to scroll down and select the Serial port setup option, and press Enter.

3. Verify that the listed serial port is the same one that is connected to the target board. If it is not, press A, and enter the correct device. This is /dev/ttyS0 on most Linux distributions.

4. Set the Bps/Par/Bits option by pressing the letter E and using the next menu to set the appropriate values. You press the key that corresponds to the value **38400**, then press Enter.

5. Set Hardware flow control to **Yes** using the F key.

6. Set Software flow control to **No** using the G key.

7. Press Enter to return to the main configuration menu, and then press Esc to exit this menu.

8. Reset the board, and wait for a moment. If you do not see output from the board, press Enter several times until you see the prompt. If you do not see any output from the board, and have verified that the serial terminal connection is setup correctly, contact your board vendor.

TIP: If you experience an error similar to Device /dev/ttyS0 is locked when starting minicom, it usually means that another process is using the serial port (which is usually another instance of minicom). You can find the process that is currently using the serial port by executing the following:

```
# fuser /dev/ttyS0
/dev/ttyS0:          28358

# ps 28358
  PID TTY      STAT  TIME COMMAND
  28923 pts/0    S+    0:00 minicom
```

This process can also be killed directly with fuser as root. Please use this command with caution:

```
# fuser -k /dev/ttyS0
```

3.1.2   Using GNU Screen

To quickly connect to a board using Gnu Screen, execute the following:

```
# screen /dev/ttyS0 38400
```

For more information about using screen, please consult the man page, or view the manual online at `http://www.gnu.org/software/screen/manual/screen.html`

3.2   YAMON

The MIPS SEAD-3 uses the YAMON PROM monitor. For more information please visit:

- `http://www.mips.com/products/system-software/yamon/`

3.3   Configuring the Network Interface

3.3.1   Finding and Changing the MAC Address

The MAC Address can be found using the **setenv** command in YAMON.
   Example

```
> setenv
baseboardserial (RO)    0000000838
bootfile        (R/W)   vmlinux.srec
bootprot        (R/W)   tftp
bootserport     (R/W)   ttyS0
bootserver      (R/W)   192.168.99.3
cpuconfig       (R/W)
ethaddr         (RO)    00.d0.a0.00.04.3e
fpu             (R/W)
gateway         (R/W)   0.0.0.0
ipaddr          (R/W)   192.168.99.161
memsize         (RO)    0x10000000
modetty0        (R/W)   38400,n,8,1,hw
modetty1        (R/W)   38400,n,8,1,hw
prompt          (R/W)   YAMON
start           (R/W)
startdelay      (R/W)
subnetmask      (R/W)   255.255.255.0
yamonrev        (RO)    02.11
```

   NOTE The MAC address on the SEAD-3 cannot be reset or changed.

3.3.2   Changing the IP Address

The IP address is an environment variable, and can be modified using the
setenv command.

```
YAMON> setenv ipaddr <ip address>
```

   bootserver may need to be specified for TFTP to function.

```
YAMON> setenv bootserver <ip address>
```

4   Preparing the Host

4.1   Setting up the network

Identify the network adapter connecting the Host to the Target

Timesys only supports direct Ethernet connections from the development Host
to the Target board. Ideally, the development Host would have two network

adapters; one adapter to connect to your LAN, and one Ethernet card to connect directly to the Target board with a crossover cable or Ethernet hub. If your development Host only has one network interface it must be directly connected to the Target board.

The Ethernet adapter connected directly to the target board must be:

- Configured with a proper static IP address and Subnet Mask.

- Connected directly to the target board with either a crossover cable or its own Ethernet hub.

From a command prompt issue the command:

```
# /sbin/ifconfig
```

Each interface will report its IP address, Subnet Mask, and Default Gateway information:

```
eth0 Link encap:Ethernet HWaddr 00:19:bb:49:ff:0e
        inet addr:192.168.3.244 Bcast:192.168.3.255 Mask:255.255.254.0
        inet6 addr: fe80::219:bbff:fe49:ff0e/64 Scope:Link
        UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
        RX packets:57214 errors:0 dropped:0 overruns:0 frame:0
        TX packets:47272 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:43109083 (41.1 MB) TX bytes:6308206 (6.0 MB)
        Interrupt:16
eth1 Link encap:Ethernet HWaddr 00:10:b5:4a:c1:a9
        inet addr:10.0.0.1 Bcast:10.0.0.255 Mask:255.0.0.0
        UP BROADCAST MULTICAST MTU:1500 Metric:1
        RX packets:0 errors:0 dropped:0 overruns:0 frame:0
        TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
        Interrupt:21 Base address:0x1100
lo   Link encap:Local Loopback
        inet addr:127.0.0.1 Mask:255.0.0.0
        inet6 addr: ::1/128 Scope:Host
        UP LOOPBACK RUNNING MTU:16436 Metric:1
        RX packets:1974 errors:0 dropped:0 overruns:0 frame:0
        TX packets:1974 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:0
        RX bytes:226637 (221.3 KB) TX bytes:226637 (221.3 KB)
```

Note the IP address and Subnet Mask of the appropriate network connection. You will use this to configure the DHCP server.

Installing the server daemons on the development host

- On Ubuntu:

```
# apt-get install xinetd tftp tftpd dhcp3-server \
                   nfs-common nfs-user-server portmap
```

- On Fedora Core:

```
# yum install xinetd tftp tftp-server dhcp nfs-utils
```

Important:
After installing these packages the DHCP server software may start auto-matically. Having the DHCP server running while you are connected to a LAN can interfere with the operation of other computers. After the DHCP service installs and starts issue these commands to stop the DHCP service and prevent it from starting automatically at boot:

- To stop the dhcp service:

  - On Ubuntu:

    ```
    # /etc/init.d/dhcp3-server stop
    ```

  - On Fedora Core:

    ```
    # /etc/init.d/dhcp stop
    ```

- To prevent the service from starting automatically:

  - On Ubuntu:

    ```
    # chmod 644 /etc/init.d/dhcp3-server
    ```

  - On Fedora Core:
    1. Click the System Menu
    2. Select Administration
    3. Select Services
    4. Select dhcpd
    5. Click the Customize button
    6. Uncheck Runlevel 2, 3, 4 and 5

4.2   Disable SELinux and Firewall on Fedora Core

On Fedora Core, SELinux and the firewall will interfere with many of the services that are needed to work with the target board. These should be disabled before continuing.

Generally Ubuntu does not have these services running by default.

1. Disable SELinux:

    (a) Click the System Menu

    (b) Select Administration

    (c) Select SELinux Management

    (d) Change System Default Enforcing Mode to Disabled

2. Disable Firewall:

    (a) Click the System Menu

    (b) Select Administration

    (c) Select Services

    (d) Select iptables

    (e) Click the Customize button

    (f) uncheck Runlevel 2, 3, 4 and 5

4.3   Setting up DHCP

1. Edit the dhcpd configuration file:

    - On Ubuntu, edit /etc/dhcp3/dhcpd.conf and include the following lines (note: on older versions of Ubuntu this file is at /etc/dhcpd.conf):

    ```
    subnet 10.0.0.0 netmask 255.0.0.0 {
    host tsboard {
    fixed-address 10.0.0.10;
    hardware ethernet 12:34:56:78:9a:bc;
    option root-path "/full/path/to/rfs";
    filename "vmlinux.srec";
    }
    }
    ```

    - On Fedora Core, edit /etc/dhcpd.conf and include the following lines:

    ```
    ddns-update-style ad-hoc;
    subnet 10.0.0.0 netmask 255.0.0.0 {
    host tsboard {
    fixed-address 10.0.0.10;
    hardware ethernet 12:34:56:78:9a:bc;
    ```

```
option root-path "/full/path/to/rfs";
next-server 10.0.0.1;
filename "vmlinux.srec";
}
}
```

2. Test the DHCP server on the network card that is connected to your development board. For this example assume eth1. This command will start the DHCP server in the foreground and output any status or error messages to the screen.

- On Ubuntu:

```
# dhcpd3 -d eth1
```

- On Fedora Core:

```
# /usr/sbin/dhcpd -d eth1
```

- It is recommended to start the DHCP server in this manner each time you need to boot your Target board.

4.4   Setting up TFTP

1. Edit the xinetd.conf file

- **On Ubuntu**, edit /etc/xinetd.conf and add the following lines just above the line that reads "includedir /etc/xinetd.d".

```
service tftp
{
socket_type = dgram
protocol = udp
wait = yes
user = root
server = /usr/sbin/in.tftpd
server_args = -s /tftpboot
disable = no
}
```

- **On Fedora Core**, the tftp-server package creates a /etc/xinetd.d/tftp file. Edit this file and change the "disable" line from yes to no. The contents of the file are:

```
service tftp
{
socket_type  = dgram
protocol  = udp
wait  = yes
```

```
user  = root
server  = /usr/sbin/in.tftpd
server_args  = -s /tftpboot
disable  = no
per_source  = 11
cps  = 100 2
flags  = IPv4
}
```

2. Create the /tftpboot folder if it does not exist:

   ```
   # mkdir /tftpboot
   ```

3. Copy the kernel image to the /tftpboot directory:

   ```
   # cp /path/to/kernel/image/vmlinux.srec \
                       /tftpboot/vmlinux.srec
   ```

   NOTE Also copy other files that are required for booting, such as a device tree blob, to /tftpboot.

4. Restart the xinetd server with the following command:

   ```
   # /etc/init.d/xinetd restart
   ```

5. Test the TFTP server with the following commands

   ```
   # tftp localhost
   tftp> get vmlinux.srec
   Received 1456898 bytes in 0.4 seconds
   tftp> quit
   ```

6. Set xinetd to start automatically on Fedora Core.
   Ubuntu users will skip this step.

   (a) Click the System Menu
   (b) Select Administration
   (c) Select Services
   (d) Select xinetd
   (e) Click the Customize button
   (f) Check Runlevel 2, 3, 4 and 5

4.5   Setting up NFS

1. Extract the "rootfs.tar.gz" to a directory and note the path. This path will be referred to as "/full/path/to/rfs" in this document.

2. Export this path by editing /etc/exports to include a line similar to the following:

   ```
   /full/path/to/rfs 10.0.0.10(rw,no_root_squash)
   ```

3. Restart the NFS services

   - On Ubuntu issue the following commands in order:

     ```
     # /etc/init.d/portmap stop
     # /etc/init.d/nfs-common stop
     # /etc/init.d/nfs-user-server stop
     # /etc/init.d/portmap start
     # /etc/init.d/nfs-common start
     # /etc/init.d/nfs-user-server start
     ```

   - On Fedora Core:

     ```
     # /etc/init.d/nfs restart
     ```

4. Set nfsd to start automatically on Fedora Core. Ubuntu users will skip this step.

   (a) Click the System Menu
   (b) Select Administration
   (c) Select Services
   (d) Select nfs
   (e) Click the Customize button
   (f) Check Runlevel 2, 3, 4 and 5

5   Booting the Board

5.1   Load The Kernel

The **load** command is used to download the kernel. If the environment is set up completely, then you can simply type the **load** command. Otherwise, it takes the following format:

```
YAMON> load tftp://<host ip>/<file name>
```

Example

```
YAMON> load
About to load tftp://192.168.99.3/vmlinux.srec
Press Ctrl-C to break
......................................
......................................
......................................
......................................
......................................
......................................
......................................
......................................
......................................
......................................
..................................
Start = 0x80443000, range = (0x80100000,0x80467297), format = SREC
```

5.2   Boot the Kernel

The **go** command is used to boot the kernel. It typically takes the following format:

```
YAMON> go . <kernel command line>
```

Example

```
YAMON> go . console=ttyS0,38400 root=/dev/nfs rw ip=dhcp
```

6   Additional Information

6.1   Changing Board Endianness

The SEAD-3 endianness is soft and can be changed in YAMON to match the endianness of your kernel and root file system. To change the endianness of the board:

1. Run "set softendian big" (or little) at the YAMON prompt

2. Power cycle the board

When YAMON starts and prints the environment you should now see your desired endianness.

6.2   Changing Boot Serial Port

The YAMON environment variable bootserport determines which device the serial console output of the board is directed to. tty1 is the RS232 port and tty0 is the USB Serial port. To change this value:

1. Run "set bootserport tty1" (or tty0) at the YAMON prompt

6.3   Factory Documentation

- https://linuxlink.timesys.com/factory/getting_started

- https://linuxlink.timesys.com/docs/wiki/factory/FactoryBestPractices

- https://linuxlink.timesys.com/docs/wiki/nirvana-workflow/Workflow

- https://linuxlink.timesys.com/docs/wiki/factory/FactoryTroubleshooting

- https://linuxlink.timesys.com/docs/wiki/factory/FactoryOutput

- https://linuxlink.timesys.com/docs/wiki/factory/FactoryArchitecture