TMS320DM6467 DVEVM v2.0 Getting Started Guide

Literature Number: SPRUF88D
December 2008

Texas Instruments

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Preface

About This Guide

The DVEVM (Digital Video Evaluation Module) kit is an evaluation platform that showcases the DM646x architecture and lets users evaluate the power and performance of the DM646x as a multimedia engine.

This guide gives you overview information about the board and the software provided with the board. It is intended to be used as an introductory document for the DVEVM. Other documents provide more in-depth information. See the DVEVM release notes for a complete list of documents that have been included with the product.

Additional Documents and Resources

You can use the following sources to supplement this user’s guide:

❏ Spectrum Digital website:
http://support.spectrumdigital.com/boards/evmdm6467

❏ TI Linux Community for DaVinci Processors:
http://linux.davincidsp.com

❏ TI DaVinci Software Updates: http://www.ti.com/dvevmupdates

❏ TI DaVinci Technology Developers Wiki: http://wiki.davincidsp.com

❏ *Codec Engine Application Developer's Guide* (SPRUE67)

❏ Other PDF documents included with the DVEVM kit

❏ Section 4.11 lists documentation in the DVSDK software installation.

❏ SoC Analyzer Help menu

Notational Conventions

This document uses the following conventions:

- Program listings, program examples, and interactive displays are shown in a `mono-spaced font`. Examples use **`bold`** for emphasis, and interactive displays use **`bold`** to distinguish commands that you enter from items that the system displays (such as prompts, command output, error messages, etc.).
- Square brackets ([and]) identify an optional parameter. If you use an optional parameter, you specify the information within the brackets. Unless the square brackets are in a **bold** typeface, do not enter the brackets themselves.

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December 18, 2008

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Chapter 1

DVEVM Overview

This chapter introduces the DVEVM (Digital Video Evaluation Module) kit.

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1.1 Welcome!

Your new DVEVM (Digital Video Evaluation Module) kit will allow you to evaluate TI's new DaVinci^{TM} Technology and the DM646x architecture.

This technology brings together system-solution components tailored for efficient and compelling digital video and audio.

1.2 What's in this Kit?

Your DVEVM kit contains the following hardware items. Section 2.1, *Setting Up the Hardware* tells how to connect these components.

- **EVM Board**. This board contains a DaVinci TMS320DM6467 dual-core device with an ARM9 and C64+ DSP for development of applications that use both a general-purpose processor and an accelerated DSP processor.
- **Hard Disk Drive**. The hard drive provided with the EVM is a 2.5" Spinpoint drive with 40 GB of storage. The drive speed in 5400 RPM and it has an 8MB cache. The drive is an Ultra ATA 66/100/133 IDE. Software has been preloaded on this EVM board's hard disk drive.
- **IR Remote Control**. This universal remote control is included to provide a user interface to the demo applications.
- **Cables.** Cables used to connect the EVM board to peripheral devices and to a host Linux workstation used for development are provided in the kit.

The DVEVM kit also comes with the following software. Information about how to use the software components is provided in Chapter 4.

- DaVinci Digital Video Evaluation Kit.
- TI DaVinci Demonstration Version of MontaVista Linux Pro v5.0 Target
- TI DaVinci Demonstration Version of MontaVista Linux Pro v5.0 Tools
- A/V Media Clips
- Spectrum Digital EVM Tools
- SoC Analyzer

1.3 What's on the Board?

The EVM comes loaded with peripherals your multimedia applications may need to make use of. The hard drive on the board also comes preloaded with demonstration software. The following block diagram shows the major hardware components.

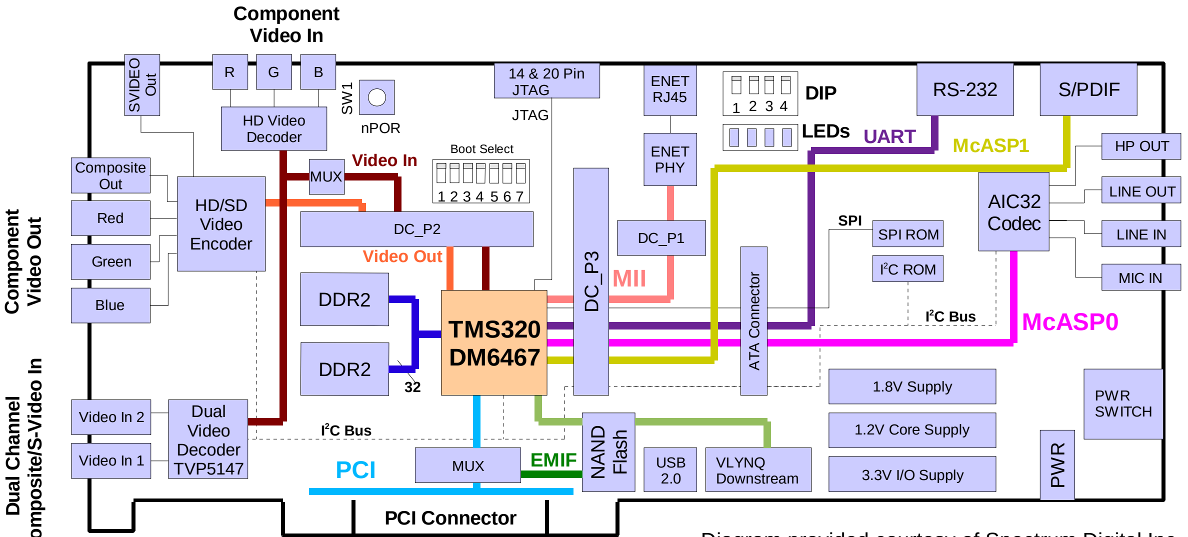

Diagram provided courtesy of Spectrum Digital Inc.

Figure 1–1 EVM Hardware Block Diagram

For more information about the EVM hardware, see the DaVinci EVM website at http://support.spectrumdigital.com/boards/evmdm6467.

1.4 What’s Next?

To get started evaluating the DVEVM kit and developing applications for the DM646x, begin by using this Getting Started guide. It will step you through connecting the hardware, testing the software, and beginning to develop applications.

When you are ready for more information about DaVinci Technology and the DM646x architecture, see the following:

❏ Spectrum Digital website: http://support.spectrumdigital.com/boards/evmdm6467

❏ TI Linux Community for DaVinci Processors: http://linux.davincidsp.com

❏ TI DaVinci Software Updates: http://www.ti.com/dvevmupdates

❏ TI DaVinci Technology Developers Wiki: http://wiki.davincidsp.com

❏ *Codec Engine Application Developer's Guide* (SPRUE67)

❏ Other PDF documents included with the DVEVM kit

❏ Section 4.11 lists documentation in the DVSDK software installation.

❏ SoC Analyzer Help menu

Chapter 2

EVM Hardware Setup

This chapter tells you how to set up the EVM hardware.

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2.1 Setting Up the Hardware

To set up the hardware provided with the EVM, use the steps in the sections that follow. You may skip sections if you do not need to access a particular peripheral. For example, if you do not need to use the serial cable, skip that section.

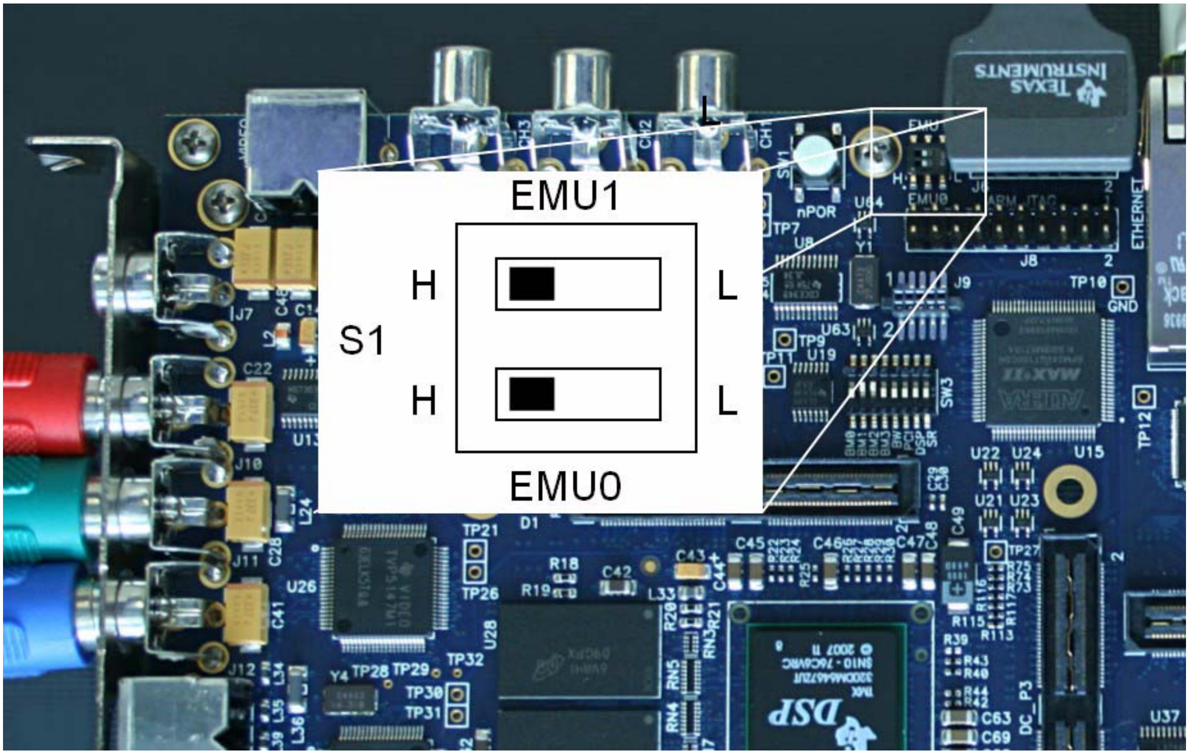
1) The EVM is sensitive to static discharges. Use a grounding strap or other device to prevent damaging the board.

   Be sure to connect communication cables before applying power to any equipment.

ATTENTION

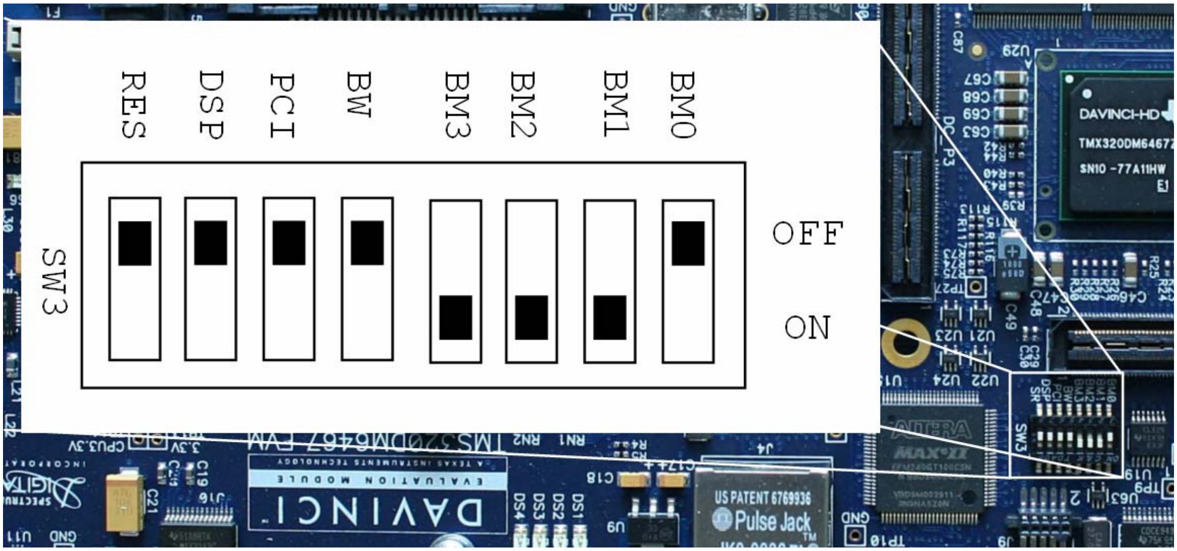
OBSERVE PRECAUTIONS FOR HANDLING
ELECTROSTATIC
SENSITIVE DEVICES

2) Verify that the EVM board's EMU0/1 select switch (S1) is set correctly. The settings shown here enable both ARM and DSP JTAG for emulation debugging.

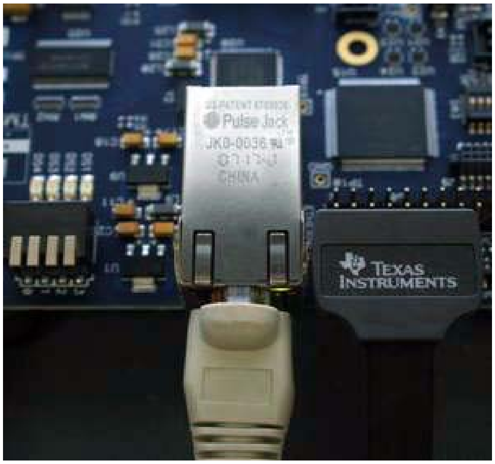


3) Verify that the EVM board's SW3 boot/muxing configuration switch is correctly set. The BM1, BM2, and BM3 switches should be set to On. These switch settings, which are shown in the following figure, enable the following:

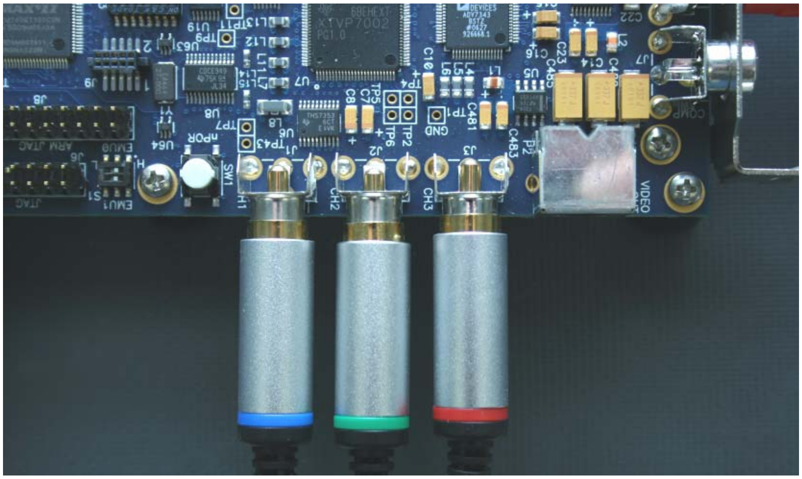
- SPI boot mode
- EMIF A is 8-bit data bus for CS2
- PCI pin multiplexing enabled on DM6467
- DSP is booted via ARM processor



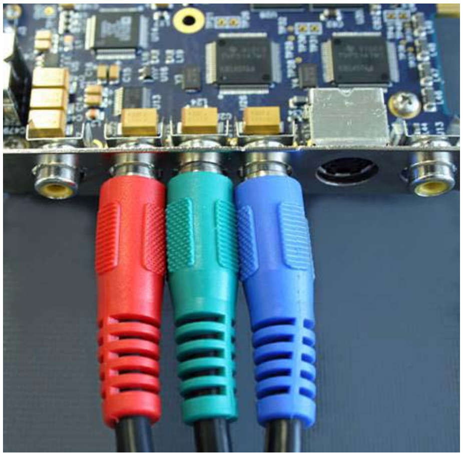
4) Connect the Ethernet cable to the Ethernet port on the EVM board and to an Ethernet network port. Note that the U-Boot bootargs must include "ip=dhcp" to enable the network connection.



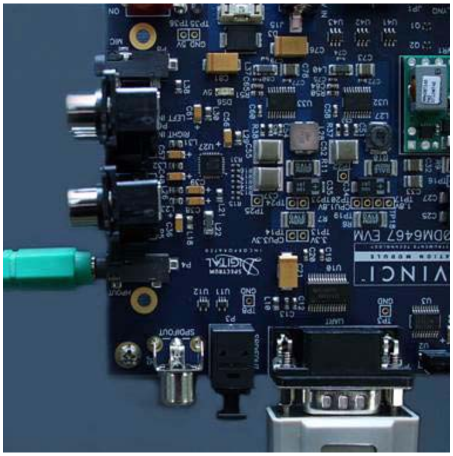
5) Connect a video source (for example, a camera or DVD player) to the component input video connectors (J1, J2, J3). **Note:** To run the demos described in Chapter 3, you will need to have an HD (720p) video source connected to the EVM board's component input connectors.



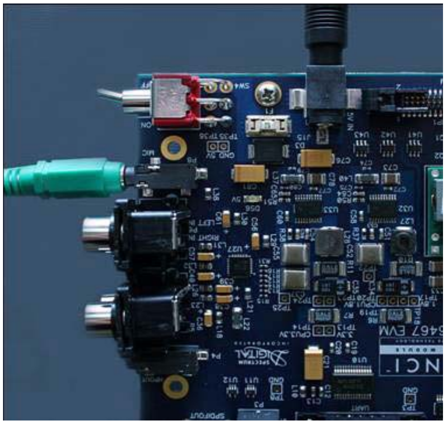
6) Connect your video display to the EVM board’s component output video connectors (J10, J11 and J12) using the component cables included with the DVEVM kit. **Note:** To run the demos described in Chapter 3, you will need to have an HD display connected to the EVM board's component output connectors.



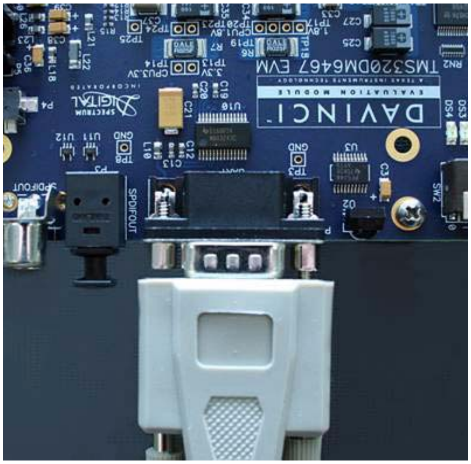
7) Connect an audio speaker to the headphone connector (P4).



8) Connect an audio source to the microphone connector (P8).

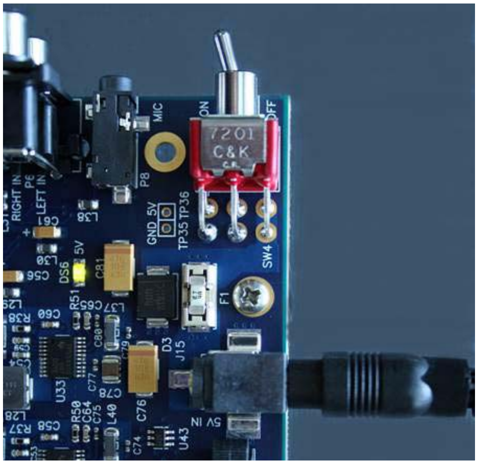


9) If you plan to use the UART port for a console window, connect the RS-232 null modem cable to the EVM UART port (P1) and to the COM port of your host workstation.



10) Power on your video input and output devices.

11) Connect the power cable to the EVM power jack on the board. To be ESD safe, plug in the other end of the power cable only after you have connected the power cord to the board. Then turn on the board.



12) The initial screen of the demo software should be displayed on your video output device. Use the IR remote to run the software as described in Chapter 3.

2.2 Connecting to a Console Window

You can open a console window that allows you to watch and interrupt EVM boot messages by following these steps:

1) Connect a serial cable between the serial port on the EVM and the serial port (for example, COM1) on a PC.
2) Run a terminal session (such as Minicom on Linux or HyperTerminal on Windows) on the workstation and configure it to connect to that serial port with the following characteristics:
   - Bits per Second: 115200
   - Data Bits: 8
   - Parity: None
   - Stop Bits: 1
   - Flow Control: None
3) When you power on the EVM, you will see boot sequence messages. You can press a key to interrupt the boot sequence and type commands in the U-Boot command shell. In this guide, commands to be typed in the U-Boot shell are indicated by an `EVM #` prompt.

Chapter 3

Running the Demonstration Software

This chapter explains how to run the software demos provided with the DVEVM kit.

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3.1 Default Boot Configuration

Out of the box, the EVM boots from flash and starts the demos automatically after a few seconds when you power up the board. It does not require an NFS mount or a TFTP server to run the standard demos.

Note: The default U-Boot bootargs definition sets "ip=off", which disables the Ethernet connection.

The out-of-the-box boot parameters are listed in Section A.3.1. The following are alternate ways you may want to boot the board:

❑ TFTP boot with hard drive file system (Section A.3.2)

❑ Flash boot with NFS file system (Section A.3.3)

❑ TFTP boot with NFS file system (Section A.3.4)

To abort the standard boot, press any key in the console window (see Section 2.2). Also see Section A.3, *Alternate Boot Methods* if you want to change the boot configuration.

3.2 Starting the Standalone Demos

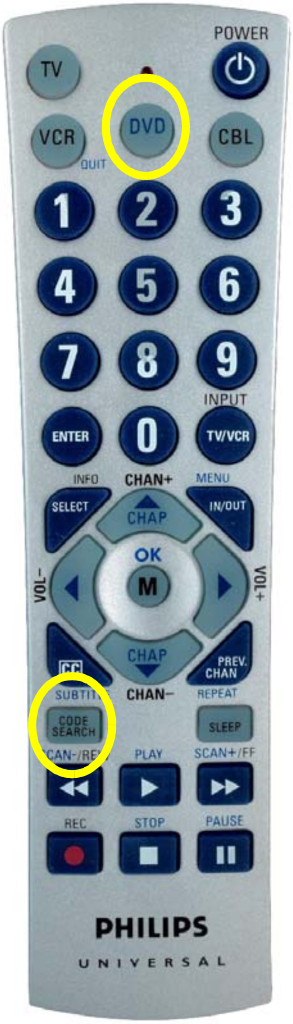
When you connect the EVM hardware, the pre-loaded examples run automatically on the display connected to the EVM board's component output connectors, using a 720p (HD) video source connected to the component input connectors. These examples encode and decode audio, video, and speech. There are two ways to use the demos:

❑ **Standalone.** This is the default power-on mode. The demos run automatically with no connection to a workstation in the default boot configuration. This is the mode documented in the rest of this chapter.

The standalone demo was set up by the DVSDK, which copies the file /examples/dvevmdemo to the directory /etc/rc.d/init.d (the central repository for startup scripts). This file is symbolically linked to /etc/rc.d/rc3id/S88demo. When the board boots up and enters runlevel 3, this file is executed to start the demo web server and the demo interface.

❑ **Command line.** Once you have connected the EVM to a workstation and installed the necessary software (as described in Section 4.3.1, *Installing the Target Linux Software*), you can run the demos from the board’s Linux command line. For further information on running the demos from the command line, see the demo documentation that is linked to by the DVSDK release notes.

Note: When you run the demos from the command line, make sure the *interface* process used by the standalone mode demos is not running. Otherwise you will see error messages raised when device drivers fail to open.



Once the EVM board has booted, the display should show a picture of the remote control. You use the IR remote to control the demos.

The order of the buttons on the actual remote may be different from the picture; if your remote looks different, find the buttons with the same labels on your remote.

To use the demos in standalone mode, follow these steps:

1) Check to make sure the batteries are installed in your IR remote.

2) Make sure an HD (720p) video source is connected to the EVM board's component input connectors. Also make sure an HD display is connected to the EVM board's component output connectors.

Note: The demos do not currently support composite video output.

3) The initial screen shows a diagram of the IR remote, which you use to run the standalone demos. Take a minute to look at the functions of the various buttons.

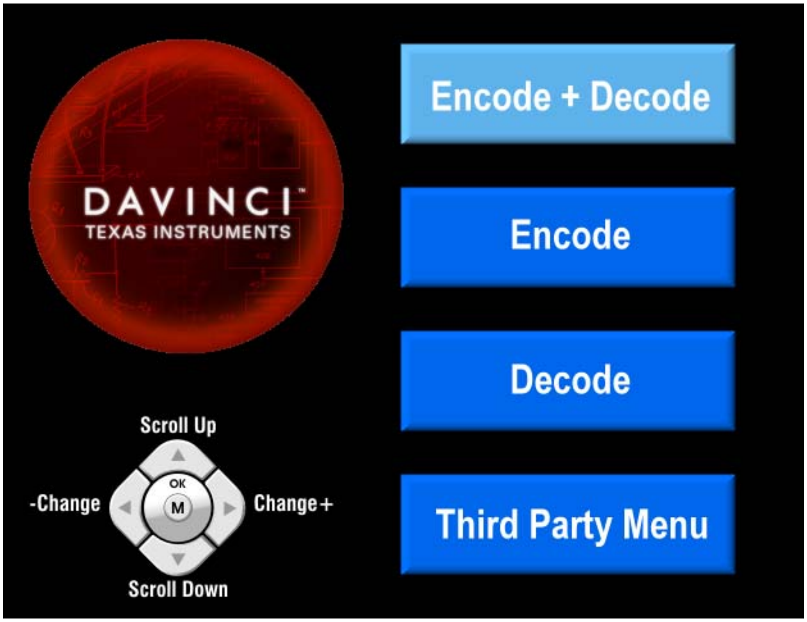
4) Since this is a universal remote, you may need to set it to use the codes necessary to run the DVEVM demos. To do this, hold down the "Code Search" button until the red light on the remote stays lit. Then press the "DVD" button and enter "0020" as the code.

5) If you accidentally put the remote in TV or some other mode, press "DVD" to return the remote to the correct mode.

6) If the remote does not accept the DVD+0020 code, do a full reset by removing the batteries, pressing the Power button for at least a minute, then reinserting the batteries. Then program the remote as in Step 3.

3.3 Running the Standalone Demos

1) Press "Play" or "OK" on the remote to move from the remote control diagram to the main menu screen, which looks like this:

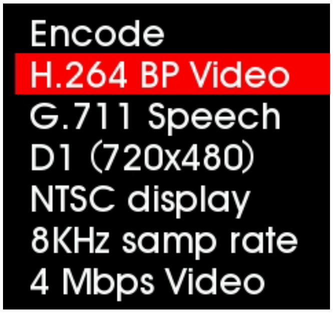


The Encode + Decode demo allows you to record and playback video. The Encode demo records audio/speech and video in the formats you select. The Decode demo plays audio/speech and video files you select. The Third-Party Menu can be used to add additional demos (see Section A.1, *Putting Demo Applications in the Third-Party Menu*).

2) Use the up and down arrows to change which demo is selected. Then, press "OK" or "Play" to move to the selected demo.

3) Within a demo, you start at the settings screen, where you see the controls you can use to run the demo at the bottom of the screen and the current settings in the upper-right.

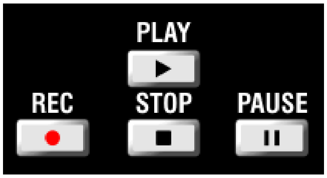
For example, the Encode demo allows you to set the video format and the bit rate at which video should be encoded. Fixed settings are also shown here.



Encode
H.264 BP Video
G.711 Speech
D1 (720x480)
NTSC display
8KHz samp rate
4 Mbps Video

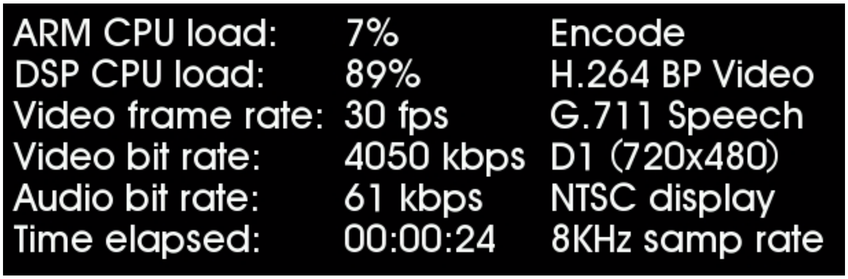
4) Use the up and down arrows to move to a setting you want to change.

5) Use the left and right arrows to cycle through the options until the setting you want is shown.

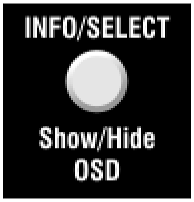


6) Press "Play" to begin the Encode+Decode and Decode demos. Press "Rec" (record) twice to begin the Encode demo.

7) While the demo runs, data about the settings, processor load, and rates are shown. Static settings are on the right. Dynamic data reporting is on the left. For example:



```
ARM CPU load:       7%          Encode
DSP CPU load:       89%         H.264 BP Video
Video frame rate:   30 fps      G.711 Speech
Video bit rate:     4050 kbps   D1 (720x480)
Audio bit rate:     61 kbps     NTSC display
Time elapsed:       00:00:24    8KHz samp rate
```



8) This information overlays the video; as a result the video you see is darker than the actual video. To hide the information display so that you can better see the video, press the "Info/Select" button on the IR remote. You can change the transparency of the OSD (overlay) while running a demo by using the left and right arrows on the remote.

9) Press "Stop" or "Pause" when you want to end or pause a demo. The first time you press "Stop", you return to the settings screen. Press "Stop" from the settings screen to go back to the main menu.

For information about running the individual demos, see Section 3.3.2 through Section 3.3.4.

The demos use the Codec Engine to allow applications to run algorithms.

You may notice that the DSP CPU load is initially high, even if the DSP is not running algorithms. The CPU load starts at 100% while the DSP is booting and then decreases while the DSP waits for work to be requested by the GPP. Even if DSP is idle, it may take a short amount of time (several seconds) for the CPU load to settle to zero. This is because the Codec Engine’s CPU load calculation includes a small amount of history.

3.3.1 Shutting Down the Demos

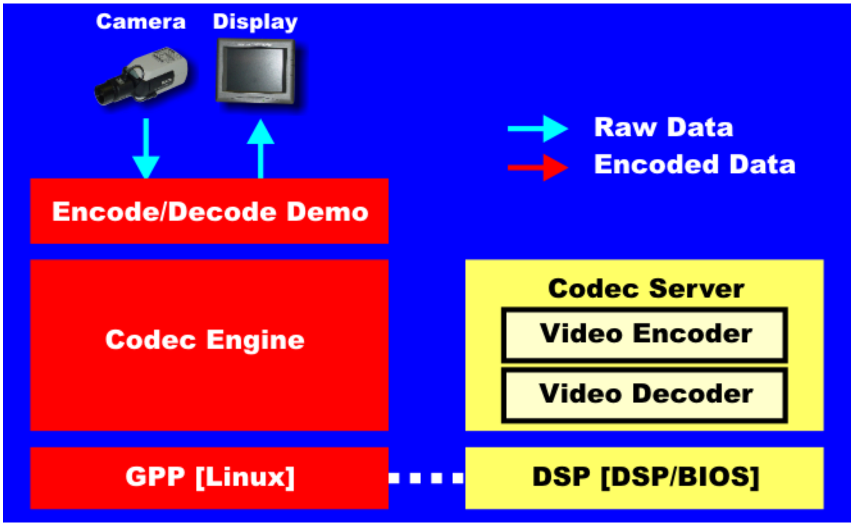
You can quit out of the demos completely while at the main menu screen by pressing "Power" on the remote.

To restart the demos, you can reboot the board or run the demos from the command line as described in Section 3.4.

3.3.2 About the Encode + Decode Demo

The Encode + Decode demo allows you to record and playback video. from an HD video source connected to the EVM board's component input connectors, is encoded, then decoded, and then sent to a display connected to the EVM board's component video output connectors.

Note: The Encode + Decode demo inputs HD video and outputs standard video—not HD (720p) video. Since HD displays accept standard video input, you should not need to modify your hardware setup to run this demo.



The Encode + Decode does only video processing; it does not encode and decode audio or speech. The supported video algorithm is H.264 Baseline Profile (.264 file extension).

Table 3–1 IR Remote Buttons for Encode + Decode Demo

IR Remote Button	Mode	Action Performed
Up/Down	--	-- no action --
Play or OK	Setup	Begin demo
Record	--	-- no action --
Info/Select	Run	Toggle information display
Left/Right	Run	Change information transparency level
Pause	Run	Pause demo (press Play to resume)
Stop	Setup / Run	Return to previous screen

The application runs on the ARM using Linux. The video signal is passed to video encoders and decoders on the DSP by the Codec Engine. Shared memory is used when passing data.

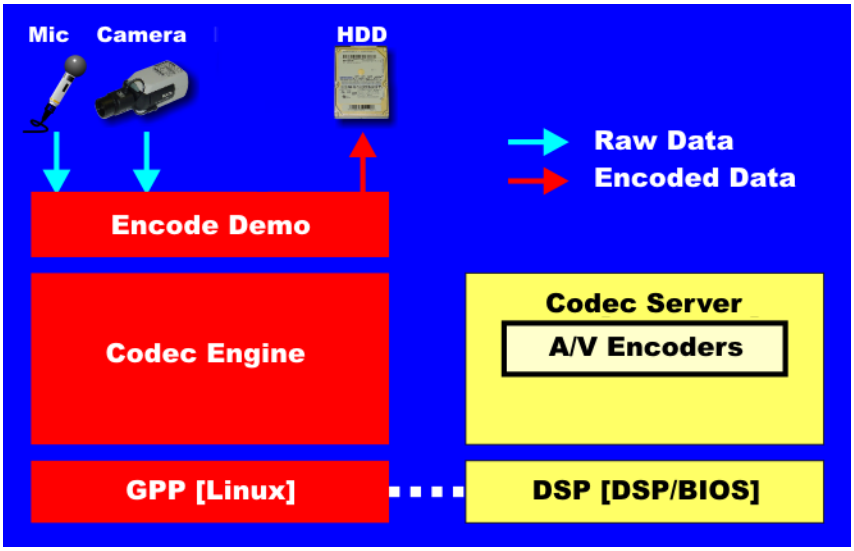
To use this demo from the command line, see Section 3.4, *Running the Demos from the Command Line*.

3.3.3 About the Encode Demo

Like the Encode + Decode demo, the Encode demo also encodes 720p video. In addition, it also encodes audio or speech. The audio/speech source is the microphone.

The encoded data is written to files on the EVM's hard disk drive. The possible filenames are demo_g711.264, demo_aac.264, demo.aac, and demo.g711. Older versions of these files are overwritten as needed.

Output is not decoded and sent to the display or speakers other than to show the settings and dynamic data collected about the load and rates.



The supported video algorithm is H.264 (.264 file extension). The supported speech algorithm is G.711 (.g711 extension). The supported audio algorithm is AAC (.aac extension).

Table 3–2 IR Remote Buttons for Encode Demo

IR Remote Button	Mode	Action Performed
Up/Down	Setup	Change option selection
Left/Right	Setup	Change setting of selected option
Play	Setup	Switch to decode demo setup
Record (twice) or OK	Setup / Run	Begin encode demo, send unencoded data to display
Info/Select	Run	Toggle information display
Left/Right	Run	Change information transparency level (There is no display for encode demo behind the information.)
Pause	Run	Pause demo (press Record to resume)
Stop	Setup / Run	Return to previous screen

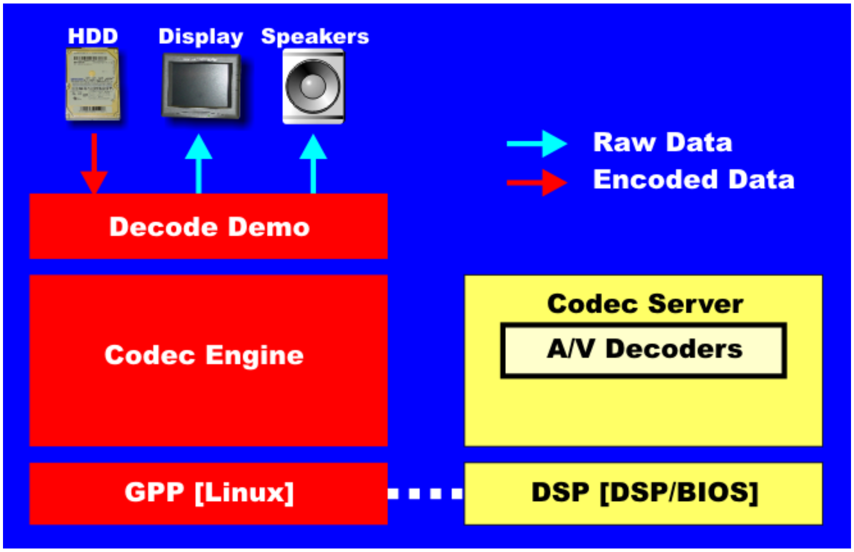
In setup mode, use the arrow buttons on the remote to adjust the settings for the video bit rate and audio format. The video codec selection and the audio bit rate are not modifiable.

The application runs on the ARM using Linux. The video and audio signals are passed to encoders on the DSP by the Codec Engine. Shared memory is used when passing data.

To use this demo from the command line, see Section 3.4, *Running the Demos from the Command Line*.

3.3.4 About the Decode Demo

The Decode demo plays audio/speech and video files you select. You can select a source video file and a source audio or speech file. Use the left and right arrow buttons to choose from the demo files and the files created by the Encode demo, which are stored on the EVM’s hard disk drive. The decoded signals are sent to an HD display connected to the EVM board's component video output connectors.



The supported video algorithms are H.264 (.264 file extension) and MPEG2 (.m2v file extension).

The supported audio algorithm is AAC (.aac file extension). The supported speech algorithm is G.711 (.g711 file extension).

Table 3–3 IR Remote Buttons for Decode Demo

IR Remote Button	Mode	Action Performed
Up/Down	--	-- no action --
Left/Right	Setup	Select a different file combination
Play or OK	Setup	Begin decode demo
Record	--	-- no action --
Info/Select	Run	Toggle information display

Table 3–3 IR Remote Buttons for Decode Demo

IR Remote Button	Mode	Action Performed
Left/Right	Run	Change information transparency level
Pause	Run	Pause demo (press Play to resume)
Stop	Setup / Run	Return to previous screen

The application runs on the ARM using Linux. The video and audio signals are passed to decoders on the DSP by the Codec Engine. Shared memory is used when passing data.

To use this demo from the command line, see Section 3.4, *Running the Demos from the Command Line*.

3.3.5 About the Third Party Menu

The Third-Party Menu can be used to add additional demos. See Section A.1, *Putting Demo Applications in the Third-Party Menu*.

3.4 Running the Demos from the Command Line

You can run the demo applications from the Linux shell in a terminal window connected to the EVM board's serial port. These are the same demos described in Section 3.2, *Starting the Standalone Demos*.

1) See Section 2.2, *Connecting to a Console Window* for instructions regarding communicating with Linux running on the EVM.

2) Login to the target as root. No password is required.

3) Move to the appropriate directory on the target using the following command. (See Section 4.1.1 for the meanings of command prompts shown in this document.)

```
Target $ cd /opt/dvsdk/dm6467
```

4) Before running demo applications from the command line, the CMEM and accelerator kernel modules must be loaded.

   - Use "lsmod" to see if they are loaded. You should see output similar to the following:

     ```
     Target $ lsmod
       Module            Size      Used by
       dsplinkk          98220        0
       cmemk             20072        0
     ```

   - If they are not loaded, use the following commands to load these modules.

     ```
     Target $ ./loadmodules.sh
     ```

5) If a standalone demo is running, kill that process. You can do this by pressing the Power button on the remote from the main menu. Or, use the following commands:

   ```
   Target $ killall -9 interface
   ```

6) To see the command-line options for the demos, use one of the following commands with the -h or --help option:

   ```
   Target $ ./encodedecode -h

   Target $ ./encode -h

   Target $ ./decode -h
   ```

7) To stop a demo, press Ctrl+C at the command line or press the Stop button on the remote.

You can also find the list of command-line options in encode.txt, decode.txt, and encodedecode.txt in the respective demo directories of the DVSDK package on the host.

> **Note:** When you run loadmodules.sh, you may see warnings about the kernel being tainted by cmemk and dsplinkk. You can ignore these warnings. They occur because DSP/BIOS Link does not use the kernel build system and is not under the same license as the kernel itself.

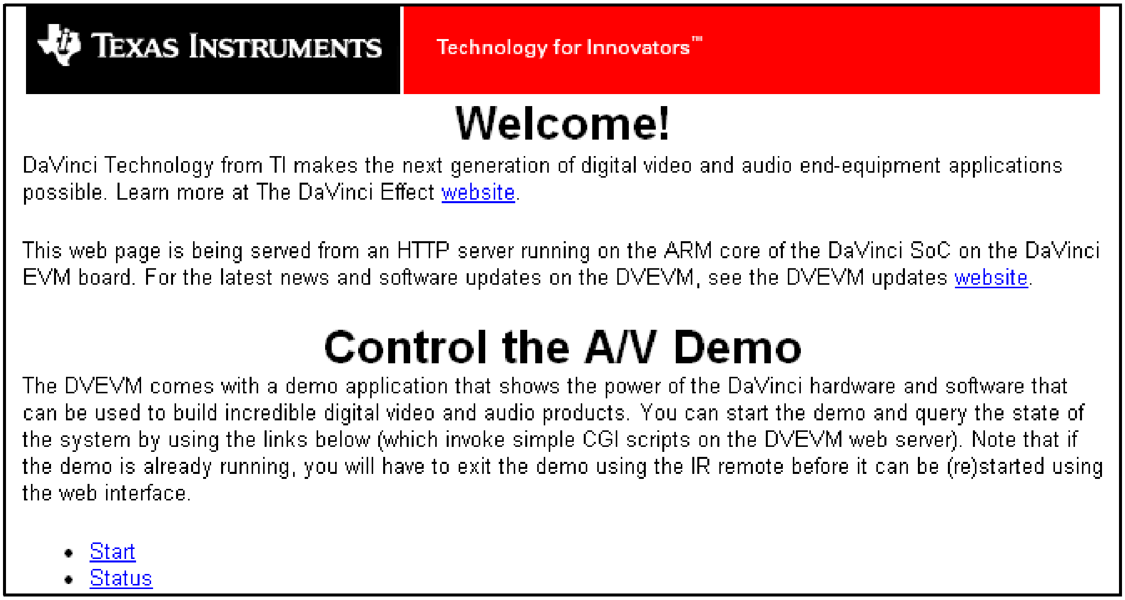
3.5 Running the Network Demo

As an example of standard TCP/IP networking support, the DVEVM examples include a small HTTP web server. This web server is started on the GPP-side as part of the Linux startup sequence. It configured to service requests from web browsers on the standard TCP/IP port 80.

See Step 4 of Section 2.1 for the hardware setup required for networking.

After the EVM board has booted, connect a PC to the same network to which the EVM board is connected. Enter a URL of the form "http://ip-address-of-evm" in a web browser (for example, Internet Explorer, Firefox, or Opera). The IP address of the board is shown in the lower-right corner of the main menu of the A/V demos.

You should see a web page with information about DaVinci technology and the DVEVM software.



Welcome!

DaVinci Technology from TI makes the next generation of digital video and audio end-equipment applications possible. Learn more at The DaVinci Effect website.

This web page is being served from an HTTP server running on the ARM core of the DaVinci SoC on the DaVinci EVM board. For the latest news and software updates on the DVEVM, see the DVEVM updates website.

Control the A/V Demo

The DVEVM comes with a demo application that shows the power of the DaVinci hardware and software that can be used to build incredible digital video and audio products. You can start the demo and query the state of the system by using the links below (which invoke simple CGI scripts on the DVEVM web server). Note that if the demo is already running, you will have to exit the demo using the IR remote before it can be (re)started using the web interface.

- Start
- Status

Use this web page to interact with the board and run the A/V demos described in Section 3.3, *Running the Standalone Demos*. Two simple CGI scripts on the EVM enable you to start the demos (assuming they are not already running) and see what processes are running on the board. If you want to see the demo started from the web page, be sure to exit the demo first (use the Power button from the main menu).

The web server software is an open-source package called THTTPD (http://www.acme.com/software/thttpd/). It is designed to be small, fast, and portable. The source code is included with the DVEVM software. You can get the latest version directly from the web. The web server and CGI scripts are installed on the target in the /opt/dvsdk/dm6467/web directory.

Chapter 4

DVEVM Software Setup

This chapter explains how to use the software provided with the DVEVM kit.

4.1 Software Overview

To begin developing applications, you need to install the DVEVM development environment. This chapter outlines the steps required to load the DVEVM software onto the development host. You will need the distribution disks or the files they contain to get started.

The DaVinci software approach provides interoperable, optimized, production-ready video and audio codecs that leverage DSP and integrated accelerators. These codecs are built into configurable frameworks, and are presented via published APIs within popular operating systems (such as Linux) for rapid software implementation.

The following software is provided with the DVEVM.

- **Standalone demonstration software.** This is provided on the hard drive on the EVM. The hard-wired examples encode and decode audio, video, and speech. Another demo shows the board’s network capabilities. See Section 3.2 and Section 3.5.
- **Disk 1: MontaVista Linux Pro v5.0 System Tools and Target File System.** The version provided with the DVEVM kit is the demonstration version. It contains the following file:
  - mvl_5_0_demo_sys_setuplinux.bin. This installation file contains the MontaVista Tool development tool chain and the target file system.
- **Disk 2: TI DVSDK Software.** This DVD includes demo applications, Codec Engine software, example codec servers, and DVEVM documentation. It contains the following files:
  - this manual in PDF format
  - dvsdk_setuplinux_#_#_#_#.bin (DVSDK installer)
  - mvl_5_0_0_demo_lsp_setuplinux_#_#_#_#.bin
  - xdctools_setuplinux_#_#_#.bin (XDCtools installer)
  - bios_setuplinux_#_#_#.bin (DSP/BIOS installer)
  - TI-C6x-CGT-v#.#.#.#.bin (TI Code Generation Tools installer)
  - SoCAnalyzer_#.#.#.#.exe. SoC Analyzer installer.
  - data.tar.gz (Contains A/V data files for use by the demos)
  - restore/overlay.tar.gz (Contains demo files in case they are needed for recovery. You can generally ignore this file.)
- **Disk 3: SDI Board Support Software.** This disk contains ARM-based test code, CCStudio GEL files, and other EVM support software.

Texas Instruments, in agreement with MontaVista Software Inc., is providing a demonstration version of the Linux Professional Edition v5.0 embedded operating system and development tools. The base DVEVM kit includes this demonstration version. The demo version is a subset of what MontaVista provides with the full Professional Edition. Tools such as DevRocket^{TM} and the Professional Edition documentation are not included, but it is otherwise fully functional and useful for customers evaluating the DaVinci platform. Also, please note that this release does not include a MontaVista user license, and no direct customer support, warranty, or indemnification from MontaVista Software Inc. is provided.

You may choose to order the DaVinci Software Production Bundle (DVSPB), which includes the production release of this demonstration version of MontaVista Linux. This includes a full MontaVista license and the DevRocket IDE.

4.1.1 Command Prompts in This Guide

In this guide, commands are preceded by prompts that indicate the environment where the command is to be typed. For example:

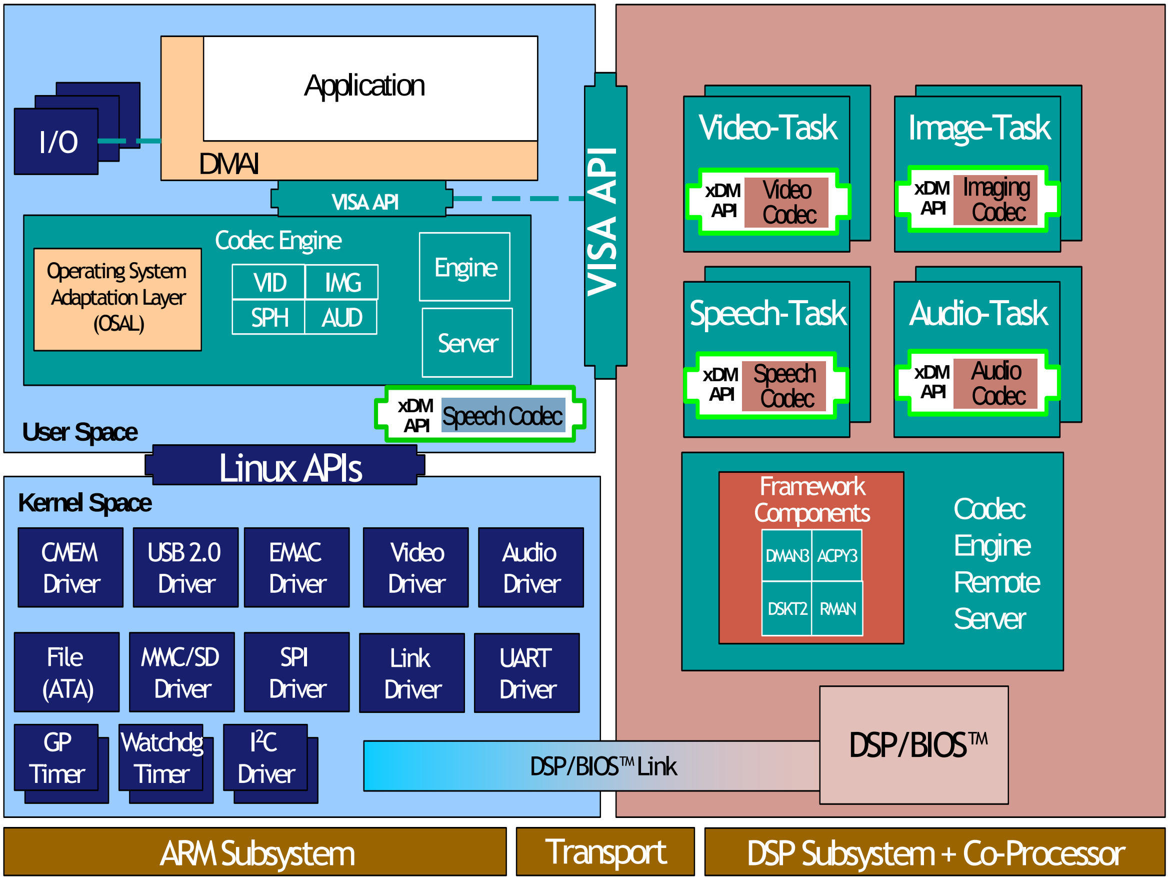
❑ **`host $`**
Indicates command to be typed into the shell window of the host Linux workstation.

❑ **`EVM #`**
Indicates commands to be typed into the U-Boot shell in a console window connected to the EVM board's serial port. (Section 2.2)

❑ **`target $`**
Indicates commands to be typed into the Linux shell in the terminal window connected to the EVM board's serial port.

4.1.2 Software Components

The following figure shows the software components used for application development with the DVEVM kit:



In the previous figure, your application runs on the ARM subsystem. It handles I/O and application processing. To process video, image, speech, and audio signals it uses the VISA APIs provided by the Codec Engine. The Codec Engine, in turn, uses services such as DSP/BIOS Link and protocols such as xDAIS and xDM to communicate with a pre-configured Codec Engine Remote Server on the DSP subsystem. The DSP handles signal processing and the results are available to the ARM subsystem in shared memory. For more information, see the *Codec Engine Application Developer's Guide* (SPRUE67).

In addition, Linux running on the ARM makes a large number of APIs available to your application, including drivers and timers.

4.2 Preparing to Install

On a host system, mount the DVEVM demonstration DVD and copy the following files to a temporary location with at least 2.3 GB available space. Since you can delete the installation files after installing the software, a directory like /tmp is recommended.

❏ mvl_5_0_demo_sys_setuplinux.bin (disk 1)

❏ mvl_5_0_0_demo_lsp_setuplinux_#_#_#_#.bin (disk 2)

❏ dvsdk_setuplinux_#_#_#_#.bin (disk 2)

❏ xdctools_setuplinux_#_#_#.bin (disk 2)

❏ bios_setuplinux_#_#_#_#.bin (disk 2)

❏ TI-C6x-CGT-v#.#.#.#.bin (disk 2)

Updates to these installers may be available on the TI DaVinci Software Updates website listed in Section 1.4.

Ensure that an X graphical display is available, and point your DISPLAY environment variable to this value. For example:

csh:

```
host $ setenv DISPLAY cnabc0314159d1:0
```

ksh or bash:

```
host $ export DISPLAY=cnabc0314159d1:0
```

4.3 Installing the Software

Installing the software used by the DVEVM involves performing the following steps:

❏ Section 4.3.1, *Installing the Target Linux Software*

❏ Section 4.3.2, *Installing the DVSDK Software*

❏ Section 4.3.3, *Installing the A/V Demo Files*

❏ Section 4.3.4, *Installing the SoC Analyzer*

❏ Section 4.3.5, *Exporting a Shared File System for Target Access*

❏ Section 4.3.6, *Testing the Shared File System*

4.3.1 Installing the Target Linux Software

This section explains how to install Linux for use on the target board. This is a demonstration version of MontaVista Linux Pro v5.0.

Note that separate versions of Linux are used by the target and your host Linux workstation. The following Linux host operating system is tested with the DVEVM: Red Hat Enterprise Linux v4 (Server Edition).

To install the Linux software, follow these steps:

1) Log in as **root** on your host Linux workstation. This will allow you to successfully run the graphical installer to install MontaVista Linux.

2) Execute each of the following bin files (where `#_#_#_#` is the current version number) from the temporary location that they were copied in order to extract the installers for the Linux tools, Linux kernel, and the file system. If a bin file does not run, make sure these files are executable (use `chmod +x *.bin`).

   Instead of the default installation directory, we suggest that you change the installation directory to /opt/mv_pro_5.0.

```
host $ ./mvl_5_0_demo_sys_setuplinux.bin
host $ ./mvl_5_0_0_demo_lsp_setuplinux_#_#_#_#.bin
```

3) After you execute these .bin files, make sure the following files are located in /opt/mv_pro_5.0 (or in the /mv_pro_5.0 subdirectory of the directory you chose in place of the default):

   - mvltools5_0_#######.tar.gz
   - DaVinciLSP_#_#_#_#.tar.gz

4) Go to the location where you will unpack the tar files. For example:

```
host $ cd /opt/mv_pro_5.0
```

5) Unpack the tar files (as root) by using the following commands:

```
host $ tar zxf mvltools5_0_#######.tar.gz
host $ tar zxf DaVinciLSP_#_#_#_#.tar.gz
```

   This creates the MontaVista directory structure under the /opt/mv_pro_5.0/montavista/ directory.

   Note that unpacking these tar files will overwrite any existing files that were previously installed.

Note: The LSP shipped with the DVSDK is a multi-platform LSP; it is not configured for a particular platform. As shipped, this LSP cannot be used to build the demo or example applications. It must first be copied to a user area and configured/built for the EVM. Please see Section 4.5 for instructions.

4.3.2 Installing the DVSDK Software

The DVSDK software includes Codec Engine components, DSP/BIOS Link, sample data files, xDAIS and xDM header files, and a contiguous memory allocator for Linux (CMEM).

> **Note:** The installers for DSP/BIOS and Code Generation Tools (codegen) have a different default installation location. However, we strongly recommend that you change the default installation locations to place the components together (if you have not already installed the Linux versions of these components elsewhere). This simplifies the build setup steps.

To install the DVSDK software using the Linux installer, follow these steps:

1) Log in using a **user account**. The user account must have execute permission for the dvsdk_setuplinux_#_#_#_#.bin and xdctools_setuplinux_#_#_#.bin files.

2) Execute the DVSDK installer that you previously copied from the DVSDK DVD. For example:

```
host $ cd /tmp
host $ ./dvsdk_setuplinux_#_#_#_#.bin
```

This installs the DVSDK in /home/<*useracct*>/dvsdk_#_#.

3) Execute the XDC installer that you previously copied from the DVSDK DVD. For example:

```
host $ ./xdctools_setuplinux_#_#_#_#.bin
```

When you are prompted, *do not* use the default installation location. Instead, install the software in the directory created in Step 2. For example, /home/<*useracct*>/dvsdk_#_#.

4) Execute the DSP/BIOS installer that you previously copied from the DVSDK DVD. For example:

```
host $ ./bios_setuplinux_5_#_#_#.bin
```

When you are prompted, *do not* use the default installation location. Instead, install the software in the directory created in Step 2. For example, /home/<*useracct*>/dvsdk_#_#.

5) Execute the Code Generation Tools installer that you previously copied from the DVSDK DVD. For example:

```
host $ ./TI-C6x-CGT-v#.#.#.#.bin
```

When the installer prompts for an installation location, *do not* use the default location. Instead, use the **entire** path to the dvsdk_#_# codegen directory. You will need to manually create the folder cg6x_6_#_#, where # represents part of the version number. For example:

```
/home/<useracct>/dvsdk_#_#/cg6x_6_0_16.
```

Remember to set the environment variable as directed by the installer. For example:

```
C6X_C_DIR="/home/<useracct>/dvsdk_#_#/cg6x_6_#_#/include:
/home/<useracct>/dvsdk_#_#/cg6x_6_#_#/lib"
```

6) You can now delete the .bin files that you loaded into the temporary directory.

> **Note:** You can uninstall these components by using the `rm -rf` command on its directory. You should ignore the uninstall files created by the installer.

4.3.3 Installing the A/V Demo Files

Disk 2 contains the A/V files used by the demos. After following the instructions in the previous section, follow these instructions to install the A/V files:

1) Go to the DVSDK directory that you set up previously. For example:

```
host $ cd /home/<useracct>/dvsdk_#_#
```

2) Mount disk 2 and copy the data.tar.gz file to your DVEVM directory. For example:

```
host $ cp <mount location>/data.tar.gz .
```

3) Extract the A/V data files. For example:

```
host $ tar xfz data.tar.gz
```

4.3.4 Installing the SoC Analyzer

SoC Analyzer is a graphical tool that runs on a Windows development host and uses data collected from Linux, DSP/BIOS, and Codec Engine to provide system-level execution and performance analysis for debugging and profiling DVEVM software execution. Follow these instructions to install SoC Analyzer:

1) Insert the TI DVSDK software disk into the Windows development host PC.
2) Browse to the SoCAnalyzer/WinXP folder.
3) Double-click on the SoCAnalyzer_#.#.#.#.exe file to start the installer.
4) Follow the installer's prompts to install the software.

4.3.5 Exporting a Shared File System for Target Access

Although the board's hard drive contains a file system, during development it is more convenient to have the target board NFS mount a file system on a host Linux workstation. Once you have tested the application, you can store it on the board's hard drive for a standalone demonstration.

Note: Using video files from an NFS file system may result in a low frame rate when encoding/decoding videos.

Before the board can mount a target file system, you must export that target file system on the host Linux workstation. The file system uses an NFS (Network File System) server. The exported file system will contain the target file system and your executables.

To export the file system from your NFS server, perform the following steps. You only need to perform these steps once.

1) Log in with a **user** account on the host Linux workstation.
2) Perform the following commands to prepare a location for the MontaVista file system. For example:

```
host $ cd /home/<useracct>
host $ mkdir -p workdir/filesys
host $ cd workdir/filesys
```

3) Switch user to "**root**" on the host Linux workstation.

```
host $ su root
```

4) Perform the following commands to create a copy of the target file system with permissions set for writing to the shared area as <*useracct*>. Substitute your user name for <*useracct*>. If you installed in a location other than /opt/mv_pro_5.0, use your location in the cp command.

```
host $ cp -a /opt/mv_pro_5.0/montavista/pro/devkit/arm/v5t_le/target/* .
host $ chown -R <useracct> opt
```

5) Edit the /etc/exports file on the host Linux workstation (not the exports file on the target filesystem). Add the following line for exporting the filesys area, substituting your user name for <*useracct*>. Use the full path from root; ~ may not work for exports on all file systems.

```
/home/<useracct>/workdir/filesys *(rw,no_root_squash,no_all_squash,sync)
```

Note: Make sure you do not add a space between the * and the (in the above command.

6) Still as root, use the following commands to make the NFS server aware of the change to its configuration and to invoke an NFS restart.

```
host $ /usr/sbin/exportfs -av
host $ /sbin/service nfs restart
```

Note: Use `exportfs  -rav` to re-export all directories. Use `/etc/init.d/nfs status` to verify that the NFS status is running.

7) Verify that the server firewall is turned off:

```
host $ /etc/init.d/iptables status
```

If the firewall is running, disable it:

```
host $ /etc/init.d/iptables stop
```

4.3.6 Testing the Shared File System

To test your NFS setup, follow these steps:

1) Get the IP address of your host Linux workstations as follows. Look for the IP address associated with the eth0 Ethernet port.

```
host $ /sbin/ifconfig
```

2) Open a terminal emulation window to connect to the EVM board via RS-232 using the instructions in Section 2.2. If you have a Windows workstation, you can use HyperTerminal. If you have a Linux workstation, you might use Minicom. (You may need to turn on line wrap.)

3) Power on the EVM board, and abort the automatic boot sequence by pressing a key in the console window (Section 2.2).

4) Set the following environment variables in the console window:

```
 EVM # setenv nfshost <ip address of nfs host>
 EVM # setenv rootpath <directory to mount>
EVM # setenv bootargs console=ttyS0,115200n8 noinitrd rw
    ip=dhcp root=/dev/nfs
    nfsroot=$(nfshost):$(rootpath),nolock mem=120M
    davincihd_capture.channel0_numbuffers=4
```

Note that the **setenv bootargs** command should be typed on a single line. Also note that you should avoid using the numeric keypad to enter numbers, as it can sometimes insert extra invisible characters.

The *<directory to mount>* must match what you specified in Step 5 of Section 4.3.5. For example, /home/<*useracct*>/workdir/filesys.

Hints: You may want to use the printenv command to print a list of your environment variables. You can also save these setenv commands in a .txt file from which you can paste them in the future.

5) Save the environment so that you don't have to retype these commands every time you cycle power on the EVM board:

```
EVM # saveenv
```

6) Boot the board using NFS:

```
EVM # boot
```

7) You can now log in as "root" with no password required.

See Section A.3, *Alternate Boot Methods* for information about booting with TFTP or NFS and using flash or the EVM’s hard drive.

4.3.7 Notes on Using Evaluation/Production Codecs

As part of the DVSDK installation, you received a number of codecs:

❑ H.264 Base Profile Decoder

❑ H.264 HP Encoder

❑ MPEG2 Decoder

❑ MPEG4 AAC LC Decoder

❑ AAC Encoder

❑ G.711 Decoder (not a TI codec)

❑ G.711 Encoder (not a TI codec)

These codecs are provided under a "for demonstration-only" license agreement. If you wish to use these codecs in a production development environment, you can go to the DVEVM Updates web site at http://www.ti.com/dvevmupdates to download the latest production versions, along with the appropriate license agreement.

4.4 Setting Up the Build/Development Environment

To set up the GPP-side development and build environment, follow these steps:

1) Log in to your **user** account (and not as root) on the NFS host system.

2) Set your PATH so that the MontaVista tool chain host tools and cross compiler (arm_v5t_le-gcc) can be found. For example, in a default installation of the MontaVista LSP, you should add a definition like the following to your shell resource file (for example, ~/.bashrc):

```
PATH="/opt/mv_pro_5.0/montavista/pro/devkit/arm/v5t_le/bin:
      /opt/mv_pro_5.0/montavista/pro/bin:
       /opt/mv_pro_5.0/montavista/common/bin:$PATH"
```

   If you installed in a location other than /opt/mv_pro_5.0, use your own location in the PATH.

3) Remember to use the following command after modifying your .bashrc file:

```
host $ source ~/.bashrc
```

4.4.1 Writing a Simple Program and Running it on the EVM

Make sure you have performed the steps in Section 4.3.5, *Exporting a Shared File System for Target Access* and Section 4.4, *Setting Up the Build/Development Environment*.

Perform the following steps on the NFS host system as user (not as root):

```
1) host $ mkdir /home/<useracct>/workdir/filesys/opt/hello
```

```
2) host $ cd /home/<useracct>/workdir/filesys/opt/hello
```

3) Create a file called hello.c with the following contents:

```
#include <stdio.h>

int main() {
   printf("Buongiorno DaVinci!\n");
   return 0;
}
```

```
4) host $ arm_v5t_le-gcc hello.c -o hello
```

Perform the following steps on the target board. You may use either the target's console window (Section 2.2) or a telnet session.

```
1) target $ cd /opt/hello
```

2) Run ./hello. The output should be:

```
Buongiorno DaVinci!
```

4.5 Building a New Linux Kernel

If you modify the target’s Linux kernel sources, you will need to rebuild it and then boot it up by either replacing the kernel that comes installed on the EVM board’s flash or by having the U-Boot utility use TFTP to boot the kernel over a network connection.

Make sure you have completed Section 4.4, *Setting Up the Build/Development Environment* and Section 4.4.1, *Writing a Simple Program and Running it on the EVM* before attempting to build a new kernel.

To rebuild the Linux Kernel, follow these steps:

1) Log in to your user account (not as root).

2) Set the **`PLATFORM`** variable in the Rules.make file as described in Section 4.6.

3) Use commands like the following to make a local working copy of the MontaVista Linux Support Package (LSP) in your home directory. This copy contains the embedded Linux 2.6.18 kernel plus the DaVinci drivers. If you installed in a location other than /opt/mv_pro_5.0, use your location in the cp command.

```
host $ cd /home/<useracct>
host $ mkdir -p workdir/lsp
host $ cd workdir/lsp
host $ cp -R /opt/mv_pro_5.0/montavista/pro/devkit/lsp/ti-davinci .
```

4) Use the following commands to configure the kernel using the DaVinci defaults. Note that CROSS_COMPILE specifies a prefix for the executables that is used during compilation:

```
host $ cd ti-davinci/linux-2.6.18_pro500
host $ make ARCH=arm CROSS_COMPILE=arm_v5t_le- davinci_dm646x_defconfig
```

5) To modify the kernel options, you will need to use a configuration command such as "make menuconfig" or "make xconfig". To enable the MontaVista default kernel options, use the following command:

```
host $ make ARCH=arm CROSS_COMPILE=arm_v5t_le- checksetconfig
```

6) If you want to enable Linux Trace for the SoC Analyzer, follow these substeps. Otherwise, skip to Step 7.

   a) Use this command to go to the configuration menu for the ARM:

   ```
   host $ make ARCH=arm CROSS_COMPILE=arm_v5t_le- menuconfig
   ```

   b) Navigate to Device Drivers->Filesystems->Pseudo Filesystems.

   c) Set **Relayfs** file system support to "built-in".

   d) Return to the main menu and navigate to **General Setup**.

   e) Enable **Linux Trace Toolkit Support** as "built-in".

   f) Select Exit to save your changes and exit the configuration screen.

7) Compile the kernel using the following command:

```
host $ make ARCH=arm CROSS_COMPILE=arm_v5t_le- uImage
```

8) If the kernel is configured with any loadable modules (that is, selecting <M> for a module in menuconfig), use the following commands to rebuild and install these modules:

```
host $ make ARCH=arm CROSS_COMPILE=arm_v5t_le- modules
host $ make ARCH=arm CROSS_COMPILE=arm_v5t_le-
       INSTALL_MOD_PATH=/home/<useracct>/workdir/filesys
       modules_install
```

9) Use the following command to copy the uImage to a place where U-Boot can use TFTP to download it to the EVM. These commands assume you are using the default TFTP boot area, which is /tftpboot. If you use another TFTP root location, please change /tftpboot to your own TFTP root location. (Perform these commands as **root** or use a `chown uImage` command to get ownership of the file.)

```
host $ cp /home/<useracct>/workdir/lsp/ti-davinci/linux-2.6.18_pro500/arch/ arm/boot/uImage
/tftpboot
host $ chmod a+r /tftpboot/uImage
```

For more information on setting up a TFTP server, see Section A.2.

See a standard Linux kernel reference book or online source for more about Linux build configuration options.

4.6 Rebuilding the DVEVM Software for the Target

To place demo files in the /opt/dvsdk/dm6467 directory, you need to rebuild the DVSDK software. To do this, follow these steps:

1) If you have not already done so, rebuild the Linux kernel as described in Section 4.5.

2) Change directory to dvsdk_#_#.

3) Edit the Rules.make file in the dvsdk_#_#. directory.

- Set PLATFORM to match your EVM board as follows:

```
PLATFORM=dm6467
```

- Set DVSDK_INSTALL_DIR to the top-level DVSDK installation directory as follows:

```
DVSDK_INSTALL_DIR=/home/<useracct>/dvsdk_#_#
```

- Make sure EXEC_DIR points to the opt directory on the NFS exported file system as follows:

```
EXEC_DIR=/home/<useracct>/workdir/filesys/opt/dvsdk/$(PLATFORM)
```

- Make sure MVTOOL_DIR points to the MontaVista Linux tools directory as follows:

```
MVTOOL_DIR=/opt/mv_pro_5.0/montavista/pro/devkit/arm/v5t_le
```

- Make sure LINUXKERNEL_INSTALL_DIR is defined as follows:

```
LINUXKERNEL_INSTALL_DIR=/home/<useracct>/workdir/lsp/ti-davinci/linux-2.6.18_pro500
```

- Modify the following environment variables as needed to match the locations of these components on your Linux host. We recommend that these components be installed in the /home/<*useracct*>/dvsdk_#_# directory, but you may have installed them elsewhere.

```
 BIOS_INSTALL_DIR=/home/<useracct>/dvsdk_#_#/bios_#_#
 FC_INSTALL_DIR=/home/<useracct>/dvsdk_#_#/fc_#_#
XDC_INSTALL_DIR=/home/<useracct>/dvsdk_#_#/xdctools_#_#
```

4) While in the same directory that contains Rules.make, use the following commands to build the DVSDK demo applications and put the resulting binaries on the target file system specified by EXEC_DIR.

```
host $ make clean
host $ make
host $ make install
```

5) You can test the rebuilt DVEVM software by booting your NFS file system and running the demos from the command line as described in Section 3.4.

4.7 Booting the New Linux Kernel

After building the new kernel, in order to use it to boot the DaVinci board, you must transfer it to the board via TFTP. It is assumed you have completed the steps in Section 4.5, *Building a New Linux Kernel* and the boot file, uImage has been copied to /tftpboot (or some other site-specific TFTP accessible location).

1) Power on the EVM board, and abort the automatic boot sequence by pressing a key in the console window (Section 2.2).

2) Set the following environment variables. (This assumes you are starting from a default, clean U-Boot environment. See Section 3.1, *Default Boot Configuration* for information on the U-Boot default environment.)

```
EVM # setenv bootcmd 'dhcp;bootm'
EVM # setenv serverip <tftp server ip address>
EVM # setenv bootfile uImage
EVM # setenv bootargs mem=120M console=ttyS0,115200n8
   root=/dev/hda1 rw noinitrd ip=dhcp
   davincihd_capture.channel0_numbuffers=4
```

Note that the **setenv bootargs** command should be typed on a single line.

3) Boot the board:

```
EVM # boot
```

This configuration boots a new Linux kernel via TFTP with a hard drive based file system. To boot via TFTP using an NFS file system, see Section A.3.4.

For instructions on how to verify that your host workstation is running a TFTP server, and for instructions on what to do if it isn’t, see Section A.2.

For more details on booting, see Section A.3. For details on installing uImage in NAND flash memory, see Section A.5.

4.8 Testing the Build Environment

To test your DVSDK software installation, you can build one of the Codec Engine servers. This server is a DSP-side application. Building it tests the installation of DSP-side development components.

To build the video_copy server, follow these steps:

1) Go to /home/<*useracct*>/dvsdk_#_#/codec_engine_#_#/examples and open the build_instructions.html file.

2) Follow the step-by-step instructions for building examples. When you are editing the xdcpaths.mak file, note that the DVSDK installation *does not* include the cetools directory, so you will need to set the USE_CETOOLS_IF_EXISTS variable to 0, and modify additional variables to point to the locations of xDAIS, DSP/BIOS Link, CMEM, and Framework Components.

3) Go to the video_copy server directory. (/home/<*useracct*>/dvsdk_#_#/codec_engine_#_#/examples/servers/video_copy) to inspect the built server.

4.9 Using the Digital Video Test Bench (DVTB)

The Digital Video Test Bench (DVTB) is a Linux utility that was developed to execute end-to-end data flows using the DVSDK for any platform. DVTB uses the Codec Engine VISA APIs and Linux driver peripheral APIs to encode and decode video, image, audio and speech streams.

Using DVTB, you can configure codecs and/or peripherals before starting a data flow. This enables you to try different use case scenarios and evaluate the system.

The DVSDK installation places DVTB in the /home/<*useracct*>/dvsdk_#_#/dvtb_#_#_# directory, where #_#_# is the DVTB version number).

To install DVTB to the target file system, perform the following steps on the host machine where the DVSDK has been installed:

1) Make sure the Rules.make file defines PLATFORM correctly as described in Section 4.6.

2) Perform the following commands:

```
host $ cd /home/<useracct>/dvsdk_#_#/dvtb_#_#_#
host $ make clean CONFIGPKG=dm6467
host $ make CONFIGPKG=dm6467
```

3) Copy the binaries "dvtb-d" and "dvtb-r" to /opt/dvsdk/dm6467 on the device’s target filesystem and run it there. It must be in the same directory as the DSP executables.

For further details on the DVTB, see the following documents:

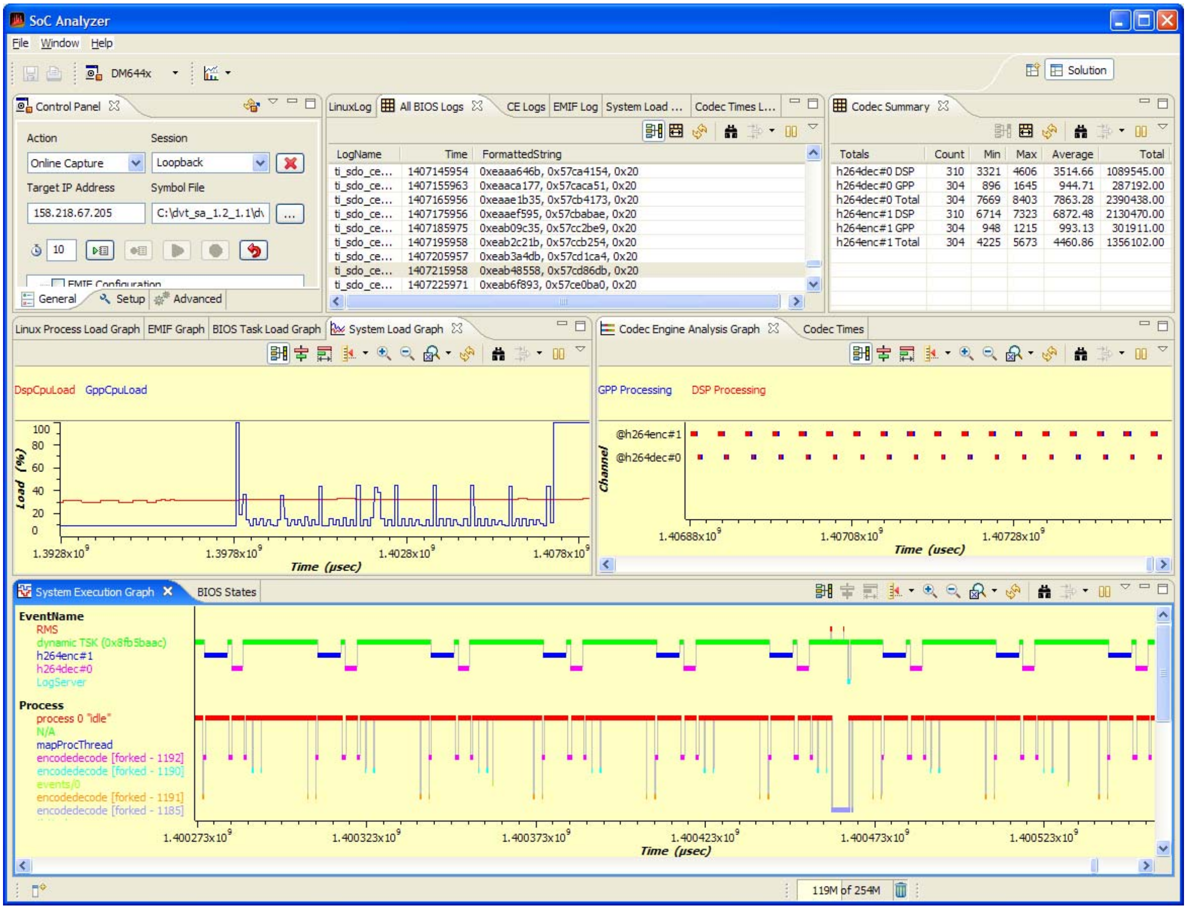
❑ **Release Notes.**
/home/<useracct>/dvsdk_#_#/dvtb_#_#_#/docs/dvtb_release_notes.pdf

❑ **User Guide.**.
/home/<useracct>/dvsdk_#_#/dvtb_#_#_#/docs/dvtb_user_guide.pdf

4.10 Running The SoC Analyzer

Built upon Texas Instruments' eXpressDSP data visualization technology (DVT), the SoC Analyzer simplifies debugging, analysis, and optimization of DVEVM applications. It collects execution, interaction, and resource utilization logs from Linux, DSP/BIOS, Codec Engine, and drivers and presents system-level analysis and graphical visualization such as:

- System execution flow
- System performance
- Resource utilization
- Processor interaction



Action: Online Capture

Session: Loopback

Target IP Address: 158.218.67.205

Symbol File: C:\dvt_sa_1.2_1.1\d\

10

LogName	Time	FormattedString
ti_sdo_ce...	1407145954	0xeaaa646b, 0x57ca4154, 0x20
ti_sdo_ce...	1407155963	0xeaaca177, 0x57caca51, 0x20
ti_sdo_ce...	1407165956	0xeaae1b35, 0x57cb4173, 0x20
ti_sdo_ce...	1407175956	0xeaaef595, 0x57cbabae, 0x20
ti_sdo_ce...	1407185975	0xeab09c35, 0x57cc2be9, 0x20
ti_sdo_ce...	1407195958	0xeab2c21b, 0x57ccb254, 0x20
ti_sdo_ce...	1407205957	0xeab3a4db, 0x57cd1ca4, 0x20
ti_sdo_ce...	1407215958	0xeab48558, 0x57cd86db, 0x20
ti_sdo_ce...	1407225971	0xeab6f893, 0x57ce0ba0, 0x20

Totals	Count	Min	Max	Average	Total
h264dec#0 DSP	310	3321	4606	3514.66	1089545.00
h264dec#0 GPP	304	896	1645	944.71	287192.00
h264dec#0 Total	304	7669	8403	7863.28	2390438.00
h264enc#1 DSP	310	6714	7323	6872.48	2130470.00
h264enc#1 GPP	304	948	1215	993.13	301911.00
h264enc#1 Total	304	4225	5673	4460.86	1356102.00

Install the SoC Analyzer as described in Section 4.3.4.

To run the SoC Analyzer, double-click the SoC Analyzer icon on the Windows Desktop or select it from the Windows Start menu under Texas Instruments.

The SoC Analyzer comes with online help, which can be accessed from the SoC Analyzer Help menu (choose **Help->Help Contents**). Select the *DM646x SoC Analyzer User Guide*.

Follow the "Getting Started" chapter of the *DM646x SoC Analyzer User Guide*, which includes steps on how to run the tool with demonstration logs shipped with the product. This "Getting Started" chapter also contains the steps you should perform to enable your applications to collect logs for the SoC Analyzer. The DVEVM Demo Application has such logging enabled by default. The uImage must be rebuilt to enable logging.

4.11 Documentation for DSP-Side Development

After you have installed the DVSDK software, you can begin to create and modify DSP-side applications for your DM646x.

The following table lists places to look for documentation on using each component of the DVSDK. Documents in PDF, HTML, and text format are included in the installations with each product.

Table 4-1. Documentation for DVSDK Components

Component	Title	Location
DSP/BIOS	*TMS320C6000 DSP/BIOS API Reference* (SPRU403)	/home/<*useracct*>/dvsdk_#_#/bios_5_#/packages/ti/bios/doc
	Application Notes	www.dspvillage.com
Code Generation Tools	*TMS320C6000 Optimizing C Compiler User's Guide* (SPRU187)	www.dspvillage.com
	TMS320C6000 Programmer's Guide (SPRU189)	www.dspvillage.com
Framework Components	Release Notes	/home/<*useracct*>/dvsdk_#_#/framework_components_#_#
Digital Video Test Bench	README.txt	/home/<*useracct*>/dvsdk_#_#/dvtb/docs

Table 4-1. Documentation for DVSDK Components

Component	Title	Location
	Section 4.9, *Using the Digital Video Test Bench (DVTB)*	this document
Codec Engine	*Codec Engine Application Developer User's Guide* (SPRUE67)	/home/<*useracct*>/dvsdk_#_#/codec_engine_#_#/docs
	Codec Engine Server Integrator User's Guide (SPRUED5)	/home/<*useracct*>/dvsdk_#_#/codec_engine_#_#/docs
	Codec Engine Algorithm Creator User's Guide (SPRUED6)	/home/<*useracct*>/dvsdk_#_#/codec_engine_#_#/docs
	Example Build and Run Instructions	/home/<*useracct*>/dvsdk_#_#/codec_engine_#_#/examples/build_instructions.html
	Codec Engine API Reference	/home/<*useracct*>/dvsdk_#_#/codec_engine_#_#/docs/html/index.html
	Codec Engine SPI Reference Guide	/home/<*useracct*>/dvsdk_#_#/codec_engine_#_#/docs/spi/html/index.html
	Configuration Reference	/home/<*useracct*>/dvsdk_#_#/codec_engine_#_#/xdoc/index.html
XDC Tools (used by Codec Engine)	Documentation Links	/home/<*useracct*>/dvsdk_#_#/xdctools_#_#/docs/index.html
xDAIS	*xDAIS-DM (Digital Media) User Guide* (SPRUEC8)	/home/<*useracct*>/dvsdk_#_#/xdais_5_00/packages/ti/xdais/dm/docs

Appendix A

Additional Procedures

This appendix describes optional procedures you may use depending on your setup and specific needs.

Topic **Page**

A.1 Putting Demo Applications in the Third-Party Menu

You can add your own demos to the Third-Party Menu by following the steps in this section. Only four demos can be shown at once in the user-interface. If you add more than four demos, the first four in alphabetical order are shown.

1) Create the following files for your demo:

   - **logo.jpg.** This is the logo of the third party company which will be showed next to the demo description. The picture needs to be in JPEG format and of size 50x50.
   - **readme.txt.** This is a text file. The first 40 characters of the file should briefly describe the demo. The demo interface displays up to 40 characters, but stops if it encounters a new line character. For example, the file might contain "Video Phone demo" or "Network Audio demo".
   - **app.sh.** This is an executable that launches your demo. It can either be the demo executable itself or a shell script that executes the executable. (If this is a shell script, make sure its executable bit is set for all). A script could look something like:

     ```
     #!/bin/sh
     exec ./mydemoname
     ```

   - **other files.** If app.sh is a shell script, your demo executable will have some other name. You may also need to include data files or other files used by the executable.

   Note: The demo application must use relative paths to access any files it needs at runtime. This because the archive is extracted to another location from which the demo is executed.

2) Create a gzipped tar file (ends with .tar.gz) that archives all the files in the previous list. For example, if your files are logo.jpg, readme.txt, and app.sh, you could use the following command:

   ```
   tar cvzf ti_videophone.tar.gz logo.jpg readme.txt app.sh
   ```

   Name the tar file using <*company*>_<*demoname*>.tar.gz (with no spaces in the file name) as the convention. For example, a video phone demo created by Texas Instruments would be named ti_videophone.tar.gz. The name must be unique since all demos are installed in the same directory.

   The three required files must be in the top-level directory of the archive. Other files may be in subdirectories, so long as the demo uses relative references to access them. For example, the following directory structure might be used in the archive:

```
|-- app.sh
|-- data
|   |-- datafile1
|   `-- datafile2
|-- logo.jpg
`-- readme.txt
```

To check the format of the file you create, execute the following command in Linux. The result should say "gzip compressed data".

```
file <filename>.tar.gz
```

3) Put your archive in the "thirdpartydemos" subdirectory of the target installation directory. This is where the DVSDK software was installed on the target file system. The default target installation directory is /opt/dvsdk/dm6467, so the default location for demo archives is /opt/dvsdk/dm6467/thirdpartydemos. Do not extract the contents of the archive in this location. Extraction is performed behind-the-scenes each time the demo is run.

A.2 Setting Up a TFTP Server

You can check to see if a TFTP server is set up with the following command:

```
host $ rpm -q tftp-server
```

If it is not set up, you can follow these steps:

1) If you have not yet installed MontaVista Linux Demo Edition (see Section 4.3.1), you can download a TFTP server for your Linux host from many locations on the Internet. Search for "tftp-server".

2) To install TFTP, use this command, where `-#.#-#` is the version number portion of the filename:

   ```
   host $ rpm -ivh tftp-server-#.#-#.rpm
   ```

   You should see the following output:

   ```
    warning: tftp-server-#.#-#.rpm:
    V3 DSA signature: NOKEY, key ID 4f2a6fd2
   Preparing... #################################### [100%]
   1:tftp-server ################################### [100%]
   ```

3) Confirm that TFTP is installed with this command:

   ```
   host $ /sbin/chkconfig --list | grep tftp
   ```

If you want to turn on the TFTP server, use this command:

```
/sbin/chkconfig tftp on
```

The default root location for servicing TFTP files is /tftpboot.

A.3 Alternate Boot Methods

The default configuration for the EVM is to boot from flash with the file system on the EVM's hard drive. The following are alternate ways you may want to boot the board:

❏ TFTP boot with hard drive file system (Section A.3.2)

❏ Flash boot with NFS file system (Section A.3.3)

❏ TFTP boot with NFS file system (Section A.3.4)

The subsections that follow show the environment variable settings used to enable each boot method.

> **Note:** Using video files from an NFS file system may result in a low frame rate when encoding/decoding videos.

To boot in one of these modes, follow these steps:

1) Power on the EVM board, and abort the automatic boot sequence by pressing a key in the console window (Section 2.2).

2) Set the environment variables indicated in the following subsections for the boot mode you want to use. (Note that the `setenv bootargs` command should be typed on a single line.)

3) If you want to use these settings as the default in the future, save the environment:

```
EVM # saveenv
```

4) Boot the board using the settings you have made:

```
EVM # boot
```

A.3.1 Booting from Flash Using the EVM's Hard Drive File System

This is the default, out-of-the-box boot configuration.

To boot in this mode, set the following parameters after you abort the automatic boot sequence:

```
EVM # setenv bootcmd 'nboot 80700000 0 a0000;bootm'
EVM # setenv bootargs mem=120M console=ttyS0,115200n8
  root=/dev/hda1 rw noinitrd ip=dhcp
  davincihd_capture.channel0_numbuffers=4
```

A.3.2 Booting via TFTP Using the EVM’s Hard Drive File System

To boot in this mode, set the following parameters after you abort the automatic boot sequence:

```
EVM # setenv bootcmd 'dhcp;bootm'
EVM # setenv bootargs mem=120M console=ttyS0,115200n8
  root=/dev/hda1 rw noinitrd ip=dhcp
  davincihd_capture.channel0_numbuffers=4
EVM # setenv serverip <tftp server ip address>
EVM # setenv bootfile <path on tftpserver>/uImage
```

A.3.3 Booting from Flash Using NFS File System

To boot in this mode, set the following parameters after you abort the automatic boot sequence:

```
EVM # setenv bootcmd 'nboot 80700000 0 a0000;bootm'
EVM # setenv nfshost <ip address of nfs host>
EVM # setenv rootpath <directory to mount*>
EVM # setenv bootargs console=ttyS0,115200n8 noinitrd rw
  ip=dhcp root=/dev/nfs
  nfsroot=$(nfshost):$(rootpath),nolock mem=120M
  davincihd_capture.channel0_numbuffers=4
```

*For example, `<directory to mount>` might be `/home/<useracct>/workdir/filesys`.

A.3.4 Booting via TFTP Using NFS File System

To boot in this mode, set the following parameters after you abort the automatic boot sequence:

```
EVM # setenv bootcmd 'dhcp;bootm'
EVM # setenv serverip <tftp server ip address>
EVM # setenv bootfile <name of kernel image>
EVM # setenv rootpath <root directory to mount>
EVM # setenv nfshost <ip address of nfs host>
EVM # setenv bootargs console=ttyS0,115200n8 noinitrd rw
  ip=dhcp root=/dev/nfs
  nfsroot=$(nfshost):$(rootpath),nolock mem=120M
  davincihd_capture.channel0_numbuffers=4
```

The <*root directory to mount*> must match the file system that you set up on your workstation. For example, /home/<*useracct*>/workdir/filesys.

A.4 Updating and Restoring the Bootloaders

The subsections that follow describe the following steps, which you perform before booting the Linux kernel using the EVM.

❏ Flash UBL to I2C/SPI EEPROM. Section A.4.1 or Section A.4.2.

❏ Flash u-boot to NAND. Section A.4.3.

❏ Write the MAC address to I2C EEPROM. Section A.4.4.

Currently I2C and SPI boot modes are supported. You can select either of them and follow the respective instructions to flash SPI or I2C EEPROM.

After programming the board's flash memory, set SW3 to the appropriate boot mode shown in Table A–1.

Table A–1 SW3 Switch Settings for Various Boot Modes

BM[0:3]	Boot mode when PCI-OFF	Boot mode when PCI-ON
0000	EMU	
0100	HPI-16	PCI without auto init
1100	HPI-32	PCI with auto init
0010	EMIFA	
0110	I2C	
1110	NAND	
0001	UART0	
1001	Emulation	
0101	VLYNQ	
1101	EMAC	
0111	SPI	
ELSE	NA	

A.4.1 Flashing UBL to I2C EEPROM

1) Change SW3 to UART boot mode (BM [0-3:0001). See Table A–1.

2) Open CCStudio and connect to the target. Use the ARM GEL file in the <*dvsdk-dir*>/PSP_#_#_#_#/bin/dm646x folder.

3) In CCStudio, use File->Load Program to load i2c_eeprom_writer.out. Run (F5) the program.

4) In the dialog box, enter the path for ubl_dm646x_297.bin.

5) I2C EEPROM write takes about 20 seconds to complete writing. Wait for "All tests passed and files match" in the CCStudio output window.

6) Set SW3 to the I2C boot mode as shown in Table A–1.

A.4.2 Flashing UBL to SPI EEPROM

1) Change SW3 to UART boot mode (BM [0-3]:0001). See Table A–1.
2) Open CCStudio and connect to the target. Use the ARM GEL file in the <*dvsdk-dir*>/PSP_#_#_#_#/bin/dm646x folder.
3) In CCStudio, use File->Load Program to load spi_eeprom_writer.out. Run (F5) the program.
4) In the dialog box, enter the path for ubl_dm646x_297.bin.
5) The SPI EEPROM write takes around 10 seconds to complete. Wait for "All tests passed and files match" in the CCStudio output window.
6) Set SW3 to the SPI boot mode as shown in Table A–1.

A.4.3 Flashing U-boot to NAND

1) With the board powered off, change the SW3 setting to UART boot mode (BM[0-3] = 0001). See Table A–1 for details.
2) With the board powered on, open CCStudio and connect to the target. Go to the <*dvsdk-dir*>/PSP_#_#_#_#/bin/dm646x folder to find the ARM GEL file.
3) In CCStudio, use File->Load Program to load nand_flash_writer.out. Run (F5) the program.
4) In the dialog box that appears, enter the path to the u-boot.bin file.
5) Wait until the flash writer completes writing u-boot to NAND.
6) Set SW3 to either I2C or SPI depending on where you wrote your UBL to in Section A.4.1 or Section A.4.2. The switch settings for these modes are listed in Table A–1.

For full LSP instructions, see the *LSP User’s Manual*.

A.4.4 Writing the MAC Address to I2C EEPROM

1) Change SW3 to UART boot mode (BM [0-3]:0001). See Table A–1.
2) Open CCStudio and connect to the target. Use the ARM GEL file in the <*dvsdk-dir*>/PSP_#_#_#_#/bin/dm646x folder.
3) In CCStudio, load the setmac.out program. Run the program.
4) In the dialog, type the second half of the MAC address in xx-xx-xx format.

Note: The Ethernet MAC address is present below the EVM near the Ethernet port. New boards do not have MAC address flashed correctly. Please flash the MAC address before using the board.

5) Wait until the MAC address writes to I2C EEPROM.
6) Set SW3 to the I2C boot mode as shown in Table A–1.

A.5 Installing uImage in NAND Flash

The instructions in this section assume that you have uImage available from a tftp location.

Follow these steps to install uImage in NAND flash memory:

1) Power on the board and stop the automatic boot sequence by pressing any key in a console window.

2) After aborting the automatic boot sequence, assign an IP address to the EVM board using one of these methods:

   - If you are on a standalone network or are using a network cross-cable to your workstation, you can assign a static IP address to the EVM as follows:

     ```
     EVM # setenv ipaddr <static IP address>
     ```

   - To assign a dynamic address, use the following:

     ```
     EVM # dhcp
     EVM # setenv ipaddr <IP address returned by dhcp>
     ```

3) Set the TFTP server IP address as follows:

   ```
   EVM # setenv serverip <TFTP server IP address>
   ```

4) Save these settings to the flash memory:

   ```
   EVM # saveenv
   ```

5) Download the uImage to RAM using the tftp command as follows. Record the “Bytes transferred” value that is returned for later use.

   ```
   EVM # tftp 80700000 <uImage tftp location>
   ```

6) Erase the NAND flash at offset 0xa0000 with a size that is larger than the “Bytes transferred” value from the previous step. The size must be a multiple of 2048 dec (800 hex). For example, if the uImage size is 1397368 bytes (155278 hex), then the erase size should be 0x155800 as shown here:

   ```
   EVM # nand erase 0xa0000 0x155800
   ```

7) Flash the new uImage from RAM at 0x80700000 to the address in flash that was just erased (0xa0000). The write size must also be a multiple of 2048 dec (800 hex). Using the previous example sizes, the write size would again be 0x155800 as shown here:

   ```
   EVM # nand write 0x80700000 0xa0000 0x155800
   ```

For information on configuring the boot environment to boot the board from NAND, see Section A.4.3.

A.6 Rebuilding DSP/BIOS Link

If you want to rebuild the DSP/BIOS Link package, follow these steps (assuming you are using the bash shell):

1) Edit the davinci_mvlpro5.0.mk file, which is in the /home/<*useracct*>/dvsdk_#_#/dsplink_#/packages/dsplink/make/Linux/ directory, to make sure the BASE_BUILDOS and BASE_CGTOOLS variables correctly point to the correct locations. For example:

```
BASE_BUILDOS := /home/<useracct>/workdir/lsp/ti-davinci/linux-2.6.18_pro500
 BASE_CGTOOLS := /opt/mv_pro_5.0/montavista/pro/devkit/arm/v5t_le/bin
```

2) Define the DSPLINK environment variable to be the absolute path to the "dsplink" directory. (Use export for bash shell, and setenv for tcsh shell.) For example:

```
host $ export DSPLINK=/home/<useracct>/dvsdk_#_#/dsplink_#/packages/dsplink
```

3) Move to the Linux build script directory:

```
host $ cd $DSPLINK/etc/host/scripts/Linux
```

4) Build DSP/BIOS Link as follows:

```
host $ sh –f buildmodule.sh
```

5) The rebuilt kernel module is called dsplinkk.ko. It is located in the $DSPLINK/gpp/export/BIN/Linux/Davinci/DM6467/RELEASE/ directory.

A.7 Restoring and Updating the EVM Hard Disk Drive

This section describes how to restore and update all the files on the EVM hard disk drive (HDD), including the Linux file system and the demos. Using these restore procedures, you can return your board to a known state if anything happens to the data on the EVM board’s HDD.

This section assumes that you have configured a host Linux workstation with the software necessary to perform an NFS root mount with the EVM as described in Section 4.3.5 and Section 4.3.6.

For further information about upgrading and flashing, see the TI DaVinci Technology Developers Wiki at http://wiki.davincidsp.com.

For instructions on how to have the EVM boot Linux from flash using an NFS file system, see Section A.3.3.

The EVM hard disk drive (HDD) can be restored from a target EVM HDD partition or from the host Linux workstation file system. Either method will achieve the same result.

Restoring the EVM HDD takes 10 to 15 minutes. The restore script must uncompress 600 MB of compressed data and load it to the /dev/hda1 partition.

After the hard drive restore process has completed, make sure to restart the EVM and configure U-Boot to root mount via the local HDD. The steps for this type of boot are provided in Section A.3.1, *Booting from Flash Using the EVM’s Hard Drive File System*.

A.7.1 Restoring From Target EVM HDD Partition

Follow these steps to restore the HDD from the restore partition on the HDD itself:

1) Make a directory for mounting the HDD restore partition:

```
EVM # mkdir /mnt/restore
```

2) Mount the HDD restore partition:

```
EVM # mount -t ext3 /dev/hda2 /mnt/restore
```

3) Set the Linux date variable to today's date. If the date is too far off, the target file system installation generates a bunch of warnings.

```
EVM # date MMDDHHMMCCYY
```

   For example, for 9:00 am on April 18th, 2006, enter 041809002006.

4) Change directory to /mnt/restore:

```
EVM # cd /mnt/restore
```

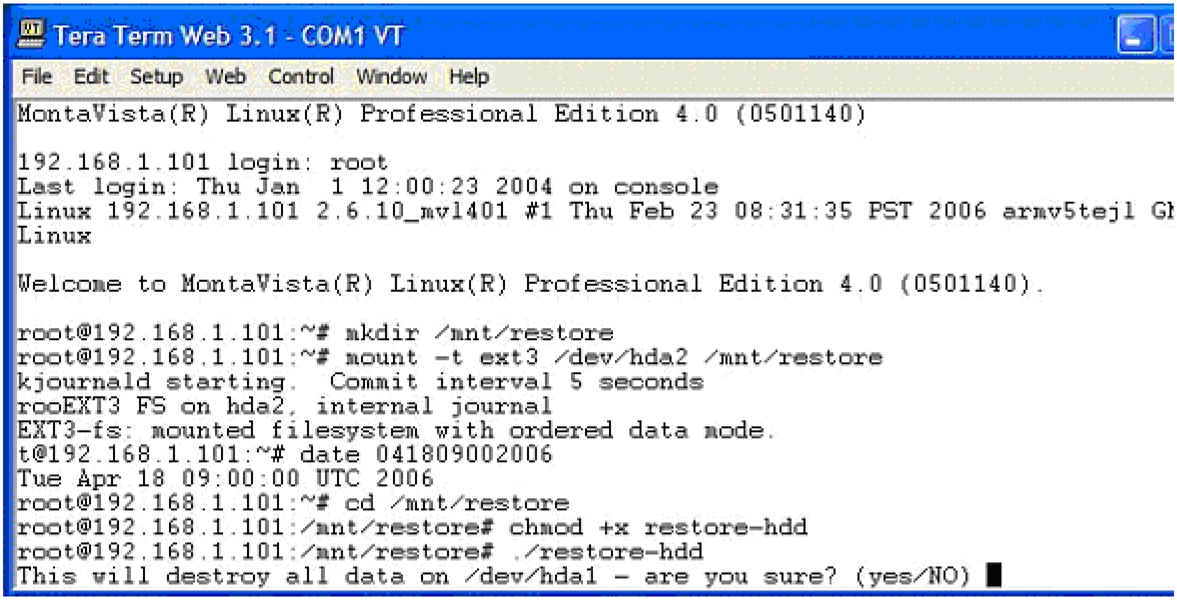
5) Add execute permissions for the script:

```
EVM # chmod +x restore-hdd
```

6) Run the restore script:

```
EVM # ./restore-hdd
```

7) The script will ask for confirmation: "This will destroy all data on /dev/hda1 - are you sure?" Type **yes**.



```
MontaVista(R) Linux(R) Professional Edition 4.0 (0501140)

192.168.1.101 login: root
Last login: Thu Jan  1 12:00:23 2004 on console
Linux 192.168.1.101 2.6.10_mvl401 #1 Thu Feb 23 08:31:35 PST 2006 armv5tejl G
Linux

Welcome to MontaVista(R) Linux(R) Professional Edition 4.0 (0501140).

root@192.168.1.101:~# mkdir /mnt/restore
root@192.168.1.101:~# mount -t ext3 /dev/hda2 /mnt/restore
kjournald starting.  Commit interval 5 seconds
rooEXT3 FS on hda2, internal journal
EXT3-fs: mounted filesystem with ordered data mode.
t@192.168.1.101:~# date 041809002006
Tue Apr 18 09:00:00 UTC 2006
root@192.168.1.101:~# cd /mnt/restore
root@192.168.1.101:/mnt/restore# chmod +x restore-hdd
root@192.168.1.101:/mnt/restore# ./restore-hdd
This will destroy all data on /dev/hda1 - are you sure? (yes/NO) █
```

8) After the HDD restore is complete, shutdown the EVM:

```
EVM # halt
```

9) When the "Power down" message is printed in the terminal window, it is safe to power down the EVM.

10) Restart the EVM and configure U-Boot to root mount via the local HDD. Follow the steps in Section A.3.1, *Booting from Flash Using the EVM's Hard Drive File System*.

A.7.2 Restoring From Host Linux Workstation File System

Follow these steps to restore the HDD from the host Linux workstation restore directory:

1) On your host workstation, copy the restore directory from the TI DVSDK disk to /home/<*useracct*>/workdir/filesys/restore. After NFS mounting this file system, this will appear as the /restore directory on the EVM.

2) Login to the EVM as root.

3) Go to the /restore directory.

```
EVM # cd /restore
```

4) Set the Linux date variable to today's date. If the date is too far off, the target file system installation generates warnings for each file it installs.

```
EVM # date MMDDHHMMCCYY
```

For example, for 9:00 am on April 18th, 2006, enter 041809002006.

5) Add execute permissions on the prep-hdd script.

```
EVM # chmod +x prep-hdd
```

6) Run the prep-hdd script in the /restore directory.

```
EVM # ./prep-hdd /restore
```

7) The script will ask for confirmation: "Are you sure you want to partition and format /dev/hda?" Type **yes**.

8) After the HDD restore is complete, shutdown the EVM:

```
EVM # halt
```

9) When the "Power down" message is printed in the terminal window, it is safe to power down the EVM.

10) Restart the EVM and configure U-Boot to root mount via the local HDD. Follow the steps in Section A.3.1, *Booting from Flash Using the EVM's Hard Drive File System*.

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509538-0001E