Intel® Atom™ E6xx Processor Series Software Capabilities

Application Note

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Revision History

Date	Revision	Description
December 2010	001	Initial release

1.0 Overview

This document provides an snapshot of the software capabilities of the Intel® Atom™ E6xx Processor Series platform and describes its major software components. As the Intel Atom ecosystem continues to expand, more software capabilities will be added.

The Intel Atom E6xx Processor Series platform provides a rich software selection, from low-level firmware and device drivers to operating systems and tools. A simplified overview of software capabilities is provided in Figure 1.

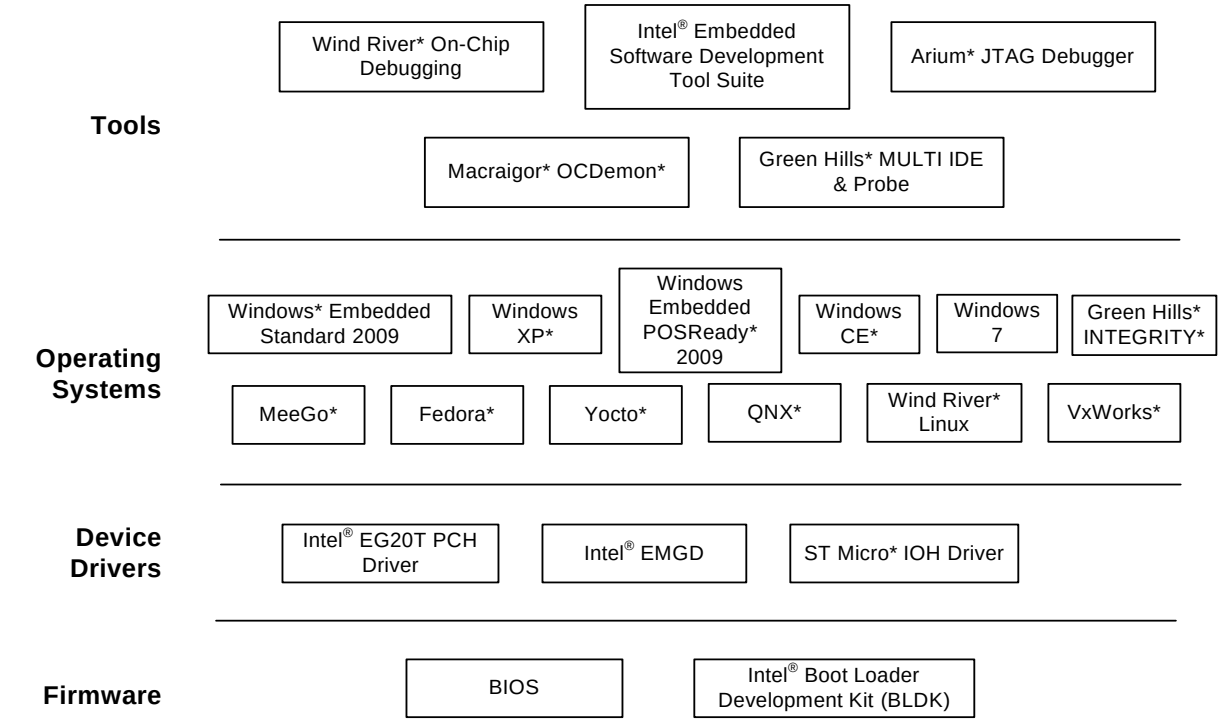
Note: This document is intended for those new to Intel Architecture or those seeking an overview of the software capabilities of the Intel Atom E6xx Processor Series platform. For details on the individual components or detailed instructions on customized configurations, please refer to the documentation for the individual software component. A list of these documents is provided in Table 1.

Table 1. Related Documents

Document	Document Number
Video Encoding Accelerator Solution for Intel® Atom™ Processor E6xx Series White Paper	324328
Using Gstreamer for Hardware Accelerated Video Decoding on Intel® Atom™ Processor E6xx Series White Paper	324294
RS - Intel® Atom™ Processor E6xx Series BIOS Writer's Guide	28867[1]
Tunnel Creek Processor - Island Bay Development Platform Windows Embedded Standard 2009 User Guide*	440610[1]
Intel® Embedded Media and Graphics Driver, EFI Video Driver, EPOG, and Video BIOS v1.5 for Windows XP and Linux* User's Guide*	442076
Crown Bay Development Platform User Guide	448008[1]
Topcliff I/O Hub Drivers for Windows Embedded Standard 2009 Installation Manual*	446692[1]
Topcliff IO Hub Drivers Programmer's Guides	448775[1]
RS - Intel® Platform Controller Hub EG20T Firmware Writer's Guide	28833[1]
Intel® Boot Loader Development Kit User Guide and API Reference Manual	442253[1]

1. Intel classified; please contact your Intel representative.

Figure 1. Software Stack



2.0 Firmware

A basic input/output system (BIOS) initializes the hardware and boots it to a point where the operating system can load, and it also abstracts the operating system from the hardware. Access to the hardware is made through specific BIOS commands.

A fully featured BIOS solution is engineered to perform complete discovery and initialization algorithms. The BIOS is used in designs that will support multiple use cases for the platform, customizable services, multiple boot paths, multiple operating systems, or rich feature sets. For some embedded designs, a traditional BIOS or a fully featured Unified Extensible Firmware Interface (UEFI*) firmware stack used by typical notebook designs may be appropriate.

Often, the design goals for embedded systems include faster boot times, smaller footprints, specialized functionality and lower cost. For these reasons, many embedded system designs would be encumbered by adopting the full-featured BIOS and therefore designers seek a more optimized solution.

2.1 BIOS

There are several firmware solutions available from leading BIOS vendors such as AMI*, Byosoft*, Insyde*, Phoenix*, etc., for booting Intel Atom E6xx processor-based platforms. As each set of peripherals requires its own unique firmware solution, please work with your BIOS vendor to create the firmware solution for your board.

Intel provides the reference BIOS solution for the Crown Bay Development Platform. This BIOS solution is based on AMI Aptio* UEFI BIOS.

Where to get it

http://edc.intel.com/Platforms/Atom-E6xx/#software

2.1.1 Updating the BIOS

The Crown Bay Development Platform EFI firmware can be upgraded or reflashed using either of two methods:

- A standalone serial peripheral interface (SPI) programmer, e.g., dediprog SF100
- AMI* Firmware Update (AFU) utility — afuefi

The AFU utility is available at

http://www.ami.com/support/product.cfm

2.1.2 Debugging BIOS Issues

If the Crown Bay Development Platform does not power up completely, the Port 80 code may provide insight into the issue. A complete list of Port 80 checkpoint definitions can be found at

http://www.ami.com/support/doc/AMI_Aptio_4.x_Status_Codes_PUB.pdf

2.2 Intel® BLDK

The Intel® Boot Loader Development Kit (Intel® BLDK) is used for developing customized firmware boot images with limited functionality. It consists of tools, reference platform codebase and documentation.

Note: A BIOS-based solution is recommended for designs that require power management or other advanced functionality at boot time and for designs that require legacy compatibility.

Where to get it

http://edc.intel.com/Software/Intel-Boot-Loader-Development-Kit/

How to install

Developing a firmware image with Intel® BLDK requires a Fedora* 8 host software development environment. The reference platform codebase (containing object libraries for initialization and control tasks, sample source files for using the libraries, and sample make files for building a firmware image) that is most closely aligned to the development target should also be downloaded. Lastly, the Development tools should be downloaded and installed. Now you're ready to launch the Development application and begin working with the selected codebase.

3.0 Operating Systems

The Intel Atom E6xx Processor Series is supported by all the leading embedded operating systems:

- Linux* – MeeGo, Fedora*, Yocto*, Wind River Linux*

- Windows* – Windows Embedded Standard*, Windows XP*, Windows 7*, Windows CE*, Windows Embedded POSReady*
- Other – VxWorks*, QNX*, Green Hills INTEGRITY*

Let's look at how to get and install each OS.

3.1 Linux

3.1.1 MeeGo

MeeGo is an open source Linux project targeted at a range of client devices: handsets, netbooks, tablets, connected TVs and in-vehicle infotainment (IVI) systems. MeeGo is a merger of Maemo* and Moblin projects and supports multiple architectures (e.g., ARM*, Intel Atom).

MeeGo IVI (In Vehicle Infotainment) release supports the Intel Atom E6xx Processor Series for the Crown Bay Development Platform. MeeGo 0.9 IVI and MeeGo 1.0 IVI builds are validated with the Crown Bay platform.

Where to get it

- MeeGo 0.9 IVI:

  http://repo.meego.com/MeeGo/builds/0.9/0.9.80.2.20100512.1/ivi/images/meego-preview-ivi-noemgd-ia32/

- MeeGo 1.0 IVI:

  http://meego.com/downloads

How to install

Note: Superuser login and password: meego

Once you boot the system with live MeeGo image, the installer guides through intuitive menus to complete the installation. For more details, follow the instructions at:

http://meego.com/devices/in-vehicle/installing-meego-your-intel-ivi-system

Resources

http://wiki.meego.com/Main_Page

Note: If you get an error using the GUI installer or don't have a GUI display after installation then you'll need an updated video BIOS (VBIOS). You can either get the latest VBIOS as part of the Intel Embedded Media Graphics Drivers (EMGD) package or generate customized VBIOS using the configuration editor utility ("CED") provided with the Intel EMGD package.

3.1.2 Fedora

Fedora is Linux-based operating system that includes the latest open source software. It is developed by the community-supported Fedora Project and sponsored by Red Hat*.

The Fedora 11 release supports the Intel Atom E6xx Processor Series for the Crown Bay Development Platform. There are two different Fedora installer configurations available: headless installer and a complete installer. The headless installer has a small footprint but is text mode only. The complete installer provides a rich feature set, including a GUI.

Where to get it

https://linuxlink.timesys.com/downloads/intel_linux_installer

How to install

The basic installation instructions and images are available on the Timesys* download page. For dual-boot systems, it is recommended to install Windows first and only use a portion of the total space. Once that installation is complete, install the Fedora OS in the remaining free space.

Note: Superuser login – root and password: fedora

Tip: If you're installing over an existing Linux image then you'll need to remove the previous logical volume manager (LVM) configuration before installing Fedora.

Note: If you get an error using the GUI installer or don't have a GUI display after installation then you'll need an updated VBIOS. You can either get the latest VBIOS as part of Intel Embedded Media Graphics Drivers (EMGD) package or generate a customized VBIOS using the configuration editor utility ("CED") provided with the EMGD package.

3.1.3 Yocto

Yocto*, an upstream open source project under the stewardship of the Linux Foundation, provides distribution building tools, current and tested metadata and open source components for building a custom distribution, image and SDK for a deeply embedded device. The Yocto Project through the Poky* build tool provides an open source development environment targeting the ARM, MIPS*, PowerPC* and x86 architectures. A Yocto BSP supports the Intel Atom E6xx Processor Series for the Crown Bay Development Platform.

Where to get it

http://www.yoctoproject.org/

How to install

Follow the instructions provided by a guide:

http://www.yoctoproject.org/docs/yocto-quick-start/yocto-project-qs.html

3.1.4 Wind River Linux

Wind River* Linux is the commercial Linux development platform for embedded products. Wind River Linux 4.0 supports the Intel Atom E6xx Processor Series for the Crown Bay Development Platform. A Wind River Linux 4.0 BSP is planned for Q1 2011.

Where to get it

The Wind River Linux 4.0 BSP should be available from Wind River OLS (Online Support) at

http://windriver.com/products/bsp_web/

How to install

Installation instructions are available with the Crown Bay Development Platform BSP.

3.2 Windows

3.2.1 Windows Embedded Standard 2009

Windows Embedded Standard 2009* is the follow-on version to Windows XP Embedded* OS.

Where to get it

Microsoft* website or Microsoft's Developer Network (requires subscription)

How to install

1. Set up the host development system by downloading and installing the Windows Embedded Standard 2009 toolkit from

   http://msdn.microsoft.com/en-us/library/bb847995.aspx

2. Componentize the Intel EG20T platform controller hub (PCH) drivers by importing `.sld` files

Note: Windows XP drivers needed for componentization for Windows Embedded Standard 2009 can be found at:

http://www.intel.com/cd/edesign/library/asmo-na/eng/450832.htm

3. Build and boot the runtime image for the target platform.

For detailed instructions on the above steps, refer to:

http://www.intel.com/cd/edesign/library/asmo-na/eng/446692.htm

3.2.2 Windows Embedded Standard 7

Windows Embedded Standard 7 is a Windows 7 OS in componentized form for the embedded market. It is available as:

- A 32-bit or 64-bit runtime image
- Windows Embedded Standard 7 toolkit image.

Where to get it

Microsoft website or Microsoft's Developer Network (requires subscription)

How to install

To install the runtime image, boot the system with the runtime image DVD. Select the Image Builder Wizard (IBW) to deploy a runtime image of Windows Embedded Standard 7 on the target platform. For installation steps refer to:

http://edc.intel.com/Software/Installation-Guides/Windows-Embedded-Standard-7/

3.2.3 Windows CE 6.0

Windows CE 6.0 is the realtime OS for embedded devices. Intel typically hosts its Atom platform Board Support Packages (BSPs) through third-party vendors Bsquare*, Adeneo* and Wipro Technologies*.

Where to get it

Download Windows CE 6.0 R3 from Microsoft website or Microsoft's Developer Network (requires subscription)

Download the Crown Bay Development Platform Windows CE BSP from the Bsquare, Adeneo and Wipro Technologies websites.

How to install

1. Install Windows CE on the host development machine. Windows CE installation instructions are available at

   http://www.microsoft.com/downloads/en/details.aspx?FamilyID=BC247D88-DDB6-4D4A-A595-8EEE3556FE46&displaylang=en

2. Install Windows CE BSP on the host development machine and build the BSP for the target platform. Installation and build instructions are available in the documentation included with the Windows CE BSP package.

3.2.4 Windows Embedded POSReady 2009

Windows Embedded POSReady* is an XP professional-based OS, tailored to Point of Service platforms.

Where to get it

Download from the Microsoft website or Microsoft's Developer Network (requires subscription)

How to install

The Windows XP and Windows Embedded Standard POSReady uses the typical Windows installer. Detailed installation instructions are available at

http://support.microsoft.com/kb/978307

Integrating Intel EG20T PCH driver

Follow the instructions documented in the Windows XP and Windows Embedded Standard POSReady driver packages at:

http://edc.intel.com/Platforms/Atom-E6xx/#software

Resources

Intel EG20T PCH drivers for XP and POS Ready:

http://www.intel.com/cd/edesign/library/asmo-na/eng/450832.htm

Note: SATA AHCI driver issue - Intel EG20T PCH SATA does not support an IDE interface that is compatible with legacy drivers, and Windows XP* SP3 does not contain the required SATA AHCI driver natively.

3.3 Other

3.3.1 VxWorks

Wind River VxWorks* provides realtime OSes for embedded markets. VxWorks 6.8 supports the Intel Atom E6xx Processor Series on the Crown Bay Development Platform.

Where to get it

The VxWorks BSP is available on Wind River OLS (OnLine Support) at

http://windriver.com/products/bsp_web/

How to install

Installation instructions are available with the Crown Bay Development Platform BSP.

3.3.2 QNX Neutrino

The QNX* Neutrino* RTOS is a full-featured and robust OS that scales down to meet the constrained resource requirements of realtime embedded systems. QNX Neutrino 6.4.1 will support the Intel Atom E6xx Processor Series. The BSP for the Crown Bay Development Platform is planned for Q1' 2011.

Where to get it

http://community.qnx.com/sf/wiki/do/viewPage/projects.bsp/wiki/BSPAndDrivers

How to install

Installation instructions will be provided with the BSP.

3.3.3 Green Hills INTEGRITY

Green Hills* INTEGRITY* provides realtime OS for embedded products, and will support Intel Atom E6xx Processor for the Crown Bay Development Platform. The BSP delivery date is planned for late 2010.

Where to get it

A BSP will be included as part of the Green Hills INTEGRITY OS.

How to install

INTEGRITY installation instructions will be included with the product CD.

4.0 Device Drivers

The modular design of an Intel Atom E6xx processor-based platform makes it a good fit for several market segments. However, each market segment will need a customized platform with its own unique set of device drivers. For the Crown Bay Development Platform, two set of device drivers are needed:

- Intel EG20T PCH driver for the IO hub
- Intel EMGD for hardware-enabled graphics/video acceleration

4.1 Intel® EG20T PCH Drivers

The Intel EG20T PCH provides the IO functionality for the Crown Bay Development Platform. The IO features include storage, connectivity, PCIe*, USB, etc. A device driver is needed to enable each IO feature. The following is a list of PCH drivers:

- Gigabit Ethernet Driver [includes utility to program MAC address]
- SATA Driver [reuses standard native driver for Linux] [Supports AHCI operation only]
- UART
- DMA
- CAN
- IEEE 1588
- I^2C [Master mode only]
- SPI [Master mode only]
- GPIO
- USB Host [reused standard native OHCI/EHCI Host Driver]
- USB Client
- SD/SDIO/MMC [reuses standard native SD/SDIO/MMC Host Driver]
- PCIe Packet Hub

Where to get it

Linux:

http://sourceforge.net/projects/generalembedded/files/

Windows:

http://edc.intel.com/Platforms/Atom-E6xx/#software

How to install

There is a readme in each of the driver packages that instruct the user on how to load the drivers.

Note: For Windows CE, Fedora, and MeeGo, the IOH drivers are included with the OS image/ BSP.

Resources

Crown Bay Development Platform User Guide

4.2 Intel® EMGD

The Intel® Embedded Media and Graphics Driver is used to enable the hardware engine that provides hardware acceleration for 2D/3D graphics and video. Intel EMGD is composed of a runtime graphics driver and a Video BIOS (VBIOS) firmware component.

Where to get it

http://edc.intel.com/Software/Downloads/EMGD/

How to install

Intel EMGD is packaged as an .exe file that needs to be executed to extract the contents. Once the contents are extracted, a Windows utility called Configuration Editor (CED) needs to be run to create customized driver package for specific OS and platform.

4.2.1 Installing on Windows

Installing and uninstalling the Intel® Embedded Media and Graphics Driver on a Microsoft Windows system by using the `setup.exe` program located in the `IEMGD_HEAD_Windows\Utilities` folder.

4.2.2 Installing on Linux

The Intel® EMGD is validated with MeeGo IVI and Fedora 11. The Intel EMGD contains the Intel EMGD Direct Rendering Manager (DRM), which controls Display, Memory management, Interrupts, Device initialization and Command queuing. This is a sub-DRM driver that requires the main kernel DRM driver to be loaded.

4.2.2.1 For MeeGo IVI

Note: Before installing the Intel EMGD, prepare the system by installing the kernel-ivi-devel package (available at MeeGo repository). Make sure the version of kernel-ivi-devel package is the same as the already installed kernel-ivi.

Untar the Intel EMGD driver package that was created by the CED utility and use the installer script located at **/IEMGD_HEAD_Linux/Utilities/

Tip: If you run into any compilation issue, you can use the following steps to use the manual installer.

1. Run installer scrip located at **/IEMGD_HEAD_Linux/MeeGo1.0/driver/Xorg-xserver-1.7.99
2. Untar emgd_drm package located at **/ IEMGD_HEAD_Linux/MeeGo1.0/driver
3. Compile and install

Note: Make sure to modify the xorg.conf located at /etc/X11/ for the target display before rebooting the system. The CED utility can be used to create the xorg.conf.

4.2.2.2 For Fedora

Note: Before installing the Intel EMGD, prepare the system by installing kernel source (available at Timesys* repository). For step by step instructions, refer to the Intel EMGD User's Guide.

Untar the Intel EMGD package that was created by the CED utility and use the installer script located at **/IEMGD_HEAD_Linux/Utilities/

Note: Make sure to modify the xorg.conf located at /etc/X11/ for the target display before rebooting the system. The CED utility can be used to create the xorg.conf.

Resources

Intel® Embedded Media and Graphics Driver, EFI Video Driver, EPOG, and Video BIOS for Windows XP and Linux* User's Guide*

5.0 Tools

Hardware-assisted software development tools can help to achieve faster debug time from first power-on at the board-debug level to enabling OS-aware and application debugging. The following subsections list tool vendors that support the Intel Atom E6xx Processor Series.

5.1 Wind River On-Chip Debugging

Wind River* Workbench* On-Chip Debugging (OCD) provides powerful diagnostic capabilities with their multicore-enabled Wind River ICE 2 network-based JTAG emulator and the portable Wind River Probe USB-based JTAG emulator.

http://www.windriver.com/products/OCD/

5.2 Intel® Embedded Software Development Tool Suite

Get a complete Software Development Tools solution for your Intel Atom processor-based embedded system and application software development — coding, compiling, debugging, and performance tuning made simple.

http://software.intel.com/en-us/articles/intel-tools-for-intel-atom-processors/

5.3 Arium

Arium* provides Intel JTAG debugger products and feature-rich hardware and software that is easy to set up and configure, reducing development time. An example is their Linux OS-aware features, which provide seamless application and kernel space debugging.

http://www.arium.com/products/3/Intel-JTAG-Debuggers.html

5.4 Macraigor Systems

OCDemon* from Macraigor Systems* helps ease debugging. The usb2Demon* is a hardware interface device for Intel Atom processors and can be used with the Intel® Embedded Software Development Tool Suite. The probe also can be used with the free Eclipse*-based/GNU* development environment, which can be downloaded from the following website:

http://macraigor.com/Intel/index.htm

5.5 Green Hills

The MULTI IDE combined with Green Hills Probe provide an advanced hardware debug device that connects to the onboard debug ports present on most modern microprocessors, such as IEEE 1149.1 JTAG and BDM enable you to quickly develop, debug, test, and optimize embedded and realtime applications.

http://ghs.com/products/intel_arch.html

Appendix A - Software Component Matrix

A.1 Validated Combinations – Selective Subset Only

Component	Version	
Kernel	2.6.29	2.6.33.5
X Server	1.6.4	1.8.0
Mesa	7.6	7.8
libVA	libVA 1.0.1 or VAAPI 0.31	
MI-X	mixcommon-0.1.8-1.1, mixvbp-0.1.15-1.1, mixvideo-0.1.15-3.1, gst-plugins-mixvideo-0.10.16-1.2	
MPlayer*	mplayer-vaapi-20100713-FULL	
MPlayer Codecs	all-20100303	
CyberLink* PowerDVD*	CyberLink PowerDVD 8.0 (v3204, OEM 2CH update)	

Appendix B - Enabling Media Playback with Hardware Acceleration

Media playback on the Intel Atom E6xx Processor Series platform is optimal when the video decoding is handled by the video engine instead of the CPU. Use of the video engine can reduce the CPU workload significantly. In order to use the video engine, the application, e.g., the media player, needs to use the VAAPI* to communicate with the video driver that controls this video engine.

For Windows

CyberLink* PowerDVD* 8.0 (v3204, OEM 2CH update) is the recommended media playback solution for Windows XP. PowerDVD uses hardware accelerates videos decoding for MPEG-2, H.264 and VC-1 formats.

Where to get it

http://www.cyberlink.com

Note: For improved 1080p video playback, configure PowerDVD to choose VMR-7 as the video renderer instead of VMR-9.

Several steps are needed to set up hardware-accelerated media playback for Linux. The setup involves installing a video acceleration (VA) library (needed by Intel EMGD to communicate with the hardware accelerator), installing multimedia framework like GStreamer* or FFmpeg*, and installing plug-ins and installing the media player like MPlayer*. Finally, the media player may also need to be configured to ensure its VAAPI enabled.

GStreamer multimedia framework provides applications with a common set of plug-ins for such tasks as media decoding, encoding, etc. While the OS may already include several plug-ins, e.g., plug-ins-good, other plug-ins such as plug-ins-ugly, plug-ins-bad may be needed to be installed as well. In addition, Media Infrastructure Accelerator (MI-X) plug-in included with the Intel EMGD package (evaluation purposes only) will need to be installed. MI-X provides hardware acceleration for GStreamer video decode and rendering process by processing and offloading the data to the video engine through Intel EMGD.

The MPlayer movie player supports a wide range of output drivers. MPlayer uses the FFmpeg multimedia framework. In order for MPlayer to use hardware-accelerated video decode, MPlayer needs to be patched to add VAAPI support. The MPlayer with VAAPI patchset is available from:

http://www.splitted-desktop.com/%7Egbeauchesne/mplayer-vaapi/

Resources

Video Encoding Accelerator Solution for Intel® Atom™ Processor E6xx Series White Paper (324328)

Using Gstreamer for Hardware Accelerated Video Decoding on Intel® Atom™ Processor E6xx Series White Paper (324294)

Appendix C - Installing GStreamer Audio

Getting the audio working requires various libraries and plug-ins needed by multimedia applications or media infrastructure such as GStreamer or FFmpeg. In summary, installation requires getting the source for liboil library for FFmpeg, FAAD2* audio codec for MPEG-4/MPEG-2, the GStreamer plug-in for FFmpeg, and compiling/installing them on the target device.

In addition, the following packages should be installed before rebooting:

For MeeGo – pavucontrol pavumeter paman padevchooser paprefs alsaplugins-pulseaudio alsa*

For Fedora – alsa

1. Get into graphics mode and in the lower-right side find the shaded sound icon.
2. Right-click and change the sound properties.
   a. Associate HDA Intel MID (ALSA* mixer)
   b. Select Master; PCM and Headphone

§ §