

Porting MythTV to OpenSolaris and the Mac Mini

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Agenda

- Background
- Hardware and Software Selection
- Porting OpenSolaris to the Mac Mini
- Porting MythTV to OpenSolaris
- Conclusions

Disclaimer

- This work is a personal project and is not associated with any work going on within Sun
- Sun paid for the presentation of the material here, but not the work itself
- No Sun proprietary info was used in the development of this work (Early access, yes. Proprietary, no)
- This is a work in progress

Background

Project Overview

- Saw a home entertainment PC at a trade show
- Wondered if I could build a consumer electronics device based on OpenSolaris
- Mostly done for fun, but I figured something useful would be learned as well
- The work presented here is a small part of the overall project

Why would this I want to do this?

- Years of experience working on set-top boxes, hard-disk-based audio field recorders, and more
- Like to build “boxes” that perform a particular function
- My responsibilities at Sun do not provide opportunity to do work like this

Why would one use OpenSolaris for this?

- Reliability
 - Because as more features are implemented in software, appliance-type devices seem to crash more frequently than older “less capable”, hard-coded devices
- Better software development environment
 - In my experience, set-top box and embedded software development environments are limited

Hardware Selection

- ECS (Elitegroup Computer Systems) P60
- Intel Core Duo
- Intel ICH-7 chip set
- Intel 945GM graphics
- Integrated tuner
- IR remote control
- No US availability



Hardware Selection, Ver. 2a

- Apple Mac Mini
- Intel Core Single/Duo
- Intel ICH-7M chip set
- Intel 945GM integrated graphics
- No tuner
- Apple Remote



Photo courtesy of Apple, Inc.

Hardware Selection, Ver. 2b

- Shuttle XPS X200
- Intel Core 2 Duo
- Intel ICH-7M chip set
- Intel 945GM graphics
- Optional tuner
- IR remote control



Hardware Selection, Ver. 3

- AOpen MiniPC MP945-VDR
- Intel Core 2 Duo
- Intel ICH-7M chip set
- Intel 945GM graphics
- Optional tuner
- IR remote control
- HDMI output
- Available too late



Why use the Mac Mini?

- Availability
- Aesthetics
- Different enough from other PCs that my experience would be helpful to my group at Sun

Mac Mini Selected

- Used base model introduced in Sept. 2006
- 1.66GHz Intel Core Duo processor
- 512MB RAM, shared with graphics controller
- 60G SATA hard disk
- DVI output (with VGA adapter)
- Gigabit ethernet, 802.11g wireless networking, Bluetooth, USB, USB2, 1394

Mac Mini Components

Component

Northbridge
Integrated graphics controller
Southbridge
SATA
IDE
Gigabit ethernet
Wireless networking (802.11g)
HD Audio
HD Audio Codec
IEEE-1394
USB
USB
USB
USB
USB2
IR Remote Control

Hardware

Intel 945GM
Intel 950GMA
Intel ICH-7M
Intel ICH-7M SATA
Intel ICH-7M IDE
Marvell Yukon Gigabit PCI-E
Atheros AR5006EG 802.11b/g PCI-E
Intel ICH-7M HD Audio
STAC 9221
Agere FW323 1394A OHCI Phy/Link
Intel ICH-7M UHCI
Intel ICH-7M UHCI
Intel ICH-7M UHCI
Intel ICH-7M UHCI
Intel ICH-7M EHCI
Apple Remote USB receiver

Connection

Memory, southbridge
DVI output port
See ICH-7 components below
60G SATA disk drive
DVD-R/CD-RW drive (front slot load)
Back panel connector
Internal antenna
HD Audio Codec
Two back panel connectors
Back panel connector
Back panel connector
Back panel connector
Back panel connector
Internally connected to Apple Remote
Back panel connector
Apple Remote

Booting a Mac Mini

- The hardware looks like a PC, but the boot firmware does not
- The Mac Mini boot manager is based on Intel's EFI (Extensible Firmware Interface)
- Apple's implementation is not compliant with the EFI specification
- Solaris does not understand EFI

Software Selection

- MythTV
 - A collection of television applications built on top of PVR and tuner functionality
 - Originally just wanted to lift the OSD (on-screen display) support
- Freevo
 - Briefly considered but not enough functionality

MythTV Description

- Primary application consists of a tuner, PVR and basic infrastructure
- Plug-in applications provide additional functionality
 - MythArchive, MythBrowser, MythControls, MythDVD, MythFlix, MythGallery, MythGame, MythMusic, MythNews, MythPhone, MythVideo, MythWeather, MythWeb

MythTV Dependencies

- Trolltech's qt GUI software toolkit
- LAME MP3 encoder
- MySQL
- XMLTV
- lirc
- freetype 2 (omitted from the paper)

MythTV Information

- Under development for about four years
- Current version number is 0.20
- Reference platform is Linux, also reportedly runs on MacOS X and Windows
- Many other platforms referenced in the configure script and source code, but support not implemented

Porting OpenSolaris to the Mac Mini

OpenSolaris Version

- OpenSolaris distro used is Solaris Nevada
- Original work done on Nevada Build 53
- Migrated to Nevada Build 55b (Solaris Express)
- MythTV development done under Solaris Express Developer Edition

Booting OpenSolaris on a Mac Mini

- Out of the box, Mac Mini will only boot from a HFS+ filesystem
- With updated firmware and Apple's Boot Camp application, Intel-based Macs will do MBR style boot
- Windows, Linux, OpenSolaris will then boot on a Mac Mini (or other Intel-based Macs)

Insert the Install DVD and Go

- After installing Boot Camp, the Mac Mini will boot off of a Solaris Installation DVD and run sysidtool and install-solaris
- There is no networking because the Yukon driver is not included with Solaris Nevada
- install-solaris fails when trying to layout the Solaris partitions

Setting up the Solaris VTOC

- The hardest part of the work completed was setting up the VTOC in the Solaris partition
- Once this was done, install-solaris completed
- The VTOC was set-up using a series of steps determined through trial and error, involving booting the installation DVD and running an application and then booting MacOS and running an application
- See my blog for more info (blogs.sun.com/alanp)

Then what?

- After installation, Open Solaris just worked (for the most part)
- Download and install the Yukon driver from Marvell and networking was enabled
- Minor issues with drivers (ata and asy)
- Missing drivers for Atheros wireless, SATA (the HD is accessed in Legacy ATA mode) and the Apple Remote (need to develop driver to work with MythTV's AppleRemote object)

Is that it?

- Audio output does not work
 - Intended to use OSS (Open Sound System) from 4Front Technologies
 - ossxmix (not ossxmixer, as indicated in the paper) reports audio streams, but nothing is presented on the speaker or headphone
- Video does not display correctly on a HDTV
 - Not reported in the paper
 - Display size is not detected
 - Video quality is poor

Porting MythTV to OpenSolaris

Issues encountered

- Nevada's /bin/sh not compatible with syntax used in the configure script
- Nevada's default grep(1) and tail(1) not compatible with the XPG4 syntax used in the configure script
- Started off compiling using the Sun Studio 11 compilers, but some files could not compile (update – now working with Alexander Gorshenev at Sun on this issue)

More issues encountered

- Disabled Xinerama support because only one display is used in my application, but the MythTV code still made Xinerama calls anyway
- Disabled IEEE-1394 support because it would have required writing adaptation libraries to the Linux 1394 interfaces
- Removed UPnP support
- Lots of header file issues because OpenSolaris defines things in different places than MythTV expects

Even more issues encountered

- The implementation of the AppleRemote object assumed only MacOS would be accessing the Apple Remote (and included MacOS calls)
 - Designed OpenSolaris Apple Remote driver and AppleRemote object
- Encountered issues linking MythTV applications
- And then time ran out and I had to write the paper

MythTV Port Status

- All of the source code compiles, but linking the application fails for missing symbols
 - A couple thousand symbols missing
 - The problem seems to be a name demangling issue, but it was not investigating sufficiently to absolutely determine this
 - Problem later reduced, but not eliminated
- Did not attempt to build the plug-in applications

MythTV Porting Issues (Update)

- The missing symbols when linking the MythTV applications seemed to be caused by the qt library not being built correctly
- Problem went away when gcc version of qt downloaded from blastwave
- Now only one object is missing
- Installed other packages from blastwave that were originally built from source just to be safe
- Stopped work to catch a plane for Berlin

Conclusions

- Based on experience associated with this work, it is easier to port OpenSolaris to a new PC platform than it is to port a moderately complicated application to OpenSolaris
- The OpenSolaris Mac Mini port was stable enough that doing the MythTV porting work on another, stable system was unnecessary
- No conclusions concerning whether OpenSolaris is suitable for use in set-top box/consumer electronics applications

Future work

- Finish the MythTV port as it relates to the overall project
- Finish the Apple Remote driver
- Debug the audio and HDTV video issues
- Find someone to port the remaining MythTV bits and integrate the code changes into MythTV code base

Thank you

- If you have any questions or wish to get involved with this work, let me know
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