



jazelle[®] - ARM Java[™] Acceleration

What is being demonstrated

- Direct execution of bytecode in hardware
- Highest performance Java with real applications
- Minimal memory overhead
- Low power-consumption
- Simple and quick product integration
- Robust and proven technology
- Available on a wide variety of Java technologies from a number of Java platform vendors
- Optimum solution for mobile Java platforms with Linux

Hardware Information

ARM RealView[®] Platform for ARM926EJ-S

How was Linux improved

- Kernel support for Jazelle execution
 - Cache handling routines
 - Exception handling
- Fully exploit hardware capabilities available with Jazelle enabled ARM processors
- Optimized execution of Java virtual machines

Patch Availability

www.kernel.org mainline tree



ARM® TrustZone™ Technology with Linux

Ian Rickards

What is being demonstrated

Linux applications using secure services provided by software running in TrustZone on ARM1176JZ(F)-S.

Demonstrated with

- Secure client-server communication (cryptography)
- Secure storage (key management and SIMLock)
- Image verification (detect OS changes/hacks)
- Secure payment services (e-commerce) and trusted User Interface.

TrustZone provides a hardware enforced separation of Normal and Secure execution worlds.

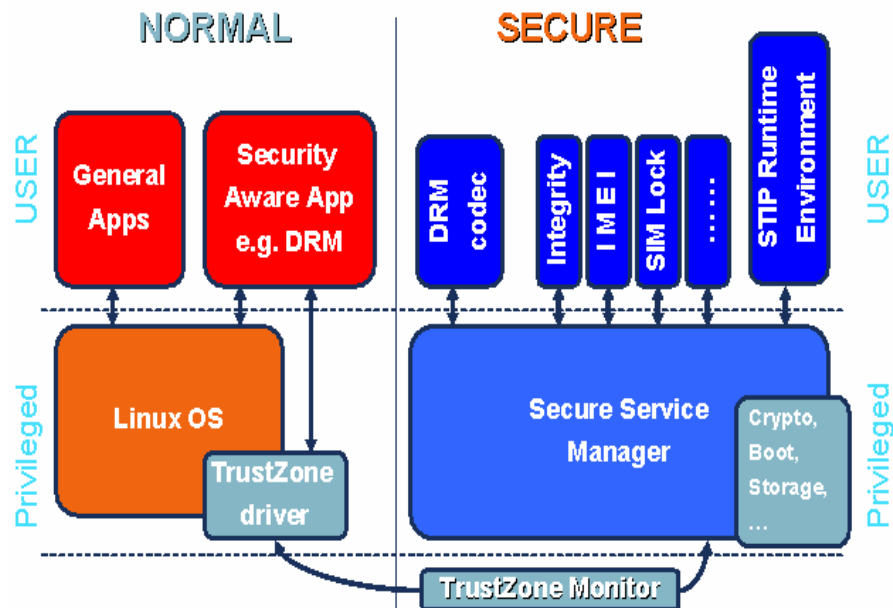
This demo uses Linux 2.6.6 kernel and a TrustZone device driver. A QT application is used to simulate basic handset functionality.

Hardware Information

- RealView® Integrator™ Compact Platform
- ARM1176JZ(F)-S FPGA implementation

How was Linux improved

- Isolated execution environment
- Enables the evolution of secure and non-secure software sides separately.
- Secure storage (e.g. key management)
- Image verification
- Crypto services to secure and transmit key data
- Secure e-commerce via secure peripherals enabling trusted user interface





Linux on ARM Symmetric Multiprocessor Core

Kevin Welton

What is being demonstrated

- Includes four ARM9™ class CPUs
 - Fully compatible with ARMv5TEJ ISA
 - 32-bit RISC processing core with ARM and Thumb instruction sets, plus SIMD and Jazelle support
- Synthesis configurability
- High efficiency coherent memory sub system
 - Localized resolution and control over cache coherency
- Software controlled interrupt sub system
 - Ability to migrate interrupt handlers to least loaded processor with integrated operating system kernel support
 - Low-latency inter-processors (IPI) and I/O interrupt distribution.
- Low-power design
 - Minimize system overhead and power requirements
- Compatible with existing design flows

Hardware Information

- RealView® Integrator™ Compact Platform
- ARM926MP Processor, 9MHz System Clock

How was Linux improved

- Kernel locking mechanism for SMP environment
- Interrupt distribution mechanism
- Adaptive Power management
- Support for OProfile

- Use of Advance Operating Systems features provided by the new ARMv6K ISA.
- Kernel and development tool support for Thread Local Storage
- CPU-local timer and watchdog

(These features developed for new ARM11-based MPCore system)

Patch Availability

Patches contributed to main kernel www.kernel.org



Intelligent Energy Management (IEM) Software

Adrian Peirson

What is being demonstrated

- Control of CPU frequency and voltage using:
 - Performance prediction algorithms.
 - Hardware Intelligent Energy Controller (IEC)
- Demonstration using video playback and simple games to display IEM levels.

How was Linux improved

- Addition of kernel-side hooks to monitor task activity
- Develop prediction algorithms in kernel module

Hardware Information

- ARM/Synopsys DVS926
 - ARM926EJ-S based platform
 - Wider range of operating points

Patch Availability

OS hooks patch available on request



<Qplus Target Builder> <ETRI>

What is being demonstrated

Qplus Target Builder is a convenient system configuration Tool for embedded linux system developer

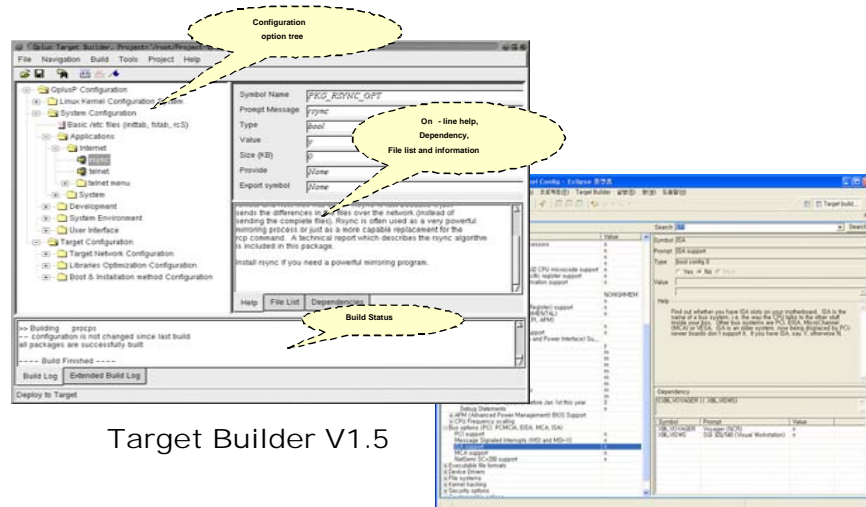
- CELF patch included BSP
- Linux kernel/Application/Target configuration
- Deploy made root file system image
- Fine-grain control of system; file-list, compile option, and more...
- Automatic dependency checking/Library optimization
- other our tool usage and convenient point for construction of embedded linux system
- Target Builder V1.5 : CML2 based implementation
- Target Builder V2.0 : kconfig based implementation

Arch	Board
I386	Generic-i386 board, ETRI HomeServer VIA EPIA-M board, Intel i810/i815 board Transmeta board
ARM9	Samsung SMDK2400, SMDK2440 Samsung ESTK2440
StrongArm	Zaurus, IPAQ
XScale	IXDP425
MIPS	PB1500
PPC	SWAN-II

How was Linux improved

We constructed the embedded linux system by 'point and click' user interface with a large amount of linux kernel sources, libraries, and application programs

- Creating the working embedded Linux system can be done by just clicking proper components as following figures



Target Builder V1.5

Target Builder V2.0

Patch Availability

This toolkit is available in the sourceforge.net and will be available in the forum archive page ASAP



Efforts toward improving application boot up time

Fujitsu Prime Software Technologies Limited

What is being demonstrated

Some efforts for reducing application boot up time

Target application: intent® (<http://www.tao-group.com>)

Characteristics of the target application:

- needs a big image file including codes, data and so on.
- loads it from a storage into memory in startup time.

Our approach:

Application side:

- front-load some data processing needed in run-time.
- change the file loading scheme.
read(2) → mmap(2)

OS side:

customize file system cache control.

- eliminate redundant page copies.
- reduce page faults

intent ready!

JavaVM, Web browser,
Rich AV system, etc...



How was Linux improved

•customizing file system cache control

•Read(2) vs. mmap(2)

Instead of loading whole data with read system call, mapping a file with mmap system call is much faster to start up applications. In this case, data will be demand loading during execution.

•Eliminating redundant page copies

When demand loading is occurred, data from a file are kept in memory as "file system cache" and mapped to a process address space. In write access case, the file system cache is copied to a newly allocated memory page. This page can be freely modified by the process which maps it.

Suppose a file is mapped or accessed by only one process, copying page mentioned above is redundant. We can convert file system cache to private pages immediately.

There is a side benefit which reduces memory consumption.

•Reducing page faults

Process address space are accessed with read then write operations. In that case, page fault will be handled twice. With using the above page copy elimination, the second page fault can be reduced.

•Controlling API

It should be controlled per file or virtual memory area. The fcntl system call or mmap system call are candidates for expansion.

Patch Availability

Not decided yet

Hardware Information

TMM1000 evaluation board (<http://www.towa-meccs.com>)

- SH3(7709) 133MHz, 32MB RAM, 4MB FlushROM
- running sh-linux 2.4.27

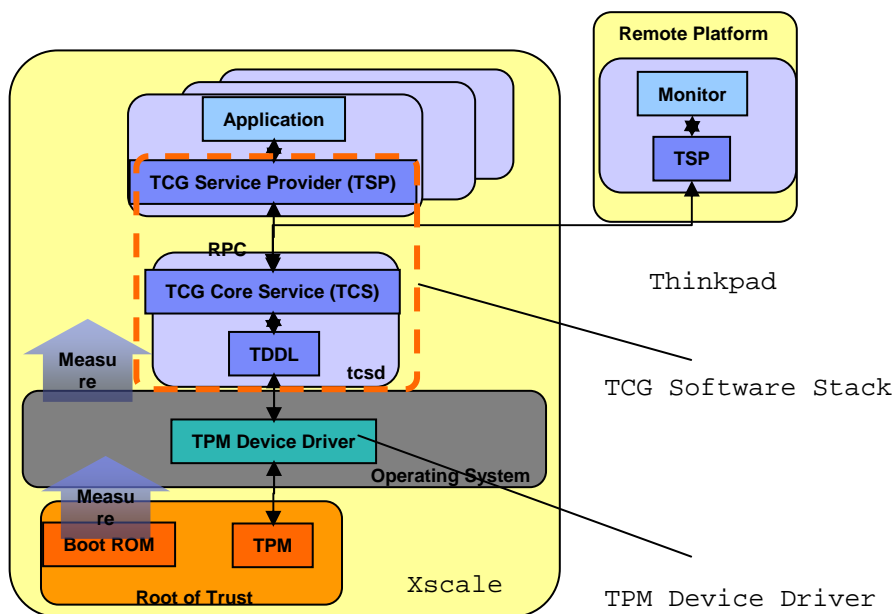


Integrating TCG Technology in Linux

IBM

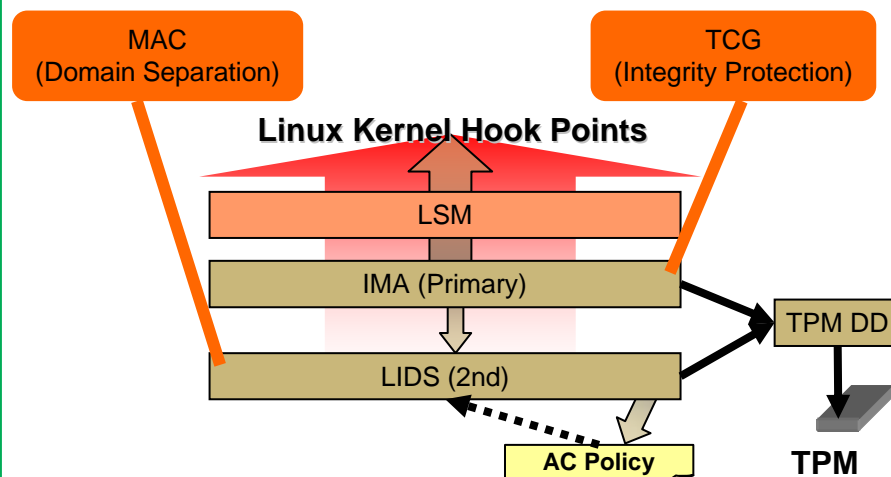
What is being demonstrated

TCG Technology running on Embedded Linux



How was Linux improved

- TCG Architecture is adapted to Embedded Linux Platform
- TCG will be able to provide an Assurance of the whole Linux Runtime.
- TCG provides Secure Storage based on the Platform Integrity



Hardware Information

Arcom Viper + PC104 TPM card

Patch Availability

Soon to be released from Arcom



XIP Linux Platform

Intel Corporation

What is being demonstrated

An eXecute-In-Place Linux kernel and application stack:

- ✓Fast Boot
- ✓Fast application response
- ✓Reduced RAM requirements (low power)
- ✓Reduced total memory requirements (low cost)

Hardware Information

- Intel PXA270 Xscale processor
- 64MB RAM
- 32MB Intel Wireless StrataFlash L18

How was Linux improved

- ✓Cached reads in MTD for Intel StrataFlash – Improves read speed from Flash >10X.
- ✓XIP cramfs with cached read and COW – Improves read speed, allows application XIP
- ✓Read While Write MTD – allows writing or erasing while executing code on the same flash.
- ✓‘make xiplmage’ – builds XIP kernel for all ARM targets in 2.6.9+

Patch Availability

Available today.

2.6.11 will likely contain all but the XIP cramfs patches.



A Proof-of-Concept Streaming Media Player

Intel Corporation

What is being demonstrated

An example streaming media player using only free and open source software on an Intel-based developer's platform for consumer electronic products.

- ✓ Concurrent record, playback and streaming of media
- ✓ Effectiveness of using a GStreamer filter graph
- ✓ Picture-in-Picture playback
- ✓ Dynamic discovery of media server
- ✓ Independent channel control
- ✓ Alpha-blended UI

Hardware Information

- Mobile Intel Celeron processor
- Intel 830M chipset

How was Linux improved

AVG Middleware for PVR/DSTB solutions that:

- ✓ Is well-defined and generic
- ✓ Uses GStreamer and DirectFB
- ✓ Is X-independent, lightweight and extensible

Patch Availability

Pending



Renesas, Hitachi, Lineo

LKST is a kernel debugging tool for Linux which traces kernel state transition. LKST was originally implemented on IA-32 based PC server and now is available for Embedded Systems.



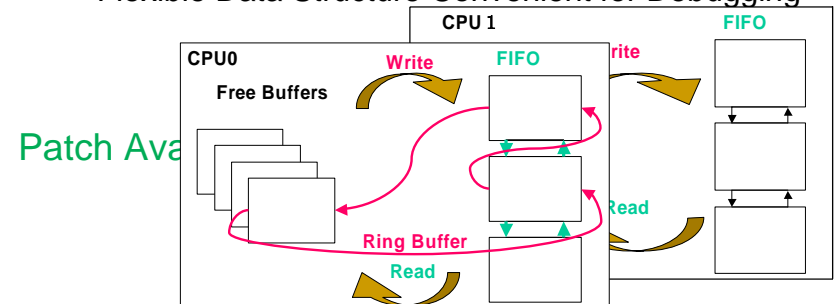
- fast and slim-line insertion to arbitrary kernel locations



-- Linking Event with Event Handler



-- Flexible Data Structure Convenient for Debugging



Hardware Information

IA-32 PC Server
SH-4(RTS7751R2D), MIPS(RHBMA4400CE),
OMAP(Innovator)

Hardware Information

The patch will be available in the forum patch archive
and at <http://sourceforge.net/projects/lkst/>



Linux reference system for Panasonic SoC

Matsushita Electric Industrial Co., Ltd. (Panasonic)

What is being demonstrated

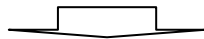
AV Mobile Reference System using Linux 2.4 with CELF Specification

- Boot UP

- Approach of Fast Boot Up with
'Calibrate Delay Avoidance' and 'Kernel XIP'

- Sounds/Graphics

- MP3 sounds by MPEG321 (Open Source) using ALSA
- MPEG-4 image (by Original Video Codec Engine)



All results are being ported to "Integrated Platform"

- DTV Mobile phones etc.



Hardware Information

Panasonic SoC

- CPU Core: ARM926EJ-S (144MHz)
- Original Video Codec Engine

How was Linux improved

Adopt CELF Specification into Linux 2.4

- ☒ Already covered
- ☒ Under porting

Startup Time

- ☒ Calibrate Delay Avoidance
- ☐ IDE NoProbe
- ☒ Kernel XIP
- ☐ Timing API

Power Management

- ☒ Platform Suspend/Resume
- ☒ Device Power Management
- ☐ Platform Dynamic Power Management
- ☐ Variable Scheduling Timeouts

Audio/Video/Graphics

- ☒ Audio (ALSA)
- ☐ Video-in/Capture (V4L2)
- ☒ Video-out/Graphics (Framebuffer)
- ☒ Video-out/Graphics (DirectFB)

Realtime

- ☒ Preemptible Kernel
- ☒ O(1) Scheduler
- ☐ Interrupt Threads
- ☐ Soft-IRQ Threads
- ☒ POSIX Timers
- ☐ POSIX Message Queues
- ☐ Priority Inheritance on User Mutexes
- ☐ Interrupt priorities
- ☐ Prioritized wait queues

System Size

- ☒ Typical Embedded Boot
- ☒ Kernel XIP
- ☒ Compress FS (Initrd)
- ☒ Compress FS (Cramfs)
- ☒ Compress FS (JFFS2)

Security

- ☐ Protected RAM File System

Patch Availability

Not study yet



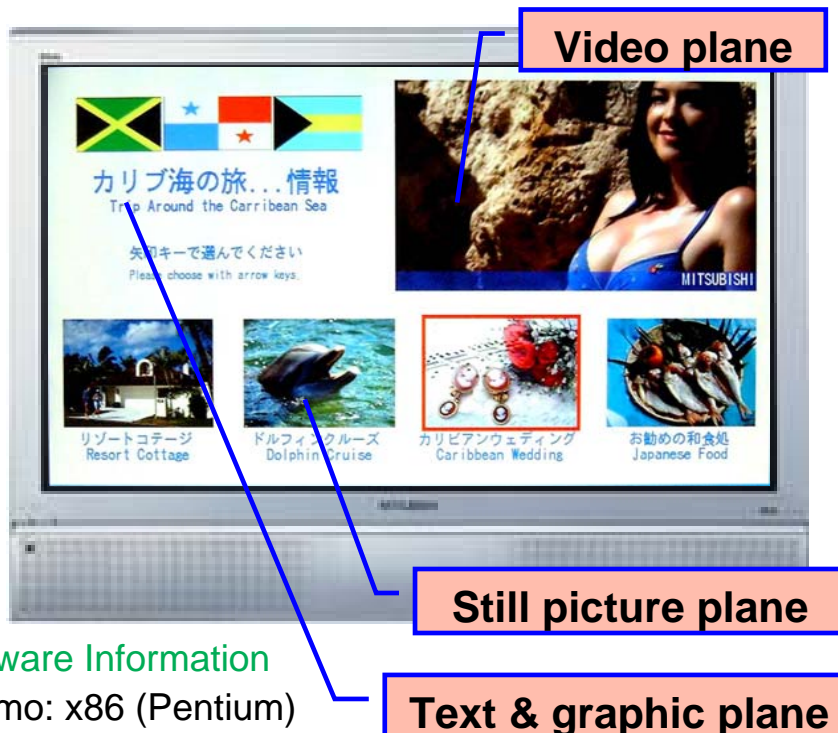
ARIB data-broadcasting browser

Mitsubishi Electric Corp.

ARIB: Association of Radio Industries and Businesses
(The standard body for broadcasting in Japan)

What is being demonstrated

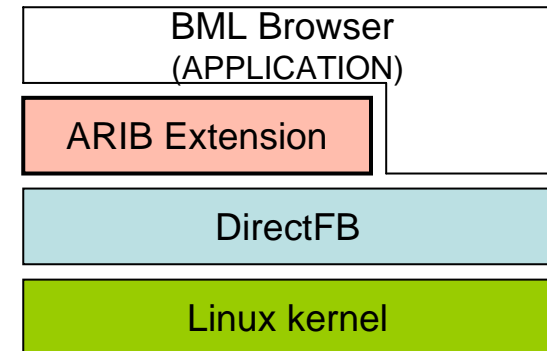
A prototype of ARIB data-broadcasting browser is built on DirectFB with extension. It presents reproduced images of data-broadcast multimedia contents, composed of a video, still pictures, texts and graphics.



How was Linux improved

With the extension we have made, DirectFB well supports AVG requirements of the ARIB data-broadcasting, such as composition of multiple graphics planes and video plane.

Because DirectFB itself already supports MHP, this extended window system is globally applicable to CE devices like DTV/STB/DVD as their software platform.



BML: Broadband Markup Language

Patch Availability

Not decided yet (but, under positive consideration)

Hardware Information

Demo: x86 (Pentium)
possibly any hardware



VOIP over GStreamer

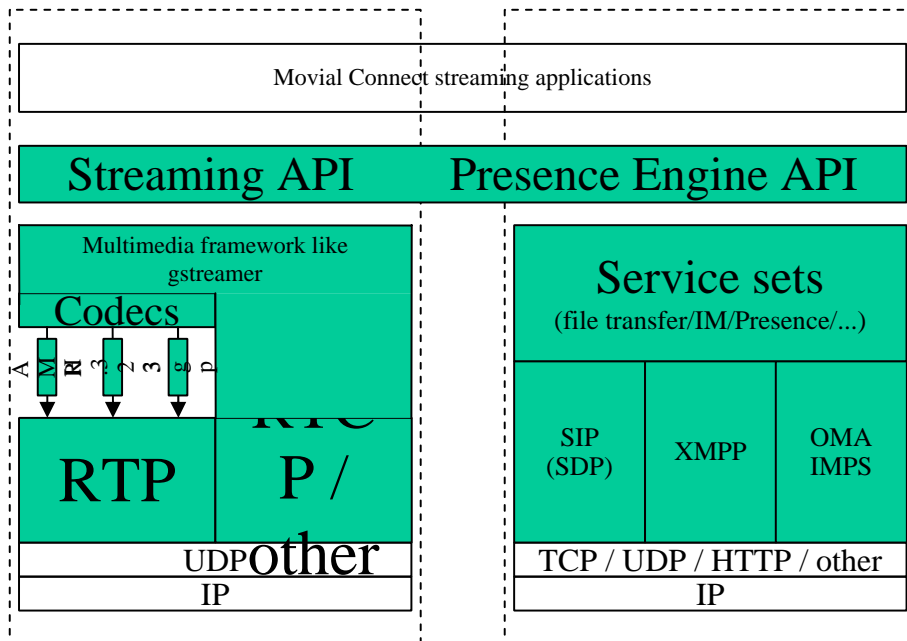
Markku Ursin, Juha Ilmelä / Movial Oy

What is being demonstrated

VOIP call between two Linux systems. Architecture:

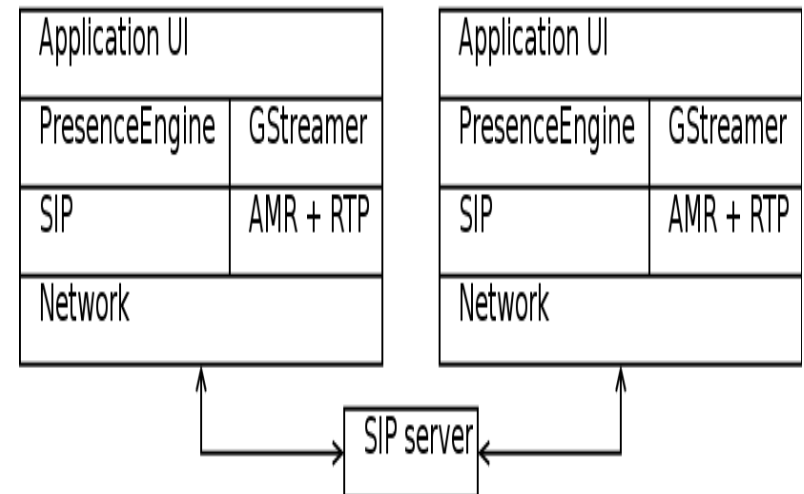
Multimedia engine for IMS

Presence Engine



How was Linux improved

- Proof-of-concept VOIP/SIP application using the GStreamer multimedia framework
- GStreamer AMR-codec plugin (3gpp ref impl)
- Bugs identified and fixed in Gstreamer



Patch Availability

<http://gstreamer.freedesktop.org/>

Hardware Information



Scratchbox – Cross compilation environment

Markku Ursin, Juha Ilmelä / Movial Oy

What is being demonstrated

Cross compilation environment **Scratchbox**:

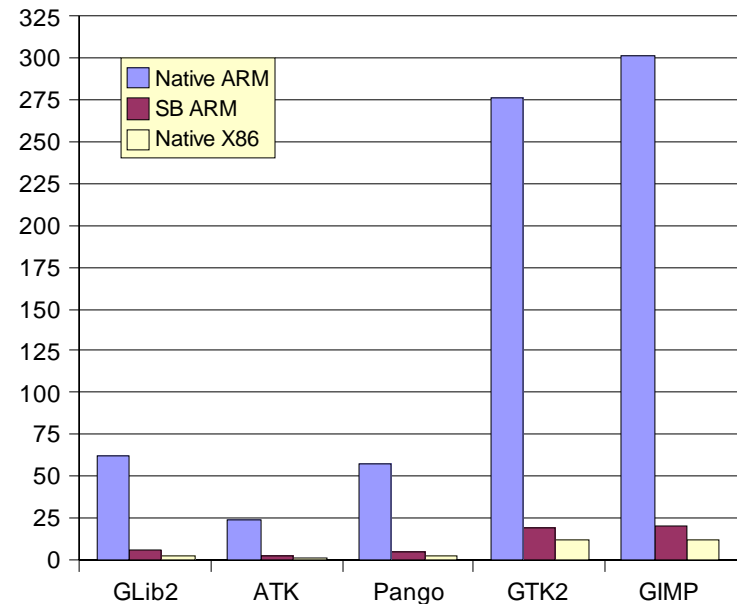
- Reduction of target compilation times by 90%
- Configuration and compilation of open source software packets for target device easy as for your Linux desktop

How Scratchbox works:

- sandboxed build environment
 - libraries seen by the toolchain are those that are present on the target device
 - target CPU code is detected and executed on the *CPU transparency device* (or an emulator)
 - File system shared via NFS mounts between the compile PC and the

How was Linux improved

Compilation times (minutes)



Patch Availability

<http://www.scratchbox.org/>

Hardware Information

Normal x86 PC as the compilation host

HP iPaq as the CPU transparency device

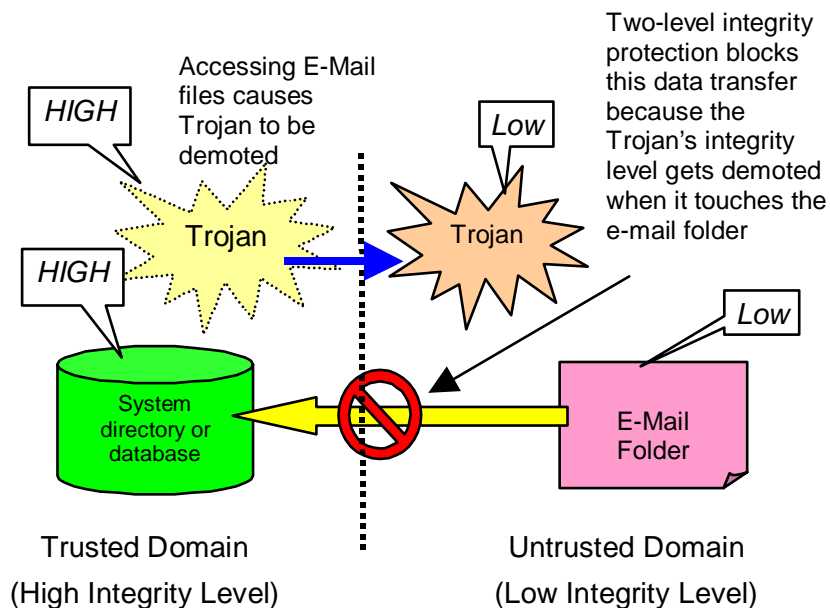


LOMAC LSM Security module

Panasonic

What is being demonstrated

A simple Mandatory Access Control (MAC) based security using “low water-mark” model (LOMAC) implemented as a Linux Security Module (LSM)



How was Linux improved

- LOMAC was originally implemented as a Linux Kernel Module (LKM) by NAI Labs. It uses Biba's low water-mark model:
 - Mediate access to critical files by un-trusted programs by monitoring the behavior of trusted programs and reducing the privileges of those that misbehave.
 - It has a relatively small footprint compared to more complicated Linux security modules such as SELinux, hence suitable for CE devices.
- The Linux Security Framework (LSM) provides mechanisms to use “plug-in” security modules.
- The demonstration shows LOMAC implemented as a LSM.

Hardware Information

Zaurus SL-6000L

Patch Availability

Soon to be released

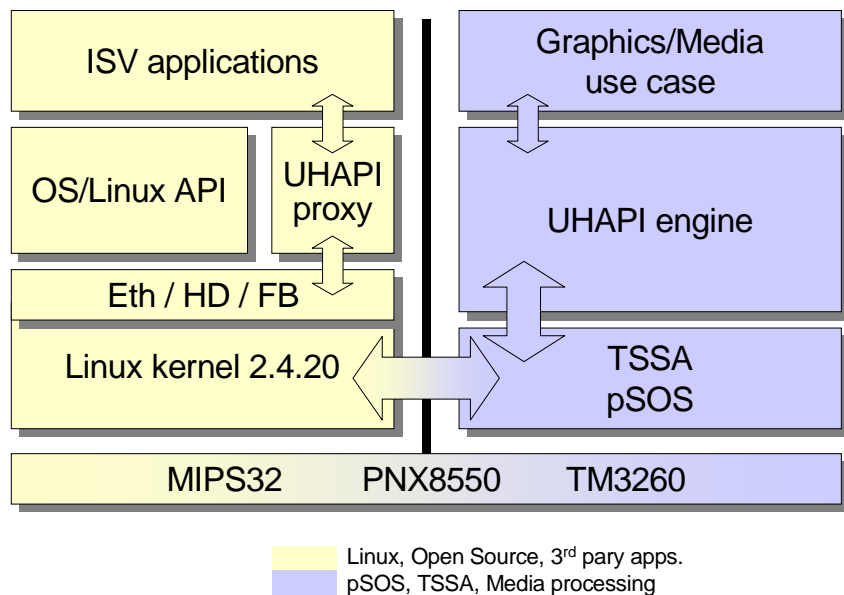


Philips Nexperia: a media-rich Linux experience

Philips Semiconductors

What is being demonstrated

The NH8550 L1 SDK Architecture.



How was Linux improved

The NH8550 L1 Software Development Kit is based around the powerful Nexperia PNX8550 SoC (System on Chip).

The PNX8550 has a MIPS32 running Linux with multiple framebuffers and media extensions accelerated by dedicated hardware and two TriMedia VLIW processors.

From a user perspective, the PNX8550 provides a CE platform with a rich set of devices and API supporting various Audio, Video and 2D Graphics applications.

Hardware Information

Philips PNX8550 multi-core IC on ATSC Motherboard

Patch Availability

N.A. (CELF 2.4.20 kernel)



3D GRAPHICS (AURORA SYSTEM)



Specially supported by



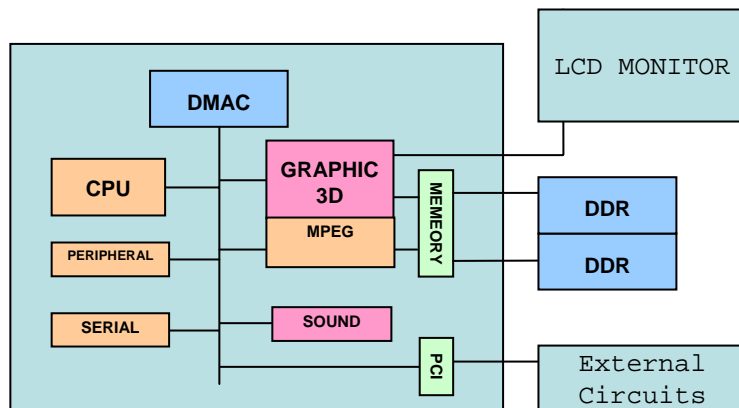
What is being demonstrated

Dramatically Beautiful Graphics Image on Embedded LINUX.

Triangle Drawing: 10Mpoly/s

Pixel Fill Rate: 150Mpixel/s

System Configuration



How was Linux improved

SH4 Specific Minor Tuning on 2.6
to improve the interrupt response 100-500μsec.

Synchronization API has been added.

Hardware Information

Renesas : SH-4 core (300MHz)

Power VR : MBX+VGP (150MHz)

Patch Availability

Not Decided Yet



2D GRAPHICS Framework (DirectFB, GTK+, Dillo)



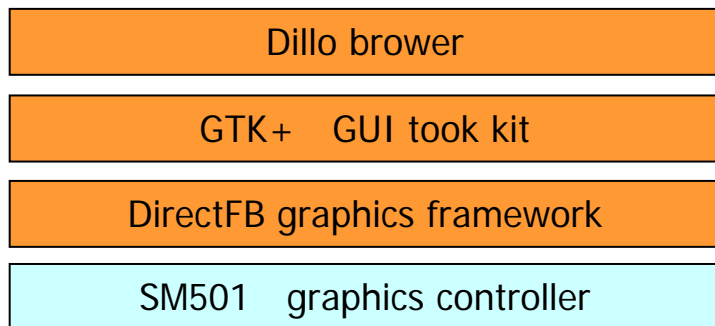
What is being demonstrated

Light weight embedded Graphics Framework

- DirectFB optimized for SM501
- GTK+ runs on DirectFB, not on X11
- OSS Web browser "Dillo" runs on GTK

<http://www.dillo.org/>

Software Configuration



How was Linux improved

Web browser application runs on embedded 2D graphics framework without X11 support.

DirectFB supports H/W 2D drawing capability built in SM501, that can achieve enough graphics performance with low-power consumption.

GTK+ combined with DirectFB can be used for embedded graphics framework, that can support generic GUI application like Web browser.

kernel	: 2.6.7
DirectFB	: 0.9.20
GTK+	: 2.0.9
Dillo	: 0.6.6

Patch Availability

Soon available on CELF wiki page
DirectFB SM501 driver would be post to community

Hardware Information

Renesas	: SH-4 [SH7751R]	(240MHz)
Silicon Motion	: SM501	2D graphics accelerator



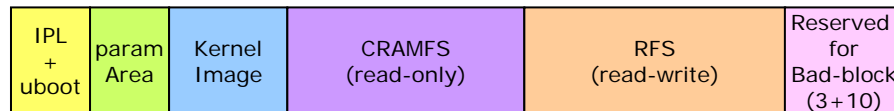
Linux RFS – a NAND Flash File System Solution for Linux

Samsung Electronics

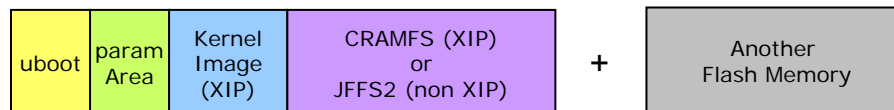
What is being demonstrated

Linux S/W stack for next generation NAND flash memory

- Using OneNAND as a unified storage
- Booting from OneNAND (comparison with NOR XIP)
- Using Linux RFS for code & data storage
- Performance benchmarking of RFS

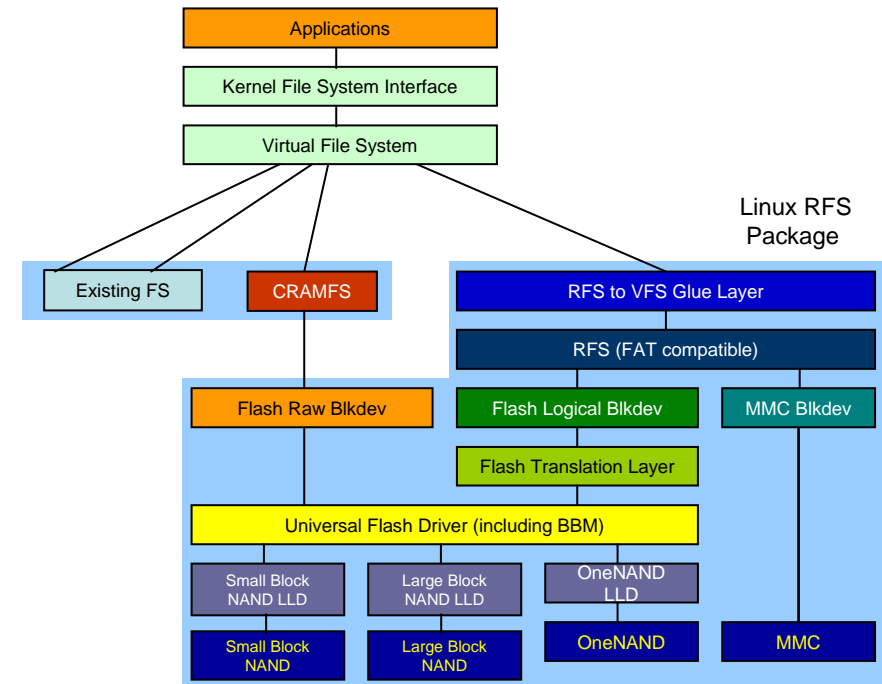


<OneNAND Flash Layout>



<NOR Flash Layout>

How was Linux improved



Hardware Information

OMAP5912 Starter Kit from Spectrum Digital

- CPU: TI OMAP5912 (192MHz)
- RAM: 32MBytes DDR RAM
- Flash Memory: 32MBytes NOR, 64MBytes OneNAND

Patch Availability

Linux RFS is a proprietary product that is supplied to Samsung's NAND customer
(However, source codes of device driver will be open sourced)



MINIKET – uClinux based Memory Camcorder

Samsung Electronics

What is being demonstrated

* uClinux based CE product in the market

- Light-weighted foot-print

- uClinux Kernel : 403KB
- FS for NAND module : 110KB
- device driver modules : 337KB
- main app : 588KB
- UI resources : 1.6MB

* all binaries are uncompressed image.



- Guarantees simultaneous real-time processes :

- MPEG4 D1(720x480) full frame AV encoding
- 8 Mb/s/sec. bit-stream recording into 1-chip NAND using FAT compatible FS
- auto focus / auto exposure / auto white balance
- x10 optical zoom motor control / image stabilization
- MPEG4 Trick-Play at x1/2 ~ x16 times

- Boot-time (cold-boot)

- about ~0.8 sec to main() of app.

* takes ~ 80msec. to shell(sash)
for vanilla kernel stored in NOR flash.

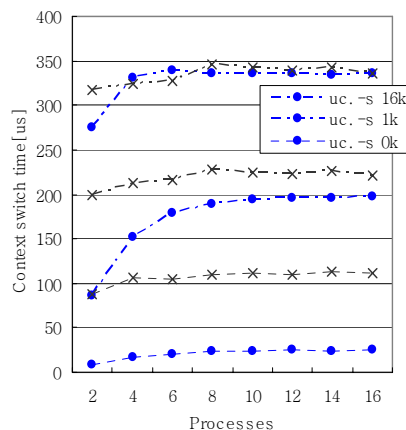


EXTREME CAMCORDING

How was Linux improved

* armnommu architecture porting for Linux 2.6 (uClinux/ARM) was done and has been maintained.

- Benchmark of IPC & CTX performance was done.



LEFT> The context switching time measured by "lat_ctx.". Each process has its own 0KB, 1KB or 16KB data access contents. The dot over the line "x" represents the value of Linux and "o" for the value of uClinux.

BELOW> The results of the IPC. "lat_fifo" measures the delayed time of FIFO. "bw_pipe" measures the bandwidth.

	Linux	uClinux
lat_fifo(μs)	160.64	31.74
bw_pipe(MB/s)	12.58	25.55

* designed to utilize the advantages of uClinux

- multi-threads (pThread, up to 36) /w message queue (custom)
- priorities balancing among kernel threads & user threads

Patch Availability

* S5C737x was the primary target platform for uClinux/ARM 2.6 project and all the GPL related source code of the product was included in the distribution. The codes and the benchmark paper is available at : <http://opensrc.sec.samsung.com/> .

Hardware Information

* MINIKET / MINIKET-X

- CPU : Samsung S5C7376 (216MHz)
- RAM : 16MBytes SDRAM
- Flash Memory : 128 KBytes NOR, 1 GBytes NAND



Sony Power Management Enhancements

H. Kaminaga, G. Levand – Sony

What is being demonstrated

safe-suspend and **fast-clean-shutdown** while playing multi-media content and while machine has active network connections.

How was Linux improved

safe-suspend provides a power management enhancement that remounts all file systems as read-only before suspending the system, and as read-write on resume. This feature adds protection in the case of accidentally exchanging batteries with a notebook or powering down a desktop PC while the system is in standby state.

fast-clean-shutdown provides a fast system shutdown by freezing all processes, remounting all file systems as read-only, closing all TCP connections, then powering down.

Hardware Information

TI - Innovator Board, OMAP 1510 (ARM 925) Processor
IBM -Ebony Board, PowerPC 440GP Processor

Patch Availability

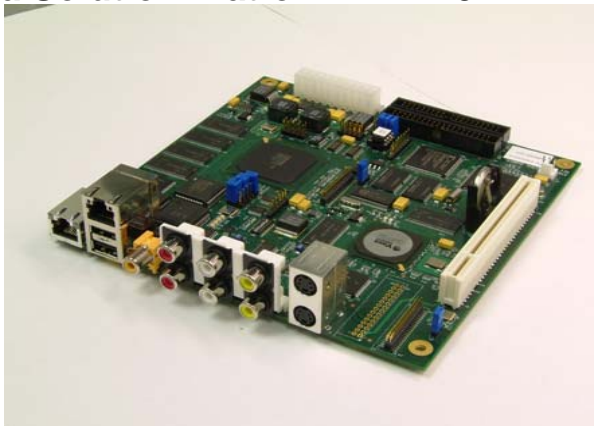
Patches available for 2.6.10 in CELF patch archive



AVM49HD Solution Platform for High Definition STB From Toshiba America Electronics Components, Inc.

What is being demonstrated

- **Toshiba Solution Platform AVM49HD**



- **AVM49HD use CELF1.0 compatible Linux Kernel**
- **AVM49HD decode WMV9 HD, MPEG2/4 from HDD/NandFlash .**

Hardware Information

**Toshiba TX4938, Goku-S(TC86C001FG)
SigmaDesigns EM8620L**

How was Linux improved

- **JFFS2 for Nand Flash is implemented on Toshiba TX4938(MIPS R4000 based Processor).**
- **Nand Flash Controller(CPLD base) and JFFS2 improve the access speed .**

Patch Availability

The patch file will be included in the AVM49HD package CD-ROM .

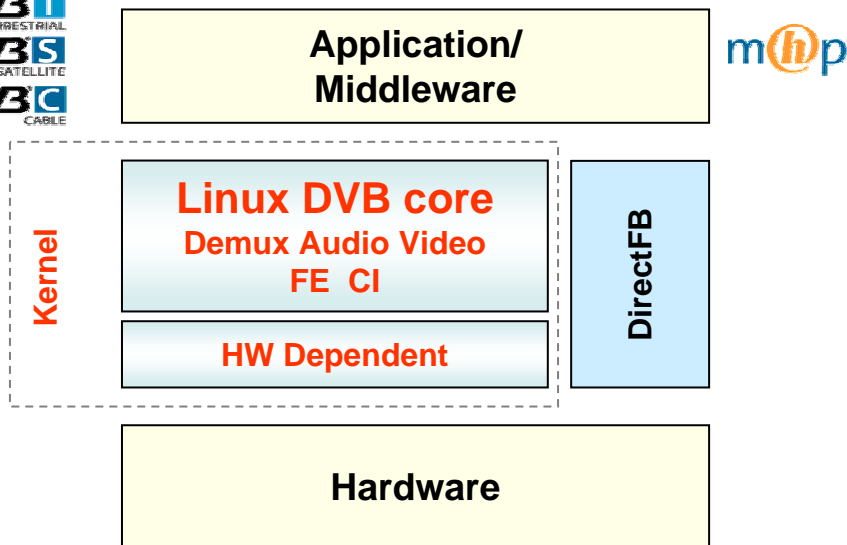


Digital TV with Linux DVB API

From Toshiba Electronics Europe GmbH

What is being demonstrated

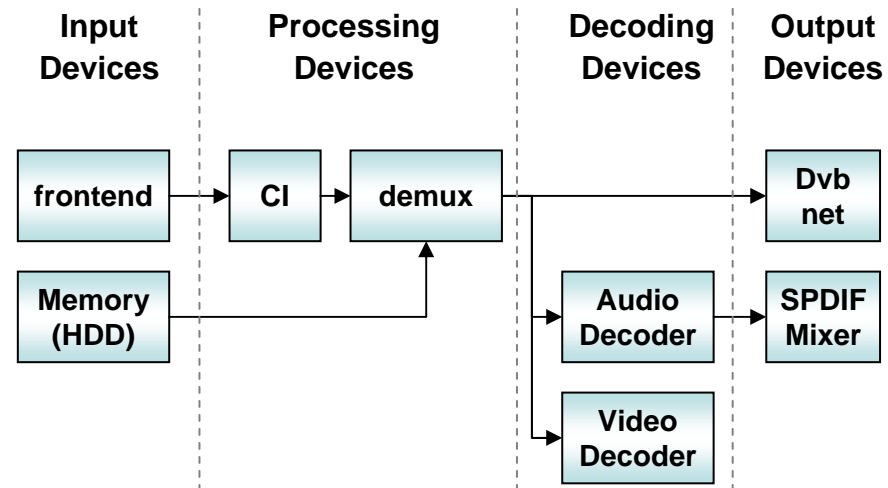
- Linux DVB Version 4 as standard API for STB and iDTV middleware and application



How was Linux improved

- Means to control modern embedded digital TV hardware easily and efficiently
- API design

character devices /dev/dvb/adapter0/...



Hardware Information

'Donau' TC90400 MPEG-2 Decoder

Patch Availability

Linux DVB v4 API available at www.linuxtv.org