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A Media Player Based On ARM by Porting of Linux

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Abstract

This paper describes the porting of embedded linux on ARM 9 platform for designing and implementing of embedded media player on S3Cmini2440 development board. A novel transplating method for linux kernel is presented here, Linux kernel as well as its cut,compile,and porting process under ARM platform are introduced. Optimized linux operating system in the processor has been installed and transplanted the SDL_FFMPEG library into S3Cmini2440 after the cross compilation. Ofthis whole system come together in playing the audio/video & picture formats files smoothly & effectively.

Keywords: Embedded Linux, ARM9,Porting, S3Cmini2440, Compilation,.Embedded Media Player.

Introduction

With the wide application of embedded systems in consumer electronics, industrial control, aerospace, automotive electronics, health care, network communications and other fields ,embedded system has been familiar to people all walks of life, embedded systems have been into people's lives, it is changing people's production and lifestyles in a variety of forms. The goal is to deliver an optimal and effective solution in terms of the parameters such as speed, accuracy, flexibility and cost. Linux is becoming the operating system for embedded devices due to the efficient and the portable design of the linux kernel. The combination of ASIC and FPGA technologies in ARM boards helps deliver an optimal solution in terms of speed, accuracy, flexibility and cost. In here Linux as an Embedded Operating system gives added advantages with its features like full memory protection, multi tasking, multi process operating system and more.

System overview

- Linux System and Kernel Architecture:

The complete Linux system can be broadly classified as three sections namely User mode, Kernel mode and Hardware. The user mode consists of Used programs and system libraries, it enables to run the applications on normal Linux system. User commands Linux Operating system is a subset of UNIX, which offers a very attractive option for embedded operating system. Linux is Core-based it supports wide range of computer hardware like ARM, X86, Blackfinn, SHARC etc. With the Linux source code being free which can be made compatible to any of the hardware with the architecture specific changes into it, Linux has become popular making the embedded system market more competitive.

include executable programs and scripts. An operating system provides applications with a platform where they can run, managing their access to the CPU and system memory. The user's operation is implemented by a set of standardized calls, and the device driver is responsible for mapping these calls to the actual target operations. The operating system also serves as a mediator between running applications and the system hardware. Most applications are not written to directly address a computer’s hardware. The kernel manages the hardware resources for the rest of the system. Linux kernel mainly consists of five modules: Network system, File system, Memory management, Process management and Inter-process communication. It also includes System cal interface and Device drivers

Linux kernel architecture

The Process management module has process control blocks (PCB)for each process, which monitors and controls the process for efficient use of CPU resources by using scheduling algorithms like Round Robin and Preemptive priority based scheduling; Memory management supports virtual memory management , so that more memory can be used by the process of Linux than actual memory. By this data in memory can be exchanged by external storage device. When needed and then exchanged back .

The File system module used to support device drivers and external storage devices. They are highly

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reliable and high performer; Interprocess communication module used for exchange of information between different processes. Semaphores, Message queues, Signals etc are used for interprocess communication; Network system modules provides access to many of network communication standards and supports many hardware .

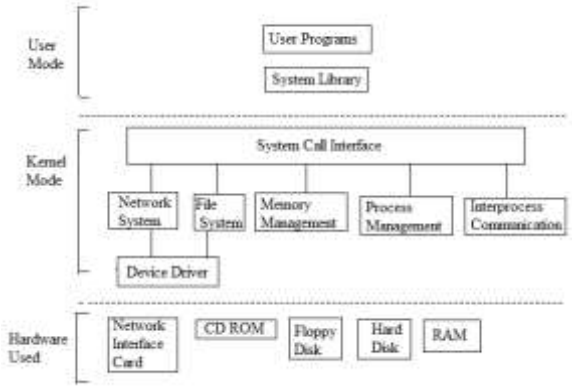


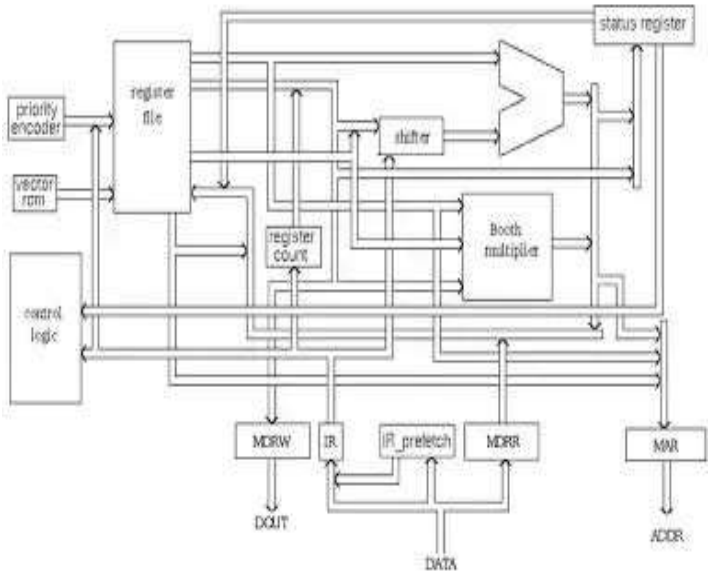
Fig. 1. Linux Kernel Architecture

ARM processor

ARM is a family of instruction set architectures for computer processors based on a reduced instruction set computing (RISC) architecture developed by British company ARM Holdings.

A RISC-based computer design approach means ARM processors require significantly fewer transistors than typical processors in average computers. This approach reduces costs, heat and power use. These are desirable traits for light, portable, battery-powered devices including smartphones, laptops, tabletS, notepad computers, and other embedded systems. A simpler design facilitates more efficient multi-core CPUs and higher core counts at lower cost, providing higher processing power and improved energy efficiency for servers and supercomputers.

The ARM9 processor family functions include single processor solution for microcontroller, DSP and Java applications. Thus saving the chip area, complexity, power consumption, cost and time.ARM9 family is the most popular ARM processor family amongst all. The ARM9 processor family functions include single processor solution for microcontroller, DSP and Java applications.



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Advantages and disadvantages of porting on arm platform

- **Advantages:**

a. It provides optimal cost and performance with arm9 boards.
b. It supports various applications of real time embedded systems.
c. It supports various c.p.u architectures, due to its dynamic design and scalability.
d. It gives high performance with fast concurrent operations.

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e. Arm 9 supports on-chip buffers in case of linux porting. Thus helps in on-chip debugging.
f. It supports dynamic power management and on-chip power supply unit.

- **Disadvantages:**

a. ARM9 board is that it is quite expensive in case of porting.
b. The main disadvantage of using embedded linux is that there are large memory footprints i.e. root file system and kernel image.
c. There is a complex device driver framework in case of embedded linux .
d. When built in real time environment, kernel issue may take place.

System design software

The system developing platform design

To develop complex embedded system a real time operating system is mandatory in order to maintain process management, manage shared resources, task management etc. Linux is open source, free and trustworthy. Many microprocessors has been transplanted into the Linux operating system. The process of installation is very simple, after installation we can create login for different users. There are many Linux distributions like Ubuntu, BackTrack, KUbuntu, XUbunt, LUbuntu etc where Ubuntu has been choosen for the process.

- **Setting up Host Environment:**

Work environment has been setup by following process:

i. Ubuntu 12.04 v. Is loaded on host machine.
ii. Cross compiler is set up, which is arm-linux-gcc which is to compile the source code to the target board.
iii. Linux kernel source code version 3.3.2 is downloaded on host machine.
iv. To configure the files needed via a GUI, the Make menuconfig is used and for it to be functional libncurses 5-dev package needs to be loaded on to the host machine.

- **Steps for Porting:**

i. Download the Linux source code from the network.
ii. Patch the Linux source code in line with ARM architecture.
iii. Now Linux configuration and customization of Linux
iv. The establishment of cross-compiler environment.
v. Cross - compile and link.
vi. Load the image file(installed) to our target platform.

- Any one of the following command can be taken for kernel configuration:

make config:

The most traditional text-based configuration interface, it is hard to use and is very Cumbersome enter the command line, we can configure the line by line.

. make menuconfig:

Text-based configuration menu interface, is a common way under the character terminal

; make xconfig:

Window mode configuration based on a graphical interface, under the Xwindow recommended

Media player installation

PC version of compiler is basically consistent with the mini2440 manual on ARM Madplay.

Algorithm for madplay: This algorithm is for PC Version of madplay-

i. Compile the ZLib-1.2.3,decompress it and configure for the target board.
ii. Compile the Libid 3tag0.15.1b, decompress and run to install it.
iii. Compile Libmad 0.15.1b library file , decompress and run to install it.
iv. Now compile the Madplay file 0.15.2b,decompress and run.
v. .After successful compilation, a my madplay file is generated.
vi. Transplant this my madplay file to target board.
vii. Test it.

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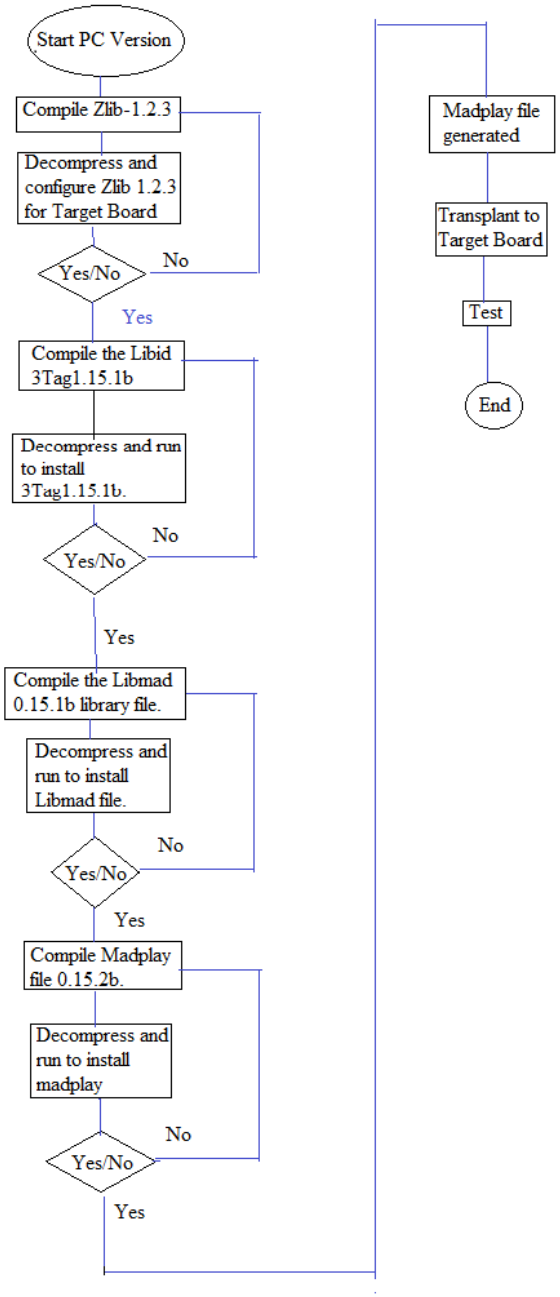
Media player flow chart



Conclusion

This paper presents guidelines showing how to port Embedded Linux on ARM platform. While configuring the real time kernel for ARM platform we need to select proper processor type. The file system is also studied for target board S3Cmini2440 ARM 9 Development board. This paper also describes the steps for running any real time application like Embedded Media Player and it's designing and implementation on S3Cmini2440 ARM9 Development Board.

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