

Embedded Linux System & Applications (Part2)

Ruth Gu

ruth4jobs@gmail.com

UUASC OC Chapter

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OUTLINE

- Review some contents of Part-I
- Complete the rest portion of Part-I
- Some Interesting Topics
 - You definitely need to answer following questions before you make decision to do something cool using Embedded Linux System
 - Why do you endorse Embedded Linux?
 - How do you choose components (hardware & software) to build your Embedded Linux system to meet your applications?

I. Why is Embedded Linux

- What is Linux?
 - Linux kernel, Linux system, Linux distribution
- What is Embedded Linux?
 - EM-Linux Kernel
 - Kernel tree, patch, debugger
 - EM-Linux system
 - An embedded system based on Linux kernel
 - EM-Linux Distribution
 - The package including development framework for Embedded Linux System (source browsers, cross compiler, debugger, project management software, boot image builds,...)

Why is Embedded Linux (cont.)

- Endorsement of Embedded Linux?
- Opponents of Embedded Linux?
- How to do assessment of using Embedded Linux?

Endorse Embedded Linux

- General Reasons

- Quality & Reliability of Code

- Configurable
- Stable
- Reliability
- Robustness
- Modularity

- Free

- No cost?
- No depends on vendors or locked in?
- No license free?
- Access source code?
- Free to modify or twist the code if you like

- Absence of royalties vs. Linux licenses (GPL, LGPL, BSD, MPL,...)

Endorse Embedded Linux (cont.)

● General Reasons

- Availabilities & Supports?
 - Source code & build tools
 - Variety of tools
 - Obtained from Freshmeat, SourceForge, and others
 - Drivers supports
 - Other OS drivers not available at reasonable prices
 - Hardware supports
 - CUP cores, SoC boards, Peripherals interfaces
 - Well-supported for many standards
 - Communication protocols, software standards
 - Development community supports
 - Many talented people
 - Tools, libraries, such as httpd, ssh, snmp, GUI, etc.

Endorse Embedded Linux (cont.)

- **Most important Reasons**

- Source code availability
- Reduced licensing
- Reliability
- Open source development community support

Opponents of Embedded Linux

- **Some Doubts & Concerns?**
 - Real-time limitations
 - Availability & Quality of supports
 - Fragmentations
 - Others ???

Assessment of Embedded Linux Adoption

- How to evaluate Embedded Linux within your organization?
 - Linux is promising
 - Trendy? So cool? Let's do it !!!
 - Analyze ROI (return-on-investment) & Risk
 - Time & Cost
 - Have experts (internally do changes)?
 - Contract out (pay someone else to do)?
 - It's not cost free!!!
 - Don't get frustrated. It does take lots of efforts to success.

II. How to select HW & SW

- Some important decisions you have to make before you start
 - System applied to industries
 - Consumer electronics
 - Telecommunications
 - Automotive system
 - Aerospace
 - Industrial control system
 - The Scope (or size) of system or products
 - System features & requirements
 - Project budgets & timeframe

System Requirements

- Size

- Processor

- Most Linux, 32-bit processor
 - 16-bit Linux on Intel 8086, 286
 - Intel 8051 microprocessor, 8-bit, 4K memory

- Small

- Lower power up, minimum 2MB ROM, 4MB RAM
 - Lots of efforts

- Large

- Powerful CPU, or CPUs, with larger RAM, permanent storage
 - Examples: large telecom switches, Flight Simulator, ...

System Requirements (cont.)

- Size

- Medium-size

- Medium powered CPU, around 32MB ROM, 64MB RAM
 - Some might include secondary storage, such as compactFlash, hardware drives.
 - Examples:
 - Most consumer-oriented devices
 - PDAs, MP3 Player
 - Entertainment systems
 - Network Appliances

System Requirements (cont.)

- Time Constraints
 - Hard real-time
 - Mission-critical system, such as power station control, etc.
 - Soft real-time
 - Streaming audio systems, PDAs, etc.
- Network Ability
 - Networking Capability
 - Ethernet, or full TCP/IP stacks, etc.
 - Wireless RF
 - 802.11 (WiFi), 802.15 (Bluetooth), ZigBee, other RF technologies

System Requirements (cont.)

- **User Interface / Graphic User Interface (GUI)**

- PDA, Cell Phone (LCD)
- Process Control System (LED, Monitor screen)
- Entertainment system (LCD, TV screen)
- Printer (Control Panel)

- **Others**

- Data Acquisition
- DSP
- Audio/Video network data stream
- Video processor
- Security

Select Software

- **Purchase Commercial Embedded Linux OS**
 - BlueCat® embedded Linux® from LynuxWorks™
 - MontaVista Linux
 - Timesys Embedded Linux
 - Wind River Linux 1.3
 - Others
- **Contract out some HW (Firmware) design company**
- **Build your own**

Select Hardware

- **Basic Requirements on Reference Boards**

- CPU core
- Flash memory
- Memory (DRAM)
- Serial port (RS232/RS485)
- Ethernet Interface

- **Something you might like to have on Boards**

- USB interface
- LCD controller
- Some kind of RF transceivers
- Graphic engine
- Audio/video inputs

Select Reference Boards

- Reference Boards

- There are many different types of reference boards provided by many semi-conduct companies based on many different CPU processors and architectures (so, too many to lists here).

- Some Popular Boards

- Here list some boards (with development kits), specially for some individuals as a hobby exploration, because of the price seems acceptable (or likely)?
- ARM System-On-Chip from (<http://www.littlechips.com>) (US\$299-\$599)
- AT91SAMxxx-EK Evaluation Kit (ARM-based) from ATMEL (<http://www.atmel.com/>) (US\$500-1250)
- OEM Single Board Computer from Cogent Computer Systems (<http://www.cogcomp.com>) (US\$550 - \$1800)
- ARM9 single board computer for \$69 from (http://www.glomationinc.com/product_9260.html)