» The Linux Foundation

10 Ways to Get Started in Embedded Linux Development

January 2010

The Linux Foundation
http://www.linuxfoundation.org

Summary

Linux is making its way very deeply into embedded devices, from consumer electronics to embedded devices to in-vehicle infotainment. According to a 2008 VDC report, Linux is used by over 18% of embedded developers, making it the most popular embedded operating system. Its popularity spawns something dear to the hearts of software developers: jobs. A 2010 study by the Linux Foundation showed that the market for Linux jobs has grown 80% over five years, with a large percentage of those in embedded Linux.

How do you join the fun? The Linux Foundation has compiled a quick and easy guide to getting started with this exciting area of computing.

Take a Class

The Linux Foundation offers a wide range of courses on Embedded Linux including:

- Embedded Linux Development
- Embedded Linux Development: A Crash Course
- Embedded Linux Development with Yocto Project / OpenEmbedded
- Portable Application Development for MeeGo Devices
- Building MeeGo: Meego Internals and a Hands-on Approach to OBS (openSUSE Build Service) For MeeGo
- MeeGo Training For Non-Developers
- Introduction to Android
- Android Internals
- Android Bootcamp

Conferences offer classes that work hands-on with embedded Linux, like the popular BYOES classes at ESC.

Attend a Conference

The biannual Embedded Linux Conference is hosted by The Linux Foundation and the CE Linux Workgroup and co-located with The Linux Foundation Collaboration Summit.

LinuxCon, The Linux Foundation's premier US conference, offers several embedded sessions. LinuxCon Japan, LinuxCon Europe, LinuxCon Brazil, linux.conf.au, and foss.in represent Linux around the world.

In the US, popular regional Linux conferences include the SCaLE, SELF, Texas LinuxFest, Flourish, and LinuxFest Northwest among others.

O'Reilly's OSCON offers many embedded Linux sessions.

Many other conferences happen every year.

1796 18th Street, Suite C
San Francisco, CA 94107
+1 415 723 9709
http://www.linuxfoundation.org
training@linuxfoundation.org

THE LINUX FOUNDATION

Read a Good Book, a Good Wiki, a Good Forum a Good Chat

Read a good book:

- Embedded Linux Primer (Chris Hallinan)
- Building Embedded Linux Systems (Karim Yaghmour et al)
- Embedded Linux System Design and Development (P. Raghavan et al)
- Embedded Linux Development Using Eclipse (Doug Abbot)
- Writing Linux Device Drivers and Linux Program Development (Dr. Jerry Cooperstein)

For wikis, it's hard to beat eLinux.org, which is maintained by the CE Linux Workgroup and provides many explanations and tutorials.

Excellent discussion forums exist:

- Linux.com (see the embedded Linux section)
- Meld, a general embedded Linux community
- Google hosts many project discussions

Many embedded-related IRC discussions happen on freenode.net.

Back to Basics: Learn Computer Architecture

Do you remember the feeling when you first looked inside a computer? Looking at that incredibly complex circuit board and seeing what it accomplished on its screen drew many of us to become developers in the first place. Working with embedded systems is one way to reacquaint yourself with that fuzzy dividing line between hardware and software.

Embedded systems can be made up of a variety of different architectures: ARM, PowerPC, MIPS, x86, and more. Most semiconductor manufacturers provide Linux as reference software. Linux has become the de facto universal reference software platform.

Learn About Tools

Embedded development tools should be very familiar. However, non-embedded development usually happens on the system for which you are developing, usually x86. Embedded code is normally developed and built on a host system (your PC) using a cross-compiler, which generates code for the target system (embedded board) rather than for the architecture on which it runs. There are also projects like The Yocto Project™ that provide the tools and information needed to create custom Linux-based systems for embedded projects. It is based on OpenEmbedded, an open source project and build framework for embedded Linux that provides coding assistance, guides and FAQs. You can also try downloading the latest MeeGo Core Software Platform and SDK.

1796 18th Street, Suite C
San Francisco, CA 94107
+1 415 723 9709
http://www.linuxfoundation.org
training@linuxfoundation.org

Investigate Kernel Features

There are many features of the Linux kernel that are highly relevant to embedded systems. Working with embedded systems lets you snuggle up close to the Linux kernel and learn its intricacies. Much of your time will be spent in making your particular collection of hardware interact properly. For example, power management is paramount in battery-operated devices. There are many power strategies that embedded Linux systems employ.

Learn Real-Time

Another embedded kernel feature is real-time, the ability for a computer system to respond deterministically, i.e. within a guaranteed real-world time frame. Dependable results can be very important in some applications (think anti-lock brakes). Linux can be made deterministic using kernel patches, particularly CONFIG_PREEMPT_RT.

Check Out Embedded Linux Projects

Mobile software providers have been particularly forthcoming in recent years. MeeGo and Android are good places to start where you can download an SDK and immediately have a working development environment, often with a simulator. You can also check out The Yocto Project™ that provides the tools and information needed to create custom Linux-based systems for embedded projects.

Some embedded distributions are built for specific devices. For example, dd-wrt and openwrt enable you to run Linux on your router. Also check out uClinux for microcontrollers.

At the other end of the spectrum, some embedded distributions like Angstrom, which is based on OpenEmbedded, and Embedded Debian are so robust they could almost be considered general-purpose operating systems.

Go Mobile

Many new smartphones, including the Motorola Droid X run Android. Netbooks running Linux abound, including the Dell Mini 9 and the Asus EeePC (which runs several distros). If yours doesn't happen to run Linux, though, never fear – there are several Linux distributions built specifically for netbooks. Also check out the Qi NanoNote, an ultra-tiny notebook. The MeeGo Project, while just started this year, stands to add a plethora of devices (phones, tablets, in-vehicle infotainment, etc) to the Linux universe.

Buy a Board

The BeagleBoard (beagleboard.org) is a Texas Instruments-sponsored single-board-computer (SBC) that features TI's OMAP3530. The BeagleBoard and is available for about $150.

Marvell's SheevaPlug is a tiny SBC that plugs directly into the wall, provides networking and USB along with a fast processor, and costs about $100. It runs Linux in several flavors.

1796 18th Street, Suite C
San Francisco, CA 94107
+1 415 723 9709
http://www.linuxfoundation.org
training@linuxfoundation.org

Gumstix provides very small OMAP-based boards at reasonable prices. Their tiny connectors can be a little difficult to manage, but they provide a lot of bang for the buck.

Chumby is a fun little (extremely hackable) device that runs its own Linux distribution. Chumby comes with a touchscreen and a widget-based development system at $100-$150.

Learn the Ecosystem

The embedded Linux ecosystem is very broad and somewhat fragmented. It helps to know the playing field, and the players on it. Start with Linux.com on the embedded news page, and also read industry news feeds like LinuxForDevices and Linux Weekly News (LWN). Also note that many Linux magazines also report on embedded news. Don't forget blogs (like Jefro's Open Source Resource).

Summary

As you can see, there are tons of ways to dive into embedded Linux. Start first by watching the Linux Foundation's free webinar, "Introduction to Embedded Linux with Jerry Cooperstein", and see where your imagination takes you.

1796 18th Street, Suite C
San Francisco, CA 94107
+1 415 723 9709
http://www.linuxfoundation.org
training@linuxfoundation.org

The Linux Foundation promotes, protects and advances Linux by providing unified resources and services needed for open source to successfully compete with closed platforms.

To learn more about The Linux Foundation, and our other initiatives please visit us at http://www.linuxfoundation.org/.