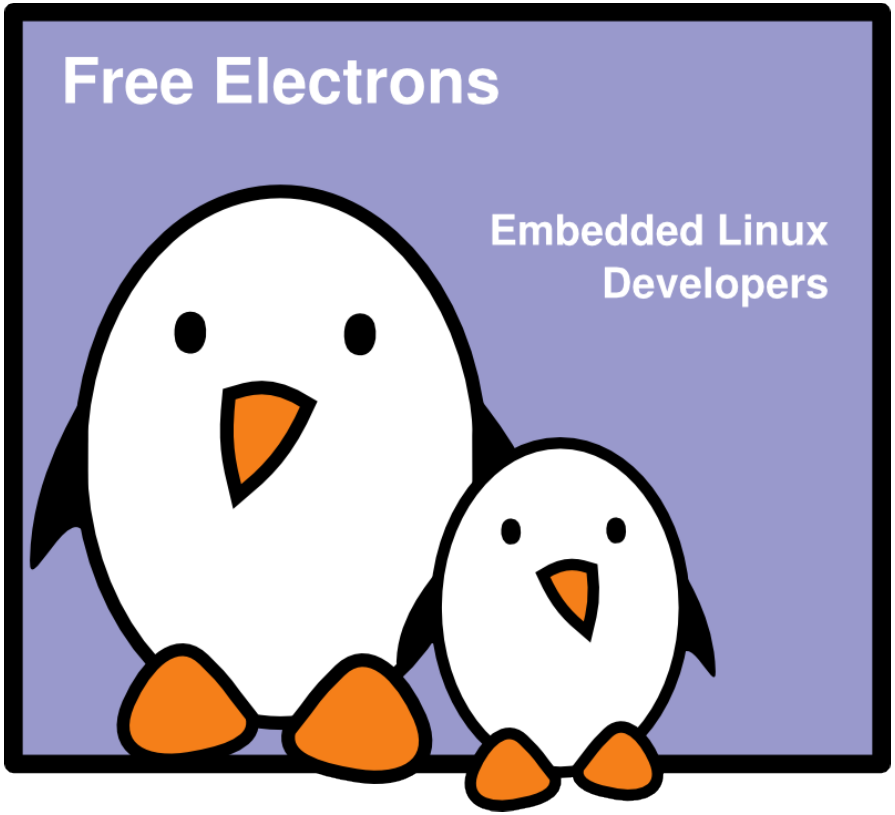
The GRUB bootloader

Michael Opdenacker
Thomas Petazzoni
Free Electrons



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http://free-electrons.com/docs/grub

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Latest update: Sep 15, 2009

Grub features (1)

- Many features and a lot of flexibility!
- Supports booting many operating systems: Linux, Hurd, *BSD, Windows, DOS, OS/2...
- Support for different boot devices: hard disk (of course), cdrom (El Torito), network (tftp)
- Support for many filesystems (unlike LILO, it doesn't need to store the physical location of each kernel): ext2/3, xfs, jfs, reiserfs, dos, fat16, fat32...
- Configuration file: unlike LILO, no need to update the MBR after making changes to the configuration file.

Grub features (2)

- Support for many network cards
  (reusing drivers from the Etherboot bootloader).
- Menu interface for regular users.
  Advanced command line interface for advanced users.
- Remote control from a serial console.
- Supports multiple executable formats:
  ELF by also a.out variants.
- Can uncompress compressed files
- Small: possible to remove features and drivers
  which are not used (`./configure --help`).
  Without recompiling: remove unused filesystem stages.

Grub size

Example from grub 0.97-1ubuntu9 (Ubuntu Dapper):

- Stage 1:
  `/lib/grub/i386-pc/stage1`: 512 bytes
- Stage 1.5:
  `/lib/grub/i386-pc/e2fs_stage1_5`: 7508 bytes
- Stage 2:
  `/lib/grub/i386-pc/stage2`: 105428 bytes

Total: only 113448 bytes!

Installing grub (1)

Install Grub on an embedded target with a blank disk.

- Do it from a GNU/Linux host with Grub installed.
- Access the disk for the embedded target as external storage:
  - Compact Flash disk: use a USB CF card reader.
  - Hard disk drive: use a USB hard disk drive enclosure.
- Create a partition on this disk (useful, but not mandatory):
  `fdisk /dev/sda` (type `m` for a menu of commands)
- Format and mount this partition:

```
mkfs.ext3 /dev/sda1
sudo mount /dev/sda1 /mnt/sda1
```

Installing grub (2)

- Install Grub:
  `grub-install --root-directory=/mnt/sda1 /dev/sda`
  - `/dev/sda`: the physical disk. Grub is installed on its Master Boot Record.
  - `/mnt/sda1`: the directory under which `grub-install` creates a `boot/` directory containing the upper stage and configuration file. Of course, you could have used another partition.
- Grub now needs a kernel to boot. Copy a kernel image to `/mnt/sda1/boot/` (for example) and describe this kernel in `/mnt/sda1/boot/grub/menu.lst`.
- Once you also copied root filesystem files, you can put your storage device back to the embedded target and boot from it.

Naming files

- Grub names partitions as follows: `(hd`*`n`*`,`*`p`*`)`
  n: *n*th disk on the system
  p: *p*th partition on this disk
- Files are described with the partition they belong to.
  Example: `(hd0,2)/boot/vmlinuz-2.6.18`
- You can specify a default partition with the `root` command:
  Example:

```
root (hd0,0)
kernel /boot/vmlinuz-2.6.18
```

Sample configuration file

/boot/grub/menu.lst

```
default 0
timeout 10

title      Ubuntu, kernel 2.6.15-27-386
root       (hd0,2)
kernel     /boot/vmlinuz-2.6.15-27-386 root=/dev/hda3 ro quiet splash
initrd     /boot/initrd.img-2.6.15-27-386
boot

title      Ubuntu, kernel 2.6.15-27-386 (recovery mode)
root       (hd0,2)
kernel     /boot/vmlinuz-2.6.15-27-386 root=/dev/hda3 ro single
initrd     /boot/initrd.img-2.6.15-27-386
boot
```

Network support

Grub can use the network in several ways

- Grub running from disk (floppy, hard drive, cdrom), and downloading kernel images from a tftp server on the network.
- Diskless system:
  - A first stage bootloader (typically Etherboot) is booted from ROM.
  - It then downloads a second stage from Grub: `pxegrub` for a PXE ROM, or `nbgrub` for a NBI loader).
  - Grub can then get kernel images from the network.

Grub security (1)

- Caution: the Grub shell can be used to display any of your files!
- Example:
  - Boot your system
  - Type the `c` command to enter command line mode.
  - `find /etc/passwd`
    Grub displays all partitions containing such a file.
  - `cat (hd0,2)/etc/passwd`
    You can see the names of users on the system!
    Of course, you can access any file. Permissions are ignored.

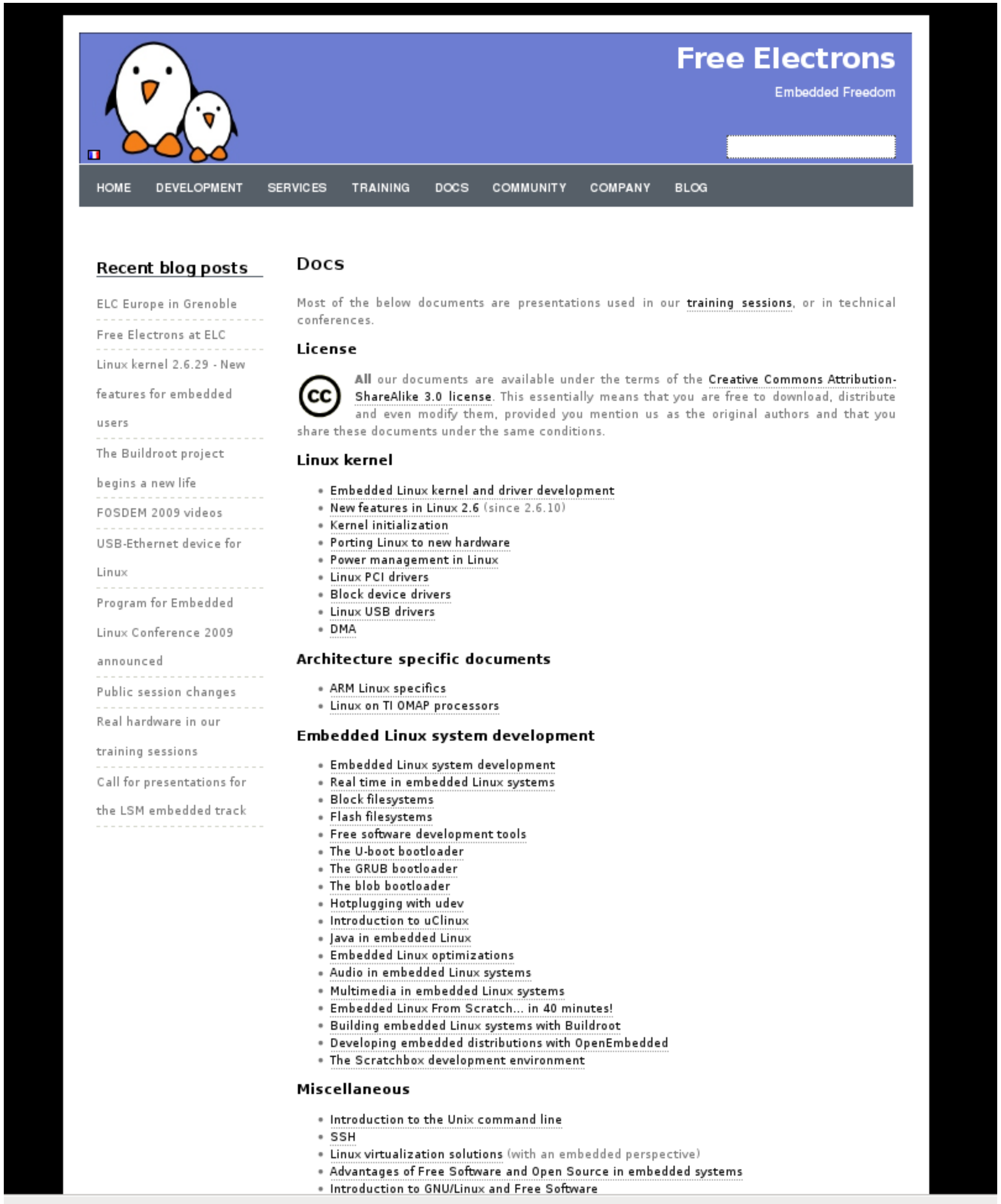
Grub security (2)

- Interactive commands can be protected with a password. Otherwise, people would even be able to view the contents of files from the Grub shell!
- You can also protect menu entries with a password. Useful to restrict failsafe modes to admin users.

Grub resources

- Grub home page:
  http://www.gnu.org/software/grub/
- Grub manual:
  http://www.gnu.org/software/grub/manual/

Related documents



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