

Exploring the GRUB 2 boot manager

JUMP START

Vlacheslav Krišanov, 123RF

The new GRUB 2 boot manager offers automation, a modular design, and a prettier boot menu. **BY ANDREAS BOHLE**

A boot loader is a program that helps you launch the operating system. The GRUB boot loader used with most Linux distributions is no exception: Whether you are booting Linux, Windows, or Mac OS X, the right commands will let you load the required system into memory.

The Ubuntu installer automatically configures GRUB to boot into your Ubuntu system. If you are dual-booting your Ubuntu system with other operating systems that are already on your

hard drive, the various systems appear in a handy boot menu.

GRUB developers recently completed a major overhaul of the GRUB boot loader, and the new GRUB is currently making its way into popular Linux distributions. Ubuntu first rolled out GRUB 2 with the Ubuntu 9.10 “Karmic Koala” release.

One reason for this new GRUB version is that the old version had absorbed many additions and modifications over the years, leading to inefficiencies. GRUB 2 [1] provides a clearer and more modular

structure, adding support for international character sets (including non-Latin characters in the startup menu) and an easily configurable, themed graphical interface for the startup screen.

GRUB 2, which is based on the now-defunct Pupa [2] project, is currently receiving some serious development work. To find out the status quo, check out the wiki [3]. Some things still don’t work, but all the basic routines are in place.

The first attempt to launch GRUB 2 in the wild was a scary experience for some. Many users reported difficulties in various forums, including systems that simply refused to boot [4] [5]. (See the box titled “GRUB 2 in Karmic Koala” later in this article for more on GRUB 2 with Ubuntu.)

New Structure

With the legacy version of GRUB, you could simply open `/boot/grub/menu.lst` in an editor to add entries to the boot menu or edit existing entries. GRUB 2 puts an end to this. Although you will still find the `grub.cfg` file previously used for configuring menu entries in the `/boot/grub` directory, the file simply acts as a container for the configuration that you create by calling `sudo update-grub`. The developers did not design the configuration file for manual editing.

Table 1: Files and Directories

<code>/boot/grub/grub.cfg</code>	Central configuration file for GRUB 2, created automatically.
<code>/etc/default/grub</code>	General options (no menu items).
<code>/etc/grub.d</code>	Directory with helper scripts for detecting partitions and the operating systems on them. You can add scripts here to create your own menu entries.

Listing 1: Startup Script

```
01 echo "Custom entry for starting a          05 set root=(hd0,10)
   Rescue CD from an image" >&2           06 linux /sysrcd/rescuecd
02 cat << EOF                               subdir=sysrcd setkmap=de
03                                           07 initrd /sysrcd/initram.igz
04 menuentry "Launch System Rescue CD      08 }
   from disk" {                             09 EOF
```

As a general rule, many features of GRUB 2 are automated. For example, helper scripts search the partitions on your machine for known operating systems and create the required entries for them without any manual attention.

The new version also changes the file and directory structure (see Table 1). The general behavior of the software is defined in the `/etc/grub/default` file.

Imagine you want to add an entry to your boot menu for a system you installed at a later stage – and which the automatic features failed to identify. Or maybe you need some special parameters at boot time. In this case, you need to write a small script. When GRUB 2 launches, it runs all the scripts in `/etc/grub.d/` that have been made executable with `sudo chmod u+x script_name`. By default, the system scripts will already have the right permissions.

Numbers in the file names ensure the right execution order. Listing 1 shows the contents of a startup script that boots the System Rescue CD from disk. This is a “here document,” which facilitates the

```
GNU GRUB  version 1.97~beta4

Ubuntu, Linux 2.6.31-14-generic
Ubuntu, Linux 2.6.31-14-generic (recovery mode)
Memory test (memtest86+)
Memory test (memtest86+, serial console 115200)

Use the ↑ and ↓ keys to select which entry is highlighted.
Press enter to boot the selected OS, 'e' to edit the
commands before booting or 'c' for a command-line.
```

Figure 1: GRUB 2 first appeared in Ubuntu’s “Karmic Koala” release. Some early trouble left many users ambivalent.

output of multiple lines of text and lets you output a string or redirect output into a file. Conventionally, an end-of-file (EOF) marker indicates which lines are part of the document.

The `set root = (hd0,10)` command sets the 10th partition on the first hard disk

as the root filesystem. The partition numbering scheme in the new version of GRUB starts at 1 rather than starting with 0, as in the previous version. The `linux` and `initrd` commands set the path to the kernel and initial ramdisk and pass two parameters in to the kernel in

DVD
openSUSE 11.2
Linux Mint 8.0
POWERHOUSE PERL
PERL
Supercharge Your Perl Scripts
POWERHOUSE PERL
11 SHARPEN YOUR SKILLS WITH
HANDS-ON
PERL PROJECTS
Power Up Your
Perl Productivity

FREE DVD inside:
openSUSE 11.2
Linux Mint 8.0

New to Perl? Perl expert **Randal L. Schwartz** provides an in-depth introduction to the principles of the versatile Perl language.

Then Perlmeister **Mike Schilli** explains how to speed up and debug your scripts. Also inside: Get hands-on with a collection of some of the Perlmeister’s best columns!

FIND POWERHOUSE PERL ON A NEWSSTAND NEAR YOU!
OR ORDER ONLINE AT linux-magazine.com/Special
Supplies are limited so order your copy today!

GRUB 2 in Karmic Koala

Canonical completed the switch to GRUB 2 for new installations with the “Karmic Koala” release. If you upgrade from version 9.04 (“Jaunty Jackalope”) to version 9.10, you keep the older version of GRUB for reasons of compatibility [6]. If you want to move to GRUB 2 on Ubuntu 9.04 or 9.10, just pop up a terminal and enter:

```
sudo apt-get install grub2
```

Then install *grub-pc*, which has a dependency for *grub-common*. When you install, you will see a dialog telling you that GRUB Legacy is still installed on your machine. Confirm by clicking *OK* and then press *Yes* in the dialog that follows to add an extra entry to your existing menu so that you can chain load GRUB 2 from GRUB Legacy for test purposes.

The configuration routine will then check your existing GRUB configuration for start

options and display them for you to edit; this completes the setup. You now have both boot loaders side by side on your system. When you reboot, you will still see the original boot menu with a new entry for GRUB 2. Select the GRUB 2 entry and launch all of your systems one after another via the GRUB 2 menu. If this works, you can launch Ubuntu 9.10, pop up another terminal, and enter:

```
sudo upgrade-from-grub-legacy
```

The system will now prompt you to specify the partition and hard disk from which you will be booting your machine. Make sure you choose the right boot partition by pressing *Space*! If you forget to do so, your system will come up with an *Error 15* (start device not found) message.

If you are sitting in front of a machine that shows you an *Error 15* message, your best

bet is to boot the live version of Ubuntu. Then mount the root partition of your distribution in */mnt* without the bootloader, type the following commands to mount the device directory, and change root (*chroot*) to the mounted device:

```
sudo mount /dev/sda1 /mnt
sudo mount --bind /dev /mnt/dev
sudo chroot /mnt
```

Enter the partition with the root directory of your Ubuntu installation in place of */dev/sda1*. Then type *dpkg-reconfigure grub-pc* to run the GRUB 2 configuration again and press the *Space* bar this time. After completing these steps, press *Ctrl+D* to quit the *chroot* environment, unmount the filesystem (*sudo umount /mnt*), and reboot your machine (*sudo reboot*). Everything should work now.

this example. You’ll find a complete list of GRUB 2 commands on the web [7].

Visually Enhanced

When you boot a computer, the start menu normally sports a somewhat staid

two-color look. GRUB 2 can use PNG, TGA, and JPG images as background images. Your best option is to save them at 640x400 pixels of resolution in the */usr/share/images/grub/* folder, which you can create by typing:

```
sudo mkdir /usr/share/images/grub
```

To install an image package on a disk, type:

```
sudo apt-get install grub2-splashimages
```

Now tell the system which of the images you want to use by creating a startup file called *05_debian_theme* in your */etc/grub.d/* folder. Open the file with administrative privileges in your favorite editor, then modify the file as in Listing 2, where the image is *airplane.jpg* and resides in */usr/share/images/grub/*. Finally, don’t forget to *sudo update-grub* to apply the changes. You can see the results in Figure 2. ■

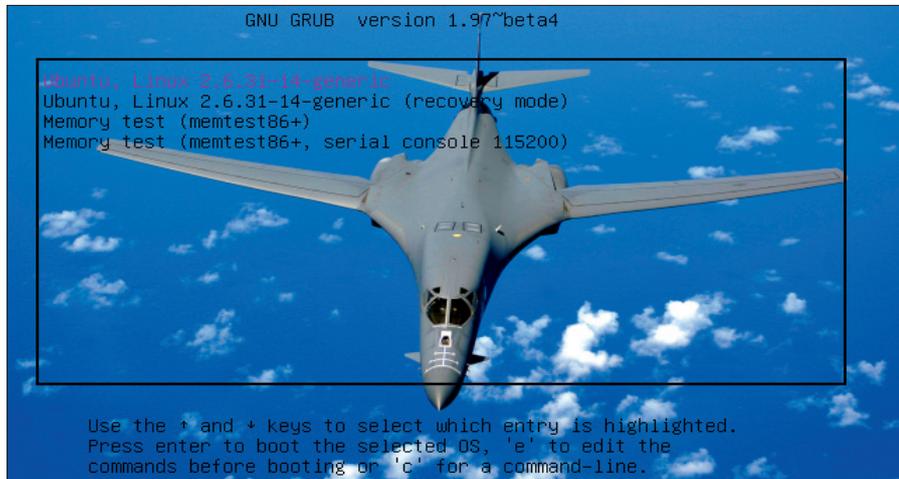


Figure 2: You can add wallpaper to the boot menu with a couple of simple commands.

Listing 2: Adding More Color

```
01 #!/bin/bash -e                               11 }
02                                               12
03 source /usr/lib/grub/grub-mkconfig_         13 # check for usable backgrounds
lib                                           14 use_bg=false
04                                               15 if [ "$GRUB_TERMINAL_OUTPUT" =
05 set_mono_theme()                          "gfxterm" ] ; then
06 {                                           16 for i in {/boot/grub,/usr/share/
07 cat << EOF                                  images/grub}/airplane.
{png,tga,jpg} ; do
08 set menu_color_normal=white/black         17 if is_path_readable_by_grub $i ;
09 set menu_color_highlight=black/white      then
10 EOF                                         18     bg=$i
```

INFO

- [1] GRUB 2 project: <http://www.gnu.org/software/grub/grub-2.en.html>
- [2] Pupa project: <http://www.nongnu.org/pupa/>
- [3] Status report GRUB 2: <http://grub.enbug.org/CurrentStatus>
- [4] Ubuntu GRUB 2 wiki: <https://wiki.ubuntu.com/Grub2>
- [5] Password bug: <https://bugs.launchpad.net/ubuntu/+source/grub2/+bug/478806/>
- [6] Upgrade bug: <https://bugs.launchpad.net/ubuntu/+source/grub2/+bug/386789>
- [7] GRUB commands: <http://grub.enbug.org/CommandList>