Introduction to Gentoo Linux

Ulrich Müller

Developer and Council member, Gentoo Linux
`<ulm@gentoo.org>`

Institut für Kernphysik, Universität Mainz
`<ulm@kph.uni-mainz.de>`

Seminar “Learn Linux the hard way”, Mainz, 2012-10-23

Table of contents

gentoo

/ˈdʒɛntuː/

Pygoscelis papua
Fastest swimming penguin

Source: Wikimedia Commons
License: CC-BY-SA-2.5, Attribution: Stan Shebs

How I came to Gentoo

- UNIX since 1987 (V7 on Perkin-Elmer 3220, later Ultrix, OSF/1, etc.)
- GNU/Linux since 1995 (Slackware, then S.u.S.E.)
- Switched to Gentoo in January 2004
- Developer since April 2007
- Council Mai 2009–June 2010 and since July 2011
- Projects: GNU Emacs, eselect, PMS, QA

Overview

- Based on GNU/Linux, FreeBSD, etc.
- Source-based metadistribution
- Can be optimised and customised for any purpose
- Extremely configurable, portable, easy-to-maintain
- Active all-volunteer developer community
- Social contract
  - GPL, LGPL, or other OSI-approved licenses
  - Will never depend on non-free software
  - Is and will always remain Free Software
  - Commitment to giving back to the FLOSS community, e.g. submit bugs and patches upstream
  - Open development and bug process

History

- Started in 1999 by Daniel Robbins under the name “Enoch”
- September 1999: Linux doesn’t run reliably on Robbins’ new two-processor system (a lucky coincidence, as it turns out)
- Late 1999: Portage – the next generation ports – born after a detour to FreeBSD
- Changed name to “Gentoo” due to speed increase as a result of EGCS adoption
- Gentoo Linux 1.0 released on 2002-03-31

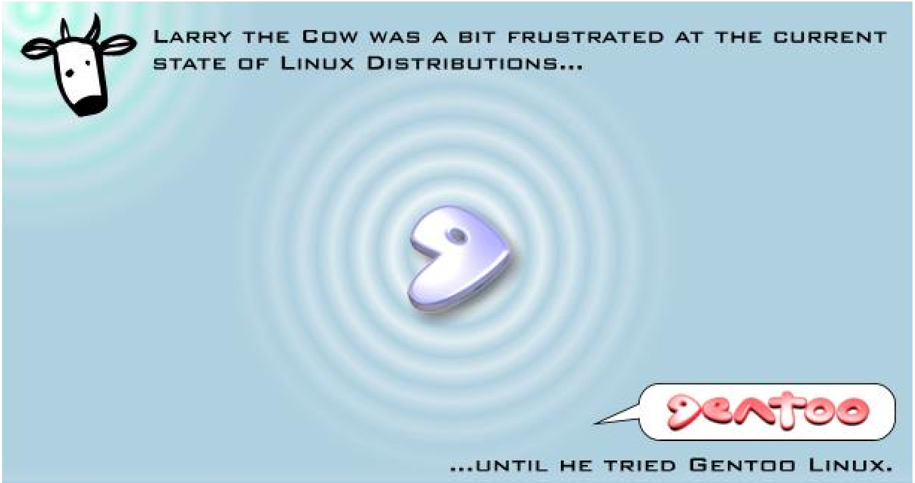
History (con’t)

- 2004: Gentoo Foundation set up (D. Robbins left project)
    - Takes care of financial issues and protects intellectual property
- Late 2005: Gentoo Council and new global project structure
    - Council decides on global issues and policies
- 2005–2007: Years of crisis
    - “Lack of clear directions and frequent developer conflicts” (Distrowatch in March 2007)
    - Several well-known developers leaving the project
    - Foundation charter temporarily revoked by state of New Mexico
- December 2008: Switch to weekly releases
- January 2010: Support for “Gentoo Prefix” in package manager
    - Allows installation on foreign host OS (e.g., Mac OS X, Solaris)

Why Gentoo?

“Gentoo is all about choices”

- Most distributions have tools that manage the entire system. Do you work their way, or do they work for you?
- Design tools and systems that allow a user to do their work as efficiently as possible, as they see fit
- Help the user to appreciate the flexibility of Free Software
- Only possible when the tool is designed to reflect and transmit the will of the user
- If the tool forces the user to do things a particular way, then the tool is working against, rather than for, the user


LARRY THE COW WAS A BIT FRUSTRATED AT THE CURRENT STATE OF LINUX DISTRIBUTIONS...
gentoo
...UNTIL HE TRIED GENTOO LINUX.

Larry the Cow was a bit frustrated with Linux. The latest distros seemed to be just a bunch of the same old stuff. Nothing new – nothing innovative. Then Larry tried Gentoo Linux. He was impressed. He found a BSD-style ports system with a bunch of advanced features. He discovered lots of up-to-date packages that could be auto-build using the optimization settings and build-time functionality that ***he*** *wanted, rather than what some distro creator thought would be best for him. All of the sudden, Larry the Cow was in control. And he liked it.*

Binary distributions – problems

- Old versions of software, fixes back-ported
- No package management for non-RPM files
- No package management for programs installed from source
- Package splits and package configuration
  - e.g., libX11 and libX11-devel
  - emacs-nox, emacs-gtk, etc.
- How do you install Ubuntu on a Raspberry Pi?
- Why install security updates for packages you have never even heard of?
- Do you reinstall each time a new version of Fedora or SUSE comes out?

Binary distributions – problems

Old versions of software – example: GNU Emacs

Ubuntu: emacs

(Note: Ubuntu only chosen as one popular example, similar in other binary distros)

Ubuntu version	released	Emacs version	released
11.10	2011-10-13	23.3	2011-03-10
12.04.1	2012-08-23	23.3	2011-03-10
At day of release: 17 months old Emacs version			
12.10 Beta 2	2012-10-11	24.1	2012-06-10

Gentoo: app-editors/emacs

Gentoo unstable	stable (amd64)	Emacs version	released
2011-03-10	2011-04-26	23.3	2011-03-10
2012-01-28	2012-02-29	23.4	2012-01-28
2012-06-10	2012-08-04	24.1	2012-06-10
2012-08-27	2012-10-01	24.2	2012-08-27

In addition: app-editors/emacs-vcs “live ebuild”

Binary distributions – problems

- Old versions of software, fixes back-ported
- No package management for non-RPM files
- No package management for programs installed from source
- Package splits and package configuration
  - e.g., libX11 and libX11-devel
  - emacs-nox, emacs-gtk, etc.
- How do you install Ubuntu on a Raspberry Pi?
- Why install security updates for packages you have never even heard of?
- Do you reinstall each time a new version of Fedora or SUSE comes out?

Example: GNU Emacs

in a binary distribution ...

```
emacs23
    The GNU Emacs editor (with GTK+ user interface)

emacs23-lucid
    The GNU Emacs editor

emacs23-nox
    The GNU Emacs editor (without X support)
```

Example: GNU Emacs

... and in Gentoo

```
$ emerge -pv app-editors/emacs

These are the packages that would be merged, in order:

Calculating dependencies... done!
[ebuild   R    ] app-editors/emacs-24.2:24  USE="X ↩
Xaw3d alsa athena dbus games gif gpm imagemagick jpeg ↩
png source svg tiff xft xpm (-aqua) -gconf -gnutls ↩
-gsettings -gtk -gtk3 -gzip-el -hesiod -kerberos ↩
-libxml2 -livecd -m17n-lib -motif -pax_kernel ↩
(-selinux) -sound -toolkit-scroll-bars -wide-int" 0 kB

Total: 1 package (1 reinstall), Size of downloads: 0 kB
```

Binary distributions – problems

- Old versions of software, fixes back-ported
- No package management for non-RPM files
- No package management for programs installed from source
- Package splits and package configuration
  - e.g., libX11 and libX11-devel
  - emacs-nox, emacs-gtk, etc.
- How do you install Ubuntu on a Raspberry Pi?
- Why install security updates for packages you have never even heard of?
- Do you reinstall each time a new version of Fedora or SUSE comes out?

Gentoo features

- Fully automated software installation
  - Automatic dependency solving and fulfillment
  - Automatic source fetching, patching, compiling, installing
- Extremely easy maintenance
  - ‘system’ and ‘world’ package set
  - Keep ‘world’ up-to-date with a single command – “emerge”
  - Versionless, seamless upgrading
- Available for almost all architectures and OS’s
  - amd64 (x86_64), alpha, hppa, ia64, mips, ppc, ppc64, s390, sh4, sparc64, x86
  - Other GNU/Linux distros, Mac OS X, Solaris, FreeBSD, AIX, Interix
- Configuration file protection and automerge

Gentoo features (con't)

- Advantages of compiling from source
  - Optimised for your own CPU
  - DIY as soon as new software release is out
  - Even if not released yet – live ebuilds (cvs/svn/git ...)
- Multiple versions/implementations handling
  - Coexist along with each other
  - Switch on-the-fly
  - Mechanisms – software slots, virtual package
  - Tools – eselect, gcc-config, binutils-config, java-config
- Binary package support
  - Native binary package format, i.e. tar.gz
  - Binary package repository
  - Alien binary package format support, e.g. rpm, deb
  - Upstream binary packages: libreoffice-bin, firefox-bin

Portage features

- Customization of CFLAGS, LDFLAGS
- USE flags (more on that later)
- Various optional features – choose to suit your own need through FEATURES variable
- Protection for live system
    - FEATURES sandbox, collision-protect, protect-owned
- Compilation speed-up
    - FEATURES ccache, distcc
- System trimming
    - FEATURES nodoc, noman, noinfo
    - INSTALL_MASK

Portage features (con’t)

- Multiprocessing support
  - emerge --jobs=JOBS --load-average=LOAD
  - MAKEOPTS="-jN", where N is number of processors + 1
  - FEATURES parallel-fetch
- Auto resuming after failure whenever possible
  - emerge --keep-going
- Automatic solving of blockers
  - com_err and ss vs e2fsprogs-libs
- Debugging support
  - Add "-g -ggdb" to CFLAGS
  - FEATURES keepwork, nostrip, splitdebug, installsources

Portage features (con't)

- Embedded system support
  - crossdev – create any arbitrary cross toolchain in one command
  - First set CBUILD, PORTAGE_CONFIGROOT and ROOT properly
  - Then just emerge!
- Features in portage 2.2
  - License filtering
  - Generic package sets
    - @live-rebuild – all live ebuilds installed on your system
    - @module-rebuild – all out-of-tree kernel module
  - FEATURES preserve-libs
    - preserve old lib after lib version bump
    - emerge @preserved-rebuild to remove old lib and link apps to new lib

Portage tree

- Gentoo's software repository
- One of the largest in terms of number of packages
  - No package splits, i.e. no packages like foo-devel
  - Non-free software can be filtered by license, e.g. Adobe flash player
  - Numerous overlays
- Bleeding edge packages
- Branches – stable, testing
  - Defined your global choice in /etc/portage/make.conf
  - Tweak for each package in /etc/portage/package.keywords
- Overlays – a subset of tree with higher priority
  - Managed by "layman"
  - Create your own!

Ebuild file

- Gentoo's package format
- Defines variables and functions used to compile and install software
  - KEYWORDS – stable and testing branches for this package
  - SLOT – mechanism for multiple version coexistence
  - DEPEND, RDEPEND – build-time and run-time dependencies
  - LICENSE – the license the software is released under
  - SRC_URI – where to fetch sources
- Functions
  - src_unpack(), src_compile(), src_install()
- Eclasses

Ebuild example

app-editors/zile-2.4.7

```
# Copyright 1999-2012 Gentoo Foundation
# Distributed under the terms of the GNU General Public License v2
# $Header: /var/cvsroot/gentoo-x86/app-editors/zile/zile-2.4.7.ebuild,v 1.8 2012/07/29 16:53:02 armin76 Exp $

EAPI=4

DESCRIPTION="Zile is a small Emacs clone"
HOMEPAGE="http://www.gnu.org/software/zile/"
SRC_URI="mirror://gnu/zile/${P}.tar.gz"

LICENSE="GPL-3"
SLOT="0"
KEYWORDS="alpha amd64 ppc sparc x86 ~x86-freebsd ~amd64-linux ~x86-linux ~ppc-macos ~x86-macos ~x86-solaris"
IUSE="acl test"

RDEPEND="dev-libs/boehm-gc
    sys-libs/ncurses
    acl? ( virtual/acl )"

DEPEND="${RDEPEND}
    test? ( dev-lang/perl )"

src_configure() {
    econf \
        --docdir="${EPREFIX}"/usr/share/doc/${PF} \
        --disable-silent-rules \
        $(use_enable acl)
}

src_install() {
    emake DESTDIR="${D}" install

    # AUTHORS, FAQ, and NEWS are installed by the build system
    dodoc README THANKS

    # Zile should never install charset.alias (even on non-glibc arches)
    rm -f "${ED}"/usr/lib/charset.alias
}
```

USE flags

- Gentoo’s way to customise software components
- USE flags generally map onto ./configure options
- Defaults defined by profile
  - /etc/portage/make.profile
- Define your own in addition to defaults
  - Global flags in /etc/portage/make.conf
  - Package specific flags in /etc/portage/package.use
- Install only what you want
  - Example: USE="-gnome kde qt -arts -nls"
- “Opt-in” versus “opt-out”

Init system

- OpenRC, written in C and POSIX-compliant shell
  - Compatibility with FreeBSD and embedded systems
- Named (not numbered) run levels
- Smart dependencies
  - Scripts can ‘use’ or ‘need’ others
  - Scripts can start ‘before’ or ‘after’ others
- Parallel startup option
- Hotplug/coldplug services

Gentoo as metadistribution

- Multi-platform, multi-archive
- Overlays
- Configurability – complete control how the end result looks like
- Generate own stages and install media – ‘catalyst’
- Binary packages
- Possible to use it as base for custom (source or binary) distribution
- Gentoo derivatives (and distros using Portage)
    - Funtoo
    - Sabayon
    - Ututo
    - Chrome OS / Chromium OS

Documentation

- Gentoo Handbook
- Desktop documentation
- Upgrade Guide
- System administration
- Developer documentation
- Project documentation

Organisation of the Gentoo project

- Gentoo Foundation
  - 501(c)(6) non-profit organization, State of New Mexico
  - Takes care of financial and legal issues, social contract
  - Board of Trustees – 5 members, elected for two years
- Council
  - Decides on global issues and policies that affect multiple projects
  - 7 members, elected for one year
- Projects
  - Can be created by any developer
    - create project web page and send RFC to mailing list
- Developers
  - With write access to Portage tree
  - Without – e.g., translators, Forum moderators
  - 262 active developers (as of 2012-10-10)
  - Mean age 32.1±7.6 years, median 30.2 years
- User community

Gentoo Community

- Close contact with end users
- Many ebuilds submitted by users (sunrise overlay)
- IRC
- Web-based forums (on forums.gentoo.org), nearly 5 000 000 topics as of today, 1800+ posts per day
- Fully public bug tracking `<http://bugs.gentoo.org/>`
- Developers attend FLOSS events around the world
- Förderverein Gentoo e. V. `<http://www.gentoo-ev.org/>`

Stay informed

- Main page <http://www.gentoo.org/>
- Gentoo planet <http://planet.gentoo.org/>
- Gentoo forums <http://forums.gentoo.org/>
- Gentoo IRC channels
  <http://www.gentoo.org/main/en/irc.xml>
- Gentoo mailing lists
  <http://www.gentoo.org/main/en/lists.xml>
- Gentoo packages <http://packages.gentoo.org/>
- Gentoo Linux Security Announcements (GLSA)

Example of developer's work

Is Gentoo for me?

- If you are lazy
- If you are a perfectionist
- If you like being in control
- If you want a stable and secure system
- If you want to know how a Unix-like system works
- If you want to make the most out of your hardware
- If you want to make your own distribution
- If you want to install GNU/Linux on `$HARDWARE` and have it easily, regularly updated
- If you want a fully functioning modern GNU/Linux system on a new CPU in a short period of time

Introduction to Gentoo Linux

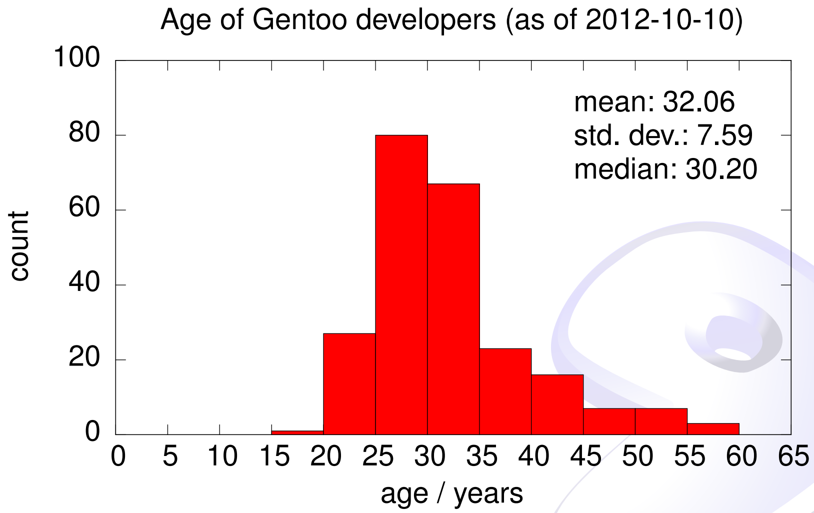
Ulrich Müller

Developer and Council member, Gentoo Linux
`<ulm@gentoo.org>`

Institut für Kernphysik, Universität Mainz
`<ulm@kph.uni-mainz.de>`

Seminar “Learn Linux the hard way”, Mainz, 2012-10-23

Age statistics



License