What is new?

Peter Korsgaard, Maintainer
ELCE 2013
What is it?

- An Embedded Linux build system
  - Cross toolchain
  - Bootloader
  - Linux kernel
  - Rootfs

- All software components of an embedded Linux system
Why Buildroot?

- One of the longest running projects
  - Started in 2001 as a way to test & demo uClibc
  - Mature and well documented
- Relatively simple
  - *For me, OE fails the easy to understand, quick to setup test. I now use buildroot. -- Kevin Hilman, ARM kernel developer.*
- Regular release schedule
  - Every 3 months + bugfix releases
- Real community project
  - No single company steering direction
  - Active and friendly community
KISS

- Lots of tradeoffs
  - Features vs simplicity
  - How can it be generalized?
- Rootfs image, no binary packages!
How does it work?

- Kconfig based interactive configuration tool
  - From the Linux kernel
  - Tree structure
  - Dependencies, conflicts
  - Help

- Make based build system

- Both familiar technologies to developers
Packages

- Buildroot is structured around **packages**
  - Each with a number of steps
    - Download, Extract, Patch, Configure, Build, Install
- A build executes all **enabled** packages
  - With the chosen options
  - In the correct order
- **Meta** build system
  - Source code is downloaded
  - Build system is driven by Buildroot
Anatomy of a package

- Config.in with options
  - In the kconfig language

```plaintext
config BR2_PACKAGE_GZIP
  bool "gzip"
  depends on BR2_USE_WCHAR
  help
    Standard GNU compressor. Provides things like gzip, gunzip, gzcat, etc...

  http://www.gnu.org/software/gzip/gzip.html

  comment "gzip requires a toolchain with WCHAR support"
  depends on !BR2_USE_WCHAR
```
Anatomy of a package

- Package.mk with build steps
  - Sensible defaults for packages using autotools or cmake

```makefile
GZIP_VERSION = 1.6
GZIP_SOURCE = gzip-$(GZIP_VERSION).tar.xz
GZIP_SITE = $(BR2_GNU_MIRROR)/gzip
$(eval $(autotools-package))
```
Anatomy of a package

• Finally include it in package/Config.in under the right sub option menu “Compressors and decompressors”

  include “package/gzip/Config.in”
Source code

- Git managed similar to Linux kernel, only maintainer has commit access
- Patches gets posted and reviewed on mailing list
  - 200-300 patches get integrated each month
- Patch queue managed in Patchwork
Mailing List

- User support and development
- 1000+ subscribers, ~2000 mails / month
Contributors

- 30 – 40 contributors each month
Developer Days

- 2x / Year
  - Around FOSDEM and Embedded Linux Conference Europe
- Sponsored by companies using Buildroot
  - Thanks!
Companies using Buildroot

- **Use in products**
  - Barco
  - Google (fiber)
  - Rockwell Collins

- **Use as SDK**
  - Atmel
  - Cadence
  - Imagination Technologies
  - Synopsys

.. And a bunch of others that don't tell us about it
What is new?
Architecture Support

- New Architectures
  - Aarch64, ARC, Blackfin, Microblaze, Nios II, Xtensa
  - ARC/Bfin/Xtensa contributed by Synopsys/Analog/Cadence
- Improved variant support
  - ARM soft/hard/hardfp, NEON, VFP variants
- Improved NOMMU support
  - Package annotation
  - FLAT/FDPIC selection
Toolchains

- C library options for internal toolchain
  - EGLIBC, GLIBC, uCLIBC
- External toolchain support
  - Preconfigs for CodeBench, Linaro
  - Musl libc support
Lots of new packages

- 30% more packages since last year
Packages

- **Multimedia**
  - Gstreamer 1.2, Wayland, EFL, Qt5, Pulseaudio, Opus, Linphone, tvheadend ..

- **Scripting**
  - Python3, nodejs, ..

- **System**
  - Flashbench, systemd, ..

- **Development**
  - Perf, lttng, trace-cmd, wireshark, ..
Google Summer of Code

- Improved support for multimedia features of popular ARM SoCs
  - Spenser Gilliland with Thomas Petazzoni as mentor
- GPU drivers
  - PowerVR on TI
  - Mali on Allwinner
  - Vivante on i.MX
  - RPi
- Video acceleration
  - Cedarx on Allwinner
  - VPU on i.MX
  - Gst-omx on RPi
Quality assurance

- Development cycle splitup
  - 2 months of feature development
  - 1 month of stabilization
    - Bugfix release if critical issues are found post release
- Continuous regression tests
  - Randpackageconfig
  - 4 servers 24/7
License compliance support

- Buildroot itself is GPLv2+, many packages also copyleft
- Packages are annotated with their license

```
GZIP_LICENSE = GPLv3+
GZIP/LICENSE_FILES = COPYING
```

- make legal-info generates
  - A manifest listing enabled packages, their version and license info
  - A copy of the license files
  - A copy of the source code tarballs
  - Buildroot configuration

- Notice that this is to support legal compliance, further work may be needed
  - Proprietary application linking to GPL libraries
  - License conflicts (E.G. OpenSSL vs GPL)
Eclipse CDT Plugin

C Project
Create C project of selected type

Project name: test

Project type:
- Executable
- Shared Library
- Static Library
- Makefile project
- GNU Autotools
  - Empty Project
  - Hello World ANSI C Autotools Project
  - Autotools Shared Library Project

Toolchains:
- Autotools Buildroot ARM (/home/melanie/buildroot/buildroot)
  - GNU Autotools Toolchain

Show project types and toolchains only if they are supported on the platform
Defconfigs

- Preconfigured setups for popular boards
  - Beaglebone, cubieboard, nitrogen6x, rpi, sheevaplug, wandboard, ..
  - A bunch of QEMU variants
System users

- Packages can now add system users:

```
# user uid group gid pass homedir shell groups comment
define TVHEADEND_USERS
tvheadend -1 tvheadend -1 * /home/tvheadend – video TVHeadend
endif
```
Customization

- System configuration menu in menuconfig
  - Hostname, banner, password, init system, getty, ..
- Rootfs overlays
  - For adding extra files
- Hook scripts to tweak
  - Post-build (after all rootfs packages have been built)
  - Post-image (after Buildroot is done)
- Custom packages
Upcoming work

- Package overlays (external packages)
- SELinux support
- Updated systemd/udev
- ... + What else gets submitted
Questions?

Build Root
Making Embedded Linux Easy

http://buildroot.org