Buildroot: what’s new?

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- Embedded Linux expertise
- Development, consulting and training
- Bootloader, Linux kernel, Yocto Project, Buildroot
- Strong open-source focus
- Freely available training materials

Co-maintainer of Buildroot
Living in Toulouse, France
Buildroot at a glance

- Is an **embedded Linux build system**, builds from source:
  - cross-compilation toolchain
  - root filesystem with many libraries/applications, cross-built
  - kernel and bootloader images
- **Fast**, simple root filesystem in minutes
- **Easy** to use and understand: kconfig and make
- **Small** root filesystem, default 2 MB
- More than **2500 packages** available
- Generates filesystem images, not a distribution
- Vendor neutral
- Active community, stable releases every 3 months
- Started in 2001, oldest still maintained build system
- [http://buildroot.org](http://buildroot.org)
Agenda

- See what’s new in Buildroot since the last two years
- Covering Buildroot 2017.11 to Buildroot 2019.11-pre
  - Community activity
  - Release schedule
  - Architecture support
  - Toolchain support
  - Package infrastructure improvements
  - Download infrastructure improvements
  - Interesting package updates and additions
  - Reproducible builds
  - Top-level parallel build
  - Tooling improvements
Buildroot: an active project

Number of commits per release

- Kernel, drivers and embedded Linux - Development, consulting, training and support - https://bootlin.com
Buildroot: an active project

Number of contributors per release

Kernel, drivers and embedded Linux - Development, consulting, training and support - https://bootlin.com
Buildroot: an active project

E-mails on the mailing list

0 500 1000 1500 2000 2500 3000 3500 4000 4500


Kernel, drivers and embedded Linux - Development, consulting, training and support - https://bootlin.com
Release schedule

➤ What we already had
  ➤ **Four releases** per year: YYYY.02, YYYY.05, YYYY.08, YYYY.11
  ➤ **3-month cycles**: 2 months development 1 month stabilization

➤ What we’ve added
  ➤ **LTS**: Long Term Support release
  ➤ Each **YYYY.02 release is supported during one year**
  ➤ Security updates, bug fixes
  ➤ YYYY.02.x maintenance branch, and regular (≈ monthly) point releases
  ➤ 2017.02: to 2017.02.11, 860 commits
  ➤ 2018.02: to 2018.02.12, 1075 commits
  ➤ 2019.02: to 2019.02.6: 734 commits (so far)
Support for new CPU architectures

- **RISC-V**, 32-bit and 64-bit
- **NDS32**

Support for **new variants** of existing architectures:
- ARM Cortex cores, x86 cores, MIPS cores, ARC cores, C-SKY cores

Removal of **Blackfin** architecture

Overall, **support for**: ARC, ARM, AArch64, C-SKY, m68k, Microblaze, MIPS, NDS32, NIOS2, OpenRISC, PowerPC, RISC-V, SuperH, SPARC, x86, Xtensa

- Kernel, drivers and embedded Linux - Development, consulting, training and support - [https://bootlin.com](https://bootlin.com)
Internal toolchain: Buildroot builds your toolchain from source

- No significant change, just regular updates
- **gcc** 8.x and 9.x added, gcc 4.9, 6.x removed
- **binutils** updated, 2.32
- **uClibc-ng** updated, 1.0.32
- **musl** updated, 1.1.24
- **glibc** updated, 2.30
- Useful testing done by Romain Naour using the **toolchains-builder** project
Toolchain support: external toolchain

**External toolchain**: Buildroot uses an existing pre-built toolchain

- ARM toolchains added
- AArch64 big-endian toolchains from ARM and Linaro added
- Andes NDS32 toolchain added
- Updates to numerous existing toolchains
- Declaring external toolchains from `BR2_EXTERNAL` trees
New package infrastructures: Go and Meson

- Package infrastructures **factorize the common logic** to configure, build and install packages that use a standardized build system

- **Two new** package infrastructures:
  - `golang-package` for Go-based packages
  - `meson-package` for Meson-based packages

- **Already** had support for: Autotools, CMake, Kconfig, Luarocks, Perl, Python, Erlang, Waf and kernel modules
Go package example: docker-cli

package/docker-cli/docker-cli.mk

# docker-cli
#

DOCKER_CLI_VERSION = 18.09.9
DOCKER_CLI_SITE = $(call github,docker,cli,v$(DOCKER_CLI_VERSION))
DOCKER_CLI_WORKSPACE = gopath

DOCKER_CLI_LICENSE = Apache-2.0
DOCKER_CLI_LICENSE_FILES = LICENSE

DOCKER_CLI_DEPENDENCIES = host-pkgconf

DOCKER_CLI_TAGS = autogen
DOCKER_CLI_BUILD_TARGETS = cmd/docker

DOCKER_CLI_LDFLAGS = \
  -X github.com/docker/cli/cli.GitCommit=$(DOCKER_CLI_VERSION) \
  -X github.com/docker/cli/cli.Version=$(DOCKER_CLI_VERSION)

DOCKER_CLI_INSTALL_BINS = $(notdir $(DOCKER_CLI_BUILD_TARGETS))

$(eval $(golang-package))
Meson package example: libmpdclient

package/libmpdclient/libmpdclient.mk

# libmpdclient

LIBMPDCLIENT_VERSION_MAJOR = 2
LIBMPDCLIENT_VERSION = $(LIBMPDCLIENT_VERSION_MAJOR).16
LIBMPDCLIENT_SOURCE = libmpdclient-$(LIBMPDCLIENT_VERSION).tar.xz
LIBMPDCLIENT_SITE = http://www.musicpd.org/download/libmpdclient/$(LIBMPDCLIENT_VERSION_MAJOR)
LIBMPDCLIENT_INSTALL_STAGING = YES
LIBMPDCLIENT_LICENSE = BSD-3-Clause
LIBMPDCLIENT_LICENSE_FILES = COPYING
$(eval $(meson/package))
Main improvement: **Git caching**, for Git-fetched packages

- Before: complete clone of the Git repository, checkout the requested version, create a tarball with the source code, throw away the Git repository
- Drawback: another full clone next time the package version is changed
- Now: keep a clone of the git repository in $DL_DIR/<package>/git/, much faster download when a Git-fetched package is updated

Tarballs are now stored in per-package sub-directories in $DL_DIR

Major rewrite of the internals of the download infrastructure, package/pkg-download.mk, support/download/
Package updates and additions

- Between 2017.11 and 2019.08
  - 378 packages have been added
  - 56 packages have been removed, 30 of which are X.org proto packages, Qt4
- Addition of: Rust (compiler, cargo), LLVM/Clang (not as a compiler), Mender, OpenJDK, OpenRC init system, OP-TEE OS, zillions of Perl/Python modules
- Update of all major software stacks: Qt 5.12, X.org 1.20, GStreamer 1.16.1, Wayland 1.17, Weston 6.0, Kodi 17.6.

```
$ git log --format=oneline 2017.11..2019.08 package/ \n  | grep -i bump | wc -l
2858
```
Hardening options

- Addition of support for building the entire code base with a number of security hardening mechanisms
- Improvement of Stack Protection options: BR2_SSP_REGULAR, BR2_SSP_STRONG, BR2_SSP_ALL
- Addition of RELRO protection options: BR2_RELRO_NONE, BR2_RELRO_PARTIAL, BR2_RELRO_FULL
- Addition of buffer-overflow detection (FORTIFY SOURCE) options: BR2_FORTIFY_SOURCE_NONE, BR2_FORTIFY_SOURCE_1, BR2_FORTIFY_SOURCE_2
- Mostly contributed by Rockwell Collins
New target: make show-info

- New top-level target: make show-info
- Outputs a JSON blurb that provides lost of metadata about the packages enabled in the current configuration
- JSON makes it easily usable in scripts and tools
- Allows to analyze the contents of a system, validate the choice of packages, get their download URL, and more.
- Other analysis tool already present:
  - legal-info
  - graph-build, graph-size

```json
{
    "busybox": {
      "type": "target",
      "virtual": false,
      "version": "1.31.0",
      "licenses": "GPL-2.0",
      "dl_dir": "busybox",
      "install_target": true,
      "install_staging": false,
      "install_images": false,
      "downloads": [
        {
          "source": "busybox-1.31.0.tar.bz2",
          "uris": [
            "http+http://www.busybox.net/downloads",
            "http|urlencode+http://sources.buildroot.net/busybox",
            "http|urlencode+http://sources.buildroot.net"
          ]
        }
      ],
      "dependencies": [
        "host-skeleton",
        "host-tar",
        "skeleton",
        "toolchain"
      ],
      "reverse_dependencies": []
    },
    "kernel": {
      "type": "target",
      "virtual": false,
      "version": "5.10.12",
      "licenses": "GPL-2.0",
      "dl_dir": "kernel",
      "install_target": true,
      "install_staging": false,
      "install_images": false,
      "downloads": [
        {
          "source": "kernel-5.10.12.tar.gz",
          "uris": [
            "http+http://kernel.bootlin.com/downloads",
            "http|urlencode+http://sources.buildroot.net/kernel",
            "http|urlencode+http://sources.buildroot.net"
          ]
        }
      ],
      "dependencies": [
        "host-skeleton",
        "host-tar",
        "skeleton",
        "toolchain"
      ],
      "reverse_dependencies": []
    }
}
```
Reproducible builds

- Goal: given a Buildroot configuration/version, two builds will give two exactly identical results
- Google Summer of Code in summer 2019, with Atharva Lele working on *Reproducible Builds*
- Mentored by Arnout Vandecappelle and Yann E. Morin
- Automated testing on autobuild.buildroot.org
  - Some builds are done twice, with `BR2_REPRODUCIBLE=y`, and then tested for equality
  - If not equal, comparison done with `diffoscope` to facilitate the analysis
  - Differences between builds: build time and location
  - Ultimately between environments
- Fixes in tar, gzip and cpio handling to avoid timestamp issues
- More work is needed: improving the `diffoscope` reporting (in progress), fix the reproducibility issues
Reproducible build result

--- /home/naourr/work//instance-1/output-1/images/rootfs.tar
+++ /home/naourr/work//instance-2/output-2/images/rootfs.tar

./usr/lib/asterisk/modules/app_agent_pool.so
/home/naourr/work/instance-1/host/bin/m68k-linux-readelf --wide --decompress --hex-dump=.rodata {}
@@ -112,15 +112,15 @@
 0x0000a2f2 20746f20 6a6f696e 20746865 20627269 to join the bri
 0x0000a302 6467652e 0a004552 524f5200 4167656e dge...ERROR.Agent
 0x0000a312 74202725 73273a20 4661696c 65642074 t '%s': Failed t
 0x0000a322 6f20616c 65727420 74686520 6167656e o alert the agent
 0x0000a332 742e0a00 4e4f545f 434f4e45 44002f68 0...NOT_CONNECTED
 0x0000a342 6e696e74 72696e67 72696e67 73746572 69736b2d31362e312f696e asterisk-16.6.1/instance-1/output-1/build/ast
- 0x0000a362 75747075 742d312f 6275696c 642f6173 utput-1/build/as
  0x0000a362 75747075 742d322f 6275696c 642f6173 utput-2/build/as
 0x0000a372 74657269 736b2d31 362e362e 312f696e74 6liverisk-16.6.1/in
 0x0000a382 636c7564 652f6f722f 74657269 736b2f73 clude/asterisk/s
 0x0000a392 7472696e 67732e68 00416374 696f6e49 trings.h.ActionI
 0x0000a3a2 44004163 74696e74 49443a20 25730d0a D.ActionID: %s..
 0x0000a3b2 00737461 72740041 676f6e74 73207769 .start.Agents with
 0x0000a3c2 6c6c696e 676f6e696e 74666669 73312f696e follow.Agent:
 0x0000a3d2 2025730d 0a004e61 6d653a20 25730d0a %s.Name: %s..
Top-level parallel build

- **Goal:** build several packages in parallel
- **Some preparation work** has been merged
  - Rework the root filesystem image generation logic so that images can be generated in parallel
  - Rework dependencies for download and extract tools to be properly expressed per-package
- **Main remaining topic:** **per-package directories**
  - Each package has its own `HOST_DIR` (including the compiler sysroot) and `TARGET_DIR`
  - Guarantees that the dependencies seen by the package are always consistent
  - Last patch series sent in December 2018
Without top-level parallel build
With top-level parallel build
Runtime tests

- A *runtime test* infrastructure was introduced in 2017.02
- Each test case:
  - Builds a well-defined configuration
  - Boots it under Qemu
  - Runs some tests to verify that a given feature is working
- Complementary to *autobuilder* testing, which tests the build of random configurations
- `./support/testing/run-tests -h`
- Since 2017.11, many new test cases added
  - ATF, Python modules, Perl modules, Lua modules, OpenJDK, X.org/Mesa3D, Docker/Docker-Compose, hardening flags
Tooling improvements

- Internship of Victor Huesca at Bootlin in summer 2019, mentored by Thomas Petazzoni
- Topic: improve the Buildroot maintenance tooling
  - Use of release-monitoring.org for tracking upstream releases
  - Improved Buildroot developer notifications
  - Improved autobuilder search capabilities
release-monitoring.org is a service from the Fedora community that tracks upstream releases of open-source projects

Currently tracks 27000+ projects

Buildroot has 2500+ packages, difficult to make sure they are all kept up-to-date

Buildroot `pkg-stats` script produces a table of statistics about Buildroot packages, especially current version vs. upstream version

Improvements:

- Lots of *mappings* between Buildroot packages and release-monitoring.org packages added
- Fixes to Buildroot packages for the package version to match better
- JSON output in addition to HTML output (useful for tooling, next slide)
- Speed improvement
# Project: busybox

**Latest version**

1.31.0

**Homepage:**

http://www.busybox.net

**Backend:**

custom

**Version scheme:**

RPM

**Version check url:**

http://www.busybox.net/downloads/

## Status

<table>
<thead>
<tr>
<th>Status</th>
<th>Updated</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OK</td>
<td>2019-10-18 08:55:56 (UTC)</td>
<td>No new version found</td>
</tr>
</tbody>
</table>

## Versions

<table>
<thead>
<tr>
<th>Version</th>
<th>Retrieved on (UTC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.31.0</td>
<td>2019-06-10 11:03</td>
</tr>
<tr>
<td>1.30.1</td>
<td>2019-02-14 15:02</td>
</tr>
<tr>
<td>1.30.0</td>
<td>2019-01-07 12:11</td>
</tr>
<tr>
<td>1.29.3</td>
<td>Date information unavailable</td>
</tr>
<tr>
<td>1.29.2</td>
<td>Date information unavailable</td>
</tr>
<tr>
<td>1.29.1</td>
<td>Date information unavailable</td>
</tr>
<tr>
<td>1.28.0</td>
<td>Date information unavailable</td>
</tr>
<tr>
<td>1.28.4</td>
<td>Date information unavailable</td>
</tr>
<tr>
<td>1.28.3</td>
<td>Date information unavailable</td>
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<tr>
<td>1.28.2</td>
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<tr>
<td>1.28.1</td>
<td>Date information unavailable</td>
</tr>
<tr>
<td>1.28.0</td>
<td>Date information unavailable</td>
</tr>
<tr>
<td>1.27.2</td>
<td>Date information unavailable</td>
</tr>
<tr>
<td>1.27.1</td>
<td>Date information unavailable</td>
</tr>
<tr>
<td>1.27.0</td>
<td>Date information unavailable</td>
</tr>
<tr>
<td>1.26.2</td>
<td>Date information unavailable</td>
</tr>
<tr>
<td>1.26.1</td>
<td>Date information unavailable</td>
</tr>
<tr>
<td>1.26.0</td>
<td>Date information unavailable</td>
</tr>
</tbody>
</table>

## Mappings

<table>
<thead>
<tr>
<th>Distribution</th>
<th>Package name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fedora</td>
<td>busybox</td>
</tr>
<tr>
<td>Alpine</td>
<td>busybox</td>
</tr>
<tr>
<td>NixOS</td>
<td>busybox</td>
</tr>
<tr>
<td>Arch Linux</td>
<td>busybox</td>
</tr>
<tr>
<td>Arch Linux</td>
<td>minitcpio-busybox</td>
</tr>
<tr>
<td>Cygwin</td>
<td>busybox</td>
</tr>
<tr>
<td>Buildroot</td>
<td>busybox</td>
</tr>
<tr>
<td>Package</td>
<td>Count</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>package/bcusdk/bcusdk.mk</td>
<td>2</td>
</tr>
<tr>
<td>package/bdwgc/bdwgc.mk</td>
<td>0</td>
</tr>
<tr>
<td>package/beecrypt/beecrypt.mk</td>
<td>3</td>
</tr>
<tr>
<td>package/bellagio/bellagio.mk</td>
<td>5</td>
</tr>
<tr>
<td>package/benejson/benejson.mk</td>
<td>1</td>
</tr>
<tr>
<td>package/berkeleydb/berkeleydb.mk</td>
<td>2</td>
</tr>
<tr>
<td>package/bind/bind.mk</td>
<td>1</td>
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<td>package/binutils/binutils.mk</td>
<td>30</td>
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<td>package/biosdevname/biosdevname.mk</td>
<td>0</td>
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<td>package/bird/bird.mk</td>
<td>0</td>
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<tr>
<td>package/bison/bison.mk</td>
<td>0</td>
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<tr>
<td>package/bitcoin/bitcoin.mk</td>
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</tr>
<tr>
<td>package/bitstream-vera/bitstream-vera.mk</td>
<td>0</td>
</tr>
<tr>
<td>package/bitstream/bitstream.mk</td>
<td>0</td>
</tr>
</tbody>
</table>
Tooling: improved developer notifications

- Buildroot has a DEVELOPERS file, associating developers with packages, defconfigs, architectures, tests they maintain
- Already used to send notifications of build failures reported by the Buildroot autobuilders
- Notification e-mail has been improved with:
  - On a weekly basis, notification about packages that are not up-to-date, according to release-monitoring.org
  - Failures in the build of defconfigs in Gitlab CI
  - Failures in the execution of runtime tests in Gitlab CI
## Tooling: improved developer notifications

### Packages having a newer version

<table>
<thead>
<tr>
<th>name</th>
<th>found by</th>
<th>link to release-monitoring.org</th>
<th>version</th>
<th>upstream</th>
<th>orph?</th>
</tr>
</thead>
<tbody>
<tr>
<td>acpica</td>
<td>DISTRO</td>
<td><a href="https://release-monitoring.org/project/00018">https://release-monitoring.org/project/00018</a></td>
<td>20190703</td>
<td>20190816</td>
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<tr>
<td>acsccid</td>
<td>DISTRO</td>
<td><a href="https://release-monitoring.org/project/15661">https://release-monitoring.org/project/15661</a></td>
<td>1.1.4</td>
<td>1.1.7</td>
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</tr>
<tr>
<td>adwaita-icon-theme</td>
<td>DISTRO</td>
<td><a href="https://release-monitoring.org/project/13117">https://release-monitoring.org/project/13117</a></td>
<td>3.22.0</td>
<td>3.34.0</td>
<td></td>
</tr>
<tr>
<td>aespipe</td>
<td>DISTRO</td>
<td><a href="https://release-monitoring.org/project/21320">https://release-monitoring.org/project/21320</a></td>
<td>2.4e</td>
<td>2.4f</td>
<td></td>
</tr>
<tr>
<td>alljoyn</td>
<td>DISTRO</td>
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<td>16.04.00a</td>
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<td>ORPH</td>
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<td>alljoyn-tcl</td>
<td>DISTRO</td>
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<td>16.04.00a</td>
<td>16.10.02</td>
<td></td>
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<tr>
<td>android-tools</td>
<td>GUESS</td>
<td><a href="https://release-monitoring.org/project/13909">https://release-monitoring.org/project/13909</a></td>
<td>4.2.2+git...</td>
<td>10.0.0_r5</td>
<td></td>
</tr>
<tr>
<td>armadillo</td>
<td>DISTRO</td>
<td><a href="https://release-monitoring.org/project/07006">https://release-monitoring.org/project/07006</a></td>
<td>7.900.1</td>
<td>9.800.1</td>
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<tr>
<td>assimp</td>
<td>DISTRO</td>
<td><a href="https://release-monitoring.org/project/06988">https://release-monitoring.org/project/06988</a></td>
<td>4.1.0</td>
<td>5.0.0</td>
<td></td>
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<tr>
<td>asterisk</td>
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<td>16.5.1</td>
<td>16.6.0</td>
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<tr>
<td>at-spi2-atk</td>
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<td>at-spi2-core</td>
<td>DISTRO</td>
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<tr>
<td>atk</td>
<td>DISTRO</td>
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<td>2.33.3</td>
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</tr>
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<td>atkmm</td>
<td>DISTRO</td>
<td><a href="https://release-monitoring.org/project/07962">https://release-monitoring.org/project/07962</a></td>
<td>2.24.2</td>
<td>2.29.1</td>
<td></td>
</tr>
</tbody>
</table>
Tooling: improved developer notifications

### Detail of defconfig failures

<table>
<thead>
<tr>
<th>defconfig</th>
<th>link to the job</th>
<th>orph?</th>
</tr>
</thead>
<tbody>
<tr>
<td>beaglebone_qt5</td>
<td><a href="https://gitlab.com/buildroot.org/buildroot/-/jobs/318105145">https://gitlab.com/buildroot.org/buildroot/-/jobs/318105145</a></td>
<td></td>
</tr>
<tr>
<td>engicam_imx6qd1_icore_qt5</td>
<td><a href="https://gitlab.com/buildroot.org/buildroot/-/jobs/318105157">https://gitlab.com/buildroot.org/buildroot/-/jobs/318105157</a></td>
<td></td>
</tr>
<tr>
<td>imx6-sabreauto</td>
<td><a href="https://gitlab.com/buildroot.org/buildroot/-/jobs/318105190">https://gitlab.com/buildroot.org/buildroot/-/jobs/318105190</a></td>
<td></td>
</tr>
<tr>
<td>minnowboard_max-graphical</td>
<td><a href="https://gitlab.com/buildroot.org/buildroot/-/jobs/318105208">https://gitlab.com/buildroot.org/buildroot/-/jobs/318105208</a></td>
<td></td>
</tr>
<tr>
<td>qemu_riscv32_virt</td>
<td><a href="https://gitlab.com/buildroot.org/buildroot/-/jobs/318105337">https://gitlab.com/buildroot.org/buildroot/-/jobs/318105337</a></td>
<td></td>
</tr>
<tr>
<td>raspberrypi3_qt5we</td>
<td><a href="https://gitlab.com/buildroot.org/buildroot/-/jobs/318105367">https://gitlab.com/buildroot.org/buildroot/-/jobs/318105367</a></td>
<td></td>
</tr>
</tbody>
</table>

### Detail of runtime-test failures

<table>
<thead>
<tr>
<th>runtime-test</th>
<th>link to the job</th>
<th>orph?</th>
</tr>
</thead>
<tbody>
<tr>
<td>TestGlxinfo</td>
<td><a href="https://gitlab.com/buildroot.org/buildroot/-/jobs/318105533">https://gitlab.com/buildroot.org/buildroot/-/jobs/318105533</a></td>
<td>ORPH</td>
</tr>
<tr>
<td>systemctldRoIfupdwn</td>
<td><a href="https://gitlab.com/buildroot.org/buildroot/-/jobs/318105519">https://gitlab.com/buildroot.org/buildroot/-/jobs/318105519</a></td>
<td>ORPH</td>
</tr>
<tr>
<td>systemctldRoNetWorkd</td>
<td><a href="https://gitlab.com/buildroot.org/buildroot/-/jobs/318105521">https://gitlab.com/buildroot.org/buildroot/-/jobs/318105521</a></td>
<td>ORPH</td>
</tr>
<tr>
<td>systemctldRwIfudpwn</td>
<td><a href="https://gitlab.com/buildroot.org/buildroot/-/jobs/318105523">https://gitlab.com/buildroot.org/buildroot/-/jobs/318105523</a></td>
<td>ORPH</td>
</tr>
<tr>
<td>systemctldRwNetworkd</td>
<td><a href="https://gitlab.com/buildroot.org/buildroot/-/jobs/318105525">https://gitlab.com/buildroot.org/buildroot/-/jobs/318105525</a></td>
<td>ORPH</td>
</tr>
</tbody>
</table>
Tooling: improved autobuilder search capabilities

- autobuild.buildroot.org collects results from random builds executed by our autobuilders.
- Testing random configurations 24/7, allows to detect numerous dependency problems, version compatibility issues, toolchain problems, and more.
- Running this testing effort for many years.
- Improvement:
  - Can now search through build results by config symbol
  - Ex: what are the successful builds that had $BR2_PACKAGE_BUSYBOX$=y on ARM, with uClibc?
  - Very useful tool when analyzing build issues, and trying to understand in which situations it happens / since when.
Tooling: improved autobuilder search capabilities

Buildroot tests - Search page

Submitter:
Submitter

Subarch:
Sub-Architecture

From:
m/dd/yyyy

Static?
Y N

Failure reason:
Reason

Symbols:
BB2 PACKAGE_BUSYBOX

Arch:
arm

C library:
uclibc

To:
m/dd/yyyy

Status?
OK NOK TIMEOUT

Search!
Other smaller improvements

- Addition of a `make <pkg>-diff-config` target for `kconfig` based packages: Linux, U-Boot, Busybox, etc.
  - Shows the difference between the current package configuration and the one that is stored in the Buildroot configuration
- Support for generating rootfs images in F2FS and BTRFS formats
- Support for `gettext-tiny` as an alternative to full blown `GNU Gettext`
  - Smaller footprint, smaller build time, for cases where native language support is not needed
Conclusion

- Very active project
- LTS release, 1 year maintenance for security/bug fixes
- New CPU architectures
- Package infrastructures for new build systems
- Git caching
- Packages kept up-to-date, many new packages
- Reproducible builds effort in progress
- Maintenance tooling improvements

**Getting started with Buildroot** tutorial at this ELCE as part of the *Embedded Development Essentials* track, on Wednesday at 2:25 PM.
Questions? Suggestions? Comments?

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