

# The State of PTXdist

Roland Hieber <rhi@pengutronix.de>

FOSDEM 2020

# What is PTXdist?

---

- Build system geared towards Embedded Linux
- Building blocks:
  - GNU Make
  - Kconfig
  - Bash
  - some AWK
- First version before August 2003
- Monthly releases
- License: GPL-2.0
- Online documentation:  
<https://ptxdist.org/doc>



- 914 target packages
- 184 host packages
- 18 pre-built toolchain architectures (via OSELAS.Toolchain)
  - ARM-v4/v5/ARM-v7, AArch64, x86, x86\_64, MIPS, RISC-V, PowerPC 600

(as of PTXdist 2019.12.0)

# A First Look

## \$ ptxdist menuconfig

```
config - PTXdist 2020.01.0
PTXdist 2020.01.0
Arrow keys navigate the menu. <Enter> selects submenu
--> (or empty submenu ----). Highlighted letters are
hotkeys. Pressing <Y> includes, <N> excludes, <M>
modularizes features. Press <Esc><Esc> to exit, <?> for

+-----+
|  |
+-----+
Project Name & Version  -->
----- Host Options  -----
PTXdist Options       -->
Host Tools            -->
Cross Tools           ----
Debug Tools          -->
-----
Root Filesystem       -->
Core (libc, locales)  -->
-----
Shell & Console Tools -->
Scripting Languages   -->
Bytecode Engines / VMs -->
Networking Tools     -->
Disk and File Utilities -->
Communication Utilities -->
Applications         -->
Editors              -->
System Libraries     -->
Security              -->
Middleware           -->
Scientific Apps      -->
Web Applications     -->
Test Suites          -->
Games                -->
Graphics & Multimedia -->
-----
Bare Metal           -->
-----
[ ] Staging          ----

< elect>  < Exit >  < Help >  < Save >  < Load >
```

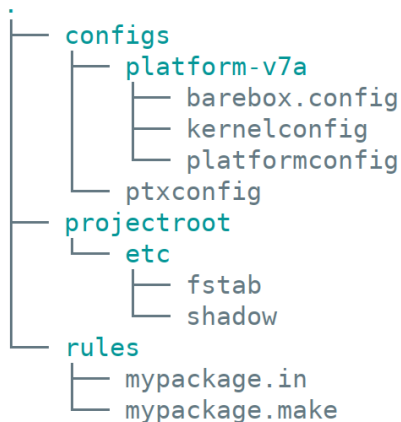
## \$ ptxdist platformconfig

```
config - PTXdist 2020.01.0
PTXdist 2020.01.0
Arrow keys navigate the menu. <Enter> selects submenu
--> (or empty submenu ----). Highlighted letters are
hotkeys. Pressing <Y> includes, <N> excludes, <M>
modularizes features. Press <Esc><Esc> to exit, <?> for

+-----+
|  |
+-----+
--- Target Platform Configuration
-----
(v7a) platform name
(-$(PTXDIST_BSP_AUTOVERSION)) platform version
  architecture  -->
-* Linux kernel  -->
[*] Build device tree  -->
-* dtc           -->
  console options  -->
  extra kernel    ----
  bootloaders     -->
  bootloader spec entries -->
  image creation options -->
[ ] Code signing  ----

< elect>  < Exit >  < Help >  < Save >  < Load >
```

# A Typical BSP



## Idea

- BSP structure == PTXdist structure
- Extend and overwrite upstream files locally

# Package Build Stages

---

## mypackage.get

- Download upstream tarball

## mypackage.extract

- Extract tarball, apply local patches

## mypackage.prepare

- Run ./configure, CMake, ...

## mypackage.compile

- *make -j*

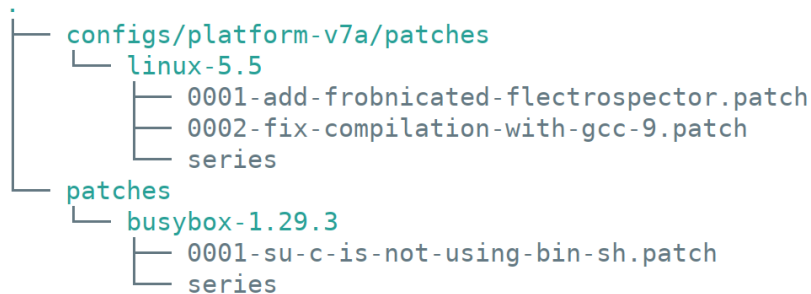
## mypackage.install

- *make install* into isolated directory

## mypackage.targetinstall

- Cherry-pick files into rootfs

# Applying Patches



- Automatically applied during the *extract* stage
- Edit patch queue with *git* or *quilt*

# Package Definition: rules/mypackage.in

---

```
## SECTION=project_specific
```

```
config MYPACKAGE
```

```
  tristate
```

```
  select HOST_CMAKE
```

```
  select LIBUSB
```

```
  prompt "mypackage"
```

```
  help
```

```
    MyPackage is an example package built for FOSDEM20.
```

```
    It is built with CMake and uses libusb at runtime.
```



# Package Definition: rules/mypackage.make

---

```
PACKAGES-$(PTXCONF_MYPACKAGE) += mypackage
```

```
MYPACKAGE_VERSION := 0.1
```

```
MYPACKAGE_MD5 := 68b329da9893e34099c7d8ad5cb9c940
```

```
MYPACKAGE := mypackage-$(MYPACKAGE_VERSION)
```

```
MYPACKAGE_SUFFIX := tar.gz
```

```
MYPACKAGE_URL := https://ftp.example.org/mypackage/$(MYPACKAGE).$(MYPACKAGE_SUFFIX)
```

```
MYPACKAGE_SOURCE := $(SRCDIR)/$(MYPACKAGE).$(MYPACKAGE_SUFFIX)
```

```
MYPACKAGE_DIR := $(BUILDDIR)/$(MYPACKAGE)
```

```
MYPACKAGE_LICENSE := 0BSD
```

```
MYPACKAGE_LICENSE_FILES := file://LICENSE;md5=60b725f10c9c85c70d97880dfe8191b3
```

# Package Definition: rules/mypackage.make

```
# -----  
# Prepare  
# -----  
  
MYPACKAGE_CONF_TOOL := cmake  
MYPACKAGE_CONF_OPT  := $(CROSS_CMAKE_USR) -DUSB=ON  
  
# -----  
# Target-Install  
# -----  
  
$(STATEDIR)/mypackage.targetinstall:  
    @$(call targetinfo)  
  
    @$(call install_init, mypackage)  
    @$(call install_fixup, mypackage,PRIORITY,optional)  
    @$(call install_fixup, mypackage,SECTION,base)  
    @$(call install_fixup, mypackage,AUTHOR,"Roland Hieber <rhi@pengutronix.de>")  
    @$(call install_fixup, mypackage,DESCRIPTION,missing)  
  
    @$(call install_copy, mypackage, 0, 0, 0755, -, )  
  
    @$(call install_finish, mypackage)  
  
    @$(call touch)
```

# Package Types

---

## Target packages

- Built on the build host for the target architecture
  - e.g: systemd, busybox, coreutils, kernel, bootloader

## Host packages

- Built on the host, executed on the host
- Compatible build environment on different host systems
  - e.g.: host-dosfstools, host-python3, host-cmake

## Image packages

- Determine the image format and the list of installed packages
  - e.g. hdimage, root.tgz, RAUC bundles

# Layering Mechanisms

---

- Platforms
- Collections
- Alternative config files
- Kconfig diffs
- Base layers

# Layering: Platforms

## userland

- systemd
- busybox
- cups

## platform-rpi

arm-1136jfs-linux-gnueabihf

- kernel  
(4.19) kernel version
- barebox
- image\_hdimg
- image\_boot\_vfat

# Layering: Platforms

## userland

- systemd
- busybox
- cups

### platform-rpi

arm-1136jfs-linux-gnueabihf

- kernel  
(4.19) kernel version
- barebox
- image\_hdimg
- image\_boot\_vfat

### platform-v7a

arm-v7a-linux-gnueabihf

- kernel  
(5.5) kernel version
- barebox
- image\_hdimg
- image\_boot\_vfat

### platform-v8a

aarch64-v8a-linux-gnu

- kernel  
(5.5-rc7) kernel version
- barebox
- image\_hdimg
- image\_boot\_vfat

# Layering: Collections

## debug collection

- [x] gdb
- [x] strace
- [x] stress-ng

## relase collection

- [ ] gdb
- [ ] strace
- [ ] stress-ng

## userland

- [x] systemd
- [x] busybox
- [x] cups

- [m] gdb
- [m] strace
- [m] stress-ng

## platform-rpi

arm-1136jfs-linux-gnueabi

- [x] kernel  
(4.19) kernel version
- [ ] barebox
- [x] image\_hdimg
- [x] image\_boot\_vfat

## platform-v7a

arm-v7a-linux-gnueabi

- [x] kernel  
(5.5) kernel version
- [x] barebox
- [x] image\_hdimg
- [ ] image\_boot\_vfat

## platform-v8a

aarch64-v8a-linux-gnu

- [x] kernel  
(5.5-rc7) kernel version
- [x] barebox
- [x] image\_hdimg
- [ ] image\_boot\_vfat

# Layering: Alternative Config Files

```
# ptxdist/rules/cups.make
$(STATEDIR)/cups.targetinstall:
# ...
@$(call install_alternative, cups, daemon, lp, 0640, /etc/printcap)
```

With platform v7a:

1. my-bsp/projectroot.v7a/etc/printcap
2. my-bsp/projectroot/etc/printcap.v7a
3. my-bsp/configs/platform-v7a/projectroot/etc/printcap.v7a
4. my-bsp/projectroot/etc/printcap
5. my-bsp/configs/platform-v7a/projectroot/etc/printcap
6. projectroot/etc/printcap from PTXdist install dir
7. /etc/printcap from *cups* install dir
8. /etc/printcap from *cups* build dir



# Layering: Kconfig Diffs

```
# configs/platform-v7a/rules/kernel-debug.make
PACKAGES-$(PTXCONF_KERNEL_DEBUG) += kernel-debug
KERNEL_DEBUG_VERSION      := 5.4
# ...
KERNEL_DEBUG_CONFIG       := $(call ptx/in-platformconfigdir, kernelconfig-debug)
KERNEL_DEBUG_REF_CONFIG   := $(call ptx/in-platformconfigdir, kernelconfig)
```

```
~/projects/my-bsp $ ptxdist menuconfig kernel-debug
# [... enable debug options ... ]
```

```
~/projects/my-bsp $ ls -l configs/platform-v7a/kernelconfig*
configs/platform-v7a/kernelconfig
configs/platform-v7a/kernelconfig-debug
configs/platform-v7a/kernelconfig-debug.diff
```

```
~/projects/my-bsp $ cat configs/platform-v7a/kernelconfig-debug.diff
1cdfdb2da785381a41fdd7320b37cd3d
CONFIG_DMA_API_DEBUG=y
CONFIG_DMA_API_DEBUG_SG=y
```

# Layering: Base Layers

---

Remember this?:

## Idea

- BSP structure == PTXdist structure
- Extend and overwrite upstream files locally

# Layering: Base Layers

---

Remember this?:

## Idea

- BSP structure == PTXdist structure
- Extend and overwrite upstream files locally

## Better Idea

- “All problems in computer science can be solved by another level of indirection.” (David Wheeler)

# Layering: Base Layers

```
distrokit/  
├── configs  
│   ├── platform-v7a  
│   │   ├── kernelconfig  
│   │   └── platformconfig  
│   └── ptxconfig  
└── rules  
    ├── datapartition.in  
    └── datapartition.make
```

```
my-bsp/  
├── base -> ../distrokit/  
├── configs  
│   ├── ptxconfig  
│   └── ptxconfig.diff  
└── rules  
    ├── mypackage.in  
    └── mypackage.make
```

# Goodies: Package Info

---

```
~/projects/my-bsp $ ptxdist package-info coreutils
```

```
-----  
target: coreutils.package-info  
-----
```

```
package:    coreutils  
version:    8.31
```

```
license:    GPL-3.0-or-later  
files:      file://COPYING;md5=d32239bcb673463ab874e80d47fae504
```

```
source:     /usr/src/coreutils-8.31.tar.xz  
md5:        0009a224d8e288e8ec406ef0161f9293  
url:        http://ftp.uni-kl.de/pub/gnu/coreutils/coreutils-8.31.tar.xz
```

```
src dir:    my-bsp/platform-v7a/build-target/coreutils-8.31  
build dir:  my-bsp/platform-v7a/build-target/coreutils-8.31  
pkg dir:    my-bsp/platform-v7a/packages/coreutils-8.31
```

```
rule file:  ptxdist-2020.01.0/rules/coreutils.make
```

```
finished target coreutils.package-info
```

# Goodies: BSP Info

```
~/projects/my-bsp $ ptxdist bsp-info
```

```
-----  
target: bsp-info  
-----
```

```
vendor:          ACME  
project:         MyBSP  
version:         -
```

```
platform:        v7a  
platform version: -
```

```
BSP:             /home/rohieb/projects/my-bsp  
PTXdist:         /usr/local/lib/ptxdist-2020.01.0
```

```
ptxconfig:       my-bsp/configs/ptxconfig  
platformconfig:  my-bsp/configs/platform-v7a/platformconfig
```

```
images:          image-hdimg  
                 image-kernel  
                 image-root-ext  
                 image-root-tgz
```

```
finished target bsp-info
```

# Goodies: License Report

## \$ ptxdist make license-report

### Contents

<b>20 dosfstools</b>	<b>42</b>
20.1 COPYING	42
20.2 src_fsck.fat.e	54
<b>21 e2fsprogs</b>	<b>55</b>
21.1 NOTICE	55
21.2 lib_uuid_gm_uuid.e	71
<b>22 expat</b>	<b>72</b>
22.1 COPYING[automatically found]	72
<b>23 gcclibs</b>	<b>73</b>
23.1 COPYING3	73
23.2 COPYING.RUNTIME	85
<b>24 gdbserver</b>	<b>87</b>
24.1 COPYING	87
24.2 COPYING3	93
24.3 COPYING.LIB	105
24.4 COPYING3.LIB	114
<b>25 glib</b>	<b>118</b>
25.1 COPYING[automatically found]	118
<b>26 glibc</b>	<b>128</b>
26.1 COPYING	128
26.2 COPYING.LIB	134
26.3 LICENSES	143

## 21 e2fsprogs

**Package:** e2fsprogs 1.44.4

**License:** GPL-2.0-or-later AND LGPL-2.0-or-later AND BSD-3-Clause AND MIT

**Flags:** attribution

**URL:** <http://downloads.sourceforge.net/sourceforge/e2fsprogs/e2fsprogs/v1.44.4/e2fsprogs-1.44.4.tar.gz>

**MD5:** 156e94a6169ca1fa3f0c6749ae5921b9



Figure 21.1: Dependency tree for e2fsprogs

### 21.1 NOTICE

This package, the EXT2 filesystems utilities, are made available under the GNU Public License version 2, with the exception of the lib/ext2fs and lib/e2p libraries, which are made available under the GNU Library General Public License Version 2, the lib/uuid library which is made available under a BSD-style license and the lib/st and lib/ss libraries which are made available under a MIT-style license. Please see lib/uuid/COPYING for more details for the license for the files comprising the libuuid library, and the source file headers of the libet and libss libraries for more information.

# Trying it all out

A stylized ASCII art logo for 'Pengutronix'. The characters are composed of various symbols like pipes, dashes, and parentheses, creating a monospaced, geometric look. The text is arranged in three lines: 'P', 'e', 'n', 'g', 'u', 't', 'r', 'o', 'n', 'i', 'x' on the first line, 'i', 'n', 't', 'e', 'r', 'n', 'e', 't', 'i', 'o', 'n', 'a', 'l', 'l', 'y' on the second line, and 'a', 'n', 'd', 'o', 'p', 'e', 'n', 'i', 'n', 'g' on the third line.

A stylized ASCII art logo for 'DistroKit'. The characters are composed of various symbols like pipes, dashes, and parentheses, creating a monospaced, geometric look. The text is arranged in three lines: 'D', 'i', 's', 't', 'r', 'o', 'K', 'i', 't' on the first line, 'a', 'n', 'd' on the second line, and 'o', 'p', 'e', 'n', 'i', 'n', 'g' on the third line.

OSELAS(R)-DistroKit-2019.12.0-00013-ga194771d1638 / v7a-2019.12.0-00013-ga194771d1638  
ptxdist-2020.01.0/2020-02-01T12:42:15+0100

DistroKit login:

## DistroKit

- preconfigured BSP for a variety of dev boards (and qemu-arm)
- <https://git.pengutronix.de/cgit/DistroKit>



# Contributing

---

- Currently: ~85% Pengutronix contributions...
- Patches welcome:  
<https://www.ptxdist.org/doc/contributing.html>

# Contributing

---

- Currently: ~85% Pengutronix contributions...
- Patches welcome:  
<https://www.ptxdist.org/doc/contributing.html>

Questions?