The State of PTXdist

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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
Statistics

- 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

---
Project Name & Version
---
PTXdist Configuration Options
---
PTXdist Platform Configuration Options
---
PTXdist Host Tools
---
PTXdist Cross Tools
---
PTXdist Debug Tools
---
PTXdist Root Filesystem
---
PTXdist 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

---
Target Platform Configuration
---

(v7a) platform name

[ ] 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

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

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*
## 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.
```
```plaintext
# 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**
- [x] systemd
- [x] busybox
- [x] cups

**platform-rpi**
arm-1136jfs-linux-gnueabihf
- [x] kernel
  - (4.19) kernel version
- [ ] barebox
- [x] image_hdimg
- [x] image_boot_vfat
Layering: Platforms

**userland**
- [x] systemd
- [x] busybox
- [x] cups

**platform-rpi**
- arm-1136jfs-linux-gnueabihf
  - [x] kernel (4.19) kernel version
  - [ ] barebox
  - [x] image_hdimg
  - [x] image_boot_vfat

**platform-v7a**
- arm-v7a-linux-gnueabihf
  - [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: Collections

### Debug Collection
- gdb
- strace
- stress-ng

### Release Collection
- gdb
- strace
- stress-ng

### Userland
- systemd
- busybox
- cups

### Platform-rpi
- arm-1136jfs-linux-gnueabi
  - 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: Alternative Config Files

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.mk
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 -1 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
1cdfe3d2da785381a41fdd7320b37cd3d
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
~/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

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

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22 expat
   22.1 COPYING[automatically found] ............................ 72
23 gcclibs
   23.1 COPYING .................................................. 73
   23.2 COPYING.RUNTIME ........................................ 85
24 gdbserver
   24.1 COPYING .................................................. 87
   24.2 COPYING .................................................. 93
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26 glibc
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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: 156e94a6169ca1fa3f00c6749a46921b9

Figure 21.1: Dependency tree for e2fsprogs

21.1 NOTICE

This package, the EXT2 filesystem utilities, are made available under the GNU Public License version 2, with the exception of the lib/ext2fs and lib/e2fs 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/et and lib/ ese libraries which are made available under an MIT-style license. Please see lib/uuid/COPYING for more details for the license for the files comprising the lib/uuid library, and the source file headers of the libet and lib/ese libraries for more information.
Trying it all out

Pengutronix

DistroKit

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
• Currently: ~85% Pengutronix contributions...
• Patches welcome:
  https://www.ptxdist.org/doc/contributing.html
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Questions?