
COLLABORA
Apertis
Open Source Reference
Linux Distribution
Open First

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Open First

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Open Source is ...

- Transparency.
- Reliability.
- Faster time to market.
- Better security.
- Cost effective.

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Open Source is ...

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Debian

- The oldest and largest OSS community
- >24 architectures
- Long Term Support (LTS) extends lifetime at least 5 years
- Solid stable baseline (high robustness)

Apertis

- Collabora supported
- Rebased on Ubuntu 16.04 LTS (“Xenial Xerus”)
- GPLv3 free runtime

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Apertis

Versatile **open source** infrastructure tailored to the automotive needs, fit for a wide variety of **electronic devices**.

- **Security** and **modularity** are two of its primary strengths.
- Provides a **feature-rich framework** for add-on software and **resilient upgrade** capabilities.
- Beyond an operating system, it offers new APIs, tools and cloud services.

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Apertis scope

- Free and open source middleware ...
  - ... for infotainment in vehicles (IVI)
  - ... for internet of things (IoT)
  - ... with long term security support (LTS)
  - ... over the air updates (OTA)

- Apertis could easily be adapted ...
  - ... for cloud services (Cloud)
  - ... for virtual reality (VR, AR, xR)
  - ... for machine learning, artificial intelligence (ML, AI)
  - ... big data analysis (big data)

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Apertis infrastructure

- Code review system (**Phabricator**, GitLab)
- Application build system (**Jenkins**)
- Package build system – eases integration in OS (**OBS**)
- Image build system (Jenkins, **debos** in **Docker** containers)
- Test system
  - Unit tests (at application build time)
  - System tests (**LAVA**)
- License check system (FOSSology, BlackDuck)

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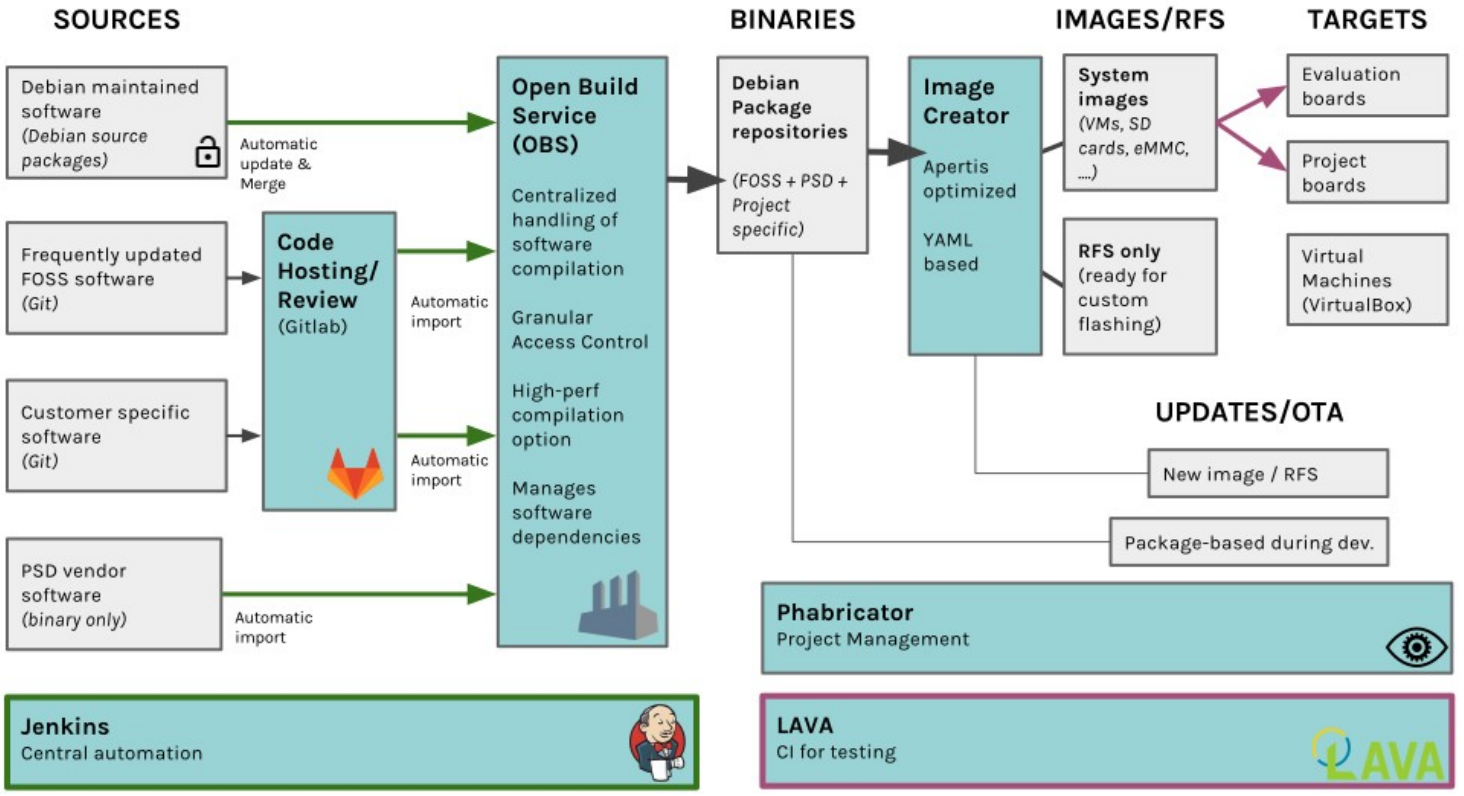
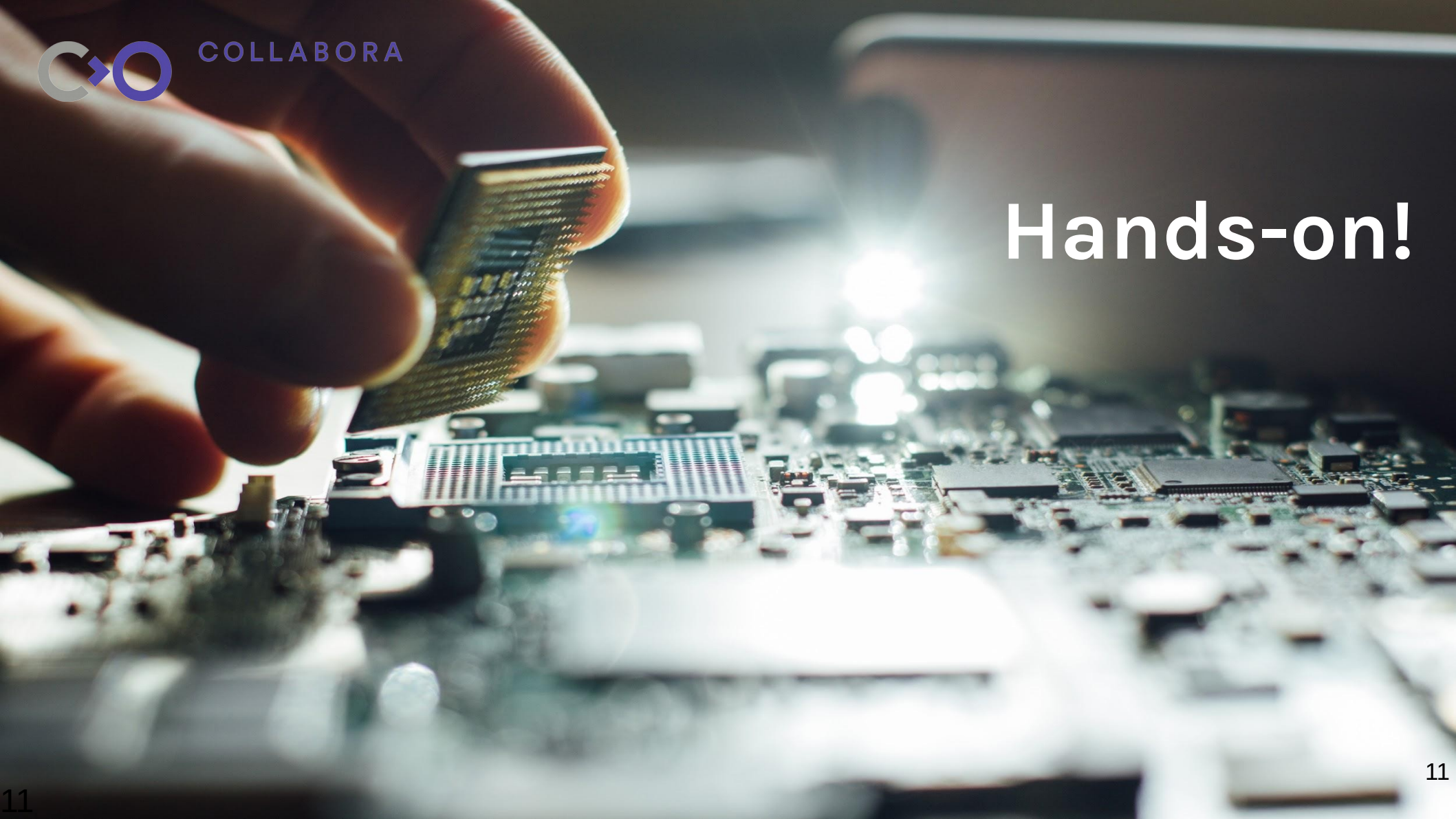
Apertis infrastructure





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Apertis SDK

- Download SDK from Apertis images site:
  - https://images.apertis.org/
  - Look for amd64 > SDK > VDI
- Uncompress the downloaded VM image
- Workshop will be based on the following tutorial:
  - https://people.collabora.com/~zumbi/bosch-linux-days/
  - https://gitlab.apertis.org/zumbi/apertis-bld-workshop

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Apertis workshop materials

- Workshop will be based on the following tutorial:
  - https://people.collabora.com/~zumbi/bosch-linux-days/
- Workshop source materials:
  - https://gitlab.apertis.org/zumbi/apertis-bld-workshop
  - https://gitlab.apertis.org/zumbi/apertis-bld-image-recipes

Apertis SDK

- Add training repository with extra packages (overlay repository)

```
$ echo "deb https://repositories.apertis.org/apertis 18.09 demo" \
  | sudo tee -a /etc/apt/sources.list.d/demo.list
```

Apertis SDK

- Install and configure software

```
$ sudo apt install qtcreator weston qt5-default nano geany
```

Apertis SDK

- SDK image can be easily customized and tuned for your needs following standard procedures to create Apertis images
  - Modifying image recipes

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Apertis SDK

- SDK can be used for:
  - Platform application development
  - Development toolkit (toolchain, debuggers, emulators)
    - GCC, GDB, autotools, cmake, weston, etc.
  - Package creation and upload to main archive
  - Generating images
  - Interfacing to the Apertis infrastructure

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Apertis SDK

- Download and install VirtualBox
- Download online
- Add image to VirtualBox
  - Type: Linux
  - Version: Ubuntu (64-bit)

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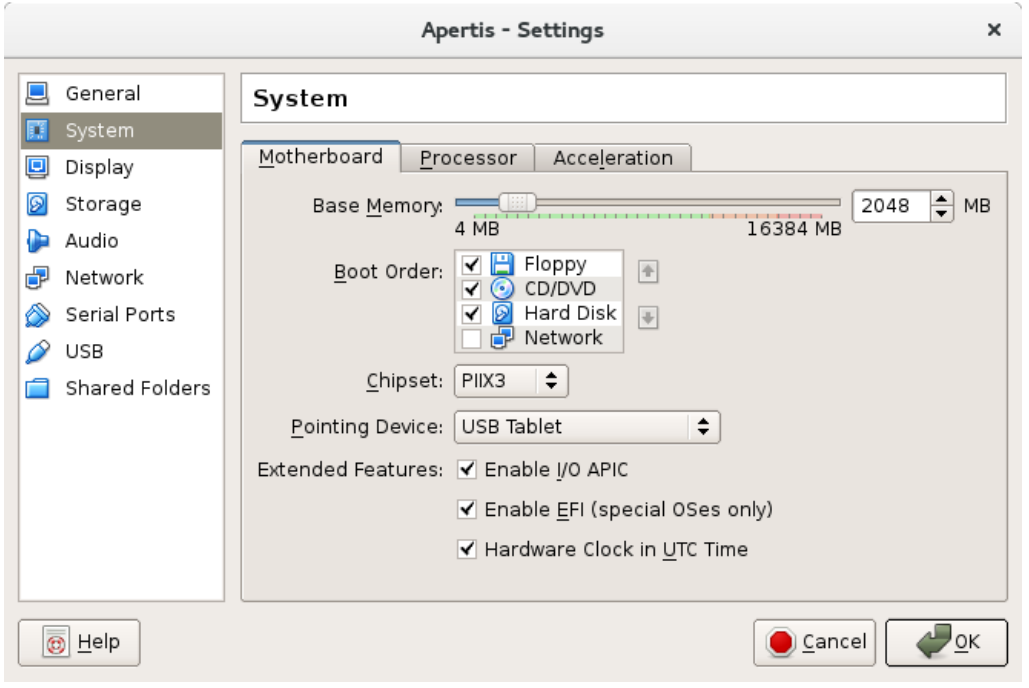
Apertis SDK

- Update your VM settings
  - More RAM
  - Enable I/O APIC
  - Enable EFI



Apertis SDK

- Install Guest Additions for the virtual machine
- Devices > Insert Guest Additions CD image…
- In the SDK, open desktop shortcut (VBOXADDITIONS…)
- Right click in file browser and open terminal
- In the terminal, run

```
$ sudo ./VboxLinuxAdditions.run
```

- Reboot the SDK

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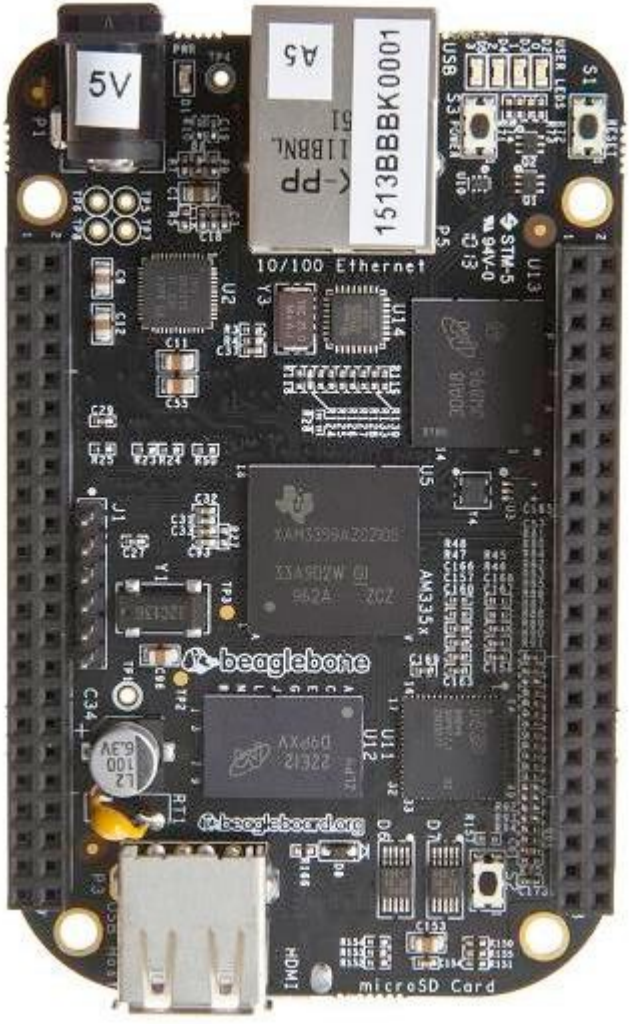
Reference hardware

BeagleBone Black (BBB) - Rev C



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Agenda

- Apertis application development

Apertis application development

- Application development can be done from SDK
- SDK is built using the same libraries and applications as the target image.
  - Additional packages provided to aid development.
- A number of editors and IDEs available:
  - Eclipse
  - QT Creator
  - Vim
  - Emacs...

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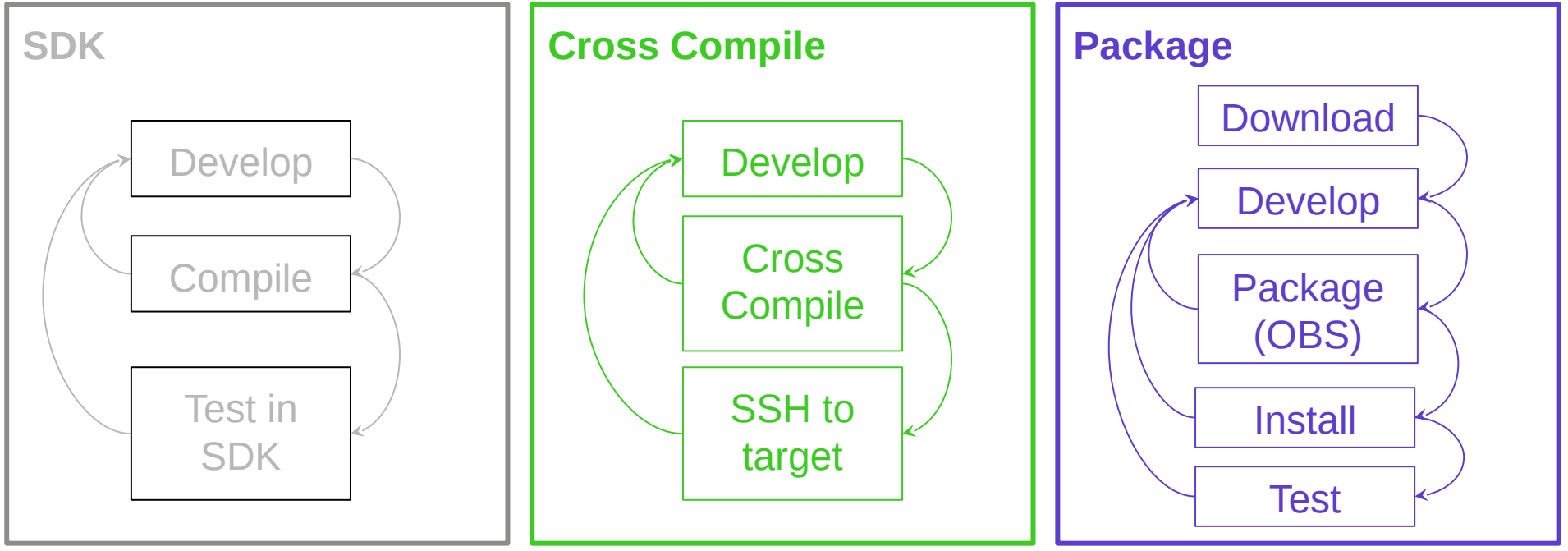
Apertis application development



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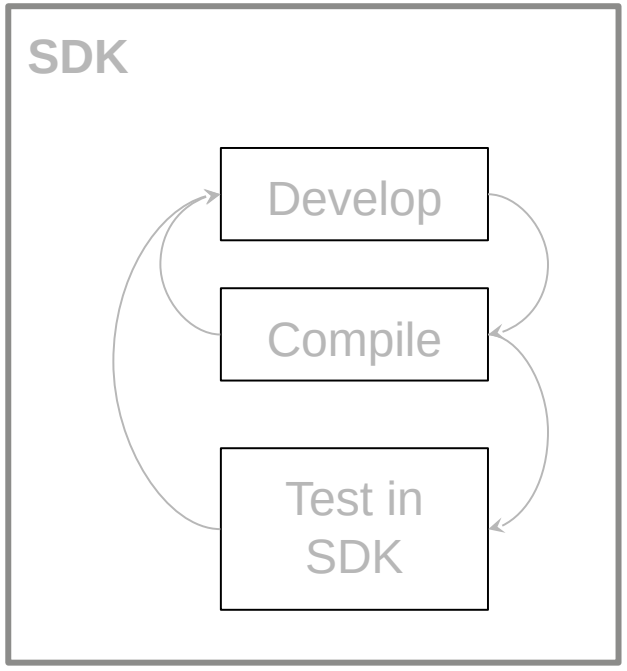
Apertis application development



- Get application source for *debconsolepkg*
- Build application using own tooling
  - CMake
- Debug application
  - Using GDB

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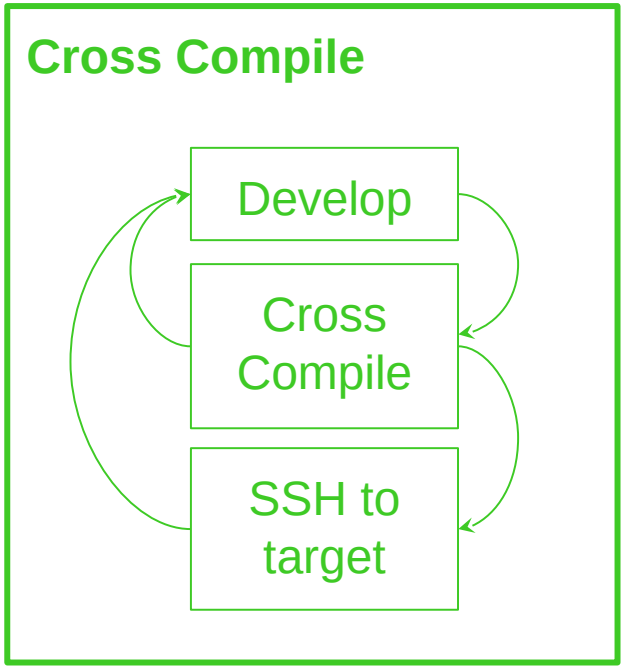
Apertis application development



- Get application source for *debconsolepkg*
- Generate cross building configuration
- Build application using own tooling
  - CMake
- Deploy application to target
  - Using secure copy (scp) command

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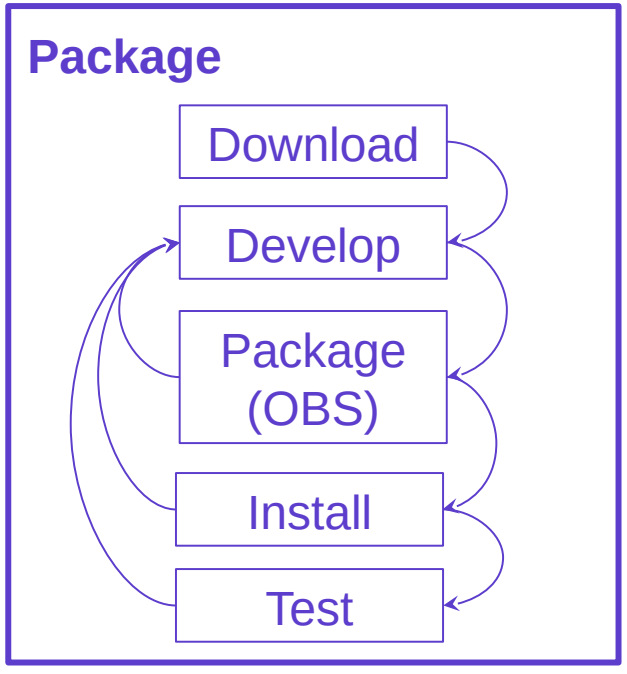
Apertis application development



- Build application the Debian way

```
$ apt source debconsolepkg
$ cd debconsole-1.0
$ dpkg-buildpackage -us -uc
```

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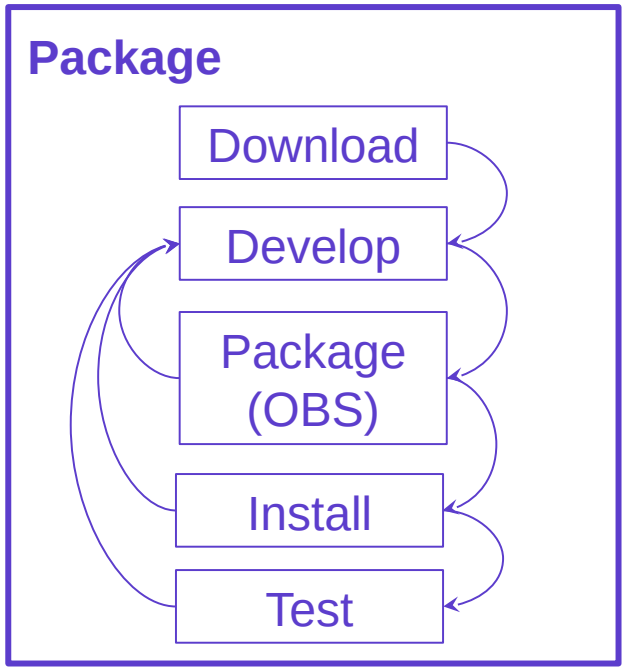
Apertis application development



- Upload to OBS using osc
- Copy orig, debian meta and dsc file in application directory

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Agenda

- Introduction to Debian packaging
- Apertis documentation resources

Introduction to Debian packaging

- Packaging
  - structure
  - versioning
  - workflow
- Building packages
- Installation and testing

Introduction to Debian packaging

The three central concepts are:

- upstream tarball
- source package
- binary package

Introduction to Debian packaging

- **upstream tarball**
  - Usually, people package software that someone else, called the **upstream developer**, has written
  - The upstream developers will make a release of their software in the "**upstream source** archive file" or tarball
  - A **tarball** is the *.tar.gz* or *.tgz* file upstream makes (*tarball* is a bit of computer jargon), and it can also be compressed to *.tar.bz2*, *.tb2* or *.tar.xz*. The tarball is exactly what Debian takes and builds a package out

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Introduction to Debian packaging

- **source package:**
  - Add **debian directory** to the unpacked compressed tarball
  - **Essential** to have:
    - *debian/control* - package relationships with other packages, list of binary packages, software description, etc.
    - *debian/rules* - set of rules to configure, build and install software
    - *debian/copyright* - list of licenses used (see DEP5 recommendation)
    - *debian/changelog* - list of changes, it is usually good to explain why changes are being made
  - Review **Debian Policy** for further details

Introduction to Debian packaging

- **binary package**:
  - From source package build the Debian **binary package** which is what actually gets installed:

    ```
    $ dpkg-buildpackage -us -uc -rfakeroot
    ```

  - DEB_BUILD_OPTIONS
    - environment variables can be set to allow different build behaviours, such avoid running tests, setting parallel build jobs, etc.

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Introduction to Debian packaging

- debian/control

```
Source: hello
Section: devel
Priority: optional
Maintainer: Santiago Vila <sanvila@debian.org>
Standards-Version: 3.9.6
Build-Depends: debhelper (>= 9.20120311)
Homepage: http://www.gnu.org/software/hello/

Package: hello
Architecture: any
Depends: ${shlibs:Depends}, ${misc:Depends}
Conflicts: hello-traditional
Replaces: hello-traditional, hello-debhelper (<< 2.9)
Breaks: hello-debhelper (<< 2.9)
Description: example package based on GNU hello
 The GNU hello program produces a familiar, friendly greeting.  It
 allows non-programmers to use a classic computer science tool which
 would otherwise be unavailable to them.
 .
 Seriously, though: this is an example of how to do a Debian package.
 It is the Debian version of the GNU Project's `hello world' program
 (which is itself an example for the GNU Project).
```

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Introduction to Debian packaging

- debian/rules

```
#!/usr/bin/make -f
%:
	dh $@

override_dh_auto_clean:
	[ ! -f Makefile ] || $(MAKE) distclean

override_dh_installdocs:
	dh_installdocs NEWS
```

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Introduction to Debian packaging

- debian/copyright
  - DEP5

```
Upstream-Name: wayland
Upstream-Contact: Kristian Høgsberg <krh@bitplanet.net>
Source: https://wayland.freedesktop.org/releases/

Files: debian/*
Copyright: © 2011 Cyril Brulebois <kibi@debian.org>
License: X11

Files: *
Copyright: © 2008-2012 Kristian Høgsberg
           © 2010-2012 Intel Corporation
           © 2011 Benjamin Franzke
           © 2012 Collabora, Ltd.
           © 2012 Jonas Ådahl
           © 2002 Keith Packard
           © 1999 SuSE, Inc.
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 about the suitability of this software for any purpose.  It is provided "as
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 DATA OR PROFITS, WHETHER IN AN ACTION OF CONTRACT, NEGLIGENCE OR OTHER
 TORTIOUS ACTION, ARISING OUT OF OR IN CONNECTION WITH THE USE OR PERFORMANCE
 OF THIS SOFTWARE.
```

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Introduction to Debian packaging

- debian/changelog

```
hello (2.10-1) unstable; urgency=low

  * New upstream release.
  * debian/patches: Drop 01-fix-i18n-of-default-message, no longer needed.
  * debian/patches: Drop 99-config-guess-config-sub, no longer needed.
  * debian/rules: Drop override_dh_auto_build hack, no longer needed.
  * Standards-Version: 3.9.6 (no changes for this).

 -- Santiago Vila <sanvila@debian.org>  Sun, 22 Mar 2015 11:56:00 +0100

hello (2.9-2) unstable; urgency=low

  * Apply patch from Reuben Thomas to fix i18n of default message.
    This is upstream commit c4aed00. Closes: #767172.
  * The previous change in src/hello.c trigger a rebuild of man/hello.1
    that we don't need. Add a "touch man/hello.1" to avoid it.
  * Use Breaks: hello-debhelper (<< 2.9), not Conflicts,
    as hello-debhelper is deprecated.
  * Restore simple watch file from old hello package that was lost
    when the packages were renamed.
  * Update 99-config-guess-config-sub patch.

 -- Santiago Vila <sanvila@debian.org>  Thu, 06 Nov 2014 12:03:40 +0100

hello (2.9-1) unstable; urgency=low

  * New upstream release. Closes: #744195.
  * Source now contains README-dev. Closes: #621716.
  * Reworded short description.
  * Renamed source and binary from "hello-debhelper" to "hello".
```

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Introduction to Debian packaging

- **Package installation**

```
$ sudo dpkg -i ../foobar_1.0-1_amd64.deb
$ sudo apt install ../foobar_1.0-1_amd64.deb
```

- **Package testing**
  - Run the application
  - List package contents

```
$ dpkg -L foobar
```

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Continuous Integration

Increasing productivity and quality control

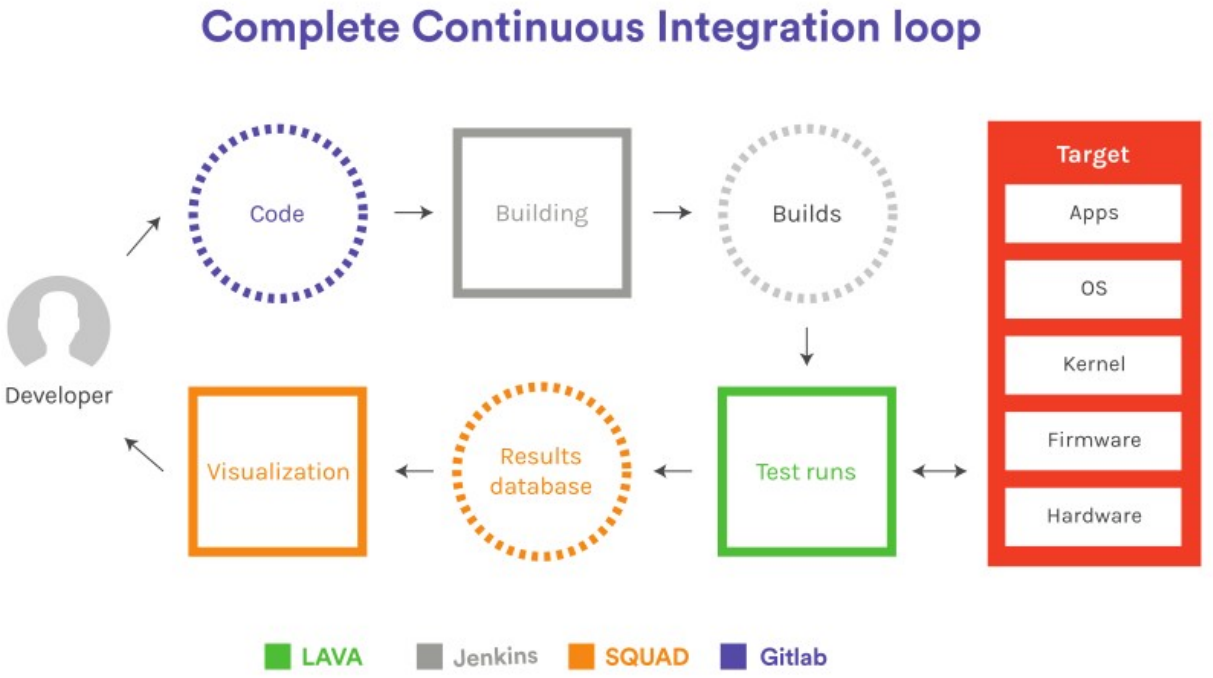
Continuous integration (CI)

is the practice of **merging**

all developer working copies

to a **shared mainline**

several times a day



Continuous Integration – best practices

- **Maintain** a code repository & **automate** the build
- Make the build **self-testing** & keep it **fast**
- Everyone **commits** to the baseline **every day** & every commit should be **built**
- **Test** in a clone of the **production environment**
- Make it easy to get the latest **deliverables**
- **Results** of the latest build visible to everyone
- Automate **deployment**

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Apertis documentation resources

- **Apertis** provides documentation in:
  - devhelp: offline documentation in SDK
  - Apertis documentation portal - designs.apertis.org
    - Apertis work-in-progress and obsolete documentation portal
  - Apertis wiki - wiki.apertis.org

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Debian documentation resources

- **Debian** documentation and useful sites
  - https://www.debian.org/doc/devel-manuals
  - http://snapshot.debian.org/
  - https://tracker.debian.org/
  - https://sources.debian.org/

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Agenda

- Apertis application integration
- Modifying existing packages

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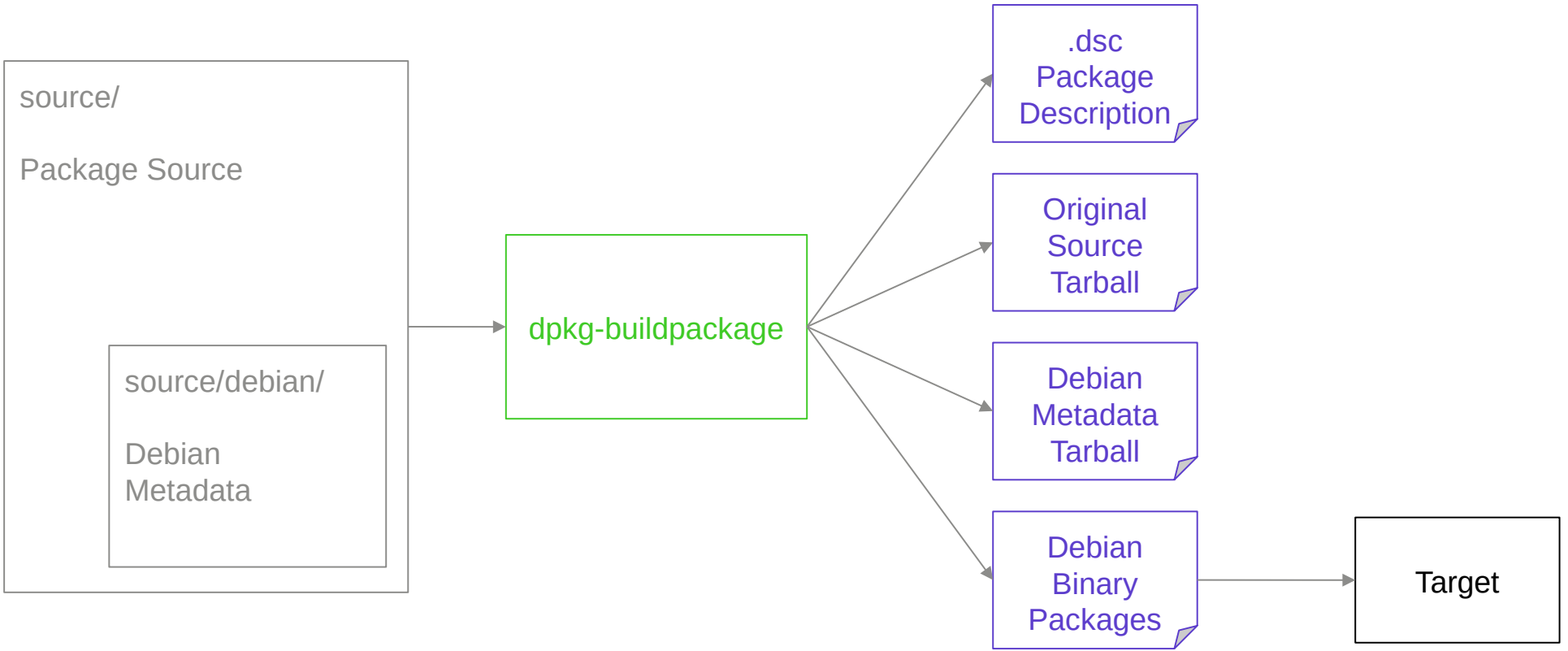
Apertis application integration



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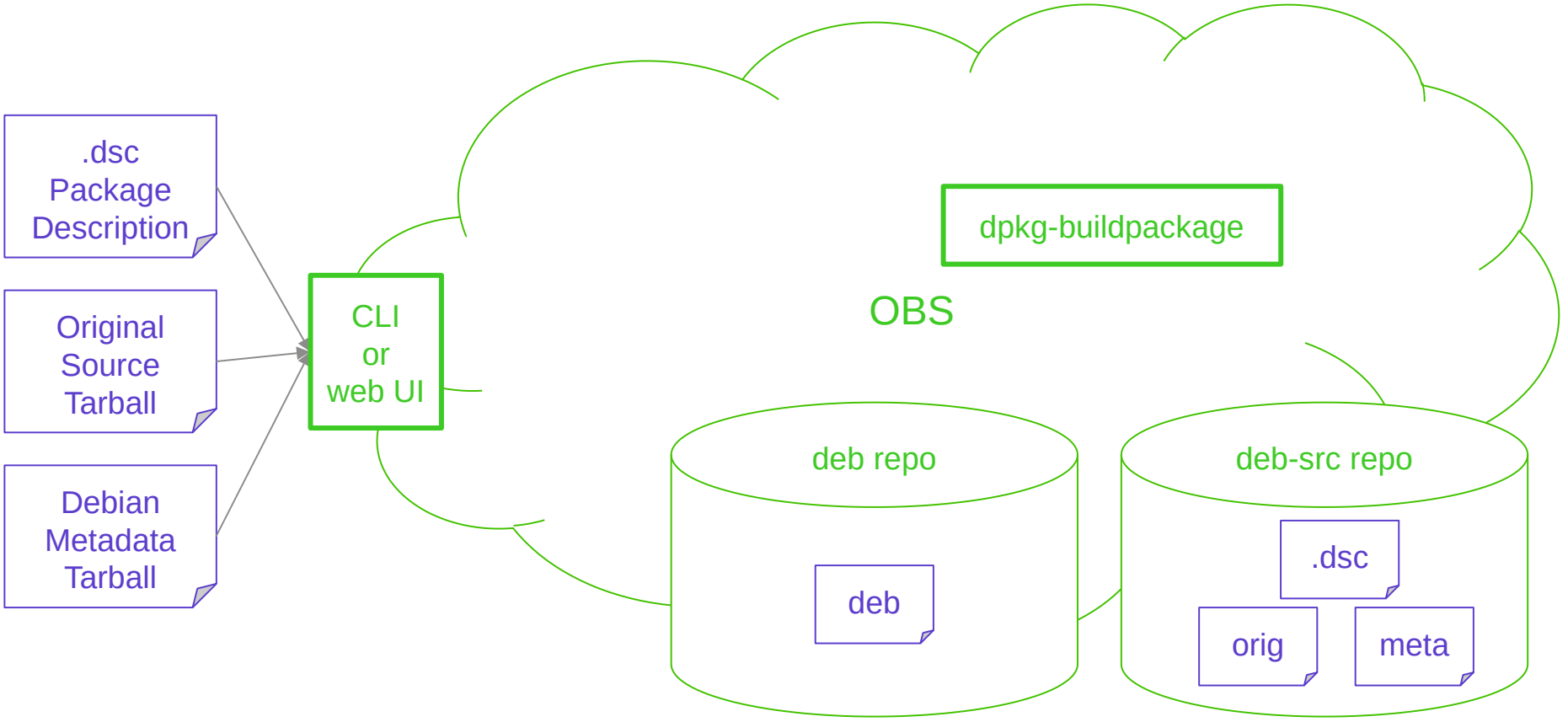
Apertis application integration



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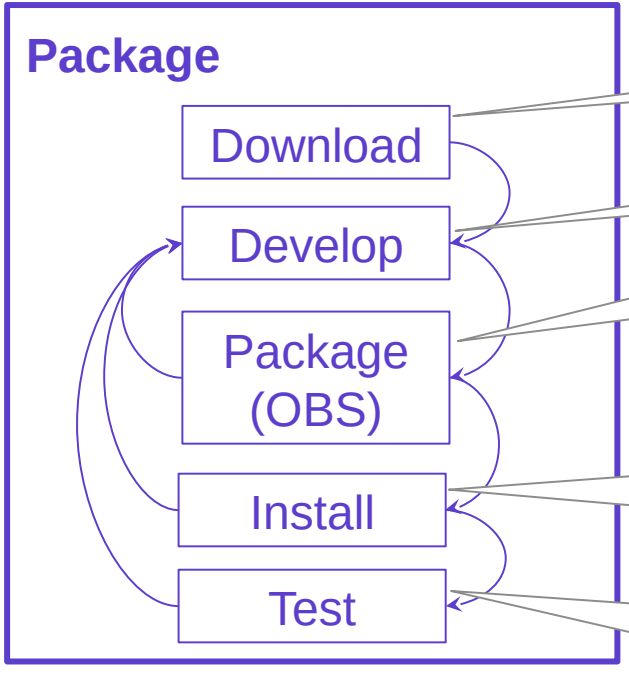
Modifying existing packages

Cover:



- Existing source packaging can be pulled from OBS
- In house projects and frequently updated packages will be in git

- Use SDK

- Upload new source packaging to OBS
- OBS will build the official binary package.

- “deb” package pulled from repo and installed
- apt update / apt install from target
- Baked into new version of the image

- Automated testing via LAVA
- Manual testing on target

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Agenda

- Apertis images
  - Apertis reference images
  - Apertis adding features (ospack)
  - Apertis cross build support (sysroot)
  - Apertis hardware enablement (hwpack)

Apertis reference images

- Images are built from:
  - **ospack:** hardware, but not architecture, independent
  - **hwpack:** hardware dependent software
- Images are built using debos and the process is controlled via a debos yaml recipe

Adding features (ospack)

- ospack is effectively a root filesystem that contains unpacked packages
- ospacks are generated using debos
  - Debos controlled via yaml recipes
  - Modifications like adding new repositories, running certain commands or installing extra packages can be done describing in the yaml file
- Automating ospack builds can be done using Jenkins service

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Cross build support (sysroot)

- For cross building purposes, a directory containing libraries and headers for target system must be populated
- A pre-built sysroot is provided, but is likely to need to be extended as development progresses to include extra headers
- Extended sysroots can be assembled in the SDK using debos
- Extensions should be added to jenkins so that the sysroots can be automatically rebuilt as components are updated

Hardware enablement (hwpack)

- A hwpack provides hardware-specific packages and settings that can be combined with ospacks
  - Multiple ospacks can be combined with an hwpack to implement different feature sets on the same hardware
  - An ospack can be combined with multiple hwpacks to implement the same feature set on different hardware
- Typically such components are:
  - Bootloader
  - Linux kernel
  - Graphic stack

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Agenda

- Apertis images
  - Apertis image creation
  - Customizing images during development

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Apertis image creation

- Create partitions and filesystems
- Deploy ospack on the image
- Combine the deployed ospack with the hwpack packages
- Prepare the bootloader
- List empty blocks for more efficient flash writes
- Compress the image

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Partitions and filesystems

```
- action: image-partition
  imagename: {{ $image }}
  imagesize: 3G
  partitiontype: gpt
  mountpoints:
    - mountpoint: /
      partition: root
      flags: [ boot ]
  partitions:
    - name: root
     fs: ext4
     start: 8MB
     end: 100%
```

Deploying the ospack on the image

```
- action: unpack
  compression: gz
  file: {{ $ospack }}

[...]

- action: filesystem-deploy
  description: Deploying filesystem onto image
```

Combining the hwpack

```
- action: apt
  description: Install hardware support packages
  packages:
  - linux-image-armmp
  - u-boot-omap
```

Preparing the bootloader

```
- action: raw
  description: Flash MLO
  offset: {{ sector 256 }}
  origin: filesystem
  source: /usr/lib/u-boot/am335x_boneblack/MLO
- action: raw
  description: Flash u-boot
  origin: filesystem
  offset: {{ sector 768 }}
  source: /usr/lib/u-boot/am335x_boneblack/u-boot.img
```

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Listing empty blocks

```
- action: run
  description: Create bmap file
  postprocess: true
  command: bmaptool create {{ $image }} > {{ $image }}.bmap
```

Compressing the image

```
- action: run
  description: Compress image
  postprocess: true
  command: gzip -f {{ $image }}
```

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Customizing images during development

- Create new overlay for packages:

  ```
  $ mkdir -p overlay/packages
  ```

- Copy linux and u-boot binary packages into overlay

  ```
  $ cp ~/linux-image-*_armhf.deb \ ~/u-boot-omap_*_armhf.deb
  overlay/packages
  ```

- Copy overlay into build environment

  ```
  - action: overlay
    source: overlays/packages
  ```

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Customizing images during development

- Install packages into image

```
- action: run
  chroot: true
  description: Install hardware support packages
  command: apt -y install ./*deb
```

- Remove packages from image, after installed

```
- action: run
  chroot: true
  description: Remove hardware support packages
  command: rm -f ./*deb
```

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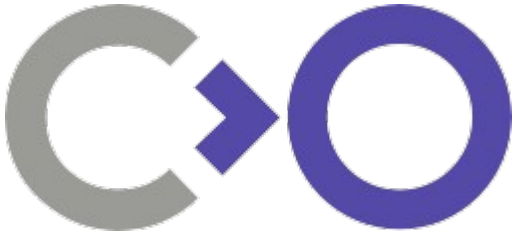
Apertis image creation

- Create partitions and filesystems
- Deploy ospack on the image
- Combine the deployed ospack with the hwpack packages
- Prepare the bootloader
- List empty blocks for more efficient flash writes
- Compress the image

```
$ sudo debos apertis-image.yaml
```



Vielen Dank!

(Thank you!)

Héctor Orón Martínez <hector.oron@collabora.com>

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