
OpenEmbedded for medical devices

Silvio Laurenti
<s.laurenti@biotechware.com>



Stefano Cotta Ramusino
<s.cotta@biotechware.com>

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Norms for medical devices



Medical Devices Directive 93/42/EEC

any instrument, apparatus, appliance, material or other article
whether used alone or in combination
including the software necessary
for its proper application

EN 62304:2006 - Software Class B

Norms for medical devices



- 1 - development planning
 - 2 - requirements analysis
 - 3 - architectural design
 - 4 - detailed design
 - 5 - unit implementation and verification
 - 6 - integration and integration testing
 - 7 - **system testing**
 - 8 - release
-

What is OpenEmbedded ?



FLOSS framework

to create custom embedded Linux distro



sets of metadata called **recipes**

build system based on **BitBake**

Poky



open source platform build tool
complete software development environment



based on OpenEmbedded
focus on **strict packages set**

Yocto Project



not a Linux distribution

umbrella project covering a widely of embedded Linux technologies



key concepts are:

collaboration

customization

Ångström



a Linux distribution based on OpenEmbedded
heavily through the Yocto Project



feeds of repository with **binary** packages

OE Platform supported



Beagle Board

Openmoko

Dreambox

Toradex – Colibri

Gumstix

Palm – webOS

MontaVista

KOAN - KaeilOS

The logo for webOS, with "web" in black and "OS" in orange, followed by a small trademark symbol (TM).

Nvidia Tegra 2



System-on-Chip

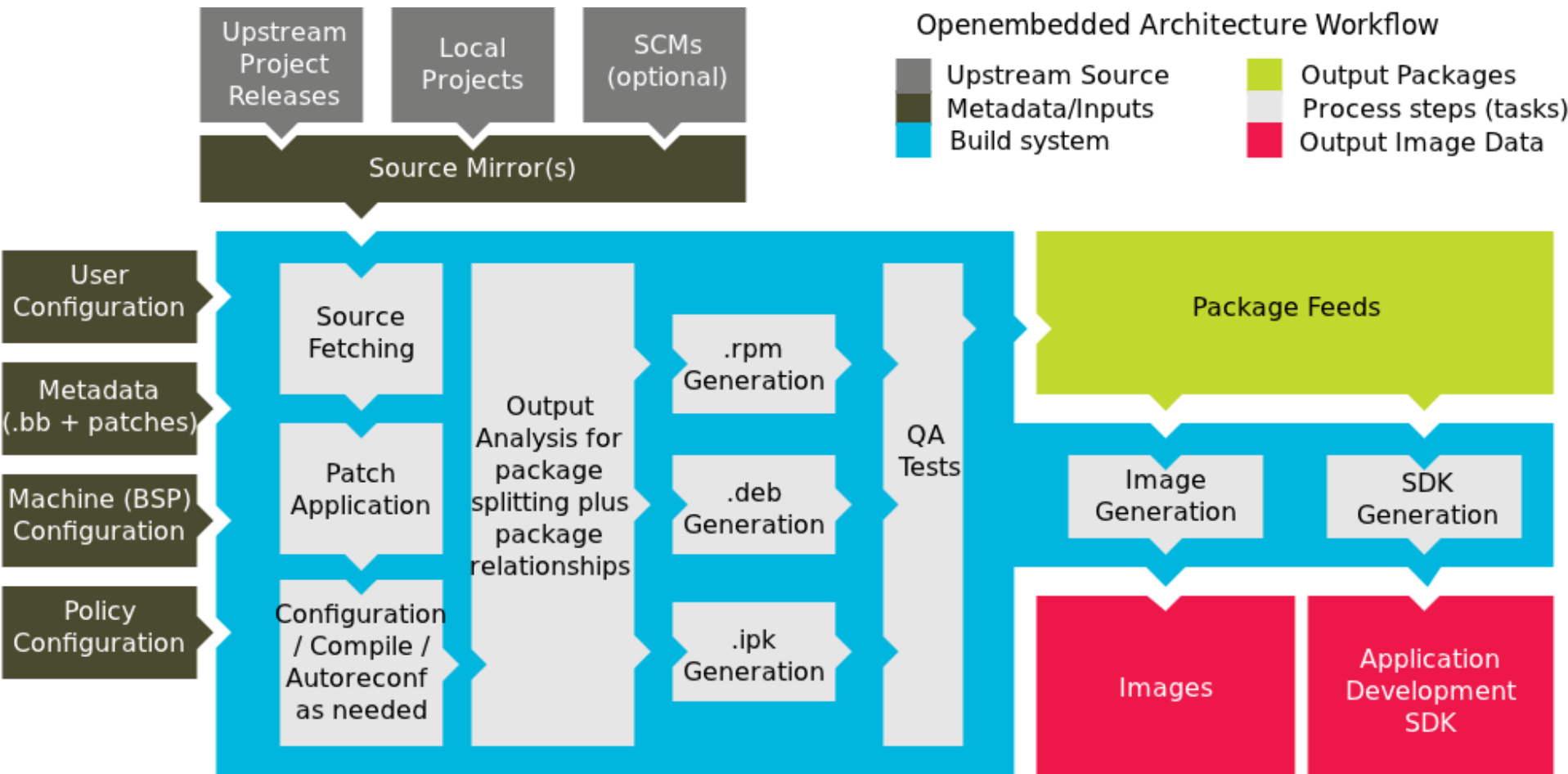
dual-core ARM **Cortex-A9** CPU



Ultra Low Power **GeForce** GPU

lacking ARM's advanced SIMD extension (NEON)

OpenEmbedded architecture



heart building tool system of OpenEmbedded

parsing metadata (recipes)

generating tasks list

executing tasks

QA checks



written in Python

Metadata (Recipes)



.bb files

contain info about software:

download source

apply patches

configure options

how to compile

how to package output files

package is recipes output from OE

.ipk files

OpenEmbedded layers



Metadata are organized, isolated and customized in **layers**

collection of recipes and configuration files

used on top of OE-Core to keep it modular

i.e. machine support and customization reside in

the Board Specific Package (**BSP**) Layer

OpenEmbedded layers



meta-multimedia

meta-networking

meta-oe

meta-systemd

meta-webserver

toolchain-layer

recipes-connectivity

recipes-core

recipes-devtools

recipes-graphics

recipes-kernel

recipes-multimedia

recipes-navigation

recipes-qt

Generated items



Package Feeds

.ipk packages in different directories
corresponding to the target machine architecture

Images

rootfs - bootloader – kernel

Toolchain SDK

to cross develop on different hosts

Making your distro



patched Linux kernel

hard-float

WiFi / Bluetooth / GSM

Systemd

Udev

D-Bus

ConnMan / NetworkManager

OpenGL-ES 2.0

Qt4

Layer modularization



Custom Layer (*meta-btw*)

Vendor Layer (*meta-toradex*)

Distro Layer (*meta-angstrom*)

OpenEmbedded Layer (*meta-oe*)

Creating your layer



meta-whateveryouwant

populate with your software/patches

add layer to **bblayers.conf**

init new build directory

oe-init-build

Bootloader: U-Boot



access via serial console

init GPIO before kernel

contains kernel parameters

Kernel: Linux



add full support to the custom board

initialize GPIO and pinmux

/sys/kernel/debug/gpio

write/port missing drivers

power saving optimization

custom boot logo

System Manager: systemd



reduce shell overhead

journalctl --full

write service for your application

systemd-analyze blame/plot

Graphic: FrameBuffer - X.Org



psplash

display image waiting X.Org

xinit

launch single graphical application

feh

display image waiting the main application

Frontend: Qt Framework



add hardware acceleration support

-IEGL -IGLESv2



Optimization



bootloader **boot_delay=0**

kernel **drivers static**

CONFIG_LEGACY_PTYS=n

remove useless systemd service

remove psplash

```
fbv -d 1 logo.bmp; cp /dev/fb0 logo.fb; lzop -9 logo.fb  
lzop -dc logo.fb.lzo > /dev/fb0
```

Questions



s.laurenti@biotechware.com

s.cotta@biotechware.com
