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# Developing on OpenBMC

*Under the hood with BitBake*  
Xo Wang (Google)

# Xo Wang

- ▶□ Embedded software engineer working on [Google's open server running POWER9 CPUs](#): Zaius
- ▶□ Freenode IRC (#openbmc) nick: **GHF**
  - ▶□ Also GitHub handle
- ▶□ San Francisco, CA

# Agenda

- ▶ □ Building a boot image
- ▶ □ Customizing a package for your server
- ▶ □ Changing package source for your build



# Building a boot image

# OpenBMC distribution

- ▶ □ Based on Yocto's Poky distro
- ▶ □ (Almost) no source code
  - ▶ □ Temporary patches
- ▶ □ References source elsewhere

The screenshot shows the GitHub repository for OpenBMC. The repository name is 'openbmc / openbmc'. It has 69 watchers, 62 stars, and 79 forks. The repository is in the 'master' branch. The commit history shows 1,702 commits, 2 branches, 22 releases, and 52 contributors. The latest commit is by 'williamspatrick' with the message 'phosphor-fan.inc: bump version' 4 days ago. The commit history table lists the following commits:

Commit	Message	Time
import-layers	systemd: point to correct resolv.conf when resolved is enabled	25 days ago
meta-openbmc-bsp/meta-aspeed	config: Add OCC driver to the ast2500 config	5 days ago
meta-openbmc-machines	Remove fan-default-speeds service	3 days ago
meta-phosphor	phosphor-fan.inc: bump version	22 hours ago
.gitignore	Add .repo/ to .gitignore	5 months ago
.gitreview	git-review config for gerrit.openbmc-project.xyz	10 months ago
.templateconf	Combine poky and meta-phosphor as subtrees.	2 years ago
LICENSE	yocto-poky: Move to import-layers subdir	9 months ago
README.md	README: Fix markdown links	2 months ago
bitbake	yocto-poky: Move to import-layers subdir	9 months ago
documentation	yocto-poky: Move to import-layers subdir	9 months ago
meta	yocto-poky: Move to import-layers subdir	9 months ago
meta-poky	yocto-poky: Move to import-layers subdir	9 months ago
meta-selftest	yocto-poky: Move to import-layers subdir	9 months ago

# Demo

# Build

```
xow@pewter ~/o/build_z> bitbake obmc-phosphor-image [2/8129]
Loading cache: 100% |#####| Time: 0:00:00
Loaded 2789 entries from dependency cache.
Parsing recipes: 100% |#####| Time: 0:00:00
Parsing of 2046 .bb files complete (2041 cached, 5 parsed). 2792 targets, 388 skipped, 0 masked, 0 errors.
NOTE: Resolving any missing task queue dependencies
```

## Build Configuration:

```
BB_VERSION      = "1.32.0"
BUILD_SYS       = "x86_64-linux"
NATIVELSBSTRING = "Ubuntu-14.04"
TARGET_SYS      = "arm-openbmc-linux-gnueabi"
MACHINE         = "zaius"
DISTRO          = "openbmc-phosphor"
DISTRO_VERSION  = "0.1.0"
TUNE_FEATURES   = "arm armv6"
TARGET_FPU      = "soft"
meta
meta-poky
meta-oe
meta-networking
meta-perl
meta-python
meta-virtualization
meta-phosphor
meta-aspeed
meta-ast2500
meta-openpower
meta-ingrasys
meta-zaius
workspace      = "dev:90dc1183143a55ad376eb3294f88038931d0fa47"
```



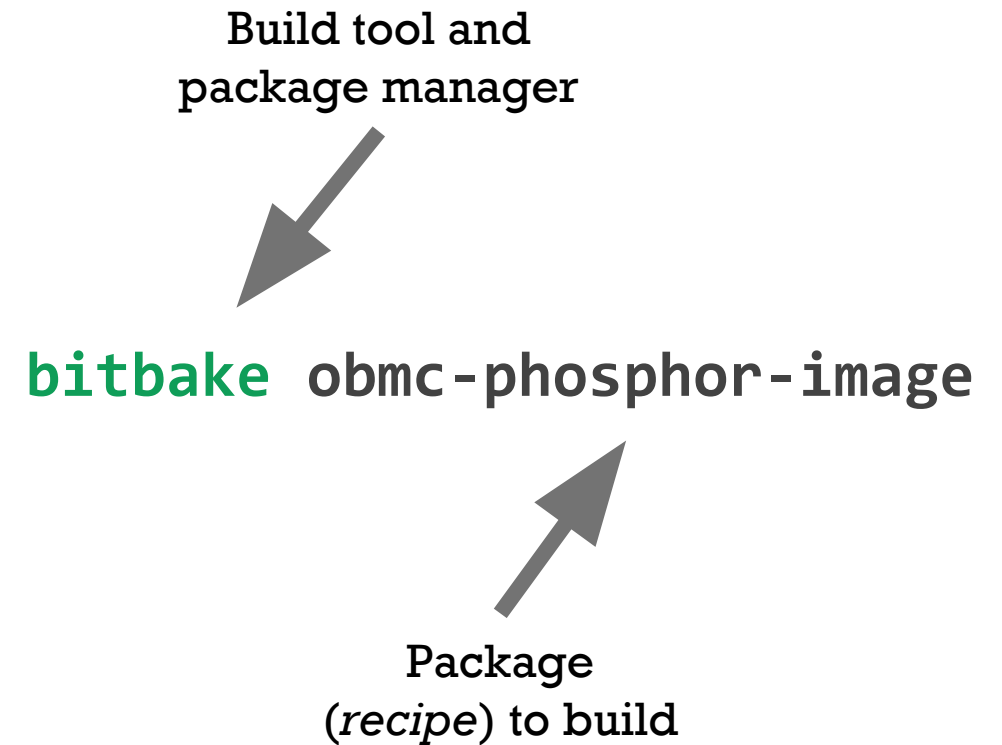
Don't use a tool you can't make.

---

– Gerry

# Image recipe

- ▶ [obmc-phosphor-image.bb](#)
- ▶ Includes [obmc-phosphor-image.bbclass](#)
- ▶ Concatenated with \*.bbappend files



# Takeaways

- ▶□ All build configuration in one directory
- ▶□ Initialize with machine-specific "template" files
  - ▶□ One TEMPLATECONF per machine is specific to the OpenBMC project
- ▶□ The OpenBMC flash image target has dependencies on other OpenBMC projects

# How are recipes found?

# openbmc/meta-openbmc-machines/meta-openpower/ meta-ingrasys/meta-zaius/conf/bblayers.conf.sample

```
BBLAYERS ?= " \  
    ##OEROOT##/meta \  
    ##OEROOT##/meta-poky \  
    ...  
    ##OEROOT##/meta-phosphor \  
    ##OEROOT##/meta-openbmc-bsp/meta-aspeed \  
    ##OEROOT##/meta-openbmc-bsp/meta-aspeed/meta-ast2500 \  
    ##OEROOT##/meta-openbmc-machines/meta-openpower \  
    ##OEROOT##/meta-openbmc-machines/meta-openpower/meta-ingrasys \  
    ##OEROOT##/meta-openbmc-machines/meta-openpower/meta-ingrasys/meta-zaius \  
    "
```



# openbmc/blob/master/meta-phosphor/conf/layer.conf

```
BBFILES += "${LAYERDIR}/common/recipes-*/*/*.bb \  
           ${LAYERDIR}/common/recipes-*/*/*.bbappend"
```

# Inspecting layers

`bitbake-layers` `show-layers`

# Customizing a package for your server

# Overriding

- ▶□ Most recipes are data in variables, with little code
- ▶□ To tailor a recipe to your machine, override those variables (conditionally)

[obmc-console.bb](#)

```
SRC_URI += "file:///${PN}.conf"
```

[obmc-console.bbappend](#) (Zaius)

```
FILESEXTRAPATHS_prepend_zaius := "${THISDIR}/${PN}:"
```

# Overriding

## **machine layer .bbappend files**

- ▶□ Changes can be mailed upstream
- ▶□ Scope: only affects recipe specified in file name
  - ▶□ obmc-phosphor-image.bbappend
  - ▶□ linux-obmc\_4.7.bbappend
  - ▶□ u-boot\_%.bbappend
- ▶□ Also affects any machine that includes that layer

## **local.conf**

- ▶□ Local to a build environment
- ▶□ Global scope: all recipes, all machines



# Recipe append



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 [meta-openbmc-machines/meta-openpower/meta-ingrasys/meta-zaius/recipes-bsp/u-boot/u-boot\\_%.bbappend](#)

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 [meta-openbmc-machines/meta-openpower/meta-ibm/meta-witherspoon/recipes-phosphor/mboxd/mboxd.bbappend](#)

 [meta-openbmc-machines/meta-openpower/meta-ibm/meta-romulus/recipes-kernel/linux/linux-obmc\\_%.bbappend](#)

 [meta-openbmc-machines/meta-openpower/meta-ibm/meta-garrison/recipes-kernel/linux/linux-obmc\\_%.bbappend](#)

 [meta-openbmc-machines/meta-openpower/meta-ibm/meta-palmetto/recipes-kernel/linux/linux-obmc\\_%.bbappend](#)

# OVERRIDES syntax

- ▶□ If OVERRIDES contains "string1", then VAR is "bar"
  - ▶□ Otherwise, VAR is "foo"
- ▶□ OVERRIDES is set by Yocto

```
OVERRIDES="string1:string2"
```

```
VAR="foo"
```

```
VAR_string1="bar"
```



Predicate string

# Demo

# OVERRIDES syntax

Building recipe linux-obmc\_4.7.bb, OVERRIDES looks like:

- ▶ `OVERRIDES=${TARGET_OS}:${TRANSLATED_TARGET_ARCH}:build-${BUILD_OS}:pn-${PN}:${MACHINEOVERRIDES}:${DISTROOVERRIDES}:${CLASSOVERRIDE}:forcevariable${LIBCOVERRIDE}`
- ▶ `OVERRIDES="linux-gnueabi:arm:build-linux:pn-obmc-phosphor-image:openbmc:armv6:zaius:openbmc-phosphor:rwfs-jffs2:class-target:forcevariable:libc-glibc"`

# OVERRIDES syntax

Variable for extra packages

Predicate substring in OVERRIDES

OBMC\_IMAGE\_EXTRA\_INSTALL\_append\_zaius = "pdbg"

"Override-style" deferred append

Text to append (delimited package name)



# .bbappend

Example:

- ▶ [openbmc/meta-openbmc-machines/meta-openpower/meta-ingrassys/meta-zaius/recipes-bsp/u-boot/u-boot\\_%.bbappend](#)

# Takeaways

- ▶□ Modifying behavior involves changing data, not scripts
  - ▶□ Yocto-on-BitBake behavior probably has what you want
  - ▶□ They're just controlled by a *lot* of variables
- ▶□ Be careful with scope

# Changing package source for your build

# Demo

# How does devtool work?



# externalsrc.bbclass

- ▶ "enables use of an existing source tree"
- ▶ Important variables
  - ▶ `EXTERNALSRC_pn-myrecipe = "/path/to/my/source/tree"`
  - ▶ `SRCTREECOVEREDTASKS ?= "do_patch do_unpack do_fetch"`

BitBake: It's complex.  
Appropriately so for creating a  
Linux distribution.

# Xo Wang

- ▶ □ Q&A
- ▶ □ Freenode IRC (#openbmc) nick: **GHF**
  - ▶ □ Also GitHub handle

# Title Here

- ▶◻ Lots of Bullets
  - ▶◻ Many Bullets
    - ▶◻ Logo Colored Bullets