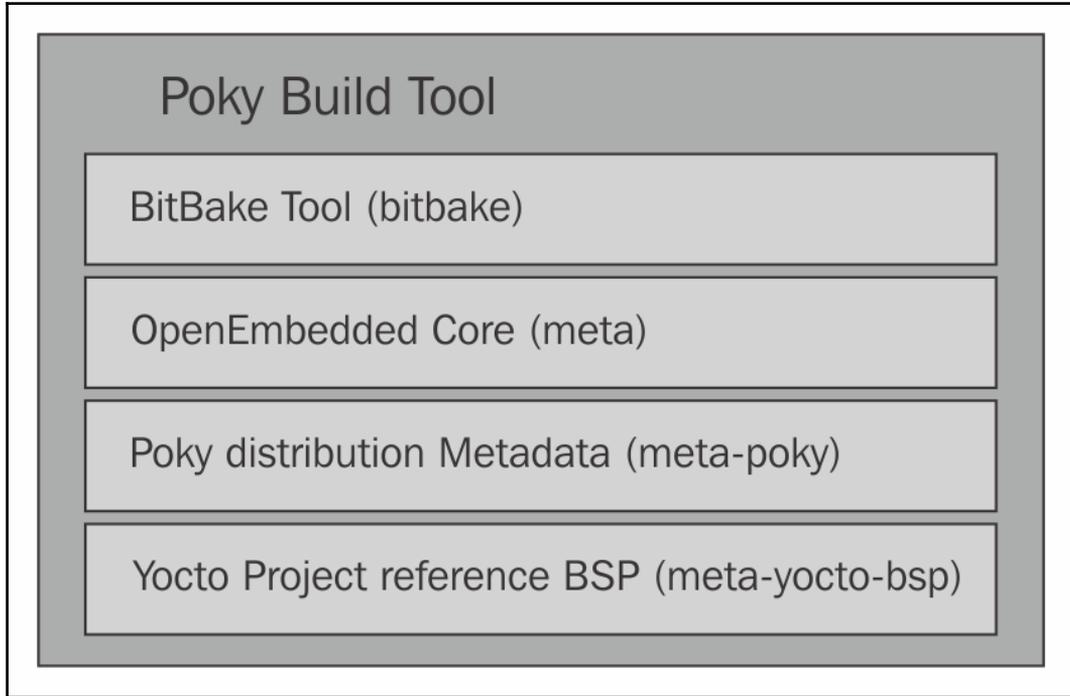


Chapter 1: Meeting the Yocto Project



Chapter 2: Baking Our Poky Based System

```
Content of Poky directory after download

$ ls -l
total 48
drwxrwxr-x 6 user user 4096 Out 22 12:36 bitbake
drwxrwxr-x 14 user user 4096 Out 22 12:36 documentation
-rw-rw-r-- 1 user user 515 Out 22 12:36 LICENSE
drwxrwxr-x 19 user user 4096 Out 22 12:36 meta
drwxrwxr-x 5 user user 4096 Out 22 12:36 meta-poky
drwxrwxr-x 8 user user 4096 Out 22 12:36 meta-selftest
drwxrwxr-x 7 user user 4096 Out 22 12:36 meta-skeleton
drwxrwxr-x 8 user user 4096 Out 22 12:36 meta-yocto-bsp
-rwxrwxr-x 1 user user 1754 Out 22 12:36 oe-init-build-env
lrwxrwxrwx 1 user user 30 Out 22 12:36 README.hardware -> meta-yocto-bsp/README.hardware
-rw-rw-r-- 1 user user 1173 Out 22 12:36 README.LSB
lrwxrwxrwx 1 user user 21 Out 22 12:36 README.poky -> meta-poky/README.poky
-rw-rw-r-- 1 user user 529 Out 22 12:36 README.qemu
drwxrwxr-x 8 user user 4096 Out 22 12:36 scripts
$ █
```

QEMU

```
null)
[ 7.020483] VFS: Mounted root (ext4 filesystem) on device 253:0.
[ 7.047062] devtmpfs: mounted
[ 7.074091] Freeing unused kernel memory: 448K
[ 7.077321] This architecture does not have kernel memory protection.
INIT: version 2.88 booting
```

Starting udev

INIT: Entering runlevel: 5

Configuring network interfaces... RTNETLINK answers: File exists

Starting system message bus: dbus.

Starting OpenBSD Secure Shell server: sshd

generating ssh RSA key...

generating ssh ECDSA key...

generating ssh DSA key...

generating ssh ED25519 key...

done.

Starting rpcbind daemon...done.

starting statd: done

Starting atd: OK

exportfs: can't open /etc/exports for reading

starting 8 nfsd kernel threads: done

starting mountd: done

Starting system log daemon...0

Starting kernel log daemon...0

Starting crond: OK

Poky (Yocto Project Reference Distro) 2.4 qemuarm /dev/tty1

qemuarm login: _

Chapter 3: Using Toaster to Bake an Image

Welcome to Toaster - Mozilla Firefox

Welcome to Toaster

127.0.0.1:8000/toastergui/landing/

yocto PROJECT Toaster Documentation New project

This is Toaster

A web interface to [OpenEmbedded](#) and [BitBake](#), the [Yocto Project](#) build system.

To start building, create your first Toaster project

[Read the Toaster manual](#)

[Contribute to Toaster](#)

Recent builds

- core-image-sato (+3) qemu66 ETA: 16:34
- core-image-sato atom-pc (15:22) 4 warnings Build time: 00:36:55
- core-image-x11 qemu66 (12:01) 3 errors 10 warnings Build time: 00:27:45

All builds

| Outcome | Target | Machine | Completed on | Errors | Warnings | Output |
|---------|-----------------|-----------|-------------------|----------|-------------|-----------------------------|
| ○ | core-image-sato | atom-pc | 11/06/13 at 15:22 | 0 | 4 warnings | self, hosting, iso, tarball |
| ○ | core-image-x11 | qemu66 | 11/06/13 at 12:01 | 3 errors | 10 warnings | |
| ○ | core-image-sato | atom-pc | 11/06/13 at 11:54 | 0 | 4 warnings | self, hosting, iso |
| ○ | busybox | qemu66-64 | 04/12/13 at 10:28 | | | |
| ○ | busybox | qemu66-64 | 04/12/13 at 09:58 | | | |

Create a new project - Toaster - Mozilla Firefox

Create a new project - Toa x +

127.0.0.1:8000/toastergui/newproject/

yocto PROJECT Toaster i Documentation

Create a new project

Project name (required)

my-first-project

Release ?

- Local Yocto Project
- Local Yocto Project**
- Yocto Project 2.4 "Rocko"
- Yocto Project master

... version of the ... downloaded to your

Create project

Configuration - my-first-project - Toaster - Mozilla Firefox

Configuration - my-first-p x +

127.0.0.1:8000/toastergui/project/2/?notify=new-project

yocto PROJECT Toaster All builds All projects Documentation New project

Your project **my-first-project** has been created. You can now **select your target machine** and **choose image recipes** to build.

my-first-project

Configuration Builds (0) Import layer New custom image Type the recipe you want to build Build

Configuration

COMPATIBLE METADATA

Custom images

Image recipes

Software recipes

Machines

Layers

Distros

EXTRA CONFIGURATION

Machine
qemux86

Distro
poky

Most built recipes

Layers (3)

Type a layer name Add layer

View compatible layers | Import layer

- openembedded-core
- meta-poky
- meta-yocto-bsp

Configuration - my-first-project - Toaster - Mozilla Firefox

Configuration - my-first-p x +

127.0.0.1:8000/toastergui/project/2/

yocto PROJECT Toaster All builds All projects Documentation New project

my-first-project

Configuration Builds (0) Import layer New custom image Type the recipe you want to build Build

Configuration

COMPATIBLE METADATA

Custom images

Image recipes

Software recipes

Machines

Layers

Distros

EXTRA CONFIGURATION

Machine

Machine suggestions come from the list of layers added to your project. If you don't see the machine you are looking for, check the full list of machines

Save Cancel

[View compatible machines](#)

Distro

[poky](#)

Layers (3)

Add layer

[View compatible layers](#) | [Import layer](#)

- [openembedded-core](#)
- [meta-poky](#)
- [meta-yocto-bsp](#)

Compatible image recipes - my-first-project - Toaster - Mozilla Firefox

Compatible image recipe x +

127.0.0.1:8000/toastergui/project/2/images/?limit=25&page=1&orderBy=name&search=cmd&default_orderby=name&

yocto PROJECT Toaster All builds All projects Documentation New project

my-first-project

Configuration Builds (0) Import layer New custom image

Type the recipe you want to build Build

Configuration

Compatible image recipes (1)

COMPATIBLE METADATA

Custom images

Image recipes

Software recipes

Machines

Layers

Distros

EXTRA CONFIGURATION

BitBake variables

ACTIONS

Delete project

cmd Search Edit columns Show rows: 25

| Image recipe | Version | Description | Layer | Build |
|-------------------------|---------|--|-------------------|--------------|
| core-image-full-cmdline | 1.0 | A console-only image with more full-featured Linux system functionality installed. | openembedded-core | Build recipe |

Show rows: 25

All project builds - my-first-project - Toaster - Mozilla Firefox

All project builds - my-firs x +

127.0.0.1:8000/toastergui/project/2/builds/

yocto PROJECT Toaster All builds All projects Documentation New project

my-first-project

Configuration Builds (0) Import layer New custom image

Type the recipe you want to build Build

Latest project builds

core-image-full-cmdline 18% of tasks complete Cancel

core-image-full-cmdline qemuarm - my-first-project - Toaster - Mozilla Firefox

core-image-full-cmdline q x +

127.0.0.1:8000/toastergui/build/1

yocto PROJECT Toaster All builds All projects Documentation New project

IMAGES

core-image-full-cmdline

Completed on 22/10/17 22:54 Build time: 02:13:34 Download build log

BUILD

Build artifacts

core-image-full-cmdline

| | |
|---------------------------|--|
| Packages included | 198 |
| Total package size | 58.9 MB |
| Manifests | License manifest Package manifest |
| Image files | ext3 (91.5 MB) ext4 (91.5 MB) jffs2 (28.8 MB) tar.bz2 (20.0 MB) |
| Kernel artifacts | modules--4.12.12+git0+eda4d18ce4_67b62d8d7b-r0-qemuarm-20171023002916.tgz (39.4 MB) zImage--4.12.12+git0+eda4d18ce4_67b62d8d7b-r0-qemuarm-20171023002916.bin (4.8 MB) zImage--4.12.12+git0+eda4d18ce4_67b62d8d7b-r0-versatile-pb-20171023002916.dtb (7.9 KB) |

PERFORMANCE

Time

CPU usage

Disk I/O

ACTIONS

Download build log

Directory structure - core-image-full-cmdline qemuarm - my-first-project - Toaster - Mozilla Firefox

Directory structure - core x +

127.0.0.1:8000/toastergui/build/1/target/6/dirinfo

yocto PROJECT Toaster All builds All projects Documentation New project

my-first-project → Builds → core-image-full-cmdline qemuarm (22/10/17 22:54) → core-image-full-cmdline

Build summary

core-image-full-cmdline

IMAGES

core-image-full-cmdline

Builds included (198 - 58.9 MB) Directory structure

| Directory / File | Symbolic link to | Source package | Size | Permissions | Owner | Group |
|------------------|------------------|----------------|--------|-------------|-------|-------|
| ▶ bin | | | 4.0 KB | drwxr-xr-x | root | root |
| boot | | | 4.0 KB | drwxr-xr-x | root | root |
| dev | | | 4.0 KB | drwxr-xr-x | root | root |
| ▶ etc | | | 4.0 KB | drwxr-xr-x | root | root |
| ▶ home | | | 4.0 KB | drwxr-xr-x | root | root |
| ▶ lib | | | 4.0 KB | drwxr-xr-x | root | root |
| media | | | 4.0 KB | drwxr-xr-x | root | root |
| ▶ mnt | | | 4.0 KB | drwxr-xr-x | root | root |
| proc | | | 4.0 KB | drwxr-xr-x | root | root |
| run | | | 4.0 KB | drwxr-xr-x | root | root |

BUILD

Configuration

Tasks

Recipes

Packages

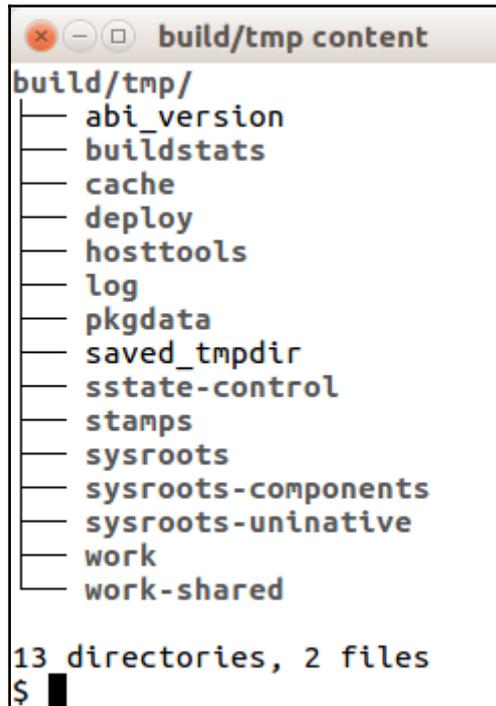
PERFORMANCE

Time

CPU usage

Disk I/O

Chapter 5: Detailing the Temporary Build Directory



```
build/tmp content
build/tmp/
├── abi_version
├── buildstats
├── cache
├── deploy
├── hosttools
├── log
├── pkgdata
├── saved_tmpdir
├── sstate-control
├── stamps
├── sysroots
├── sysroots-components
├── sysroots-uninative
├── work
└── work-shared

13 directories, 2 files
$
```

```
work/qemuarm-poky-linux-gnueabi/sysvinit-inittab/2.88dsf-r10/
├── configure.sstate
├── deploy-rpms
├── image
├── inittab
├── license-destdir
├── package
├── packages-split
├── patches
├── pkgdata
├── pseudo
├── recipe-sysroot
├── recipe-sysroot-native
├── start_getty
├── sysroot-destdir
├── sysvinit-inittab.spec
└── temp

12 directories, 4 files
$
```

Chapter 6: Assimilating Packaging Support



```
Installation of sdk from build/tmp/deploy/sdk
Poky (Yocto Project Reference Distro) SDK installer version 2.4
=====
Enter target directory for SDK (default: /opt/poky/2.4):
You are about to install the SDK to "/opt/poky/2.4". Proceed[Y/n]? Y
Extracting SDK.....done
Setting it up...done
SDK has been successfully set up and is ready to be used.
Each time you wish to use the SDK in a new shell session, you need to
source the environment setup script e.g.
$ . /opt/poky/2.4/environment-setup-armv5e-poky-linux-gnueabi
$ █
```

Chapter 9: Debugging with the Yocto Projects

```
buildhistory-diff output
$ ./scripts/buildhistory-diff
Changes to images/qemuarm/glibc/core-image-minimal (files-in-image.txt):
  /usr/bin/strace-log-merge was added
  /usr/bin/strace was added
  * (installed-package-names.txt):
  *   strace was added
  *   * IMAGE_INSTALL: added "strace"
images/qemuarm/glibc/core-image-minimal: IMAGE_INSTALL: added "strace"
images/qemuarm/glibc/core-image-minimal: IMAGESIZE changed from 6728 to 7172 (+6%)
Changes to images/qemuarm/glibc/core-image-minimal (installed-package-names.txt):
  strace was added
  * IMAGE_INSTALL: added "strace"
$
```

```
devshell example
$ bitbake linux-yocto -c devshell
Loading cache: 100% |#####| Time: 0:00:00
Loaded 1275 entries from dependency cache.
NOTE: Resolving any missing task queue dependencies

Build Configuration:
BB_VERSION      = "1.35.0"
BUILD_SYS      = "x86_64-linux"
NATIVELSBSTRING = "universal"
TARGET_SYS     = "arm-poky-linux-gnueabi"
MACHINE        = "qemuarm"
DISTRO         = "poky"
DISTRO_VERSION = "2.4"
TUNE_FEATURES  = "arm armv5 thumb dsp"
TARGET_FPU     = "soft"
meta
meta-poky
meta-yocto-bsp = "rocko:65d23bd7986615fd0f1717b615534a2a14ab80"

Initialising tasks: 100% |#####|
NOTE: Executing SetScene Tasks
NOTE: Executing RunQueue Tasks
Currently 1 running tasks (286 of 286)
0: linux-yocto-4.12.12+gitAUTOINC+eda4d18
Terminal
$ ls
arch      CREDITS      firmware    ipc         lib         net         security   virt
block    crypto       fs          Kbuild     MAINTAINERS  README     sound
certs    Documentation include     Kconfig     Makefile    samples    tools
COPYING  drivers      init        kernel     mm          scripts    usr
$ export | grep ARCH
declare -x ARCH="arm"
declare -x UBOOT_ARCH="arm"
$
```

Chapter 10: Exploring External Layers

```
Included layers
$ bitbake-layers show-layers
NOTE: Starting bitbake server...
layer                path                                                    priority
-----
meta                 /media/disco2/root_for_user_boot_ed2/poky/meta        5
meta-poky            /media/disco2/root_for_user_boot_ed2/poky/meta-poky    5
meta-yocto-bsp       /media/disco2/root_for_user_boot_ed2/poky/meta-yocto-bsp 5
$
```

```
Layers source code example
meta-*/
├── classes
├── conf
├── COPYING
├── README
└── recipes-*

3 directories, 2 files
$
```

```
BSP conf directory
conf/
├── layer.conf
├── machine
│   └── include
│       ├── <another>.conf
│       └── <machine-name>.conf
└── <other>.conf

2 directories, 4 files
$
```

```
Recipes multimedia directory
recipes-multimedia/
├── alsa
│   ├── alsa-fpu.inc
│   ├── alsa-lib
│   ├── alsa-lib_1.1.4.1.bb
│   ├── alsa-plugins_1.1.4.bb
│   ├── alsa-tools
│   ├── alsa-tools_1.1.3.bb
│   ├── alsa-utils
│   ├── alsa-utils_1.1.4.bb
│   └── alsa-utils-scripts_1.1.4.bb
├── ffmpeg
│   ├── ffmpeg
│   └── ffmpeg_3.3.3.bb
├── flac
│   └── flac_1.3.2.bb
├── gstreamer
└── files
```

```
build/conf/bblayers.conf content
# POKY_BBLAYERS_CONF_VERSION is increased each time build/conf/bblayers.conf
# changes incompatibly
POKY_BBLAYERS_CONF_VERSION = "2"

BBPATH = "${TOPDIR}"
BBFILES ?= ""

BBLAYERS ?= " \
/home/user/poky/meta \
/home/user/poky/meta-poky \
/home/user/poky/meta-yocto-bsp \
"

BBLAYERS += \
/home/user/poky/meta-openembedded/meta-oe \
"
$
```

Branch: master ▾ Layers Recipes Machines Distros

raspberrypi

| Machine name | Description | Layer |
|-----------------------------------|---|----------------------------------|
| raspberrypi | RaspberryPi http://www.raspberrypi.org/ Board | meta-raspberrypi |
| raspberrypi-cm | RaspberryPi Compute Module (CM1) | meta-raspberrypi |
| raspberrypi-cm3 | RaspberryPi Compute Module 3 (CM3) | meta-raspberrypi |
| raspberrypi0 | RaspberryPi Zero board (https://www.raspberrypi.org/blog/raspberry-pi-zero) | meta-raspberrypi |
| raspberrypi0-wifi | RaspberryPi Zero WIFI board (https://www.raspberrypi.org/blog/raspberry-pi-zero-w-joins-family/) | meta-raspberrypi |
| raspberrypi2 | RaspberryPi 2 | meta-raspberrypi |
| raspberrypi3 | RaspberryPi 3 | meta-raspberrypi |
| raspberrypi3-64 | RaspberryPi 3 in 64 bits mode | meta-raspberrypi |

Branch: rocko ▾ Layers Recipes Machines Distros

| Layer name | Description | Type | Repository |
|---------------------------------|------------------------------------|----------|---|
| meta-gnome | GNOME UI support | Software | git://git.openembedded.org/meta-openembedded |
| meta-networking | Network-related software | Software | git://git.openembedded.org/meta-openembedded |
| meta-android | Android specific tools | Software | git://github.com/shr-distribution/meta-smartphone.git |
| meta-fileystems | Support for additional filesystems | Software | git://git.openembedded.org/meta-openembedded |
| meta-initramfs | initramfs tools | Software | git://git.openembedded.org/meta-openembedded |
| meta-luneui | Recipes for LuneOS UI | Software | https://github.com/webOS-ports/meta-webos-ports |
| meta-mono | Mono | Software | git://git.yoctoproject.org/meta-mono |
| meta-multimedia | Multimedia-related software | Software | git://git.openembedded.org/meta-openembedded |
| meta-perl | Additional Perl recipes | Software | git://git.openembedded.org/meta-openembedded |
| meta-python | Python support | Software | git://git.openembedded.org/meta-openembedded |
| meta-qt5 | Qt5 modules | Software | git://github.com/meta-qt5/meta-qt5.git |
| meta-webserver | Web server related software | Software | git://git.openembedded.org/meta-openembedded |
| meta-xfce | XFCE UI support | Software | git://git.openembedded.org/meta-openembedded |

Chapter 11: Creating Custom Layers

```
Creating a new layer meta-newlayer
$ ./poky/scripts/yocto-layer create newlayer
Please enter the layer priority you'd like to use for the layer: [default: 6]
Would you like to have an example recipe created? (y/n) [default: n] y
Please enter the name you'd like to use for your example recipe: [default: example]
Would you like to have an example bbappend file created? (y/n) [default: n] y
Please enter the name you'd like to use for your bbappend file: [default: example]
Please enter the version number you'd like to use for your bbappend file (this should
match the recipe you're appending to): [default: 0.1]

New layer created in meta-newlayer.

Don't forget to add it to your BBLAYERS (for details see meta-newlayer/README).
$ █
```

```
Content of meta-newlayer
meta-newlayer/
├── conf
│   └── layer.conf
├── COPYING.MIT
├── README
├── recipes-example
│   └── example
│       ├── example-0.1
│       │   ├── example.patch
│       │   └── helloworld.c
│       └── example_0.1.bb
├── recipes-example-bbappend
│   └── example-bbappend
│       ├── example-0.1
│       │   └── example.patch
│       └── example_0.1.bbappend
7 directories, 8 files
$ █
```

```
Using recipetool to ease the recipe creation
$ recipetool create -V 1.0 https://github.com/OsSystems/bbexample
NOTE: Starting bitbake server...
NOTE: Fetching git://github.com/OsSystems/bbexample;protocol=https...
Loading cache: 100% |#####| Time: 0:00:00
Loaded 1275 entries from dependency cache.
Parsing recipes: 100% |#####| Time: 0:00:00
Parsing of 819 .bb files complete (818 cached, 1 parsed). 1276 targets, 62 skipped, 0 masked, 0 errors.
NOTE: Resolving any missing task queue dependencies

Build Configuration:
BB_VERSION      = "1.35.0"
BUILD_SYS       = "x86_64-linux"
NATIVELSBSTRING = "universal"
TARGET_SYS      = "arm-poky-linux-gnueabi"
MACHINE         = "qemuarm"
DISTRO          = "poky"
DISTRO_VERSION  = "2.4"
TUNE_FEATURES   = "arm armv5 thumb dsp"
TARGET_FPU      = "soft"
meta
meta-poky
meta-yocto-bsp  = "rocko:65d23bd7986615fdfb0f1717b615534a2a14ab80"

Initialising tasks: 100% |#####| Time: 0:00:00
NOTE: Executing RunQueue Tasks
NOTE: Tasks Summary: Attempted 2 tasks of which 0 didn't need to be rerun and all succeeded.
NOTE: Writing buildhistory
NOTE: Recipe bbexample_git.bb has been created; further editing may be required to make it fully functional
$ █
```

```
The recipe bbexample_git.bb created by recipetool
$ cat bbexample_git.bb
# Recipe created by recipetool
# This is the basis of a recipe and may need further editing in order to be fully functional.
# (Feel free to remove these comments when editing.)

# WARNING: the following LICENSE and LIC_FILES_CHKSUM values are best guesses - it is
# your responsibility to verify that the values are complete and correct.
LICENSE = "MIT"
LIC_FILES_CHKSUM = "file://LICENSE;md5=96af5705d6f64a88e035781ef00e98a8"

SRC_URI = "git://github.com/OsSystems/bbexample;protocol=https"

# Modify these as desired
PV = "1.0+git${SRCPV}"
SRCREV = "ece3cef9abc95cb77c931f9f27860102e43cc1d9"

S = "${WORKDIR}/git"

# NOTE: if this software is not capable of being built in a separate build directory
# from the source, you should replace autotools with autotools-brokensep in the
# inherit line
inherit autotools

# Specify any options you want to pass to the configure script using EXTRA_OECONF:
EXTRA_OECONF = ""

$ █
```

Chapter 14: Booting Our Custom Embedded Linux

```
Terminal
├── build
└── sources
    ├── meta-freescale
    ├── meta-freescale-3rdparty
    ├── meta-openembedded
    ├── meta-raspberrypi
    ├── meta-ti
    └── poky

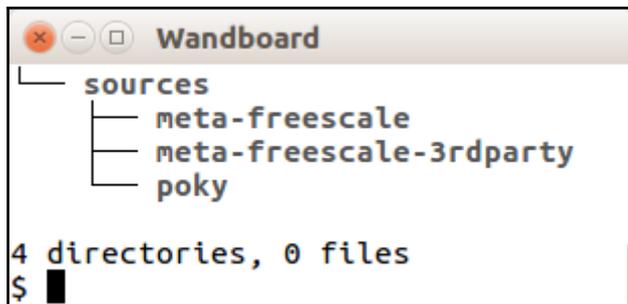
8 directories, 0 files
$
```

```
BeagleBone Black
├── sources
│   ├── meta-ti
│   └── poky
└──

3 directories, 0 files
$
```

```
RaspberryPi 3
sources/
├── meta-openembedded
├── meta-raspberrypi
└── poky

3 directories, 0 files
$
```



```
Wandboard
├── sources
│   ├── meta-freescale
│   ├── meta-freescale-3rdparty
│   └── poky
4 directories, 0 files
$
```