

Yocto Project Reference Manual



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Note

For the latest version of this manual associated with this Yocto Project release, see the [Yocto Project Reference Manual](#) from the Yocto Project website.

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Chapter 1. Introduction ¶

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1.1. Introduction¶

This manual provides reference information for the current release of the Yocto Project. The Yocto Project is an open-source collaboration project focused on embedded Linux developers. Amongst other things, the Yocto Project uses the OpenEmbedded build system, which is based on the Poky project, to construct complete Linux images. You can find complete introductory and getting started information on the Yocto Project by reading the [Yocto Project Quick Start](#). For task-based information using the Yocto Project, see the [Yocto Project Development Manual](#) and the [Yocto Project Linux Kernel Development Manual](#). For Board Support Package (BSP) structure information, see the [Yocto Project Board Support Package \(BSP\) Developer's Guide](#). You can find information on tracing and profiling in the [Yocto Project Profiling and Tracing Manual](#). For information on BitBake, which is the task execution tool the OpenEmbedded build system is based on, see the [BitBake User Manual](#). Finally, you can also find lots of Yocto Project information on the [Yocto Project website](#).

1.2. Documentation Overview¶

This reference manual consists of the following:

- **[Using the Yocto Project](#)**: Provides an overview of the components that make up the Yocto Project followed by information about debugging images created in the Yocto Project.
- **[A Closer Look at the Yocto Project Development Environment](#)**: Provides a more detailed look at the Yocto Project development environment within the context of development.
- **[Technical Details](#)**: Describes fundamental Yocto Project components as well as an explanation behind how the Yocto Project uses shared state (sstate) cache to speed build time.
- **[Migrating to a Newer Yocto Project Release](#)**: Describes release-specific information that helps you move from one Yocto Project Release to another.
- **[Directory Structure](#)**: Describes the [Source Directory](#) created either by unpacking a released Yocto Project tarball on your host development system, or by cloning the upstream Poky Git repository.
- **[Classes](#)**: Describes the classes used in the Yocto Project.
- **[Tasks](#)**: Describes the tasks defined by the OpenEmbedded build system.
- **[QA Error and Warning Messages](#)**: Lists and describes QA warning and error messages.
- **[Images](#)**: Describes the standard images that the Yocto Project supports.
- **[Features](#)**: Describes mechanisms for creating distribution, machine, and image features during the build process using the OpenEmbedded build system.
- **[Variables Glossary](#)**: Presents most variables used by the OpenEmbedded build system, which uses BitBake. Entries describe the function of the variable and how to apply them.
- **[Variable Context](#)**: Provides variable locality or context.
- **[FAQ](#)**: Provides answers for commonly asked questions in the Yocto Project development

environment.

- ***Contributing to the Yocto Project*** Provides guidance on how you can contribute back to the Yocto Project.

1.3. System Requirements

For general Yocto Project system requirements, see the "[Setting Up to Use the Yocto Project](#)" section in the Yocto Project Quick Start. The remainder of this section provides details on system requirements not covered in the Yocto Project Quick Start.

1.3.1. Supported Linux Distributions

Currently, the Yocto Project is supported on the following distributions:

Note

Yocto Project releases are tested against the stable Linux distributions in the following list. The Yocto Project should work on other distributions but validation is not performed against them.

In particular, the Yocto Project does not support and currently has no plans to support rolling-releases or development distributions due to their constantly changing nature. We welcome patches and bug reports, but keep in mind that our priority is on the supported platforms listed below.

If you encounter problems, please go to [Yocto Project Bugzilla](#) and submit a bug. We are interested in hearing about your experience.

- Ubuntu 14.04 (LTS)
- Ubuntu 14.10
- Ubuntu 15.04
- Ubuntu 15.10
- Fedora release 21
- Fedora release 22
- CentOS release 6.x
- CentOS release 7.x
- Debian GNU/Linux 7.x (Wheezy)
- Debian GNU/Linux 8.x (Jessie)
- openSUSE 13.2

Note

While the Yocto Project Team attempts to ensure all Yocto Project releases are one hundred percent compatible with each officially supported Linux distribution, instances might exist where you encounter a problem while using the Yocto Project on a specific distribution. For example, the CentOS 6.4 distribution does not include the Gtk+ 2.20.0 and PyGtk 2.21.0 (or higher) packages, which are required to run [Hob](#).

1.3.2. Required Packages for the Host Development System

The list of packages you need on the host development system can be large when covering all build scenarios using the Yocto Project. This section provides required packages according to Linux distribution and function.

1.3.2.1. Ubuntu and Debian

The following list shows the required packages by function given a supported Ubuntu or Debian Linux distribution:

Note

If your build system has the `oss4-dev` package installed, you might experience QEMU build failures due to the package installing its own custom `/usr/include/linux/soundcard.h` on the Debian system. If you run into this situation, either of the following solutions exist:

```
$ sudo apt-get build-dep qemu
$ sudo apt-get remove oss4-dev
```

- **Essentials:** Packages needed to build an image on a headless system:

```
$ sudo apt-get install gawk wget git-core diffstat unzip texinfo gcc-multilib \
build-essential chrpath socat
```

- **Graphical and Eclipse Plug-In Extras:** Packages recommended if the host system has graphics support or if you are going to use the Eclipse IDE:

```
$ sudo apt-get install libssl1.2-dev xterm
```

- **Documentation:** Packages needed if you are going to build out the Yocto Project documentation manuals:

```
$ sudo apt-get install make xsltproc docbook-utils fop dblatex xmlto
```

- **ADT Installer Extras:** Packages needed if you are going to be using the [Application Development Toolkit \(ADT\) Installer](#):

```
$ sudo apt-get install autoconf automake libtool libglib2.0-dev libarchive-dev
```

- **OpenEmbedded Self-Test (oe-selftest):** Packages needed if you are going to run `oe-selftest`:

```
$ sudo apt-get install python-git
```

1.3.2.2. Fedora Packages

The following list shows the required packages by function given a supported Fedora Linux distribution:

- **Essentials:** Packages needed to build an image for a headless system:

```
$ sudo dnf install gawk make wget tar bzip2 gzip python unzip perl patch \
diffutils diffstat git cpp gcc gcc-c++ glibc-devel texinfo chrpath \
ccache perl-Data-Dumper perl-Text-ParseWords perl-Thread-Queue socat \
findutils which
```

- **Graphical and Eclipse Plug-In Extras:** Packages recommended if the host system has graphics support or if you are going to use the Eclipse IDE:

```
$ sudo dnf install SDL-devel xterm
```

- **Documentation:** Packages needed if you are going to build out the Yocto Project documentation manuals:

```
$ sudo dnf install make docbook-style-dsssl docbook-style-xsl \
docbook-dtds docbook-utils fop libxslt dblatex xmlto xsltproc
```

- **ADT Installer Extras:** Packages needed if you are going to be using the [Application Development Toolkit \(ADT\) Installer](#):

```
$ sudo dnf install autoconf automake libtool glib2-devel libarchive-devel
```

- **OpenEmbedded Self-Test (*oe-selftest*):** Packages needed if you are going to run `oe-selftest`:

```
$ sudo dnf install GitPython
```

1.3.2.3. openSUSE Packages

The following list shows the required packages by function given a supported openSUSE Linux distribution:

- **Essentials:** Packages needed to build an image for a headless system:

```
$ sudo zypper install python gcc gcc-c++ git chrpath make wget python-xml \
diffstat makeinfo python-curses patch socat
```

- **Graphical and Eclipse Plug-In Extras:** Packages recommended if the host system has graphics support or if you are going to use the Eclipse IDE:

```
$ sudo zypper install libSDL-devel xterm
```

- **Documentation:** Packages needed if you are going to build out the Yocto Project documentation manuals:

```
$ sudo zypper install make fop xsltproc dblatex xmlto
```

- **ADT Installer Extras:** Packages needed if you are going to be using the [Application Development Toolkit \(ADT\) Installer](#):

```
$ sudo zypper install autoconf automake libtool glib2-devel libarchive-devel
```

- **OpenEmbedded Self-Test (*oe-selftest*):** Packages needed if you are going to run `oe-selftest`:

```
$ sudo zypper install python-GitPython
```

1.3.2.4. CentOS Packages

The following list shows the required packages by function given a supported CentOS Linux distribution:

Note

For CentOS 6.x, some of the versions of the components provided by the distribution are too old (e.g. Git, Python, and tar). It is recommended that you install the buildtools in order to provide versions that will work with the OpenEmbedded build system. For information on how to install the buildtools tarball, see the "[Required Git, Tar, and Python Versions](#)" section.

- **Essentials:** Packages needed to build an image for a headless system:

```
$ sudo yum install gawk make wget tar bzip2 gzip python unzip perl patch \
diffutils diffstat git cpp gcc gcc-c++ glibc-devel texinfo chrpath socat \
perl-Data-Dumper perl-Text-ParseWords perl-Thread-Queue
```

- **Graphical and Eclipse Plug-In Extras:** Packages recommended if the host system has graphics support or if you are going to use the Eclipse IDE:

```
$ sudo yum install SDL-devel xterm
```

- **Documentation:** Packages needed if you are going to build out the Yocto Project documentation manuals:

```
$ sudo yum install make docbook-style-dsssl docbook-style-xsl \
docbook-dtds docbook-utils fop libxslt dblatex xsltproc
```

- **ADT Installer Extras:** Packages needed if you are going to be using the [Application Development Toolkit \(ADT\) Installer](#):

```
$ sudo yum install autoconf automake libtool glib2-devel libarchive-devel
```

Note

For CentOS 6.x, in order for the ADT installer script to work, you must have installed the `liblzma5`, `libarchive3.x`, and `libarchive-devel-3.1.3` (or newer) packages, in that order.

- **OpenEmbedded Self-Test (*oe-selftest*):** Packages needed if you are going to run `oe-selftest`:

```
$ sudo yum install GitPython
```

1.3.3. Required Git, tar, and Python Versions

In order to use the build system, your host development system must meet the following version requirements for Git, tar, and Python:

- Git 1.7.8 or greater
- tar 1.24 or greater
- Python 2.7.3 or greater not including Python 3.x, which is not supported.

If your host development system does not meet all these requirements, you can resolve this by installing a `buildtools` tarball that contains these tools. You can get the tarball one of two ways: download a pre-built tarball or use BitBake to build the tarball.

1.3.3.1. Downloading a Pre-Built `buildtools` Tarball

Downloading and running a pre-built `buildtools` installer is the easiest of the two methods by which you can get these tools:

1. Locate and download the `*.sh` at <http://downloads.yoctoproject.org/releases/yocto/yocto-2.0.1/buildtools/>.
2. Execute the installation script. Here is an example:

```
$ sh poky-glibc-x86_64-buildtools-tarball-x86_64-buildtools-nativesdk-standalone-2.0.1.sh
```

During execution, a prompt appears that allows you to choose the installation directory. For example, you could choose the following:

```
/home/your-username/buildtools
```

3. Source the tools environment setup script by using a command like the following:

```
$ source /home/your_username/buildtools/environment-setup-i586-poky-linux
```

Of course, you need to supply your installation directory and be sure to use the right file (i.e. `i586` or `x86-64`).

After you have sourced the setup script, the tools are added to `PATH` and any other environment variables required to run the tools are initialized. The results are working versions of Git, tar, Python and `chrpath`.

1.3.3.2. Building Your Own `buildtools` Tarball

Building and running your own buildtools installer applies only when you have a build host that can already run BitBake. In this case, you use that machine to build the `.sh` file and then take steps to transfer and run it on a machine that does not meet the minimal Git, tar, and Python requirements.

Here are the steps to take to build and run your own buildtools installer:

1. On the machine that is able to run BitBake, be sure you have set up your build environment with the setup script ([oe-init-build-env](#) or [oe-init-build-env-memres](#)).
2. Run the BitBake command to build the tarball:

```
$ bitbake buildtools-tarball
```

Note

The `SDKMACHINE` variable in your `local.conf` file determines whether you build tools for a 32-bit or 64-bit system.

Once the build completes, you can find the `.sh` file that installs the tools in the `tmp/depoy/sdk` subdirectory of the [Build Directory](#). The installer file has the string "buildtools" in the name.

3. Transfer the `.sh` file from the build host to the machine that does not meet the Git, tar, or Python requirements.
4. On the machine that does not meet the requirements, run the `.sh` file to install the tools. Here is an example:

```
$ sh poky-glibc-x86_64-buildtools-tarball-x86_64-buildtools-nativesdk-standalone-2.0.1.sh
```

During execution, a prompt appears that allows you to choose the installation directory. For example, you could choose the following:

```
/home/your_username/buildtools
```

5. Source the tools environment setup script by using a command like the following:

```
$ source /home/your_username/buildtools/environment-setup-i586-poky-linux
```

Of course, you need to supply your installation directory and be sure to use the right file (i.e. i585 or x86-64).

After you have sourced the setup script, the tools are added to `PATH` and any other environment variables required to run the tools are initialized. The results are working versions of Git, tar, Python and `chrpath`.

1.4. Obtaining the Yocto Project

The Yocto Project development team makes the Yocto Project available through a number of methods:

- **Source Repositories:** Working from a copy of the upstream poky repository is the preferred method for obtaining and using a Yocto Project release. You can view the Yocto Project Source Repositories at <http://git.yoctoproject.org/cgit.cgi>. In particular, you can find the poky repository at <http://git.yoctoproject.org/cgit.cgi/poky/>.
- **Releases:** Stable, tested releases are available as tarballs through <http://downloads.yoctoproject.org/releases/yocto/>.
- **Nightly Builds:** These tarball releases are available at <http://autobuilder.yoctoproject.org/pub/nightly/>. These builds include Yocto Project

releases, meta-toolchain tarball installation scripts, and experimental builds.

- **Yocto Project Website:** You can find tarball releases of the Yocto Project and supported BSPs at the [Yocto Project website](#). Along with these downloads, you can find lots of other information at this site.

1.5. Development Checkouts ¶

Development using the Yocto Project requires a local [Source Directory](#). You can set up the Source Directory by cloning a copy of the upstream [poky](#) Git repository. For information on how to do this, see the "[Getting Set Up](#)" section in the Yocto Project Development Manual.

Chapter 2. Using the Yocto Project ¶

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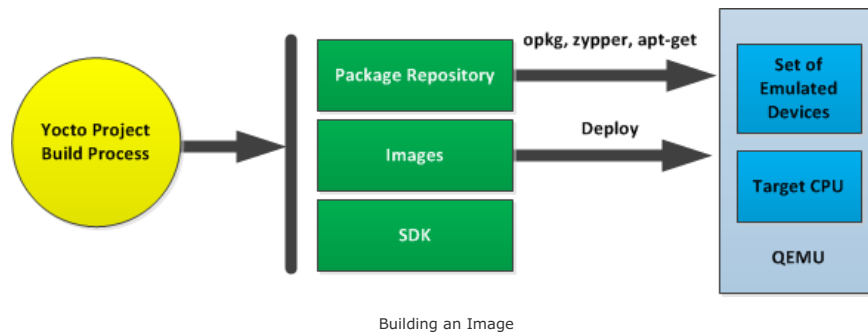
This chapter describes common usage for the Yocto Project. The information is introductory in nature as other manuals in the Yocto Project documentation set provide more details on how to use the Yocto Project.

2.1. Running a Build ¶

This section provides a summary of the build process and provides information for less obvious aspects of the build process. For general information on how to build an image using the OpenEmbedded build system, see the "[Building Images](#)" section of the Yocto Project Quick Start.

2.1.1. Build Overview ¶

In the development environment you will need to build an image whenever you change hardware support, add or change system libraries, or add or change services that have dependencies.



The first thing you need to do is set up the OpenEmbedded build environment by sourcing an environment setup script (i.e. `oe-init-build-env` or `oe-init-build-env-memres`). Here is an example:

```
$ source oe-init-build-env [build_dir]
```

The `build_dir` argument is optional and specifies the directory the OpenEmbedded build system uses for the build - the [Build Directory](#). If you do not specify a Build Directory, it defaults to a directory named `build` in your current working directory. A common practice is to use a different Build Directory for different targets. For example, `~/build/x86` for a `qemux86` target, and `~/build/arm` for a `qemuarm` target.

Once the build environment is set up, you can build a target using:

```
$ bitbake target
```

The `target` is the name of the recipe you want to build. Common targets are the images in `meta/recipes-core/images`, `meta/recipes-sato/images`, etc. all found in the [Source Directory](#). Or, the target can be the name of a recipe for a specific piece of software such as BusyBox. For more details about the images the OpenEmbedded build system supports, see the ["Images"](#) chapter.

Note

Building an image without GNU General Public License Version 3 (GPLv3), or similarly licensed, components is supported for only minimal and base images. See the ["Images"](#) chapter for more information.

2.1.2. Building an Image Using GPL Components ¶

When building an image using GPL components, you need to maintain your original settings and not switch back and forth applying different versions of the GNU General Public License. If you rebuild using different versions of GPL, dependency errors might occur due to some components not being rebuilt.

2.2. Installing and Using the Result ¶

Once an image has been built, it often needs to be installed. The images and kernels built by the OpenEmbedded build system are placed in the [Build Directory](#) in `tmp/deploym/images`. For information on how to run pre-built images such as `qemux86` and `qemuarm`, see the ["Example Using Pre-Built Binaries and QEMU"](#) section in the Yocto Project Application Developer's Guide. For information about how to install these images, see the documentation for your particular board or machine.

2.3. Debugging Build Failures ¶

The exact method for debugging build failures depends on the nature of the problem and on

the system's area from which the bug originates. Standard debugging practices such as comparison against the last known working version with examination of the changes and the re-application of steps to identify the one causing the problem are valid for the Yocto Project just as they are for any other system. Even though it is impossible to detail every possible potential failure, this section provides some general tips to aid in debugging.

A useful feature for debugging is the error reporting tool. Configuring the Yocto Project to use this tool causes the OpenEmbedded build system to produce error reporting commands as part of the console output. You can enter the commands after the build completes to log error information into a common database, that can help you figure out what might be going wrong. For information on how to enable and use this feature, see the "[Using the Error Reporting Tool](#)" section in the Yocto Project Development Manual.

For discussions on debugging, see the "[Debugging With the GNU Project Debugger \(GDB\) Remotely](#)" and "[Working within Eclipse](#)" sections in the Yocto Project Development Manual.

Note

The remainder of this section presents many examples of the `bitbake` command. You can learn about BitBake by reading the [BitBake User Manual](#).

2.3.1. Task Failures

The log file for shell tasks is available in `${WORKDIR}/temp/log.do_taskname.pid`. For example, the `do_compile` task for the QEMU minimal image for the x86 machine (`qemux86`) might be `tmp/work/qemux86-poky-linux/core-image-minimal/1.0-r0/temp/log.do_compile.20830`. To see what [BitBake](#) runs to generate that log, look at the corresponding `run.do_taskname.pid` file located in the same directory.

Presently, the output from Python tasks is sent directly to the console.

2.3.2. Running Specific Tasks

Any given package consists of a set of tasks. The standard BitBake behavior in most cases is: `do_fetch`, `do_unpack`, `do_patch`, `do_configure`, `do_compile`, `do_install`, `do_package`, `do_package_write_*`, and `do_build`. The default task is `do_build` and any tasks on which it depends build first. Some tasks, such as `do_devshell`, are not part of the default build chain. If you wish to run a task that is not part of the default build chain, you can use the `-c` option in BitBake. Here is an example:

```
$ bitbake matchbox-desktop -c devshell
```

If you wish to rerun a task, use the `-f` force option. For example, the following sequence forces recompilation after changing files in the work directory.

```
$ bitbake matchbox-desktop
.
.
make some changes to the source code in the work directory
.
.
$ bitbake matchbox-desktop -c compile -f
$ bitbake matchbox-desktop
```

This sequence first builds and then recompiles `matchbox-desktop`. The last command reruns all tasks (basically the packaging tasks) after the compile. BitBake recognizes that the `do_compile` task was rerun and therefore understands that the other tasks also need to be run again.

You can view a list of tasks in a given package by running the `do_listtasks` task as follows:

```
$ bitbake matchbox-desktop -c listtasks
```

The results appear as output to the console and are also in the file

```
${WORKDIR}/temp/log.do_listtasks.
```

2.3.3. Dependency Graphs

Sometimes it can be hard to see why BitBake wants to build other packages before building a given package you have specified. The `bitbake -g targetname` command creates the `pn-buildlist`, `pn-depends.dot`, `package-depends.dot`, and `task-depends.dot` files in the current directory. These files show what will be built and the package and task dependencies, which are useful for debugging problems. You can use the `bitbake -g -u depexp targetname` command to display the results in a more human-readable form.

2.3.4. General BitBake Problems

You can see debug output from BitBake by using the `-D` option. The debug output gives more information about what BitBake is doing and the reason behind it. Each `-D` option you use increases the logging level. The most common usage is `-DDD`.

The output from `bitbake -DDD -v targetname` can reveal why BitBake chose a certain version of a package or why BitBake picked a certain provider. This command could also help you in a situation where you think BitBake did something unexpected.

2.3.5. Development Host System Issues

Sometimes issues on the host development system can cause your build to fail. Following are known, host-specific problems. Be sure to always consult the [Release Notes](#) for a look at all release-related issues.

- ***glibc-initial fails to build***: If your development host system has the unpatched GNU Make 3.82, the `do_install` task fails for `glibc-initial` during the build.

Typically, every distribution that ships GNU Make 3.82 as the default already has the patched version. However, some distributions, such as Debian, have GNU Make 3.82 as an option, which is unpatched. You will see this error on these types of distributions. Switch to GNU Make 3.81 or patch your `make` to solve the problem.

2.3.6. Building with No Dependencies

To build a specific recipe (`.bb` file), you can use the following command form:

```
$ bitbake -b somepath/somerecipe.bb
```

This command form does not check for dependencies. Consequently, you should use it only when you know existing dependencies have been met.

Note

You can also specify fragments of the filename. In this case, BitBake checks for a unique match.

2.3.7. Variables

You can use the `-e` BitBake option to display the parsing environment for a configuration. The following displays the general parsing environment:

```
$ bitbake -e
```

This next example shows the parsing environment for a specific recipe:

```
$ bitbake -e recipename
```

2.3.8. Recipe Logging Mechanisms

Best practices exist while writing recipes that both log build progress and act on build conditions such as warnings and errors. Both Python and Bash language bindings exist for the logging mechanism:

- **Python:** For Python functions, BitBake supports several loglevels: `bb.fatal`, `bb.error`, `bb.warn`, `bb.note`, `bb.plain`, and `bb.debug`.
- **Bash:** For Bash functions, the same set of loglevels exist and are accessed with a similar syntax: `bbfatal`, `bberror`, `bbwarn`, `bbnote`, `bbplain`, and `bbdebug`.

For guidance on how logging is handled in both Python and Bash recipes, see the `logging.bbclass` file in the `meta/classes` folder of the [Source Directory](#).

2.3.8.1. Logging With Python

When creating recipes using Python and inserting code that handles build logs, keep in mind the goal is to have informative logs while keeping the console as "silent" as possible. Also, if you want status messages in the log, use the "debug" loglevel.

Following is an example written in Python. The code handles logging for a function that determines the number of tasks needed to be run. See the "[do_listtasks](#)" section for additional information:

```
python do_listtasks() {
    bb.debug(2, "Starting to figure out the task list")
    if noteworthy_condition:
        bb.note("There are 47 tasks to run")
    bb.debug(2, "Got to point xyz")
    if warning_trigger:
        bb.warn("Detected warning_trigger, this might be a problem later.")
    if recoverable_error:
        bb.error("Hit recoverable_error, you really need to fix this!")
    if fatal_error:
        bb.fatal("fatal_error detected, unable to print the task list")
    bb.plain("The tasks present are abc")
    bb.debug(2, "Finished figuring out the tasklist")
}
```

2.3.8.2. Logging With Bash

When creating recipes using Bash and inserting code that handles build logs, you have the same goals - informative with minimal console output. The syntax you use for recipes written in Bash is similar to that of recipes written in Python described in the previous section.

Following is an example written in Bash. The code logs the progress of the `do_my_function` function.

```
do_my_function() {
    bbdebug 2 "Running do_my_function"
    if [ exceptional_condition ]; then
        bbnote "Hit exceptional_condition"
    fi
    bbdebug 2 "Got to point xyz"
    if [ warning_trigger ]; then
        bbwarn "Detected warning_trigger, this might cause a problem later."
    fi
    if [ recoverable_error ]; then
        bberror "Hit recoverable_error, correcting"
    fi
    if [ fatal_error ]; then
        bbfatal "fatal_error detected"
    fi
    bbdebug 2 "Completed do_my_function"
}
```

2.3.9. Other Tips

Here are some other tips that you might find useful:

- When adding new packages, it is worth watching for undesirable items making their way

into compiler command lines. For example, you do not want references to local system files like `/usr/lib/` or `/usr/include/`.

- If you want to remove the `psplash` boot splashscreen, add `psplash=false` to the kernel command line. Doing so prevents `psplash` from loading and thus allows you to see the console. It is also possible to switch out of the splashscreen by switching the virtual console (e.g. `Fn+Left` or `Fn+Right` on a Zaurus).

2.4. Maintaining Build Output Quality ¶

Many factors can influence the quality of a build. For example, if you upgrade a recipe to use a new version of an upstream software package or you experiment with some new configuration options, subtle changes can occur that you might not detect until later. Consider the case where your recipe is using a newer version of an upstream package. In this case, a new version of a piece of software might introduce an optional dependency on another library, which is auto-detected. If that library has already been built when the software is building, the software will link to the built library and that library will be pulled into your image along with the new software even if you did not want the library.

The `buildhistory` class exists to help you maintain the quality of your build output. You can use the class to highlight unexpected and possibly unwanted changes in the build output. When you enable build history, it records information about the contents of each package and image and then commits that information to a local Git repository where you can examine the information.

The remainder of this section describes the following:

- How you can enable and disable build history
- How to understand what the build history contains
- How to limit the information used for build history
- How to examine the build history from both a command-line and web interface

2.4.1. Enabling and Disabling Build History ¶

Build history is disabled by default. To enable it, add the following `INHERIT` statement and set the `BUILDHISTORY_COMMIT` variable to "1" at the end of your `conf/local.conf` file found in the [Build Directory](#):

```
INHERIT += "buildhistory"
BUILDHISTORY_COMMIT = "1"
```

Enabling build history as previously described causes the build process to collect build output information and commit it to a local [Git](#) repository.

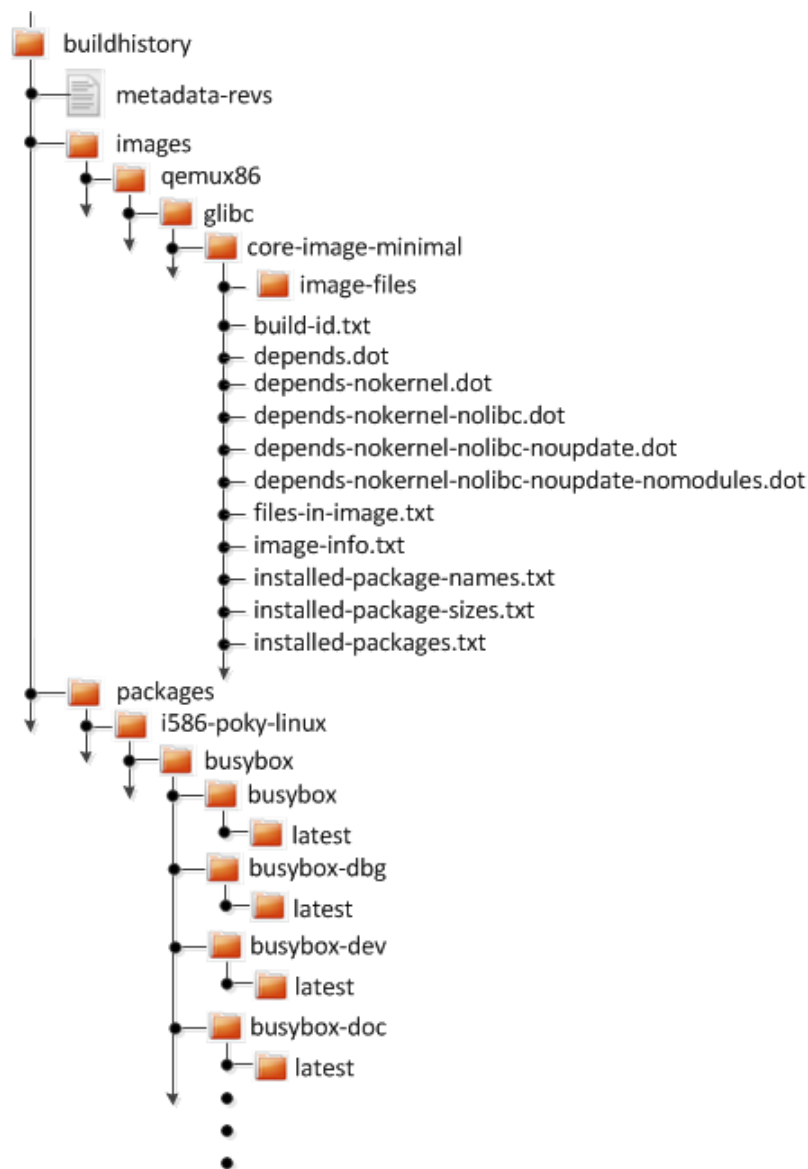
Note

Enabling build history increases your build times slightly, particularly for images, and increases the amount of disk space used during the build.

You can disable build history by removing the previous statements from your `conf/local.conf` file.

2.4.2. Understanding What the Build History Contains ¶

Build history information is kept in `${TOPDIR}/buildhistory` in the Build Directory as defined by the `BUILDHISTORY_DIR` variable. The following is an example abbreviated listing:



At the top level, there is a `metadata-revs` file that lists the revisions of the repositories for the layers enabled when the build was produced. The rest of the data splits into separate `packages`, `images` and `sdk` directories, the contents of which are described below.

2.4.2.1. Build History Package Information

The history for each package contains a text file that has name-value pairs with information about the package. For example, `buildhistory/packages/i586-poky-linux/busybox/busybox/latest` contains the following:

```

PV = 1.22.1
PR = r32
RPROVIDES =
RDEPENDS = glibc (>= 2.20) update-alternatives-opkg
RRECOMMENDS = busybox-syslog busybox-udhcp update-rc.d
PKGSIZE = 540168
FILES = /usr/bin/* /usr/sbin/* /usr/lib/busybox/* /usr/lib/lib*.so.* \
        /etc /com /var /bin/* /sbin/* /lib/*so.* /lib/udev/rules.d \
        /usr/lib/udev/rules.d /usr/share/busybox /usr/lib/busybox/* \
        /usr/share/pixmaps /usr/share/applications /usr/share/ld \
        /usr/share/omf /usr/share/sounds /usr/lib/bonobo/servers
FILELIST = /bin/busybox /bin/busybox.nosuid /bin/busybox.suid /bin/sh \
        /etc/busybox.links.nosuid /etc/busybox.links.suid

```

Most of these name-value pairs correspond to variables used to produce the package. The exceptions are `FILELIST`, which is the actual list of files in the package, and `PKGSIZE`, which is the total size of files in the package in bytes.

There is also a file corresponding to the recipe from which the package came (e.g. `buildhistory/packages/i586-poky-linux/busybox/latest`):

```
PV = 1.22.1
PR = r32
DEPENDS = initscripts kern-tools-native update-rc.d-native \
  virtual/i586-poky-linux-compilerlibs virtual/i586-poky-linux-gcc \
  virtual/libc virtual/update-alternatives
PACKAGES = busybox-ptest busybox-httpd busybox-udhcpd busybox-udhcpd \
  busybox-syslog busybox-mdev busybox-hwclock busybox-dbg \
  busybox-staticdev busybox-dev busybox-doc busybox-locale busybox
```

Finally, for those recipes fetched from a version control system (e.g., Git), a file exists that lists source revisions that are specified in the recipe and lists the actual revisions used during the build. Listed and actual revisions might differ when `SRCREV` is set to `${AUTOREV}`. Here is an example assuming `buildhistory/packages/qemux86-poky-linux/linux-yocto/latest_srcrev`:

```
# SRCREV_machine = "38cd560d5022ed2dbd1ab0dca9642e47c98a0aa1"
SRCREV_machine = "38cd560d5022ed2dbd1ab0dca9642e47c98a0aa1"
# SRCREV_meta = "a227f20eff056e511d504b2e490f3774ab260d6f"
SRCREV_meta = "a227f20eff056e511d504b2e490f3774ab260d6f"
```

You can use the `buildhistory-collect-srcrevs` command with the `-a` option to collect the stored `SRCREV` values from build history and report them in a format suitable for use in global configuration (e.g., `local.conf` or a distro include file) to override floating `AUTOREV` values to a fixed set of revisions. Here is some example output from this command:

```
$ buildhistory-collect-srcrevs -a
# i586-poky-linux
SRCREV_pn-glibc = "b8079dd0d360648e4e8de48656c5c38972621072"
SRCREV_pn-glibc-initial = "b8079dd0d360648e4e8de48656c5c38972621072"
SRCREV_pn-opkg-utils = "53274f087565fd45d8452c5367997ba6a682a37a"
SRCREV_pn-kmod = "fd56638aed3fe147015bfa10ed4a5f7491303cb4"
# x86_64-linux
SRCREV_pn-gtk-doc-stub-native = "1dea266593edb766d6d898c79451ef193eb17cfa"
SRCREV_pn-dtc-native = "65cc4d2748a2c2e6f27f1cf39e07a5dbabd80ebf"
SRCREV_pn-update-rc.d-native = "eca680ddf28d024954895f59a241a622dd575c11"
SRCREV_glibc_pn-cross-localedef-native = "b8079dd0d360648e4e8de48656c5c38972621072"
SRCREV_localedef_pn-cross-localedef-native = "c833367348d39dad7ba018990bfdaffaec8e9ed3"
SRCREV_pn-prelink-native = "faa069deec99bf61418d0bab831c83d7c1b797ca"
SRCREV_pn-opkg-utils-native = "53274f087565fd45d8452c5367997ba6a682a37a"
SRCREV_pn-kern-tools-native = "23345b8846fe4bd167efdf1bd8a1224b2ba9a5ff"
SRCREV_pn-kmod-native = "fd56638aed3fe147015bfa10ed4a5f7491303cb4"
# qemux86-poky-linux
SRCREV_machine_pn-linux-yocto = "38cd560d5022ed2dbd1ab0dca9642e47c98a0aa1"
SRCREV_meta_pn-linux-yocto = "a227f20eff056e511d504b2e490f3774ab260d6f"
# all-poky-linux
SRCREV_pn-update-rc.d = "eca680ddf28d024954895f59a241a622dd575c11"
```

Note

Here are some notes on using the `buildhistory-collect-srcrevs` command:

- By default, only values where the `SRCREV` was not hardcoded (usually when `AUTOREV` was used) are reported. Use the `-a` option to see all `SRCREV` values.
- The output statements might not have any effect if overrides are applied elsewhere in the build system configuration. Use the `-f` option to add the `forcevariable` override to each output line if you need to work around this restriction.
- The script does apply special handling when building for multiple machines. However, the script does place a comment before each set of values that specifies which triplet to which they belong as shown above (e.g., `i586-poky-linux`).

2.4.2.2. Build History Image Information

The files produced for each image are as follows:

- `image-files`: A directory containing selected files from the root filesystem. The files are defined by `BUILDHISTORY_IMAGE_FILES`.
- `build-id.txt`: Human-readable information about the build configuration and metadata

source revisions. This file contains the full build header as printed by BitBake.

- *.dot: Dependency graphs for the image that are compatible with graphviz.
- files-in-image.txt: A list of files in the image with permissions, owner, group, size, and symlink information.
- image-info.txt: A text file containing name-value pairs with information about the image. See the following listing example for more information.
- installed-package-names.txt: A list of installed packages by name only.
- installed-package-sizes.txt: A list of installed packages ordered by size.
- installed-packages.txt: A list of installed packages with full package filenames.

Note

Installed package information is able to be gathered and produced even if package management is disabled for the final image.

Here is an example of image-info.txt:

```
DISTRO = poky
DISTRO_VERSION = 1.7
USER_CLASSES = buildstats image-mklibs image-prelink
IMAGE_CLASSES = image_types
IMAGE_FEATURES = debug-tweaks
IMAGE_LINGUAS =
IMAGE_INSTALL = packagegroup-core-boot run-postinsts
BAD_RECOMMENDATIONS =
NO_RECOMMENDATIONS =
PACKAGE_EXCLUDE =
ROOTFS_POSTPROCESS_COMMAND = write_package_manifest; license_create_manifest; \
    write_image_manifest; buildhistory_list_installed_image; \
    buildhistory_get_image_installed; ssh_allow_empty_password; \
    postinst_enable_logging; rootfs_update_timestamp; ssh_disable_dns_lookup;
IMAGE_POSTPROCESS_COMMAND = buildhistory_get_imageinfo;
IMAGESIZE = 6900
```

Other than `IMAGESIZE`, which is the total size of the files in the image in Kbytes, the name-value pairs are variables that may have influenced the content of the image. This information is often useful when you are trying to determine why a change in the package or file listings has occurred.

2.4.2.3. Using Build History to Gather Image Information Only

As you can see, build history produces image information, including dependency graphs, so you can see why something was pulled into the image. If you are just interested in this information and not interested in collecting specific package or SDK information, you can enable writing only image information without any history by adding the following to your `conf/local.conf` file found in the [Build Directory](#):

```
INHERIT += "buildhistory"
BUILDHISTORY_COMMIT = "0"
BUILDHISTORY_FEATURES = "image"
```

Here, you set the `BUILDHISTORY_FEATURES` variable to use the image feature only.

2.4.2.4. Build History SDK Information

Build history collects similar information on the contents of SDKs (e.g. `meta-toolchain` or `bitbake -c populate_sdk imagename`) as compared to information it collects for images. The following list shows the files produced for each SDK:

- files-in-sdk.txt: A list of files in the SDK with permissions, owner, group, size, and symlink information. This list includes both the host and target parts of the SDK.
- sdk-info.txt: A text file containing name-value pairs with information about the SDK. See the following listing example for more information.

- The following information appears under each of the `host` and `target` directories for the portions of the SDK that run on the host and on the target, respectively:
 - `depends.dot`: Dependency graph for the SDK that is compatible with `graphviz`.
 - `installed-package-names.txt`: A list of installed packages by name only.
 - `installed-package-sizes.txt`: A list of installed packages ordered by size.
 - `installed-packages.txt`: A list of installed packages with full package filenames.

Here is an example of `sdk-info.txt`:

```
DISTRO = poky
DISTRO_VERSION = 1.3+snapshot-20130327
SDK_NAME = poky-glibc-i686-arm
SDK_VERSION = 1.3+snapshot
SDKMACHINE =
SDKIMAGE_FEATURES = dev-pkgs dbg-pkgs
BAD_RECOMMENDATIONS =
SDKSIZE = 352712
```

Other than `SDKSIZE`, which is the total size of the files in the SDK in Kbytes, the name-value pairs are variables that might have influenced the content of the SDK. This information is often useful when you are trying to determine why a change in the package or file listings has occurred.

2.4.2.5. Examining Build History Information

You can examine build history output from the command line or from a web interface.

To see any changes that have occurred (assuming you have `BUILDHISTORY_COMMIT = "1"`), you can simply use any Git command that allows you to view the history of a repository. Here is one method:

```
$ git log -p
```

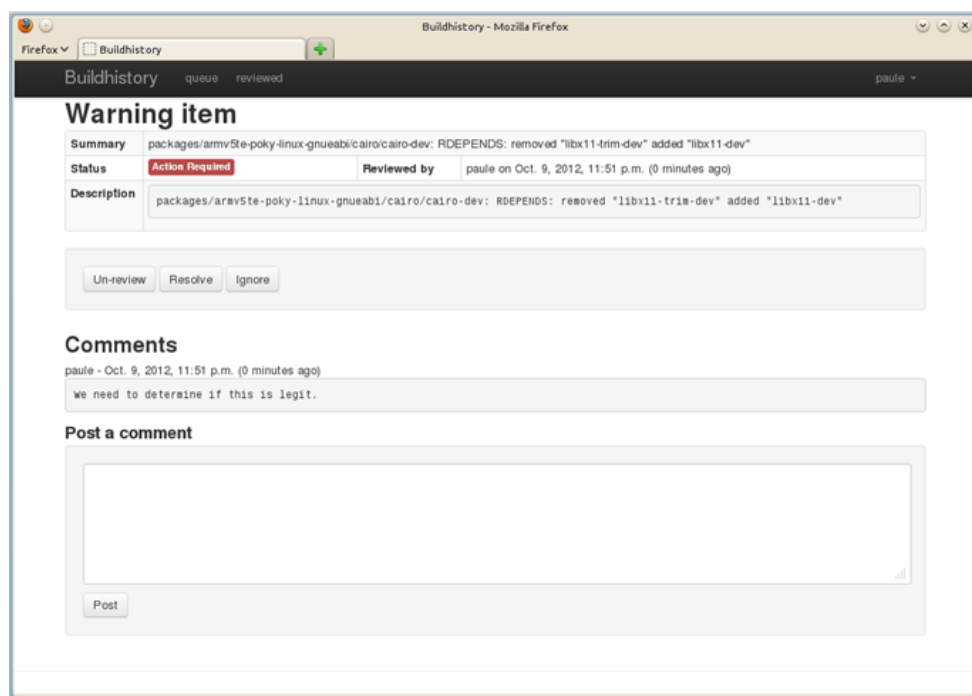
You need to realize, however, that this method does show changes that are not significant (e.g. a package's size changing by a few bytes).

A command-line tool called `buildhistory-diff` does exist, though, that queries the Git repository and prints just the differences that might be significant in human-readable form. Here is an example:

```
$ ~/poky/poky/scripts/buildhistory-diff . HEAD^
Changes to images/qemux86_64/glibc/core-image-minimal (files-in-image.txt):
  /etc/anotherpkg.conf was added
  /sbin/anotherpkg was added
  * (installed-package-names.txt):
    * anotherpkg was added
Changes to images/qemux86_64/glibc/core-image-minimal (installed-package-names.txt):
  anotherpkg was added
packages/qemux86_64-poky-linux/v86d: PACKAGES: added "v86d-extras"
  * PR changed from "r0" to "r1"
  * PV changed from "0.1.10" to "0.1.12"
packages/qemux86_64-poky-linux/v86d/v86d: PKGSIZE changed from 110579 to 144381 (+30%)
  * PR changed from "r0" to "r1"
  * PV changed from "0.1.10" to "0.1.12"
```

To see changes to the build history using a web interface, follow the instruction in the `README` file here. <http://git.yoctoproject.org/cgit/cgit/buildhistory-web/>.

Here is a sample screenshot of the interface:



2.5. Speeding Up the Build ¶

Build time can be an issue. By default, the build system uses simple controls to try and maximize build efficiency. In general, the default settings for all the following variables result in the most efficient build times when dealing with single socket systems (i.e. a single CPU). If you have multiple CPUs, you might try increasing the default values to gain more speed. See the descriptions in the glossary for each variable for more information:

- **BB_NUMBER_THREADS**: The maximum number of threads BitBake simultaneously executes.
- **BB_NUMBER_PARSE_THREADS**: The number of threads BitBake uses during parsing.
- **PARALLEL_MAKE**: Extra options passed to the `make` command during the `do_compile` task in order to specify parallel compilation on the local build host.
- **PARALLEL_MAKEINST**: Extra options passed to the `make` command during the `do_install` task in order to specify parallel installation on the local build host.

As mentioned, these variables all scale to the number of processor cores available on the build system. For single socket systems, this auto-scaling ensures that the build system fundamentally takes advantage of potential parallel operations during the build based on the build machine's capabilities.

Following are additional factors that can affect build speed:

- **File system type**: The file system type that the build is being performed on can also influence performance. Using `ext4` is recommended as compared to `ext2` and `ext3` due to `ext4` improved features such as extents.
- **Disabling the updating of access time using `noatime`**: The `noatime` mount option prevents the build system from updating file and directory access times.
- **Setting a longer commit**: Using the `"commit="` mount option increases the interval in seconds between disk cache writes. Changing this interval from the five second default to something longer increases the risk of data loss but decreases the need to write to the disk, thus increasing the build performance.
- **Choosing the packaging backend**: Of the available packaging backends, IPK is the fastest. Additionally, selecting a singular packaging backend also helps.

- Using `tmpfs` for `TMPDIR` as a temporary file system: While this can help speed up the build, the benefits are limited due to the compiler using `-pipe`. The build system goes to some lengths to avoid `sync()` calls into the file system on the principle that if there was a significant failure, the `Build Directory` contents could easily be rebuilt.
- Inheriting the `rm_work` class: Inheriting this class has shown to speed up builds due to significantly lower amounts of data stored in the data cache as well as on disk. Inheriting this class also makes cleanup of `TMPDIR` faster, at the expense of being easily able to dive into the source code. File system maintainers have recommended that the fastest way to clean up large numbers of files is to reformat partitions rather than delete files due to the linear nature of partitions. This, of course, assumes you structure the disk partitions and file systems in a way that this is practical.

Aside from the previous list, you should keep some trade offs in mind that can help you speed up the build:

- Remove items from `DISTRO_FEATURES` that you might not need.
- Exclude debug symbols and other debug information: If you do not need these symbols and other debug information, disabling the `*-dbg` package generation can speed up the build. You can disable this generation by setting the `INHIBIT_PACKAGE_DEBUG_SPLIT` variable to `"1"`.
- Disable static library generation for recipes derived from `autoconf` or `libtool`: Following is an example showing how to disable static libraries and still provide an override to handle exceptions:

```
STATICLIBCONF = "--disable-static"
STATICLIBCONF_sqlite3-native = ""
EXTRA_OECONF += "${STATICLIBCONF}"
```

Notes

- Some recipes need static libraries in order to work correctly (e.g. `pseudo-native` needs `sqlite3-native`). Overrides, as in the previous example, account for these kinds of exceptions.
- Some packages have packaging code that assumes the presence of the static libraries. If so, you might need to exclude them as well.

Chapter 3. A Closer Look at the Yocto Project Development Environment

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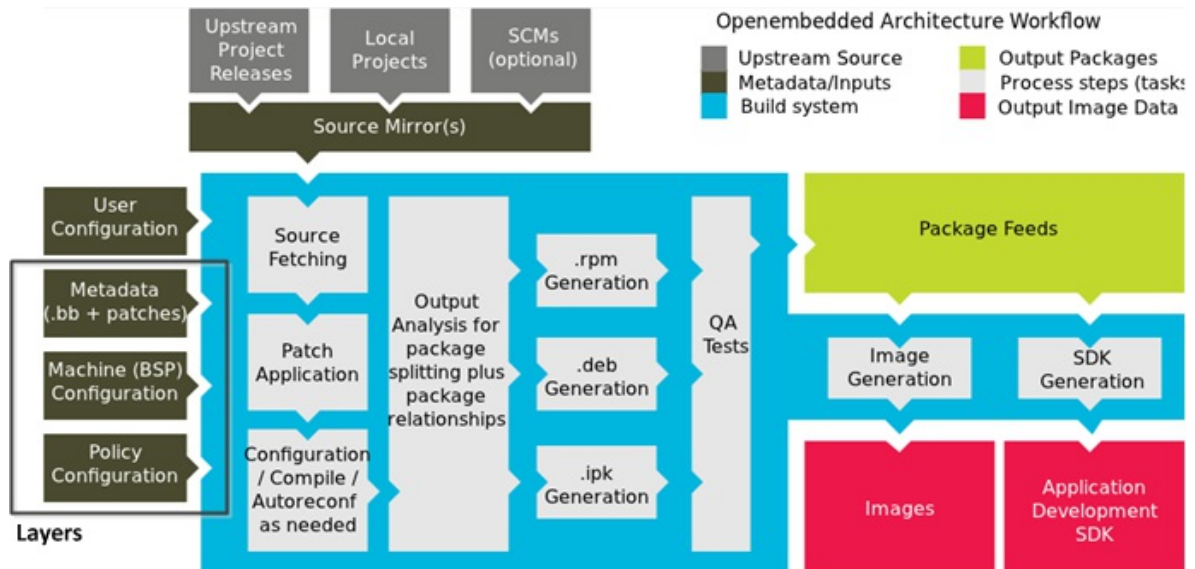
[3.5.5. Image Generation](#)

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[3.6. Images](#)

[3.7. Application Development SDK](#)

This chapter takes a more detailed look at the Yocto Project development environment. The following diagram represents the development environment at a high level. The remainder of this chapter expands on the fundamental input, output, process, and [Metadata](#) blocks in the Yocto Project development environment.



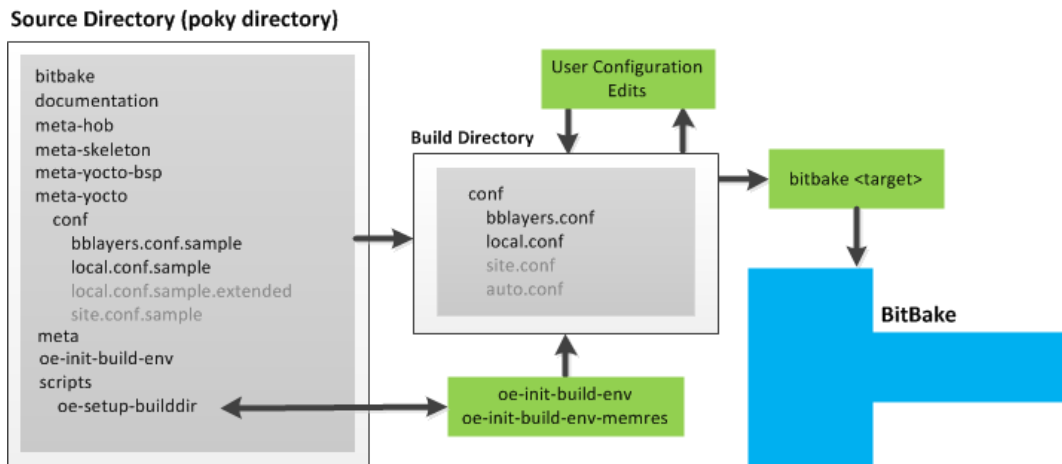
The generalized Yocto Project Development Environment consists of several functional areas:

- **User Configuration:** Metadata you can use to control the build process.
- **Metadata Layers:** Various layers that provide software, machine, and distro Metadata.
- **Source Files:** Upstream releases, local projects, and SCMs.
- **Build System:** Processes under the control of [BitBake](#). This block expands on how BitBake fetches source, applies patches, completes compilation, analyzes output for package generation, creates and tests packages, generates images, and generates cross-development tools.
- **Package Feeds:** Directories containing output packages (RPM, DEB or IPK), which are subsequently used in the construction of an image or SDK, produced by the build system. These feeds can also be copied and shared using a web server or other means to facilitate extending or updating existing images on devices at runtime if runtime package management is enabled.
- **Images:** Images produced by the development process.
- **Application Development SDK:** Cross-development tools that are produced along with an image or separately with BitBake.

3.1. User Configuration

User configuration helps define the build. Through user configuration, you can tell BitBake the target architecture for which you are building the image, where to store downloaded source, and other build properties.

The following figure shows an expanded representation of the "User Configuration" box of the general Yocto Project Development Environment figure:



BitBake needs some basic configuration files in order to complete a build. These files are `*.conf` files. The minimally necessary ones reside as example files in the [Source Directory](#). For simplicity, this section refers to the Source Directory as the "Poky Directory."

When you clone the poky Git repository or you download and unpack a Yocto Project release, you can set up the Source Directory to be named anything you want. For this discussion, the cloned repository uses the default name poky.

Note

The Poky repository is primarily an aggregation of existing repositories. It is not a canonical upstream source.

The `meta-yocto` layer inside Poky contains a `conf` directory that has example configuration files. These example files are used as a basis for creating actual configuration files when you source the build environment script (i.e. `oe-init-build-env` or `oe-init-build-env-memres`).

Sourcing the build environment script creates a [Build Directory](#) if one does not already exist. BitBake uses the Build Directory for all its work during builds. The Build Directory has a `conf` directory that contains default versions of your `local.conf` and `bblayers.conf` configuration files. These default configuration files are created only if versions do not already exist in the Build Directory at the time you source the build environment setup script.

Because the Poky repository is fundamentally an aggregation of existing repositories, some users might be familiar with running the `oe-init-build-env` or `oe-init-build-env-memres` script in the context of separate OpenEmbedded-Core and BitBake repositories rather than a single Poky repository. This discussion assumes the script is executed from within a cloned or unpacked version of Poky.

Depending on where the script is sourced, different sub-scripts are called to set up the Build Directory (Yocto or OpenEmbedded). Specifically, the script `scripts/oe-setup-buildidir` inside the poky directory sets up the Build Directory and seeds the directory (if necessary) with configuration files appropriate for the Yocto Project development environment.

Note

The `scripts/oe-setup-buildidir` script uses the `$TEMPLATECONF` variable to determine which sample configuration files to locate.

The `local.conf` file provides many basic variables that define a build environment. Here is a list of a few. To see the default configurations in a `local.conf` file created by the build environment script, see the `local.conf.sample` in the `meta-yocto` layer:

- **Parallelism Options:** Controlled by the `BB_NUMBER_THREADS`, `PARALLEL_MAKE`, and `BB_NUMBER_PARSE_THREADS` variables.

- **Target Machine Selection:** Controlled by the `MACHINE` variable.
- **Download Directory:** Controlled by the `DL_DIR` variable.
- **Shared State Directory:** Controlled by the `SSTATE_DIR` variable.
- **Build Output:** Controlled by the `TMPDIR` variable.

Note

Configurations set in the `conf/local.conf` file can also be set in the `conf/site.conf` and `conf/auto.conf` configuration files.

The `bblayers.conf` file tells BitBake what layers you want considered during the build. By default, the layers listed in this file include layers minimally needed by the build system. However, you must manually add any custom layers you have created. You can find more information on working with the `bblayers.conf` file in the "[Enabling Your Layer](#)" section in the Yocto Project Development Manual.

The files `site.conf` and `auto.conf` are not created by the environment initialization script. If you want these configuration files, you must create them yourself:

- **site.conf:** You can use the `conf/site.conf` configuration file to configure multiple build directories. For example, suppose you had several build environments and they shared some common features. You can set these default build properties here. A good example is perhaps the packaging format to use through the `PACKAGE_CLASSES` variable.

One useful scenario for using the `conf/site.conf` file is to extend your `BBPATH` variable to include the path to a `conf/site.conf`. Then, when BitBake looks for Metadata using `BBPATH`, it finds the `conf/site.conf` file and applies your common configurations found in the file. To override configurations in a particular build directory, alter the similar configurations within that build directory's `conf/local.conf` file.

- **auto.conf:** This file is not hand-created. Rather, the file is usually created and written to by an autobuilder. The settings put into the file are typically the same as you would find in the `conf/local.conf` or the `conf/site.conf` files.

You can edit all configuration files to further define any particular build environment. This process is represented by the "User Configuration Edits" box in the figure.

When you launch your build with the `bitbake target` command, BitBake sorts out the configurations to ultimately define your build environment. It is important to understand that the OpenEmbedded build system reads the configuration files in a specific order: `site.conf`, `auto.conf`, and `local.conf`. And, the build system applies the normal assignment statement rules. Because the files are parsed in a specific order, variable assignments for the same variable could be affected. For example, if the `auto.conf` file and the `local.conf` set `variable1` to different values, because the build system parses `local.conf` after `auto.conf`, `variable1` is assigned the value from the `local.conf` file.

3.2. Metadata, Machine Configuration, and Policy Configuration ¶

The previous section described the user configurations that define BitBake's global behavior. This section takes a closer look at the layers the build system uses to further control the build. These layers provide Metadata for the software, machine, and policy.

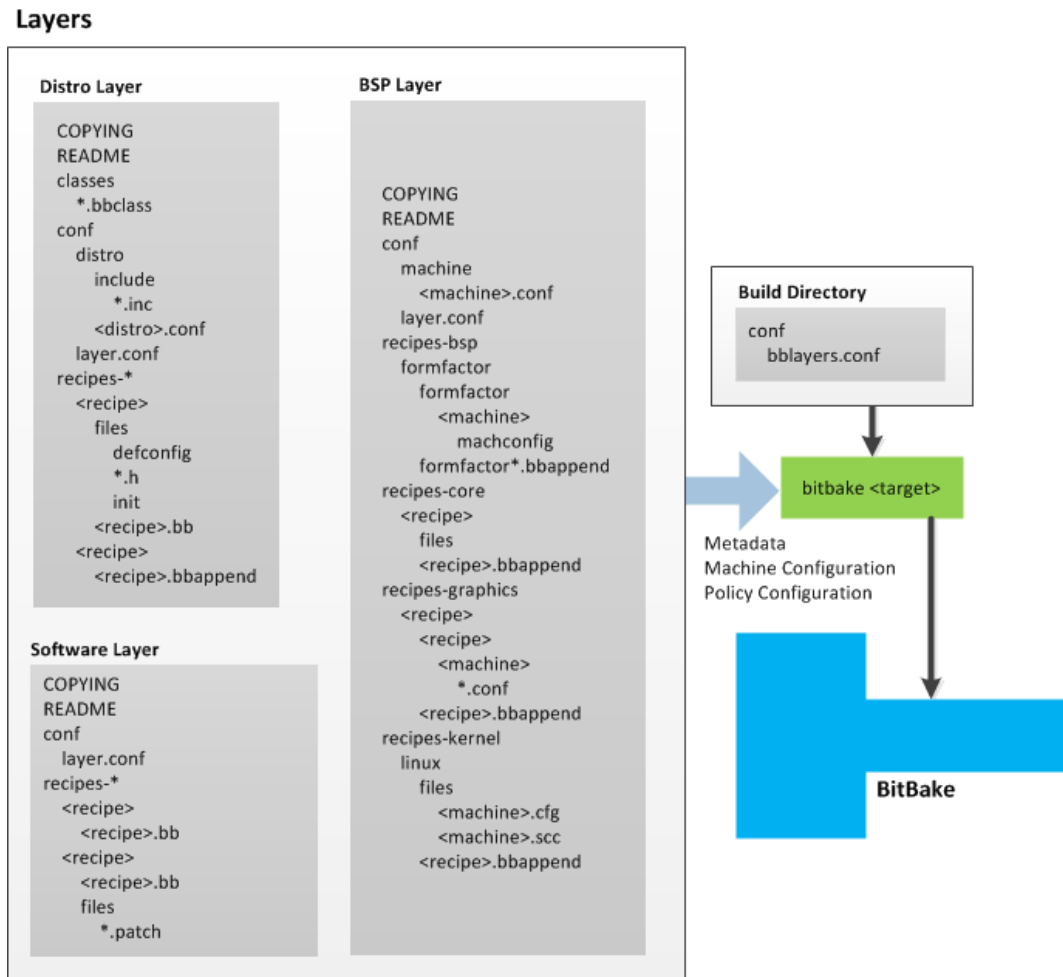
In general, three types of layer input exist:

- **Policy Configuration:** Distribution Layers provide top-level or general policies for the image or SDK being built. For example, this layer would dictate whether BitBake produces

RPM or IPK packages.

- **Machine Configuration:** Board Support Package (BSP) layers provide machine configurations. This type of information is specific to a particular target architecture.
- **Metadata:** Software layers contain user-supplied recipe files, patches, and append files.

The following figure shows an expanded representation of the Metadata, Machine Configuration, and Policy Configuration input (layers) boxes of the [general Yocto Project Development Environment](#) figure:



In general, all layers have a similar structure. They all contain a licensing file (e.g. `COPYING`) if the layer is to be distributed, a `README` file as good practice and especially if the layer is to be distributed, a configuration directory, and recipe directories.

The Yocto Project has many layers that can be used. You can see a web-interface listing of them on the [Source Repositories](#) page. The layers are shown at the bottom categorized under "Yocto Metadata Layers." These layers are fundamentally a subset of the [OpenEmbedded Metadata Index](#), which lists all layers provided by the OpenEmbedded community.

Note

Layers exist in the Yocto Project Source Repositories that cannot be found in the OpenEmbedded Metadata Index. These layers are either deprecated or experimental in nature.

BitBake uses the `conf/bblayers.conf` file, which is part of the user configuration, to find what layers it should be using as part of the build.

For more information on layers, see the ["Understanding and Creating Layers"](#) section in the Yocto Project Development Manual.

3.2.1. Distro Layer

The distribution layer provides policy configurations for your distribution. Best practices dictate that you isolate these types of configurations into their own layer. Settings you provide in `conf/distro/distro.conf` override similar settings that BitBake finds in your `conf/local.conf` file in the Build Directory.

The following list provides some explanation and references for what you typically find in the distribution layer:

- **classes:** Class files (`.bbclass`) hold common functionality that can be shared among recipes in the distribution. When your recipes inherit a class, they take on the settings and functions for that class. You can read more about class files in the "[Classes](#)" section.
- **conf:** This area holds configuration files for the layer (`conf/layer.conf`), the distribution (`conf/distro/distro.conf`), and any distribution-wide include files.
- **recipes-***: Recipes and append files that affect common functionality across the distribution. This area could include recipes and append files to add distribution-specific configuration, initialization scripts, custom image recipes, and so forth.

3.2.2. BSP Layer

The BSP Layer provides machine configurations. Everything in this layer is specific to the machine for which you are building the image or the SDK. A common structure or form is defined for BSP layers. You can learn more about this structure in the [Yocto Project Board Support Package \(BSP\) Developer's Guide](#).

Note

In order for a BSP layer to be considered compliant with the Yocto Project, it must meet some structural requirements.

The BSP Layer's configuration directory contains configuration files for the machine (`conf/machine/machine.conf`) and, of course, the layer (`conf/layer.conf`).

The remainder of the layer is dedicated to specific recipes by function: `recipes-bsp`, `recipes-core`, `recipes-graphics`, and `recipes-kernel`. Metadata can exist for multiple formfactors, graphics support systems, and so forth.

Note

While the figure shows several `recipes-*` directories, not all these directories appear in all BSP layers.

3.2.3. Software Layer

The software layer provides the Metadata for additional software packages used during the build. This layer does not include Metadata that is specific to the distribution or the machine, which are found in their respective layers.

This layer contains any new recipes that your project needs in the form of recipe files.

3.3. Sources

In order for the OpenEmbedded build system to create an image or any target, it must be able to access source files. The [general Yocto Project Development Environment figure](#) represents source files using the "Upstream Project Releases", "Local Projects", and "SCMs (optional)"

boxes. The figure represents mirrors, which also play a role in locating source files, with the "Source Mirror(s)" box.

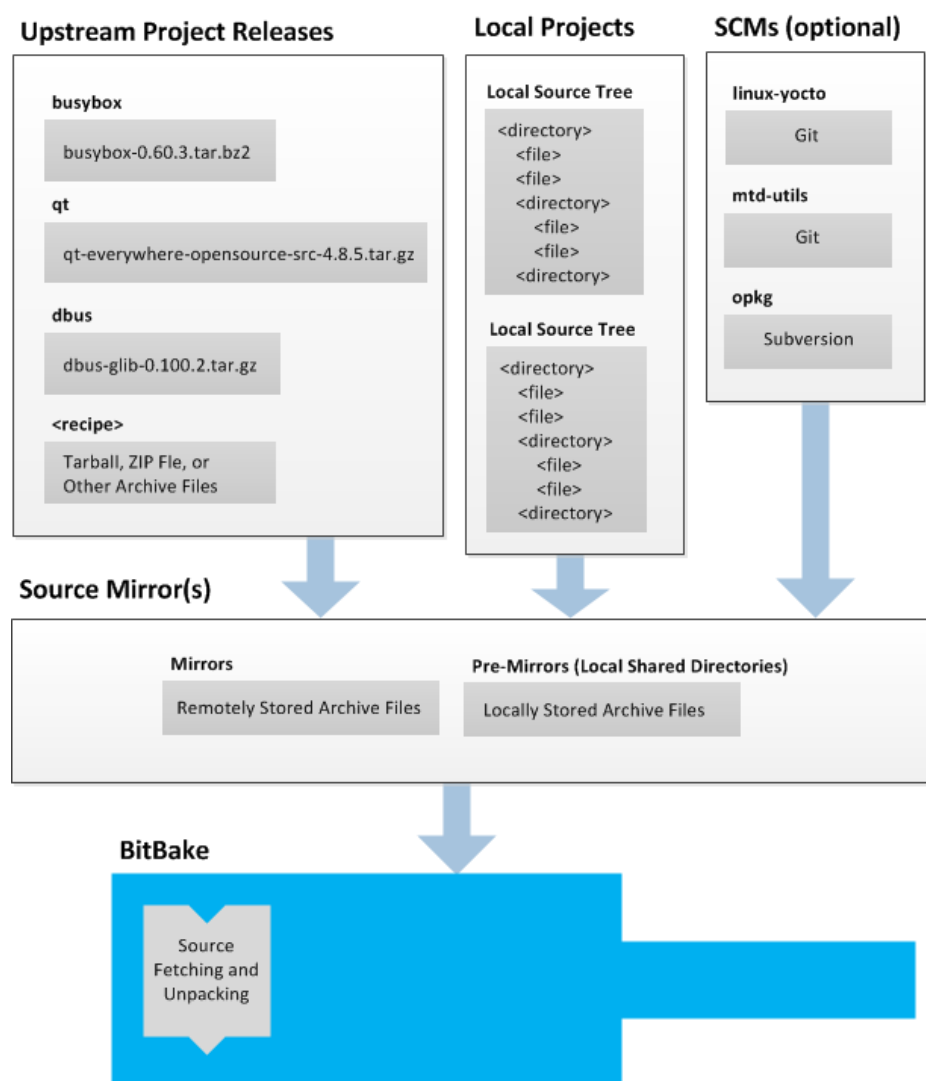
The method by which source files are ultimately organized is a function of the project. For example, for released software, projects tend to use tarballs or other archived files that can capture the state of a release guaranteeing that it is statically represented. On the other hand, for a project that is more dynamic or experimental in nature, a project might keep source files in a repository controlled by a Source Control Manager (SCM) such as Git. Pulling source from a repository allows you to control the point in the repository (the revision) from which you want to build software. Finally, a combination of the two might exist, which would give the consumer a choice when deciding where to get source files.

BitBake uses the `SRC_URI` variable to point to source files regardless of their location. Each recipe must have a `SRC_URI` variable that points to the source.

Another area that plays a significant role in where source files come from is pointed to by the `DL_DIR` variable. This area is a cache that can hold previously downloaded source. You can also instruct the OpenEmbedded build system to create tarballs from Git repositories, which is not the default behavior, and store them in the `DL_DIR` by using the `BB_GENERATE_MIRROR_TARBALLS` variable.

Judicious use of a `DL_DIR` directory can save the build system a trip across the Internet when looking for files. A good method for using a download directory is to have `DL_DIR` point to an area outside of your Build Directory. Doing so allows you to safely delete the Build Directory if needed without fear of removing any downloaded source file.

The remainder of this section provides a deeper look into the source files and the mirrors. Here is a more detailed look at the source file area of the base figure:



3.3.1. Upstream Project Releases

Upstream project releases exist anywhere in the form of an archived file (e.g. tarball or zip file). These files correspond to individual recipes. For example, the figure uses specific releases each for BusyBox, Qt, and Dbus. An archive file can be for any released product that can be built using a recipe.

3.3.2. Local Projects

Local projects are custom bits of software the user provides. These bits reside somewhere local to a project - perhaps a directory into which the user checks in items (e.g. a local directory containing a development source tree used by the group).

The canonical method through which to include a local project is to use the `externalsrc` class to include that local project. You use either the `local.conf` or a recipe's append file to override or set the recipe to point to the local directory on your disk to pull in the whole source tree.

For information on how to use the `externalsrc` class, see the "`externalsrc.bbclass`" section.

3.3.3. Source Control Managers (Optional)

Another place the build system can get source files from is through an SCM such as Git or Subversion. In this case, a repository is cloned or checked out. The `do_fetch` task inside BitBake uses the `SRC_URI` variable and the argument's prefix to determine the correct fetcher module.

Note

For information on how to have the OpenEmbedded build system generate tarballs for Git repositories and place them in the `DL_DIR` directory, see the `BB_GENERATE_MIRROR_TARBALLS` variable.

When fetching a repository, BitBake uses the `SRCREV` variable to determine the specific revision from which to build.

3.3.4. Source Mirror(s)

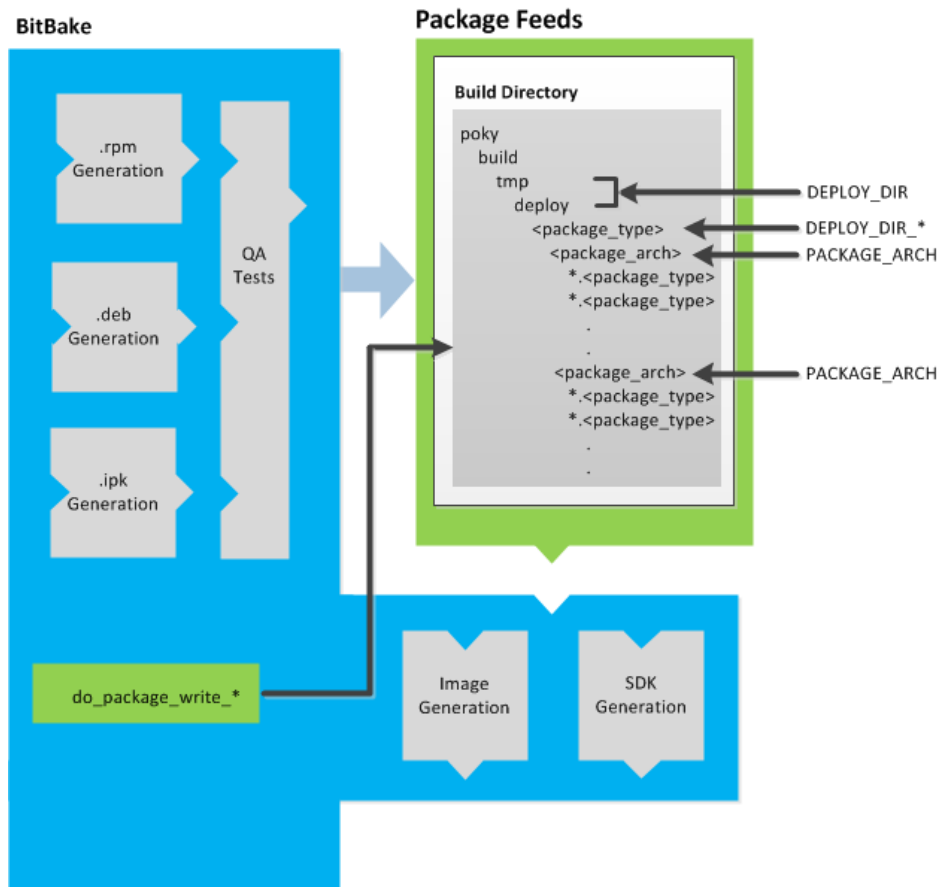
Two kinds of mirrors exist: pre-mirrors and regular mirrors. The `PREMIRRORS` and `MIRRORS` variables point to these, respectively. BitBake checks pre-mirrors before looking upstream for any source files. Pre-mirrors are appropriate when you have a shared directory that is not a directory defined by the `DL_DIR` variable. A Pre-mirror typically points to a shared directory that is local to your organization.

Regular mirrors can be any site across the Internet that is used as an alternative location for source code should the primary site not be functioning for some reason or another.

3.4. Package Feeds

When the OpenEmbedded build system generates an image or an SDK, it gets the packages from a package feed area located in the `Build Directory`. The [general Yocto Project Development Environment figure](#) shows this package feeds area in the upper-right corner.

This section looks a little closer into the package feeds area used by the build system. Here is a more detailed look at the area:



Package feeds are an intermediary step in the build process. The OpenEmbedded build system provides classes to generate different package types, and you specify which classes to enable through the `PACKAGE_CLASSES` variable. Before placing the packages into package feeds, the build process validates them with generated output quality assurance checks through the `insane` class.

The package feed area resides in the Build Directory. The directory the build system uses to temporarily store packages is determined by a combination of variables and the particular package manager in use. See the "Package Feeds" box in the illustration and note the information to the right of that area. In particular, the following defines where package files are kept:

- `DEPLOY_DIR`: Defined as `tmp/deploy` in the Build Directory.
- `DEPLOY_DIR_*`: Depending on the package manager used, the package type sub-folder. Given RPM, IPK, or DEB packaging and tarball creation, the `DEPLOY_DIR_RPM`, `DEPLOY_DIR_IPK`, `DEPLOY_DIR_DEB`, or `DEPLOY_DIR_TAR`, variables are used, respectively.
- `PACKAGE_ARCH`: Defines architecture-specific sub-folders. For example, packages could exist for the i586 or qemux86 architectures.

BitBake uses the `do_package_write_*` tasks to generate packages and place them into the package holding area (e.g. `do_package_write_ipk` for IPK packages). See the "`do_package_write_deb`", "`do_package_write_ipk`", "`do_package_write_rpm`", and "`do_package_write_tar`" sections for additional information. As an example, consider a scenario where an IPK packaging manager is being used and package architecture support for both i586 and qemux86 exist. Packages for the i586 architecture are placed in `build/tmp/deploy/ipk/i586`, while packages for the qemux86 architecture are placed in `build/tmp/deploy/ipk/qemux86`.

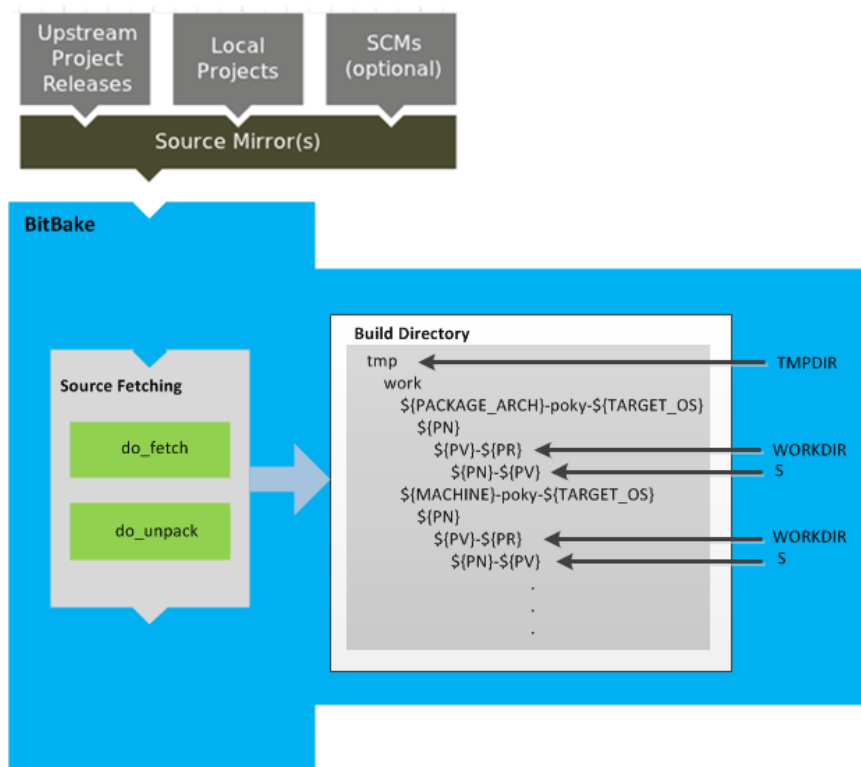
3.5. BitBake

The OpenEmbedded build system uses [BitBake](#) to produce images. You can see from the [general Yocto Project Development Environment figure](#), the BitBake area consists of several functional areas. This section takes a closer look at each of those areas.

Separate documentation exists for the BitBake tool. See the [BitBake User Manual](#) for reference material on BitBake.

3.5.1. Source Fetching

The first stages of building a recipe are to fetch and unpack the source code:



The `do_fetch` and `do_unpack` tasks fetch the source files and unpack them into the work directory.

Note

For every local file (e.g. `file://`) that is part of a recipe's `SRC_URI` statement, the OpenEmbedded build system takes a checksum of the file for the recipe and inserts the checksum into the signature for the `do_fetch`. If any local file has been modified, the `do_fetch` task and all tasks that depend on it are re-executed.

By default, everything is accomplished in the [Build Directory](#), which has a defined structure. For additional general information on the Build Directory, see the "[build/](#)" section.

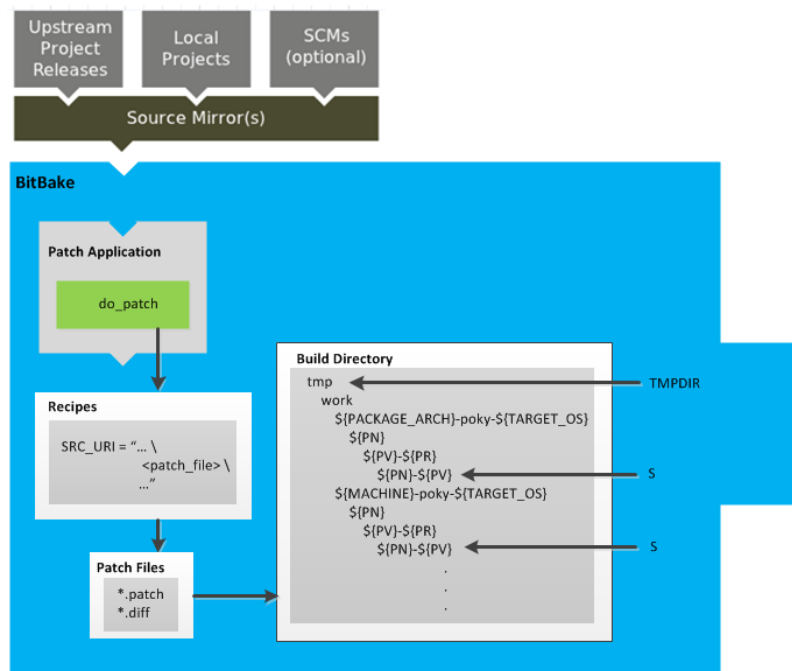
Unpacked source files are pointed to by the `s` variable. Each recipe has an area in the Build Directory where the unpacked source code resides. The name of that directory for any given recipe is defined from several different variables. You can see the variables that define these directories by looking at the figure:

- [TMPDIR](#) - The base directory where the OpenEmbedded build system performs all its work during the build.
- [PACKAGE_ARCH](#) - The architecture of the built package or packages.
- [TARGET_OS](#) - The operating system of the target device.
- [PN](#) - The name of the built package.

- PV - The version of the recipe used to build the package.
- PR - The revision of the recipe used to build the package.
- WORKDIR - The location within TMPDIR where a specific package is built.
- S - Contains the unpacked source files for a given recipe.

3.5.2. Patching¶

Once source code is fetched and unpacked, BitBake locates patch files and applies them to the source files:



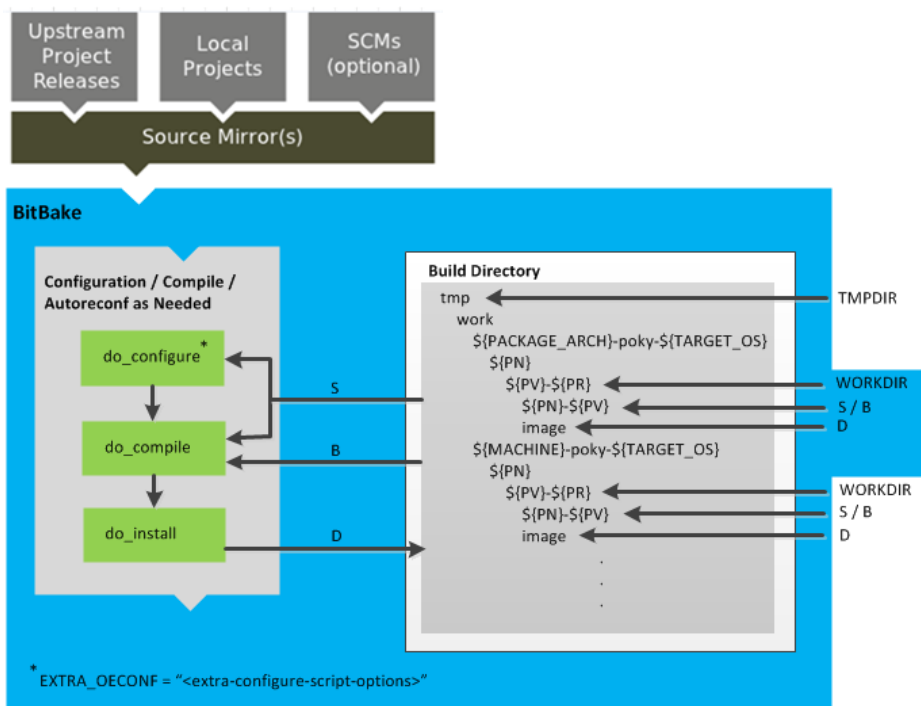
The `do_patch` task processes recipes by using the `SRC_URI` variable to locate applicable patch files, which by default are `*.patch` or `*.diff` files, or any file if "apply=yes" is specified for the file in `SRC_URI`.

BitBake finds and applies multiple patches for a single recipe in the order in which it finds the patches. Patches are applied to the recipe's source files located in the `S` directory.

For more information on how the source directories are created, see the "[Source Fetching](#)" section.

3.5.3. Configuration and Compilation¶

After source code is patched, BitBake executes tasks that configure and compile the source code:



This step in the build process consists of three tasks:

- **do_configure:** This task configures the source by enabling and disabling any build-time and configuration options for the software being built. Configurations can come from the recipe itself as well as from an inherited class. Additionally, the software itself might configure itself depending on the target for which it is being built.

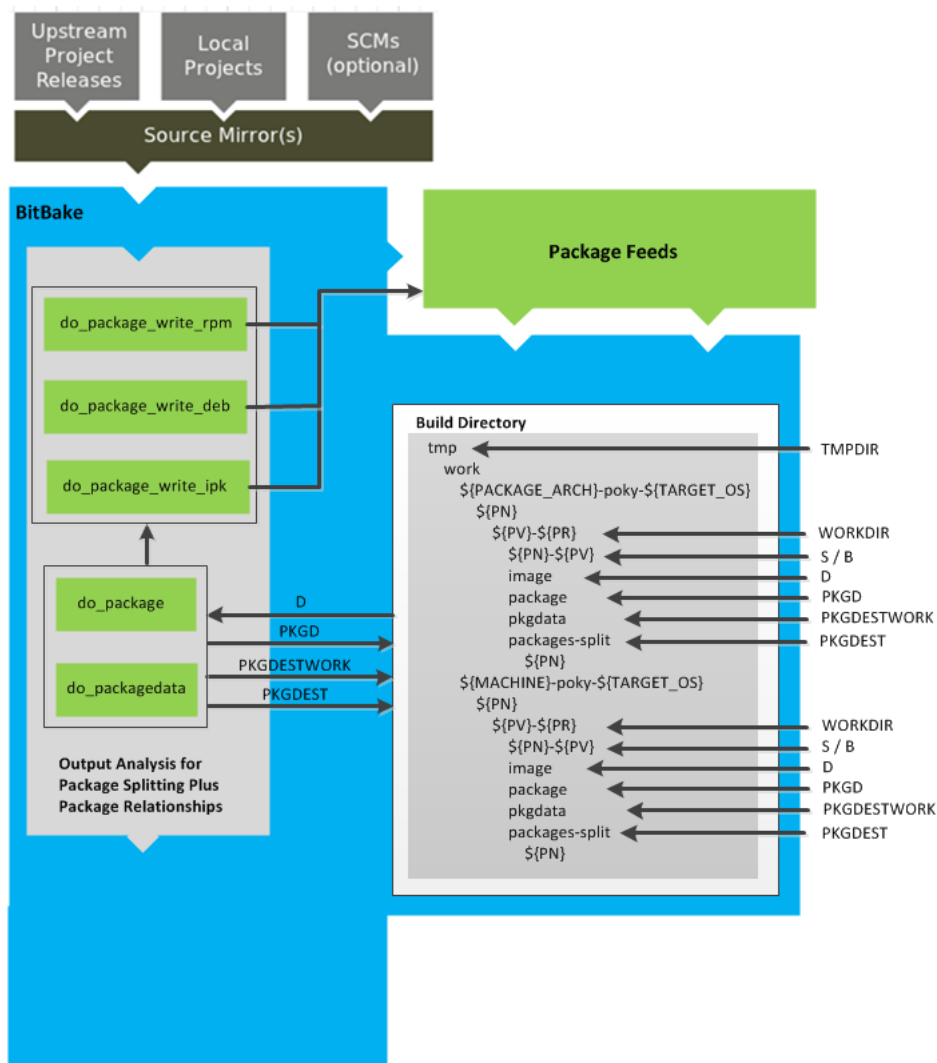
The configurations handled by the `do_configure` task are specific to source code configuration for the source code being built by the recipe.

If you are using the `autotools` class, you can add additional configuration options by using the `EXTRA_OECONF` variable. For information on how this variable works within that class, see the `meta/classes/autotools.bbclass` file.

- **do_compile:** Once a configuration task has been satisfied, BitBake compiles the source using the `do_compile` task. Compilation occurs in the directory pointed to by the `B` variable. Realize that the `B` directory is, by default, the same as the `S` directory.
- **do_install:** Once compilation is done, BitBake executes the `do_install` task. This task copies files from the `B` directory and places them in a holding area pointed to by the `D` variable.

3.5.4. Package Splitting

After source code is configured and compiled, the OpenEmbedded build system analyzes the results and splits the output into packages:



The `do_package` and `do_packagedata` tasks combine to analyze the files found in the `D` directory and split them into subsets based on available packages and files. The analyzing process involves the following as well as other items: splitting out debugging symbols, looking at shared library dependencies between packages, and looking at package relationships. The `do_packagedata` task creates package metadata based on the analysis such that the OpenEmbedded build system can generate the final packages. Working, staged, and intermediate results of the analysis and package splitting process use these areas:

- `PKGDEST` - The destination directory for packages before they are split.
- `PKGDESTWORK` - A shared, global-state directory that holds data generated during the packaging process.
- `PKGDESTWORK` - A temporary work area used by the `do_package` task.
- `PKGDEST` - The parent directory for packages after they have been split.

The `FILES` variable defines the files that go into each package in `PACKAGES`. If you want details on how this is accomplished, you can look at the `package` class.

Depending on the type of packages being created (RPM, DEB, or IPK), the `do_package_write_*` task creates the actual packages and places them in the Package Feed area, which is `${TMPDIR}/deploy`. You can see the "Package Feeds" section for more detail on that part of the build process.

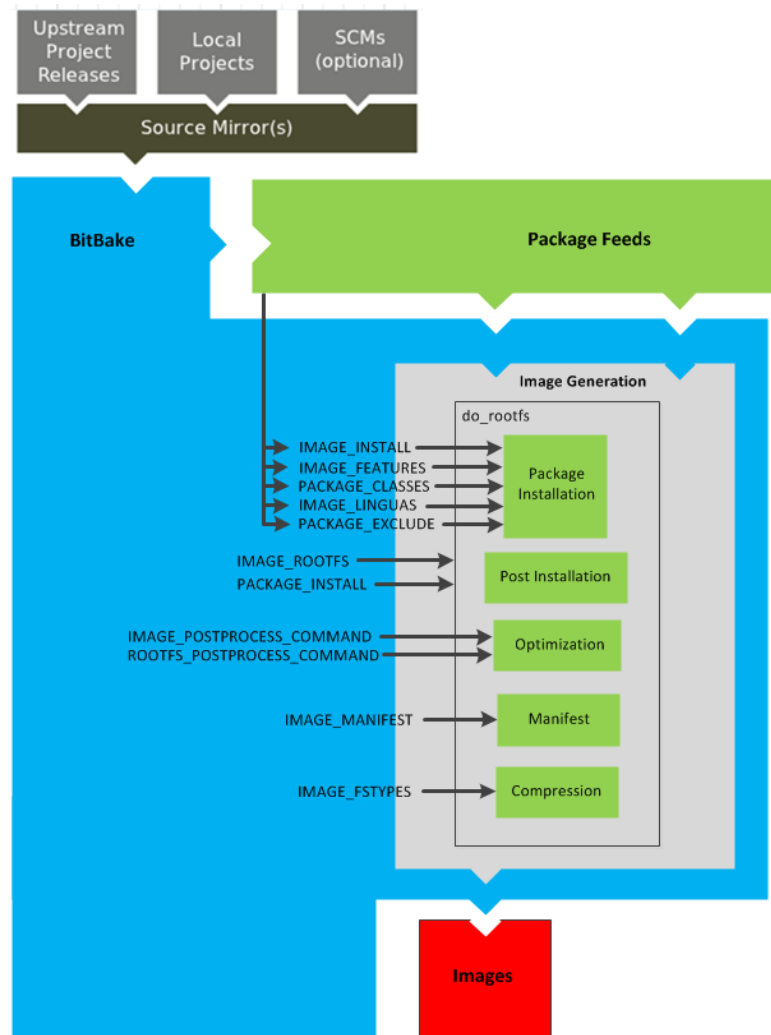
Note

Support for creating feeds directly from the `deploy/*` directories does not exist. Creating such feeds usually requires some kind of feed maintenance mechanism that would upload the new packages into an official package feed

(e.g. the Ångström distribution). This functionality is highly distribution-specific and thus is not provided out of the box.

3.5.5. Image Generation

Once packages are split and stored in the Package Feeds area, the OpenEmbedded build system uses BitBake to generate the root filesystem image:



The image generation process consists of several stages and depends on many variables. The `do_rootfs` task uses these key variables to help create the list of packages to actually install:

- `IMAGE_INSTALL`: Lists out the base set of packages to install from the Package Feeds area.
- `PACKAGE_EXCLUDE`: Specifies packages that should not be installed.
- `IMAGE_FEATURES`: Specifies features to include in the image. Most of these features map to additional packages for installation.
- `PACKAGE_CLASSES`: Specifies the package backend to use and consequently helps determine where to locate packages within the Package Feeds area.
- `IMAGE_LINGUAS`: Determines the language(s) for which additional language support packages are installed.

Package installation is under control of the package manager (e.g. smart/rpm, opkg, or apt/dpkg) regardless of whether or not package management is enabled for the target. At the end of the process, if package management is not enabled for the target, the package manager's data files are deleted from the root filesystem.

During image generation, the build system attempts to run all post-installation scripts. Any

that fail to run on the build host are run on the target when the target system is first booted. If you are using a [read-only root filesystem](#), all the post installation scripts must succeed during the package installation phase since the root filesystem is read-only.

During Optimization, optimizing processes are run across the image. These processes include `mklibs` and `prelink`. The `mklibs` process optimizes the size of the libraries. A `prelink` process optimizes the dynamic linking of shared libraries to reduce start up time of executables.

Along with writing out the root filesystem image, the `do_rootfs` task creates a manifest file (`.manifest`) in the same directory as the root filesystem image that lists out, line-by-line, the installed packages. This manifest file is useful for the `testimage` class, for example, to determine whether or not to run specific tests. See the [IMAGE_MANIFEST](#) variable for additional information.

Part of the image generation process includes compressing the root filesystem image. Compression is accomplished through several optimization routines designed to reduce the overall size of the image.

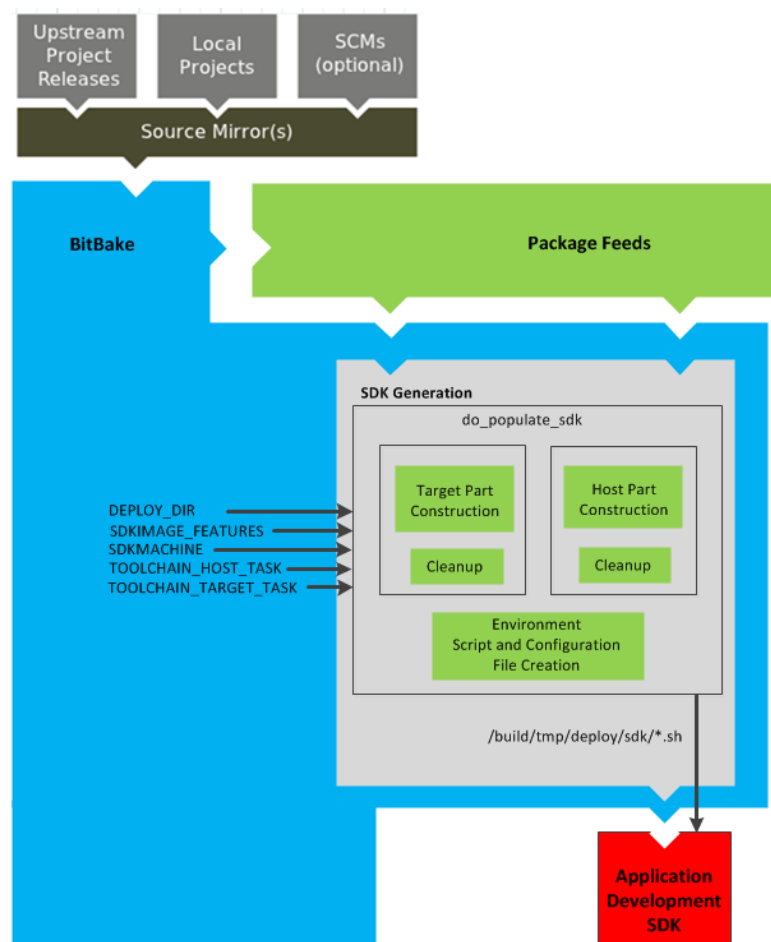
After the root filesystem has been constructed, the image generation process turns everything into an image file or a set of image files. The formats used for the root filesystem depend on the [IMAGE_FSTYPES](#) variable.

Note

The entire image generation process is run under Pseudo. Running under Pseudo ensures that the files in the root filesystem have correct ownership.

3.5.6. SDK Generation

The OpenEmbedded build system uses BitBake to generate the Software Development Kit (SDK) installer script:



Note

For more information on the cross-development toolchain generation, see the "[Cross-Development Toolchain Generation](#)" section. For information on advantages gained when building a cross-development toolchain using the `do_populate_sdk` task, see the "[Optionally Building a Toolchain Installer](#)" section in the Yocto Project Application Developer's Guide.

Like image generation, the SDK script process consists of several stages and depends on many variables. The `do_populate_sdk` task uses these key variables to help create the list of packages to actually install. For information on the variables listed in the figure, see the "[Application Development SDK](#)" section.

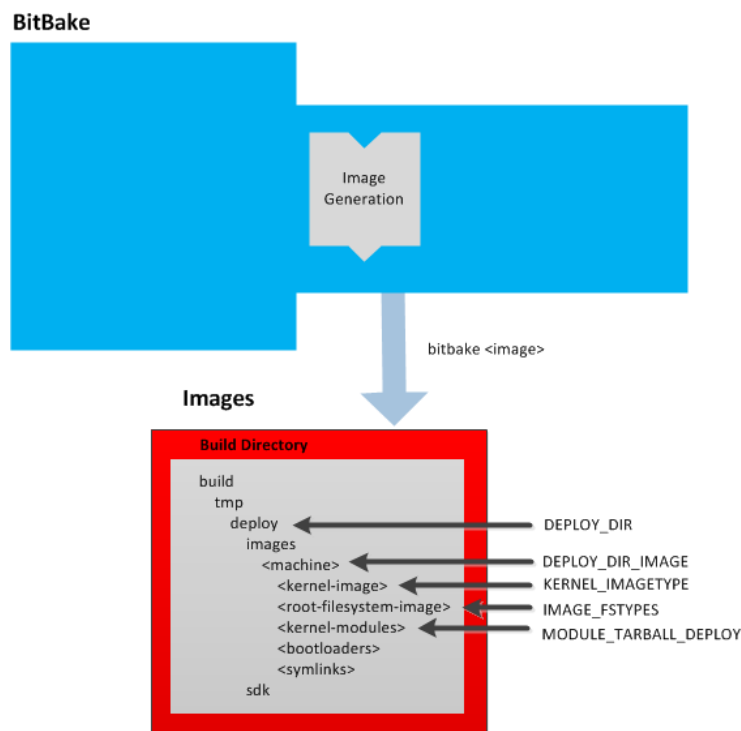
The `do_populate_sdk` task handles two parts: a target part and a host part. The target part is the part built for the target hardware and includes libraries and headers. The host part is the part of the SDK that runs on the [SDKMACHINE](#).

Once both parts are constructed, the `do_populate_sdk` task performs some cleanup on both parts. After the cleanup, the task creates a cross-development environment setup script and any configuration files that might be needed.

The final output of the task is the Cross-development toolchain installation script (.sh file), which includes the environment setup script.

3.6. Images

The images produced by the OpenEmbedded build system are compressed forms of the root filesystem that are ready to boot on a target device. You can see from the [general Yocto Project Development Environment figure](#) that BitBake output, in part, consists of images. This section is going to look more closely at this output:



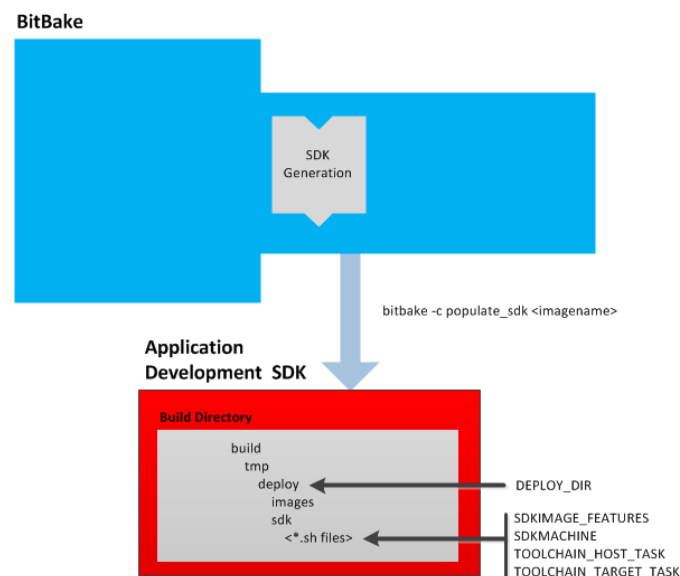
For a list of example images that the Yocto Project provides, see the "[Images](#)" chapter.

Images are written out to the [Build Directory](#) inside the `tmp/deploy/images/machine/` folder as shown in the figure. This folder contains any files expected to be loaded on the target device. The `DEPLOY_DIR` variable points to the `deploy` directory, while the `DEPLOY_DIR_IMAGE` variable points to the appropriate directory containing images for the current configuration.

- *kernel-image*: A kernel binary file. The `KERNEL_IMAGETYPE` variable setting determines the naming scheme for the kernel image file. Depending on that variable, the file could begin with a variety of naming strings. The `deploy/images/machine` directory can contain multiple image files for the machine.
- *root-filesystem-image*: Root filesystems for the target device (e.g. *.ext3 or *.bz2 files). The `IMAGE_FSTYPES` variable setting determines the root filesystem image type. The `deploy/images/machine` directory can contain multiple root filesystems for the machine.
- *kernel-modules*: Tarballs that contain all the modules built for the kernel. Kernel module tarballs exist for legacy purposes and can be suppressed by setting the `MODULE_TARBALL_DEPLOY` variable to "0". The `deploy/images/machine` directory can contain multiple kernel module tarballs for the machine.
- *bootloaders*: Bootloaders supporting the image, if applicable to the target machine. The `deploy/images/machine` directory can contain multiple bootloaders for the machine.
- *symlinks*: The `deploy/images/machine` folder contains a symbolic link that points to the most recently built file for each machine. These links might be useful for external scripts that need to obtain the latest version of each file.

3.7. Application Development SDK

In the [general Yocto Project Development Environment figure](#), the output labeled "Application Development SDK" represents an SDK. This section is going to take a closer look at this output:



The specific form of this output is a self-extracting SDK installer (*.sh) that, when run, installs the SDK, which consists of a cross-development toolchain, a set of libraries and headers, and an SDK environment setup script. Running this installer essentially sets up your cross-development environment. You can think of the cross-toolchain as the "host" part because it runs on the SDK machine. You can think of the libraries and headers as the "target" part because they are built for the target hardware. The setup script is added so that you can initialize the environment before using the tools.

Note

The Yocto Project supports several methods by which you can set up this cross-development environment. These methods include downloading pre-built SDK installers, building and installing your own SDK installer, or running an Application Development Toolkit (ADT) installer to install not just cross-development toolchains but also additional tools to help in this type of

development.

For background information on cross-development toolchains in the Yocto Project development environment, see the "[Cross-Development Toolchain Generation](#)" section. For information on setting up a cross-development environment, see the "[Installing the ADT and Toolchains](#)" section in the Yocto Project Application Developer's Guide.

Once built, the SDK installers are written out to the `deploy/sdk` folder inside the [Build Directory](#) as shown in the figure at the beginning of this section. Several variables exist that help configure these files:

- [DEPLOY_DIR](#): Points to the `deploy` directory.
- [SDKMACHINE](#): Specifies the architecture of the machine on which the cross-development tools are run to create packages for the target hardware.
- [SDKIMAGE_FEATURES](#): Lists the features to include in the "target" part of the SDK.
- [TOOLCHAIN_HOST_TASK](#): Lists packages that make up the host part of the SDK (i.e. the part that runs on the `SDKMACHINE`). When you use `bitbake -c populate_sdk imagename` to create the SDK, a set of default packages apply. This variable allows you to add more packages.
- [TOOLCHAIN_TARGET_TASK](#): Lists packages that make up the target part of the SDK (i.e. the part built for the target hardware).
- [SDKPATH](#): Defines the default SDK installation path offered by the installation script.

Chapter 4. Technical Details

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This chapter provides technical details for various parts of the Yocto Project. Currently, topics include Yocto Project components, cross-toolchain generation, shared state (sstate) cache, x32, Wayland support, and Licenses.

4.1. Yocto Project Components

The [BitBake](#) task executor together with various types of configuration files form the OpenEmbedded Core. This section overviews these components by describing their use and how they interact.

BitBake handles the parsing and execution of the data files. The data itself is of various types:

- **Recipes:** Provides details about particular pieces of software.
- **Class Data:** Abstracts common build information (e.g. how to build a Linux kernel).
- **Configuration Data:** Defines machine-specific settings, policy decisions, and so forth. Configuration data acts as the glue to bind everything together.

BitBake knows how to combine multiple data sources together and refers to each data source as a layer. For information on layers, see the "[Understanding and Creating Layers](#)" section of the Yocto Project Development Manual.

Following are some brief details on these core components. For additional information on how these components interact during a build, see the "[A Closer Look at the Yocto Project Development Environment](#)" Chapter.

4.1.1. BitBake

BitBake is the tool at the heart of the OpenEmbedded build system and is responsible for parsing the [Metadata](#), generating a list of tasks from it, and then executing those tasks.

This section briefly introduces BitBake. If you want more information on BitBake, see the [BitBake User Manual](#).

To see a list of the options BitBake supports, use either of the following commands:

```
$ bitbake -h
$ bitbake --help
```

The most common usage for BitBake is `bitbake packagename`, where *packagename* is the name of the package you want to build (referred to as the "target" in this manual). The target often equates to the first part of a recipe's filename (e.g. "foo" for a recipe named `foo_1.3.0-r0.bb`). So, to process the `matchbox-desktop_1.2.3.bb` recipe file, you might type the following:

```
$ bitbake matchbox-desktop
```

Several different versions of `matchbox-desktop` might exist. BitBake chooses the one selected by the distribution configuration. You can get more details about how BitBake chooses between different target versions and providers in the "[Preferences](#)" section of the BitBake User Manual.

BitBake also tries to execute any dependent tasks first. So for example, before building `matchbox-desktop`, BitBake would build a cross compiler and `glibc` if they had not already been built.

A useful BitBake option to consider is the `-k` or `--continue` option. This option instructs BitBake to try and continue processing the job as long as possible even after encountering an error. When an error occurs, the target that failed and those that depend on it cannot be remade. However, when you use this option other dependencies can still be processed.

4.1.2. Metadata (Recipes)

Files that have the `.bb` suffix are "recipes" files. In general, a recipe contains information about a single piece of software. This information includes the location from which to download the unaltered source, any source patches to be applied to that source (if needed), which special

configuration options to apply, how to compile the source files, and how to package the compiled output.

The term "package" is sometimes used to refer to recipes. However, since the word "package" is used for the packaged output from the OpenEmbedded build system (i.e. `.ipk` or `.deb` files), this document avoids using the term "package" when referring to recipes.

4.1.3. Classes

Class files (`.bbclass`) contain information that is useful to share between [Metadata](#) files. An example is the `autotools` class, which contains common settings for any application that Autotools uses. The "[Classes](#)" chapter provides details about classes and how to use them.

4.1.4. Configuration

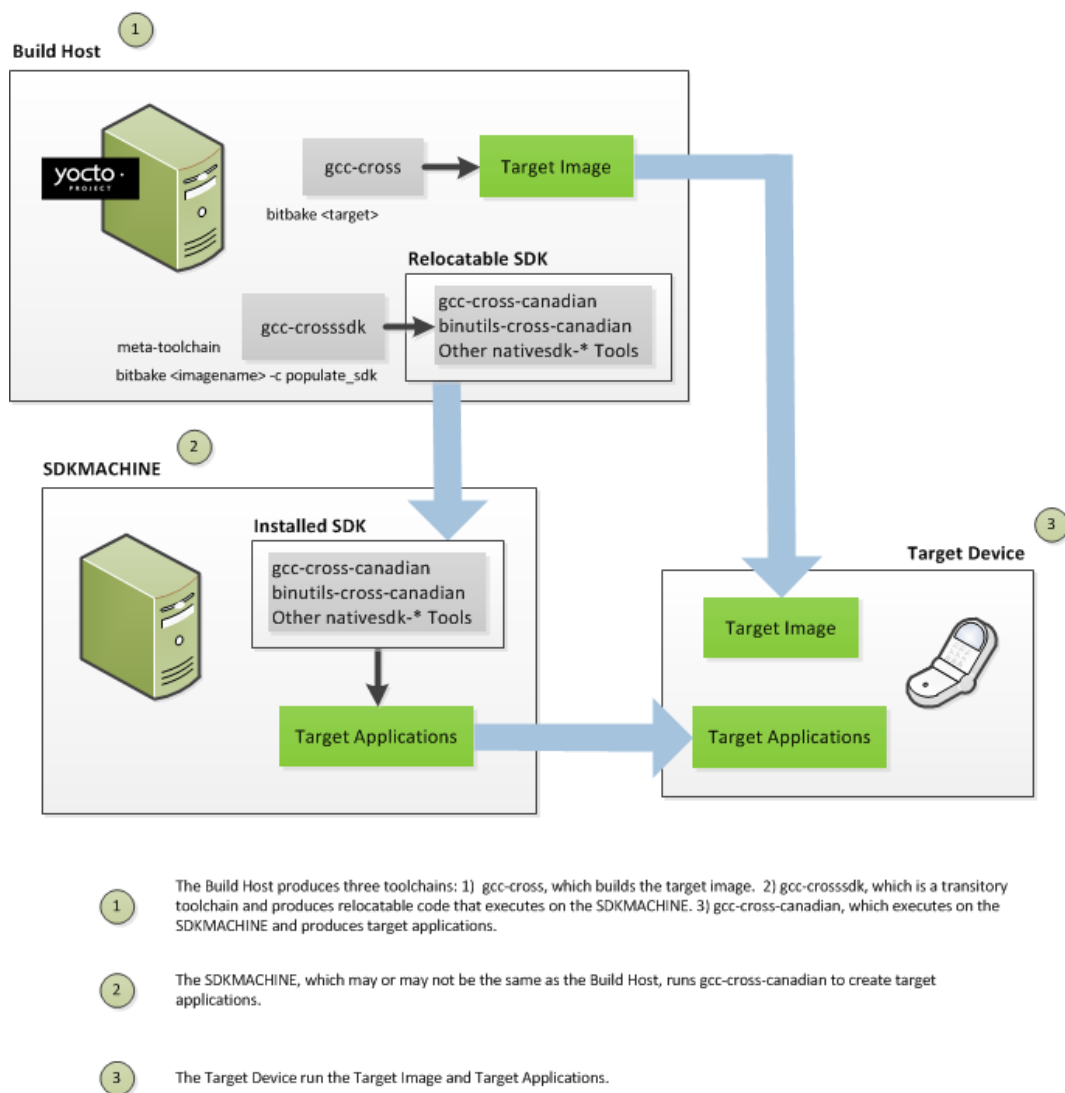
The configuration files (`.conf`) define various configuration variables that govern the OpenEmbedded build process. These files fall into several areas that define machine configuration options, distribution configuration options, compiler tuning options, general common configuration options, and user configuration options in `local.conf`, which is found in the [Build Directory](#).

4.2. Cross-Development Toolchain Generation

The Yocto Project does most of the work for you when it comes to creating [cross-development toolchains](#). This section provides some technical background on how cross-development toolchains are created and used. For more information on toolchains, you can also see the [Yocto Project Application Developer's Guide](#).

In the Yocto Project development environment, cross-development toolchains are used to build the image and applications that run on the target hardware. With just a few commands, the OpenEmbedded build system creates these necessary toolchains for you.

The following figure shows a high-level build environment regarding toolchain construction and use.



Most of the work occurs on the Build Host. This is the machine used to build images and generally work within the the Yocto Project environment. When you run BitBake to create an image, the OpenEmbedded build system uses the host `gcc` compiler to bootstrap a cross-compiler named `gcc-cross`. The `gcc-cross` compiler is what BitBake uses to compile source files when creating the target image. You can think of `gcc-cross` simply as an automatically generated cross-compiler that is used internally within BitBake only.

The chain of events that occurs when `gcc-cross` is bootstrapped is as follows:

```
gcc -> binutils-cross -> gcc-cross-initial -> linux-libc-headers -> glibc-initial -> glibc -> gcc
```

- `gcc`: The build host's GNU Compiler Collection (GCC).
- `binutils-cross`: The bare minimum binary utilities needed in order to run the `gcc-cross-initial` phase of the bootstrap operation.
- `gcc-cross-initial`: An early stage of the bootstrap process for creating the cross-compiler. This stage builds enough of the `gcc-cross`, the C library, and other pieces needed to finish building the final cross-compiler in later stages. This tool is a "native" package (i.e. it is designed to run on the build host).
- `linux-libc-headers`: Headers needed for the cross-compiler.
- `glibc-initial`: An initial version of the Embedded GLIBC needed to bootstrap `glibc`.
- `gcc-cross`: The final stage of the bootstrap process for the cross-compiler. This stage results in the actual cross-compiler that BitBake uses when it builds an image for a targeted device.

Note

If you are replacing this cross compiler toolchain with a custom version, you must replace `gcc-cross`.

This tool is also a "native" package (i.e. it is designed to run on the build host).

- `gcc-runtime`: Runtime libraries resulting from the toolchain bootstrapping process. This tool produces a binary that consists of the runtime libraries need for the targeted device.

You can use the OpenEmbedded build system to build an installer for the relocatable SDK used to develop applications. When you run the installer, it installs the toolchain, which contains the development tools (e.g., the `gcc-cross-canadian`), `binutils-cross-canadian`, and other `nativesdk-*` tools you need to cross-compile and test your software. The figure shows the commands you use to easily build out this toolchain. This cross-development toolchain is built to execute on the SDKMACHINE, which might or might not be the same machine as the Build Host.

Note

If your target architecture is supported by the Yocto Project, you can take advantage of pre-built images that ship with the Yocto Project and already contain cross-development toolchain installers.

Here is the bootstrap process for the relocatable toolchain:

```
gcc -> binutils-crosssdk -> gcc-crosssdk-initial -> linux-libc-headers ->
glibc-initial -> nativesdk-glibc -> gcc-crosssdk -> gcc-cross-canadian
```

- `gcc`: The build host's GNU Compiler Collection (GCC).
- `binutils-crosssdk`: The bare minimum binary utilities needed in order to run the `gcc-crosssdk-initial` phase of the bootstrap operation.
- `gcc-crosssdk-initial`: An early stage of the bootstrap process for creating the cross-compiler. This stage builds enough of the `gcc-crosssdk` and supporting pieces so that the final stage of the bootstrap process can produce the finished cross-compiler. This tool is a "native" binary that runs on the build host.
- `linux-libc-headers`: Headers needed for the cross-compiler.
- `glibc-initial`: An initial version of the Embedded GLIBC needed to bootstrap `nativesdk-glibc`.
- `nativesdk-glibc`: The Embedded GLIBC needed to bootstrap the `gcc-crosssdk`.
- `gcc-crosssdk`: The final stage of the bootstrap process for the relocatable cross-compiler. The `gcc-crosssdk` is a transitory compiler and never leaves the build host. Its purpose is to help in the bootstrap process to create the eventual relocatable `gcc-cross-canadian` compiler, which is relocatable. This tool is also a "native" package (i.e. it is designed to run on the build host).
- `gcc-cross-canadian`: The final relocatable cross-compiler. When run on the SDKMACHINE, this tool produces executable code that runs on the target device. Only one cross-canadian compiler is produced per architecture since they can be targeted at different processor optimizations using configurations passed to the compiler through the compile commands. This circumvents the need for multiple compilers and thus reduces the size of the toolchains.

Note

For information on advantages gained when building a cross-development toolchain installer, see the "Optionally Building a Toolchain Installer" section in the Yocto Project Application Developer's Guide.

4.3. Shared State Cache

By design, the OpenEmbedded build system builds everything from scratch unless BitBake can determine that parts do not need to be rebuilt. Fundamentally, building from scratch is attractive as it means all parts are built fresh and there is no possibility of stale data causing problems. When developers hit problems, they typically default back to building from scratch so they know the state of things from the start.

Building an image from scratch is both an advantage and a disadvantage to the process. As mentioned in the previous paragraph, building from scratch ensures that everything is current and starts from a known state. However, building from scratch also takes much longer as it generally means rebuilding things that do not necessarily need to be rebuilt.

The Yocto Project implements shared state code that supports incremental builds. The implementation of the shared state code answers the following questions that were fundamental roadblocks within the OpenEmbedded incremental build support system:

- What pieces of the system have changed and what pieces have not changed?
- How are changed pieces of software removed and replaced?
- How are pre-built components that do not need to be rebuilt from scratch used when they are available?

For the first question, the build system detects changes in the "inputs" to a given task by creating a checksum (or signature) of the task's inputs. If the checksum changes, the system assumes the inputs have changed and the task needs to be rerun. For the second question, the shared state (sstate) code tracks which tasks add which output to the build process. This means the output from a given task can be removed, upgraded or otherwise manipulated. The third question is partly addressed by the solution for the second question assuming the build system can fetch the sstate objects from remote locations and install them if they are deemed to be valid.

Note

The OpenEmbedded build system does not maintain PR information as part of the shared state packages. Consequently, considerations exist that affect maintaining shared state feeds. For information on how the OpenEmbedded build system works with packages and can track incrementing PR information, see the "[Incrementing a Package Revision Number](#)" section.

The rest of this section goes into detail about the overall incremental build architecture, the checksums (signatures), shared state, and some tips and tricks.

4.3.1. Overall Architecture

When determining what parts of the system need to be built, BitBake works on a per-task basis rather than a per-recipe basis. You might wonder why using a per-task basis is preferred over a per-recipe basis. To help explain, consider having the IPK packaging backend enabled and then switching to DEB. In this case, the `do_install` and `do_package` task outputs are still valid. However, with a per-recipe approach, the build would not include the `.deb` files. Consequently, you would have to invalidate the whole build and rerun it. Rerunning everything is not the best solution. Also, in this case, the core must be "taught" much about specific tasks. This methodology does not scale well and does not allow users to easily add new tasks in layers or as external recipes without touching the packaged-staging core.

4.3.2. Checksums (Signatures)

The shared state code uses a checksum, which is a unique signature of a task's inputs, to determine if a task needs to be run again. Because it is a change in a task's inputs that triggers a rerun, the process needs to detect all the inputs to a given task. For shell tasks, this turns out to be fairly easy because the build process generates a "run" shell script for each task and it is possible to create a checksum that gives you a good idea of when the task's data changes.

To complicate the problem, there are things that should not be included in the checksum. First, there is the actual specific build path of a given task - the `WORKDIR`. It does not matter if the work directory changes because it should not affect the output for target packages. Also, the build process has the objective of making native or cross packages relocatable. The checksum therefore needs to exclude `WORKDIR`. The simplistic approach for excluding the work directory is to set `WORKDIR` to some fixed value and create the checksum for the "run" script.

Another problem results from the "run" scripts containing functions that might or might not get called. The incremental build solution contains code that figures out dependencies between shell functions. This code is used to prune the "run" scripts down to the minimum set, thereby alleviating this problem and making the "run" scripts much more readable as a bonus.

So far we have solutions for shell scripts. What about Python tasks? The same approach applies even though these tasks are more difficult. The process needs to figure out what variables a Python function accesses and what functions it calls. Again, the incremental build solution contains code that first figures out the variable and function dependencies, and then creates a checksum for the data used as the input to the task.

Like the `WORKDIR` case, situations exist where dependencies should be ignored. For these cases, you can instruct the build process to ignore a dependency by using a line like the following:

```
PACKAGE_ARCHS[vardepsexclude] = "MACHINE"
```

This example ensures that the `PACKAGE_ARCHS` variable does not depend on the value of `MACHINE`, even if it does reference it.

Equally, there are cases where we need to add dependencies BitBake is not able to find. You can accomplish this by using a line like the following:

```
PACKAGE_ARCHS[vardeps] = "MACHINE"
```

This example explicitly adds the `MACHINE` variable as a dependency for `PACKAGE_ARCHS`.

Consider a case with in-line Python, for example, where BitBake is not able to figure out dependencies. When running in debug mode (i.e. using `-DDD`), BitBake produces output when it discovers something for which it cannot figure out dependencies. The Yocto Project team has currently not managed to cover those dependencies in detail and is aware of the need to fix this situation.

Thus far, this section has limited discussion to the direct inputs into a task. Information based on direct inputs is referred to as the "basehash" in the code. However, there is still the question of a task's indirect inputs - the things that were already built and present in the [Build Directory](#). The checksum (or signature) for a particular task needs to add the hashes of all the tasks on which the particular task depends. Choosing which dependencies to add is a policy decision. However, the effect is to generate a master checksum that combines the basehash and the hashes of the task's dependencies.

At the code level, there are a variety of ways both the basehash and the dependent task hashes can be influenced. Within the BitBake configuration file, we can give BitBake some extra information to help it construct the basehash. The following statement effectively results in a list of global variable dependency excludes - variables never included in any checksum:

```
BB_HASHBASE_WHITELIST ?= "TMPDIR FILE_PATH PWD BB_TASKHASH BBPATH DL_DIR \
    SSTATE_DIR THISDIR FILESEXPATHS FILE_DIRNAME HOME LOGNAME SHELL TERM \
    USER FILESPATH STAGING_DIR_HOST STAGING_DIR_TARGET COREBASE PRSERV_HOST \
    PRSERV_DUMPDIR PRSERV_DUMPFILE PRSERV_LOCKDOWN PARALLEL MAKE \
    CCACHE_DIR EXTERNAL_TOOLCHAIN CCACHE CCACHE_DISABLE LICENSE_PATH SDKPKGSUFFIX"
```

The previous example excludes `WORKDIR` since that variable is actually constructed as a path

within `TMPDIR`, which is on the whitelist.

The rules for deciding which hashes of dependent tasks to include through dependency chains are more complex and are generally accomplished with a Python function. The code in `meta/lib/oe/sstatesig.py` shows two examples of this and also illustrates how you can insert your own policy into the system if so desired. This file defines the two basic signature generators OE-Core uses: "OEBasic" and "OEBasicHash". By default, there is a dummy "noop" signature handler enabled in BitBake. This means that behavior is unchanged from previous versions. OE-Core uses the "OEBasicHash" signature handler by default through this setting in the `bitbake.conf` file:

```
BB_SIGNATURE_HANDLER ?= "OEBasicHash"
```

The "OEBasicHash" `BB_SIGNATURE_HANDLER` is the same as the "OEBasic" version but adds the task hash to the stamp files. This results in any `Metadata` change that changes the task hash, automatically causing the task to be run again. This removes the need to bump `PR` values, and changes to `Metadata` automatically ripple across the build.

It is also worth noting that the end result of these signature generators is to make some dependency and hash information available to the build. This information includes:

- `BB_BASEHASH_task-taskname`: The base hashes for each task in the recipe.
- `BB_BASEHASH_filename:taskname`: The base hashes for each dependent task.
- `BBHASHDEPS_filename:taskname`: The task dependencies for each task.
- `BB_TASKHASH`: The hash of the currently running task.

4.3.3. Shared State

Checksums and dependencies, as discussed in the previous section, solve half the problem of supporting a shared state. The other part of the problem is being able to use checksum information during the build and being able to reuse or rebuild specific components.

The `sstate` class is a relatively generic implementation of how to "capture" a snapshot of a given task. The idea is that the build process does not care about the source of a task's output. Output could be freshly built or it could be downloaded and unpacked from somewhere - the build process does not need to worry about its origin.

There are two types of output, one is just about creating a directory in `WORKDIR`. A good example is the output of either `do_install` or `do_package`. The other type of output occurs when a set of data is merged into a shared directory tree such as the `sysroot`.

The Yocto Project team has tried to keep the details of the implementation hidden in `sstate` class. From a user's perspective, adding shared state wrapping to a task is as simple as this `do_deploy` example taken from the `deploy` class:

```
DEPLOYDIR = "${WORKDIR}/deploy-${PN}"
SSTATETASKS += "do_deploy"
do_deploy[sstate-name] = "deploy"
do_deploy[sstate-inputdirs] = "${DEPLOYDIR}"
do_deploy[sstate-outputdirs] = "${DEPLOYDIR_IMAGE}"

python do_deploy_setscene () {
    sstate_setscene(d)
}
addtask do_deploy_setscene
do_deploy[dirs] = "${DEPLOYDIR} ${B}"
```

In this example, we add some extra flags to the task, a name field ("deploy"), an input directory where the task sends data, and the output directory where the data from the task should eventually be copied. We also add a `_setscene` variant of the task and add the task name to the `SSTATETASKS` list.

If you have a directory whose contents you need to preserve, you can do this with a line like

the following:

```
do_package[sstate-plaindirs] = "${PKGDEST} ${PKGDEST}"
```

This method, as well as the following example, also works for multiple directories.

```
do_package[sstate-inputdirs] = "${PKGDESTWORK} ${SHLIBSWORKDIR}"
do_package[sstate-outputdirs] = "${PKGDATA_DIR} ${SHLIBSDIR}"
do_package[sstate-lockfile] = "${PACKAGELOCK}"
```

These methods also include the ability to take a lockfile when manipulating shared state directory structures since some cases are sensitive to file additions or removals.

Behind the scenes, the shared state code works by looking in `SSTATE_DIR` and `SSTATE_MIRRORS` for shared state files. Here is an example:

```
SSTATE_MIRRORS ?= "\
file://.* http://someserver.tld/share/sstate/PATH \n \
file://.* file:///some/local/dir/sstate/PATH"
```

Note

The shared state directory (`SSTATE_DIR`) is organized into two-character subdirectories, where the subdirectory names are based on the first two characters of the hash. If the shared state directory structure for a mirror has the same structure as `SSTATE_DIR`, you must specify "PATH" as part of the URI to enable the build system to map to the appropriate subdirectory.

The shared state package validity can be detected just by looking at the filename since the filename contains the task checksum (or signature) as described earlier in this section. If a valid shared state package is found, the build process downloads it and uses it to accelerate the task.

The build processes use the `*_setscene` tasks for the task acceleration phase. BitBake goes through this phase before the main execution code and tries to accelerate any tasks for which it can find shared state packages. If a shared state package for a task is available, the shared state package is used. This means the task and any tasks on which it is dependent are not executed.

As a real world example, the aim is when building an IPK-based image, only the `do_package_write_ipk` tasks would have their shared state packages fetched and extracted. Since the sysroot is not used, it would never get extracted. This is another reason why a task-based approach is preferred over a recipe-based approach, which would have to install the output from every task.

4.3.4. Tips and Tricks

The code in the build system that supports incremental builds is not simple code. This section presents some tips and tricks that help you work around issues related to shared state code.

4.3.4.1. Debugging

When things go wrong, debugging needs to be straightforward. Because of this, the Yocto Project includes strong debugging tools:

- Whenever a shared state package is written out, so is a corresponding `.siginfo` file. This practice results in a pickled Python database of all the metadata that went into creating the hash for a given shared state package.
- If you run BitBake with the `--dump-signatures` (or `-s`) option, BitBake dumps out `.siginfo` files in the stamp directory for every task it would have executed instead of building the specified target package.
- There is a `bitbake-diffsigs` command that can process `.siginfo` files. If you specify one

of these files, BitBake dumps out the dependency information in the file. If you specify two files, BitBake compares the two files and dumps out the differences between the two. This more easily helps answer the question of "What changed between X and Y?"

4.3.4.2. Invalidating Shared State

The OpenEmbedded build system uses checksums and shared state cache to avoid unnecessarily rebuilding tasks. Collectively, this scheme is known as "shared state code."

As with all schemes, this one has some drawbacks. It is possible that you could make implicit changes to your code that the checksum calculations do not take into account. These implicit changes affect a task's output but do not trigger the shared state code into rebuilding a recipe. Consider an example during which a tool changes its output. Assume that the output of `rpmdeps` changes. The result of the change should be that all the `package` and `package_write_rpm` shared state cache items become invalid. However, because the change to the output is external to the code and therefore implicit, the associated shared state cache items do not become invalidated. In this case, the build process uses the cached items rather than running the task again. Obviously, these types of implicit changes can cause problems.

To avoid these problems during the build, you need to understand the effects of any changes you make. Realize that changes you make directly to a function are automatically factored into the checksum calculation. Thus, these explicit changes invalidate the associated area of shared state cache. However, you need to be aware of any implicit changes that are not obvious changes to the code and could affect the output of a given task.

When you identify an implicit change, you can easily take steps to invalidate the cache and force the tasks to run. The steps you can take are as simple as changing a function's comments in the source code. For example, to invalidate package shared state files, change the comment statements of `do_package` or the comments of one of the functions it calls. Even though the change is purely cosmetic, it causes the checksum to be recalculated and forces the OpenEmbedded build system to run the task again.

Note

For an example of a commit that makes a cosmetic change to invalidate shared state, see this [commit](#).

4.4. x32

x32 is a processor-specific Application Binary Interface (psABI) for x86_64. An ABI defines the calling conventions between functions in a processing environment. The interface determines what registers are used and what the sizes are for various C data types.

Some processing environments prefer using 32-bit applications even when running on Intel 64-bit platforms. Consider the i386 psABI, which is a very old 32-bit ABI for Intel 64-bit platforms. The i386 psABI does not provide efficient use and access of the Intel 64-bit processor resources, leaving the system underutilized. Now consider the x86_64 psABI. This ABI is newer and uses 64-bits for data sizes and program pointers. The extra bits increase the footprint size of the programs, libraries, and also increases the memory and file system size requirements. Executing under the x32 psABI enables user programs to utilize CPU and system resources more efficiently while keeping the memory footprint of the applications low. Extra bits are used for registers but not for addressing mechanisms.

4.4.1. Support

This Yocto Project release supports the final specifications of x32 psABI. Support for x32 psABI exists as follows:

- You can create packages and images in x32 psABI format on x86_64 architecture targets.

- You can successfully build many recipes with the x32 toolchain.
- You can create and boot `core-image-minimal` and `core-image-sato` images.

4.4.2. Completing x32

Future Plans for the x32 psABI in the Yocto Project include the following:

- Enhance and fix the few remaining recipes so they work with and support x32 toolchains.
- Enhance RPM Package Manager (RPM) support for x32 binaries.
- Support larger images.

4.4.3. Using x32 Right Now

Follow these steps to use the x32 psABI:

- Enable the x32 psABI tuning file for `x86_64` machines by editing the `conf/local.conf` like this:

```
MACHINE = "qemux86-64"
DEFAULTTUNE = "x86-64-x32"
baselib = "${@d.getVar('BASE_LIB_tune-' + (d.getVar('DEFAULTTUNE', True) \
or 'INVALID'), True) or 'lib'}"
#MACHINE = "genericx86"
#DEFAULTTUNE = "core2-64-x32"
```

- As usual, use BitBake to build an image that supports the x32 psABI. Here is an example:

```
$ bitbake core-image-sato
```

- As usual, run your image using QEMU:

```
$ runqemu qemux86-64 core-image-sato
```

4.5. Wayland

[Wayland](#) is a computer display server protocol that provides a method for compositing window managers to communicate directly with applications and video hardware and expects them to communicate with input hardware using other libraries. Using Wayland with supporting targets can result in better control over graphics frame rendering than an application might otherwise achieve.

The Yocto Project provides the Wayland protocol libraries and the reference [Weston](#) compositor as part of its release. This section describes what you need to do to implement Wayland and use the compositor when building an image for a supporting target.

4.5.1. Support

The Wayland protocol libraries and the reference Weston compositor ship as integrated packages in the meta layer of the [Source Directory](#). Specifically, you can find the recipes that build both Wayland and Weston at `meta/recipes-graphics/wayland`.

You can build both the Wayland and Weston packages for use only with targets that accept the [Mesa 3D and Direct Rendering Infrastructure](#), which is also known as Mesa DRI. This implies that you cannot build and use the packages if your target uses, for example, the Intel® Embedded Media and Graphics Driver (Intel® EMGD) that overrides Mesa DRI.

Note

Due to lack of EGL support, Weston 1.0.3 will not run directly on the emulated QEMU hardware. However, this version of Weston will run under X emulation

without issues.

4.5.2. Enabling Wayland in an Image

To enable Wayland, you need to enable it to be built and enable it to be included in the image.

4.5.2.1. Building

To cause Mesa to build the wayland-egl platform and Weston to build Wayland with Kernel Mode Setting (KMS) support, include the "wayland" flag in the `DISTRO_FEATURES` statement in your `local.conf` file:

```
DISTRO_FEATURES_append = " wayland"
```

Note

If X11 has been enabled elsewhere, Weston will build Wayland with X11 support

4.5.2.2. Installing

To install the Wayland feature into an image, you must include the following `CORE_IMAGE_EXTRA_INSTALL` statement in your `local.conf` file:

```
CORE_IMAGE_EXTRA_INSTALL += "wayland weston"
```

4.5.3. Running Weston

To run Weston inside X11, enabling it as described earlier and building a Sato image is sufficient. If you are running your image under Sato, a Weston Launcher appears in the "Utility" category.

Alternatively, you can run Weston through the command-line interpreter (CLI), which is better suited for development work. To run Weston under the CLI, you need to do the following after your image is built:

1. Run these commands to export `XDG_RUNTIME_DIR`:

```
mkdir -p /tmp/$USER-weston
chmod 0700 /tmp/$USER-weston
export XDG_RUNTIME_DIR=/tmp/$USER-weston
```

2. Launch Weston in the shell:

```
weston
```

4.6. Licenses

This section describes the mechanism by which the OpenEmbedded build system tracks changes to licensing text. The section also describes how to enable commercially licensed recipes, which by default are disabled.

For information that can help you maintain compliance with various open source licensing during the lifecycle of the product, see the "[Maintaining Open Source License Compliance During Your Project's Lifecycle](#)" section in the Yocto Project Development Manual.

4.6.1. Tracking License Changes

The license of an upstream project might change in the future. In order to prevent these

changes going unnoticed, the `LIC_FILES_CHKSUM` variable tracks changes to the license text. The checksums are validated at the end of the configure step, and if the checksums do not match, the build will fail.

4.6.1.1. Specifying the `LIC_FILES_CHKSUM` Variable

The `LIC_FILES_CHKSUM` variable contains checksums of the license text in the source code for the recipe. Following is an example of how to specify `LIC_FILES_CHKSUM`:

```
LIC_FILES_CHKSUM = "file://COPYING;md5=xxxx \
file://licfile1.txt;beginline=5;endline=29;md5=yyyy \
file://licfile2.txt;endline=50;md5=zzzz \
..."
```

The build system uses the `s` variable as the default directory when searching files listed in `LIC_FILES_CHKSUM`. The previous example employs the default directory.

Consider this next example:

```
LIC_FILES_CHKSUM = "file://src/ls.c;beginline=5;endline=16;\
md5=bb14ed3c4cda583abc85401304b5cd4e"
LIC_FILES_CHKSUM = "file://${WORKDIR}/license.html;md5=5c94767cedb5d6987c902ac850ded2c6"
```

The first line locates a file in `${S}/src/ls.c`. The second line refers to a file in `WORKDIR`.

Note that `LIC_FILES_CHKSUM` variable is mandatory for all recipes, unless the `LICENSE` variable is set to "CLOSED".

4.6.1.2. Explanation of Syntax

As mentioned in the previous section, the `LIC_FILES_CHKSUM` variable lists all the important files that contain the license text for the source code. It is possible to specify a checksum for an entire file, or a specific section of a file (specified by beginning and ending line numbers with the "beginline" and "endline" parameters, respectively). The latter is useful for source files with a license notice header, README documents, and so forth. If you do not use the "beginline" parameter, then it is assumed that the text begins on the first line of the file. Similarly, if you do not use the "endline" parameter, it is assumed that the license text ends with the last line of the file.

The "md5" parameter stores the md5 checksum of the license text. If the license text changes in any way as compared to this parameter then a mismatch occurs. This mismatch triggers a build failure and notifies the developer. Notification allows the developer to review and address the license text changes. Also note that if a mismatch occurs during the build, the correct md5 checksum is placed in the build log and can be easily copied to the recipe.

There is no limit to how many files you can specify using the `LIC_FILES_CHKSUM` variable. Generally, however, every project requires a few specifications for license tracking. Many projects have a "COPYING" file that stores the license information for all the source code files. This practice allows you to just track the "COPYING" file as long as it is kept up to date.

Tip

If you specify an empty or invalid "md5" parameter, BitBake returns an md5 mis-match error and displays the correct "md5" parameter value during the build. The correct parameter is also captured in the build log.

Tip

If the whole file contains only license text, you do not need to use the "beginline" and "endline" parameters.

4.6.2. Enabling Commercially Licensed Recipes

By default, the OpenEmbedded build system disables components that have commercial or other special licensing requirements. Such requirements are defined on a recipe-by-recipe basis through the `LICENSE_FLAGS` variable definition in the affected recipe. For instance, the `poky/meta/recipes-multimedia/gstreamer/gst-plugins-ugly` recipe contains the following statement:

```
LICENSE_FLAGS = "commercial"
```

Here is a slightly more complicated example that contains both an explicit recipe name and version (after variable expansion):

```
LICENSE_FLAGS = "license_${PN}_${PV}"
```

In order for a component restricted by a `LICENSE_FLAGS` definition to be enabled and included in an image, it needs to have a matching entry in the global `LICENSE_FLAGS_WHITELIST` variable, which is a variable typically defined in your `local.conf` file. For example, to enable the `poky/meta/recipes-multimedia/gstreamer/gst-plugins-ugly` package, you could add either the string `"commercial_gst-plugins-ugly"` or the more general string `"commercial"` to `LICENSE_FLAGS_WHITELIST`. See the ["License Flag Matching"](#) section for a full explanation of how `LICENSE_FLAGS` matching works. Here is the example:

```
LICENSE_FLAGS_WHITELIST = "commercial_gst-plugins-ugly"
```

Likewise, to additionally enable the package built from the recipe containing `LICENSE_FLAGS = "license_${PN}_${PV}"`, and assuming that the actual recipe name was `emgd_1.10.bb`, the following string would enable that package as well as the original `gst-plugins-ugly` package:

```
LICENSE_FLAGS_WHITELIST = "commercial_gst-plugins-ugly license_emgd_1.10"
```

As a convenience, you do not need to specify the complete license string in the whitelist for every package. You can use an abbreviated form, which consists of just the first portion or portions of the license string before the initial underscore character or characters. A partial string will match any license that contains the given string as the first portion of its license. For example, the following whitelist string will also match both of the packages previously mentioned as well as any other packages that have licenses starting with `"commercial"` or `"license"`.

```
LICENSE_FLAGS_WHITELIST = "commercial license"
```

4.6.2.1. License Flag Matching

License flag matching allows you to control what recipes the OpenEmbedded build system includes in the build. Fundamentally, the build system attempts to match `LICENSE_FLAGS` strings found in recipes against `LICENSE_FLAGS_WHITELIST` strings found in the whitelist. A match causes the build system to include a recipe in the build, while failure to find a match causes the build system to exclude a recipe.

In general, license flag matching is simple. However, understanding some concepts will help you correctly and effectively use matching.

Before a flag defined by a particular recipe is tested against the contents of the whitelist, the expanded string `_${PN}` is appended to the flag. This expansion makes each `LICENSE_FLAGS` value recipe-specific. After expansion, the string is then matched against the whitelist. Thus, specifying `LICENSE_FLAGS = "commercial"` in recipe `"foo"`, for example, results in the string `"commercial_foo"`. And, to create a match, that string must appear in the whitelist.

Judicious use of the `LICENSE_FLAGS` strings and the contents of the `LICENSE_FLAGS_WHITELIST` variable allows you a lot of flexibility for including or excluding recipes based on licensing. For example, you can broaden the matching capabilities by using license flags string subsets in the whitelist.

Note

When using a string subset, be sure to use the part of the expanded string that precedes the appended underscore character (e.g. `usethispart_1.3`, `usethispart_1.4`, and so forth).

For example, simply specifying the string "commercial" in the whitelist matches any expanded `LICENSE_FLAGS` definition that starts with the string "commercial" such as "commercial_foo" and "commercial_bar", which are the strings the build system automatically generates for hypothetical recipes named "foo" and "bar" assuming those recipes simply specify the following:

```
LICENSE_FLAGS = "commercial"
```

Thus, you can choose to exhaustively enumerate each license flag in the whitelist and allow only specific recipes into the image, or you can use a string subset that causes a broader range of matches to allow a range of recipes into the image.

This scheme works even if the `LICENSE_FLAGS` string already has `_${PN}` appended. For example, the build system turns the license flag "commercial_1.2_foo" into "commercial_1.2_foo_foo" and would match both the general "commercial" and the specific "commercial_1.2_foo" strings found in the whitelist, as expected.

Here are some other scenarios:

- You can specify a versioned string in the recipe such as "commercial_foo_1.2" in a "foo" recipe. The build system expands this string to "commercial_foo_1.2_foo". Combine this license flag with a whitelist that has the string "commercial" and you match the flag along with any other flag that starts with the string "commercial".
- Under the same circumstances, you can use "commercial_foo" in the whitelist and the build system not only matches "commercial_foo_1.2" but also matches any license flag with the string "commercial_foo", regardless of the version.
- You can be very specific and use both the package and version parts in the whitelist (e.g. "commercial_foo_1.2") to specifically match a versioned recipe.

4.6.2.2. Other Variables Related to Commercial Licenses

Other helpful variables related to commercial license handling exist and are defined in the `poky/meta/conf/distro/include/default-distrovars.inc` file:

```
COMMERCIAL_AUDIO_PLUGINS ?= ""  
COMMERCIAL_VIDEO_PLUGINS ?= ""  
COMMERCIAL_QT = ""
```

If you want to enable these components, you can do so by making sure you have statements similar to the following in your `local.conf` configuration file:

```
COMMERCIAL_AUDIO_PLUGINS = "gst-plugins-ugly-mad \  
    gst-plugins-ugly-mpegaudioparse"  
COMMERCIAL_VIDEO_PLUGINS = "gst-plugins-ugly-mpeg2dec \  
    gst-plugins-ugly-mpegstream gst-plugins-bad-mpegvideoparse"  
COMMERCIAL_QT ?= "qtmmp"  
LICENSE_FLAGS_WHITELIST = "commercial_gst-plugins-ugly commercial_gst-plugins-bad commercial_qt"
```

Of course, you could also create a matching whitelist for those components using the more general "commercial" in the whitelist, but that would also enable all the other packages with `LICENSE_FLAGS` containing "commercial", which you may or may not want:

```
LICENSE_FLAGS_WHITELIST = "commercial"
```

Specifying audio and video plug-ins as part of the `COMMERCIAL_AUDIO_PLUGINS` and `COMMERCIAL_VIDEO_PLUGINS` statements or commercial Qt components as part of the `COMMERCIAL_QT` statement (along with the enabling `LICENSE_FLAGS_WHITELIST`) includes the

plug-ins or components into built images, thus adding support for media formats or components.

Chapter 5. Migrating to a Newer Yocto Project Release ¶

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This chapter provides information you can use to migrate work to a newer Yocto Project release. You can find the same information in the release notes for a given release.

5.1. General Migration Considerations ¶

Some considerations are not tied to a specific Yocto Project release. This section presents information you should consider when migrating to any new Yocto Project release.

- **Dealing with Customized Recipes:** Issues could arise if you take older recipes that contain customizations and simply copy them forward expecting them to work after you migrate to new Yocto Project metadata. For example, suppose you have a recipe in your layer that is a customized version of a core recipe copied from the earlier release, rather than through the use of an append file. When you migrate to a newer version of Yocto Project, the metadata (e.g. perhaps an include file used by the recipe) could have changed in a way that would break the build. Say, for example, a function is removed from an include file and the customized recipe tries to call that function.

You could "forward-port" all your customizations in your recipe so that everything works for the new release. However, this is not the optimal solution as you would have to repeat this process with each new release if changes occur that give rise to problems.

The better solution (where practical) is to use append files (*.bbappend) to capture any customizations you want to make to a recipe. Doing so, isolates your changes from the main recipe making them much more manageable. However, sometimes it is not practical to use an append file. A good example of this is when introducing a newer or older version of a recipe in another layer.

- **Updating Append Files:** Since append files generally only contain your customizations, they often do not need to be adjusted for new releases. However, if the .bbappend file is specific to a particular version of the recipe (i.e. its name does not use the % wildcard) and the version of the recipe to which it is appending has changed, then you will at a minimum need to rename the append file to match the name of the recipe file. A mismatch between an append file and its corresponding recipe file (.bb) will trigger an error during parsing.

Depending on the type of customization the append file applies, other incompatibilities might occur when you upgrade. For example, if your append file applies a patch and the recipe to which it is appending is updated to a newer version, the patch might no longer apply. If this is the case and assuming the patch is still needed, you must modify the patch

file so that it does apply.

5.2. Moving to the Yocto Project 1.3 Release ¶

This section provides migration information for moving to the Yocto Project 1.3 Release from the prior release.

5.2.1. Local Configuration ¶

Differences include changes for `SSTATE_MIRRORS` and `bblayers.conf`.

5.2.1.1. SSTATE_MIRRORS ¶

The shared state cache (sstate-cache), as pointed to by `SSTATE_DIR`, by default now has two-character subdirectories to prevent issues arising from too many files in the same directory. Also, native sstate-cache packages will go into a subdirectory named using the distro ID string. If you copy the newly structured sstate-cache to a mirror location (either local or remote) and then point to it in `SSTATE_MIRRORS`, you need to append "PATH" to the end of the mirror URL so that the path used by BitBake before the mirror substitution is appended to the path used to access the mirror. Here is an example:

```
SSTATE_MIRRORS = "file://.* http://someserver.tld/share/sstate/PATH"
```

5.2.1.2. bblayers.conf ¶

The meta-yocto layer consists of two parts that correspond to the Poky reference distribution and the reference hardware Board Support Packages (BSPs), respectively: meta-yocto and meta-yocto-bsp. When running BitBake or Hob for the first time after upgrading, your `conf/bblayers.conf` file will be updated to handle this change and you will be asked to re-run or restart for the changes to take effect.

5.2.2. Recipes ¶

Differences include changes for the following:

- Python function whitespace
- `proto=` in `SRC_URI`
- `nativesdk`
- Task recipes
- `IMAGE_FEATURES`
- Removed recipes

5.2.2.1. Python Function Whitespace ¶

All Python functions must now use four spaces for indentation. Previously, an inconsistent mix of spaces and tabs existed, which made extending these functions using `_append` or `_prepend` complicated given that Python treats whitespace as syntactically significant. If you are defining or extending any Python functions (e.g. `populate_packages`, `do_unpack`, `do_patch` and so forth) in custom recipes or classes, you need to ensure you are using consistent four-space indentation.

5.2.2.2. proto= in SRC_URI ¶

Any use of `proto=` in `SRC_URI` needs to be changed to `protocol=`. In particular, this applies to

the following URIs:

- `svn://`
- `bzr://`
- `hg://`
- `osc://`

Other URIs were already using `protocol=`. This change improves consistency.

5.2.2.3. nativesdk

The suffix `nativesdk` is now implemented as a prefix, which simplifies a lot of the packaging code for `nativesdk` recipes. All custom `nativesdk` recipes and any references need to be updated to use `nativesdk-*` instead of `*-nativesdk`.

5.2.2.4. Task Recipes

"Task" recipes are now known as "Package groups" and have been renamed from `task-*.bb` to `packagegroup-*.bb`. Existing references to the previous `task-*` names should work in most cases as there is an automatic upgrade path for most packages. However, you should update references in your own recipes and configurations as they could be removed in future releases. You should also rename any custom `task-*` recipes to `packagegroup-*`, and change them to inherit `packagegroup` instead of `task`, as well as taking the opportunity to remove anything now handled by `packagegroup.bbclass`, such as providing `-dev` and `-dbg` packages, setting `LIC_FILES_CHKSUM`, and so forth. See the "[packagegroup.bbclass](#)" section for further details.

5.2.2.5. IMAGE_FEATURES

Image recipes that previously included "apps-console-core" in `IMAGE_FEATURES` should now include "splash" instead to enable the boot-up splash screen. Retaining "apps-console-core" will still include the splash screen but generates a warning. The "apps-x11-core" and "apps-x11-games" `IMAGE_FEATURES` features have been removed.

5.2.2.6. Removed Recipes

The following recipes have been removed. For most of them, it is unlikely that you would have any references to them in your own [Metadata](#). However, you should check your metadata against this list to be sure:

- **`libx11-trim`**: Replaced by `libx11`, which has a negligible size difference with modern Xorg.
- **`xserver-xorg-lite`**: Use `xserver-xorg`, which has a negligible size difference when DRI and GLX modules are not installed.
- **`xserver-kdrive`**: Effectively unmaintained for many years.
- **`mesa-xlib`**: No longer serves any purpose.
- **`galago`**: Replaced by `telepathy`.
- **`gail`**: Functionality was integrated into GTK+ 2.13.
- **`eggdbus`**: No longer needed.
- **`gcc-*-intermediate`**: The build has been restructured to avoid the need for this step.
- **`libgsmd`**: Unmaintained for many years. Functionality now provided by `ofono` instead.
- **`contacts`, `dates`, `tasks`, `eds-tools`**: Largely unmaintained PIM application suite. It has been

moved to meta-gnome in meta-openembedded.

In addition to the previously listed changes, the meta-demoapps directory has also been removed because the recipes in it were not being maintained and many had become obsolete or broken. Additionally, these recipes were not parsed in the default configuration. Many of these recipes are already provided in an updated and maintained form within the OpenEmbedded community layers such as meta-oe and meta-gnome. For the remainder, you can now find them in the meta-extras repository, which is in the Yocto Project [Source Repositories](#).

5.2.3. Linux Kernel Naming

The naming scheme for kernel output binaries has been changed to now include `PE` as part of the filename:

```
KERNEL_IMAGE_BASE_NAME ?= "${KERNEL_IMAGETYPE}-${PE}-${PV}-${PR}-${MACHINE}-${DATETIME}"
```

Because the `PE` variable is not set by default, these binary files could result with names that include two dash characters. Here is an example:

```
bzImage--3.10.9+git0+cd502a8814_7144bcc4b8-r0-qemux86-64-20130830085431.bin
```

5.3. Moving to the Yocto Project 1.4 Release

This section provides migration information for moving to the Yocto Project 1.4 Release from the prior release.

5.3.1. BitBake

Differences include the following:

- **Comment Continuation:** If a comment ends with a line continuation (`\`) character, then the next line must also be a comment. Any instance where this is not the case, now triggers a warning. You must either remove the continuation character, or be sure the next line is a comment.
- **Package Name Overrides:** The runtime package specific variables `RDEPENDS`, `RRECOMMENDS`, `RSUGGESTS`, `RPROVIDES`, `RCONFLICTS`, `RREPLACES`, `FILES`, `ALLOW_EMPTY`, and the pre, post, install, and uninstall script functions `pkg_preinst`, `pkg_postinst`, `pkg_prerm`, and `pkg_postrm` should always have a package name override. For example, use `RDEPENDS_${PN}` for the main package instead of `RDEPENDS`. BitBake uses more strict checks when it parses recipes.

5.3.2. Build Behavior

Differences include the following:

- **Shared State Code:** The shared state code has been optimized to avoid running unnecessary tasks. For example, the following no longer populates the target sysroot since that is not necessary:

```
$ bitbake -c rootfs some-image
```

Instead, the system just needs to extract the output package contents, re-create the packages, and construct the root filesystem. This change is unlikely to cause any problems unless you have missing declared dependencies.

- **Scanning Directory Names:** When scanning for files in `SRC_URI`, the build system now uses `FILESOVERRIDES` instead of `OVERRIDES` for the directory names. In general, the values

previously in `OVERRIDES` are now in `FILESOVERRIDES` as well. However, if you relied upon an additional value you previously added to `OVERRIDES`, you might now need to add it to `FILESOVERRIDES` unless you are already adding it through the `MACHINEOVERRIDES` or `DISTROOVERRIDES` variables, as appropriate. For more related changes, see the "[Variables](#)" section.

5.3.3. Proxies and Fetching Source

A new `oe-git-proxy` script has been added to replace previous methods of handling proxies and fetching source from Git. See the `meta-yocto/conf/site.conf.sample` file for information on how to use this script.

5.3.4. Custom Interfaces File (netbase change)

If you have created your own custom `etc/network/interfaces` file by creating an append file for the `netbase` recipe, you now need to create an append file for the `init-ifupdown` recipe instead, which you can find in the [Source Directory](#) at `meta/recipes-core/init-ifupdown`. For information on how to use append files, see the "[Using .bbappend Files](#)" in the Yocto Project Development Manual.

5.3.5. Remote Debugging

Support for remote debugging with the Eclipse IDE is now separated into an image feature (`eclipse-debug`) that corresponds to the `packagegroup-core-eclipse-debug` package group. Previously, the debugging feature was included through the `tools-debug` image feature, which corresponds to the `packagegroup-core-tools-debug` package group.

5.3.6. Variables

The following variables have changed:

- **`SANITY_TESTED_DISTROS`:** This variable now uses a distribution ID, which is composed of the host distributor ID followed by the release. Previously, `SANITY_TESTED_DISTROS` was composed of the description field. For example, "Ubuntu 12.10" becomes "Ubuntu-12.10". You do not need to worry about this change if you are not specifically setting this variable, or if you are specifically setting it to "".
- **`SRC_URI`:** The `${PN}`, `${PF}`, `${P}`, and `FILE_DIRNAME` directories have been dropped from the default value of the `FILESPATH` variable, which is used as the search path for finding files referred to in `SRC_URI`. If you have a recipe that relied upon these directories, which would be unusual, then you will need to add the appropriate paths within the recipe or, alternatively, rearrange the files. The most common locations are still covered by `${BP}`, `${BPN}`, and "files", which all remain in the default value of `FILESPATH`.

5.3.7. Target Package Management with RPM

If runtime package management is enabled and the RPM backend is selected, Smart is now installed for package download, dependency resolution, and upgrades instead of Zypper. For more information on how to use Smart, run the following command on the target:

```
smart --help
```

5.3.8. Recipes Moved

The following recipes were moved from their previous locations because they are no longer used by anything in the OpenEmbedded-Core:

- ***clutter-box2d***: Now resides in the meta-oe layer.
- ***evolution-data-server***: Now resides in the meta-gnome layer.
- ***gthumb***: Now resides in the meta-gnome layer.
- ***gtkhtml2***: Now resides in the meta-oe layer.
- ***gupnp***: Now resides in the meta-multimedia layer.
- ***gypsy***: Now resides in the meta-oe layer.
- ***libcanberra***: Now resides in the meta-gnome layer.
- ***libgdata***: Now resides in the meta-gnome layer.
- ***libmusicbrainz***: Now resides in the meta-multimedia layer.
- ***metacity***: Now resides in the meta-gnome layer.
- ***polkit***: Now resides in the meta-oe layer.
- ***zeroconf***: Now resides in the meta-networking layer.

5.3.9. Removals and Renames

The following list shows what has been removed or renamed:

- ***evieext***: Removed because it has been removed from `xserver` since 2008.
- ***Gtk+ DirectFB***: Removed support because upstream Gtk+ no longer supports it as of version 2.18.
- ***libxfontcache* / *xfontcacheproto***: Removed because they were removed from the Xorg server in 2008.
- ***libxp* / *libxprintapputil* / *libxprintutil* / *printproto***: Removed because the XPrint server was removed from Xorg in 2008.
- ***libxtrap* / *xtrapproto***: Removed because their functionality was broken upstream.
- ***linux-yocto 3.0 kernel***: Removed with linux-yocto 3.8 kernel being added. The linux-yocto 3.2 and linux-yocto 3.4 kernels remain as part of the release.
- ***lsbsetup***: Removed with functionality now provided by `lsbtest`.
- ***matchbox-stroke***: Removed because it was never more than a proof-of-concept.
- ***matchbox-wm-2* / *matchbox-theme-sato-2***: Removed because they are not maintained. However, `matchbox-wm` and `matchbox-theme-sato` are still provided.
- ***mesa-dri***: Renamed to `mesa`.
- ***mesa-xlib***: Removed because it was no longer useful.
- ***mutter***: Removed because nothing ever uses it and the recipe is very old.
- ***orinoco-conf***: Removed because it has become obsolete.
- ***update-modules***: Removed because it is no longer used. The kernel module `postinstall` and `postrm` scripts can now do the same task without the use of this script.
- ***web***: Removed because it is not maintained. Superseded by `web-webkit`.
- ***xf86bigfontproto***: Removed because upstream it has been disabled by default since 2007.

Nothing uses `xf86bigfontproto`.

- **`xf86rushproto`**: Removed because its dependency in `xserver` was spurious and it was removed in 2005.
- **`zypper` / `libzypp` / `sat-solver`**: Removed and been functionally replaced with Smart (`python-smartpm`) when RPM packaging is used and package management is enabled on the target.

5.4. Moving to the Yocto Project 1.5 Release ¶

This section provides migration information for moving to the Yocto Project 1.5 Release from the prior release.

5.4.1. Host Dependency Changes ¶

The OpenEmbedded build system now has some additional requirements on the host system:

- Python 2.7.3+
- Tar 1.24+
- Git 1.7.8+
- Patched version of Make if you are using 3.82. Most distributions that provide Make 3.82 use the patched version.

If the Linux distribution you are using on your build host does not provide packages for these, you can install and use the Buildtools tarball, which provides an SDK-like environment containing them.

For more information on this requirement, see the ["Required Git, tar, and Python Versions"](#) section.

5.4.2. `atom-pc` Board Support Package (BSP) ¶

The `atom-pc` hardware reference BSP has been replaced by a `genericx86` BSP. This BSP is not necessarily guaranteed to work on all x86 hardware, but it will run on a wider range of systems than the `atom-pc` did.

Note

Additionally, a `genericx86-64` BSP has been added for 64-bit Atom systems.

5.4.3. BitBake ¶

The following changes have been made that relate to BitBake:

- BitBake now supports a `_remove` operator. The addition of this operator means you will have to rename any items in recipe space (functions, variables) whose names currently contain `_remove_` or end with `_remove` to avoid unexpected behavior.
- BitBake's global method pool has been removed. This method is not particularly useful and led to clashes between recipes containing functions that had the same name.
- The "none" server backend has been removed. The "process" server backend has been serving well as the default for a long time now.
- The `bitbake-runtask` script has been removed.

- `_${P}` and `_${PF}` are no longer added to `PROVIDES` by default in `bitbake.conf`. These version-specific `PROVIDES` items were seldom used. Attempting to use them could result in two versions being built simultaneously rather than just one version due to the way BitBake resolves dependencies.

5.4.4. QA Warnings

The following changes have been made to the package QA checks:

- If you have customized `ERROR_QA` or `WARN_QA` values in your configuration, check that they contain all of the issues that you wish to be reported. Previous Yocto Project versions contained a bug that meant that any item not mentioned in `ERROR_QA` or `WARN_QA` would be treated as a warning. Consequently, several important items were not already in the default value of `WARN_QA`. All of the possible QA checks are now documented in the "`insane.bbclass`" section.
- An additional QA check has been added to check if `/usr/share/info/dir` is being installed. Your recipe should delete this file within `do_install` if "make install" is installing it.
- If you are using the `buildhistory` class, the check for the package version going backwards is now controlled using a standard QA check. Thus, if you have customized your `ERROR_QA` or `WARN_QA` values and still wish to have this check performed, you should add "version-going-backwards" to your value for one or the other variables depending on how you wish it to be handled. See the documented QA checks in the "`insane.bbclass`" section.

5.4.5. Directory Layout Changes

The following directory changes exist:

- Output SDK installer files are now named to include the image name and tuning architecture through the `SDK_NAME` variable.
- Images and related files are now installed into a directory that is specific to the machine, instead of a parent directory containing output files for multiple machines. The `DEPLOY_DIR_IMAGE` variable continues to point to the directory containing images for the current `MACHINE` and should be used anywhere there is a need to refer to this directory. The `runqemu` script now uses this variable to find images and kernel binaries and will use BitBake to determine the directory. Alternatively, you can set the `DEPLOY_DIR_IMAGE` variable in the external environment.
- When `buildhistory` is enabled, its output is now written under the `Build Directory` rather than `TMPDIR`. Doing so makes it easier to delete `TMPDIR` and preserve the build history. Additionally, data for produced SDKs is now split by `IMAGE_NAME`.
- The `pkgdata` directory produced as part of the packaging process has been collapsed into a single machine-specific directory. This directory is located under `sysroots` and uses a machine-specific name (i.e. `tmp/sysroots/machine/pkgdata`).

5.4.6. Shortened Git SRCREV Values

BitBake will now shorten revisions from Git repositories from the normal 40 characters down to 10 characters within `SRCREV` for improved usability in path and file names. This change should be safe within contexts where these revisions are used because the chances of spatially close collisions is very low. Distant collisions are not a major issue in the way the values are used.

5.4.7. IMAGE_FEATURES

The following changes have been made that relate to `IMAGE_FEATURES`:

- The value of `IMAGE_FEATURES` is now validated to ensure invalid feature items are not added. Some users mistakenly add package names to this variable instead of using `IMAGE_INSTALL` in order to have the package added to the image, which does not work. This change is intended to catch those kinds of situations. Valid `IMAGE_FEATURES` are drawn from `PACKAGE_GROUP` definitions, `COMPLEMENTARY_GLOB` and a new "validitems" varflag on `IMAGE_FEATURES`. The "validitems" varflag change allows additional features to be added if they are not provided using the previous two mechanisms.
- The previously deprecated "apps-console-core" `IMAGE_FEATURES` item is no longer supported. Add "splash" to `IMAGE_FEATURES` if you wish to have the splash screen enabled, since this is all that apps-console-core was doing.

5.4.8. `/run`

The `/run` directory from the Filesystem Hierarchy Standard 3.0 has been introduced. You can find some of the implications for this change [here](#). The change also means that recipes that install files to `/var/run` must be changed. You can find a guide on how to make these changes [here](#).

5.4.9. Removal of Package Manager Database Within Image Recipes

The image `core-image-minimal` no longer adds `remove_packaging_data_files` to `ROOTFS_POSTPROCESS_COMMAND`. This addition is now handled automatically when "package-management" is not in `IMAGE_FEATURES`. If you have custom image recipes that make this addition, you should remove the lines, as they are not needed and might interfere with correct operation of postinstall scripts.

5.4.10. Images Now Rebuild Only on Changes Instead of Every Time

The `do_rootfs` and other related image construction tasks are no longer marked as "nostamp". Consequently, they will only be re-executed when their inputs have changed. Previous versions of the OpenEmbedded build system always rebuilt the image when requested rather than when necessary.

5.4.11. Task Recipes

The previously deprecated `task.bbclass` has now been dropped. For recipes that previously inherited from this class, you should rename them from `task-*` to `packagegroup-*` and inherit `packagegroup` instead.

For more information, see the "`packagegroup.bbclass`" section.

5.4.12. BusyBox

By default, we now split BusyBox into two binaries: one that is `suid root` for those components that need it, and another for the rest of the components. Splitting BusyBox allows for optimization that eliminates the `tinylogin` recipe as recommended by upstream. You can disable this split by setting `BUSYBOX_SPLIT_SUID` to "0".

5.4.13. Automated Image Testing

A new automated image testing framework has been added through the `testimage.bbclass` class. This framework replaces the older `imagetest-gemu` framework.

You can learn more about performing automated image tests in the "[Performing Automated Runtime Testing](#)" section.

5.4.14. Build History

Following are changes to Build History:

- Installed package sizes: `installed-package-sizes.txt` for an image now records the size of the files installed by each package instead of the size of each compressed package archive file.
- The dependency graphs (`depends*.dot`) now use the actual package names instead of replacing dashes, dots and plus signs with underscores.
- The `buildhistory-diff` and `buildhistory-collect-srcrevs` utilities have improved command-line handling. Use the `--help` option for each utility for more information on the new syntax.

For more information on Build History, see the "[Maintaining Build Output Quality](#)" section.

5.4.15. udev

Following are changes to udev:

- udev no longer brings in `udev-extraconf` automatically through `RRECOMMENDS`, since this was originally intended to be optional. If you need the extra rules, then add `udev-extraconf` to your image.
- udev no longer brings in `pciutils-ids` or `usbutils-ids` through `RRECOMMENDS`. These are not needed by udev itself and removing them saves around 350KB.

5.4.16. Removed and Renamed Recipes

- The `linux-yocto 3.2` kernel has been removed.
- `libtool-nativesdk` has been renamed to `nativesdk-libtool`.
- `tinylogin` has been removed. It has been replaced by a `suid` portion of Busybox. See the "[BusyBox](#)" section for more information.
- `external-python-tarball` has been renamed to `buildtools-tarball`.
- `web-webkit` has been removed. It has been functionally replaced by `midori`.
- `imake` has been removed. It is no longer needed by any other recipe.
- `transfig-native` has been removed. It is no longer needed by any other recipe.
- `anjuta-remote-run` has been removed. Anjuta IDE integration has not been officially supported for several releases.

5.4.17. Other Changes

Following is a list of short entries describing other changes:

- `run-postinsts`: Make this generic.
- `base-files`: Remove the unnecessary `media/xxx` directories.
- `alsa-state`: Provide an empty `asound.conf` by default.
- `classes/image`: Ensure `BAD_RECOMMENDATIONS` supports pre-renamed package names.
- `classes/rootfs_rpm`: Implement `BAD_RECOMMENDATIONS` for RPM.

- `systemd`: Remove `systemd_unitdir` if `systemd` is not in `DISTRO_FEATURES`.
- `systemd`: Remove `init.d` dir if `systemd` unit file is present and `sysvinit` is not a distro feature.
- `libpam`: Deny all services for the `OTHER` entries.
- `image.bbclass`: Move `runtime_mapping_rename` to avoid conflict with `multilib`. See [YOCTO #4993](#) in Bugzilla for more information.
- `linux-dtb`: Use kernel build system to generate the dtb files.
- `kern-tools`: Switch from `guilt` to new `kgit-s2q` tool.

5.5. Moving to the Yocto Project 1.6 Release ¶

This section provides migration information for moving to the Yocto Project 1.6 Release from the prior release.

5.5.1. archiver Class ¶

The `archiver` class has been rewritten and its configuration has been simplified. For more details on the source archiver, see the "[Maintaining Open Source License Compliance During Your Product's Lifecycle](#)" section in the Yocto Project Development Manual.

5.5.2. Packaging Changes ¶

The following packaging changes have been made:

- The `binutils` recipe no longer produces a `binutils-symlinks` package. `update-alternatives` is now used to handle the preferred `binutils` variant on the target instead.
- The `tc` (traffic control) utilities have been split out of the main `iproute2` package and put into the `iproute2-tc` package.
- The `gtk-engines` schemas have been moved to a dedicated `gtk-engines-schemas` package.
- The `armv7a` with `thumb` package architecture suffix has changed. The suffix for these packages with the `thumb` optimization enabled is `"t2"` as it should be. Use of this suffix was not the case in the 1.5 release. Architecture names will change within package feeds as a result.

5.5.3. BitBake ¶

The following changes have been made to `BitBake`.

5.5.3.1. Matching Branch Requirement for Git Fetching ¶

When fetching source from a Git repository using `SRC_URI`, `BitBake` will now validate the `SRCREV` value against the branch. You can specify the branch using the following form:

```
SRC_URI = "git://server.name/repository;branch=branchname"
```

If you do not specify a branch, `BitBake` looks in the default `"master"` branch.

Alternatively, if you need to bypass this check (e.g. if you are fetching a revision corresponding to a tag that is not on any branch), you can add `";nobranch=1"` to the end of the URL within `SRC_URI`.

5.5.3.2. Python Definition substitutions

BitBake had some previously deprecated Python definitions within its `bb` module removed. You should use their sub-module counterparts instead:

- `bb.MalformedUrl`: Use `bb.fetch.MalformedUrl`.
- `bb.encodeurl`: Use `bb.fetch.encodeurl`.
- `bb.decodeurl`: Use `bb.fetch.decodeurl`.
- `bb.mkdirhier`: Use `bb.utils.mkdirhier`.
- `bb.movefile`: Use `bb.utils.movefile`.
- `bb.copyfile`: Use `bb.utils.copyfile`.
- `bb.which`: Use `bb.utils.which`.
- `bb.vercmp_string`: Use `bb.utils.vercmp_string`.
- `bb.vercmp`: Use `bb.utils.vercmp`.

5.5.3.3. SVK Fetcher

The SVK fetcher has been removed from BitBake.

5.5.3.4. Console Output Error Redirection

The BitBake console UI will now output errors to `stderr` instead of `stdout`. Consequently, if you are piping or redirecting the output of `bitbake` to somewhere else, and you wish to retain the errors, you will need to add `2>&1` (or something similar) to the end of your `bitbake` command line.

5.5.3.5. `task-taskname` Overrides

`task-taskname` overrides have been adjusted so that tasks whose names contain underscores have the underscores replaced by hyphens for the override so that they now function properly. For example, the task override for `do_populate_sdk` is `task-populate-sdk`.

5.5.4. Changes to Variables

The following variables have changed. For information on the OpenEmbedded build system variables, see the "[Variables Glossary](#)" Chapter.

5.5.4.1. `TMPDIR`

`TMPDIR` can no longer be on an NFS mount. NFS does not offer full POSIX locking and inode consistency and can cause unexpected issues if used to store `TMPDIR`.

The check for this occurs on startup. If `TMPDIR` is detected on an NFS mount, an error occurs.

5.5.4.2. `PRINC`

The `PRINC` variable has been deprecated and triggers a warning if detected during a build. For `PR` increments on changes, use the `PR` service instead. You can find out more about this service in the "[Working With a PR Service](#)" section in the Yocto Project Development Manual.

5.5.4.3. `IMAGE_TYPES`

The `"sum.jffs2"` option for `IMAGE_TYPES` has been replaced by the `"jffs2.sum"` option, which fits

the processing order.

5.5.4.4. `COPY_LIC_MANIFEST`

The `COPY_LIC_MANIFEST` variable must now be set to "1" rather than any value in order to enable it.

5.5.4.5. `COPY_LIC_DIRS`

The `COPY_LIC_DIRS` variable must now be set to "1" rather than any value in order to enable it.

5.5.4.6. `PACKAGE_GROUP`

The `PACKAGE_GROUP` variable has been renamed to `FEATURE_PACKAGES` to more accurately reflect its purpose. You can still use `PACKAGE_GROUP` but the OpenEmbedded build system produces a warning message when it encounters the variable.

5.5.4.7. Preprocess and Post Process Command Variable Behavior

The following variables now expect a semicolon separated list of functions to call and not arbitrary shell commands:

```
ROOTFS_PREPROCESS_COMMAND
ROOTFS_POSTPROCESS_COMMAND
SDK_POSTPROCESS_COMMAND
POPULATE_SDK_POST_TARGET_COMMAND
POPULATE_SDK_POST_HOST_COMMAND
IMAGE_POSTPROCESS_COMMAND
IMAGE_PREPROCESS_COMMAND
ROOTFS_POSTUNINSTALL_COMMAND
ROOTFS_POSTINSTALL_COMMAND
```

For migration purposes, you can simply wrap shell commands in a shell function and then call the function. Here is an example:

```
my_postprocess_function() {
    echo "hello" > ${IMAGE_ROOTFS}/hello.txt
}
ROOTFS_POSTPROCESS_COMMAND += "my_postprocess_function; "
```

5.5.5. Directory Layout Changes

The meta-hob layer has been removed from the top-level of the [Source Directory](#). The contents of this layer are no longer needed by the Hob user interface for building images and toolchains.

5.5.6. Package Test (ptest)

Package Tests (ptest) are built but not installed by default. For information on using Package Tests, see the "[Setting up and running package test \(ptest\)](#)" section in the Yocto Project Development Manual. For information on the `ptest.bbclass` section.

5.5.7. Build Changes

Separate build and source directories have been enabled by default for selected recipes where it is known to work (a whitelist) and for all recipes that inherit the `cmake` class. In future releases the `autotools` class will enable a separate build directory by default as well. Recipes building Autotools-based software that fails to build with a separate build directory should be changed to inherit from the `autotools-brokensep` class instead of the `autotools` or `autotools_stageclasses`.

5.5.8. `qemu-native`

`qemu-native` now builds without SDL-based graphical output support by default. The following

additional lines are needed in your `local.conf` to enable it:

```
PACKAGECONFIG_pn-qemu-native = "sdl"  
ASSUME_PROVIDED += "libsdl-native"
```

Note

The default `local.conf` contains these statements. Consequently, if you are building a headless system and using a default `local.conf` file, you will need comment these two lines out.

5.5.9. `core-image-basic`

`core-image-basic` has been renamed to `core-image-full-cmdline`.

In addition to `core-image-basic` being renamed, `packagegroup-core-basic` has been renamed to `packagegroup-core-full-cmdline` to match.

5.5.10. Licensing

The top-level `LICENSE` file has been changed to better describe the license of the various components of OE-Core. However, the licensing itself remains unchanged.

Normally, this change would not cause any side-effects. However, some recipes point to this file within `LIC_FILES_CHKSUM` (as `${COREBASE}/LICENSE`) and thus the accompanying checksum must be changed from `3f40d7994397109285ec7b81fdeb3b58` to `4d92cd373abda3937c2bc47fbc49d690`. A better alternative is to have `LIC_FILES_CHKSUM` point to a file describing the license that is distributed with the source that the recipe is building, if possible, rather than pointing to `${COREBASE}/LICENSE`.

5.5.11. `CFLAGS` Options

The `"-fpermissive"` option has been removed from the default `CFLAGS` value. You need to take action on individual recipes that fail when building with this option. You need to either patch the recipes to fix the issues reported by the compiler, or you need to add `"-fpermissive"` to `CFLAGS` in the recipes.

5.5.12. Custom Image Output Types

Custom image output types, as selected using `IMAGE_FSTYPES`, must declare their dependencies on other image types (if any) using a new `IMAGE_TYPEDEP` variable.

5.5.13. Tasks

The `do_package_write` task has been removed. The task is no longer needed.

5.5.14. `update-alternative` Provider

The default `update-alternatives` provider has been changed from `opkg` to `opkg-utils`. This change resolves some troublesome circular dependencies. The runtime package has also been renamed from `update-alternatives-cworth` to `update-alternatives-opkg`.

5.5.15. `virtclass` Overrides

The `virtclass` overrides are now deprecated. Use the equivalent class overrides instead (e.g. `virtclass-native` becomes `class-native`.)

5.5.16. Removed and Renamed Recipes

The following recipes have been removed:

- `packagegroup-toolset-native` - This recipe is largely unused.
- `linux-yocto-3.8` - Support for the Linux yocto 3.8 kernel has been dropped. Support for the 3.10 and 3.14 kernels have been added with the `linux-yocto-3.10` and `linux-yocto-3.14` recipes.
- `ocf-linux` - This recipe has been functionally replaced using `cryptodev-linux`.
- `genext2fs` - `genext2fs` is no longer used by the build system and is unmaintained upstream.
- `js` - This provided an ancient version of Mozilla's javascript engine that is no longer needed.
- `zaurusd` - The recipe has been moved to the `meta-handheld` layer.
- `eglibc 2.17` - Replaced by the `eglibc 2.19` recipe.
- `gcc 4.7.2` - Replaced by the now stable `gcc 4.8.2`.
- `external-sourcery-toolchain` - this recipe is now maintained in the `meta-sourcery` layer.
- `linux-libc-headers-yocto 3.4+git` - Now using version 3.10 of the `linux-libc-headers` by default.
- `meta-toolchain-gmae` - This recipe is obsolete.
- `packagegroup-core-sdk-gmae` - This recipe is obsolete.
- `packagegroup-core-standalone-gmae-sdk-target` - This recipe is obsolete.

5.5.17. Removed Classes

The following classes have become obsolete and have been removed:

- `module_strip`
- `pkg_metainfo`
- `pkg_distribute`
- `image-empty`

5.5.18. Reference Board Support Packages (BSPs)

The following reference BSPs changes occurred:

- The BeagleBoard (`beagleboard`) ARM reference hardware has been replaced by the BeagleBone (`beaglebone`) hardware.
- The RouterStation Pro (`routerstationpro`) MIPS reference hardware has been replaced by the EdgeRouter Lite (`edgerouter`) hardware.

The previous reference BSPs for the `beagleboard` and `routerstationpro` machines are still available in a new `meta-yocto-bsp-old` layer in the [Source Repositories](http://git.yoctoproject.org/cgit/cgit.cgi/meta-yocto-bsp-old/) at <http://git.yoctoproject.org/cgit/cgit.cgi/meta-yocto-bsp-old/>.

5.6. Moving to the Yocto Project 1.7 Release ¶

This section provides migration information for moving to the Yocto Project 1.7 Release from the prior release.

5.6.1. Changes to Setting QEMU `PACKAGECONFIG` Options in `local.conf` ¶

The QEMU recipe now uses a number of `PACKAGECONFIG` options to enable various optional features. The method used to set defaults for these options means that existing `local.conf` files will need to be modified to append to `PACKAGECONFIG` for `qemu-native` and `nativesdk-qemu` instead of setting it. In other words, to enable graphical output for QEMU, you should now have these lines in `local.conf`:

```
PACKAGECONFIG_append_pn-qemu-native = " sdl"
PACKAGECONFIG_append_pn-nativesdk-qemu = " sdl"
```

5.6.2. Minimum Git version ¶

The minimum `Git` version required on the build host is now 1.7.8 because the `--list` option is now required by BitBake's Git fetcher. As always, if your host distribution does not provide a version of Git that meets this requirement, you can use the `buildtools-tarball` that does. See the "[Required Git, tar, and Python Versions](#)" section for more information.

5.6.3. Autotools Class Changes ¶

The following `autotools` class changes occurred:

- **A separate build directory is now used by default:** The `autotools` class has been changed to use a directory for building (`B`), which is separate from the source directory (`S`). This is commonly referred to as `B != S`, or an out-of-tree build.

If the software being built is already capable of building in a directory separate from the source, you do not need to do anything. However, if the software is not capable of being built in this manner, you will need to either patch the software so that it can build separately, or you will need to change the recipe to inherit the `autotools-brokensep` class instead of the `autotools` or `autotools_stage` classes.

- **The `--foreign` option is no longer passed to `automake` when running `autoconf`:** This option tells `automake` that a particular software package does not follow the GNU standards and therefore should not be expected to distribute certain files such as `ChangeLog`, `AUTHORS`, and so forth. Because the majority of upstream software packages already tell `automake` to enable foreign mode themselves, the option is mostly superfluous. However, some recipes will need patches for this change. You can easily make the change by patching `configure.ac` so that it passes "foreign" to `AM_INIT_AUTOMAKE()`. See [this commit](#) for an example showing how to make the patch.

5.6.4. Binary Configuration Scripts Disabled ¶

Some of the core recipes that package binary configuration scripts now disable the scripts due to the scripts previously requiring error-prone path substitution. Software that links against these libraries using these scripts should use the much more robust `pkg-config` instead. The list of recipes changed in this version (and their configuration scripts) is as follows:

```

directfb (directfb-config)
freetype (freetype-config)
gpgme (gpgme-config)
libassuan (libassuan-config)
libcroco (croco-6.0-config)
libgcrypt (libgcrypt-config)
libgpg-error (gpg-error-config)
libksba (ksba-config)
libpcap (pcap-config)
libpcre (pcre-config)
libpng (libpng-config, libpng16-config)
libsdl (sdl-config)
libusb-compat (libusb-config)
libxml2 (xml2-config)
libxslt (xslt-config)
ncurses (ncurses-config)
neon (neon-config)
npth (npth-config)
pth (pth-config)
taglib (taglib-config)

```

Additionally, support for `pkg-config` has been added to some recipes in the previous list in the rare cases where the upstream software package does not already provide it.

5.6.5. `eglibc 2.19` Replaced with `glibc 2.20`

Because `eglibc` and `glibc` were already fairly close, this replacement should not require any significant changes to other software that links to `eglibc`. However, there were a number of minor changes in `glibc 2.20` upstream that could require patching some software (e.g. the removal of the `_BSD_SOURCE` feature test macro).

`glibc 2.20` requires version 2.6.32 or greater of the Linux kernel. Thus, older kernels will no longer be usable in conjunction with it.

For full details on the changes in `glibc 2.20`, see the upstream release notes [here](#).

5.6.6. Kernel Module Autoloading

The `module_autoload_*` variable is now deprecated and a new `KERNEL_MODULE_AUTOLOAD` variable should be used instead. Also, `module_conf_*` must now be used in conjunction with a new `KERNEL_MODULE_PROBECONF` variable. The new variables no longer require you to specify the module name as part of the variable name. This change not only simplifies usage but also allows the values of these variables to be appropriately incorporated into task signatures and thus trigger the appropriate tasks to re-execute when changed. You should replace any references to `module_autoload_*` with `KERNEL_MODULE_AUTOLOAD`, and add any modules for which `module_conf_*` is specified to `KERNEL_MODULE_PROBECONF`.

For more information, see the `KERNEL_MODULE_AUTOLOAD` and `KERNEL_MODULE_PROBECONF` variables.

5.6.7. QA Check Changes

The following changes have occurred to the QA check process:

- Additional QA checks `file-rdeps` and `build-deps` have been added in order to verify that file dependencies are satisfied (e.g. package contains a script requiring `/bin/bash`) and build-time dependencies are declared, respectively. For more information, please see the "[QA Error and Warning Messages](#)" chapter.
- Package QA checks are now performed during a new `do_package_qa` task rather than being part of the `do_package` task. This allows more parallel execution. This change is unlikely to be an issue except for highly customized recipes that disable packaging tasks themselves by marking them as `noexec`. For those packages, you will need to disable the `do_package_qa` task as well.
- Files being overwritten during the `do_populate_sysroot` task now trigger an error instead of a warning. Recipes should not be overwriting files written to the `sysroot` by other recipes.

If you have these types of recipes, you need to alter them so that they do not overwrite these files.

You might now receive this error after changes in configuration or metadata resulting in orphaned files being left in the sysroot. If you do receive this error, the way to resolve the issue is to delete your `TMPDIR` or to move it out of the way and then re-start the build. Anything that has been fully built up to that point and does not need rebuilding will be restored from the shared state cache and the rest of the build will be able to proceed as normal.

5.6.8. Removed Recipes ¶

The following recipes have been removed:

- `x-load`: This recipe has been superseded by U-boot SPL for all Cortex-based TI SoCs. For legacy boards, the `meta-ti` layer, which contains a maintained recipe, should be used instead.
- `ubootchart`: This recipe is obsolete. A `bootchart2` recipe has been added to functionally replace it.
- `linux-yocto 3.4`: Support for the linux-yocto 3.4 kernel has been dropped. Support for the 3.10 and 3.14 kernels remains, while support for version 3.17 has been added.
- `eglibc` has been removed in favor of `glibc`. See the "[eglibc 2.19 Replaced with glibc 2.20](#)" section for more information.

5.6.9. Miscellaneous Changes ¶

The following miscellaneous change occurred:

- The build history feature now writes `build-id.txt` instead of `build-id`. Additionally, `build-id.txt` now contains the full build header as printed by BitBake upon starting the build. You should manually remove old "build-id" files from your existing build history repositories to avoid confusion. For information on the build history feature, see the "[Maintaining Build Output Quality](#)" section.

5.7. Moving to the Yocto Project 1.8 Release ¶

This section provides migration information for moving to the Yocto Project 1.8 Release from the prior release.

5.7.1. Removed Recipes ¶

The following recipes have been removed:

- `owl-video`: Functionality replaced by `gst-player`.
- `gaku`: Functionality replaced by `gst-player`.
- `gnome-desktop`: This recipe is now available in `meta-gnome` and is no longer needed.
- `gsettings-desktop-schemas`: This recipe is now available in `meta-gnome` and is no longer needed.
- `python-argparse`: The `argparse` module is already provided in the default Python distribution in a package named `python-argparse`. Consequently, the separate `python-argparse` recipe is no longer needed.

- `telepathy-python`, `libtelepathy`, `telepathy-glib`, `telepathy-idle`, `telepathy-mission-control`: All these recipes have moved to `meta-oe` and are consequently no longer needed by any recipes in `OpenEmbedded-Core`.
- `linux-yocto_3.10` and `linux-yocto_3.17`: Support for the `linux-yocto` 3.10 and 3.17 kernels has been dropped. Support for the 3.14 kernel remains, while support for 3.19 kernel has been added.
- `poky-feed-config-opkg`: This recipe has become obsolete and is no longer needed. Use `distro-feed-config` from `meta-oe` instead.
- `libav 0.8.x`: `libav 9.x` is now used.
- `sed-native`: No longer needed. A working version of `sed` is expected to be provided by the host distribution.

5.7.2. BlueZ 4.x / 5.x Selection ¶

Proper built-in support for selecting BlueZ 5.x in preference to the default of 4.x now exists. To use BlueZ 5.x, simply add `"bluez5"` to your `DISTRO_FEATURES` value. If you had previously added append files (`*.bbappend`) to make this selection, you can now remove them.

Additionally, a `bluetooth` class has been added to make selection of the appropriate bluetooth support within a recipe a little easier. If you wish to make use of this class in a recipe, add something such as the following:

```
inherit bluetooth
PACKAGECONFIG ??= "${@bb.utils.contains('DISTRO_FEATURES', 'bluetooth', '${BLUEZ}', '', d)}
PACKAGECONFIG[bluez4] = "--enable-bluetooth,--disable-bluetooth,bluez4"
PACKAGECONFIG[bluez5] = "--enable-bluez5,--disable-bluez5,bluez5"
```

5.7.3. Kernel Build Changes ¶

The kernel build process was changed to place the source in a common shared work area and to place build artifacts separately in the source code tree. In theory, migration paths have been provided for most common usages in kernel recipes but this might not work in all cases. In particular, users need to ensure that `${S}` (source files) and `${B}` (build artifacts) are used correctly in functions such as `do_configure` and `do_install`. For kernel recipes that do not inherit from `kernel-yocto` or include `linux-yocto.inc`, you might wish to refer to the `linux.inc` file in the `meta-oe` layer for the kinds of changes you need to make. For reference, here is the [commit](#) where the `linux.inc` file in `meta-oe` was updated.

Recipes that rely on the kernel source code and do not inherit the module classes might need to add explicit dependencies on the `do_shared_workdir` kernel task, for example:

```
do_configure[depends] += "virtual/kernel:do_shared_workdir"
```

5.7.4. SSL 3.0 is Now Disabled in OpenSSL ¶

SSL 3.0 is now disabled when building OpenSSL. Disabling SSL 3.0 avoids any lingering instances of the POODLE vulnerability. If you feel you must re-enable SSL 3.0, then you can add an append file (`*.bbappend`) for the `openssl` recipe to remove `"-no-ssl3"` from `EXTRA_OECONF`.

5.7.5. Default Sysroot Poisoning ¶

`gcc`'s default sysroot and include directories are now "poisoned". In other words, the sysroot and include directories are being redirected to a non-existent location in order to catch when host directories are being used due to the correct options not being passed. This poisoning applies both to the cross-compiler used within the build and to the cross-compiler produced in

the SDK.

If this change causes something in the build to fail, it almost certainly means the various compiler flags and commands are not being passed correctly to the underlying piece of software. In such cases, you need to take corrective steps.

5.7.6. Rebuild Improvements ¶

Changes have been made to the `base`, `autotools`, and `cmake` classes to clean out generated files when the `do_configure` task needs to be re-executed.

One of the improvements is to attempt to run "make clean" during the `do_configure` task if a `Makefile` exists. Some software packages do not provide a working clean target within their make files. If you have such recipes, you need to set `CLEANBROKEN` to "1" within the recipe, for example:

```
CLEANBROKEN = "1"
```

5.7.7. QA Check and Validation Changes ¶

The following QA Check and Validation Changes have occurred:

- Usage of `PRINC` previously triggered a warning. It now triggers an error. You should remove any remaining usage of `PRINC` in any recipe or append file.
- An additional QA check has been added to detect usage of `${D}` in `FILES` values where `D` values should not be used at all. The same check ensures that `$D` is used in `pkg_preinst/pkg_postinst/pkg_prerm/pkg_postrm` functions instead of `${D}`.
- `S` now needs to be set to a valid value within a recipe. If `S` is not set in the recipe, the directory is not automatically created. If `S` does not point to a directory that exists at the time the `do_unpack` task finishes, a warning will be shown.
- `LICENSE` is now validated for correct formatting of multiple licenses. If the format is invalid (e.g. multiple licenses are specified with no operators to specify how the multiple licenses interact), then a warning will be shown.

5.7.8. Miscellaneous Changes ¶

The following miscellaneous changes have occurred:

- The `send-error-report` script now expects a "-s" option to be specified before the server address. This assumes a server address is being specified.
- The `oe-pkgdata-util` script now expects a "-p" option to be specified before the `pkgdata` directory, which is now optional. If the `pkgdata` directory is not specified, the script will run BitBake to query `PKGDATA_DIR` from the build environment.

5.8. Moving to the Yocto Project 2.0 Release ¶

This section provides migration information for moving to the Yocto Project 2.0 Release from the prior release.

5.8.1. GCC 5 ¶

The default compiler is now GCC 5.2. This change has required fixes for compilation errors in a number of other recipes.

One important example is a fix for when the Linux kernel freezes at boot time on ARM when built with GCC 5. If you are using your own kernel recipe or source tree and building for ARM, you will likely need to apply this [patch](#). The standard `linux-yocto` kernel source tree already has a workaround for the same issue.

For further details, see <https://gcc.gnu.org/gcc-5/changes.html> and the porting guide at https://gcc.gnu.org/gcc-5/porting_to.html.

Alternatively, you can switch back to GCC 4.9 or 4.8 by setting `GCCVERSION` in your configuration, as follows:

```
GCCVERSION = "4.9%"
```

5.8.2. Gstreamer 0.10 Removed

Gstreamer 0.10 has been removed in favor of Gstreamer 1.x. As part of the change, recipes for Gstreamer 0.10 and related software are now located in `meta-multimedia`. This change results in Qt4 having Phonon and Gstreamer support in QtWebkit disabled by default.

5.8.3. Removed Recipes

The following recipes have been moved or removed:

- `bluez4`: The recipe is obsolete and has been moved due to `bluez5` becoming fully integrated. The `bluez4` recipe now resides in `meta-oe`.
- `gamin`: The recipe is obsolete and has been removed.
- `gnome-icon-theme`: The recipe's functionality has been replaced by `adwaita-icon-theme`.
- `Gstreamer 0.10 Recipes`: Recipes for Gstreamer 0.10 have been removed in favor of the recipes for Gstreamer 1.x.
- `insserv`: The recipe is obsolete and has been removed.
- `libunique`: The recipe is no longer used and has been moved to `meta-oe`.
- `midori`: The recipe's functionality has been replaced by `epiphany`.
- `python-gst`: The recipe is obsolete and has been removed since it only contains bindings for Gstreamer 0.10.
- `qt-mobility`: The recipe is obsolete and has been removed since it requires Gstreamer 0.10, which has been replaced.
- `subversion`: All 1.6.x versions of this recipe have been removed.
- `webkit-gtk`: The older 1.8.3 version of this recipe has been removed in favor of `webkitgtk`.

5.8.4. BitBake datastore improvements

The method by which BitBake's datastore handles overrides has changed. Overrides are now applied dynamically and `bb.data.update_data()` is now a no-op. Thus, `bb.data.update_data()` is no longer required in order to apply the correct overrides. In practice, this change is unlikely to require any changes to Metadata. However, these minor changes in behavior exist:

- All potential overrides are now visible in the variable history as seen when you run the following:

```
$ bitbake -e
```

- `d.delVar('VARNAME')` and `d.setVar('VARNAME', None)` result in the variable and all of its overrides being cleared out. Before the change, only the non-overridden values were cleared.

5.8.5. Shell Message Function Changes ¶

The shell versions of the BitBake message functions (i.e. `bbdebug`, `bbnote`, `bbwarn`, `bbplain`, `bberror`, and `bbfatal`) are now connected through to their BitBake equivalents `bb.debug()`, `bb.note()`, `bb.warn()`, `bb.plain()`, `bb.error()`, and `bb.fatal()`, respectively. Thus, those message functions that you would expect to be printed by the BitBake UI are now actually printed. In practice, this change means two things:

- If you now see messages on the console that you did not previously see as a result of this change, you might need to clean up the calls to `bbwarn`, `bberror`, and so forth. Or, you might want to simply remove the calls.
- The `bbfatal` message function now suppresses the full error log in the UI, which means any calls to `bbfatal` where you still wish to see the full error log should be replaced by `die` or `bbfatal_log`.

5.8.6. Extra Development/Debug Package Cleanup ¶

The following recipes have had extra dev/dbg packages removed:

- `acl`
- `apmd`
- `aspell`
- `attr`
- `augeas`
- `bzip2`
- `cogl`
- `curl`
- `elfutils`
- `gcc-target`
- `libgcc`
- `libtool`
- `libxmu`
- `opkg`
- `pciutils`
- `rpm`
- `sysfsutils`
- `tiff`
- `xz`

All of the above recipes now conform to the standard packaging scheme where a single `-dev`, `-`

dbg, and `-staticdev` package exists per recipe.

5.8.7. Recipe Maintenance Tracking Data Moved to OE-Core

Maintenance tracking data for recipes that was previously part of meta-yocto has been moved to OE-Core. The change includes `package_regex.inc` and `distro_alias.inc`, which are typically enabled when using the `distrodata` class. Additionally, the contents of `upstream_tracking.inc` has now been split out to the relevant recipes.

5.8.8. Automatic Stale Sysroot File Cleanup

Stale files from recipes that no longer exist in the current configuration are now automatically removed from sysroot as well as removed from any other place managed by shared state. This automatic cleanup means that the build system now properly handles situations such as renaming the build system side of recipes, removal of layers from `bblayers.conf`, and `DISTRO_FEATURES` changes.

Additionally, work directories for old versions of recipes are now pruned. If you wish to disable pruning old work directories, you can set the following variable in your configuration:

```
SSTATE_PRUNE_OBSOLETEWORKDIR = "0"
```

5.8.9. linux-yocto Kernel Metadata Repository Now Split from Source

The linux-yocto tree has up to now been a combined set of kernel changes and configuration (meta) data carried in a single tree. While this format is effective at keeping kernel configuration and source modifications synchronized, it is not always obvious to developers how to manipulate the Metadata as compared to the source.

Metadata processing has now been removed from the `kernel-yocto` class and the external Metadata repository `yocto-kernel-cache`, which has always been used to seed the linux-yocto "meta" branch. This separate linux-yocto cache repository is now the primary location for this data. Due to this change, linux-yocto is no longer able to process combined trees. Thus, if you need to have your own combined kernel repository, you must do the split there as well and update your recipes accordingly. See the `meta/recipes-kernel/linux/linux-yocto_4.1.bb` recipe for an example.

5.8.10. Additional QA checks

The following QA checks have been added:

- Added a "host-user-contaminated" check for ownership issues for packaged files outside of `/home`. The check looks for files that are incorrectly owned by the user that ran BitBake instead of owned by a valid user in the target system.
- Added an "invalid-chars" check for invalid (non-UTF8) characters in recipe metadata variable values (i.e. `DESCRIPTION`, `SUMMARY`, `LICENSE`, and `SECTION`). Some package managers do not support these characters.
- Added an "invalid-packageconfig" check for any options specified in `PACKAGECONFIG` that do not match any `PACKAGECONFIG` option defined for the recipe.

5.8.11. Miscellaneous Changes

These additional changes exist:

- `gtk-update-icon-cache` has been renamed to `gtk-icon-utils`.

- The tools-profile `IMAGE_FEATURES` item as well as its corresponding packagegroup and packagegroup-core-tools-profile no longer bring in `oprofile`. Bringing in `oprofile` was originally added to aid compilation on resource-constrained targets. However, this aid has not been widely used and is not likely to be used going forward due to the more powerful target platforms and the existence of better cross-compilation tools.
- The `IMAGE_FSTYPES` variable's default value now specifies `ext4` instead of `ext3`.
- All support for the `PRINC` variable has been removed.
- The packagegroup-core-full-cmdline packagegroup no longer brings in `lighttpd` due to the fact that bringing in `lighttpd` is not really in line with the packagegroup's purpose, which is to add full versions of command-line tools that by default are provided by `busybox`.

Chapter 6. Source Directory Structure

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The [Source Directory](#) consists of several components. Understanding them and knowing where they are located is key to using the Yocto Project well. This chapter describes the Source Directory and gives information about the various files and directories.

For information on how to establish a local Source Directory on your development system, see the "[Getting Set Up](#)" section in the Yocto Project Development Manual.

Note

The OpenEmbedded build system does not support file or directory names that contain spaces. Be sure that the Source Directory you use does not contain these types of names.

6.1. Top-Level Core Components ¶

This section describes the top-level components of the [Source Directory](#).

6.1.1. bitbake/ ¶

This directory includes a copy of BitBake for ease of use. The copy usually matches the current stable BitBake release from the BitBake project. BitBake, a [Metadata](#) interpreter, reads the Yocto Project Metadata and runs the tasks defined by that data. Failures are usually from the Metadata and not from BitBake itself. Consequently, most users do not need to worry about BitBake.

When you run the `bitbake` command, the main BitBake executable, which resides in the `bitbake/bin/` directory, starts. Sourcing an environment setup script (e.g. `oe-init-build-env` or `oe-init-build-env-memres`) places the scripts and `bitbake/bin` directories (in that order) into the shell's `PATH` environment variable.

For more information on BitBake, see the [BitBake User Manual](#).

6.1.2. build/ ¶

This directory contains user configuration files and the output generated by the OpenEmbedded build system in its standard configuration where the source tree is combined with the output. The [Build Directory](#) is created initially when you source the OpenEmbedded build environment setup script (i.e. `oe-init-build-env` or `oe-init-build-env-memres`).

It is also possible to place output and configuration files in a directory separate from the [Source Directory](#) by providing a directory name when you source the setup script. For information on separating output from your local Source Directory files, see the "`oe-init-build-env`" and "`oe-init-build-env-memres`" sections.

6.1.3. `documentation/`

This directory holds the source for the Yocto Project documentation as well as templates and tools that allow you to generate PDF and HTML versions of the manuals. Each manual is contained in a sub-folder. For example, the files for this manual reside in the `ref-manual/` directory.

6.1.4. `meta/`

This directory contains the OpenEmbedded Core metadata. The directory holds recipes, common classes, and machine configuration for emulated targets (`qemux86`, `qemuarm`, and so forth.)

6.1.5. `meta-yocto/`

This directory contains the configuration for the Poky reference distribution.

6.1.6. `meta-yocto-bsp/`

This directory contains the Yocto Project reference hardware Board Support Packages (BSPs). For more information on BSPs, see the [Yocto Project Board Support Package \(BSP\) Developer's Guide](#).

6.1.7. `meta-selftest/`

This directory adds additional recipes and append files used by the OpenEmbedded selftests to verify the behavior of the build system.

You do not have to add this layer to your `bbayers.conf` file unless you want to run the selftests.

6.1.8. `meta-skeleton/`

This directory contains template recipes for BSP and kernel development.

6.1.9. `scripts/`

This directory contains various integration scripts that implement extra functionality in the Yocto Project environment (e.g. QEMU scripts). The `oe-init-build-env` and `oe-init-build-env-memres` scripts append this directory to the shell's `PATH` environment variable.

The `scripts` directory has useful scripts that assist in contributing back to the Yocto Project, such as `create-pull-request` and `send-pull-request`.

6.1.10. `oe-init-build-env`

This script is one of two scripts that set up the OpenEmbedded build environment. For information on the other script, see the "`oe-init-build-env-memres`" section.

Running this script with the `source` command in a shell makes changes to `PATH` and sets other core BitBake variables based on the current working directory. You need to run an environment setup script before running BitBake commands. The script uses other scripts within the `scripts` directory to do the bulk of the work.

When you run this script, your Yocto Project environment is set up, a [Build Directory](#) is created, your working directory becomes the Build Directory, and you are presented with a list of common BitBake targets. Here is an example:

```

$ source oe-init-build-env

### Shell environment set up for builds. ###

You can now run 'bitbake <target>'

Common targets are:
  core-image-minimal
  core-image-sato
  meta-toolchain
  adt-installer
  meta-ide-support

You can also run generated qemu images with a command like 'runqemu qemux86'

```

The script gets its default list of common targets from the `conf-notes.txt` file, which is found in the `meta-yocto` directory within the [Source Directory](#). Should you have custom distributions, it is very easy to modify this configuration file to include your targets for your distribution. See the "[Creating a Custom Template Configuration Directory](#)" section in the Yocto Project Development Manual for more information.

By default, running this script without a [Build Directory](#) argument creates the build directory in your current working directory. If you provide a Build Directory argument when you source the script, you direct the OpenEmbedded build system to create a Build Directory of your choice. For example, the following command creates a Build Directory named `mybuilds` that is outside of the [Source Directory](#):

```
$ source oe-init-build-env ~/mybuilds
```

The OpenEmbedded build system uses the template configuration files, which are found by default in the `meta-yocto/conf` directory in the [Source Directory](#). See the "[Creating a Custom Template Configuration Directory](#)" section in the Yocto Project Development Manual for more information.

Note

The OpenEmbedded build system does not support file or directory names that contain spaces. If you attempt to run the `oe-init-build-env` script from a Source Directory that contains spaces in either the filenames or directory names, the script returns an error indicating no such file or directory. Be sure to use a Source Directory free of names containing spaces.

6.1.11. `oe-init-build-env-memres`

This script is one of two scripts that set up the OpenEmbedded build environment. Aside from setting up the environment, this script starts a memory-resident BitBake server. For information on the other setup script, see the "[oe-init-build-env](#)" section.

Memory-resident BitBake resides in memory until you specifically remove it using the following BitBake command:

```
$ bitbake -m
```

Running this script with the `source` command in a shell makes changes to `PATH` and sets other core BitBake variables based on the current working directory. One of these variables is the `BBSERVER` variable, which allows the OpenEmbedded build system to locate the server that is running BitBake.

You need to run an environment setup script before using BitBake commands. Following is the script syntax:

```
$ source oe-init-build-env-memres port_number build_dir
```

Following are some considerations when sourcing this script:

- The script uses other scripts within the `scripts` directory to do the bulk of the work.
- If you do not provide a port number with the script, the BitBake server starts at a randomly

selected port.

- The script's parameters are positionally dependent. Consequently, you cannot run the script and provide a [Build Directory](#) name without also providing a port number. In other words, the following syntax is illegal:

```
$ source oe-initbuild-env-memres build_dir
```

Note

The previous restriction might be resolved in the future. See [Bug 7555](#) for more information.

When you run this script, your Yocto Project environment is set up, a Build Directory is created, your working directory becomes the Build Directory, and you are presented with a list of common BitBake targets. Here is an example:

```
$ source oe-init-build-env-memres
No port specified, using dynamically selected port

### Shell environment set up for builds. ###

You can now run 'bitbake <target>'

Common targets are:
  core-image-minimal
  core-image-sato
  meta-toolchain
  adt-installer
  meta-ide-support

You can also run generated qemu images with a command like 'runqemu qemu86'
Bitbake server address: 127.0.0.1, server port: 53995
Bitbake server started on demand as needed, use bitbake -m to shut it down
```

The script gets its default list of common targets from the `conf-notes.txt` file, which is found in the `meta-yocto` directory within the [Source Directory](#). Should you have custom distributions, it is very easy to modify this configuration file to include your targets for your distribution. See the "[Creating a Custom Template Configuration Directory](#)" section in the Yocto Project Development Manual for more information.

By default, running this script without a [Build Directory](#) argument creates a build directory named `build`. If you provide a Build Directory argument and port number when you source the script, the Build Directory is created using that name. For example, the following command starts the BitBake server using port 53995 and creates a Build Directory named `mybuilds` that is outside of the [Source Directory](#):

```
$ source oe-init-build-env-memres 53995 ~/mybuilds
```

The `oe-init-build-env-memres` script starts a memory resident BitBake server. This BitBake instance uses the `bitbake-cookerdaemon.log` file, which is located in the Build Directory.

The OpenEmbedded build system uses the template configuration files, which are found by default in the `meta-yocto/conf` directory in the [Source Directory](#). See the "[Creating a Custom Template Configuration Directory](#)" section in the Yocto Project Development Manual for more information.

Note

The OpenEmbedded build system does not support file or directory names that contain spaces. If you attempt to run the `oe-init-build-env-memres` script from a Source Directory that contains spaces in either the filenames or directory names, the script returns an error indicating no such file or directory. Be sure to use a Source Directory free of names containing spaces.

6.1.12. LICENSE, README, and README.hardware ¶

These files are standard top-level files.

6.2. The Build Directory - `build/`

The OpenEmbedded build system creates the [Build Directory](#) when you run one of the build environment setup scripts (i.e. `oe-init-build-env` or `oe-init-build-env-memres`).

If you do not give the Build Directory a specific name when you run a setup script, the name defaults to `build`.

The `TOPDIR` variable points to the Build Directory.

6.2.1. `build/buildhistory`

The OpenEmbedded build system creates this directory when you enable the build history feature. The directory tracks build information into image, packages, and SDK subdirectories. For information on the build history feature, see the "[Maintaining Build Output Quality](#)" section.

6.2.2. `build/conf/local.conf`

This configuration file contains all the local user configurations for your build environment. The `local.conf` file contains documentation on the various configuration options. Any variable set here overrides any variable set elsewhere within the environment unless that variable is hard-coded within a file (e.g. by using '=' instead of '?='). Some variables are hard-coded for various reasons but these variables are relatively rare.

Edit this file to set the [MACHINE](#) for which you want to build, which package types you wish to use ([PACKAGE_CLASSES](#)), and the location from which you want to access downloaded files ([DL_DIR](#)).

If `local.conf` is not present when you start the build, the OpenEmbedded build system creates it from `local.conf.sample` when you source the top-level build environment setup script (i.e. `oe-init-build-env` or `oe-init-build-env-memres`).

The source `local.conf.sample` file used depends on the `$TEMPLATECONF` script variable, which defaults to `meta-yocto/conf` when you are building from the Yocto Project development environment and defaults to `meta/conf` when you are building from the OpenEmbedded Core environment. Because the script variable points to the source of the `local.conf.sample` file, this implies that you can configure your build environment from any layer by setting the variable in the top-level build environment setup script as follows:

```
TEMPLATECONF=your_layer/conf
```

Once the build process gets the sample file, it uses `sed` to substitute final `${OEROOT}` values for all `##OEROOT##` values.

Note

You can see how the `TEMPLATECONF` variable is used by looking at the `scripts/oe-setup-builddir` script in the [Source Directory](#). You can find the Yocto Project version of the `local.conf.sample` file in the `meta-yocto/conf` directory.

6.2.3. `build/conf/bblayers.conf`

This configuration file defines [layers](#), which are directory trees, traversed (or walked) by BitBake. The `bblayers.conf` file uses the [BBLAYERS](#) variable to list the layers BitBake tries to find.

If `bblayers.conf` is not present when you start the build, the OpenEmbedded build system creates it from `bblayers.conf.sample` when you source the top-level build environment setup

script (i.e. `oe-init-build-env` or `oe-init-build-env-memres`).

The source `bblayers.conf.sample` file used depends on the `$TEMPLATECONF` script variable, which defaults to `meta-yocto/conf` when you are building from the Yocto Project development environment and defaults to `meta/conf` when you are building from the OpenEmbedded Core environment. Because the script variable points to the source of the `bblayers.conf.sample` file, this implies that you can base your build from any layer by setting the variable in the top-level build environment setup script as follows:

```
TEMPLATECONF=your_layer/conf
```

Once the build process gets the sample file, it uses `sed` to substitute final `${OEROOT}` values for all `##OEROOT##` values.

Note

You can see how the `TEMPLATECONF` variable `scripts/oe-setup-builddir` script in the [Source Directory](#). You can find the Yocto Project version of the `bblayers.conf.sample` file in the `meta-yocto/conf` directory.

6.2.4. `build/conf/sanity_info`

This file indicates the state of the sanity checks and is created during the build.

6.2.5. `build/downloads`

This directory contains downloaded upstream source tarballs. You can reuse the directory for multiple builds or move the directory to another location. You can control the location of this directory through the `DL_DIR` variable.

6.2.6. `build/sstate-cache`

This directory contains the shared state cache. You can reuse the directory for multiple builds or move the directory to another location. You can control the location of this directory through the `SSTATE_DIR` variable.

6.2.7. `build/tmp`

The OpenEmbedded build system creates and uses this directory for all the build system's output. The `TMPDIR` variable points to this directory.

BitBake creates this directory if it does not exist. As a last resort, to clean up a build and start it from scratch (other than the downloads), you can remove everything in the `tmp` directory or get rid of the directory completely. If you do, you should also completely remove the `build/sstate-cache` directory.

6.2.8. `build/tmp/buildstats`

This directory stores the build statistics.

6.2.9. `build/tmp/cache`

When BitBake parses the metadata, it creates a cache file of the result that can be used when subsequently running commands. BitBake stores these results here on a per-machine basis.

6.2.10. `build/tmp/deploy`

This directory contains any "end result" output from the OpenEmbedded build process. The `DEPLOY_DIR` variable points to this directory. For more detail on the contents of the `deploy` directory, see the "[Images](#)" and "[Application Development SDK](#)" sections.

6.2.11. `build/tmp/deploy/deb/`

This directory receives any `.deb` packages produced by the build process. The packages are sorted into feeds for different architecture types.

6.2.12. `build/tmp/deploy/rpm/`

This directory receives any `.rpm` packages produced by the build process. The packages are sorted into feeds for different architecture types.

6.2.13. `build/tmp/deploy/ipk/`

This directory receives `.ipk` packages produced by the build process.

6.2.14. `build/tmp/deploy/licenses/`

This directory receives package licensing information. For example, the directory contains sub-directories for `bash`, `busybox`, and `glibc` (among others) that in turn contain appropriate `COPYING` license files with other licensing information. For information on licensing, see the "[Maintaining Open Source License Compliance During Your Product's Lifecycle](#)" section.

6.2.15. `build/tmp/deploy/images/`

This directory receives complete filesystem images. If you want to flash the resulting image from a build onto a device, look here for the image.

Be careful when deleting files in this directory. You can safely delete old images from this directory (e.g. `core-image-*`, `hob-image-*`, etc.). However, the kernel (`*zImage*`, `*uImage*`, etc.), bootloader and other supplementary files might be deployed here prior to building an image. Because these files are not directly produced from the image, if you delete them they will not be automatically re-created when you build the image again.

If you do accidentally delete files here, you will need to force them to be re-created. In order to do that, you will need to know the target that produced them. For example, these commands rebuild and re-create the kernel files:

```
$ bitbake -c clean virtual/kernel
$ bitbake virtual/kernel
```

6.2.16. `build/tmp/deploy/sdk/`

The OpenEmbedded build system creates this directory to hold toolchain installer scripts, which when executed, install the sysroot that matches your target hardware. You can find out more about these installers in the "[Optionally Building a Toolchain Installer](#)" section in the Yocto Project Application Developer's Guide.

6.2.17. `build/tmp/sstate-control/`

The OpenEmbedded build system uses this directory for the shared state manifest files. The shared state code uses these files to record the files installed by each `sstate` task so that the files can be removed when cleaning the recipe or when a newer version is about to be installed. The build system also uses the manifests to detect and produce a warning when files from one task are overwriting those from another.

6.2.18. `build/tmp/sysroots/`

This directory contains shared header files and libraries as well as other shared data. Packages that need to share output with other packages do so within this directory. The directory is subdivided by architecture so multiple builds can run within the one Build Directory.

6.2.19. `build/tmp/stamps/`

This directory holds information that BitBake uses for accounting purposes to track what tasks have run and when they have run. The directory is sub-divided by architecture, package name, and version. Following is an example:

```
stamps/all-poky-linux/distcc-config/1.0-r0.do_build-2fdd....2do
```

Although the files in the directory are empty of data, BitBake uses the filenames and timestamps for tracking purposes.

6.2.20. `build/tmp/log/`

This directory contains general logs that are not otherwise placed using the package's `WORKDIR`. Examples of logs are the output from the `do_check_pkg` or `do_distro_check` tasks. Running a build does not necessarily mean this directory is created.

6.2.21. `build/tmp/work/`

This directory contains architecture-specific work sub-directories for packages built by BitBake. All tasks execute from the appropriate work directory. For example, the source for a particular package is unpacked, patched, configured and compiled all within its own work directory. Within the work directory, organization is based on the package group and version for which the source is being compiled as defined by the `WORKDIR`.

It is worth considering the structure of a typical work directory. As an example, consider `linux-yocto-kernel-3.0` on the machine `qemux86` built within the Yocto Project. For this package, a work directory of `tmp/work/qemux86-poky-linux/linux-yocto/3.0+git1+<....>`, referred to as the `WORKDIR`, is created. Within this directory, the source is unpacked to `linux-qemux86-standard-build` and then patched by Quilt. (See the "[Using Quilt in Your Workflow](#)" section in the Yocto Project Development Manual for more information.) Within the `linux-qemux86-standard-build` directory, standard Quilt directories `linux-3.0/patches` and `linux-3.0/.pc` are created, and standard Quilt commands can be used.

There are other directories generated within `WORKDIR`. The most important directory is `WORKDIR/tmp/`, which has log files for each task (`log.do_*.pid`) and contains the scripts BitBake runs for each task (`run.do_*.pid`). The `WORKDIR/image/` directory is where "make install" places its output that is then split into sub-packages within `WORKDIR/packages-split/`.

6.2.22. `build/tmp/work-shared/`

For efficiency, the OpenEmbedded build system creates and uses this directory to hold recipes that share a work directory with other recipes. In practice, this is only used for `gcc` and its variants (e.g. `gcc-cross`, `libgcc`, `gcc-runtime`, and so forth).

6.3. The Metadata - `meta/`

As mentioned previously, `Metadata` is the core of the Yocto Project. Metadata has several important subdivisions:

6.3.1. `meta/classes/`

This directory contains the `*.bbclass` files. Class files are used to abstract common code so it can be reused by multiple packages. Every package inherits the `base.bbclass` file. Examples of other important classes are `autotools.bbclass`, which in theory allows any Autotool-enabled package to work with the Yocto Project with minimal effort. Another example is `kernel.bbclass` that contains common code and functions for working with the Linux kernel. Functions like image generation or packaging also have their specific class files such as `image.bbclass`, `rootfs_*.bbclass` and `package*.bbclass`.

For reference information on classes, see the "[Classes](#)" chapter.

6.3.2. `meta/conf/`

This directory contains the core set of configuration files that start from `bitbake.conf` and from which all other configuration files are included. See the include statements at the end of the `bitbake.conf` file and you will note that even `local.conf` is loaded from there. While `bitbake.conf` sets up the defaults, you can often override these by using the (`local.conf`) file, machine file or the distribution configuration file.

6.3.3. `meta/conf/machine/`

This directory contains all the machine configuration files. If you set `MACHINE = "qemux86"`, the OpenEmbedded build system looks for a `qemux86.conf` file in this directory. The `include` directory contains various data common to multiple machines. If you want to add support for a new machine to the Yocto Project, look in this directory.

6.3.4. `meta/conf/distro/`

The contents of this directory controls any distribution-specific configurations. For the Yocto Project, the `defaultsetup.conf` is the main file here. This directory includes the versions and the `SRCDATE` definitions for applications that are configured here. An example of an alternative configuration might be `poky-bleeding.conf`. Although this file mainly inherits its configuration from Poky.

6.3.5. `meta/conf/machine-sdk/`

The OpenEmbedded build system searches this directory for configuration files that correspond to the value of `SDKMACHINE`. By default, 32-bit and 64-bit x86 files ship with the Yocto Project that support some SDK hosts. However, it is possible to extend that support to other SDK hosts by adding additional configuration files in this subdirectory within another layer.

6.3.6. `meta/files/`

This directory contains common license files and several text files used by the build system. The text files contain minimal device information and lists of files and directories with known permissions.

6.3.7. `meta/lib/`

This directory contains OpenEmbedded Python library code used during the build process.

6.3.8. `meta/recipes-bsp/`

This directory contains anything linking to specific hardware or hardware configuration

information such as "u-boot" and "grub".

6.3.9. `meta/recipes-connectivity/`

This directory contains libraries and applications related to communication with other devices.

6.3.10. `meta/recipes-core/`

This directory contains what is needed to build a basic working Linux image including commonly used dependencies.

6.3.11. `meta/recipes-devtools/`

This directory contains tools that are primarily used by the build system. The tools, however, can also be used on targets.

6.3.12. `meta/recipes-extended/`

This directory contains non-essential applications that add features compared to the alternatives in core. You might need this directory for full tool functionality or for Linux Standard Base (LSB) compliance.

6.3.13. `meta/recipes-gnome/`

This directory contains all things related to the GTK+ application framework.

6.3.14. `meta/recipes-graphics/`

This directory contains X and other graphically related system libraries

6.3.15. `meta/recipes-kernel/`

This directory contains the kernel and generic applications and libraries that have strong kernel dependencies.

6.3.16. `meta/recipes-lsb4/`

This directory contains recipes specifically added to support the Linux Standard Base (LSB) version 4.x.

6.3.17. `meta/recipes-multimedia/`

This directory contains codecs and support utilities for audio, images and video.

6.3.18. `meta/recipes-qt/`

This directory contains all things related to the Qt application framework.

6.3.19. `meta/recipes-rt/`

This directory contains package and image recipes for using and testing the `PREEMPT_RT` kernel.

6.3.20. `meta/recipes-sato/`

This directory contains the Sato demo/reference UI/UX and its associated applications and

configuration data.

6.3.21. [meta/recipes-support/](#)

This directory contains recipes used by other recipes, but that are not directly included in images (i.e. dependencies of other recipes).

6.3.22. [meta/site/](#)

This directory contains a list of cached results for various architectures. Because certain "autoconf" test results cannot be determined when cross-compiling due to the tests not able to run on a live system, the information in this directory is passed to "autoconf" for the various architectures.

6.3.23. [meta/recipes.txt](#)

This file is a description of the contents of `recipes-*`.

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Class files are used to abstract common functionality and share it amongst multiple recipe (`.bb`) files. To use a class file, you simply make sure the recipe inherits the class. In most cases, when a recipe inherits a class it is enough to enable its features. There are cases, however, where in the recipe you might need to set variables or override some default behavior.

Any [Metadata](#) usually found in a recipe can also be placed in a class file. Class files are identified by the extension `.bbclass` and are usually placed in a `classes/` directory beneath the `meta*/` directory found in the [Source Directory](#). Class files can also be pointed to by [BUILDDIR](#) (e.g. `build/`) in the same way as `.conf` files in the `conf` directory. Class files are searched for in [BBPATH](#) using the same method by which `.conf` files are searched.

This chapter discusses only the most useful and important classes. Other classes do exist within the `meta/classes` directory in the [Source Directory](#). You can reference the `.bbclass` files directly for more information.

7.1. [allarch.bbclass](#)

The `allarch` class is inherited by recipes that do not produce architecture-specific output. The class disables functionality that is normally needed for recipes that produce executable binaries (such as building the cross-compiler and a C library as pre-requisites, and splitting out of debug symbols during packaging).

Note

Unlike some distro recipes (e.g. Debian), OpenEmbedded recipes that produce packages that depend on tunings through use of the `RDEPENDS` and `TUNE_PKGARCH` variables, should never be configured for all architectures using `allarch`. This is the case even if the recipes do not produce architecture-specific output.

Configuring such recipes for all architectures causes the `do_package_write_*` tasks to have different signatures for the machines with different tunings. Additionally, unnecessary rebuilds occur every time an image for a different `MACHINE` is built even when the recipe never changes.

By default, all recipes inherit the `base` and `package` classes, which enable functionality needed for recipes that produce executable output. If your recipe, for example, only produces packages that contain configuration files, media files, or scripts (e.g. Python and Perl), then it should inherit the `allarch` class.

7.2. `archiver.bbclass`

The `archiver` class supports releasing source code and other materials with the binaries.

For more details on the source archiver, see the "[Maintaining Open Source License Compliance During Your Product's Lifecycle](#)" section in the Yocto Project Development Manual. You can also see the `ARCHIVER_MODE` variable for information about the variable flags (varflags) that help control archive creation.

7.3. `autotools*.bbclass`

The `autotools*` classes support Autotooled packages.

The `autoconf`, `automake`, and `libtool` packages bring standardization. This class defines a set of tasks (e.g. `configure`, `compile` and so forth) that work for all Autotooled packages. It should usually be enough to define a few standard variables and then simply inherit `autotools`. These classes can also work with software that emulates Autotools. For more information, see the "[Autotooled Package](#)" section in the Yocto Project Development Manual.

By default, the `autotools*` classes use out-of-tree builds (i.e. `autotools.bbclass` and `autotools_stage.bbclass`). (`B != S`).

If the software being built by a recipe does not support using out-of-tree builds, you should have the recipe inherit the `autotools-brokensep` class. The `autotools-brokensep` class behaves the same as the `autotools` and `autotools_stage` classes but builds with `B == S`. This method is useful when out-of-tree build support is either not present or is broken.

Note

It is recommended that out-of-tree support be fixed and used if at all possible.

It's useful to have some idea of how the tasks defined by the `autotools*` classes work and what they do behind the scenes.

- `do_configure` - Regenerates the `configure` script (using `autoreconf`) and then launches it with a standard set of arguments used during cross-compilation. You can pass additional parameters to `configure` through the `EXTRA_OECONF` variable.

- `do_compile` - Runs `make` with arguments that specify the compiler and linker. You can pass additional arguments through the `EXTRA_OEMAKE` variable.
- `do_install` - Runs `make install` and passes in `${D}` as `DESTDIR`.

7.4. `base.bbclass`

The `base` class is special in that every `.bb` file implicitly inherits the class. This class contains definitions for standard basic tasks such as fetching, unpacking, configuring (empty by default), compiling (runs any `Makefile` present), installing (empty by default) and packaging (empty by default). These classes are often overridden or extended by other classes such as the `autotools` class or the `package` class. The class also contains some commonly used functions such as `oe_runmake`.

7.5. `bin_package.bbclass`

The `bin_package` class is a helper class for recipes that extract the contents of a binary package (e.g. an RPM) and install those contents rather than building the binary from source. The binary package is extracted and new packages in the configured output package format are created. Extraction and installation of proprietary binaries is a good example use for this class.

Note

For RPMs and other packages that do not contain a subdirectory, you should specify an appropriate `fetcher` parameter to point to the subdirectory. For example, if BitBake is using the `Git` fetcher (`git://`), the `"subpath"` parameter limits the checkout to a specific subpath of the tree. Here is an example where `${BP}` is used so that the files are extracted into the subdirectory expected by the default value of `S`:

```
SRC_URI = "git://example.com/downloads/somepackage.rpm;subpath=${BP}"
```

See the "[Fetchers](#)" section in the BitBake User Manual for more information on supported BitBake Fetchers.

7.6. `binconfig.bbclass`

The `binconfig` class helps to correct paths in shell scripts.

Before `pkg-config` had become widespread, libraries shipped shell scripts to give information about the libraries and include paths needed to build software (usually named `LIBNAME-config`). This class assists any recipe using such scripts.

During staging, the OpenEmbedded build system installs such scripts into the `sysroots/` directory. Inheriting this class results in all paths in these scripts being changed to point into the `sysroots/` directory so that all builds that use the script use the correct directories for the cross compiling layout. See the `BINCONFIG_GLOB` variable for more information.

7.7. `binconfig-disabled.bbclass`

An alternative version of the `binconfig` class, which disables binary configuration scripts by making them return an error in favor of using `pkg-config` to query the information. The scripts to be disabled should be specified using the `BINCONFIG` variable within the recipe inheriting the class.

7.8. `blacklist.bbclass`

The `blacklist` class prevents the OpenEmbedded build system from building specific recipes (blacklists them). To use this class, inherit the class globally and set `PNBLACKLIST` for each recipe you wish to blacklist. Specify the `PN` value as a variable flag (varflag) and provide a reason, which is reported, if the package is requested to be built as the value. For example, if you want to blacklist a recipe called "exoticware", you add the following to your `local.conf` or distribution configuration:

```
INHERIT += "blacklist"
PNBLACKLIST[exoticware] = "Not supported by our organization."
```

7.9. `bluetooth.bbclass`

The `bluetooth` class defines a variable that expands to the recipe (package) providing core bluetooth support on the platform.

For details on how the class works, see the `meta/classes/bluetooth.bbclass` file in the Yocto Project [Source Directory](#).

7.10. `boot-directdisk.bbclass`

The `boot-directdisk` class creates an image that can be placed directly onto a hard disk using `dd` and then booted. The image uses SYSLINUX.

The end result is a 512 boot sector populated with a Master Boot Record (MBR) and partition table followed by an MSDOS FAT16 partition containing SYSLINUX and a Linux kernel completed by the `ext2` and `ext3` root filesystems.

7.11. `bootimg.bbclass`

The `bootimg` class creates a bootable image using SYSLINUX, your kernel, and an optional initial RAM disk (`initrd`).

When you use this class, two things happen:

- A `.hddimg` file is created. This file is an MSDOS filesystem that contains SYSLINUX, a kernel, an `initrd`, and a root filesystem image. All three of these can be written to hard drives directly and also booted on a USB flash disks using `dd`.
- A CD `.iso` image is created. When this file is booted, the `initrd` boots and processes the label selected in SYSLINUX. Actions based on the label are then performed (e.g. installing to a hard drive).

The `bootimg` class supports the `INITRD`, `NOISO`, `NOHDD`, and `ROOTFS` variables.

7.12. `bugzilla.bbclass`

The `bugzilla` class supports setting up an instance of Bugzilla in which you can automatically files bug reports in response to build failures. For this class to work, you need to enable the XML-RPC interface in the instance of Bugzilla.

7.13. `buildhistory.bbclass`

The `buildhistory` class records a history of build output metadata, which can be used to detect possible regressions as well as used for analysis of the build output. For more information on using Build History, see the "[Maintaining Build Output Quality](#)" section.

7.14. `buildstats.bbclass`

The `buildstats` class records performance statistics about each task executed during the build (e.g. elapsed time, CPU usage, and I/O usage).

When you use this class, the output goes into the `BUILDSTATS_BASE` directory, which defaults to `${TMPDIR}/buildstats/`. You can analyze the elapsed time using `scripts/pybootchartgui/pybootchartgui.py`, which produces a cascading chart of the entire build process and can be useful for highlighting bottlenecks.

Collecting build statistics is enabled by default through the `USER_CLASSES` variable from your `local.conf` file. Consequently, you do not have to do anything to enable the class. However, if you want to disable the class, simply remove "buildstats" from the `USER_CLASSES` list.

7.15. `buildstats-summary.bbclass`

When inherited globally, prints statistics at the end of the build on sstate re-use. In order to function, this class requires the `buildstats` class be enabled.

7.16. `ccache.bbclass`

The `ccache` class enables the [C/C++ Compiler Cache](#) for the build. This class is used to give a minor performance boost during the build. However, using the class can lead to unexpected side-effects. Thus, it is recommended that you do not use this class. See <http://ccache.samba.org/> for information on the C/C++ Compiler Cache.

7.17. `chrpath.bbclass`

The `chrpath` class is a wrapper around the "chrpath" utility, which is used during the build process for `nativesdk`, `cross`, and `cross-canadian` recipes to change `RPATH` records within binaries in order to make them relocatable.

7.18. `clutter.bbclass`

The `clutter` class consolidates the major and minor version naming and other common items used by Clutter and related recipes.

Note

Unlike some other classes related to specific libraries, recipes building other software that uses Clutter do not need to inherit this class unless they use the same recipe versioning scheme that the Clutter and related recipes do.

7.19. `cmake.bbclass`

The `cmake` class allows for recipes that need to build software using the CMake build system. You can use the `EXTRA_OECMAKE` variable to specify additional configuration options to be

passed on the `cmake` command line.

7.20. `cm11.bbclass`

The `cm11` class provides basic support for the Linux kernel style build configuration system.

7.21. `compress_doc.bbclass`

Enables compression for man pages and info pages. This class is intended to be inherited globally. The default compression mechanism is `gz` (`gzip`) but you can select an alternative mechanism by setting the `DOC_COMPRESS` variable.

7.22. `copyleft_compliance.bbclass`

The `copyleft_compliance` class preserves source code for the purposes of license compliance. This class is an alternative to the `archiver` class and is still used by some users even though it has been deprecated in favor of the `archiver` class.

7.23. `copyleft_filter.bbclass`

A class used by the `archiver` and `copyleft_compliance` classes for filtering licenses. The `copyleft_filter` class is an internal class and is not intended to be used directly.

7.24. `core-image.bbclass`

The `core-image` class provides common definitions for the `core-image-*` image recipes, such as support for additional `IMAGE_FEATURES`.

7.25. `cpan*.bbclass`

The `cpan*` classes support Perl modules.

Recipes for Perl modules are simple. These recipes usually only need to point to the source's archive and then inherit the proper class file. Building is split into two methods depending on which method the module authors used.

- Modules that use old `Makefile.PL`-based build system require `cpan.bbclass` in their recipes.
- Modules that use `Build.PL`-based build system require using `cpan_build.bbclass` in their recipes.

Both build methods inherit the `cpan-base` class for basic Perl support.

7.26. `cross.bbclass`

The `cross` class provides support for the recipes that build the cross-compilation tools.

7.27. `cross-canadian.bbclass`

The `cross-canadian` class provides support for the recipes that build the Canadian Cross-compilation tools for SDKs. See the "[Cross-Development Toolchain Generation](#)" section for more discussion on these cross-compilation tools.

7.28. `crosssdk.bbclass`

The `crosssdk` class provides support for the recipes that build the cross-compilation tools used for building SDKs. See the "[Cross-Development Toolchain Generation](#)" section for more discussion on these cross-compilation tools.

7.29. `debian.bbclass`

The `debian` class renames output packages so that they follow the Debian naming policy (i.e. `glibc` becomes `libc6` and `glibc-devel` becomes `libc6-dev`.) Renaming includes the library name and version as part of the package name.

If a recipe creates packages for multiple libraries (shared object files of `.so` type), use the `LEAD_SONAME` variable in the recipe to specify the library on which to apply the naming scheme.

7.30. `deploy.bbclass`

The `deploy` class handles deploying files to the `DEPLOY_DIR_IMAGE` directory. The main function of this class is to allow the deploy step to be accelerated by shared state. Recipes that inherit this class should define their own `do_deploy` function to copy the files to be deployed to `DEPLOYDIR`, and use `addtask` to add the task at the appropriate place, which is usually after `do_compile` or `do_install`. The class then takes care of staging the files from `DEPLOYDIR` to `DEPLOY_DIR_IMAGE`.

7.31. `devshell.bbclass`

The `devshell` class adds the `do_devshell` task. Distribution policy dictates whether to include this class. See the "[Using a Development Shell](#)" section in the Yocto Project Development Manual for more information about using `devshell`.

7.32. `distro_features_check.bbclass`

The `distro_features_check` class allows individual recipes to check for required and conflicting `DISTRO_FEATURES`.

This class provides support for the `REQUIRED_DISTRO_FEATURES` and `CONFLICT_DISTRO_FEATURES` variables. If any conditions specified in the recipe using the above variables are not met, the recipe will be skipped.

7.33. `distrodata.bbclass`

The `distrodata` class provides for automatic checking for upstream recipe updates. The class creates a comma-separated value (CSV) spreadsheet that contains information about the recipes. The information provides the `do_distrodata` and `do_distro_check` tasks, which do

upstream checking and also verify if a package is used in multiple major distributions.

The class is not included by default. To use it, you must set the `INHERIT` variable:

```
INHERIT+= "distrodata"
```

7.34. `distutils*.bbclass`

The `distutils*` classes support recipes for Python version 2.x extensions, which are simple. These recipes usually only need to point to the source's archive and then inherit the proper class. Building is split into two methods depending on which method the module authors used.

- Extensions that use an Autotools-based build system require Autotools and the classes based on `distutils` in their recipes.
- Extensions that use build systems based on `distutils` require the `distutils` class in their recipes.
- Extensions that use build systems based on `setuptools` require the `setuptools` class in their recipes.

The `distutils-common-base` class is required by some of the `distutils*` classes to provide common Python2 support.

The `distutils-tools` class supports recipes for additional "distutils" tools.

7.35. `distutils3*.bbclass`

The `distutils3*` classes support recipes for Python version 3.x extensions, which are simple. These recipes usually only need to point to the source's archive and then inherit the proper class. Building is split into three methods depending on which method the module authors used.

- Extensions that use an Autotools-based build system require Autotools and `distutils`-based classes in their recipes.
- Extensions that use `distutils`-based build systems require the `distutils` class in their recipes.
- Extensions that use build systems based on `setuptools3` require the `setuptools3` class in their recipes.

The `distutils3*` classes either inherit their corresponding `distutils*` class or replicate them using a Python3 version instead (e.g. `distutils3-base` inherits `distutils-common-base`, which is the same as `distutils-base` but inherits `python3native` instead of `pythonnative`).

7.36. `externalsrc.bbclass`

The `externalsrc` class supports building software from source code that is external to the OpenEmbedded build system. Building software from an external source tree means that the build system's normal fetch, unpack, and patch process is not used.

By default, the OpenEmbedded build system uses the `s` and `B` variables to locate unpacked recipe source code and to build it, respectively. When your recipe inherits the `externalsrc` class, you use the `EXTERNALSRC` and `EXTERNALSRC_BUILD` variables to ultimately define `s` and `B`.

By default, this class expects the source code to support recipe builds that use the `B` variable to

point to the directory in which the OpenEmbedded build system places the generated objects built from the recipes. By default, the `B` directory is set to the following, which is separate from the source directory (`S`):

```
${WORKDIR}/${BPN}/${PV}/
```

See these variables for more information: [WORKDIR](#), [BPN](#), and [PV](#),

For more information on the `externalsrc` class, see the comments in `meta/classes/externalsrc.bbclass` in the [Source Directory](#). For information on how to use the `externalsrc` class, see the "[Building Software from an External Source](#)" section in the Yocto Project Development Manual.

7.37. `extrausers.bbclass`

The `extrausers` class allows additional user and group configuration to be applied at the image level. Inheriting this class either globally or from an image recipe allows additional user and group operations to be performed using the `EXTRA_USERS_PARAMS` variable.

Note

The user and group operations added using the `extrausers` class are not tied to a specific recipe outside of the recipe for the image. Thus, the operations can be performed across the image as a whole. Use the `useradd` class to add user and group configuration to a specific recipe.

Here is an example that uses this class in an image recipe:

```
inherit extrausers
EXTRA_USERS_PARAMS = "\
    useradd -p '' tester; \
    groupadd developers; \
    userdel nobody; \
    groupdel -g video; \
    groupmod -g 1020 developers; \
    usermod -s /bin/sh tester; \
"
```

Here is an example that adds two users named "tester-jim" and "tester-sue" and assigns passwords:

```
inherit extrausers
EXTRA_USERS_PARAMS = "\
    useradd -P tester01 tester-jim; \
    useradd -P tester01 tester-sue; \
"
```

Finally, here is an example that sets the root password to "1876*18":

```
inherit extrausers
EXTRA_USERS_PARAMS = "\
    usermod -P 1876*18 root; \
"
```

7.38. `fontcache.bbclass`

The `fontcache` class generates the proper post-install and post-remove (postinst and postrm) scriptlets for font packages. These scriptlets call `fc-cache` (part of `Fontconfig`) to add the fonts to the font information cache. Since the cache files are architecture-specific, `fc-cache` runs using QEMU if the postinst scriptlets need to be run on the build host during image creation.

If the fonts being installed are in packages other than the main package, set `FONT_PACKAGES` to specify the packages containing the fonts.

7.39. `fs-uuid.bbclass`

The `fs-uuid` class extracts UUID from `${ROOTFS}`, which must have been built by the time that this function gets called. The `fs-uuid` class only works on `ext` file systems and depends on `tune2fs`.

7.40. `gconf.bbclass`

The `gconf` class provides common functionality for recipes that need to install GConf schemas. The schemas will be put into a separate package (`${PN}-gconf`) that is created automatically when this class is inherited. This package uses the appropriate post-install and post-remove (`postinst/postrm`) scriptlets to register and unregister the schemas in the target image.

7.41. `gettext.bbclass`

The `gettext` class provides support for building software that uses the GNU `gettext` internationalization and localization system. All recipes building software that use `gettext` should inherit this class.

7.42. `gnome.bbclass`

The `gnome` class supports recipes that build software from the GNOME stack. This class inherits the `gnomebase`, `gtk-icon-cache`, `gconf` and `mime` classes. The class also disables GObject introspection where applicable.

7.43. `gnomebase.bbclass`

The `gnomebase` class is the base class for recipes that build software from the GNOME stack. This class sets `SRC_URI` to download the source from the GNOME mirrors as well as extending `FILES` with the typical GNOME installation paths.

7.44. `grub-efi.bbclass`

The `grub-efi` class provides `grub-efi`-specific functions for building bootable images.

This class supports several variables:

- `INITRD`: Indicates list of filesystem images to concatenate and use as an initial RAM disk (`initrd`) (optional).
- `ROOTFS`: Indicates a filesystem image to include as the root filesystem (optional).
- `GRUB_GFXSERIAL`: Set this to "1" to have graphics and serial in the boot menu.
- `LABELS`: A list of targets for the automatic configuration.
- `APPEND`: An override list of append strings for each `LABEL`.
- `GRUB_OPTS`: Additional options to add to the configuration (optional). Options are delimited using semi-colon characters (;).
- `GRUB_TIMEOUT`: Timeout before executing the default `LABEL` (optional).

7.45. `gsettings.bbclass`

The `gsettings` class provides common functionality for recipes that need to install GSettings (glib) schemas. The schemas are assumed to be part of the main package. Appropriate post-install and post-remove (postinst/postrm) scriptlets are added to register and unregister the schemas in the target image.

7.46. `gtk-doc.bbclass`

The `gtk-doc` class is a helper class to pull in the appropriate `gtk-doc` dependencies and disable `gtk-doc`.

7.47. `gtk-icon-cache.bbclass`

The `gtk-icon-cache` class generates the proper post-install and post-remove (postinst/postrm) scriptlets for packages that use GTK+ and install icons. These scriptlets call `gtk-update-icon-cache` to add the fonts to GTK+'s icon cache. Since the cache files are architecture-specific, `gtk-update-icon-cache` is run using QEMU if the postinst scriptlets need to be run on the build host during image creation.

7.48. `gtk-immodules-cache.bbclass`

The `gtk-immodules-cache` class generates the proper post-install and post-remove (postinst/postrm) scriptlets for packages that install GTK+ input method modules for virtual keyboards. These scriptlets call `gtk-update-icon-cache` to add the input method modules to the cache. Since the cache files are architecture-specific, `gtk-update-icon-cache` is run using QEMU if the postinst scriptlets need to be run on the build host during image creation.

If the input method modules being installed are in packages other than the main package, set `GTKIMMODULES_PACKAGES` to specify the packages containing the modules.

7.49. `gummiboot.bbclass`

The `gummiboot` class provides functions specific to the gummiboot bootloader for building bootable images. This is an internal class and is not intended to be used directly. Set the `EFI_PROVIDER` variable to "gummiboot" to use this class.

For information on more variables used and supported in this class, see the `GUMMIBOOT_CFG`, `GUMMIBOOT_ENTRIES`, and `GUMMIBOOT_TIMEOUT` variables.

You can also see the [Gummiboot documentation](#) for more information.

7.50. `gzipnative.bbclass`

The `gzipnative` class enables the use of native versions of `gzip` and `pigz` rather than the versions of these tools from the build host.

7.51. `icecc.bbclass`

The `icecc` class supports [Icecream](#), which facilitates taking compile jobs and distributing them

among remote machines.

The class stages directories with symlinks from `gcc` and `g++` to `icecc`, for both native and cross compilers. Depending on each configure or compile, the OpenEmbedded build system adds the directories at the head of the `PATH` list and then sets the `ICECC_CXX` and `ICEC_CC` variables, which are the paths to the `g++` and `gcc` compilers, respectively.

For the cross compiler, the class creates a `tar.gz` file that contains the Yocto Project toolchain and sets `ICECC_VERSION`, which is the version of the cross-compiler used in the cross-development toolchain, accordingly.

The class handles all three different compile stages (i.e native ,cross-kernel and target) and creates the necessary environment `tar.gz` file to be used by the remote machines. The class also supports SDK generation.

If `ICECC_PATH` is not set in your `local.conf` file, then the class tries to locate the `icecc` binary using `which`. If `ICECC_ENV_EXEC` is set in your `local.conf` file, the variable should point to the `icecc-create-env` script provided by the user. If you do not point to a user-provided script, the build system uses the default script provided by the recipe `icecc-create-env-native.bb`.

Note

This script is a modified version and not the one that comes with `icecc`.

If you do not want the Icecream distributed compile support to apply to specific recipes or classes, you can effectively "blacklist" them by listing the recipes and classes using the `ICECC_USER_PACKAGE_BL` and `ICECC_USER_CLASS_BL`, variables, respectively, in your `local.conf` file. Doing so causes the OpenEmbedded build system to handle these compilations locally.

Additionally, you can list recipes using the `ICECC_USER_PACKAGE_WL` variable in your `local.conf` file to force `icecc` to be enabled for recipes using an empty `PARALLEL_MAKE` variable.

Inheriting the `icecc` class changes all sstate signatures. Consequently, if a development team has a dedicated build system that populates `STATE_MIRRORS` and they want to reuse sstate from `STATE_MIRRORS`, then all developers and the build system need to either inherit the `icecc` class or nobody should.

At the distribution level, you can inherit the `icecc` class to be sure that all builders start with the same sstate signatures. After inheriting the class, you can then disable the feature by setting the `ICECC_DISABLED` variable to "1" as follows:

```
INHERIT_DISTRO_append = " icecc"
ICECC_DISABLED ??= "1"
```

This practice makes sure everyone is using the same signatures but also requires individuals that do want to use Icecream to enable the feature individually as follows in your `local.conf` file:

```
ICECC_DISABLED = ""
```

7.52. `image.bbclass`

The `image` class helps support creating images in different formats. First, the root filesystem is created from packages using one of the `rootfs*.bbclass` files (depending on the package format used) and then one or more image files are created.

- The `IMAGE_FSTYPES` variable controls the types of images to generate.

- The `IMAGE_INSTALL` variable controls the list of packages to install into the image.

For information on customizing images, see the "[Customizing Images](#)" section in the Yocto Project Development Manual. For information on how images are created, see the "[Images](#)" section elsewhere in this manual.

7.53. `image-buildinfo.bbclass`

The `image-buildinfo` class writes information to the target filesystem on `/etc/build`.

7.54. `image_types.bbclass`

The `image_types` class defines all of the standard image output types that you can enable through the `IMAGE_FSTYPES` variable. You can use this class as a reference on how to add support for custom image output types.

By default, this class is enabled through the `IMAGE_CLASSES` variable in `image.bbclass`. If you define your own image types using a custom BitBake class and then use `IMAGE_CLASSES` to enable it, the custom class must either inherit `image_types` or `image_types` must also appear in `IMAGE_CLASSES`.

7.55. `image_types_uboot.bbclass`

The `image_types_uboot` class defines additional image types specifically for the U-Boot bootloader.

7.56. `image-live.bbclass`

The `image-live` class supports building "live" images.

Normally, you do not use this class directly. Instead, you add "live" to `IMAGE_FSTYPES`. For example, if you were building an ISO image, you would add "live" to `IMAGE_FSTYPES`, set the `NOISO` variable to "0" and the build system would use the `image-live` class to build the ISO image.

7.57. `image-mklibs.bbclass`

The `image-mklibs` class enables the use of the `mklibs` utility during the `do_rootfs` task, which optimizes the size of libraries contained in the image.

By default, the class is enabled in the `local.conf.template` using the `USER_CLASSES` variable as follows:

```
USER_CLASSES += "buildstats image-mklibs image-prelink"
```

7.58. `image-prelink.bbclass`

The `image-prelink` class enables the use of the `prelink` utility during the `do_rootfs` task, which optimizes the dynamic linking of shared libraries to reduce executable startup time.

By default, the class is enabled in the `local.conf.template` using the `USER_CLASSES` variable

as follows:

```
USER_CLASSES += "buildstats image-mklibs image-prelink"
```

7.59. `image-swab.bbclass`

The `image-swab` class enables the [Swabber](#) tool in order to detect and log accesses to the host system during the OpenEmbedded build process.

Note

This class is currently unmaintained. The `strace` package needs to be installed in the build host as a dependency for this tool.

7.60. `image-vm.bbclass`

The `image-vm` class supports building VM images.

7.61. `image-vmdk.bbclass`

The `image-vmdk` class supports building VMware VMDK images. Normally, you do not use this class directly. Instead, you add "vmdk" to `IMAGE_FSTYPES`.

7.62. `insane.bbclass`

The `insane` class adds a step to the package generation process so that output quality assurance checks are generated by the OpenEmbedded build system. A range of checks are performed that check the build's output for common problems that show up during runtime. Distribution policy usually dictates whether to include this class.

You can configure the sanity checks so that specific test failures either raise a warning or an error message. Typically, failures for new tests generate a warning. Subsequent failures for the same test would then generate an error message once the metadata is in a known and good condition. See the "[QA Error and Warning Messages](#)" Chapter for a list of all the warning and error messages you might encounter using a default configuration.

Use the `WARN_QA` and `ERROR_QA` variables to control the behavior of these checks at the global level (i.e. in your custom distro configuration). However, to skip one or more checks in recipes, you should use `INSANE_SKIP`. For example, to skip the check for symbolic link `.so` files in the main package of a recipe, add the following to the recipe. You need to realize that the package name override, in this example `{PN}`, must be used:

```
INSANE_SKIP_${PN} += "dev-so"
```

Please keep in mind that the QA checks exist in order to detect real or potential problems in the packaged output. So exercise caution when disabling these checks.

The following list shows the tests you can list with the `WARN_QA` and `ERROR_QA` variables:

- **`already-stripped`**: Checks that produced binaries have not already been stripped prior to the build system extracting debug symbols. It is common for upstream software projects to default to stripping debug symbols for output binaries. In order for debugging to work on the target using `-dbg` packages, this stripping must be disabled.
- **`arch`**: Checks the Executable and Linkable Format (ELF) type, bit size, and endianness of

any binaries to ensure they match the target architecture. This test fails if any binaries do not match the type since there would be an incompatibility. The test could indicate that the wrong compiler or compiler options have been used. Sometimes software, like bootloaders, might need to bypass this check.

- **buildpaths:** Checks for paths to locations on the build host inside the output files. Currently, this test triggers too many false positives and thus is not normally enabled.
- **build-deps:** Determines if a build-time dependency that is specified through DEPENDS, explicit RDEPENDS, or task-level dependencies exists to match any runtime dependency. This determination is particularly useful to discover where runtime dependencies are detected and added during packaging. If no explicit dependency has been specified within the metadata, at the packaging stage it is too late to ensure that the dependency is built, and thus you can end up with an error when the package is installed into the image during the do_rootfs task because the auto-detected dependency was not satisfied. An example of this would be where the update-rc.d class automatically adds a dependency on the initscripts-functions package to packages that install an initscript that refers to /etc/init.d/functions. The recipe should really have an explicit RDEPENDS for the package in question on initscripts-functions so that the OpenEmbedded build system is able to ensure that the initscripts recipe is actually built and thus the initscripts-functions package is made available.
- **compile-host-path:** Checks the do_compile log for indications that paths to locations on the build host were used. Using such paths might result in host contamination of the build output.
- **debug-deps:** Checks that all packages except -dbg packages do not depend on -dbg packages, which would cause a packaging bug.
- **debug-files:** Checks for .debug directories in anything but the -dbg package. The debug files should all be in the -dbg package. Thus, anything packaged elsewhere is incorrect packaging.
- **dep-cmp:** Checks for invalid version comparison statements in runtime dependency relationships between packages (i.e. in RDEPENDS, RRECOMMENDS, RSUGGESTS, RPROVIDES, RREPLACES, and RCONFLICTS variable values). Any invalid comparisons might trigger failures or undesirable behavior when passed to the package manager.
- **desktop:** Runs the desktop-file-validate program against any .desktop files to validate their contents against the specification for .desktop files.
- **dev-deps:** Checks that all packages except -dev or -staticdev packages do not depend on -dev packages, which would be a packaging bug.
- **dev-so:** Checks that the .so symbolic links are in the -dev package and not in any of the other packages. In general, these symlinks are only useful for development purposes. Thus, the -dev package is the correct location for them. Some very rare cases do exist for dynamically loaded modules where these symlinks are needed instead in the main package.
- **file-rdeps:** Checks that file-level dependencies identified by the OpenEmbedded build system at packaging time are satisfied. For example, a shell script might start with the line #!/bin/bash. This line would translate to a file dependency on /bin/bash. Of the three package managers that the OpenEmbedded build system supports, only RPM directly handles file-level dependencies, resolving them automatically to packages providing the files. However, the lack of that functionality in the other two package managers does not mean the dependencies do not still need resolving. This QA check attempts to ensure that explicitly declared RDEPENDS exist to handle any file-level dependency detected in packaged files.
- **files-invalid:** Checks for FILES variable values that contain "/", which is invalid.

- ***incompatible-license***: Report when packages are excluded from being created due to being marked with a license that is in INCOMPATIBLE_LICENSE.
- ***install-host-path***: Checks the do_install log for indications that paths to locations on the build host were used. Using such paths might result in host contamination of the build output.
- ***installed-vs-shipped***: Reports when files have been installed within do_install but have not been included in any package by way of the FILES variable. Files that do not appear in any package cannot be present in an image later on in the build process. Ideally, all installed files should be packaged or not installed at all. These files can be deleted at the end of do_install if the files are not needed in any package.
- ***la***: Checks .la files for any TMPPDIR paths. Any .la file containing these paths is incorrect since libtool adds the correct sysroot prefix when using the files automatically itself.
- ***ldflags***: Ensures that the binaries were linked with the LDFLAGS options provided by the build system. If this test fails, check that the LDFLAGS variable is being passed to the linker command.
- ***libdir***: Checks for libraries being installed into incorrect (possibly hardcoded) installation paths. For example, this test will catch recipes that install /lib/bar.so when {base_libdir} is "lib32". Another example is when recipes install /usr/lib64/foo.so when {libdir} is "/usr/lib".
- ***libexec***: Checks if a package contains files in /usr/libexec. This check is not performed if the libexecdir variable has been set explicitly to /usr/libexec.
- ***packages-list***: Checks for the same package being listed multiple times through the PACKAGES variable value. Installing the package in this manner can cause errors during packaging.
- ***perm-config***: Reports lines in fs-perms.txt that have an invalid format.
- ***perm-line***: Reports lines in fs-perms.txt that have an invalid format.
- ***perm-link***: Reports lines in fs-perms.txt that specify 'link' where the specified target already exists.
- ***perms***: Currently, this check is unused but reserved.
- ***pkgconfig***: Checks .pc files for any TMPPDIR/WORKDIR paths. Any .pc file containing these paths is incorrect since pkg-config itself adds the correct sysroot prefix when the files are accessed.
- ***pkgname***: Checks that all packages in PACKAGES have names that do not contain invalid characters (i.e. characters other than 0-9, a-z, ., +, and -).
- ***pkgv-undefined***: Checks to see if the PKG_V variable is undefined during do_package.
- ***pkgvarcheck***: Checks through the variables RDEPENDS, RRECOMMENDS, RSUGGESTS, RCONFLICTS, RPROVIDES, RREPLACES, FILES, ALLOW_EMPTY, pkg_preinst, pkg_postinst, pkg_prerm and pkg_postrm, and reports if there are variable sets that are not package-specific. Using these variables without a package suffix is bad practice, and might unnecessarily complicate dependencies of other packages within the same recipe or have other unintended consequences.
- ***pn-overrides***: Checks that a recipe does not have a name (PN) value that appears in OVERRIDES. If a recipe is named such that its PN value matches something already in OVERRIDES (e.g. PN happens to be the same as MACHINE or DISTRO), it can have unexpected consequences. For example, assignments such as FILES_\${PN} = "xyz" effectively turn

into FILES = "xyz".

- **rpaths:** Checks for rpaths in the binaries that contain build system paths such as `TMPLDIR`. If this test fails, bad `-rpath` options are being passed to the linker commands and your binaries have potential security issues.
- **split-strip:** Reports that splitting or stripping debug symbols from binaries has failed.
- **staticdev:** Checks for static library files (`*.a`) in non-staticdev packages.
- **symlink-to-sysroot:** Checks for symlinks in packages that point into `TMPLDIR` on the host. Such symlinks will work on the host, but are clearly invalid when running on the target.
- **textrel:** Checks for ELF binaries that contain relocations in their `.text` sections, which can result in a performance impact at runtime. See the explanation for the [ELF binary](#) message for more information regarding runtime performance issues.
- **unsafe-references-in-binaries:** Reports when a binary installed in `${base_libdir}`, `${base_bindir}`, or `${base_sbindir}`, depends on another binary installed under `${exec_prefix}`. This dependency is a concern if you want the system to remain basically operable if `/usr` is mounted separately and is not mounted.

Note

Defaults for binaries installed in `${base_libdir}`, `${base_bindir}`, and `${base_sbindir}` are `/lib`, `/bin`, and `/sbin`, respectively. The default for a binary installed under `${exec_prefix}` is `/usr`.

- **unsafe-references-in-scripts:** Reports when a script file installed in `${base_libdir}`, `${base_bindir}`, or `${base_sbindir}`, depends on files installed under `${exec_prefix}`. This dependency is a concern if you want the system to remain basically operable if `/usr` is mounted separately and is not mounted.

Note

Defaults for binaries installed in `${base_libdir}`, `${base_bindir}`, and `${base_sbindir}` are `/lib`, `/bin`, and `/sbin`, respectively. The default for a binary installed under `${exec_prefix}` is `/usr`.

- **useless-rpaths:** Checks for dynamic library load paths (rpaths) in the binaries that by default on a standard system are searched by the linker (e.g. `/lib` and `/usr/lib`). While these paths will not cause any breakage, they do waste space and are unnecessary.
- **var-undefined:** Reports when variables fundamental to packaging (i.e. `WORKDIR`, `DEPLOY_DIR`, `D`, `PN`, and `PKGID`) are undefined during `do_package`.
- **version-going-backwards:** If Build History is enabled, reports when a package being written out has a lower version than the previously written package under the same name. If you are placing output packages into a feed and upgrading packages on a target system using that feed, the version of a package going backwards can result in the target system not correctly upgrading to the "new" version of the package.

Note

If you are not using runtime package management on your target system, then you do not need to worry about this situation.

- **xorg-driver-abi:** Checks that all packages containing Xorg drivers have ABI dependencies. The `xserver-xorg` recipe provides driver ABI names. All drivers should depend on the ABI versions that they have been built against. Driver recipes that include `xorg-driver-`

`input.inc` or `xorg-driver-video.inc` will automatically get these versions. Consequently, you should only need to explicitly add dependencies to binary driver recipes.

7.63. `insserv.bbclass`

The `insserv` class uses the `insserv` utility to update the order of symbolic links in `/etc/rc?.d/` within an image based on dependencies specified by LSB headers in the `init.d` scripts themselves.

7.64. `kernel.bbclass`

The `kernel` class handles building Linux kernels. The class contains code to build all kernel trees. All needed headers are staged into the `STAGING_KERNEL_DIR` directory to allow out-of-tree module builds using the `module` class.

This means that each built kernel module is packaged separately and inter-module dependencies are created by parsing the `modinfo` output. If all modules are required, then installing the `kernel-modules` package installs all packages with modules and various other kernel packages such as `kernel-vmlinux`.

Various other classes are used by the `kernel` and `module` classes internally including the `kernel-arch`, `module-base`, and `linux-kernel-base` classes.

7.65. `kernel-arch.bbclass`

The `kernel-arch` class sets the `ARCH` environment variable for Linux kernel compilation (including modules).

7.66. `kernel-fitimage.bbclass`

The `kernel-fitimage` class provides support to pack zImages.

7.67. `kernel-grub.bbclass`

The `kernel-grub` class updates the boot area and the boot menu with the kernel as the priority boot mechanism while installing a RPM to update the kernel on a deployed target.

7.68. `kernel-module-split.bbclass`

The `kernel-module-split` class provides common functionality for splitting Linux kernel modules into separate packages.

7.69. `kernel-uboot.bbclass`

The `kernel-uboot` class provides support for building from `vmlinux`-style kernel sources.

7.70. `kernel-uimage.bbclass`

The `kernel-uimage` class provides support to pack uImage.

7.71. `kernel-yocto.bbclass`

The `kernel-yocto` class provides common functionality for building from linux-yocto style kernel source repositories.

7.72. `kernelsrc.bbclass`

The `kernelsrc` class sets the Linux kernel source and version.

7.73. `lib_package.bbclass`

The `lib_package` class supports recipes that build libraries and produce executable binaries, where those binaries should not be installed by default along with the library. Instead, the binaries are added to a separate `${PN}-bin` package to make their installation optional.

7.74. `libc*.bbclass`

The `libc*` classes support recipes that build packages with `libc`:

- The `libc-common` class provides common support for building with `libc`.
- The `libc-package` class supports packaging up `glibc` and `eglibc`.

7.75. `license.bbclass`

The `license` class provides license manifest creation and license exclusion. This class is enabled by default using the default value for the `INHERIT_DISTRO` variable.

7.76. `linux-kernel-base.bbclass`

The `linux-kernel-base` class provides common functionality for recipes that build out of the Linux kernel source tree. These builds goes beyond the kernel itself. For example, the `Perf` recipe also inherits this class.

7.77. `linuxloader.bbclass`

Provides the function `linuxloader()`, which gives the value of the dynamic loader/linker provided on the platform. This value is used by a number of other classes.

7.78. `logging.bbclass`

The `logging` class provides the standard shell functions used to log messages for various BitBake severity levels (i.e. `bbplain`, `bbnote`, `bbwarn`, `bberror`, `bbfatal`, and `bbdebug`).

This class is enabled by default since it is inherited by the `base` class.

7.79. `meta.bbclass`

The `meta` class is inherited by recipes that do not build any output packages themselves, but act as a "meta" target for building other recipes.

7.80. `metadata_scm.bbclass`

The `metadata_scm` class provides functionality for querying the branch and revision of a Source Code Manager (SCM) repository.

The `base` class uses this class to print the revisions of each layer before starting every build. The `metadata_scm` class is enabled by default because it is inherited by the `base` class.

7.81. `migrate_localcount.bbclass`

The `migrate_localcount` class verifies a recipe's localcount data and increments it appropriately.

7.82. `mime.bbclass`

The `mime` class generates the proper post-install and post-remove (postinst/postrm) scriptlets for packages that install MIME type files. These scriptlets call `update-mime-database` to add the MIME types to the shared database.

7.83. `mirrors.bbclass`

The `mirrors` class sets up some standard `MIRRORS` entries for source code mirrors. These mirrors provide a fall-back path in case the upstream source specified in `SRC_URI` within recipes is unavailable.

This class is enabled by default since it is inherited by the `base` class.

7.84. `module.bbclass`

The `module` class provides support for building out-of-tree Linux kernel modules. The class inherits the `module-base` and `kernel-module-split` classes, and implements the `do_compile` and `do_install` tasks. The class provides everything needed to build and package a kernel module.

For general information on out-of-tree Linux kernel modules, see the "[Incorporating Out-of-Tree Modules](#)" section in the Yocto Project Linux Kernel Development Manual.

7.85. `module-base.bbclass`

The `module-base` class provides the base functionality for building Linux kernel modules. Typically, a recipe that builds software that includes one or more kernel modules and has its own means of building the module inherits this class as opposed to inheriting the `module` class.

7.86. `multilib*.bbclass`

The `multilib*` classes provide support for building libraries with different target optimizations or target architectures and installing them side-by-side in the same image.

For more information on using the Multilib feature, see the "[Combining Multiple Versions of Library Files into One Image](#)" section in the Yocto Project Development Manual.

7.87. `native.bbclass`

The `native` class provides common functionality for recipes that wish to build tools to run on the build host (i.e. tools that use the compiler or other tools from the build host).

You can create a recipe that builds tools that run natively on the host a couple different ways:

- Create a `myrecipe-native.bb` that inherits the `native` class. If you use this method, you must order the `inherit` statement in the recipe after all other `inherit` statements so that the `native` class is inherited last.
- Create or modify a target recipe that contains the following:

```
BBCLASSEXTEND = "native"
```

Inside the recipe, use `_class-native` and `_class-target` overrides to specify any functionality specific to the respective native or target case.

Although applied differently, the `native` class is used with both methods. The advantage of the second method is that you do not need to have two separate recipes (assuming you need both) for native and target. All common parts of the recipe are automatically shared.

7.88. `nativesdk.bbclass`

The `nativesdk` class provides common functionality for recipes that wish to build tools to run as part of an SDK (i.e. tools that run on [SDKMACHINE](#)).

You can create a recipe that builds tools that run on the SDK machine a couple different ways:

- Create a `nativesdk-myrecipe.bb` recipe that inherits the `nativesdk` class. If you use this method, you must order the `inherit` statement in the recipe after all other `inherit` statements so that the `nativesdk` class is inherited last.
- Create a `nativesdk` variant of any recipe by adding the following:

```
BBCLASSEXTEND = "nativesdk"
```

Inside the recipe, use `_class-nativesdk` and `_class-target` overrides to specify any functionality specific to the respective SDK machine or target case.

Although applied differently, the `nativesdk` class is used with both methods. The advantage of the second method is that you do not need to have two separate recipes (assuming you need both) for the SDK machine and the target. All common parts of the recipe are automatically shared.

7.89. `oelint.bbclass`

The `oelint` class is an obsolete lint checking tool that exists in `meta/classes` in the [Source Directory](#).

A number of classes exist that could be generally useful in OE-Core but are never actually used within OE-Core itself. The `oelint` class is one such example. However, being aware of this

class can reduce the proliferation of different versions of similar classes across multiple layers.

7.90. `own-mirrors.bbclass`

The `own-mirrors` class makes it easier to set up your own `PREMIRRORS` from which to first fetch source before attempting to fetch it from the upstream specified in `SRC_URI` within each recipe.

To use this class, inherit it globally and specify `SOURCE_MIRROR_URL`. Here is an example:

```
INHERIT += "own-mirrors"
SOURCE_MIRROR_URL = "http://example.com/my-source-mirror"
```

You can specify only a single URL in `SOURCE_MIRROR_URL`.

7.91. `package.bbclass`

The `package` class supports generating packages from a build's output. The core generic functionality is in `package.bbclass`. The code specific to particular package types resides in these package-specific classes: `package_deb`, `package_rpm`, `package_ipk`, and `package_tar`.

Warning

The `package_tar` class is broken and not supported. It is recommended that you do not use this class.

You can control the list of resulting package formats by using the `PACKAGE_CLASSES` variable defined in your `conf/local.conf` configuration file, which is located in the [Build Directory](#). When defining the variable, you can specify one or more package types. Since images are generated from packages, a packaging class is needed to enable image generation. The first class listed in this variable is used for image generation.

If you take the optional step to set up a repository (package feed) on the development host that can be used by Smart, you can install packages from the feed while you are running the image on the target (i.e. runtime installation of packages). For more information, see the ["Using Runtime Package Management"](#) section in the Yocto Project Development Manual.

The package-specific class you choose can affect build-time performance and has space ramifications. In general, building a package with IPK takes about thirty percent less time as compared to using RPM to build the same or similar package. This comparison takes into account a complete build of the package with all dependencies previously built. The reason for this discrepancy is because the RPM package manager creates and processes more [Metadata](#) than the IPK package manager. Consequently, you might consider setting `PACKAGE_CLASSES` to `"package_ipk"` if you are building smaller systems.

Before making your package manager decision, however, you should consider some further things about using RPM:

- RPM starts to provide more abilities than IPK due to the fact that it processes more Metadata. For example, this information includes individual file types, file checksum generation and evaluation on install, sparse file support, conflict detection and resolution for Multilib systems, ACID style upgrade, and repackaging abilities for rollbacks.
- For smaller systems, the extra space used for the Berkeley Database and the amount of metadata when using RPM can affect your ability to perform on-device upgrades.

You can find additional information on the effects of the package class at these two Yocto Project mailing list links:

- <https://lists.yoctoproject.org/pipermail/poky/2011-May/006362.html>

- <https://lists.yoctoproject.org/pipermail/poky/2011-May/006363.html>

7.92. `package_deb.bbclass`

The `package_deb` class provides support for creating packages that use the Debian (i.e. `.deb`) file format. The class ensures the packages are written out in a `.deb` file format to the `${DEPLOY_DIR_DEB}` directory.

This class inherits the `package` class and is enabled through the `PACKAGE_CLASSES` variable in the `local.conf` file.

7.93. `package_ipk.bbclass`

The `package_ipk` class provides support for creating packages that use the IPK (i.e. `.ipk`) file format. The class ensures the packages are written out in a `.ipk` file format to the `${DEPLOY_DIR_IPK}` directory.

This class inherits the `package` class and is enabled through the `PACKAGE_CLASSES` variable in the `local.conf` file.

7.94. `package_rpm.bbclass`

The `package_rpm` class provides support for creating packages that use the RPM (i.e. `.rpm`) file format. The class ensures the packages are written out in a `.rpm` file format to the `${DEPLOY_DIR_RPM}` directory.

This class inherits the `package` class and is enabled through the `PACKAGE_CLASSES` variable in the `local.conf` file.

7.95. `package_tar.bbclass`

The `package_tar` class provides support for creating tarballs. The class ensures the packages are written out in a tarball format to the `${DEPLOY_DIR_TAR}` directory.

This class inherits the `package` class and is enabled through the `PACKAGE_CLASSES` variable in the `local.conf` file.

Note

You cannot specify the `package_tar` class first using the `PACKAGE_CLASSES` variable. You must use `.deb`, `.ipk`, or `.rpm` file formats for your image or SDK.

7.96. `packagedata.bbclass`

The `packagedata` class provides common functionality for reading `pkgdata` files found in `PKGDATA_DIR`. These files contain information about each output package produced by the OpenEmbedded build system.

This class is enabled by default because it is inherited by the `package` class.

7.97. `packagegroup.bbclass`

The `packagegroup` class sets default values appropriate for package group recipes (e.g. `PACKAGES`, `PACKAGE_ARCH`, `ALLOW_EMPTY`, and so forth). It is highly recommended that all package group recipes inherit this class.

For information on how to use this class, see the "[Customizing Images Using Custom Package Groups](#)" section in the Yocto Project Development Manual.

Previously, this class was called the `task` class.

7.98. `packageinfo.bbclass`

The `packageinfo` class gives a BitBake user interface the ability to retrieve information about output packages from the `pkgdata` files.

This class is enabled automatically when using the [Hob](#) user interface.

7.99. `patch.bbclass`

The `patch` class provides all functionality for applying patches during the `do_patch` task.

This class is enabled by default because it is inherited by the `base` class.

7.100. `perlnative.bbclass`

When inherited by a recipe, the `perlnative` class supports using the native version of Perl built by the build system rather than using the version provided by the build host.

7.101. `pixbufcache.bbclass`

The `pixbufcache` class generates the proper post-install and post-remove (`postinst`/`postrm`) scriptlets for packages that install pixbuf loaders, which are used with `gdk-pixbuf`. These scriptlets call `update_pixbuf_cache` to add the pixbuf loaders to the cache. Since the cache files are architecture-specific, `update_pixbuf_cache` is run using QEMU if the `postinst` scriptlets need to be run on the build host during image creation.

If the pixbuf loaders being installed are in packages other than the recipe's main package, set `PIXBUF_PACKAGES` to specify the packages containing the loaders.

7.102. `pkgconfig.bbclass`

The `pkgconfig` class provides a standard way to get header and library information by using `pkg-config`. This class aims to smooth integration of `pkg-config` into libraries that use it.

During staging, BitBake installs `pkg-config` data into the `sysroots/` directory. By making use of `sysroot` functionality within `pkg-config`, the `pkgconfig` class no longer has to manipulate the files.

7.103. `populate_sdk.bbclass`

The `populate_sdk` class provides support for SDK-only recipes. For information on advantages gained when building a cross-development toolchain using the `do_populate_sdk` task, see the "[Optionally Building a Toolchain Installer](#)" section in the Yocto Project Application Developer's Guide.

7.104. `populate_sdk*.bbclass`

The `populate_sdk_*` classes support SDK creation and consist of the following classes:

- **`populate_sdk_base`**: The base class supporting SDK creation under all package managers (i.e. DEB, RPM, and opkg).
- **`populate_sdk_deb`**: Supports creation of the SDK given the Debian package manager.
- **`populate_sdk_rpm`**: Supports creation of the SDK given the RPM package manager.
- **`populate_sdk_ipk`**: Supports creation of the SDK given the opkg (IPK format) package manager.
- **`populate_sdk_ext`**: Supports extensible SDK creation under all package managers.

The `populate_sdk_base` class inherits the appropriate `populate_sdk_*` (i.e. `deb`, `rpm`, and `ipk`) based on `IMAGE_PKGTYPE`.

The base class ensures all source and destination directories are established and then populates the SDK. After populating the SDK, the `populate_sdk_base` class constructs two sysroots: `${SDK_ARCH}-nativesdk`, which contains the cross-compiler and associated tooling, and the target, which contains a target root filesystem that is configured for the SDK usage. These two images reside in `SDK_OUTPUT`, which consists of the following:

```
${SDK_OUTPUT}/${SDK_ARCH}-nativesdk-pkgs  
${SDK_OUTPUT}/${SDKTARGETSYSROOT}/target-pkgs
```

Finally, the base `populate SDK` class creates the toolchain environment setup script, the tarball of the SDK, and the installer.

The respective `populate_sdk_deb`, `populate_sdk_rpm`, and `populate_sdk_ipk` classes each support the specific type of SDK. These classes are inherited by and used with the `populate_sdk_base` class.

For more information on the cross-development toolchain generation, see the "[Cross-Development Toolchain Generation](#)" section. For information on advantages gained when building a cross-development toolchain using the `do_populate_sdk` task, see the "[Optionally Building a Toolchain Installer](#)" section in the Yocto Project Application Developer's Guide.

7.105. `prexport.bbclass`

The `prexport` class provides functionality for exporting `PR` values.

Note

This class is not intended to be used directly. Rather, it is enabled when using "`bitbake-prserv-tool export`".

7.106. `primport.bbclass`

The `primport` class provides functionality for importing `PR` values.

Note

This class is not intended to be used directly. Rather, it is enabled when using "bitbake-prserv-tool import".

7.107. `prserv.bbclass`

The `prserv` class provides functionality for using a [PR service](#) in order to automatically manage the incrementing of the `PR` variable for each recipe.

This class is enabled by default because it is inherited by the [package](#) class. However, the OpenEmbedded build system will not enable the functionality of this class unless `PRSERV_HOST` has been set.

7.108. `pptest.bbclass`

The `pptest` class provides functionality for packaging and installing runtime tests for recipes that build software that provides these tests.

This class is intended to be inherited by individual recipes. However, the class' functionality is largely disabled unless "ptest" appears in [DISTRO_FEATURES](#). See the "[Testing Packages With ptest](#)" section in the Yocto Project Development Manual for more information on ptest.

7.109. `pptest-gnome.bbclass`

Enables package tests (ptests) specifically for GNOME packages, which have tests intended to be executed with `gnome-desktop-testing`.

For information on setting up and running ptests, see the "[Testing Packages With ptest](#)" section in the Yocto Project Development Manual.

7.110. `python-dir.bbclass`

The `python-dir` class provides the base version, location, and site package location for Python.

7.111. `python3native.bbclass`

The `python3native` class supports using the native version of Python 3 built by the build system rather than support of the version provided by the build host.

7.112. `pythonnative.bbclass`

When inherited by a recipe, the `pythonnative` class supports using the native version of Python built by the build system rather than using the version provided by the build host.

7.113. `qemu.bbclass`

The `qemu` class provides functionality for recipes that either need QEMU or test for the existence of QEMU. Typically, this class is used to run programs for a target system on the build host using QEMU's application emulation mode.

7.114. `qmake*.bbclass`

The `qmake*` classes support recipes that need to build software that uses Qt's `qmake` build system and are comprised of the following:

- **`qmake_base`:** Provides base functionality for all versions of `qmake`.
- **`qmake2`:** Extends base functionality for `qmake 2.x` as used by Qt 4.x.

If you need to set any configuration variables or pass any options to `qmake`, you can add these to the `EXTRA_OMAKEVARS_PRE` or `EXTRA_OMAKEVARS_POST` variables, depending on whether the arguments need to be before or after the `.pro` file list on the command line, respectively.

By default, all `.pro` files are built. If you want to specify your own subset of `.pro` files to be built, specify them in the `OMAKE_PROFILES` variable.

7.115. `qt4*.bbclass`

The `qt4*` classes support recipes that need to build software that uses the Qt development framework version 4.x and consist of the following:

- **`qt4e`:** Supports building against Qt/Embedded, which uses the framebuffer for graphical output.
- **`qt4x11`:** Supports building against Qt/X11.

The classes inherit the `qmake2` class.

7.116. `recipe_sanity.bbclass`

The `recipe_sanity` class checks for the presence of any host system recipe prerequisites that might affect the build (e.g. variables that are set or software that is present).

7.117. `relocatable.bbclass`

The `relocatable` class enables relocation of binaries when they are installed into the `sysroot`.

This class makes use of the `chrpath` class and is used by both the `cross` and `native` classes.

7.118. `report-error.bbclass`

The `report-error` class supports enabling the [error reporting tool](#), which allows you to submit build error information to a central database.

The class collects debug information for recipe, recipe version, task, machine, distro, build system, target system, host distro, branch, commit, and log. From the information, report files using a JSON format are created and stored in `${LOG_DIR}/error-report`.

7.119. `rm_work.bbclass`

The `rm_work` class supports deletion of temporary workspace, which can ease your hard drive

demands during builds.

The OpenEmbedded build system can use a substantial amount of disk space during the build process. A portion of this space is the work files under the `${TMPDIR}/work` directory for each recipe. Once the build system generates the packages for a recipe, the work files for that recipe are no longer needed. However, by default, the build system preserves these files for inspection and possible debugging purposes. If you would rather have these files deleted to save disk space as the build progresses, you can enable `rm_work` by adding the following to your `local.conf` file, which is found in the [Build Directory](#).

```
INHERIT += "rm_work"
```

If you are modifying and building source code out of the work directory for a recipe, enabling `rm_work` will potentially result in your changes to the source being lost. To exclude some recipes from having their work directories deleted by `rm_work`, you can add the names of the recipe or recipes you are working on to the `RM_WORK_EXCLUDE` variable, which can also be set in your `local.conf` file. Here is an example:

```
RM_WORK_EXCLUDE += "busybox glibc"
```

7.120. `rootfs*.bbclass`

The `rootfs*` classes support creating the root filesystem for an image and consist of the following classes:

- The `rootfs_deb` class, which supports creation of root filesystems for images built using `.deb` packages.
- The `rootfs_rpm` class, which supports creation of root filesystems for images built using `.rpm` packages.
- The `rootfs_ipk` class, which supports creation of root filesystems for images built using `.ipk` packages.
- The `rootfsdebugfiles` class, which installs additional files found on the build host directly into the root filesystem.

The root filesystem is created from packages using one of the `rootfs*.bbclass` files as determined by the `PACKAGE_CLASSES` variable.

For information on how root filesystem images are created, see the ["Image Generation"](#) section.

7.121. `sanity.bbclass`

The `sanity` class checks to see if prerequisite software is present on the host system so that users can be notified of potential problems that might affect their build. The class also performs basic user configuration checks from the `local.conf` configuration file to prevent common mistakes that cause build failures. Distribution policy usually determines whether to include this class.

7.122. `scons.bbclass`

The `scons` class supports recipes that need to build software that uses the SCons build system. You can use the `EXTRA_OESCONS` variable to specify additional configuration options you want to pass SCons command line.

7.123. `sdl.bbclass`

The `sdl` class supports recipes that need to build software that uses the Simple DirectMedia Layer (SDL) library.

7.124. `setuptools.bbclass`

The `setuptools` class supports Python version 2.x extensions that use build systems based on `setuptools`. If your recipe uses these build systems, the recipe needs to inherit the `setuptools` class.

7.125. `setuptools3.bbclass`

The `setuptools3` class supports Python version 3.x extensions that use build systems based on `setuptools3`. If your recipe uses these build systems, the recipe needs to inherit the `setuptools3` class.

7.126. `sign_rpm.bbclass`

The `sign_rpm` class supports generating signed RPM packages.

7.127. `sip.bbclass`

The `sip` class supports recipes that build or package SIP-based Python bindings.

7.128. `siteconfig.bbclass`

The `siteconfig` class provides functionality for handling site configuration. The class is used by the `autotools` class to accelerate the `do_configure` task.

7.129. `siteinfo.bbclass`

The `siteinfo` class provides information about the targets that might be needed by other classes or recipes.

As an example, consider Autotools, which can require tests that must execute on the target hardware. Since this is not possible in general when cross compiling, site information is used to provide cached test results so these tests can be skipped over but still make the correct values available. The `meta/site_directory` contains test results sorted into different categories such as architecture, endianness, and the `libc` used. Site information provides a list of files containing data relevant to the current build in the `CONFIG_SITE` variable that Autotools automatically picks up.

The class also provides variables like `SITEINFO_ENDIANNES` and `SITEINFO_BITS` that can be used elsewhere in the metadata.

Because the `base` class includes the `siteinfo` class, it is always active.

7.130. `spdx.bbclass`

The `spdx` class integrates real-time license scanning, generation of SPDX standard output, and verification of license information during the build.

Note

This class is currently at the prototype stage in the 1.6 release.

7.131. `sstate.bbclass`

The `sstate` class provides support for Shared State (`sstate`). By default, the class is enabled through the `INHERIT_DISTRO` variable's default value.

For more information on `sstate`, see the "[Shared State Cache](#)" section.

7.132. `staging.bbclass`

The `staging` class provides the `do_populate_sysroot` task, which stages files into the `sysroot` to make them available to other recipes at build time. The class is enabled by default because it is inherited by the `base` class.

7.133. `syslinux.bbclass`

The `syslinux` class provides `syslinux`-specific functions for building bootable images.

The class supports the following variables:

- `INITRD`: Indicates list of filesystem images to concatenate and use as an initial RAM disk (`initrd`). This variable is optional.
- `ROOTFS`: Indicates a filesystem image to include as the root filesystem. This variable is optional.
- `AUTO_SYSLINUXMENU`: Enables creating an automatic menu when set to "1".
- `LABELS`: Lists targets for automatic configuration.
- `APPEND`: Lists append string overrides for each label.
- `SYSINUX_OPTS`: Lists additional options to add to the `syslinux` file. Semicolon characters separate multiple options.
- `SYSINUX_SPLASH`: Lists a background for the VGA boot menu when you are using the boot menu.
- `SYSINUX_DEFAULT_CONSOLE`: Set to "console=ttyX" to change kernel boot default console.
- `SYSINUX_SERIAL`: Sets an alternate serial port. Or, turns off serial when the variable is set with an empty string.
- `SYSINUX_SERIAL_TTY`: Sets an alternate "console=tty..." kernel boot argument.

7.134. `systemd.bbclass`

The `systemd` class provides support for recipes that install `systemd` unit files.

The functionality for this class is disabled unless you have "systemd" in `DISTRO_FEATURES`.

Under this class, the recipe or Makefile (i.e. whatever the recipe is calling during the `do_install` task) installs unit files into `${D}${systemd_unitdir}/system`. If the unit files being installed go into packages other than the main package, you need to set `SYSTEMD_PACKAGES` in your recipe to identify the packages in which the files will be installed.

You should set `SYSTEMD_SERVICE` to the name of the service file. You should also use a package name override to indicate the package to which the value applies. If the value applies to the recipe's main package, use `${PN}`. Here is an example from the `connman` recipe:

```
SYSTEMD_SERVICE_${PN} = "connman.service"
```

Services are set up to start on boot automatically unless you have set `SYSTEMD_AUTO_ENABLE` to "disable".

For more information on `systemd`, see the "[Selecting an Initialization Manager](#)" section in the Yocto Project Development Manual.

7.135. `terminal.bbclass`

The `terminal` class provides support for starting a terminal session. The `OE_TERMINAL` variable controls which terminal emulator is used for the session.

Other classes use the `terminal` class anywhere a separate terminal session needs to be started. For example, the `patch` class assuming `PATCHRESOLVE` is set to "user", the `cm11` class, and the `devshell` class all use the `terminal` class.

7.136. `testimage*.bbclass`

The `testimage*` classes support running automated tests against images using QEMU and on actual hardware. The classes handle loading the tests and starting the image. To use the classes, you need to perform steps to set up the environment.

The tests are commands that run on the target system over `ssh`. Each test is written in Python and makes use of the `unittest` module.

The `testimage.bbclass` runs tests on an image when called using the following:

```
$ bitbake -c testimage image
```

The `testimage-auto` class runs tests on an image after the image is constructed (i.e. `TEST_IMAGE` must be set to "1").

For information on how to enable, run, and create new tests, see the "[Performing Automated Runtime Testing](#)" section in the Yocto Project Development Manual.

7.137. `texinfo.bbclass`

This class should be inherited by recipes whose upstream packages invoke the `texinfo` utilities at build-time. Native and cross recipes are made to use the dummy scripts provided by `texinfo-dummy-native`, for improved performance. Target architecture recipes use the genuine Texinfo utilities. By default, they use the Texinfo utilities on the host system.

Note

If you want to use the Texinfo recipe shipped with the build system, you can remove "texinfo-native" from `ASSUME_PROVIDED` and makeinfo from `SANITY_REQUIRED_UTILITIES`.

7.138. `tinderclient.bbclass`

The `tinderclient` class submits build results to an external Tinderbox instance.

Note

This class is currently unmaintained.

7.139. `toaster.bbclass`

The `toaster` class collects information about packages and images and sends them as events that the BitBake user interface can receive. The class is enabled when the Toaster user interface is running.

This class is not intended to be used directly.

7.140. `toolchain-scripts.bbclass`

The `toolchain-scripts` class provides the scripts used for setting up the environment for installed SDKs.

7.141. `typecheck.bbclass`

The `typecheck` class provides support for validating the values of variables set at the configuration level against their defined types. The OpenEmbedded build system allows you to define the type of a variable using the "type" varflag. Here is an example:

```
IMAGE_FEATURES[type] = "list"
```

7.142. `uboot-config.bbclass`

The `uboot-config` class provides support for U-Boot configuration for a machine. Specify the machine in your recipe as follows:

```
UBOOT_CONFIG ??= <default>  
UBOOT_CONFIG[foo] = "config,images"
```

You can also specify the machine using this method:

```
UBOOT_MACHINE = "config"
```

See the [UBOOT_CONFIG](#) and [UBOOT_MACHINE](#) variables for additional information.

7.143. `uninative.bbclass`

Provides a means of reusing `native/cross` over multiple distros.

Note

Currently, the method used by the `uninative` class is experimental.

For more information, see the commit message [here](#).

7.144. `update-alternatives.bbclass`

The `update-alternatives` class helps the alternatives system when multiple sources provide the same command. This situation occurs when several programs that have the same or similar function are installed with the same name. For example, the `ar` command is available from the `busybox`, `binutils` and `elfutils` packages. The `update-alternatives` class handles renaming the binaries so that multiple packages can be installed without conflicts. The `ar` command still works regardless of which packages are installed or subsequently removed. The class renames the conflicting binary in each package and symlinks the highest priority binary during installation or removal of packages.

To use this class, you need to define a number of variables:

- `ALTERNATIVE`
- `ALTERNATIVE_LINK_NAME`
- `ALTERNATIVE_TARGET`
- `ALTERNATIVE_PRIORITY`

These variables list alternative commands needed by a package, provide pathnames for links, default links for targets, and so forth. For details on how to use this class, see the comments in the `update-alternatives.bbclass`.

Note

You can use the `update-alternatives` command directly in your recipes. However, this class simplifies things in most cases.

7.145. `update-rc.d.bbclass`

The `update-rc.d` class uses `update-rc.d` to safely install an initialization script on behalf of the package. The OpenEmbedded build system takes care of details such as making sure the script is stopped before a package is removed and started when the package is installed.

Three variables control this class: `INITSCRIPT_PACKAGES`, `INITSCRIPT_NAME` and `INITSCRIPT_PARAMS`. See the variable links for details.

7.146. `useradd*.bbclass`

The `useradd*` classes support the addition of users or groups for usage by the package on the target. For example, if you have packages that contain system services that should be run under their own user or group, you can use these classes to enable creation of the user or group. The `meta-skeleton/recipes-skeleton/useradd/useradd-example.bb` recipe in the [Source Directory](#) provides a simple example that shows how to add three users and groups to two packages. See the `useradd-example.bb` recipe for more information on how to use these classes.

The `useradd_base` class provides basic functionality for user or groups settings.

The `useradd*` classes support the `USERADD_PACKAGES`, `USERADD_PARAM`, `GROUPADD_PARAM`, and `GROUPMEMS_PARAM` variables.

The `useradd-staticids` class supports the addition of users or groups that have static user

identification (`uid`) and group identification (`gid`) values.

The default behavior of the OpenEmbedded build system for assigning `uid` and `gid` values when packages add users and groups during package install time is to add them dynamically. This works fine for programs that do not care what the values of the resulting users and groups become. In these cases, the order of the installation determines the final `uid` and `gid` values. However, if non-deterministic `uid` and `gid` values are a problem, you can override the default, dynamic application of these values by setting static values. When you set static values, the OpenEmbedded build system looks in `BBPATH` for `files/passwd` and `files/group` files for the values.

To use static `uid` and `gid` values, you need to set some variables. See the `USERADDEXTENSION`, `USERADD_UID_TABLES`, `USERADD_GID_TABLES`, and `USERADD_ERROR_DYNAMIC` variables. You can also see the `useradd` class for additional information.

Notes

You do not use the `useradd-staticids` class directly. You either enable or disable the class by setting the `USERADDEXTENSION` variable. If you enable or disable the class in a configured system, `TMPDIR` might contain incorrect `uid` and `gid` values. Deleting the `TMPDIR` directory will correct this condition.

7.147. `utility-tasks.bbclass`

The `utility-tasks` class provides support for various "utility" type tasks that are applicable to all recipes, such as `do_clean` and `do_listtasks`.

This class is enabled by default because it is inherited by the `base` class.

7.148. `utils.bbclass`

The `utils` class provides some useful Python functions that are typically used in inline Python expressions (e.g. `${@...}`). One example use is for `bb.utils.contains()`.

This class is enabled by default because it is inherited by the `base` class.

7.149. `vala.bbclass`

The `vala` class supports recipes that need to build software written using the Vala programming language.

7.150. `waf.bbclass`

The `waf` class supports recipes that need to build software that uses the Waf build system. You can use the `EXTRA_OECONF` variable to specify additional configuration options to be passed on the Waf command line.

Chapter 8. Tasks

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Tasks are units of execution for BitBake. Recipes (.bb files) use tasks to complete configuring, compiling, and packaging software. This chapter provides a reference of the tasks defined in the OpenEmbedded build system.

8.1. Normal Recipe Build Tasks ¶

The following sections describe normal tasks associated with building a recipe.

8.1.1. `do_build`

The default task for all recipes. This task depends on all other normal tasks required to build a recipe.

8.1.2. `do_compile`

Compiles the source in the compilation directory, which is pointed to by the `B` variable.

8.1.3. `do_compile_ptest_base`

Compiles the runtime test suite included in the software being built.

8.1.4. `do_configure`

Configures the source by enabling and disabling any build-time and configuration options for the software being built.

8.1.5. `do_configure_ptest_base`

Configures the runtime test suite included in the software being built.

8.1.6. `do_deploy`

Writes output files that are to be deployed to the deploy directory, which is defined by the `DEPLOYDIR` variable.

The `do_deploy` task is a shared state (sstate) task, which means that the task can be accelerated through sstate use. Realize also that if the task is re-executed, any previous output is removed (i.e. "cleaned").

8.1.7. `do_fetch`

Fetches the source code. This task uses the `SRC_URI` variable and the argument's prefix to determine the correct fetcher module.

8.1.8. `do_install`

Copies files from the compilation directory, which is defined by the `B` variable, to a holding area defined by the `D` variable.

8.1.9. `do_install_ptest_base`

Copies the runtime test suite files from the compilation directory to a holding area.

8.1.10. `do_package`

Analyzes the content of the holding area and splits it into subsets based on available packages and files.

8.1.11. `do_package_qa`

Runs QA checks on packaged files. For more information on these checks, see the [`insane`](#)

class.

8.1.12. `do_package_write_deb`

Creates Debian packages (i.e. *.deb files) and places them in the `${DEPLOY_DIR_DEB}` directory in the package feeds area. For more information, see the "[Package Feeds](#)" section.

8.1.13. `do_package_write_ipk`

Creates IPK packages (i.e. *.ipk files) and places them in the `${DEPLOY_DIR_IPK}` directory in the package feeds area. For more information, see the "[Package Feeds](#)" section.

8.1.14. `do_package_write_rpm`

Creates RPM packages (i.e. *.rpm files) and places them in the `${DEPLOY_DIR_RPM}` directory in the package feeds area. For more information, see the "[Package Feeds](#)" section.

8.1.15. `do_package_write_tar`

Creates tarballs and places them in the `${DEPLOY_DIR_TAR}` directory in the package feeds area. For more information, see the "[Package Feeds](#)" section.

8.1.16. `do_packagedata`

Creates package metadata used by the build system to generate the final packages.

8.1.17. `do_patch`

Locates patch files and applies them to the source code. See the "[Patching](#)" section for more information.

8.1.18. `do_populate_lic`

Writes license information for the recipe that is collected later when the image is constructed.

8.1.19. `do_populate_sdk`

Creates the file and directory structure for an installable SDK. See the "[SDK Generation](#)" section for more information.

8.1.20. `do_populate_sysroot`

Copies a subset of files installed by the `do_install` task into the sysroot in order to make them available to other recipes.

The `do_populate_sysroot` task is a shared state (sstate) task, which means that the task can be accelerated through sstate use. Realize also that if the task is re-executed, any previous output is removed (i.e. "cleaned").

8.1.21. `do_rm_work`

Removes work files after the OpenEmbedded build system has finished with them. You can learn more by looking at the "[rm_work.bbclass](#)" section.

8.1.22. `do_rm_work_all`

Top-level task for removing work files after the build system has finished with them.

8.1.23. `do_unpack`

Unpacks the source code into a working directory pointed to by `${WORKDIR}`. The `s` variable also plays a role in where unpacked source files ultimately reside. For more information on how source files are unpacked, see the "[Source Fetching](#)" section and the `WORKDIR` and `s` variable descriptions.

8.2. Manually Called Tasks

These tasks are typically manually triggered (e.g. by using the `bitbake -c` command-line option):

8.2.1. `do_checkuri`

Validates the `SRC_URI` value.

8.2.2. `do_checkuriall`

Validates the `SRC_URI` value for all recipes required to build a target.

8.2.3. `do_clean`

Removes all output files for a target from the `do_unpack` task forward (i.e. `do_unpack`, `do_configure`, `do_compile`, `do_install`, and `do_package`).

You can run this task using BitBake as follows:

```
$ bitbake -c clean recipe
```

Running this task does not remove the `sstate` cache files. Consequently, if no changes have been made and the recipe is rebuilt after cleaning, output files are simply restored from the `sstate` cache. If you want to remove the `sstate` cache files for the recipe, you need to use the `do_cleansstate` task instead (i.e. `bitbake -c cleansstate recipe`).

8.2.4. `do_cleanall`

Removes all output files, shared state (`sstate`) cache, and downloaded source files for a target (i.e. the contents of `DL_DIR`). Essentially, the `do_cleanall` task is identical to the `do_cleansstate` task with the added removal of downloaded source files.

You can run this task using BitBake as follows:

```
$ bitbake -c cleanall recipe
```

Typically, you would not normally use the `cleanall` task. Do so only if you want to start fresh with the `do_fetch` task.

8.2.5. `do_cleansstate`

Removes all output files and shared state (`sstate`) cache for a target. Essentially, the `do_cleansstate` task is identical to the `do_clean` task with the added removal of shared state (`sstate`) cache.

You can run this task using BitBake as follows:

```
$ bitbake -c cleansstate recipe
```

When you run the `do_cleansstate` task, the OpenEmbedded build system no longer uses any sstate. Consequently, building the recipe from scratch is guaranteed.

Note

The `do_cleansstate` task cannot remove sstate from a remote sstate mirror. If you need to build a target from scratch using remote mirrors, use the `"-f"` option as follows:

```
$ bitbake -f -c do_cleansstate target
```

8.2.6. `do_devshell`

Starts a shell whose environment is set up for development, debugging, or both. See the "[Using a Development Shell](#)" section in the Yocto Project Development Manual for more information about using `devshell`.

8.2.7. `do_fetchall`

Fetches all remote sources required to build a target.

8.2.8. `do_listtasks`

Lists all defined tasks for a target.

8.2.9. `do_package_index`

Creates or updates the index in the [Package Feeds](#) area.

Note

This task is not triggered with the `bitbake -c` command-line option as are the other tasks in this section. Because this task is specifically for the `package-index` recipe, you run it using `bitbake package-index`.

8.3. Image-Related Tasks

The following tasks are applicable to image recipes.

8.3.1. `do_bootimg`

Creates a bootable live image. See the `IMAGE_FSTYPES` variable for additional information on live image types.

8.3.2. `do_bundle_initramfs`

Combines an initial RAM disk (initramfs) image and kernel together to form a single image. The `CONFIG_INITRAMFS_SOURCE` variable has some more information about these types of images.

8.3.3. `do_rootfs`

Creates the root filesystem (file and directory structure) for an image. See the "[Image Generation](#)" section for more information on how the root filesystem is created.

8.3.4. `do_testimage`

Boots an image and performs runtime tests within the image. For information on automatically testing images, see the "[Performing Automated Runtime Testing](#)" section in the Yocto Project Development Manual.

8.3.5. `do_testimage_auto`

Boots an image and performs runtime tests within the image immediately after it has been built. This task is enabled when you set `TEST_IMAGE` equal to "1".

For information on automatically testing images, see the "[Performing Automated Runtime Testing](#)" section in the Yocto Project Development Manual.

8.3.6. `do_vmdkimg`

Creates a `.vmdk` image for use with [VMware](#) and compatible virtual machine hosts.

8.4. Kernel-Related Tasks

The following tasks are applicable to kernel recipes. Some of these tasks (e.g. the `do_menuconfig` task) are also applicable to recipes that use Linux kernel style configuration such as the BusyBox recipe.

8.4.1. `do_compile_kernelmodules`

Compiles loadable modules for the Linux kernel.

8.4.2. `do_diffconfig`

Compares the old and new config files after running the `do_menuconfig` task for the kernel.

8.4.3. `do_kernel_checkout`

Checks out source/meta branches for a linux-yocto style kernel.

8.4.4. `do_kernel_configcheck`

Validates the kernel configuration for a linux-yocto style kernel.

8.4.5. `do_kernel_configme`

Assembles the kernel configuration for a linux-yocto style kernel.

8.4.6. `do_kernel_link_vmlinux`

Creates a symbolic link in `arch/$arch/boot` for vmlinux kernel images.

8.4.7. `do_kernel_metadata`

Collects kernel metadata for a linux-yocto style kernel.

8.4.8. `do_menuconfig`

Runs `make menuconfig` for the kernel. For information on `menuconfig`, see the "[Using `menuconfig`](#)" section in the Yocto Project Development Manual.

8.4.9. `do_savedefconfig`

Creates a minimal Linux kernel configuration file.

8.4.10. `do_shared_workdir`

Creates the shared working directory for the kernel.

8.4.11. `do_sizecheck`

Checks the size of the kernel image against `KERNEL_IMAGE_MAXSIZE` when set.

8.4.12. `do_strip`

Strips unneeded sections out of the Linux kernel image.

8.4.13. `do_uboot_mkimage`

Creates a uImage file from the kernel for the U-Boot bootloader.

8.4.14. `do_validate_branches`

Ensures that the source, metadata (or both) branches are on the locations specified by their `SRCREV` values for a linux-yocto style kernel.

8.5. Miscellaneous Tasks

The following sections describe miscellaneous tasks.

8.5.1. `do_generate_qt_config_file`

Writes a `qt.conf` configuration file used for building a Qt-based application.

8.5.2. `do_spdx`

A build stage that takes the source code and scans it on a remote FOSSOLOGY server in order to produce an SPDX document. This task applies only to the `spdx` class.

Chapter 9. QA Error and Warning Messages

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- [9.1. Introduction](#)
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- [9.3. Configuring and Disabling QA Checks](#)

9.1. Introduction ¶

When building a recipe, the OpenEmbedded build system performs various QA checks on the output to ensure that common issues are detected and reported. Sometimes when you create a new recipe to build new software, it will build with no problems. When this is not the case, or when you have QA issues building any software, it could take a little time to resolve them.

While it is tempting to ignore a QA message or even to disable QA checks, it is best to try and resolve any reported QA issues. This chapter provides a list of the QA messages and brief explanations of the issues you could encounter so that you can properly resolve problems.

The next section provides a list of all QA error and warning messages based on a default configuration. Each entry provides the message or error form along with an explanation.

Notes

- At the end of each message, the name of the associated QA test (as listed in the "[insane.bbclass](#)" section) appears within square brackets.
- As mentioned, this list of error and warning messages is for QA checks only. The list does not cover all possible build errors or warnings you could encounter.
- Because some QA checks are disabled by default, this list does not include all possible QA check errors and warnings.

9.2. Errors and Warnings ¶

- `<packagename>: <path> is using libexec please relocate to <libexecdir> [libexec] ¶`

The specified package contains files in `/usr/libexec`. By default, `libexecdir` is set to `"${libdir}/${BPN}"` rather than to `/usr/libexec`. Thus, installing to `/usr/libexec` is likely not desirable.

- `package <packagename> contains bad RPATH <rpath> in file <file> [rpaths] ¶`

The specified binary produced by the recipe contains dynamic library load paths (rpaths) that contain build system paths such as `TMPPDIR`, which are incorrect for the target and could potentially be a security issue. Check for bad `-rpath` options being passed to the linker in your `do_compile` log. Depending on the build system used by the software being built, there might be a configure option to disable rpath usage completely within the build of the software.

- `<packagename>: <file> contains probably-redundant RPATH <rpath> [useless-rpaths] ¶`

The specified binary produced by the recipe contains dynamic library load paths (rpaths) that on a standard system are searched by default by the linker (e.g. `/lib` and `/usr/lib`). While these paths will not cause any breakage, they do waste space and are unnecessary. Depending on the build system used by the software being built, there might be a configure option to disable rpath usage completely within the build of the software.

- `<packagename> requires <files>, but no providers in its RDEPENDS [file-rdeps] ¶`

A file-level dependency has been identified from the specified package on the specified files,

but there is no explicit corresponding entry in [RDEPENDS](#). If particular files are required at runtime then [RDEPENDS](#) should be declared in the recipe to ensure the packages providing them are built.

- `<packagename1> rdepends on <packagename2>, but it isn't a build dependency? [build-deps]` [🔗](#)

A runtime dependency exists between the two specified packages, but there is nothing explicit within the recipe to enable the OpenEmbedded build system to ensure that dependency is satisfied. This condition is usually triggered by an [RDEPENDS](#) value being added at the packaging stage rather than up front, which is usually automatic based on the contents of the package. In most cases, you should change the recipe to add an explicit [RDEPENDS](#) for the dependency.

- `non -dev/-dbg/nativesdk- package contains symlink .so: <packagename> path '<path>' [dev-so]` [🔗](#)

Symlink `.so` files are for development only, and should therefore go into the `-dev` package. This situation might occur if you add `*.so*` rather than `*.so.*` to a non-dev package. Change [FILES](#) (and possibly [PACKAGES](#)) such that the specified `.so` file goes into an appropriate `-dev` package.

- `non -staticdev package contains static .a library: <packagename> path '<path>' [staticdev]` [🔗](#)

Static `.a` library files should go into a `-staticdev` package. Change [FILES](#) (and possibly [PACKAGES](#)) such that the specified `.a` file goes into an appropriate `-staticdev` package.

- `<packagename>: found library in wrong location [libdir]` [🔗](#)

The specified file may have been installed into an incorrect (possibly hardcoded) installation path. For example, this test will catch recipes that install `/lib/bar.so` when `${base_libdir}` is `"lib32"`. Another example is when recipes install `/usr/lib64/foo.so` when `${libdir}` is `"/usr/lib"`. False positives occasionally exist. For these cases add `"libdir"` to [INSANE_SKIP](#) for the package.

- `non debug package contains .debug directory: <packagename> path <path> [debug-files]` [🔗](#)

The specified package contains a `.debug` directory, which should not appear in anything but the `-dbg` package. This situation might occur if you add a path which contains a `.debug` directory and do not explicitly add the `.debug` directory to the `-dbg` package. If this is the case, add the `.debug` directory explicitly to `FILES_${PN}-dbg`. See [FILES](#) for additional information on [FILES](#).

- `Architecture did not match (<machine_arch> to <file_arch>) on <file> [arch]` [🔗](#)

By default, the OpenEmbedded build system checks the Executable and Linkable Format (ELF) type, bit size, and endianness of any binaries to ensure they match the target architecture. This test fails if any binaries do not match the type since there would be an incompatibility. The test could indicate that the wrong compiler or compiler options have been used. Sometimes software, like bootloaders, might need to bypass this check. If the file you receive the error for is firmware that is not intended to be executed within the target operating system or is intended to run on a separate processor within the device, you can

add "arch" to `INSANE_SKIP` for the package. Another option is to check the `do_compile` log and verify that the compiler options being used are correct.

- Bit size did not match (<machine_bits> to <file_bits>) <recipe> on <file> [arch] ⓘ

By default, the OpenEmbedded build system checks the Executable and Linkable Format (ELF) type, bit size, and endianness of any binaries to ensure they match the target architecture. This test fails if any binaries do not match the type since there would be an incompatibility. The test could indicate that the wrong compiler or compiler options have been used. Sometimes software, like bootloaders, might need to bypass this check. If the file you receive the error for is firmware that is not intended to be executed within the target operating system or is intended to run on a separate processor within the device, you can add "arch" to `INSANE_SKIP` for the package. Another option is to check the `do_compile` log and verify that the compiler options being used are correct.

- Endianness did not match (<machine_endianness> to <file_endianness>) on <file> [arch] ⓘ

By default, the OpenEmbedded build system checks the Executable and Linkable Format (ELF) type, bit size, and endianness of any binaries to ensure they match the target architecture. This test fails if any binaries do not match the type since there would be an incompatibility. The test could indicate that the wrong compiler or compiler options have been used. Sometimes software, like bootloaders, might need to bypass this check. If the file you receive the error for is firmware that is not intended to be executed within the target operating system or is intended to run on a separate processor within the device, you can add "arch" to `INSANE_SKIP` for the package. Another option is to check the `do_compile` log and verify that the compiler options being used are correct.

- ELF binary '<file>' has relocations in .text [textrel] ⓘ

The specified ELF binary contains relocations in its `.text` sections. This situation can result in a performance impact at runtime.

Typically, the way to solve this performance issue is to add "-fPIC" or "-fpic" to the compiler command-line options. For example, given software that reads `CFLAGS` when you build it, you could add the following to your recipe:

```
CFLAGS_append = " -fPIC "
```

For more information on text relocations at runtime, see <http://www.akkadia.org/drepper/textrelocs.html>.

- No GNU_HASH in the elf binary: '<file>' [ldflags] ⓘ


This indicates that binaries produced when building the recipe have not been linked with the `LDFLAGS` options provided by the build system. Check to be sure that the `LDFLAGS` variable is being passed to the linker command. A common workaround for this situation is to pass in `LDFLAGS` using `TARGET_CC_ARCH` within the recipe as follows:

```
TARGET_CC_ARCH += "${LDFLAGS}"
```

- Package <packagename> contains Xorg driver (<driver>) but no xorg-abi- dependencies [xorg-driver-abi] ⓘ


The specified package contains an Xorg driver, but does not have a corresponding ABI

package dependency. The `xserver-xorg` recipe provides driver ABI names. All drivers should depend on the ABI versions that they have been built against. Driver recipes that include `xorg-driver-input.inc` or `xorg-driver-video.inc` will automatically get these versions. Consequently, you should only need to explicitly add dependencies to binary driver recipes.


- The `/usr/share/info/dir` file is not meant to be shipped in a particular package. [infodir] 

The `/usr/share/info/dir` should not be packaged. Add the following line to your `do_install` task or to your `do_install_append` within the recipe as follows:

```
rm ${D}${infodir}/dir
```

- Symlink `<path>` in `<packagename>` points to `TMPDIR` [symlink-to-sysroot] 

The specified symlink points into `TMPDIR` on the host. Such symlinks will work on the host. However, they are clearly invalid when running on the target. You should either correct the symlink to use a relative path or remove the symlink.

- `<file>` failed sanity test (workdir) in path `<path>` [la] 

The specified `.la` file contains `TMPDIR` paths. Any `.la` file containing these paths is incorrect since `libtool` adds the correct `sysroot` prefix when using the files automatically itself.

- `<file>` failed sanity test (tmpdir) in path `<path>` [pkgconfig] 


The specified `.pc` file contains `TMPDIR/WORKDIR` paths. Any `.pc` file containing these paths is incorrect since `pkg-config` itself adds the correct `sysroot` prefix when the files are accessed.

- `<packagename>` rdepends on `<debug_packagename>` [debug-deps] 

A dependency exists between the specified non-dbg package (i.e. a package whose name does not end in `-dbg`) and a package that is a dbg package. The dbg packages contain debug symbols and are brought in using several different methods:

- Using the `dbg-pkgs` `IMAGE_FEATURES` value.
- Using `IMAGE_INSTALL`.
- As a dependency of another dbg package that was brought in using one of the above methods.

The dependency might have been automatically added because the dbg package erroneously contains files that it should not contain (e.g. a non-symlink `.so` file) or it might have been added manually (e.g. by adding to `RDEPENDS`).

- `<packagename>` rdepends on `<dev_packagename>` [dev-deps] 

A dependency exists between the specified non-dev package (a package whose name does not end in `-dev`) and a package that is a dev package. The dev packages contain development headers and are usually brought in using several different methods:

- Using the `dev-pkgs` `IMAGE_FEATURES` value.

- Using `IMAGE_INSTALL`.
- As a dependency of another dev package that was brought in using one of the above methods.

The dependency might have been automatically added (because the dev package erroneously contains files that it should not have (e.g. a non-symlink `.so` file) or it might have been added manually (e.g. by adding to `RDEPENDS`).

- `<var>_<packagename>` is invalid: `<comparison>` (`<value>`) only comparisons `<`, `=`, `>`, `<=`, and `>=` are allowed [dep-cmp] [¶](#)

If you are adding a versioned dependency relationship to one of the dependency variables (`RDEPENDS`, `RRECOMMENDS`, `RSUGGESTS`, `RPROVIDES`, `RREPLACES`, or `RCONFLICTS`), you must only use the named comparison operators. Change the versioned dependency values you are adding to match those listed in the message.

- `<recipe>`: The compile log indicates that host include and/or library paths were used. Please check the log '`<logfile>`' for more information. [compile-host-path] [¶](#)

The log for the `do_compile` task indicates that paths on the host were searched for files, which is not appropriate when cross-compiling. Look for "is unsafe for cross-compilation" or "CROSS COMPILE Badness" in the specified log file.

- `<recipe>`: The install log indicates that host include and/or library paths were used. Please check the log '`<logfile>`' for more information. [install-host-path] [¶](#)

The log for the `do_install` task indicates that paths on the host were searched for files, which is not appropriate when cross-compiling. Look for "is unsafe for cross-compilation" or "CROSS COMPILE Badness" in the specified log file.

- This autoconf log indicates errors, it looked at host include and/or library paths while determining system capabilities. Rerun configure task after fixing this. The path was '`<path>`' [¶](#)

The log for the `do_configure` task indicates that paths on the host were searched for files, which is not appropriate when cross-compiling. Look for "is unsafe for cross-compilation" or "CROSS COMPILE Badness" in the specified log file.


- `<packagename>` doesn't match the `[a-z0-9.+~]+` regex [pkgname] [¶](#)

The convention within the OpenEmbedded build system (sometimes enforced by the package manager itself) is to require that package names are all lower case and to allow a restricted set of characters. If your recipe name does not match this, or you add packages to `PACKAGES` that do not conform to the convention, then you will receive this error. Rename your recipe. Or, if you have added a non-conforming package name to `PACKAGES`, change the package name appropriately.


- `<recipe>`: configure was passed unrecognized options: `<options>` [unknown-configure-option] [¶](#)

The configure script is reporting that the specified options are unrecognized. This situation could be because the options were previously valid but have been removed from the


configure script. Or, there was a mistake when the options were added and there is another option that should be used instead. If you are unsure, consult the upstream build documentation, the `./configure --help` output, and the upstream change log or release notes. Once you have worked out what the appropriate change is, you can update `EXTRA_OECONF` or the individual `PACKAGECONFIG` option values accordingly.

- Recipe `<recipefile>` has PN of "`<recipename>`" which is in `OVERRIDES`, this can result in unexpected behavior. `[pn-overrides]` 

The specified recipe has a name (`PN`) value that appears in `OVERRIDES`. If a recipe is named such that its `PN` value matches something already in `OVERRIDES` (e.g. `PN` happens to be the same as `MACHINE` or `DISTRO`), it can have unexpected consequences. For example, assignments such as `FILES_${PN} = "xyz"` effectively turn into `FILES = "xyz"`. Rename your recipe (or if `PN` is being set explicitly, change the `PN` value) so that the conflict does not occur. See `FILES` for additional information.

- `<recipefile>`: Variable `<variable>` is set as not being package specific, please fix this. `[pkgvarcheck]` 

Certain variables (`RDEPENDS`, `RRECOMMENDS`, `RSUGGESTS`, `RCONFLICTS`, `RPROVIDES`, `RREPLACES`, `FILES`, `pkg_preinst`, `pkg_postinst`, `pkg_prerm`, `pkg_postrm`, and `ALLOW_EMPTY`) should always be set specific to a package (i.e. they should be set with a package name override such as `RDEPENDS_${PN} = "value"` rather than `RDEPENDS = "value"`). If you receive this error, correct any assignments to these variables within your recipe.


- File '`<file>`' from `<recipename>` was already stripped, this will prevent future debugging! `[already-stripped]` 

Produced binaries have already been stripped prior to the build system extracting debug symbols. It is common for upstream software projects to default to stripping debug symbols for output binaries. In order for debugging to work on the target using `-dbg` packages, this stripping must be disabled.

Depending on the build system used by the software being built, disabling this stripping could be as easy as specifying an additional configure option. If not, disabling stripping might involve patching the build scripts. In the latter case, look for references to "strip" or "STRIP", or the `"-s"` or `"-S"` command-line options being specified on the linker command line (possibly through the compiler command line if preceded with `"-Wl,"`).

Note

Disabling stripping here does not mean that the final packaged binaries will be unstripped. Once the OpenEmbedded build system splits out debug symbols to the `-dbg` package, it will then strip the symbols from the binaries.

- `<packagename>` is listed in `PACKAGES` multiple times, this leads to packaging errors. `[packages-list]` 

Package names must appear only once in the `PACKAGES` variable. You might receive this error if you are attempting to add a package to `PACKAGES` that is already in the variable's value.

- `FILES` variable for package `<packagename>` contains `'//'` which is invalid. Attempting to fix this but you should correct the metadata. `[files-invalid]` [¶](#)

The string `"//"` is invalid in a Unix path. Correct all occurrences where this string appears in a `FILES` variable so that there is only a single `"/"`.

- `<recipename>`: Files/directories were installed but not shipped `[installed-vs-shipped]` [¶](#)

Files have been installed within the `do_install` task but have not been included in any package by way of the `FILES` variable. Files that do not appear in any package cannot be present in an image later on in the build process. You need to do one of the following:

- Add the files to `FILES` for the package you want them to appear in (e.g. `FILES_${PN}` for the main package).
- Delete the files at the end of the `do_install` task if the files are not needed in any package.

- `<oldpackage>-<oldpkgversion>` was registered as shlib provider for `<library>`, changing it to `<newpackage>-<newpkgversion>` because it was built later [¶](#)

This message means that both `<oldpackage>` and `<newpackage>` provide the specified shared library. You can expect this message when a recipe has been renamed. However, if that is not the case, the message might indicate that a private version of a library is being erroneously picked up as the provider for a common library. If that is the case, you should add the library's `.so` file name to `PRIVATE_LIBS` in the recipe that provides the private version of the library.

9.3. Configuring and Disabling QA Checks [¶](#)

You can configure the QA checks globally so that specific check failures either raise a warning or an error message, using the `WARN_OA` and `ERROR_OA` variables, respectively. You can also disable checks within a particular recipe using `INSANE_SKIP`. For information on how to work with the QA checks, see the "[insane.bbclass](#)" section.

Tip

Please keep in mind that the QA checks exist in order to detect real or potential problems in the packaged output. So exercise caution when disabling these checks.

Chapter 10. Images [¶](#)

The OpenEmbedded build system provides several example images to satisfy different needs. When you issue the `bitbake` command you provide a "top-level" recipe that essentially begins the build for the type of image you want.

Note

Building an image without GNU General Public License Version 3 (GPLv3), GNU Lesser General Public License Version 3 (LGPLv3), and the GNU Affero General Public License Version 3 (AGPL-3.0) components is only supported for minimal and base images. Furthermore, if you are going to build an image using non-

GPLv3 and similarly licensed components, you must make the following changes in the `local.conf` file before using the BitBake command to build the minimal or base image:

1. Comment out the `EXTRA_IMAGE_FEATURES` line
2. Set `INCOMPATIBLE_LICENSE = "GPL-3.0 LGPL-3.0 AGPL-3.0"`

From within the poky Git repository, you can use the following command to display the list of directories within the [Source Directory](#) that contain image recipe files:

```
$ ls meta*/recipes*/images/*.bb
```

Following is a list of supported recipes:

- `build-appliance-image`: An example virtual machine that contains all the pieces required to run builds using the build system as well as the build system itself. You can boot and run the image using either the [VMware Player](#) or [VMware Workstation](#). For more information on this image, see the [Build Appliance](#) page on the Yocto Project website.
- `core-image-base`: A console-only image that fully supports the target device hardware.
- `core-image-clutter`: An image with support for the Open GL-based toolkit Clutter, which enables development of rich and animated graphical user interfaces.
- `core-image-directfb`: An image that uses `directfb` instead of `X11`.
- `core-image-full-cmdline`: A console-only image with more full-featured Linux system functionality installed.
- `core-image-lsb`: An image that conforms to the Linux Standard Base (LSB) specification. This image requires a distribution configuration that enables LSB compliance (e.g. `poky-lsb`). If you build `core-image-lsb` without that configuration, the image will not be LSB-compliant.
- `core-image-lsb-dev`: A `core-image-lsb` image that is suitable for development work using the host. The image includes headers and libraries you can use in a host development environment. This image requires a distribution configuration that enables LSB compliance (e.g. `poky-lsb`). If you build `core-image-lsb-dev` without that configuration, the image will not be LSB-compliant.
- `core-image-lsb-sdk`: A `core-image-lsb` that includes everything in `meta-toolchain` but also includes development headers and libraries to form a complete standalone SDK. This image requires a distribution configuration that enables LSB compliance (e.g. `poky-lsb`). If you build `core-image-lsb-sdk` without that configuration, the image will not be LSB-compliant. This image is suitable for development using the target.
- `core-image-minimal`: A small image just capable of allowing a device to boot.
- `core-image-minimal-dev`: A `core-image-minimal` image suitable for development work using the host. The image includes headers and libraries you can use in a host development environment.
- `core-image-minimal-initramfs`: A `core-image-minimal` image that has the Minimal RAM-based Initial Root Filesystem (`initramfs`) as part of the kernel, which allows the system to find the first "init" program more efficiently. See the [PACKAGE_INSTALL](#) variable for additional information helpful when working with `initramfs` images.
- `core-image-minimal-mtdutils`: A `core-image-minimal` image that has support for the Minimal MTD Utilities, which let the user interact with the MTD subsystem in the kernel to perform operations on flash devices.
- `core-image-rt`: A `core-image-minimal` image plus a real-time test suite and tools

appropriate for real-time use.

- `core-image-rt-sdk`: A `core-image-rt` image that includes everything in `meta-toolchain`. The image also includes development headers and libraries to form a complete stand-alone SDK and is suitable for development using the target.
- `core-image-sato`: An image with Sato support, a mobile environment and visual style that works well with mobile devices. The image supports X11 with a Sato theme and applications such as a terminal, editor, file manager, media player, and so forth.
- `core-image-sato-dev`: A `core-image-sato` image suitable for development using the host. The image includes libraries needed to build applications on the device itself, testing and profiling tools, and debug symbols. This image was formerly `core-image-sdk`.
- `core-image-sato-sdk`: A `core-image-sato` image that includes everything in `meta-toolchain`. The image also includes development headers and libraries to form a complete standalone SDK and is suitable for development using the target.
- `core-image-testmaster`: A "master" image designed to be used for automated runtime testing. Provides a "known good" image that is deployed to a separate partition so that you can boot into it and use it to deploy a second image to be tested. You can find more information about runtime testing in the "[Performing Automated Runtime Testing](#)" section in the Yocto Project Development Manual.
- `core-image-testmaster-initramfs`: A RAM-based Initial Root Filesystem (initramfs) image tailored for use with the `core-image-testmaster` image.
- `core-image-weston`: A very basic Wayland image with a terminal. This image provides the Wayland protocol libraries and the reference Weston compositor. For more information, see the "[Wayland](#)" section.
- `core-image-x11`: A very basic X11 image with a terminal.
- `qt4e-demo-image`: An image that launches into the demo application for the embedded (not based on X11) version of Qt.

Chapter 11. Features

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[11.1. Machine Features](#)

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This chapter provides a reference of shipped machine and distro features you can include as part of your image, a reference on image features you can select, and a reference on feature backfilling.

Features provide a mechanism for working out which packages should be included in the generated images. Distributions can select which features they want to support through the `DISTRO_FEATURES` variable, which is set or appended to in a distribution's configuration file such as `poky.conf`, `poky-tiny.conf`, `poky-lsb.conf` and so forth. Machine features are set in the `MACHINE_FEATURES` variable, which is set in the machine configuration file and specifies the hardware features for a given machine.

These two variables combine to work out which kernel modules, utilities, and other packages to include. A given distribution can support a selected subset of features so some machine features might not be included if the distribution itself does not support them.

One method you can use to determine which recipes are checking to see if a particular feature is contained or not is to `grep` through the [Metadata](#) for the feature. Here is an example that discovers the recipes whose build is potentially changed based on a given feature:

```
$ cd poky
$ git grep 'contains.*MACHINE_FEATURES.*feature'
```

11.1. Machine Features

The items below are features you can use with [MACHINE_FEATURES](#). Features do not have a one-to-one correspondence to packages, and they can go beyond simply controlling the installation of a package or packages. Sometimes a feature can influence how certain recipes are built. For example, a feature might determine whether a particular configure option is specified within the [do_configure](#) task for a particular recipe.

This feature list only represents features as shipped with the Yocto Project metadata:

- **acpi:** Hardware has ACPI (x86/x86_64 only)
- **alsa:** Hardware has ALSA audio drivers
- **apm:** Hardware uses APM (or APM emulation)
- **bluetooth:** Hardware has integrated BT
- **efi:** Support for booting through EFI
- **ext2:** Hardware HDD or Microdrive
- **irda:** Hardware has IrDA support
- **keyboard:** Hardware has a keyboard
- **pcbios:** Support for booting through BIOS
- **pci:** Hardware has a PCI bus
- **pcmcia:** Hardware has PCMCIA or CompactFlash sockets
- **phone:** Mobile phone (voice) support
- **qvga:** Machine has a QVGA (320x240) display
- **rtc:** Machine has a Real-Time Clock
- **screen:** Hardware has a screen
- **serial:** Hardware has serial support (usually RS232)
- **touchscreen:** Hardware has a touchscreen
- **usb gadget:** Hardware is USB gadget device capable
- **usb host:** Hardware is USB Host capable
- **vfat:** FAT file system support
- **wifi:** Hardware has integrated WiFi

11.2. Distro Features

The items below are features you can use with [DISTRO_FEATURES](#) to enable features across your distribution. Features do not have a one-to-one correspondence to packages, and they can go beyond simply controlling the installation of a package or packages. In most cases, the

presence or absence of a feature translates to the appropriate option supplied to the configure script during the [do_configure](#) task for the recipes that optionally support the feature.

Some distro features are also machine features. These select features make sense to be controlled both at the machine and distribution configuration level. See the [COMBINED_FEATURES](#) variable for more information.

This list only represents features as shipped with the Yocto Project metadata:

- **alsa:** Include ALSA support (OSS compatibility kernel modules installed if available).
- **bluetooth:** Include bluetooth support (integrated BT only).
- **cramfs:** Include CramFS support.
- **directfb:** Include DirectFB support.
- **ext2:** Include tools for supporting for devices with internal HDD/Microdrive for storing files (instead of Flash only devices).
- **ipsec:** Include IPSec support.
- **ipv6:** Include IPv6 support.
- **irda:** Include IrDA support.
- **keyboard:** Include keyboard support (e.g. keymaps will be loaded during boot).
- **nfs:** Include NFS client support (for mounting NFS exports on device).
- **opengl:** Include the Open Graphics Library, which is a cross-language, multi-platform application programming interface used for rendering two and three-dimensional graphics.
- **pci:** Include PCI bus support.
- **pcmcia:** Include PCMCIA/CompactFlash support.
- **ppp:** Include PPP dialup support.
- **ptest:** Enables building the package tests where supported by individual recipes. For more information on package tests, see the "[Testing Packages With ptest](#)" section in the Yocto Project Development Manual.
- **smbfs:** Include SMB networks client support (for mounting Samba/Microsoft Windows shares on device).
- **systemd:** Include support for this `init` manager, which is a full replacement of for `init` with parallel starting of services, reduced shell overhead, and other features. This `init` manager is used by many distributions.
- **usb gadget:** Include USB Gadget Device support (for USB networking/serial/storage).
- **usb host:** Include USB Host support (allows to connect external keyboard, mouse, storage, network etc).
- **wayland:** Include the Wayland display server protocol and the library that supports it.
- **wifi:** Include WiFi support (integrated only).
- **x11:** Include the X server and libraries.

11.3. Image Features

The contents of images generated by the OpenEmbedded build system can be controlled by the [IMAGE_FEATURES](#) and [EXTRA_IMAGE_FEATURES](#) variables that you typically configure in your

image recipes. Through these variables, you can add several different predefined packages such as development utilities or packages with debug information needed to investigate application problems or profile applications.

The following image features are available for all images:

- ***allow-empty-password***: Allows Dropbear and OpenSSH to accept root logins and logins from accounts having an empty password string.
- ***dbg-pkgs***: Installs debug symbol packages for all packages installed in a given image.
- ***debug-tweaks***: Makes an image suitable for development (e.g. allows root logins without passwords and enables post-installation logging). See the 'allow-empty-password', 'empty-root-password', and 'post-install-logging' features in this list for additional information.
- ***dev-pkgs***: Installs development packages (headers and extra library links) for all packages installed in a given image.
- ***doc-pkgs***: Installs documentation packages for all packages installed in a given image.
- ***empty-root-password***: Sets the root password to an empty string, which allows logins with a blank password.
- ***package-management***: Installs package management tools and preserves the package manager database.
- ***post-install-logging***: Enables logging postinstall script runs to the `/var/log/postinstall.log` file on first boot of the image on the target system.
- ***ptest-pkgs***: Installs ptest packages for all ptest-enabled recipes.
- ***read-only-rootfs***: Creates an image whose root filesystem is read-only. See the "[Creating a Read-Only Root Filesystem](#)" section in the Yocto Project Development Manual for more information.
- ***splash***: Enables showing a splash screen during boot. By default, this screen is provided by `psplash`, which does allow customization. If you prefer to use an alternative splash screen package, you can do so by setting the `SPLASH` variable to a different package name (or names) within the image recipe or at the distro configuration level.
- ***staticdev-pkgs***: Installs static development packages, which are static libraries (i.e. *.a files), for all packages installed in a given image.

Some image features are available only when you inherit the `core-image` class. The current list of these valid features is as follows:

- ***eclipse-debug***: Provides Eclipse remote debugging support.
- ***hwcodecs***: Installs hardware acceleration codecs.
- ***nfs-server***: Installs an NFS server.
- ***qt4-pkgs***: Supports Qt4/X11 and demo applications.
- ***ssh-server-dropbear***: Installs the Dropbear minimal SSH server.
- ***ssh-server-openssh***: Installs the OpenSSH SSH server, which is more full-featured than Dropbear. Note that if both the OpenSSH SSH server and the Dropbear minimal SSH server are present in `IMAGE_FEATURES`, then OpenSSH will take precedence and Dropbear will not be installed.
- ***tools-debug***: Installs debugging tools such as `strace` and `gdb`. For information on GDB, see the "[Debugging With the GNU Project Debugger \(GDB\) Remotely](#)" section in the Yocto Project Development Manual. For information on tracing and profiling, see the [Yocto Project Profiling and Tracing Manual](#).

- **tools-profile:** Installs profiling tools such as `oprofile`, `exmap`, and `LTTng`. For general information on user-space tools, see the "[User-Space Tools](#)" section in the Yocto Project Application Developer's Guide.
- **tools-sdk:** Installs a full SDK that runs on the device.
- **tools-testapps:** Installs device testing tools (e.g. touchscreen debugging).
- **x11:** Installs the X server.
- **x11-base:** Installs the X server with a minimal environment.
- **x11-sato:** Installs the OpenedHand Sato environment.

11.4. Feature Backfilling

Sometimes it is necessary in the OpenEmbedded build system to extend `MACHINE_FEATURES` or `DISTRO_FEATURES` to control functionality that was previously enabled and not able to be disabled. For these cases, we need to add an additional feature item to appear in one of these variables, but we do not want to force developers who have existing values of the variables in their configuration to add the new feature in order to retain the same overall level of functionality. Thus, the OpenEmbedded build system has a mechanism to automatically "backfill" these added features into existing distro or machine configurations. You can see the list of features for which this is done by finding the `DISTRO_FEATURES_BACKFILL` and `MACHINE_FEATURES_BACKFILL` variables in the `meta/conf/bitbake.conf` file.

Because such features are backfilled by default into all configurations as described in the previous paragraph, developers who wish to disable the new features need to be able to selectively prevent the backfilling from occurring. They can do this by adding the undesired feature or features to the `DISTRO_FEATURES_BACKFILL_CONSIDERED` or `MACHINE_FEATURES_BACKFILL_CONSIDERED` variables for distro features and machine features respectively.

Here are two examples to help illustrate feature backfilling:

- **The "pulseaudio" distro feature option:** Previously, PulseAudio support was enabled within the Qt and GStreamer frameworks. Because of this, the feature is backfilled and thus enabled for all distros through the `DISTRO_FEATURES_BACKFILL` variable in the `meta/conf/bitbake.conf` file. However, your distro needs to disable the feature. You can disable the feature without affecting other existing distro configurations that need PulseAudio support by adding "pulseaudio" to `DISTRO_FEATURES_BACKFILL_CONSIDERED` in your distro's `.conf` file. Adding the feature to this variable when it also exists in the `DISTRO_FEATURES_BACKFILL` variable prevents the build system from adding the feature to your configuration's `DISTRO_FEATURES`, effectively disabling the feature for that particular distro.
- **The "rtc" machine feature option:** Previously, real time clock (RTC) support was enabled for all target devices. Because of this, the feature is backfilled and thus enabled for all machines through the `MACHINE_FEATURES_BACKFILL` variable in the `meta/conf/bitbake.conf` file. However, your target device does not have this capability. You can disable RTC support for your device without affecting other machines that need RTC support by adding the feature to your machine's `MACHINE_FEATURES_BACKFILL_CONSIDERED` list in the machine's `.conf` file. Adding the feature to this variable when it also exists in the `MACHINE_FEATURES_BACKFILL` variable prevents the build system from adding the feature to your configuration's `MACHINE_FEATURES`, effectively disabling RTC support for that particular machine.

Chapter 12. Variables Glossary

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Glossary

This chapter lists common variables used in the OpenEmbedded build system and gives an overview of their function and contents.

Glossary

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A

ABIEXTENSION

Extension to the Application Binary Interface (ABI) field of the GNU canonical architecture name (e.g. "eabi").

ABI extensions are set in the machine include files. For example, the `meta/conf/machine/include/arm/arch-arm.inc` file sets the following extension:

```
ABIEXTENSION = "eabi"
```

ALLOW_EMPTY

Specifies if an output package should still be produced if it is empty. By default, BitBake does not produce empty packages. This default behavior can cause issues when there is an [RDEPENDS](#) or some other hard runtime requirement on the existence of the package.

Like all package-controlling variables, you must always use them in conjunction with a package name override, as in:

```
ALLOW_EMPTY_${PN} = "1"  
ALLOW_EMPTY_${PN}-dev = "1"  
ALLOW_EMPTY_${PN}-staticdev = "1"
```

ALTERNATIVE

Lists commands in a package that need an alternative binary naming scheme. Sometimes the same command is provided in multiple packages. When this occurs, the OpenEmbedded build system needs to use the alternatives system to create a different binary naming scheme so the commands can co-exist.

To use the variable, list out the package's commands that also exist as part of another package. For example, if the `busybox` package has four commands that also exist

as part of another package, you identify them as follows:

```
ALTERNATIVE_busybox = "sh sed test bracket"
```

For more information on the alternatives system, see the "[update-alternatives.bbclass](#)" section.

ALTERNATIVE_LINK_NAME ¶

Used by the alternatives system to map duplicated commands to actual locations. For example, if the `bracket` command provided by the `busybox` package is duplicated through another package, you must use the `ALTERNATIVE_LINK_NAME` variable to specify the actual location:

```
ALTERNATIVE_LINK_NAME[bracket] = "/usr/bin."
```

In this example, the binary for the `bracket` command (i.e. `[]`) from the `busybox` package resides in `/usr/bin/`.

Note

If `ALTERNATIVE_LINK_NAME` is not defined, it defaults to `${bindir}/name`.

For more information on the alternatives system, see the "[update-alternatives.bbclass](#)" section.

ALTERNATIVE_PRIORITY ¶

Used by the alternatives system to create default priorities for duplicated commands. You can use the variable to create a single default regardless of the command name or package, a default for specific duplicated commands regardless of the package, or a default for specific commands tied to particular packages. Here are the available syntax forms:

```
ALTERNATIVE_PRIORITY = "priority"
ALTERNATIVE_PRIORITY[name] = "priority"
ALTERNATIVE_PRIORITY_pkg[name] = "priority"
```

For more information on the alternatives system, see the "[update-alternatives.bbclass](#)" section.

ALTERNATIVE_TARGET ¶

Used by the alternatives system to create default link locations for duplicated commands. You can use the variable to create a single default location for all duplicated commands regardless of the command name or package, a default for specific duplicated commands regardless of

the package, or a default for specific commands tied to particular packages. Here are the available syntax forms:

```
ALTERNATIVE_TARGET = "target"  
ALTERNATIVE_TARGET[name] = "target"  
ALTERNATIVE_TARGET_pkg[name] = "target"
```

Note

If `ALTERNATIVE_TARGET` is not defined, it inherits the value from the `ALTERNATIVE_LINK_NAME` variable.

If `ALTERNATIVE_LINK_NAME` and `ALTERNATIVE_TARGET` are the same, the target for `ALTERNATIVE_TARGET` has ".{BPN}" appended to it.

Finally, if the file referenced has not been renamed, the alternatives system will rename it to avoid the need to rename alternative files in the `do_install` task while retaining support for the command if necessary.

For more information on the alternatives system, see the "`update-alternatives.bbclass`" section.

APPEND ¶

An override list of append strings for each `LABEL`.

See the `grub-efi` class for more information on how this variable is used.

AR ¶

The minimal command and arguments used to run `ar`.

ARCHIVER_MODE ¶

When used with the `archiver` class, determines the type of information used to create a released archive. You can use this variable to create archives of patched source, original source, configured source, and so forth by employing the following variable flags (`varflags`):

```

ARCHIVER_MODE[src] = "original"

ARCHIVER_MODE[src] = "patched"

ARCHIVER_MODE[src] = "configured"
ARCHIVER_MODE[diff] = "1"

ARCHIVER_MODE[diff-exclude] ?= "file file"

ARCHIVER_MODE[dumpdata] = "1"
ARCHIVER_MODE[recipe] = "1"
ARCHIVER_MODE[srpm] = "1"

```

For information on how the variable works, see the `meta/classes/archiver.bbclass` file in the [Source Directory](#).

AS

The minimal command and arguments used to run the assembler.

ASSUME_PROVIDED

Lists recipe names (`PN` values) BitBake does not attempt to build. Instead, BitBake assumes these recipes have already been built.

In OpenEmbedded Core, `ASSUME_PROVIDED` mostly specifies native tools that should not be built. An example is `git-native`, which when specified, allows for the Git binary from the host to be used rather than building `git-native`.

ASSUME_SHLIBS

Provides additional `shlibs` provider mapping information, which adds to or overwrites the information provided automatically by the system. Separate multiple entries using spaces.

As an example, use the following form to add an `shlib` provider of `shlibname` in `packagename` with the optional `version`:

```
shlibname:packagename[_version]
```

Here is an example that adds a shared library named `libEGL.so.1` as being provided by the `libegl-implementation` package:

```
ASSUME_SHLIBS = "libEGL.so.1:libegl-implem
```

AUTHOR

The email address used to contact the original author or authors in order to send patches and forward bugs.

AUTO_LIBNAME_PKGS

When the `debian` class is inherited, which is the default behavior, `AUTO_LIBNAME_PKGS`

specifies which packages should be checked for libraries and renamed according to Debian library package naming.

The default value is "\${PACKAGES}", which causes the debian class to act on all packages that are explicitly generated by the recipe.

AUTO_SYSLINUXMENU

Enables creating an automatic menu for the syslinux bootloader. You must set this variable in your recipe. The `syslinux` class checks this variable.

AUTOREV

When `SRCREV` is set to the value of this variable, it specifies to use the latest source revision in the repository. Here is an example:

```
SRCREV = "${AUTOREV}"
```

If you use the previous statement to retrieve the latest version of software, you need to be sure `PV` contains `${SRCPV}`. For example, suppose you have a kernel recipe that inherits the `kernel` class and you use the previous statement. In this example, `${SRCPV}` does not automatically get into `PV`. Consequently, you need to change `PV` in your recipe so that it does contain `${SRCPV}`.

AVAILTUNES

The list of defined CPU and Application Binary Interface (ABI) tunings (i.e. "tunes") available for use by the OpenEmbedded build system.

The list simply presents the tunes that are available. Not all tunes may be compatible with a particular machine configuration, or with each other in a `Multilib` configuration.

To add a tune to the list, be sure to append it with spaces using the `"+="` BitBake operator. Do not simply replace the list by using the `"="` operator. See the "[Basic Syntax](#)" section in the BitBake User Manual for more information.

B

B

The directory within the `Build Directory` in which the OpenEmbedded build system places generated objects during a recipe's build process. By default, this directory is the same as the `_S` directory, which is defined as:

```
S = "${WORKDIR}/${BP}/"
```

You can separate the `(s)` directory and the directory pointed to by the `B` variable. Most Autotools-based recipes support separating these directories. The build system defaults to using separate directories for `gcc` and some kernel recipes.

BAD_RECOMMENDATIONS ¶

Lists "recommended-only" packages to not install. Recommended-only packages are packages installed only through the `RRECOMMENDS` variable. You can prevent any of these "recommended" packages from being installed by listing them with the `BAD_RECOMMENDATIONS` variable:

```
BAD_RECOMMENDATIONS = "package_name packag
```

You can set this variable globally in your `local.conf` file or you can attach it to a specific image recipe by using the recipe name override:

```
BAD_RECOMMENDATIONS_pn-target_image = "pac.
```

It is important to realize that if you choose to not install packages using this variable and some other packages are dependent on them (i.e. listed in a recipe's `RDEPENDS` variable), the OpenEmbedded build system ignores your request and will install the packages to avoid dependency errors.

Support for this variable exists only when using the IPK and RPM packaging backend. Support does not exist for DEB.

See the `NO_RECOMMENDATIONS` and the `PACKAGE_EXCLUDE` variables for related information.

BASE_LIB ¶

The library directory name for the CPU or Application Binary Interface (ABI) tune. The `BASE_LIB` applies only in the Multilib context. See the "[Combining Multiple Versions of Library Files into One Image](#)" section in the Yocto Project Development Manual for information on Multilib.

The `BASE_LIB` variable is defined in the machine include files in the [Source Directory](#). If Multilib is not being used, the value defaults to `"lib"`.

BASE_WORKDIR ¶

Points to the base of the work directory for all recipes. The default value is `"${TMPDIR}/work"`.

BB_ALLOWED_NETWORKS ¶

Specifies a space-delimited list of hosts that the fetcher is allowed to use to obtain the required source code. Following are considerations surrounding this variable:

- This host list is only used if `BB_NO_NETWORK` is either not set or set to "0".
- Limited support for wildcard matching against the beginning of host names exists. For example, the following setting matches `git.gnu.org`, `ftp.gnu.org`, and `foo.git.gnu.org`.

```
BB_ALLOWED_NETWORKS = "*.gnu.org"
```

- Mirrors not in the host list are skipped and logged in debug.
- Attempts to access networks not in the host list cause a failure.

Using `BB_ALLOWED_NETWORKS` in conjunction with `PREMIRRORS` is very useful. Adding the host you want to use to `PREMIRRORS` results in the source code being fetched from an allowed location and avoids raising an error when a host that is not allowed is in a `SRC_URI` statement. This is because the fetcher does not attempt to use the host listed in `SRC_URI` after a successful fetch from the `PREMIRRORS` occurs.

BB_DANGLINGAPPENDS_WARNONLY ¶

Defines how BitBake handles situations where an append file (`.bbappend`) has no corresponding recipe file (`.bb`). This condition often occurs when layers get out of sync (e.g. `oe-core` bumps a recipe version and the old recipe no longer exists and the other layer has not been updated to the new version of the recipe yet).

The default fatal behavior is safest because it is the sane reaction given something is out of sync. It is important to realize when your changes are no longer being applied.

You can change the default behavior by setting this variable to "1", "yes", or "true" in your `local.conf` file, which is located in the [Build Directory](#): Here is an example:

```
BB_DANGLINGAPPENDS_WARNONLY = "1"
```

BB_DISKMON_DIRS ¶

Monitors disk space and available inodes during the build and allows you to control the build based on these parameters.

Disk space monitoring is disabled by default.

To enable monitoring, add the `BB_DISKMON_DIRS` variable to your `conf/local.conf` file found in the [Build Directory](#). Use the following form:

```
BB_DISKMON_DIRS = "action,dir,threshold [
```

where:

action is:

ABORT: Immediately abort the build when a threshold is broken.

STOPTASKS: Stop the build after the currently executing tasks have finished. A threshold is broken.

WARN: Issue a warning but continue the build when a threshold is broken. Subsequent warnings are issued at intervals defined by the `BB_DISKMON_WARNINTERVAL` variable, which must be defined in your `conf/local.conf` file.

dir is:

Any directory you choose. You can specify more directories to monitor by separate groupings with a space. If two directories on the same device, only the first directory is monitored.

threshold is:

Either the minimum available disk space, the minimum number of free inodes, or both. You must specify at least one. To omit one or the other, simply omit it. Specify the threshold using G, M, K for Gbytes, Mbytes, and Kbytes, respectively. If not specify G, M, or K, Kbytes is assumed as default. Do not use GB, MB, or KB.

Here are some examples:

```
BB_DISKMON_DIRS = "ABORT,${TMPDIR},1G,100K"
BB_DISKMON_DIRS = "STOPTASKS,${TMPDIR},1G"
BB_DISKMON_DIRS = "ABORT,${TMPDIR},,100K"
```

The first example works only if you also provide the `BB_DISKMON_WARNINTERVAL` variable in the `conf/local.conf`. This example causes the build system to immediately abort when either the disk space in `${TMPDIR}` drops below 1 Gbyte or the available free inodes drops below 100 Kbytes. Because two directories are provided with the variable, the build system also issue a warning when the disk space in the `${SSTATE_DIR}` directory drops below 1 Gbyte or the number of free inodes drops below 100 Kbytes. Subsequent warnings are issued during intervals as defined by the `BB_DISKMON_WARNINTERVAL` variable.

The second example stops the build after all currently executing tasks complete when the minimum disk space in the `${TMPDIR}` directory drops below 1 Gbyte. No disk monitoring occurs for the free inodes in this case.

The final example immediately aborts the build when the number of free inodes in the `${TMPDIR}` directory drops below 100 Kbytes. No disk space monitoring for the directory itself occurs in this case.

BB_DISKMON_WARNINTERVAL

Defines the disk space and free inode warning intervals. To set these intervals, define the variable in your `conf/local.conf` file in the [Build Directory](#).

If you are going to use the `BB_DISKMON_WARNINTERVAL` variable, you must also use the `BB_DISKMON_DIRS` variable and define its action as "WARN". During the build, subsequent warnings are issued each time disk space or number of free inodes further reduces by the respective interval.

If you do not provide a `BB_DISKMON_WARNINTERVAL` variable and you do use `BB_DISKMON_DIRS` with the "WARN" action, the disk monitoring interval defaults to the following:

```
BB_DISKMON_WARNINTERVAL = "50M,5K"
```

When specifying the variable in your configuration file, use the following form:

```
BB_DISKMON_WARNINTERVAL = "disk_space_inte"
```

where:

disk_space_interval is:

An interval of memory expressed in e. G, M, or K for Gbytes, Mbytes, or Kb; respectively. You cannot use GB, MB,

disk_inode_interval is:

An interval of free inodes expressed G, M, or K for Gbytes, Mbytes, or Kb; respectively. You cannot use GB, MB,

Here is an example:

```
BB_DISKMON_DIRS = "WARN,${SSTATE_DIR},1G,100K"
BB_DISKMON_WARNINTERVAL = "50M,5K"
```

These variables cause the OpenEmbedded build system to issue subsequent warnings each time the available disk space further reduces by 50 Mbytes or the number of free inodes further reduces by 5 Kbytes in the `${SSTATE_DIR}` directory. Subsequent warnings based on the interval occur each time a respective interval is reached beyond the initial warning (i.e. 1 Gbytes and 100 Kbytes).

BB_GENERATE_MIRROR_TARBALLS

Causes tarballs of the Git repositories, including the Git metadata, to be placed in the `DL_DIR` directory.

For performance reasons, creating and placing tarballs of the Git repositories is not the default action by the OpenEmbedded build system.

```
BB_GENERATE_MIRROR_TARBALLS = "1"
```

Set this variable in your `local.conf` file in the [Build Directory](#).

BB_NUMBER_THREADS ¶

The maximum number of tasks BitBake should run in parallel at any one time. The OpenEmbedded build system automatically configures this variable to be equal to the number of cores on the build system. For example, a system with a dual core processor that also uses hyper-threading causes the `BB_NUMBER_THREADS` variable to default to "4".

For single socket systems (i.e. one CPU), you should not have to override this variable to gain optimal parallelism during builds. However, if you have very large systems that employ multiple physical CPUs, you might want to make sure the `BB_NUMBER_THREADS` variable is not set higher than "20".

For more information on speeding up builds, see the ["Speeding Up the Build"](#) section.

BBCLASSEXTEND ¶

Allows you to extend a recipe so that it builds variants of the software. Common variants for recipes exist such as "natives" like `quilt-native`, which is a copy of Quilt built to run on the build system; "crosses" such as `gcc-cross`, which is a compiler built to run on the build machine but produces binaries that run on the target `MACHINE`; "nativesdk", which targets the SDK machine instead of `MACHINE`; and "multilibs" in the form `"multilib:multilib_name"`.

To build a different variant of the recipe with a minimal amount of code, it usually is as simple as adding the following to your recipe:

```
BBCLASSEXTEND += "native nativesdk"
BBCLASSEXTEND += "multilib:multilib_name"
```

BBFILE_COLLECTIONS ¶

Lists the names of configured layers. These names are used to find the other `BBFILE_*` variables. Typically, each layer will append its name to this variable in its `conf/layer.conf` file.

BBFILE_PATTERN ¶

Variable that expands to match files from [BBFILES](#) in a particular layer. This variable is used in the `conf/layer.conf` file and must be suffixed with the name of the specific layer (e.g. `BBFILE_PATTERN_emenlow`).

BBFILE_PRIORITY ¶

Assigns the priority for recipe files in each

layer.

This variable is useful in situations where the same recipe appears in more than one layer. Setting this variable allows you to prioritize a layer against other layers that contain the same recipe - effectively letting you control the precedence for the multiple layers. The precedence established through this variable stands regardless of a recipe's version (pv variable). For example, a layer that has a recipe with a higher `pv` value but for which the `BBFILE_PRIORITY` is set to have a lower precedence still has a lower precedence.

A larger value for the `BBFILE_PRIORITY` variable results in a higher precedence. For example, the value 6 has a higher precedence than the value 5. If not specified, the `BBFILE_PRIORITY` variable is set based on layer dependencies (see the LAYERDEPENDS variable for more information). The default priority, if unspecified for a layer with no dependencies, is the lowest defined priority + 1 (or 1 if no priorities are defined).

Tip

You can use the command `bitbake-layers show-layers` to list all configured layers along with their priorities.

BBFILES ¶

List of recipe files used by BitBake to build software.

BBINCLUDELOGS ¶

Variable that controls how BitBake displays logs on build failure.

BBINCLUDELOGS_LINES ¶

If BBINCLUDELOGS is set, specifies the maximum number of lines from the task log file to print when reporting a failed task. If you do not set `BBINCLUDELOGS_LINES`, the entire log is printed.

BBLAYERS ¶

Lists the layers to enable during the build. This variable is defined in the `bblayers.conf` configuration file in the Build Directory. Here is an example:

```
BBLAYERS = " \
/home/scottrif/poky/meta \
/home/scottrif/poky/meta-yocto \
/home/scottrif/poky/meta-yocto-bsp \
/home/scottrif/poky/meta-mykernel \
"

BBLAYERS_NON_REMOVABLE ?= " \
/home/scottrif/poky/meta \
/home/scottrif/poky/meta-yocto \
"
```

Note

The `BBLAYERS_NON_REMOVABLE` variable exists only for Hob. The OpenEmbedded build system does not use this variable.

This example enables four layers, one of which is a custom, user-defined layer named `meta-mykernel`.

BBLAYERS_NON_REMOVABLE

Lists core layers that cannot be removed from the `bblayers.conf` file during a build using the Hob.

Note

When building an image outside of Hob, the OpenEmbedded build system ignores this variable.

In order for BitBake to build your image using Hob, your `bblayers.conf` file must include the `meta` and `meta-yocto` core layers. Here is an example that shows these two layers listed in the `BBLAYERS_NON_REMOVABLE` statement:

```
BBLAYERS = " \
/home/scottrif/poky/meta \
/home/scottrif/poky/meta-yocto \
/home/scottrif/poky/meta-yocto-bsp \
/home/scottrif/poky/meta-mykernel \
"

BBLAYERS_NON_REMOVABLE ?= " \
/home/scottrif/poky/meta \
/home/scottrif/poky/meta-yocto \
"
```

BBMASK

Prevents BitBake from processing recipes and recipe append files. Use the `BBMASK` variable from within the `conf/local.conf` file found in the Build Directory.

You can use the `BBMASK` variable to "hide" these `.bb` and `.bbappend` files. BitBake ignores any recipe or recipe append files that match the expression. It is as if BitBake does not see them at all. Consequently, matching files are not parsed or otherwise used by BitBake.

The value you provide is passed to Python's regular expression compiler. The expression is compared against the full paths to the files. For complete syntax information, see Python's documentation at <http://docs.python.org/release/2.3/lib/re-syntax.html>.

The following example uses a complete regular expression to tell BitBake to ignore all recipe and recipe append files in the `meta-ti/recipes-misc/` directory:

```
BBMASK = "meta-ti/recipes-misc/"
```

If you want to mask out multiple directories or recipes, use the vertical bar to separate the regular expression fragments. This next example masks out multiple directories and individual recipes:

```
BBMASK = "meta-ti/recipes-misc/|meta-ti/re
BBMASK .= " |.*meta-oe/recipes-support/"
BBMASK .= " |.*openldap"
BBMASK .= " |.*opencv"
BBMASK .= " |.*lzma"
```

Notice how the vertical bar is used to append the fragments.

Note

When specifying a directory name, use the trailing slash character to ensure you match just that directory name.

BBPATH

Used by BitBake to locate `.bbclass` and configuration files. This variable is analogous to the `PATH` variable.

Note

If you run BitBake from a directory outside of the Build Directory, you must be sure to set `BBPATH` to point to the Build Directory. Set the variable as you would any environment variable and then run BitBake:

```
$ BBPATH = "build_directo
$ export BBPATH
$ bitbake target
```

BBSERVER

Points to the server that runs memory-resident BitBake. This variable is set by the `oe-init-build-env-memres` setup script and should not be hand-edited. The variable is only used when you employ memory-resident BitBake. The setup script exports the value as follows:

```
export BBSERVER=localhost:$port
```

For more information on how the `BBSERVER` is used, see the `oe-init-build-env-memres`

script, which is located in the [Source Directory](#).

BINCONFIG

When inheriting the [binconfig-disabled](#) class, this variable specifies binary configuration scripts to disable in favor of using `pkg-config` to query the information. The `binconfig-disabled` class will modify the specified scripts to return an error so that calls to them can be easily found and replaced.

To add multiple scripts, separate them by spaces. Here is an example from the `libpng` recipe:

```
BINCONFIG = "${bindir}/libpng-config ${bin
```

BINCONFIG_GLOB

When inheriting the [binconfig](#) class, this variable specifies a wildcard for configuration scripts that need editing. The scripts are edited to correct any paths that have been set up during compilation so that they are correct for use when installed into the `sysroot` and called by the build processes of other recipes.

For more information on how this variable works, see `meta/classes/binconfig.bbclass` in the [Source Directory](#). You can also find general information on the class in the "[binconfig.bbclass](#)" section.

BP

The base recipe name and version but without any special recipe name suffix (i.e. `-native`, `lib64-`, and so forth). `BP` is comprised of the following:

```
${BPN}-${PV}
```

BPN

The bare name of the recipe. This variable is a version of the [PN](#) variable but removes common suffixes such as `-native` and `-cross` as well as removes common prefixes such as multilib's `lib64-` and `lib32-`. The exact list of suffixes removed is specified by the [SPECIAL_PKGSUFFIX](#) variable. The exact list of prefixes removed is specified by the [MLPREFIX](#) variable. Prefixes are removed for multilib and `nativesdk` cases.

BUGTRACKER

Specifies a URL for an upstream bug tracking website for a recipe. The OpenEmbedded build system does not use this variable. Rather, the variable is a useful pointer in

case a bug in the software being built needs to be manually reported.

`BUILD_ARCH`

Specifies the architecture of the build host (e.g. `i686`). The OpenEmbedded build system sets the value of `BUILD_ARCH` from the machine name reported by the `uname` command.

`BUILD_CFLAGS`

Specifies the flags to pass to the C compiler when building for the build host. When building in the `-native` context, `CFLAGS` is set to the value of this variable by default.

`BUILD_CPPFLAGS`

Specifies the flags to pass to the C pre-processor (i.e. to both the C and the C++ compilers) when building for the build host. When building in the `native` context, `CPPFLAGS` is set to the value of this variable by default.

`BUILD_CXXFLAGS`

Specifies the flags to pass to the C++ compiler when building for the build host. When building in the `native` context, `CXXFLAGS` is set to the value of this variable by default.

`BUILD_LDFLAGS`

Specifies the flags to pass to the linker when building for the build host. When building in the `-native` context, `LDFLAGS` is set to the value of this variable by default.

`BUILD_OPTIMIZATION`

Specifies the optimization flags passed to the C compiler when building for the build host or the SDK. The flags are passed through the `BUILD_CFLAGS` and `BUILDSDK_CFLAGS` default values.

The default value of the `BUILD_OPTIMIZATION` variable is `"-O2 -pipe"`.

`BUILD_OS`

Specifies the operating system in use on the build host (e.g. `"linux"`). The OpenEmbedded build system sets the value of `BUILD_OS` from the OS reported by the `uname` command - the first word, converted to lower-case characters.

`BUILD_PREFIX`

The toolchain binary prefix used for native recipes. The OpenEmbedded build system uses the `BUILD_PREFIX` value to set the `TARGET_PREFIX` when building for native recipes.

`BUILD_SYS`

Specifies the system, including the architecture and the operating system, to use when building for the build host (i.e. when building native recipes).

The OpenEmbedded build system automatically sets this variable based on `BUILD_ARCH`, `BUILD_VENDOR`, and `BUILD_OS`. You do not need to set the `BUILD_SYS` variable yourself.

`BUILD_VENDOR`

Specifies the vendor name to use when building for the build host. The default value is an empty string (`""`).

`BUILDDIR`

Points to the location of the [Build Directory](#). You can define this directory indirectly through the `oe-init-build-env` and `oe-init-build-env-memres` scripts by passing in a Build Directory path when you run the scripts. If you run the scripts and do not provide a Build Directory path, the `BUILDDIR` defaults to `build` in the current directory.

`BUILDHISTORY_COMMIT`

When inheriting the `buildhistory` class, this variable specifies whether or not to commit the build history output in a local Git repository. If set to `"1"`, this local repository will be maintained automatically by the `buildhistory` class and a commit will be created on every build for changes to each top-level subdirectory of the build history output (images, packages, and sdk). If you want to track changes to build history over time, you should set this value to `"1"`.

By default, the `buildhistory` class does not commit the build history output in a local Git repository:

```
BUILDHISTORY_COMMIT ?= "0"
```

`BUILDHISTORY_COMMIT_AUTHOR`

When inheriting the `buildhistory` class, this variable specifies the author to use for each Git commit. In order for the `BUILDHISTORY_COMMIT_AUTHOR` variable to work, the `BUILDHISTORY_COMMIT` variable must be set to `"1"`.

Git requires that the value you provide for the `BUILDHISTORY_COMMIT_AUTHOR` variable takes the form of `"name <email@host>"`. Providing an email address or host that is not valid does not produce an error.

By default, the `buildhistory` class sets the variable as follows:

```
BUILDHISTORY_COMMIT_AUTHOR ?= "buildhistory"
```

BUILDHISTORY_DIR

When inheriting the `buildhistory` class, this variable specifies the directory in which build history information is kept. For more information on how the variable works, see the `buildhistory.class`.

By default, the `buildhistory` class sets the directory as follows:

```
BUILDHISTORY_DIR ?= "${TOPDIR}/buildhistory"
```

BUILDHISTORY_FEATURES

When inheriting the `buildhistory` class, this variable specifies the build history features to be enabled. For more information on how build history works, see the "[Maintaining Build Output Quality](#)" section.

You can specify three features in the form of a space-separated list:

- **image:** Analysis of the contents of images, which includes the list of installed packages among other things.
- **package:** Analysis of the contents of individual packages.
- **sdk:** Analysis of the contents of the software development kit (SDK).

By default, the `buildhistory` class enables all three features:

```
BUILDHISTORY_FEATURES ?= "image package sdk"
```

BUILDHISTORY_IMAGE_FILES

When inheriting the `buildhistory` class, this variable specifies a list of paths to files copied from the image contents into the build history directory under an "image-files" directory in the directory for the image, so that you can track the contents of each file. The default is to copy `/etc/passwd` and `/etc/group`, which allows you to monitor for changes in user and group entries. You can modify the list to include any file. Specifying an invalid path does not produce an error. Consequently, you can include files that might not always be present.

By default, the `buildhistory` class provides paths to the following files:

```
BUILDHISTORY_IMAGE_FILES ?= "/etc/passwd /etc/group"
```

BUILDHISTORY_PUSH_REPO

When inheriting the `buildhistory` class, this

variable optionally specifies a remote repository to which build history pushes Git changes. In order for `BUILDHISTORY_PUSH_REPO` to work, `BUILDHISTORY_COMMIT` must be set to "1".

The repository should correspond to a remote address that specifies a repository as understood by Git, or alternatively to a remote name that you have set up manually using `git remote` within the local repository.

By default, the `buildhistory` class sets the variable as follows:

```
BUILDHISTORY_PUSH_REPO ?= ""
```

`BUILDSDK_CFLAGS`

Specifies the flags to pass to the C compiler when building for the SDK. When building in the `nativesdk` context, `CFLAGS` is set to the value of this variable by default.

`BUILDSDK_CPPFLAGS`

Specifies the flags to pass to the C pre-processor (i.e. to both the C and the C++ compilers) when building for the SDK. When building in the `nativesdk` context, `CPPFLAGS` is set to the value of this variable by default.

`BUILDSDK_CXXFLAGS`

Specifies the flags to pass to the C++ compiler when building for the SDK. When building in the `nativesdk` context, `CXXFLAGS` is set to the value of this variable by default.

`BUILDSDK_LDFLAGS`

Specifies the flags to pass to the linker when building for the SDK. When building in the `nativesdk` context, `LD_FLAGS` is set to the value of this variable by default.

`BUILDSTATS_BASE`

Points to the location of the directory that holds build statistics when you use and enable the `buildstats` class. The `BUILDSTATS_BASE` directory defaults to `${TMPDIR}/buildstats/`.

`BUSYBOX_SPLIT_SUID`

For the BusyBox recipe, specifies whether to split the output executable file into two parts: one for features that require `setuid root`, and one for the remaining features (i.e. those that do not require `setuid root`).

The `BUSYBOX_SPLIT_SUID` variable defaults to "1", which results in a single output executable file. Set the variable to "0" to split the output file.

C

CACHE

Specifies the directory BitBake uses to store a cache of the [Metadata](#) so it does not need to be parsed every time BitBake is started.

CC

The minimal command and arguments used to run the C compiler.

CFLAGS

Specifies the flags to pass to the C compiler. This variable is exported to an environment variable and thus made visible to the software being built during the compilation step.

Default initialization for `CFLAGS` varies depending on what is being built:

- [TARGET_CFLAGS](#) when building for the target
- [BUILD_CFLAGS](#) when building for the build host (i.e. `-native`)
- [BUILDSDK_CFLAGS](#) when building for an SDK (i.e. `nativesdk-`)

CLASSOVERRIDE

An internal variable specifying the special class override that should currently apply (e.g. "class-target", "class-native", and so forth). The classes that use this variable set it to appropriate values.

You do not normally directly interact with this variable. The value for the `CLASSOVERRIDE` variable goes into [OVERRIDES](#) and then can be used as an override. Here is an example where "python-native" is added to [DEPENDS](#) only when building for the native case:

```
DEPENDS_append_class-native = " python-nat.
```

CLEANBROKEN

If set to "1" within a recipe, `CLEANBROKEN` specifies that the `make clean` command does not work for the software being built. Consequently, the OpenEmbedded build system will not try to run `make clean` during the [do_configure](#) task, which is the default behavior.

COMBINED_FEATURES

Provides a list of hardware features that are enabled in both [MACHINE_FEATURES](#) and [DISTRO_FEATURES](#). This select list of features contains features that make sense to be

controlled both at the machine and distribution configuration level. For example, the "bluetooth" feature requires hardware support but should also be optional at the distribution level, in case the hardware supports Bluetooth but you do not ever intend to use it.

For more information, see the [MACHINE_FEATURES](#) and [DISTRO_FEATURES](#) variables.

COMMON_LICENSE_DIR

Points to `meta/files/common-licenses` in the [Source Directory](#), which is where generic license files reside.

COMPATIBLE_HOST

A regular expression that resolves to one or more hosts (when the recipe is native) or one or more targets (when the recipe is non-native) with which a recipe is compatible. The regular expression is matched against [HOST_SYS](#). You can use the variable to stop recipes from being built for classes of systems with which the recipes are not compatible. Stopping these builds is particularly useful with kernels. The variable also helps to increase parsing speed since the build system skips parsing recipes not compatible with the current system.

COMPATIBLE_MACHINE

A regular expression that resolves to one or more target machines with which a recipe is compatible. The regular expression is matched against [MACHINEOVERRIDES](#). You can use the variable to stop recipes from being built for machines with which the recipes are not compatible. Stopping these builds is particularly useful with kernels. The variable also helps to increase parsing speed since the build system skips parsing recipes not compatible with the current machine.

COMPLEMENTARY_GLOB

Defines wildcards to match when installing a list of complementary packages for all the packages explicitly (or implicitly) installed in an image. The resulting list of complementary packages is associated with an item that can be added to [IMAGE_FEATURES](#). An example usage of this is the "dev-pkgs" item that when added to [IMAGE_FEATURES](#) will install -dev packages (containing headers and other development files) for every package in the image.

To add a new feature item pointing to a wildcard, use a variable flag to specify the feature item name and use the value to

specify the wildcard. Here is an example:

```
COMPLEMENTARY_GLOB[dev-pkgs] = '*-dev'
```

CONF_VERSION

Tracks the version of the local configuration file (i.e. `local.conf`). The value for `CONF_VERSION` increments each time `build/conf/` compatibility changes.

CONFFILES

Identifies editable or configurable files that are part of a package. If the Package Management System (PMS) is being used to update packages on the target system, it is possible that configuration files you have changed after the original installation and that you now want to remain unchanged are overwritten. In other words, editable files might exist in the package that you do not want reset as part of the package update process. You can use the `CONFFILES` variable to list the files in the package that you wish to prevent the PMS from overwriting during this update process.

To use the `CONFFILES` variable, provide a package name override that identifies the resulting package. Then, provide a space-separated list of files. Here is an example:

```
CONFFILES_${PN} += "${sysconfdir}/file1 \
${sysconfdir}/file2 ${sysconfdir}/file3
```

A relationship exists between the `CONFFILES` and `FILES` variables. The files listed within `CONFFILES` must be a subset of the files listed within `FILES`. Because the configuration files you provide with `CONFFILES` are simply being identified so that the PMS will not overwrite them, it makes sense that the files must already be included as part of the package through the `FILES` variable.

Note

When specifying paths as part of the `CONFFILES` variable, it is good practice to use appropriate path variables. For example, `${sysconfdir}` rather than `/etc` or `${bindir}` rather than `/usr/bin`. You can find a list of these variables at the top of the `meta/conf/bitbake.conf` file in the [Source Directory](#).

CONFIG_INITRAMFS_SOURCE

Identifies the initial RAM disk (initramfs)

source files. The OpenEmbedded build system receives and uses this kernel Kconfig variable as an environment variable. By default, the variable is set to null ("").

The `CONFIG_INITRAMFS_SOURCE` can be either a single cpio archive with a `.cpio` suffix or a space-separated list of directories and files for building the initramfs image. A cpio archive should contain a filesystem archive to be used as an initramfs image. Directories should contain a filesystem layout to be included in the initramfs image. Files should contain entries according to the format described by the `usr/gen_init_cpio` program in the kernel tree.

If you specify multiple directories and files, the initramfs image will be the aggregate of all of them.

`CONFIG_SITE` ⓘ

A list of files that contains `autoconf` test results relevant to the current build. This variable is used by the Autotools utilities when running `configure`.

`CONFIGURE_FLAGS` ⓘ

The minimal arguments for GNU `configure`.

`CONFLICT_DISTRO_FEATURES` ⓘ

When inheriting the `distro_features_check` class, this variable identifies distribution features that would be in conflict should the recipe be built. In other words, if the `CONFLICT_DISTRO_FEATURES` variable lists a feature that also appears in `DISTRO_FEATURES` within the current configuration, an error occurs and the build stops.

`COPY_LIC_DIRS` ⓘ

If set to "1" along with the `COPY_LIC_MANIFEST` variable, the OpenEmbedded build system copies into the image the license files, which are located in `/usr/share/common-licenses`, for each package. The license files are placed in directories within the image itself during build time.

Note

The `COPY_LIC_DIRS` does not offer a path for adding licenses for newly installed packages to an image, which might be most suitable for read-only filesystems that cannot be upgraded. See the `LICENSE_CREATE_PACKAGE` variable for additional

information. You can also reference the "[Providing License Text](#)" section in the Yocto Project Development Manual for information on providing license text.

`COPY_LIC_MANIFEST`

If set to "1", the OpenEmbedded build system copies the license manifest for the image to `/usr/share/common-licenses/license.manifest` within the image itself during build time.

Note

The `COPY_LIC_MANIFEST` does not offer a path for adding licenses for newly installed packages to an image, which might be most suitable for read-only filesystems that cannot be upgraded. See the [LICENSE_CREATE_PACKAGE](#) variable for additional information. You can also reference the "[Providing License Text](#)" section in the Yocto Project Development Manual for information on providing license text.

`CORE_IMAGE_EXTRA_INSTALL`

Specifies the list of packages to be added to the image. You should only set this variable in the `local.conf` configuration file found in the [Build Directory](#).

This variable replaces `POKY_EXTRA_INSTALL`, which is no longer supported.

`COREBASE`

Specifies the parent directory of the OpenEmbedded Core Metadata layer (i.e. `meta`).

It is an important distinction that `COREBASE` points to the parent of this layer and not the layer itself. Consider an example where you have cloned the Poky Git repository and retained the `poky` name for your local copy of the repository. In this case, `COREBASE` points to the `poky` folder because it is the parent directory of the `poky/meta` layer.

`CPP`

The minimal command and arguments used to run the C preprocessor.

`CPPFLAGS`

Specifies the flags to pass to the C pre-processor (i.e. to both the C and the C++ compilers). This variable is exported to an

environment variable and thus made visible to the software being built during the compilation step.

Default initialization for `CPPFLAGS` varies depending on what is being built:

- `TARGET_CPPFLAGS` when building for the target
- `BUILD_CPPFLAGS` when building for the build host (i.e. `-native`)
- `BUILDSDK_CPPFLAGS` when building for an SDK (i.e. `nativesdk-`)

CROSS_COMPILE

The toolchain binary prefix for the target tools. The `CROSS_COMPILE` variable is the same as the `TARGET_PREFIX` variable.

Note

The OpenEmbedded build system sets the `CROSS_COMPILE` variable only in certain contexts (e.g. when building for kernel and kernel module recipes).

CVSDIR

The directory in which files checked out under the CVS system are stored.

CXX

The minimal command and arguments used to run the C++ compiler.

CXXFLAGS

Specifies the flags to pass to the C++ compiler. This variable is exported to an environment variable and thus made visible to the software being built during the compilation step.

Default initialization for `CXXFLAGS` varies depending on what is being built:

- `TARGET_CXXFLAGS` when building for the target
- `BUILD_CXXFLAGS` when building for the build host (i.e. `-native`)
- `BUILDSDK_CXXFLAGS` when building for an SDK (i.e. `nativesdk`)

D

D

The destination directory. The location in the Build Directory where components are

installed by the `do_install` task. This location defaults to:

```
${WORKDIR}/image
```

DATE

The date the build was started. Dates appear using the year, month, and day (YMD) format (e.g. "20150209" for February 9th, 2015).

DATETIME

The date and time on which the current build started. The format is suitable for timestamps.

DEBIAN_NOAUTONAME

When the `debian` class is inherited, which is the default behavior, `DEBIAN_NOAUTONAME` specifies a particular package should not be renamed according to Debian library package naming. You must use the package name as an override when you set this variable. Here is an example from the `fontconfig` recipe:

```
DEBIAN_NOAUTONAME_fontconfig-utils = "1"
```

DEBIANNAME

When the `debian` class is inherited, which is the default behavior, `DEBIANNAME` allows you to override the library name for an individual package. Overriding the library name in these cases is rare. You must use the package name as an override when you set this variable. Here is an example from the `dbus` recipe:

```
DEBIANNAME_${PN} = "dbus-1"
```

DEBUG_BUILD

Specifies to build packages with debugging information. This influences the value of the `SELECTED_OPTIMIZATION` variable.

DEBUG_OPTIMIZATION

The options to pass in `TARGET_CFLAGS` and `CFLAGS` when compiling a system for debugging. This variable defaults to `"-O -fno-omit-frame-pointer ${DEBUG_FLAGS} -pipe"`.

DEFAULT_PREFERENCE

Specifies a weak bias for recipe selection priority.

The most common usage of this variable is to set it to `"-1"` within a recipe for a development version of a piece of software. Using the variable in this way causes the stable version of the recipe to build by default in the absence of `PREFERRED_VERSION` being used to build the development version.

Note

The bias provided by `DEFAULT_PREFERENCE` is weak and is overridden by `BBFILE_PRIORITY` if that variable is different between two layers that contain different versions of the same recipe.

DEFAULTTUNE

The default CPU and Application Binary Interface (ABI) tunings (i.e. the "tune") used by the OpenEmbedded build system. The `DEFAULTTUNE` helps define `TUNE_FEATURES`.

The default tune is either implicitly or explicitly set by the machine (`MACHINE`). However, you can override the setting using available tunes as defined with `AVAILTUNES`.

DEPENDS

Lists a recipe's build-time dependencies (i.e. other recipe files). The system ensures that all the dependencies listed have been built and have their contents in the appropriate sysroots before the recipe's configure task is executed.

Consider this simple example for two recipes named "a" and "b" that produce similarly named packages. In this example, the `DEPENDS` statement appears in the "a" recipe:

```
DEPENDS = "b"
```

Here, the dependency is such that the `do_configure` task for recipe "a" depends on the `do_populate_sysroot` task of recipe "b". This means anything that recipe "b" puts into sysroot is available when recipe "a" is configuring itself.

For information on runtime dependencies, see the `RDEPENDS` variable.

DEPLOY_DIR

Points to the general area that the OpenEmbedded build system uses to place images, packages, SDKs and other output files that are ready to be used outside of the build system. By default, this directory resides within the `Build Directory` as `${TMPDIR}/deploy`.

For more information on the structure of the Build Directory, see "[The Build Directory - build/](#)" section. For more detail on the contents of the `deploy` directory, see the "[Images](#)", "[Package Feeds](#)", and "[Application Development SDK](#)" sections.

DEPLOY_DIR_DEB

Points to the area that the OpenEmbedded build system uses to place Debian packages that are ready to be used outside of the build system. This variable applies only when PACKAGE_CLASSES contains "package_deb".

The BitBake configuration file initially defines the `DEPLOY_DIR_DEB` variable as a sub-folder of DEPLOY_DIR:

```
DEPLOY_DIR_DEB = "${DEPLOY_DIR}/deb"
```

The package_deb class uses the `DEPLOY_DIR_DEB` variable to make sure the do_package_write_deb task writes Debian packages into the appropriate folder. For more information on how packaging works, see the "Package Feeds" section.

DEPLOY_DIR_IMAGE

Points to the area that the OpenEmbedded build system uses to place images and other associated output files that are ready to be deployed onto the target machine. The directory is machine-specific as it contains the `${MACHINE}` name. By default, this directory resides within the Build Directory as `${DEPLOY_DIR}/images/${MACHINE}/`.

For more information on the structure of the Build Directory, see "The Build Directory - build/" section. For more detail on the contents of the `deploy` directory, see the "Images" and "Application Development SDK" sections.

DEPLOY_DIR_IPK

Points to the area that the OpenEmbedded build system uses to place IPK packages that are ready to be used outside of the build system. This variable applies only when PACKAGE_CLASSES contains "package_ipk".

The BitBake configuration file initially defines this variable as a sub-folder of DEPLOY_DIR:

```
DEPLOY_DIR_IPK = "${DEPLOY_DIR}/ipk"
```

The package_ipk class uses the `DEPLOY_DIR_IPK` variable to make sure the do_package_write_ipk task writes IPK packages into the appropriate folder. For more information on how packaging works, see the "Package Feeds" section.

DEPLOY_DIR_RPM

Points to the area that the OpenEmbedded build system uses to place RPM packages that are ready to be used outside of the build system. This variable applies only when

PACKAGE_CLASSES contains "package_rpm".

The BitBake configuration file initially defines this variable as a sub-folder of DEPLOY_DIR:

```
DEPLOY_DIR_RPM = "${DEPLOY_DIR}/rpm"
```

The package_rpm class uses the DEPLOY_DIR_RPM variable to make sure the do_package_write_rpm task writes RPM packages into the appropriate folder. For more information on how packaging works, see the "Package Feeds" section.

DEPLOY_DIR_TAR

Points to the area that the OpenEmbedded build system uses to place tarballs that are ready to be used outside of the build system. This variable applies only when PACKAGE_CLASSES contains "package_tar".

The BitBake configuration file initially defines this variable as a sub-folder of DEPLOY_DIR:

```
DEPLOY_DIR_TAR = "${DEPLOY_DIR}/tar"
```

The package_tar class uses the DEPLOY_DIR_TAR variable to make sure the do_package_write_tar task writes TAR packages into the appropriate folder. For more information on how packaging works, see the "Package Feeds" section.

DEPLOYDIR

When inheriting the deploy class, the DEPLOYDIR points to a temporary work area for deployed files that is set in the deploy class as follows:

```
DEPLOYDIR = "${WORKDIR}/deploy-${PN}"
```

Recipes inheriting the deploy class should copy files to be deployed into DEPLOYDIR, and the class will take care of copying them into DEPLOY_DIR_IMAGE afterwards.

DESCRIPTION

The package description used by package managers. If not set, DESCRIPTION takes the value of the SUMMARY variable.

DISK_SIGNATURE

A 32-bit MBR disk signature used by directdisk images.

By default, the signature is set to an automatically generated random value that allows the OpenEmbedded build system to create a boot loader. You can override the signature in the image recipe by setting DISK_SIGNATURE to an 8-digit hex string. You might want to override DISK_SIGNATURE if

you want the disk signature to remain constant between image builds.

When using Linux 3.8 or later, you can use `DISK_SIGNATURE` to specify the root by UUID to allow the kernel to locate the root device even if the device name changes due to differences in hardware configuration. By default, `SYSLINUX_ROOT` is set as follows:

```
SYSLINUX_ROOT = "root=/dev/sda2"
```

However, you can change this to locate the root device using the disk signature instead:

```
SYSLINUX_ROOT = "root=PARTUUID=${DISK_SIGN
```

As previously mentioned, it is possible to set the `DISK_SIGNATURE` variable in your `local.conf` file to a fixed value if you do not want `syslinux.cfg` changing for each build. You might find this useful when you want to upgrade the root filesystem on a device without having to recreate or modify the master boot record.

DISTRO

The short name of the distribution. This variable corresponds to a distribution configuration file whose root name is the same as the variable's argument and whose filename extension is `.conf`. For example, the distribution configuration file for the Poky distribution is named `poky.conf` and resides in the `meta-yocto/conf/distro` directory of the [Source Directory](#).

Within that `poky.conf` file, the `DISTRO` variable is set as follows:

```
DISTRO = "poky"
```

Distribution configuration files are located in a `conf/distro` directory within the [Metadata](#) that contains the distribution configuration. The value for `DISTRO` must not contain spaces, and is typically all lower-case.

Note

If the `DISTRO` variable is blank, a set of default configurations are used, which are specified within `meta/conf/distro/defaultsetup.conf` also in the Source Directory.

DISTRO_CODENAME

Specifies a codename for the distribution being built.

DISTRO_EXTRA_RDEPENDS

Specifies a list of distro-specific packages to add to all images. This variable takes affect through `packagegroup-base` so the variable only really applies to the more full-featured images that include `packagegroup-base`. You can use this variable to keep distro policy out of generic images. As with all other distro variables, you set this variable in the distro `.conf` file.

`DISTRO_EXTRA_RRECOMMENDS`

Specifies a list of distro-specific packages to add to all images if the packages exist. The packages might not exist or be empty (e.g. kernel modules). The list of packages are automatically installed but you can remove them.

`DISTRO_FEATURES`

The software support you want in your distribution for various features. You define your distribution features in the distribution configuration file.

In most cases, the presence or absence of a feature in `DISTRO_FEATURES` is translated to the appropriate option supplied to the configure script during the `do_configure` task for recipes that optionally support the feature. For example, specifying "x11" in `DISTRO_FEATURES`, causes every piece of software built for the target that can optionally support X11 to have its X11 support enabled.

Two more examples are Bluetooth and NFS support. For a more complete list of features that ships with the Yocto Project and that you can provide with this variable, see the "[Distro Features](#)" section.

`DISTRO_FEATURES_BACKFILL`

Features to be added to `DISTRO_FEATURES` if not also present in `DISTRO_FEATURES_BACKFILL_CONSIDERED`.

This variable is set in the `meta/conf/bitbake.conf` file. It is not intended to be user-configurable. It is best to just reference the variable to see which distro features are being backfilled for all distro configurations. See the [Feature backfilling](#) section for more information.

`DISTRO_FEATURES_BACKFILL_CONSIDERED`

Features from `DISTRO_FEATURES_BACKFILL` that should not be backfilled (i.e. added to `DISTRO_FEATURES`) during the build. See the "[Feature Backfilling](#)" section for more information.

DISTRO_FEATURES_DEFAULT

A convenience variable that gives you the default list of distro features with the exception of any features specific to the C library (`libc`).

When creating a custom distribution, you might find it useful to be able to reuse the default `DISTRO_FEATURES` options without the need to write out the full set. Here is an example that uses `DISTRO_FEATURES_DEFAULT` from a custom distro configuration file:

```
DISTRO_FEATURES ?= "${DISTRO_FEATURES_DEFAULT}
```

DISTRO_FEATURES_LIBC

A convenience variable that specifies the list of distro features that are specific to the C library (`libc`). Typically, these features are prefixed with "libc-" and control which features are enabled at during the build within the C library itself.

DISTRO_NAME

The long name of the distribution.

DISTRO_VERSION

The version of the distribution.

DISTROOVERRIDES

This variable lists overrides specific to the current distribution. By default, the variable list includes the value of the `DISTRO` variable. You can extend the variable to apply any variable overrides you want as part of the distribution and are not already in `OVERRIDES` through some other means.

DL_DIR

The central download directory used by the build process to store downloads. By default, `DL_DIR` gets files suitable for mirroring for everything except Git repositories. If you want tarballs of Git repositories, use the `BB_GENERATE_MIRROR_TARBALLS` variable.

You can set this directory by defining the `DL_DIR` variable in the `conf/local.conf` file. This directory is self-maintaining and you should not have to touch it. By default, the directory is `downloads` in the [Build Directory](#).

```
#DL_DIR ?= "${TOPDIR}/downloads"
```

To specify a different download directory, simply remove the comment from the line and provide your directory.

During a first build, the system downloads many different source code tarballs from various upstream projects. Downloading can

take a while, particularly if your network connection is slow. Tarballs are all stored in the directory defined by `DL_DIR` and the build system looks there first to find source tarballs.

Note

When wiping and rebuilding, you can preserve this directory to speed up this part of subsequent builds.

You can safely share this directory between multiple builds on the same development machine. For additional information on how the build process gets source files when working behind a firewall or proxy server, see this specific question in the "[FAQ](#)" chapter.

`DOC_COMPRESS`

When inheriting the `compress_doc` class, this variable sets the compression policy used when the OpenEmbedded build system compresses man pages and info pages. By default, the compression method used is gz (gzip). Other policies available are xz and bz2.

For information on policies and on how to use this variable, see the comments in the `meta/classes/compress_doc.bbclass` file.

E

`EFI_PROVIDER`

When building bootable images (i.e. where `hddimg` or `vmdk` is in `IMAGE_FSTYPES`), the `EFI_PROVIDER` variable specifies the EFI bootloader to use. The default is "grub-efi", but "gummiboot" can be used instead.

See the `gummiboot` class for more information.

`ENABLE_BINARY_LOCALE_GENERATION`

Variable that controls which locales for `glibc` are generated during the build (useful if the target device has 64Mbytes of RAM or less).

`ERR_REPORT_DIR`

When used with the `report-error` class, specifies the path used for storing the debug files created by the `error reporting tool`, which allows you to submit build errors you encounter to a central database. By default, the value of this variable is `${LOG_DIR}/error-report`.

You can set `ERR_REPORT_DIR` to the path you

want the error reporting tool to store the debug files as follows in your `local.conf` file:

```
ERR_REPORT_DIR = "path"
```

ERROR_QA

Specifies the quality assurance checks whose failures are reported as errors by the OpenEmbedded build system. You set this variable in your distribution configuration file. For a list of the checks you can control with this variable, see the "[insane.bbclass](#)" section.

EXCLUDE_FROM_SHLIBS

Triggers the OpenEmbedded build system's shared libraries resolver to exclude an entire package when scanning for shared libraries.

Note

The shared libraries resolver's functionality results in part from the internal function `package_do_shlibs`, which is part of the `do_package` task. You should be aware that the shared libraries resolver might implicitly define some dependencies between packages.

The `EXCLUDE_FROM_SHLIBS` variable is similar to the `PRIVATE_LIBS` variable, which excludes a package's particular libraries only and not the whole package.

Use the `EXCLUDE_FROM_SHLIBS` variable by setting it to "1" for a particular package:

```
EXCLUDE_FROM_SHLIBS = "1"
```

EXCLUDE_FROM_WORLD

Directs BitBake to exclude a recipe from world builds (i.e. `bitbake world`). During world builds, BitBake locates, parses and builds all recipes found in every layer exposed in the `bblayers.conf` configuration file.

To exclude a recipe from a world build using this variable, set the variable to "1" in the recipe.

Note

Recipes added to `EXCLUDE_FROM_WORLD` may still be built during a world build in order to satisfy dependencies of other recipes. Adding a recipe to `EXCLUDE_FROM_WORLD` only

ensures that the recipe is not explicitly added to the list of build targets in a world build.

EXTENDPE ¶

Used with file and pathnames to create a prefix for a recipe's version based on the recipe's `PE` value. If `PE` is set and greater than zero for a recipe, `EXTENDPE` becomes that value (e.g if `PE` is equal to "1" then `EXTENDPE` becomes "1_"). If a recipe's `PE` is not set (the default) or is equal to zero, `EXTENDPE` becomes "".

See the [STAMP](#) variable for an example.

EXTENDPKGVS ¶

The full package version specification as it appears on the final packages produced by a recipe. The variable's value is normally used to fix a runtime dependency to the exact same version of another package in the same recipe:

```
RDEPENDS_${PN}-additional-module = "${PN}
```

The dependency relationships are intended to force the package manager to upgrade these types of packages in lock-step.

EXTERNAL_KERNEL_TOOLS ¶

When set, the `EXTERNAL_KERNEL_TOOLS` variable indicates that these tools are not in the source tree.

When kernel tools are available in the tree, they are preferred over any externally installed tools. Setting the `EXTERNAL_KERNEL_TOOLS` variable tells the OpenEmbedded build system to prefer the installed external tools. See the [kernel-yocto](#) class in `meta/classes` to see how the variable is used.

EXTERNALSRC ¶

When inheriting the [externalsrc](#) class, this variable points to the source tree, which is outside of the OpenEmbedded build system. When set, this variable sets the `s` variable, which is what the OpenEmbedded build system uses to locate unpacked recipe source code.

For more information on `externalsrc.bbclass`, see the ["externalsrc.bbclass"](#) section. You can also find information on how to use this variable in the ["Building Software from an External Source"](#) section in the Yocto Project

EXTERNALSRC_BUILD

When inheriting the `externalsrc` class, this variable points to the directory in which the recipe's source code is built, which is outside of the OpenEmbedded build system. When set, this variable sets the `_b` variable, which is what the OpenEmbedded build system uses to locate the Build Directory.

For more information on `externalsrc.bbclass`, see the "`externalsrc.bbclass`" section. You can also find information on how to use this variable in the "[Building Software from an External Source](#)" section in the Yocto Project Development Manual.

EXTRA_AUTORECONF

For recipes inheriting the `autotools` class, you can use `EXTRA_AUTORECONF` to specify extra options to pass to the `autoreconf` command that is executed during the `do_configure` task.

The default value is "`--exclude=autopoint`".

EXTRA_IMAGE_FEATURES

A list of additional features to include in an image. When listing more than one feature, separate them with a space.

Typically, you configure this variable in your `local.conf` file, which is found in the [Build Directory](#). Although you can use this variable from within a recipe, best practices dictate that you do not.

Note

To enable primary features from within the image recipe, use the `IMAGE_FEATURES` variable.

Here are some examples of features you can add:

"dbg-pkgs" - Adds -dbg packages for all installs including symbol information for debugging and profiling.

"debug-tweaks" - Makes an image suitable for development. For example, allows root login: passwords and enables post-install logging. See the 'allow-empty-root' and 'post-install-logging' features in the "[Image Features](#)" section for more information.

"dev-pkgs" - Adds -dev packages for all installs. This is useful if you want to develop the libraries in the image.

"read-only-rootfs" - Creates an image whose root filesystem is read-only. See the "[Creating a Read-Only Root](#)" section in the Yocto Project Development Manual for more information.

"tools-debug" - Adds debugging tools such as gdb and strace.

"tools-profile" - Adds profiling tools such as oprofile, exmap, ltnng and valgrind (x86_64).

"tools-sdk" - Adds development tools such as gcc, pkgconfig and so forth.

"tools-testapps" - Adds useful testing tools such as ts_print, aplay, arecord and so forth.

For a complete list of image features that ships with the Yocto Project, see the "[Image Features](#)" section.

For an example that shows how to customize your image by using this variable, see the "[Customizing Images Using Custom IMAGE_FEATURES and EXTRA_IMAGE_FEATURES](#)" section in the Yocto Project Development Manual.

EXTRA_IMAGECMD

Specifies additional options for the image creation command that has been specified in [IMAGE_CMD](#). When setting this variable, you should use an override for the associated type. Here is an example:

```
EXTRA_IMAGECMD_ext3 ?= "-i 4096"
```

EXTRA_IMAGEDEPENDS

A list of recipes to build that do not provide packages for installing into the root filesystem.

Sometimes a recipe is required to build the final image but is not needed in the root filesystem. You can use the `EXTRA_IMAGEDEPENDS` variable to list these recipes and thus specify the dependencies. A typical example is a required bootloader in a machine configuration.

Note

To add packages to the root filesystem, see the various [*RDEPENDS](#) and [*RECOMMENDS](#) variables.

<code>EXTRA_OECMAKE</code>	Additional <code>cmake</code> options.
<code>EXTRA_OECONF</code>	Additional <code>configure</code> script options.
<code>EXTRA_OEMAKE</code>	Additional GNU <code>make</code> options.
<code>EXTRA_OESCONS</code>	When inheriting the <code>scons</code> class, this variable specifies additional configuration options you want to pass to the <code>scons</code> command line.
<code>EXTRA_QMAKEVARS_POST</code>	<p>Configuration variables or options you want to pass to <code>qmake</code>. Use this variable when the arguments need to be after the <code>.pro</code> file list on the command line.</p> <p>This variable is used with recipes that inherit the <code>qmake_base</code> class or other classes that inherit <code>qmake_base</code>.</p>
<code>EXTRA_QMAKEVARS_PRE</code>	<p>Configuration variables or options you want to pass to <code>qmake</code>. Use this variable when the arguments need to be before the <code>.pro</code> file list on the command line.</p> <p>This variable is used with recipes that inherit the <code>qmake_base</code> class or other classes that inherit <code>qmake_base</code>.</p>
<code>EXTRA_USERS_PARAMS</code>	<p>When inheriting the <code>extrausers</code> class, this variable provides image level user and group operations. This is a more global method of providing user and group configuration as compared to using the <code>useradd</code> class, which ties user and group configurations to a specific recipe.</p> <p>The set list of commands you can configure using the <code>EXTRA_USERS_PARAMS</code> is shown in the <code>extrausers</code> class. These commands map to the normal Unix commands of the same names:</p> <pre># EXTRA_USERS_PARAMS = "\ # useradd -p ' ' tester; \ # groupadd developers; \ # userdel nobody; \ # groupdel -g video; \ # groupmod -g 1020 developers; \ # usermod -s /bin/sh tester; \ # "</pre>
<code>FEATURE_PACKAGES</code>	Defines one or more packages to include in an image when a specific item is included in <code>IMAGE_FEATURES</code> . When setting the value,

`FEATURE_PACKAGES` should have the name of the feature item as an override. Here is an example:

```
FEATURE_PACKAGES_widget = "package1 packag
```

In this example, if "widget" were added to `IMAGE_FEATURES`, `package1` and `package2` would be included in the image.

Note

Packages installed by features defined through `FEATURE_PACKAGES` are often package groups. While similarly named, you should not confuse the `FEATURE_PACKAGES` variable with package groups, which are discussed elsewhere in the documentation.

FEED_DEPLOYDIR_BASE_URI

Points to the base URL of the server and location within the document-root that provides the metadata and packages required by OPKG to support runtime package management of IPK packages. You set this variable in your `local.conf` file.

Consider the following example:

```
FEED_DEPLOYDIR_BASE_URI = "http://192.168."
```

This example assumes you are serving your packages over HTTP and your databases are located in a directory named `BOARD-dir`, which is underneath your HTTP server's document-root. In this case, the OpenEmbedded build system generates a set of configuration files for you in your target that work with the feed.

FILES

The list of directories or files that are placed in packages.

To use the `FILES` variable, provide a package name override that identifies the resulting package. Then, provide a space-separated list of files or paths that identify the files you want included as part of the resulting package. Here is an example:

```
FILES_${PN} += "${bindir}/mydir1/ ${bindir}
```

Note

When specifying paths as part of the `FILES` variable, it is good practice to use

appropriate path variables. For example, use `${sysconfdir}` rather than `/etc`, or `${bindir}` rather than `/usr/bin`. You can find a list of these variables at the top of the `meta/conf/bitbake.conf` file in the [Source Directory](#).

If some of the files you provide with the `FILES` variable are editable and you know they should not be overwritten during the package update process by the Package Management System (PMS), you can identify these files so that the PMS will not overwrite them. See the [CONFFILES](#) variable for information on how to identify these files to the PMS.

`FILES_SOLIBSDEV`

Defines the file specification to match [SOLIBSDEV](#). In other words, `FILES_SOLIBSDEV` defines the full path name of the development symbolic link (symlink) for shared libraries on the target platform.

The following statement from the `bitbake.conf` shows how it is set:

```
FILES_SOLIBSDEV ?= "${base_libdir}/lib*${S
```

`FILESEXTRAPATHS`

Extends the search path the OpenEmbedded build system uses when looking for files and patches as it processes recipes and append files. The default directories BitBake uses when it processes recipes are initially defined by the [FILESPATH](#) variable. You can extend `FILESPATH` variable by using `FILESEXTRAPATHS`.

Best practices dictate that you accomplish this by using `FILESEXTRAPATHS` from within a `.bbappend` file and that you prepend paths as follows:

```
FILESEXTRAPATHS_prepend := "${THISDIR}/${P
```

In the above example, the build system first looks for files in a directory that has the same name as the corresponding append file.

Note

When extending `FILESEXTRAPATHS`, be sure to use the immediate expansion (`:=`) operator. Immediate expansion makes sure that BitBake

evaluates `THISDIR` at the time the directive is encountered rather than at some later time when expansion might result in a directory that does not contain the files you need.

Also, include the trailing separating colon character if you are prepending. The trailing colon character is necessary because you are directing BitBake to extend the path by prepending directories to the search path.

Here is another common use:

```
FILESEXTRAPATHS_prepend := "${THISDIR}/files
```

In this example, the build system extends the `FILESPATH` variable to include a directory named `files` that is in the same directory as the corresponding append file.

Here is a final example that specifically adds three paths:

```
FILESEXTRAPATHS_prepend := "path_1:path_2:
```

By prepending paths in `.bbappend` files, you allow multiple append files that reside in different layers but are used for the same recipe to correctly extend the path.

FILESOVERRIDES

A subset of `OVERRIDES` used by the OpenEmbedded build system for creating `FILESPATH`. You can find more information on how overrides are handled in the [BitBake Manual](#).

By default, the `FILESOVERRIDES` variable is defined as:

```
FILESOVERRIDES = "${TRANSLATED_TARGET_ARCH
```

Note

Do not hand-edit the `FILESOVERRIDES` variable. The values match up with expected overrides and are used in an expected manner by the build system.

FILESPATH

The default set of directories the OpenEmbedded build system uses when searching for patches and files. During the build process, BitBake searches each directory in `FILESPATH` in the specified order when looking for files and patches specified by each `file://` URI in a recipe.

The default value for the `FILESPATH` variable is defined in the `base.bbclass` class found in `meta/classes` in the [Source Directory](#):

```
FILESPATH = "${@base_set_files_path(["${FILE_
"${FILE_DIRNAME}/${BPN}", "${FILE_DIRNAME]
```

Note

Do not hand-edit the `FILESPATH` variable. If you want the build system to look in directories other than the defaults, extend the `FILESPATH` variable by using the [FILESEXTRAPATHS](#) variable.

Be aware that the default `FILESPATH` directories do not map to directories in custom layers where append files (`.bbappend`) are used. If you want the build system to find patches or files that reside with your append files, you need to extend the `FILESPATH` variable by using the [FILESEXTRAPATHS](#) variable.

FILESYSTEM_PERMS_TABLES

Allows you to define your own file permissions settings table as part of your configuration for the packaging process. For example, suppose you need a consistent set of custom permissions for a set of groups and users across an entire work project. It is best to do this in the packages themselves but this is not always possible.

By default, the OpenEmbedded build system uses the `fs-perms.txt`, which is located in the `meta/files` folder in the [Source Directory](#). If you create your own file permissions setting table, you should place it in your layer or the distro's layer.

You define the `FILESYSTEM_PERMS_TABLES` variable in the `conf/local.conf` file, which is found in the [Build Directory](#), to point to your custom `fs-perms.txt`. You can specify more than a single file permissions setting table. The paths you specify to these files must be defined within the [BBPATH](#) variable.

For guidance on how to create your own file permissions settings table file, examine the existing `fs-perms.txt`.

FONT_EXTRA_RDEPENDS

When inheriting the `fontcache` class, this variable specifies the runtime dependencies for font packages. By default, the `FONT_EXTRA_RDEPENDS` is set to "fontconfig-utils".

FONT_PACKAGES

When inheriting the `fontcache` class, this variable identifies packages containing font files that need to be cached by Fontconfig. By default, the `fontcache` class assumes that fonts are in the recipe's main package (i.e. `_${PN}`). Use this variable if fonts you need are in a package other than that main package.

FULL_OPTIMIZATION

The options to pass in `TARGET_CFLAGS` and `CFLAGS` when compiling an optimized system. This variable defaults to "-O2 -pipe `_${DEBUG_FLAGS}`".

G

GDB

The minimal command and arguments to run the GNU Debugger.

GITDIR

The directory in which a local copy of a Git repository is stored when it is cloned.

GLIBC_GENERATE_LOCALES

Specifies the list of GLIBC locales to generate should you not wish generate all LIBC locals, which can be time consuming.

Note

If you specifically remove the locale `en_US.UTF-8`, you must set `IMAGE_LINGUAS` appropriately.

You can set `GLIBC_GENERATE_LOCALES` in your `local.conf` file. By default, all locales are generated.

```
GLIBC_GENERATE_LOCALES = "en_GB.UTF-8 en_1
```

GROUPADD_PARAM

When inheriting the `useradd` class, this variable specifies for a package what parameters should be passed to the `groupadd` command if you wish to add a

group to the system when the package is installed.

Here is an example from the `dbus` recipe:

```
GROUPADD_PARAM_${PN} = "-r netdev"
```

For information on the standard Linux shell command `groupadd`, see <http://linux.die.net/man/8/groupadd>.

GROUPMEMS_PARAM ¶

When inheriting the `useradd` class, this variable specifies for a package what parameters should be passed to the `groupmems` command if you wish to modify the members of a group when the package is installed.

For information on the standard Linux shell command `groupmems`, see <http://linux.die.net/man/8/groupmems>.

GRUB_GFXSERIAL ¶

Configures the GNU GRand Unified Bootloader (GRUB) to have graphics and serial in the boot menu. Set this variable to "1" in your `local.conf` or distribution configuration file to enable graphics and serial in the menu.

See the `grub-efi` class for more information on how this variable is used.

GRUB_OPTS ¶

Additional options to add to the GNU GRand Unified Bootloader (GRUB) configuration. Use a semi-colon character (;) to separate multiple options.

The `GRUB_OPTS` variable is optional. See the `grub-efi` class for more information on how this variable is used.

GRUB_TIMEOUT ¶

Specifies the timeout before executing the default `LABEL` in the GNU GRand Unified Bootloader (GRUB).

The `GRUB_TIMEOUT` variable is optional. See the `grub-efi` class for more information on how this variable is used.

GTKIMMODULES_PACKAGES ¶

When inheriting the `gtk-immodules-cache` class, this variable specifies the packages that contain the GTK+ input method modules being installed when the modules are in packages other than the main package.

GUMMIBOOT_CFG ¶

When `EFI_PROVIDER` is set to "gummiboot", the `GUMMIBOOT_CFG` variable specifies the

configuration file that should be used. By default, the `gummiboot` class sets the `GUMMIBOOT_CFG` as follows:

```
GUMMIBOOT_CFG ?= "${S}/loader.conf"
```

For information on Gummiboot, see the [Gummiboot documentation](#).

GUMMIBOOT_ENTRIES

When `EFI_PROVIDER` is set to "gummiboot", the `GUMMIBOOT_ENTRIES` variable specifies a list of entry files (*.conf) to be installed containing one boot entry per file. By default, the `gummiboot` class sets the `GUMMIBOOT_ENTRIES` as follows:

```
GUMMIBOOT_ENTRIES ?= ""
```

For information on Gummiboot, see the [Gummiboot documentation](#).

GUMMIBOOT_TIMEOUT

When `EFI_PROVIDER` is set to "gummiboot", the `GUMMIBOOT_TIMEOUT` variable specifies the boot menu timeout in seconds. By default, the `gummiboot` class sets the `GUMMIBOOT_TIMEOUT` as follows:

```
GUMMIBOOT_TIMEOUT ?= "10"
```

For information on Gummiboot, see the [Gummiboot documentation](#).

H

HOMEPAGE

Website where more information about the software the recipe is building can be found.

HOST_ARCH

The name of the target architecture, which is normally the same as `TARGET_ARCH`. The OpenEmbedded build system supports many architectures. Here is an example list of architectures supported. This list is by no means complete as the architecture is configurable:

```
arm
i586
x86_64
powerpc
powerpc64
mips
mipsel
```

HOST_CC_ARCH

Specifies architecture-specific compiler flags that are passed to the C compiler.

Default initialization for `HOST_CC_ARCH` varies depending on what is being built:

- `TARGET_CC_ARCH` when building for the

target

- `BUILD_CC_ARCH` when building for the build host (i.e. native)
- `BUILDSDK_CC_ARCH` when building for an SDK (i.e. nativesdk)

HOST_OS

Specifies the name of the target operating system, which is normally the same as the `TARGET_OS`. The variable can be set to "linux" for glibc-based systems and to "linux-uclibc" for uclibc. For ARM/EABI targets, there are also "linux-gnueabi" and "linux-uclibc-gnueabi" values possible.

HOST_PREFIX

Specifies the prefix for the cross-compile toolchain. `HOST_PREFIX` is normally the same as `TARGET_PREFIX`.

HOST_SYS

Specifies the system, including the architecture and the operating system, for which the build is occurring in the context of the current recipe.

The OpenEmbedded build system automatically sets this variable based on `HOST_ARCH`, `HOST_VENDOR`, and `HOST_OS` variables.

Note

You do not need to set the variable yourself.

Consider these two examples:

- Given a native recipe on a 32-bit x86 machine running Linux, the value is "i686-linux".
- Given a recipe being built for a little-endian MIPS target running Linux, the value might be "mipsel-linux".

HOST_VENDOR

Specifies the name of the vendor. `HOST_VENDOR` is normally the same as `TARGET_VENDOR`.

ICECC_DISABLED

Disables or enables the `icecc` (Icecream) function. For more information on this function and best practices for using this variable, see the "`icecc.bbclass`" section.

Setting this variable to "1" in your

`local.conf` disables the function:

```
ICECC_DISABLED ??= "1"
```

To enable the function, set the variable as follows:

```
ICECC_DISABLED = ""
```

ICECC_ENV_EXEC

Points to the `icecc-create-env` script that you provide. This variable is used by the `icecc` class. You set this variable in your `local.conf` file.

If you do not point to a script that you provide, the OpenEmbedded build system uses the default script provided by the `icecc-create-env.bb` recipe, which is a modified version and not the one that comes with `icecc`.

ICECC_PARALLEL_MAKE

Extra options passed to the `make` command during the `do_compile` task that specify parallel compilation. This variable usually takes the form of `"-j x"`, where `x` represents the maximum number of parallel threads `make` can run.

Note

The options passed affect builds on all enabled machines on the network, which are machines running the `iceccd` daemon.

If your enabled machines support multiple cores, coming up with the maximum number of parallel threads that gives you the best performance could take some experimentation since machine speed, network lag, available memory, and existing machine loads can all affect build time. Consequently, unlike the `PARALLEL_MAKE` variable, there is no rule-of-thumb for setting `ICECC_PARALLEL_MAKE` to achieve optimal performance.

If you do not set `ICECC_PARALLEL_MAKE`, the build system does not use it (i.e. the system does not detect and assign the number of cores as is done with `PARALLEL_MAKE`).

ICECC_PATH

The location of the `icecc` binary. You can set this variable in your `local.conf` file. If your `local.conf` file does not define this variable, the `icecc` class attempts to define it by locating `icecc` using `which`.

ICECC_USER_CLASS_BL

Identifies user classes that you do not want the Icecream distributed compile support to consider. This variable is used by the `icecc` class. You set this variable in your `local.conf` file.

When you list classes using this variable, you are "blacklisting" them from distributed compilation across remote hosts. Any classes you list will be distributed and compiled locally.

ICECC_USER_PACKAGE_BL

Identifies user recipes that you do not want the Icecream distributed compile support to consider. This variable is used by the `icecc` class. You set this variable in your `local.conf` file.

When you list packages using this variable, you are "blacklisting" them from distributed compilation across remote hosts. Any packages you list will be distributed and compiled locally.

ICECC_USER_PACKAGE_WL

Identifies user recipes that use an empty `PARALLEL_MAKE` variable that you want to force remote distributed compilation on using the Icecream distributed compile support. This variable is used by the `icecc` class. You set this variable in your `local.conf` file.

IMAGE_BASENAME

The base name of image output files. This variable defaults to the recipe name (`${PN}`).

IMAGE_BOOT_FILES

A space-separated list of files installed into the boot partition when preparing an image using the `wic` tool with the `bootimg-partition` source plugin. By default, the files are installed under the same name as the source files. To change the installed name, separate it from the original name with a semi-colon (;). Source files need to be located in `DEPLOY_DIR_IMAGE`. Here are two examples:

```
IMAGE_BOOT_FILES = "u-boot.img uImage;kern-  
IMAGE_BOOT_FILES = "u-boot.${UBOOT_SUFFIX}
```

Alternatively, source files can be picked up using a glob pattern. In this case, the destination file will have the same name as the base name of the source file path. To install files into a directory within the target location, pass its name after a semi-colon (;). Here are two examples:

```
IMAGE_BOOT_FILES = "bcm2835-bootfiles/*"  
IMAGE_BOOT_FILES = "bcm2835-bootfiles/*;bo
```

The first example installs all files from `${DEPLOY_DIR_IMAGE}/bcm2835-bootfiles` into the root of the target partition. The second example installs the same files into a `boot` directory within the target partition.

IMAGE_CLASSES

A list of classes that all images should inherit. You typically use this variable to specify the list of classes that register the different types of images the OpenEmbedded build system creates.

The default value for `IMAGE_CLASSES` is `image_types`. You can set this variable in your `local.conf` or in a distribution configuration file.

For more information, see `meta/classes/image_types.bbclass` in the [Source Directory](#).

IMAGE_CMD

Specifies the command to create the image file for a specific image type, which corresponds to the value set in `IMAGE_FSTYPES`, (e.g. `ext3`, `btrfs`, and so forth). When setting this variable, you should use an override for the associated type. Here is an example:

```
IMAGE_CMD_jffs2 = "mkfs.jffs2 --root=${IMA  
--faketime --output=${DEPLOY_DIR_IMAGE}.  
${EXTRA_IMAGECMD}"
```

You typically do not need to set this variable unless you are adding support for a new image type. For more examples on how to set this variable, see the `image_types` class file, which is `meta/classes/image_types.bbclass`.

IMAGE_DEVICE_TABLES

Specifies one or more files that contain custom device tables that are passed to the `makedevs` command as part of creating an image. These files list basic device nodes that should be created under `/dev` within the image. If `IMAGE_DEVICE_TABLES` is not set, `files/device_table-minimal.txt` is used, which is located by `BBPATH`. For details on how you should write device table files, see `meta/files/device_table-minimal.txt` as an example.

IMAGE_FEATURES

The primary list of features to include in an image. Typically, you configure this variable

in an image recipe. Although you can use this variable from your `local.conf` file, which is found in the [Build Directory](#), best practices dictate that you do not.

Note

To enable extra features from outside the image recipe, use the [EXTRA_IMAGE_FEATURES](#) variable.

For a list of image features that ships with the Yocto Project, see the "[Image Features](#)" section.

For an example that shows how to customize your image by using this variable, see the "[Customizing Images Using Custom IMAGE_FEATURES and EXTRA_IMAGE_FEATURES](#)" section in the Yocto Project Development Manual.

IMAGE_FSTYPES

Specifies the formats the OpenEmbedded build system uses during the build when creating the root filesystem. For example, setting `IMAGE_FSTYPES` as follows causes the build system to create root filesystems using two formats: `.ext3` and `.tar.bz2`:

```
IMAGE_FSTYPES = "ext3 tar.bz2"
```

For the complete list of supported image formats from which you can choose, see [IMAGE_TYPES](#).

Note

If you add "live" to `IMAGE_FSTYPES` inside an image recipe, be sure that you do so prior to the "inherit image" line of the recipe or the live image will not build.

Note

Due to the way this variable is processed, it is not possible to update its contents using `_append` or `_prepend`. To add one or more additional options to this variable the `+=` operator must be used.

IMAGE_INSTALL

Specifies the packages to install into an image. The `IMAGE_INSTALL` variable is a mechanism for an image recipe and you

should use it with care to avoid ordering issues.

Note

When working with an `core-image-minimal-initramfs` image, do not use the `IMAGE_INSTALL` variable to specify packages for installation. Instead, use the `PACKAGE_INSTALL` variable, which allows the initial RAM disk (initramfs) recipe to use a fixed set of packages and not be affected by `IMAGE_INSTALL`.

Image recipes set `IMAGE_INSTALL` to specify the packages to install into an image through `image.bbclass`. Additionally, "helper" classes exist, such as `core-image.bbclass`, that can take `IMAGE_FEATURES` lists and turn these into auto-generated entries in `IMAGE_INSTALL` in addition to its default contents.

Using `IMAGE_INSTALL` with the `+=` operator from the `/conf/local.conf` file or from within an image recipe is not recommended as it can cause ordering issues. Since `core-image.bbclass` sets `IMAGE_INSTALL` to a default value using the `?=` operator, using a `+=` operation against `IMAGE_INSTALL` will result in unexpected behavior when used in `conf/local.conf`. Furthermore, the same operation from within an image recipe may or may not succeed depending on the specific situation. In both these cases, the behavior is contrary to how most users expect the `+=` operator to work.

When you use this variable, it is best to use it as follows:

```
IMAGE_INSTALL_append = " package-name"
```

Be sure to include the space between the quotation character and the start of the package name or names.

IMAGE_LINGUAS

Specifies the list of locales to install into the image during the root filesystem construction process. The OpenEmbedded build system automatically splits locale files, which are used for localization, into separate packages. Setting the `IMAGE_LINGUAS` variable ensures that any locale packages that correspond to packages already selected for installation into the image are also installed. Here is an example:

```
IMAGE_LINGUAS = "pt-br de-de"
```

In this example, the build system ensures any Brazilian Portuguese and German locale files that correspond to packages in the image are installed (i.e. *-locale-pt-br and *-locale-de-de as well as *-locale-pt and *-locale-de, since some software packages only provide locale files by language and not by country-specific language).

See the [GLIBC_GENERATE_LOCALES](#) variable for information on generating GLIBC locales.

IMAGE_MANIFEST

The manifest file for the image. This file lists all the installed packages that make up the image. The file contains package information on a line-per-package basis as follows:

```
packagename packagearch version
```

The [image](#) class defines the manifest file as follows:

```
IMAGE_MANIFEST = "${DEPLOY_DIR_IMAGE}/${IM
```

The location is derived using the [DEPLOY_DIR_IMAGE](#) and [IMAGE_NAME](#) variables. You can find information on how the image is created in the "[Image Generation](#)" section.

IMAGE_NAME

The name of the output image files minus the extension. This variable is derived using the [IMAGE_BASENAME](#), [MACHINE](#), and [DATETIME](#) variables:

```
IMAGE_NAME = "${IMAGE_BASENAME}-${MACHINE}.
```

IMAGE_OVERHEAD_FACTOR

Defines a multiplier that the build system applies to the initial image size for cases when the multiplier times the returned disk usage value for the image is greater than the sum of [IMAGE_ROOTFS_SIZE](#) and [IMAGE_ROOTFS_EXTRA_SPACE](#). The result of the multiplier applied to the initial image size creates free disk space in the image as overhead. By default, the build process uses a multiplier of 1.3 for this variable. This default value results in 30% free disk space added to the image when this method is used to determine the final generated image size. You should be aware that post install scripts and the package management system uses disk space inside this overhead area. Consequently, the multiplier does not produce an image with all the theoretical free

disk space. See [IMAGE_ROOTFS_SIZE](#) for information on how the build system determines the overall image size.

The default 30% free disk space typically gives the image enough room to boot and allows for basic post installs while still leaving a small amount of free disk space. If 30% free space is inadequate, you can increase the default value. For example, the following setting gives you 50% free space added to the image:

```
IMAGE_OVERHEAD_FACTOR = "1.5"
```

Alternatively, you can ensure a specific amount of free disk space is added to the image by using the [IMAGE_ROOTFS_EXTRA_SPACE](#) variable.

IMAGE_PKGTYPE

Defines the package type (DEB, RPM, IPK, or TAR) used by the OpenEmbedded build system. The variable is defined appropriately by the [package_deb](#), [package_rpm](#), [package_ipk](#), or [package_tar](#) class.

Warning

The [package_tar](#) class is broken and is not supported. It is recommended that you do not use it.

The [package_sdk_base](#) and [image](#) classes use the [IMAGE_PKGTYPE](#) for packaging up images and SDKs.

You should not set the [IMAGE_PKGTYPE](#) manually. Rather, the variable is set indirectly through the appropriate [package_*](#) class using the [PACKAGE_CLASSES](#) variable. The OpenEmbedded build system uses the first package type (e.g. DEB, RPM, or IPK) that appears with the variable

Note

Files using the `.tar` format are never used as a substitute packaging format for DEB, RPM, and IPK formatted files for your image or SDK.

IMAGE_POSTPROCESS_COMMAND

Specifies a list of functions to call once the OpenEmbedded build system has created the final image output files. You can specify functions separated by semicolons:


```
IMAGE_POSTPROCESS_COMMAND += "function; ..
```

If you need to pass the root filesystem path to a command within the function, you can use `${IMAGE_ROOTFS}`, which points to the directory that becomes the root filesystem image. See the [IMAGE_ROOTFS](#) variable for more information.

IMAGE_PREPROCESS_COMMAND

Specifies a list of functions to call before the OpenEmbedded build system has created the final image output files. You can specify functions separated by semicolons:

```
IMAGE_PREPROCESS_COMMAND += "function; ...
```

If you need to pass the root filesystem path to a command within the function, you can use `${IMAGE_ROOTFS}`, which points to the directory that becomes the root filesystem image. See the [IMAGE_ROOTFS](#) variable for more information.

IMAGE_ROOTFS

The location of the root filesystem while it is under construction (i.e. during the [do_rootfs](#) task). This variable is not configurable. Do not change it.

IMAGE_ROOTFS_ALIGNMENT

Specifies the alignment for the output image file in Kbytes. If the size of the image is not a multiple of this value, then the size is rounded up to the nearest multiple of the value. The default value is "1". See [IMAGE_ROOTFS_SIZE](#) for additional information.

IMAGE_ROOTFS_EXTRA_SPACE

Defines additional free disk space created in the image in Kbytes. By default, this variable is set to "0". This free disk space is added to the image after the build system determines the image size as described in [IMAGE_ROOTFS_SIZE](#).

This variable is particularly useful when you want to ensure that a specific amount of free disk space is available on a device after an image is installed and running. For example, to be sure 5 Gbytes of free disk space is available, set the variable as follows:

```
IMAGE_ROOTFS_EXTRA_SPACE = "5242880"
```

For example, the Yocto Project Build Appliance specifically requests 40 Gbytes of extra space with the line:

```
IMAGE_ROOTFS_EXTRA_SPACE = "41943040"
```

IMAGE_ROOTFS_SIZE

Defines the size in Kbytes for the generated image. The OpenEmbedded build system determines the final size for the generated image using an algorithm that takes into account the initial disk space used for the generated image, a requested size for the image, and requested additional free disk space to be added to the image. Programatically, the build system determines the final size of the generated image as follows:

```
if (image-du * overhead) < rootfs-size:
    internal-rootfs-size = rootfs-size + xspace
else:
    internal-rootfs-size = (image-du * overhead) +
where:
    image-du = Returned value of the du comma
               the image.
    overhead = IMAGE_OVERHEAD_FACTOR
    rootfs-size = IMAGE_ROOTFS_SIZE
    internal-rootfs-size = Initial root files;
                           size before any mo
    xspace = IMAGE_ROOTFS_EXTRA_SPACE
```

See the [IMAGE_OVERHEAD_FACTOR](#) and [IMAGE_ROOTFS_EXTRA_SPACE](#) variables for related information.

IMAGE_TYPEDEP

Specifies a dependency from one image type on another. Here is an example from the [image-live](#) class:

```
IMAGE_TYPEDEP_live = "ext3"
```

In the previous example, the variable ensures that when "live" is listed with the [IMAGE_FSTYPES](#) variable, the OpenEmbedded build system produces an ext3 image first since one of the components of the live image is an ext3 formatted partition containing the root filesystem.

IMAGE_TYPES

Specifies the complete list of supported image types by default:

```

btrfs
cpio
cpio.gz
cpio.lz4
cpio.lzma
cpio.xz
cramfs
elf
ext2
ext2.bz2
ext2.gz
ext2.lzma
ext3
ext3.gz
ext4
ext4.gz
hdddirect
hddimg
iso
jffs2
jffs2.sum
multiubi
qcow2
squashfs
squashfs-lzo
squashfs-xz
tar
tar.bz2
tar.gz
tar.lz4
tar.xz
ubi
ubifs
vdi
vmdk
wic
wic.bz2
wic.gz
wic.lzma

```

For more information about these types of images, see `meta/classes/image_types*.bbclass` in the [Source Directory](#).

INC_PR

Helps define the recipe revision for recipes that share a common `include` file. You can think of this variable as part of the recipe revision as set from within an include file.

Suppose, for example, you have a set of recipes that are used across several projects. And, within each of those recipes the revision (its `PR` value) is set accordingly. In this case, when the revision of those recipes changes, the burden is on you to find all those recipes and be sure that they get changed to reflect the updated version of the recipe. In this scenario, it can get complicated when recipes that are used in many places and provide common functionality are upgraded to a new revision.

A more efficient way of dealing with this situation is to set the `INC_PR` variable inside the `include` files that the recipes share and then expand the `INC_PR` variable within the recipes to help define the recipe revision.

The following provides an example that shows how to use the `INC_PR` variable given a common `include` file that defines the variable. Once the variable is defined in the `include` file, you can use the variable to set the `PR` values in each recipe. You will notice that when you set a recipe's `PR` you can

provide more granular revisioning by appending values to the `INC_PR` variable:

```
recipes-graphics/xorg-font/xorg-font-common.inc
recipes-graphics/xorg-font/encodings_1.0.4.bb:P
recipes-graphics/xorg-font/font-util_1.3.0.bb:P
recipes-graphics/xorg-font/font-alias_1.0.3.bb:~
```

The first line of the example establishes the baseline revision to be used for all recipes that use the `include` file. The remaining lines in the example are from individual recipes and show how the `PR` value is set.

INCOMPATIBLE_LICENSE

Specifies a space-separated list of license names (as they would appear in `LICENSE`) that should be excluded from the build. Recipes that provide no alternatives to listed incompatible licenses are not built. Packages that are individually licensed with the specified incompatible licenses will be deleted.

Note

This functionality is only regularly tested using the following setting:

```
INCOMPATIBLE_LICENSE = "(
```

Although you can use other settings, you might be required to remove dependencies on or provide alternatives to components that are required to produce a functional system image.

INHIBIT_DEFAULT_DEPS

Prevents the default dependencies, namely the C compiler and standard C library (`libc`), from being added to `DEPENDS`. This variable is usually used within recipes that do not require any compilation using the C compiler.

Set the variable to "1" to prevent the default dependencies from being added.

INHIBIT_PACKAGE_DEBUG_SPLIT

Prevents the OpenEmbedded build system from splitting out debug information during packaging. By default, the build system splits out debugging information during the `do_package` task. For more information on how debug information is split out, see the `PACKAGE_DEBUG_SPLIT_STYLE` variable.

To prevent the build system from splitting out debug information during packaging, set the `INHIBIT_PACKAGE_DEBUG_SPLIT` variable as follows:

```
INHIBIT_PACKAGE_DEBUG_SPLIT = "1"
```

INHIBIT_PACKAGE_STRIP ¶

If set to "1", causes the build to not strip binaries in resulting packages.

INHERIT ¶

Causes the named class to be inherited at this point during parsing. The variable is only valid in configuration files.

INHERIT_DISTRO ¶

Lists classes that will be inherited at the distribution level. It is unlikely that you want to edit this variable.

The default value of the variable is set as follows in the `meta/conf/distro/defaultsetup.conf` file:

```
INHERIT_DISTRO ?= "debian devshell sstate .
```

INITRAMFS_FSTYPES ¶

Defines the format for the output image of an initial RAM disk (initramfs), which is used during boot. Supported formats are the same as those supported by the [IMAGE_FSTYPES](#) variable.

INITRAMFS_IMAGE ¶

Causes the OpenEmbedded build system to build an additional recipe as a dependency to your root filesystem recipe (e.g. `core-image-sato`). The additional recipe is used to create an initial RAM disk (initramfs) that might be needed during the initial boot of the target system to accomplish such things as loading kernel modules prior to mounting the root file system.

When you set the variable, specify the name of the initramfs you want created. The following example, which is set in the `local.conf` configuration file, causes a separate recipe to be created that results in an initramfs image named `core-image-sato-initramfs.bb` to be created:

```
INITRAMFS_IMAGE = "core-image-minimal-init:
```

By default, the [kernel](#) class sets this variable to a null string as follows:

```
INITRAMFS_IMAGE = ""
```

See the [local.conf.sample.extended](#) file for additional information. You can also reference the [kernel.bbclass](#) file to see how the variable is used.

INITRAMFS_IMAGE_BUNDLE ¶

Controls whether or not the image recipe

specified by `INITRAMFS_IMAGE` is run through an extra pass during kernel compilation in order to build a single binary that contains both the kernel image and the initial RAM disk (initramfs). Using an extra compilation pass ensures that when a kernel attempts to use an initramfs, it does not encounter circular dependencies should the initramfs include kernel modules.

The combined binary is deposited into the `tmp/deploy` directory, which is part of the [Build Directory](#).

Setting the variable to "1" in a configuration file causes the OpenEmbedded build system to make the extra pass during kernel compilation:

```
INITRAMFS_IMAGE_BUNDLE = "1"
```

By default, the `kernel` class sets this variable to a null string as follows:

```
INITRAMFS_IMAGE_BUNDLE = ""
```

Note

You must set the `INITRAMFS_IMAGE_BUNDLE` variable in a configuration file. You cannot set the variable in a recipe file.

See the [local.conf.sample.extended](#) file for additional information.

INITRD

Indicates list of filesystem images to concatenate and use as an initial RAM disk (initrd).

The `INITRD` variable is an optional variable used with the [bootimg](#) class.

INITRD_IMAGE

When building a "live" bootable image (i.e. when `IMAGE_FSTYPES` contains "live"), `INITRD_IMAGE` specifies the image recipe that should be built to provide the initial RAM disk image. The default value is "core-image-minimal-initramfs".

See the [image-live](#) class for more information.

INITSCRIPT_NAME

The filename of the initialization script as installed to `${sysconfdir}/init.d`.

This variable is used in recipes when using `update-rc.d.bbclass`. The variable is mandatory.

INITSCRIPT_PACKAGES

A list of the packages that contain initscripts. If multiple packages are specified, you need to append the package name to the other `INITSCRIPT_*` as an override.

This variable is used in recipes when using `update-rc.d.bbclass`. The variable is optional and defaults to the `PN` variable.

INITSCRIPT_PARAMS

Specifies the options to pass to `update-rc.d`. Here is an example:

```
INITSCRIPT_PARAMS = "start 99 5 2 . stop 2)
```

In this example, the script has a runlevel of 99, starts the script in initlevels 2 and 5, and stops the script in levels 0, 1 and 6.

The variable's default value is "defaults", which is set in the `update-rc.d` class.

The value in `INITSCRIPT_PARAMS` is passed through to the `update-rc.d` command. For more information on valid parameters, please see the `update-rc.d` manual page at <http://www.tin.org/bin/man.cgi?section=8&topic=update-rc.d>.

INSANE_SKIP

Specifies the QA checks to skip for a specific package within a recipe. For example, to skip the check for symbolic link `.so` files in the main package of a recipe, add the following to the recipe. The package name override must be used, which in this example is `${PN}`:

```
INSANE_SKIP_${PN} += "dev-so"
```

See the "`insane.bbclass`" section for a list of the valid QA checks you can specify using this variable.

IPK_FEED_URI

When the IPK backend is in use and package management is enabled on the target, you can use this variable to set up `opkg` in the target image to point to package feeds on a nominated server. Once the feed is established, you can perform installations or upgrades using the package manager at runtime.

K

KARCH

Defines the kernel architecture used when assembling the configuration. Architectures supported for this release are:

```
powerpc
i386
x86_64
arm
qemu
mips
```

You define the `KARCH` variable in the [BSP Descriptions](#).

KBRANCH

A regular expression used by the build process to explicitly identify the kernel branch that is validated, patched, and configured during a build. You must set this variable to ensure the exact kernel branch you want is being used by the build process.

Values for this variable are set in the kernel's recipe file and the kernel's append file. For example, if you are using the Yocto Project kernel that is based on the Linux 3.14 kernel, the kernel recipe file is the `meta/recipes-kernel/linux/linux-yocto_3.14.bb` file. Following is an example for a kernel recipe file:

```
KBRANCH ?= "standard/base"
```

This variable is also used from the kernel's append file to identify the kernel branch specific to a particular machine or target hardware. The kernel's append file is located in the BSP layer for a given machine. For example, the kernel append file for the Emenlow BSP is in the `meta-intel` Git repository and is named `meta-emenlow/recipes-kernel/linux/linux-yocto_3.14.bbappend`. Here are the related statements from the append file:

```
COMPATIBLE_MACHINE_emenlow-noemgd = "emenlow"
KMACHINE_emenlow-noemgd = "emenlow"
KBRANCH_emenlow-noemgd = "standard/base"
KERNEL_FEATURES_append_emenlow-noemgd = " :"
```

The `KBRANCH` statement identifies the kernel branch to use when building for the Emenlow BSP.

KBUILD_DEFCONFIG

When used with the [kernel-yocto](#) class, specifies an "in-tree" kernel configuration file for use during a kernel build.

Typically, when using a `defconfig` to configure a kernel during a build, you place the file in your layer in the same manner as you would patch files and configuration fragment files (i.e. "out-of-tree"). However, if you want to use a `defconfig` file that is part of the kernel tree (i.e. "in-tree"), you can use the `KBUILD_DEFCONFIG` variable to point to the `defconfig` file.

To use the variable, set it in the append file for your kernel recipe using the following form:

```
KBUILD_DEFCONFIG_KMACHINE ?= defconfig_file
```

Here is an example from a "raspberrypi2" KMACHINE build that uses a defconfig file named "bcm2709_defconfig":

```
KBUILD_DEFCONFIG_raspberrypi2 = "bcm2709_defconfig"
```

As an alternative, you can use the following within your append file:

```
KBUILD_DEFCONFIG_pn-linux-yocto ?= defconfig
```

For more information on how to use the KBUILD_DEFCONFIG variable, see the "[Using an "In-Tree" defconfig File](#)" section.

KERNEL_ALT_IMAGETYPE

Specifies an alternate kernel image type for creation in addition to the kernel image type specified using the `KERNEL_IMAGETYPE` variable.

KERNEL_CLASSES

A list of classes defining kernel image types that the `kernel` class should inherit. You typically append this variable to enable extended image types. An example is the "kernel-fitimage", which enables fitImage support and resides in `meta/classes/kernel-fitimage.bbclass`. You can register custom kernel image types with the `kernel` class using this variable.

KERNEL_DEVICETREE

Specifies the name of the generated Linux kernel device tree (i.e. the `.dtb`) file.

Note

Legacy support exists for specifying the full path to the device tree. However, providing just the `.dtb` file is preferred.

In order to use this variable, you must have the include files in your kernel recipe:

```
require recipes-kernel/linux/linux-dtb.inc
```

or

```
require recipes-kernel/linux/linux-yocto.inc
```

KERNEL_EXTRA_ARGS

Specifies additional `make` command-line

arguments the OpenEmbedded build system passes on when compiling the kernel.

KERNEL_FEATURES

Includes additional metadata from the Yocto Project kernel Git repository. In the OpenEmbedded build system, the default Board Support Packages (BSPs) [Metadata](#) is provided through the [KMACHINE](#) and [KBRANCH](#) variables. You can use the `KERNEL_FEATURES` variable to further add metadata for all BSPs.

The metadata you add through this variable includes config fragments and features descriptions, which usually includes patches as well as config fragments. You typically override the `KERNEL_FEATURES` variable for a specific machine. In this way, you can provide validated, but optional, sets of kernel configurations and features.

For example, the following adds `netfilter` to all the Yocto Project kernels and adds sound support to the `qemux86` machine:

```
# Add netfilter to all linux-yocto kernels
KERNEL_FEATURES="features/netfilter/netfil

# Add sound support to the qemux86 machine
KERNEL_FEATURES_append_qemux86=" cfg/sound
```

KERNEL_IMAGE_BASE_NAME

The base name of the kernel image. This variable is set in the [kernel](#) class as follows:

```
KERNEL_IMAGE_BASE_NAME ?= "${KERNEL_IMAGET
```

See the [KERNEL_IMAGETYPE](#), [PKGGE](#), [PKGCV](#), [PKGR](#), [MACHINE](#), and [DATETIME](#) variables for additional information.

KERNEL_IMAGE_MAXSIZE

Specifies the maximum size of the kernel image file in kilobytes. If `KERNEL_IMAGE_MAXSIZE` is set, the size of the kernel image file is checked against the set value during the [do_sizecheck](#) task. The task fails if the kernel image file is larger than the setting.

`KERNEL_IMAGE_MAXSIZE` is useful for target devices that have a limited amount of space in which the kernel image must be stored.

By default, this variable is not set, which means the size of the kernel image is not checked.

KERNEL_IMAGETYPE

The type of kernel to build for a device, usually set by the machine configuration files and defaults to `"zImage"`. This variable is used when building the kernel and is passed

to make as the target to build.

If you want to build an alternate kernel image type, use the [KERNEL_ALT_IMAGETYPE](#) variable.

KERNEL_MODULE_AUTOLOAD

Lists kernel modules that need to be auto-loaded during boot.

Note

This variable replaces the deprecated [module_autoload](#) variable.

You can use the `KERNEL_MODULE_AUTOLOAD` variable anywhere that it can be recognized by the kernel recipe or by an out-of-tree kernel module recipe (e.g. a machine configuration file, a distribution configuration file, an append file for the recipe, or the recipe itself).

Specify it as follows:

```
KERNEL_MODULE_AUTOLOAD += "module_name1 mo
```

Including `KERNEL_MODULE_AUTOLOAD` causes the OpenEmbedded build system to populate the `/etc/modules-load.d/modname.conf` file with the list of modules to be auto-loaded on boot. The modules appear one-per-line in the file. Here is an example of the most common use case:

```
KERNEL_MODULE_AUTOLOAD += "module_name"
```

For information on how to populate the `modname.conf` file with `modprobe.d` syntax lines, see the [KERNEL_MODULE_PROBECONF](#) variable.

KERNEL_MODULE_PROBECONF

Provides a list of modules for which the OpenEmbedded build system expects to find `module_conf_modname` values that specify configuration for each of the modules. For information on how to provide those module configurations, see the [module_conf_*](#) variable.

KERNEL_PATH

The location of the kernel sources. This variable is set to the value of the [STAGING_KERNEL_DIR](#) within the `module` class. For information on how this variable is used, see the ["Incorporating Out-of-Tree Modules"](#) section.

To help maximize compatibility with out-of-

tree drivers used to build modules, the OpenEmbedded build system also recognizes and uses the `KERNEL_SRC` variable, which is identical to the `KERNEL_PATH` variable. Both variables are common variables used by external Makefiles to point to the kernel source directory.

`KERNEL_SRC`

The location of the kernel sources. This variable is set to the value of the `STAGING_KERNEL_DIR` within the `module` class. For information on how this variable is used, see the "[Incorporating Out-of-Tree Modules](#)" section.

To help maximize compatibility with out-of-tree drivers used to build modules, the OpenEmbedded build system also recognizes and uses the `KERNEL_PATH` variable, which is identical to the `KERNEL_SRC` variable. Both variables are common variables used by external Makefiles to point to the kernel source directory.

`KERNEL_VERSION`

Specifies the version of the kernel as extracted from `version.h` or `utsrelease.h` within the kernel sources. Effects of setting this variable do not take affect until the kernel has been configured. Consequently, attempting to refer to this variable in contexts prior to configuration will not work.

`KERNELDEPMODDEPEND`

Specifies whether the data referenced through `PKGDATA_DIR` is needed or not. The `KERNELDEPMODDEPEND` does not control whether or not that data exists, but simply whether or not it is used. If you do not need to use the data, set the `KERNELDEPMODDEPEND` variable in your `initramfs` recipe. Setting the variable there when the data is not needed avoids a potential dependency loop.

`KFEATURE_DESCRIPTION`

Provides a short description of a configuration fragment. You use this variable in the `.scc` file that describes a configuration fragment file. Here is the variable used in a file named `smpt.scc` to describe SMP being enabled:

```
define KFEATURE_DESCRIPTION "Enable SMP"
```

`KMACHINE`

The machine as known by the kernel. Sometimes the machine name used by the kernel does not match the machine name used by the OpenEmbedded build system.

For example, the machine name that the OpenEmbedded build system understands as `core2-32-intel-common` goes by a different name in the Linux Yocto kernel. The kernel understands that machine as `intel-core2-32`. For cases like these, the `KMACHINE` variable maps the kernel machine name to the OpenEmbedded build system machine name.

These mappings between different names occur in the Yocto Linux Kernel's meta branch. As an example take a look in the `common/recipes-kernel/linux/linux-yocto_3.19.bbappend` file:

```
LINUX_VERSION_core2-32-intel-common = "3.11"
COMPATIBLE_MACHINE_core2-32-intel-common =
SRCREV_meta_core2-32-intel-common = "8897e"
SRCREV_machine_core2-32-intel-common = "431"
KMACHINE_core2-32-intel-common = "intel-core2-32"
KBRANCH_core2-32-intel-common = "standard/linux-yocto/3.19"
KERNEL_FEATURES_append_core2-32-intel-common = "linux-yocto-3.19.bbappend"
```

The `KMACHINE` statement says that the kernel understands the machine name as `"intel-core2-32"`. However, the OpenEmbedded build system understands the machine as `"core2-32-intel-common"`.

KTYPE ¶

Defines the kernel type to be used in assembling the configuration. The linux-yocto recipes define `"standard"`, `"tiny"`, and `"preempt-rt"` kernel types. See the ["Kernel Types"](#) section in the Yocto Project Linux Kernel Development Manual for more information on kernel types.

You define the `KTYPE` variable in the [BSP Descriptions](#). The value you use must match the value used for the `LINUX_KERNEL_TYPE` value used by the kernel recipe.

L

LABELS ¶

Provides a list of targets for automatic configuration.

See the [grub-efi](#) class for more information on how this variable is used.

LAYERDEPENDS ¶

Lists the layers that this recipe depends upon, separated by spaces. Optionally, you can specify a specific layer version for a dependency by adding it to the end of the layer name with a colon, (e.g. `"anotherlayer:3"` to be compared against `LAYERVERSION_anotherlayer` in this case). An error will be produced if any dependency is missing or the version numbers do not

match exactly (if specified). This variable is used in the `conf/layer.conf` file and must be suffixed with the name of the specific layer (e.g. `LAYERDEPENDS_mylayer`).

LAYERDIR

When used inside the `layer.conf` configuration file, this variable provides the path of the current layer. This variable is not available outside of `layer.conf` and references are expanded immediately when parsing of the file completes.

LAYERVERSION

Optionally specifies the version of a layer as a single number. You can use this within LAYERDEPENDS for another layer in order to depend on a specific version of the layer. This variable is used in the `conf/layer.conf` file and must be suffixed with the name of the specific layer (e.g. `LAYERVERSION_mylayer`).

LD

The minimal command and arguments used to run the linker.

LDFLAGS

Specifies the flags to pass to the linker. This variable is exported to an environment variable and thus made visible to the software being built during the compilation step.

Default initialization for `LDFLAGS` varies depending on what is being built:

- TARGET_LDFLAGS when building for the target
- BUILD_LDFLAGS when building for the build host (i.e. `-native`)
- BUILDSDK_LDFLAGS when building for an SDK (i.e. `nativesdk-`)

LEAD_SONAME

Specifies the lead (or primary) compiled library file (`.so`) that the debian class applies its naming policy to given a recipe that packages multiple libraries.

This variable works in conjunction with the debian class.

LIC_FILES_CHKSUM

Checksums of the license text in the recipe source code.

This variable tracks changes in license text of the source code files. If the license text is changed, it will trigger a build failure, which gives the developer an opportunity to review

any license change.

This variable must be defined for all recipes (unless `LICENSE` is set to "CLOSED").

For more information, see the "[Tracking License Changes](#)" section.

LICENSE

The list of source licenses for the recipe. Follow these rules:

- Do not use spaces within individual license names.
- Separate license names using | (pipe) when there is a choice between licenses.
- Separate license names using & (ampersand) when multiple licenses exist that cover different parts of the source.
- You can use spaces between license names.
- For standard licenses, use the names of the files in `meta/files/common-licenses/` or the `SPDXLICENSEMAP` flag names defined in `meta/conf/licenses.conf`.

Here are some examples:

```
LICENSE = "LGPLv2.1 | GPLv3"
LICENSE = "MPL-1 & LGPLv2.1"
LICENSE = "GPLv2+"
```

The first example is from the recipes for Qt, which the user may choose to distribute under either the LGPL version 2.1 or GPL version 3. The second example is from Cairo where two licenses cover different parts of the source code. The final example is from `sysstat`, which presents a single license.

You can also specify licenses on a per-package basis to handle situations where components of the output have different licenses. For example, a piece of software whose code is licensed under GPLv2 but has accompanying documentation licensed under the GNU Free Documentation License 1.2 could be specified as follows:

```
LICENSE = "GFDL-1.2 & GPLv2"
LICENSE_${PN} = "GPLv2"
LICENSE_${PN}-doc = "GFDL-1.2"
```

LICENSE_CREATE_PACKAGE

Setting `LICENSE_CREATE_PACKAGE` to "1" causes the OpenEmbedded build system to create an extra package (i.e. `${PN}-lic`) for each recipe and to add those packages to the `RECOMMENDS_${PN}`.

The `${PN}-lic` package installs a directory in `/usr/share/licenses` named `${PN}`, which is the recipe's base name, and installs files in that directory that contain license and copyright information (i.e. copies of the appropriate license files from `meta/common-licenses` that match the licenses specified in the `LICENSE` variable of the recipe metadata and copies of files marked in `LIC_FILES_CHKSUM` as containing license text).

For related information on providing license text, see the `COPY_LIC_DIRS` variable, the `COPY_LIC_MANIFEST` variable, and the "Providing License Text" section in the Yocto Project Development Manual.

LICENSE_FLAGS

Specifies additional flags for a recipe you must whitelist through `LICENSE_FLAGS_WHITELIST` in order to allow the recipe to be built. When providing multiple flags, separate them with spaces.

This value is independent of `LICENSE` and is typically used to mark recipes that might require additional licenses in order to be used in a commercial product. For more information, see the "Enabling Commercially Licensed Recipes" section.

LICENSE_FLAGS_WHITELIST

Lists license flags that when specified in `LICENSE_FLAGS` within a recipe should not prevent that recipe from being built. This practice is otherwise known as "whitelisting" license flags. For more information, see the "Enabling Commercially Licensed Recipes" section.

LICENSE_PATH

Path to additional licenses used during the build. By default, the OpenEmbedded build system uses `COMMON_LICENSE_DIR` to define the directory that holds common license text used during the build. The `LICENSE_PATH` variable allows you to extend that location to other areas that have additional licenses:

```
LICENSE_PATH += "path-to-additional-common"
```

LINUX_KERNEL_TYPE

Defines the kernel type to be used in assembling the configuration. The linux-yocto recipes define "standard", "tiny", and "preempt-rt" kernel types. See the "Kernel Types" section in the Yocto Project Linux Kernel Development Manual for more information on kernel types.

If you do not specify a `LINUX_KERNEL_TYPE`, it defaults to "standard". Together with `KMACHINE`, the `LINUX_KERNEL_TYPE` variable defines the search arguments used by the kernel tools to find the appropriate description within the kernel Metadata with which to build out the sources and configuration.

LINUX_VERSION

The Linux version from `kernel.org` on which the Linux kernel image being built using the OpenEmbedded build system is based. You define this variable in the kernel recipe. For example, the `linux-yocto-3.4.bb` kernel recipe found in `meta/recipes-kernel/linux` defines the variables as follows:

```
LINUX_VERSION ?= "3.4.24"
```

The `LINUX_VERSION` variable is used to define PV for the recipe:

```
PV = "${LINUX_VERSION}+git${SRCPV}"
```

LINUX_VERSION_EXTENSION

A string extension compiled into the version string of the Linux kernel built with the OpenEmbedded build system. You define this variable in the kernel recipe. For example, the `linux-yocto` kernel recipes all define the variable as follows:

```
LINUX_VERSION_EXTENSION ?= "-yocto-${LINUX
```

Defining this variable essentially sets the Linux kernel configuration item `CONFIG_LOCALVERSION`, which is visible through the `uname` command. Here is an example that shows the extension assuming it was set as previously shown:

```
$ uname -r
3.7.0-rc8-custom
```

LOG_DIR

Specifies the directory to which the OpenEmbedded build system writes overall log files. The default directory is `${TMPDIR}/log`.

For the directory containing logs specific to each task, see the T variable.

M

MACHINE

Specifies the target device for which the image is built. You define `MACHINE` in the `local.conf` file found in the Build Directory. By default, `MACHINE` is set to "qemux86",

which is an x86-based architecture machine to be emulated using QEMU:

```
MACHINE ?= "qemux86"
```

The variable corresponds to a machine configuration file of the same name, through which machine-specific configurations are set. Thus, when `MACHINE` is set to "qemux86" there exists the corresponding `qemux86.conf` machine configuration file, which can be found in the [Source Directory](#) in `meta/conf/machine`.

The list of machines supported by the Yocto Project as shipped include the following:

```
MACHINE ?= "qemuarm"
MACHINE ?= "qemuarm64"
MACHINE ?= "qemumips"
MACHINE ?= "qemumips64"
MACHINE ?= "qemuppc"
MACHINE ?= "qemux86"
MACHINE ?= "qemux86-64"
MACHINE ?= "genericx86"
MACHINE ?= "genericx86-64"
MACHINE ?= "beaglebone"
MACHINE ?= "mpc8315e-rdb"
MACHINE ?= "edgerouter"
```

The last five are Yocto Project reference hardware boards, which are provided in the `meta-yocto-bsp` layer.

Note

Adding additional Board Support Package (BSP) layers to your configuration adds new possible settings for `MACHINE`.

`MACHINE_ARCH`

Specifies the name of the machine-specific architecture. This variable is set automatically from `MACHINE` or `TUNE_PKGARCH`. You should not hand-edit the `MACHINE_ARCH` variable.

`MACHINE_ESSENTIAL_EXTRA_RDEPENDS`

A list of required machine-specific packages to install as part of the image being built. The build process depends on these packages being present. Furthermore, because this is a "machine essential" variable, the list of packages are essential for the machine to boot. The impact of this variable affects images based on `packagegroup-core-boot`, including the `core-image-minimal` image.

This variable is similar to the `MACHINE_ESSENTIAL_EXTRA_RRECOMMENDS` variable with the exception that the image being built has a build dependency on the variable's list of packages. In other words, the image will not build if a file in this list is

not found.

As an example, suppose the machine for which you are building requires `example-init` to be run during boot to initialize the hardware. In this case, you would use the following in the machine's `.conf` configuration file:

```
MACHINE_ESSENTIAL_EXTRA_RDEPENDS += "example-init"
```

MACHINE_ESSENTIAL_EXTRA_RRECOMMENDS

A list of recommended machine-specific packages to install as part of the image being built. The build process does not depend on these packages being present. However, because this is a "machine essential" variable, the list of packages are essential for the machine to boot. The impact of this variable affects images based on `packagegroup-core-boot`, including the `core-image-minimal` image.

This variable is similar to the `MACHINE_ESSENTIAL_EXTRA_RDEPENDS` variable with the exception that the image being built does not have a build dependency on the variable's list of packages. In other words, the image will still build if a package in this list is not found. Typically, this variable is used to handle essential kernel modules, whose functionality may be selected to be built into the kernel rather than as a module, in which case a package will not be produced.

Consider an example where you have a custom kernel where a specific touchscreen driver is required for the machine to be usable. However, the driver can be built as a module or into the kernel depending on the kernel configuration. If the driver is built as a module, you want it to be installed. But, when the driver is built into the kernel, you still want the build to succeed. This variable sets up a "recommends" relationship so that in the latter case, the build will not fail due to the missing package. To accomplish this, assuming the package for the module was called `kernel-module-ab123`, you would use the following in the machine's `.conf` configuration file:

```
MACHINE_ESSENTIAL_EXTRA_RRECOMMENDS += "kernel-module-ab123"
```

Note

In this example, the `kernel-module-ab123` recipe needs to explicitly set

its `PACKAGES` variable to ensure that BitBake does not use the kernel recipe's `PACKAGES_DYNAMIC` variable to satisfy the dependency.

Some examples of these machine essentials are flash, screen, keyboard, mouse, or touchscreen drivers (depending on the machine).

`MACHINE_EXTRA_RDEPENDS`

A list of machine-specific packages to install as part of the image being built that are not essential for the machine to boot. However, the build process for more fully-featured images depends on the packages being present.

This variable affects all images based on `packagegroup-base`, which does not include the `core-image-minimal` or `core-image-full-cmdline` images.

The variable is similar to the `MACHINE_EXTRA_RRECOMMENDS` variable with the exception that the image being built has a build dependency on the variable's list of packages. In other words, the image will not build if a file in this list is not found.

An example is a machine that has WiFi capability but is not essential for the machine to boot the image. However, if you are building a more fully-featured image, you want to enable the WiFi. The package containing the firmware for the WiFi hardware is always expected to exist, so it is acceptable for the build process to depend upon finding the package. In this case, assuming the package for the firmware was called `wifidriver-firmware`, you would use the following in the `.conf` file for the machine:

```
MACHINE_EXTRA_RDEPENDS += "wifidriver-firm
```

`MACHINE_EXTRA_RRECOMMENDS`

A list of machine-specific packages to install as part of the image being built that are not essential for booting the machine. The image being built has no build dependency on this list of packages.

This variable affects only images based on `packagegroup-base`, which does not include the `core-image-minimal` or `core-image-full-cmdline` images.

This variable is similar to the `MACHINE_EXTRA_RDEPENDS` variable with the

exception that the image being built does not have a build dependency on the variable's list of packages. In other words, the image will build if a file in this list is not found.

An example is a machine that has WiFi capability but is not essential for the machine to boot the image. However, if you are building a more fully-featured image, you want to enable WiFi. In this case, the package containing the WiFi kernel module will not be produced if the WiFi driver is built into the kernel, in which case you still want the build to succeed instead of failing as a result of the package not being found. To accomplish this, assuming the package for the module was called `kernel-module-examplewifi`, you would use the following in the `.conf` file for the machine:

```
MACHINE_EXTRA_RRECOMMENDS += "kernel-module-examplewifi"
```

MACHINE_FEATURES ¶

Specifies the list of hardware features the MACHINE is capable of supporting. For related information on enabling features, see the DISTRO_FEATURES, COMBINED_FEATURES, and IMAGE_FEATURES variables.

For a list of hardware features supported by the Yocto Project as shipped, see the "Machine Features" section.

MACHINE_FEATURES_BACKFILL ¶

Features to be added to MACHINE_FEATURES if not also present in MACHINE_FEATURES_BACKFILL_CONSIDERED.

This variable is set in the `meta/conf/bitbake.conf` file. It is not intended to be user-configurable. It is best to just reference the variable to see which machine features are being backfilled for all machine configurations. See the "Feature backfilling" section for more information.

MACHINE_FEATURES_BACKFILL_CONSIDERED ¶

Features from MACHINE_FEATURES_BACKFILL that should not be backfilled (i.e. added to MACHINE_FEATURES) during the build. See the "Feature backfilling" section for more information.

MACHINEOVERRIDES ¶

Lists overrides specific to the current machine. By default, this list includes the value of MACHINE. You can extend the list to apply variable overrides for classes of machines. For example, all QEMU emulated machines (e.g. `qemuarm`, `qemux86`, and so

forth) include a common file named `meta/conf/machine/include/qemu.inc` that prepends `MACHINEOVERRIDES` with the following variable override:

```
MACHINEOVERRIDES =. "qemuall:"
```

Applying an override like `qemuall` affects all QEMU emulated machines elsewhere. Here is an example from the `connman-conf` recipe:

```
SRC_URI_append_qemuall = "file://wired.conf.  
                        file://wired-setup  
                        "
```

MAINTAINER ¶

The email address of the distribution maintainer.

MIRRORS ¶

Specifies additional paths from which the OpenEmbedded build system gets source code. When the build system searches for source code, it first tries the local download directory. If that location fails, the build system tries locations defined by PREMIRRORS, the upstream source, and then locations specified by `MIRRORS` in that order.

Assuming your distribution (DISTRO) is "poky", the default value for `MIRRORS` is defined in the `conf/distro/poky.conf` file in the meta-yocto Git repository.

MLPREFIX ¶

Specifies a prefix has been added to PN to create a special version of a recipe or package, such as a Multilib version. The variable is used in places where the prefix needs to be added to or removed from a the name (e.g. the BPN variable). `MLPREFIX` gets set when a prefix has been added to `PN`.

module_autoload ¶

This variable has been replaced by the `KERNEL_MODULE_AUTOLOAD` variable. You should replace all occurrences of `module_autoload` with additions to `KERNEL_MODULE_AUTOLOAD`, for example:

```
module_autoload_rfcomm = "rfcomm"
```

should now be replaced with:

```
KERNEL_MODULE_AUTOLOAD += "rfcomm"
```

See the KERNEL_MODULE_AUTOLOAD variable for more information.

module_conf ¶

Specifies modprobe.d syntax lines for inclusion in the `/etc/modprobe.d/modname.conf` file.

You can use this variable anywhere that it can be recognized by the kernel recipe or out-of-tree kernel module recipe (e.g. a machine configuration file, a distribution configuration file, an append file for the recipe, or the recipe itself). If you use this variable, you must also be sure to list the module name in the `KERNEL_MODULE_AUTOLOAD` variable.

Here is the general syntax:

```
module_conf_module_name = "modprobe.d-synt
```

You must use the kernel module name override.

Run `man modprobe.d` in the shell to find out more information on the exact syntax you want to provide with `module_conf`.

Including `module_conf` causes the OpenEmbedded build system to populate the `/etc/modprobe.d/modname.conf` file with `modprobe.d` syntax lines. Here is an example that adds the options `arg1` and `arg2` to a module named `mymodule`:

```
module_conf_mymodule = "options mymodule a:
```

For information on how to specify kernel modules to auto-load on boot, see the `KERNEL_MODULE_AUTOLOAD` variable.

MODULE_IMAGE_BASE_NAME ¶

The base name of the kernel modules tarball. This variable is set in the `kernel` class as follows:

```
MODULE_IMAGE_BASE_NAME ?= "modules-${PKGGE}.
```

See the `PKGGE`, `PKGCV`, `PKGR`, `MACHINE`, and `DATETIME` variables for additional information.

MODULE_TARBALL_DEPLOY ¶

Controls creation of the `modules-*.tgz` file. Set this variable to "0" to disable creation of this file, which contains all of the kernel modules resulting from a kernel build.

MULTIMACH_TARGET_SYS ¶

Separates files for different machines such that you can build for multiple target machines using the same output directories. See the `STAMP` variable for an example.

N

NATIVESBSTRING ¶

A string identifying the host distribution. Strings consist of the host distributor ID followed by the release, as reported by the `lsb_release` tool or as read from `/etc/lsb-release`. For example, when running a build on Ubuntu 12.10, the value is "Ubuntu-12.10". If this information is unable to be determined, the value resolves to "Unknown".

This variable is used by default to isolate native shared state packages for different distributions (e.g. to avoid problems with `glibc` version incompatibilities). Additionally, the variable is checked against `SANITY_TESTED_DISTROS` if that variable is set.

NM

The minimal command and arguments to run `nm`.

NO_RECOMMENDATIONS

Prevents installation of all "recommended-only" packages. Recommended-only packages are packages installed only through the `RRECOMMENDS` variable). Setting the `NO_RECOMMENDATIONS` variable to "1" turns this feature on:

```
NO_RECOMMENDATIONS = "1"
```

You can set this variable globally in your `local.conf` file or you can attach it to a specific image recipe by using the recipe name override:

```
NO_RECOMMENDATIONS_pn-target_image = "pack
```

It is important to realize that if you choose to not install packages using this variable and some other packages are dependent on them (i.e. listed in a recipe's `RDEPENDS` variable), the OpenEmbedded build system ignores your request and will install the packages to avoid dependency errors.

Note

Some recommended packages might be required for certain system functionality, such as kernel modules. It is up to you to add packages with the `IMAGE_INSTALL` variable.

Support for this variable exists only when using the IPK and RPM packaging backend. Support does not exist for DEB.

See the [BAD_RECOMMENDATIONS](#) and the [PACKAGE_EXCLUDE](#) variables for related information.

NOHDD

Causes the OpenEmbedded build system to skip building the `.hddimg` image. The `NOHDD` variable is used with the `bootimg` class. Set the variable to "1" to prevent the `.hddimg` image from being built.

NOISO

Causes the OpenEmbedded build system to skip building the ISO image. The `NOISO` variable is used with the `bootimg` class. Set the variable to "1" to prevent the ISO image from being built. To enable building an ISO image, set the variable to "0".

O

OBJCOPY

The minimal command and arguments to run `objcopy`.

OBJDUMP

The minimal command and arguments to run `objdump`.

OE_BINCONFIG_EXTRA_MANGLE

When inheriting the `binconfig` class, this variable specifies additional arguments passed to the "sed" command. The sed command alters any paths in configuration scripts that have been set up during compilation. Inheriting this class results in all paths in these scripts being changed to point into the `sysroots/` directory so that all builds that use the script will use the correct directories for the cross compiling layout.

See the `meta/classes/binconfig.bbclass` in the [Source Directory](#) for details on how this class applies these additional sed command arguments. For general information on the `binconfig.bbclass` class, see the "[Binary Configuration Scripts - binconfig.bbclass](#)" section.

OE_IMPORTS

An internal variable used to tell the OpenEmbedded build system what Python modules to import for every Python function run by the system.

Note

Do not set this variable. It is for internal use only.

OE_TERMINAL

Controls how the OpenEmbedded build system spawns interactive terminals on the host development system (e.g. using the BitBake command with the `-c devshell` command-line option). For more information, see the "[Using a Development Shell](#)" section in the Yocto Project Development Manual.

You can use the following values for the `OE_TERMINAL` variable:

```
auto
gnome
xfce
rxvt
screen
konsole
none
```

OEROOT

The directory from which the top-level build environment setup script is sourced. The Yocto Project makes two top-level build environment setup scripts available: `oe-init-build-env` and `oe-init-build-env-memres`. When you run one of these scripts, the `OEROOT` variable resolves to the directory that contains the script.

For additional information on how this variable is used, see the initialization scripts.

OLDEST_KERNEL

Declares the oldest version of the Linux kernel that the produced binaries must support. This variable is passed into the build of the Embedded GNU C Library (`glibc`).

The default for this variable comes from the `meta/conf/bitbake.conf` configuration file. You can override this default by setting the variable in a custom distribution configuration file.

OVERRIDES

BitBake uses `OVERRIDES` to control what variables are overridden after BitBake parses recipes and configuration files. You can find more information on how overrides are handled in the "[Conditional Syntax \(Overrides\)](#)" section of the BitBake User Manual.

P

P

The recipe name and version. `P` is comprised of the following:

```
${PN}-${PV}
```

PACKAGE_ARCH

The architecture of the resulting package or

packages.

By default, the value of this variable is set to `TUNE_PKGARCH` when building for the target, `BUILD_ARCH` when building for the build host and `"${SDK_ARCH}-${SDKPKGSUFFIX}"` when building for the SDK. However, if your recipe's output packages are built specific to the target machine rather than general for the architecture of the machine, you should set `PACKAGE_ARCH` to the value of `MACHINE_ARCH` in the recipe as follows:

```
PACKAGE_ARCH = "${MACHINE_ARCH}"
```

`PACKAGE_ARCHS`

Specifies a list of architectures compatible with the target machine. This variable is set automatically and should not normally be hand-edited. Entries are separated using spaces and listed in order of priority. The default value for `PACKAGE_ARCHS` is `"all any noarch ${PACKAGE_EXTRA_ARCHS} ${MACHINE_ARCH}"`.

`PACKAGE_BEFORE_PN`

Enables easily adding packages to `PACKAGES` before `${PN}` so that those added packages can pick up files that would normally be included in the default package.

`PACKAGE_CLASSES`

This variable, which is set in the `local.conf` configuration file found in the `conf` folder of the [Build Directory](#), specifies the package manager the OpenEmbedded build system uses when packaging data.

You can provide one or more of the following arguments for the variable:

```
PACKAGE_CLASSES ?= "package_rpm package_deb"
```

Warning

While it is a legal option, the `package_tar` class is broken and is not supported. It is recommended that you do not use it.

The build system uses only the first argument in the list as the package manager when creating your image or SDK. However, packages will be created using any additional packaging classes you specify. For example, if you use the following in your `local.conf` file:

```
PACKAGE_CLASSES ?= "package_ipk"
```

The OpenEmbedded build system uses the IPK package manager to create your image or SDK.

For information on packaging and build performance effects as a result of the package manager in use, see the "[package.bbclass](#)" section.

PACKAGE_DEBUG_SPLIT_STYLE

Determines how to split up the binary and debug information when creating *-dbg packages to be used with the GNU Project Debugger (GDB).

With the PACKAGE_DEBUG_SPLIT_STYLE variable, you can control where debug information, which can include or exclude source files, is stored:

- ".debug": Debug symbol files are placed next to the binary in a .debug directory on the target. For example, if a binary is installed into /bin, the corresponding debug symbol files are installed in /bin/.debug. Source files are placed in /usr/src/debug. This is the default behavior.
- "debug-file-directory": Debug symbol files are placed under /usr/lib/debug on the target, and separated by the path from where the binary is installed. For example, if a binary is installed in /bin, the corresponding debug symbols are installed in /usr/lib/debug/bin. Source files are placed in /usr/src/debug.
- "debug-without-src": The same behavior as ".debug" previously described with the exception that no source files are installed.

You can find out more about debugging using GDB by reading the "[Debugging With the GNU Project Debugger \(GDB\) Remotely](#)" section in the Yocto Project Development Manual.

PACKAGE_EXCLUDE_COMPLEMENTARY

Prevents specific packages from being installed when you are installing complementary packages.

You might find that you want to prevent installing certain packages when you are installing complementary packages. For example, if you are using [IMAGE_FEATURES](#) to install dev-pkgs, you might not want to install all packages from a particular multilib. If you find yourself in this situation, you can

use the `PACKAGE_EXCLUDE_COMPLEMENTARY` variable to specify regular expressions to match the packages you want to exclude.

`PACKAGE_EXCLUDE`

Lists packages that should not be installed into an image. For example:

```
PACKAGE_EXCLUDE = "package_name package_na
```

You can set this variable globally in your `local.conf` file or you can attach it to a specific image recipe by using the recipe name override:

```
PACKAGE_EXCLUDE_pn-target_image = "package
```

If you choose to not install a package using this variable and some other package is dependent on it (i.e. listed in a recipe's `RDEPENDS` variable), the OpenEmbedded build system generates a fatal installation error. Because the build system halts the process with a fatal error, you can use the variable with an iterative development process to remove specific components from a system.

Support for this variable exists only when using the IPK and RPM packaging backend. Support does not exist for DEB.

See the `NO_RECOMMENDATIONS` and the `BAD_RECOMMENDATIONS` variables for related information.

`PACKAGE_EXTRA_ARCHS`

Specifies the list of architectures compatible with the device CPU. This variable is useful when you build for several different devices that use miscellaneous processors such as XScale and ARM926-EJS.

`PACKAGE_FEED_ARCHS`

Specifies the package architectures used as part of the package feed URIs during the build. The `PACKAGE_FEED_ARCHS` variable is appended to the final package feed URI, which is constructed using the `PACKAGE_FEED_URI` and `PACKAGE_FEED_BASE_PATHS` variables.

Consider the following example where the `PACKAGE_FEED_URI`, `PACKAGE_FEED_BASE_PATHS`, and `PACKAGE_FEED_ARCHS` variables are defined in your `local.conf` file:

```
PACKAGE_FEED_URI = "https://example.com/p.  
https://example.com/p.  
PACKAGE_FEED_BASE_PATHS = "rpm rpm-dev"  
PACKAGE_FEED_ARCHS = "all core2-64"
```

Given these settings, the resulting package feeds are as follows:

```
https://example.com/packagerepos/release/rp
https://example.com/packagerepos/release/rp
https://example.com/packagerepos/release/rp
https://example.com/packagerepos/release/rp
https://example.com/packagerepos/updates/rp
https://example.com/packagerepos/updates/rp
https://example.com/packagerepos/updates/rp
https://example.com/packagerepos/updates/rp
```

PACKAGE_FEED_BASE_PATHS

Specifies the base path used when constructing package feed URIs. The `PACKAGE_FEED_BASE_PATHS` variable makes up the middle portion of a package feed URI used by the OpenEmbedded build system. The base path lies between the `PACKAGE_FEED_URIS` and `PACKAGE_FEED_ARCHS` variables.

Consider the following example where the `PACKAGE_FEED_URIS`, `PACKAGE_FEED_BASE_PATHS`, and `PACKAGE_FEED_ARCHS` variables are defined in your `local.conf` file:

```
PACKAGE_FEED_URIS = "https://example.com/p
                    https://example.com/p
PACKAGE_FEED_BASE_PATHS = "rpm rpm-dev"
PACKAGE_FEED_ARCHS = "all core2-64"
```

Given these settings, the resulting package feeds are as follows:

```
https://example.com/packagerepos/release/rp
https://example.com/packagerepos/release/rp
https://example.com/packagerepos/release/rp
https://example.com/packagerepos/release/rp
https://example.com/packagerepos/updates/rp
https://example.com/packagerepos/updates/rp
https://example.com/packagerepos/updates/rp
https://example.com/packagerepos/updates/rp
```

PACKAGE_FEED_URIS

Specifies the front portion of the package feed URI used by the OpenEmbedded build system. Each final package feed URI is comprised of `PACKAGE_FEED_URIS`, `PACKAGE_FEED_BASE_PATHS`, and `PACKAGE_FEED_ARCHS` variables.

Consider the following example where the `PACKAGE_FEED_URIS`, `PACKAGE_FEED_BASE_PATHS`, and `PACKAGE_FEED_ARCHS` variables are defined in your `local.conf` file:

```
PACKAGE_FEED_URIS = "https://example.com/p
                    https://example.com/p
PACKAGE_FEED_BASE_PATHS = "rpm rpm-dev"
PACKAGE_FEED_ARCHS = "all core2-64"
```

Given these settings, the resulting package feeds are as follows:

```
https://example.com/packagerepos/release/r]
https://example.com/packagerepos/release/r]
https://example.com/packagerepos/release/r]
https://example.com/packagerepos/release/r]
https://example.com/packagerepos/updates/r]
https://example.com/packagerepos/updates/r]
https://example.com/packagerepos/updates/r]
https://example.com/packagerepos/updates/r]
```

PACKAGE_GROUP

The `PACKAGE_GROUP` variable has been renamed to `FEATURE_PACKAGES`. See the variable description for `FEATURE_PACKAGES` for information.

If if you use the `PACKAGE_GROUP` variable, the OpenEmbedded build system issues a warning message.

PACKAGE_INSTALL

The final list of packages passed to the package manager for installation into the image.

Because the package manager controls actual installation of all packages, the list of packages passed using `PACKAGE_INSTALL` is not the final list of packages that are actually installed. This variable is internal to the image construction code. Consequently, in general, you should use the `IMAGE_INSTALL` variable to specify packages for installation. The exception to this is when working with the `core-image-minimal-initramfs` image. When working with an initial RAM disk (initramfs) image, use the `PACKAGE_INSTALL` variable.

PACKAGE_INSTALL_ATTEMPTONLY

Specifies a list of packages the OpenEmbedded build system attempts to install when creating an image. If a listed package fails to install, the build system does not generate an error. This variable is generally not user-defined.

PACKAGE_PREPROCESS_FUNCS

Specifies a list of functions run to pre-process the `PKGDE` directory prior to splitting the files out to individual packages.

PACKAGECONFIG

This variable provides a means of enabling or disabling features of a recipe on a per-recipe basis. `PACKAGECONFIG` blocks are defined in recipes when you specify features and then arguments that define feature behaviors. Here is the basic block structure:

```
PACKAGECONFIG ??= "f1 f2 f3 ..."
PACKAGECONFIG[f1] = "--with-f1,--without-f1"
PACKAGECONFIG[f2] = "--with-f2,--without-f2"
PACKAGECONFIG[f3] = "--with-f3,--without-f3"
```

The `PACKAGECONFIG` variable itself specifies a

space-separated list of the features to enable. Following the features, you can determine the behavior of each feature by providing up to four order-dependent arguments, which are separated by commas. You can omit any argument you like but must retain the separating commas. The order is important and specifies the following:

1. Extra arguments that should be added to the configure script argument list (EXTRA_OECONF) if the feature is enabled.
2. Extra arguments that should be added to `EXTRA_OECONF` if the feature is disabled.
3. Additional build dependencies (DEPENDS) that should be added if the feature is enabled.
4. Additional runtime dependencies (RDEPENDS) that should be added if the feature is enabled.

Consider the following `PACKAGECONFIG` block taken from the `librsvg` recipe. In this example the feature is `croco`, which has three arguments that determine the feature's behavior.

```
PACKAGECONFIG ??= "croco"  
PACKAGECONFIG[croco] = "--with-croco,--wit
```

The `--with-croco` and `libcroco` arguments apply only if the feature is enabled. In this case, `--with-croco` is added to the configure script argument list and `libcroco` is added to DEPENDS. On the other hand, if the feature is disabled say through a `.bbappend` file in another layer, then the second argument `--without-croco` is added to the configure script rather than `--with-croco`.

The basic `PACKAGECONFIG` structure previously described holds true regardless of whether you are creating a block or changing a block. When creating a block, use the structure inside your recipe.

If you want to change an existing `PACKAGECONFIG` block, you can do so one of two ways:

- **Append file:** Create an append file named `recipename.bbappend` in your layer and override the value of `PACKAGECONFIG`.

You can either completely override the variable:

```
PACKAGECONFIG="f4 f5"
```

Or, you can just append the variable:

```
PACKAGECONFIG_append = " f4"
```

- **Configuration file:** This method is identical to changing the block through an append file except you edit your `local.conf` or `mydistro.conf` file. As with append files previously described, you can either completely override the variable:

```
PACKAGECONFIG_pn-recipe="f4 f5"
```

Or, you can just amend the variable:

```
PACKAGECONFIG_append_pn-recipe = "
```

PACKAGEGROUP_DISABLE_COMPLEMENTARY

For recipes inheriting the `packagegroup` class, setting `PACKAGEGROUP_DISABLE_COMPLEMENTARY` to "1" specifies that the normal complementary packages (i.e. `-dev`, `-dbg`, and so forth) should not be automatically created by the `packagegroup` recipe, which is the default behavior.

PACKAGES

The list of packages to be created from the recipe. The default value is the following:

```
${PN}-dbg ${PN}-staticdev ${PN}-dev ${PN}-i
```

PACKAGES_DYNAMIC

A promise that your recipe satisfies runtime dependencies for optional modules that are found in other recipes. `PACKAGES_DYNAMIC` does not actually satisfy the dependencies, it only states that they should be satisfied. For example, if a hard, runtime dependency (`RDEPENDS`) of another package is satisfied at build time through the `PACKAGES_DYNAMIC` variable, but a package with the module name is never actually produced, then the other package will be broken. Thus, if you attempt to include that package in an image, you will get a dependency failure from the packaging system during the `do_rootfs` task.

Typically, if there is a chance that such a situation can occur and the package that is not created is valid without the dependency being satisfied, then you should use `RRECOMMENDS` (a soft runtime dependency) instead of `RDEPENDS`.

For an example of how to use the `PACKAGES_DYNAMIC` variable when you are splitting packages, see the "[Handling Optional Module Packaging](#)" section in the Yocto Project Development Manual.

`PACKAGESPLITFUNCS`

Specifies a list of functions run to perform additional splitting of files into individual packages. Recipes can either prepend to this variable or prepend to the `populate_packages` function in order to perform additional package splitting. In either case, the function should set `PACKAGES`, `FILES`, `RDEPENDS` and other packaging variables appropriately in order to perform the desired splitting.

`PARALLEL_MAKE`

Extra options passed to the `make` command during the `do_compile` task in order to specify parallel compilation on the local build host. This variable is usually in the form `"-j x"`, where `x` represents the maximum number of parallel threads `make` can run.

By default, the OpenEmbedded build system automatically sets this variable to be equal to the number of cores the build system uses.

Note

If the software being built experiences dependency issues during the `do_compile` task that result in race conditions, you can clear the `PARALLEL_MAKE` variable within the recipe as a workaround. For information on addressing race conditions, see the "[Debugging Parallel Make Races](#)" section in the Yocto Project Development Manual.

For single socket systems (i.e. one CPU), you should not have to override this variable to gain optimal parallelism during builds. However, if you have very large systems that employ multiple physical CPUs, you might want to make sure the `PARALLEL_MAKE` variable is not set higher than `"-j 20"`.

For more information on speeding up builds, see the "[Speeding Up the Build](#)" section.

`PARALLEL_MAKEINST`

Extra options passed to the `make install` command during the `do_install` task in order to specify parallel installation. This variable defaults to the value of

PARALLEL_MAKE.

Note

If the software being built experiences dependency issues during the `do_install` task that result in race conditions, you can clear the `PARALLEL_MAKEINST` variable within the recipe as a workaround. For information on addressing race conditions, see the ["Debugging Parallel Make Races"](#) section in the Yocto Project Development Manual.

PATCHRESOLVE

Determines the action to take when a patch fails. You can set this variable to one of two values: "noop" and "user".

The default value of "noop" causes the build to simply fail when the OpenEmbedded build system cannot successfully apply a patch. Setting the value to "user" causes the build system to launch a shell and places you in the right location so that you can manually resolve the conflicts.

Set this variable in your `local.conf` file.

PATCHTOOL

Specifies the utility used to apply patches for a recipe during the `do_patch` task. You can specify one of three utilities: "patch", "quilt", or "git". The default utility used is "quilt" except for the quilt-native recipe itself. Because the quilt tool is not available at the time quilt-native is being patched, it uses "patch".

If you wish to use an alternative patching tool, set the variable in the recipe using one of the following:

```
PATCHTOOL = "patch"
PATCHTOOL = "quilt"
PATCHTOOL = "git"
```

PE

The epoch of the recipe. By default, this variable is unset. The variable is used to make upgrades possible when the versioning scheme changes in some backwards incompatible way.

PF

Specifies the recipe or package name and includes all version and revision numbers (i.e. `glibc-2.13-r20+svnr15508/` and `bash-4.2-r1/`). This variable is comprised of the

following:

```
${PN}-${EXTENDEDPE}${PV}-${PR}
```

PIXBUF_PACKAGES

When inheriting the `pixbufcache` class, this variable identifies packages that contain the pixbuf loaders used with `gdk-pixbuf`. By default, the `pixbufcache` class assumes that the loaders are in the recipe's main package (i.e. `${PN}`). Use this variable if the loaders you need are in a package other than that main package.

PKG

The name of the resulting package created by the OpenEmbedded build system.

Note

When using the `PKG` variable, you must use a package name override.

For example, when the `debian` class renames the output package, it does so by setting `PKG_packageName`.

PKG_CONFIG_PATH

The path to `pkg-config` files for the current build context. `pkg-config` reads this variable from the environment.

PKGD

Points to the destination directory for files to be packaged before they are split into individual packages. This directory defaults to the following:

```
${WORKDIR}/package
```

Do not change this default.

PKGDATA_DIR

Points to a shared, global-state directory that holds data generated during the packaging process. During the packaging process, the `do_packagedata` task packages data for each recipe and installs it into this temporary, shared area. This directory defaults to the following:

```
${STAGING_DIR_HOST}/pkgdata
```

Do not change this default.

PKGDEST

Points to the parent directory for files to be packaged after they have been split into individual packages. This directory defaults to the following:

```
${WORKDIR}/packages-split
```

Under this directory, the build system creates directories for each package specified in PACKAGES. Do not change this default.

PKGDESTWORK

Points to a temporary work area used by the do_package task to write output from the do_packagedata task. The `PKGDESTWORK` location defaults to the following:

```
${WORKDIR}/pkgdata
```

The `do_packagedata` task then packages the data in the temporary work area and installs it into a shared directory pointed to by PKGDATA_DIR.

Do not change this default.

PKGE

The epoch of the output package built by the OpenEmbedded build system. By default, `PKGE` is set to PE.

PKGR

The revision of the output package built by the OpenEmbedded build system. By default, `PKGR` is set to PR.

PKGVS

The version of the output package built by the OpenEmbedded build system. By default, `PKGVS` is set to PV.

PN

This variable can have two separate functions depending on the context: a recipe name or a resulting package name.

`PN` refers to a recipe name in the context of a file used by the OpenEmbedded build system as input to create a package. The name is normally extracted from the recipe file name. For example, if the recipe is named `expat_2.0.1.bb`, then the default value of `PN` will be "expat".

The variable refers to a package name in the context of a file created or produced by the OpenEmbedded build system.

If applicable, the `PN` variable also contains any special suffix or prefix. For example, using `bash` to build packages for the native machine, `PN` is `bash-native`. Using `bash` to build packages for the target and for Multilib, `PN` would be `bash` and `lib64-bash`, respectively.

PNBLACKLIST

Lists recipes you do not want the OpenEmbedded build system to build. This variable works in conjunction with the

`blacklist` class, which the recipe must inherit globally.

To prevent a recipe from being built, inherit the class globally and use the variable in your `local.conf` file. Here is an example that prevents `myrecipe` from being built:

```
INHERIT += "blacklist"
PNBLACKLIST[myrecipe] = "Not supported by "
```

POPULATE_SDK_POST_HOST_COMMAND

Specifies a list of functions to call once the OpenEmbedded build system has created the host part of the SDK. You can specify functions separated by semicolons:

```
POPULATE_SDK_POST_HOST_COMMAND += "function"
```

If you need to pass the SDK path to a command within a function, you can use `${SDK_DIR}`, which points to the parent directory used by the OpenEmbedded build system when creating SDK output. See the `SDK_DIR` variable for more information.

POPULATE_SDK_POST_TARGET_COMMAND

Specifies a list of functions to call once the OpenEmbedded build system has created the target part of the SDK. You can specify functions separated by semicolons:

```
POPULATE_SDK_POST_TARGET_COMMAND += "function"
```

If you need to pass the SDK path to a command within a function, you can use `${SDK_DIR}`, which points to the parent directory used by the OpenEmbedded build system when creating SDK output. See the `SDK_DIR` variable for more information.

PR

The revision of the recipe. The default value for this variable is "r0".

PREFERRED_PROVIDER

If multiple recipes provide an item, this variable determines which recipe should be given preference. You should always suffix the variable with the name of the provided item, and you should set it to the `PN` of the recipe to which you want to give precedence. Some examples:

```
PREFERRED_PROVIDER_virtual/kernel ?= "linux"
PREFERRED_PROVIDER_virtual/xserver = "xserver"
PREFERRED_PROVIDER_virtual/libgl ?= "mesa"
```

PREFERRED_VERSION

If there are multiple versions of recipes available, this variable determines which recipe should be given preference. You must

always suffix the variable with the `PN` you want to select, and you should set the `PV` accordingly for precedence. You can use the `"%"` character as a wildcard to match any number of characters, which can be useful when specifying versions that contain long revision numbers that could potentially change. Here are two examples:

```
PREFERRED_VERSION_python = "2.7.3"  
PREFERRED_VERSION_linux-yocto = "3.19%"
```

PREMIRRORS

Specifies additional paths from which the OpenEmbedded build system gets source code. When the build system searches for source code, it first tries the local download directory. If that location fails, the build system tries locations defined by `PREMIRRORS`, the upstream source, and then locations specified by `MIRRORS` in that order.

Assuming your distribution (`DISTRO`) is "poky", the default value for `PREMIRRORS` is defined in the `conf/distro/poky.conf` file in the meta-yocto Git repository.

Typically, you could add a specific server for the build system to attempt before any others by adding something like the following to the `local.conf` configuration file in the Build Directory:

```
PREMIRRORS_prepend = "\n  
git://.*.* http://www.yoctoproject.org/so  
ftp://.*.* http://www.yoctoproject.org/so  
http://.*.* http://www.yoctoproject.org/s  
https://.*.* http://www.yoctoproject.org/
```

These changes cause the build system to intercept Git, FTP, HTTP, and HTTPS requests and direct them to the `http://` sources mirror. You can use `file://` URLs to point to local directories or network shares as well.

PRIORITY

Indicates the importance of a package.

`PRIORITY` is considered to be part of the distribution policy because the importance of any given recipe depends on the purpose for which the distribution is being produced. Thus, `PRIORITY` is not normally set within recipes.

You can set `PRIORITY` to "required", "standard", "extra", and "optional", which is the default.

PRIVATE_LIBS

Specifies libraries installed within a recipe that should be ignored by the OpenEmbedded build system's shared library

resolver. This variable is typically used when software being built by a recipe has its own private versions of a library normally provided by another recipe. In this case, you would not want the package containing the private libraries to be set as a dependency on other unrelated packages that should instead depend on the package providing the standard version of the library.

Libraries specified in this variable should be specified by their file name. For example, from the Firefox recipe in meta-browser:

```
PRIVATE_LIBS = "libmozjs.so \  
libxpcom.so \  
libnspr4.so \  
libxul.so \  
libmozalloc.so \  
libplc4.so \  
libplds4.so"
```

PROVIDES

A list of aliases by which a particular recipe can be known. By default, a recipe's own PN is implicitly already in its `PROVIDES` list. If a recipe uses `PROVIDES`, the additional aliases are synonyms for the recipe and can be useful satisfying dependencies of other recipes during the build as specified by DEPENDS.

Consider the following example `PROVIDES` statement from a recipe file

```
libav_0.8.11.bb:
```

```
    PROVIDES += "libpostproc"
```

The `PROVIDES` statement results in the "libav" recipe also being known as "libpostproc".

PRSERV_HOST

The network based PR service host and port.

The `conf/local.conf.sample.extended` configuration file in the Source Directory shows how the `PRSERV_HOST` variable is set:

```
PRSERV_HOST = "localhost:0"
```

You must set the variable if you want to automatically start a local PR service. You can set `PRSERV_HOST` to other values to use a remote PR service.

PTEST_ENABLED

Specifies whether or not Package Test (ptest) functionality is enabled when building a recipe. You should not set this variable directly. Enabling and disabling building Package Tests at build time should be done by adding "ptest" to (or removing it from) DISTRO_FEATURES.

PV

The version of the recipe. The version is normally extracted from the recipe filename. For example, if the recipe is named `expat_2.0.1.bb`, then the default value of `PV` will be `"2.0.1"`. `PV` is generally not overridden within a recipe unless it is building an unstable (i.e. development) version from a source code repository (e.g. Git or Subversion).

PYTHON_ABI

When used by recipes that inherit the `distutils3`, `setuptools3`, `distutils`, or `setuptools` classes, denotes the Application Binary Interface (ABI) currently in use for Python. By default, the ABI is `"m"`. You do not have to set this variable as the OpenEmbedded build system sets it for you.

The OpenEmbedded build system uses the ABI to construct directory names used when installing the Python headers and libraries in `sysroot` (e.g. `.../python3.3m/...`).

Recipes that inherit the `distutils` class during cross-builds also use this variable to locate the headers and libraries of the appropriate Python that the extension is targeting.

PYTHON_PN

When used by recipes that inherit the `distutils3`, `setuptools3`, `distutils`, or `setuptools` classes, specifies the major Python version being built. For Python 2.x, `PYTHON_PN` would be `"python2"`. For Python 3.x, the variable would be `"python3"`. You do not have to set this variable as the OpenEmbedded build system automatically sets it for you.

The variable allows recipes to use common infrastructure such as the following:

```
DEPENDS += "${PYTHON_PN}-native"
```

In the previous example, the version of the dependency is `PYTHON_PN`.

Q

QMAKE_PROFILES

Specifies your own subset of `.pro` files to be built for use with `qmake`. If you do not set this variable, all `.pro` files in the directory pointed to by `_s` will be built by default.

This variable is used with recipes that inherit the `qmake_base` class or other classes that

inherit qmake_base.

R

RANLIB

The minimal command and arguments to run `ranlib`.

RCONFLICTS

The list of packages that conflict with packages. Note that packages will not be installed if conflicting packages are not first removed.

Like all package-controlling variables, you must always use them in conjunction with a package name override. Here is an example:

```
RCONFLICTS_${PN} = "another_conflicting_pa
```

BitBake, which the OpenEmbedded build system uses, supports specifying versioned dependencies. Although the syntax varies depending on the packaging format, BitBake hides these differences from you. Here is the general syntax to specify versions with the `RCONFLICTS` variable:

```
RCONFLICTS_${PN} = "package (operator vers
```

For `operator`, you can specify the following:

```
=  
<  
>  
<=  
>=
```

For example, the following sets up a dependency on version 1.2 or greater of the package `foo`:

```
RCONFLICTS_${PN} = "foo (>= 1.2)"
```

RDEPENDS

Lists a package's runtime dependencies (i.e. other packages) that must be installed in order for the built package to run correctly. If a package in this list cannot be found during the build, you will get a build error.

When you use the `RDEPENDS` variable in a recipe, you are essentially stating that the recipe's `do_build` task depends on the existence of a specific package. Consider this simple example for two recipes named "a" and "b" that produce similarly named IPK packages. In this example, the `RDEPENDS` statement appears in the "a" recipe:

```
RDEPENDS_${PN} = "b"
```

Here, the dependency is such that the

do_build task for recipe "a" depends on the do_package_write_ipk task of recipe "b". This means the package file for "b" must be available when the output for recipe "a" has been completely built. More importantly, package "a" will be marked as depending on package "b" in a manner that is understood by the package manager.

The names of the packages you list within RDEPENDS must be the names of other packages - they cannot be recipe names. Although package names and recipe names usually match, the important point here is that you are providing package names within the RDEPENDS variable. For an example of the default list of packages created from a recipe, see the PACKAGES variable.

Because the RDEPENDS variable applies to packages being built, you should always use the variable in a form with an attached package name. For example, suppose you are building a development package that depends on the perl package. In this case, you would use the following RDEPENDS statement:

```
RDEPENDS_${PN}-dev += "perl"
```

In the example, the development package depends on the perl package. Thus, the RDEPENDS variable has the \${PN}-dev package name as part of the variable.

The package name you attach to the RDEPENDS variable must appear as it would in the PACKAGES namespace before any renaming of the output package by classes like debian.

In many cases you do not need to explicitly add runtime dependencies using RDEPENDS since some automatic handling occurs:

- **shlibdeps:** If a runtime package contains a shared library (.so), the build processes the library in order to determine other libraries to which it is dynamically linked. The build process adds these libraries to RDEPENDS when creating the runtime package.
- **pcdeps:** If the package ships a pkg-config information file, the build process uses this file to add items to the RDEPENDS variable to create the runtime packages.

BitBake, which the OpenEmbedded build

system uses, supports specifying versioned dependencies. Although the syntax varies depending on the packaging format, BitBake hides these differences from you. Here is the general syntax to specify versions with the `RDEPENDS` variable:

```
RDEPENDS_${PN} = "package (operator versio
```

For operator, you can specify the following:

```
=  
<  
>  
<=  
>=
```

For example, the following sets up a dependency on version 1.2 or greater of the package `foo`:

```
RDEPENDS_${PN} = "foo (>= 1.2)"
```

For information on build-time dependencies, see the [DEPENDS](#) variable.

REQUIRED_DISTRO_FEATURES

When inheriting the `distro_features_check` class, this variable identifies distribution features that must exist in the current configuration in order for the OpenEmbedded build system to build the recipe. In other words, if the `REQUIRED_DISTRO_FEATURES` variable lists a feature that does not appear in `DISTRO_FEATURES` within the current configuration, an error occurs and the build stops.

RM_OLD_IMAGE

Reclaims disk space by removing previously built versions of the same image from the `images` directory pointed to by the `DEPLOY_DIR` variable.

Set this variable to "1" in your `local.conf` file to remove these images.

RM_WORK_EXCLUDE

With `rm_work` enabled, this variable specifies a list of recipes whose work directories should not be removed. See the "`rm_work.bbclass`" section for more details.

ROOT_HOME

Defines the root home directory. By default, this directory is set as follows in the BitBake configuration file:

```
ROOT_HOME ??= "/home/root"
```

Note

This default value is likely used because some embedded solutions prefer

to have a read-only root filesystem and prefer to keep writeable data in one place.

You can override the default by setting the variable in any layer or in the `local.conf` file. Because the default is set using a "weak" assignment (i.e. `??=`), you can use either of the following forms to define your override:

```
ROOT_HOME = "/root"  
ROOT_HOME ??= "/root"
```

These override examples use `/root`, which is probably the most commonly used override.

ROOTFS

Indicates a filesystem image to include as the root filesystem.

The `ROOTFS` variable is an optional variable used with the `bootimg` class.

ROOTFS_POSTINSTALL_COMMAND

Specifies a list of functions to call after the OpenEmbedded build system has installed packages. You can specify functions separated by semicolons:

```
ROOTFS_POSTINSTALL_COMMAND += "function; .
```

If you need to pass the root filesystem path to a command within a function, you can use `${IMAGE_ROOTFS}`, which points to the directory that becomes the root filesystem image. See the `IMAGE_ROOTFS` variable for more information.

ROOTFS_POSTPROCESS_COMMAND

Specifies a list of functions to call once the OpenEmbedded build system has created the root filesystem. You can specify functions separated by semicolons:

```
ROOTFS_POSTPROCESS_COMMAND += "function; .
```

If you need to pass the root filesystem path to a command within a function, you can use `${IMAGE_ROOTFS}`, which points to the directory that becomes the root filesystem image. See the `IMAGE_ROOTFS` variable for more information.

ROOTFS_POSTUNINSTALL_COMMAND

Specifies a list of functions to call after the OpenEmbedded build system has removed unnecessary packages. When runtime package management is disabled in the image, several packages are removed including `base-passwd`, `shadow`, and `update-`

alternatives. You can specify functions separated by semicolons:

```
ROOTFS_POSTUNINSTALL_COMMAND += "function;
```

If you need to pass the root filesystem path to a command within a function, you can use `${IMAGE_ROOTFS}`, which points to the directory that becomes the root filesystem image. See the [IMAGE_ROOTFS](#) variable for more information.

ROOTFS_PREPROCESS_COMMAND

Specifies a list of functions to call before the OpenEmbedded build system has created the root filesystem. You can specify functions separated by semicolons:

```
ROOTFS_PREPROCESS_COMMAND += "function; ..
```

If you need to pass the root filesystem path to a command within a function, you can use `${IMAGE_ROOTFS}`, which points to the directory that becomes the root filesystem image. See the [IMAGE_ROOTFS](#) variable for more information.

RPROVIDES

A list of package name aliases that a package also provides. These aliases are useful for satisfying runtime dependencies of other packages both during the build and on the target (as specified by [RDEPENDS](#)).

Note

A package's own name is implicitly already in its `RPROVIDES` list.

As with all package-controlling variables, you must always use the variable in conjunction with a package name override. Here is an example:

```
RPROVIDES_${PN} = "widget-abi-2"
```

RRECOMMENDS

A list of packages that extends the usability of a package being built. The package being built does not depend on this list of packages in order to successfully build, but rather uses them for extended usability. To specify runtime dependencies for packages, see the [RDEPENDS](#) variable.

The package manager will automatically install the `RRECOMMENDS` list of packages when installing the built package. However, you can prevent listed packages from being

installed by using the `BAD_RECOMMENDATIONS`, `NO_RECOMMENDATIONS`, and `PACKAGE_EXCLUDE` variables.

Packages specified in `RRECOMMENDS` need not actually be produced. However, a recipe must exist that provides each package, either through the `PACKAGES` or `PACKAGES_DYNAMIC` variables or the `RPROVIDES` variable, or an error will occur during the build. If such a recipe does exist and the package is not produced, the build continues without error.

Because the `RRECOMMENDS` variable applies to packages being built, you should always attach an override to the variable to specify the particular package whose usability is being extended. For example, suppose you are building a development package that is extended to support wireless functionality. In this case, you would use the following:

```
RRECOMMENDS_${PN}-dev += "wireless_package"
```

In the example, the package name (`${PN}-dev`) must appear as it would in the `PACKAGES` namespace before any renaming of the output package by classes such as `debian.bbclass`.

BitBake, which the OpenEmbedded build system uses, supports specifying versioned recommends. Although the syntax varies depending on the packaging format, BitBake hides these differences from you. Here is the general syntax to specify versions with the `RRECOMMENDS` variable:

```
RRECOMMENDS_${PN} = "package (operator ver"
```

For operator, you can specify the following:

```
=  
<  
>  
<=  
>=
```

For example, the following sets up a recommend on version 1.2 or greater of the package `foo`:

```
RRECOMMENDS_${PN} = "foo (>= 1.2)"
```

RREPLACES

A list of packages replaced by a package. The package manager uses this variable to determine which package should be installed to replace other package(s) during an upgrade. In order to also have the other package(s) removed at the same time, you

must add the name of the other package to the `RCONFLICTS` variable.

As with all package-controlling variables, you must use this variable in conjunction with a package name override. Here is an example:

```
RREPLACES_${PN} = "other_package_being_rep
```

BitBake, which the OpenEmbedded build system uses, supports specifying versioned replacements. Although the syntax varies depending on the packaging format, BitBake hides these differences from you. Here is the general syntax to specify versions with the `RREPLACES` variable:

```
RREPLACES_${PN} = "package (operator versi
```

For operator, you can specify the following:

```
=  
<  
>  
<=  
>=
```

For example, the following sets up a replacement using version 1.2 or greater of the package `foo`:

```
RREPLACES_${PN} = "foo (>= 1.2)"
```

RSUGGESTS

A list of additional packages that you can suggest for installation by the package manager at the time a package is installed. Not all package managers support this functionality.

As with all package-controlling variables, you must always use this variable in conjunction with a package name override. Here is an example:

```
RSUGGESTS_${PN} = "useful_package another_
```

S

S

The location in the Build Directory where unpacked recipe source code resides. This location is within the work directory (WORKDIR), which is not static. The unpacked source location depends on the recipe name (PN) and recipe version (PV) as follows:

```
${WORKDIR}/${PN}-${PV}
```

As an example, assume a Source Directory top-level folder named `poky` and a default Build Directory at `poky/build`. In this case,

the work directory the build system uses to keep the unpacked recipe for `db` is the following:

```
poky/build/tmp/work/qemux86-poky-linux/db/!
```

This next example assumes a Git repository. By default, Git repositories are cloned to `${WORKDIR}/git` during `do_fetch`. Since this path is different from the default value of `s`, you must set it specifically so the source can be located:

```
SRC_URI = "git://path/to/repo.git"
S = "${WORKDIR}/git"
```

SANITY_REQUIRED_UTILITIES

Specifies a list of command-line utilities that should be checked for during the initial sanity checking process when running BitBake. If any of the utilities are not installed on the build host, then BitBake immediately exits with an error.

SANITY_TESTED_DISTROS

A list of the host distribution identifiers that the build system has been tested against. Identifiers consist of the host distributor ID followed by the release, as reported by the `lsb_release` tool or as read from `/etc/lsb-release`. Separate the list items with explicit newline characters (`\n`). If

`SANITY_TESTED_DISTROS` is not empty and the current value of `NATIVELSBSTRING` does not appear in the list, then the build system reports a warning that indicates the current host distribution has not been tested as a build host.

SDK_ARCH

The target architecture for the SDK. Typically, you do not directly set this variable. Instead, use `SDKMACHINE`.

SDK_DEPLOY

The directory set up and used by the `populate_sdk_base` to which the SDK is deployed. The `populate_sdk_base` class defines `SDK_DEPLOY` as follows:

```
SDK_DEPLOY = "${TMPDIR}/deploy/sdk"
```

SDK_DIR

The parent directory used by the OpenEmbedded build system when creating SDK output. The `populate_sdk_base` class defines the variable as follows:

```
SDK_DIR = "${WORKDIR}/sdk"
```

Note

The `SDK_DIR` directory is a temporary directory as it is part of `WORKDIR`. The final output directory is `SDK_DEPLOY`.

SDK_HOST_MANIFEST

The manifest file for the host part of the SDK. This file lists all the installed packages that make up the host part of SDK. The file contains package information on a line-per-package basis as follows:

```
packagename packagearch version
```

The `populate_sdk_base` class defines the manifest file as follows:

```
SDK_HOST_MANIFEST = "${SDK_DEPLOY}/${TOOLC
```

The location is derived using the `SDK_DEPLOY` and `TOOLCHAIN_OUTPUTNAME` variables.

SDK_NAME

The base name for SDK output files. The name is derived from the `DISTRO`, `TCLIBC`, `SDK_ARCH`, `IMAGE_BASENAME`, and `TUNE_PKGARCH` variables:

```
SDK_NAME = "${DISTRO}-${TCLIBC}-${SDK_ARCH
```

SDK_OS

Specifies the operating system for which the SDK will be built. The default value is the value of `BUILD_OS`.

SDK_OUTPUT

The location used by the OpenEmbedded build system when creating SDK output. The `populate_sdk_base` class defines the variable as follows:

```
SDK_OUTPUT = "${SDK_DIR}/image"
```

Note

The `SDK_OUTPUT` directory is a temporary directory as it is part of `WORKDIR` by way of `SDK_DIR`. The final output directory is `SDK_DEPLOY`.

SDK_PACKAGE_ARCHS

Specifies a list of architectures compatible with the SDK machine. This variable is set automatically and should not normally be hand-edited. Entries are separated using spaces and listed in order of priority. The default value for `SDK_PACKAGE_ARCHS` is "all any noarch \${SDK_ARCH}-\${SDKPKGSUFFIX}".

SDK_POSTPROCESS_COMMAND

Specifies a list of functions to call once the OpenEmbedded build system has created the SDK. You can specify functions separated by semicolons:

```
SDK_POSTPROCESS_COMMAND += "function; ... "
```

If you need to pass an SDK path to a command within a function, you can use `${SDK_DIR}`, which points to the parent directory used by the OpenEmbedded build system when creating SDK output. See the [SDK_DIR](#) variable for more information.

SDK_PREFIX

The toolchain binary prefix used for nativesdk recipes. The OpenEmbedded build system uses the `SDK_PREFIX` value to set the [TARGET_PREFIX](#) when building nativesdk recipes. The default value is "`${SDK_SYS}`".

SDK_SYS

Specifies the system, including the architecture and the operating system, for which the SDK will be built.

The OpenEmbedded build system automatically sets this variable based on [SDK_ARCH](#), [SDK_VENDOR](#), and [SDK_OS](#). You do not need to set the `SDK_SYS` variable yourself.

SDK_TARGET_MANIFEST

The manifest file for the target part of the SDK. This file lists all the installed packages that make up the target part of the SDK. The file contains package information on a line-per-package basis as follows:

```
packagename packagearch version
```

The `populate_sdk_base` class defines the manifest file as follows:

```
SDK_TARGET_MANIFEST = "${SDK_DEPLOY}/${TOO:
```

The location is derived using the [SDK_DEPLOY](#) and [TOOLCHAIN_OUTPUTNAME](#) variables.

SDK_VENDOR

Specifies the name of the SDK vendor.

SDK_VERSION

Specifies the version of the SDK. The distribution configuration file (e.g. `/meta-yocto/conf/distro/poky.conf`) defines the `SDK_VERSION` as follows:

```
SDK_VERSION := "${@'${DISTRO_VERSION}'} .rep
```

For additional information, see the

DISTRO_VERSION and DATE variables.

SDKIMAGE_FEATURES

Equivalent to IMAGE_FEATURES. However, this variable applies to the SDK generated from an image using the following command:

```
$ bitbake -c populate_sdk imagename
```

SDKMACHINE

The machine for which the Application Development Toolkit (ADT) or SDK is built. In other words, the SDK or ADT is built such that it runs on the target you specify with the `SDKMACHINE` value. The value points to a corresponding `.conf` file under `conf/machine-sdk/`.

You can use "i686" and "x86_64" as possible values for this variable. The variable defaults to "i686" and is set in the `local.conf` file in the Build Directory.

```
SDKMACHINE ?= "i686"
```

Note

You cannot set the `SDKMACHINE` variable in your distribution configuration file. If you do, the configuration will not take affect.

SDKPATH

Defines the path offered to the user for installation of the SDK that is generated by the OpenEmbedded build system. The path appears as the default location for installing the SDK when you run the SDK's installation script. You can override the offered path when you run the script.

SDKTARGETSYSROOT

The full path to the sysroot used for cross-compilation within an SDK as it will be when installed into the default SDKPATH.

SECTION

The section in which packages should be categorized. Package management utilities can make use of this variable.

SELECTED_OPTIMIZATION

Specifies the optimization flags passed to the C compiler when building for the target. The flags are passed through the default value of the TARGET_CFLAGS variable.

The `SELECTED_OPTIMIZATION` variable takes the value of FULL_OPTIMIZATION unless `DEBUG_BUILD = "1"`. If that is the case, the value of DEBUG_OPTIMIZATION is used.

SERIAL_CONSOLE

Defines a serial console (TTY) to enable using getty. Provide a value that specifies the baud rate followed by the TTY device name separated by a space. You cannot specify more than one TTY device:

```
SERIAL_CONSOLE = "115200 ttyS0"
```

Note

The `SERIAL_CONSOLE` variable is deprecated. Please use the `SERIAL_CONSOLES` variable.

SERIAL_CONSOLES

Defines the serial consoles (TTYs) to enable using getty. Provide a value that specifies the baud rate followed by the TTY device name separated by a semicolon. Use spaces to separate multiple devices:

```
SERIAL_CONSOLES = "115200;ttyS0 115200;ttyS1"
```

SERIAL_CONSOLES_CHECK

Similar to `SERIAL_CONSOLES` except the device is checked for existence before attempting to enable it. This variable is currently only supported with SysVinit (i.e. not with systemd).

SIGGEN_EXCLUDE_SAFE_RECIPE_DEPS

A list of recipe dependencies that should not be used to determine signatures of tasks from one recipe when they depend on tasks from another recipe. For example:

```
SIGGEN_EXCLUDE_SAFE_RECIPE_DEPS += "intone-:mpplayer2"
```

In this example, `intone` depends on `mpplayer2`.

Use of this variable is one mechanism to remove dependencies that affect task signatures and thus force rebuilds when a recipe changes.

Caution

If you add an inappropriate dependency for a recipe relationship, the software might break during runtime if the interface of the second recipe was changed after the first recipe had been built.

SIGGEN_EXCLUDERECPES_ABISAFE

A list of recipes that are completely stable and will never change. The ABI for the

recipes in the list are presented by output from the tasks run to build the recipe. Use of this variable is one way to remove dependencies from one recipe on another that affect task signatures and thus force rebuilds when the recipe changes.

Caution

If you add an inappropriate variable to this list, the software might break at runtime if the interface of the recipe was changed after the other had been built.

SITEINFO_BITS

Specifies the number of bits for the target system CPU. The value should be either "32" or "64".

SITEINFO_ENDIANNESS

Specifies the endian byte order of the target system. The value should be either "le" for little-endian or "be" for big-endian.

SKIP_FILEDEPS

Enables removal of all files from the "Provides" section of an RPM package. Removal of these files is required for packages containing prebuilt binaries and libraries such as `libstdc++` and `glibc`.

To enable file removal, set the variable to "1" in your `conf/local.conf` configuration file in your: [Build Directory](#).

```
SKIP_FILEDEPS = "1"
```

SOC_FAMILY

Groups together machines based upon the same family of SOC (System On Chip). You typically set this variable in a common `.inc` file that you include in the configuration files of all the machines.

Note

You must include `conf/machine/include/soc-family.inc` for this variable to appear in [MACHINEOVERRIDES](#).

SOLIBS

Defines the suffix for shared libraries used on the target platform. By default, this suffix is ".so.*" for all Linux-based systems and is defined in the `meta/conf/bitbake.conf` configuration file.

You will see this variable referenced in the

default values of `FILES_${PN}`.

SOLIBSDEV

Defines the suffix for the development symbolic link (symlink) for shared libraries on the target platform. By default, this suffix is ".so" for Linux-based systems and is defined in the `meta/conf/bitbake.conf` configuration file.

You will see this variable referenced in the default values of `FILES_${PN}-dev`.

SOURCE_MIRROR_FETCH

When you are fetching files to create a mirror of sources (i.e. creating a source mirror), setting `SOURCE_MIRROR_FETCH` to "1" in your `local.conf` configuration file ensures the source for all recipes are fetched regardless of whether or not a recipe is compatible with the configuration. A recipe is considered incompatible with the currently configured machine when either or both the `COMPATIBLE_MACHINE` variable and `COMPATIBLE_HOST` variables specify compatibility with a machine other than that of the current machine or host.

Warning

Do not set the `SOURCE_MIRROR_FETCH` variable unless you are creating a source mirror. In other words, do not set the variable during a normal build.

SOURCE_MIRROR_URL

Defines your own `PREMIRRORS` from which to first fetch source before attempting to fetch from the upstream specified in `SRC_URI`.

To use this variable, you must globally inherit the `own-mirrors` class and then provide the URL to your mirrors. Here is the general syntax:

```
INHERIT += "own-mirrors"
SOURCE_MIRROR_URL = "http://example.com/my
```

Note

You can specify only a single URL in `SOURCE_MIRROR_URL`.

SPDXLICENSEMAP

Maps commonly used license names to their SPDX counterparts found in `meta/files/common-licenses/`. For the default `SPDXLICENSEMAP` mappings, see the

meta/conf/licenses.conf file.

For additional information, see the [LICENSE](#) variable.

SPECIAL_PKGSUFFIX

A list of prefixes for [PN](#) used by the OpenEmbedded build system to create variants of recipes or packages. The list specifies the prefixes to strip off during certain circumstances such as the generation of the [BPN](#) variable.

SRC_URI

The list of source files - local or remote. This variable tells the OpenEmbedded build system which bits to pull in for the build and how to pull them in. For example, if the recipe or append file only needs to fetch a tarball from the Internet, the recipe or append file uses a single [SRC_URI](#) entry. On the other hand, if the recipe or append file needs to fetch a tarball, apply two patches, and include a custom file, the recipe or append file would include four instances of the variable.

The following list explains the available URI protocols. URI protocols are highly dependent on particular BitBake Fetcher submodules. Depending on the fetcher BitBake uses, various URL parameters are employed. For specifics on the supported Fetchers, see the "[Fetchers](#)" section in the BitBake User Manual.

- **file://** - Fetches files, which are usually files shipped with the [Metadata](#), from the local machine. The path is relative to the [FILESPATH](#) variable. Thus, the build system searches, in order, from the following directories, which are assumed to be subdirectories of the directory in which the recipe file (`.bb`) or append file (`.bbappend`) resides:
 - **`${BPN}`** - The base recipe name without any special suffix or version numbers.
 - **`${BP}`** - `${BPN}-${PV}`. The base recipe name and version but without any special package name suffix.
 - **files** - Files within a directory, which is named `files` and is also alongside the recipe or append file.

Note

If you want the build system to pick up files specified through a

SRC_URI statement from your append file, you need to be sure to extend the FILESPATH variable by also using the FILESEXTRAPATHS variable from within your append file.

- **bzr://** - Fetches files from a Bazaar revision control repository.
- **git://** - Fetches files from a Git revision control repository.
- **osc://** - Fetches files from an OSC (OpenSUSE Build service) revision control repository.
- **repo://** - Fetches files from a repo (Git) repository.
- **ccrc://** - Fetches files from a ClearCase repository.
- **http://** - Fetches files from the Internet using http.
- **https://** - Fetches files from the Internet using https.
- **ftp://** - Fetches files from the Internet using ftp.
- **cvcs://** - Fetches files from a CVS revision control repository.
- **hg://** - Fetches files from a Mercurial (hg) revision control repository.
- **p4://** - Fetches files from a Perforce (p4) revision control repository.
- **ssh://** - Fetches files from a secure shell.
- **svn://** - Fetches files from a Subversion (svn) revision control repository.

Standard and recipe-specific options for SRC_URI exist. Here are standard options:

- **apply** - Whether to apply the patch or not. The default action is to apply the patch.
- **striplevel** - Which striplevel to use when applying the patch. The default level is 1.
- **patchdir** - Specifies the directory in which the patch should be applied. The default is \${S}.

Here are options specific to recipes building code from a revision control system:

- ***mindate*** - Apply the patch only if SRCDATE is equal to or greater than mindate.
- ***maxdate*** - Apply the patch only if SRCDATE is not later than mindate.
- ***minrev*** - Apply the patch only if SRCREV is equal to or greater than minrev.
- ***maxrev*** - Apply the patch only if SRCREV is not later than maxrev.
- ***rev*** - Apply the patch only if SRCREV is equal to rev.
- ***notrev*** - Apply the patch only if SRCREV is not equal to rev.

Here are some additional options worth mentioning:

- ***unpack*** - Controls whether or not to unpack the file if it is an archive. The default action is to unpack the file.
- ***destsuffix*** - Places the file (or extracts its contents) into the specified subdirectory of WORKDIR when the Git fetcher is used.
- ***subdir*** - Places the file (or extracts its contents) into the specified subdirectory of WORKDIR when the local (`file://`) fetcher is used.
- ***localdir*** - Places the file (or extracts its contents) into the specified subdirectory of WORKDIR when the CVS fetcher is used.
- ***subpath*** - Limits the checkout to a specific subpath of the tree when using the Git fetcher is used.
- ***name*** - Specifies a name to be used for association with SRC_URI checksums when you have more than one file specified in SRC_URI.
- ***downloadfilename*** - Specifies the filename used when storing the downloaded file.

SRC_URI_OVERRIDES_PACKAGE_ARCH

By default, the OpenEmbedded build system automatically detects whether SRC_URI contains files that are machine-specific. If so, the build system automatically changes PACKAGE_ARCH. Setting this variable to "0" disables this behavior.

SRCDATE

The date of the source code used to build the package. This variable applies only if the source was fetched from a Source Code Manager (SCM).

SRCPV

Returns the version string of the current package. This string is used to help define the value of `PV`.

The `SRCPV` variable is defined in the `meta/conf/bitbake.conf` configuration file in the [Source Directory](#) as follows:

```
SRCPV = "${@bb.fetch2.get_srcrev(d)}"
```

Recipes that need to define `PV` do so with the help of the `SRCPV`. For example, the `ofono` recipe (`ofono_git.bb`) located in `meta/recipes-connectivity` in the Source Directory defines `PV` as follows:

```
PV = "0.12-git${SRCPV}"
```

SRCREV

The revision of the source code used to build the package. This variable applies to Subversion, Git, Mercurial and Bazaar only. Note that if you want to build a fixed revision and you want to avoid performing a query on the remote repository every time BitBake parses your recipe, you should specify a `SRCREV` that is a full revision identifier and not just a tag.

Note

For information on limitations when inheriting the latest revision of software using `SRCREV`, see the [AUTOREV](#) variable description.

SSTATE_DIR

The directory for the shared state cache.

SSTATE_MIRROR_ALLOW_NETWORK

If set to "1", allows fetches from mirrors that are specified in `SSTATE_MIRRORS` to work even when fetching from the network has been disabled by setting `BB_NO_NETWORK` to "1". Using the `SSTATE_MIRROR_ALLOW_NETWORK` variable is useful if you have set `SSTATE_MIRRORS` to point to an internal server for your shared state cache, but you want to disable any other fetching from the network.

SSTATE_MIRRORS

Configures the OpenEmbedded build system

to search other mirror locations for prebuilt cache data objects before building out the data. This variable works like `fetcher` `MIRRORS` and `PREMIRRORS` and points to the cache locations to check for the shared objects.

You can specify a filesystem directory or a remote URL such as HTTP or FTP. The locations you specify need to contain the shared state cache (sstate-cache) results from previous builds. The sstate-cache you point to can also be from builds on other machines.

If a mirror uses the same structure as `SSTATE_DIR`, you need to add "PATH" at the end as shown in the examples below. The build system substitutes the correct path within the directory structure.

```
SSTATE_MIRRORS ?= "\
file://.* http://someserver.tld/share/ssta
file://.* file:///some-local-dir/sstate/PA'
```

STAGING_BASE_LIBDIR_NATIVE

Specifies the path to the `/lib` subdirectory of the `sysroot` directory for the build host.

STAGING_BASELIBDIR

Specifies the path to the `/lib` subdirectory of the `sysroot` directory for the target for which the current recipe is being built (`STAGING_DIR_HOST`).

STAGING_BINDIR

Specifies the path to the `/usr/bin` subdirectory of the `sysroot` directory for the target for which the current recipe is being built (`STAGING_DIR_HOST`).

STAGING_BINDIR_CROSS

Specifies the path to the directory containing binary configuration scripts. These scripts provide configuration information for other software that wants to make use of libraries or include files provided by the software associated with the script.

Note

This style of build configuration has been largely replaced by `pkg-config`. Consequently, if `pkg-config` is supported by the library to which you are linking, it is recommended you use `pkg-config` instead of a provided configuration script.

STAGING_BINDIR_NATIVE

	Specifies the path to the <code>/usr/bin</code> subdirectory of the sysroot directory for the build host.
<code>STAGING_DATADIR</code>	Specifies the path to the <code>/usr/share</code> subdirectory of the sysroot directory for the target for which the current recipe is being built (<code>STAGING_DIR_HOST</code>).
<code>STAGING_DATADIR_NATIVE</code>	Specifies the path to the <code>/usr/share</code> subdirectory of the sysroot directory for the build host.
<code>STAGING_DIR</code>	Specifies the path to the top-level sysroots directory (i.e. <code>\${TMPDIR}/sysroots</code>).
	<div> <p>Note</p> <p>Recipes should never write files directly under this directory because the OpenEmbedded build system manages the directory automatically. Instead, files should be installed to <code>\${D}</code> within your recipe's <code>do_install</code> task and then the OpenEmbedded build system will stage a subset of those files into the sysroot.</p> </div>
<code>STAGING_DIR_HOST</code>	<p>Specifies the path to the primary sysroot directory for which the target is being built. Depending on the type of recipe and the build target, the recipe's value is as follows:</p> <ul style="list-style-type: none"> For recipes building for the target machine, the value is <code>"\${STAGING_DIR}/\${MACHINE}"</code>. For <code>native</code> recipes building for the build host, the value is empty given the assumption that when building for the build host, the build host's own directories should be used. For <code>nativesdk</code> recipes that build for the SDK, the value is <code>"\${STAGING_DIR}/\${MULTIMACH_HOST_SYS}"</code>.
<code>STAGING_DIR_NATIVE</code>	Specifies the path to the sysroot directory for the build host.
<code>STAGING_DIR_TARGET</code>	Specifies the path to the sysroot directory for the target for which the current recipe is being built. In most cases, this path is the <code>STAGING_DIR_HOST</code> .

Some recipes build binaries that can run on the target system but those binaries in turn generate code for another different system (e.g. cross-canadian recipes). Using terminology from GNU, the primary system is referred to as the "HOST" and the secondary, or different, system is referred to as the "TARGET". Thus, the binaries run on the "HOST" system and generate binaries for the "TARGET" system. `STAGING_DIR_TARGET` points to the sysroot used for the "TARGET" system.

`STAGING_ETCDIR_NATIVE`

Specifies the path to the `/etc` subdirectory of the sysroot directory for the build host.

`STAGING_EXECPREFIXDIR`

Specifies the path to the `/usr` subdirectory of the sysroot directory for the target for which the current recipe is being built (`STAGING_DIR_HOST`).

`STAGING_INCDIR`

Specifies the path to the `/usr/include` subdirectory of the sysroot directory for the target for which the current recipe being built (`STAGING_DIR_HOST`).

`STAGING_INCDIR_NATIVE`

Specifies the path to the `/usr/include` subdirectory of the sysroot directory for the build host.

`STAGING_KERNEL_BUILDDIR`

Points to the directory containing the kernel build artifacts. Recipes building software that needs to access kernel build artifacts (e.g. `systemtap-uprobes`) can look in the directory specified with the `STAGING_KERNEL_BUILDDIR` variable to find these artifacts after the kernel has been built.

`STAGING_KERNEL_DIR`

The directory with kernel headers that are required to build out-of-tree modules.

`STAGING_LIBDIR`

Specifies the path to the `/usr/lib` subdirectory of the sysroot directory for the target for which the current recipe is being built (`STAGING_DIR_HOST`).

`STAGING_LIBDIR_NATIVE`

Specifies the path to the `/usr/lib` subdirectory of the sysroot directory for the build host.

`STAMP`

Specifies the base path used to create recipe stamp files. The path to an actual stamp file

is constructed by evaluating this string and then appending additional information. Currently, the default assignment for `STAMP` as set in the `meta/conf/bitbake.conf` file is:

```
STAMP = "${STAMPS_DIR}/${MULTIMACH_TARGET_;
```

See `STAMPS_DIR`, `MULTIMACH_TARGET_SYS`, `PN`, `EXTENDPE`, `PV`, and `PR` for related variable information.

STAMPS_DIR

Specifies the base directory in which the OpenEmbedded build system places stamps. The default directory is `${TMPDIR}/stamps`.

STRIP

The minimal command and arguments to run `strip`, which is used to strip symbols.

SUMMARY

The short (72 characters or less) summary of the binary package for packaging systems such as `opkg`, `rpm` or `dpkg`. By default, `SUMMARY` is used to define the `DESCRIPTION` variable if `DESCRIPTION` is not set in the recipe.

SVNDIR

The directory in which files checked out of a Subversion system are stored.

SYSLINUX_DEFAULT_CONSOLE

Specifies the kernel boot default console. If you want to use a console other than the default, set this variable in your recipe as follows where "X" is the console number you want to use:

```
SYSLINUX_DEFAULT_CONSOLE = "console=ttyX"
```

The `syslinux` class initially sets this variable to null but then checks for a value later.

SYSLINUX_OPTS

Lists additional options to add to the `syslinux` file. You need to set this variable in your recipe. If you want to list multiple options, separate the options with a semicolon character (;).

The `syslinux` class uses this variable to create a set of options.

SYSLINUX_SERIAL

Specifies the alternate serial port or turns it off. To turn off serial, set this variable to an empty string in your recipe. The variable's default value is set in the `syslinux` as follows:

```
SYSLINUX_SERIAL ?= "0 115200"
```

SYSINUX_SPLASH

The class checks for and uses the variable as needed.

An `.LSS` file used as the background for the VGA boot menu when you are using the boot menu. You need to set this variable in your recipe.

The `syslinux` class checks for this variable and if found, the OpenEmbedded build system installs the splash screen.

SYSINUX_SERIAL_TTY

Specifies the alternate console=`tty...` kernel boot argument. The variable's default value is set in the `syslinux` as follows:

```
SYSINUX_SERIAL_TTY ?= "console=ttyS0,115200"
```

The class checks for and uses the variable as needed.

SYSROOT_PREPROCESS_FUNCS

A list of functions to execute after files are staged into the sysroot. These functions are usually used to apply additional processing on the staged files, or to stage additional files.

SYSTEMD_AUTO_ENABLE

When inheriting the `systemd` class, this variable specifies whether the service you have specified in `SYSTEMD_SERVICE` should be started automatically or not. By default, the service is enabled to automatically start at boot time. The default setting is in the `systemd` class as follows:

```
SYSTEMD_AUTO_ENABLE ??= "enable"
```

You can disable the service by setting the variable to "disable".

SYSTEMD_PACKAGES

When inheriting the `systemd` class, this variable locates the systemd unit files when they are not found in the main recipe's package. By default, the `SYSTEMD_PACKAGES` variable is set such that the systemd unit files are assumed to reside in the recipes main package:

```
SYSTEMD_PACKAGES ?= "${PN}"
```

If these unit files are not in this recipe's main package, you need to use `SYSTEMD_PACKAGES` to list the package or packages in which the build system can find the systemd unit files.

SYSTEMD_SERVICE

When inheriting the `systemd` class, this variable specifies the systemd service name

for a package.

When you specify this file in your recipe, use a package name override to indicate the package to which the value applies. Here is an example from the connman recipe:

```
SYSTEMD_SERVICE_${PN} = "connman.service"
```

SYSVINIT_ENABLED_GETTYS

When using SysVinit, specifies a space-separated list of the virtual terminals that should be running a getty (allowing login), assuming USE_VT is not set to "0".

The default value for SYSVINIT_ENABLED_GETTYS is "1" (i.e. only run a getty on the first virtual terminal).

T

T

This variable points to a directory where BitBake places temporary files, which consist mostly of task logs and scripts, when building a particular recipe. The variable is typically set as follows:

```
T = "${WORKDIR}/temp"
```

The WORKDIR is the directory into which BitBake unpacks and builds the recipe. The default `bitbake.conf` file sets this variable.

The T variable is not to be confused with the TMPDIR variable, which points to the root of the directory tree where BitBake places the output of an entire build.

TARGET_ARCH

The target machine's architecture. The OpenEmbedded build system supports many architectures. Here is an example list of architectures supported. This list is by no means complete as the architecture is configurable:

```
arm
i586
x86_64
powerpc
powerpc64
mips
mipsel
```

For additional information on machine architectures, see the TUNE_ARCH variable.

TARGET_AS_ARCH

Specifies architecture-specific assembler flags for the target system. TARGET_AS_ARCH is initialized from TUNE_ASARGS by default in the BitBake configuration file (`meta/conf/bitbake.conf`):

TARGET_AS_ARCH = "\${TUNE_ASARGS}"

TARGET_CC_ARCH

Specifies architecture-specific C compiler flags for the target system. `TARGET_CC_ARCH` is initialized from `TUNE_CCARGS` by default.

Note

It is a common workaround to append `LDFLAGS` to `TARGET_CC_ARCH` in recipes that build software for the target that would not otherwise respect the exported `LDFLAGS` variable.

TARGET_CC_KERNEL_ARCH

This is a specific kernel compiler flag for a CPU or Application Binary Interface (ABI) tune. The flag is used rarely and only for cases where a userspace `TUNE_CCARGS` is not compatible with the kernel compilation. The `TARGET_CC_KERNEL_ARCH` variable allows the kernel (and associated modules) to use a different configuration. See the `meta/conf/machine/include/arm/feature-arm-thumb.inc` file in the [Source Directory](#) for an example.

TARGET_CFLAGS

Specifies the flags to pass to the C compiler when building for the target. When building in the target context, `CFLAGS` is set to the value of this variable by default.

Additionally, the SDK's environment setup script sets the `CFLAGS` variable in the environment to the `TARGET_CFLAGS` value so that executables built using the SDK also have the flags applied.

TARGET_CPPFLAGS

Specifies the flags to pass to the C pre-processor (i.e. to both the C and the C++ compilers) when building for the target. When building in the target context, `CPPFLAGS` is set to the value of this variable by default.

Additionally, the SDK's environment setup script sets the `CPPFLAGS` variable in the environment to the `TARGET_CPPFLAGS` value so that executables built using the SDK also have the flags applied.

TARGET_CXXFLAGS

Specifies the flags to pass to the C++ compiler when building for the target. When building in the target context, `CXXFLAGS` is set to the value of this variable by default.

Additionally, the SDK's environment setup script sets the `CXXFLAGS` variable in the environment to the `TARGET_CXXFLAGS` value so that executables built using the SDK also have the flags applied.

`TARGET_FPU`

Specifies the method for handling FPU code. For FPU-less targets, which include most ARM CPUs, the variable must be set to "soft". If not, the kernel emulation gets used, which results in a performance penalty.

`TARGET_LD_ARCH`

Specifies architecture-specific linker flags for the target system. `TARGET_LD_ARCH` is initialized from `TUNE_LDARGS` by default in the BitBake configuration file (`meta/conf/bitbake.conf`):

```
TARGET_LD_ARCH = "${TUNE_LDARGS}"
```

`TARGET_LDFLAGS`

Specifies the flags to pass to the linker when building for the target. When building in the target context, `LD_FLAGS` is set to the value of this variable by default.

Additionally, the SDK's environment setup script sets the `LD_FLAGS` variable in the environment to the `TARGET_LDFLAGS` value so that executables built using the SDK also have the flags applied.

`TARGET_OS`

Specifies the target's operating system. The variable can be set to "linux" for glibc-based systems and to "linux-uclibc" for uclibc. For ARM/EABI targets, there are also "linux-gnueabi" and "linux-uclibc-gnueabi" values possible.

`TARGET_PREFIX`

Specifies the prefix used for the toolchain binary target tools.

Depending on the type of recipe and the build target, `TARGET_PREFIX` is set as follows:

- For recipes building for the target machine, the value is "\${`TARGET_SYS`}-".
- For native recipes, the build system sets the variable to the value of `BUILD_PREFIX`.
- For nativesdk recipes, the build system sets the variable to the value of `SDK_PREFIX`.

`TARGET_SYS`

Specifies the system, including the

architecture and the operating system, for which the build is occurring in the context of the current recipe.

The OpenEmbedded build system automatically sets this variable based on `TARGET_ARCH`, `TARGET_VENDOR`, and `TARGET_OS` variables.

Note

You do not need to set the `TARGET_SYS` variable yourself.

Consider these two examples:

- Given a native recipe on a 32-bit, x86 machine running Linux, the value is "i686-linux".
- Given a recipe being built for a little-endian, MIPS target running Linux, the value might be "mipsel-linux".

`TARGET_VENDOR`

Specifies the name of the target vendor.

`TCLIBCAPPEND`

Specifies a suffix to be appended onto the `TMPDIR` value. The suffix identifies the `libc` variant for building. When you are building for multiple variants with the same [Build Directory](#), this mechanism ensures that output for different `libc` variants is kept separate to avoid potential conflicts.

In the `defaultsetup.conf` file, the default value of `TCLIBCAPPEND` is `"-${TCLIBC}"`. However, distros such as poky, which normally only support one `libc` variant, set `TCLIBCAPPEND` to `"` in their distro configuration file resulting in no suffix being applied.

`TCLIBC`

Specifies the GNU standard C library (`libc`) variant to use during the build process. This variable replaces `POKYLIBC`, which is no longer supported.

You can select `"glibc"` or `"uclibc"`.

`TCMODE`

Specifies the toolchain selector. `TCMODE` controls the characteristics of the generated packages and images by telling the OpenEmbedded build system which toolchain profile to use. By default, the OpenEmbedded build system builds its own internal toolchain. The variable's default value is `"default"`, which uses that internal toolchain.

Note

If `TCMODE` is set to a value other than "default", then it is your responsibility to ensure that the toolchain is compatible with the default toolchain. Using older or newer versions of these components might cause build problems. See the [Release Notes](#) for the specific components with which the toolchain must be compatible.

The `TCMODE` variable is similar to `TCLIBC`, which controls the variant of the GNU standard C library (`libc`) used during the build process: `glibc` or `uclibc`.

With additional layers, it is possible to use a pre-compiled external toolchain. One example is the Sourcery G++ Toolchain. The support for this toolchain resides in the separate Mentor Graphics® meta-sourcery layer at <http://github.com/MentorEmbedded/meta-sourcery/>.

The layer's `README` file contains information on how to use the Sourcery G++ Toolchain as an external toolchain. In summary, you must be sure to add the layer to your `bblayers.conf` file in front of the meta layer and then set the `EXTERNAL_TOOLCHAIN` variable in your `local.conf` file to the location in which you installed the toolchain.

The fundamentals used for this example apply to any external toolchain. You can use meta-sourcery as a template for adding support for other external toolchains.

TEST_EXPORT_DIR

The location the OpenEmbedded build system uses to export tests when the `TEST_EXPORT_ONLY` variable is set to "1".

The `TEST_EXPORT_DIR` variable defaults to `"${TMPDIR}/testimage/${PN}"`.

TEST_EXPORT_ONLY

Specifies to export the tests only. Set this variable to "1" if you do not want to run the tests but you want them to be exported in a manner that you to run them outside of the build system.

TEST_IMAGE

Automatically runs the series of automated tests for images when an image is successfully built.

These tests are written in Python making use of the `unittest` module, and the majority of them run commands on the target system over `ssh`. You can set this variable to "1" in your `local.conf` file in the [Build Directory](#) to have the OpenEmbedded build system automatically run these tests after an image successfully builds:

```
TEST_IMAGE = "1"
```

For more information on enabling, running, and writing these tests, see the "[Performing Automated Runtime Testing](#)" section in the Yocto Project Development Manual and the "[testimage*.bbclass](#)" section.

TEST_LOG_DIR ¶

Holds the SSH log and the boot log for QEMU machines. The `TEST_LOG_DIR` variable defaults to "`${WORKDIR}/testimage`".

Note

Actual test results reside in the task log (`log.do_testimage`), which is in the `${WORKDIR}/temp/` directory.

TEST_POWERCONTROL_CMD ¶

For automated hardware testing, specifies the command to use to control the power of the target machine under test. Typically, this command would point to a script that performs the appropriate action (e.g. interacting with a web-enabled power strip). The specified command should expect to receive as the last argument "off", "on" or "cycle" specifying to power off, on, or cycle (power off and then power on) the device, respectively.

TEST_POWERCONTROL_EXTRA_ARGS ¶

For automated hardware testing, specifies additional arguments to pass through to the command specified in [TEST_POWERCONTROL_CMD](#). Setting `TEST_POWERCONTROL_EXTRA_ARGS` is optional. You can use it if you wish, for example, to separate the machine-specific and non-machine-specific parts of the arguments.

TEST_QEMUBOOT_TIMEOUT ¶

The time in seconds allowed for an image to boot before automated runtime tests begin to run against an image. The default timeout period to allow the boot process to reach the login prompt is 500 seconds. You can specify a different value in the `local.conf` file.

For more information on testing images, see

the "[Performing Automated Runtime Testing](#)" section in the Yocto Project Development Manual.

TEST_SERIALCONTROL_CMD

For automated hardware testing, specifies the command to use to connect to the serial console of the target machine under test. This command simply needs to connect to the serial console and forward that connection to standard input and output as any normal terminal program does.

For example, to use the Picocom terminal program on serial device `/dev/ttyUSB0` at 115200bps, you would set the variable as follows:

```
TEST_SERIALCONTROL_CMD = "picocom /dev/ttyl
```

TEST_SERIALCONTROL_EXTRA_ARGS

For automated hardware testing, specifies additional arguments to pass through to the command specified in [TEST_SERIALCONTROL_CMD](#). Setting `TEST_SERIALCONTROL_EXTRA_ARGS` is optional. You can use it if you wish, for example, to separate the machine-specific and non-machine-specific parts of the command.

TEST_SERVER_IP

The IP address of the build machine (host machine). This IP address is usually automatically detected. However, if detection fails, this variable needs to be set to the IP address of the build machine (i.e. where the build is taking place).

Note

The `TEST_SERVER_IP` variable is only used for a small number of tests such as the "smart" test suite, which needs to download packages from `DEPLOY_DIR/rpm`.

TEST_TARGET

Specifies the target controller to use when running tests against a test image. The default controller to use is "qemu":

```
TEST_TARGET = "qemu"
```

A target controller is a class that defines how an image gets deployed on a target and how a target is started. A layer can extend the controllers by adding a module in the layer's `/lib/oeqa/controllers` directory and by inheriting the `BaseTarget` class, which is an

abstract class that cannot be used as a value of `TEST_TARGET`.

You can provide the following arguments with `TEST_TARGET`:

- **"qemu" and "QemuTarget"**: Boots a QEMU image and runs the tests. See the ["Enabling Runtime Tests on QEMU"](#) section in the Yocto Project Development Manual for more information.
- **"simpleremote" and "SimpleRemoteTarget"**: Runs the tests on target hardware that is already up and running. The hardware can be on the network or it can be a device running an image on QEMU. You must also set `TEST_TARGET_IP` when you use "simpleremote" or "SimpleRemoteTarget".

Note

This argument is defined in `meta/lib/oeqa/targetcontrol.py`. The small caps names are kept for compatibility reasons.

- **"GummibootTarget"**: Automatically deploys and runs tests on an EFI-enabled machine that has a master image installed.

Note

This argument is defined in `meta/lib/oeqa/controllers/masterimage.py`.

For information on running tests on hardware, see the ["Enabling Runtime Tests on Hardware"](#) section in the Yocto Project Development Manual.

TEST_TARGET_IP

The IP address of your hardware under test. The `TEST_TARGET_IP` variable has no effect when `TEST_TARGET` is set to "qemu".

When you specify the IP address, you can also include a port. Here is an example:

```
TEST_TARGET_IP = "192.168.1.4:2201"
```

Specifying a port is useful when SSH is started on a non-standard port or in cases when your hardware under test is behind a firewall or network that is not directly accessible from your host and you need to do port address translation.

TEST_SUITES

An ordered list of tests (modules) to run against an image when performing automated runtime testing.

The OpenEmbedded build system provides a core set of tests that can be used against images.

Note

Currently, there is only support for running these tests under QEMU.

Tests include `ping`, `ssh`, `df` among others. You can add your own tests to the list of tests by appending `TEST_SUITES` as follows:

```
TEST_SUITES_append = " mytest"
```

Alternatively, you can provide the "auto" option to have all applicable tests run against the image.

```
TEST_SUITES_append = " auto"
```

Using this option causes the build system to automatically run tests that are applicable to the image. Tests that are not applicable are skipped.

The order in which tests are run is important. Tests that depend on another test must appear later in the list than the test on which they depend. For example, if you append the list of tests with two tests (`test_A` and `test_B`) where `test_B` is dependent on `test_A`, then you must order the tests as follows:

```
TEST_SUITES = " test_A test_B"
```

For more information on testing images, see the "[Performing Automated Runtime Testing](#)" section in the Yocto Project Development Manual.

THISDIR

The directory in which the file `BitBake` is currently parsing is located. Do not manually set this variable.

TIME

The time the build was started. Times appear using the hour, minute, and second (HMS) format (e.g. "140159" for one minute and fifty-nine seconds past 1400 hours).

TMPDIR

This variable is the base directory the OpenEmbedded build system uses for all build output and intermediate files (other

than the shared state cache). By default, the `TMPDIR` variable points to `tmp` within the [Build Directory](#).

If you want to establish this directory in a location other than the default, you can uncomment and edit the following statement in the `conf/local.conf` file in the [Source Directory](#):

```
#TMPDIR = "${TOPDIR}/tmp"
```

An example use for this scenario is to set `TMPDIR` to a local disk, which does not use NFS, while having the Build Directory use NFS.

The filesystem used by `TMPDIR` must have standard filesystem semantics (i.e. mixed-case files are unique, POSIX file locking, and persistent inodes). Due to various issues with NFS and bugs in some implementations, NFS does not meet this minimum requirement. Consequently, `TMPDIR` cannot be on NFS.

TOOLCHAIN_HOST_TASK

This variable lists packages the OpenEmbedded build system uses when building an SDK, which contains a cross-development environment. The packages specified by this variable are part of the toolchain set that runs on the [SDKMACHINE](#), and each package should usually have the prefix "nativesdk-". When building an SDK using `bitbake -c populate_sdk <imagename>`, a default list of packages is set in this variable, but you can add additional packages to the list.

For background information on cross-development toolchains in the Yocto Project development environment, see the "[Cross-Development Toolchain Generation](#)" section. For information on setting up a cross-development environment, see the "[Installing the ADT and Toolchains](#)" section in the Yocto Project Application Developer's Guide.

TOOLCHAIN_OUTPUTNAME

This variable defines the name used for the toolchain output. The `populate_sdk_base` class sets the `TOOLCHAIN_OUTPUTNAME` variable as follows:

```
TOOLCHAIN_OUTPUTNAME ?= "${SDK_NAME}-toolchain"
```

See the [SDK_NAME](#) and [SDK_VERSION](#) variables for additional information.

TOOLCHAIN_TARGET_TASK

This variable lists packages the OpenEmbedded build system uses when it creates the target part of an SDK (i.e. the part built for the target hardware), which includes libraries and headers.

For background information on cross-development toolchains in the Yocto Project development environment, see the "[Cross-Development Toolchain Generation](#)" section. For information on setting up a cross-development environment, see the "[Installing the ADT and Toolchains](#)" section in the Yocto Project Application Developer's Guide.

TOPDIR

The top-level [Build Directory](#). BitBake automatically sets this variable when you initialize your build environment using either `oe-init-build-env` or `oe-init-build-env-memres`.

TRANSLATED_TARGET_ARCH

A sanitized version of [TARGET_ARCH](#). This variable is used where the architecture is needed in a value where underscores are not allowed, for example within package filenames. In this case, dash characters replace any underscore characters used in [TARGET_ARCH](#).

Do not edit this variable.

TUNE_ARCH

The GNU canonical architecture for a specific architecture (i.e. arm, armeb, mips, mips64, and so forth). BitBake uses this value to setup configuration.

[TUNE_ARCH](#) definitions are specific to a given architecture. The definitions can be a single static definition, or can be dynamically adjusted. You can see details for a given CPU family by looking at the architecture's [README](#) file. For example, the `meta/conf/machine/include/mips/README` file in the [Source Directory](#) provides information for [TUNE_ARCH](#) specific to the mips architecture.

[TUNE_ARCH](#) is tied closely to [TARGET_ARCH](#), which defines the target machine's architecture. The BitBake configuration file (`meta/conf/bitbake.conf`) sets [TARGET_ARCH](#) as follows:

```
TARGET_ARCH = "${TUNE_ARCH}"
```

The following list, which is by no means complete since architectures are

configurable, shows supported machine architectures:

```
arm
i586
x86_64
powerpc
powerpc64
mips
mipsel
```

TUNE_ASARGS

Specifies architecture-specific assembler flags for the target system. The set of flags is based on the selected tune features. `TUNE_ASARGS` is set using the tune include files, which are typically under `meta/conf/machine/include/` and are influenced through `TUNE_FEATURES`. For example, the `meta/conf/machine/include/x86/arch-x86.inc` file defines the flags for the x86 architecture as follows:

```
TUNE_ASARGS += "${@bb.utils.contains("TUNE_
```

Note

Board Support Packages (BSPs) select the tune. The selected tune, in turn, affects the tune variables themselves (i.e. the tune can supply its own set of flags).

TUNE_CCARGS

Specifies architecture-specific C compiler flags for the target system. The set of flags is based on the selected tune features. `TUNE_CCARGS` is set using the tune include files, which are typically under `meta/conf/machine/include/` and are influenced through `TUNE_FEATURES`.

Note

Board Support Packages (BSPs) select the tune. The selected tune, in turn, affects the tune variables themselves (i.e. the tune can supply its own set of flags).

TUNE_LDARGS

Specifies architecture-specific linker flags for the target system. The set of flags is based on the selected tune features. `TUNE_LDARGS` is set using the tune include files, which are typically under `meta/conf/machine/include/` and are influenced through `TUNE_FEATURES`. For example, the

meta/conf/machine/include/x86/arch-x86.inc file defines the flags for the x86 architecture as follows:

```
TUNE_LDARGS += "${@bb.utils.contains("TUNE_
```

Note

Board Support Packages (BSPs) select the tune. The selected tune, in turn, affects the tune variables themselves (i.e. the tune can supply its own set of flags).

TUNE_FEATURES

Features used to "tune" a compiler for optimal use given a specific processor. The features are defined within the tune files and allow arguments (i.e. TUNE_*ARGS) to be dynamically generated based on the features.

The OpenEmbedded build system verifies the features to be sure they are not conflicting and that they are supported.

The BitBake configuration file (meta/conf/bitbake.conf) defines TUNE_FEATURES as follows:

```
TUNE_FEATURES ??= "${TUNE_FEATURES_tune-${
```

See the [DEFAULTTUNE](#) variable for more information.

TUNE_PKGARCH

The package architecture understood by the packaging system to define the architecture, ABI, and tuning of output packages. The specific tune is defined using the "_tune" override as follows:

```
TUNE_PKGARCH_tune-tune = "tune"
```

These tune-specific package architectures are defined in the machine include files. Here is an example of the "core2-32" tuning as used in the meta/conf/machine/include/tune-core2.inc file:

```
TUNE_PKGARCH_tune-core2-32 = "core2-32"
```

TUNEABI

An underlying Application Binary Interface (ABI) used by a particular tuning in a given toolchain layer. Providers that use prebuilt libraries can use the TUNEABI, [TUNEABI_OVERRIDE](#), and [TUNEABI_WHITELIST](#) variables to check compatibility of tunings

against their selection of libraries.

If `TUNEABI` is undefined, then every tuning is allowed. See the [sanity](#) class to see how the variable is used.

`TUNEABI_OVERRIDE`

If set, the OpenEmbedded system ignores the `TUNEABI_WHITELIST` variable. Providers that use prebuilt libraries can use the `TUNEABI_OVERRIDE`, `TUNEABI_WHITELIST`, and `TUNEABI` variables to check compatibility of a tuning against their selection of libraries.

See the [sanity](#) class to see how the variable is used.

`TUNEABI_WHITELIST`

A whitelist of permissible `TUNEABI` values. If `TUNEABI_WHITELIST` is not set, all tunes are allowed. Providers that use prebuilt libraries can use the `TUNEABI_WHITELIST`, `TUNEABI_OVERRIDE`, and `TUNEABI` variables to check compatibility of a tuning against their selection of libraries.

See the [sanity](#) class to see how the variable is used.

`TUNECONFLICTS[feature]`

Specifies CPU or Application Binary Interface (ABI) tuning features that conflict with *feature*.

Known tuning conflicts are specified in the machine include files in the [Source Directory](#). Here is an example from the `meta/conf/machine/include/mips/arch-mips.inc` include file that lists the "o32" and "n64" features as conflicting with the "n32" feature:

```
TUNECONFLICTS[n32] = "o32 n64"
```

`TUNEVALID[feature]`

Specifies a valid CPU or Application Binary Interface (ABI) tuning feature. The specified feature is stored as a flag. Valid features are specified in the machine include files (e.g. `meta/conf/machine/include/arm/arch-arm.inc`). Here is an example from that file:

```
TUNEVALID[bigendian] = "Enable big-endian "
```

See the machine include files in the [Source Directory](#) for these features.

U

`UBOOT_CONFIG`

Configures the `UBOOT_MACHINE` and can also

define `IMAGE_FSTYPES` for individual cases.

Following is an example from the meta-fsl-arm layer.

```
UBOOT_CONFIG ??= "sd"
UBOOT_CONFIG[sd] = "mx6qsabreauto_config,sd"
UBOOT_CONFIG[eimnor] = "mx6qsabreauto_eimnor"
UBOOT_CONFIG[nand] = "mx6qsabreauto_nand_config"
UBOOT_CONFIG[spinor] = "mx6qsabreauto_spinor"
```

In this example, "sd" is selected as the configuration of the possible four for the `UBOOT_MACHINE`. The "sd" configuration defines "mx6qsabreauto_config" as the value for `UBOOT_MACHINE`, while the "sdcard" specifies the `IMAGE_FSTYPES` to use for the U-boot image.

For more information on how the `UBOOT_CONFIG` is handled, see the [uboot-config](#) class.

`UBOOT_ENTRYPOINT`

Specifies the entry point for the U-Boot image. During U-Boot image creation, the `UBOOT_ENTRYPOINT` variable is passed as a command-line parameter to the `uboot-mkimage` utility.

`UBOOT_LOADADDRESS`

Specifies the load address for the U-Boot image. During U-Boot image creation, the `UBOOT_LOADADDRESS` variable is passed as a command-line parameter to the `uboot-mkimage` utility.

`UBOOT_LOCALVERSION`

Appends a string to the name of the local version of the U-Boot image. For example, assuming the version of the U-Boot image built was "2013.10", the full version string reported by U-Boot would be "2013.10-yocto" given the following statement:

```
UBOOT_LOCALVERSION = "-yocto"
```

`UBOOT_MACHINE`

Specifies the value passed on the `make` command line when building a U-Boot image. The value indicates the target platform configuration. You typically set this variable from the machine configuration file (i.e. `conf/machine/machine_name.conf`).

Please see the "Selection of Processor Architecture and Board Type" section in the U-Boot README for valid values for this variable.

`UBOOT_MAKE_TARGET`

Specifies the target called in the Makefile. The default target is "all".

UBOOT_SUFFIX

Points to the generated U-Boot extension. For example, `u-boot.sb` has a `.sb` extension.

The default U-Boot extension is `.bin`

UBOOT_TARGET

Specifies the target used for building U-Boot. The target is passed directly as part of the "make" command (e.g. `SPL` and `AIS`). If you do not specifically set this variable, the OpenEmbedded build process passes and uses "all" for the target during the U-Boot building process.

UNKNOWN_CONFIGURE_WHITELIST

Specifies a list of options that, if reported by the configure script as being invalid, should not generate a warning during the `do_configure` task. Normally, invalid configure options are simply not passed to the configure script (e.g. should be removed from `EXTRA_OECONF`). However, common options, for example, exist that are passed to all configure scripts at a class level that might not be valid for some configure scripts. It follows that no benefit exists in seeing a warning about these options. For these cases, the options are added to `UNKNOWN_CONFIGURE_WHITELIST`.

The configure arguments check that uses `UNKNOWN_CONFIGURE_WHITELIST` is part of the `insane` class and is only enabled if the recipe inherits the `autotools` class.

UPDATERCPN

For recipes inheriting the `update-rc.d` class, `UPDATERCPN` specifies the package that contains the initscript that is to be enabled.

The default value is `"${PN}"`. Given that almost all recipes that install initscripts package them in the main package for the recipe, you rarely need to set this variable in individual recipes.

USE_DEVFS

Determines if `devtmpfs` is used for `/dev` population. The default value used for `USE_DEVFS` is "1" when no value is specifically set. Typically, you would set `USE_DEVFS` to "0" for a statically populated `/dev` directory.

See the "[Selecting a Device Manager](#)" section in the Yocto Project Development Manual for information on how to use this variable.

USE_VT

When using `SysVinit`, determines whether or not to run a `getty` on any virtual terminals in

order to enable logging in through those terminals.

The default value used for `USE_VT` is "1" when no default value is specifically set. Typically, you would set `USE_VT` to "0" in the machine configuration file for machines that do not have a graphical display attached and therefore do not need virtual terminal functionality.

USER_CLASSES

A list of classes to globally inherit. These classes are used by the OpenEmbedded build system to enable extra features (e.g. `buildstats`, `image-mklibs`, and so forth).

The default list is set in your `local.conf` file:

```
USER_CLASSES ?= "buildstats image-mklibs i
```

For more information, see `meta-yocto/conf/local.conf.sample` in the [Source Directory](#).

USERADD_ERROR_DYNAMIC

Forces the OpenEmbedded build system to produce an error if the user identification (`uid`) and group identification (`gid`) values are not defined in `files/passwd` and `files/group` files.

The default behavior for the build system is to dynamically apply `uid` and `gid` values. Consequently, the `USERADD_ERROR_DYNAMIC` variable is by default not set. If you plan on using statically assigned `gid` and `uid` values, you should set the `USERADD_ERROR_DYNAMIC` variable in your `local.conf` file as follows:

```
USERADD_ERROR_DYNAMIC = "1"
```

Overriding the default behavior implies you are going to also take steps to set static `uid` and `gid` values through use of the [`USERADDEXTENSION`](#), [`USERADD_UID_TABLES`](#), and [`USERADD_GID_TABLES`](#) variables.

USERADD_GID_TABLES

Specifies a password file to use for obtaining static group identification (`gid`) values when the OpenEmbedded build system adds a group to the system during package installation.

When applying static group identification (`gid`) values, the OpenEmbedded build system looks in [`BBPATH`](#) for a `files/group` file and then applies those `uid` values. Set the variable as follows in your `local.conf`

file:

```
USERADD_GID_TABLES = "files/group"
```

Note

Setting the USERADDEXTENSION variable to "useradd-staticids" causes the build system to use static gid values.

USERADD_PACKAGES

When inheriting the useradd class, this variable specifies the individual packages within the recipe that require users and/or groups to be added.

You must set this variable if the recipe inherits the class. For example, the following enables adding a user for the main package in a recipe:

```
USERADD_PACKAGES = "${PN}"
```

Note

It follows that if you are going to use the USERADD_PACKAGES variable, you need to set one or more of the USERADD_PARAM, GROUPADD_PARAM, or GROUPMEMS_PARAM variables.

USERADD_PARAM

When inheriting the useradd class, this variable specifies for a package what parameters should be passed to the useradd command if you wish to add a user to the system when the package is installed.

Here is an example from the dbus recipe:

```
USERADD_PARAM_${PN} = "--system --home ${HOME} \
--no-create-home -- \
--user-group messagebus"
```

For information on the standard Linux shell command useradd, see <http://linux.die.net/man/8/useradd>.

USERADD_UID_TABLES

Specifies a password file to use for obtaining static user identification (uid) values when the OpenEmbedded build system adds a user to the system during package installation.

When applying static user identification (uid) values, the OpenEmbedded build system looks in BBPATH for a files/passwd file and then applies those uid values. Set the variable as follows in your local.conf file:

```
USERADD_UID_TABLES = "files/passwd"
```

Note

Setting the `USERADDEXTENSION` variable to "useradd-staticids" causes the build system to use static uid values.

USERADDEXTENSION ¶

When set to "useradd-staticids", causes the OpenEmbedded build system to base all user and group additions on a static `passwd` and `group` files found in `BBPATH`.

To use static user identification (`uid`) and group identification (`gid`) values, set the variable as follows in your `local.conf` file:

```
USERADDEXTENSION = "useradd-staticids"
```

Note

Setting this variable to use static `uid` and `gid` values causes the OpenEmbedded build system to employ the `useradd-staticids` class.

If you use static `uid` and `gid` information, you must also specify the `files/passwd` and `files/group` files by setting the `USERADD_UID_TABLES` and `USERADD_GID_TABLES` variables. Additionally, you should also set the `USERADD_ERROR_DYNAMIC` variable.

W

WARN_QA ¶

Specifies the quality assurance checks whose failures are reported as warnings by the OpenEmbedded build system. You set this variable in your distribution configuration file. For a list of the checks you can control with this variable, see the "`insane.bbclass`" section.

WORKDIR ¶

The pathname of the work directory in which the OpenEmbedded build system builds a recipe. This directory is located within the `TMPDIR` directory structure and is specific to the recipe being built and the system for which it is being built.

The `WORKDIR` directory is defined as follows:

```
${TMPDIR}/work/${MULTIMACH_TARGET_SYS}/${PI
```

The actual directory depends on several things:

- TMPDIR: The top-level build output directory
- MULTIMACH_TARGET_SYS: The target system identifier
- PN: The recipe name
- EXTENDPE: The epoch - (if PE is not specified, which is usually the case for most recipes, then EXTENDPE is blank)
- PV: The recipe version
- PR: The recipe revision

As an example, assume a Source Directory top-level folder name poky, a default Build Directory at poky/build, and a qemux86-poky-linux machine target system.

Furthermore, suppose your recipe is named foo_1.3.0-r0.bb. In this case, the work directory the build system uses to build the package would be as follows:

```
poky/build/tmp/work/qemux86-poky-linux/foo
```

X

XSERVER

Specifies the packages that should be installed to provide an X server and drivers for the current machine, assuming your image directly includes packagegroup-core-x11-xserver or, perhaps indirectly, includes "x11-base" in IMAGE_FEATURES.

The default value of XSERVER, if not specified in the machine configuration, is "xserver-xorg xf86-video-fbdev xf86-input-evdev".

Chapter 13. Variable Context

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While you can use most variables in almost any context such as .conf, .bbclass, .inc, and .bb files, some variables are often associated with a particular locality or context. This chapter describes some common associations.

13.1. Configuration¶

The following subsections provide lists of variables whose context is configuration: distribution, machine, and local.

13.1.1. Distribution (Distro)¶

This section lists variables whose configuration context is the distribution, or distro.

- DISTRO
- DISTRO_NAME
- DISTRO_VERSION
- MAINTAINER
- PACKAGE_CLASSES
- TARGET_OS
- TARGET_FPU
- TCMODE
- TCLIBC

13.1.2. Machine¶

This section lists variables whose configuration context is the machine.

- TARGET_ARCH
- SERIAL_CONSOLES
- PACKAGE_EXTRA_ARCHS
- IMAGE_FSTYPES
- MACHINE_FEATURES
- MACHINE_EXTRA_RDEPENDS
- MACHINE_EXTRA_RRECOMMENDS
- MACHINE_ESSENTIAL_EXTRA_RDEPENDS
- MACHINE_ESSENTIAL_EXTRA_RRECOMMENDS

13.1.3. Local¶

This section lists variables whose configuration context is the local configuration through the `local.conf` file.

- DISTRO
- MACHINE
- DL_DIR
- BBFILES
- EXTRA_IMAGE_FEATURES

- PACKAGE_CLASSES
- BB_NUMBER_THREADS
- BBINCLUDELOGS
- ENABLE_BINARY_LOCALE_GENERATION

13.2. Recipes ¶

The following subsections provide lists of variables whose context is recipes: required, dependencies, path, and extra build information.

13.2.1. Required ¶

This section lists variables that are required for recipes.

- LICENSE
- LIC_FILES_CHKSUM
- SRC_URI - used in recipes that fetch local or remote files.

13.2.2. Dependencies ¶

This section lists variables that define recipe dependencies.

- DEPENDS
- RDEPENDS
- RRECOMMENDS
- RCONFLICTS
- RREPLACES

13.2.3. Paths ¶

This section lists variables that define recipe paths.

- WORKDIR
- S
- FILES

13.2.4. Extra Build Information ¶

This section lists variables that define extra build information for recipes.

- EXTRA_OECMAKE
- EXTRA_OECONF
- EXTRA_OEMAKE
- PACKAGES
- DEFAULT_PREFERENCE

Chapter 14. FAQ

- 14.1. [How does Poky differ from OpenEmbedded?](#)
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14.1. How does Poky differ from OpenEmbedded?

The term "Poky" refers to the specific reference build system that the Yocto Project provides. Poky is based on [OE-Core](#) and [BitBake](#). Thus, the generic term used here for the build system is the "OpenEmbedded build system." Development in the Yocto Project using Poky is closely tied to OpenEmbedded, with changes always being merged to OE-Core or BitBake first before being pulled back into Poky. This practice benefits both projects immediately.

14.2. My development system does not meet the required Git, tar, and Python versions. In particular, I do not have Python 2.7.3 or greater, or I do have Python 3.x, which is specifically not supported by the Yocto Project. Can I still use the Yocto Project?

You can get the required tools on your host development system a couple different ways (i.e. building a tarball or downloading a tarball). See the "[Required Git, tar, and Python Versions](#)" section for steps on how to update your build tools.

14.3. How can you claim Poky / OpenEmbedded-Core is stable?

There are three areas that help with stability;

- The Yocto Project team keeps [OE-Core](#) small and focused, containing around 830 recipes as opposed to the thousands available in other OpenEmbedded community layers. Keeping it small makes it easy to test and maintain.
- The Yocto Project team runs manual and automated tests using a small, fixed set of reference hardware as well as emulated targets.

- The Yocto Project uses an autobuilder, which provides continuous build and integration tests.

14.4. How do I get support for my board added to the Yocto Project?

Support for an additional board is added by creating a Board Support Package (BSP) layer for it. For more information on how to create a BSP layer, see the "[Understanding and Creating Layers](#)" section in the Yocto Project Development Manual and the [Yocto Project Board Support Package \(BSP\) Developer's Guide](#).

Usually, if the board is not completely exotic, adding support in the Yocto Project is fairly straightforward.

14.5. Are there any products built using the OpenEmbedded build system?

The software running on the [Vernier LabQuest](#) is built using the OpenEmbedded build system. See the [Vernier LabQuest](#) website for more information. There are a number of pre-production devices using the OpenEmbedded build system and the Yocto Project team announces them as soon as they are released.

14.6. What does the OpenEmbedded build system produce as output?

Because you can use the same set of recipes to create output of various formats, the output of an OpenEmbedded build depends on how you start it. Usually, the output is a flashable image ready for the target device.

14.7. How do I add my package to the Yocto Project?

To add a package, you need to create a BitBake recipe. For information on how to create a BitBake recipe, see the "[Writing a New Recipe](#)" in the Yocto Project Development Manual.

14.8. Do I have to reflash my entire board with a new Yocto Project image when recompiling a package?

The OpenEmbedded build system can build packages in various formats such as IPK for OPKG, Debian package (.deb), or RPM. You can then upgrade the packages using the package tools on the device, much like on a desktop distribution such as Ubuntu or Fedora. However, package management on the target is entirely optional.

14.9. I see the error 'chmod: XXXXX new permissions are r-xrwxrwx, not r-xr-xr-x'. What is wrong?

You are probably running the build on an NTFS filesystem. Use ext2, ext3, or ext4 instead.

14.10. I see lots of 404 responses for files on http://www.yoctoproject.org/sources/*. Is something wrong?

Nothing is wrong. The OpenEmbedded build system checks any configured source mirrors before downloading from the upstream sources. The build system does this

searching for both source archives and pre-checked out versions of SCM-managed software. These checks help in large installations because it can reduce load on the SCM servers themselves. The address above is one of the default mirrors configured into the build system. Consequently, if an upstream source disappears, the team can place sources there so builds continue to work.

14.11. I have machine-specific data in a package for one machine only but the package is being marked as machine-specific in all cases, how do I prevent this?

Set `SRC_URI_OVERRIDES_PACKAGE_ARCH = "0"` in the `.bb` file but make sure the package is manually marked as machine-specific for the case that needs it. The code that handles `SRC_URI_OVERRIDES_PACKAGE_ARCH` is in the `meta/classes/base.bbclass` file.

14.12. I'm behind a firewall and need to use a proxy server. How do I do that?

Most source fetching by the OpenEmbedded build system is done by `wget` and you therefore need to specify the proxy settings in a `.wgetrc` file in your home directory. Here are some example settings:

```
http_proxy = http://proxy.yoyodyne.com:18023/  
ftp_proxy = http://proxy.yoyodyne.com:18023/
```

The Yocto Project also includes a `site.conf.sample` file that shows how to configure CVS and Git proxy servers if needed.

14.13. What's the difference between `target` and `target-native`?

The `*-native` targets are designed to run on the system being used for the build. These are usually tools that are needed to assist the build in some way such as `quilt-native`, which is used to apply patches. The non-native version is the one that runs on the target device.

14.14. I'm seeing random build failures. Help?!

If the same build is failing in totally different and random ways, the most likely explanation is:

- The hardware you are running the build on has some problem.
- You are running the build under virtualization, in which case the virtualization probably has bugs.

The OpenEmbedded build system processes a massive amount of data that causes lots of network, disk and CPU activity and is sensitive to even single-bit failures in any of these areas. True random failures have always been traced back to hardware or virtualization issues.

14.15. When I try to build a native recipe, the build fails with `iconv.h` problems.

If you get an error message that indicates GNU `libiconv` is not in use but `iconv.h` has been included from `libiconv`, you need to check to see if you have a previously installed version of the header file in `/usr/local/include`.

```
#error GNU libiconv not in use but included iconv.h is from libiconv
```

If you find a previously installed file, you should either uninstall it or temporarily rename it and try the build again.

This issue is just a single manifestation of "system leakage" issues caused when the OpenEmbedded build system finds and uses previously installed files during a native build. This type of issue might not be limited to `iconv.h`. Be sure that leakage cannot occur from `/usr/local/include` and `/opt` locations.

14.16. What do we need to ship for license compliance?

This is a difficult question and you need to consult your lawyer for the answer for your specific case. It is worth bearing in mind that for GPL compliance, there needs to be enough information shipped to allow someone else to rebuild and produce the same end result you are shipping. This means sharing the source code, any patches applied to it, and also any configuration information about how that package was configured and built.

You can find more information on licensing in the "[Licensing](#)" and "[Maintaining Open Source License Compliance During Your Product's Lifecycle](#)" sections, both of which are in the Yocto Project Development Manual.

14.17. How do I disable the cursor on my touchscreen device?

You need to create a form factor file as described in the "[Miscellaneous BSP-Specific Recipe Files](#)" section in the Yocto Project Board Support Packages (BSP) Developer's Guide. Set the `HAVE_TOUCHSCREEN` variable equal to one as follows:

```
HAVE_TOUCHSCREEN=1
```

14.18. How do I make sure connected network interfaces are brought up by default?

The default interfaces file provided by the netbase recipe does not automatically bring up network interfaces. Therefore, you will need to add a BSP-specific netbase that includes an interfaces file. See the "[Miscellaneous BSP-Specific Recipe Files](#)" section in the Yocto Project Board Support Packages (BSP) Developer's Guide for information on creating these types of miscellaneous recipe files.

For example, add the following files to your layer:

```
meta-MACHINE/recipes-bsp/netbase/netbase/MACHINE/interfaces
meta-MACHINE/recipes-bsp/netbase/netbase_5.0.bbappend
```

14.19. How do I create images with more free space?

By default, the OpenEmbedded build system creates images that are 1.3 times the size of the populated root filesystem. To affect the image size, you need to set various configurations:

- **Image Size:** The OpenEmbedded build system uses the `IMAGE_ROOTFS_SIZE` variable to define the size of the image in Kbytes. The build system determines the size by taking into account the initial root filesystem size before any modifications such as requested size for the image and any requested additional free disk space to be added to the image.
- **Overhead:** Use the `IMAGE_OVERHEAD_FACTOR` variable to define the multiplier that the build system applies to the initial image size, which is 1.3 by default.

- **Additional Free Space:** Use the `IMAGE_ROOTFS_EXTRA_SPACE` variable to add additional free space to the image. The build system adds this space to the image after it determines its `IMAGE_ROOTFS_SIZE`.

14.20. Why don't you support directories with spaces in the pathnames?

The Yocto Project team has tried to do this before but too many of the tools the OpenEmbedded build system depends on, such as `autoconf`, break when they find spaces in pathnames. Until that situation changes, the team will not support spaces in pathnames.

14.21. How do I use an external toolchain?

The toolchain configuration is very flexible and customizable. It is primarily controlled with the `TCMODE` variable. This variable controls which `tcmode-*.inc` file to include from the `meta/conf/distro/include` directory within the [Source Directory](#).

The default value of `TCMODE` is "default", which tells the OpenEmbedded build system to use its internally built toolchain (i.e. `tcmode-default.inc`). However, other patterns are accepted. In particular, "external-*" refers to external toolchains. One example is the Sourcery G++ Toolchain. The support for this toolchain resides in the separate `meta-sourcery` layer at <http://github.com/MentorEmbedded/meta-sourcery/>.

In addition to the toolchain configuration, you also need a corresponding toolchain recipe file. This recipe file needs to package up any pre-built objects in the toolchain such as `libgcc`, `libstdc++`, any locales, and `libc`.

14.22. How does the OpenEmbedded build system obtain source code and will it work behind my firewall or proxy server?

The way the build system obtains source code is highly configurable. You can setup the build system to get source code in most environments if HTTP transport is available.

When the build system searches for source code, it first tries the local download directory. If that location fails, Poky tries [PREMIRRORS](#), the upstream source, and then [MIRRORS](#) in that order.

Assuming your distribution is "poky", the OpenEmbedded build system uses the Yocto Project source [PREMIRRORS](#) by default for SCM-based sources, upstreams for normal tarballs, and then falls back to a number of other mirrors including the Yocto Project source mirror if those fail.

As an example, you could add a specific server for the build system to attempt before any others by adding something like the following to the `local.conf` configuration file:

```
PREMIRRORS_prepend = "\
git://.*.* http://www.yoctoproject.org/sources/ \n \
ftp://.*.* http://www.yoctoproject.org/sources/ \n \
http://.*.* http://www.yoctoproject.org/sources/ \n \
https://.*.* http://www.yoctoproject.org/sources/ \n"
```

These changes cause the build system to intercept Git, FTP, HTTP, and HTTPS requests and direct them to the `http://` sources mirror. You can use `file://` URLs to point to local directories or network shares as well.

Aside from the previous technique, these options also exist:

```
BB_NO_NETWORK = "1"
```

This statement tells BitBake to issue an error instead of trying to access the Internet. This technique is useful if you want to ensure code builds only from local sources.

Here is another technique:

```
BB_FETCH_PREMIRRORONLY = "1"
```

This statement limits the build system to pulling source from the `PREMIRRORS` only. Again, this technique is useful for reproducing builds.

Here is another technique:

```
BB_GENERATE_MIRROR_TARBALLS = "1"
```

This statement tells the build system to generate mirror tarballs. This technique is useful if you want to create a mirror server. If not, however, the technique can simply waste time during the build.

Finally, consider an example where you are behind an HTTP-only firewall. You could make the following changes to the `local.conf` configuration file as long as the `PREMIRRORS` server is current:

```
PREMIRRORS_prepend = "\n\
ftp://.*.* http://www.yoctoproject.org/sources/ \n \
http://.*.* http://www.yoctoproject.org/sources/ \n \
https://.*.* http://www.yoctoproject.org/sources/ \n"
BB_FETCH_PREMIRRORONLY = "1"
```

These changes would cause the build system to successfully fetch source over HTTP and any network accesses to anything other than the `PREMIRRORS` would fail.

The build system also honors the standard shell environment variables `http_proxy`, `ftp_proxy`, `https_proxy`, and `all_proxy` to redirect requests through proxy servers.

Note

You can find more information on the "[Working Behind a Network Proxy](#)" Wiki page.

14.23. Can I get rid of build output so I can start over?

Yes - you can easily do this. When you use BitBake to build an image, all the build output goes into the directory created when you run the build environment setup script (i.e. `oe-init-build-env` or `oe-init-build-env-memres`). By default, this Build Directory is named `build` but can be named anything you want.

Within the Build Directory, is the `tmp` directory. To remove all the build output yet preserve any source code or downloaded files from previous builds, simply remove the `tmp` directory.

14.24. Why do `${bindir}` and `${libdir}` have strange values for `-native` recipes?

Executables and libraries might need to be used from a directory other than the directory into which they were initially installed. Complicating this situation is the fact that sometimes these executables and libraries are compiled with the expectation of being run from that initial installation target directory. If this is the case, moving them causes problems.

This scenario is a fundamental problem for package maintainers of mainstream Linux distributions as well as for the OpenEmbedded build system. As such, a well-

established solution exists. Makefiles, Autotools configuration scripts, and other build systems are expected to respect environment variables such as `bindir`, `libdir`, and `sysconfdir` that indicate where executables, libraries, and data reside when a program is actually run. They are also expected to respect a `DESTDIR` environment variable, which is prepended to all the other variables when the build system actually installs the files. It is understood that the program does not actually run from within `DESTDIR`.

When the OpenEmbedded build system uses a recipe to build a target-architecture program (i.e. one that is intended for inclusion on the image being built), that program eventually runs from the root file system of that image. Thus, the build system provides a value of `"/usr/bin"` for `bindir`, a value of `"/usr/lib"` for `libdir`, and so forth.

Meanwhile, `DESTDIR` is a path within the [Build Directory](#). However, when the recipe builds a native program (i.e. one that is intended to run on the build machine), that program is never installed directly to the build machine's root file system. Consequently, the build system uses paths within the Build Directory for `DESTDIR`, `bindir` and related variables. To better understand this, consider the following two paths where the first is relatively normal and the second is not:

Note

Due to these lengthy examples, the paths are artificially broken across lines for readability.

```
/home/maxtothemax/poky-bootchart2/build/tmp/work/i586-poky-linux/zlib/
1.2.8-r0/sysroot-destdir/usr/bin

/home/maxtothemax/poky-bootchart2/build/tmp/work/x86_64-linux/
zlib-native/1.2.8-r0/sysroot-destdir/home/maxtothemax/poky-bootchart2/
build/tmp/sysroots/x86_64-linux/usr/bin
```

Even if the paths look unusual, they both are correct - the first for a target and the second for a native recipe. These paths are a consequence of the `DESTDIR` mechanism and while they appear strange, they are correct and in practice very effective.

14.25. The files provided by my `-native` recipe do not appear to be available to other recipes. Files are missing from the native `sysroot`, my recipe is installing to the wrong place, or I am getting permissions errors during the `do_install` task in my recipe! What is wrong?

This situation results when a build system does not recognize the environment variables supplied to it by [BitBake](#). The incident that prompted this FAQ entry involved a Makefile that used an environment variable named `BINDIR` instead of the more standard variable `bindir`. The makefile's hardcoded default value of `"/usr/bin"` worked most of the time, but not for the recipe's `-native` variant. For another example, permissions errors might be caused by a Makefile that ignores `DESTDIR` or uses a different name for that environment variable. Check the the build system to see if these kinds of issues exist.

Chapter 15. Contributing to the Yocto Project

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15.1. Introduction ¶

The Yocto Project team is happy for people to experiment with the Yocto Project. A number of places exist to find help if you run into difficulties or find bugs. To find out how to download source code, see the "[Yocto Project Release](#)" section in the Yocto Project Development Manual.

15.2. Tracking Bugs ¶

If you find problems with the Yocto Project, you should report them using the Bugzilla application at <http://bugzilla.yoctoproject.org>.

15.3. Mailing lists ¶

A number of mailing lists maintained by the Yocto Project exist as well as related OpenEmbedded mailing lists for discussion, patch submission and announcements. To subscribe to one of the following mailing lists, click on the appropriate URL in the following list and follow the instructions:

- <http://lists.yoctoproject.org/listinfo/yocto> - General Yocto Project discussion mailing list.
- <http://lists.openembedded.org/mailman/listinfo/openembedded-core> - Discussion mailing list about OpenEmbedded-Core (the core metadata).
- <http://lists.openembedded.org/mailman/listinfo/openembedded-devel> - Discussion mailing list about OpenEmbedded.
- <http://lists.openembedded.org/mailman/listinfo/bitbake-devel> - Discussion mailing list about the [BitBake](#) build tool.
- <http://lists.yoctoproject.org/listinfo/poky> - Discussion mailing list about [Poky](#).
- <http://lists.yoctoproject.org/listinfo/yocto-announce> - Mailing list to receive official Yocto Project release and milestone announcements.

For more Yocto Project-related mailing lists, see the Yocto Project community mailing lists page [here](#).

15.4. Internet Relay Chat (IRC) ¶

Two IRC channels on freenode are available for the Yocto Project and Poky discussions:

- [#yocto](#)
- [#poky](#)

15.5. Links ¶

Here is a list of resources you will find helpful:

- **The Yocto Project website**: The home site for the Yocto Project.
- **OpenEmbedded**: The upstream, generic, embedded distribution used as the basis for the build system in the Yocto Project. Poky derives from and contributes back to the OpenEmbedded project.
- **BitBake**: The tool used to process metadata.

For more links, see the "[Other Information](#)" section in the Yocto Project Development Manual.

15.6. Contributions¶

The Yocto Project gladly accepts contributions. You can submit changes to the project either by creating and sending pull requests, or by submitting patches through email. For information on how to do both as well as information on how to identify the maintainer for each area of code, see the "[How to Submit a Change](#)" section in the Yocto Project Development Manual.