

Yocto Project Reference Manual



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by Richard Purdie
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Note

For the latest version of this manual associated with this Yocto Project release, see the Yocto Project Reference Manual [<http://www.yoctoproject.org/docs/1.6/ref-manual/ref-manual.html>] from the Yocto Project website.

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Chapter 1. Introduction

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 [<http://www.yoctoproject.org/docs/1.6/yocto-project-qs/yocto-project-qs.html>]. For task-based information using the Yocto Project, see the Yocto Project Development Manual [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html>] and the Yocto Project Linux Kernel Development Manual [<http://www.yoctoproject.org/docs/1.6/kernel-dev/kernel-dev.html>]. For Board Support Package (BSP) structure information, see the Yocto Project Board Support Package (BSP) Developer's Guide [<http://www.yoctoproject.org/docs/1.6/bsp-guide/bsp-guide.html>]. You can find information on tracing and profiling in the Yocto Project Profiling and Tracing Manual [<http://www.yoctoproject.org/docs/1.6/profile-manual/profile-manual.html#profile-manual>]. For information on BitBake, which is the task execution tool the OpenEmbedded build system is based on, see the BitBake User Manual [<http://www.yoctoproject.org/docs/1.6/bitbake-user-manual/bitbake-user-manual.html#bitbake-user-manual>]. Finally, you can also find lots of Yocto Project information on the Yocto Project website [<http://www.yoctoproject.org>].

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#source-directory>] created either by unpacking a released Yocto Project tarball on your host development system, or by cloning the upstream Poky [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#poky>] Git repository.
- Classes: Describes the classes used in the Yocto Project.
- 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 "What You Need and How You Get It [<http://www.yoctoproject.org/docs/1.6/yocto-project-qs/yocto-project-qs.html#yp-resources>]" 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 [<http://bugzilla.yoctoproject.org>] and submit a bug. We are interested in hearing about your experience.

- Ubuntu 12.04 (LTS)
- Ubuntu 13.10
- Ubuntu 14.04 (LTS)
- Fedora release 19 (Schrödinger's Cat)
- Fedora release 20 (Heisenbug)
- CentOS release 6.4
- CentOS release 6.5
- Debian GNU/Linux 7.0 (Wheezy)
- Debian GNU/Linux 7.1 (Wheezy)
- Debian GNU/Linux 7.2 (Wheezy)
- Debian GNU/Linux 7.3 (Wheezy)
- Debian GNU/Linux 7.4 (Wheezy)
- openSUSE 12.2
- openSUSE 12.3
- openSUSE 13.1

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 [<http://www.yoctoproject.org/tools-resources/projects/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:

- 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
```

- 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 libsdl1.2-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 [<http://www.yoctoproject.org/docs/1.6/adt-manual/adt-manual.html#using-the-adt-installer>]:

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

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 yum 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
```

- 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 perl-Thread-Queue
```

- 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 xmlto
```

- ADT Installer Extras: Packages needed if you are going to be using the Application Development Toolkit (ADT) Installer [<http://www.yoctoproject.org/docs/1.6/adt-manual/adt-manual.html#using-the-adt-installer>]:

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

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 texinfo python-curses patch
```

- 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 [<http://www.yoctoproject.org/docs/1.6/adt-manual/adt-manual.html#using-the-adt-installer>]:

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

1.3.2.4. CentOS Packages

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

Note

Depending on the CentOS version you are using, other requirements and dependencies might exist. For details, you should look at the CentOS sections on the Poky/GettingStarted/Dependencies [<https://wiki.yoctoproject.org/wiki/Poky/GettingStarted/Dependencies>] wiki page.

- 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
```

- 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 xmlto
```

- ADT Installer Extras: Packages needed if you are going to be using the Application Development Toolkit (ADT) Installer [<http://www.yoctoproject.org/docs/1.6/adt-manual/adt-manual.html#using-the-adt-installer>]:

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

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 1.7.5 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-1.6/buildtools/>.
2. Execute the installation script. Here is an example:

```
$ sh poky-eglibc-x86_64-buildtools-tarball-x86_64-buildtools-nativesdk-standalone-1.6.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. 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.

1.3.3.2. 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/deploy/sdk` subdirectory of the Build Directory [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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-eglibc-x86_64-buildtools-tarball-x86_64-buildtools-nativesdk-standalone-1.6.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/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 [<http://www.yoctoproject.org>]. 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#source-directory>]. You can set up the Source Directory by cloning a copy of the upstream poky [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#poky>] Git repository. For information on how to do this, see the "Getting Set Up [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#getting-setup>]" section in the Yocto Project Development Manual.

Chapter 2. Using the Yocto Project

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 an Image [<http://www.yoctoproject.org/docs/1.6/yocto-project-qs/yocto-project-qs.html#building-image>]" section of the Yocto Project Quick Start.

2.1.1. Build Overview

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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) 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#build-directory>] in `tmp/deploy/images`. For information on how to run pre-built images such as `qemux86` and `qemuarm`, see the "Using Pre-Built Binaries and QEMU [<http://www.yoctoproject.org/docs/1.6/yocto-project-qs/yocto-project-qs.html#using-pre>]

built]" section in the Yocto Project Quick Start. 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#platdev-gdb-remotedebug>]" and "Working within Eclipse [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#adt-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 [<http://www.yoctoproject.org/docs/1.6/bitbake-user-manual/bitbake-user-manual.html#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 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#bitbake-term>] 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: fetch, unpack, patch, configure, compile, install, package, package_write, and build. The default task is build and any tasks on which it depends build first. Some tasks, such as 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 `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 `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 [<http://www.yoctoproject.org/download/yocto-project-16-poky-1100>] for a look at all release-related issues.

- `eglibc-initial` fails to build: If your development host system has the unpatched GNU Make 3.82, the `do_install` task fails for `eglibc-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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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:

```
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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#git>] repository.

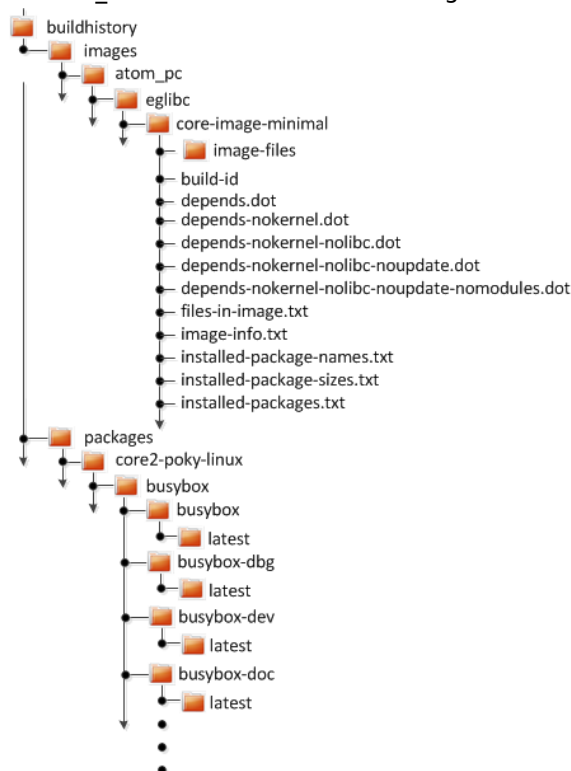
Note

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/core2-poky-linux/busybox/busybox/latest` contains the following:

```

PV = 1.19.3
PR = r3
RDEPENDS = update-rc.d eglibc (>= 2.13)
RRECOMMENDS = busybox-syslog busybox-udhcp
PKGSIZE = 564701
FILES = /usr/bin/* /usr/sbin/* /usr/libexec/* /usr/lib/lib*.so.* \
        /etc /com /var /bin/* /sbin/* /lib/*.so.* /usr/share/busybox \
        /usr/lib/busybox/* /usr/share/pixmaps /usr/share/applications \
        /usr/share/idl /usr/share/omf /usr/share/sounds /usr/lib/bonobo/servers
FILELIST = /etc/busybox.links /etc/init.d/hwclock.sh /bin/busybox /bin/sh

```

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/core2-poky-linux/busybox/latest):

```
PV = 1.19.3
PR = r3
DEPENDS = virtual/i586-poky-linux-gcc virtual/i586-poky-linux-compilerlibs \
          virtual/libc update-rc.d-native
PACKAGES = busybox-httpd busybox-udhcpd busybox-udhcpc busybox-syslog \
          busybox-mdev busybox-dbg busybox busybox-doc busybox-dev \
          busybox-staticdev busybox-locales
```

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/emenlow-poky-linux/linux-yocto/latest_srcrev):

```
# SRCREV_machine = "b5c37fe6e24eec194bb29d22fdd55d73bcc709bf"
SRCREV_machine = "b5c37fe6e24eec194bb29d22fdd55d73bcc709bf"
# SRCREV_emgd = "caea08c988e0f41103bbe18eafca20348f95da02"
SRCREV_emgd = "caea08c988e0f41103bbe18eafca20348f95da02"
# SRCREV_meta = "c2ed0f16fdec628242a682897d5d86df4547cf24"
SRCREV_meta = "c2ed0f16fdec628242a682897d5d86df4547cf24"
```

You can use the buildhistory-collect-srcrevs command 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:

```
# emenlow-poky-linux
SRCREV_machine_pn-linux-yocto = "b5c37fe6e24eec194bb29d22fdd55d73bcc709bf"
SRCREV_emgd_pn-linux-yocto = "caea08c988e0f41103bbe18eafca20348f95da02"
SRCREV_meta_pn-linux-yocto = "c2ed0f16fdec628242a682897d5d86df4547cf24"
# core2-poky-linux
SRCREV_pn-kmod = "62081c0f68905b22f375156d4532fd37fa5c8d33"
SRCREV_pn-blktrace = "d6918c8832793b4205ed3bfede78c2f915c23385"
SRCREV_pn-opkg = "649"
```

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., emenlow-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`: Human-readable information about the build configuration and metadata source revisions.
- `*.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 = 1.1+snapshot-20120207
USER_CLASSES = image-mklibs image-prelink
IMAGE_CLASSES = image_types
IMAGE_FEATURES = debug-tweaks x11-base apps-x11-core \
    package-management ssh-server-dropbear package-management
IMAGE_LINGUAS = en-us en-gb
IMAGE_INSTALL = task-core-boot task-base-extended
BAD_RECOMMENDATIONS =
ROOTFS_POSTPROCESS_COMMAND = buildhistory_get_image_installed ;    rootfs_update_timestamp ;
IMAGE_POSTPROCESS_COMMAND = buildhistory_get_imageinfo ;
IMAGESIZE = 171816
```

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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-eglibc-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/eglibc/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/eglibc/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.cgi/buildhistory-web/>.

Here is a sample screenshot of the interface:

Buildhistory - Mozilla Firefox

Buildhistory queue reviewed

Warning item

Summary	packages/armv5te-poky-linux-gnueabi/cairo/cairo-dev: RDEPENDS: removed "libx11-trim-dev" added "libx11-dev"		
Status	Action Required	Reviewed by	paule on Oct. 9, 2012, 11:51 p.m. (0 minutes ago)
Description	packages/armv5te-poky-linux-gnueabi/cairo/cairo-dev: RDEPENDS: removed "libx11-trim-dev" added "libx11-de		

Un-review Resolve Ignore

Comments

paule - Oct. 9, 2012, 11:51 p.m. (0 minutes ago)

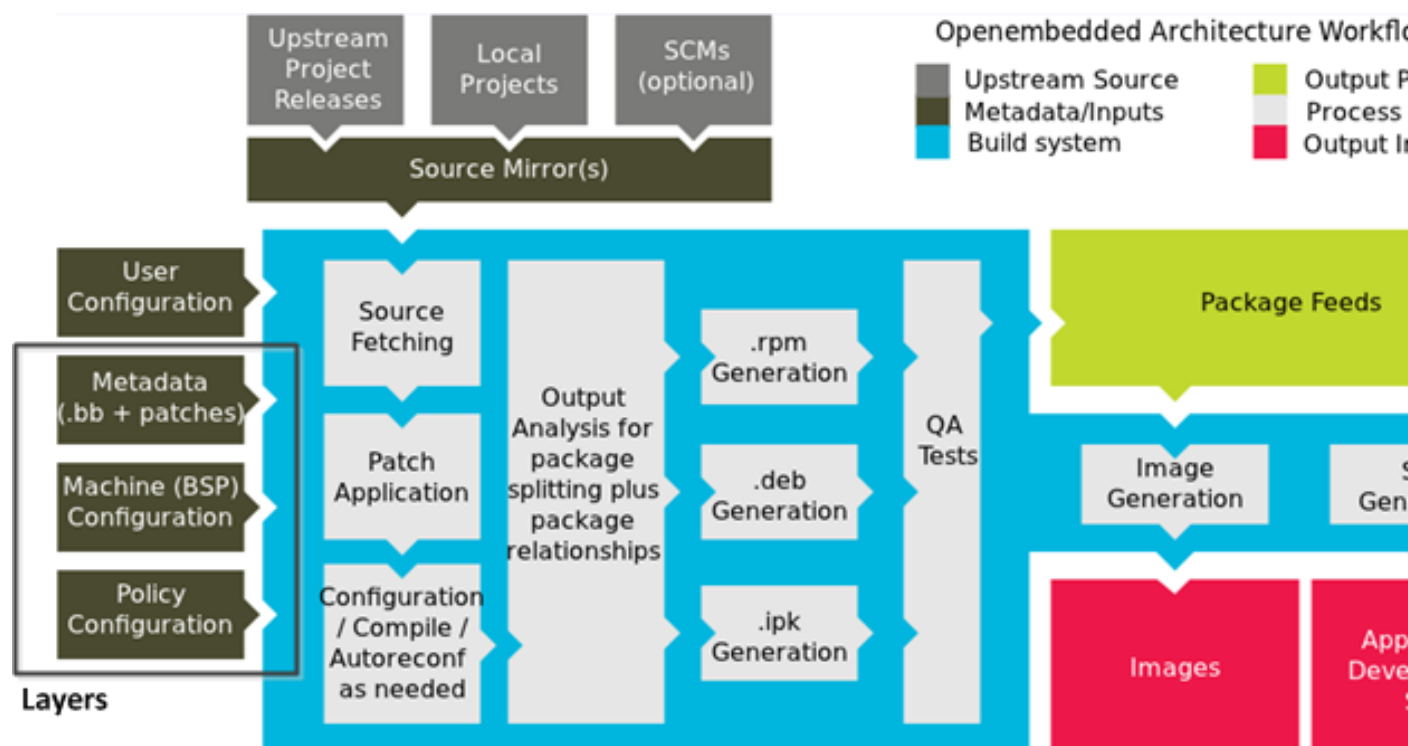
we need to determine if this is legit.

Post a comment

Post

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

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#metadata>] blocks in the Yocto Project development environment.



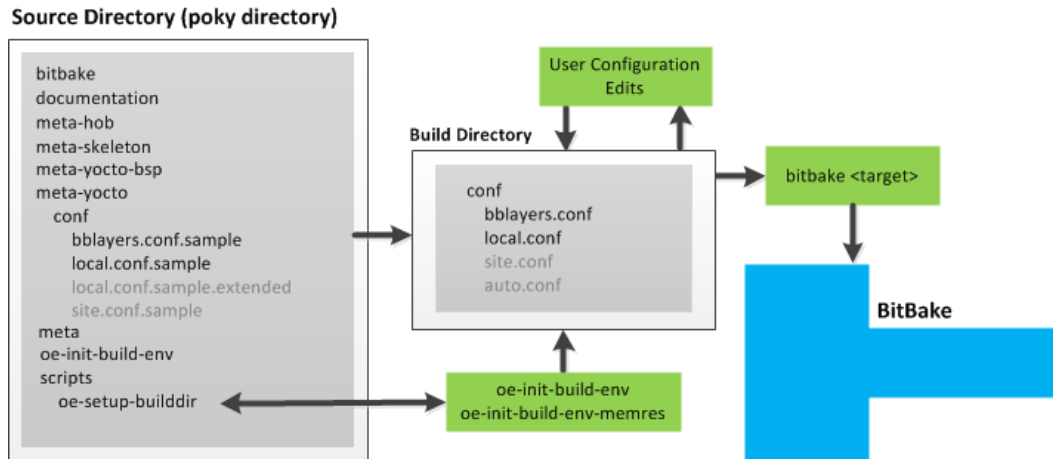
The generalized Yocto Project Development Environment consists of several functional areas:

- 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#bitbake-term>]. 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 [18]:



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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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-builddir` 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-builddir` 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` and `PARALLEL_MAKE` 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 level of parallelism you want to use through the `BB_NUMBER_THREADS` and `PARALLEL_MAKE` variables.

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.

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.

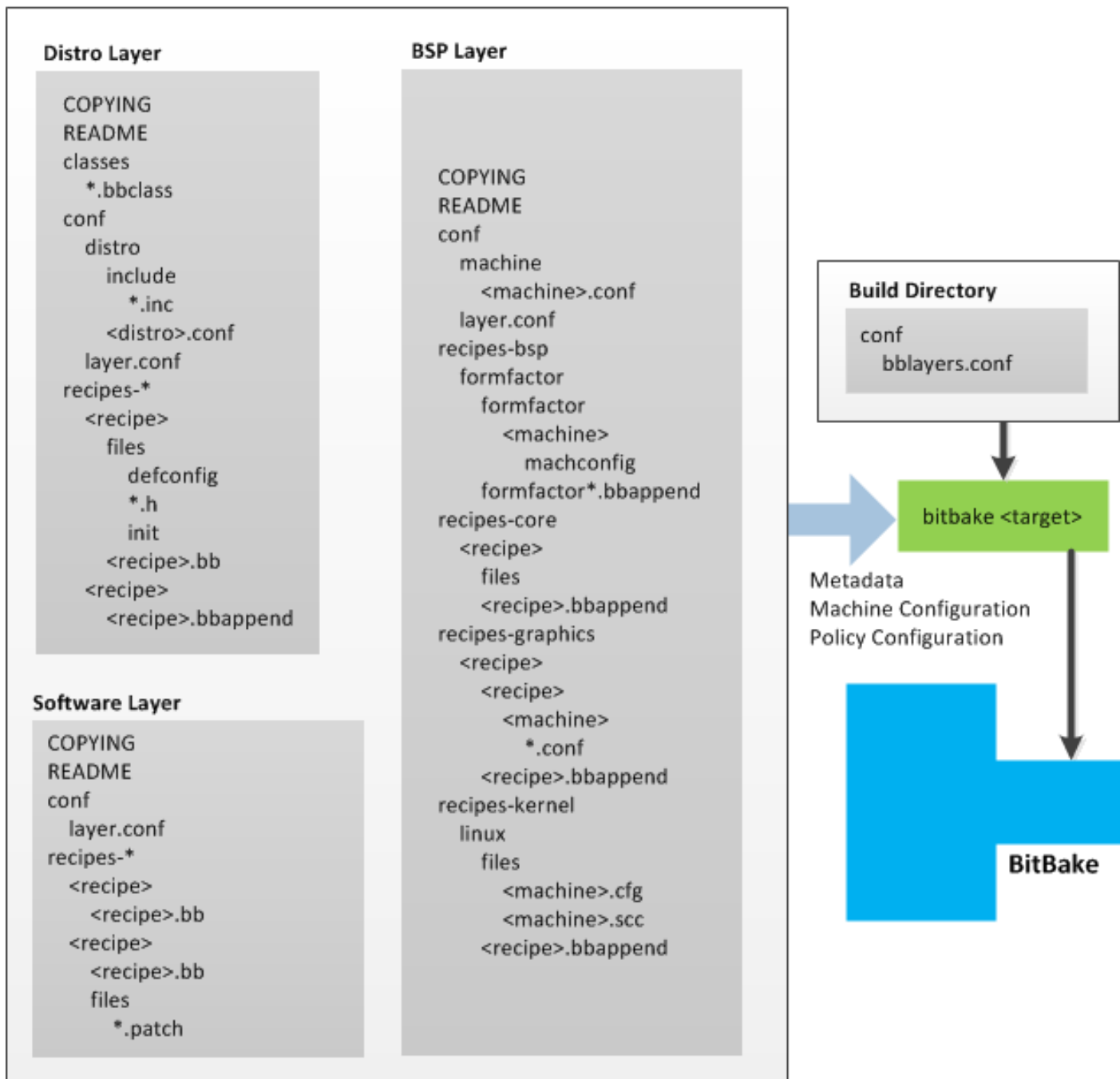
In general, three types of layer input exist:

- 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 [18]:

Layers



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 [<http://git.yoctoproject.org/>] page. The layers are shown at the bottom categorized under "Yocto Metadata Layers." These layers are fundamentally a subset of the OpenEmbedded Metadata Index [<http://layers.openembedded.org/layerindex/layers/>], 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/bsp-guide/bsp-guide.html>].

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[18] 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.

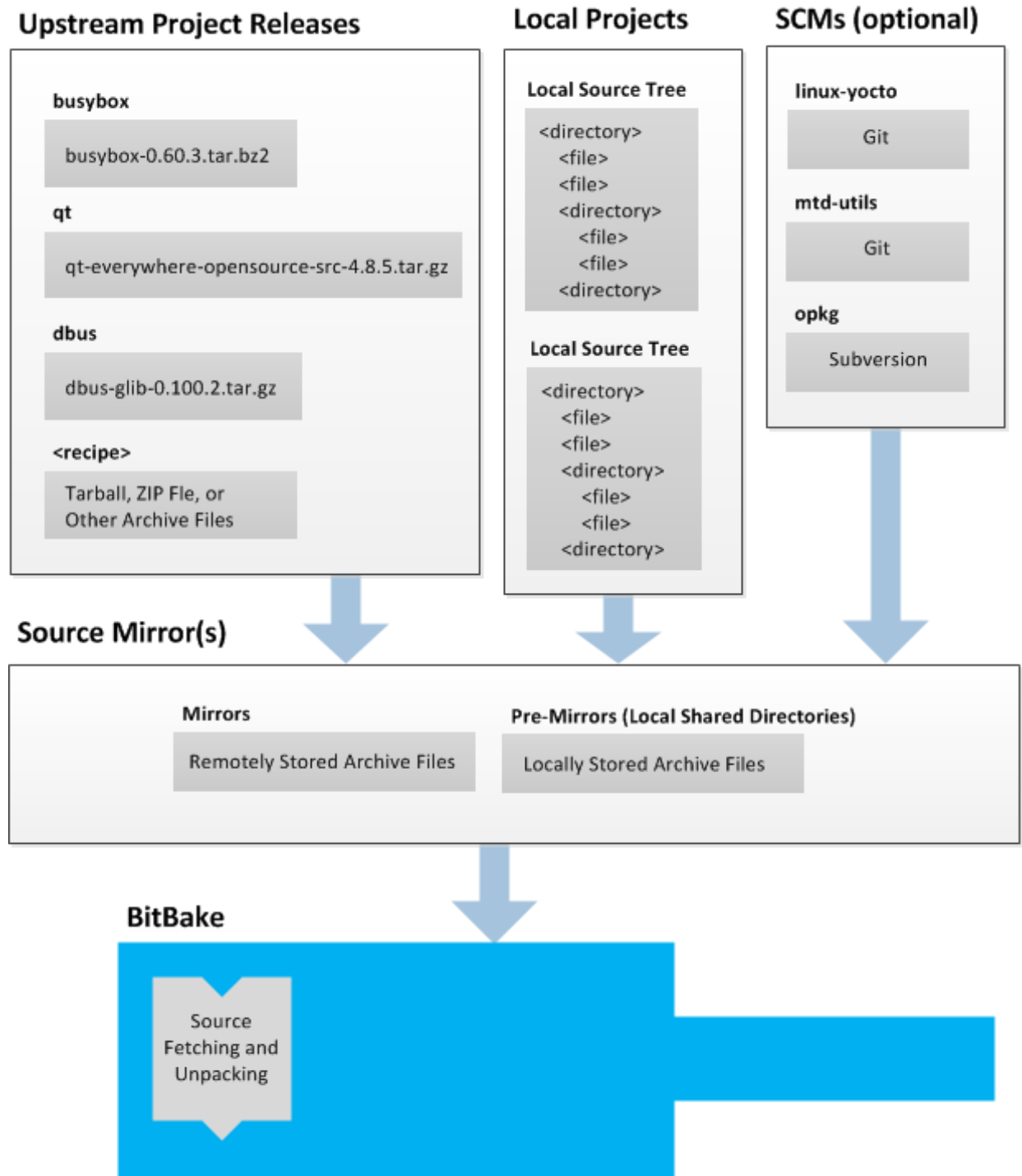
The method by which source files are ultimately organized is a function of the project. For example, for released software, projects tend to use tarballs or other archived files that can capture the state of a release guaranteeing that it is statically represented. On the other hand, for a project that 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)

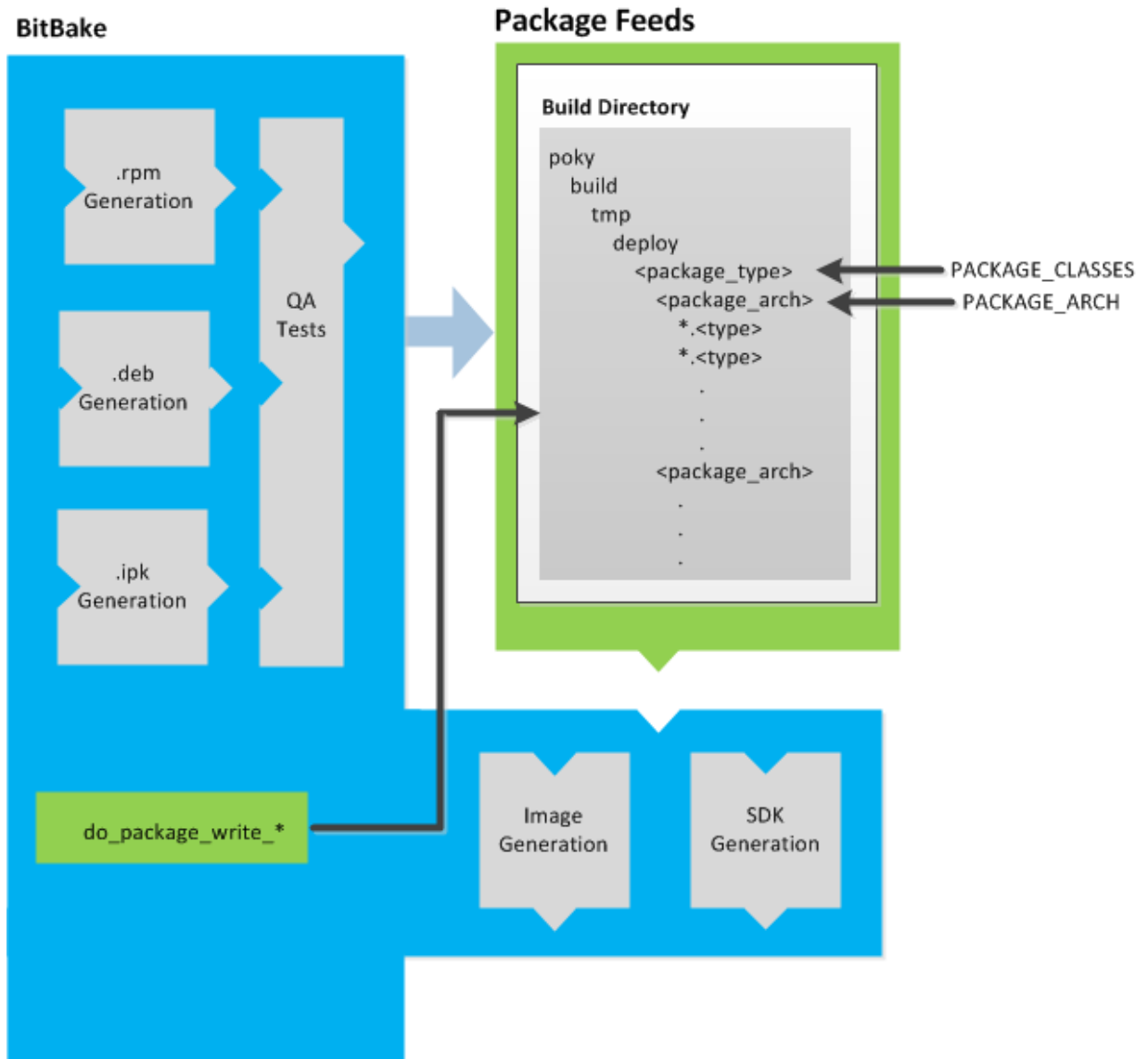
Two kinds of mirrors exist: pre-mirrors and regular mirrors. The `PREMIRRORS` and `MIRRORS` variables point to these, respectively. BitBake checks pre-mirrors before looking upstream for any source files. Pre-mirrors are appropriate when you have a shared directory that is not a directory defined by 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#build-directory>]. The general Yocto Project Development Environment figure 18 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. BitBake generates packages whose types are defined by 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 `tmp/deploy` of the Build Directory. Folders are created that correspond to the package type (IPK, DEB, or RPM) created. Further organization is derived through the value of the `PACKAGE_ARCH` variable for each package. For example, packages can exist for the `i586` or `qemux86` architectures. The package files themselves reside within the appropriate architecture folder.

BitBake uses the `do_package_write_*` task to place generated packages into the package holding area (e.g. `do_package_write_ipk` for IPK packages).

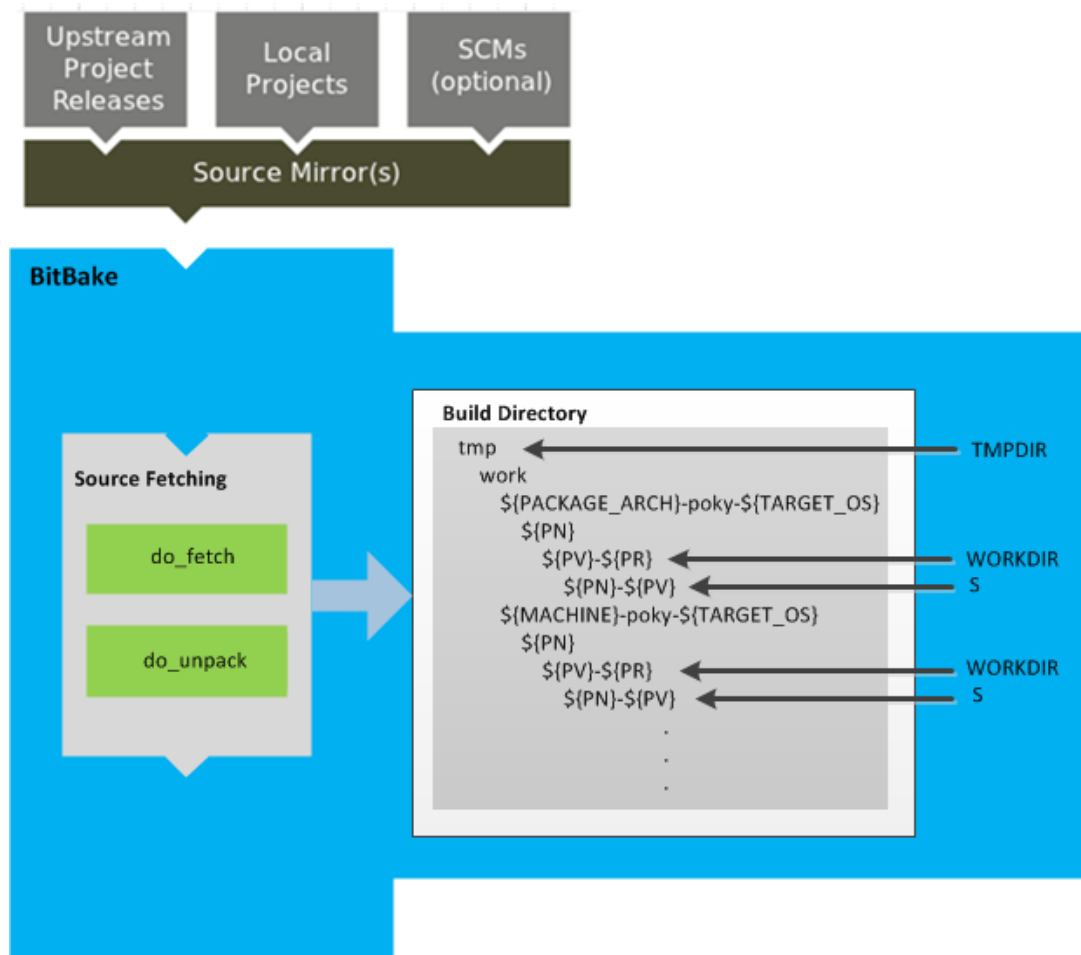
3.5. BitBake

The OpenEmbedded build system uses BitBake [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#bitbake-term>] to produce images. You can see from the general Yocto Project Development Environment figure [18], 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 [<http://www.yoctoproject.org/docs/1.6/bitbake-user-manual/bitbake-user-manual.html#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. By default, everything is accomplished in the Build Directory [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#build-directory>], which has a defined structure. For additional general information on the Build Directory, see the "build/" section.

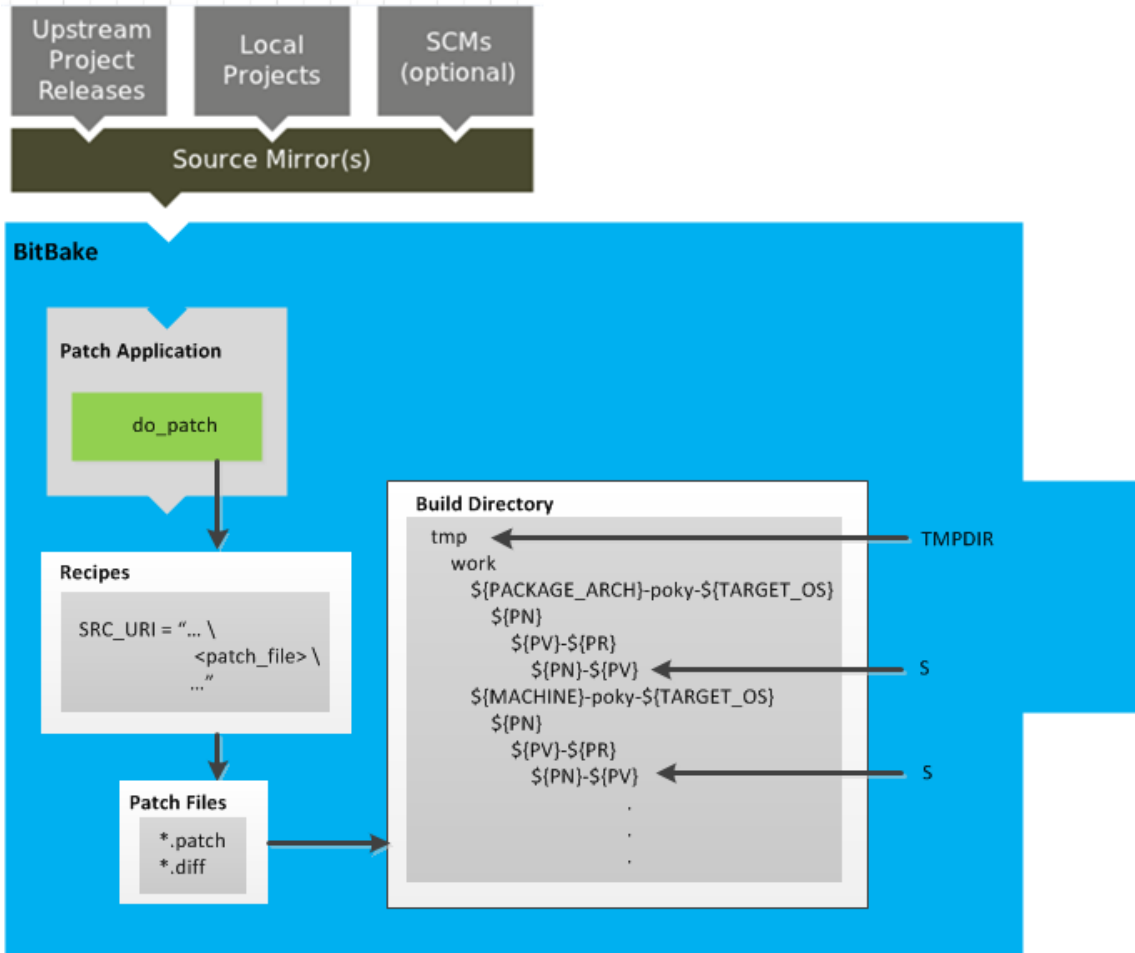
Unpacked source files are pointed to by the `S` variable. Each recipe has an area in the Build Directory where the unpacked source code resides. The name of that directory for any given recipe is defined from several different variables. You can see the variables that define these directories by looking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



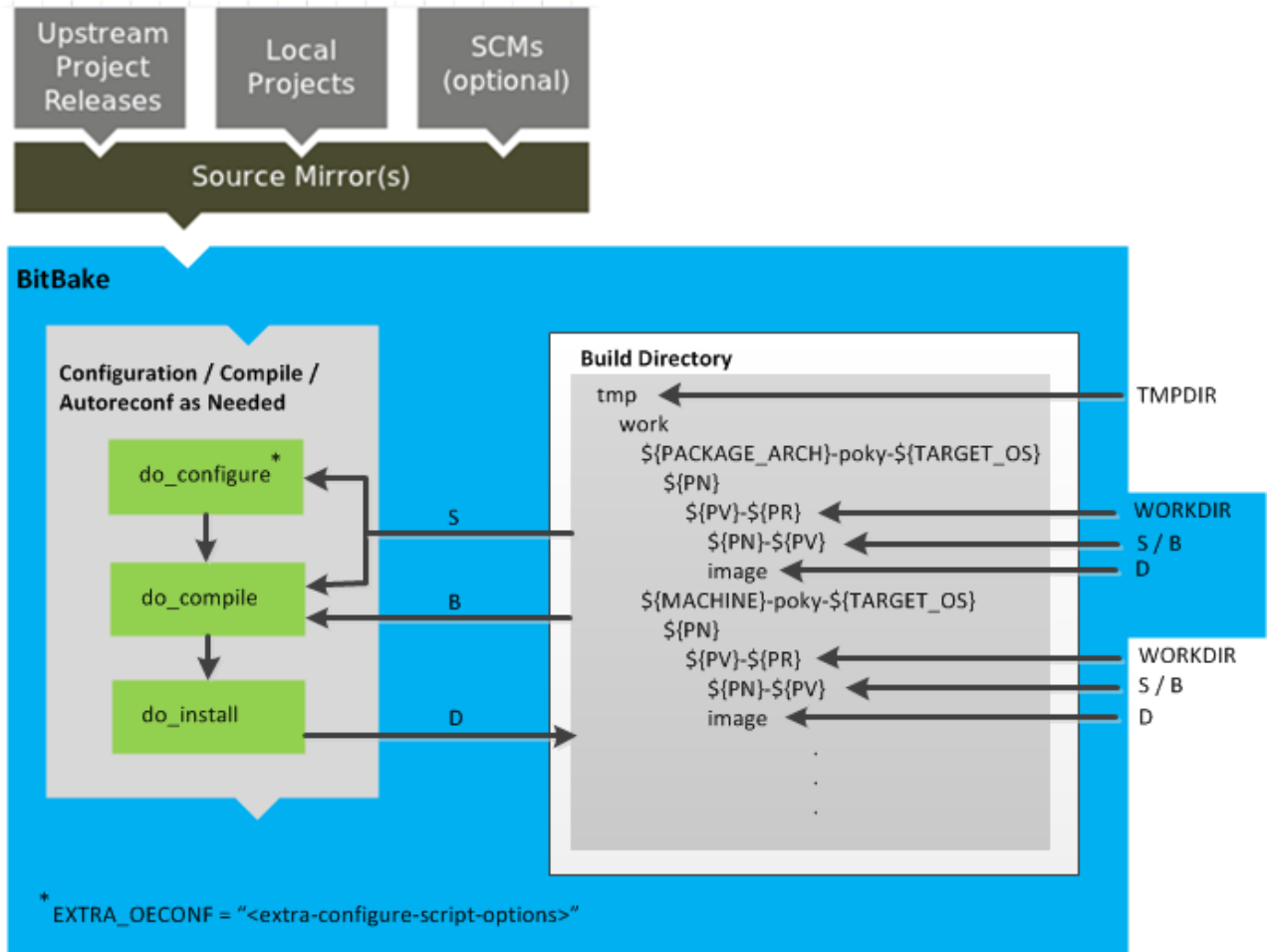
The `do_patch` task processes recipes by using the `SRC_URI` variable to locate applicable patch files, which by default are `*.patch` or `*.diff` files, or any file if "apply=yes" is specified for the file in `SRC_URI`.

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.

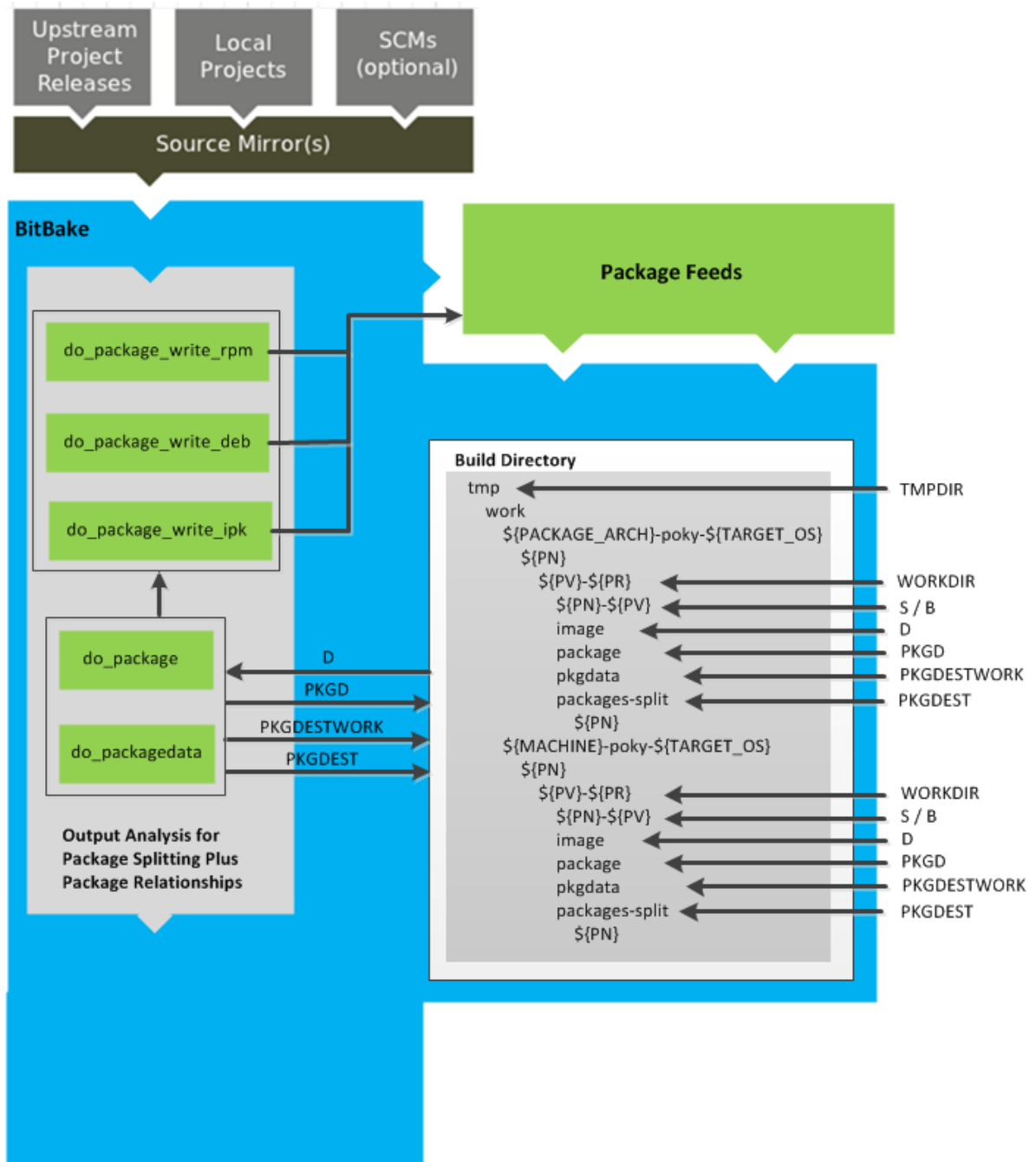
The configurations handled by the `do_configure` task are specific to source code configuration for the source code being built by the recipe.

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.

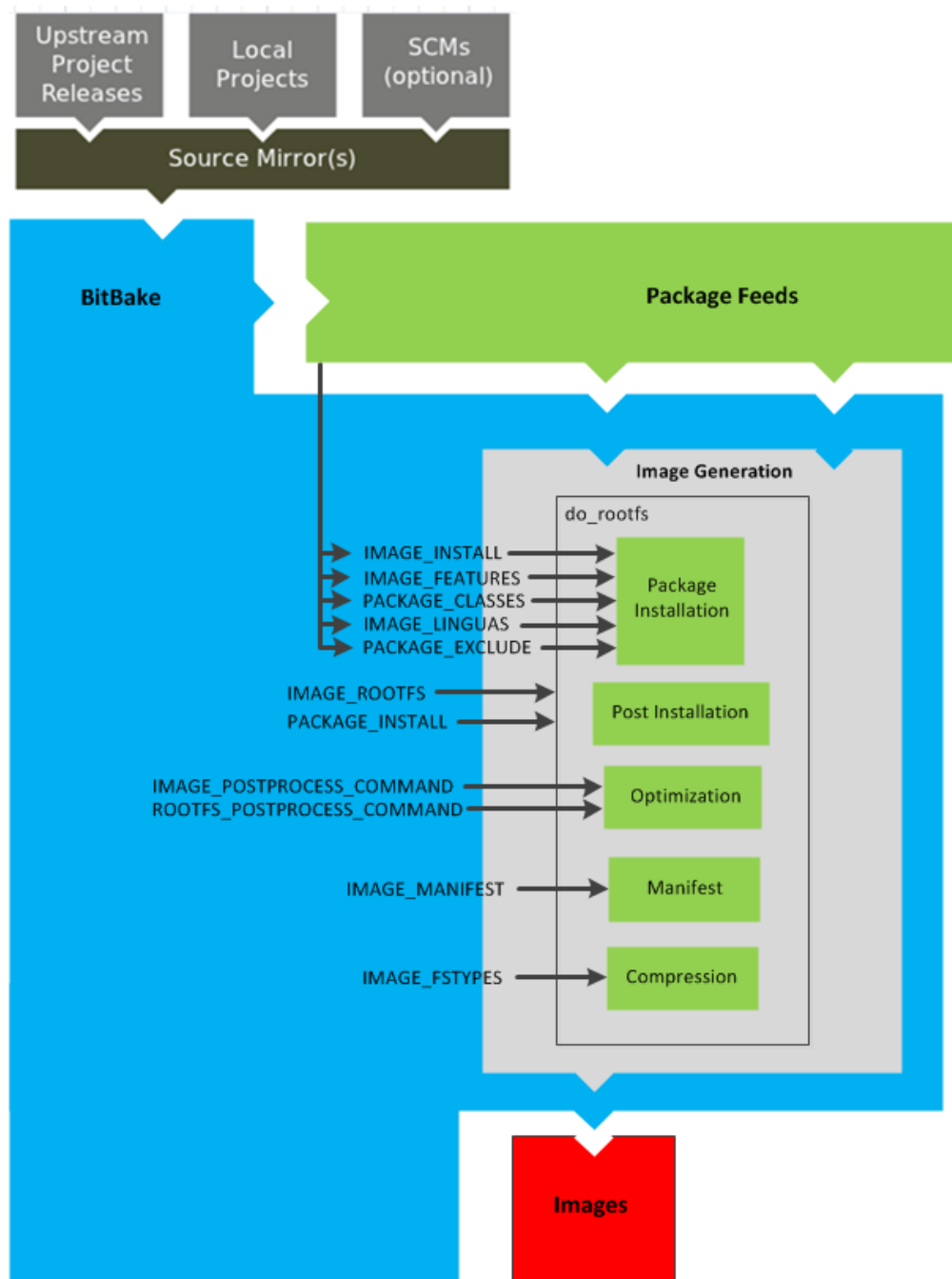
Depending on the type of packages being created (RPM, DEB, or IPK), the `do_package_write_*` task creates the actual packages and places them in the Package Feed area, which is `${TMPDIR}/deploy`. You can see the "Package Feeds" section for more detail on that part of the build process.

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#creating-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.

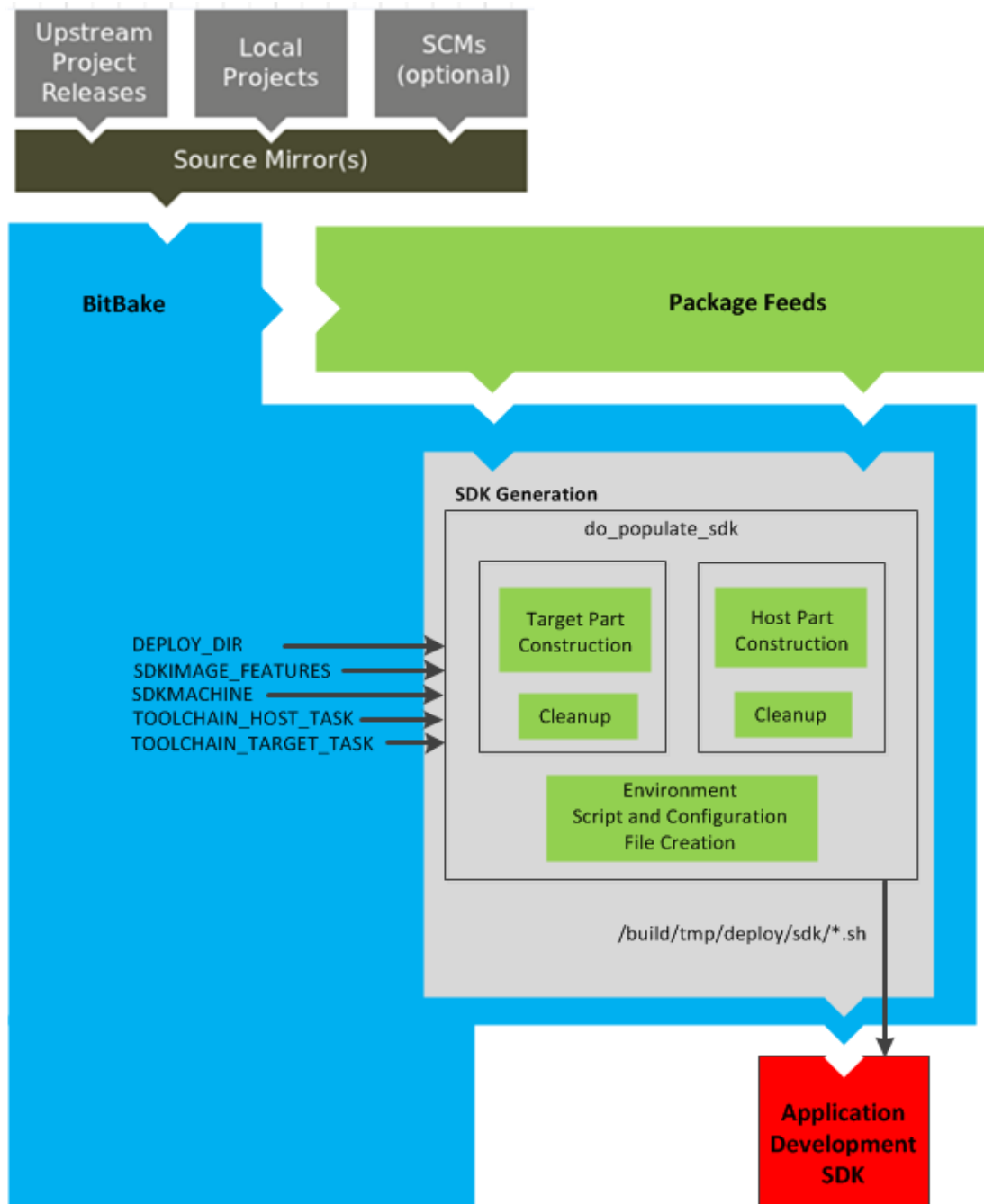
After the root filesystem has been constructed, the image generation process turns everything into an image file or a set of image files. The formats used for the root filesystem depend on the `IMAGE_FSTYPES` variable.

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 [<http://www.yoctoproject.org/docs/1.6/adt-manual/adt-manual.html#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`.

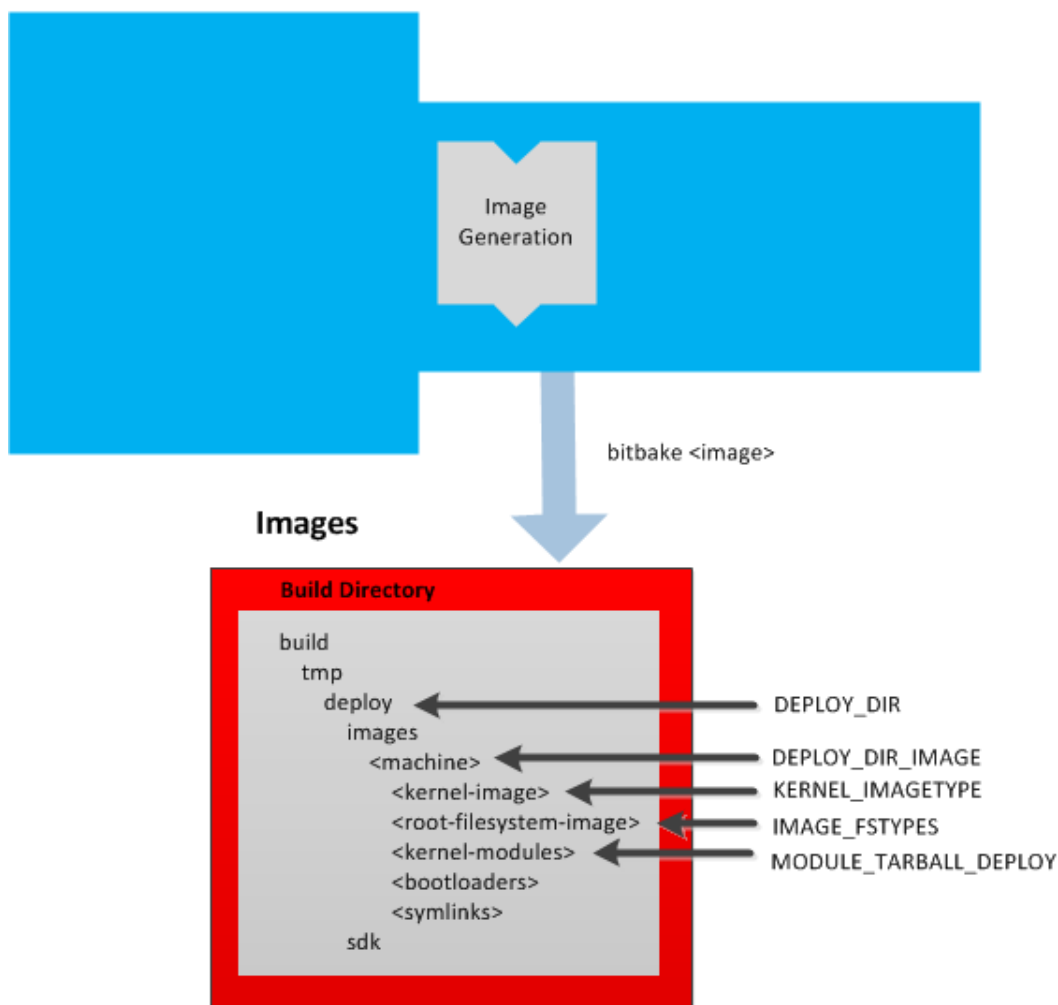
Once both parts are constructed, the `do_populate_sdk` task performs some cleanup on both parts. After the cleanup, the task creates a cross-development environment setup script and any configuration files that might be needed.

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 [18] that BitBake output, in part, consists of images. This section is going to look more closely at this output:

BitBake



For a list of example images that the Yocto Project provides, see the "Images" chapter.

Images are written out to the Build Directory [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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.

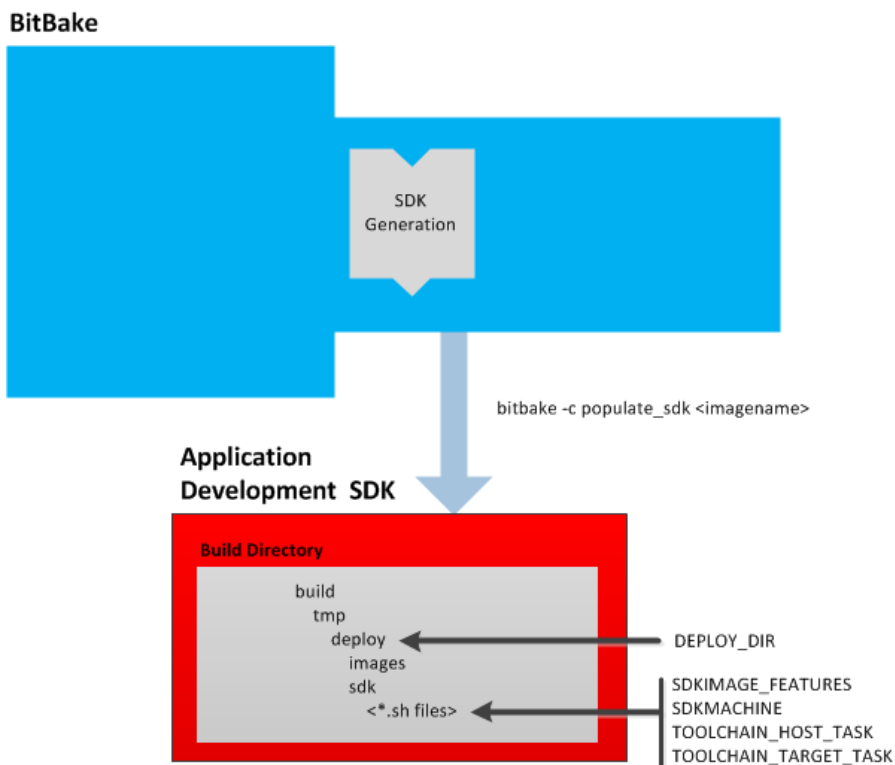
- `<kernel-image>`: A kernel binary file. The `KERNEL_IMAGETYPE` variable setting determines the naming scheme for the kernel image file. Depending on that variable, the file could begin with a

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[18], 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 [<http://www.yoctoproject.org/docs/1.6/adt-manual/adt-manual.html#installing-the-adt>]" 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#bitbake-term>] 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/bitbake-user-manual/bitbake-user-manual.html#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 and Providers [<http://www.yoctoproject.org/docs/1.6/bitbake-user-manual/bitbake-user-manual.html#bb-bitbake-providers>]" 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 `eglibc` if they had not already been built.

Note

This release of the Yocto Project does not support the `glibc` GNU version of the Unix standard C library. By default, the OpenEmbedded build system builds with `eglibc`.

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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

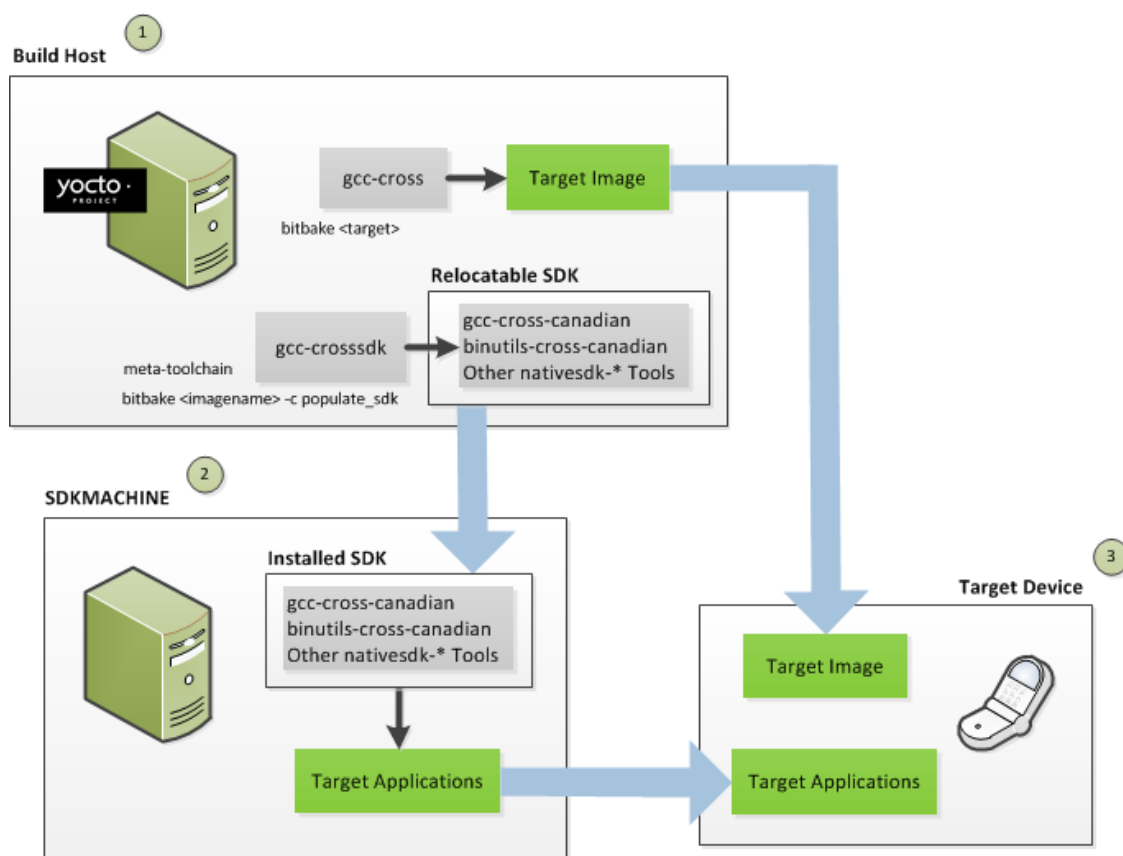
The configuration files (`.conf`) define various configuration variables that govern the OpenEmbedded build process. These files fall into several areas that define machine configuration options, distribution configuration options, compiler tuning options, general common configuration options, and user configuration options in `local.conf`, which is found in the Build Directory [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#cross-development-toolchain>]. 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 [<http://www.yoctoproject.org/docs/1.6/ad-manual/ad-manual.html>].

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.



- 1 The Build Host produces three toolchains: 1) `gcc-cross`, which builds the target image. 2) `gcc-crosssdk`, which is a transitory toolchain and produces relocatable code that executes on the SDKMACHINE. 3) `gcc-cross-canadian`, which executes on the SDKMACHINE and produces target applications.
- 2 The SDKMACHINE, which may or may not be the same as the Build Host, runs `gcc-cross-canadian` to create target applications.
- 3 The Target Device run the Target Image and Target Applications.

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 -> eglibc-initial -> eglibc
```

- `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.

- `eglibc-initial`: An initial version of the Embedded GLIBC needed to bootstrap `eglibc`.
- `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 -> eglibc-initial ->
```

- `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.
- `eglibc-initial`: An initial version of the Embedded GLIBC needed to bootstrap `nativesdk-eglibc`.
- `nativesdk-eglibc`: 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 [<http://www.yoctoproject.org/docs/1.6/adt-manual/adt-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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, `do_install` and `do_package` 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 FILESEXTRAPATHS 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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] = "${DEPLOYDIR}"
do_deploy[sstate-outputdirs] = "${DEPLOY_DIR_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 [<http://git.yoctoproject.org/cgi/poky/commit/meta/classes/package.bbclass?id=737f8bbb4f27b4837047cb9b4fbfe01dfde36d54>].

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 [[http://en.wikipedia.org/wiki/Wayland_\(display_server_protocol\)](http://en.wikipedia.org/wiki/Wayland_(display_server_protocol))] 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 [[http://en.wikipedia.org/wiki/Wayland_\(display_server_protocol\)#Weston](http://en.wikipedia.org/wiki/Wayland_(display_server_protocol)#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://dri.freedesktop.org/wiki/>], 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 [https://wiki.archlinux.org/index.php/Kernel_Mode_Setting]) 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#maintaining-open-source-license-compliance-during-your-products-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;\n                  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 ?= "qmp"
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

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. 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.

5.1.1. Local Configuration

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

5.1.1.1. 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"
```

5.1.1.2. bbayers.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/bbayers.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.

5.1.2. Recipes

Differences include changes for the following:

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

5.1.2.1. 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.

5.1.2.2. 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.

5.1.2.3. 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`.

5.1.2.4. 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.bbclass` 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.

5.1.2.5. 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.

5.1.2.6. 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#source-repositories>].

5.1.3. 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
```

5.2. 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.

5.2.1. 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.

5.2.2. Build Behavior

Differences include the following:

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

5.2.3. 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.

5.2.4. 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#source-directory>] at `meta/recipes-core/init-ifupdown`. For information on how to use append files, see the "Using `.bbappend` Files [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#using-bbappend-files>]" in the Yocto Project Development Manual.

5.2.5. 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.

5.2.6. 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`.

5.2.7. 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
```

5.2.8. 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.

5.2.9. 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` / `xfontcacheprot`: 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.

5.3. 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.

5.3.1. Host Dependency Changes

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

- Python 2.7.3+
- Tar 1.24+

- Git 1.7.5+
- 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.

5.3.2. **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.

5.3.3. 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.

5.3.4. 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.

5.3.5. 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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`).

5.3.6. Shortened GitSRCREV Values

BitBake will now shorten revisions from Git repositories from the normal 40 characters down to 10 characters within `SRCPV` 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.

5.3.7. 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.

5.3.8. /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 [<http://cgkit.openembedded.org/openembedded-core/commit/?id=0e326280a15b0f2c4ef2ef4ec441f63f55b75873>]. 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 [<http://permalink.gmane.org/gmane.comp.handhelds.openembedded/58530>].

5.3.9. 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.

5.3.10. 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.

5.3.11. 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.

5.3.12. 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".

5.3.13. Automated Image Testing

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

You can learn more about performing automated image tests in the "Performing Automated Runtime Testing [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#performing-automated-runtime-testing>]" section.

5.3.14. 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.

5.3.15. 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.

5.3.16. 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.

5.3.17. 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 Y0CTO #4993 [https://bugzilla.yoctoproject.org/show_bug.cgi?id=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.

5.4. 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.

5.4.1. 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" [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#maintaining-open-source-license-compliance-during-your-products-lifecycle>] section in the Yocto Project Development Manual.

5.4.2. 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.

5.4.3. BitBake

The following changes have been made to BitBake [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#bitbake-term>].

5.4.3.1. 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.

5.4.3.2. 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.fetch.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.

5.4.3.3. SVK Fetcher

The SVK fetcher has been removed from BitBake.

5.4.3.4. 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.

5.4.3.5. 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.

5.4.4. Changes to Variables

The following variables have changed. For information on the OpenEmbedded build system variables, see the "Variables Glossary" Chapter.

5.4.4.1. 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.

5.4.4.2. 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#working-with-a-pr-service>]" section in the Yocto Project Development Manual.

5.4.4.3. IMAGE_TYPES

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

5.4.4.4. COPY_LIC_MANIFEST

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

5.4.4.5. COPY_LIC_DIRS

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

5.4.4.6. 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.

5.4.5. Directory Layout Changes

The meta-hob layer has been removed from the top-level of the Source Directory [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#source-directory>]. The contents of this layer are no longer needed by the Hob user interface for building images and toolchains.

5.4.6. 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) [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#testing-packages-with-ptest>]" section in the Yocto Project Development Manual. For information on the ptest class, see the "ptest.bbclass" section.

5.4.7. 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 class.

5.4.8. 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.

5.4.9. **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.

5.4.10. 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.

5.4.11. **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.

5.4.12. 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.

5.4.13. Tasks

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

5.4.14. **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.

5.4.15. **virtclass** Overrides

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

5.4.16. 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.

5.4.17. Removed Classes

The following classes have become obsolete and have been removed:

- module_strip
- pkg_metainfo
- pkg_distribute
- image-empty

5.4.18. 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>] at <http://git.yoctoproject.org/cgit/cgit.cgi/meta-yocto-bsp-old/>.

Chapter 6. Source Directory Structure

The Source Directory [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#getting-setup>]" 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 documentation included in the `bitbake/doc/manual` directory of the Source Directory [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#source-directory>].

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/bsp-guide/bsp-guide.html>].

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 `bblayers.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.

By default, running this script without a Build Directory [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#source-directory>]:

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

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>
```

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 at port "12345" is started.

By default, running this script without a Build Directory [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#build-directory>] argument creates a build directory named build. If you provide a Build Directory argument when you source the script, the Build Directory is created using that name. For example, the following command starts the BitBake server using the default port "12345" and creates a Build Directory named mybuilds that is outside of the Source Directory [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#source-directory>]:

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

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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`), the location from which you want to access downloaded files (`DL_DIR`), and how you want your host machine to use resources (`BB_NUMBER_THREADS` and `PARALLEL_MAKE`).

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#understanding-and-creating-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, and uses the `BBLAYERS_NON_REMOVABLE` variable to list layers that must not be removed.

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 eglibc (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" [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#maintaining-open-source-license-compliance-during-your-products-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" [<http://www.yoctoproject.org/docs/1.6/adt-manual/adt-manual.html#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 `check_pkg` or `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 a Quilt Flow [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#using-a-quilt-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/temp/, 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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-.*.

Chapter 7. Classes

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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).

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" [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#maintaining-open-source-license-compliance-during-your-products-lifecycle>] section in the Yocto Project Development Manual.

7.3. autotools.bbclass

The autotools class supports Autotooled packages.

The autoconf, automake, and libtool bring standardization. This class defines a set of tasks (configure, compile etc.) that work for all Autotooled packages. It should usually be enough to define a few standard variables and then simply inherit autotools. This class can also work with software that emulates Autotools. For more information, see the "Autotooled Package" [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#new-recipe-autotooled-package>] section in the Yocto Project Development Manual.

It's useful to have some idea of how the tasks defined by this class 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.

Note

It is planned for future Yocto Project releases that by default, the `autotools` class supports out-of-tree builds (`B != S`). If your recipes do not support out-of-tree builds, you should have them inherit the `autotools-brokensep` class.

7.4. `autotools-brokensep.bbclass`

The `autotools-brokensep` class behaves the same as the `autotools` class 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.

7.5. `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`.

7.6. `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.

Note

For RPMs and other packages that do not contain a subdirectory, you should specify a `"subdir"` parameter. 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 = "http://example.com/downloads/somepackage.rpm;subdir=${BP}"
```

7.7. `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.

7.8. `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. `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.

7.10. `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.

7.11. `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.

7.12. `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.

7.13. `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.

7.14. `ccache.bbclass`

The `ccache` class enables the C/C++ Compiler Cache [<http://ccache.samba.org/>] 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.

7.15. `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.

7.16. **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.

7.17. **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.

7.18. **cml1.bbclass**

The cml1 class provides basic support for the Linux kernel style build configuration system.

7.19. **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.

7.20. **core-image.bbclass**

The core-image class provides common definitions for the core-image-* image recipes, such as support for additional IMAGE_FEATURES.

7.21. **cpan.bbclass**

The cpan class supports 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.

7.22. **cross.bbclass**

The cross class provides support for the recipes that build the cross-compilation tools.

7.23. **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.

7.24. **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.

7.25. **debian.bbclass**

The `debian` class renames output packages so that they follow the Debian naming policy (i.e. `eglibc` becomes `libc6` and `eglibc-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.

7.26. **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`.

7.27. **devshell.bbclass**

The `devshell` class adds the `devshell` task. Distribution policy dictates whether to include this class. See the "Using a Development Shell [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#platdev-appdev-devshell>]" section in the Yocto Project Development Manual for more information about using `devshell`.

7.28. **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.

7.29. **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 `distrodata` and `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 include the following files and set the `INHERIT` variable:

```
include conf/distro/include/distro_alias.inc
include conf/distro/include/recipe_color.inc
include conf/distro/include/maintainers.inc
include conf/distro/include/upstream_tracking.inc
include conf/distro/include/package_regex.inc
INHERIT+= "distrodata"
```

7.30. **distutils.bbclass**

The `distutils` class supports 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 `distutils`-based classes 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.

7.31. `distutils3.bbclass`

The `distutils3` class supports 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 two 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.

7.32. `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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#source-directory>]. For information on how to use the `externalsrc` class, see the "Building Software from an External Source [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#building-software-from-an-external-source>]" section in the Yocto Project Development Manual.

7.33. `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; \
"
```

7.34. 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.

7.35. 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.

7.36. 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.

7.37. 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.

7.38. 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.

7.39. grub-efi.bbclass

The grub-efi class provides grub-efi-specific functions for building bootable images.

This class supports several variables:

- INITRD: Indicates a filesystem image to use as an 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).

7.40. 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.

7.41. gtk-doc.bbclass

The gtk-doc class is a helper class to pull in the appropriate gtk-doc dependencies and disable gtk-doc.

7.42. 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.

7.43. 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.

7.44. 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.

7.45. icecc.bbclass

The icecc class supports Icecream [<https://github.com/icecc/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 += "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 = ""
```

7.46. `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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#usingpoky-extend-customimage>]" section in the Yocto Project Development Manual. For information on how images are created, see the "Images" section elsewhere in this manual.

7.47. `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`.

7.48. `image_types_uboot.bbclass`

The `image_types_uboot` class defines additional image types specifically for the U-Boot bootloader.

7.49. **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.

7.50. **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"
```

7.51. **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"
```

7.52. **image-swab.bbclass**

The image-swab class enables the Swabber [<http://www.yoctoproject.org/tools-resources/projects/swabber>] tool in order to detect and log accesses to the host system during the OpenEmbedded build process.

Note

This class is currently unmaintained.

7.53. **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.

7.54. **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.

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.
- `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 `-dbg` packages only depend on other `-dbg` packages and not on any other types of 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 `-dev` packages only depend on other `-dev` packages and not on any other types of 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.
- `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 `TMPDIR` 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 `TMPLDIR/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_${PN} = "xyz"` effectively turn into `FILES = "xyz"`.
- **rpaths**: Checks for `rpaths` in the binaries that contain build system paths such as `TMPLDIR`. If this test fails, bad `-rpath` options are being passed to the linker commands and your binaries have potential security issues.
- **split-strip**: Reports that splitting or stripping debug symbols from binaries has failed.
- **staticdev**: Checks for static library files (`*.a`) in non-staticdev packages.
- **symlink-to-sysroot**: Checks for symlinks in packages that point into `TMPLDIR` on the host. Such symlinks will work on the host, but are clearly invalid when running on the target.
- **textrel**: Checks for ELF binaries that contain relocations in their `.text` sections, which can result in a performance impact at runtime.
- **unsafe-references-in-binaries**: Reports when a binary installed in `${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 `PKGDIR`) 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.

7.55. `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.

7.56. `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.

7.57. `kernel-arch.bbclass`

The `kernel-arch` class sets the `ARCH` environment variable for Linux kernel compilation (including modules).

7.58. `kernel-module-split.bbclass`

The `kernel-module-split` class provides common functionality for splitting Linux kernel modules into separate packages.

7.59. `kernel-yocto.bbclass`

The `kernel-yocto` class provides common functionality for building from `linux-yocto` style kernel source repositories.

7.60. **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.

7.61. **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.

7.62. **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.

7.63. **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.

7.64. **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.

7.65. **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.

7.66. **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.

7.67. **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.

7.68. **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 `do_compile` and `do_install` functions. 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" [<http://www.yoctoproject.org/docs/1.6/kernel-manual/kernel-manual.html#incorporating-out-of-tree-modules>] section in the Yocto Project Linux Kernel Development Manual.

7.69. `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.

7.70. `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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#combining-multiple-versions-library-files-into-one-image>]" section in the Yocto Project Development Manual.

7.71. `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 has adds 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.

7.72. `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 `myrecipe-nativesdk.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.

7.73. oelint.bbclass

The oelint class is an obsolete lint checking tool that exists in meta/classes in the Source Directory [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#source-directory>].

A number of classes exist that are 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.

7.74. 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.

7.75. 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.

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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" [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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> [<http://lists.yoctoproject.org/pipermail/poky/2011-May/006362.html>]
- <https://lists.yoctoproject.org/pipermail/poky/2011-May/006363.html> [<http://lists.yoctoproject.org/pipermail/poky/2011-May/006363.html>]

7.76. `package_deb.bbclass`

The `package_deb` class provides support for creating packages that use the `.deb` file format. The class ensures the packages are written out to the `${DEPLOY_DIR}/deb` directory in a `.deb` file format.

This class inherits the `package` class and is enabled through the `PACKAGE_CLASSES` variable in the `local.conf` file.

7.77. `package_ipk.bbclass`

The `package_ipk` class provides support for creating packages that use the `.ipk` file format. The class ensures the packages are written out to the `${DEPLOY_DIR}/ipk` directory in a `.ipk` file format.

This class inherits the `package` class and is enabled through the `PACKAGE_CLASSES` variable in the `local.conf` file.

7.78. `package_rpm.bbclass`

The `package_deb` class provides support for creating packages that use the `.rpm` file format. The class ensures the packages are written out to the `${DEPLOY_DIR}/rpm` directory in a `.rpm` file format.

This class inherits the `package` class and is enabled through the `PACKAGE_CLASSES` variable in the `local.conf` file.

7.79. `package_tar.bbclass`

The `package_tar` class provides support for creating packages that use the `.tar` file format. The class ensures the packages are written out to the `${DEPLOY_DIR}/tar` directory in a `.tar` file format.

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.

7.80. `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.

7.81. `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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#usingpoky-extend-customimage-customtasks>]" section in the Yocto Project Development Manual.

Previously, this class was called the `task` class.

7.82. `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 [<http://www.yoctoproject.org/tools-resources/projects/hob>] user interface.

7.83. `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.

7.84. `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.

7.85. `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.

7.86. `pkgconfig.bbclass`

The `pkg-config` class provides a standard way to get header and library information. 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`, this class no longer has to manipulate the files.

7.87. `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 [<http://www.yoctoproject.org/docs/1.6/adt-manual/adt-manual.html#optionally-building-a-toolchain-installer>]" section in the Yocto Project Application Developer's Guide.

7.88. `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 IPK).
- `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 IPK package manager.

The `populate_sdk_base` package 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 images: `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 [<http://www.yoctoproject.org/docs/1.6/adt-manual/adt-manual.html#optionally-building-a-toolchain-installer>]" section in the Yocto Project Application Developer's Guide.

7.89. `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`".

7.90. `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`".

7.91. `prserv.bbclass`

The `prserv` class provides functionality for using a PR service [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#working-with-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.

7.92. `ptest.bbclass`

The `ptest` 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` [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#testing-packages-with-ptest>]" section in the Yocto Project Development Manual for more information on `ptest`.

7.93. `python-dir.bbclass`

The `python-dir` class provides the base version, location, and site package location for Python.

7.94. **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.

7.95. **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.

7.96. **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_QMAKEVARS_PRE` or `EXTRA_QMAKEVARS_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 `QMAKE_PROFILES` variable.

7.97. **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.

7.98. **relocatable.bbclass**

The `relocatable` class enables relocation of binaries when they are installed into the `sysroot`.

This class makes use of the `chrtpath` class and is used by both the `cross` and `native` classes.

7.99. **report-error.bbclass**

The `report-error` class supports enabling the error reporting tool [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#using-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`.

7.100. **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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 eglibc"
```

7.101. `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 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.

7.102. `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.

7.103. `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.

7.104. `SDL.bbclass`

The `SDL` class supports recipes that need to build software that uses the Simple DirectMedia Layer (SDL) library.

7.105. `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.

7.106. **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.

7.107. **sip.bbclass**

The `sip` class supports recipes that build or package SIP-based Python bindings.

7.108. **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.

7.109. **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_ENDIANNESS` and `SITEINFO_BITS` that can be used elsewhere in the metadata.

Because the base class includes the `siteinfo` class, it is always active.

7.110. **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 1.5 release.

7.111. **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.

7.112. **staging.bbclass**

The `staging` class provides support for staging files into the `sysroot` during the `do_populate_sysroot` task. The class is enabled by default because it is inherited by the base class.

7.113. **syslinux.bbclass**

The `syslinux` class provides `syslinux`-specific functions for building bootable images.

The class supports the following variables:

- `INITRD`: Indicates a filesystem image to 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.

7.114. **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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#selecting-an-initialization-manager>]" section in the Yocto Project Development Manual.

7.115. **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.

7.116. **testimage.bbclass**

The `testimage` class supports running automated tests against images using QEMU and on actual hardware. The class handles loading the tests and starting the image.

To use the class, you need to perform steps to set up the environment. The tests are commands that run on the target system over ssh. they are written in Python and make use of the `unittest` module.

For information on how to enable, run, and create new tests, see the "Performing Automated Runtime Testing [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#performing-automated-runtime-testing>]" section.

7.117. **tinderclient.bbclass**

The `tinderclient` class submits build results to an external Tinderbox instance.

Note

This class is currently unmaintained.

7.118. **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.

7.119. **toolchain-scripts.bbclass**

The `toolchain-scripts` class provides the scripts used for setting up the environment for installed SDKs.

7.120. **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"
```

7.121. **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.

7.122. **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` [<http://git.yoctoproject.org/cgit/cgit.cgi/poky/tree/meta/classes/update-alternatives.bbclass>].

Note

You can use the `update-alternatives` command directly in your recipes. However, this class simplifies things in most cases.

7.123. `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.

7.124. `useradd.bbclass`

The `useradd` class supports 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 this class to enable creation of the user or group. The meta-skeleton/recipes-skeleton/useradd/useradd-example.bb recipe in the Source Directory [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 this class.

The `useradd` class supports the `USERADD_PACKAGES`, `USERADD_PARAM`, `GROUPADD_PARAM`, and `GROUPMEMS_PARAM` variables.

7.125. `useradd-staticids.bbclass`

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 this 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.

7.126. `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.

7.127. **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 `base_contains()`.

This class is enabled by default because it is inherited by the base class.

7.128. **vala.bbclass**

The `vala` class supports recipes that need to build software written using the Vala programming language.

7.129. **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. 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) components is only supported for minimal and base images. Furthermore, if you are going to build an image using non-GPLv3 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 = "GPLv3"`

From within the poky Git repository, use the following command to list the supported images:

```
$ ls meta*/recipes*/images/*.bb
```

These recipes reside in the `meta/recipes-core/images`, `meta/recipes-extended/images`, `meta/recipes-graphics/images`, `meta/recipes-qt/images`, `meta/recipes-rt/images`, `meta/recipes-sato/images`, and `meta-skeleton/recipes-multilib/images` directories within the Source Directory [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#source-directory>]. Although the recipe names are somewhat explanatory, here is a list that describes them:

- `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 [<http://www.vmware.com/products/player/overview.html>] or VMware Workstation [<http://www.vmware.com/products/workstation/overview.html>]. For more information on this image, see the Build Appliance [<http://www.yoctoproject.org/documentation/build-appliance>] page on the Yocto Project website.
- `core-image-base`: A console-only image that fully supports the target device hardware.
- `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-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.
- `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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#performing-automated-runtime-testing>]” section in the Yocto Project Development Manual.
- `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.

- `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 is suitable for development using the target.
- `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-x11`: A very basic X11 image with a terminal.
- `core-image-weston`: An image that provides the Wayland protocol libraries and the reference Weston compositor. For more information, see the "Wayland" section.
- `qt4e-demo-image`: An image that launches into the demo application for the embedded (not based on X11) version of Qt.
- `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-multilib-example`: An example image that includes a `lib32` version of Bash into an otherwise standard sato image. The image assumes a "lib32" multilib has been enabled in the your configuration.

Tip

From the Yocto Project release 1.1 onwards, `-live` and `-directdisk` images have been replaced by a "live" option in `IMAGE_FSTYPES` that will work with any image to produce an image file that can be copied directly to a CD or USB device and run as is. To build a live image, simply add "live" to `IMAGE_FSTYPES` within the `local.conf` file or wherever appropriate and then build the desired image as normal.

Chapter 9. Features

This chapter provides a reference of shipped machine and distro features you can include as part of the image, a reference on image types you can build, 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 in the `poky.conf` distribution configuration file. 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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>'
```

9.1. 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 `do_configure` 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
- `ext2`: Hardware HDD or Microdrive
- `irda`: Hardware has IrDA support
- `keyboard`: Hardware has a keyboard
- `pci`: Hardware has a PCI bus
- `pcmcia`: Hardware has PCMCIA or CompactFlash sockets
- `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
- `wifi`: Hardware has integrated WiFi

9.2. 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 `do_configure` 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` [http://www.yoctoproject.org/docs/1.6/ref-manual/ref-manual.html#var-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.
- `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.

9.3. 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.

Current list of `IMAGE_FEATURES` contains the following:

- `dbg-pkgs`: Installs debug symbol packages for all packages installed in a given image.
- `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.
- `nfs-server`: Installs an NFS server.
- `read-only-rootfs`: Creates an image whose root filesystem is read-only. See the "Creating a Read-Only Root Filesystem [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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.
- `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.
- `staticdev-pkgs`: Installs static development packages (i.e. static libraries containing *.a files) for all packages installed in a given image.
- `tools-debug`: Installs debugging tools such as `strace` and `gdb`. For information on GDB, see the "Debugging With the GNU Project Debugger (GDB) Remotely [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#platdev-gdb-remotedebug>]" section in the Yocto Project Development Manual. For information on tracing and profiling, see the Yocto Project Profiling and Tracing Manual [<http://www.yoctoproject.org/docs/1.6/profile-manual/profile-manual.html>].
- `tools-profile`: Installs profiling tools such as `oprofile`, `exmap`, and `LTTng`. For general information on user-space tools, see the "User-Space Tools [<http://www.yoctoproject.org/docs/1.6/adt-manual/adt-manual.html#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.

9.4. 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 10. Variables Glossary

This chapter lists common variables used in the OpenEmbedded build system and gives an overview of their function and contents.

Glossary

A B C D E F G H I K L M O P Q R S T U W

A

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.

AUTHOR The email address used to contact the original author or authors in order to send patches and forward bugs.

AUTO_SYSLINUXMENU Enables creating an automatic menu. You must set this 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}"
```

B

B The directory within the Build Directory [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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> <package_name> <package_name> ..."
```

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> = "<package_name>"
```

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.

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 when a threshold is broken.
- WARN: Issue a warning but continue the build when a threshold is broken. Subsequent warnings are issued as defined by the BB_DISKMON_WARNINTERVAL variable, which must be defined in the conf/local.conf file.

<dir> is:

Any directory you choose. You can specify one or more directories to monitor by separating the groupings with a space. If two directories are 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 the value. Specify the threshold using G, M, K for Gbytes, Mbytes, and Kbytes, respectively. If you do not specify G, M, or K, Kbytes is assumed by default. Do not use GB, MB, or KB.

Here are some examples:

```
BB_DISKMON_DIRS = "ABORT,${TMPDIR},1G,100K WARN,${SSTATE_DIR},1G,  
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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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_interval>,<disk_inode_inte
```

where:

`<disk_space_interval>` is:

An interval of memory expressed in either G, M, or K for Gbytes, Mbytes, or Kbytes, respectively. You cannot use GB, MB, or KB.

`<disk_inode_interval>` is:

An interval of free inodes expressed in either G, M, or K for Gbytes, Mbytes, or Kbytes, respectively. You cannot use GB, MB, or KB.

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#build-directory>].

BB_NUMBER_THREADS

The maximum number of tasks BitBake should run in parallel at any one time. If your host development system supports multiple cores, a good rule of thumb is to set this variable to twice the number of cores.

The default value for `BB_NUMBER_THREADS` is equal to the number of cores your build system has.

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.
BBLAYERS	Lists the layers to enable during the build. This variable is defined in the <code>bblayers.conf</code> configuration file in the Build Directory [http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 \
"
```

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 <code>bblayers.conf</code> file during a build using the Hob [https://www.yoctoproject.org/tools-resources/projects/hob].
------------------------	---

Note

When building an image outside of Hob, this variable is ignored.

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 <code>BBMASK</code> variable from within the <code>conf/local.conf</code> file found in the Build Directory [http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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/recipes-ti/packagegroup/"  
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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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_directory>"  
$ 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#source-directory>].

BINCONFIG_GLOB

When inheriting binconfig.bbclass from a recipe, 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev->

manual.html#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.

BUILDDIR Points to the location of the Build Directory [http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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, 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, 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@${DISTRO}>"
```

BUILDHISTORY_DIR When inheriting the buildhistory class, 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, 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, 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, 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 ?= ""
```

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

CFLAGS	Flags passed to the C compiler for the target system. This variable evaluates to the same as TARGET_CFLAGS. For information on flags that help with creating more secure code, see the "Making Images More Secure [http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#making-images-more-secure]" section in the Yocto Project Development Manual.
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: <pre>DEPENDS_append_class-native = " python-native"</pre>
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 [http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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'
```

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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`.

CONFLICT_DISTRO_FEATURES

When a recipe inherits 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.

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.

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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.

D

D

The destination directory. The location in the Build Directory [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#build-directory>] where components are installed by the `do_install` task. This location defaults to:

`${WORKDIR}/image`

DATETIME

The date and time on which the current build started. The format is suitable for timestamps.

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.

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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" and "Application Development SDK" sections.

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 `${MACHINE}` name. By default, this directory resides within the Build Directory [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#build-directory>] as `${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.

DEPLOYDIR

For recipes that inherit 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_SIGNATURE}-02"
```

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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_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 `do_configure` 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 ~~Considered~~ 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_NAME The long name of the distribution.

DISTRO_PN_ALIAS Alias names used for the recipe in various Linux distributions.

See the "Handling a Package Name Alias [http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#usingpoky-configuring-DISTRO_PN_ALIAS]" section in the Yocto Project Development Manual for more information.

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [184]" chapter.

E

ENABLE_BINARY_LOCALE_GENERATION

Variable that controls which locales for `eglibc` are generated during the build (useful if the target device has 64Mbytes of RAM or less).

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.

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#using-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"
```

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} (= ${EXTENDPKG})"
```

The dependency relationships are intended to force the package manager to upgrade these types of packages in lock-step.

EXTERNALSRC

If `externalsrc.bbclass` is inherited, 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#building-software-from-an-external-source>]" section in the Yocto Project Development Manual.

EXTERNALSRC_BUILD

If `externalsrc.bbclass` is inherited, 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#building-software-from-an-external-source>]" section in the Yocto Project Development Manual.

EXTRA_IMAGE_FEATURES

The list of additional features to include in an image. Typically, you configure this variable in your `local.conf` file, which is found in the Build Directory [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 installed packages including symbol information for debugging and profiling.

"`debug-tweaks`" - Makes an image suitable for development. For example, `ssh` root access has a blank password. You should remove this feature before you produce a production image.

"`dev-pkgs`" - Adds `-dev` packages for all installed packages. This is useful if you want to develop against the libraries in the image.

"`read-only-rootfs`" - Creates an image whose root filesystem is read-only. See the "Creating a Read-Only Root Filesystem [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#creating-a-read-only-root-filesystem>]" 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, lttng and valgrind (x86 only).

"tools-sdk" - Adds development tools such as gcc, make, 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#usingpoky-extend-customimage-imagefeatures>]" section in the Yocto Project Development Manual.

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 *RRECOMMENDS variables.

EXTRA_OECMAKE

Additional cmake options.

EXTRA_OECONF

Additional configure script options.

EXTRA_OEMAKE

Additional GNU make options.

EXTRA_OESCONS

When a recipe inherits the scon class, this variable specifies additional configuration options you want to pass to the scon command line.

EXTRA_QMAKEVARS_POST

Configuration variables or options you want to pass to qmake. Use this variable when the arguments need to be after the .pro file list on the command line.

This variable is used with recipes that inherit the qmake_base class or other classes that inherit qmake_base.

EXTRA_QMAKEVARS_PRE

Configuration variables or options you want to pass to qmake. Use this variable when the arguments need to be before the .pro file list on the command line.

This variable is used with recipes that inherit the qmake_base class or other classes that inherit qmake_base.

EXTRA_USERS_PARAMS

When a recipe inherits the extrausers 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 useradd class, which ties user and group configurations to a specific recipe.

The set list of commands you can configure using the `EXTRA_USERS_PARAMS` is shown in the `extrausers` class. These commands map to the normal Unix commands of the same names:

```
# EXTRA_USERS_PARAMS = "\
# useradd -p '' tester; \
# groupadd developers; \
# userdel nobody; \
# groupdel -g video; \
# groupmod -g 1020 developers; \
# usermod -s /bin/sh tester; \
# "
```

F

`FEATURE_PACKAGES`

Defines one or more packages to include in an image when a specific item is included in `IMAGE_FEATURES`. 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 package2"
```

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://192.168.7.1/BOARD-dir"
```

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 identifies the files you want included as part of the resulting package. Here is an example:

```
FILES_${PN} += "${bindir}/mydir1/ ${bindir}/mydir2/myfile"
```

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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.

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

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:path_3:"
```

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 that is located at `bitbake/doc/manual` in the Source Directory [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#source-directory>].

By default, the `FILESOVERRIDES` variable is defined as:

```
FILESOVERRIDES = "${TRANSLATED_TARGET_ARCH}:${MACHINEOVERRIDES}:"
```

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#source-directory>]:

```
FILESPATH = "${@base_set_filespath(["${FILE_DIRNAME}/${BP}", \
    "${FILE_DIRNAME}/${BPN}", "${FILE_DIRNAME}/files"], d)}"
```

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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_PACKAGES

When a recipe inherits 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

GROUPADD_PARAM

When a recipe inherits 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 a recipe inherits 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

For recipes that inherit 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.

H

HOMEPAGE Website where more information about the software the recipe is building can be found.

HOST_SYS Specifies the system, including the architecture and the operating system, for with the build is occurring in the context of the current recipe. The OpenEmbedded build system automatically sets this variable. You do not need to set the variable yourself.

Here are 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".

I

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 4`, where the number 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 <code>ICECC_PARALLEL_MAKE</code> , the build system does not use it (i.e. the system does not detect and assign the number of cores as is done with <code>PARALLEL_MAKE</code>).
<code>ICECC_PATH</code>	The location of the <code>icecc</code> binary. You can set this variable in your <code>local.conf</code> file. If your <code>local.conf</code> file does not define this variable, the <code>icecc</code> class attempts to define it by locating <code>icecc</code> using <code>which</code> .
<code>ICECC_USER_CLASS_BL</code>	Identifies user classes that you do not want the Icecream distributed compile support to consider. This variable is used by the <code>icecc</code> class. You set this variable in your <code>local.conf</code> 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.
<code>ICECC_USER_PACKAGE_BL</code>	Identifies user recipes that you do not want the Icecream distributed compile support to consider. This variable is used by the <code>icecc</code> class. You set this variable in your <code>local.conf</code> 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.
<code>ICECC_USER_PACKAGE_WL</code>	Identifies user recipes that use an empty <code>PARALLEL_MAKE</code> variable that you want to force remote distributed compilation on using the Icecream distributed compile support. This variable is used by the <code>icecc</code> class. You set this variable in your <code>local.conf</code> file.
<code>IMAGE_BASENAME</code>	The base name of image output files. This variable defaults to the recipe name (<code>\${PN}</code>).
<code>IMAGE_CLASSES</code>	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 <code>IMAGE_CLASSES</code> is <code>image_types</code>. You can set this variable in your <code>local.conf</code> or in a distribution configuration file. For more information, see <code>meta/classes/image_types.bbclass</code> in the Source Directory [http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#source-directory].
<code>IMAGE_FEATURES</code>	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 <code>local.conf</code> file, which is found in the Build Directory [http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#build-directory], best practices dictate that you do not. Note To enable extra features from outside the image recipe, use the <code>EXTRA_IMAGE_FEATURES</code> 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 <code>IMAGE_FEATURES</code> and <code>EXTRA_IMAGE_FEATURES</code>" [http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#usingpoky-extend-customimage-imagefeatures] section in the Yocto Project Development Manual.
<code>IMAGE_FSTYPES</code>	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 [100]` 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).

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 = "${DEPLOY_DIR_IMAGE}/${IMAGE_NAME}.rootfs.manifest"
```

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}-${DATETIME}"
```

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.

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 Added by classes to run post processing commands once the OpenEmbedded build system has created the image. You can specify shell commands separated by semicolons:

```
IMAGE_POSTPROCESS_COMMAND += "<shell_command>; ... "
```

If you need to pass the path to the root filesystem within the command, you can use `${IMAGE_ROOTFS}`, which points to the root filesystem image.

IMAGE_ROOTFS The location of the root filesystem while it is under construction (i.e. during `do_rootfs`). This variable is not configurable. Do not change it.

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) + xspace

where:

image-du = Returned value of the du command on
           the image.

overhead = IMAGE_OVERHEAD_FACTOR

rootfs-size = IMAGE_ROOTFS_SIZE

internal-rootfs-size = Initial root filesystem
                      size before any modifications.

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:

```
jffs2
jffs2.sum
cramfs
ext2
ext2.gz
ext2.bz2
ext3
ext3.gz
ext2.lzma
btrfs
live
squashfs
squashfs-xz
ubi
ubifs
tar
tar.gz
tar.bz2
tar.xz
cpio
cpio.gz
cpio.xz
cpio.lzma
vmdk
elf
```

For more information on how these types of images, see `meta/classes/image_types*.bbclass` in the Source

Directory [http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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:INC_PR = "r2"
recipes-graphics/xorg-font/encodings_1.0.4.bb:PR = "${INC_PR}.1"
recipes-graphics/xorg-font/font-util_1.3.0.bb:PR = "${INC_PR}.0"
recipes-graphics/xorg-font/font-alias_1.0.3.bb:PR = "${INC_PR}.3"
```

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 = "GPLv3"
```

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_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 license"
```

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-initramfs"
```

By default, the kernel class sets this variable to a null string as follows:

```
INITRAMFS_IMAGE = ""
```

See the local.conf.sample.extended [<http://git.yoctoproject.org/cgit/cgit.cgi/poky/tree/meta-yocto/conf/local.conf.sample.extended>] file for additional information. You can also reference the kernel.bbclass [<http://git.yoctoproject.org/cgit/cgit.cgi/poky/tree/meta/classes/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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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` [<http://git.yoctoproject.org/cgit/cgit.cgi/poky/tree/meta-yocto/conf/local.conf.sample.extended>] file for additional information.

INITRD	Indicates a filesystem image to use as an initial RAM disk (<code>initrd</code>). The <code>INITRD</code> variable is an optional variable used with the <code>building</code> class.
INITSCRIPT_NAME	The filename of the initialization script as installed to <code>\${sysconfdir}/init.d</code>. This variable is used in recipes when using <code>update-rc.d.bbclass</code>. The variable is mandatory.
INITSCRIPT_PACKAGES	A list of the packages that contain <code>initscripts</code>. If multiple packages are specified, you need to append the package name to the other <code>INITSCRIPT_*</code> as an override. This variable is used in recipes when using <code>update-rc.d.bbclass</code>. The variable is optional and defaults to the <code>PN</code> variable.
INITSCRIPT_PARAMS	Specifies the options to pass to <code>update-rc.d</code>. Here is an example: <pre>INITSCRIPT_PARAMS = "start 99 5 2 . stop 20 0 1 6 ."</pre> 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 is mandatory and is used in recipes when using <code>update-rc.d.bbclass</code>.
INSANE_SKIP	Specifies the QA checks to skip for a specific package within a recipe. For example, to skip the check for symbolic link <code>.so</code> 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 <code>\${PN}</code>: <pre>INSANE_SKIP_\${PN} += "dev-so"</pre> See the "<code>insane.bbclass</code>" 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 <code>opkg</code> 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 [<http://www.yoctoproject.org/docs/1.6/kernel-dev/kernel-dev.html#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. The KBRANCH variable is optional. You can use it to trigger checks 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 3.10 kernel, the kernel recipe file is the meta/recipes-kernel/linux/linux-yocto_3.10.bb file. Following is the default value for KBRANCH and the default override for the architectures the Yocto Project supports:

```
KBRANCH_DEFAULT = "standard/base"
KBRANCH = "${KBRANCH_DEFAULT}"
```

This branch exists in the linux-yocto-3.10 kernel Git repository <http://git.yoctoproject.org/cgi/linux-yocto-3.10/refs/heads>.

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 Crown Bay BSP is in the meta-intel Git repository and is named meta-crownbay/recipes-kernel/linux/linux-yocto_3.10.bbappend. Here are the related statements from the append file:

```
COMPATIBLE_MACHINE_crownbay = "crownbay"
KMACHINE_crownbay = "crownbay"
KBRANCH_crownbay = "standard/crownbay"
KERNEL_FEATURES_append_crownbay = " features/drm-emgd/drm-emgd-1.

COMPATIBLE_MACHINE_crownbay-noemgd = "crownbay-noemgd"
KMACHINE_crownbay-noemgd = "crownbay"
KBRANCH_crownbay-noemgd = "standard/crownbay"
KERNEL_FEATURES_append_crownbay-noemgd = " cfg/vesafb"
```

The KBRANCH_* statements identify the kernel branch to use when building for the Crown Bay BSP. In this case there are two identical statements: one for each type of Crown Bay machine.

KBRANCH_DEFAULT Defines the Linux kernel source repository's default branch used to build the Linux kernel. The KBRANCH_DEFAULT value is the default

	value for KBRANCH. Unless you specify otherwise, KBRANCH_DEFAULT initializes to "master".
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 [http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 qemu86 machine: <pre># Add netfilter to all linux-yocto kernels KERNEL_FEATURES="features/netfilter" # Add sound support to the qemu86 machine KERNEL_FEATURES_append_qemu86=" cfg/sound"</pre>
KERNEL_IMAGE_BASE_NAME	The base name of the kernel image. This variable is set in the kernel class as follows: <pre>KERNEL_IMAGE_BASE_NAME ?= "\${KERNEL_IMAGETYPE}-\${PKGNAME}-\${PKGVERSION}"</pre> See the KERNEL_IMAGETYPE, PKGNAME, PKGVERSION, PKGNAME, MACHINE, and DATETIME variables for additional information.
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.
KERNEL_PATH	The location of the kernel sources. This variable is set to the value of the STAGING_KERNEL_DIR within the module.bbclass class. For information on how this variable is used, see the "Incorporating Out-of-Tree Modules" [http://www.yoctoproject.org/docs/1.6/kernel-dev/kernel-dev.html#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.bbclass class. For information on how this variable is used, see the "Incorporating Out-of-Tree Modules" [http://www.yoctoproject.org/docs/1.6/kernel-dev/kernel-dev.html#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.

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 smp.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 qemuarm goes by a different name in the Linux Yocto kernel. The kernel understands that machine as arm_versatile926ejs. For cases like these, the KMACHINE variable maps the kernel machine name to the OpenEmbedded build system machine name.

Kernel machine names are initially defined in the Yocto Linux Kernel's meta branch. From the meta branch, look in the meta/cfg/kernel-cache/bsp/<bsp_name>/<bsp-name>-<kernel-type>.scc file. For example, from the meta branch in the linux-yocto-3.0 kernel, the meta/cfg/kernel-cache/bsp/cedartrail/cedartrail-standard.scc file has the following:

```
define KMACHINE cedartrail
define KTYPE standard
define KARCH i386

include ktypes/standard
branch cedartrail

include cedartrail.scc
```

You can see that the kernel understands the machine name for the Cedar Trail Board Support Package (BSP) as cedartrail.

If you look in the Cedar Trail BSP layer in the meta-intel Source Repositories [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#source-repositories>] at meta-cedartrail/recipes-kernel/linux/linux-yocto_3.0.bbappend, you will find the following statements among others:

```
COMPATIBLE_MACHINE_cedartrail = "cedartrail"
KMACHINE_cedartrail = "cedartrail"
KBRANCH_cedartrail = "yocto/standard/cedartrail"
KERNEL_FEATURES_append_cedartrail += "bsp/cedartrail/cedartrail-p
KERNEL_FEATURES_append_cedartrail += "cfg/efi-ext.scc"

COMPATIBLE_MACHINE_cedartrail-nopvr = "cedartrail"
KMACHINE_cedartrail-nopvr = "cedartrail"
KBRANCH_cedartrail-nopvr = "yocto/standard/cedartrail"
KERNEL_FEATURES_append_cedartrail-nopvr += " cfg/smp.scc"
```

The KMACHINE statements in the kernel's append file make sure that the OpenEmbedded build system and the Yocto Linux kernel understand the same machine names.

This append file uses two `KMACHINE` statements. The first is not really necessary but does ensure that the machine known to the OpenEmbedded build system as `cedartrail` maps to the machine in the kernel also known as `cedartrail`:

```
KMACHINE_cedartrail = "cedartrail"
```

The second statement is a good example of why the `KMACHINE` variable is needed. In this example, the OpenEmbedded build system uses the `cedartrail-nopvr` machine name to refer to the Cedar Trail BSP that does not support the proprietary PowerVR driver. The kernel, however, uses the machine name `cedartrail`. Thus, the append file must map the `cedartrail-nopvr` machine name to the kernel's `cedartrail` name:

```
KMACHINE_cedartrail-nopvr = "cedartrail"
```

BSPs that ship with the Yocto Project release provide all mappings between the Yocto Project kernel machine names and the OpenEmbedded machine names. Be sure to use the `KMACHINE` if you create a BSP and the machine name you use is different than that used in the kernel.

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 [<http://www.yoctoproject.org/docs/1.6/kernel-dev/kernel-dev.html#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 [<http://www.yoctoproject.org/docs/1.6/kernel-dev/kernel-dev.html#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 <code>conf/layer.conf</code> file and must be suffixed with the name of the specific layer (e.g. <code>LAYERVERSION_mylayer</code>).
LEAD_SONAME	Specifies the lead (or primary) compiled library file (<code>.so</code>) 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 <code>LICENSE</code> 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 <code> </code> (pipe) when there is a choice between licenses. • Separate license names using <code>&</code> (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 <code>meta/files/common-licenses/</code> or the <code>SPDXLICENSEMAP</code> flag names defined in <code>meta/conf/licenses.conf</code>. Here are some examples: <pre>LICENSE = "LGPLv2.1 GPLv3" LICENSE = "MPL-1 & LGPLv2.1" LICENSE = "GPLv2+"</pre> 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 <code>sysstat</code>, 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: <pre>LICENSE = "GFDL-1.2 & GPLv2" LICENSE_\${PN} = "GPLv2" LICENSE_\${PN}-doc = "GFDL-1.2"</pre>
LICENSE_PATH	Path to additional licenses used during the build. By default, the OpenEmbedded build system uses <code>COMMON_LICENSE_DIR</code> to define the directory that holds common license text used during the build. The <code>LICENSE_PATH</code> variable allows you to extend that location to other areas that have additional licenses:

```
LICENSE_PATH += "/path/to/additional/common/licenses"
```

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 [<http://www.yoctoproject.org/docs/1.6/kernel-dev/kernel-dev.html#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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_KERNEL_TYPE}"
```

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#source-directory>] in meta/conf/machine.

The list of machines supported by the Yocto Project as shipped include the following:

```
MACHINE ?= "qemuarm"
MACHINE ?= "qemumips"
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_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"
```

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-firmware"
```

`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-examplerwifi`, you would use the following in the `.conf` file for the machine:

```
MACHINE_EXTRA_RRECOMMENDS += "kernel-module-examplerwifi"
```

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_CONSIDERED 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.config \
                           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 (DISTR0) 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

Lists kernel modules that need to be auto-loaded during boot.

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).

Specify it as follows:

```
module_autoload_<modname> = "modname1 modname2 modname3"
```

You must use the kernel module name override.

Including 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:

```
module_autoload_modname = "modname"
```

For information on how to populate the modname.conf file with modprobe.d syntax lines, see the module_conf variable.

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).

Here is the general syntax:

```
module_conf_<modname> = "modprobe.d-syntax"
```

You must use the kernel module name override.

Run `man modprobe.d` in the shell to find out more information on the exact syntax for lines 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:

```
module_conf_<modname> = "options modname arg1=val1 arg2=val2"
```

For information on how to specify kernel modules to auto-load on boot, see the `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-${PKGE}-${PKGVERSION}-${PKGR}-${MACHINE}"
```

See the `PKGE`, `PKGVERSION`, `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.

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> = "<package_name>"
```

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 `building` 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 `building` 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

OE_BINCONFIG_EXTRA_MANGLE When a recipe inherits the `binconfig.bbclass` 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#platdev-appdev-devshell>]" 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
```

Note

Konsole support only works for KDE 3.x. Also, "auto" is the default behavior for `OE_TERMINAL`.

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 OER00T 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 (eglibc).

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 BitBake Manual that is located at bitbake/doc/manual in the Source Directory [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#source-directory>].

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.

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 package_ipk package_t
```

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 package_tar"
```

The OpenEmbedded build system uses the IPK package manager to create your image or SDK as well as generating TAR packages.

You cannot specify the package_tar class first in the list. Files using the .tar format cannot be used as a substitute packaging format for DEB, RPM, and IPK formatted files for 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_EXCLUDE Lists packages that should not be installed into an image. For example:

```
PACKAGE_EXCLUDE = "<package_name> <package_name> <package_name> .
```

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_name>"
```

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_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` [100] image. When working with an initial RAM disk (initramfs) image, use the `PACKAGE_INSTALL` variable.

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,build-deps-f1,rt-deps  
PACKAGECONFIG[f2] = "--with-f2,--without-f2,build-deps-f2,rt-deps  
PACKAGECONFIG[f3] = "--with-f3,--without-f3,build-deps-f3,rt-deps
```

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,--without-croco,libcroco"
```

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-<recipename>="f4 f5"
```

Or, you can just amend the variable:

```
PACKAGECONFIG_append_pn-<recipename> = " f4"
```

PACKAGES The list of packages to be created from the recipe. The default value is the following:

```
${PN}-dbg ${PN}-staticdev ${PN}-dev ${PN}-doc ${PN}-locale ${PACK
```

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 `do_rootfs`.

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" [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#handling-optional-module-packaging>] section in the Yocto Project Development Manual.

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.

If your development host supports multiple cores, a good rule of thumb is to set this variable to twice the number of cores on the host. If you do not set `PARALLEL_MAKE`, it defaults to the number of cores your build system has.

Note

Individual recipes might clear out this variable if the software being built has problems running its `make` process in parallel.

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

Individual recipes might clear out this variable if the software being built has problems running its `make install` process in parallel.

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 `do_patch`. 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. `eglibc-2.13-r20+svnr15508/` and `bash-4.2-r1/`). This variable is comprised of the following:

```
${PN} - ${EXTENDPE} ${PV} - ${PR}
```

PIXBUF_PACKAGES When a recipe inherits 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>`.

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 <code>do_package</code> task to write output from the <code>do_packagedata</code> task. The <code>PKGDESTWORK</code> location defaults to the following: <pre style="text-align: center;">\${WORKDIR}/pkgdata</pre> The <code>do_packagedata</code> task then packages the data in the temporary work area and installs it into a shared directory pointed to by <code>PKGDATA_DIR</code>. Do not change this default.
PKGE	The epoch of the output package built by the OpenEmbedded build system. By default, <code>PKGE</code> is set to <code>PE</code>.
PKGR	The revision of the output package built by the OpenEmbedded build system. By default, <code>PKGR</code> is set to <code>PR</code>.
PGKV	The version of the output package built by the OpenEmbedded build system. By default, <code>PGKV</code> is set to <code>PV</code>.
PN	This variable can have two separate functions depending on the context: a recipe name or a resulting package name. <code>PN</code> 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 <code>expat_2.0.1.bb</code>, then the default value of <code>PN</code> will be <code>"expat"</code>. The variable refers to a package name in the context of a file created or produced by the OpenEmbedded build system. If applicable, the <code>PN</code> variable also contains any special suffix or prefix. For example, using <code>bash</code> to build packages for the native machine, <code>PN</code> is <code>bash-native</code>. Using <code>bash</code> to build packages for the target and for Multilib, <code>PN</code> would be <code>bash</code> and <code>lib64-bash</code>, respectively.
PNBLACKLIST	Lists recipes you do not want the OpenEmbedded build system to build. This variable works in conjunction with the <code>blacklist</code> class, which the recipe must inherit globally. To prevent a recipe from being built, inherit the class globally and use the variable in your <code>local.conf</code> file. Here is an example that prevents <code>myrecipe</code> from being built: <pre>INHERIT += "blacklist" PNBLACKLIST[myrecipe] = "Not supported by our organization."</pre>
PR	The revision of the recipe. The default value for this variable is <code>"r0"</code>.
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 <code>PN</code> of the recipe to which you want to give precedence. Some examples: <pre>PREFERRED_PROVIDER_virtual/kernel ?= "linux-yocto"</pre>

```
PREFERRED_PROVIDER_virtual/xserver = "xserver-xf86"  
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 = "3.10%"
```

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#build-directory>]:

```
PREMIRRORS_prepend = "\n  
git://.*.* http://www.yoctoproject.org/sources/ \n \n  
ftp://.*.* http://www.yoctoproject.org/sources/ \n \n  
http://.*.* http://www.yoctoproject.org/sources/ \n \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.

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#working-with-a-pr-service>]" section in the Yocto Project Development Manual.

PROVIDES

A list of aliases that a recipe also provides. These aliases are useful for satisfying dependencies of other recipes during the build (as specified by DEPENDS).

Note

A recipe's own PN is implicitly already in its PROVIDES list.

PRSERV_HOST

The network based PR service host and port.

The `conf/local.conf.sample.extended` configuration file in the Source Directory [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#working-with-a-pr-service]. You can set PRSERV_HOST to other values to use a remote PR service.

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

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-package-name"
```

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> <version>)"
```

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.bbclass`.

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> <version>)"
```

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 a recipe inherits 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 <code>local.conf</code> file to remove these images.
<code>RM_WORK_EXCLUDE</code>	With <code>rm_work</code> enabled, this variable specifies a list of recipes whose work directories should not be removed. See the " <code>rm_work.bbclass</code> " section for more details.
<code>ROOT_HOME</code>	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.

<code>ROOTFS</code>	Indicates a filesystem image to include as the root filesystem. The <code>ROOTFS</code> variable is an optional variable used with the <code>building</code> class.
<code>ROOTFS_POSTPROCESS_COMMAND</code>	Used by classes to run post processing commands once the OpenEmbedded build system has created the root filesystem. You can specify shell commands separated by semicolons:

```
ROOTFS_POSTPROCESS_COMMAND += "<shell_command>; ... "
```

If you need to pass the path to the root filesystem within the command, you can use `${IMAGE_ROOTFS}`, which points to the root filesystem image.

<code>RPROVIDES</code>	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 <code>RDEPENDS</code>).
------------------------	---

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 needs them for the extended usability. To specify runtime dependencies for packages, see the RDEPENDS variable.

The OpenEmbedded build process automatically installs the list of packages as part of the built package. However, you can remove these packages later if you want. If, during the build, a package from the RRECOMMENDS list cannot be found, the build process continues without an error.

You can also prevent packages in the list from being installed by using several variables. See the BAD_RECOMMENDATIONS, NO_RECOMMENDATIONS, and PACKAGE_EXCLUDE variables for more information.

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_name>"
```

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> <version>)"
```

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-replaced"
```

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> <version>)"
```

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-package"
```

S

S

The location in the Build Directory [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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/5.1.19-r3/db-5.1.19

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_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}-${SDK_ARCH}-${IMAGE_BASENAME}-${TUNE_PKGARCH}"
```

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`.

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 architecture of the machine that runs Application Development Toolkit (ADT) items. In other words, packages are built so that they

will run on the target you specify with the argument. This implies that you can build out ADT/SDK items that run on an architecture other than that of your build host. For example, you can use an x86_64-based build host to create packages that will run on an i686-based SDK Machine.

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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.
SECTION	The section in which packages should be categorized. Package management utilities can make use of this variable.
SELECTED_OPTIMIZATION	The variable takes the value of <code>FULL_OPTIMIZATION</code> unless <code>DEBUG_BUILD = "1"</code> . In this case the value of <code>DEBUG_OPTIMIZATION</code> 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 <code>SERIAL_CONSOLES</code> 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	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->mplayer2"
```

In this example, `intone` depends on `mplayer2`.

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_EXCLUDERECIPES_ABISAFE 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.

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_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 an example:

```
INHERIT += "own-mirrors"
SOURCE_MIRROR_URL = "http://example.com/my-source-mirror"
```

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:

- `file://` - Fetches files, which are usually files shipped with the Metadata [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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.
- `svk://` - Fetches files from an SVK revision control 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`.
- `cvs://` - 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.
- `subdir` - Places the file (or extracts its contents) into the specified subdirectory of `WORKDIR`. This option is useful for unusual tarballs or other archives that do not have their files already in a subdirectory within the archive.
- `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 [http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 wish to build a fixed revision and you wish 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.

SSTATE_DIR The directory for the shared state cache.

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/sstate/PATH \n \
file://.* file:///some/local/dir/sstate/PATH"
```

STAGING_KERNEL_DIR The directory with kernel headers that are required to build out-of-tree modules.

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_SYS}/${PN}/${EXTENDPE}$"
```

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.

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.

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"
```

The class checks for and uses the variable as needed.

SYSLINUX_SPLASH 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.

SYSLINUX_SERIAL_TTY Specifies the alternate `console=tty...` kernel boot argument. The variable's default value is set in the `syslinux` as follows:

```
SYSLINUX_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 For recipes that inherit 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 For recipes that inherit 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 recipe's 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 For recipes that inherit 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"
```

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
```

TARGET_CFLAGS Flags passed to the C compiler for the target system. This variable evaluates to the same as `CFLAGS`.

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_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.

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 "eglibc" or "uclibc".

Note

This release of the Yocto Project does not support the glibc implementation of libc.

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 [<http://www.yoctoproject.org/download/yocto-project-16-poky-1100>] for the specific components with which the toolchain must be compatible.

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 meta-sourcery layer at <http://github.com/MentorEmbedded/meta-sourcery/>. You can use meta-sourcery as a template for adding support for other external toolchains.

The TCMODE variable points the build system to a file in `conf/distro/include/tcmode-${TCMODE}.inc`. Thus, for meta-sourcery, which has `conf/distro/include/tcmode-external-sourcery.inc`, you would set the variable as follows:

```
TCMODE ?= "external-sourcery"
```

The variable is similar to TCLIBC, which controls the variant of the GNU standard C library (libc) used during the build process: eglibc or uclibc.

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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_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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#performing-automated-runtime-testing>]" section in the Yocto Project Development Manual.

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#qemu-image-enabling-tests>]" 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#hardware-image-enabling-tests>]" 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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.

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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 [<http://www.yoctoproject.org/docs/1.6/adt-manual/adt-manual.html#installing-the-adt>]" section in the Yocto Project Application Developer's Guide.

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 [<http://www.yoctoproject.org/docs/1.6/adt-manual/adt-manual.html#installing-the-adt>]" section in the Yocto Project Application Developer's Guide.

TOPDIR The top-level Build Directory [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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_PKGARCH The package architecture understood by the packaging system to define the architecture, ABI, and tuning of output packages.

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,sdcard"
UBOOT_CONFIG[eimnor] = "mx6qsabreauto_eimnor_config"
UBOOT_CONFIG[nand] = "mx6qsabreauto_nand_config,ubifs"
UBOOT_CONFIG[spinor] = "mx6qsabreauto_spinor_config"
```

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` [<http://git.yoctoproject.org/cgi/cgit.cgi/poky/tree/meta/classes/uboot-config.bbclass>] 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`).

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 <code>.bin</code>
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.
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 <code>local.conf</code> file: <pre>USER_CLASSES ?= "buildstats image-mklibs image-prelink"</pre> For more information, see <code>meta-yocto/conf/local.conf.sample</code> in the Source Directory [http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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 <code>files/passwd</code> and <code>files/group</code> files. The default behavior for the build system is to dynamically apply uid and gid values. Consequently, the <code>USERADD_ERROR_DYNAMIC</code> variable is by default not set. If you plan on using statically assigned gid and uid values, you should set the <code>USERADD_ERROR_DYNAMIC</code> variable in your <code>local.conf</code> file as follows: <pre>USERADD_ERROR_DYNAMIC = "1"</pre>
USERADD_GID_TABLES	Overriding the default behavior implies you are going to also take steps to set static uid and gid values through use of the <code>USERADDEXTENSION</code>, <code>USERADD_UID_TABLES</code>, and <code>USERADD_GID_TABLES</code> variables. 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 <code>BBPATH</code> for a <code>files/group</code> file and then applies those uid values. Set the variable as follows in your <code>local.conf</code> file: <pre>USERADD_GID_TABLES = "files/group"</pre>
	Note Setting the <code>USERADDEXTENSION</code> variable to "useradd-staticids" causes the build system to use static gid values.
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 <code>BBPATH</code> for a <code>files/passwd</code> file and then applies those uid values. Set the variable as follows in your <code>local.conf</code> file:

```
USERADD_UID_TABLES = "files/passwd"
```

Note

Setting the `USERADDEXTENSION` variable to "useradd-staticids" causes the build system to use static uid values.

USERADD_PACKAGES

When a recipe inherits 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 a recipe inherits 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 ${localstatedir}/lib/dbus  
--no-create-home --shell /bin/false \  
--user-group messagebus"
```

For information on the standard Linux shell command `useradd`, see <http://linux.die.net/man/8/useradd>.

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}/${PN}/${EXTENDPE}${PV}-${P
```

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/1.3.0-r0
```

Chapter 11. Variable Context

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.

11.1. Configuration

The following subsections provide lists of variables whose context is configuration: distribution, machine, and local.

11.1.1. 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`

11.1.2. 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`

11.1.3. 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

11.2. Recipes

The following subsections provide lists of variables whose context is recipes: required, dependencies, path, and extra build information.

11.2.1. 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.

11.2.2. Dependencies

This section lists variables that define recipe dependencies.

- DEPENDS
- RDEPENDS
- RRECOMMENDS
- RCONFLICTS
- RREPLACES

11.2.3. Paths

This section lists variables that define recipe paths.

- WORKDIR
- S
- FILES

11.2.4. Extra Build Information

This section lists variables that define extra build information for recipes.

- EXTRA_OECMAKE
- EXTRA_OECONF
- EXTRA_OEMAKE
- PACKAGES
- DEFAULT_PREFERENCE

Chapter 12. FAQ

12.1. How does Poky differ from OpenEmbedded [<http://www.openembedded.org/>]?

The term "Poky [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#poky>]" refers to the specific reference build system that the Yocto Project provides. Poky is based on OE-Core [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#oe-core>] and BitBake [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#bitbake-term>]. 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.

12.2. 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.

12.3. How can you claim Poky / OpenEmbedded-Core is stable?

There are three areas that help with stability;

- The Yocto Project team keeps OE-Core [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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.

12.4. 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#understanding-and-creating-layers>]" section in the Yocto Project Development Manual and the Yocto Project Board Support Package (BSP) Developer's Guide [<http://www.yoctoproject.org/docs/1.6/bsp-guide/bsp-guide.html>].

Usually, if the board is not completely exotic, adding support in the Yocto Project is fairly straightforward.

12.5. Are there any products built using the OpenEmbedded build system?

The software running on the Vernier LabQuest [<http://vernier.com/labquest/>] is built using the OpenEmbedded build system. See the Vernier LabQuest [<http://www.vernier.com/products/interfaces/labq/>] 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.

12.6. 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.

12.7. 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 [<http://www.yoctoproject.org/docs/1.6/dev->

`manual/dev-manual.html#new-recipe-writing-a-new-recipe]`" in the Yocto Project Development Manual.

- 12.8. 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.

- 12.9. What is GNOME Mobile and what is the difference between GNOME Mobile and GNOME?

GNOME Mobile is a subset of the GNOME [<http://www.gnome.org>] platform targeted at mobile and embedded devices. The main difference between GNOME Mobile and standard GNOME is that desktop-orientated libraries have been removed, along with deprecated libraries, creating a much smaller footprint.

- 12.10. 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.

- 12.11. 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.

- 12.12. 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.

- 12.13. 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.

- 12.14. What's the difference between `foo` and `foo-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.

- 12.15. 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.

12.16.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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#licensing>]" and "Maintaining Open Source License Compliance During Your Product's Lifecycle [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#maintaining-open-source-license-compliance-during-your-products-lifecycle>]" sections, both of which are in the Yocto Project Development Manual.

12.17.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 [<http://www.yoctoproject.org/docs/1.6/bsp-guide/bsp-guide.html#bsp-filelayout-misc-recipes>]" 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
```

12.18.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 [<http://www.yoctoproject.org/docs/1.6/bsp-guide/bsp-guide.html#bsp-filelayout-misc-recipes>]" 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
```

12.19.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.

12.20.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.

12.21 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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`.

12.22 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 = "\n\ngit://.*.* http://www.yoctoproject.org/sources/ \n \n\nftp://.*.* http://www.yoctoproject.org/sources/ \n \n\nhttp://.*.* http://www.yoctoproject.org/sources/ \n \n\nhttps://.*.* 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.

12.23. 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#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.

Chapter 13. Contributing to the Yocto Project

13.1. 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#local-yp-release>]" section in the Yocto Project Development Manual.

13.2. Tracking Bugs

If you find problems with the Yocto Project, you should report them using the Bugzilla application at <http://bugzilla.yoctoproject.org>.

13.3. 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 [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#bitbake-term>] build tool.
- <http://lists.yoctoproject.org/listinfo/poky> - Discussion mailing list about Poky [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#poky>].
- <http://lists.yoctoproject.org/listinfo/yocto-announce> - Mailing list to receive official Yocto Project release and milestone announcements.

13.4. Internet Relay Chat (IRC)

Two IRC channels on freenode are available for the Yocto Project and Poky discussions:

- #yocto
- #poky

13.5. Links

Here is a list of resources you will find helpful:

- The Yocto Project website [<http://www.yoctoproject.org>]: The home site for the Yocto Project.
- Intel Corporation [<http://www.intel.com/>]: The company who acquired OpenedHand in 2008 and began development on the Yocto Project.
- OpenEmbedded [<http://www.openembedded.org>]: 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 [<http://developer.berlios.de/projects/bitbake/>]: The tool used to process metadata.
- BitBake User Manual: A comprehensive guide to the BitBake tool. You can find the BitBake User Manual in the `bitbake/doc/manual` directory, which is found in the Source Directory [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#source-directory>].
- QEMU [<http://wiki.qemu.org/Index.html>]: An open source machine emulator and virtualizer.

13.6. 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 find out who is the maintainer for areas of code, see the "How to Submit a Change [<http://www.yoctoproject.org/docs/1.6/dev-manual/dev-manual.html#how-to-submit-a-change>]" section in the Yocto Project Development Manual.