

# Freescale Yocto Project User's Guide

## 1 Overview

This document describes how to build an image for an i.MX Freescale board by using a Yocto Project build environment. It describes the Freescale release layer and Freescale-specific usage.

The Yocto Project is an open-source collaboration focused on embedded Linux® OS development. For more information regarding Yocto Project, see the Yocto Project page: [www.yoctoproject.org/](http://www.yoctoproject.org/). There are several documents on the Yocto Project home page that describe in detail how to use the system. The basic Yocto Project, without the latest Freescale release layer, can be used by following the instructions in the *Yocto Project Quick Start* found at [www.yoctoproject.org/docs/current/yocto-project-qs/yocto-project-qs.html](http://www.yoctoproject.org/docs/current/yocto-project-qs/yocto-project-qs.html).

The FSL Yocto Project Community BSP (found at [freescale.github.io](http://freescale.github.io)) is a development community outside Freescale providing support for i.MX boards in the Yocto Project environment. Freescale i.MX joined the Yocto Project community providing a release based on the Yocto Project framework. Information specific to FSL community BSP use can be found on the community web page. This document is an extension of the community BSP documentation.

Files used to build an image are stored in layers. Layers contain different types of customizations and come from different sources. Some of the files in a layer are called

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## Overview

recipes. Yocto Project recipes contain the mechanism to retrieve source code, build and package a component. The following lists show the layers used in this release.

### Freescall release layer

- meta-fsl-bsp-release
  - updates for meta-fsl-arm, poky, and meta-openembedded layers
  - updates for meta-fsl-demos

### Yocto Project community layer

- meta-fsl-arm: provides support for the base and for Freescale ARM reference boards.
- meta-fsl-arm-extra: provides support for 3rd party and partner boards.
- meta-fsl-demos: additional items to aid in development.
- meta-fsl-community-base: often renamed to base. Provides base configuration for FSL Community BSP.
- meta-openembedded: Collection of layers for the OE-core universe. See [layers.openembedded.org/](http://layers.openembedded.org/).
- poky: basic Yocto Project items in Poky. See the Poky README for details.
- meta-browser: provides several browsers.
- meta-qt5: provides Qt5.

References to community layers in this document are for all the layers in Yocto Project except meta-fsl-bsp-release. Freescale i.MX boards are configured in the meta-fsl-arm layer. This includes U-Boot, the Linux kernel, and reference board specific details.

Freescale provides an additional layer called the Freescale BSP Release, named meta-fsl-bsp-release, to integrate a new Freescale release with the FSL Yocto Project Community BSP. The meta-fsl-bsp-release layer aims to release the updated and new Yocto Project recipes and machine configurations for new releases that are not yet available on the existing meta-fsl-arm and meta-fsl-demos layers in the Yocto Project. The contents of the Freescale BSP Release layer are recipes and machine configurations. In many cases, other layers implement recipes or include files and the Freescale release layer provides updates to the recipes by either appending to a current recipe, or including a component and updating with patches or source locations. Most Freescale release layer recipes are very small because they use what the community has provided and update what is needed for each new package version that is unavailable in the other layers.

The Freescale BSP Release layer also provides image recipes that include all the components needed for a system image to boot, making it easier for the user. Components can be built individually or through an image recipe, which pulls in all the components required in an image into one build process.

Freescale kernel and U-Boot releases are accessed through Freescale public git servers. However, several components are released as packages on the Freescale mirror. The package-based recipes pull files from the Freescale mirror instead of a git location and generate the package needed.

Starting with the L3.5.7\_1.0.0-alpha release, packages which are released as binary are built with hardware floating point enabled. In a few cases, we have provided a software floating point version. The package selection floating point configuration is determined by using the DEFAULTTUNE setting.

Release L3.14.28\_1.0.0 is released for Yocto Project 1.7 (Dizzy). The same recipes for Yocto Project 1.7 are going to be upstreamed and made available on Yocto Project release 1.8. The Yocto Project release cycle lasts roughly six months.

The recipes and patches in meta-fsl-bsp-release will be upstreamed to the community layers. Once that is done for a particular component, the files in meta-fsl-bsp-release are no longer needed and the FSL Yocto Project Community BSP will provide support. The community supports Freescale reference boards, community boards, and third-party boards. A complete list can be found at [freescale.github.io/doc/release-notes/1.6/index.html#document-bsp-scope](https://freescale.github.io/doc/release-notes/1.6/index.html#document-bsp-scope). All board references in this document are related to the Freescale machine configuration files only.

## 1.1 End user license agreement

During the setup environment process of Freescale Yocto Project Community BSP, the Freescale i.MX End User License Agreement (EULA) is displayed. To continue, users must agree to the conditions of this license. The agreement to the terms allows the Yocto Project build to untar packages from the Freescale mirror. Please read this license agreement carefully during the setup process, because once accepted, all further work in the Freescale Yocto Project environment is tied to this accepted agreement.

## 1.2 References

This release includes the following references and additional information.

- *i.MX Linux® Release Notes (IMX6LXRN)* - Provides the release information.
- *i.MX Linux® User's Guide (IMXLUG)* - Contains the information on installing U-Boot and Linux OS and using i.MX specific features.
- *Freescale Yocto Project User's Guide (IMXLXYOCTOUG)* - Contains the instructions for setting up and building Linux in the Yocto Project.
- *i.MX 6 Linux® Reference Manual (IMX6LXRM)* - Contains the information on Linux drivers for i.MX.
- *i.MX 6 Graphics User's Guide* - Describes the graphics used.
- *i.MX 6 Linux® High Assurance Boot (HAB) User's Guide (IMX6HABUG)* - Contains the information on using High Assurance Boot.
- *i.MX 6 BSP Porting Guide (IMX6XBSPPG)* - Contains the instructions on porting the BSP to a new board.
- *i.MX 6 VPU Application Programming Interface Linux® Reference Manual (IMX6VPUAPI)* - Provides the reference information on the VPU API.

The quick start guides contain basic information on the board and setting it up. They are on the Freescale website.

- [SABRE Platform Quick Start Guide \(IMX6QSDPQSG\)](#)
- [SABRE Board Quick Start Guide \(IMX6QSDBQSG\)](#)
- [SABRE Automotive Infotainment Quick Start Guide \(IMX6SABREINFOQSG\)](#)
- [i.MX 6SoloLite Evaluation Kit Quick Start Guide \(IMX6SLEVKQSG\)](#)

Documentation is available online at [freescale.com](http://freescale.com).

- i.MX 6 information is at [freescale.com/iMX6series](http://freescale.com/iMX6series)
- i.MX 6 SABRE information is at [freescale.com/imxSABRE](http://freescale.com/imxSABRE)
- i.MX 6SoloLite EVK information is at [freescale.com/6SLEVK](http://freescale.com/6SLEVK)

## 2 Features

Freescale Yocto Project Release layers have the following features:

- Linux kernel recipe
  - The kernel recipe resides in the recipes-kernel folder and integrates a Freescale kernel from the source downloaded from the Freescale git server. This is done automatically by the recipes in the project.
  - L3.14.28\_1.0.0 is a Linux kernel that Freescale has released only for the Yocto Project. Previous BSP releases based on Linux version 3.0.35 are released with ltib and are provided only from FSL Community BSP in the Yocto Project environment.
  - Freescale L3.14.28\_1.0.0 supports using device trees. Device tree settings are found in the i.MX 6 machine configuration files.
- U-Boot recipe

- The U-Boot recipe resides in the recipes-bsp folder and integrates a Freescale uboot-imx.git from the source downloaded from the Freescale git server.
- Certain i.MX boards use different U-Boot versions.
- Freescale release L3.14.28\_1.0.0 for the i.MX 6 devices uses an updated v2014.04 Freescale version. This version has not been updated for other i.MX Freescale hardware.
- The Freescale Yocto Project Community BSP uses u-boot-fslc from the mainline, but this is only supported by the community kernel and might not work for the L3.14.28 kernel.
- Freescale release L3.14.28\_1.0.0 requires the Freescale v2014.04 U-Boot release.
- The Freescale Yocto Project Community BSP updates U-Boot versions frequently, so the information above might change as new U-Boot versions are integrated to meta-fsl-arm layers and updates from Freescale u-boot-imx releases are integrated into the mainline.
- Graphics recipes
  - Graphics recipes reside in recipes-graphics.
  - Graphics recipes integrate the Freescale graphics package release. For the i.MX 6 boards, the imx-gpu-viv recipes package the graphic components for each backend – X11, frame buffer (fb), Direct Frame Buffer (directfb), Wayland backend, and Weston compositor (weston).
  - Xorg-driver integrates our xserver-xorg.
  - For i.MX 5, the amd-gpu-bin provides packages for X11 and frame buffer backends.
  - Graphics and other kernel versions can be selected using the imx-gpu-viv-kernel package which loads the appropriate GPU drivers for the imx-gpu-viv package.
- i.MX package recipes

imx-lib, imx-test, and firmware-imx reside in recipes-bsp and pull from the Freescale mirror to build and package into image recipes.

- Multimedia recipes
  - Multimedia recipes reside in recipes-multimedia.
  - Recipes include libfslcodec, libfslparser, libvpwrap, and gstreamer that pull from the Freescale mirror to build and package into image recipes.
  - Some recipes are provided for codecs that are restricted. Packages for these are not on the Freescale mirror. These packages are available separately. Contact your Freescale Marketing representative to acquire these.
- Core recipes

Some recipes for rules, such as udev, provide updated i.MX rules to be deployed in the system. These recipes are usually updates of policy recipes and are used for customization only. Releases only provide updates if needed.

- Demo recipes

Demonstration recipes reside in the meta-fsl-demos directory. This layer contains image recipes and recipes for customization, such as touch calibration, or recipes for demonstration applications.

## 3 Host Setup

To get the Yocto Project expected behavior in a Linux Host Machine, the packages and utilities described below must be installed. An important consideration is the hard disk space required in the host machine. For example, when building on a machine running Ubuntu, the minimum hard disk space required is about 50 GB for the X11 backend. It is recommended that at least 120 GB is provided, which is enough to compile any backend.

The recommended minimum Ubuntu version is 14.04 but builds for dizzy will work on 12.04 or later. Earlier versions may cause the Yocto Project build setup to fail, because it requires python versions only available starting with Ubuntu 12.04. See [The Yocto Project reference manual](#) for more information.

## 3.1 Host packages

A Freescale Yocto Project Community BSP build requires that some packages be installed for the build that are documented under the Yocto Project.

You can go to [Yocto Project Quick Start](#) and check for the packages that must be installed for your build machine.

Essential Yocto Project host packages:

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

i.MX layers host packages for a Ubuntu 12.04 or 14.04 host setup:

```
$ sudo apt-get install libsdl1.2-dev xterm sed cvs subversion coreutils texi2html \
  docbook-utils python-pysqlite2 help2man make gcc g++ desktop-file-utils \
  libgl1-mesa-dev libglu1-mesa-dev mercurial autoconf automake groff curl lzip asciidoc
```

i.MX layers host packages for a Ubuntu 12.04 host setup only:

```
$ sudo apt-get install uboot-mkimage
```

i.MX layers host packages for a Ubuntu 14.04 host setup only:

```
$ sudo apt-get install u-boot-tools
```

The configuration tool uses the default version of `grep` that is on your build machine. If there is a different version of `grep` in your path, it may cause builds to fail. One workaround is to rename the special version to something not containing "grep".

## 3.2 Setting up the repo utility

Repo is a tool built on top of Git that makes it easier to manage projects that contain multiple repositories, which do not need to be on the same server. Repo complements very well the layered nature of the Yocto Project, making it easier for customers to add their own layers to the BSP.

To install the “repo” utility, perform these steps:

1. Create a bin folder in the home directory.

```
$ mkdir ~/bin (this step may not be needed if the bin folder already exists)
$ curl http://commondatastorage.googleapis.com/git-repo-downloads/repo > ~/bin/repo
$ chmod a+x ~/bin/repo
```

2. Add the following line to the `.bashrc` file to ensure that the `~/bin` folder is in your `PATH` variable.

```
export PATH=~/bin:$PATH
```

## 4 Yocto Project Setup

The Freescale Yocto Project BSP Release directory contains a "sources" directory, which contains the recipes used to build, one or more build directories, and a set of scripts used to set up the environment.

The recipes used to build the project come from both the community and Freescale. The Yocto Project layers are downloaded and placed in the `sources` directory. This sets up the recipes that are used to build the project.

The following example shows how to download the Freescale Yocto Project Community BSP recipe layers. For this example, a directory called `fs1-release-bsp` is created for the project.

## Image Build

```
$ mkdir fsl-release-bsp
$ cd fsl-release-bsp
$ git config --global user.name "Your Name"
$ git config --global user.email "Your Email"
$ git config --list
$ repo init -u git://git.freescale.com/imx/fsl-arm-yocto-bsp.git -b imx-3.14.28-1.0.0_ga
$ repo sync
```

When this process is completed, the source code is checked out into the directory `fsl-release-bsp/sources`.

You can perform repo synchronization, with the command `repo sync`, periodically to update to the latest code.

If errors occur during repo initialization, try deleting the `.repo` directory and running the repo initialization command again.

## 5 Image Build

This section provides the detailed information along with the process for building an image.

### 5.1 Choosing a Freescale Yocto project image

The Yocto Project provides some images which are available on different layers. Poky provides some images, `meta-fsl-arm` and `meta-fsl-demos` provide others, and additional image recipes are provided in the `meta-fsl-bsp-release` layer. The following table lists various key images, their contents, and the layers that provide the image recipes.

**Table 1. Freescale Yocto project images**

Image name	Target	Provided by layer
core-image-minimal	A small image that only allows a device to boot.	poky
core-image-base	A console-only image that fully supports the target device hardware.	poky
core-image-sato	An image with Sato, a mobile environment and visual style for mobile devices. The image supports X11 with a Sato theme, Pimlico applications. It contains a terminal, an editor and a file manager.	poky
fsl-image-machine-test	An FSL Community i.MX core image with console environment - no GUI interface	poky
fsl-image-gui	Builds a Freescale image with a GUI without any QT content. This image recipe works on all backends for X11, DirectFB, Frame Buffer and Wayland	meta-fsl-bsp-release/imx/meta-fsl-demos
fsl-image-qt5	Builds a QT5 image for X11, Frame Buffer and Wayland backends	meta-fsl-bsp-release/imx/meta-fsl-demos

### 5.2 Machine configurations

In the `meta-fsl-bsp-release` layer, Freescale provides new or updated machine configurations that overlay the `meta-fsl-arm` machine configurations. These files are copied into the `meta-fsl-arm/conf/machine` directory by the `fsl-setup-release.sh` script.

The following are all the Freescale machine configuration files that can be selected:

- imx6dlsabreauto
- imx6dlsabresd
- imx6qsabreauto
- imx6qsabresd
- imx6slevk
- imx6solosabreauto
- imx6solosabresd
- imx6sxsabresd
- imx6sxsabreauto

To see all MACHINE options:

```
$ source setup-environment
```

Usage: source setup-environment <build-dir>

<build-dir>: specifies the build directory location (required).

If undefined, this script will set \$MACHINE to 'imx6qsabresd'.

Use the machine configuration for the board that is being used and specify the graphical backend desired. The backend can be x11, fb (Frame Buffer), dfb (DirectFB), or wayland.

Ignore the imx6qdsolo machine. In the meta-fsl-bsp-release layer, a consolidated machine configuration is provided, imx6qdsolo. Freescale uses this to build a common image with all the device trees for i.MX 6Quad, 6DualLite, and Solo (not SoloLite) in one image for testing. Do not use this image for a real build.

The command below is used to set up a directory and configuration files for the specified board and backend. After this step, the build environment is initialized and configured for building an image.

```
$ MACHINE=<machine name> source fsl-setup-release.sh -b <build dir> -e <backend>
```

The EULA must be accepted the first time. After that, the acceptance is logged and EULA acceptance is not required again.

MACHINE=<machine configuration name> is the machine name which points to the configuration file in meta-fsl-arm/conf/machine. The setup script checks for a valid machine. Without setting MACHINE, the setup script assumes imx6qsabresd as the default. The i.MX machine files are provided in meta-fsl-arm/conf/machine and meta-fsl-bsp-release/imx/meta-fsl-arm/conf/machine. The MACHINE configuration can also be changed in <build dir>/conf/local.conf.

The following is a part of a local.conf created from the setup-environment script:

```
MACHINE ??= 'imx6qsabresd'
DISTRO ?= 'poky'

ACCEPT_FSL_EULA = "1"
```

The fsl-setup-release.sh script integrates the Freescale Yocto Project release layer into the Yocto Project build by inserting the layer into the <build dir>/conf/bblayers.conf file.

This setup script has the following optional parameters:

- -b sets the build directory.
  - b <build dir >
- -e sets the graphical back end for frame buffer and direct fb images. X11 is default if no backend is set.
  - -e fb
  - -e dfb
  - -e wayland
  - -e x11

ACCEPT\_FSL\_EULA in the local.conf file indicates that you have accepted the conditions of the EULA.

## 5.3 Bitbake options

The bitbake command used to build an image is `bitbake <image name>`. Additional parameters can be used for specific activities described below. Bitbake provides various useful options for developing a single component. To run with a bitbake parameter, the command looks like this:

```
bitbake <parameter> <component>
```

<component> is a desired build package.

The following table provides some bitbake options.

**Table 2. Bitbake options**

Bitbake paramater	Description
-c fetch	Fetches if the downloads state is not marked as done.
-c cleanall	Cleans the entire component build directory. All the changes in the build directory will be lost. The roots and state of the component are also cleared. The component is also removed from the download directory.
-c deploy	Deploys an image or component to the roots.
-k	Continues building components even if a build break occurs.
-c compile -f	It is not recommended that the source code under the tmp directory is changed directly, but if it is, the Yocto Project might not rebuild it unless this option is used. Use this option to force a recompile after the image is deployed.
-g	Lists a dependency tree for an image or component.
-DDD	Turns on debug 3 levels deep. Each D adds another level of debug.

## 5.4 U-Boot configuration

U-Boot configurations are defined in the main machine configuration file. The configuration is specified by using the UBOOT\_CONFIG settings. This requires setting UBOOT\_CONFIG in local.conf; otherwise, the U-Boot build will default to SD boot.

The UBOOT\_CONFIG must be set. Otherwise, the default SD is used. These can be built separately by using the following commands (change MACHINE to the correct target):

U-Boot type	Build setup	Build command
<b>U-Boot EIM-NOR</b>	<code>\$ echo "UBOOT_CONFIG = \"eimnor\"" &gt;&gt; conf/local.conf</code>	<code>\$ MACHINE=imx6dlsabreauto bitbake -c deploy u-boot-imx</code>
<b>U-Boot SPI-NOR</b>	<code>\$ echo "UBOOT_CONFIG = \"spinor\"" &gt;&gt; conf/local.conf</code>	<code>\$ MACHINE=imx6qsabreauto bitbake -c deploy u-boot-imx</code>
<b>U-Boot NAND</b>	<code>\$ echo "UBOOT_CONFIG = \"nand\"" &gt;&gt; conf/local.conf</code>	<code>\$ MACHINE=imx6solosabreauto bitbake -c deploy u-boot-imx</code>
<b>U-Boot SATA</b>	<code>\$ echo "UBOOT_CONFIG = \"sata\"" &gt;&gt; conf/local.conf</code>	<code>\$ MACHINE=imx6qsabresd bitbake -c deploy u-boot-imx</code>
<b>U-Boot M4</b>	<code>\$ echo "UBOOT_CONFIG = \"m4fastup\"" &gt;&gt; conf/local.conf</code>	<code>\$ MACHINE=imx6sxsabresd bitbake -c deploy u-boot-imx</code>

*Table continues on the next page...*



U-Boot type	Build setup	Build command
<b>U-Boot QSPI1</b>	<code>\$ echo "UBOOT_CONFIG = \"qspi1\"" &gt;&gt; conf/local.conf</code>	<code>\$ MACHINE=imx6sxsabreauto bitbake -c deploy u-boot-imx</code>
<b>U-Boot QSPI2</b>	<code>\$ echo "UBOOT_CONFIG = \"qspi2\"" &gt;&gt; conf/local.conf</code>	<code>\$ MACHINE=imx6sxsabresd bitbake -c deploy u-boot-imx</code>
<b>U-Boot EMMC</b>	<code>\$ echo "UBOOT_CONFIG = \"emmc\"" &gt;&gt; conf/local.conf</code>	<code>\$ MACHINE=imx6sxsabresd bitbake -c deploy u-boot-imx</code>
<b>U-Boot m4fastup</b>	<code>\$ echo "UBOOT_CONFIG = \"m4fastup\"" &gt;&gt; conf/local.conf</code>	<code>\$ MACHINE=imx6sxsabresd bitbake -c deploy u-boot-imx</code>

## 5.5 Building an image

The Yocto Project build uses the bitbake command. For example, `bitbake <component>` builds the named component. Each component build has multiple tasks, such as fetching, configuration, compilation, packaging, and deploying to the target roots. The bitbake image build gathers all the components required by the image and build in order of the dependency per task. The first build is the toolchain along with the tools required for the components to build.

The following command is an example on how to build an image:

```
$ bitbake fsl-image-gui
```

## 5.6 Build scenarios

The following are build setup scenarios for various configurations.

```
$ mkdir fsl-release-bsp
$ cd fsl-release-bsp
$ repo init -u git://git.freescale.com/imx/fsl-arm-yocto-bsp.git -b imx-3.14.28-1.0.0_ga
$ repo sync
```

### 5.6.1 X-11 image on i.MX 6Quad SABRE-SD

```
$ MACHINE=imx6qsabresd source fsl-setup-release.sh -b build-x11 -e x11
$ bitbake fsl-image-gui
```

This builds an X11 image without QT5. To build with QT5, build `fsl-image-qt5`.

### 5.6.2 FB image on i.MX 6Quad SABRE-AI

```
$ MACHINE=imx6qsabreauto source fsl-setup-release.sh -b build-fb -e fb
$ bitbake fsl-image-qt5
```

This builds QT5 on a frame buffer backend. To build without QT5, use image recipe `fsl-image-gui`.

## 5.6.3 DFB image on i.MX 6SoloX SABRE-SD

```
$ MACHINE=imx6sxsabresd source fsl-setup-release.sh -b build-dfb -e dfb
$ bitbake fsl-image-gui
```

The `fsl-image-gui` image works on all backends and, if DirectFB is setup correctly in the build environment, it will enable the DirectFB components. DirectFB does not support QT5 so only `fsl-image-gui` can be used with it.

## 5.6.4 Wayland image on i.MX 6SoloX SABRE-SD

```
$ MACHINE=imx6sxsabresd source fsl-setup-release.sh -b build-wayland -e wayland
$ bitbake fsl-image-qt5
```

This builds a QT5 Weston Wayland image. To build without QT5, build `fsl-image-gui`.

## 5.6.5 Restarting a build environment

If a new terminal window is opened or the machine is rebooted after a build directory is set up, the setup environment script should be used to set up the environment variables and run a build again. The full `fsl-setup-release.sh` is not needed.

```
source setup-environment <build-dir>
```

## 5.6.6 Chromium Browser on X11 and Wayland

The Yocto Project community has chromium-imx recipes in the dizzy branch for X11 and Wayland. Note that the VPU patches used have problems but GPU patches work. This section describes how to integrate Chromium into your rootfs and enable hardware accelerated rendering of WebGL. The Chromium browser requires additional layers added in the `fsl-release-setup.sh` script.

In `local.conf`, you can perform the following operations:

- Add Chromium into your image.

```
CORE_IMAGE_EXTRA_INSTALL += "chromium"
```

- Add the commercial white list into `local.conf`.

```
LICENSE_FLAGS_WHITELIST="commercial"
```

This allows proprietary code to be built into your image. Additional license obligations will need to be met for these additions. Make sure you know what they are and are in compliance.

## 5.6.7 Qt5 and WebKit browser

Qt5 has both a commercial and an open source license. When building in Yocto Project the open source license is the default. Make sure to understand the differences between these licenses and choose appropriately. Once custom Qt5 development has started on the open source license it can't be used with the commercial license. Work with a legal representative to understand the differences between these licenses.

There are two Qt5 browsers available. Qt5WebKit can be found in `/usr/share/qt5/examples/webkitwidgets/browser` and WebKit2 can be found in `/usr/share/qt5/examples/webkitqml/flickerview`.

To run these, after booting up Linux on your device, tell Qt5 which graphics to use but setting the environment variable below. See Section "Qt5" in the *i.MX Linux User's Guide* for the information on the graphics for different graphical backends.

```
$export QT_QPA_PLATFORM=$Graphics
```

Both browsers can be run by going to the directory above and running the executable found there. Touchscreen can be enabled by adding the parameters `-plugin evdevtouch:/dev/input/event0` to the executable. So the command line would look like one of these:

```
./browser -plugin evdevtouch:/dev/input/event0
.flickerview -plugin evdevtouch:/dev/input/event0
```

## 6 Image Deployment

After a build is complete, the created image resides in `<build directory>/tmp/deploy/images`. An image is, for the most part, specific to the machine set in the environment setup. Each image build creates a U-Boot, a kernel, and an image type based on the `IMAGE_FSTYPES` defined in the machine configuration file. Most machine configurations provide an SD card image (`.sdcard`), an `ext3` and `tar.bz2`. The `ext3` is the root file system only. The `.sdcard` image contains U-Boot, the kernel and the rootfs completely set up for use on an SD card.

### 6.1 Flashing an SD card image

An SD card image provides the full system to boot with U-Boot and kernel. To flash an SD card image, run the following command:

```
$ sudo dd if=<image name>.sdcard of=/dev/sd<partition> bs=1M && sync
```

For more information on flashing, see Section "Preparing an SD/MMC Card to Boot" in the *i.MX Linux User's Guide* (IMXLUG).

### 6.2 Manufacturing Tool, MFGTool

One way to place an image on a device is to use the Manufacturing Tool, MFGTool. The recipes used to build a manufacturing tool image are `linux-imx-mfgtool` and `u-boot-mfgtool`.

To build a manufacturing image do the following -

```
$ bitbake fsl-image-mfgtool-initramfs
```

A manufacturing tool kernel is built using the `imx_v7_mfg_defconfig` while the default kernel is built by using the `imx_v7_defconfig`. This is handled automatically by the MFGTool recipes listed above.

For more details on how to use the manufacturing tool, see Section "How to Enter Serial Download Mode for MFGTool" in the *i.MX Linux User's Guide*.

## 7 Creating a Custom Board Configuration

Vendors who are developing reference boards may want to add their board to the FSL Community BSP. Having the new machine supported by the FSL Community BSP makes it easy to share source code with the community, and allows for feedback from the community.

The Yocto Project makes it fairly easy to create and share a BSP for a new Freescale based board. The upstreaming process should start when a Linux kernel and a bootloader are working and tested for that machine. It is highly important to have a stable Linux kernel and bootloader (for example, U-Boot) to be pointed to in the machine configuration file, to be the default one used for that machine.

Another important step is to determinate a maintainer for the new machine. The maintainer is the one responsible for keeping the set of main packages working for that board. The machine maintainer should keep the kernel and bootloader updated, and the user-space packages tested for that machine. For more information on the machine maintainer role see [freescale.github.io/doc/release-notes/1.6/index.html#document-machines-maintainers](https://freescale.github.io/doc/release-notes/1.6/index.html#document-machines-maintainers).

The steps needed are listed below.

1. Customize the kernel config files as needed. See the *i.MX 6 BSP Porting Guide* for details on this.
2. Customize U-Boot as needed. See the *i.MX 6 BSP Porting Guide* for details on this.
3. Assign someone to be the maintainer of the board. This person makes sure that files are updated as needed so the build always works. For more information see [freescale.github.io/doc/release-notes/1.6/index.html#document-machines-maintainers](https://freescale.github.io/doc/release-notes/1.6/index.html#document-machines-maintainers).
4. Set up the Yocto Project build as described in the Yocto Project community instructions, simplified below. Use the community master branch.
  - a. Download the needed host package, depending on your host Linux distribution, from [www.yoctoproject.org/docs/current/yocto-project-qs/yocto-project-qs.html](http://www.yoctoproject.org/docs/current/yocto-project-qs/yocto-project-qs.html).
  - b. Download repo with the command:
 

```
curl http://commondatastorage.googleapis.com/git-repo-downloads/repo > ~/bin/repo
```
  - c. Create a directory to keep everything in. Any name will work. This document is using `fsl-community-bsp`.
 

```
mkdir fsl-community-bsp
```
  - d. `cd fsl-community-bsp`
  - e. Initialize the repo with the master branch of the repository.
 

```
repo init -u https://github.com/Freescale/fsl-community-bsp-platform -b master
```
  - f. Get the recipes that will be used to build.
 

```
repo sync
```
  - g. Set up the environment with:
 

```
source setup-environment build
```
5. Choose a similar machine file in `fsl-community-bsp/sources/meta-fsl-arm-extra/conf/machine` and copy it, using a name indicative of your board. Edit the new board file with the information about your board. Change the name and

description at least. Add MACHINE\_FEATURE. See [www.yoctoproject.org/docs/1.6/ref-manual/ref-manual.html#ref-features-machine](http://www.yoctoproject.org/docs/1.6/ref-manual/ref-manual.html#ref-features-machine).

6. Test your changes with the latest community master branch, making sure everything works well. Use at least `core-image-minimal`.

```
bitbake core-image-minimal
```

7. Prepare the patches. Follow the style guide at [www.openembedded.org/wiki/Styleguide](http://www.openembedded.org/wiki/Styleguide) and [git.yoctoproject.org/cgi/cgit/meta-fsl-arm/tree/README](http://git.yoctoproject.org/cgi/cgit/meta-fsl-arm/tree/README) in the section entitled *Contributing*.
8. Upstream into meta-fsl-extras. To upstream, join send the patches to [meta-freescale@yoctoproject.org](mailto:meta-freescale@yoctoproject.org).

## Appendix A Frequently Asked Questions

### A.1 Local configuration tuning

A Yocto Project build can take considerable build resources both in time and disk usage, especially when building in multiple build directories. There are methods to optimize this, for example, use a shared sstate cache (caches the state of the build) and downloads directory (holds the downloaded packages). These can be set to be at any location in the `local.conf` file by adding statements such as these:

```
DL_DIR="/opt/freescale/yocto/imx/download"
SSTATE_DIR="/opt/freescale/yocto/imx/sstate-cache"
```

The directories need to already exist and have appropriate permissions. The shared sstate helps when multiple build directories are set, each of which uses a shared cache to minimize the build time. A shared download directory minimizes the fetch time. Without these settings, Yocto Project defaults to the build directory for the sstate cache and downloads.

Every package downloaded in the `DL_DIR` directory is marked with a `<package name>.done`. To avoid fetching, touch the `.done` file for the package name.

For more information, see the [Yocto Project Reference Manual](#).

### A.2 Recipes

Each component is built by using a recipe. For new components, a recipe must be created to point to the source (`SRC_URI`) and specify patches, if applicable. The Yocto Project environment builds from a makefile in the location specified by the `SRC_URI` in the recipe. When a build is established from auto tools, a recipe should inherit `autotools` and `pkgconfig`. Makefiles must allow `CC` to be overridden by Cross Compile tools to get the package built with Yocto Project.

Some components have recipes but need additional patches or updates. This can be accomplished by using a `bbappend` recipe. This appends to an existing recipe details about the updated source. For example, a `bbappend` recipe to include a new patch should have the following contents:

```
FILESEXTRAPATHS_prepend := "${THISDIR}/${PN}:"
SRC_URI += file://<patch name>.patch
```

`FILESEXTRAPATHS_prepend` tells Yocto Project to look in the directory listed to find the patch listed in `SRC_URI`.

**Tip:** If a `bbappend` recipe is not picked up, check the fetch log. Sometimes a git version of the recipe is being used over the version of the `bbappend` files.

## A.3 How to select additional packages

Additional packages can be added to images as long as there is a recipe provided for that package. Layers can be found in places such as [layers.openembedded.org/](http://layers.openembedded.org/).

### A.3.1 Updating an image

An image is a set of packages and the environment configuration.

An image file (such as `fsl-image-gui.bb`) defines the packages that go inside the file system. Root file systems, kernels, modules, and the U-Boot binary are available in `build/tmp/deploym/images/`.

**Note:** You can build packages without including it in an image, but you must rebuild the image if you want the package installed automatically on a rootfs.

### A.3.2 Package group

A package group is a set of packages that can be included on any image.

A package group can contain a set of packages. For example, a multimedia task could determine, according to the machine, whether the VPU package is built or not, so the selection of multimedia packages may be automated for every board supported by the BSP, and only the multimedia package is included on the images.

Additional packages can be installed by adding the following line in `<build_dir>/local.conf`.

```
CORE_IMAGE_EXTRA_INSTALL += "<package_name1 package_name2>"
```

There are many package groups. Look for them in subdirectories name "packagegroup" or "packagegroups".

### A.3.3 Preferred version

The preferred version is used to specify the preferred version of a recipe to use for a specific component. Sometimes a component might have multiple recipes in different layers and a preferred version points to a specific version to use.

In the `meta-fsl-bsp-release` layer, in `layer.conf`, preferred versions are set for all the recipes to provide a static system for a production environment. These preferred version settings are used for formal Freescale releases but are not essential for future development.

Preferred versions also help when previous versions may cause confusion about which recipe should be used. For example, previous recipes for `imx-test` and `imx-lib` used a year-month versioning which has changed to `<kernel-version>` versioning. Without a preferred version, an older version might be picked up. Recipes that have `_git` versions are usually picked over other recipes, unless a preferred version is set. To set a preferred version, put the following in `local.conf`.

```
PREFERRED_VERSION_<component>_<soc family> = "<version>"
```

For example, `imx-lib` would be:

```
PREFERRED_VERSION_imx-lib_mx6 = "3.10.53-1.1.0"
```

See the Yocto Project manuals for more information on using preferred versions.

## A.3.4 Preferred provider

The preferred provider is used to specify the preferred provider for a specific component. A component can have multiple providers. For example, the Linux kernel can be provided by Freescale or by `kernel.org` and preferred provider states the provider to use.

For example, U-Boot is provided by both the community via `denx.de` and Freescale. The community provider is specified by `u-boot-fslc`. The Freescale provider is specified by `u-boot-imx`. To state a preferred provider, put the following in `local.conf`:

```
PREFERRED_PROVIDER_<component>_<soc family> = "<provider>"
PREFERRED_PROVIDER_u-boot_mx6 = "u-boot-imx"
```

## A.3.5 SoC family

The SoC family documents a class of changes that apply to a specific set of system chips. In each machine configuration file, the machine is listed with a specific SoC family. For example, i.MX 6DualLite Sabre-SD is listed under the i.MX 6 and i.MX 6DualLite SoC families. i.MX 6Solo Sabre-auto is listed under the i.MX 6 and i.MX 6Solo SoC families. Some changes can be targeted to a specific SoC family in `local.conf` to override a change in a machine configuration file. The following is an example of a change to an `mx6dlsabresd` kernel setting.

```
KERNEL_DEVICETREE_mx6dl = "imx6dl-sabresd.dts"
```

SoC families are useful when making a change that is specific only for a class of hardware. For example, i.MX 28 EVK does not have a Video Processing Unit (VPU), so all the settings for VPU should use i.MX 5 or i.MX 6 to be specific to the right class of chips.

## A.3.6 Bitbake logs

Bitbake logs the build and package processes in the temp directory in `tmp/work/<architecture>/<component>/temp`.

If a component fails to fetch a package, the log showing the errors is in the file `log.do_fetch`.

If a component fails to compile, the log showing the errors is in the file `log.do_compile`.

Sometimes a component does not deploy as expected. Check the directories under the build component directory (`tmp/work/<architecture>/<component>`). Check the `package`, `packages-split`, `sysroot-destdir` directories to see if the files were placed there (where they are staged prior to being copied to the deploy directory).

## Appendix B References

- For details on boot switches, see Section "How to Boot the i.MX Boards" in the *i.MX Linux User's Guide*.
- For how to download images using U-boot, see Section "Downloading Images Using U-Boot" in the *i.MX Linux User's Guide*.
- For how to set up an SD/MMC card, see Section "Preparing an SD/MMC Card to Boot" in the *i.MX Linux User's Guide*.

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