i.MX28 Linux Bring Up

Hands On

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Development Environment

- A VMWare Ubuntu Image was provided to you for the hands on sessions

- User: madfsl
- Password: madfsl

- But, let’s have a look at the instructions for you to start your own image
  - If you want to prepare your development environment in a PC natively (out of the virtual machine environment), you can use the same instructions as reference, ignoring some parts that are exclusive to virtual machines

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Development Environment

- Download and install VMWare Player *
  - Version 3.1.4 build-385536 used in this training
  - Create a new Linux – Ubuntu machine with at least 40GB HD, 1GB RAM
- Download and install Ubuntu 10.04 LTS (or a later version) from CD ROM or .iso file
  - After installing, update system packages
- Update VM Ware Tools to the latest version (8.4.6-385536 on September 05th) *
  - Download and install using VM Ware menu item
  - Auto mount vmware tools .iso image inside Ubuntu
  - Untar VMWare Tools package available inside the .iso image
  - Run *vmware-install.pl* script

*Ignore in native PC

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Development Environment

- Follow the steps described before in LTIB Overview session to install LTIB
  - Unpack .tar.gz files to $HOME/Software/Packages/iMX28
  - Choose $HOME/Software/Build/iMX28 as destination directory

- Copy scripts from L2.6.35_10.12.01_SDK_scripts to $HOME/Software/Scripts and add this directory to your PATH environment variable
  - *# Export PATH=$HOME/Software/Scripts*

- Go to $HOME/Software/Build/iMX28/ltib to configure and build the system images to be flashed in the iMX28 SD card

- Select profile “min Profile” and add the following packages during configuration process
  - Freescale Multimedia Plugins/Codecs
    - fsl-mm-codec-libs, fsl-mm-flv-codec-libs, gstreamer-fsl-plugins
  - freetype,
  - gstreamer - gstreamer-plugins-base, gstreamer-plugins-good, gstreamer-plugins-bad, gstreamer-plugins-ugly, gstreamer FFmpeg plugins
  - tslib

- Note: Configuration screens sequence are shown in the next slides

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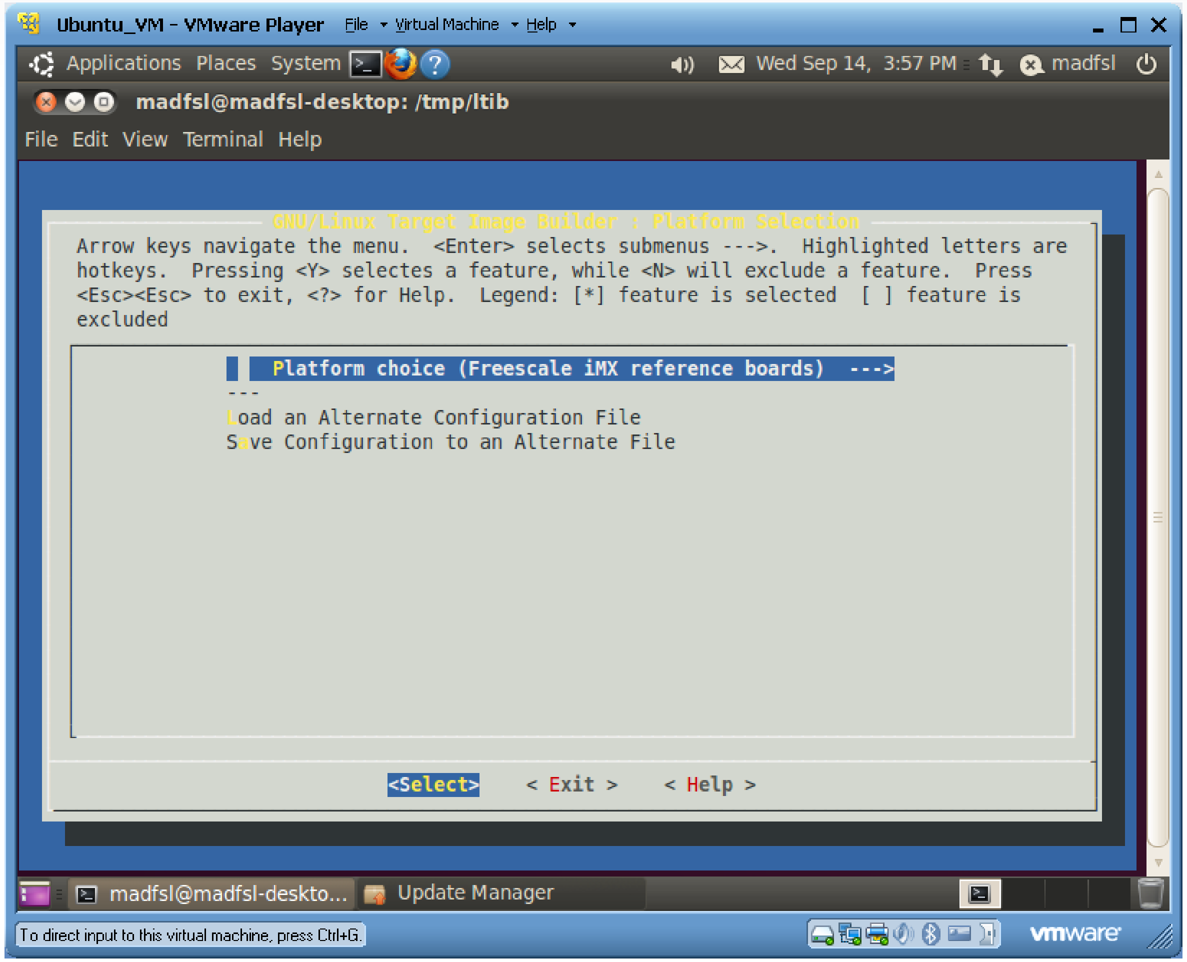
Configuring LTIB and building system image



Ubuntu_VM - VMware Player File Virtual Machine Help
Applications Places System
Wed Sep 14, 3:57 PM madfsl
madfsl@madfsl-desktop: /tmp/ltib
File Edit View Terminal Help
madfsl@madfsl-deskto... Update Manager
To direct input to this virtual machine, press Ctrl+G.
vmware

```
 GNU/Linux Target Image Builder : Platform Selection
  Arrow keys navigate the menu.  <Enter> selects submenus --->.  Highlighted letters are
  hotkeys.  Pressing <Y> selectes a feature, while <N> will exclude a feature.  Press
  <Esc><Esc> to exit, <?> for Help.  Legend: [*] feature is selected  [ ] feature is
  excluded

              Platform choice (Freescale iMX reference boards)  --->
             ---
             Load an Alternate Configuration File
             Save Configuration to an Alternate File

                        <Select>    < Exit >    < Help >
```

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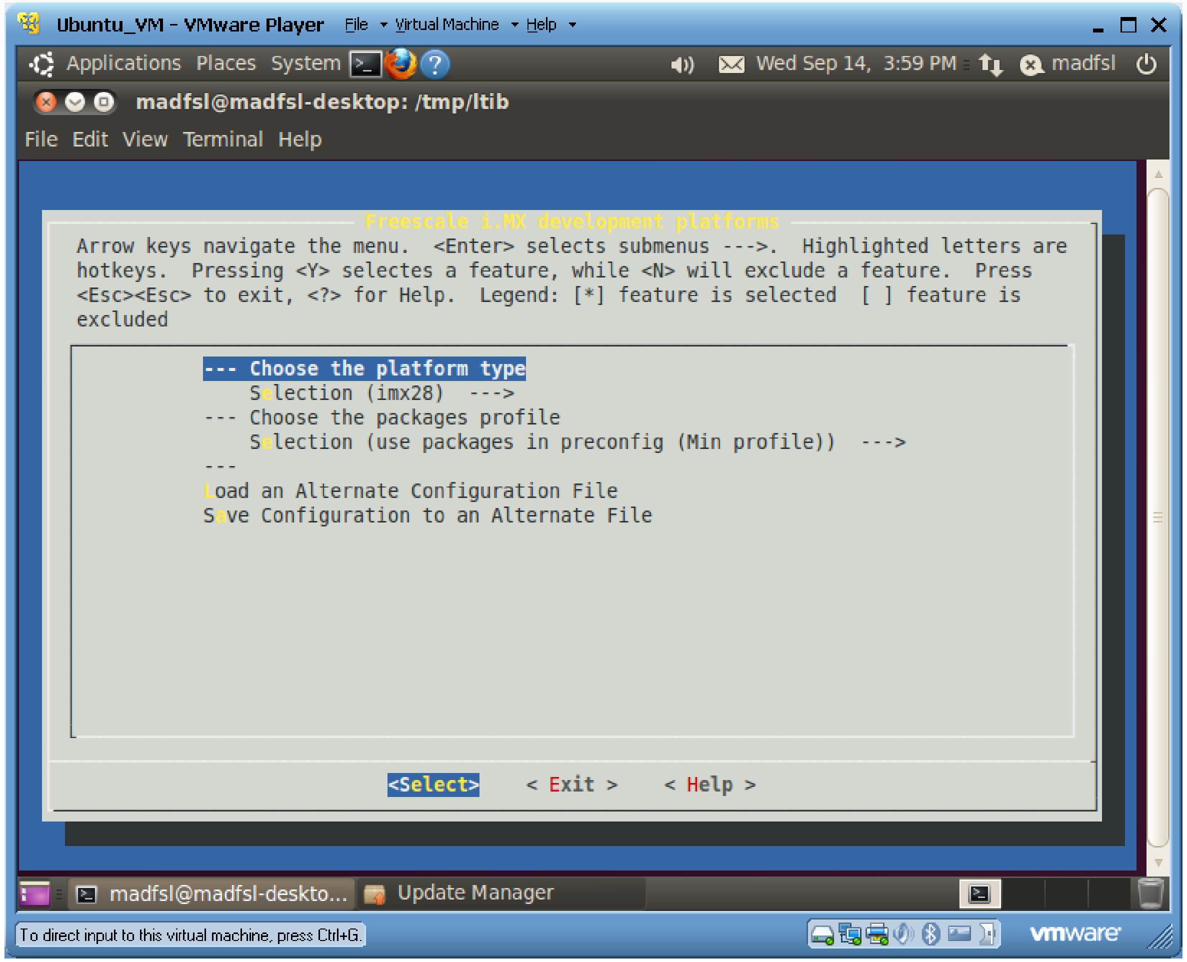
Ubuntu_VM - VMware Player
File Virtual Machine Help
Applications Places System
Wed Sep 14, 3:59 PM
madfsl
madfsl@madfsl-desktop: /tmp/ltib
File Edit View Terminal Help
madfsl@madfsl-deskto...
Update Manager
To direct input to this virtual machine, press Ctrl+G.
vmware

```
                    Freescale i.MX development platforms
  Arrow keys navigate the menu.  <Enter> selects submenus --->.  Highlighted letters are
  hotkeys.  Pressing <Y> selectes a feature, while <N> will exclude a feature.  Press
  <Esc><Esc> to exit, <?> for Help.  Legend: [*] feature is selected  [ ] feature is
  excluded

           --- Choose the platform type
               Selection (imx28)  --->
           --- Choose the packages profile
               Selection (use packages in preconfig (Min profile))  --->
           ---
           Load an Alternate Configuration File
           Save Configuration to an Alternate File

                      <Select>    < Exit >    < Help >
```

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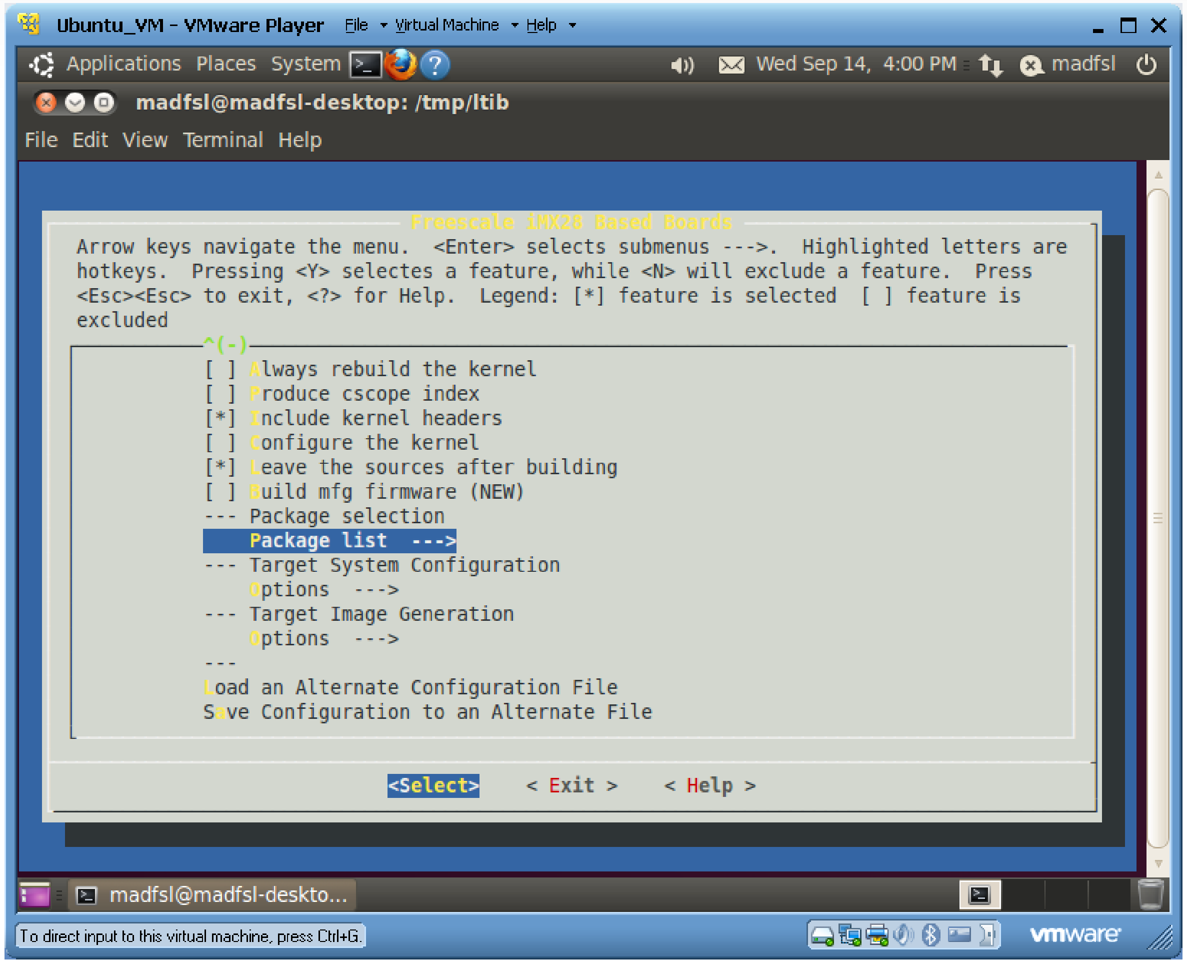
Configuring LTIB and building system image



```
                         Freescale iMX28 Based Boards
  Arrow keys navigate the menu.  <Enter> selects submenus --->.  Highlighted letters are
  hotkeys.  Pressing <Y> selectes a feature, while <N> will exclude a feature.  Press
  <Esc><Esc> to exit, <?> for Help.  Legend: [*] feature is selected  [ ] feature is
  excluded
           ^(-)
           [ ] Always rebuild the kernel
           [ ] Produce cscope index
           [*] Include kernel headers
           [ ] Configure the kernel
           [*] Leave the sources after building
           [ ] Build mfg firmware (NEW)
           --- Package selection
               Package list  --->
           --- Target System Configuration
               Options  --->
           --- Target Image Generation
               Options  --->
           ---
           Load an Alternate Configuration File
           Save Configuration to an Alternate File

                    <Select>    < Exit >    < Help >
```

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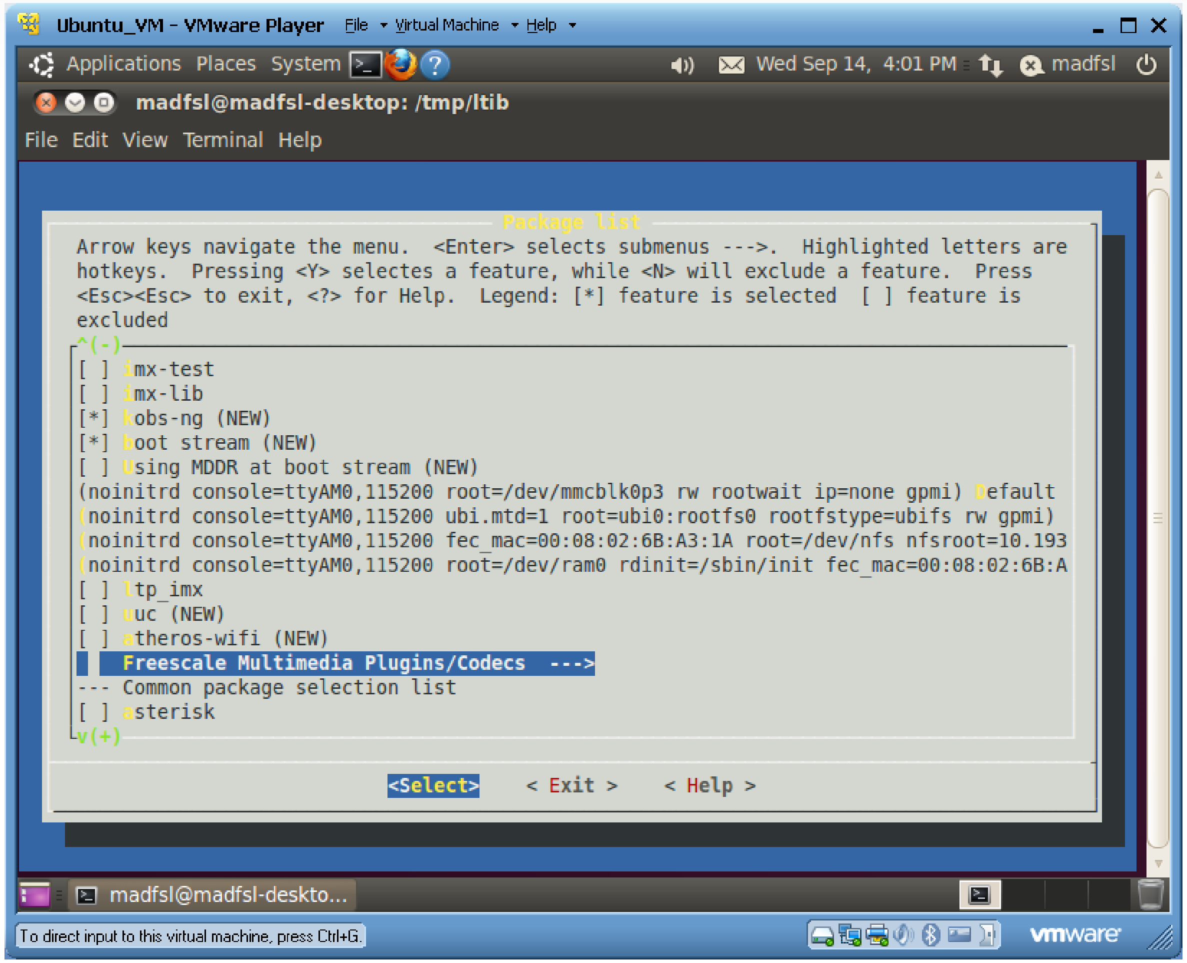
Ubuntu_VM - VMware Player
File Virtual Machine Help
Applications Places System
Wed Sep 14, 4:01 PM
madfsl
madfsl@madfsl-desktop: /tmp/ltib
File Edit View Terminal Help
madfsl@madfsl-deskto...
To direct input to this virtual machine, press Ctrl+G.
vmware

```
                              Package list
 Arrow keys navigate the menu.  <Enter> selects submenus --->.  Highlighted letters are
 hotkeys.  Pressing <Y> selectes a feature, while <N> will exclude a feature.  Press
 <Esc><Esc> to exit, <?> for Help.  Legend: [*] feature is selected  [ ] feature is
 excluded
 ^(-)
 [ ] imx-test
 [ ] imx-lib
 [*] kobs-ng (NEW)
 [*] boot stream (NEW)
 [ ] Using MDDR at boot stream (NEW)
 (noinitrd console=ttyAM0,115200 root=/dev/mmcblk0p3 rw rootwait ip=none gpmi) Default
 (noinitrd console=ttyAM0,115200 ubi.mtd=1 root=ubi0:rootfs0 rootfstype=ubifs rw gpmi)
 (noinitrd console=ttyAM0,115200 fec_mac=00:08:02:6B:A3:1A root=/dev/nfs nfsroot=10.193
 (noinitrd console=ttyAM0,115200 root=/dev/ram0 rdinit=/sbin/init fec_mac=00:08:02:6B:A
 [ ] ltp_imx
 [ ] uuc (NEW)
 [ ] atheros-wifi (NEW)
     Freescale Multimedia Plugins/Codecs  --->
 --- Common package selection list
 [ ] asterisk
 v(+)

               <Select>    < Exit >    < Help >
```

Select all the packages listed before

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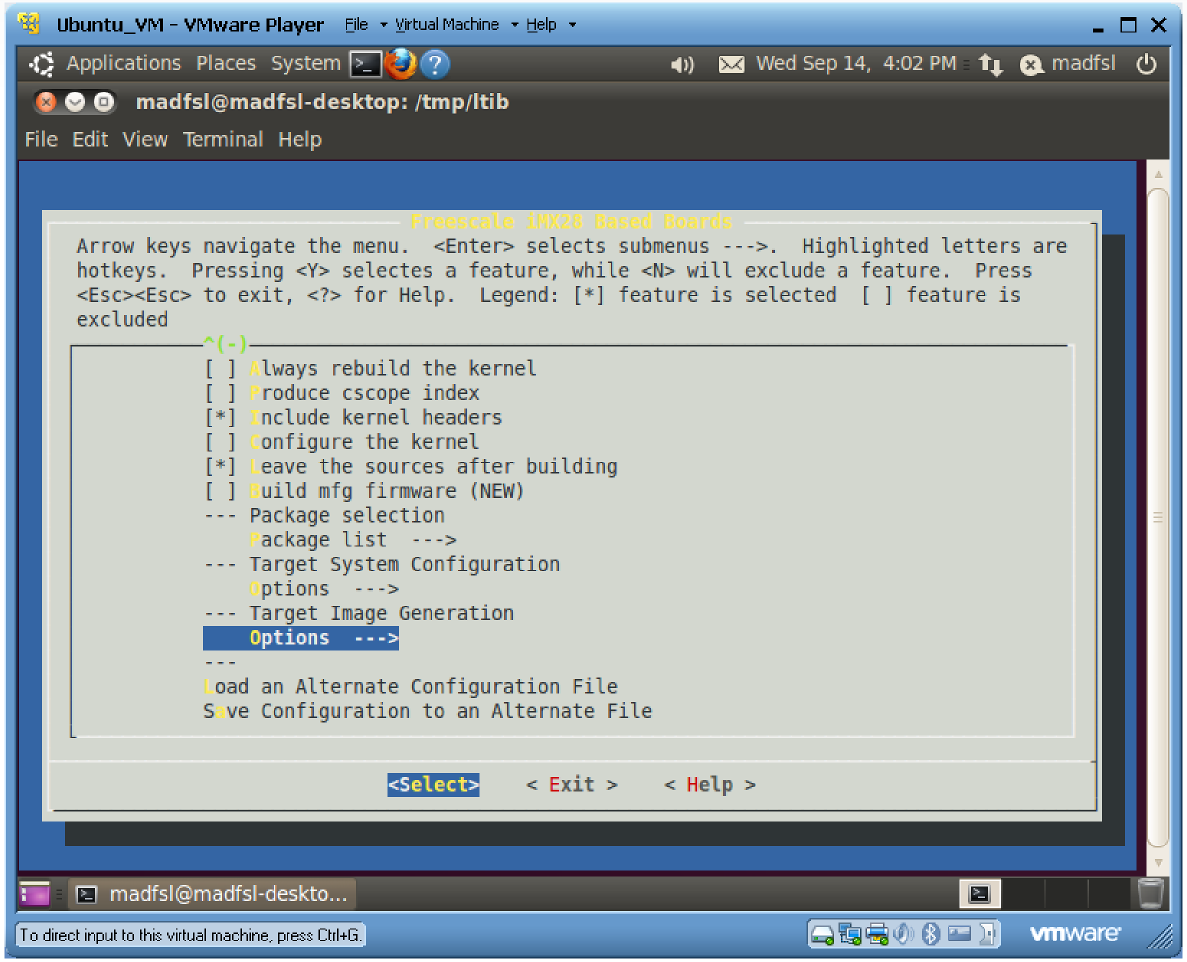
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File Edit View Terminal Help
madfsl@madfsl-deskto...
To direct input to this virtual machine, press Ctrl+G.
vmware

```
                     Freescale iMX28 Based Boards
 Arrow keys navigate the menu.  <Enter> selects submenus --->.  Highlighted letters are
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 <Esc><Esc> to exit, <?> for Help.  Legend: [*] feature is selected  [ ] feature is
 excluded
            ^(-)
            [ ] Always rebuild the kernel
            [ ] Produce cscope index
            [*] Include kernel headers
            [ ] Configure the kernel
            [*] Leave the sources after building
            [ ] Build mfg firmware (NEW)
            --- Package selection
                Package list  --->
            --- Target System Configuration
                Options  --->
            --- Target Image Generation
                Options  --->
            ---
            Load an Alternate Configuration File
            Save Configuration to an Alternate File

                   <Select>    < Exit >    < Help >
```

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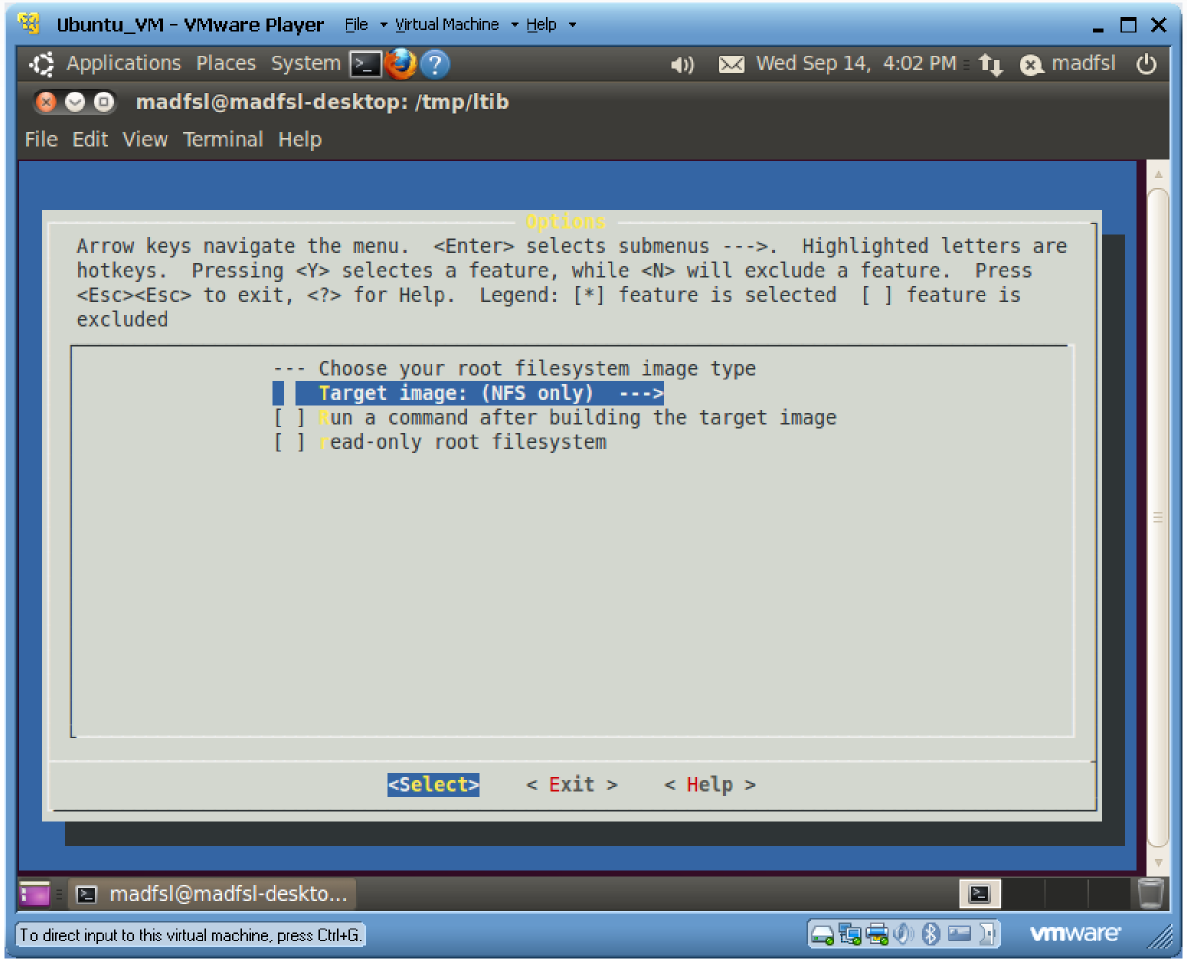
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madfsl
madfsl@madfsl-desktop: /tmp/ltib
File Edit View Terminal Help
madfsl@madfsl-deskto...
To direct input to this virtual machine, press Ctrl+G.
vmware

```
                                 Options
  Arrow keys navigate the menu.  <Enter> selects submenus --->.  Highlighted letters are
  hotkeys.  Pressing <Y> selectes a feature, while <N> will exclude a feature.  Press
  <Esc><Esc> to exit, <?> for Help.  Legend: [*] feature is selected  [ ] feature is
  excluded

                --- Choose your root filesystem image type
                    Target image: (NFS only)  --->
                [ ] Run a command after building the target image
                [ ] read-only root filesystem

                        <Select>    < Exit >    < Help >
```

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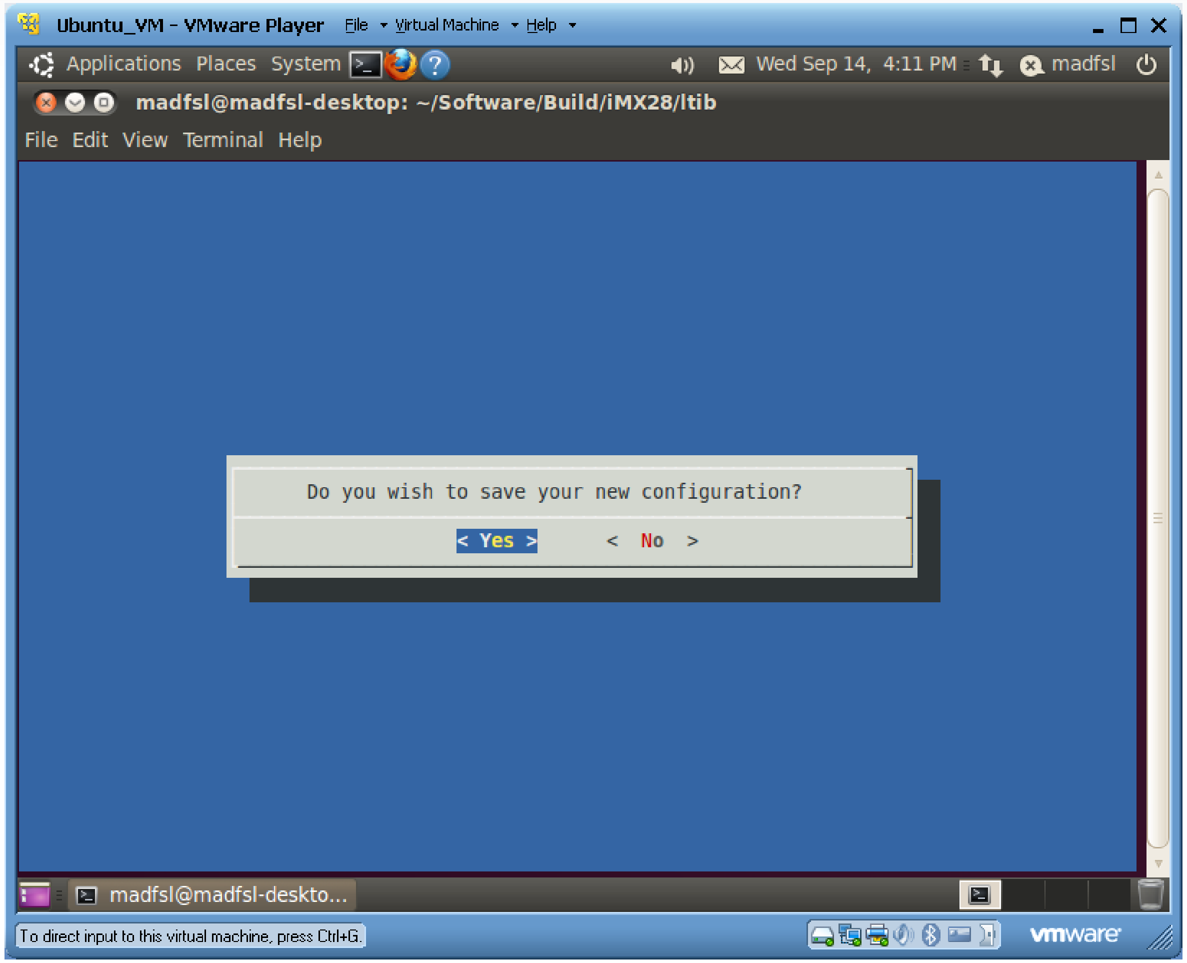
Configuring LTIB and building system image



```
madfsl@madfsl-desktop: ~/Software/Build/iMX28/ltib

Do you wish to save your new configuration?

              < Yes >      <  No  >
```

Save the new configuration and start building the system

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Preparing the SD Card

- Insert SD card into the SD card reader and connect to the Host PC USB
  - Make sure to make the SD card visible to the virtual machine
  - You should see the SD available as */dev/sdb*, for instance
- If there is one or more partitions in the SD card that are automatically mounted in the Linux system inside the virtual machine player, make sure to *umount* them all
  - *# umount /media/<sd_card_patition_name>*
- Run the *mk_mx28_sd* script with the SD card device node as argument
  - *# cd ~/Software/Build/iMX28/ltib*
  - *# mk_mx28_sd /dev/sdb*
  - After completion, remove and re-insert SD card
- Copy video clip to SD card and remove it
  - *# sudo cp $HOME/Video/iMXOOBFlyOver_256kb_320x240_Base.mp4 /media/**[your_sd_card_partition]**/root*
  - *# umount /media/**[your_sd_card_partition]***

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Running…

- Connect serial cable
  - Run a terminal program (like putty) in the host machine (115200 8N1 no flow control)
- Set boot mode switch to 1001
- Insert SD card
- Power on the evk
  - Linux penguin appears on the LCD
- Testing system image and preparing for next steps
  - Login as *root* – no password needed
  - Calibrate touch screen
    - *# export TSLIB_TSDEVICE=/dev/input/ts0*
    - *# ts_calibrate*
  - Test touch screen
    - *# ts_test*
  - Test gstreamer media framework
    - # gplay /root/iMXOOBFlyOver_256kb_320x240_Base.mp4

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Developing Qt Apps

Hands On

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Preparing Qt Libraries (Host side)

- Download Qt libraries source code
  - *qt-everywhere-opensource-src-4.7.4.tar.gz*
  - Extract the content from package to *$HOME/Software/Packages*

- Build the libraries for Ubuntu
  - Install additional packages
    - *gstreamer0.10-plugins-good, libgstreamer0.10-dev, libglib2.0-dev, libgstreamer-plugins-base0.10-dev*
  - Change to *$HOME/Software/Build*
  - Create subdirectory *qt-4.7.4* and change to it
  - Configure Qt for PC using following configure line
    - *# $HOME/Software/Packages/qt-everywhere-opensource-src-4.7.4/configure -release -opensource -prefix $HOME/Software/Qt-4.7.4-x86 -multimedia -audio-backend -phonon -phonon-backend -gstreamer -glib -force-pkg-config -confirm-license*
  - Build and install the libraries for the host machine
    - *# make && make install*

- Qt libraries will be installed to *$HOME/Software/Qt-4.7.4-x86*

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Preparing Qt Libraries (Device side)

- Use the same source code already used for the host side

- Build the libraries for iMX28
  - Inside qt source code, copy *mkspecs/qws/linux-arm-gnueabi-g++* to *mkspecs/qws/linux-mxc-g++*
  - Edit *mkspecs/qws/linux-mxc-g++*/qmake.conf and add before the last line
    - PKG_CONFIG = pkg-config-wrapper.sh
    - QMAKE_LIBS = -lglib-2.0 -lgthread-2.0 -lgstreamer-0.10 -lxml2 -lz -lgmodule-2.0 -lgobject-2.0 -lts -lasound
  - Create *$HOME/Software/Scripts/pkg-config-wrapper.sh* and make it executable

```
#!/bin/sh
if [ -n "${SYSROOT:+x}" ];
then
    export PKG_CONFIG_LIBDIR="${SYSROOT}/usr/lib/pkgconfig"
    cmd="pkg-config $@ | sed -e 's:-I:-I${SYSROOT}:g' -e 's:-L:-L${SYSROOT}:g'"
    eval "$cmd"
else
    eval "pkg-config $@"
fi
```

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Preparing Qt Libraries (Device side)

- Build the libraries for iMX28 (continuing…)
  - Change to *$HOME/Software/Build/iMX28*
  - Create subdirectory *qt-4.7.4* and change to it
  - Export SYSROOT environment variable
    - *# export SYSROOT=$HOME/Software/Build/iMX28/ltib/rootfs*
  - Configure Qt for iMX28 using following configure line
    - *$HOMESoftware/Packages/qt-everywhere-opensource-src-4.7.4/configure -embedded arm -xplatform qws/linux-mxc-g++ -release -opensource -prefix $HOME/Software/QtEmbedded-4.7.4-imx -qt-gfx-linuxfb -qt-kbd-tty -qt-mouse-tslib -little-endian -host-little-endian -multimedia -audio-backend -phonon -phonon-backend -gstreamer -glib -force-pkg-config -confirm-license -I$HOME/Software/Build/iMX28/ltib/rootfs/usr/include -L$HOME/Software/Build/iMX28/ltib/rootfs/usr/lib*
  - Build and install the libraries locally to further deploy to iMX28 SD card
    - *# make && make install*

- Qt libraries will be installed to *$HOME/Software/QtEmbedded-4.7.4-imx*

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Preparing Qt Libraries (Device side)

- Besides Qt libraries are all built and available in the host side, now we need to deploy them to iMX28
- Deploying Qt libraries to the iMX28evk
  - Insert the SD card back to the SD card reader in the host PC
  - Copy all the content from *$HOME/Software/QtEmbedded-4.7.4-imx* to the filesystem of your SD card inside */home/madfsl/Software/QtEmbedded-4.7.4-imx*
    - Your SD card is probably mounted under **/media/[sd_card_partition_name]**
  - Umount your SD card and put it back to the iMX28evk board
- Power on your kit and login
- Tell Qt to use tslib to interpret touch screen as a mouse
  - *export QWS_MOUSE_PROTO=tslib:/dev/input/ts0*

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Running some demos…

- After completing preparation steps, you will find lots of Qt demos and examples inside in your iMX28evk
  - Go to /home/madfsl/Software/*QtEmbedded-4.7.4-imx*
  - You have both *demos* and *examples* directories

- Start by trying *fluidlauncher*
  - *# cd demos/embedded/fluidlauncher*
  - *# ./fluidlauncher -qws*

- Note: the -qws argument is necessary so that Qt starts its inernal Window Manager

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Installing Qt Creator

- Download Qt Creator binaries for linux
  - *qt-creator-linux-x86-opensource-2.3.0.bin*

- Make it an executable file
  - *chmod +x qt-creator-linux-x86-opensource-2.3.0.bin*

- Run the file and install Qt Creator
  - Choose *$HOME/Software/IDEs/qtcreator-2.3.0* as installation directory

- After installing, launch Qt Creator and configure it as described ahead

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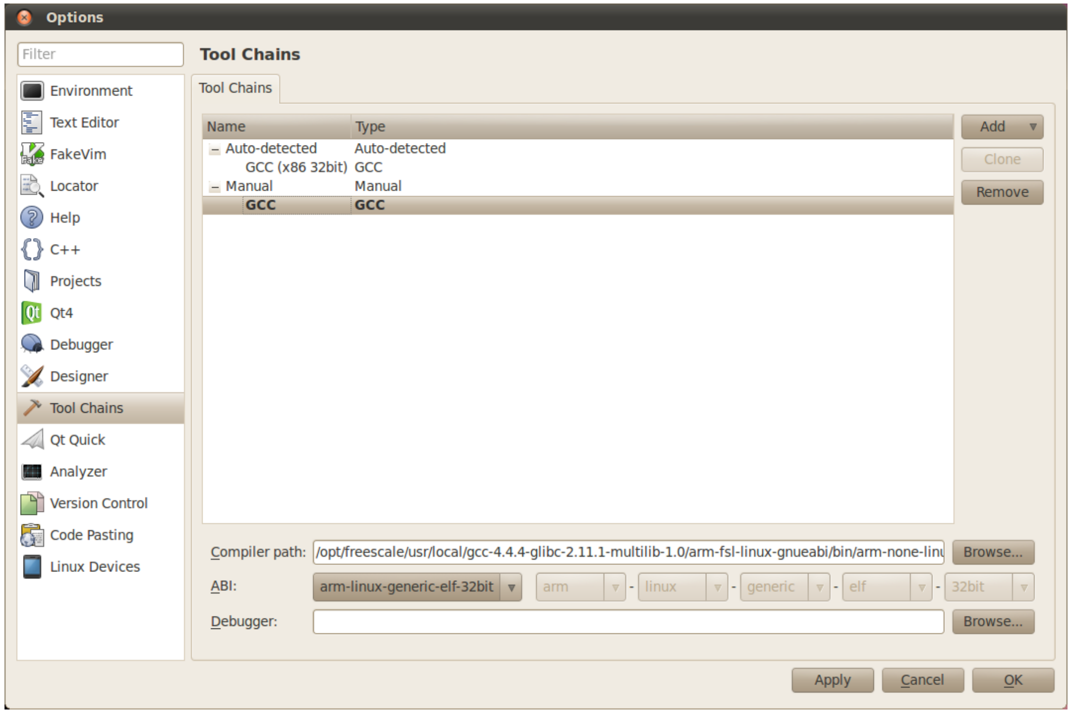
Configuring Qt Creator

- Tools -> Options…
  - Tool Chains -> Tool Chains -> Add -> GCC
  - Set compiler path to: /opt/freescale/usr/local/gcc-4.4.4-glibc-2.11.1-multilib-1.0/arm-fsl-linux-gnueabi/bin/arm-none-linux-gnueabi-gcc



Name	Type
– Auto-detected	Auto-detected
GCC (x86 32bit)	GCC
– Manual	Manual
GCC	GCC

Compiler path: /opt/freescale/usr/local/gcc-4.4.4-glibc-2.11.1-multilib-1.0/arm-fsl-linux-gnueabi/bin/arm-none-linu

ABI: arm-linux-generic-elf-32bit | arm - linux - generic - elf - 32bit

Debugger:

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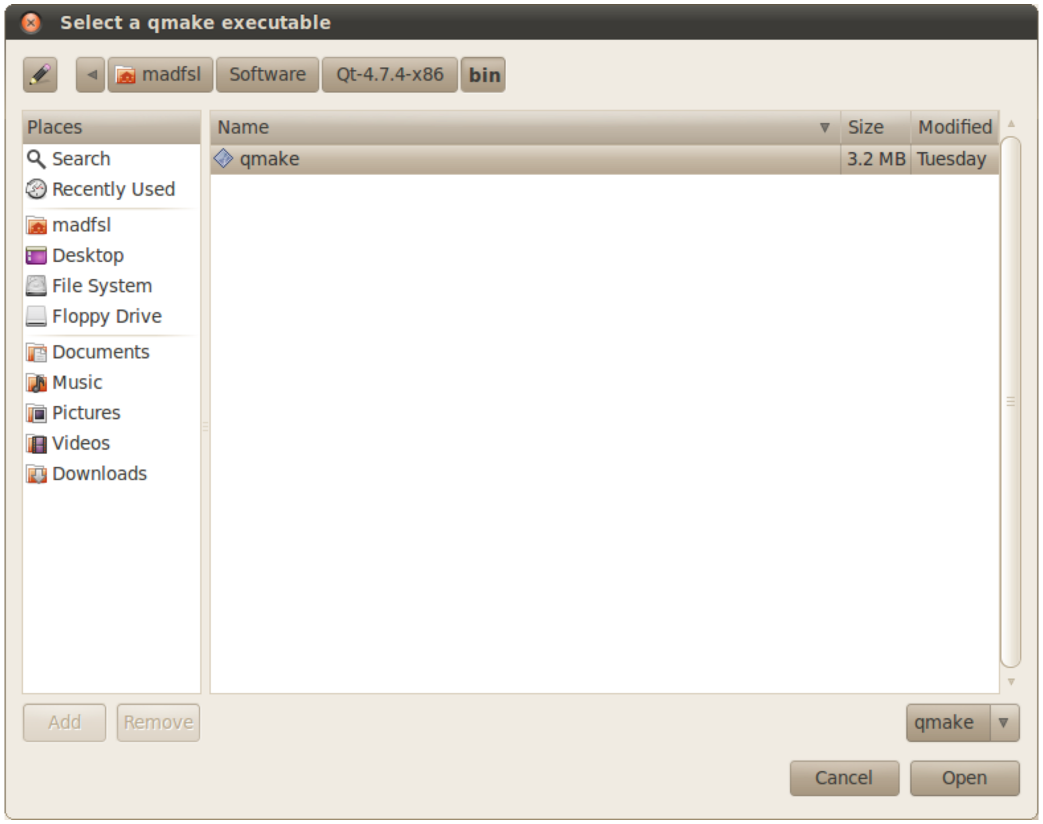
Configuring Qt Creator

- Tools -> Options…
  - Qt 4 -> Qt Versions -> Add



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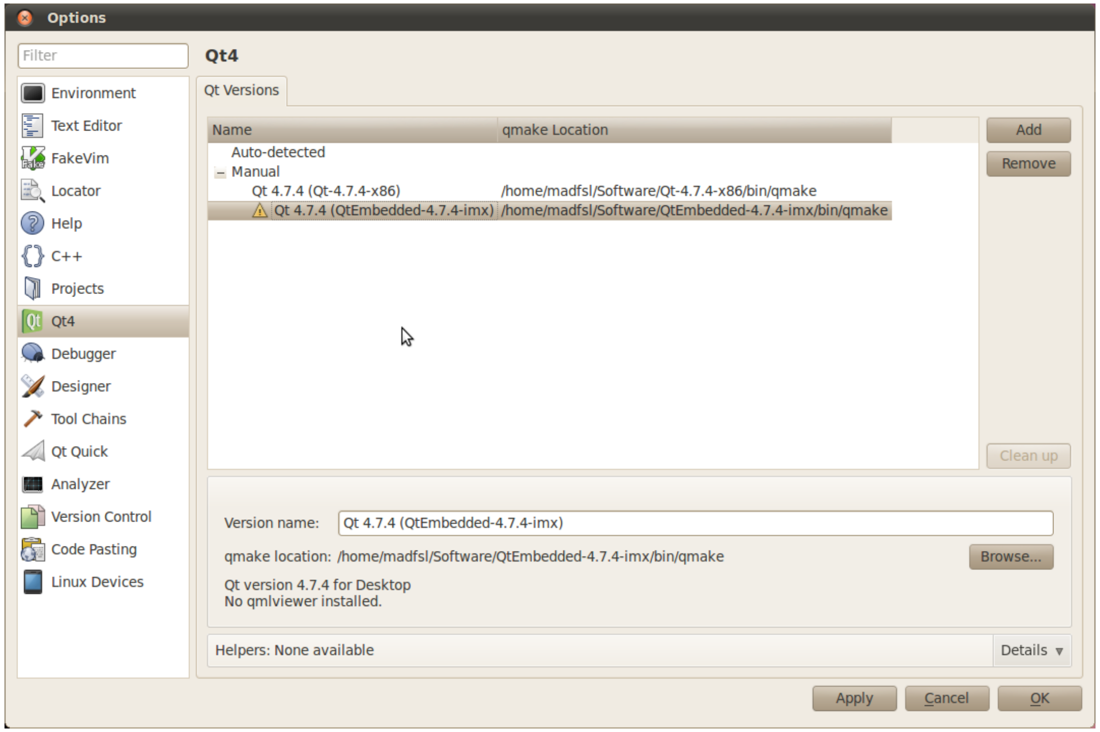
Configuring Qt Creator

- Tools -> Options…
  - Qt 4 -> Qt Versions -> Add (x2)
    - /home/madfsl/Software/Qt-4.7.4-x86/bin/qmake
    - /home/madfsl/Software/QtEmbedded-4.7.4-imx/bin/qmake



Name	qmake Location
Auto-detected	
Manual	
Qt 4.7.4 (Qt-4.7.4-x86)	/home/madfsl/Software/Qt-4.7.4-x86/bin/qmake
Qt 4.7.4 (QtEmbedded-4.7.4-imx)	/home/madfsl/Software/QtEmbedded-4.7.4-imx/bin/qmake

Version name: Qt 4.7.4 (QtEmbedded-4.7.4-imx)

qmake location: /home/madfsl/Software/QtEmbedded-4.7.4-imx/bin/qmake

Qt version 4.7.4 for Desktop
No qmlviewer installed.

Helpers: None available

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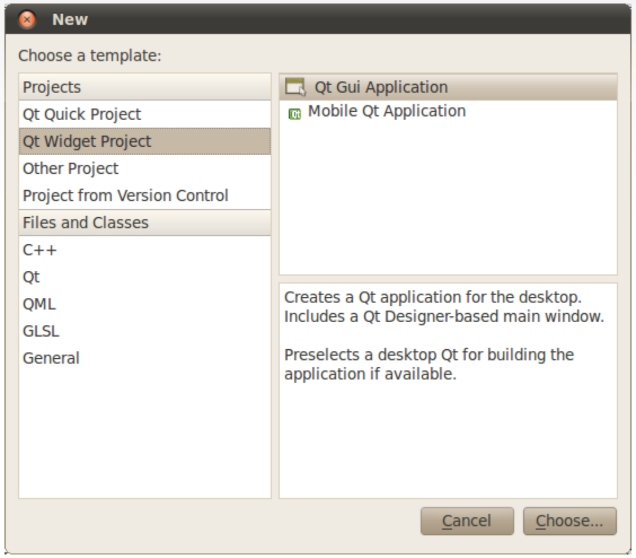
Hello World (C++)

- File -> New File or Project…
  - Qt Widget Project -> Qt Gui Application -> Choose…
  - Name: *Hello*
  - Create in: */home/madfsl/Software/QtProjects*
  - *Select "Use as default project location"*
  - Target Setup -> Next
  - Class Information -> Next
  - Finish



New

Choose a template:

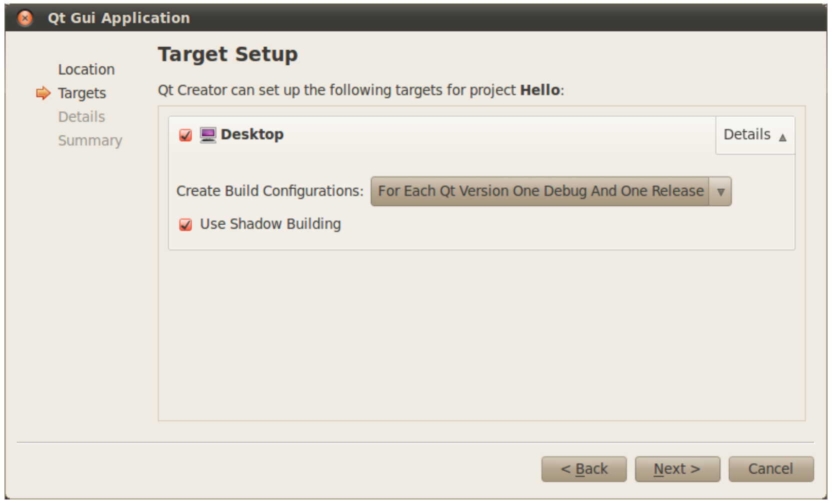
Projects
Qt Quick Project
Qt Widget Project
Other Project
Project from Version Control
Files and Classes
C++
Qt
QML
GLSL
General

Qt Gui Application
Mobile Qt Application

Creates a Qt application for the desktop. Includes a Qt Designer-based main window.

Preselects a desktop Qt for building the application if available.

Cancel | Choose...



Qt Gui Application

Location
Targets
Details
Summary

Target Setup

Qt Creator can set up the following targets for project **Hello**:

☑ **Desktop** Details

Create Build Configurations: For Each Qt Version One Debug And One Release

☑ Use Shadow Building

< Back | Next > | Cancel

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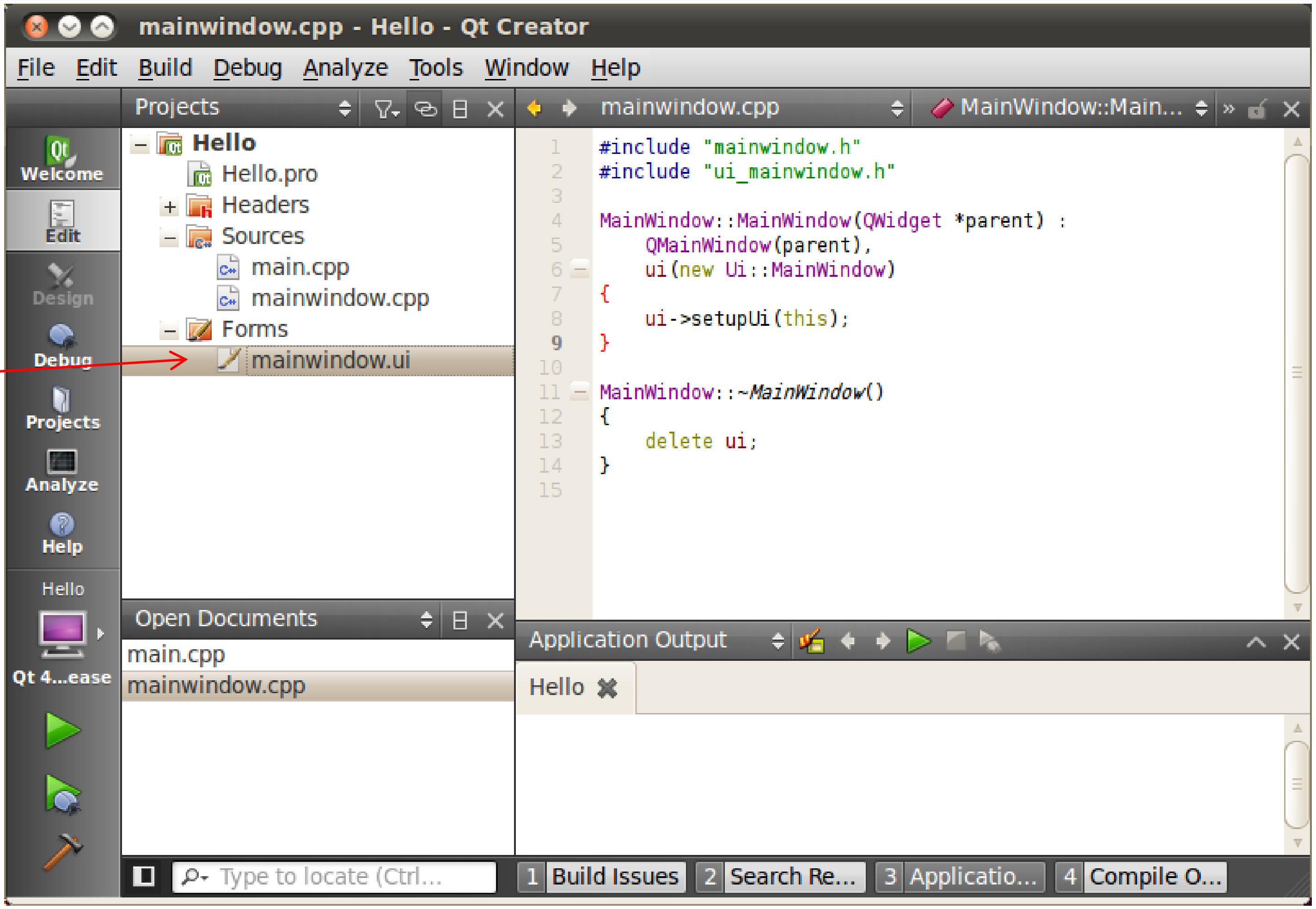
Hello World (C++) – PC Release

Double Click



```
#include "mainwindow.h"
#include "ui_mainwindow.h"

MainWindow::MainWindow(QWidget *parent) :
    QMainWindow(parent),
    ui(new Ui::MainWindow)
{
    ui->setupUi(this);
}

MainWindow::~MainWindow()
{
    delete ui;
}
```

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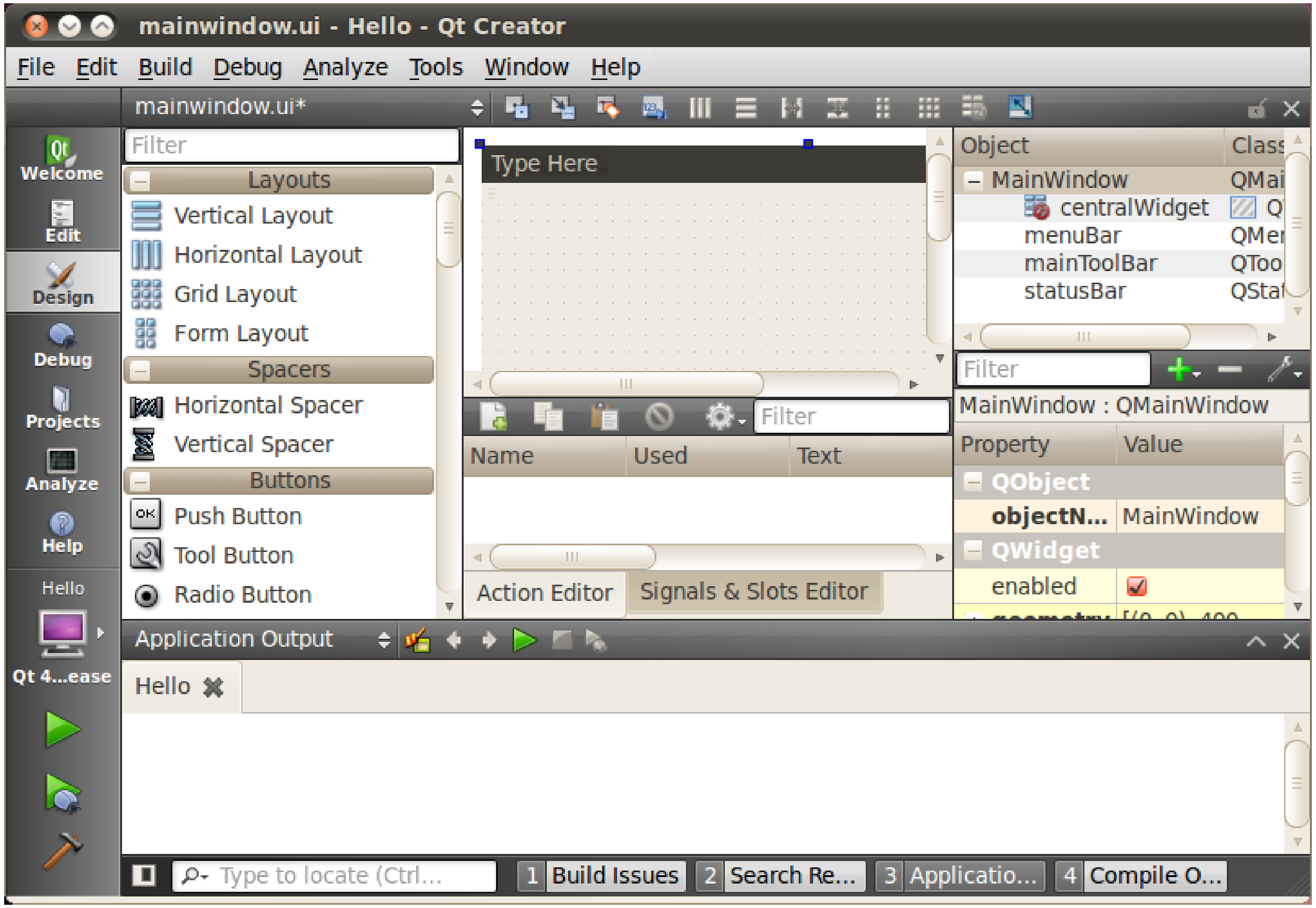
Hello World (C++) – PC Release



Play Around with the UI…

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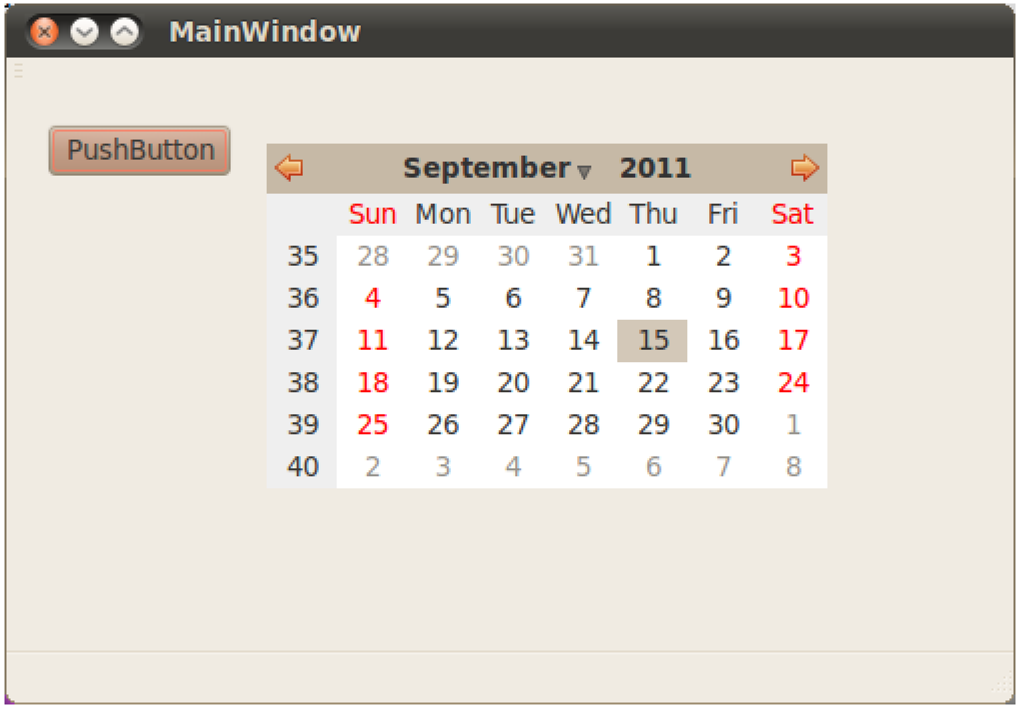
Hello World (C++) – PC Release

- Build using Ctrl + Shift + F5 or the hammer (down left)
- Run using Ctrl + R or the green play button
- Example:



	Sun	Mon	Tue	Wed	Thu	Fri	Sat
35	28	29	30	31	1	2	3
36	4	5	6	7	8	9	10
37	11	12	13	14	15	16	17
38	18	19	20	21	22	23	24
39	25	26	27	28	29	30	1
40	2	3	4	5	6	7	8

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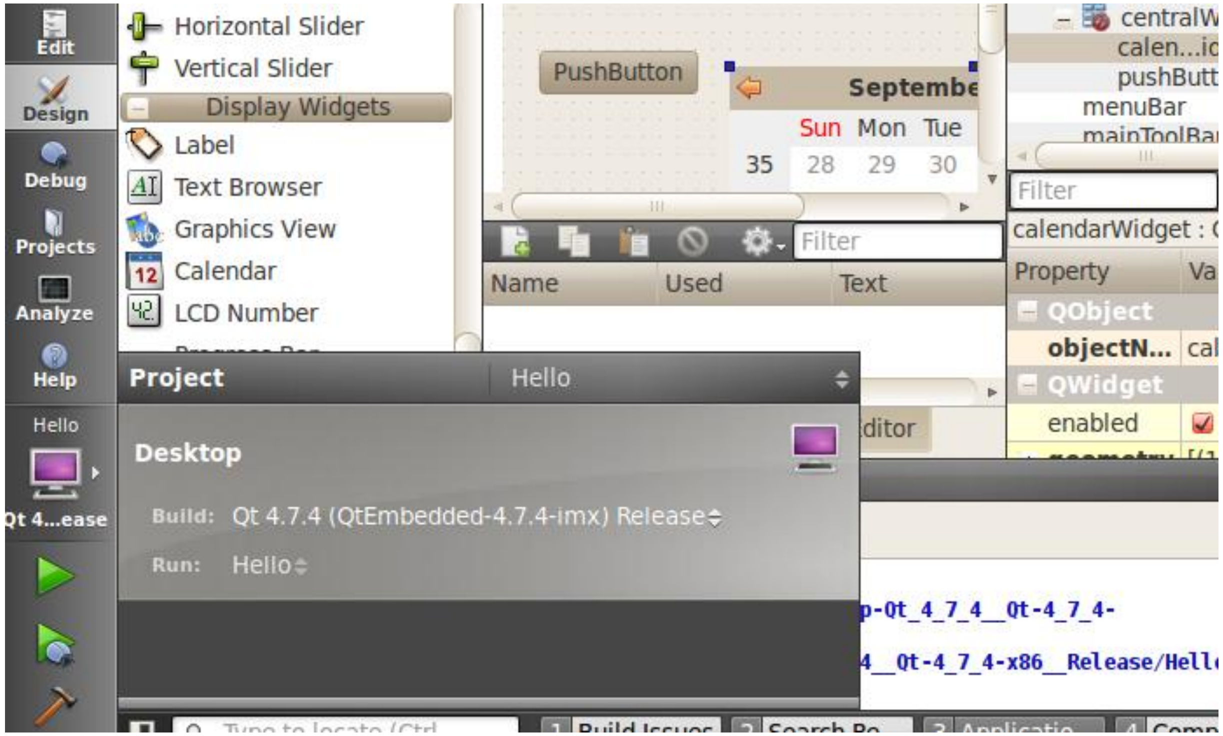
Hello World (C++) – iMX28 Release

- Click the Desktop icon (above the green play button)
- Select *Qt 4.7.4 (QtEmbedded-4.7.4-imx) Release*



Project: Hello

Desktop

Build: Qt 4.7.4 (QtEmbedded-4.7.4-imx) Release

Run: Hello

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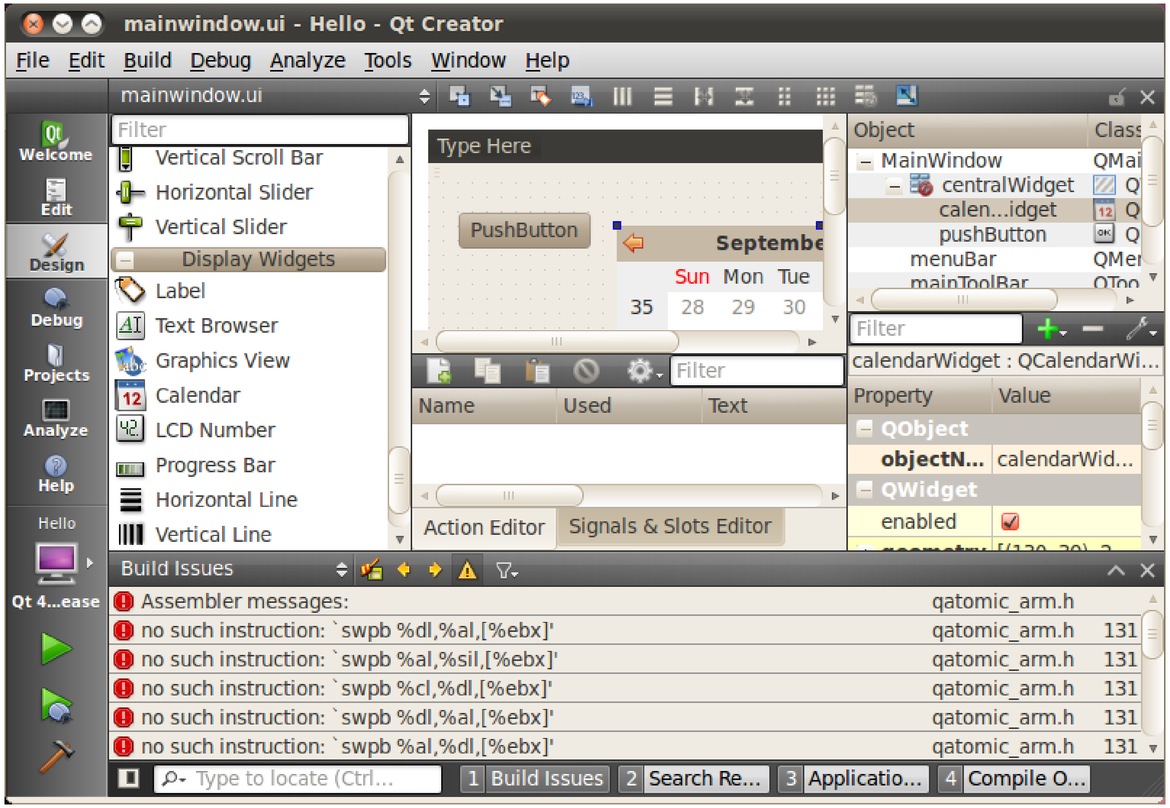
Hello World (C++) – iMX28 Release

- Try to build again using the hammer
- Something went wrong



```
Assembler messages:                                    qatomic_arm.h
no such instruction: `swpb %dl,%al,[%ebx]'             qatomic_arm.h   131
no such instruction: `swpb %al,%sil,[%ebx]'            qatomic_arm.h   131
no such instruction: `swpb %cl,%dl,[%ebx]'             qatomic_arm.h   131
no such instruction: `swpb %dl,%al,[%ebx]'             qatomic_arm.h   131
no such instruction: `swpb %al,%dl,[%ebx]'             qatomic_arm.h   131
```

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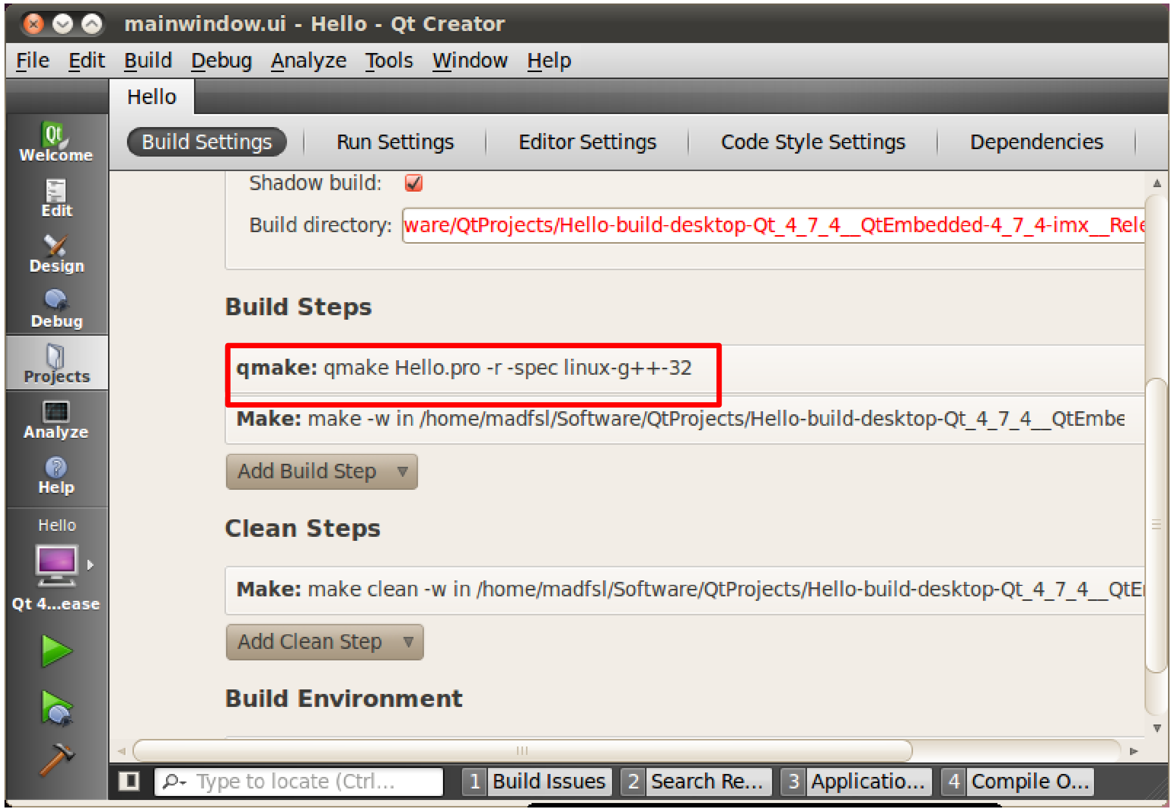
Hello World (C++) – iMX28 Release

- Click Project on the left
- Delete the default *qmake* build step and add a custom step…



Shadow build: ✓

Build directory: ware/QtProjects/Hello-build-desktop-Qt_4_7_4__QtEmbedded-4_7_4-imx__Rele

Build Steps

qmake: qmake Hello.pro -r -spec linux-g++-32

Make: make -w in /home/madfsl/Software/QtProjects/Hello-build-desktop-Qt_4_7_4__QtEmbe

Clean Steps

Make: make clean -w in /home/madfsl/Software/QtProjects/Hello-build-desktop-Qt_4_7_4__QtE

Build Environment

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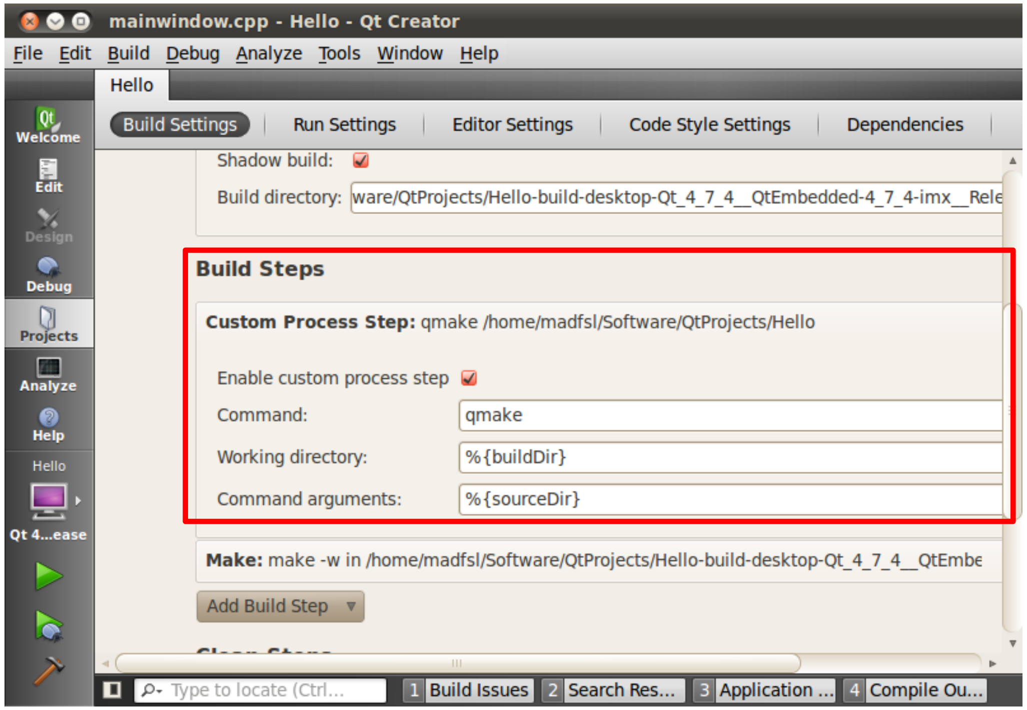
Hello World (C++) – iMX28 Release

- … that runs a simple *qmake* command
- Place it before the *Make* build step and try building again
- Don't forget to enable it
- But you also need to set *Command Arguments* as *%{sourceDir}*



Shadow build: ✓

Build directory: ware/QtProjects/Hello-build-desktop-Qt_4_7_4__QtEmbedded-4_7_4-imx__Rele

Build Steps

Custom Process Step: qmake /home/madfsl/Software/QtProjects/Hello

Enable custom process step ✓

Command:	qmake
Working directory:	%{buildDir}
Command arguments:	%{sourceDir}

Make: make -w in /home/madfsl/Software/QtProjects/Hello-build-desktop-Qt_4_7_4__QtEmbe

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Hello World (C++) – iMX28 Release

- Copy *$HOME/Software/QtProjects/Hello-build-desktop-Qt_4_7_4__QtEmbedded-4_7_4-imx__Release* to the SD card to run in iMX28evk

- Note: Don’t forget to export QWS_MOUSE_PROTO environment variable every time you reboot your system

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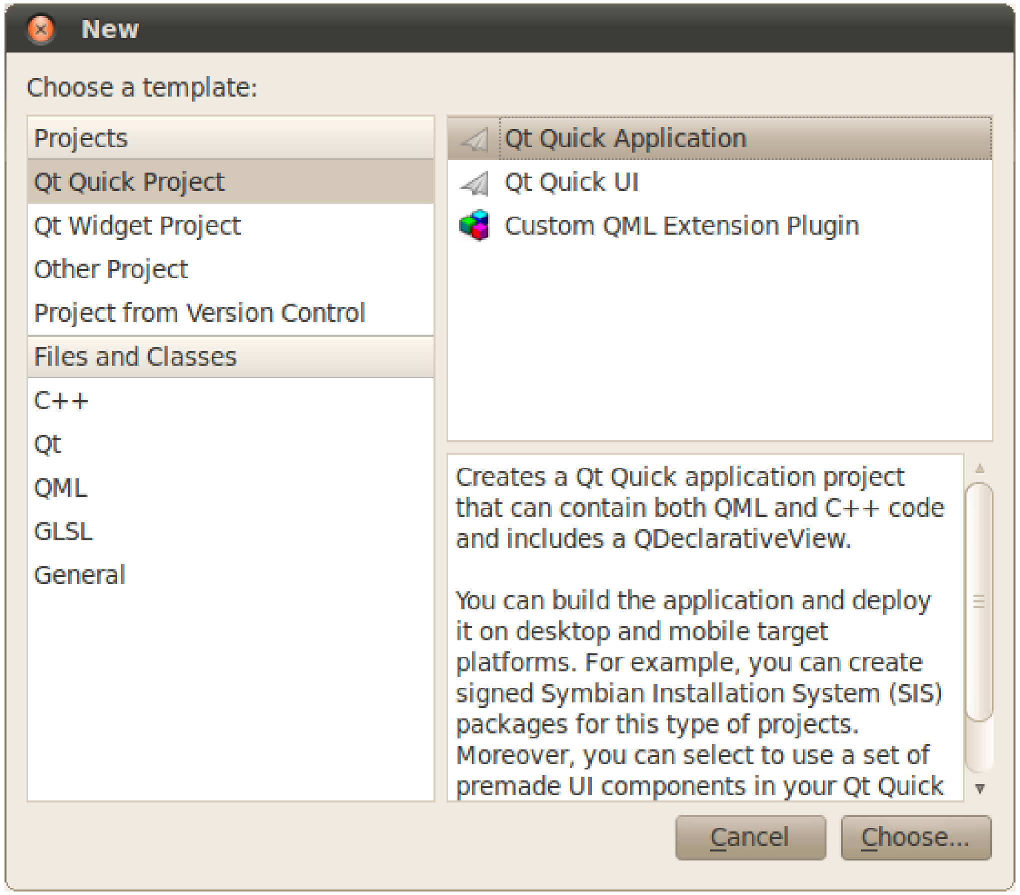
Hello World (QML)

- Now lets play around with QML



Creates a Qt Quick application project that can contain both QML and C++ code and includes a QDeclarativeView.

You can build the application and deploy it on desktop and mobile target platforms. For example, you can create signed Symbian Installation System (SIS) packages for this type of projects. Moreover, you can select to use a set of premade UI components in your Qt Quick

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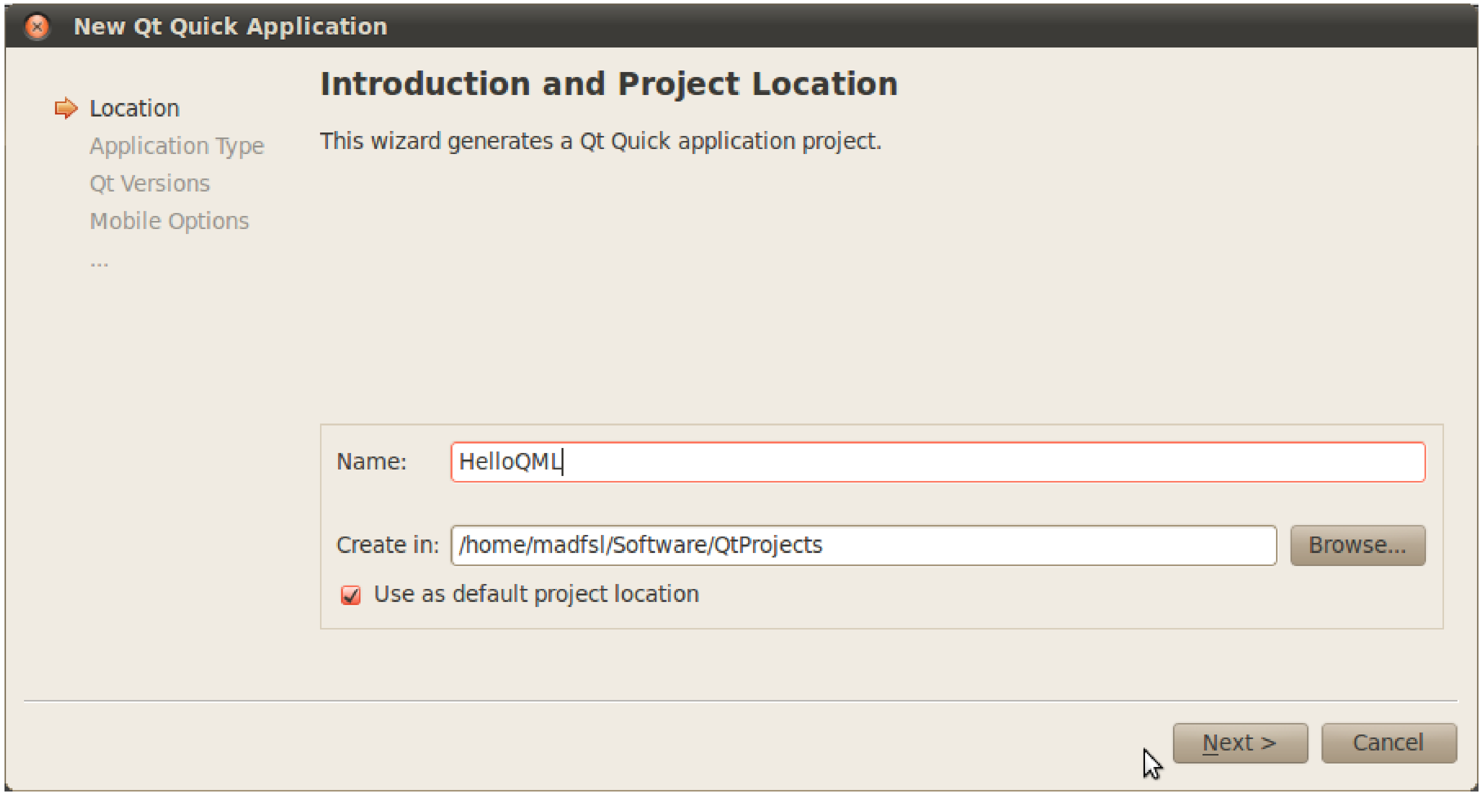
Hello World (QML)

- Now lets play around with QML



Introduction and Project Location

This wizard generates a Qt Quick application project.

Name: HelloQML

Create in: /home/madfsl/Software/QtProjects

✓ Use as default project location

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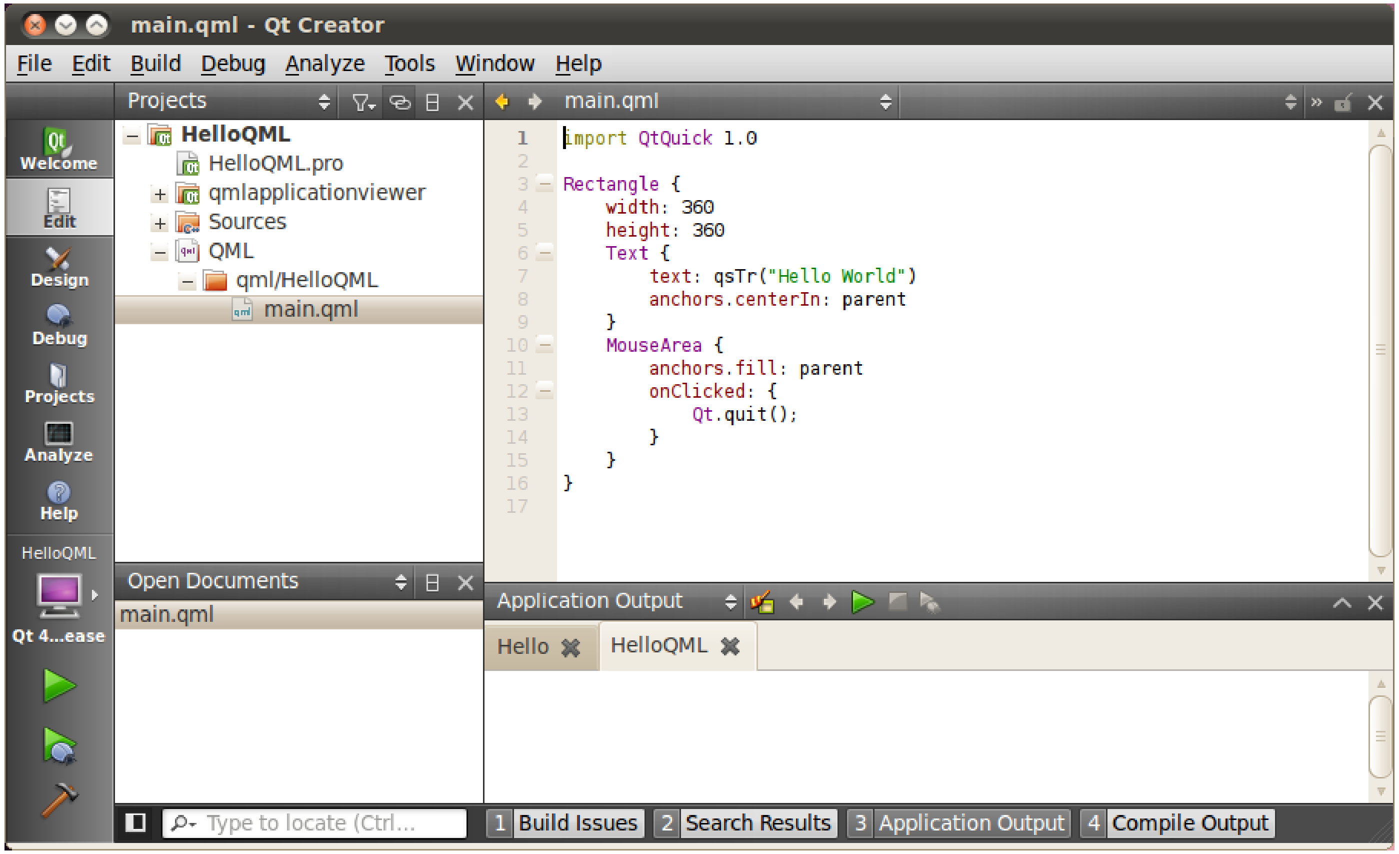
Hello World (QML)

- Now lets play around with QML



```
import QtQuick 1.0

Rectangle {
    width: 360
    height: 360
    Text {
        text: qsTr("Hello World")
        anchors.centerIn: parent
    }
    MouseArea {
        anchors.fill: parent
        onClicked: {
            Qt.quit();
        }
    }
}
```

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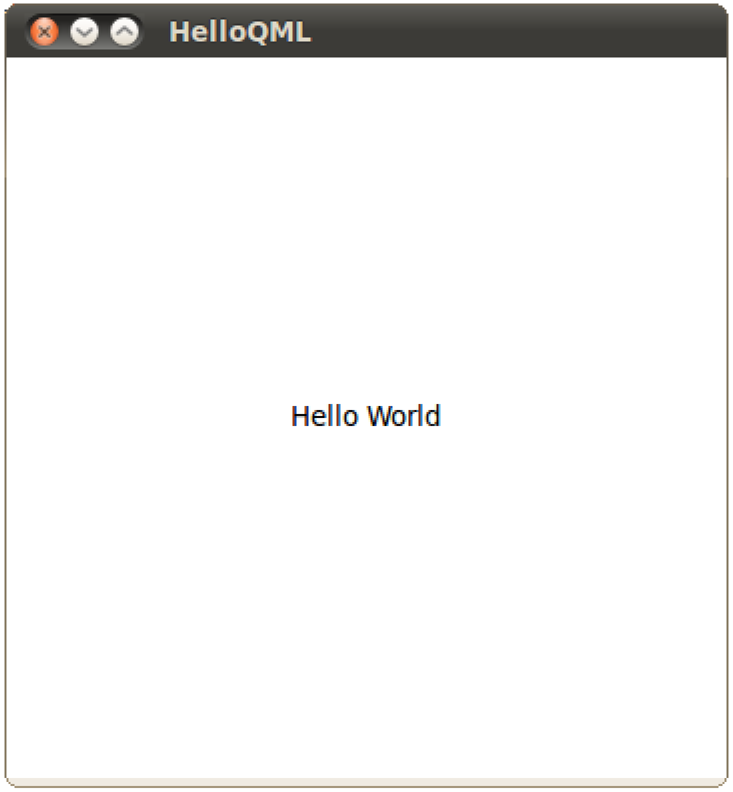
Hello World (QML)

- Now lets play around with QML



Hello World

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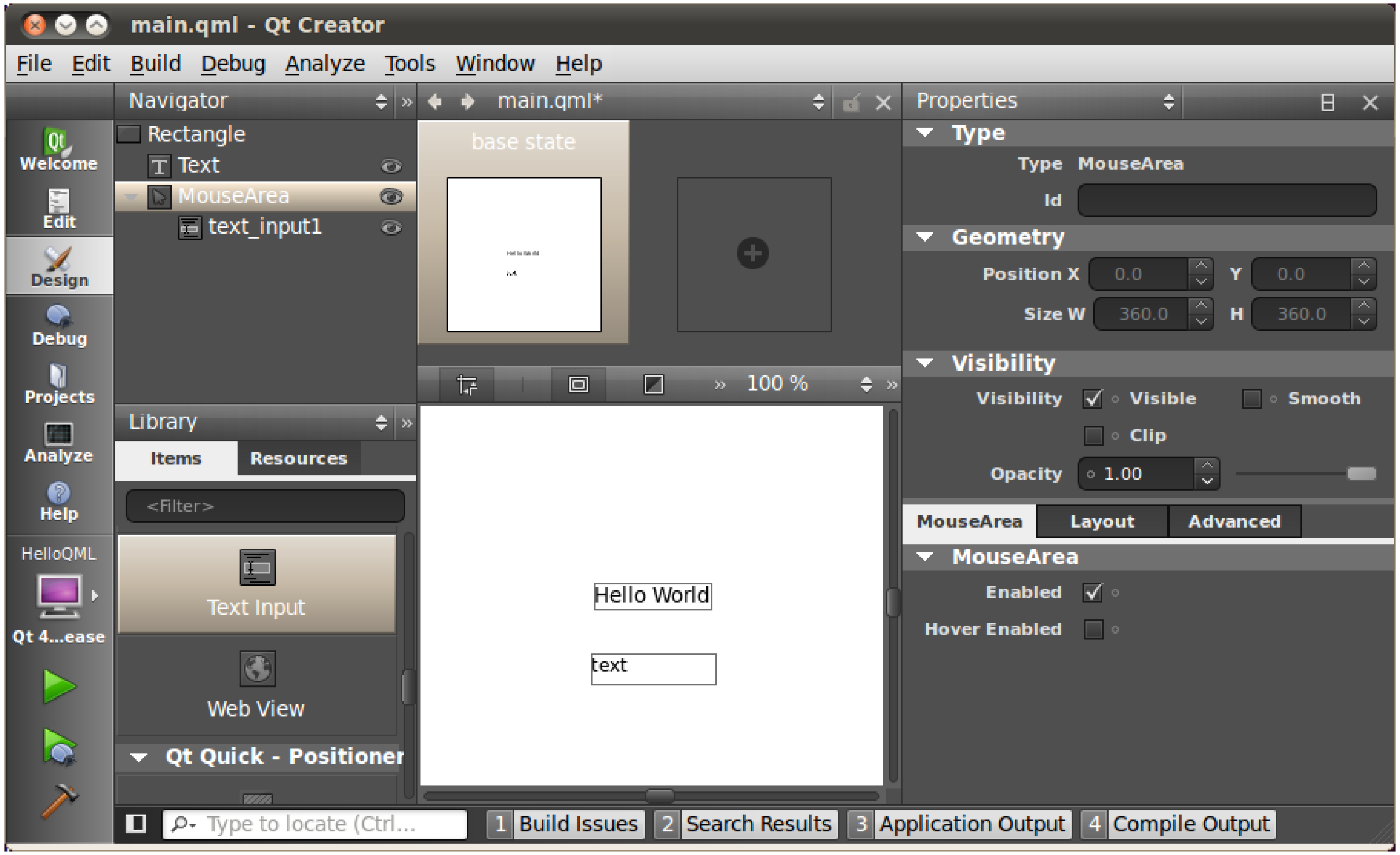
Hello World (QML)

- Play around with the design view…



Properties

Type

Type	MouseArea
Id	

Geometry

Position X	0.0	Y	0.0
Size W	360.0	H	360.0

Visibility

Visibility	✓ Visible	Smooth
	Clip	
Opacity	1.00	

MouseArea | Layout | Advanced

MouseArea

Enabled	✓
Hover Enabled	

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