Get Started with Qt for MCUs 1.0

Qt

All in One - Framework

Powerful & Modern Development Framework

Code Once, Deploy Everywhere

Cross-Platform

Integrated Development Tools

Productive development environment

Qt Creator IDE

Design Tools

Target All Your End Users with One Technology

Embedded:

- Embedded Linux, Windows Embedded
- RTOS: QNX, VxWorks, INTEGRITY

Desktop:

- Windows, Linux, macOS
- Enterprise UNIX

Mobile:

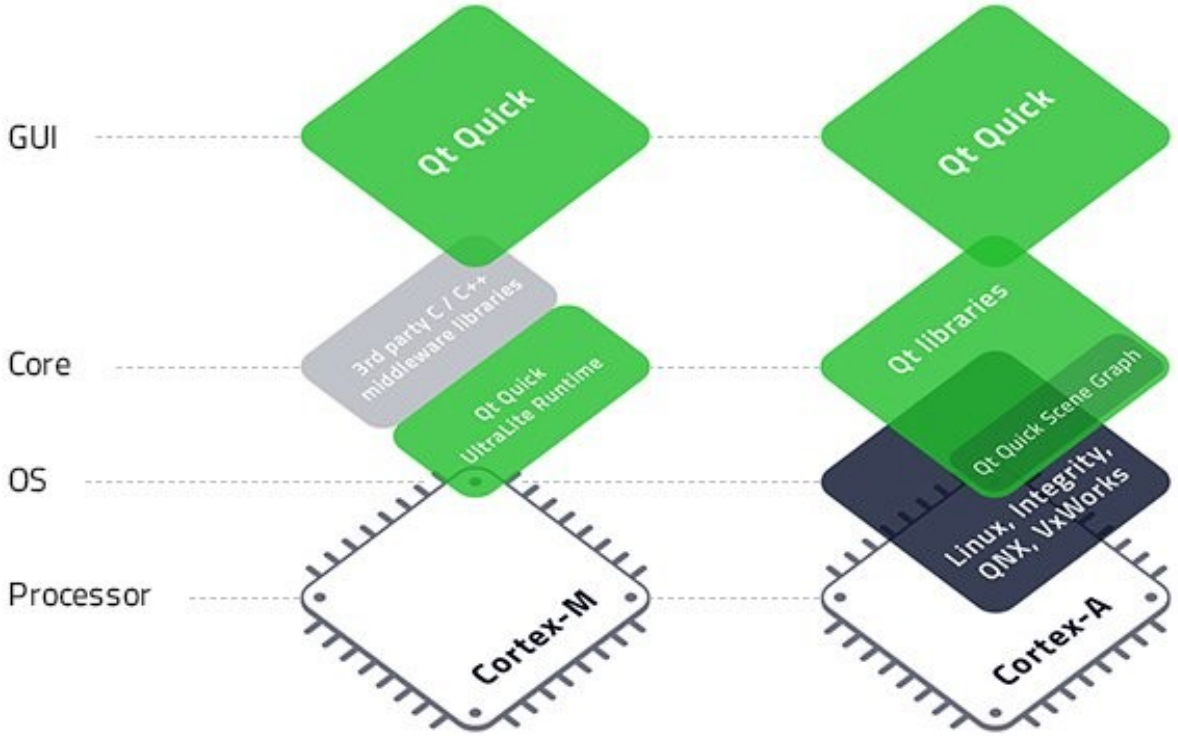
- Android, iOS, Universal Windows Platform

Web:

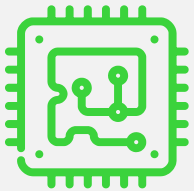
- WebAssembly

Qt for MCUs

Ultimate Performance. Tiny Footprint.



Qt for MCUs 1.0



Quick Ultralite Graphics runtime

Qt Quick Controls

- Subset of Qt Quick Controls 2.0
- Styling and theming

Platform Adaptation

Bare Metal
- NXP
- STM32
- Renesas

Dev. Tools

- Qt Creator Integration
- Localization (Linguist)

Documentation

Examples with Source Code

Get Started with Qt for MCUs 1.0

Platforms included in the evaluation package:

- **NXP i.MX RT1050 EVK (Bare Metal)**
- **STM32F769i (Bare Metal)**

Software requirements:

- Microsoft Windows
- Qt for MCUs Evaluation Package
- Qt Creator 4.11 or higher
- Qt 5.14
- CMake 3.13 or higher
- Python 2.7 32-bit
- Arm GCC version 8-2019-q3-update or later

NXP:

- Segger J-Link Software Pack
- J-Link OpenSDA RT1050 Firmware

STM32

- STM32CubeProgrammer
- STM32 ST-LINK Utility

Installation

- Qt: https://account.qt.io/downloads
- CMake: https://cmake.org/download/
- Python 2.7 32-bit: https://www.python.org/downloads/release/python-2716/
- Arm GCC: https://developer.arm.com/tools-and-software/open-source-software/developer-tools/gnu-toolchain/gnu-rm/downloads
- J-Link Software Pack: https://www.segger.com/downloads/jlink/JLink_Windows.exe
- J-Link OpenSDA Firmware: https://www.segger.com/downloads/jlink/OpenSDA_MIMXRT1050-EVK-Hyperflash
- STM32CubeProgrammer: https://www.st.com/en/development-tools/stm32cubeprog.html
- STM32 ST-LINK Utility: https://www.st.com/en/development-tools/stsw-link004.html

- Must add in PATH:
  - `<Qt_5.14_install_location>/bin` (for translation tools)

Qt Creator Configuration

- Enable Bare Metal and MCU plugins in Help -> About Plugins (requires a restart)
- Go to Tools -> Options -> Devices
  - Select the ‘MCU’ tab
  - Select the needed board in the ‘Target’ dropdown list
  - Configure the paths of all necessary packages
  - Click ‘Apply’ to generate the Kit
  - (Repeat for each board you want to use)

Qt Creator Configuration (debugging - NXP)

- Add GDB Server Provider
  - Tools -> Options -> Devices -> Bare Metal --> Add -> Default
  - Enter “j-link gdb" as name
  - Set port to 9876
  - Add to init commands:

```
mon reset
mon halt
load
mon reset
mon halt
eval "monitor reg pc %#x", &Reset_Handler
mon go
```

  - Add 'mon reset' to reset commands

```
mon reset
mon halt
eval "monitor reg pc %#x", &Reset_Handler
mon go
```

- Create Device
  - Tools -> Options -> Devices -> Add…
  - Select ‘Bare Metal Device’
  - Give a name and select the GDB server provider created in the previous step
- Clone the i.MX RT1050 kit created in slide 8 (And rename it to indicate that it is used for debugging)
  - Change the device type to Bare Metal Device
  - Select the device created in the previous step

Qt Creator Configuration (debugging – STM32)

- Add GDB Server Provider
  - Tools -> Options -> Devices -> Bare Metal --> Add -> Default
  - Enter “j-link gdb" as name
  - Set port to 9876
  - Add to init commands:

    ```
    load
    ```

  - Add 'mon reset' to reset commands

    ```
    mon reset
    ```

- Create Device
  - Tools -> Options -> Devices -> Add…
  - Select ‘Bare Metal Device’
  - Give a name and select the GDB server provider created in the previous step
- Clone the STM32F769i kit created in slide 8 (And rename it to indicate that it is used for debugging)
  - Change the device type to Bare Metal Device
  - Select the device created in the previous step

Create Project

- New Project -> Application-> Mcu Support Application
  - Make sure to not have spaces in the project path or flashing won't work
  - Select the Kit corresponding to your board
- Open CMakeLists.txt
  - Add 'C' to the languages argument in the line, as such:
    `project(<myproject> VERSION 0.0.1 LANGUAGES C CXX)`

Flash and Run on Board

- Click *Run* (green play button) in Qt Creator

Or

- NXP: Using Segger J-Flash Lite utility
  - Select MIMXRT1052DVL6B in device list then ‘OK’
  - In ‘Data File’, select the .hex file from the project’s build directory
  - Click “Program Device”

- STM32: Using ST-LINK Utility (or CubeProgrammer)
  - External Loader -> Add External Loader
  - Select 'MX25L512G_STM32F769I-DISCO' and validate
  - Target -> Connect
  - Target -> Program & Verify
  - Open built .hex file and click ‘Start’

Develop - Basics

- Root Rectangle
  - Set color to "#f0f3f4"
  - Setting the size is optional, the UI will fill the screen by default
- Text
  - Change `color` property to `“black”`
  - Set `font.pixelSize: 24`

Develop – Fonts

To use custom fonts:

- Copy font files to a ‘fonts’ directory inside the project
- In CMakeLists.txt, add:

```
set(QUL_FONTS_DIR "${CMAKE_CURRENT_SOURCE_DIR}/fonts")
set(QUL_DEFAULT_FONT_FAMILY “<name_of_your_default_font_family>")
```

- If multiple fonts are used, configure which font to use in each Text item with:

```
font.family: “<name_of_your_default_font_family>")
```

Develop – Layout and Images

- Layout: Add `Column` and set `spacing` property to `16`
  - Set `anchors.centerIn: parent`
- In Text: replace `anchors.centerIn` with `anchors.horizontalCenter: parent.horizontalCenter`
- Image
  - Add and image file to the project directory (it can be in a subdirectory)
  - Add `Image` in QML file
    - Set `source` property to the relative path of the image e.g. `“images/logo.png”`
    - Set `anchors.horizontalCenter: parent.horizontalCenter`

Develop - Controls

- Add `Qul::QuickUltraliteControlsStyleDefault` in `target_link_libraries` in CMakeLists.txt
- If you want to customize the controls' look & feel, read the '*Qt Quick Ultralite Controls styling*' documentation page
- Add QtQuick.Controls import
- Add `Switch` in qml file
  - Set `anchors.horizontalCenter: parent.horizontalCenter`
  - `id: switchButton`
- In the `Image`
  - `opacity: switchButton.checked ? 1 : 0`

Develop - Animations

- Add to Image: *`Behavior on opacity { NumberAnimation { duration: 600; easing.type: Easing.OutCubic } }`*
- Wrap Image inside an Item
  - Set `id: logo` inside Image
  - In Item:
    - `width: logo.width`
    - `height: logo.height`
    - `anchors.horizontalCenter: parent.horizontalCenter`
  - Remove anchors from Image
- Add to Image
  - *`y: switchButton.checked ? 0 : 50`*
  - Duplicate behavior line, but apply to 'y'

Develop – Business Logic in C++

- Business logic and HW access is implemented in C++
- Add your .h and .cpp to CMakeLists.txt with `target_sources(<project_name> PRIVATE …)`
- Create a QML wrapper for your C++ APIs:
  - File -> New -> C++ -> C++ Header File
  - Add to *target_ sources() in* CMakeLists.txt

Develop – Business Logic in C++

- Add `#include <qul/singleton.h>` or `<qul/qtobject.h>`
- Add
  ```
  struct YourWrapper : public Qul::Singleton<YourWrapper>
  or
  struct YourWrapper: public Qul::Items:QtObject
  ```
- Add your properties, functions and signals (see documentation)
- In CMakeLists.txt
  - `qul_target_generate_interfaces(<projectname> your_wrapper.h)`
  - `target_include_directories(<projectname> PUBLIC ${CMAKE_CURRENT_SOURCE_DIR})`
  - `target_include_directories(<projectname> PUBLIC ${CMAKE_CURRENT_BINARY_DIR})`
- You can instantiate YourWrapper in QML if using QtObject or directly use YourWrapper.someFunction() if using Singleton.

Develop – Translations

- Wrap all your translatable strings with `qsTr()` in QML files
- In CMakeLists.txt
  - `qul_target_embed_translations(<project_name> <project>.<language_code>.ts)`
    example file name: myproject.en_US.ts
  - Add as many filename.ts as languages you need to support
- Generate .ts file
  - Projects -> Add build configuration (release)
  - Rename to “Update Translations”
  - Click on ‘Details’ in ‘Build Steps’
  - Select the ‘update_translations’ target
  - Build to generate the .ts files
  - The “Update Translations” target needs to be re-run every time you add or modify any occurrence of `qsTr()`
- Open .ts files with Linguist to translate the strings
- The active runtime language can be changed with:

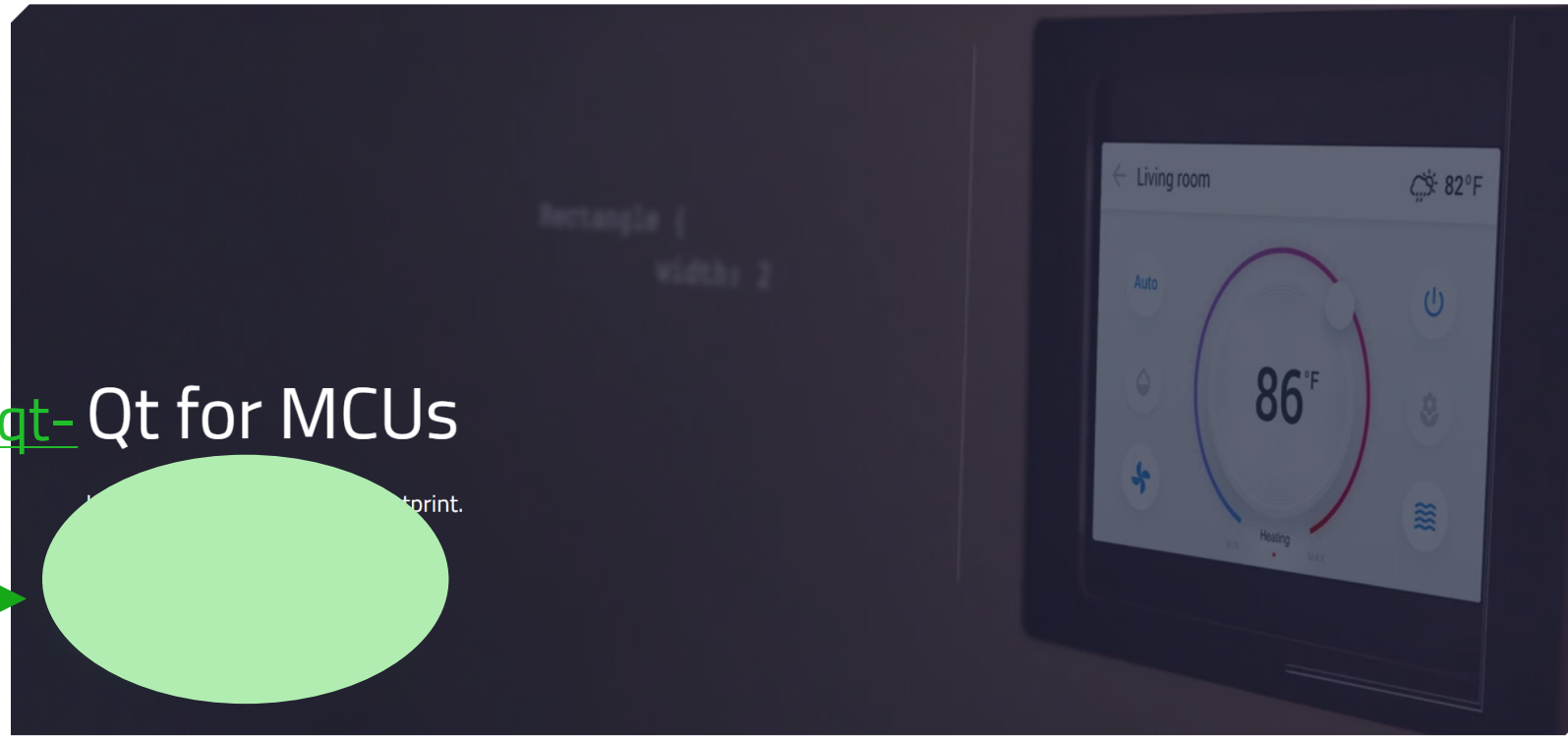
```
Qul.uiLanguage = “<language_code” // or “source” to use the language used in the source code
```

Debug

- Start GDB Server
  - Open Command Prompt
  - NXP:
    - "C:\Program Files (x86)\SEGGER\JLink\JLinkGDBServer.exe" -device MCIMXRT1052 -if SWD -scriptfile <Qt_for_MCUs_install_dir>\CMake\evkbimxrt1050\evkbimxrt1050_sdram_init.jlinkscript -port 61234
  - STM32
    - cd C:\ST\STM32CubeIDE_1.0.2\STM32CubeIDE\plugins\com.st.stm32cube.ide.mcu.externaltools.stlink-gdb-server.win32_1.0.0.201904160814\tools\bin
    - .\ST-LINK_gdbserver.exe -l 31 -p 61234 -r 15 –d -e -cp "C:\Program Files\STMicroelectronics\STM32Cube\STM32CubeProgrammer\bin" -el "C:\Program Files\STMicroelectronics\STM32Cube\STM32CubeProgrammer\bin\ExternalLoader\MX25L512G_STM32F769I-DISCO.stldr"
- Use GDB CLI
  - Open Command Prompt
    - cd <arm_gcc_install_dir>\bin
    - arm-none-eabi-gdb.exe "<your_project_build_directory>\Debug\<your_project>.elf"
    - target extended-remote localhost:61234
- Or use the Bare Metal plugin in Qt Creator
  - Before debugging, select the kit that uses the Bare Metal Device (configured in slide 9-10)
  - Start debugging

Thank You!

Give it a try! https://www.qt.io/qt-for-mcu



Small but Mighty!

Microcontrollers are great! Their lower power consumption saves you batteries, their price saves you money, and now, with Qt they