BlackBerry Jam Americas

Build and Packaging for Native Apps

JAM39

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Overview

- Introduction to the BlackBerry10 NDK build system
- Using third party components and shared libraries
- Release packaging
- Creating an effective build systems which saves developers time
- Supporting multiple operating systems and devices

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Introduction to the BlackBerry10 NDK build system

The qmake build system

The Cascades project template

The Qmake Build System

From the Qt Project

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- Generates Makefiles
- Project configuration in the .pro file
- Supports features (.prf)
  - Same format as .pro file
  - Extensible – make your own
  - Features can have options
- Scopes allow conditional code
- Simple functions available

Commonly Used Qmake Variables

CONFIG	TEMPLATE
QMAKE_CFLAGS	QMAKE_CXXFLAGS
INCLUDEPATH	QMAKE_LFLAGS
DEFINES	LIBS

```
device {
 CONFIG(debug, debug|release) {
   DEFINES += $$(envvar)
 }
}
device:profile:LIBS += -
   lprofilingS
```

The Cascades Project Template 1

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- Top-level Makefile with each build type as a target
  - Includes a release mode package target

```
$ make Device-Debug
$ make package
```

- Main project file (.pro)
  - Common scopes for customization

```
APP_NAME = MyApplication
TEMPLATE = app

CONFIG += qt warn_on cascades10

include(config.pri)

device {
  CONFIG(debug, debug|release) {
    # Device-Debug custom config
  }
  CONFIG(release, debug|release) {
    # Device-Release custom config
  }
}
```

The Cascades Project Template 2

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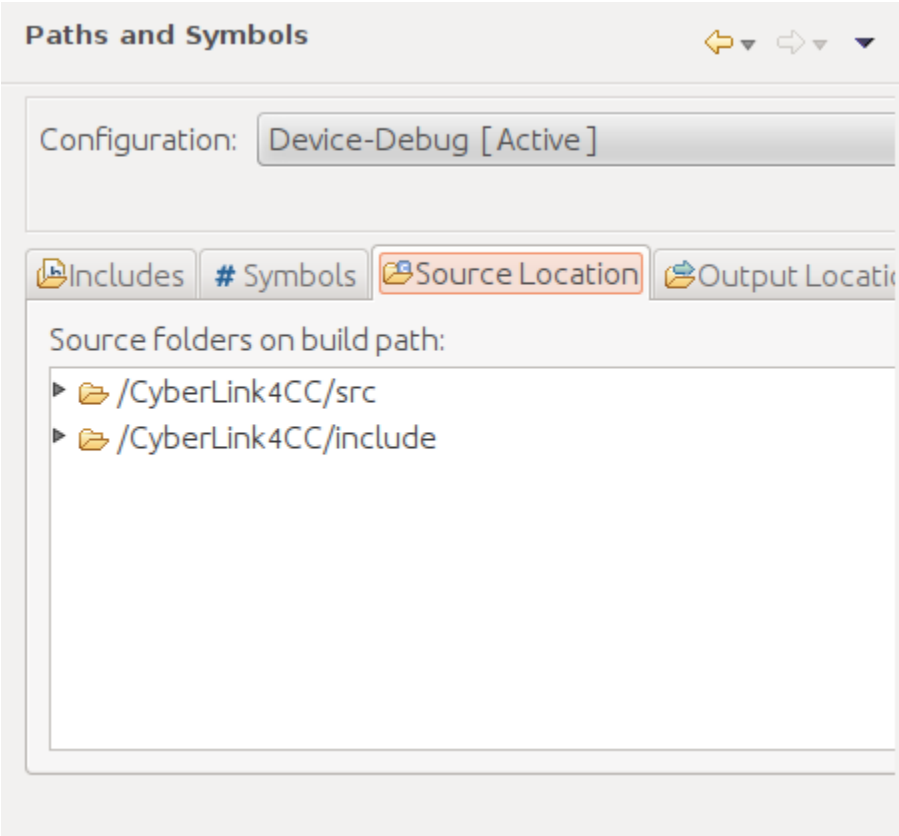
- Momentics managed qmake file config.pri
  - Automatically sets source, header and translation variables
- Configuration must be set for each project
  - Configuration: all does not work (known bug)



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Using third party libraries and shared components

Building Cascades and Qt library projects

Using third party libraries

Packaging external assets

Building Cascades and Qt Libaries

- Modify the cascades application template .pro file
  - Set TEMPLATE = lib
  - Include dependent includes with INCLUDES += <paths>
  - Link dependent libraries with LIBS += -l<library>
- Modify the Momentics C++ Build settings to include only the relevant sources and includes
  - Filter a folder with patterns or file lists
- Create a .prf file for easy inclusion in other projects
- Full example on github.com/blackberry
  - Also, see the cascades10.prf file shipped with the NDK

Using Third Party Libraries

- Momentics has an Add Library wizard to automate simple cases
- If the library has .prf files, set the path in the QMAKEFEATURES environment variable
- Modify the your application's .pro file
  - Include library includes with INCLUDES += <library include path>
  - Link the library with LIBS += -l<library>
- Add the library to your bar descriptor as Qnx/Elf asset
- If the library has QML assets, make sure to include them as assets in the application bar descriptor

Packaging External Assets

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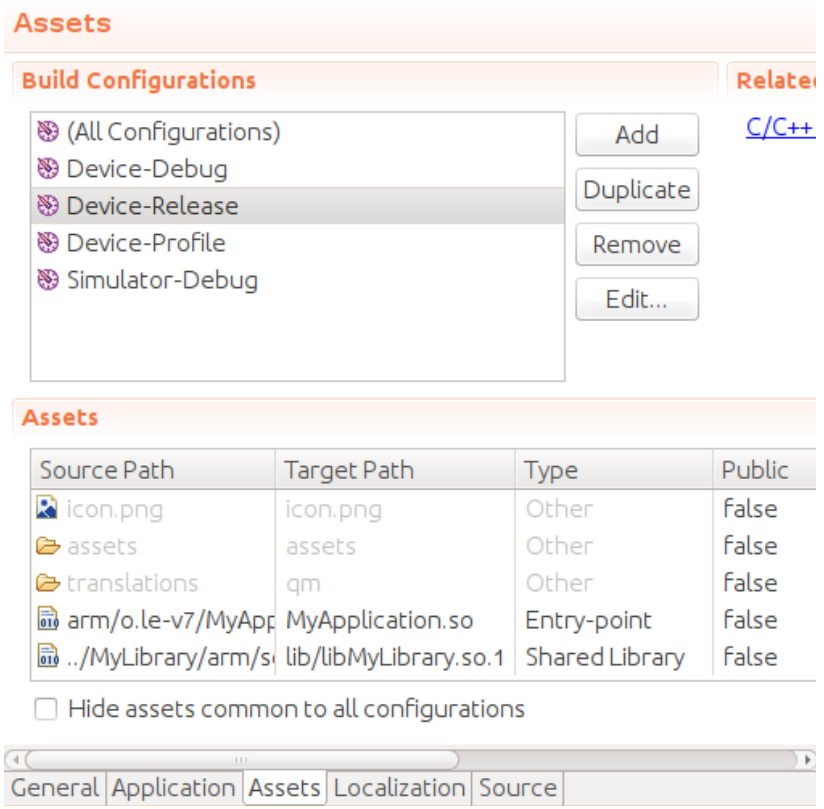
- Assets in the bar descriptor are any file you wish to include in your package
- Assets can be configured per build type, ie: debug or release
- Libraries must be marked as type Qnx/Elf
- Warning: Momentics will use special variables for “workspace” assets



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Release Packaging

Dealing with large resources

Tweaking the release build

Complier and Linker Defenses

Dealing with large resources

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- Some Carriers limit application size for cellular download to as little as 50 MB
- For OpenGL applications, use multiple packages if you include compressed or resolution specific textures
- Include compressed resources and decompress on first run
- Dynamically load resources from the internet when needed
- BlackBerry10 has native decompression libraries such as zlib

Tweaking the Release Build 1

- Use a release selector in your .pro file
- Cascades10 feature define a few release specific flags
  - Optimize for size with `-Os`
  - Stack smashing protector with `-fstack-protector-strong`
  - Fortify-source with `-DFORTIFY_SOURCE=2`
  - Release mode stripping
  - Reduces load time with `-fvisibility=hidden`
  - Read-only relocation sections with `-Wl,-z,relro`
- Qcc supports common gcc options directly
  - Other options must be passed using specific compiler mode flags

    `-Wp, -Wc, -Wl, -Wa`

Tweaking the Release Build 2

- Enable link-time optimizations for additional speed and size optimizations
  - Should not be used with debug mode (-g flag)

```
QMAKE_CFLAGS += -flto
QMAKE_LFLAGS += -flto -fuse-linker-plugin
```

- Strip non-zygote or pure native apps

```
QMAKE_POST_LINK += $${QMAKE_STRIP} -strip-all "$@"
```

- Customize the creation of separate debug symbols
  - Release mode with debug symbols for full postmortem debugging
  - Stripping debug symbols from debug mode executable to reduce debug build size and deploy time

Compiler and Linker Defenses

- Enable extra format string warnings as errors

  `-Wformat-security -Werror=format-security`
- Warn on trampolines, which generate extra vulnerabilities

  `-Wtrampolines`
- Apply stack smashing protection to smaller buffers

  `-Wc,--param=ssp-buffer-size=4`
- Apply the stack protector to all functions

  `-fstack-protector-all`
- Stack checking is currently broken
  - Incorrect code produced when using the `-fstack-check` option

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Creating an effective build systems which saves developers time

Use the NDK from command line

Automated build systems

Using the NDK CLI

Unleash the power of the command line

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- All of the NDK tools are available from the command line
  - Source the bbndk-env.sh script, or bbndk-env_10_1_0_1020.sh for a specific version
  - Windows users can run the corresponding .bat file
- Make a project configuration:

```
$ make Device-Release
```

- Make an exportable release build (interactive):

```
$ make package
```

- Traditional cross-compiling:
  - The binutils 2.22 suite and gcc/g++ 4.6.3 are available

```
$ ./configure --host=arm-unknown-nto-qnx8.0.0eabi
```

Automated Build Systems

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- Use a wide range of build systems such as ant to run periodic or commit-triggered builds

```
$ blackberry-nativepackager -package MyApp.bar
-configuration Device-Release -sign
-storepass <password> -cskpass <cskpass> bar-
descriptor.xml
```

- Use a webserver to deploy in-house builds via the browser

```
$ blackberry-deploy –installApp –device <ip
address> -password <user password> <bar file>
```

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Supporting multiple operating systems and devices

Architectural strategy

Wrapping an Objective-C library

Architectural Strategy

- BlackBerry 10 supports POSIX, as well as many gnu extensions to the standard
- Separate business logic from UI Code
  - This model is encouraged by the Qml / C++ split on BlackBerry10
- Use cross-platform libraries, frameworks and engines
  - BlackBerry10 includes a number of cross platform libraries
- Isolate platform specific code
  - If your app interacts with functionality that is specific to one OS, package the associated code in distinct classes

Wrapping an Objective-C Library

- In the public header, add a forward declaration of the implementation struct
- Use the struct type to hold the members you want to exclude from the public header
- Add a pointer to the struct as a class instance variable
- Define the members of the struct's in the .cpp file
- Construct an instance of the struct using the new operator
- Set the instance variable to the newly created struct
- Make sure delete is called on destruction.

For More Information …

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- Examples of building and using a third party library
  - Cascades-Community-Samples on github.com/blackberry
- KB Articles
  - Cascades and Qt library projects
  - Using Third party libraries
- The qmake Manual on qt-project.org
  - qmake variable and function reference
  - qmake advanced usage
- BlackBerry10 Developer Microsite Documentation
  - Best practices

For More Information …

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- Other courses that discuss strategies for supporting multiple BlackBerry devices
  - JAM27: Cascades 201: Three Devices, One App! Developing for Tablet, All Touch, and Physical Keyboard Devices.

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THANK YOU

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