

Qualcomm Research

Issues With LLVM Linker(s) and PX4

Mark Charlebois, Aug 19th 2015

- PX4 is a Dronecode project
- Flight controller
- C and C++
- BSD licensed
- Ported to Linux, and QuRT™
- Single process, multiple threads



Dronecode

- <https://github.com/PX4/Firmware>

Porting PX4

Linux

- Works with GCC/Clang and binutils (ld.bfd not ld.gold)

Hexagon

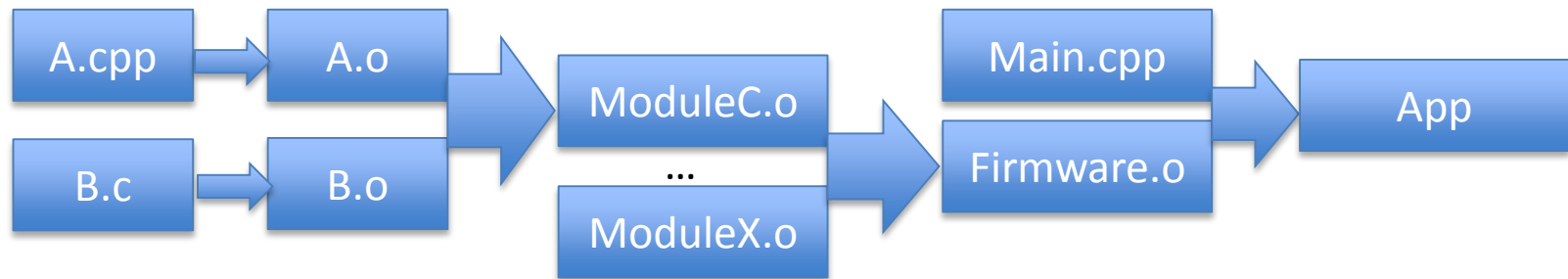
- QuRT is Hexagon DSP RTOS
- Hexagon SDK has multiple versions:
 - 6.3 version uses Clang and binutils
 - 7.X version uses Clang and QCLinker (MCLinker based)
- Builds with Clang and binutils (version 6.3)

OS X

- Partial linking not supported by LLD

Codebase Issues

- Make system uses partial linking
 - Code is comprised of modules that are a mixture of C and C++
 - Each module is partially linked (with `-Ur`) and hidden global variables are given local scope
 - Only `ld.bfd` supports `-Ur`
 - Modules are linked together with a linker script that combines all variables with section attribute `"_param"` into contiguous memory
 - Final link is done with `g++` and `main.cpp` to satisfy C++ dependencies.



Codebase Issues

- Param
 - Uses code segment (`__param`) and partial linker script to place parameters in flash
- Linker Script is very simple:

```
SECTIONS
{
    __param : ALIGN(8) {
        __param_start = .;
        KEEP(*(__param*))
        __param_end = .;
    }
}
```

- Full linker script not required

Options?

- Add `-Ur` support to LLD/MCLinker/QCLinker
- (Unlikely to happen)

- Compile modules as archives
- Link archives with `main.cpp`
- (Doesn't resolve `_param` issue and linker script)

- Link all object files at once (hundreds) and write full linker script
- (Um... eww)

- ???



research.qualcomm.com

thank you

Not to be used, copied, reproduced, or modified in whole or in part, nor its contents revealed in any manner to others without the express written permission of Qualcomm Technologies, Inc.

Qualcomm is a trademark of QUALCOMM Incorporated, registered in the United States and other countries. All QUALCOMM Incorporated trademarks are used with permission. Other products and brand names may be trademarks or registered trademarks of their respective owners.

© 2015 Qualcomm Technologies, Inc. All rights reserved.