Abusing Zephyr and meta-zephyr

Eilís ‘pidge’ Ní Fhlannagáin
Principal Engineer – Huawei
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Who Am I?

- Software Developer for 30 years
  - Initial Linux Install Slackware circa 1994ish
- Principal Open Source Architect at the Oniro Project
- Embedded Systems the past 20 years
  - OpenEmbedded/Yocto Project since 2011
- Maker of funny demos
  - Yocto Blimp
  - Yocto Portable DJ
  - Embedded Hurdy Gurdy
- Lead the team responsible for the initial work on meta-zephyr
Openembedded/zephyr stack

- Eclipse Oniro
  - Openembedded
    - meta-zephyr (2.7)
      - conf/machine
        - MACHINEOVERRIDES
        - ZEPHYR_MODULES
        - SRC_URI
      - Zephyr-kernel recipes
      - cmake
      - cmake.bbclass
      - Machine, proj and kernel config

What if we add/delete ZEPHYR_MODULES in zephyr?
Openembedded/zephyr stack

Only 8 Machines available? Zephyr? 390+

Eclipse Oniro
Openembedded
meta-zephyr (2.7)
conf/machine
ZEPHYR_MODULES
MACHINEOVERRIDES
Zephyr-kernel recipes
SRC_URI
cmake.bbclass

cmake
zephyr

96 Boards Avenger
96 Boards Nitrogen
Arduino Nano
QEMU Cortex M
MCUs (meta-bsps)
Layer structure is arguably Not YP compatible
meta-zephyr issues

- Treats zephyr projects as cmake projects
  - Which they are....
  - But. West....
- No knowledge of ZEPHYR_MODULES unless told
  - MACHINEOVERRIDES is used for this
  - Really shouldn’t be in a machine definition
  - Zephyr should really take care of this
- ZEPHYR_EXTRA_MODULES
- 8 supported machines
  - Out of 300+ Zephyr Machines
  - How to support as many as possible?
- Layer structure is technically not Yocto Project Compatible
• Machine BSP layers should stand alone
  • Yocto Project Compatibility is clear about this

  “Where multiple types of functionality are present, the layer should be internally divided into sublayers to separate these components. That’s because some users may only need one of them and separability is a key best practice.”

• Zephyr should control as much about the compilation as possible
  • ZEPHYR_EXTRA_MODULES at the OE layer is fine
  • Needing to replicate config metadata should be avoided
  • More Machines supported
    • Means full Zephyr checkout
    • How to get as many of those machines as possible out of zephyr
Getting Rid of MACHINEOVERRIDIES

- Could read Kconfig, etc.
- Lot of work to build/maintain
- Could autogenerate MACHINEOVERRIDIES from Kconfigs
  - Went down this path at first
  - Machine definitions shouldn’t really contain this
  - Lot of work to build/maintain
  - Doesn’t solve the problem
- zephyr/module.yml?
  - zephyr_module.py?
  - But it requires west?
  - Points to the solution
Getting Rid of MACHINEOVERRIDIDES

- west is interesting
  - Documented way to get/build zephyr
  - Swiss pocket-knife (wraps git, cmake, manifests, etc)
  - Plugin framework to extend
  - west list gives us what we want.
- Ensure our checkout complies with west workspace
- west-native DEPENDS
- do_get_zmods
  - west list|awk 'NR>1 {print $2}' to get ZEPHYR_MODULES
  - nostamp
  - Allows us to let OE discover what modules and pass in -DZEPHYR_MODULES
  - Pass in extra modules with -DZEPHYR_EXTRA_MODULES
Abusing Cmake exports to generate machine configs

- This stumped me for a bit
- Not a cmake expert
- cmake/makefile_exports/CmakeLists.txt
  - Looks interesting?
- cmake/oe_exports/CmakeLists.txt
  - Not perfect
  - Missing tunes in some machines (esp32/riscv)
- Results:
  - 395 zephyr machines
  - 323 generated somewhat correctly
  - 291 will produce a zephyr-helloworld.elf
Autogenerated machine issues

- Does Solving the Problem Causes Others Problems?
  - Vendors have their own BSP layers!
  - This fixes my problem, can/does it fix everyones?
- Work with stakeholders
- Not all machines make sense
  - Posix* doesn’t really make a lot of sense
Openembedded/zephyr stack post-changes

- Eclipse Oniro
- Openembedded
  - meta-zephyr-bsp (2.7)
    - conf/machine
    - generate-zephyr-machines.bb
    - Optional 291 Additional Machines
    - Reduced metadata replication
  - meta-zephyr-core (2.7)
    - zephyr.bbclass
    - west
    - Zephyr-kernel recipes
    - Full SRC_URI
    - ZEPHYR_MODULES
    - cmake

- zephyr
  - MCUs (meta-bsps)
  - 96 Boards Avenger
  - 96 Boards Nitrogen
  - Arduino Nano
  - QEMU Cortex M
Questions?

- Eclipse Oniro Project
  - https://oniroproject.org/
- Oniro Project Documentation
  - https://docs.oniroproject.org/en/latest/
- Meta-zephyr
  - https://github.com/saininav/meta-zephyr