**Embedded Xinu: Benefits of Teaching on a 32-bit Architecture**

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**Introduction**

- Embedded Xinu has only run on 32-bit platforms previously
- Porting to a Raspberry Pi 3, a 64-bit platform
- Raspberry Pi 3 can run both 64-bit and 32-bit code

**64-bit Is Difficult**

- Tried to initially use Raspberry Pi 3 in 64-bit mode
- Had to learn new instruction set, harder to understand compared to 32-bit instruction set
- Had to rewrite many files to comply with the 64-bit compiler
- Spent more time trying to understand new architecture than being productive
- Took less time to complete equivalent tasks in 32 bit
- Compatibility for old Raspberry Pi code was an attractive factor

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**Code Comparison**

```c
 // Vector table. This is copied to VBAR register. */
 /* Vector table has to be 32-byte aligned. */
 .align 4
 __vectors:
    16 r0, pc, reset_addr /* Reset handler */
    16 r0, unif_addr /* Undefined instruction handler */
    16 r0, sw_addr /* Software interrupt handler */
    16 r0, prefetch_addr /* Prefetch abort handler */
    16 r0, abort_addr /* Data abort handler */
    16 r0, reserved_addr /* Reserved */
    16 r0, irq_addr /* IRQ [Interrupt request] handler */
    16 r0, fin_addr /* FIQ [Fast interrupt request] handler */

Interrupt Vector Table for 64-bit ARM

/* ARM exception vector table. This is copied to VBAR register. */
 /* Vector table has to be 32-byte aligned. */
 .align 4
 __vectors:
    16 r0, pc, reset_addr /* Reset handler */
    16 r0, unif_addr /* Undefined instruction handler */
    16 r0, sw_addr /* Software interrupt handler */
    16 r0, prefetch_addr /* Prefetch abort handler */
    16 r0, abort_addr /* Data abort handler */
    16 r0, reserved_addr /* Reserved */
    16 r0, irq_addr /* IRQ [Interrupt request] handler */
    16 r0, fin_addr /* FIQ [Fast interrupt request] handler */

Interrupt Vector Table for 32-bit ARM
```

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**Meaning**

- Example shows code that does equivalent tasks in 64 and 32 bit
- Code for 64 bit is longer to do the same task
- Same pattern can be seen in more places

**Conclusions**

- Students would have difficulty learning on a 64 bit platform
- Not ideal for teaching basic concepts
- Adds complexity where none is needed

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**References**