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Zettalinux: It's Not Too Late To Start

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The current trend in memory sizes lead me to believe that we'll need 128-bit pointers by 2035. Hardware people are starting to think about it [1a] [1b] [2]. We have a cultural problem in Linux where we believe that all pointers (user or kernel) can be stuffed into an unsigned long and newer C solutions (uintptr_t) are derided as "userspace namespace mess".

The only sane way to set up a C environment for a CPU with 128-bit pointers is `sizeof(void *) == 16`, `sizeof(short) == 2`, `sizeof(int) == 4`, `sizeof(long) == 8`, `sizeof(long long) == 16`.

That means that casting a pointer to a long will drop the upper 64 bits, and we'll have to use long long for the uintptr_t on 128-bit. Fixing Linux to be 128-bit clean is going to be a big job, and I'm not proposing to do it myself. But we can at least start by not questioning when people use uintptr_t inside the kernel to represent an address.

Getting the userspace API fixed is going to be the most important thing (eg io_uring was just added and is definitely not 128-bit clean). Fortunately, no 128-bit machines exist today, so we have a bit of time to get the UAPI right. But if not today, then we should start soon.

There are two purposes for this session:

- Agree that we do need to start thinking about 128-bit architectures (even if they're not going to show up in our offices tomorrow)
- Come to terms with needing to use uintptr_t instead of unsigned long

[1a] <https://github.com/michaeljclark/rv8/blob/master/doc/src/rv128.md>

[1b] https://github.com/riscv/riscv-opcodes/blob/master/unratified/rv128_i

[2] <https://www.cl.cam.ac.uk/research/security/ctsrtd/cheri/>

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Yes

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