



TOKYO, JAPAN / DECEMBER 11-13, 2025

# 32bit and noMMU Linux BoF

Still alive and running in the background.

But people use devices with it every day... without knowing it



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Hello all !

“Ruinland” ChuanTzu Tsai (Andes Technology, RISC-V 32)

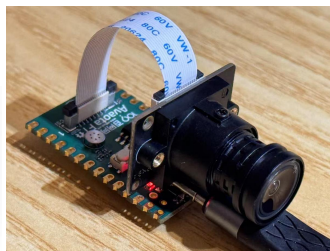
D Jeff Dionne (Coresemi, SuperH, J-Core)

Geert Uytterhoeven (m68k)

## 32 is the new 8-bit

RISC-V and SuperH are still very well adopted and thriving.

Nanny-cams, automotive controller, low-end internet connecting device ..... a lot of them are running Linux for their tasks.



## “Userspace aliveness”

Names carrying weight are pointing fingers on userspace SW ecosystem for coping with 2038 issues – –

- OpenWRT is still well alive and maintaining the healthiness of programs.
- buildroot housed noMMU Linux “distributions.”
- I personally [ported Alpine Linux to RV32](#) and is willing to upgrade it.
- musl libc is of course maintained specifically for such use cases, most things are built on that today

The unmaintained projects simply aren’t used by 32bit adopters anymore.



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## CAN bus driver for STM32 noMMU Linux

FOSDEM 2024 “Linux CAN upstreaming on MMU-less systems”:

<https://github.com/torvalds/linux/commit/f00647d8127be4d3f37f7e07dace24c04689ec63>

stm32f469-disco



**Modify** Buildroot configuration  
**Create** Linux driver - **dual CAN**

stm32f769-disco



**Create** Buildroot configuration  
**Modify** Linux driver - **single CAN**



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## rv64ilp32

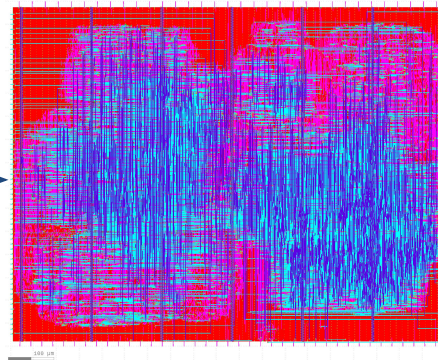
To run 32bit userspace on 64bit hardware :

[https://lpc.events/event/17/contributions/1475/attachments/1186/2442/rv64ilp32\\_%20Run%20ILP32%20on%20RV64%20ISA.pdf](https://lpc.events/event/17/contributions/1475/attachments/1186/2442/rv64ilp32_%20Run%20ILP32%20on%20RV64%20ISA.pdf)

<https://fedoraproject.org/wiki/Architectures/RISC-V/64ILP32>

Small memory footprint is crucial for embedded Linux scenarios.

J32+FPU  
130nm



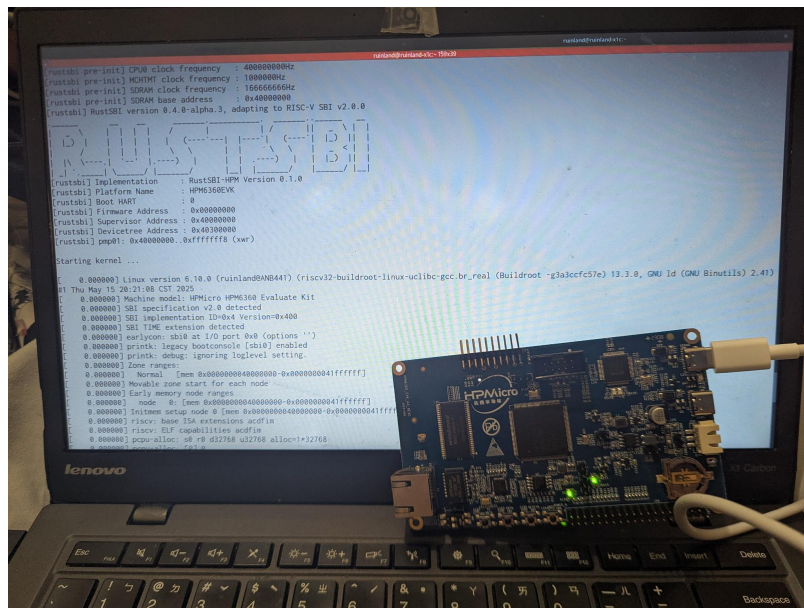
- Memory footprint and bandwidth are a major driver for hardware designs.
- Don't forget the process node the chips are fabricated in is important too
  - An application specific Linux capable RV32 or J-Core design can be fabricated for \$15,000
  - All open hardware, prototyped on your desk. Your chip, your hardware, your security.

## noMMU Linux on newly manufactured RV32 hardware

Automotive platforms are very keen to small but power efficient controllers.

Compare to noMMU Linux, RTOSes requires a tons of work to effort to port complicated programs.

[buildroot src](#)





## Educational purpose

TinyTapeout kianV SoC : end-to-end open source-ly manufactured IC, running 32bit noMMU mainline Linux  
(with minimal driver modifications).



```
0.000000 mem auto-init: stack:off, heap alloc:off, heap free:off
0.000000 Memory: 5324K/8192K available (1619K kernel code, 200K rdata,
0.000000 SLUB: HWalign=64, Order=0-3, MinObjects=0, CPUs=1, Nodes=1
0.000000 NR_IRQS: 64, nr_irqs: 64, preallocated irq: 0
0.000000 riscv-intc: 32 local interrupts mapped
0.000000 clint: clint0:1000000: timer running at 10000 Hz
0.000000 clocksource: clint_clocksource: mask: 0xffffffffffffff max_cycles
0.001200 sched clock: 64 bits at 10KHz, resolution 100000ns, wraps every
0.308399 Console: colour dummy device 80x25
0.379700 Calibrating delay loop (skipped), value calculated using timer f
0.462500 pid_max: default: 4096 minimum: 301
0.651500 Mount-cache hash table entries: 1024 (order: 0, 4096 bytes, line
0.725900 Mountpoint-cache hash table entries: 1024 (order: 0, 4096 bytes,
2.028000 devtmpfs: initialized
3.382900 clocksource: jiffies: mask: 0xffffffff max_cycles: 0xffffffff, ma
5.467000 futex hash table entries: 16 (order: -5, 192 bytes, linear)
6.518000 cpu0: Ratio of byte access time to unaligned word access is 4.75,
9.441000 clocksource: Switched to clocksource clint_clocksource
20.485000 workingset: timestamp_bits=30 max_order=11 bucket_order=0
31.197100 Serial: 0250/16550 driver, 1 ports, IRQ sharing disabled
34.116300 printk: legacy console [ttyS0] disabled
34.937300 10000000,uart: ttyS0 at MMIO 0x10000000 (irq = 0, base_baud = 1000
35.036200 printk: legacy console [ttyS0] enabled
35.036200 printk: legacy console [ttyS0] enabled
35.132700 printk: legacy bootconsole [uart8250] disabled
35.132700 printk: legacy bootconsole [uart8250] disabled
35.422200 clk: Disabling unused clocks
[ 0.280 run nedre mg tim eoy 2K
[ 0.300 061mtrics [ 0.580 061mtrics [ 0.630 hsaciet osnthv enlmar rtcin
init started: BusyBox v1.36.1 (2024-12-23 19:45:54 UTC)
starting pid 19, tty '': /bin/mount -t proc /proc'
starting pid 20, tty '': /bin/mount -o remount,rw /'
starting pid 21, tty '': /bin/mkdir -p /dev/pts /dev/shm'
starting pid 22, tty '': /bin/mount -s'
starting pid 23, tty '': /bin/mkdir -p /run/lock/subsys'
starting pid 26, tty '': /etc/passwd /etc/passwd'
starting pid 31, tty '': /bin/cat /etc/passwd'

KIANV RISC-V
TinyTapeout
061

Starting pid 32, tty '/dev/console': /sbin/getty -L -n -l /bin/sh console 0 vt100'
# 19
```



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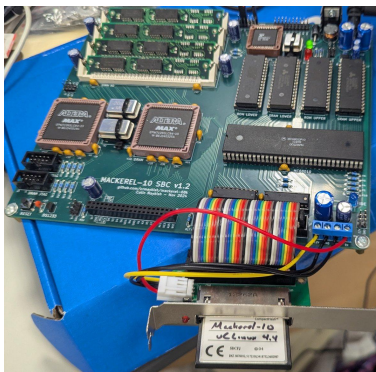
Don't forget hobbyist works. This is where innovation comes from

Mackerel boards, made by maykish, the M68Ks are still booting Linux :

<https://github.com/crmaykish/mackerel-68k>

And he even has gotten a basic port of the latest Linux kernel (v6.17) running on Mackerel-30. It boots to userspace and has a Toybox-based init and interactive shell !

<https://hackaday.io/project/183861-mackerel-68k-linux-sbcs/log/244041-linux-617-on-mackerel-30>



```
starting pid 39, tty '': /bin/mkdir /var/tmp
starting pid 40, tty '': /bin/mkdir /var/log
starting pid 41, tty '': /bin/mkdir /var/run
starting pid 42, tty '': /bin/mkdir /var/lock
starting pid 42, tty '': /bin/cat /etc/motd

Welcome to uClinux on
Mackerel-10
github.com/crmaykish/mackerel-68k

starting pid 43, tty '': '/bin/cttyhack /bin/mesh'
# cat /proc/cpuinfo
CPU:           MC68000
MMU:           none
FPU:           none
Clocking:      4.094Hz
BogoMips:      0.69
Calibration:   361700 loops
# cat /random: nonblocking pool is initialized
#
#
# cat /etc/os-release
cat: can't open '/etc/os-release': No such file or directory
# uname -a
uClinux mackerel-10 4.4.0-ucb 81 Mon Sep 22 20:27:27 EDT 2025 m68k GNU/Linux
```



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## Current issues for maintenance

Real Hardware for testing :

- SuperH J-Core in FPGA and on multiple silicon processes, in multiple hardware is available.
- m68k are still well-stocked and there are other new hardware, such as Apollo 68080.
- RISC-V has plenty of hardware manufactured.

Workforce perspective :

- Hardware vendors are tend to maintain only a few releases of Linux.
  - It's important for the community to pay attention to what embedded engineers actually use
- SLTS from CIP is what many vendors are looking for.
- Regular clean-up and testing are needed.



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## 32 is the new 8-bit

RISC-V and SuperH are still very well adopted and thriving.

Cams, automotive controller, energy monitors, critical infrastructure, real time devices, other IIoT devices .....

A lot of them are running Linux for their tasks.

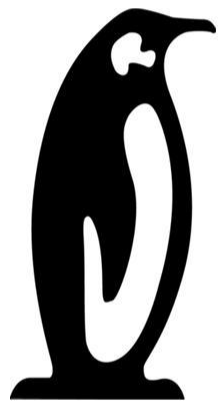
But it's important to understand that the reason is it is easy to build things with this technology

You can get OpenHardware/Gateway versions of all of this, that are supported in mainline Linux

Development boards and kits are available

Yes, there is commercial support... but the community drives the innovation

To suggest that 32bit and nommu is irrelevant today is just incorrect.



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Backup

Place holders

Place holders