

# State of the Arch: Fedora on RISC-V

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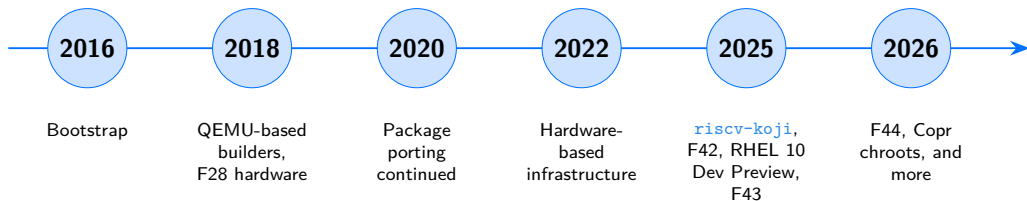
— 31 Jan 2026, FOSDEM

# Credits

- David Abdurachmanov
- Jennifer Berringer
- Andrea Bolognani
- Kevin Fenzi
- Wei Fu
- Neil Hanlon

- Richard W.M. Jones
- Marcin Juskiewicz
- Charles Mirabile
- Jason Montleon
- ... and many others!

# A rough timeline



## Recent work in Fedora RISC-V land

- [riscv-koji.fedoraproject.org](https://riscv-koji.fedoraproject.org) — migrated to a new Koji server
  - ↳ now running on Fedora Infrastructure
- F43 rebuild and the ‘debugedit’ [saga](#)
- Upstreaming of changes from a ‘dist-git’ overlay to Fedora proper
- Fedora images now built with standard infra (Koji + ‘kiwi’)
- ↪ RISC-V chroots in Fedora ‘Copr’ (QEMU-emulated) — [details](#)

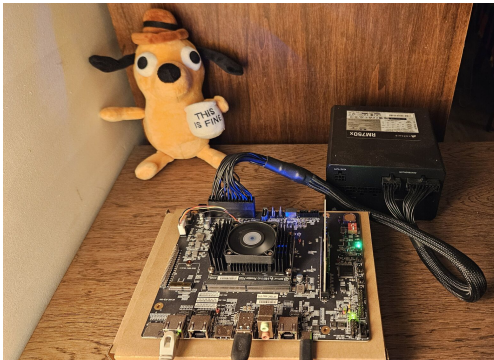
# The hardware situation

## Prior art

Refer to RISC-V hardware: where are we?,  
Emil Renner Berthing, FOSDEM 2025.

↳ It covers SoCs & boards from 2018-2024

# SiFive 'HiFive Premier P550' (2024)



On my desk

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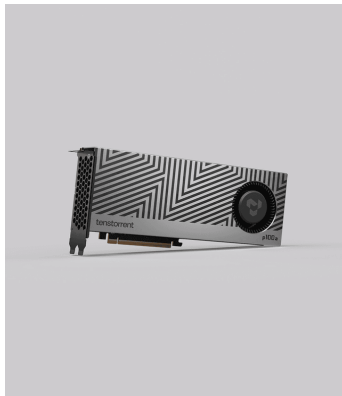
→ Based on ESWIN EIC7700 SoC

→ **Upstream status:** Some drivers are merged (e.g. pinctrl, reset); **pending:** clock, PCIe, and more

# Tenstorrent 'Blackhole' (2025)



SoC in 'p100a' & 'p150a'



'p100a' (desktop variant)

- 
- RISC-V “AI accelerator” as a PCIe card. Use-case: LLM inferencing/training
  - **Upstream status:** Drew Fustini [posted patches to LKML](#). Can boot mainline kernel, with caveats

# Milk-V ‘Titan’ (2025/2026)



CPU: UltraRISC ‘DP1000’



Fedora on Titan, RISC-V Summit NA 2025

- 
- Spec: RVA22, no vector extension, 8 cores, 16MB L3 cache — [details](#). ETA: “soon”
  - ~ 1.5–3x performance increase compared to SiFive P550. Simple benchmark: [‘xz’ scaling](#)
  - **Upstream status**: some patches are merged (e.g. PLIC); needs device tree and PCIe patches

## Just in: Milk-V 'Jupiter 2' (2026)

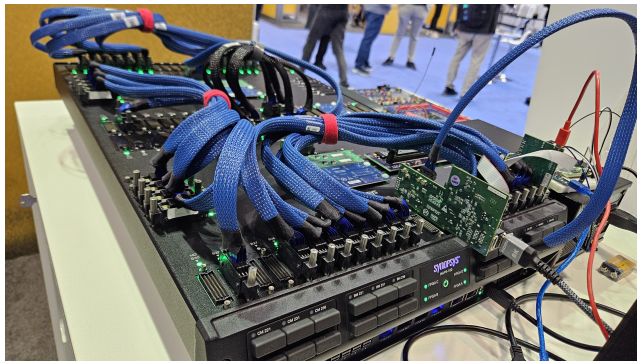
↪ Announced in Jan 2026: [milkv.io/jupiter2](https://milkv.io/jupiter2)

→ Based on SpacemiT 'K3'; 8-core CPU, 2.4GHz

→ Claims:

- RVA23-ready, RVV 1.0, 16-core SoC
- Hypervisor 1.0, AIA, and RV IOMMU extensions
- Full hardware virt for CPU, memory, interrupts, and I/O

# Upcoming: Tenstorrent 'Atlantis' (2026?)



'Ascalon' CPU for Atlantis — running on a Synopsys HAPS-100 FPGA

- 
- RVA23-compliant. High-performance CPU. ETA: ~Q3 2026
  - Emulated board [merged](#) in QEMU 10.0.0. Linux upstreaming [started](#)
  - Seen at RISC-V Summit NA 2025

## Performance: 'xz' scaling: P550 vs. Titan

| Threads | P550 (Real) | DP1000 (Real) | Speedup      |
|---------|-------------|---------------|--------------|
| 1       | 40m 26s     | 27m 55s       | <b>1.45x</b> |
| 4       | 10m 41s     | 7m 24s        | <b>1.44x</b> |
| 8       | 11m 31s     | 3m 55s        | <b>2.94x</b> |

### Summary:

- Benchmark: LZMA2 compression of a Fedora Linux 43 ISO file — [details](#)
- Single core:  $\sim 45\%$  performance lead for DP1000
- Multicore: At 8 threads, DP1000 is  **$\sim 3x$  faster**

*(NB: P550 == SiFive 'HiFive Premier P550' with 4 cores, while DP1000 has 8 cores)*

## Performance: Fedora 'binutils' build

| Time              | P550    | DP1000  | Speedup      |
|-------------------|---------|---------|--------------|
| Real (wall clock) | 29m 34s | 12m 10s | <b>2.43x</b> |
| User              | 39m 42s | 19m 15s | <b>2.06x</b> |
| Sys               | 5m 52s  | 2m 24s  | <b>2.44x</b> |

### Summary:

- Benchmark: `fedpkg mockbuild -r fedora-43-riscv64 -- --without testsuite`
- DP1000 slashes kernel-time by half (with higher IPC, 16MB LLC)
- ~2.5x build speedup; DP1000 scales well at 8 cores

## See also: Vector benchmarks and more

- [RISC-V Vector \(RVV\) benchmarks](#), maintained by Olaf Bernstein
- [Benchmarking SpacemiT X60 and others](#), Rich Jones and Andrea Bolognani

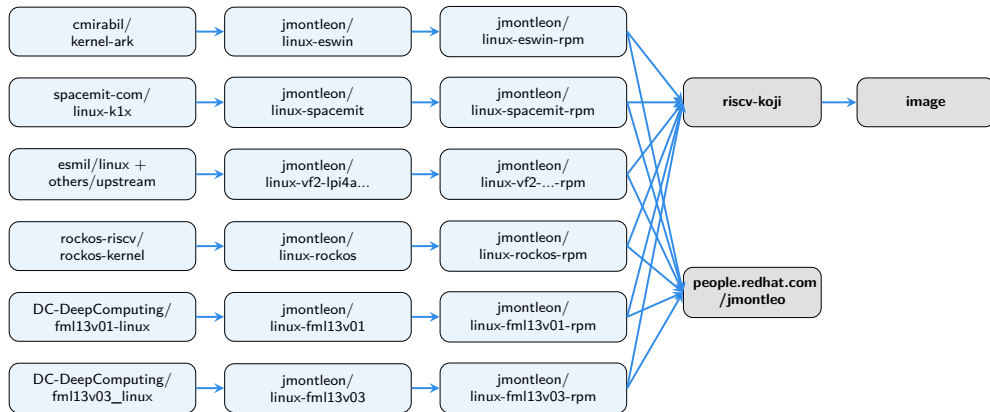
## What board to pick?

Much of the advice from Emil's [last year's talk](#) still stands.

- **VisionFive 2**: cheap and hassle-free, RV64GC-based, has upstream support
- **SiFive 'HiFive Premier P550'**: reasonable performance
  - heavy-duty packages (kernel, GCC, etc) get built on this
- **Milk-V Jupiter** or **Banana Pi BPI-F3**: for vector support (RVV 1.0)
- ↪ When they're here: Tenstorrent **Atlantis**, Milk-V **Titan** and **Jupiter 2**

# Plans for Fedora Linux 44 and beyond

# Fedora RISC-V kernel builds: today (F43)

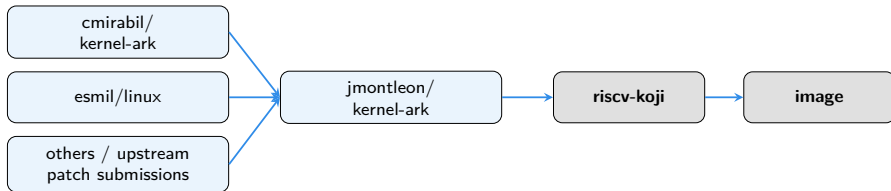


Slide credit: Jason Montleon

## A “unified” kernel for multiple boards

- A single kernel that can boot across different boards
- Rebase/forward-port vendor trees onto mainline
  - ↪ integrate into a single Fedora tree
- Details: Jason Montleon’s [kernel-ark](#) repo

# Kernel build flow: future (F44+)



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## LTS Alternatives



## Unified kernel, continued: boards

| Board                      | SoC                 |
|----------------------------|---------------------|
| Banana Pi BPI-F3           | SpacemiT K1         |
| Bit-Brick K1               | SpacemiT K1         |
| DeepComputing fml13v01     | JH7110              |
| DeepComputing fml13v03     | EIC7702             |
| Lichee Pi 4A               | TH1520              |
| Milk-V Jupiter             | SpacemiT K1 / M1    |
| Milk-V Mars                | JH7110              |
| Milk-V Megrez              | EIC7700             |
| OrangePi R2S               | Ky X1 (SpacemiT K1) |
| OrangePi RV                | JH7110              |
| OrangePi RV2               | Ky X1 (SpacemiT K1) |
| Pine64 STAR64              | JH7110              |
| Pine64 STARPro64           | EIC7700             |
| SiFive HiFive P550         | EIC7700             |
| SiFive HiFive Unmatched    | FU740               |
| StarFive VisionFive 2      | JH7110              |
| StarFive VisionFive 2 Lite | JH7110S             |
| UltraRISC DP1000 EVB       | UR-DP1000           |

→ List maintained by Jason

→ Testing is a group effort

→ Next: switch to upstream drivers for EIC7700 (no complete device tree yet)

## Chip away at the RISC-V tracker

- A handful of packages still need work: kernel, shim, LLVM, OpenJDK, and more
- Investigate test failures, work upstream, submit patches
- Details: see the [Fedora RISC-V tracker](#)

## Hardware in the Fedora datacenter

- Most of the current hardware is running under people's desks
- Expect to rack datacenter-grade RVA23 systems “soon”
- [Working](#) with the Fedora Infra team on technical requirements

## ISA profile readiness: RVA23?

- Fedora's current baseline: RV64GC
- Waiting on a reference platform ('SpacemiT K3' or 'Atlantis'?)
- Linux ecosystem readiness:
  - See Drew Jones' talk on how [the RISC-V software ecosystem is primed for the latest ISA extensions](#), RISC-V Summit, NA 2025
  - RVA23 kernels will (should) support RV64GC userspace
  - `riscv_hwprobe()` — a syscall to reliably detect RISC-V extensions

# Get involved

⇒ Many ways to contribute!

→ Test packages you care about, kernels, debug test/build failures

→ Communication:

- Fedora [Matrix channel](#) — active discussion happens here
- Discussion [forum](#)

# References

- [1] Fedora 43 RISC-V images. [https://riscv-koji.fedoraproject.org/koji/search?match=glob&type=package&terms=Fedora-\\*Generic\\*](https://riscv-koji.fedoraproject.org/koji/search?match=glob&type=package&terms=Fedora-*Generic*).
- [2] Fedora RISC-V tracker. <https://abologna.gitlab.io/fedora-riscv-tracker/>.
- [3] A poster session on Fedora RISC-V, RISC-V Summit, Paris 2025.  
<https://kashyapc.fedorapeople.org/fedora-risc-v-paris2025-extended.pdf>.
- [4] An update on Fedora's RISC-V port, 2024.  
<https://pretalx.com/devconf-cz-2024/talk/Q7XB3M/>.
- [5] Fedora RISC-V on QEMU.  
<https://fedoraproject.org/wiki/Architectures/RISC-V/QEMU>.
- [6] Fedora RISC-V Matrix.  
<https://chat.fedoraproject.org/#/room/#riscv:fedoraproject.org>.