Scaleway

Cloud-based RISC-V servers

How and why we built them
How you can use them

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Who is Scaleway

European Leader in Public Cloud & AI

+5,000 GPUs

Full service Cloud & AI Provider Expanding Across Europe

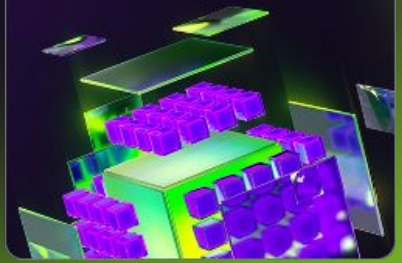
100s of PCIe cards (custom DC builds)

Fast growing with clear focus on Open-Source solutions

+100,000 servers in +10 data centers

+1000 Clusters

(Supercomputers)



Scaleway: A Track Record of Early Adoption

1999 Online.net founded

2006 Dedibox Launch

2014 First bare metal ARM servers in the cloud

2024 First bare metal RISC-V servers in the cloud

Mid 2023,
it started with a question:

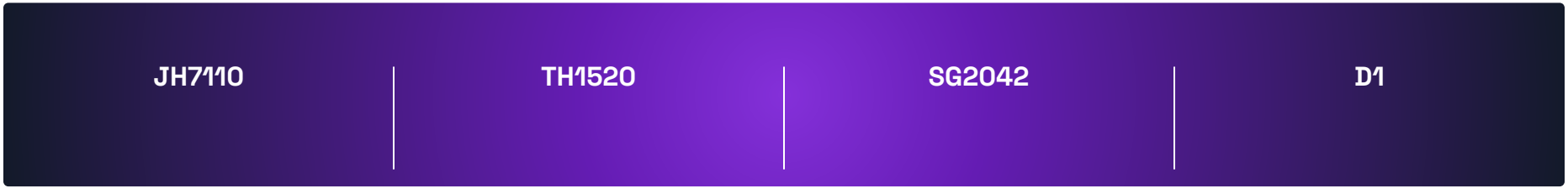
Is RISC-V Viable for Servers?

Hardware landscape

Mid 2023

RV64GC Hardware was starting to become available but:

- Still difficult to obtain
- Not standardized
- Low level of kernel mainlining



Software landscape

Mid 2023

User space software support for RV64GC was better than we expected:

- **Debian ran fine** on the JH7110 and the TH1520
- **98%** of Debian packages already compiled for RV64GC

But:

- **No** Linux distributions with a **stable** release yet
- **Very few** compatible **Docker images**

The missing piece

Mid 2023

We identified that **lack** of **easily accessible** RISC-V servers as a **shortcoming** of the ecosystem, especially considering the **difficulties** in acquiring hardware.

Developers need **fast** and **easy** access to **real hardware** to **build** and **test** their software

The missing piece

Mid 2023

We knew we could **help** with this. And **contribute** to the ecosystem.

Elastic Metal is our **bare metal** service **already designed** to accommodate **multiple architectures**.

We decided to build RISC-V servers for Elastic Metal to provide **access to real RISC-V hardware on demand to anyone**.

Hardware selection

Finalists

JH7110 - Starfive

- Process Size: 14nm
- 4 Cores
- Up to 1500MHz
- Up to 8GB DDR4
- PCI-e: **Gen2**
- TDP: 5W

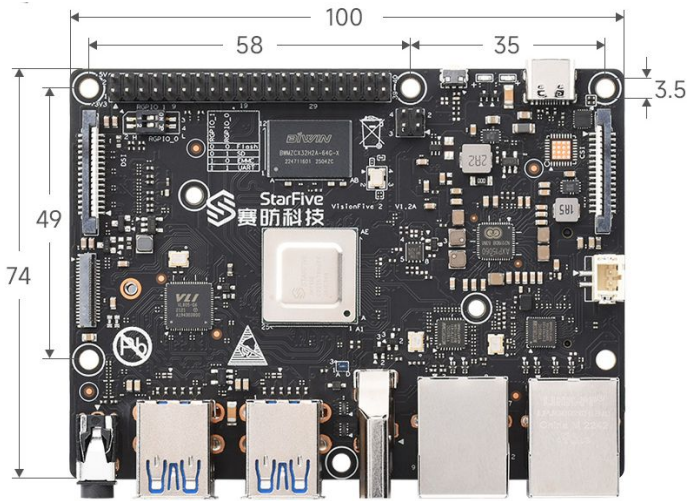
TH1520 - T-Head

- Process Size: 12nm
- 4 cores
- Up to 1850MHz
- Up to 16GB DDR4
- PCI-e: **none**
- TDP: 6W

Hardware selection

Form factor

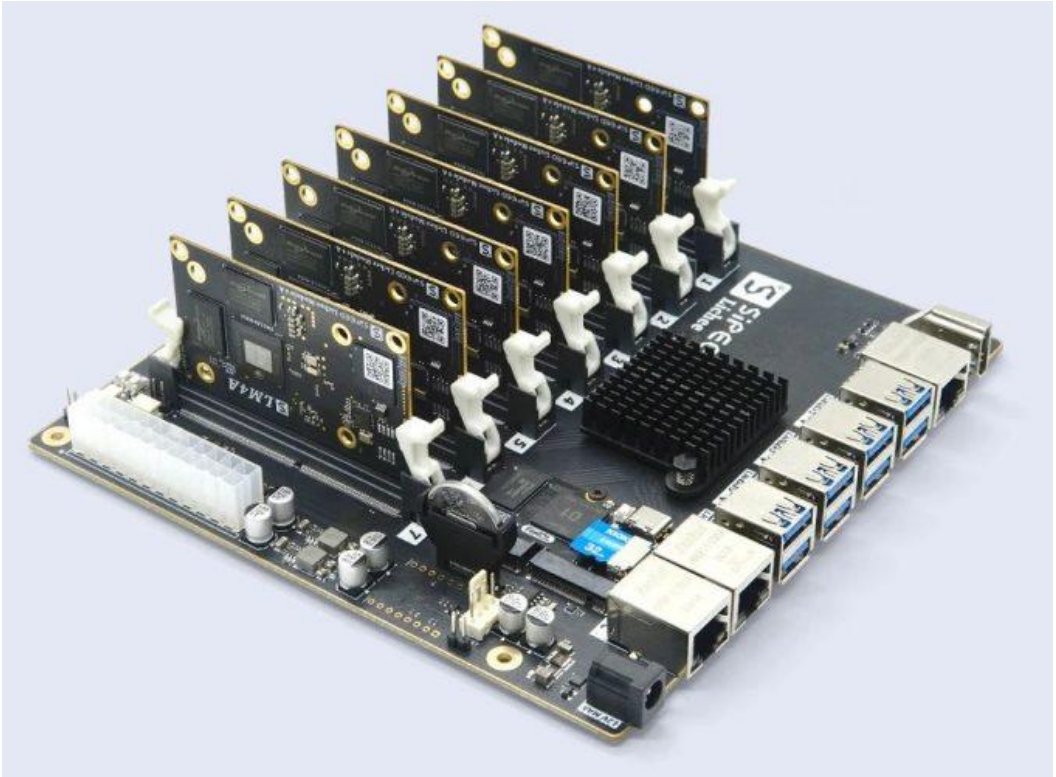
JH7110: Vision Five 2: 100 × 74mm



TH1520: LM4A: 69 × 45mm

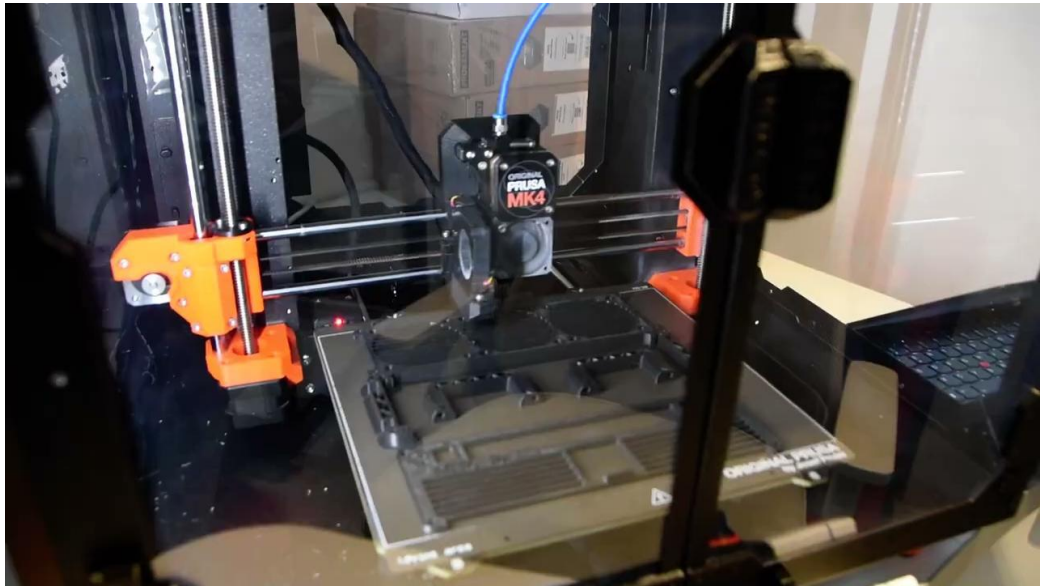
Lichee Cluster

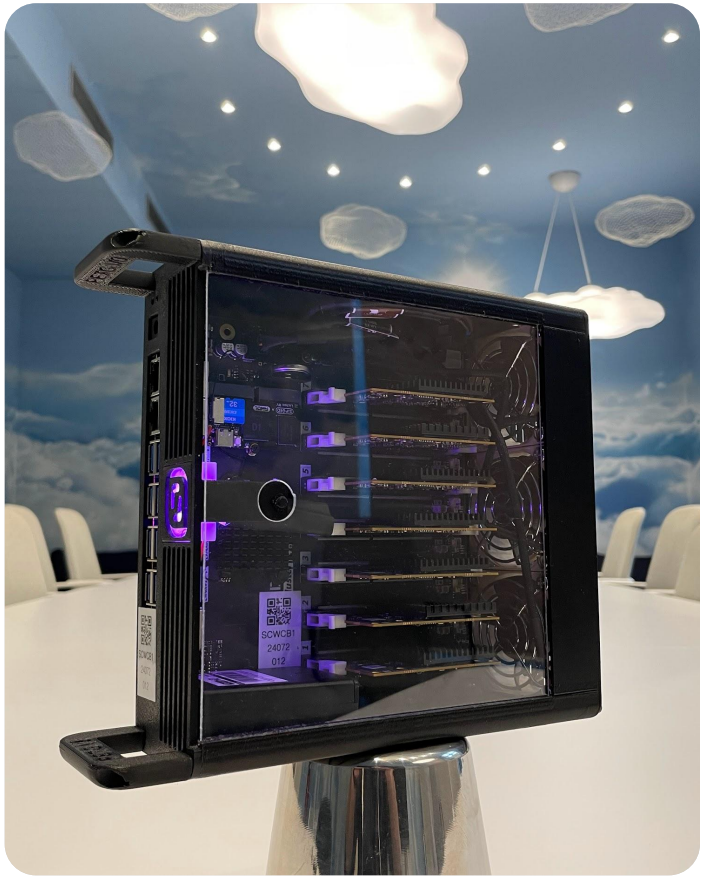
- Mini-ITX
- 7 LM4A modules
- Internal gigabit switch
- BMC for all 7 modules



3D printed case

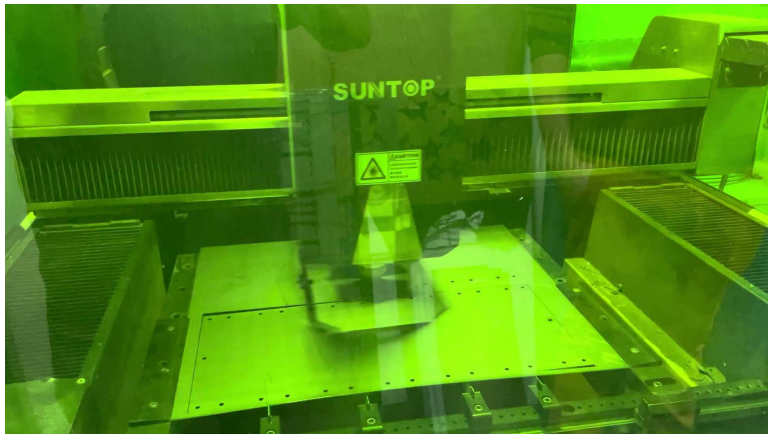
Designed, printed and assembled in our headquarters in Paris





Laser cut chassis

- Cut using a fiber laser locally
- Hand assembled in our office
- 6U in height
- Can hold 12 cases, 6 in the front,
  6 in the back and their external PSU



Rack

52U Rack

7 (modules per case) x
12 (case per chassis) x
8 (chassis per rack)
= **672** servers per rack

Energy budget of **6kW**

```
module subrack(show_panels=true, show_fascia=true) {
  vertical_extrusion_position = [14, 207];
  horizontal_extrusion_position = [14, subrack_width - 14];
  // Front to back struss
  for (i=horizontal_extrusion_position, j=vertical_extrusion_position)
          translate([i, subrack_depth/2, j])
          rotate([90, 0, 0])
          extrusion(E2020, subrack_depth);
  if(show_panels) {
          // top and bottom panels
          // front
          for(z=[vertical_extrusion_position[0] - 10,
vertical_extrusion_position[1] + 10])
          translate([5, 0, z])
          horizontal_panel();
          // back
          for(z=[vertical_extrusion_position[0] - 10,
vertical_extrusion_position[1] + 10])
          translate([5, subrack_depth - subrack_panel_depth, z])
          horizontal_panel();
          // center
          for(z=[vertical_extrusion_position[0] - 10,
vertical_extrusion_position[1] + 10])
          translate([5 + (subrack_width -10)/2, subrack_depth/2, z])
          center_panel();
          // side panels
          for(x=[4, subrack_width - 4], y=[subrack_depth/4, 3 * subrack_depth/4])
          translate([x, y, subrack_height/2])
          rotate([0, 90, 0])
          side_panel();
          // front panel
          if (show_fascia)
          translate([subrack_width/2, -subrack_fascia_thickness/2,
subrack_height/2])
          rotate([90, 0, 0])
          back_panel();
          // fascia back
          if (show_fascia)
          translate([ subrack_width/2, subrack_depth + subrack_fascia_thickness,
subrack_height/2])
          rotate([90, 0, 0])
          back_panel();
  }
}
```

Made with code

Case and chassis made with a Hardware design as code Approach

- Using OpenSCAD
- Parametric
- Integrated into our CI/CD

Software and Firmware Work

KERNEL

- None of the kernels provided were adequate for our usage
- We wanted something closer to mainline
- We carefully selected patches
- We use the same kernel for different OS images

U-BOOT

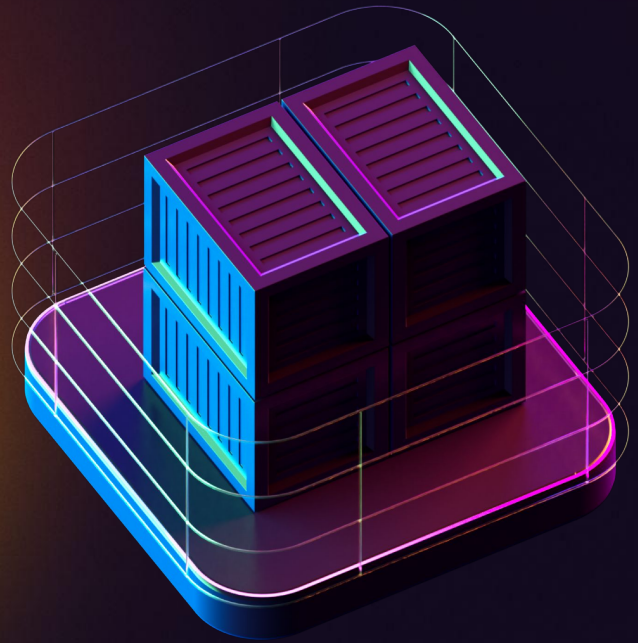
- Added a small subset of iPXE features
- Implemented memory wipe on reboot
- Fixing shutdown issues

BMC

- Built an OpenBMC image
- Implement reboot via IPMI
- Created an API server for configuring the internal switch remotely

OS IMAGES

- Built custom images for each distributions
- Added more images since the launch



EM-RV1 Launch

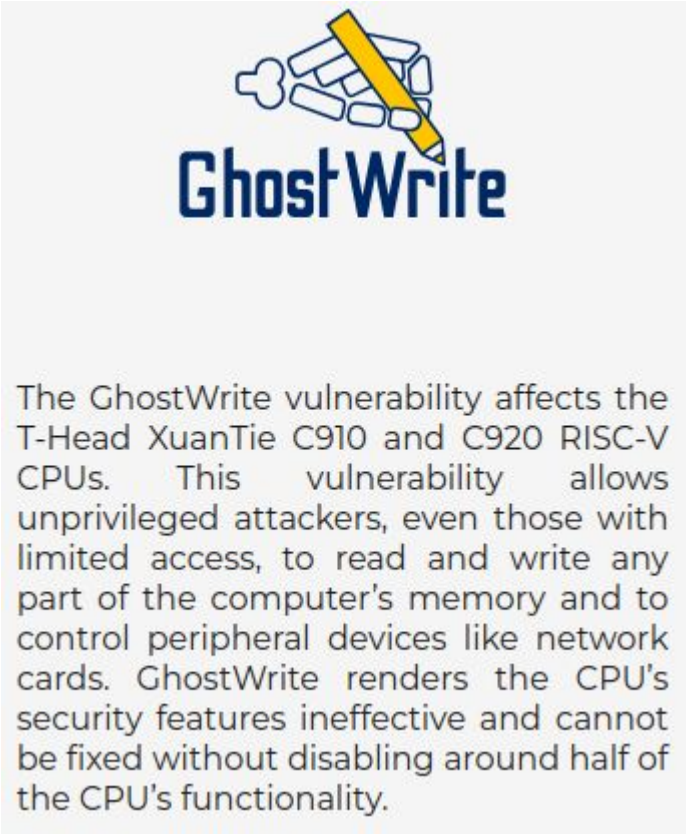
2024-02-29

EM-RV1

Bare metal servers based on the TH1520 SoC accessible on demand.
Fully integrated into Scaleway Elements cloud services ecosystem.

15,99€/month Hourly billing also available	16GiB DDR4	128GB eMMC	100Mbps networking

Feedback from our customers

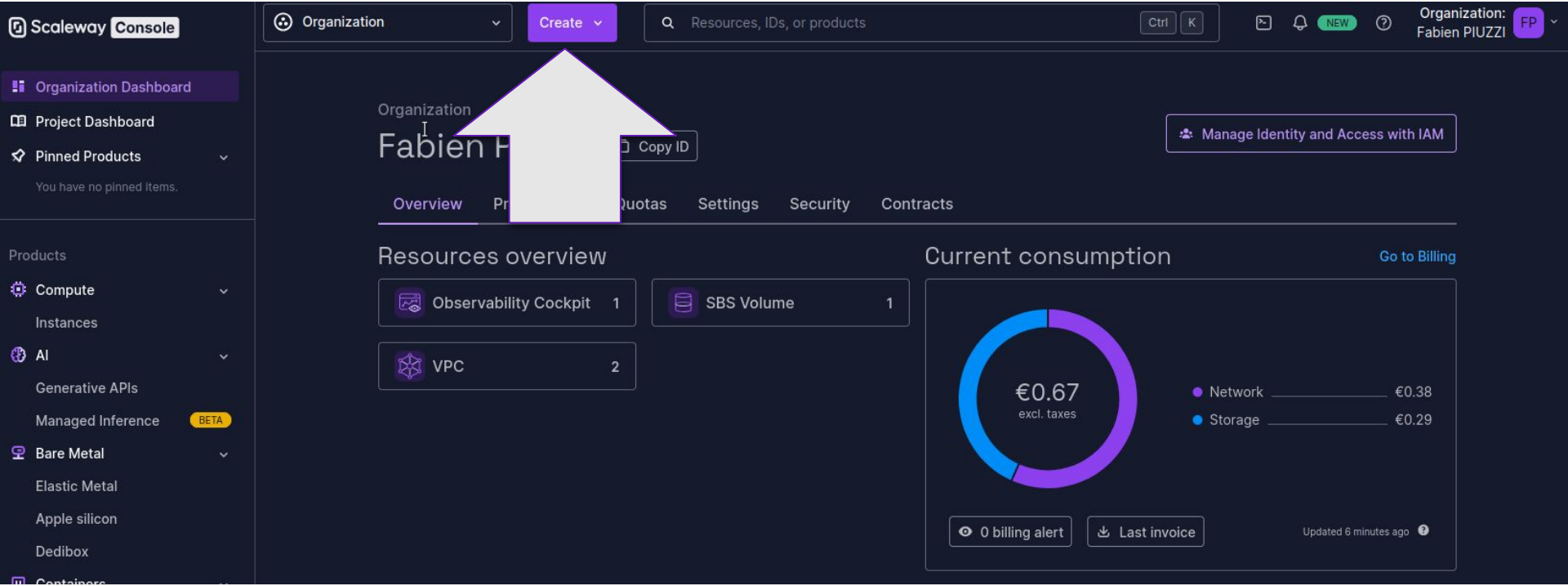


GhostWrite

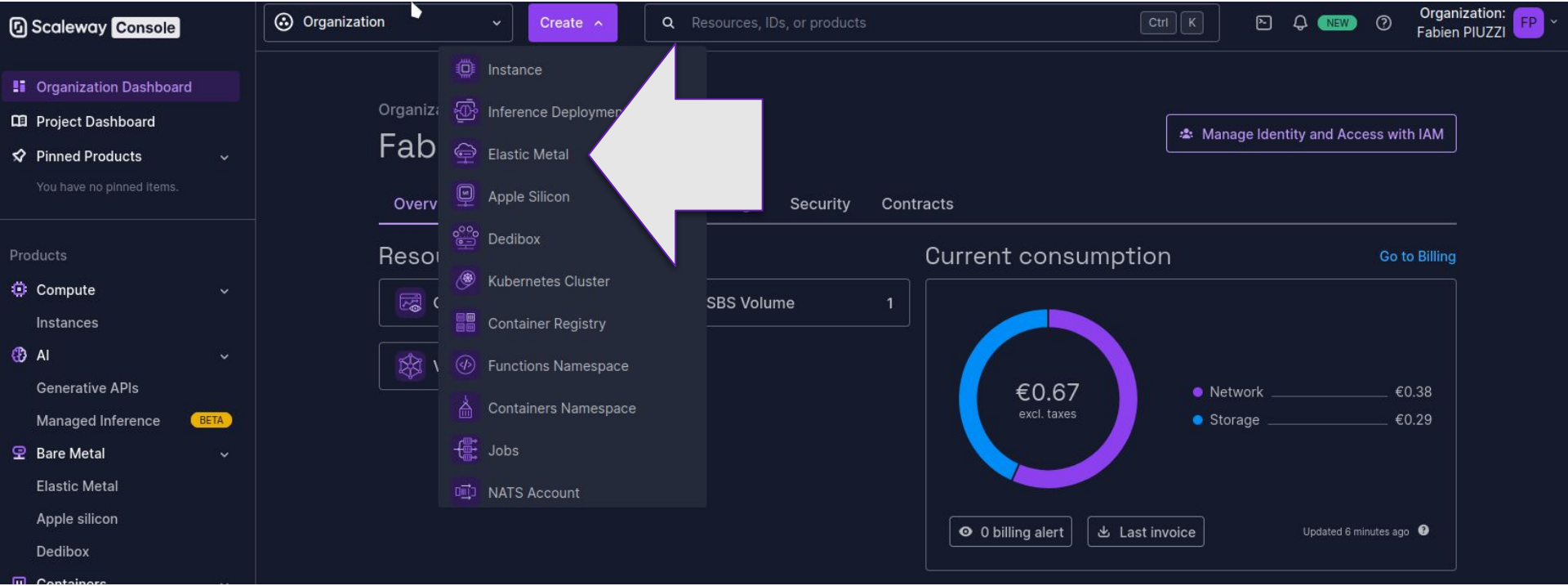
- Allows read/write anywhere to the physical memory
- Doesn't require privileges
- Caused by a defective CPU instruction
- The instruction could not be disabled without disabling all RVV 0.7.1
- Thanks to CISPA advance warning, we mitigated the issue before publication

How to use them

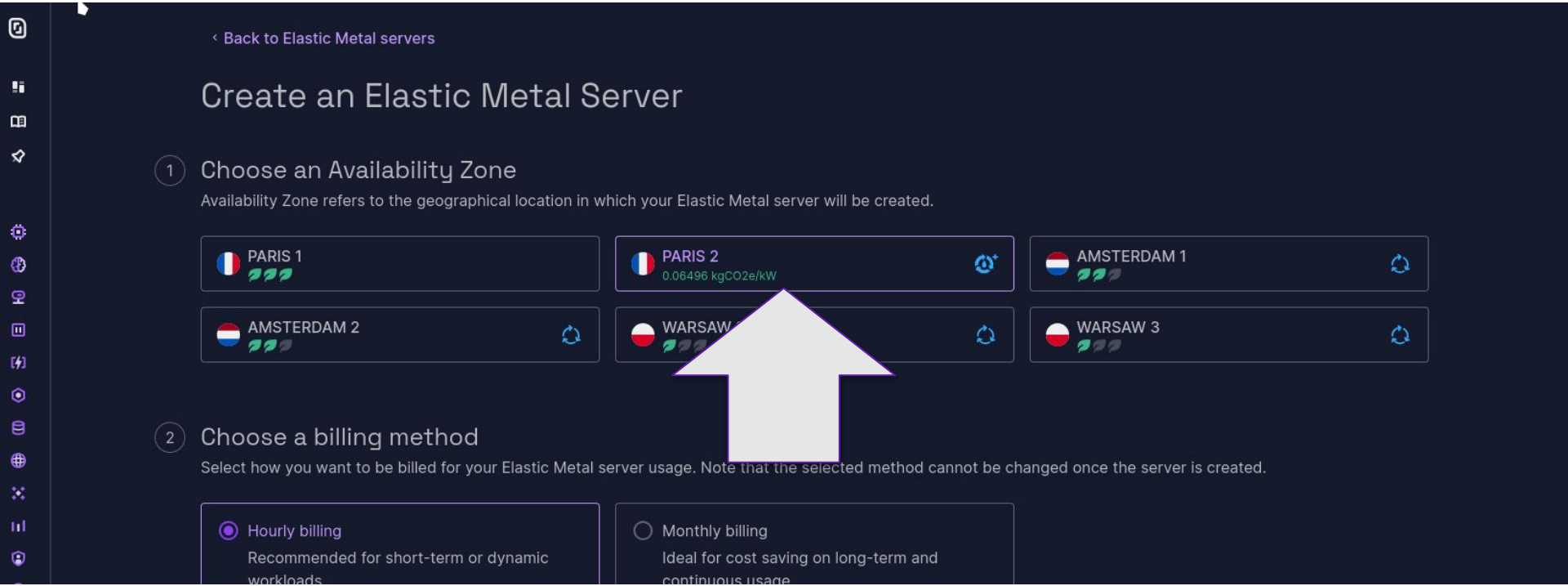
➡console.scaleway.com



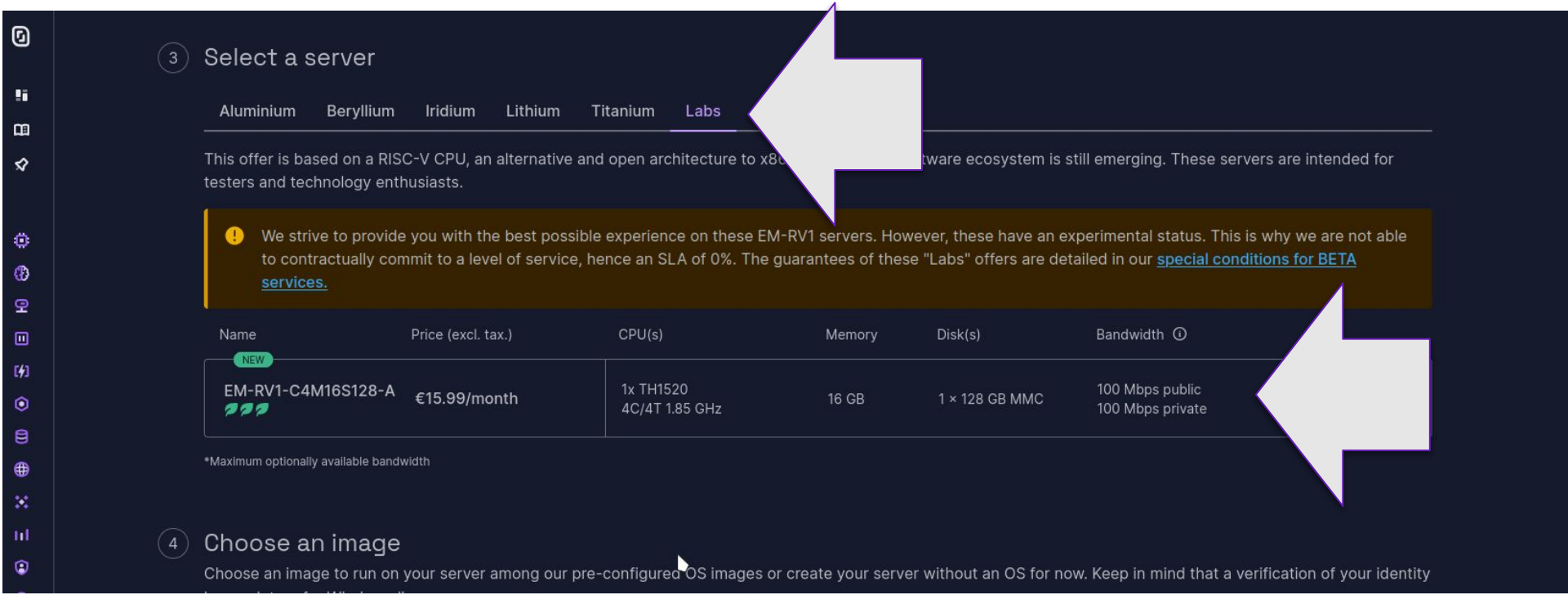
Select “Elastic Metal”



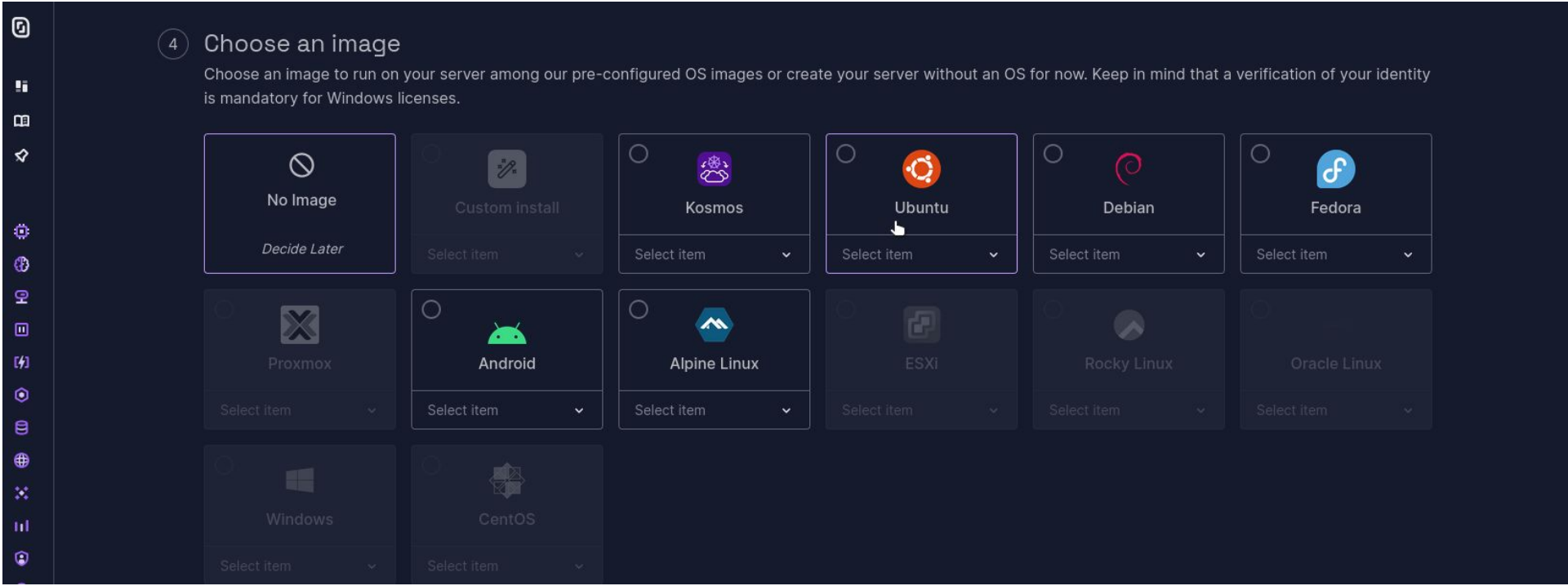
Select “Paris 2”



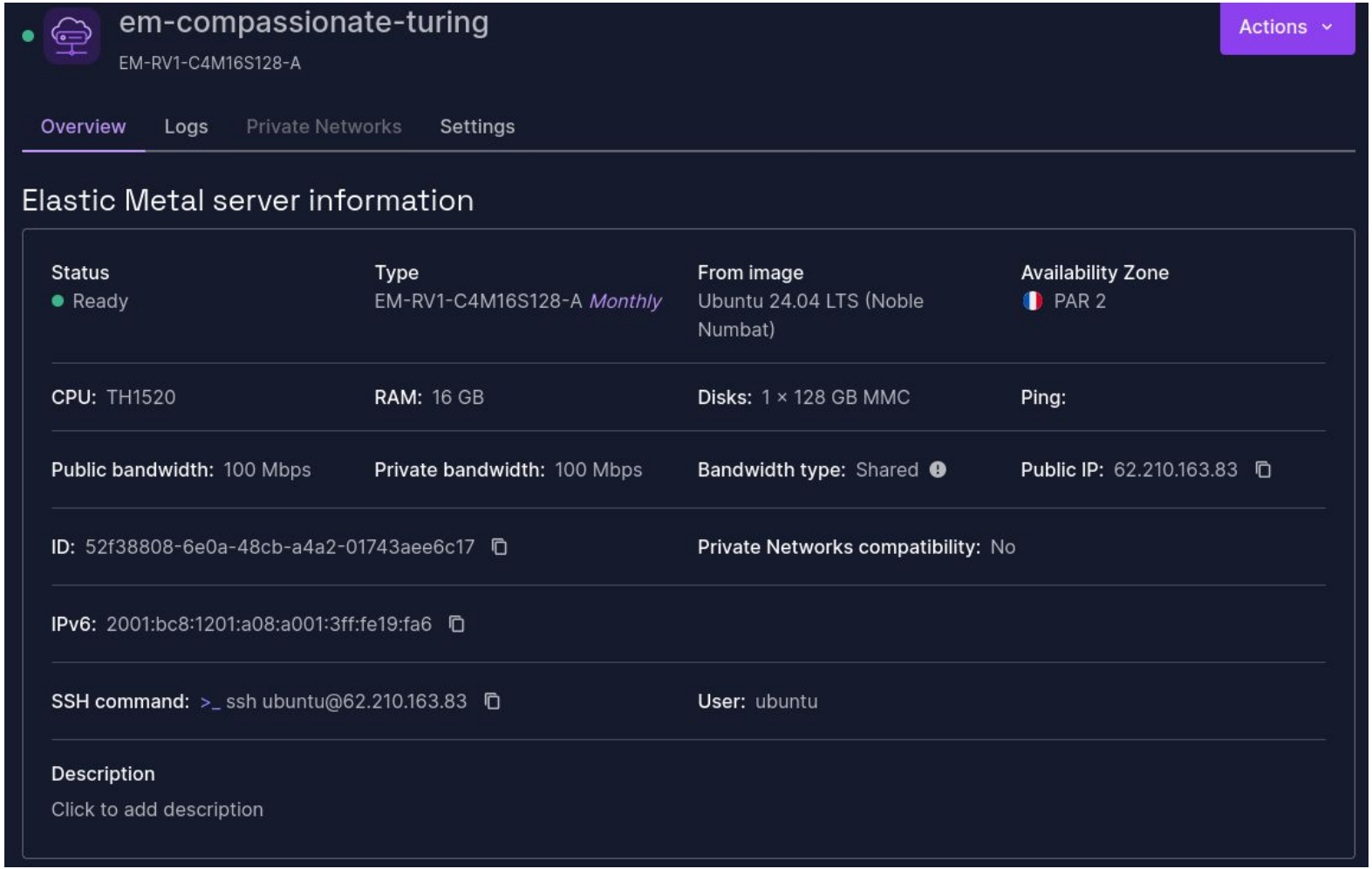
Select “EM-RV1”



Choose an OS image



Click on “Create Elastic Metal server”


em-compassionate-turing
EM-RV1-C4M16S128-A
Actions
Overview
Logs
Private Networks
Settings
Elastic Metal server information
Status
Ready
Type
EM-RV1-C4M16S128-A Monthly
From image
Ubuntu 24.04 LTS (Noble Numbat)
Availability Zone
PAR 2
CPU: TH1520
RAM: 16 GB
Disks: 1 × 128 GB MMC
Ping:
Public bandwidth: 100 Mbps
Private bandwidth: 100 Mbps
Bandwidth type: Shared
Public IP: 62.210.163.83
ID: 52f38808-6e0a-48cb-a4a2-01743aee6c17
Private Networks compatibility: No
IPv6: 2001:bc8:1201:a08:a001:3ff:fe19:fa6
SSH command: >_ ssh ubuntu@62.210.163.83
User: ubuntu
Description
Click to add description


The world's first on-demand RISC-V server by Scaleway.
Arch : riscv64
CPU : 4 cores @ 1.848Ghz - isa rv64imafdcsu
Memory : 16GiB
Storage : 128GB
Network : 100Mb/s
More details: https://labs.scaleway.com/en/em-rv1/
Welcome to Ubuntu 24.04 LTS (GNU/Linux 5.10.113-scw1 riscv64)

Call to action for hardware designers and manufacturers

“For RISC-V to gain mainstream acceptance in cloud environments, the hardware should be more standardized so that it’s seamless to deploy.”

Call to Action

For mainstream RISC-V server adoption

- Boot process:
  - UEFI support
  - UEFI networking support
  - Network booting with TFTP and HTTP over TLS
  - ACPI support
  - Secure boot
- Linux integration:
  - More mainlining of kernel patches

In general: Follow the RISC-V Server Platform Specification

https://github.com/riscv-non-isa/riscv-server-platform

So, Is RISC-V viable for servers?

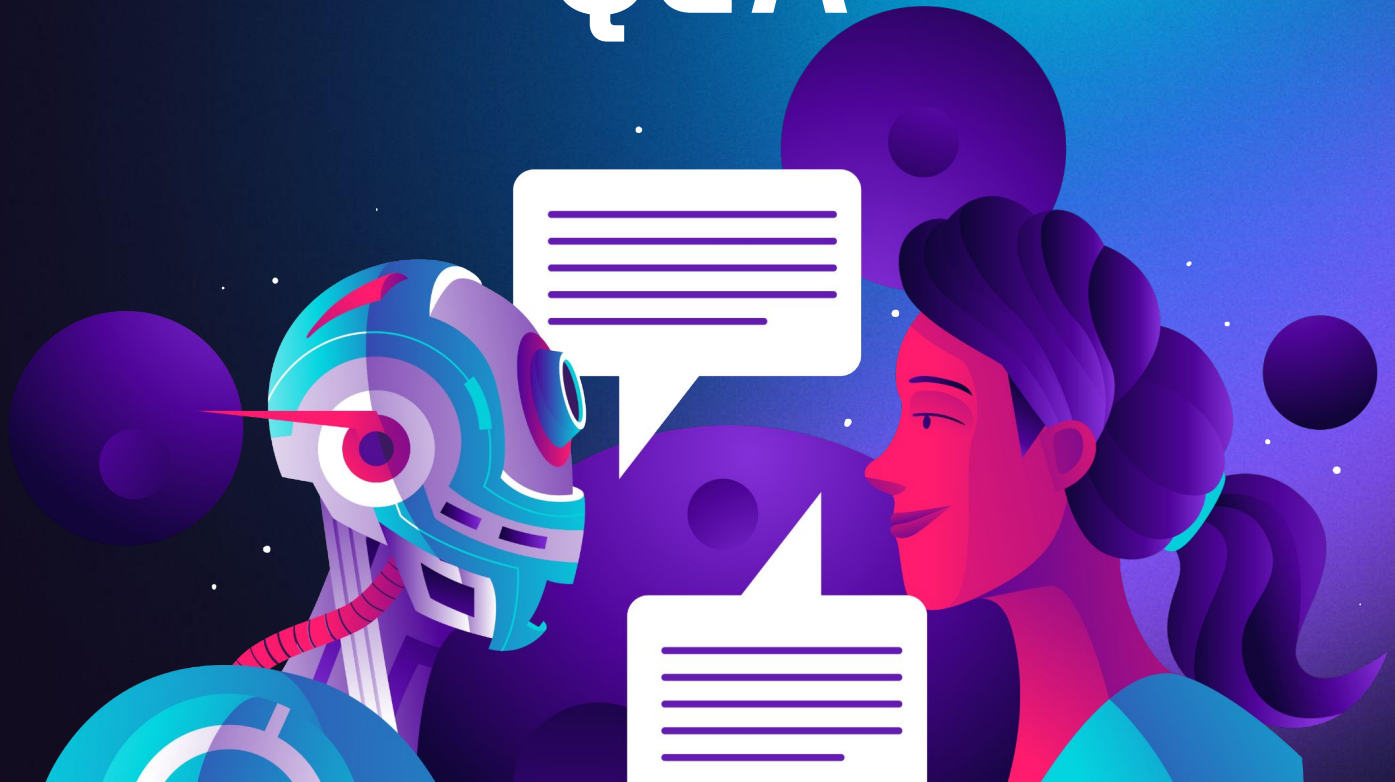
Yes

We built this service to prove it and you can try it to see for yourself.

Thanks

- RISE
- CISPA
- **Scaleway Labs RISC-V team members**
  - Nils Le Roux
  - Theo Zapata
  - Coline Seguret
  - Raphael Gault
- **Scaleway Labs team members**
  - Ludovic Le Frioux
  - Antoine Blin
  - Valentin Macheret
  - Antoine Radet
- **Scaleway Labs head of R&D**
  - Sebastien Luttringer
  - Mickael Marchand
- **Scaleway CEO**
  - Damien Lucas
- **All other Scaleway teams for their constant help and advice**

Q&A



Thank you!