



# Cloud-based RISC-V servers

How and why we built them  
How you can use them



Fabien Piuze, R&D Engineer, Scaleway Labs



May 14th 2025



# Who is Scaleway

European Leader in Public Cloud & AI



+5,000  
GPUs

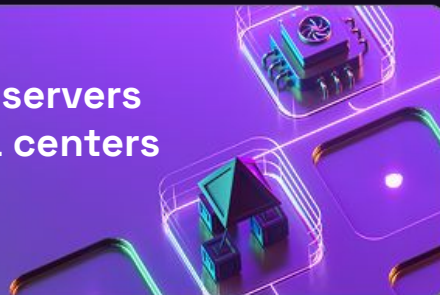
Full service  
Cloud & AI Provider  
Expanding Across  
Europe

100s of PCIe cards  
(custom DC builds)

Fast growing  
with clear  
focus on  
Open-Source  
solutions

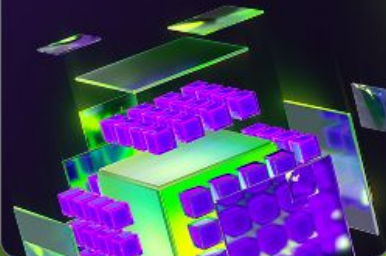


+100,000 servers  
in +10 data centers



+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

JH7110

TH1520

SG2042

D1

## 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 journey begins

## 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

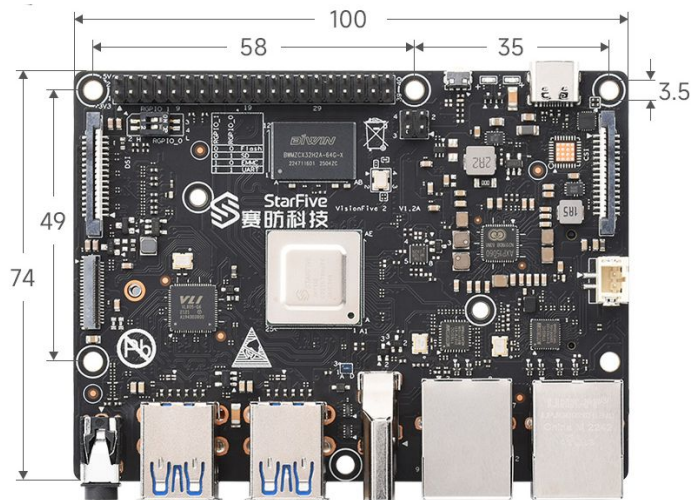
- Process Size: 12nm
- 4 cores
- Up to 1850MHz
- Up to 16GB DDR4
- PCI-e: **none**
- TDP: 6W

## Building the Platform

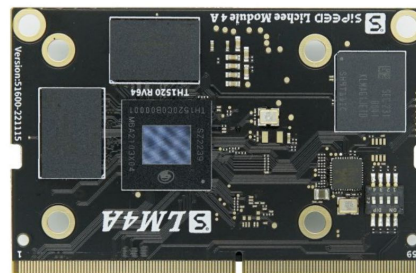
# Hardware selection

### Form factor

**JH7110: Vision Five 2: 100 × 74mm**

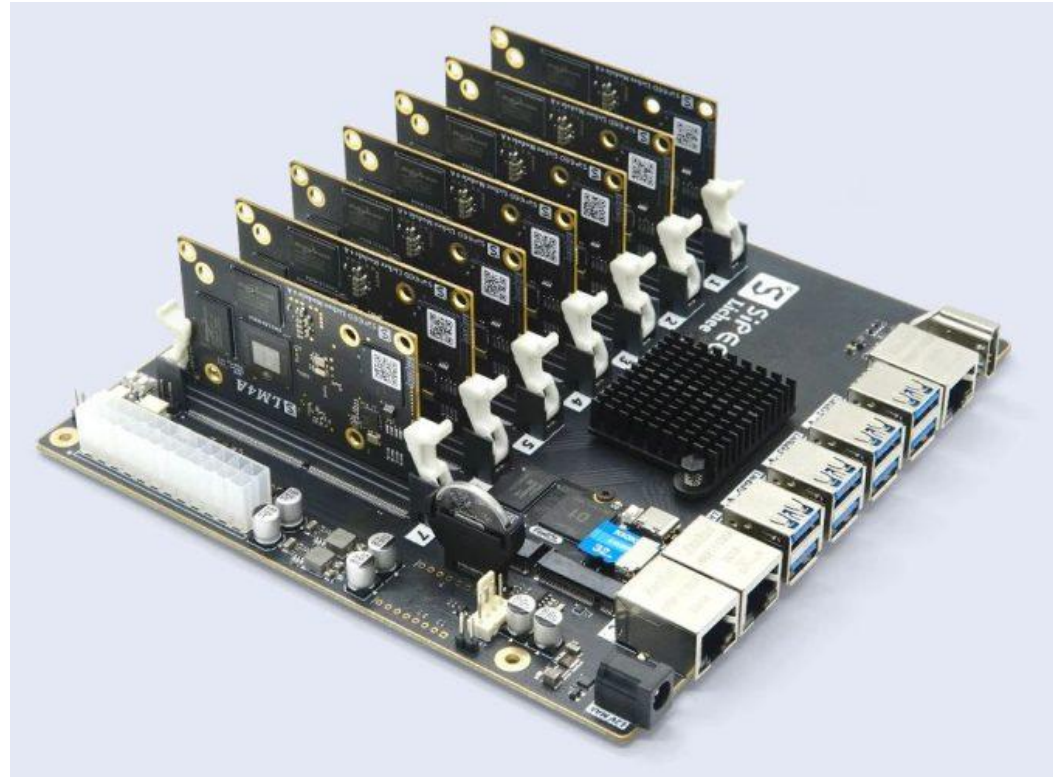


**TH1520: LM4A: 69 × 45mm**



# Lichee Cluster

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

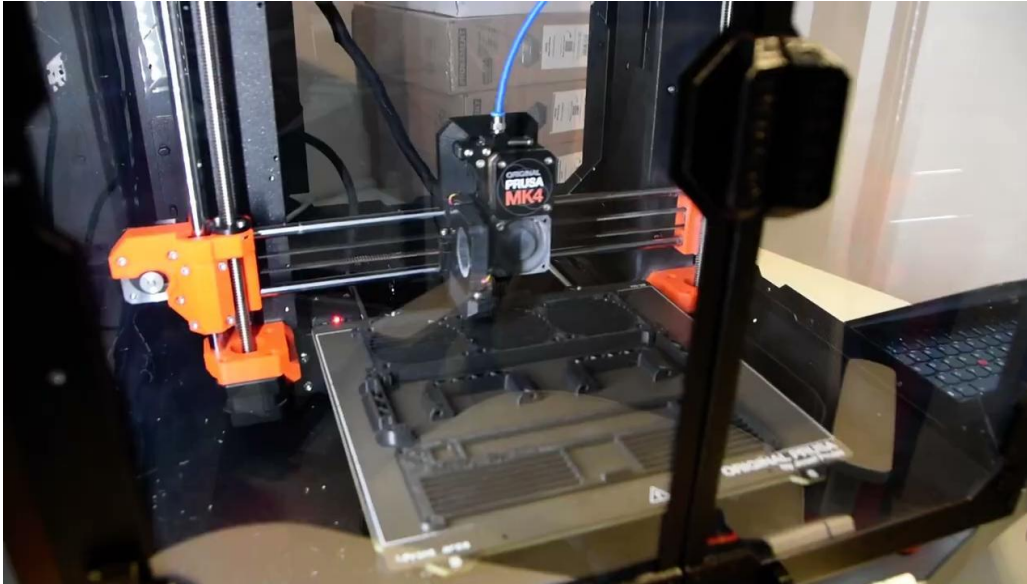




## Building the Platform

### 3D printed case

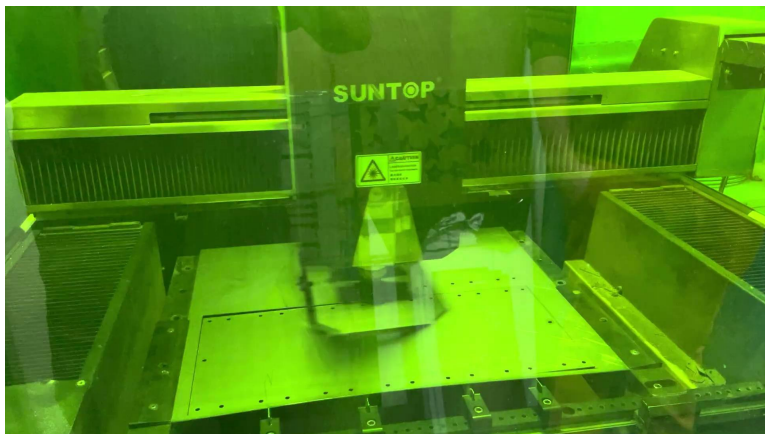
Designed, printed and assembled in our headquarters  
in Paris



## Building the Platform

### 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

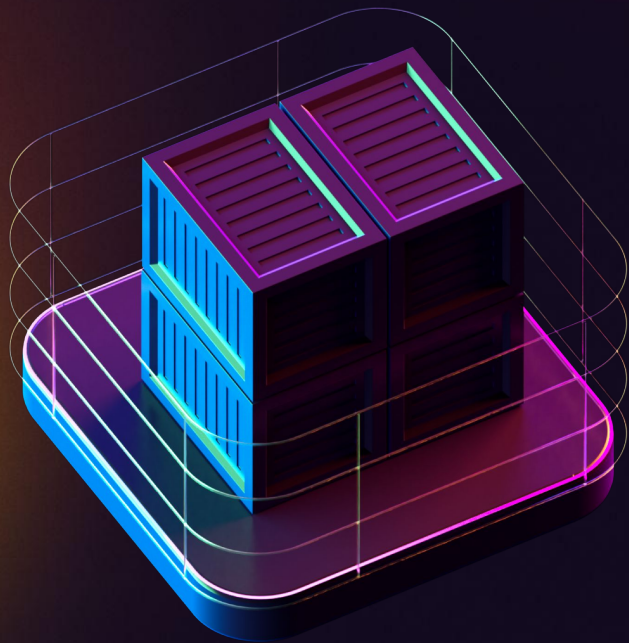
## BMC

- 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



**Blog**

# Leveraging Scaleway to support the RISC-V Software Ecosystem

September 9, 2024



The GhostWrite vulnerability affects the T-Head XuanTie C910 and C920 RISC-V CPUs. This vulnerability allows unprivileged attackers, even those with limited access, to read and write any part of the computer's memory and to control peripheral devices like network cards. GhostWrite renders the CPU's security features ineffective and cannot be fixed without disabling around half of the CPU's functionality.

## 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 CISA advance warning, we mitigated the issue before publication

# How to use them



How to use them

➔ [console.scaleway.com](https://console.scaleway.com)

The screenshot displays the Scaleway Console interface. On the left is a sidebar with navigation options: Organization Dashboard, Project Dashboard, Pinned Products, and a list of products including Compute, AI, Bare Metal, and Containers. The main content area shows the 'Organization Dashboard' for 'Fabien PIUZZI'. A large white arrow points to the 'Create' button in the top navigation bar. Below the organization name, there are tabs for Overview, Projects, Quotas, Settings, Security, and Contracts. The 'Resources overview' section lists three resources: Observability Cockpit (1), SBS Volume (1), and VPC (2). The 'Current consumption' section features a donut chart showing a total of €0.67 (excluding taxes), with Network at €0.38 and Storage at €0.29. A 'Go to Billing' link is present. At the bottom of the consumption section, there are buttons for '0 billing alert' and 'Last invoice', and a note that the data was updated 6 minutes ago.

Scaleway Console

Organization Fabien PIUZZI

Create

Resources, IDs, or products

Ctrl K

NEW

Organization: Fabien PIUZZI

Organization Dashboard

Project Dashboard

Pinned Products

You have no pinned Items.

Products

- Compute
- AI
- Bare Metal
- Containers

Instances

Generative APIs

Managed Inference BETA

Elastic Metal

Apple silicon

Dedibox

Overview Projects Quotas Settings Security Contracts

Resources overview

- Observability Cockpit 1
- SBS Volume 1
- VPC 2

Current consumption

Go to Billing

€0.67 excl. taxes

- Network €0.38
- Storage €0.29

0 billing alert

Last invoice

Updated 6 minutes ago

How to use them

## Select “Elastic Metal”

The screenshot shows the Scaleway Console interface. On the left, there is a sidebar with navigation links: Organization Dashboard, Project Dashboard, Pinned Products, and a Products section with links to Compute, AI, Bare Metal, and Containers. The 'Compute' section is expanded, showing 'Instances' and 'Elastic Metal'. The 'Create' button in the top navigation bar is highlighted, and its dropdown menu is open, displaying various services. A large white arrow points to the 'Elastic Metal' option in this menu. The main content area shows the 'Current consumption' section with a donut chart indicating a total cost of €0.67 (excluding taxes). The chart is divided into two segments: Network (€0.38) and Storage (€0.29). Below the chart, there are buttons for '0 billing alert' and 'Last invoice', and a note that the data was updated 6 minutes ago.

Scaleway Console

Organization

Create

Resources, IDs, or products

Ctrl K

NEW

Organization: Fabien PIUZZI

Organization Dashboard

Project Dashboard

Pinned Products

You have no pinned Items.

Products

Compute

Instances

AI

Generative APIs

Managed Inference

BETA

Bare Metal

Elastic Metal

Apple silicon

Dedibox

Containers

Organization

Project

Resources

Instances

Inference Deployment

Elastic Metal

Apple Silicon

Dedibox

Kubernetes Cluster

Container Registry

Functions Namespace

Containers Namespace

Jobs

NATS Account

Security

Contracts

Current consumption

Go to Billing

SBS Volume 1

€0.67  
excl. taxes

Network €0.38

Storage €0.29

0 billing alert

Last invoice

Updated 6 minutes ago


# Select “Paris 2”


◀ Back to Elastic Metal servers


## Create an Elastic Metal Server


1 Choose an Availability Zone


Availability Zone refers to the geographical location in which your Elastic Metal server will be created.


 PARIS 1  
🌿🌿🌿

 PARIS 2  
0.06496 kgCO2e/kW

 AMSTERDAM 1  
🌿🌿🌿

 AMSTERDAM 2  
🌿🌿🌿

 WARSAW 1  
🌿🌿🌿

 WARSAW 3  
🌿🌿🌿

2 Choose a billing method

Select how you want to be billed for your Elastic Metal server usage. Note that the selected method cannot be changed once the server is created.

☒ Hourly billing  
Recommended for short-term or dynamic workloads

☐ Monthly billing  
Ideal for cost saving on long-term and continuous usage

# Select “EM-RV1”

3

Select a server

AluminiumBerylliumIridiumLithiumTitaniumLabs

This offer is based on a RISC-V CPU, an alternative and open architecture to x86. The software ecosystem is still emerging. These servers are intended for testers and technology enthusiasts.

⚠

We strive to provide you with the best possible experience on these EM-RV1 servers. However, these have an experimental status. This is why we are not able to contractually commit to a level of service, hence an SLA of 0%. The guarantees of these "Labs" offers are detailed in our [special conditions for BETA services](#).

Name	Price (excl. tax.)	CPU(s)	Memory	Disk(s)	Bandwidth ⓘ
<div>NEW</div> EM-RV1-C4M16S128-A 👍👍👍	€15.99/month	1x TH1520 4C/4T 1.85 GHz	16 GB	1 × 128 GB MMC	100 Mbps public 100 Mbps private

\*Maximum optionally available bandwidth

4

Choose an image

Choose an image to run on your server among our pre-configured OS images or create your server without an OS for now. Keep in mind that a verification of your identity

## Choose an OS image

4

Choose an image

Choose an image to run on your server among our pre-configured OS images or create your server without an OS for now. Keep in mind that a verification of your identity is mandatory for Windows licenses.

<div><div><input type="radio"/></div><div>No Image</div><div>Decide Later</div></div>	<div><div><input type="radio"/></div><div>Custom install</div><div>Select item</div></div>	<div><div><input type="radio"/></div><div>Kosmos</div><div>Select item</div></div>	<div><div><input checked="" type="radio"/></div><div>Ubuntu</div><div>Select item</div></div>	<div><div><input type="radio"/></div><div>Debian</div><div>Select item</div></div>	<div><div><input type="radio"/></div><div>Fedora</div><div>Select item</div></div>
<div><div><input type="radio"/></div><div>Proxmox</div><div>Select item</div></div>	<div><div><input type="radio"/></div><div>Android</div><div>Select item</div></div>	<div><div><input type="radio"/></div><div>Alpine Linux</div><div>Select item</div></div>	<div><div><input type="radio"/></div><div>ESXi</div><div>Select item</div></div>	<div><div><input type="radio"/></div><div>Rocky Linux</div><div>Select item</div></div>	<div><div><input type="radio"/></div><div>Oracle Linux</div><div>Select item</div></div>
<div><div><input type="radio"/></div><div>Windows</div><div>Select item</div></div>	<div><div><input type="radio"/></div><div>CentOS</div><div>Select item</div></div>				



# Click on “Create Elastic Metal server”



9

## Your order summary

The first month of your Elastic Metal server will be charged on a pro-rata basis. Note that commercial software licenses are billed differently.

[Understand Elastic Metal billing](#)

### Each month

Availability Zone	 PARIS 2	€0.00
Image	 Ubuntu	€0.00
Server	EM-RV1-C4M16S128-A 4C/4T - 1x TH1520 - 16 GB Memory - 128 G...	€15.99
Public bandwidth	0.1 Gbps	Included
		€15.99

Create Elastic Metal server





Installation can take up to 1 hour.



## 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



# 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



**So, Is RISC-V viable for servers?**

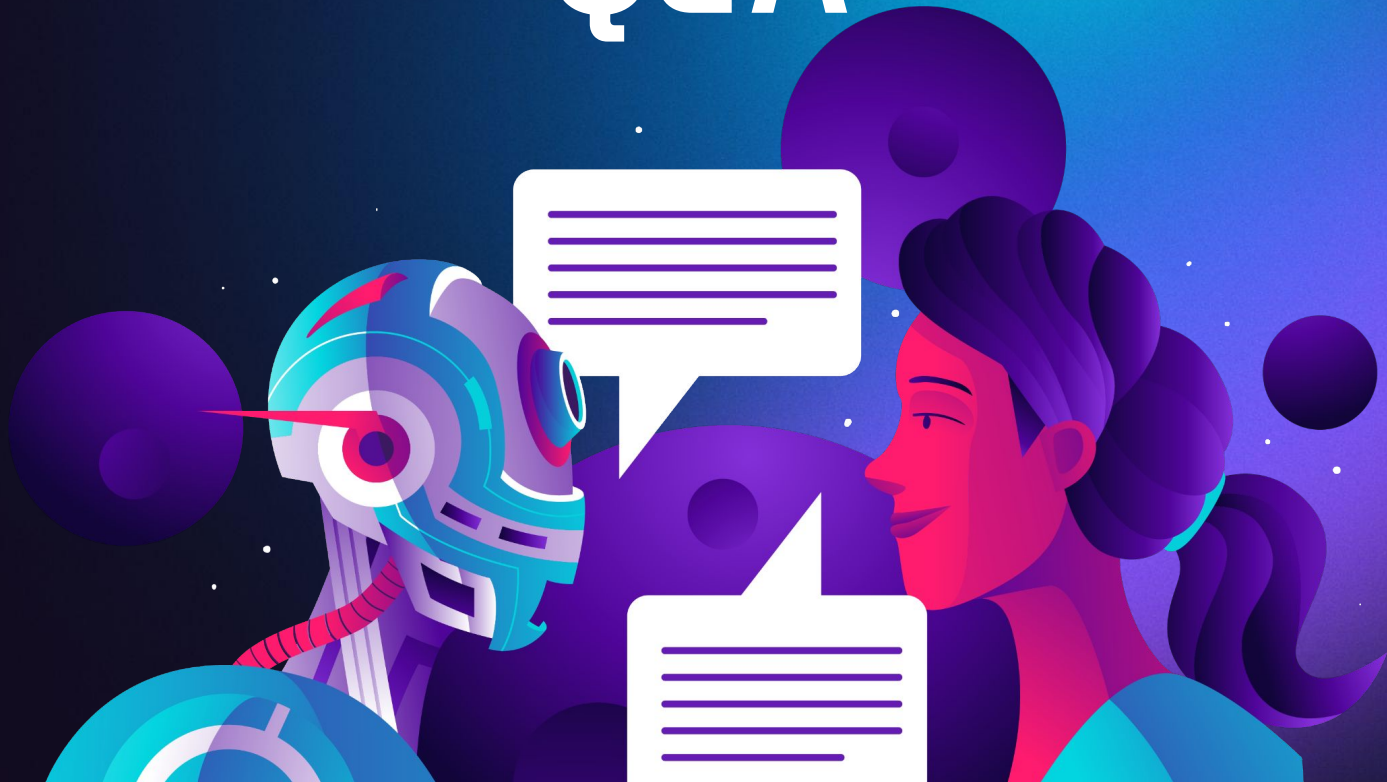
**Yes**

**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!

