



# Cloud-based RISC-V servers

**How and why we built them  
How you can use them**



Fabien Piuzzi, R&D Engineer, Scaleway Labs

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# Who is Scaleway

European Leader in Public Cloud & AI



+5,000  
GPUs

Fast growing  
with clear  
focus on  
Open-Source  
solutions



Full service  
Cloud & AI Provider  
Expanding Across  
Europe

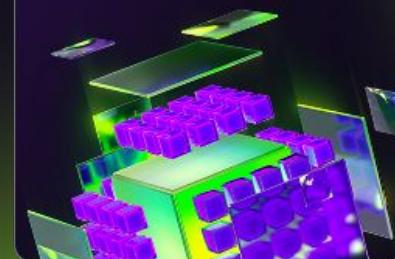


+100,000 servers  
in +10 data centers

100s of PCIe cards  
(custom DC builds)

+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

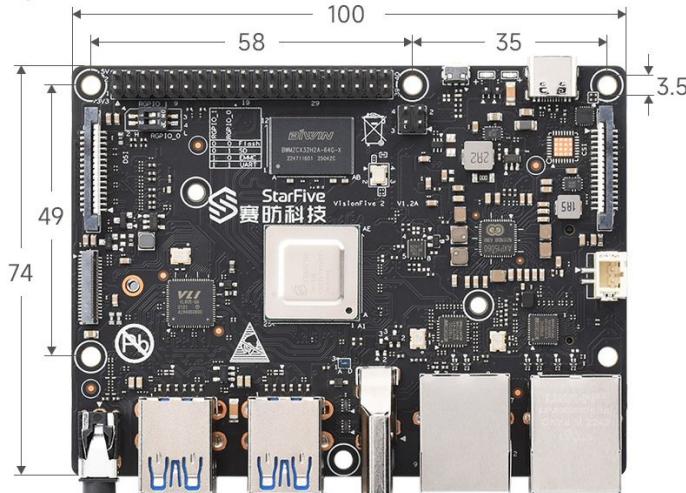
- Process Size: 12nm
- 4 cores
- Up to 1850MHz
- Up to 16GB DDR4
- PCI-e: **none**
- TDP: 6W

# Building the Platform

## Hardware selection

### Form factor

JH7110: Vision Five 2: 100 × 74mm

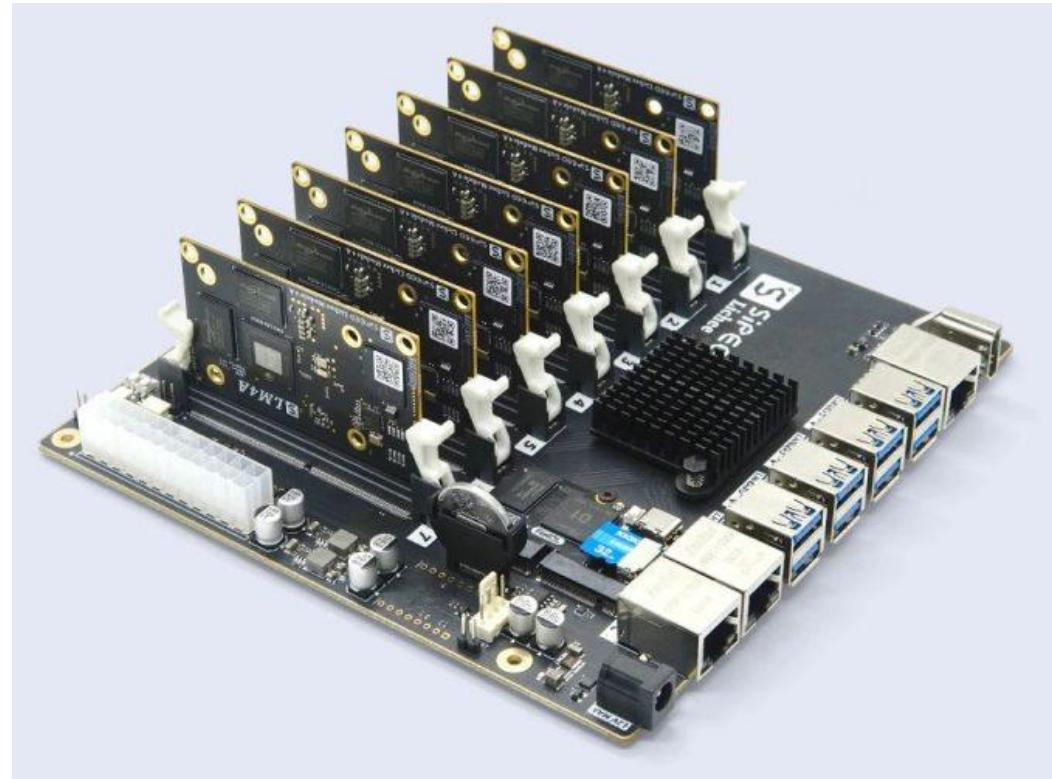


TH1520: LM4A: 69 × 45mm



## Lichee Cluster

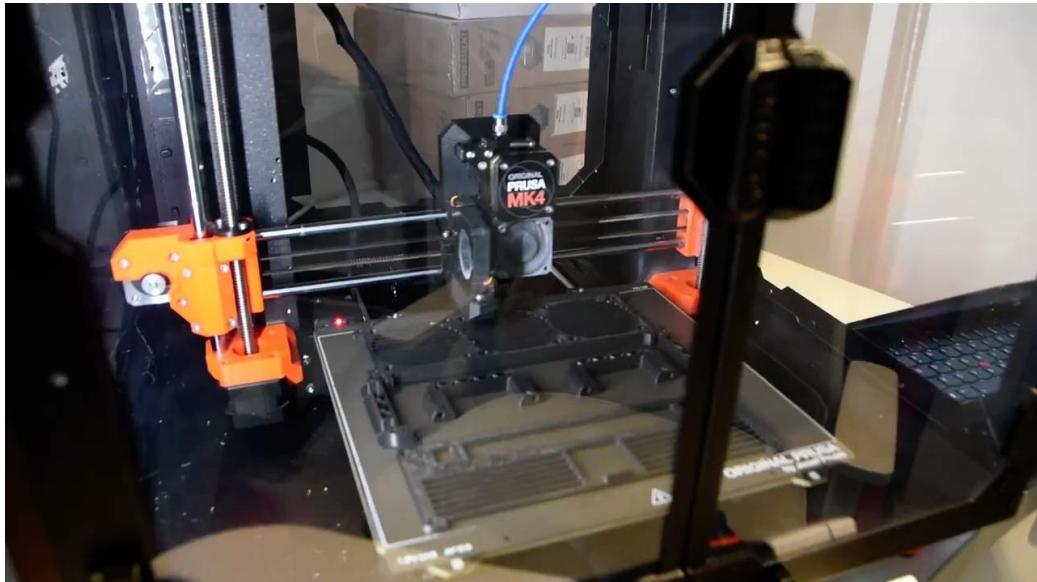
- Mini-ITX
- 7 LM4A modules
- Internal gigabit switch
- BMC for all 7 modules



Building the Platform

## 3D printed case

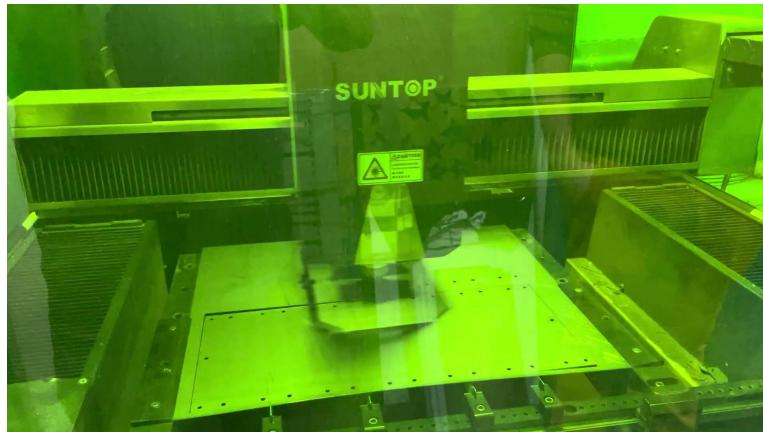
Designed, printed and assembled in our headquarters  
in Paris



## 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

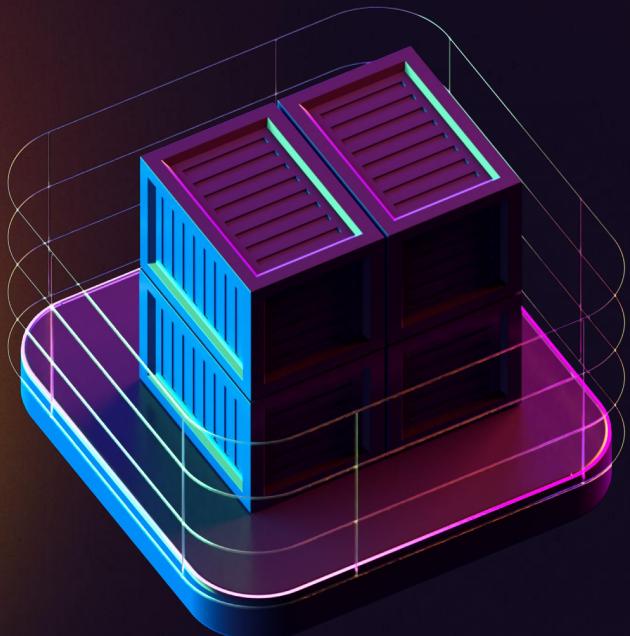
- Added a small subset of iPXE features
- Implemented memory wipe on reboot
- Fixing shutdown issues

## 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



# Leveraging Scaleway to support the RISC-V Software Ecosystem

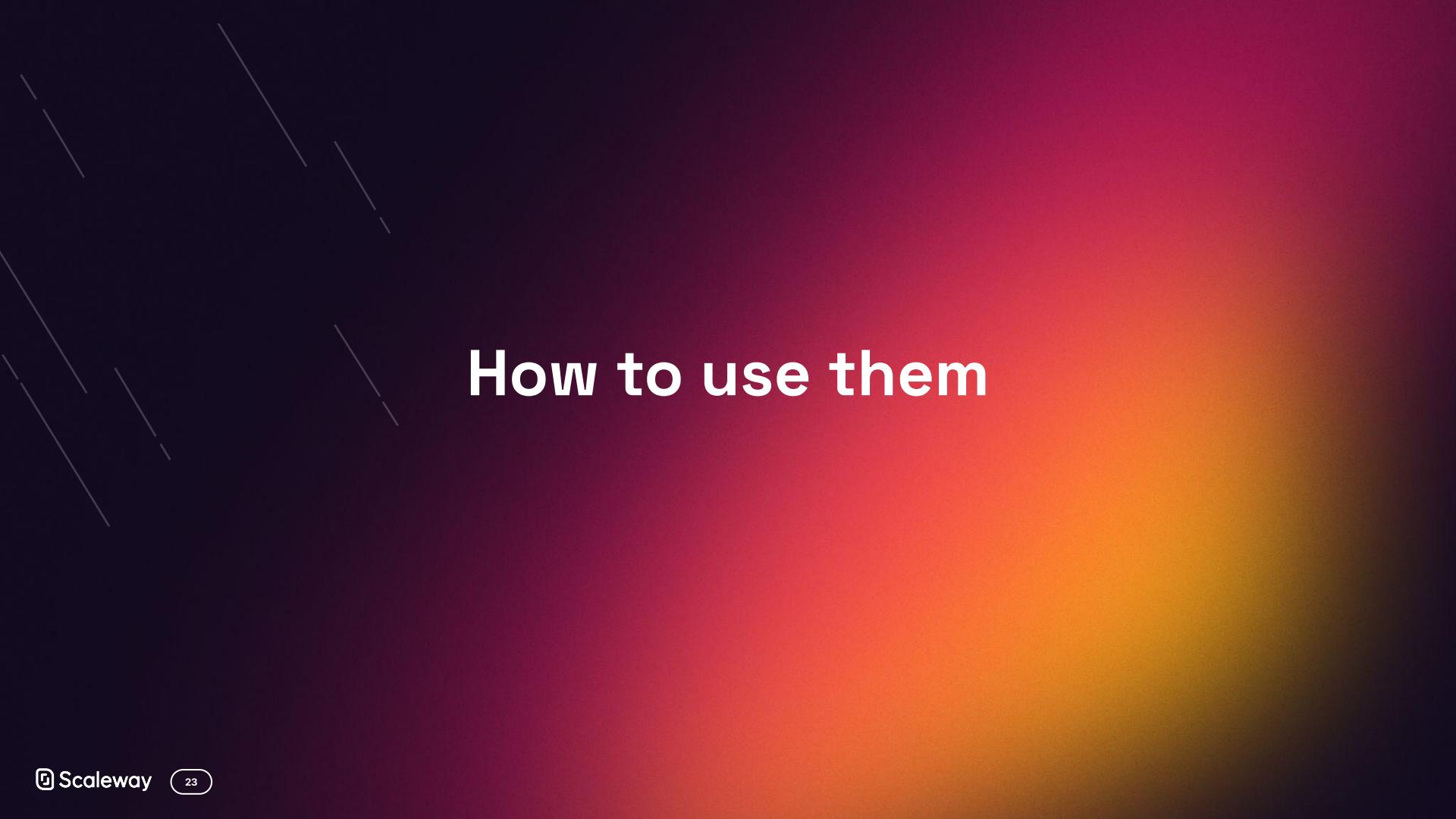
September 9, 2024



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 CISPA advance warning, we mitigated the issue before publication



# How to use them

How to use them

→console.scaleway.com

The screenshot shows the Scaleway console interface. At the top, there's a navigation bar with 'Organization' dropdown, 'Create' button, search bar ('Resources, IDs, or products'), and various status indicators. On the right, it shows 'Organization: Fabien PIUZZI' and a 'FP' icon.

The main area is the 'Organization Dashboard' for 'Fabien PIUZZI'. It features a large white triangle pointing upwards from the center. Inside the triangle, the text 'Organization' is at the top, followed by the organization name 'Fabien PIUZZI' in a large font, and a 'Copy ID' button at the bottom right.

Below the triangle, there are tabs for 'Overview', 'Pr...', 'Quotas', 'Settings', 'Security', and 'Contracts'. The 'Overview' tab is selected.

On the left sidebar, under 'Products', there are sections for 'Compute' (Instances), 'AI' (Generative APIs, Managed Inference - BETA), 'Bare Metal' (Elastic Metal, Apple silicon, Dedibox), and 'Containers'.

The central part of the dashboard has two main sections:

- Resources overview:** Shows 'Observability Cockpit' (1), 'SBS Volume' (1), and 'VPC' (2).
- Current consumption:** A circular chart showing a total consumption of €0.67 excl. taxes. The breakdown is: Network (€0.38) and Storage (€0.29). It also indicates 0 billing alerts and the last invoice.

At the bottom right of the dashboard, it says 'Updated 6 minutes ago'.

How to use them

## Select “Elastic Metal”

The screenshot shows the Scaleway Console interface. On the left, there's a sidebar with various navigation items like Organization Dashboard, Project Dashboard, Pinned Products, and sections for Products (Compute, AI, Bare Metal), Compute (Instances, Functions, NATS Account), AI (Generative APIs, Managed Inference BETA), and Bare Metal (Elastic Metal, Apple silicon, Dedibox, Containers). A large white arrow points from the text "Select ‘Elastic Metal’" to the "Elastic Metal" item in the sidebar. The main dashboard area has tabs for Overview, Resources, Security, and Contracts. It displays current consumption data: SBS Volume 1, Current consumption €0.67 excl. taxes, and a breakdown of costs: Network €0.38 and Storage €0.29. It also shows 0 billing alerts and the last invoice. The top right corner shows the organization name "Fabien PIUZZI".

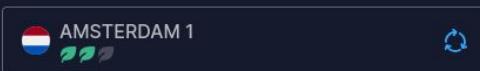
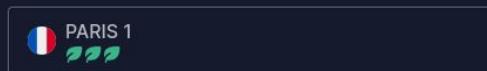
# Select “Paris 2”

[← 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.



### 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”

The screenshot shows a web-based server configuration tool. On the left, there's a vertical sidebar with various icons. The main area has a dark header with the text "Select a server". Below the header, a navigation bar includes tabs for "Aluminium", "Beryllium", "Iridium", "Lithium", "Titanium", and "Labs", with "Labs" being the active tab. A large white arrow points from the top right towards the "Labs" tab.

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 <small>①</small>
<b>EM-RV1-C4M16S128-A</b> 	€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

A large white arrow points from the bottom right towards the table.

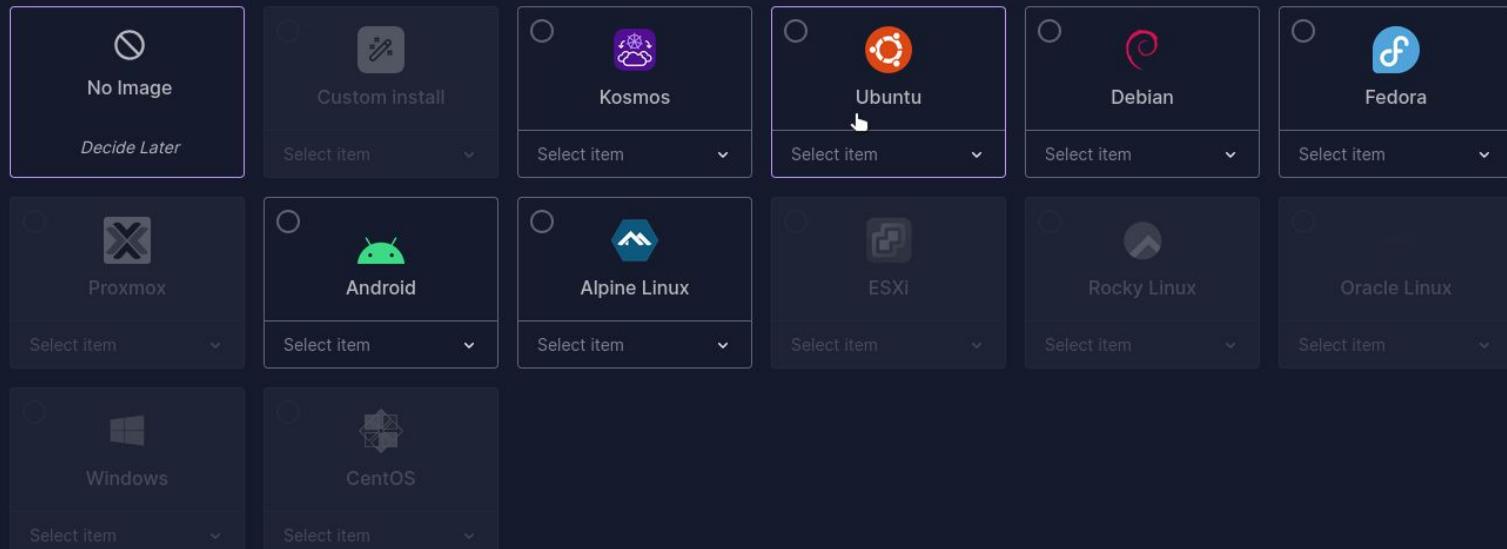
**4 Choose an image**

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.



# 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	FR 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.

[Overview](#)   [Logs](#)   [Private Networks](#)   [Settings](#)

## Elastic Metal server information

Status	Type	From image	Availability Zone
● Ready	EM-RV1-C4M16S128-A <i>Monthly</i>	Ubuntu 24.04 LTS (Noble Numbat)	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		
<b>Description</b>			
Click to add description			

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

**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!

