



基于 RISC-V 的 Linux 系统

发行版及软件生态

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Thu, Dec 15, 2022 @ 厦门市开源芯片产业促进会

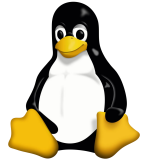


AGENDA



Fedora

Fedora on RISC-V



Distro

Linux Distros on RISC-V



Status

The software component



Prospect

From IoT to HPC



Part I

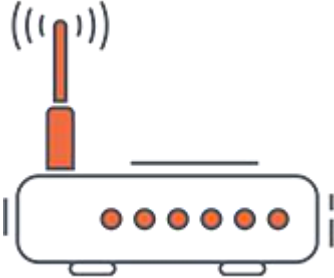
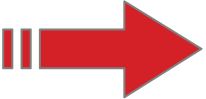
Fedora on RISC-V



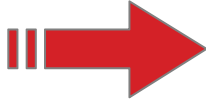
Linux distros are everywhere



End devices



Gateway



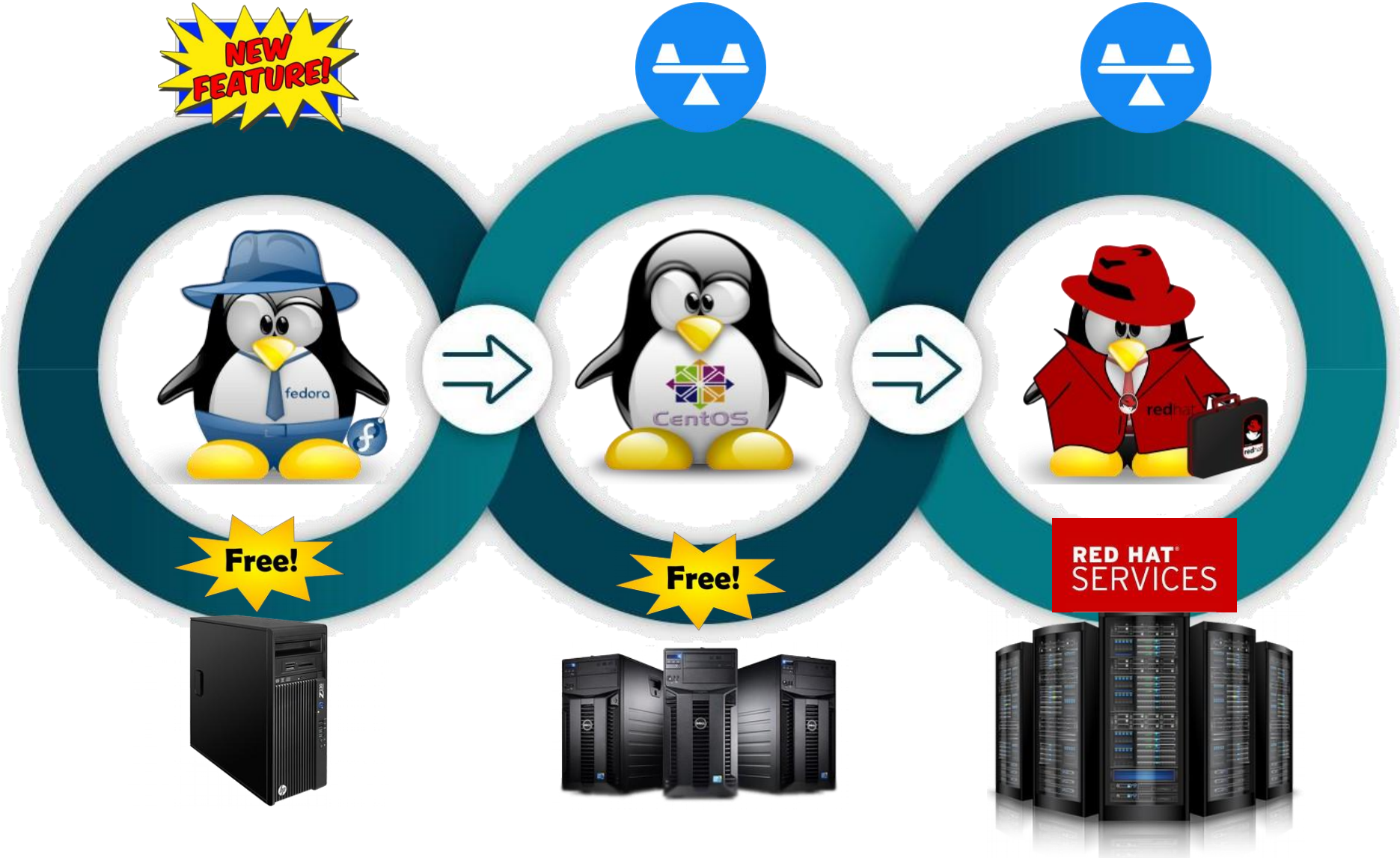
Cloud platform & Edge computing

Cross Compilation

Cross Compilation



Fedora/CentOS stream/RHEL

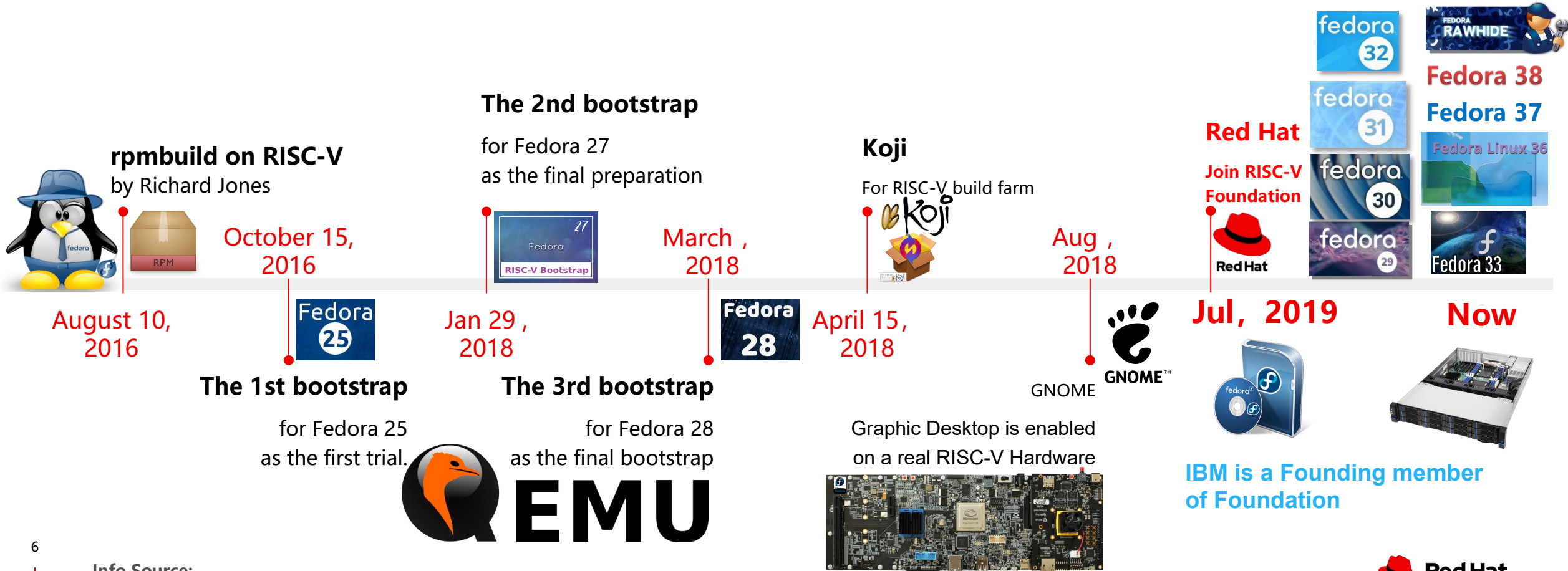


History

Fedora on RISC-V History

Since Fedora has an **upstream first policy** and it also applies to Fedora/RISC-V.

We need all the key patchsets for **toolchain**, **Linux kernel** and **glibc** to be merged, then we can do the final **bootstrap** on RISC-V.



History



“Fedora 29 GNOME desktop” on SiFive Unleashed with Expansion Board and PCI-E graphic Card



The issue for a new architecture with Linux Distro

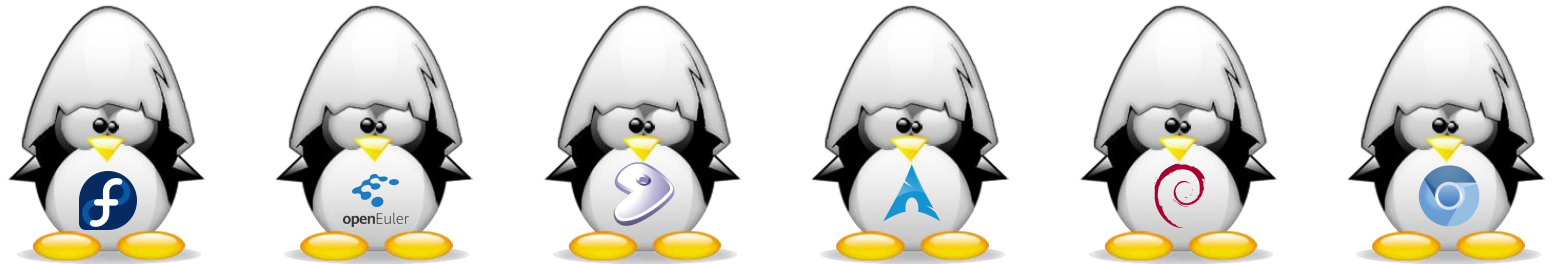


Chicken And Egg Situation

Generally, one Linux Distro release is built upon the previous release. But this can **NOT** be done for a brand new architecture, because we don't have a "previous release" at that point.

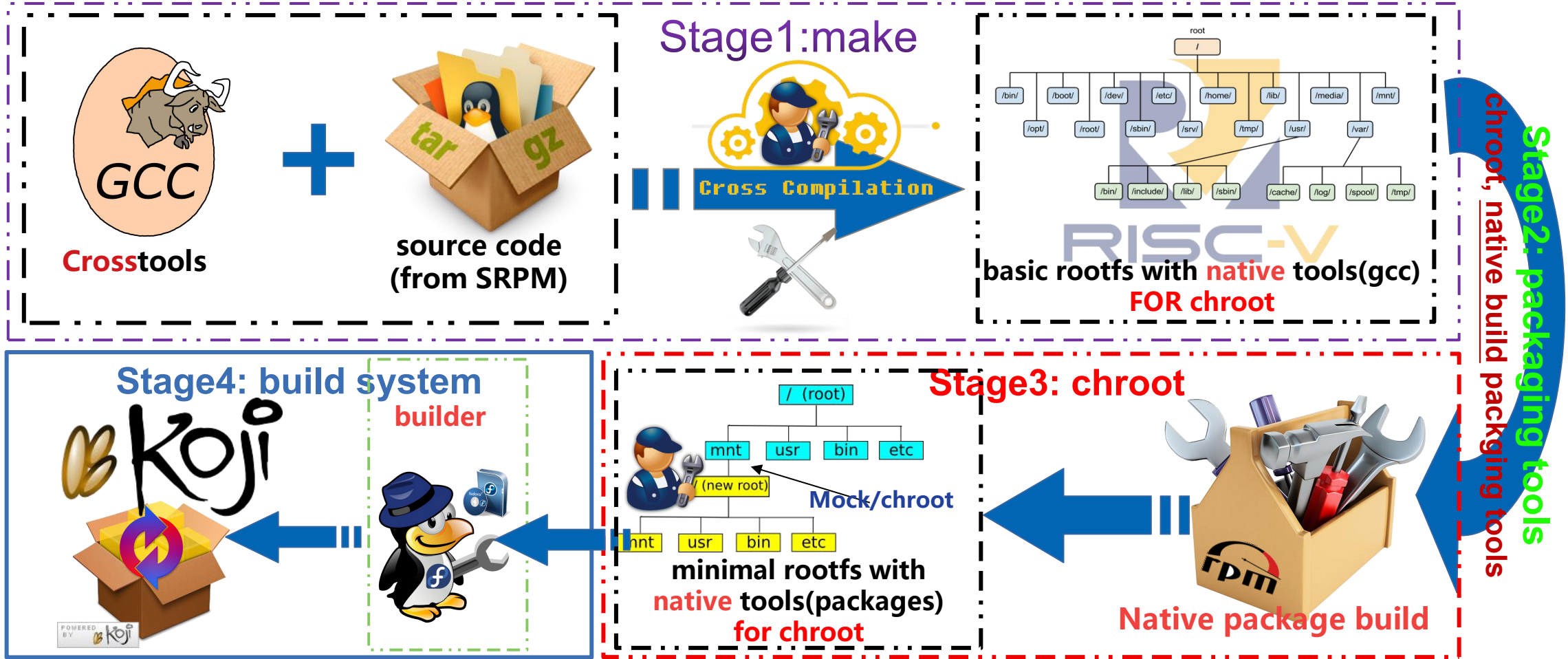
Breakout

We must **cross-compile** enough software/packages to "**bootstrap**" the new architecture.



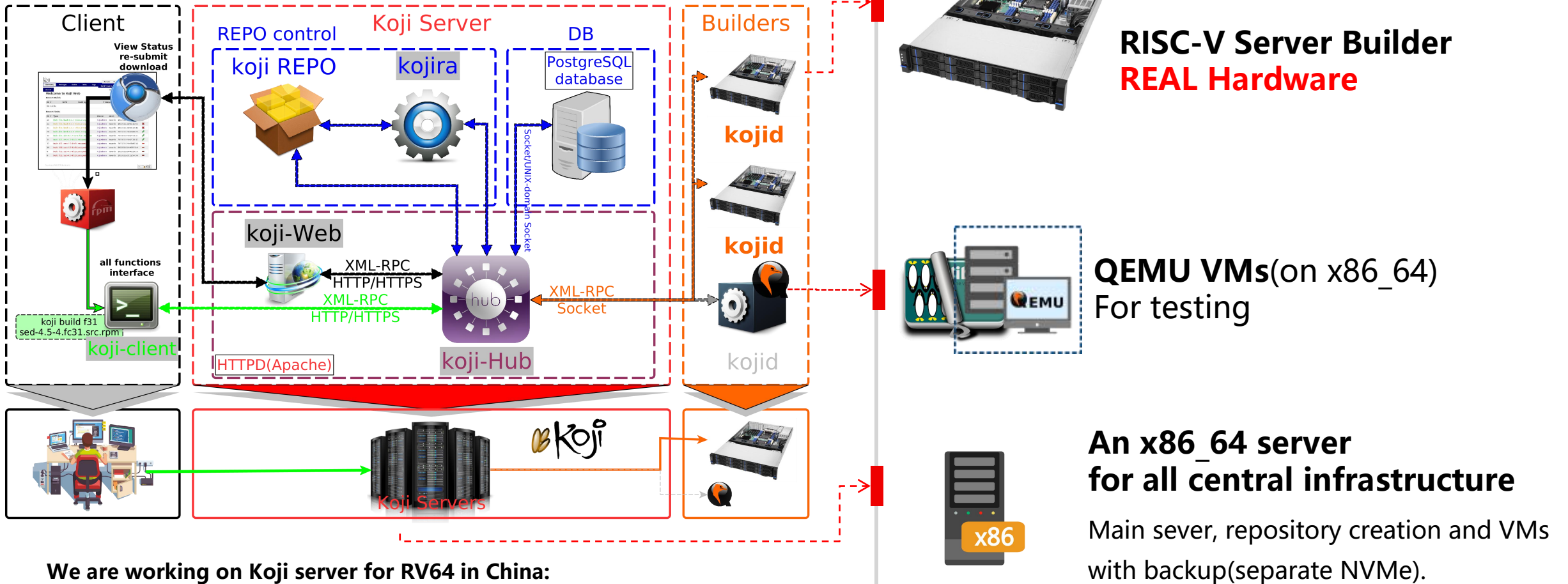


Linux Distros bootstrap



Koji Build System for RPMs & Image

Koji builds RPMs for the Fedora Project and EPEL.



We are working on Koji server for RV64 in China:

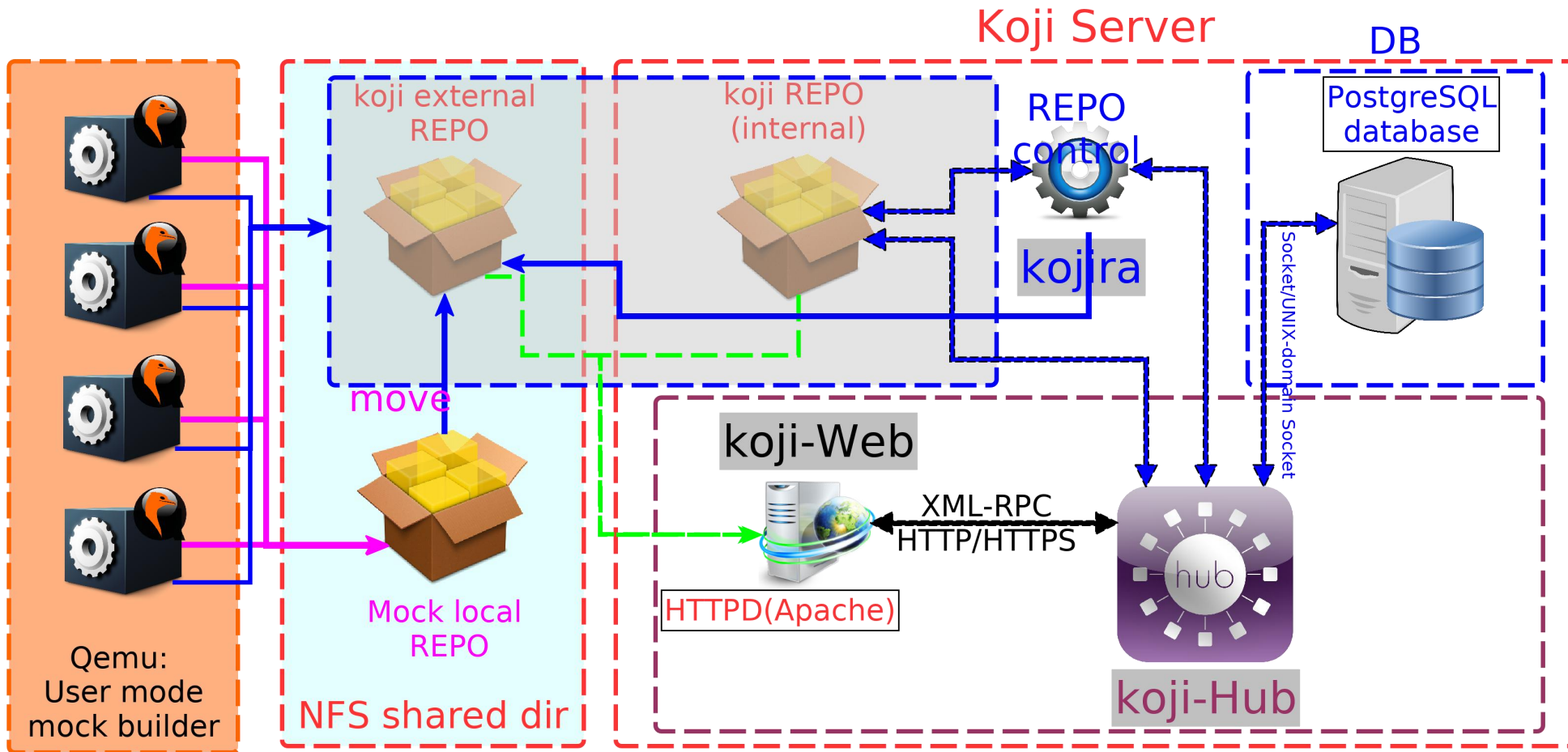
ISCAS support: <https://openkoji.iscas.ac.cn/repos/fc36dev/>

David is working on ROCKS server

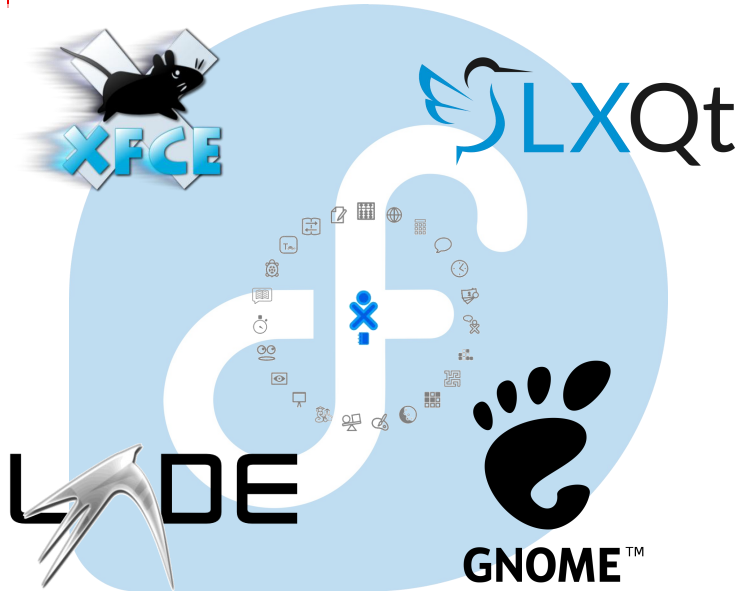
<http://fedora.riscv.rocks/koji/>

mock builder(user mode) with Koji Build System

当我们没有真正的RISC-V服务器的时候，
qemu user mode可以帮助我们加速编译，但也有他的局限性。



The Status of Fedora on RISC-V



Fedora

Bootable: Yes, OpenSBI + U-Boot + GRUB on QEMU&Hardware
package management: dnf + rpm

Build system: Koji + Mock

Status: Upgrading to Fedora 37, then **Rawhide**

REPO: 14400+ srpm have been built

Repositories

Openkoji

<https://openkoji.iscas.ac.cn/repos/>

Rocks

<http://fedora.riscv.rocks/repos/>

The Status of Fedora on RISC-V



RPM packaging

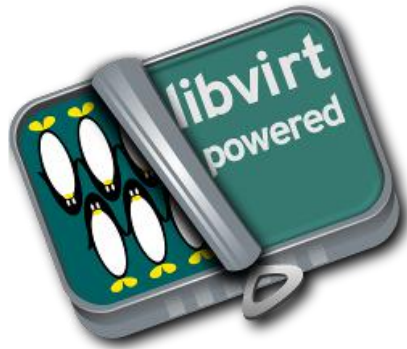
- [F37-->rawhide] **【 On Going 】**

[<https://openkoji.iscas.ac.cn/repos/fc36dev/>] as REPO

main package version:

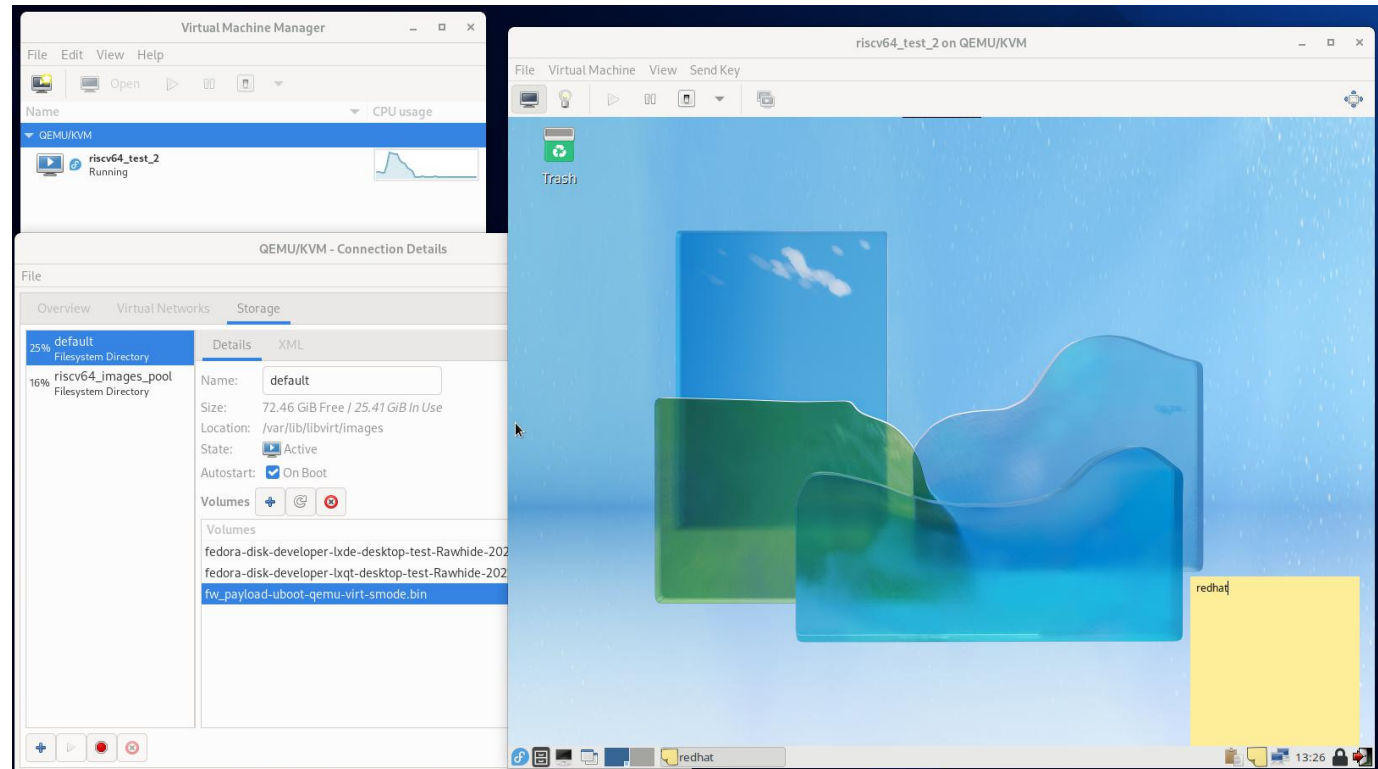
- Toolchain(**up-to-date**)
 - gcc-12.2.1-2
 - glibc-2.36-4
 - Binutils 2.39-3
- libffi-3.4.3-1.1(**up-to-date**)
- java-latest-openjdk-19.0.0.0.36-2(**up-to-date**)
- perl-5.36.0-492[rawhide](**up-to-date**)
- Python 3.11(**up-to-date**)
- LLVM/Clang 15.0.0-1(**up-to-date**)
- Go 1.18-1 → 1.19-1[rawhide](**updating**)
- Rust 1.63.0-1 → Rust 1.65[rawhide] (**updating**)

Major test Platform



Virtual: QEMU and libvirt/QEMU

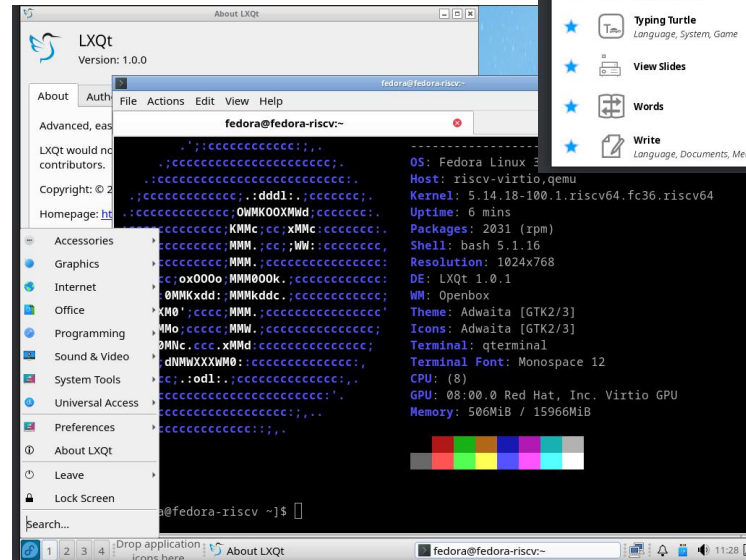
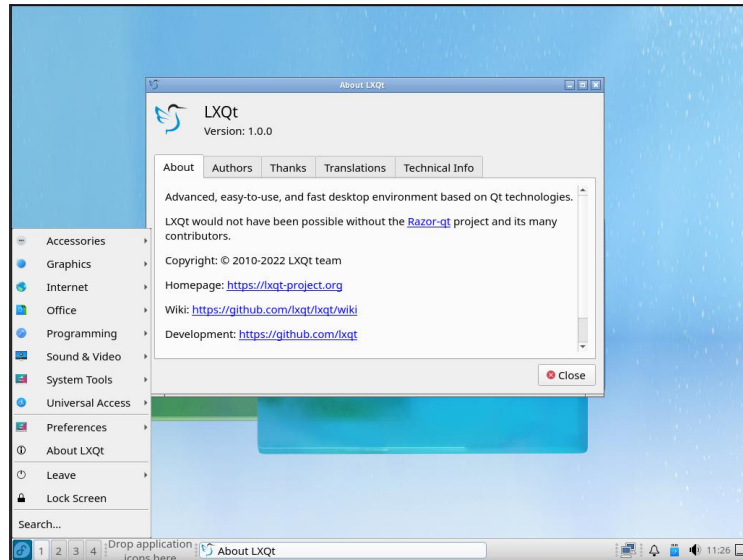
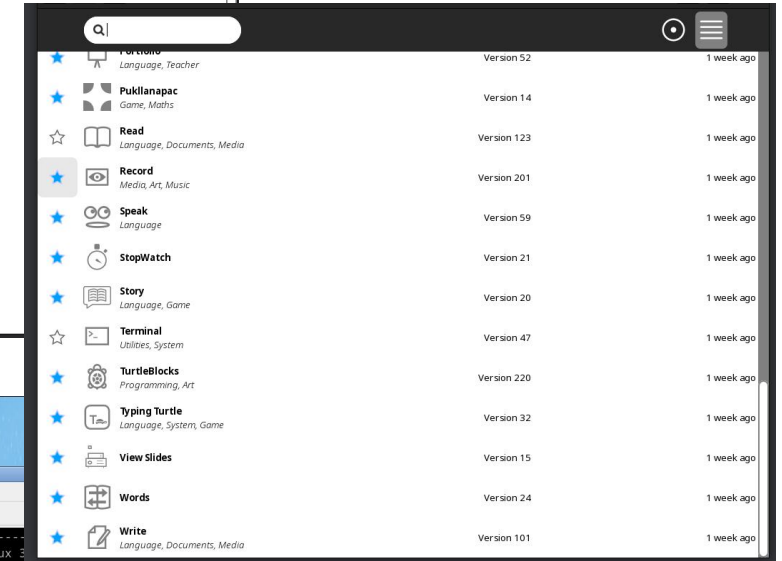
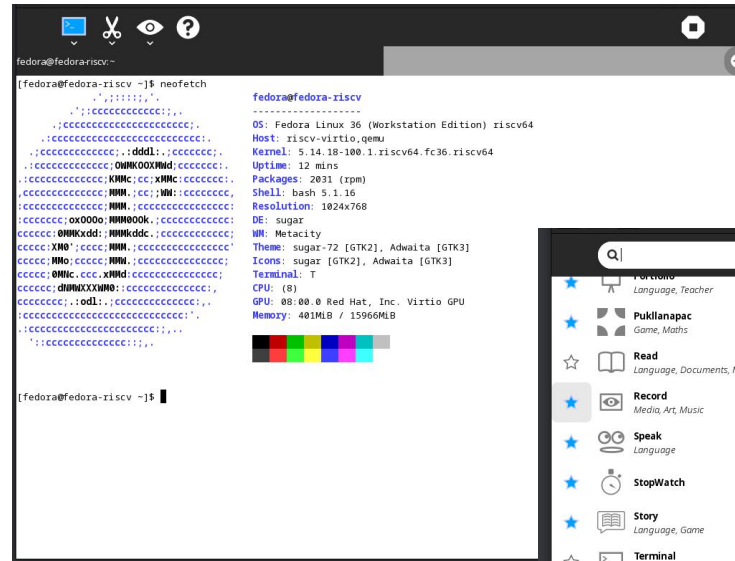
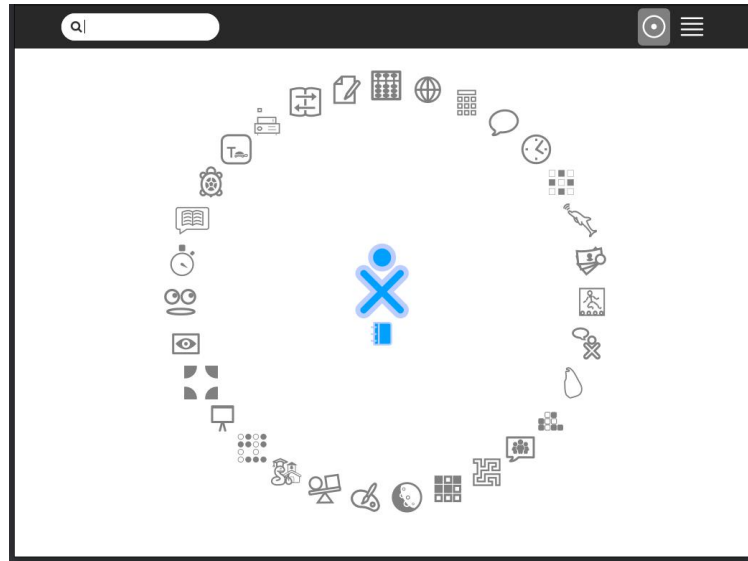
Fedora Images can run on the libvirt/QEMU with graphics parameters (Spice).



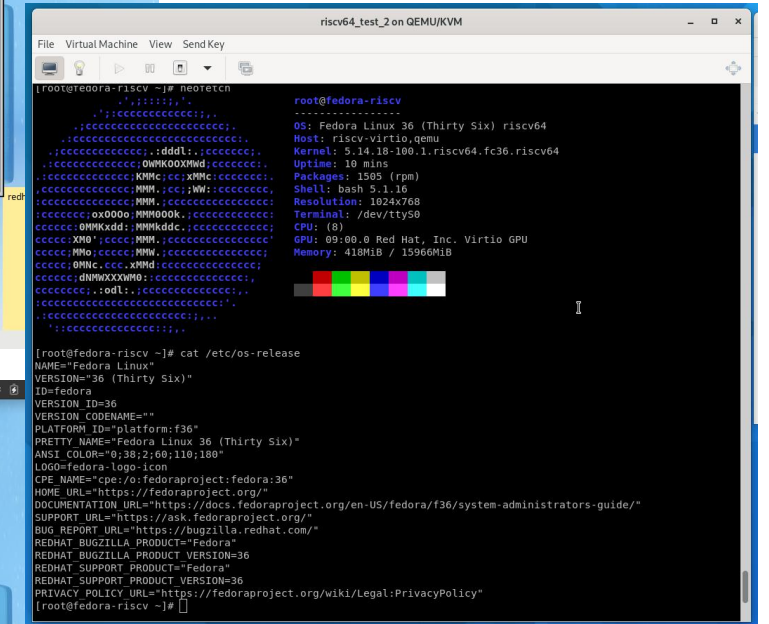
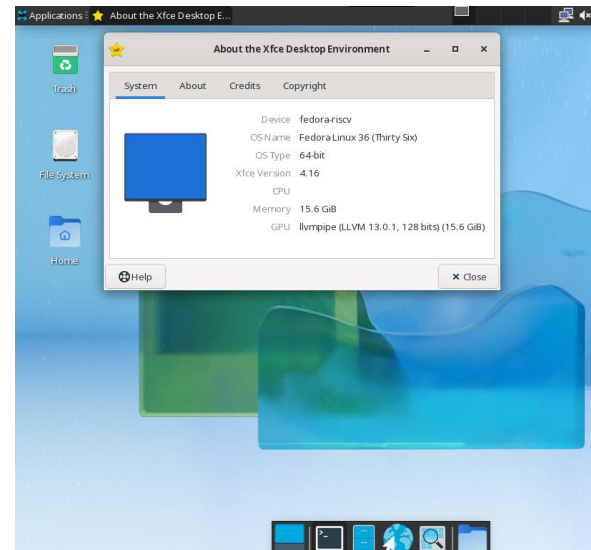
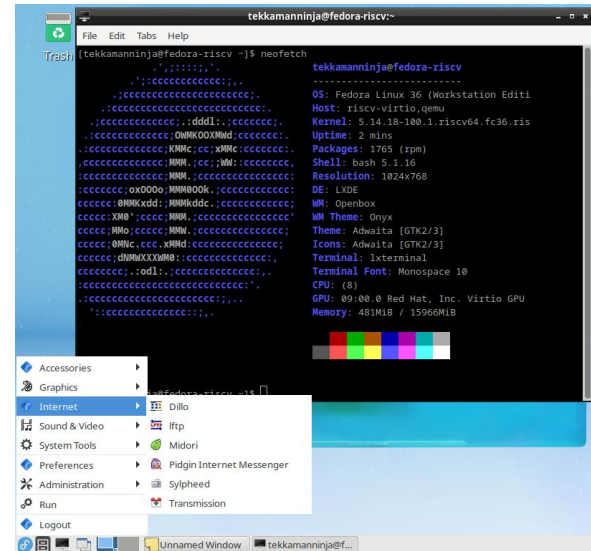
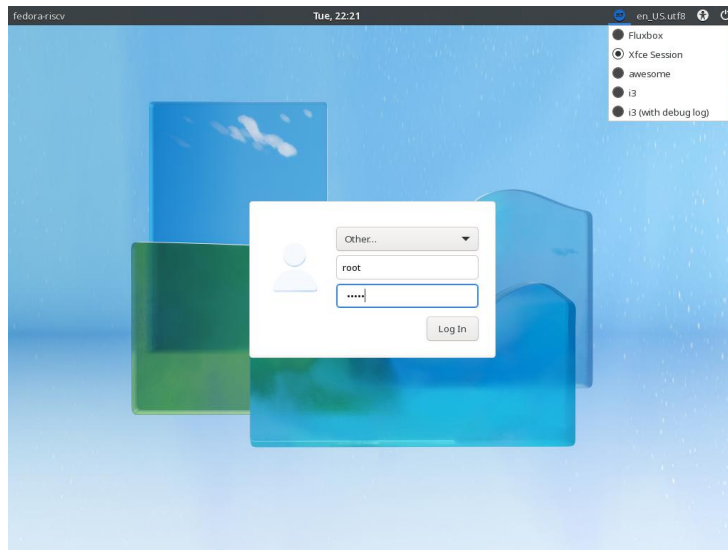
Run Fedora 36 on QEMU(riscv64)



OLPC



Run Fedora 36 on QEMU(riscv64)



Supported Platform

Allwinner D1

[Fedora 36 Images](#) can run on this development platform .

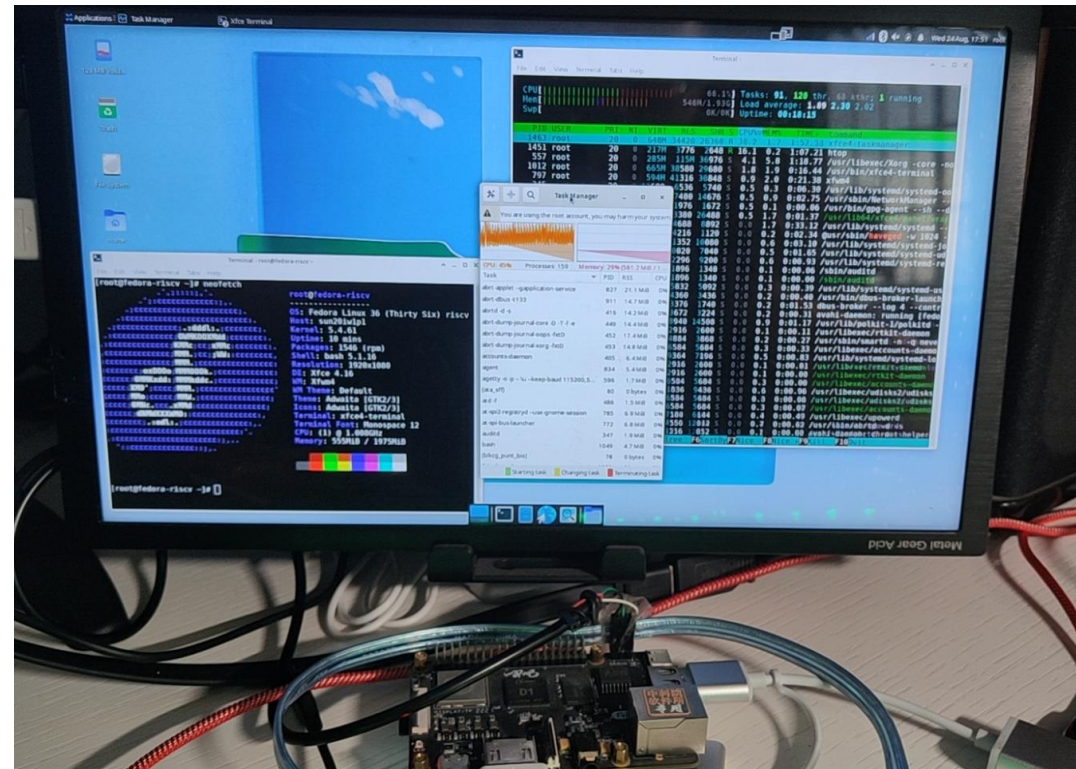
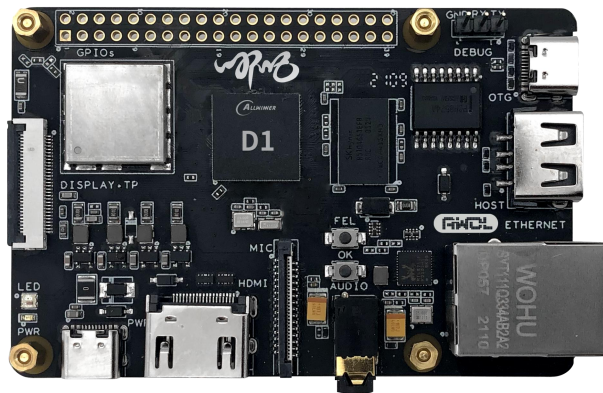


Image Download:

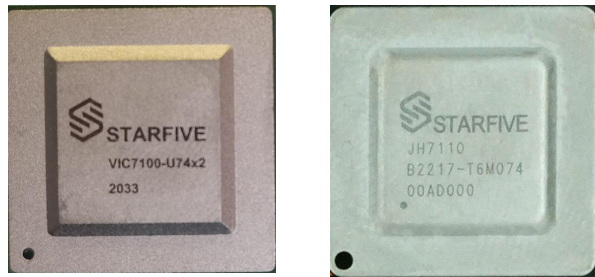
https://openkoji.iscas.ac.cn/pub/dl/riscv/Allwinner/Nezha_D1/images-release/Fedora/



Platforms (TODO)



StarFive
赛昉科技

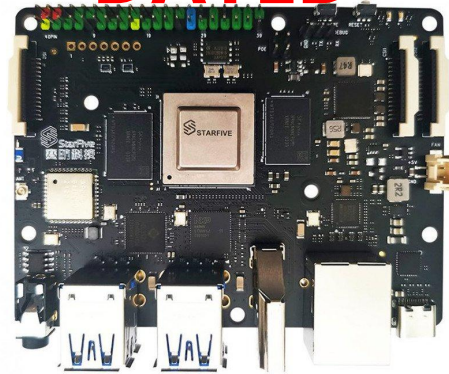


JingHong Platform - JH71X0

Fedora Images can run on VisionFive V1 & V2.

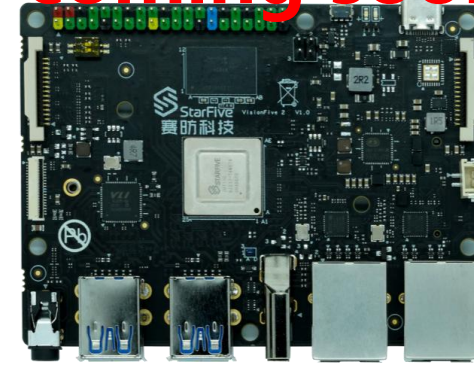
OpenSBI+U-Boot+GRUB + Linux kernel are upstreaming.

DATED



StarFive VisionFive
V1 (JH7100)

coming soon



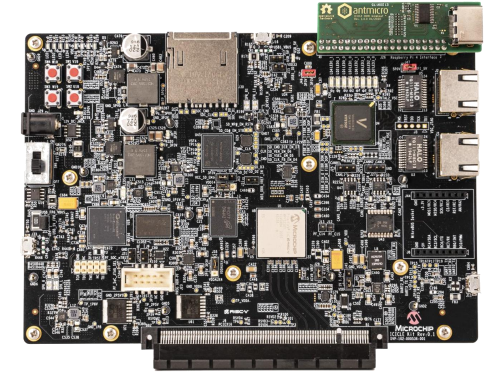
StarFive VisionFive
V2 (JH7110)



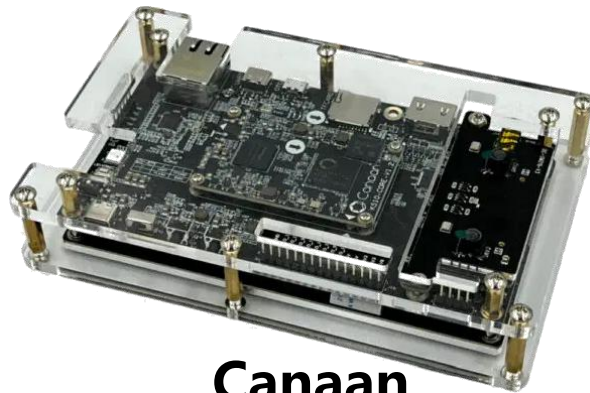
Platforms (TODO)



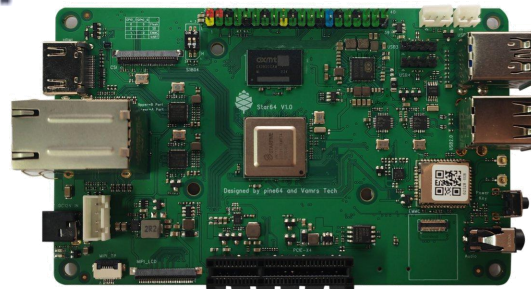
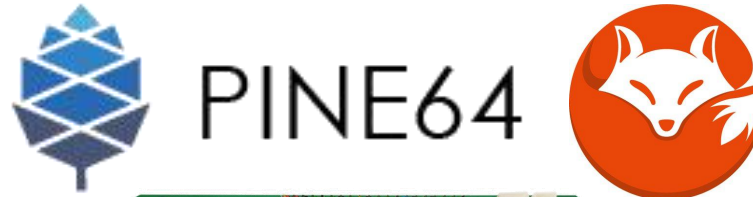
SiFive Unmatched



PolarFire SoC Icicle Kit



**Canaan
Kendryte K510**



Star64 (基于 JH7110)



Part II

Linux Distros on RISC-V



Debian

Arch-Linux

Gentoo

.....



The Status of Linux Distro on RISC-V



Arch-Linux

Bootable: yes, OpenSBI + U-Boot on QEMU and Hardwares
package management: pacman + bsdtar

Build system: Arch Build System(ABS) , but currently using devtools (systemd-nspawn)

Status: **bootable Image**



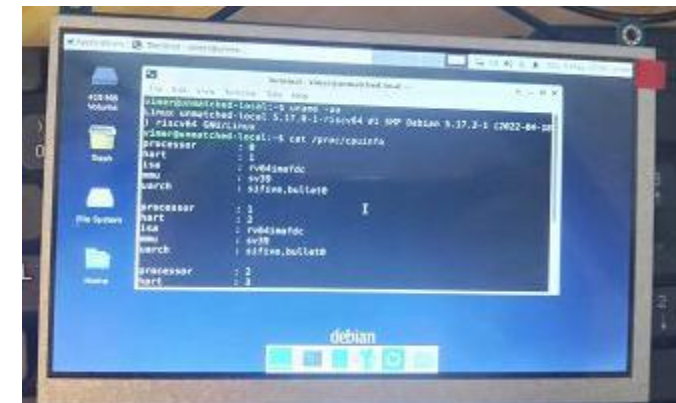
Debian

Bootable: Yes, on QEMU and Hardware

package management: apt + deb

Build system: buildD

Status: In maintenance



Info Source:

Arch: Felix Yan(晏然), Sequencer(刘玖阳)

Debian: <https://wiki.debian.org/RISC-V>

<https://riscv.org/exchange/software/>

The Status of Linux Distro on RISC-V



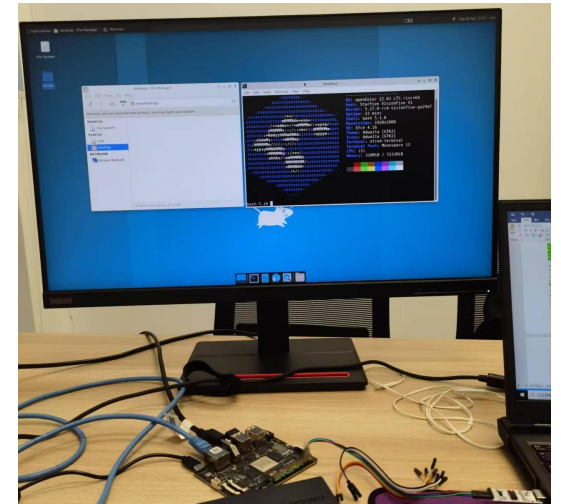
Gentoo

Bootable: Yes, OpenSBI + U-Boot on QEMU&hardware
package management: emerge + portage
Build system: portage
Status: **bootable Image**

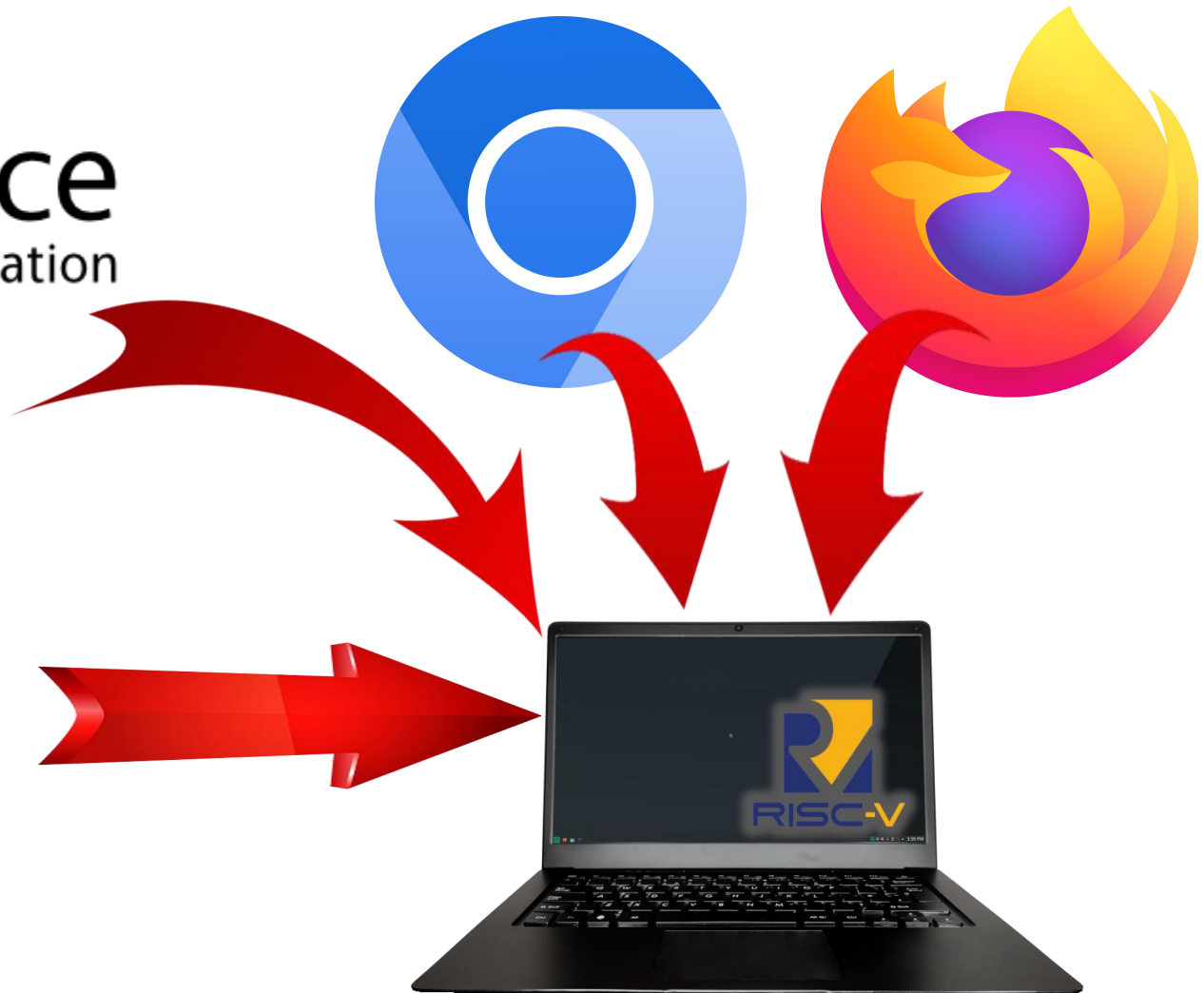


openEuler

Bootable: Yes, OpenSBI + U-Boot on QEMU and Hardwares
package management: dnf + rpm
Build system: OBS, Koji or oepkg
Status: **bootable Image**



The Status of Linux Application on RISC-V



Android on RISC-V



Info Source:

Android : <https://github.com/T-head-Semi/aosp-riscv>

<https://plctlab.github.io/aosp/create-a-minimal-android-system-for-riscv.html>

<https://riscv.org/blog/2022/10/first-patches-from-alibaba-cloud-enable-android-open-source-project-on-risc-v-han-mao-and-david-chen-alibaba-could/>

Android Open Source Project (AOSP)

Bootable: Yes, OpenSBI + U-Boot on QEMU and C910

package management: apk

Build system: Android Studio

Status: demo can run on C910



RVI: <https://github.com/riscv-android-src>

PLCT lab: <https://github.com/aosp-riscv>

[First Patches from Alibaba Cloud Enable AOSP on RISC-V](#)



Android on RISC-V

<https://android-review.googlesource.com/c/platform/external/kernel-headers/+2239953>

Android Open Source Project CHANGES ▾ DOCUMENTATION ▾ BROWSE ▾

Merged [2239953](#) Regenerate the v5.19 kernel headers to include riscv.

Change Info SHOW LESS ^

Submitted Oct 01
Updated Oct 01
Owner Elliott Hughes
Reviewers Dan Albert +2 Treehugger R...
 Lint Lint Lint
CC Han Mao
Repo | Branch [platform/external/kernel-headers](#) | [master](#)
Parent [479f010](#)
Merged As [ecd9d2d](#)
Hashtags

Submit Requirements

- Code-Review +2
- Presubmit-Verified +2
- Code-Owners Approved
- Open-Source-Licensing No votes
- Lint No votes

Trigger Votes

Autosubmit +1

Regenerate the v5.19 kernel headers to include riscv.

Kernel headers coming from the same source as the previous commit:

Git: <https://android.googlesource.com/kernel/common/>
Branch: android-mainline
Tag: android-mainline-5.19

Signed-off-by: Mao Han <han_mao@linux.alibaba.com>
Signed-off-by: Xia Lifang <lifang_xia@linux.alibaba.com>
Signed-off-by: Chen Guoyin <chenguoysin.cgy@linux.alibaba.com>
Signed-off-by: Wang Chen <wangchen20@iscas.ac.cn>
Signed-off-by: Lu Xufan <luxufan@iscas.ac.cn>
Test: NA
Change-Id: [Iec6299f42a3599dfcb0f0df0cd9762ee2731a6b0](#)

Comments No comments

Linux software development info for RISC-V



ISCAS

中国科学院软件研究所
Institute of Software Chinese Academy of Sciences

./ PLCT Lab

Compilers, Runtimes, and Emulators.

RISC-V East Asia Biweekly Sync [中文]



I WANT YOU! I WANT YOU



RISC-V Open Hours [English]

Info Source:

<https://github.com/cnrv/RISCV-East-Asia-Biweekly-Sync>

<https://community.riscv.org/risc-v-open-hours/>

RISC-V Lab in China by ISCAS PLCT Lab

ISCAS

中国科学院软件研究所
Institute of Software Chinese Academy of Sciences

./ PLCT Lab

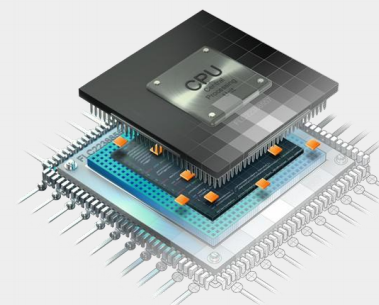
Compilers, Runtimes, and Emulators.



- PLCT Lab is building a RISC-V Cluster
 - near 1024 cores, Nezha/D1 board
 - date to public (plan): Dec 1, 2022
- ISCAS has a few more Unmatched board available
 - Free free to send PRs! <https://github.com/plctlab/riscv-lab-access/pulls>

Part III

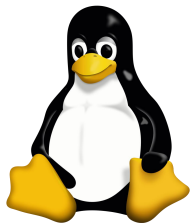
The software component



The Status of RISC-V Firmware and Linux



U-Boot



OpenSBI

Firmware for RISC-V, upstream **main** branch, **generic** platform with the right **dtb** file.
NO patch required for most of platforms



U-boot

The latest u-boot(upstream, **main**)with **some patches** works fine on RISC-V, can boot some **Linux** distros.



GRUB2

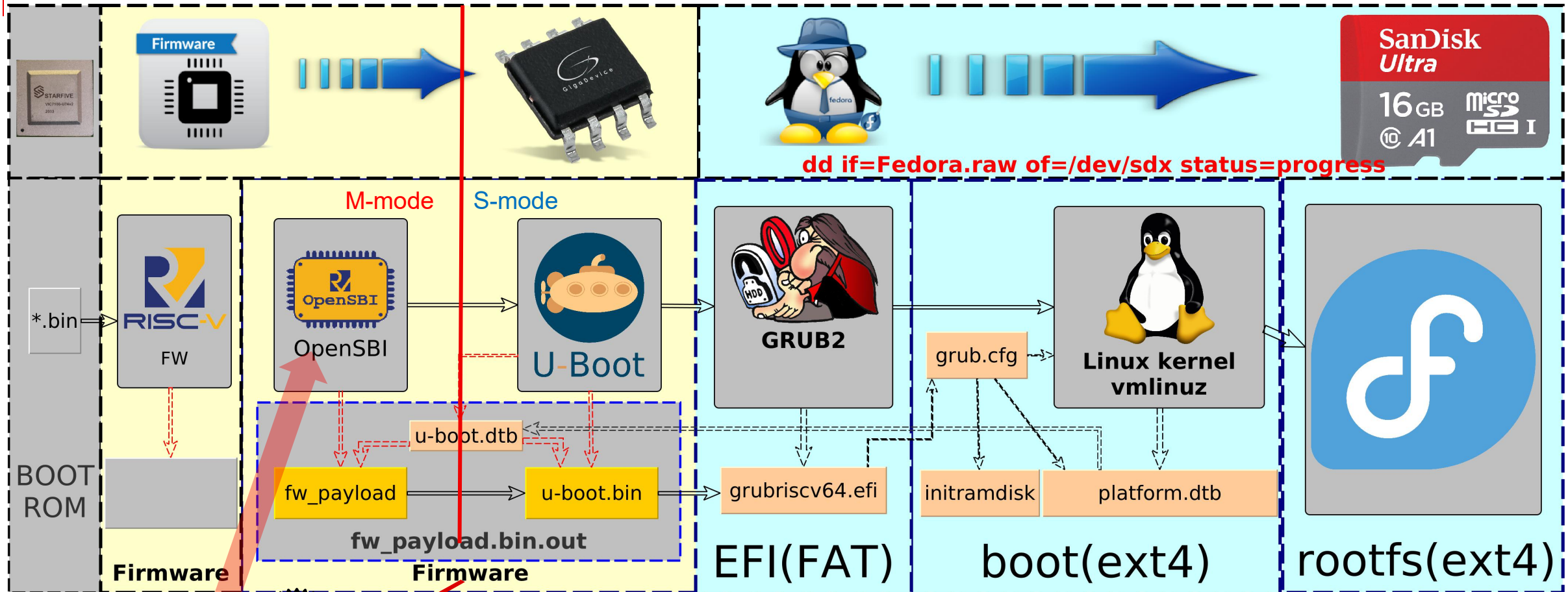
The GRUB(mainline)with a few patches works well on riscv64, can boot Linux distros.



Linux kernel

The **upstream main** branch of Linux works well on RISC-V. We are working with opensource community together on upstreaming the patches for some platform.

Boot flow for Linux on riscv64



RustSBI



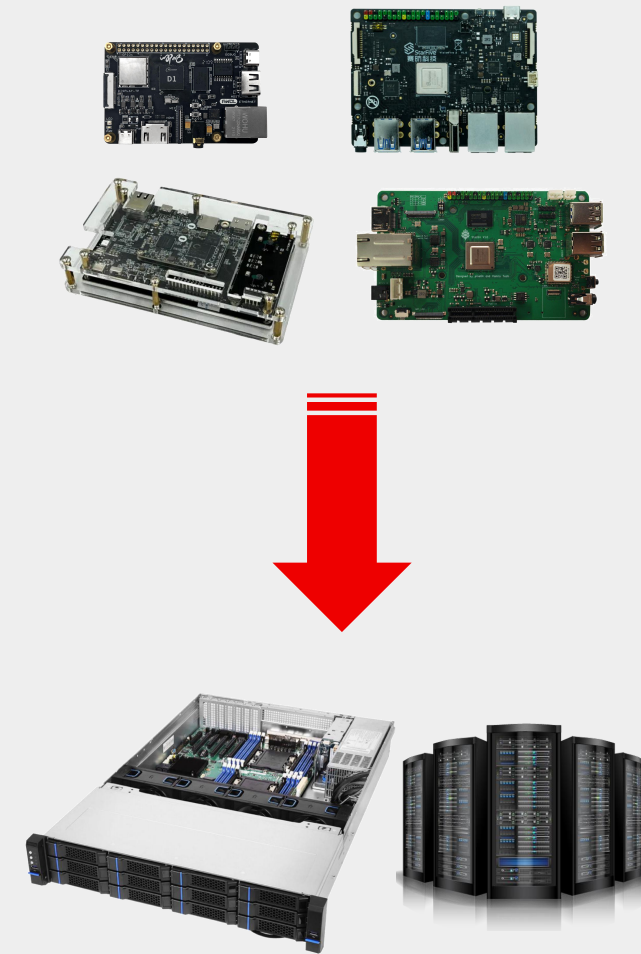
RISC-V SBI library in Rust, runs on M or HS mode; good support for embedded Rust ecosystem.

Info Source:

<https://github.com/rustsbi>

Part III

From IoT to HPC



The Status of RISC-V Firmware for PC & Server



UEFI: Unified Extensible Firmware Interface.

HPE is currently working on the next RISC-V edk2 port release which incorporates with OpenSBI v0.9 that supports the firmware domains for HSM.

HPE is also working on RISC-V EDK2 OVMF and Starlight platforms. Contributors from HPE :

Abner Chang

Daniel Schaefer

ACPI: Advanced Configuration and Power Interface

Static tables provided by system firmware to the standard ACPI compliant OS for system info and configuration.

Contributors from Ventana Micro Systems:

Sunil V L

Rahul Pathak

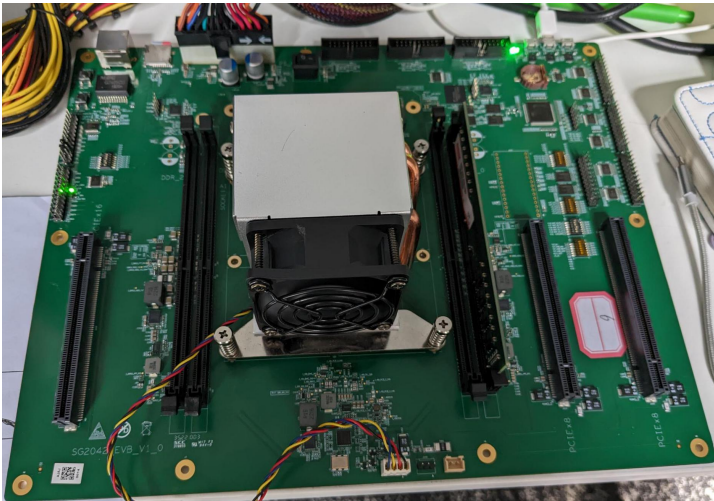
Kumar Sankaran

Mayuresh Chitale

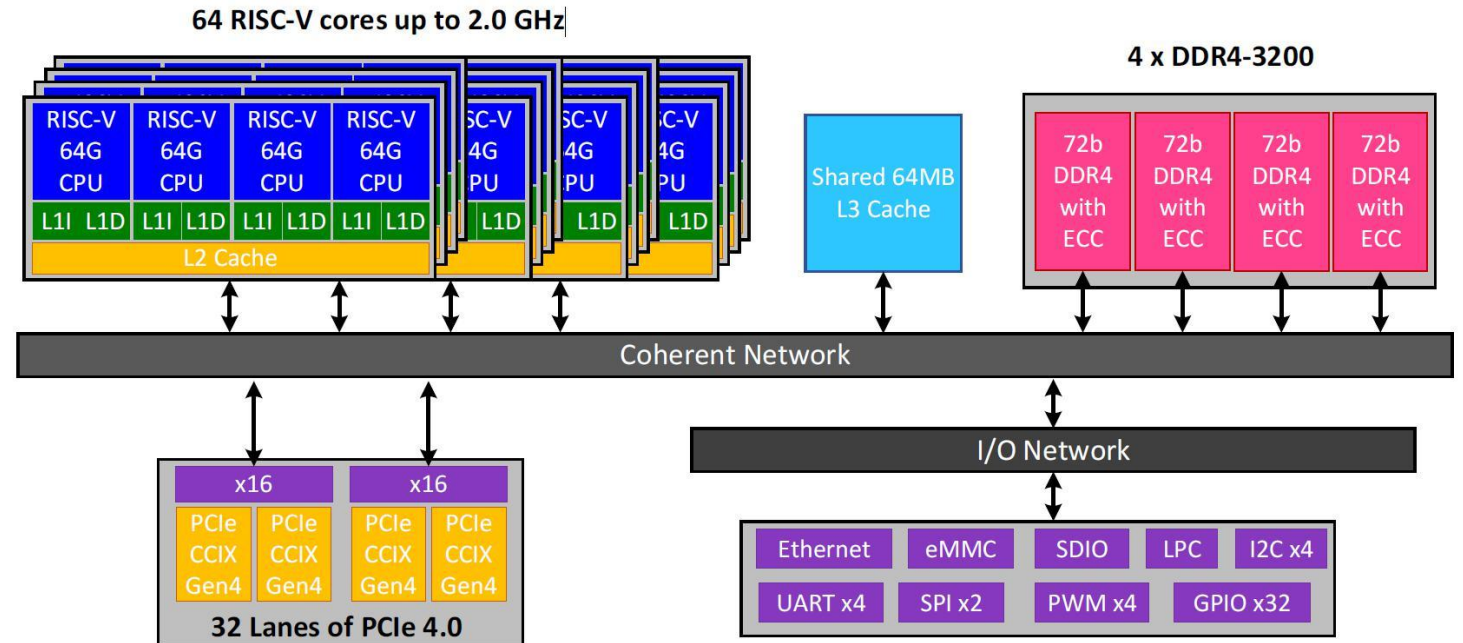
<https://linuxplumbersconf.org/event/11/sessions/114/#20210921>

The world FIRST RISC-V Server development platform

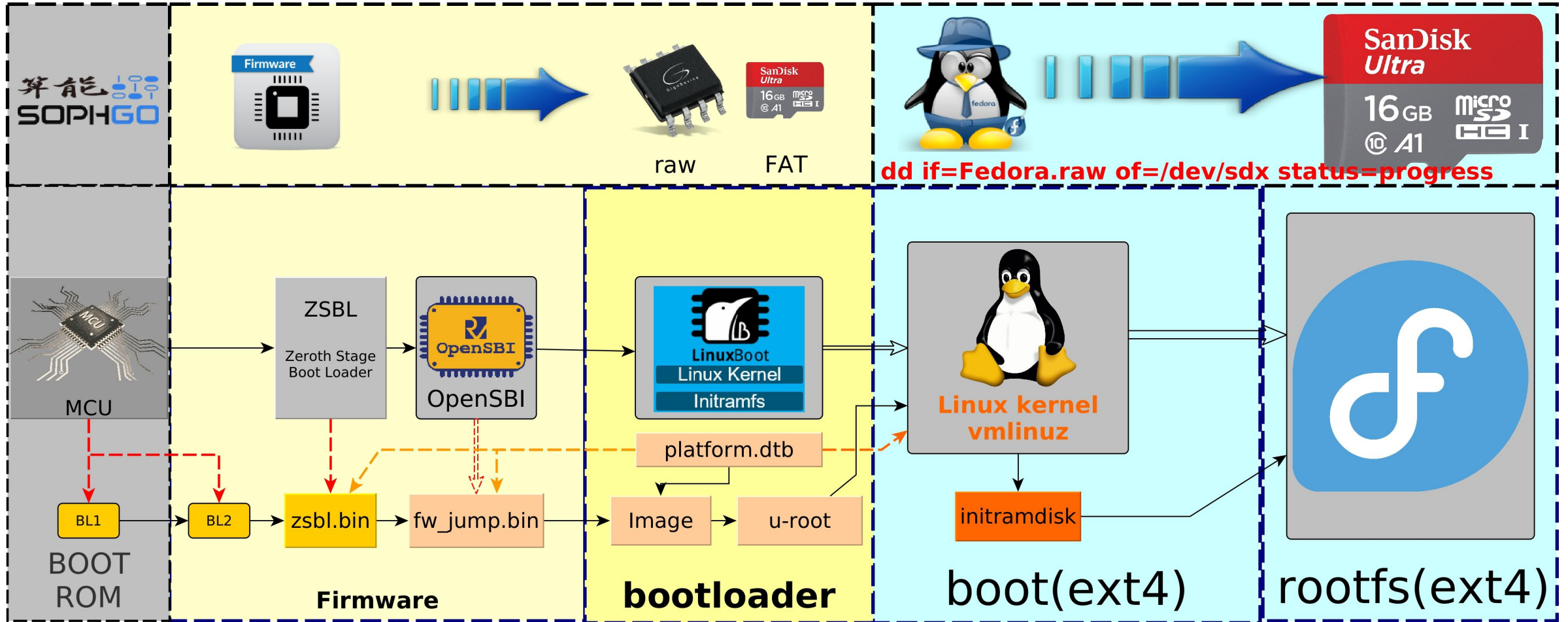
SOPHGO 算能



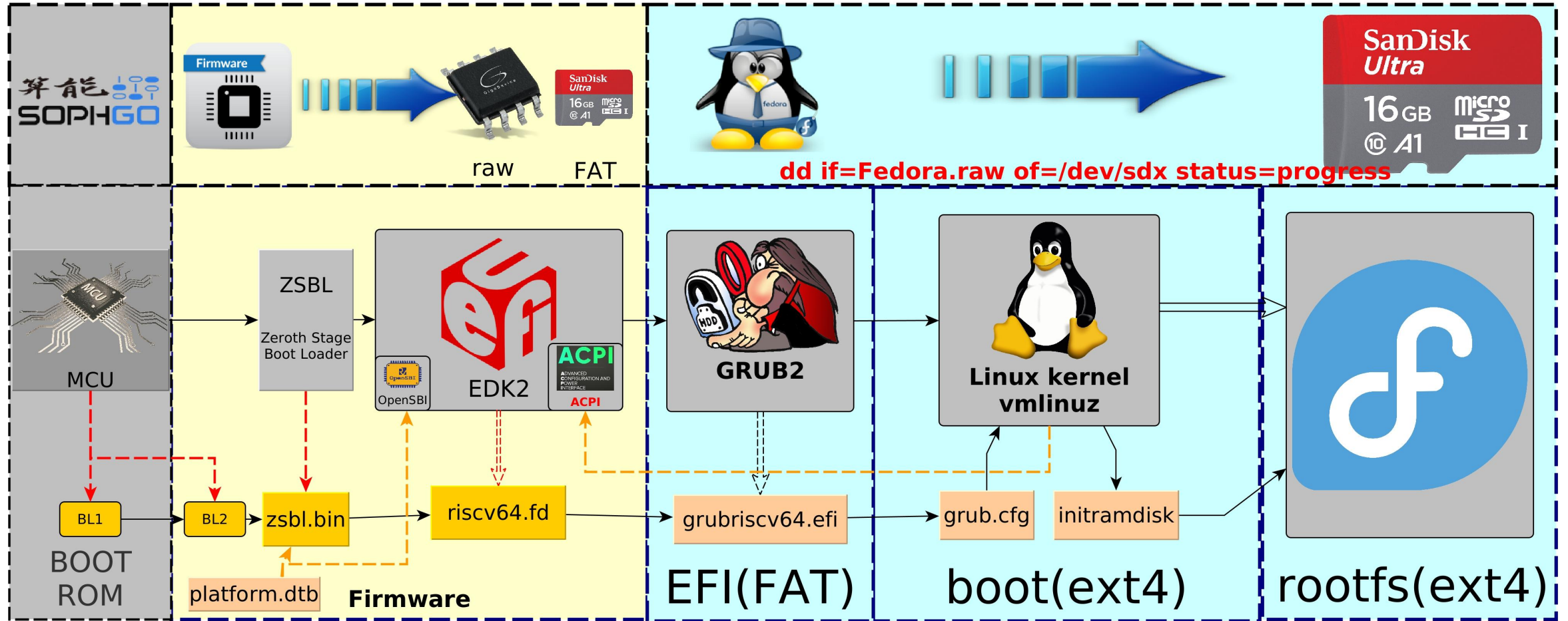
SG2042 RISC-V General Server



The current boot flow for SG2042



The future boot flow for SG2042



RISC-V Server platform



EuroHPC
Joint Undertaking



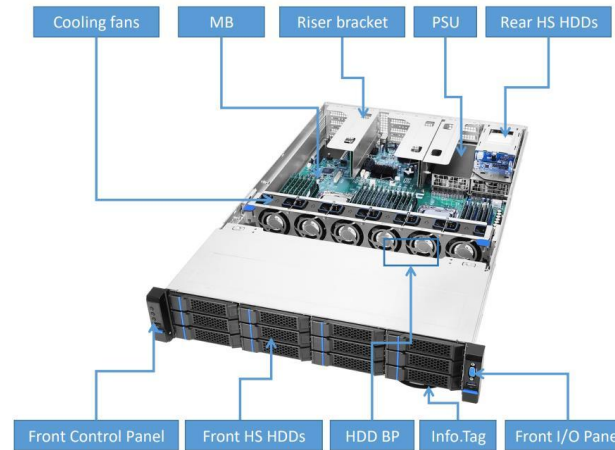
VENTANAMICRO

Veyron V1



intel

算能 SOPHGO



COMING SOON



Info Source:

<https://riscv.org/blog/2022/08/risc-v-international-and-intel-team-up-to-accelerate-risc-v-adoption-introducing-intel-pathfinder-for-risc-v-intel-corporation/>



Acknowledgments



Abner Chang
Gilbert Chen

Al Stone
Andrea Bolognani
Charles Wei
DJ Delorie
John Feeney
Mark Salter
Richard Jones

David Abdurachmanov

Alistair Francis
Anup Patel
Atish Kumar Patra

Akira Tsukamoto
Drew Fustini
Mikael Frykholm
Stefan O'Rear



... and countless other individuals and companies, who have contributed to RISC-V specifications and software eco-system!



Thank you

Red Hat is the world's leading provider of enterprise open source software solutions. Award-winning support, training, and consulting services make Red Hat a trusted adviser to the Fortune 500.



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