Linux on RISC-V

software ecosystem update

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Fri, Nov 18, 2022 @ RISC-V Days Tokyo 2022 Autumn

RISC-V Days Tokyo2022 Autumn

AGENDA

Fedora — **Fedora on RISC-V**

Distro — **Linux Distros on RISC-V**

Status — **The software component**

Prospect — **From IoT to HPC**

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Part I

Fedora on RISC-V

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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.

rpmbuild on RISC-V

by Richard Jones

August 10, 2016

October 15, 2016

The 1st bootstrap

for Fedora 25
as the first trial.

Jan 29 , 2018

The 2nd bootstrap

for Fedora 27
as the final preparation

March , 2018

The 3rd bootstrap

for Fedora 28
as the final bootstrap

April 15, 2018

Koji

For RISC-V build farm

Aug , 2018

GNOME

Graphic Desktop is enabled
on a real RISC-V Hardware

IBM is a Founding member of Foundation

Red Hat

Join RISC-V Foundation

Jul, 2019

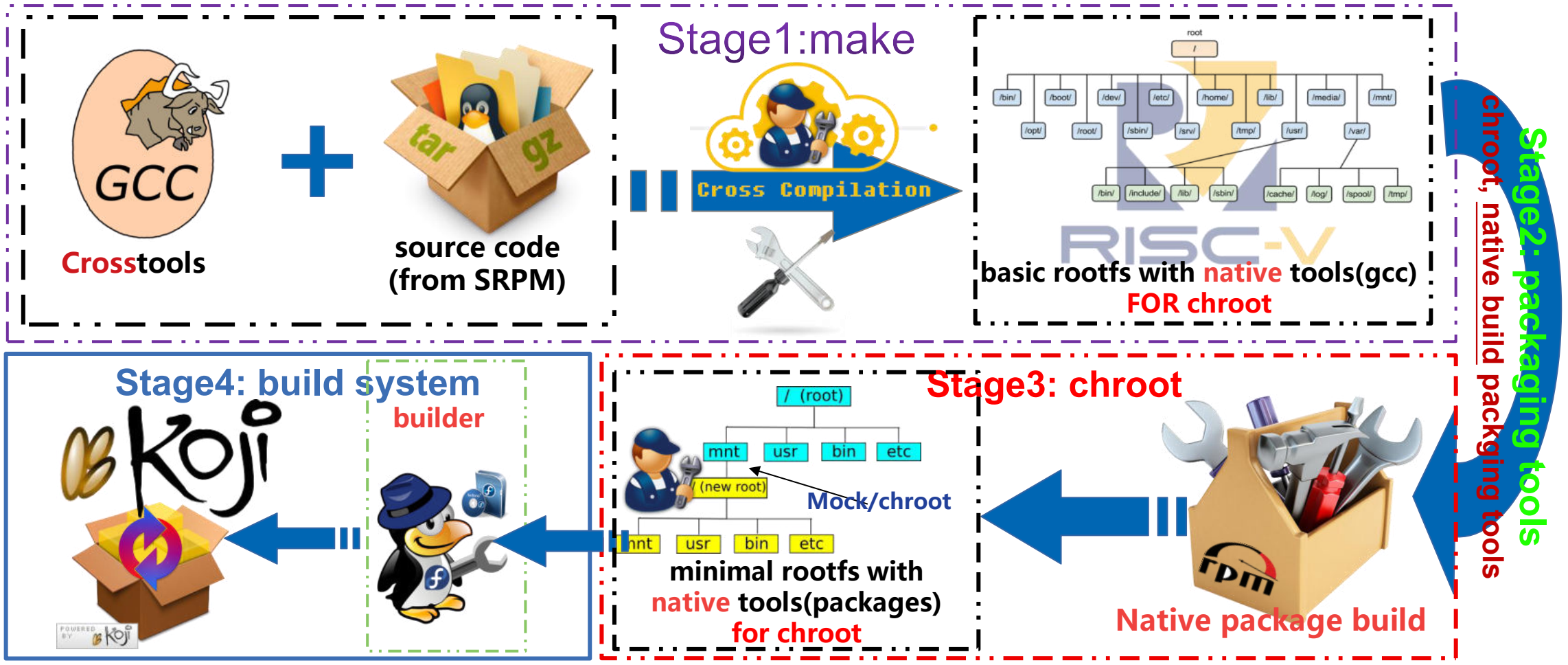
Fedora 38

Now

Info Source:

Most of info comes from Richard Jones and his weblog: https://rwmj.wordpress.com/

Linux Distros bootstrap



Do a Fedora bootstrap for RV32

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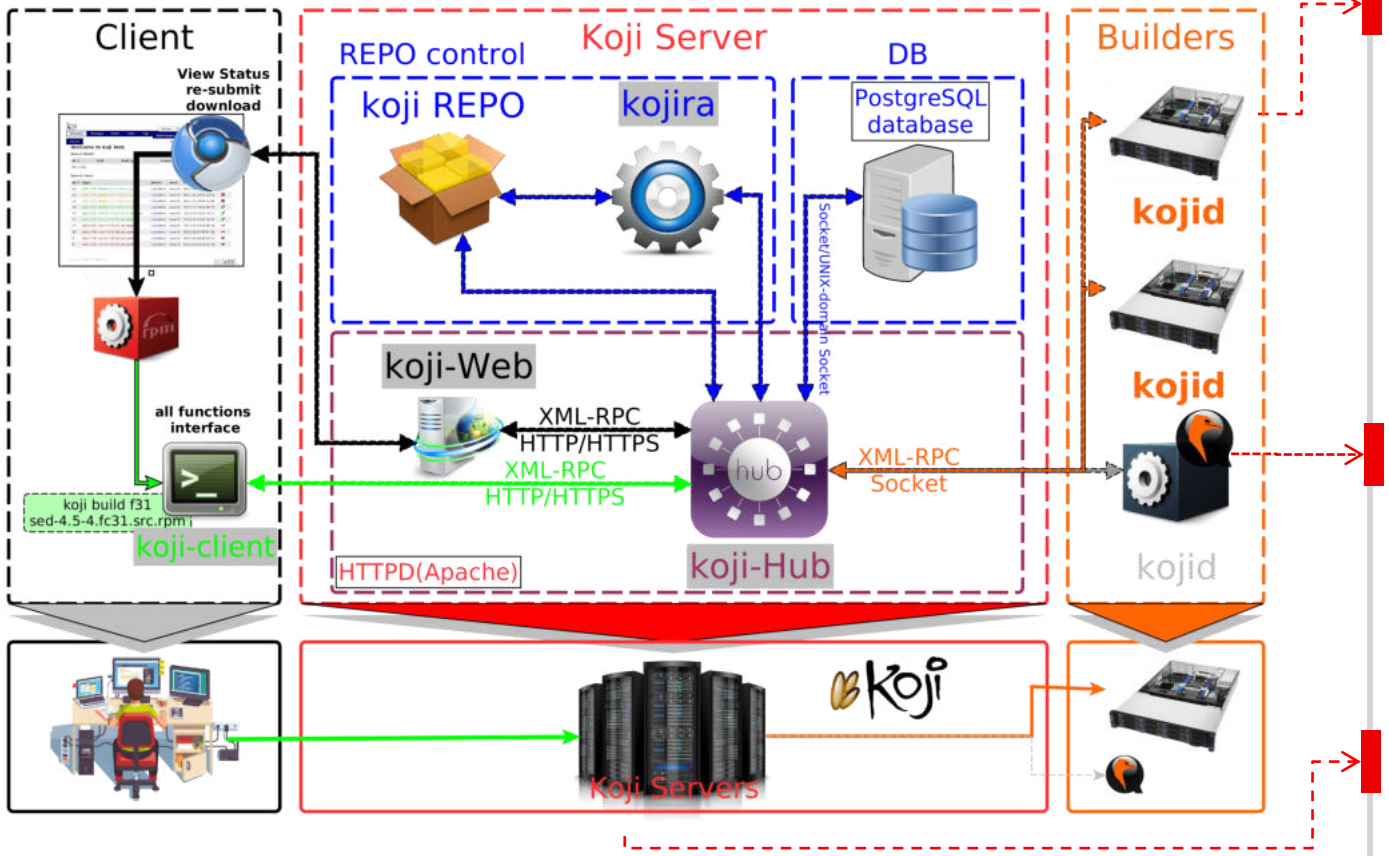
Koji Build System for RPMs & Image

Koji builds RPMs for the Fedora Project and EPEL.



RISC-V Server Builder
REAL Hardware

QEMU VMs(on x86_64)
For testing

An x86_64 server
for all central infrastructure

Main sever, repository creation and VMs with backup(separate NVMe).

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/

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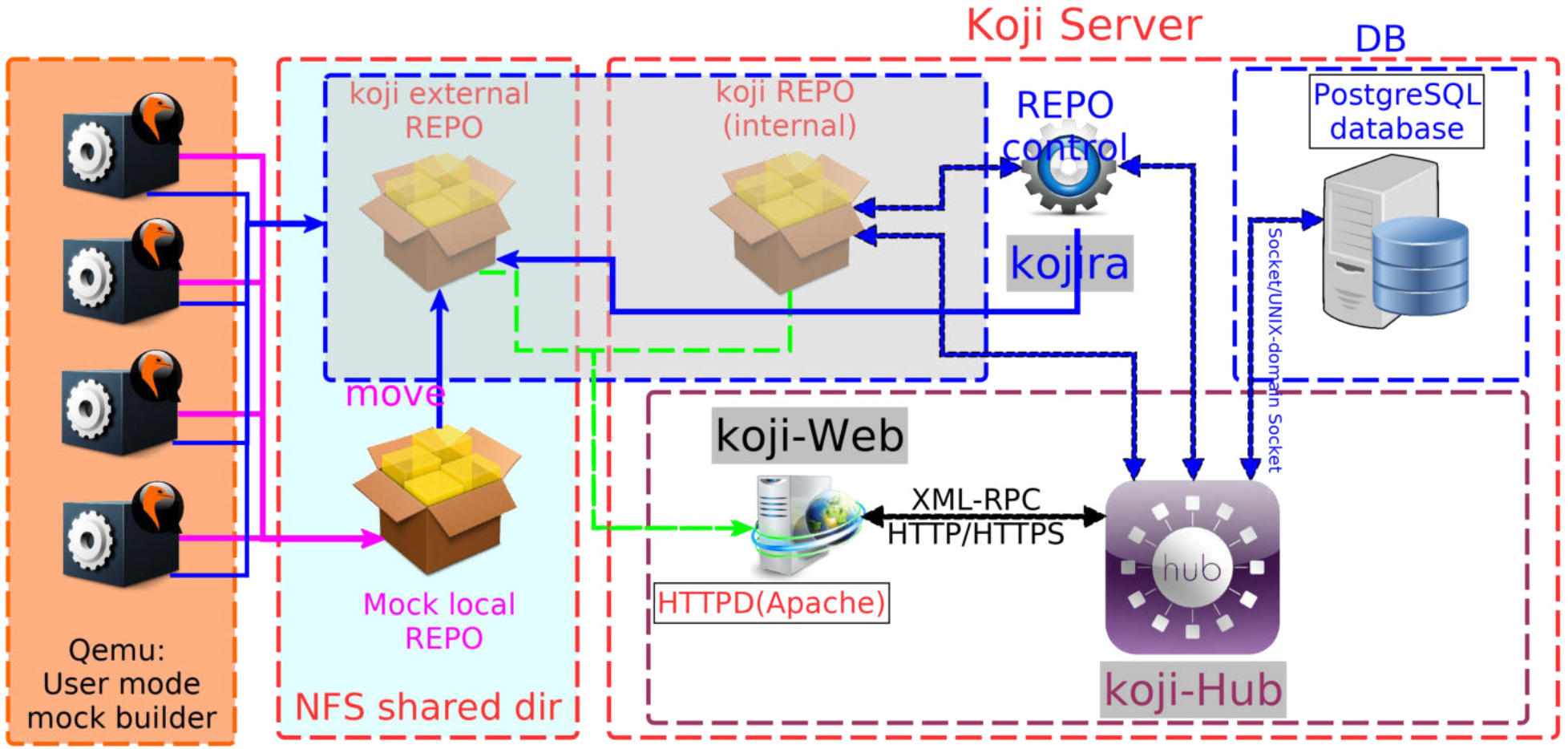
mock builder(user mode) with Koji Build System



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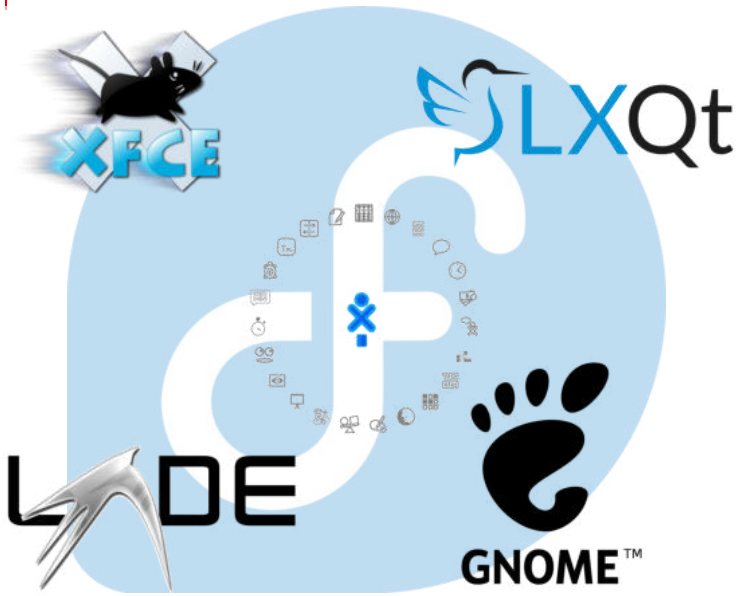
The Status of Fedora on RISC-V



Fedora

Bootable: Yes, OpenSBI + U-Boot on QEMU&Hardware
package management: dnf + rpm
Build system: Koji + Mock
Status: Upgrading from Fedora 36 to **Rawhide**
REPO：14400+ srpm have been built

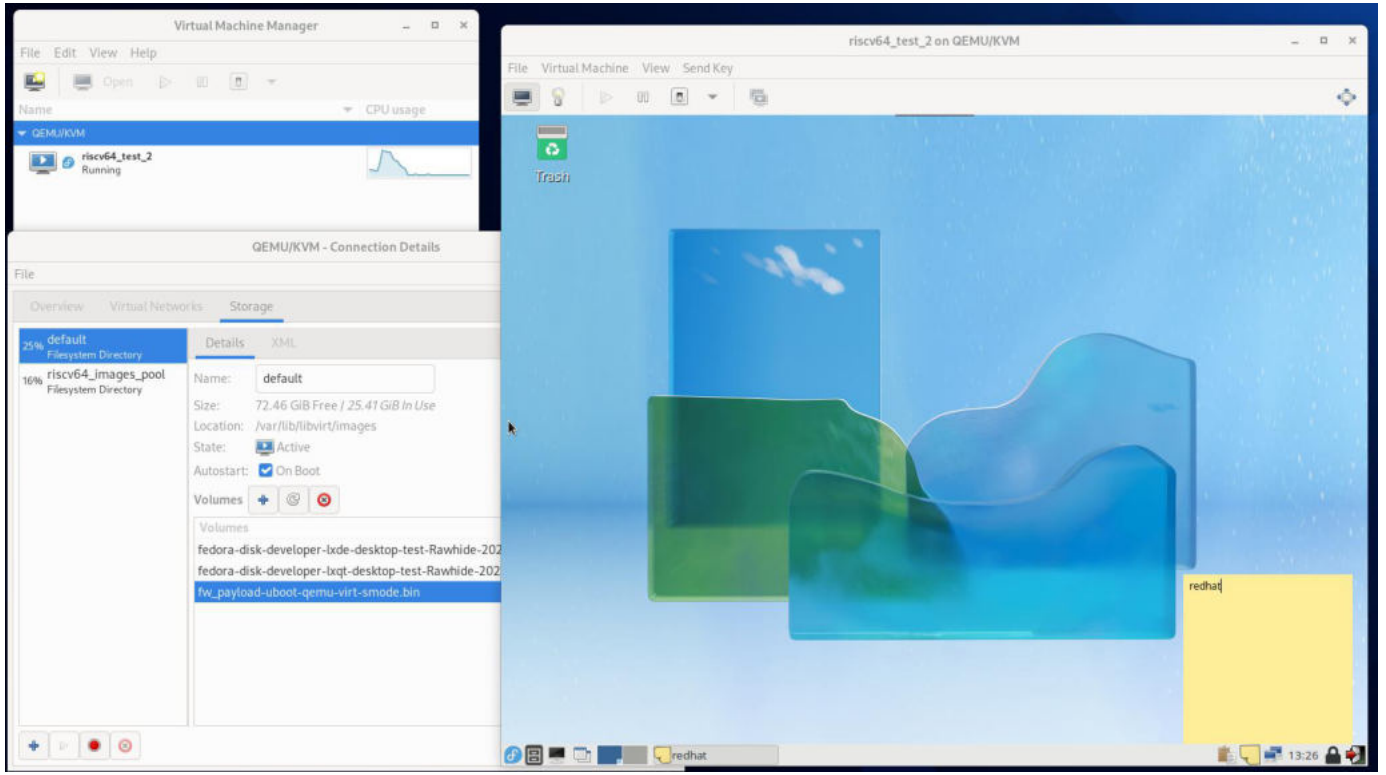
Repositories

Openkoji
https://openkoji.iscas.ac.cn/repos/
Rocks
http://fedora.riscv.rocks/repos/

Major test Platform

Virtual: QEMU and libvirt/QEMU

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



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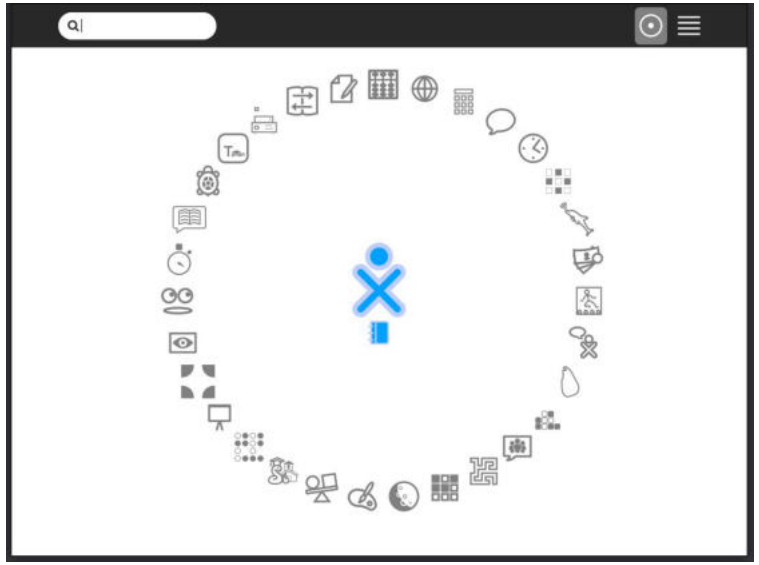
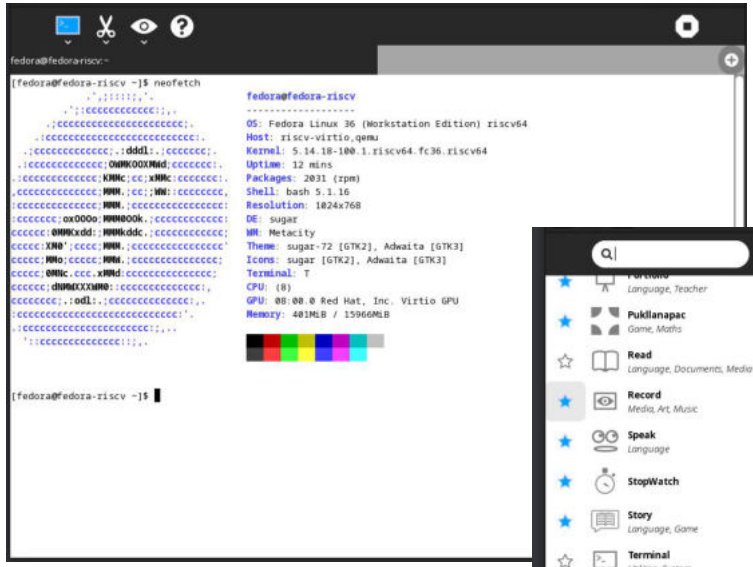
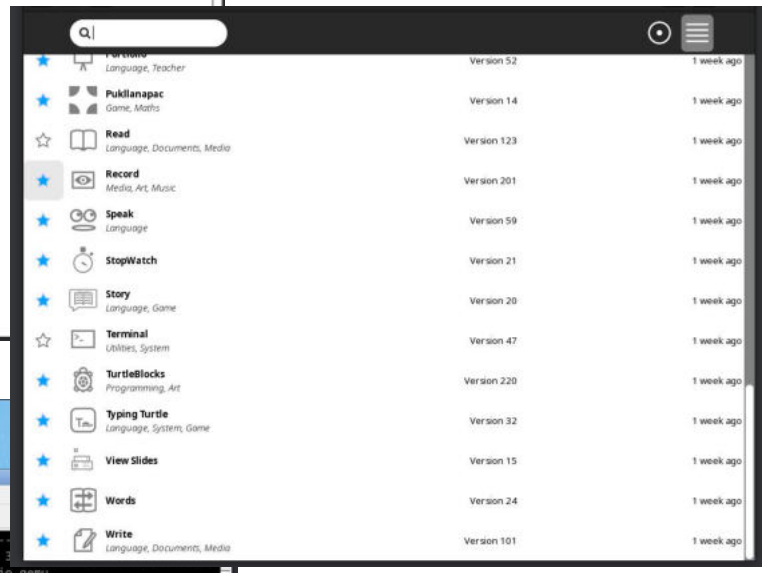
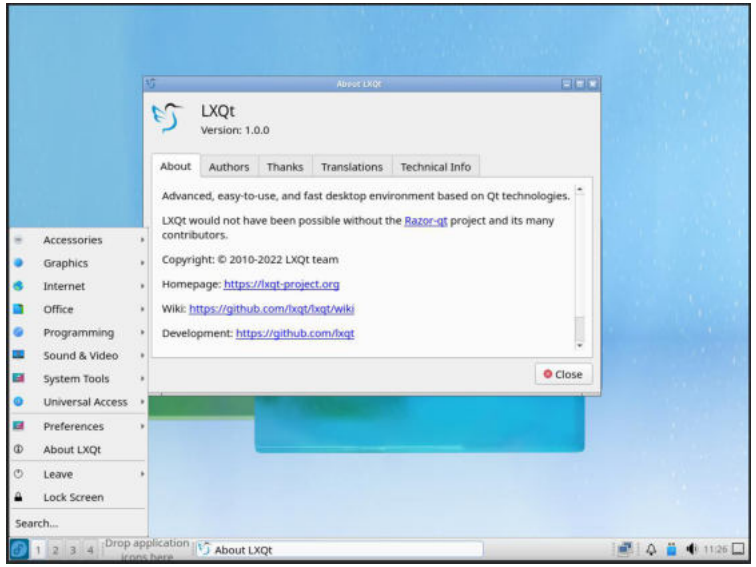
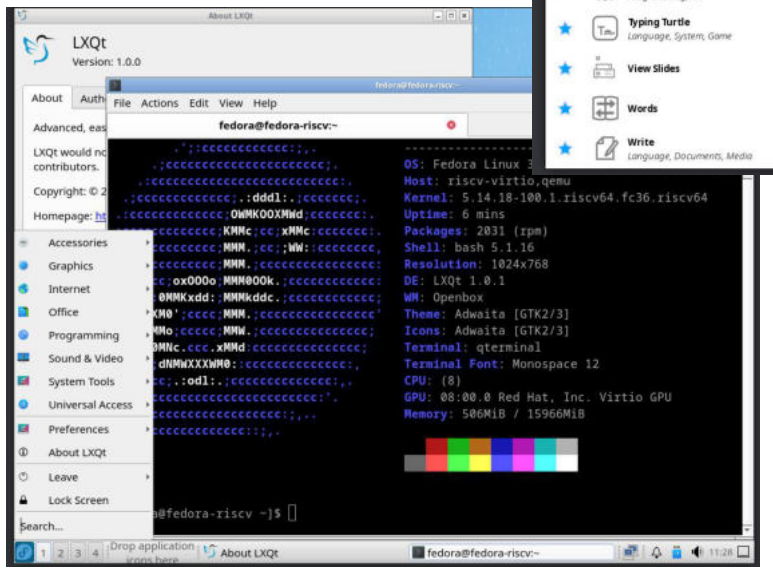
Run Fedora 36 on QEMU(riscv64)











LXQt

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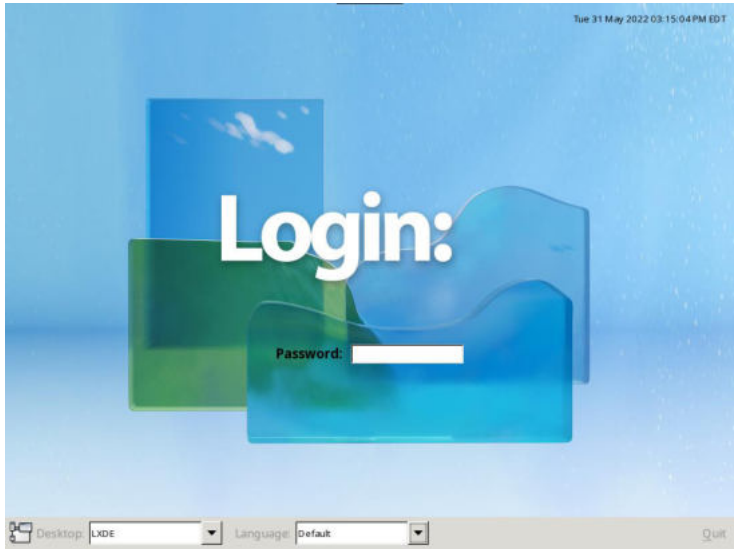
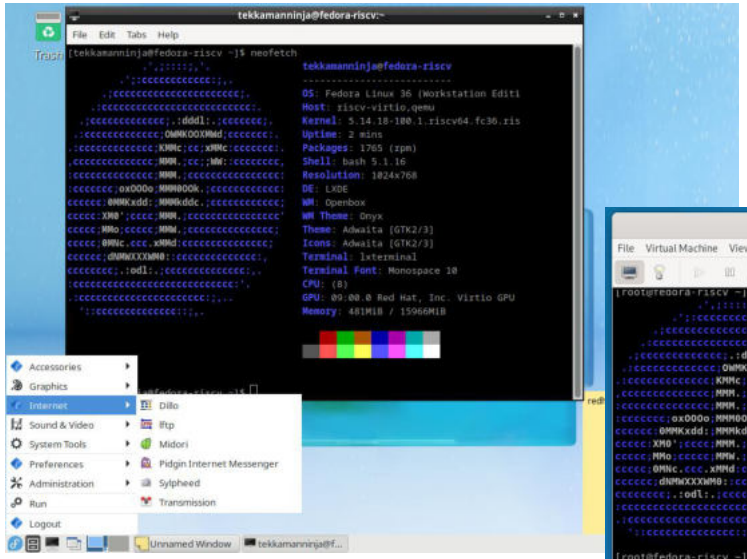
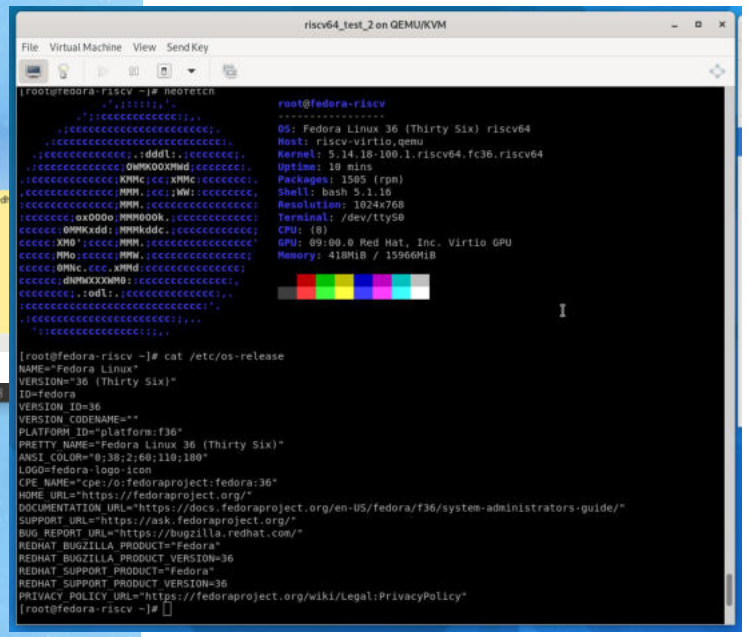
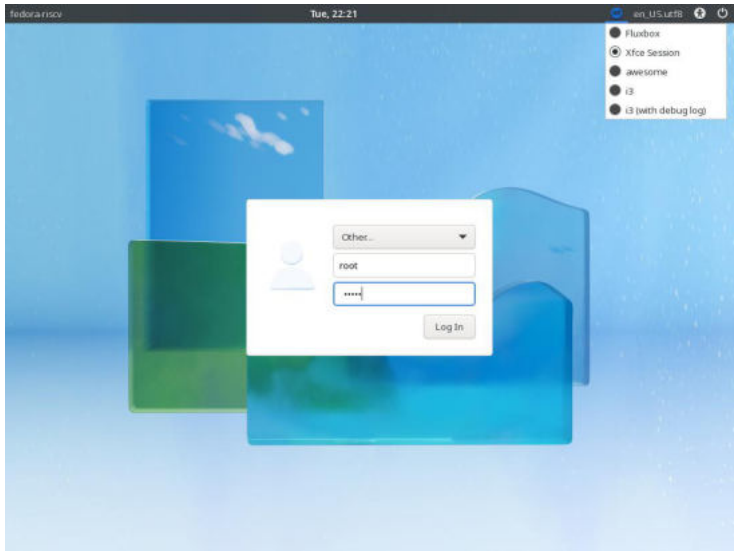
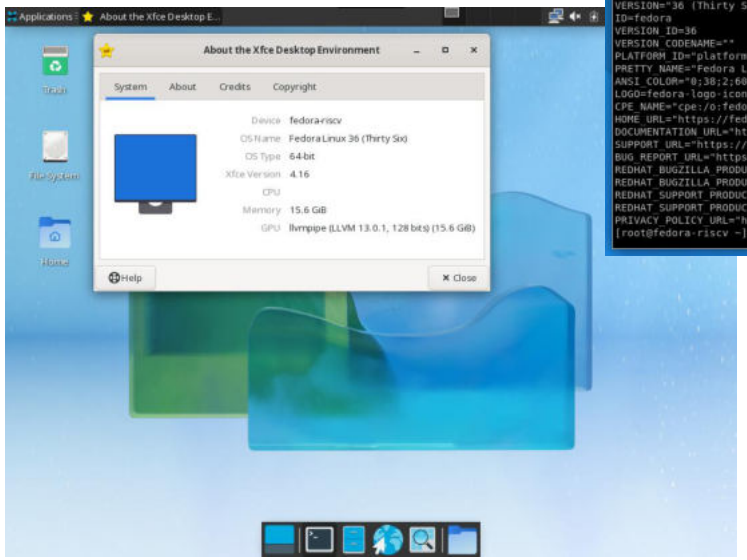
Run Fedora 36 on QEMU(riscv64)











The Status of Fedora on RISC-V

- RPM packaging
  - [rawhide/F38] 【On Going】 [https://openkoji.iscas.ac.cn/repos/fc36dev/] as REPO
- main package version:
  - Toolchain gcc-12.2.1-2 / glibc-2.36-4 (up-to-date)/Binutils 2.39-3 (up-to-date)
  - Libffi (updating) MAIN TASKS
  - java-latest-openjdk-19.0.0.0.36-2(up-to-date)
  - perl-5.36.0-492[rawhide](up-to-date)，documenting
  - Python 3.11(up-to-date) ， documenting
  - Rust 1.63.0-1→Rust 1.65 (updating)
  - LLVM/Clang 14.0.0-1→ 14.0.5-3[rawhide](updating)
  - Go 1.18-1→ 1.19-1[rawhide](updating)

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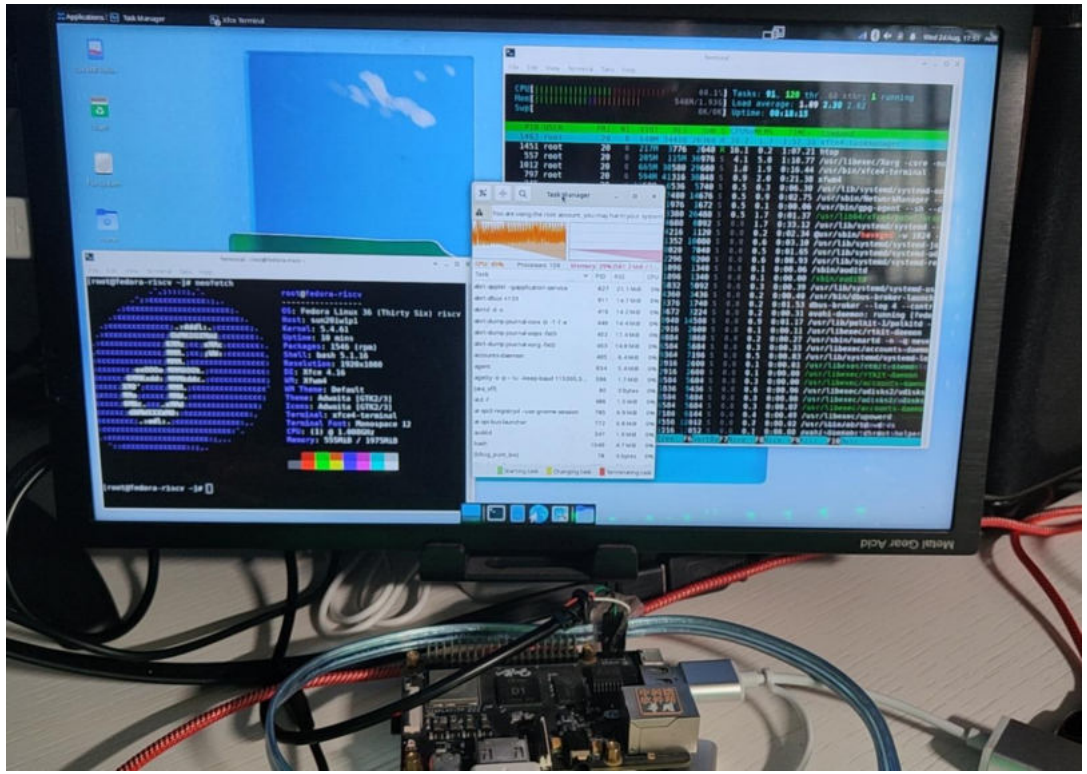
Supported Platform

Allwinner D1

Fedora 36 Images can run on this development platform .



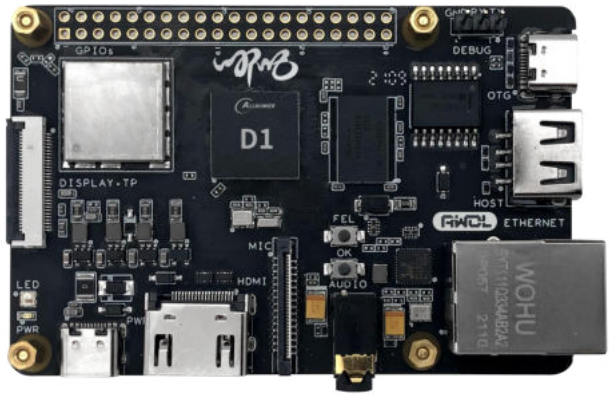
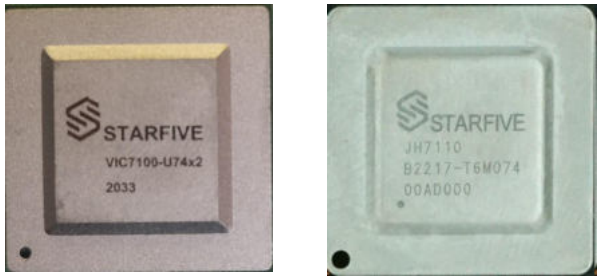


Image Download:

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

Platforms (TODO)

StarFive 赛昉科技



LIBERTAD AMIGOS RASGOS PRIMERO

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)

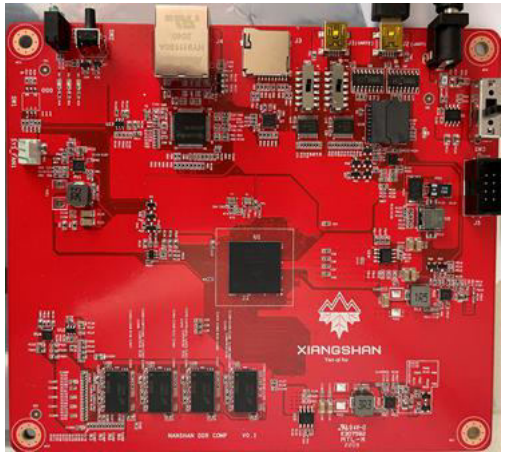
fedora remix GNOME XFCE LXDE LXQt Red Hat

Info Source:

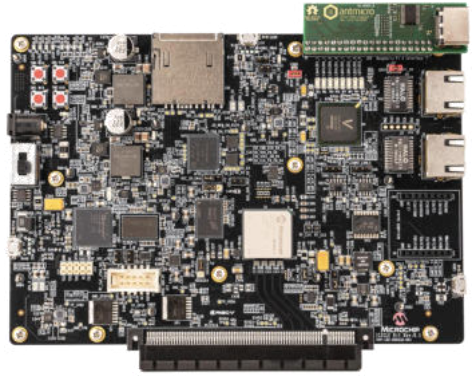
https://www.starfivetech.com/site/newsdetail/568

Platforms（TODO）

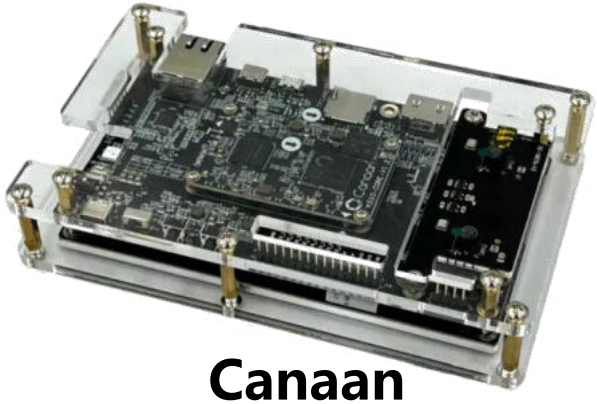
SiFive Unmatched



XIANGSHAN



PolarFire SoC Icicle Kit



Canaan
Kendryte K510

PINE64

Star64 (基于 JH7110)

算能
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Info Source:

Star64 is a RISC-V single-board PC from Pine64

Part II

Linux Distros on RISC-V

Debian

Arch-Linux

Gentoo

.....

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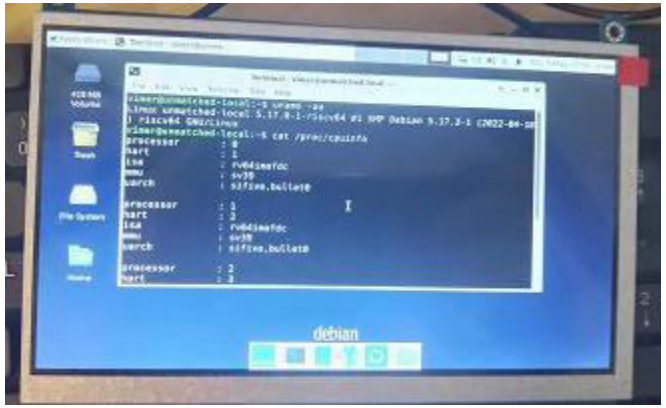
The Status of Linux Distro on RISC-V

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/

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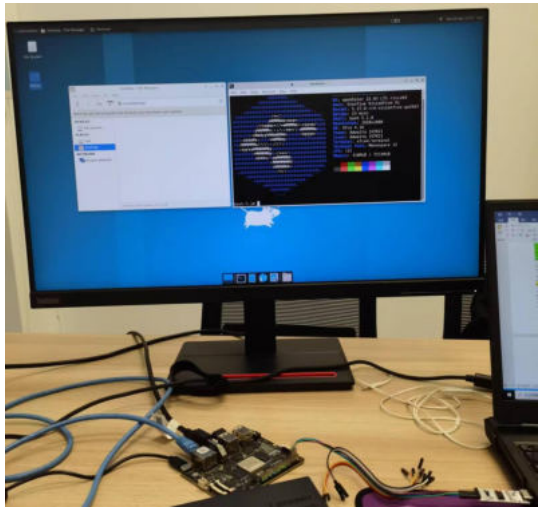
The Status of Linux Distro on RISC-V

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**



Info Source:

Gentoo: https://github.com/dlan17， 蓝一勋， 曹野@RIOS
openEuler: openEuler RISC-V SIG， Institute of Software, CAS.

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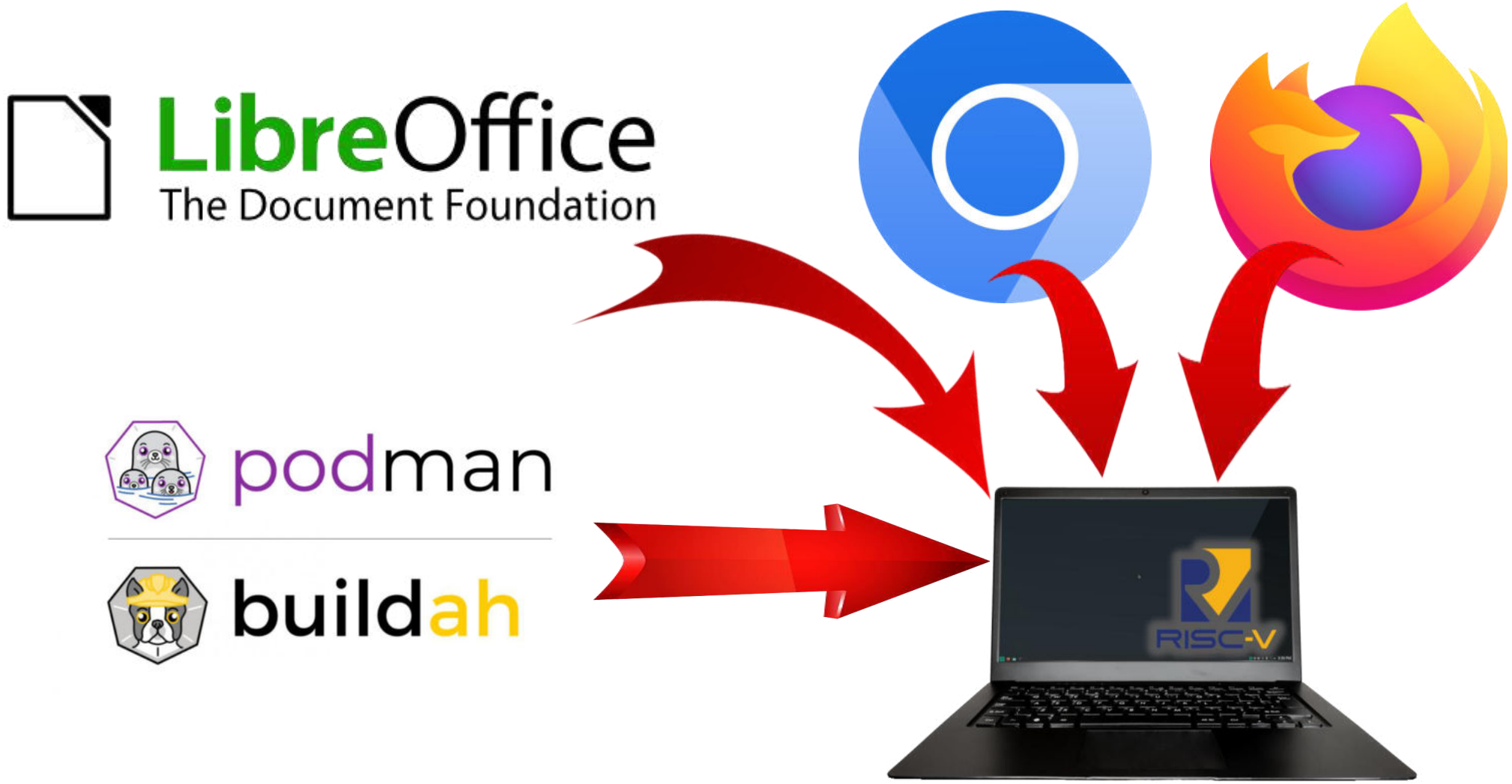
The Status of Linux Application on RISC-V



Android on RISC-V

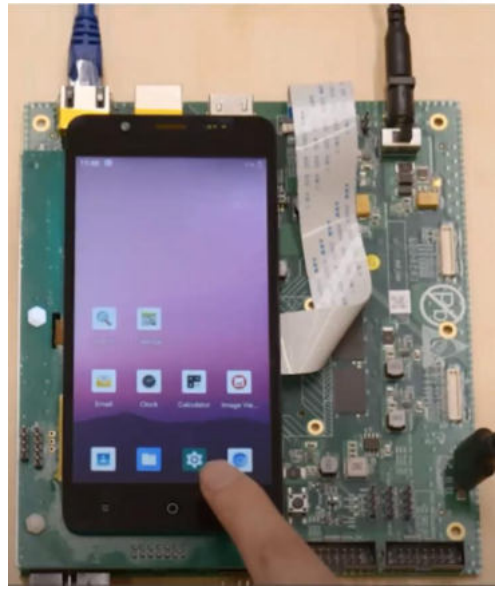
Android Open Source Project （AOSP）

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



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/

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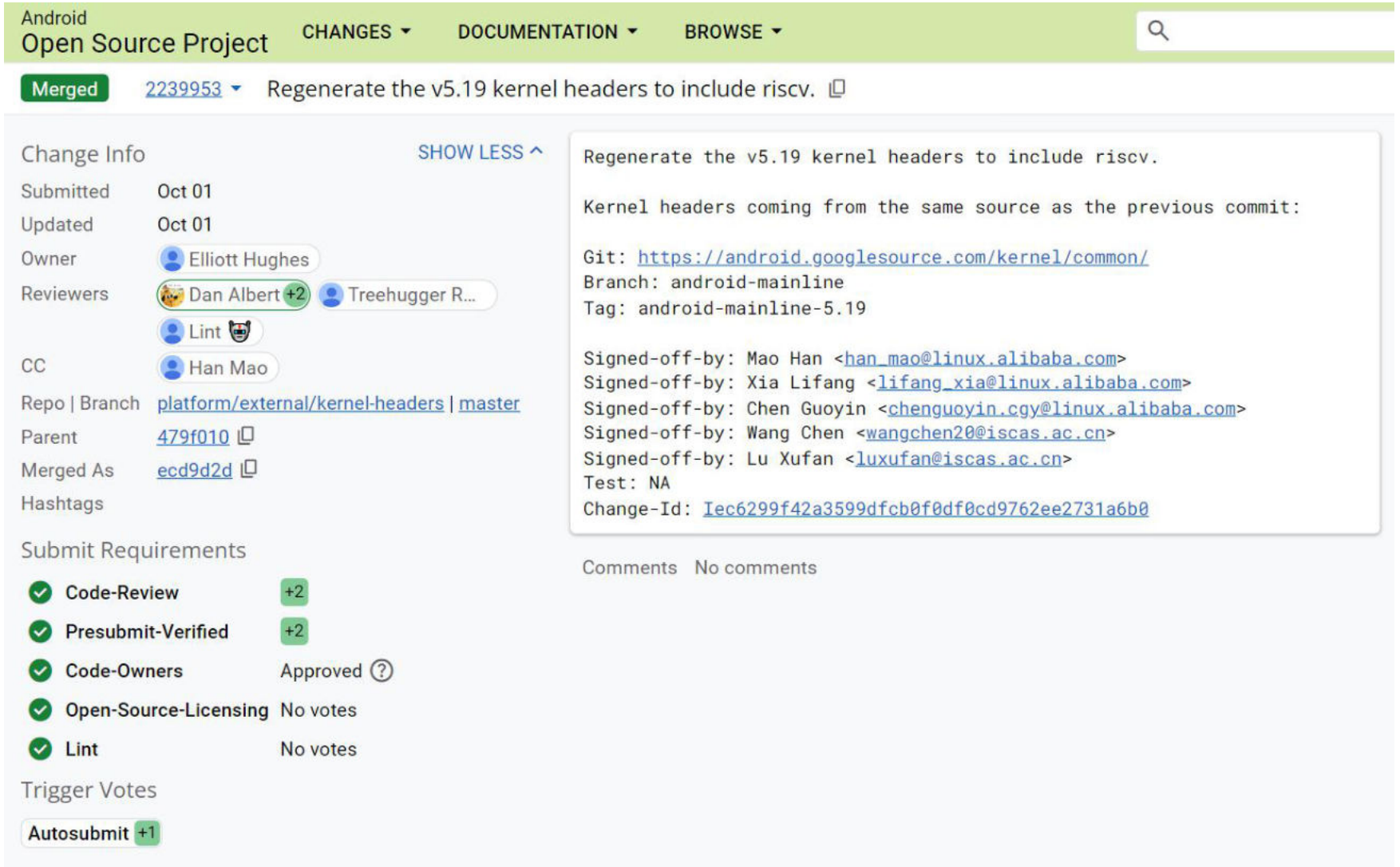
Android on RISC-V

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



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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]

RISC-V Open Hours [English]

Info Source:

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

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

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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

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Part III

The software component

RISC-V®

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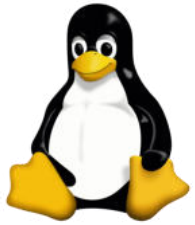
The Status of RISC-V Firmware and Linux

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.

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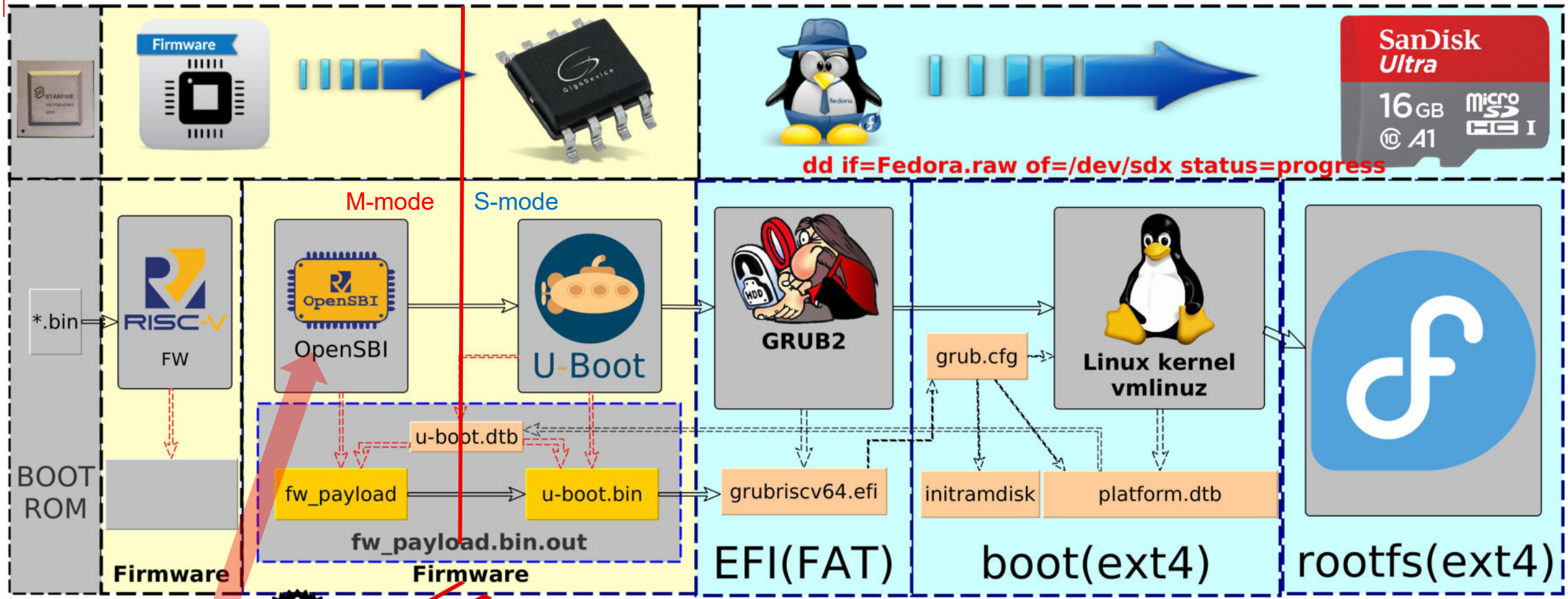
Boot flow for Linux on riscv64



RustSBI

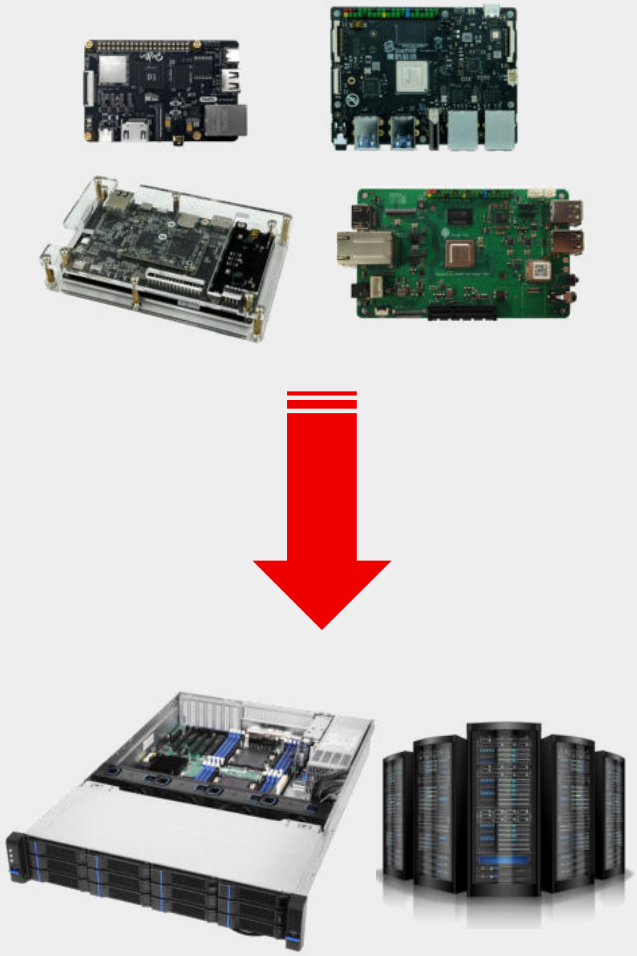
RISC-V SBI library in Rust, runs on M or HS mode; good support for embedded Rust ecosystem.

Info Source:

https://github.com/rustsbi

Part IIII

From IoT to HPC



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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

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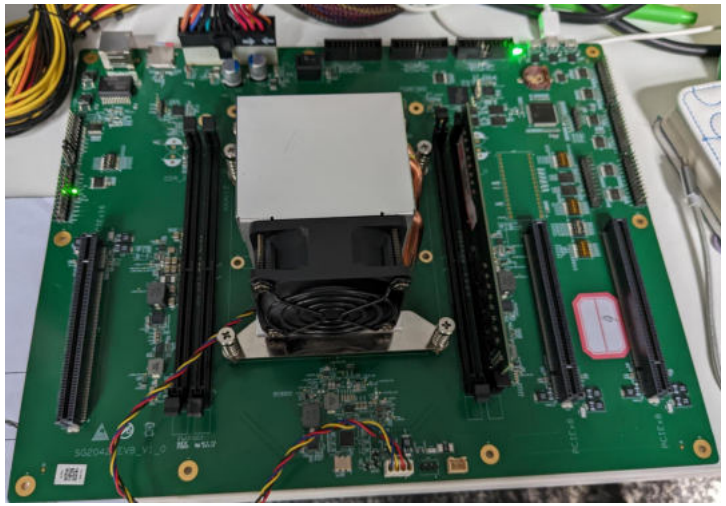
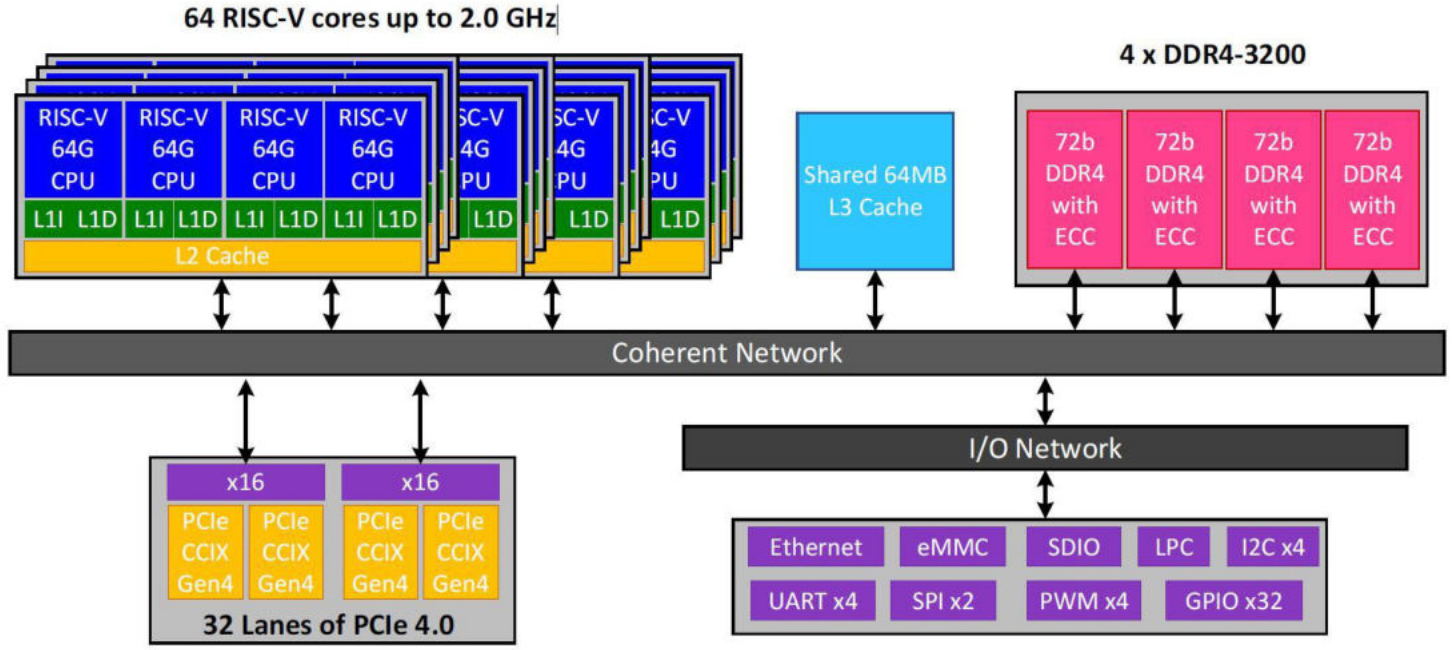
The world FIRST RISC-V Server development platform

SOPHGO 算能



SG2042 RISC-V General Server



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RISC-V Server platform

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/

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Acknowledgments

Hewlett Packard Enterprise

Abner Chang
Gilbert Chen

Red Hat

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

David Abdurachmanov

WD

Alistair Francis
Anup Patel
Atish Kumar Patra

Akira Tsukamoto
Drew Fustini
Mikael Frykholm
Stefan O'Rear

Alphabetical Listing by Company Name

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

算能 SOPHGO

ROCKPI

BeagleV

StarFive 赛昉科技

T-HEAD

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RISC-V® AMBASSADOR

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

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Thank you

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