Linux on RISC-V

status update from firmware to distros

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Tue, Jun 20, 2023 @ RISC-V Days Tokyo 2023 Summer

RISC-V Day Tokyo2023 Summer

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

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Fedora on riscv64 History

RISE
RISC-V Software Ecosystem

rpmbuild on RISC-V
by Richard Jones

August 10, 2016

October 15, 2016

The 1st bootstrap

for Fedora **25**
as the first trial.

The 2nd bootstrap

for Fedora 27
as the final preparation

Jan 29 , 2018

March , 2018

The 3rd bootstrap

for Fedora 28
as the final bootstrap

Koji

For RISC-V build farm

April 15, 2018

Aug , 2018

Graphic Desktop is enabled
on a real RISC-V Hardware

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Join RISC-V Foundation

Jul, 2019

Fedora 29~32

Fedora 38

Fedora 37

Now

IBM is a Founding member of Foundation

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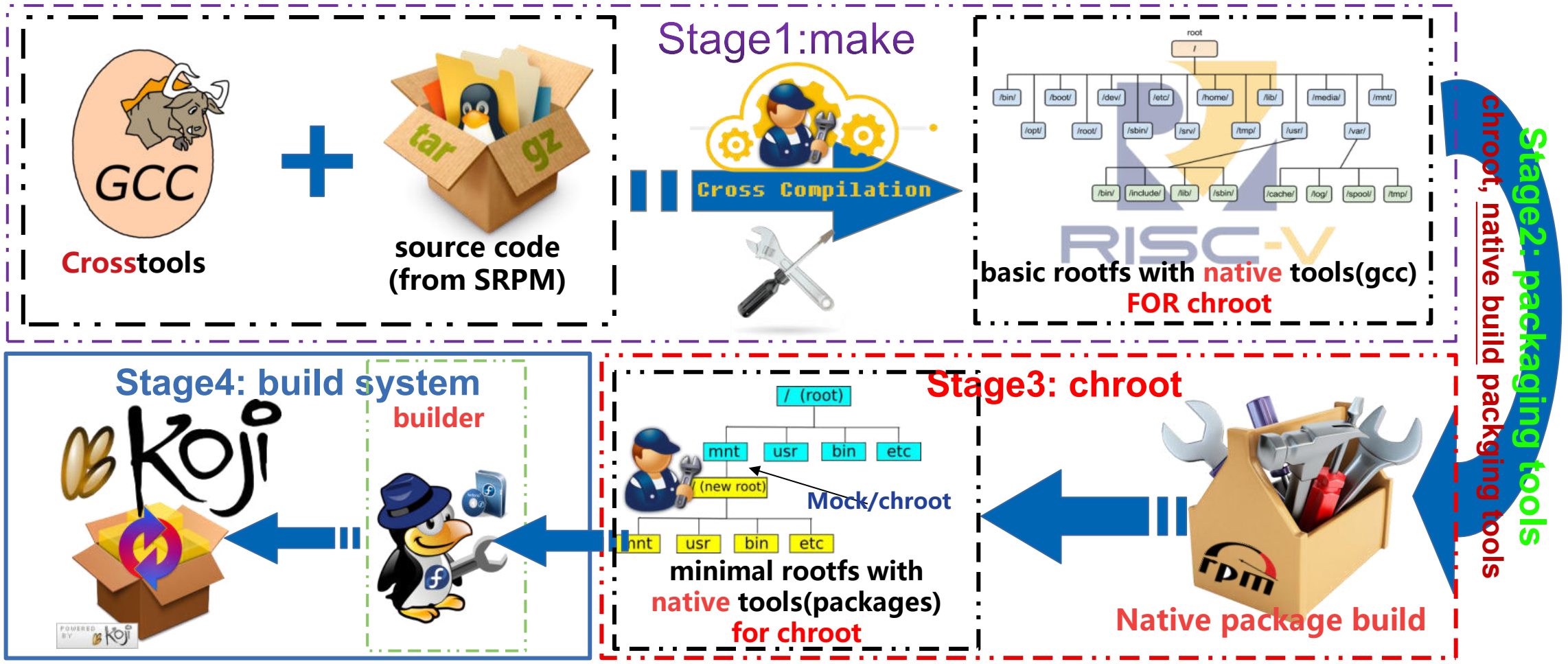
Fedora bootstrap for RV32 Now!



We are building the rpms for minimal rootfs in stage 3

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The Status of Fedora on RISC-V

Fedora

Bootable: Yes, OpenSBI + U-Boot/UEFI + GRUB
package management: dnf + rpm
Build system: Koji + Mock
Status: Upgrading **Fedora 38**
REPO：19950/23118 [86.3%] srpm have been built

Koji system

Openkoji : https://openkoji.iscas.ac.cn/

RISC-V Server Builder
REAL Hardware Soon!

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The Status of Fedora on RISC-V

- **Remix Images**
  - **Spin: Server/Workstation/Cloud**
  - WIP Spin: IoT/CoreOS
- **main package version:**
  - Toolchain(up-to-date for F38)
    - gcc-13.1.1-2[DONE]
    - glibc-2.37.4[DONE]
    - Binutils 2.39-12[DONE]
  - libffi-3.4.4-2(up-to-date)
  - java-latest-openjdk-19.0.2.0.7→20 [ONGING]
  - perl-5.36.1-497(up-to-date)
  - Python 3.11.3-2(up-to-date) → 3.12[building]
  - LLVM/Clang 16.0.4-1(up-to-date)
  - golang-1.20.4-1(up-to-date)
  - rust-1.70.0-1(up-to-date)

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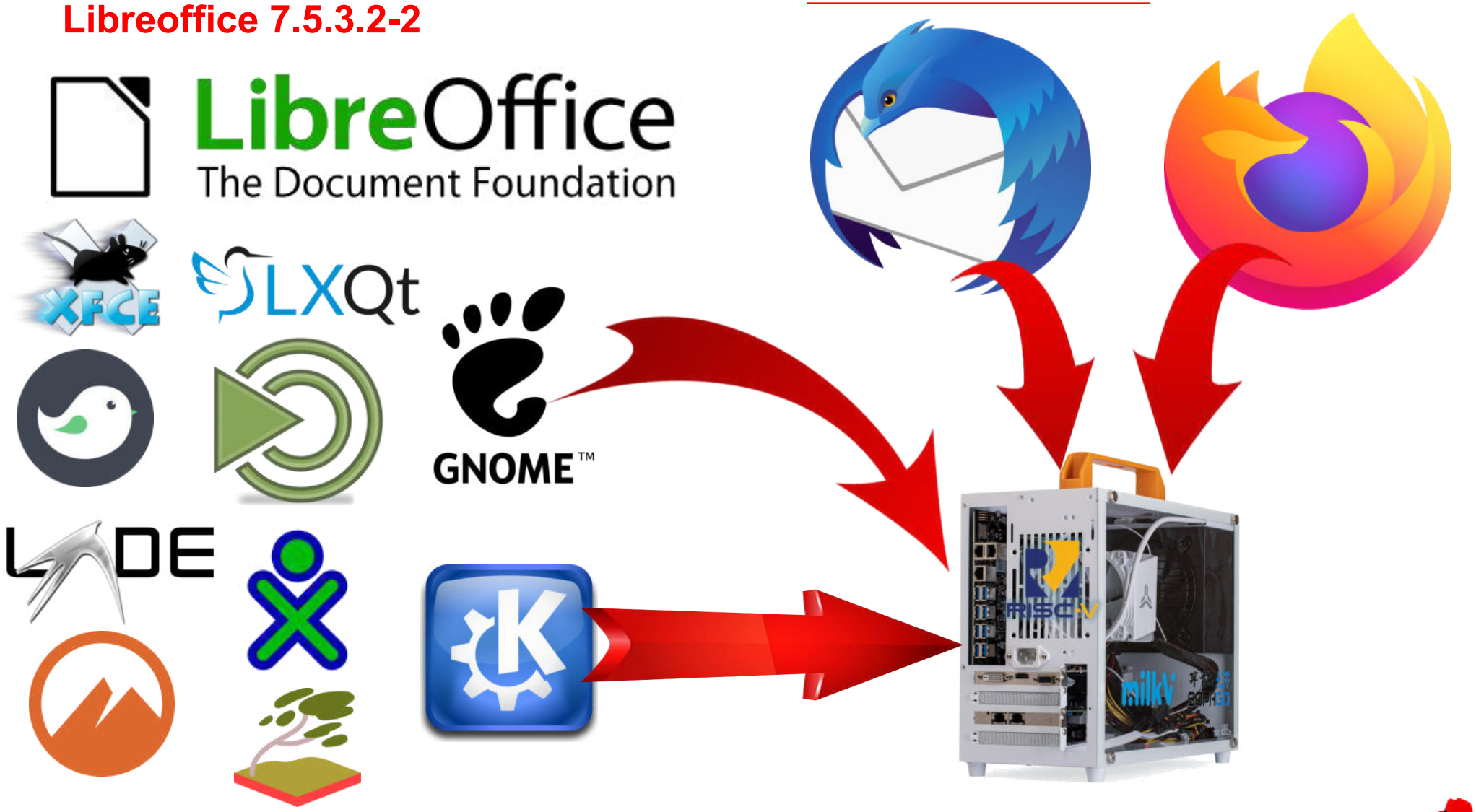
The Status of desktop appreciation on RISC-V

Libreoffice 7.5.3.2-2

Thunderbird 102.10.0 firefox-114.0-1



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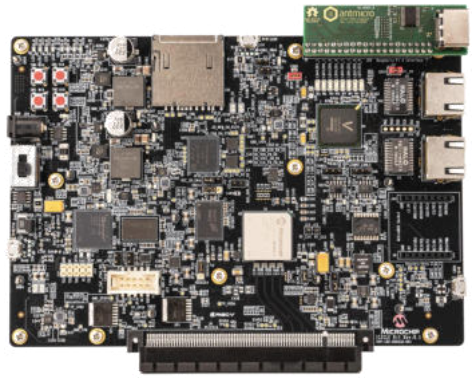
The Status of Server appreciation on RISC-V

Rich Hardware ecosystem

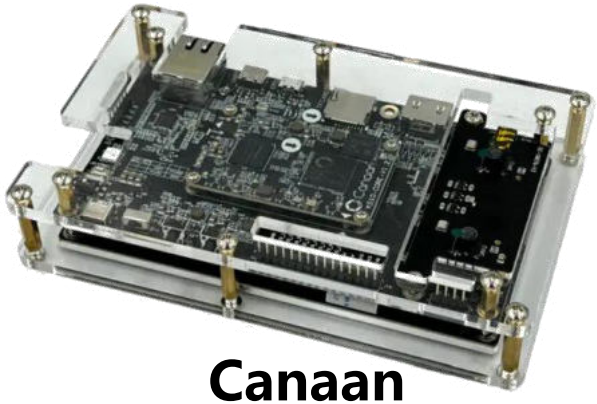
SiFive Unmatched



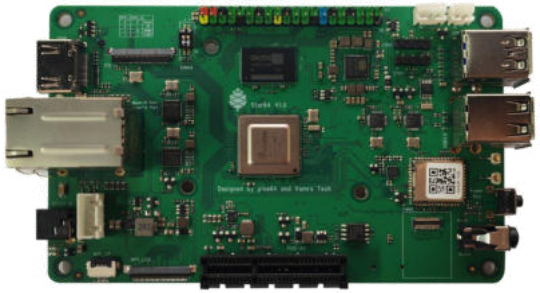
PolarFire SoC Icicle Kit

算能 SOPHGO

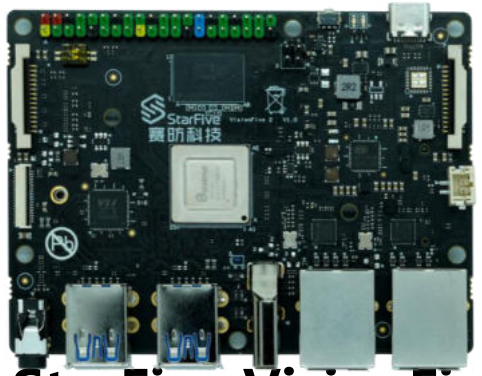
Lichee Pi 4A



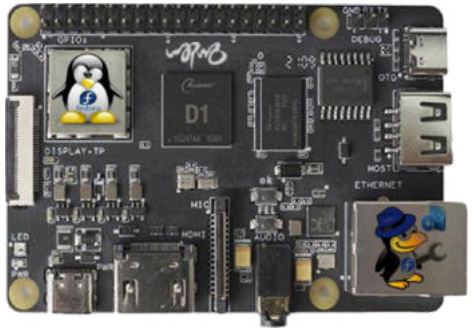
Canaan Kendryte K510



Star64



StarFive VisionFive V2



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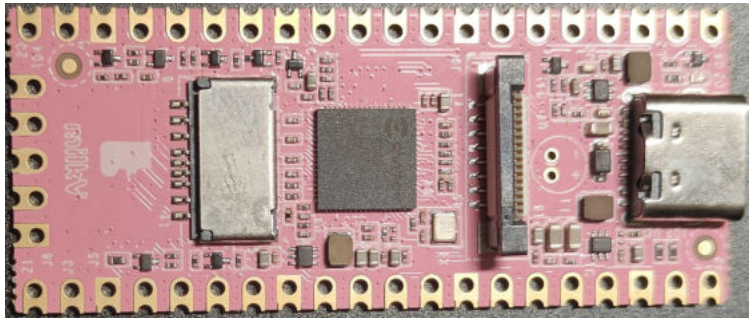
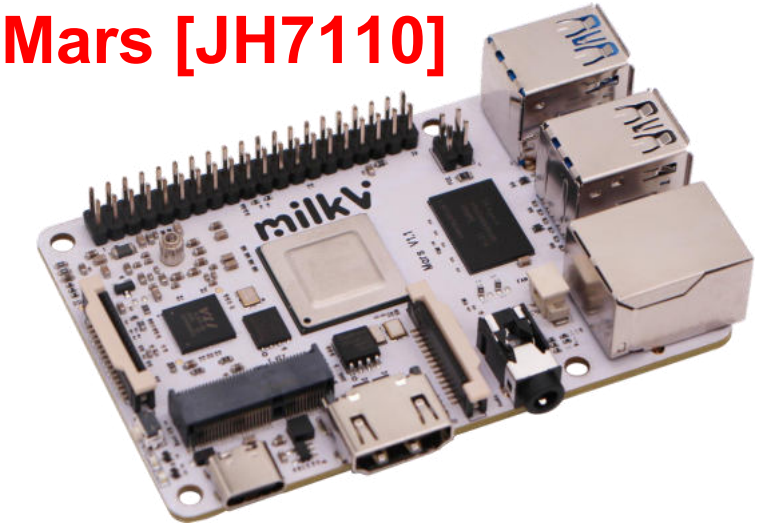
Rich Hardware ecosystem: Milk-V Family

Duo [CV1800B]



Mars [JH7110]



Pioneer[SG2042]

M*** [******]

COMING SOON

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Part II

Linux Distros on RISC-V

Debian

Arch-Linux

Gentoo

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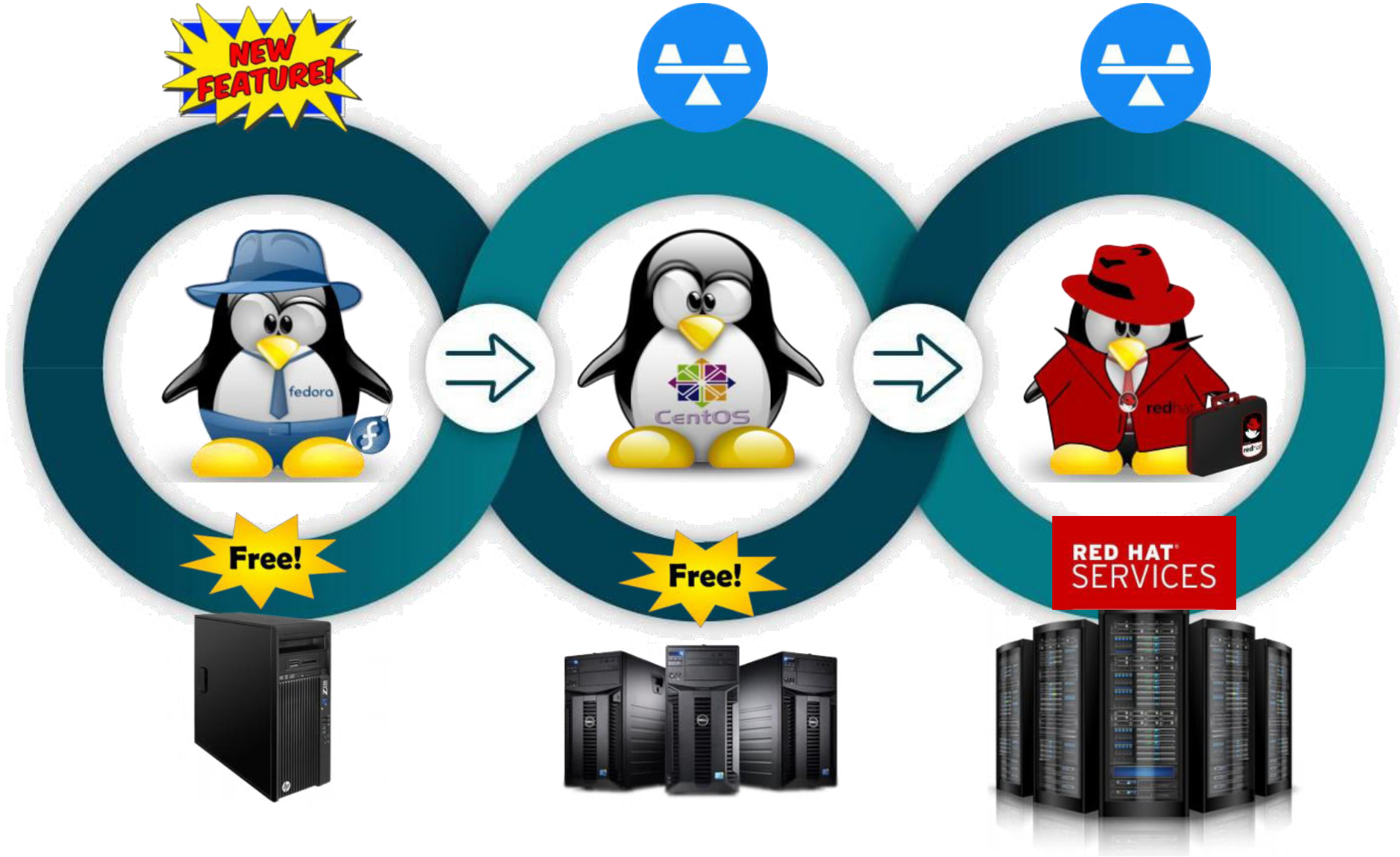
Fedora/CentOS stream/RHEL



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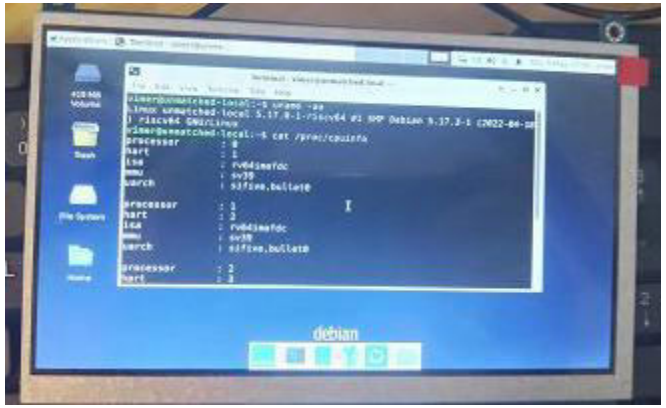
The Status of Linux Distro on RISC-V

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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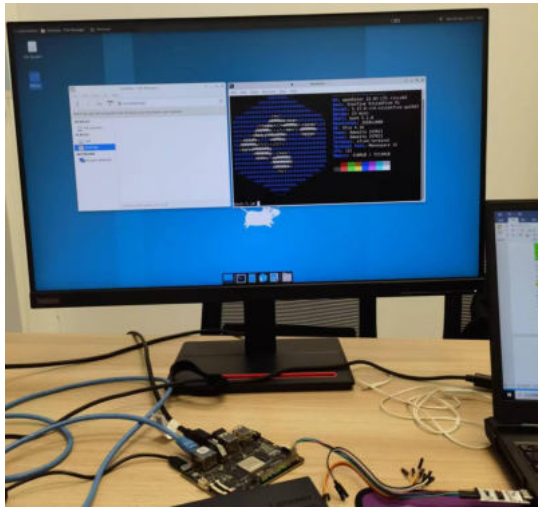
The Status of Linux Distro on RISC-V

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**



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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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Android on RISC-V

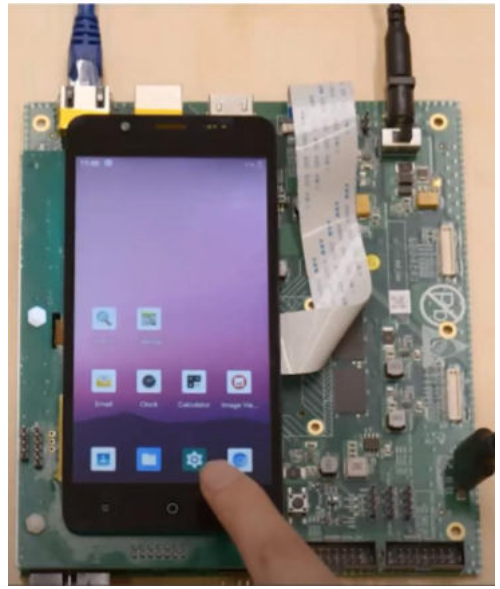
Android Open Source Project （AOSP）

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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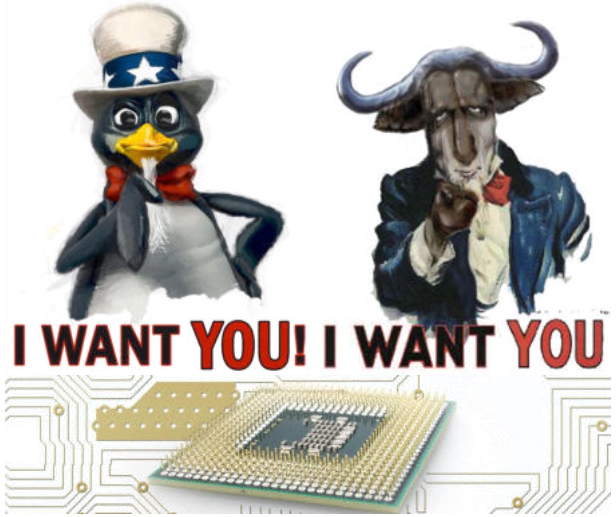
Linux software development info for RISC-V



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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Part III

The software component

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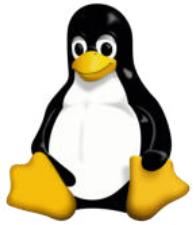
The Status of RISC-V Firmware and Linux



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) **without any patch** 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.

ok

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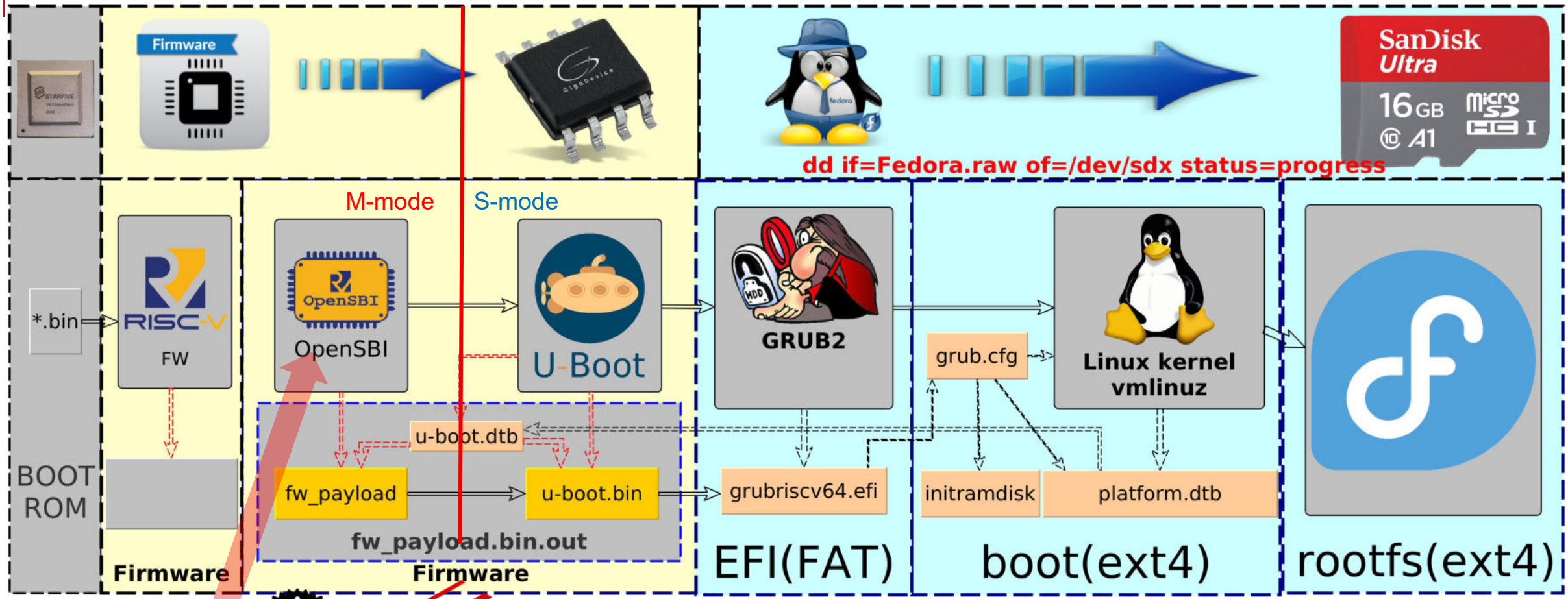
Boot flow for Linux on riscv64 [embedded]



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

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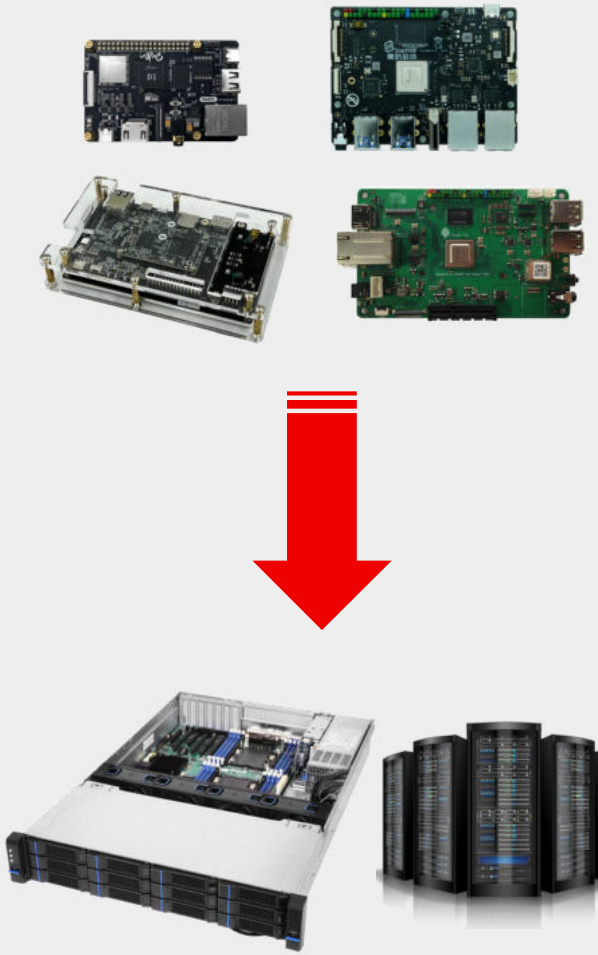
Part IIII

From IoT to HPC



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The Status of RISC-V Firmware for PC & Server

UEFI: Unified Extensible Firmware Interface.

Some companies have worked on edk2 based on HPE’ work which incorporates with OpenSBI .

Some real hardware platforms have got edk2 support since the development stage.

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

[PATCH V6 00/21] Add basic ACPI support for RISC-V patchset has been MERGED into maintainer’ s tree since 1 Jun 2023.

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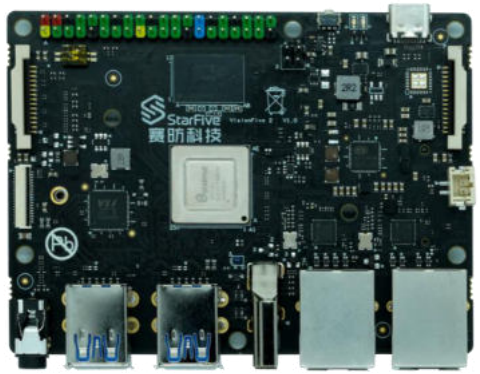
The Platfroms have run EDK2 with GRUB on them

tianocore

QEMU

算能 SOPHGO



StarFive VisionFive V2（JH7110）

And MORE are under development

XIANGSHAN

COMING SOON

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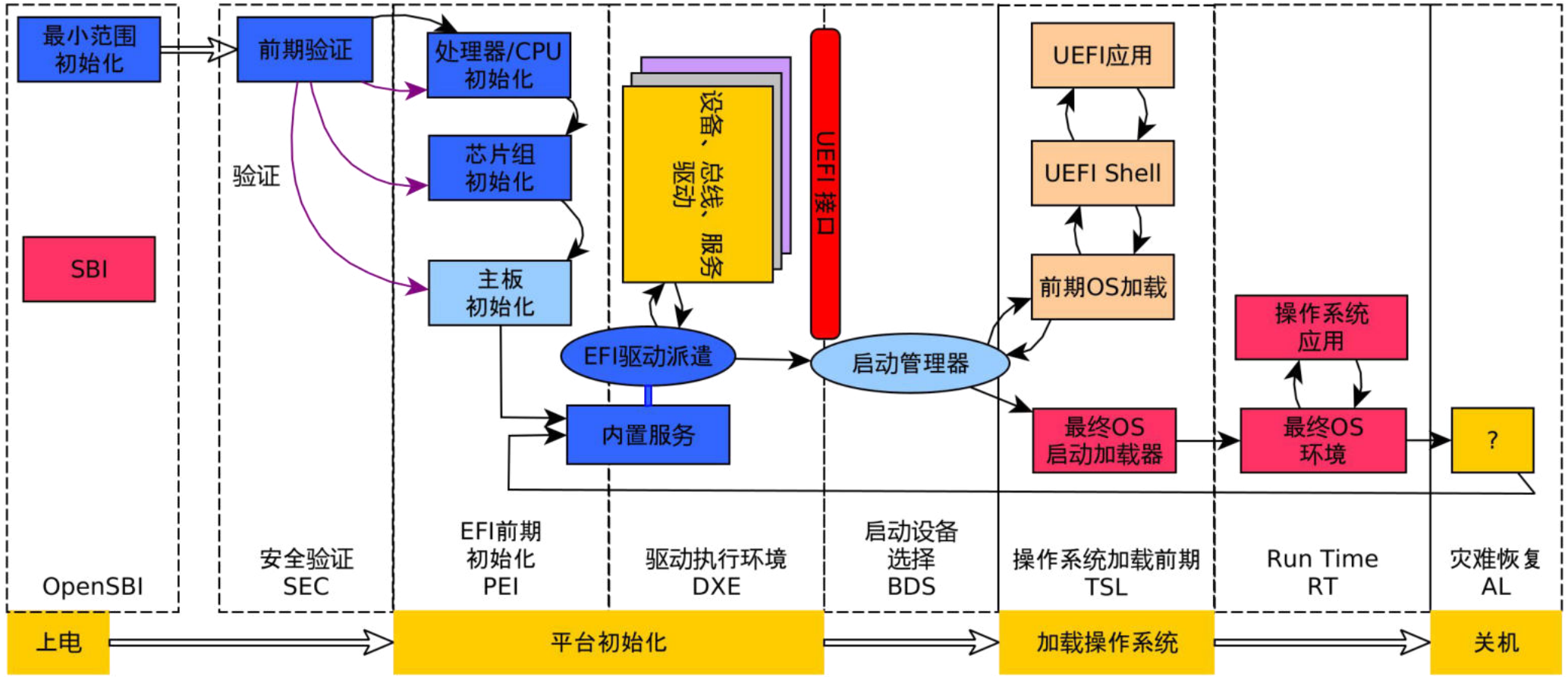
The OpenSBI + EDK2 SG2042[Ongoing]



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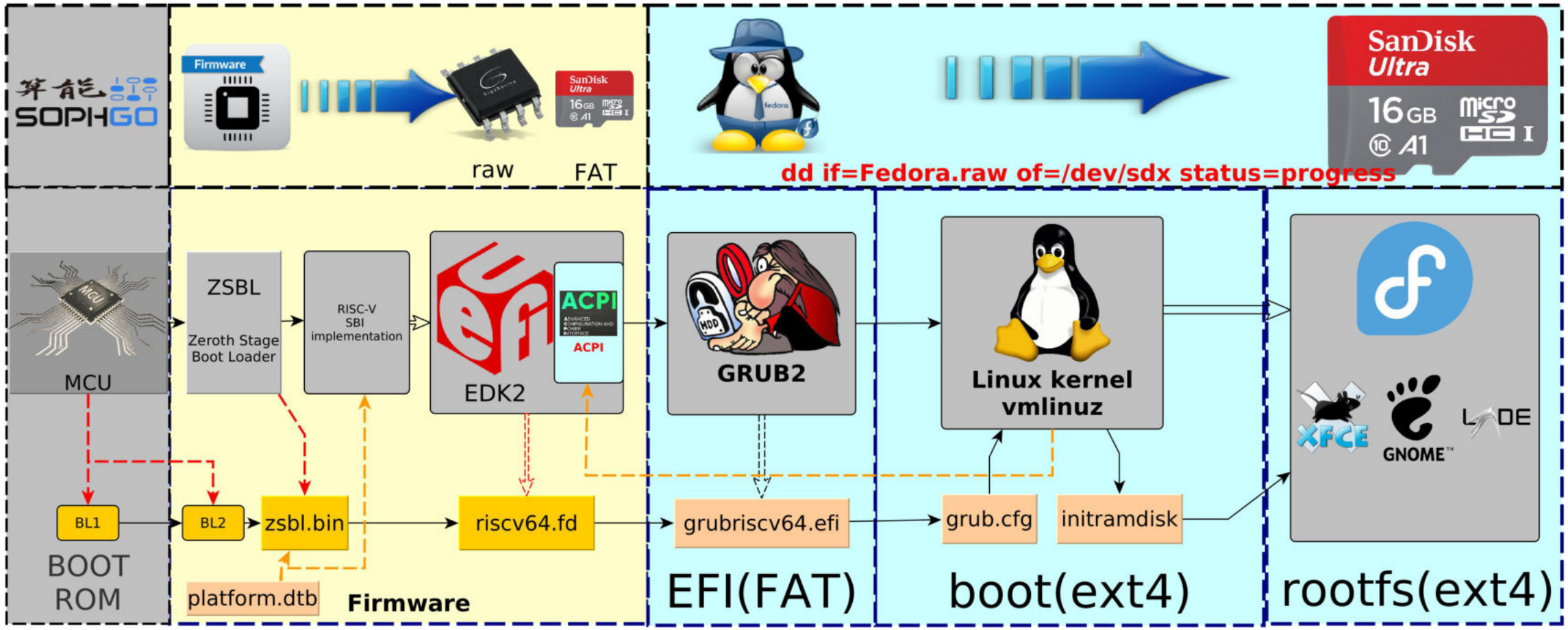
The future boot flow for SG2042[EDK2 + GRUB]



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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
milkV
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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