



Linux Distro and Firmware on RISC-V

Wei Fu <wefu@redhat.com>

RISC-V Ambassador @ RISC-V Foundation

Senior Software Engineer @ Platform Enablement, Red Hat Software (Beijing) Co.,Ltd.

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AGENDA



Distro

Linux Distro on RISC-V



FW/HW

Industry standard RISC-V server/PC

Part I

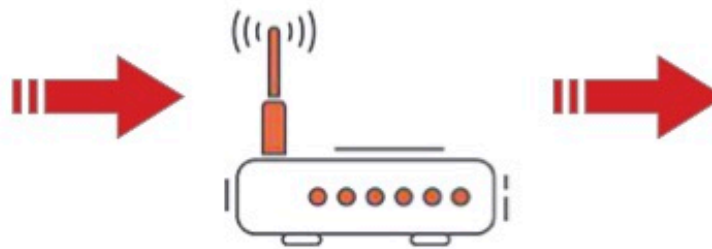
Linux Distro on RISC-V



Linux is everywhere



End devices



Gateway



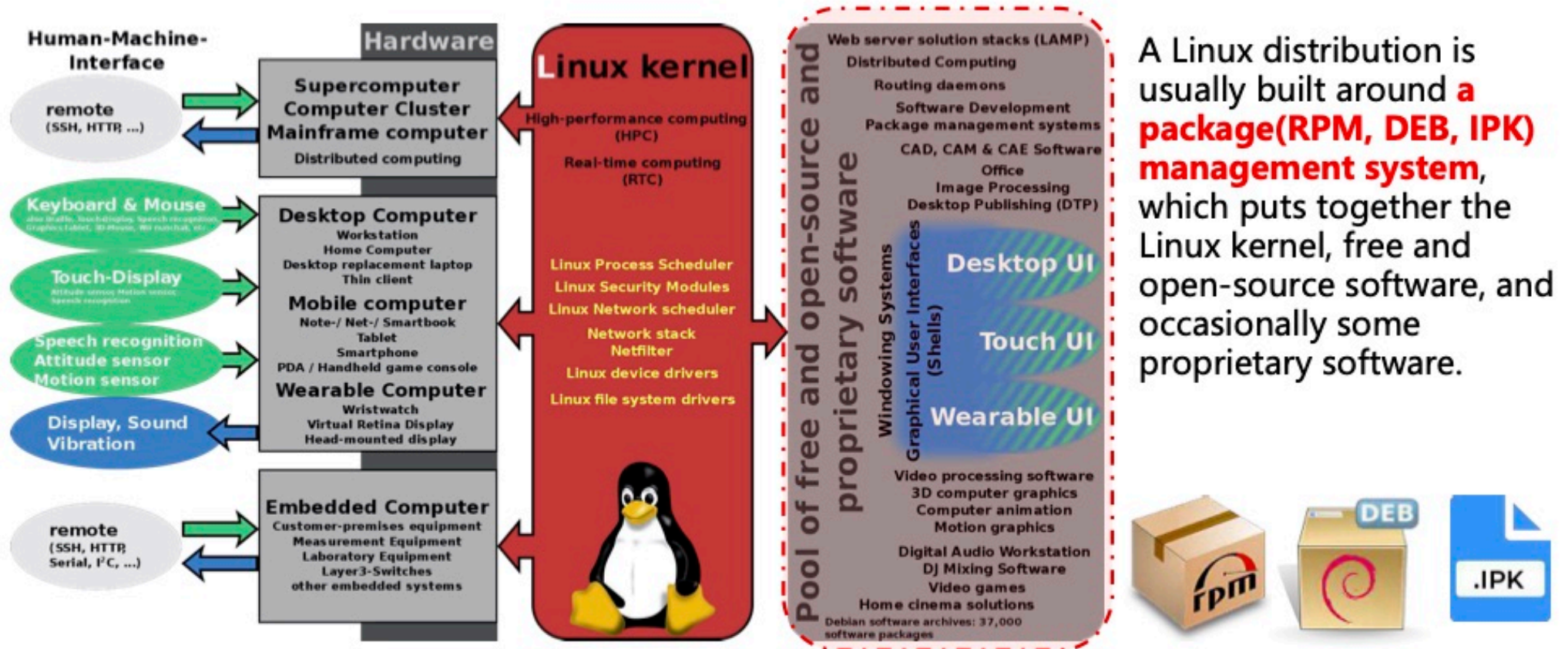
Cloud platform &
Edge computing



OpenWrt
Wireless Freedom



Linux distribution



Fedora/RHEL/CentOS(Linux/Stream)



Fedora

- Focus on **new features and new technology**
- Community-driven, Free
- Short release cycles (approximately 6M)



CentOS Stream

- Focus on next RHEL
- Collaboration with Red Hat, its ecosystem, and CentOS



RHEL

- Focus on **stability**
- Supported by Red Hat, Comes with subscription
- Slower releases (approximately 9M)



CentOS Linux

- Focus on **stability**
- Community driven, Free, but lack of official support
- Based on the same code base with **RHEL**



The Status of Fedora on RISC-V



Fedora

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

Build system: Koji

Status: In maintenance, **Fedora 33**/Rawhide

Image: Developer/Minimal/GNOME

- **Repositories**

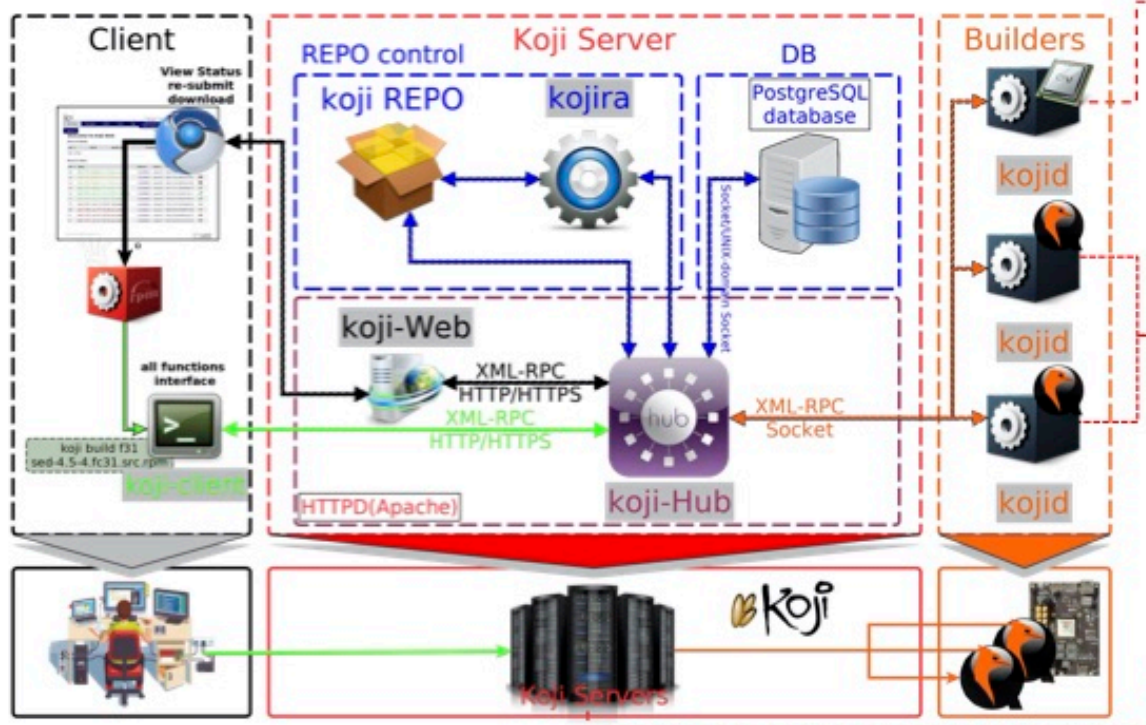
<https://dl.fedoraproject.org/pub/alt/risc-v/>

<https://mirror.math.princeton.edu/pub/alt/risc-v/>

<https://isrc.iscas.ac.cn/mirror/fedora-riscv/>

Koji Build System for Fedora

Koji builds RPMs for the Fedora Project and EPEL.



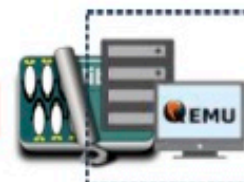
The current Koji servers for RV64 are at Fremont, CA, USA.

But in China, We **may** can use a package build system , called "oepkgs" .



3 HiFive Unleasheds

One of them connects with SSD.



160+ QEMU VMs(on x86_64)

fedora-riscv-x.gcc1xx.osuosl.org

managed by libvirt

(will add more by adding more servers)



An x86_64 server for all central infrastructure

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

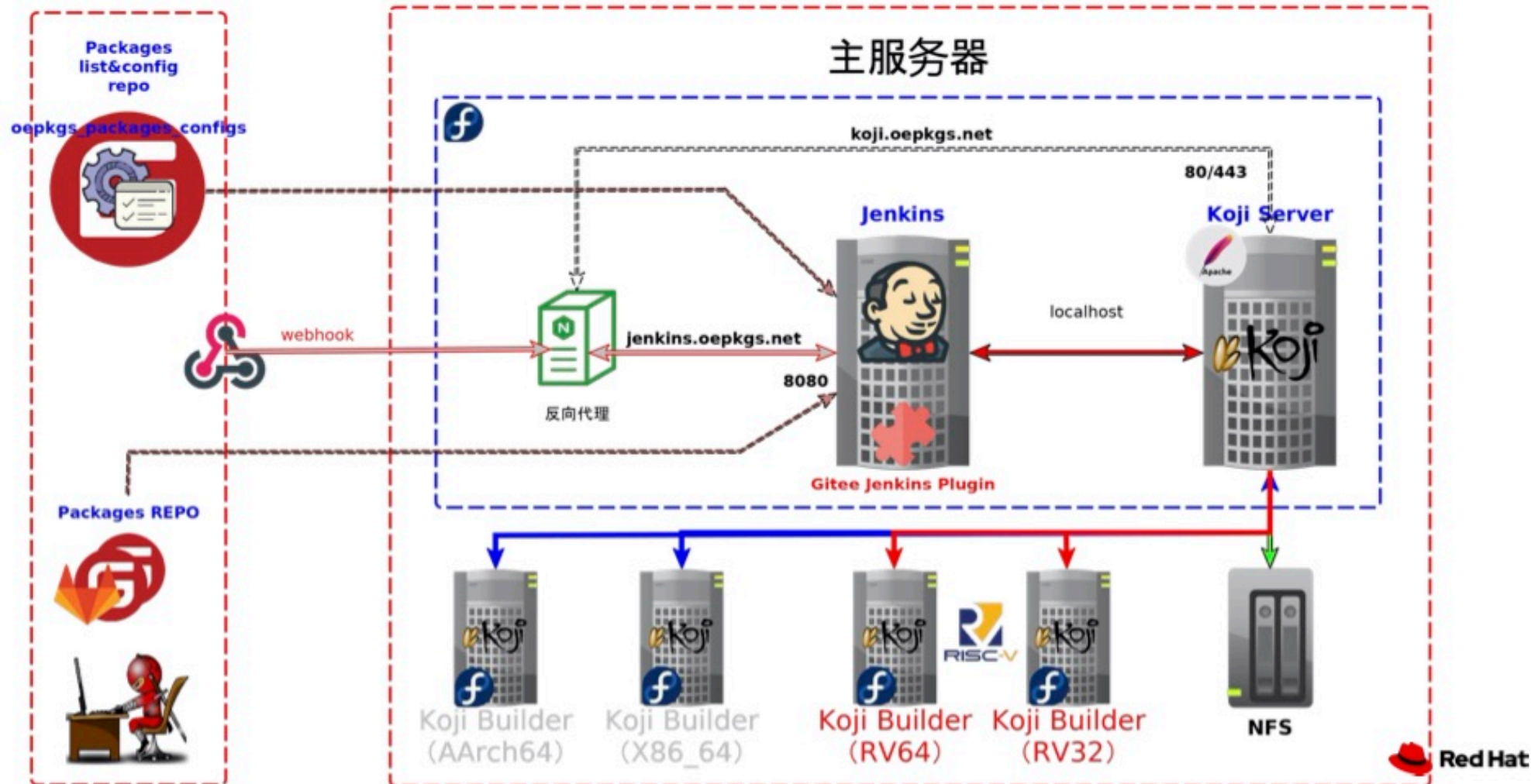
Oepkgs Build System (Preview)

Gitee

Cloud



智能软件研究中心
Intelligent Software Research Center



Supported Targets



Virtual: QEMU and libvirt/QEMU

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



SiFive Unleashed

Fedora GNOME Image can run on SiFive Unleashed(with Expansion Board, PCI-E graphic Card & SATA SSD.)



Targets (On Going)

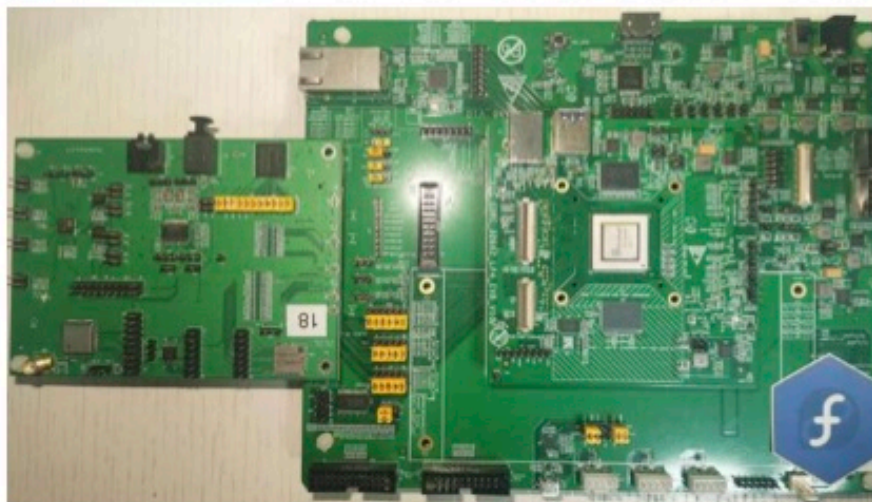


StarFive
赛昉科技



Intelligent Visual Computing Platform - VIC7100

We are working on making Fedora Images can run on this development platform.



Targets (TODO)



HiFive Unmatched - SiFive Freedom U740

We will work on making Fedora Images can run on this high-performance platform in a PC form factor next month.

It is running OpenEmbedde now.

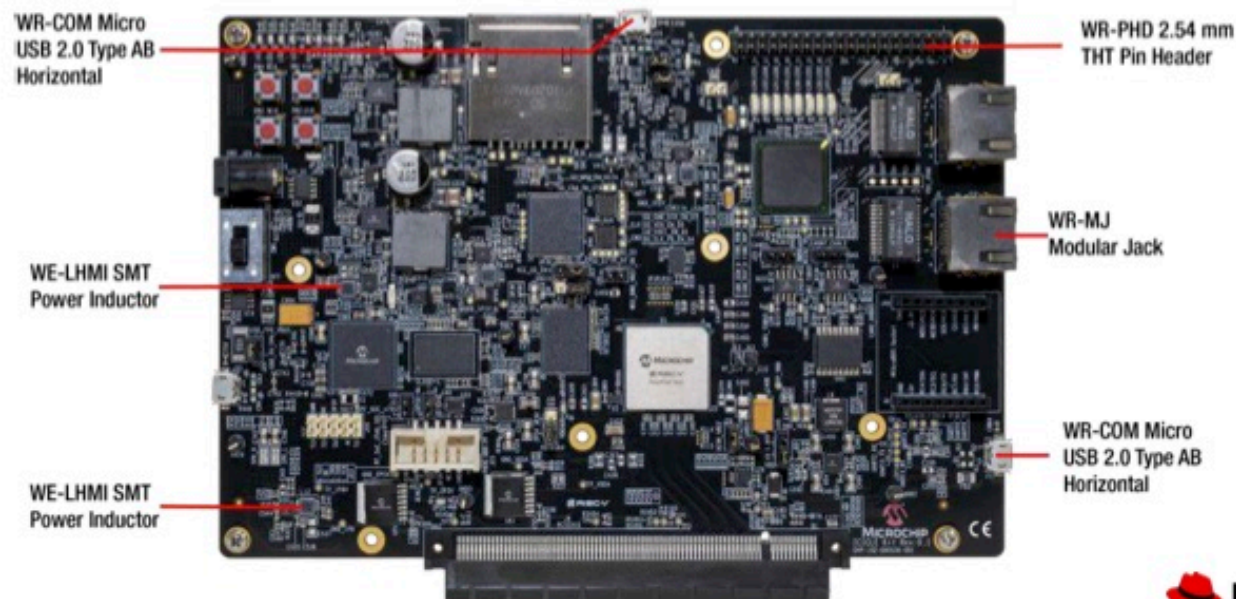


Targets (TODO)



PolarFire SoC Icicle Kit

We would like to work on making Fedora Image can run on this open-spec FPGA-enabled, SiFive U540 based PolarFire SoC platform once we get a board.



Info Source:

<https://linuxgizmos.com/risc-v-based-polarfire-soc-debuts-on-499-dev-board/>

Tested Targets



QEMU for AndeStar V5 && AndeShape Development Platform ADP-XC7KFF676

Fedora Images can run on the QEMU and
AndeShape FPGA board



Collaboration



中国科学院计算技术研究所
INSTITUTE OF COMPUTING TECHNOLOGY, CHINESE ACADEMY OF SCIENCES



ICT Development Platform

Fedora Developer Image can run on ICT FPGA
Cloud development platform (with PCI-E SSD
and graphic Card)

ISRC PLCT: V8 Team

Fedora Developer Image has been chosen as
the main development platform for their V8
team.

<https://zhuanlan.zhihu.com/p/153336696>

Fedora Developer Image on ICT FlameCluster



FlameCluster =
SERVE.c + SERVE.v



```
Starting Hostname Service...
[ OK ] Started Permit User Sessions.
Starting Terminate Plymouth Boot Screen...
Starting Hold until boot process finishes up...
[ OK ] Started Terminate Plymouth Boot Screen.
[ OK ] Started Hold until boot process finishes up.

Welcome to the Fedora/RISC-V disk image
https://fedoraproject.org/wiki/Architectures/RISC-V

Build date: Wed Jul  3 20:19:49 UTC 2019

Kernel 4.18.0-ga57318a4-dirty on an riscv64 (hvc0)

The root password is ..riscv...

To install new packages use 'dnf install ...'

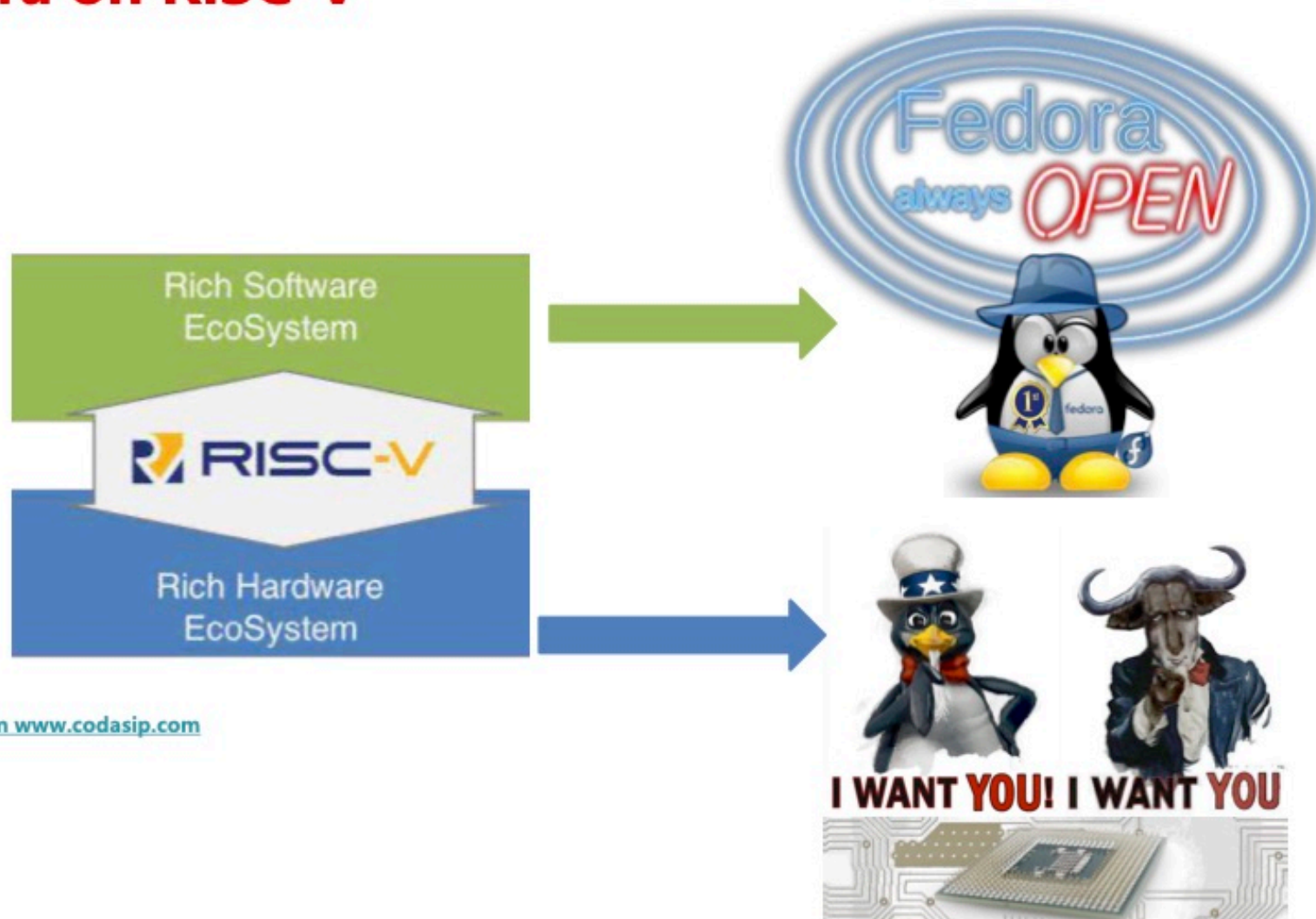
To upgrade disk image use 'dnf upgrade --best'

If DNS isn't working, try editing ../etc/yum.repos.d/fedora-riscv.repo...

For updates and latest information read:
https://fedorapeople.org/groups/risc-v/disk-images/readme.txt

Fedora/RISC-V
-----
Koji:             http://fedora-riscv.tranquillity.se/koji/
SCM:              http://fedora-riscv.tranquillity.se:3000/
Distribution rep.: http://fedora-riscv.tranquillity.se/repos-dist/
Koji internal rep.: http://fedora-riscv.tranquillity.se/repos/
[ 230.410000] tx_irq = 4
[ 230.410000] rx_irq = 5
fedora-riscv login: root
Password:
[root@fedora-riscv ~]# passwd
Changing password for user root
```


Fedora on RISC-V



We would like to support more targets based on standard RISC-V Spec.

The Status of Linux Distro on RISC-V



Debian

Bootable: Yes, BBL on QEMU and Hardware

package management: apt + deb

Build system: build

Status: In maintenance, need more packages



Slackware

Bootable: No, chroot for Fedora Image

package management: slackpkg+pkgtools

Status: under development

Info Source:

Slackware: https://github.com/fede2cr/slackware_riscv

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

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

The Status of Linux Distro on RISC-V



Gentoo

Bootable: No, need to build OpenSBI and U-boot manually
package management: emerge + portage
Build system: portage
Status: under development



Arch-Linux

Bootable: No, only boot from qemu user-mode
package management: pacman + bsdtar
Build system: Arch Build System(ABS) , but currently using devtools (systemd-nspawn)
Status: under development, waiting for a good firmware

The Status of Embedded Linux on RISC-V



OpenWRT
Buildroot
Yocto/OpenEmbedded

Bootable: yes, BBL or U-boot
package management: buildtime or Opkg
Build system: Cross-compilation
Status: In maintenance

Part IV

Industry standard RISC-V server/PC

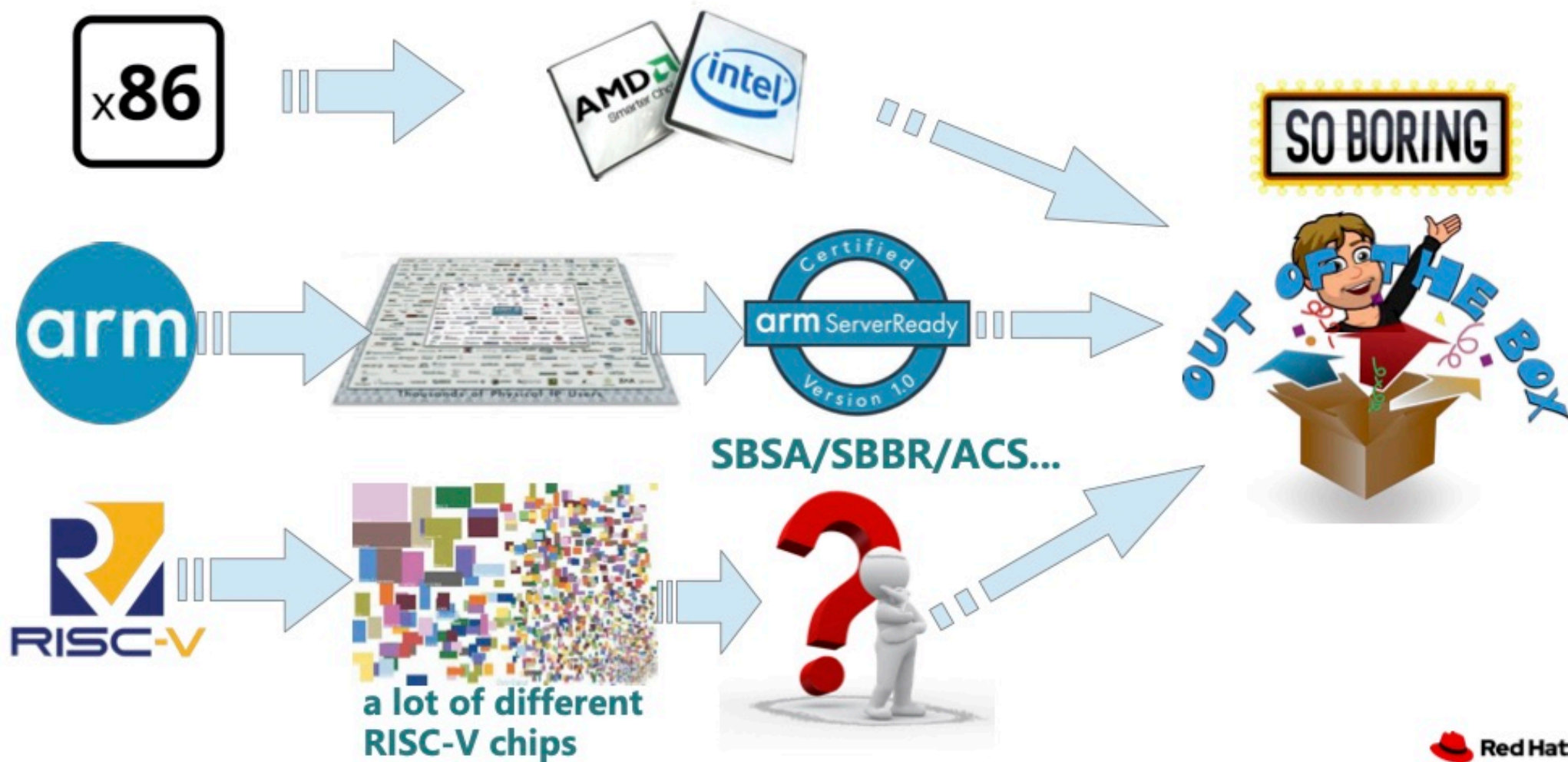


Specs

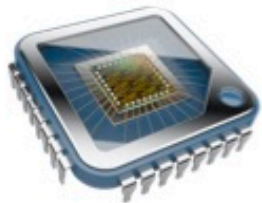
UEFI

TODO

Learn from other architectures



specs for RISC-V server/PC : UNIX-Class Platform Specification Task Group



<RISC-V PC/Server Base System Architecture>
like the SB SA:

- Define minimal **architectural** features
- Define minimal server SoC features

<RISC-V PC/Server Base Boot Requirements>
like the SBBR

- Define minimal **firmware** platform
- Enables mainstream general purpose OS

<RISC-V PC/Server Architectural Compliance Suite (ACS)>
like the ACS

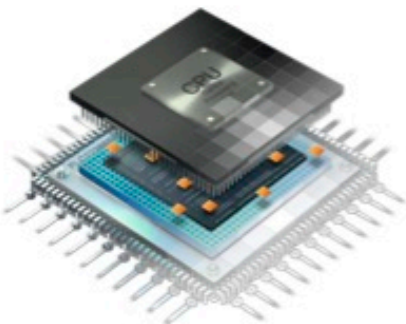
- SB SA and SBBR **verification**

The Status of RISC-V Firmware



U-boot

The upstream u-boot can boot Fedora image, works WELL.



OpenSBI + U-Boot + Linux

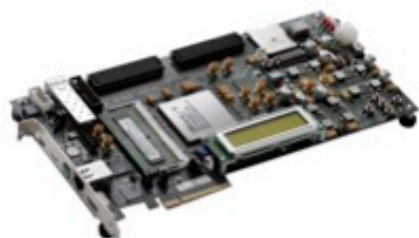
For now, it has become a **standard boot flow for Fedora** on RISC-V



GRUB2

The RISC-V support has been merged, the rpm package is built in Koji, and it is already available in Fedora. Everything is ready to go.

Firmwares for RV64 are almost ready



2018 , HPE engineers have made Tianocore successfully boot on SiFive Freedom U500 VC707 FPGA Dev Kit with OpenSBI integrated in edk2 RISC-V port.

HPE also worked on standardizing firmware spec:

- **SMBIOS** 3.3.0 with new record type (type 44)
- **CIM** with RISC-V processor definitions
- **UEFI** spec



HPE has upstreamed all the patches for RV64, EDK2 support is ready. For Now, EDK2 with edk2-platform(+ OpenSBI) can run on QEMU(>V4.1.5, -machine sifive_u -cpu sifive-u54) and **Real Hardware SiFive Unleashed. Linux can boot from UEFI.**

Acknowledgments



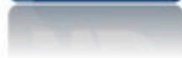
Hewlett Packard
Enterprise



Red Hat



SiFive



Abner Chang
Gilbert Chen

Al Stone
Andrea Bolognani
DJ Delorie
John Feeney
Richard Jones
Yang Liu

David Abdurachmanov

Alistair Francis
Anup Patel
Atish Kumar Patra

Felix Yan
Mikael Frykholm
Stefan O'Rear
Yixun Lan



StarFive
赛昉科技

RISC-V Day
Tokyo 2020

RISC-V®
AMBASSADOR

facebook

TRANQUILITY

OSL
OPEN SOURCE LAB



... 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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