

## Linux on RISC-V

#### Fedora and Firmware in practice

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 From Linux to Fedora



Part I

# From Linux to Fedora



Linux Fedora RHEL CentOS





#### **Linux distribution**



A Linux distribution is usually built around a package(RPM, DEB, IPK) management system, which puts together the Linux kernel, free and open-source software, and occasionally some proprietary software.



Info Source: https://en.wikipedia.org/wiki/Linux distribution



#### Linux is everywhere





## The top supercomputers run Red Hat Enterprise Linux



**Summit** 

#1 Supercomputer on the TOP500 list



#### Sierra

#2 Supercomputer on the TOP500 list

"Every single supercomputer—at least every one that broke the speed barrier and made it into the top 500 list—is running Linux. **Every one. 100%** market share of the current fastest computers the world has ever seen."

RHEL -- 20 CentOS -- 132

#### 6 Info Source:

https://www.linuxjournal.com/content/linux-and-supercomputers https://www.top500.org/



#### **Fedora/RHEL/CentOS**







#### **Fedora**

#### **CentOS** Stream

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



#### Fedora focus is on new technology



Fedora is the **pioneer** on new technology.

Fedora is also corporate supported by RedHat. *It feeds the RHEL product.* Everything that is considered to be stable and useful for demanding enterprises, might be moved in phases towards the RHEL distribution.

If any new arch wanna get RHEL support, it need to **get Fedora support first**.



#### **How is Fedora Organized**



https://docs.fedoraproject.org/en-US/project/

#### From Communities To Enterprise 从社区开源软件到企业级软件





Info Source: Red Hat

#### **Product Development Model** 产品开发模式



**Red Hat** 

#### From Opensource to RISC-V 从开源到RISC-V





Part II

# Fedora on RISC-V



Firmware Status Fedora Bootstrap Koji Status Supported Targets



#### **The Status of RISC-V Firmware**



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. But we still miss the EFI support in kernel.



## The good progress of RISC-V Firmware





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 is also working 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 most of patches, EDK2 support is almost 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.** 



#### The issue for a new architecture with Linux Distro



#### **Chicken And Egg Situation**

Generally, one Fedora 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.









## **Story : Fedora on RISC-V**



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.

18 Info Source:

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

RISC-V Koji maintainer: David Abdurachmanov



### Linux Distro on RISC-V: OpenSource way







#### The First bootstrap

October 15, 2016, The First bootstrap for Fedora 25 on RV64 was finished by:

- David Abdurachmanov
- Richard WM Jones
- Stef O'Rear

DJ Delorie provided some significant contributions to **glibc** for RISC-V.

#### Why did this project stop?

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

We need all the significant patches for **GCC/glibc/Linux** kernel to be merged, then we can do the final bootstrap on RV64.



### Linux Distro on RISC-V: OpenSource way







#### **The Second Bootstrap**

The second bootstrap on Dec 2017 for Fedora 27 as preparation for the final one!

On 29th Jan 2018, the "RISC-V **glibc** port v7" patchset was committed. As the final piece was upstreamed, then the final bootstrap on RV64 was prepared to run.

#### **The Final Bootstrap**

The Fedora bootstrap for RISC-V was finished in March 2018. On 2018 April 15th, We moved to **koji**, and now are building packages normally, just like all other architectures.



## Koji Build System



**Red Hat** 

We are working on a Koji server for RV32/64 in China, we call it "OpenKoji".

#### **Status**



#### **Active projects**

**Fedora 33**/Rawhide, including debuginfo, debugsource and source





#### Fedora Developer Image has extra packages installed for

developers, all common editors, RPM tools, building tools, koji

stuff, etc.



Minimal





#### **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/

https://fedoraproject.org/wiki/Infrastructure/Mirroring





#### **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.)



#### Fedora GNOME on SiFive Unleashed



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#### **Collaboration**



中国科学院计算技术研究吗 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 developement platform for their V8 team.

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





#### Fedora Developer Image on ICT FlameCluster

# **SERVE 20 risc-v**

#### FlameCluster = SERVE.c + SERVE.v



#### 26 Learn more about SERVE:

https://code.ihub.org.cn/projects/373 https://github.com/ict-accel-team/SERVE.r

Ling 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 http://fedora-riscv.tranguillity.se/koji/ Koji: http://fedora-riscv.tranguillity.se:3000/ SCM: Distribution rep.: http://fedora-riscv.tranguillity.se/repos-dist/ Koji internal rep.: http://fedora-riscv.tranquillity.se/repos/ 230.410000] tx irg = 4 230.410000] rx irq = 5 fedora-riscv login: root Password: [root@fedora-riscv ~]# passwd



#### **Fedora on RISC-V**





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

Alphabetical Listing by Company Name

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**Acknowledgments** 

**Hewlett Packard** 

**Red Hat** 

SiFive

Enterprise

Mark Salter Richard Jones David Abdurachmanov

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Abner Chang

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Charles Wei

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DJ Delorie

Al Stone

Alistair Francis Anup Patel Atish Kumar Patra

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.

- in linkedin.com/company/red-hat
  - youtube.com/user/RedHatVideos
    - facebook.com/redhatinc

#### twitter.com/RedHat

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