Red Hat

Fedora on RISC-V

Status and practice

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Sep 30th
RISC-V Day Tokyo 2019

AGENDA

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Fedora on RISC-V

History

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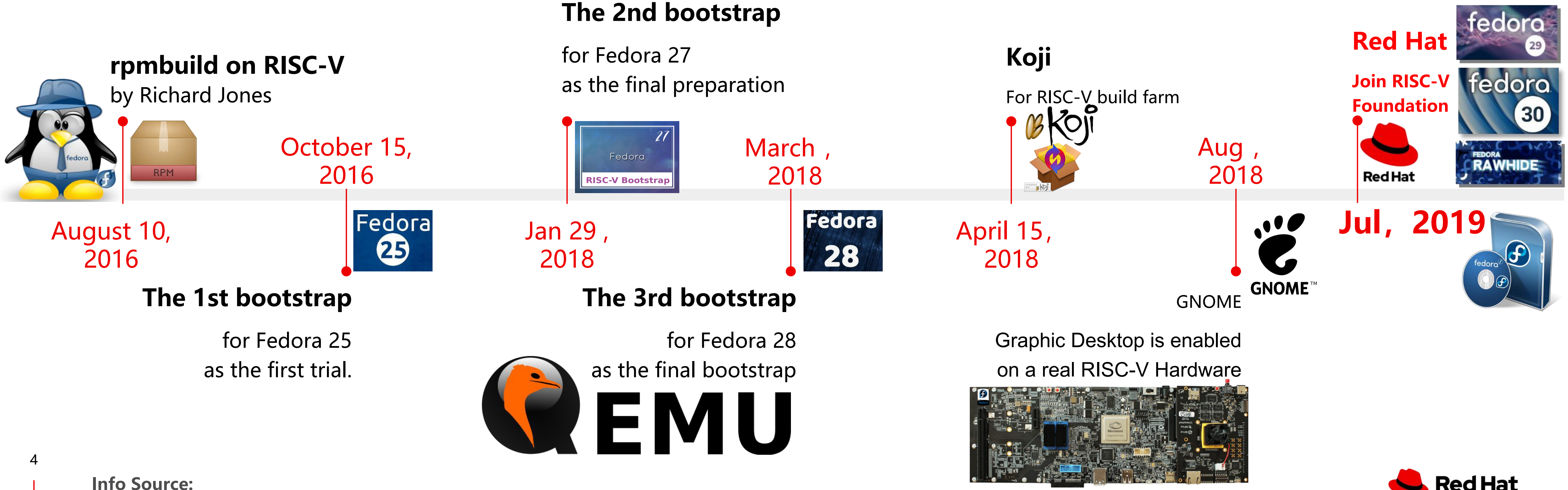
History

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.



August 10, 2016
rpmbuild on RISC-V
by Richard Jones

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

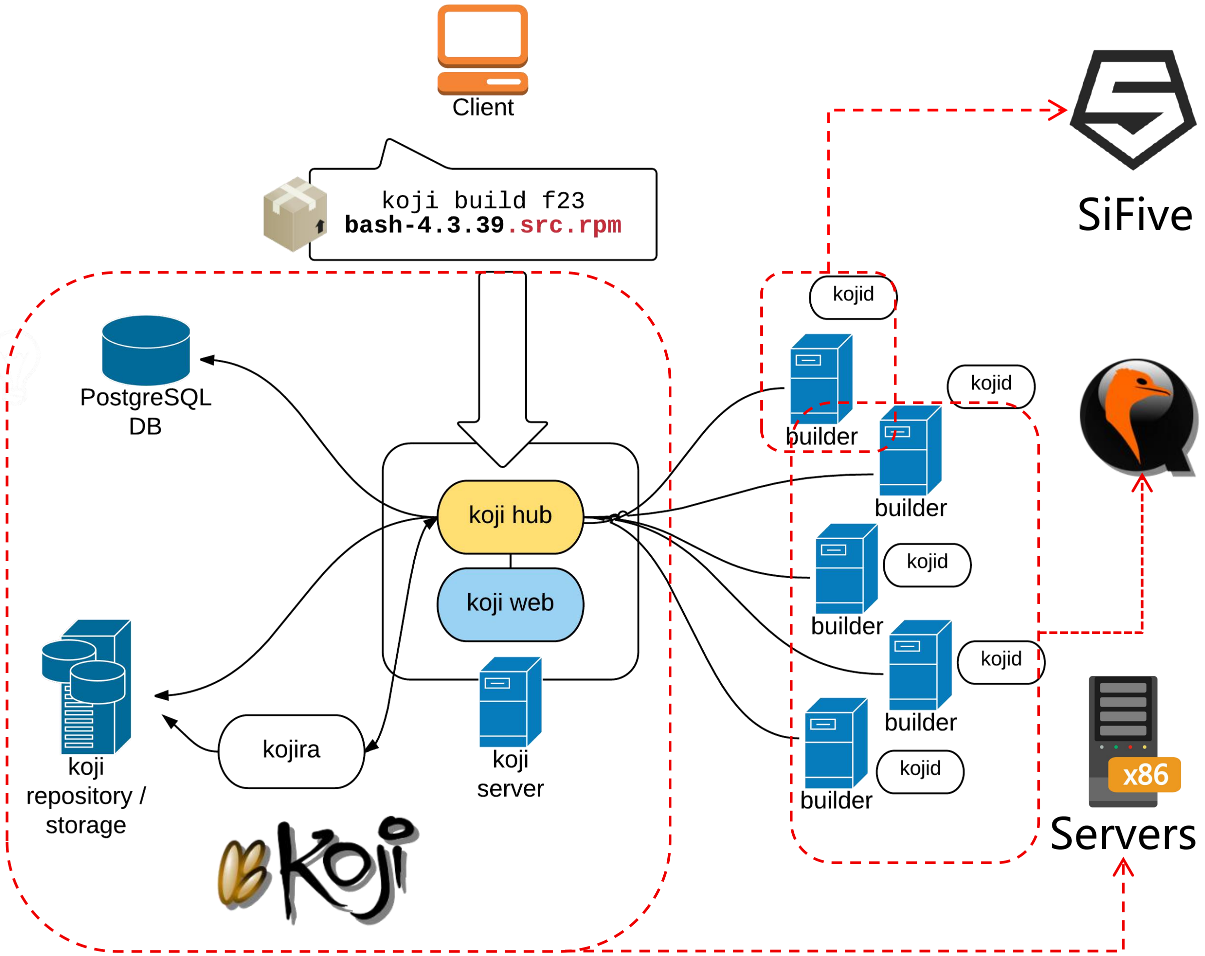
Aug , 2018
GNOME
Graphic Desktop is enabled
on a real RISC-V Hardware

Jul， 2019
Red Hat
Join RISC-V Foundation

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

Facility: Koji Build System

Koji builds RPMs for the Fedora Project and EPEL.



3 HiFive Unleasheds

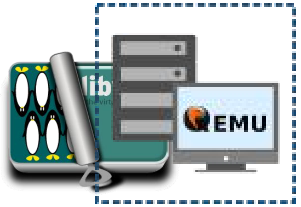
One of them connects with SSD.

94 QEMU VMs(on x86_64)

fedora-riscv-x.gcc1xx.osuosl.org

managed by libvirt

(will add more by adding more servers)



2 x86_64 servers for all central infrastructure

1 * Main sever and repository creation

1 * VM with Ceph for backup (restic based)

This picture is from Glaser Lo's blog

Koji build system overview

http://gklo.github.io/open-source/koji-build-systems-overview/

These Koji servers for RISC-V are being moved to hardware supplied by SiFive and WD (near by San Francisco).

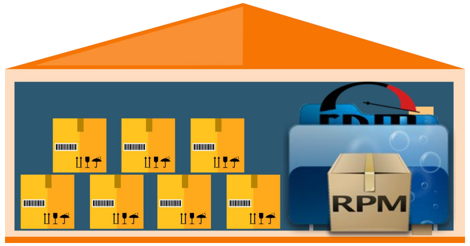
Status: Packages

Fedora for RISC-V is mirrored as
a Fedora “**alternative**” Architecture

Active projects:

Fedora 31/Rawhide

Fedora 30



Repositories

ALT DOWNLOADS

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

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

The Koji Build System

All kinds of packages are building here, including debuginfo, debugsource and source packages.

Before we got some decent RISC-V build systems, we couldn't make RISC-V become an official Alt architecture.

Wanna help to make a mirror?
https://fedoraproject.org/wiki/Infrastructure/Mirroring

Status: Images

Koji is building 3 types of disk image

Fedora Nano

smaller than Minimal, @core, kernel and no docs

Fedora Minimal

just include @core, @buildsys-build, kernel.

Fedora Developer

has extra packages installed for developers, all common editors, X11, a few small WMs, RPM tools, building tools, koji stuff, etc.

Fedora GNOME

Developer with GNOME desktop GUI support.

fedora-riscv login: root
Password: riscv

Supported Targets

Virtual: QEMU and libvirt/QEMU

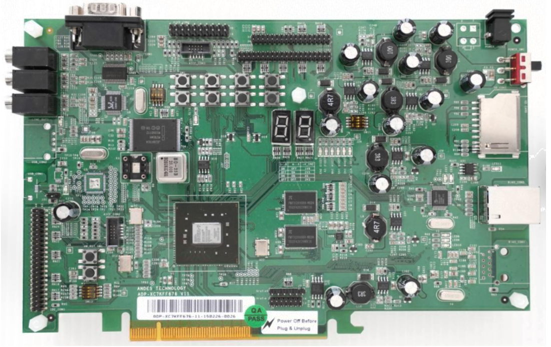
Fedora Images can run on the libvirt/QEMU with graphics parameters (Spice).

SiFive Unleashed

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

Tested Targets

ANDES TECHNOLOGY



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

Fedora Images can run on the QEMU and AndeShape FPGA board

RISC-V

ICT Development Platform

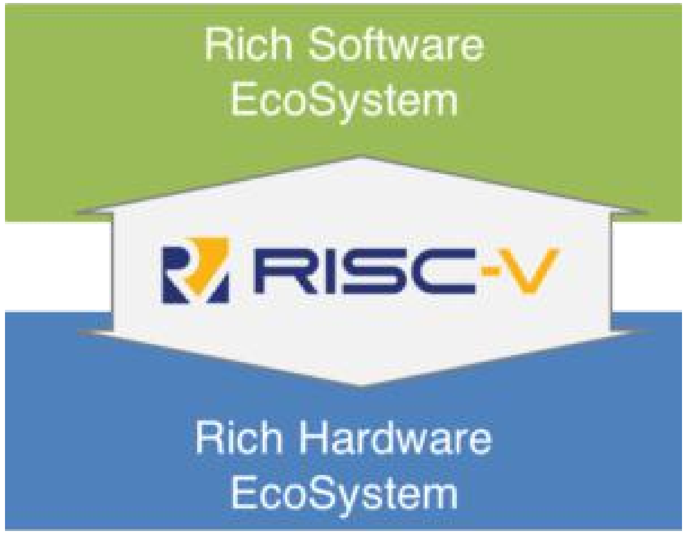
Fedora Developer Image can run on ICT FPGA Cloud development platform (with PCI-E SSD and graphic Card)

ICT

中国科学院计算技术研究所

INSTITUTE OF COMPUTING TECHNOLOGY, CHINESE ACADEMY OF SCIENCES

Fedora on RISC-V

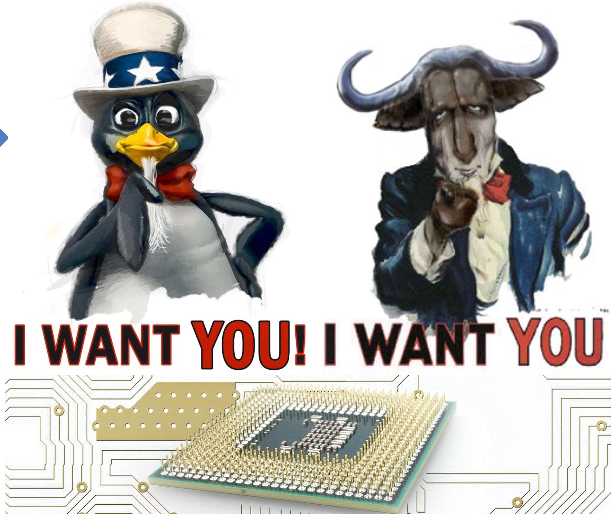


Rich Software EcoSystem

RISC-V

Rich Hardware EcoSystem

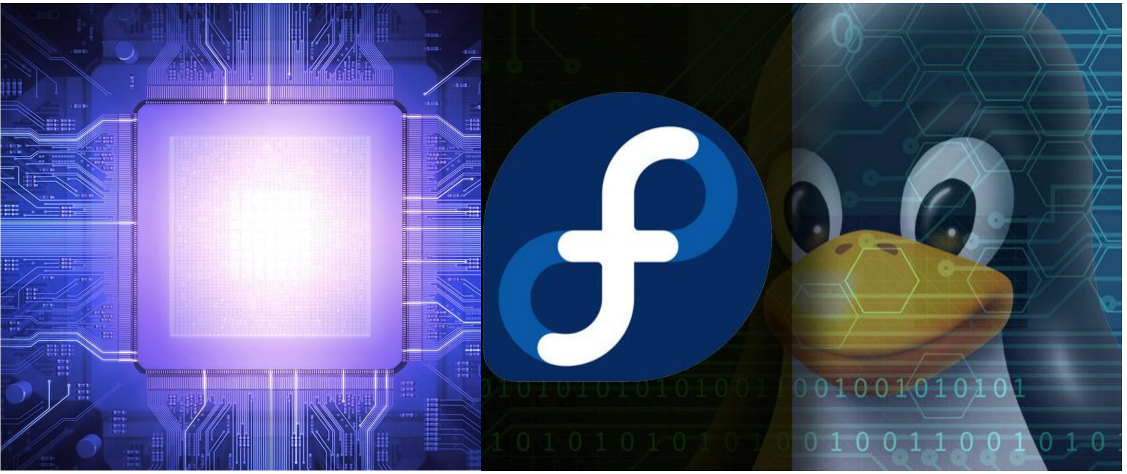
From www.codasip.com



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

Part Two

RISC-V Development on Fedora



Toolchain

QEMU

VM Tools

Please try Fedora 30 Docker image, if you are using other Distros

Red Hat

Toolchain

Cross compiler for RV64:

Since Fedora 29, you can just:

“sudo dnf install gcc-riscv64-linux-gnu”

you can get the relative package list by

“dnf list *-riscv*”

Native compiler for RV64:

"Fedora Developer" Image has extra packages installed for developers, including RPM tools, building tools, koji stuff, etc.
You can use them just like on X86 machine.

For Building RPM packages and Fedora Images, we only use **native compilation**.

QEMU

QEMU RPM for RISC-V

Since Fedora 29, you can just:

“sudo dnf install qemu-system-riscv”

But please install the latest version of them by

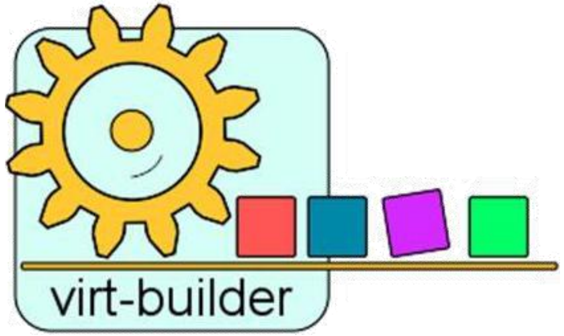
“sudo dnf copr enable @virtmaint-sig/virt-preview”

Build QEMU from source code

The upstream QEMU has supported most of latest RISC-V spec and can work with latest software for RISC-V.

If you use dated QEMU, it will be incompatible with the latest RISC-V Software.

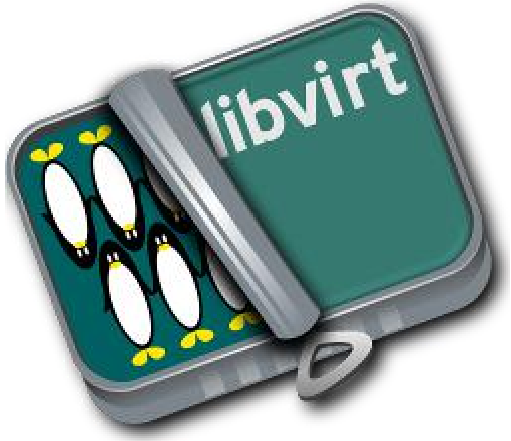
VM Tools



Fedora virt-builder:

You can quickly and easily build new virtual machines to practice Fedora on RISC-V .

sudo dnf install libguestfs-tools-c



The libvirt project:

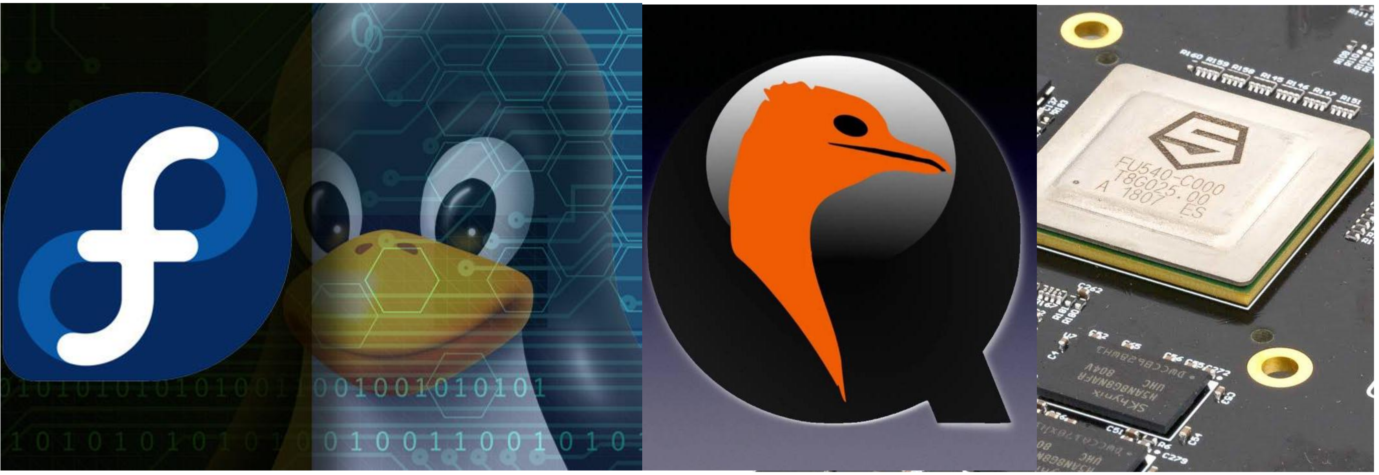
a toolkit to manage virtualization platforms, like creating new KVM, list the supported operating system variants, and start/stop/remove a VM.

sudo dnf install virt-manager libvirt

https://dl.fedoraproject.org/pub/alt/risc-v/repo/virt-builder-images/images/

Part Three

Fedora Image in practice



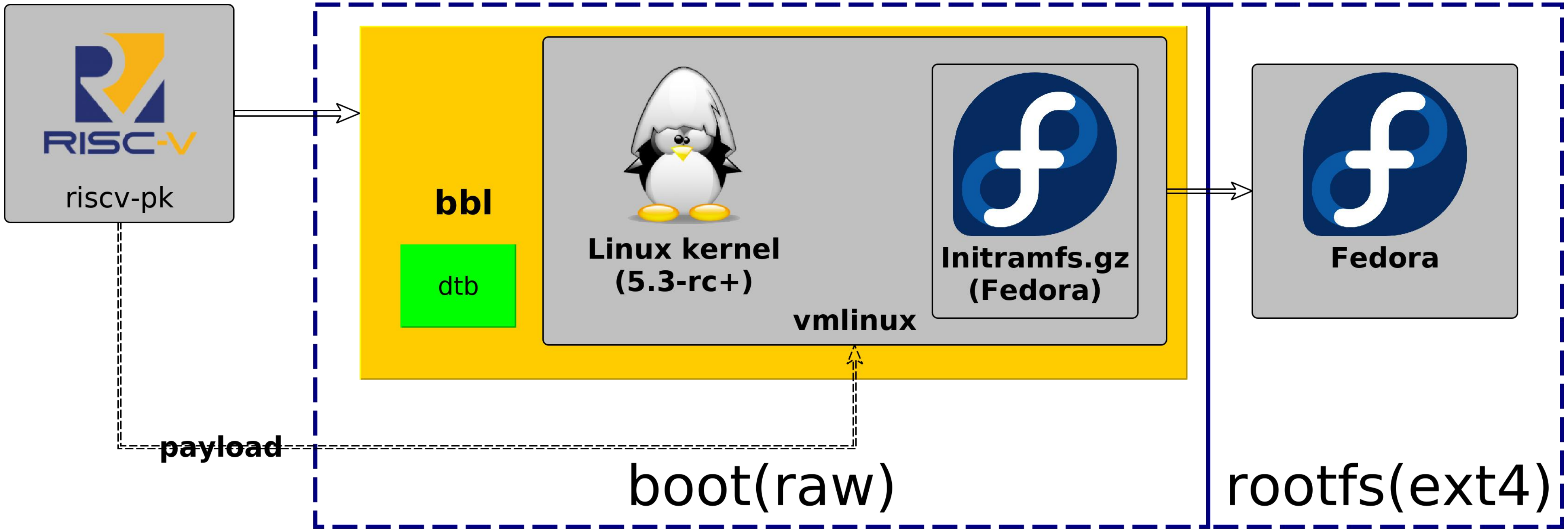
OpenSBI

U-Boot

Linux kernel

Fedora Image

The dated boot flow for Fedora on RISC-V



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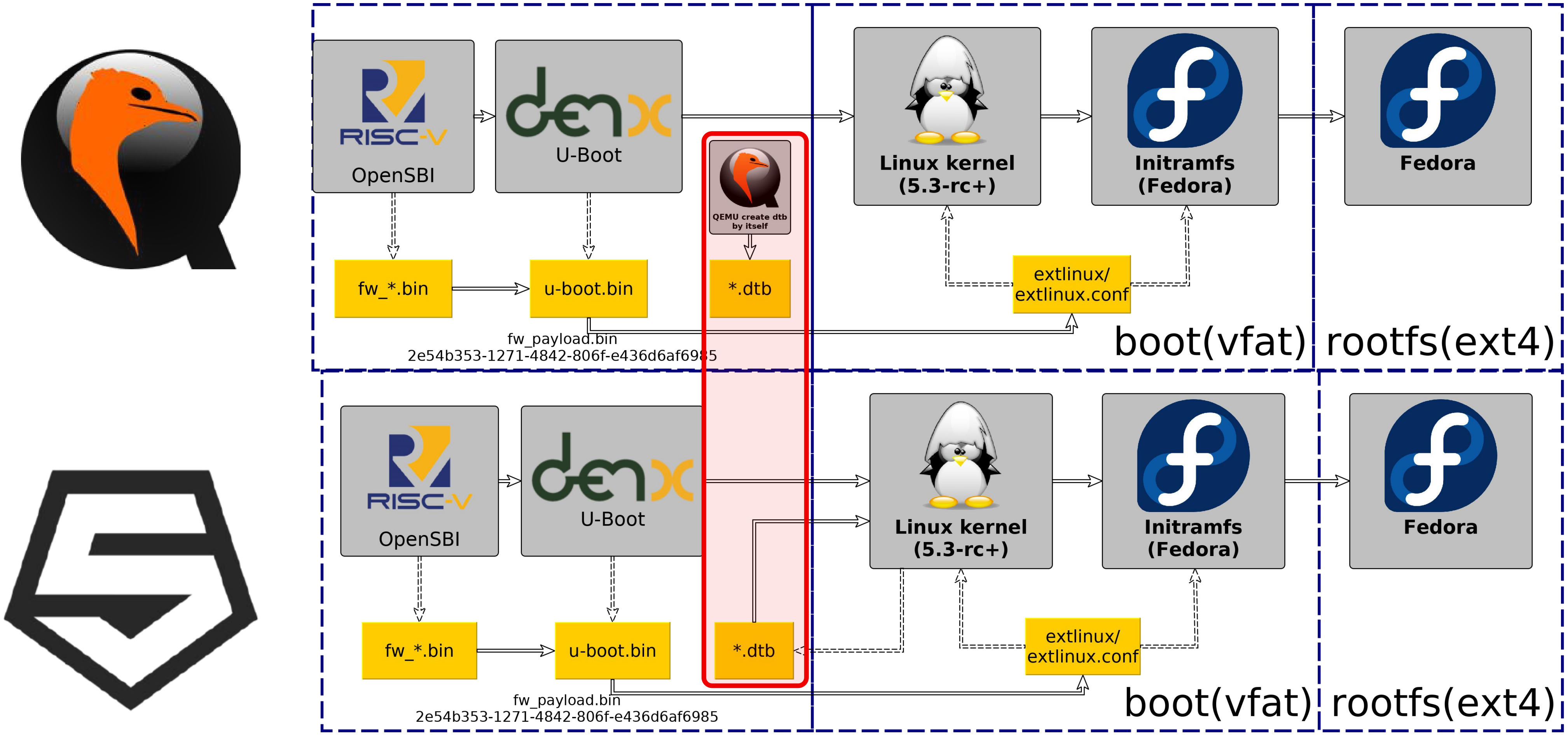
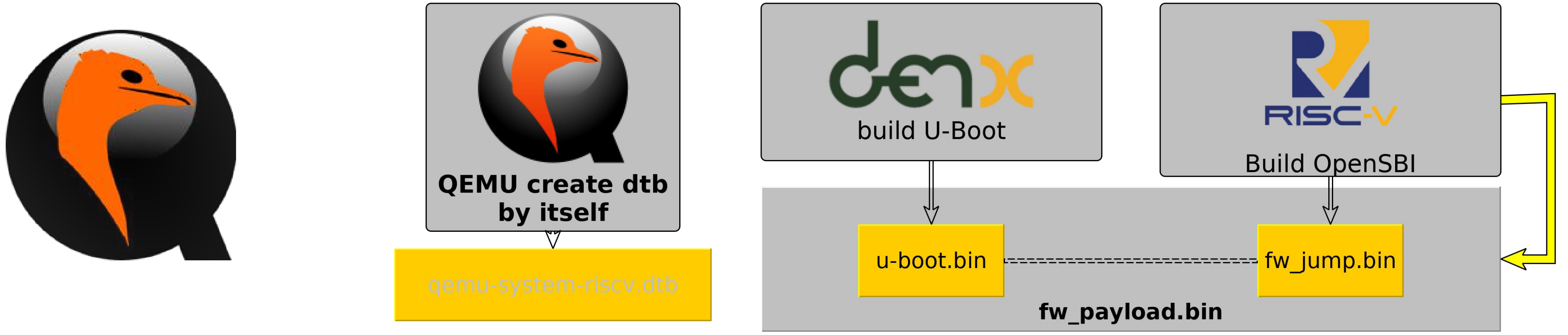
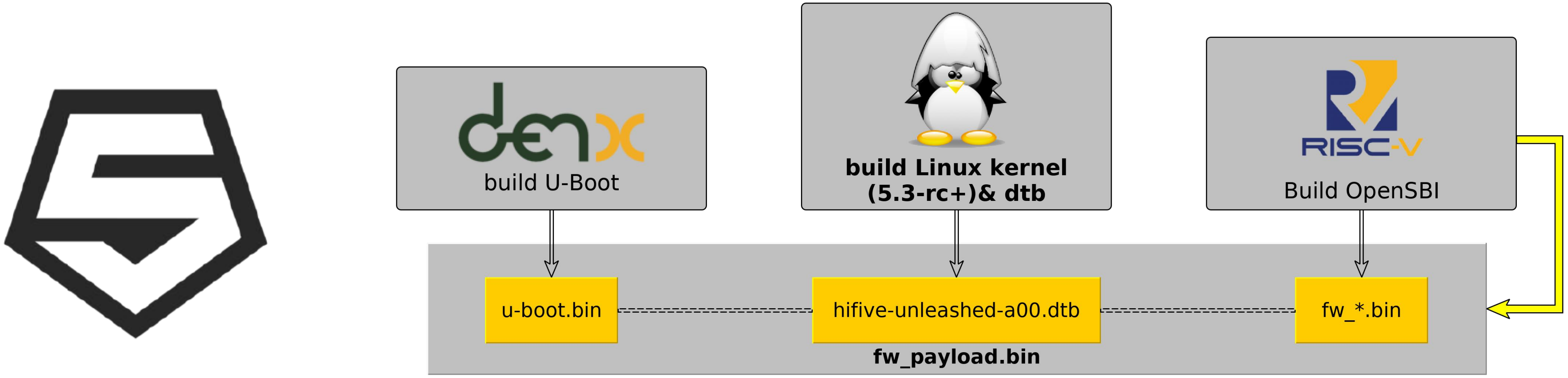
The current boot flow for Fedora on RISC-V

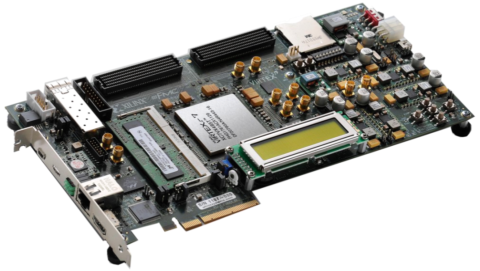


The current Build flow for firmware on RISC-V





The new progress of UEFI on RISC-V



Last year, HPE engineers have made Tianocore successfully boot on SiFive Freedom U500 VC707 FPGA Dev Kit(with USB3.0 and PCIe 3.0 support).

Then they were busy on standardizing UEFI spec and other firmware spec for RISC-V.

HPE has posted their patchset for review.

Now we are working together on runing EDK2 on QEMU and Sifive Unleashed.

Acknowledgments

Hewlett Packard Enterprise	Abner Chang
Red Hat	Al Stone Andrea Bolognani Charles Wei DJ Delorie John Feeney Richard Jones
SHC	Naomi Tsujioka **Shumpei Kawasaki**
SiFive	David Abdurachmanov
WD	Alistair Francis Anup Patel Atish Kumar Patra
	Mikael Frykholm Stefan O'Rear

RISC-V Day Tokyo 2019

facebook

TRANQUILLITY

OSL OPEN SOURCE LAB

Academic Computer Club Umeå University

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

Alphabetical Listing by Company Name

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

f facebook.com/redhatinc

twitter.com/RedHat

FYI

Steps to build firmware(OpenSBI/U-boot) for Fedora Image on RISC-V platform

Development Info:

IRC
#fedora-riscv (FreeNode)

Fedora Wiki pages For RISC-V

- **Main Entrance:**
  https://fedoraproject.org/wiki/Architectures/RISC-V
- **Instruction of installation:**
  https://fedoraproject.org/wiki/Architectures/RISC-V/Installing

Fedora Main REPO for RISC-V:
https://dl.fedoraproject.org/pub/alt/risc-v/

Koji for RISC-V:
IP: 185.97.32.145 **Domain Name:** fedora.riscv.rocks

- **Nightly build images:** http://fedora.riscv.rocks/koji/**tasks**?order=-completion_time&state=closed&view=flat&**method=createAppliance**
- **dist-repos:** http://fedora.riscv.rocks/repos-dist/
- **SCM:** http://fedora.riscv.rocks:3000/

QEMU：u-boot.bin & fw_payload.bin

U-boot: git://git.denx.de/u-boot.git

```
make qemu-riscv64_smode_defconfig
make
```

<u-boot>/u-boot.bin

OpenSBI: https://github.com/riscv/opensbi.git

```
make PLATFORM=qemu/virt \
FW_PAYLOAD_PATH=<u-boot_source>/u-boot.bin
```

<opensbi>/build/platform/qemu/virt/firmware/fw_payload.bin

Cross compiler:

ARCH=riscv CROSS_COMPILE=riscv64-linux-gnu-

Test on QEMU

QEMU

```
 qemu-system-riscv64 \
-smp 8 -m 2G  -machine virt -nographic \
-bios fw_payload.bin \
-device virtio-blk-device,drive=hd0 \
-drive file=Fedora-Developer-Rawhide-20190703.n.0-sda.raw,format=raw,id=hd0 \
-object rng-random,filename=/dev/urandom,id=rng0 \
-device virtio-rng-device,rng=rng0 \
-device virtio-net-device,netdev=usernet \
-netdev tap,id=usernet,ifname=tap0,script=no,downscript=no \
-serial telnet:localhost:7000,server
```

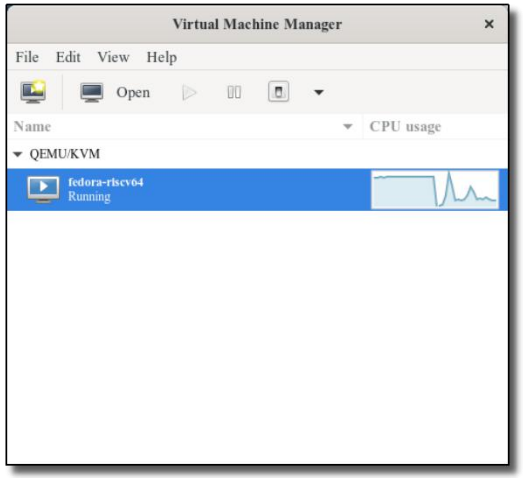
Please set up the network on your host machine correctly for “-netdev”

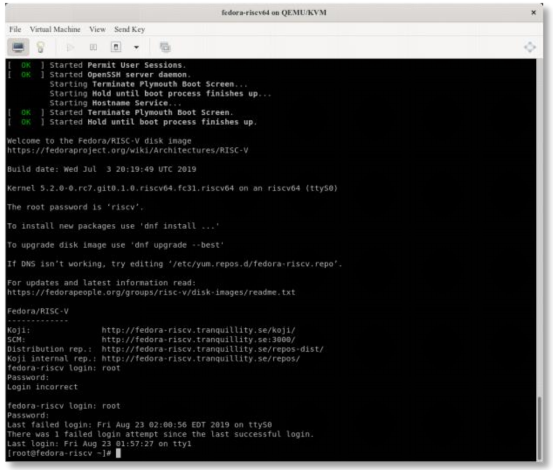
Test with Libvirt

Libvirt

```
virt-install --name fedora-riscv64 --arch riscv64 --vcpus 8 --memory 4096 \
  --os-variant fedora30 \
  --boot loader=/var/lib/libvirt/images/fw_payload.bin \
  --import --disk path=/var/lib/libvirt/images/Fedora-Developer-Rawhide-
20190703.n.0-sda.raw \
  --network network=default \
  --graphics spice
```

virt-manager





```
[  OK  ] Started Permit User Sessions.
[  OK  ] Started OpenSSH server daemon.
         Starting Terminate Plymouth Boot Screen...
         Starting Hold until boot process finishes up...
         Starting Hostname Service...
[  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 5.2.0-0.rc7.git0.1.0.riscv64.fc31.riscv64 on an riscv64 (ttyS0)

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/
fedora-riscv login: root
Password:
Login incorrect

fedora-riscv login: root
Password:
Last failed login: Fri Aug 23 02:00:56 EDT 2019 on ttyS0
There was 1 failed login attempt since the last successful login.
Last login: Fri Aug 23 01:57:27 on tty1
[root@fedora-riscv ~]# 
```

Please copy the firmware and image to the **right directory** and set up the **correct permission** of these files

HiFive Unleashed： u-boot.bin & hifive-unleashed-a00.dtb

U-boot

```
make sifive_fu540_defconfig
make
```

/u-boot.bin

DTB

```
#in Linux kernel tree (5.3-rc+)
make defconfig
make dtbs
```

arch/riscv/boot/dts/sifive/hifive-unleashed-a00.dtb

Cross compiler:

```
ARCH=riscv CROSS_COMPILE=riscv64-linux-gnu-
```

HiFive Unleashed：fw_payload.bin

OpenSBI

```
make PLATFORM=sifive/fu540 \
FW_PAYLOAD_PATH=u-boot.bin \
FW_PAYLOAD_FDT_PATH=<linux source>/arch/riscv/boot/dts/sifive/hifive-unleashed-a00.dtb
```

/build/platform/sifive/fu540/firmware/fw_payload.bin

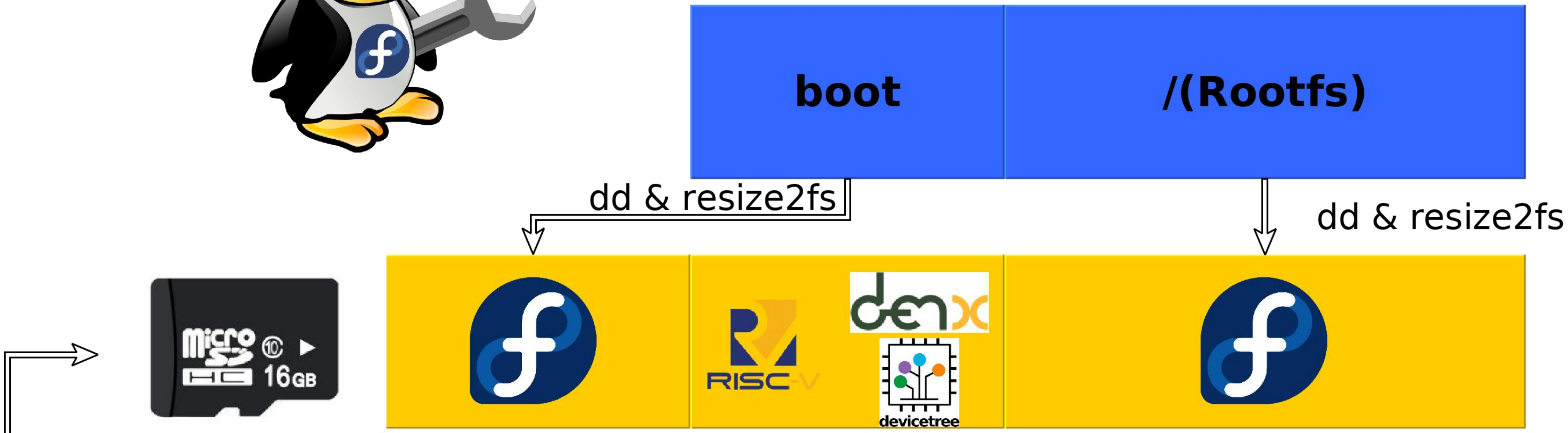
Cross compiler:

ARCH=riscv CROSS_COMPILE=riscv64-linux-gnu-

HiFive Unleashed: Flash into uSD

```
unxz -k Fedora-*$BUILD_DATE.n.0-sda.raw.xz

guestfish -a Fedora-*$BUILD_DATE.n.0-sda.raw \
 run : download /dev/sda1 boot.raw
guestfish -a Fedora-*$BUILD_DATE.n.0-sda.raw \
 run : download /dev/sda2 rootfs.raw
```



```
dd if=fw_payload.bin \
of=/dev/sdx2 bs=1024
```

```
sgdisk --clear                                                        \
      --new=1:*:*     --change-name=1:boot        --typecode=1:* \
      --new=2:*:*  --change-name=2:bootloader --typecode=2:2E54B353-1271-4842-806F-E436D6AF6985   \
      --new=3:*:     --change-name=3:rootfs       --typecode=3:* \
      ${DISK}
```