Linux Distro on RISC-V

Linux Distro in practice

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AGENDA

Distro — **What is Linux Distro**

Status — **Linux Distro on RISC-V**

Practice — **Try Linux Distro on QEMU user-mode**

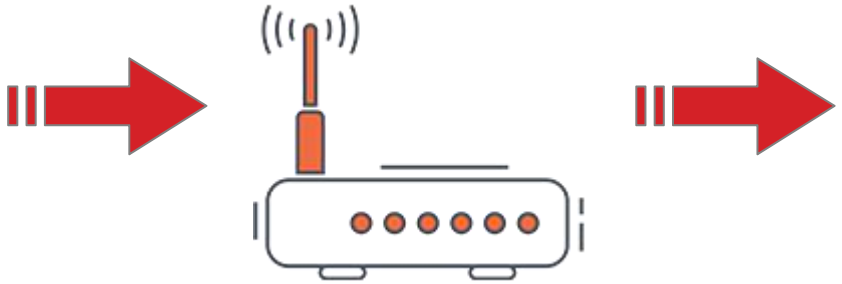
Part I

What is Linux Distro

Red Hat

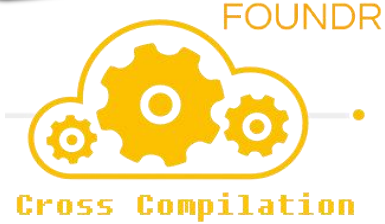
Linux is everywhere

End devices



Gateway

Cloud platform



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All the top supercomputers run 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

Info Source:

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

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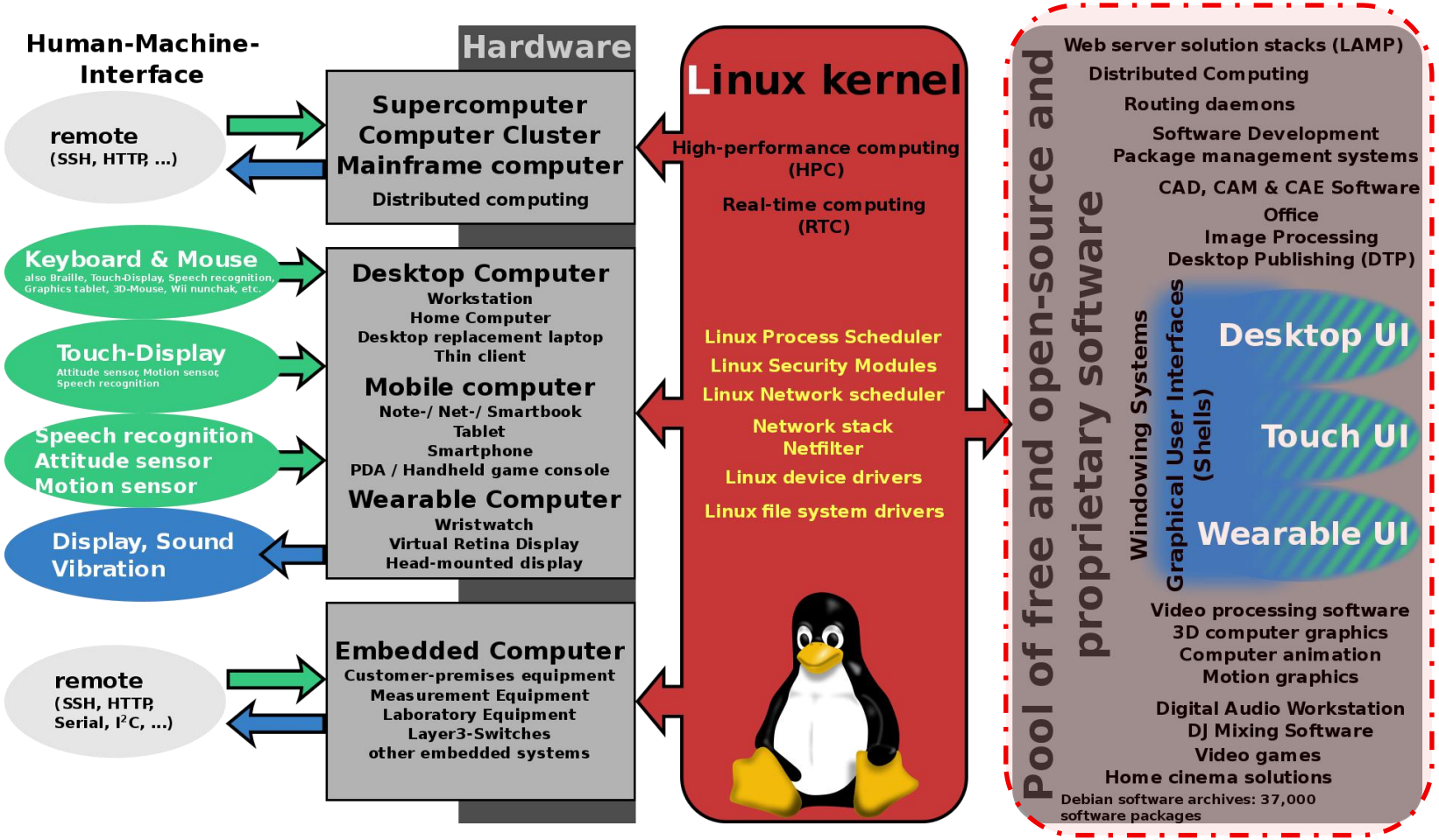
Linux distribution



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

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Part II

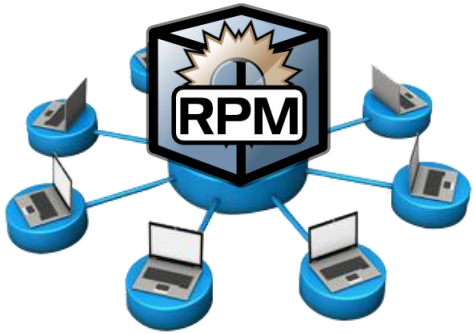
Linux Distro on RISC-V

Red Hat

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



- **Repositories**

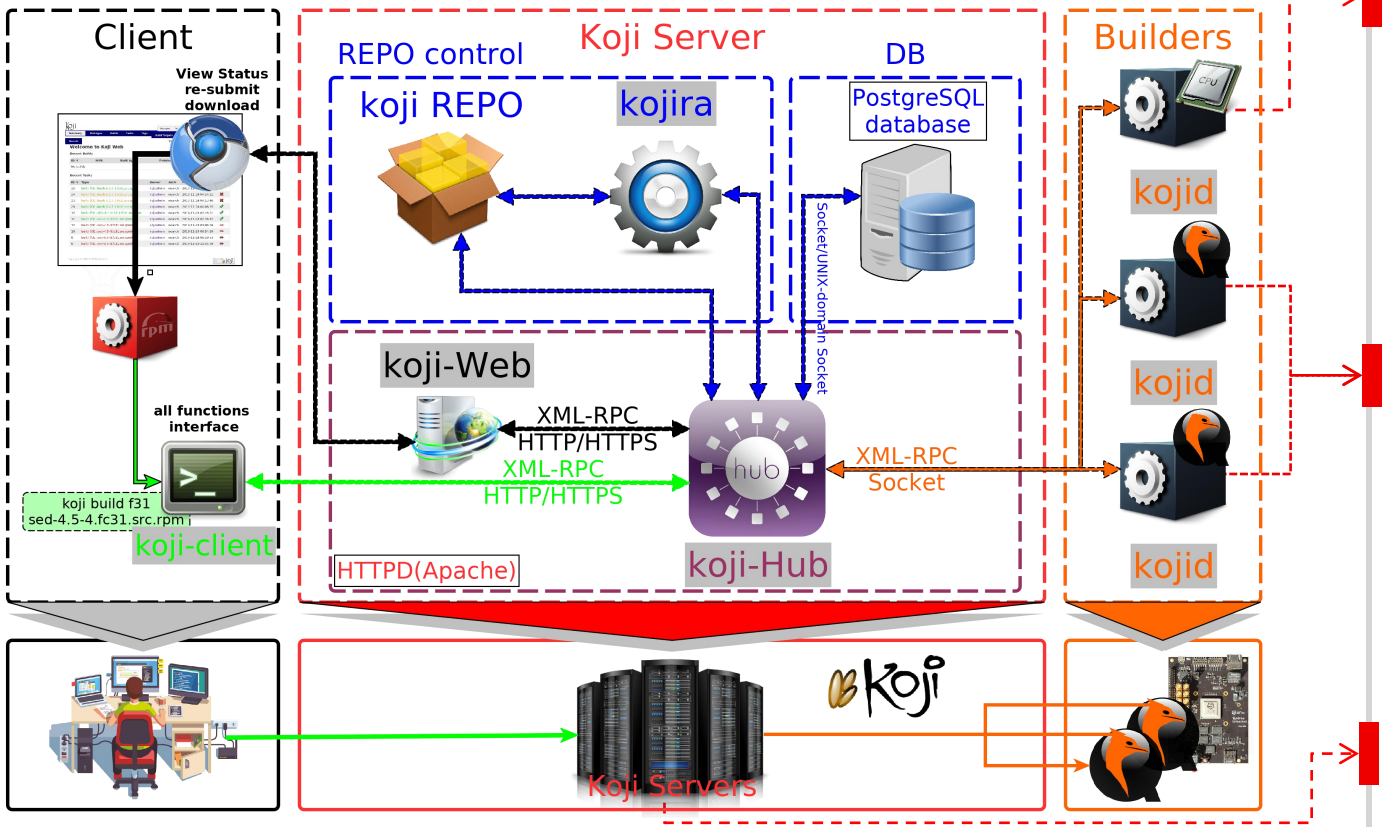
https://dl.fedoraproject.org/pub/alt/risc-v/

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

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

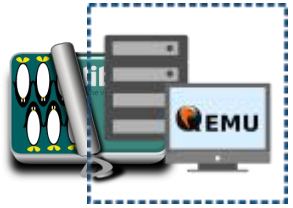
Koji Build System for Fedora

Koji builds RPMs for the Fedora Project and EPEL.



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).

These Koji servers for RV64 are supplied by SiFive and WD at Fremont, CA, USA.

We are working on a Koji server in China, we call it "oepkgs".

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The Status of Linux Distro on RISC-V

Debian

Bootable: Yes, BBL on QEMU and Hardware
package management: apt + deb
Build system: buildd
Status: In maintenance, need more packages

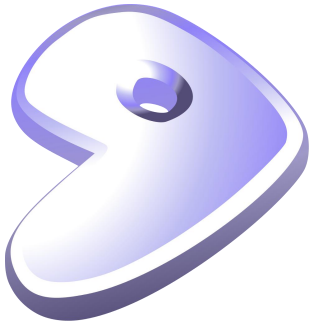
Slackware

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 manully
package management: emerge + portage
Build system: portage
Status: under development

Arch-Linux

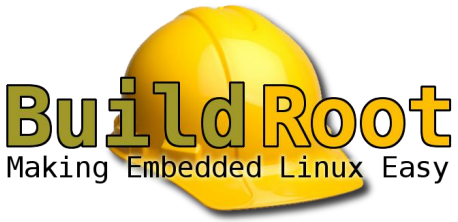
Bootable: No, only boot from qemu user-mode
package management: pacman + bsdtar
Build system: Arch Build System(ABS) , but currently using devtools (systemd-nspawn)
Status: under development, waiting for a good firmware

Info Source:

Gentoo: https://github.com/dlan17

Arch: Felix Yan

The Status of Embedded Linux on RISC-V



OpenWRT
Buildroot
Yocto/OpenEmbedded

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

Info Source:
https://riscv.org/exchange/software/

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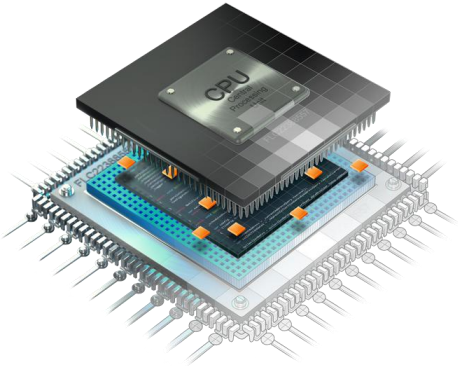
The Status of RISC-V Firmware



U-boot

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

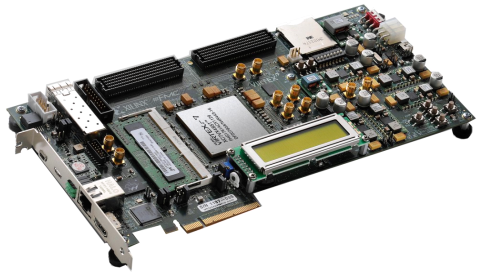
OpenSBI + U-Boot + Linux

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.
But we still miss the EFI support in kernel.

The good progress of RISC-V Firmware



tianocore

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:

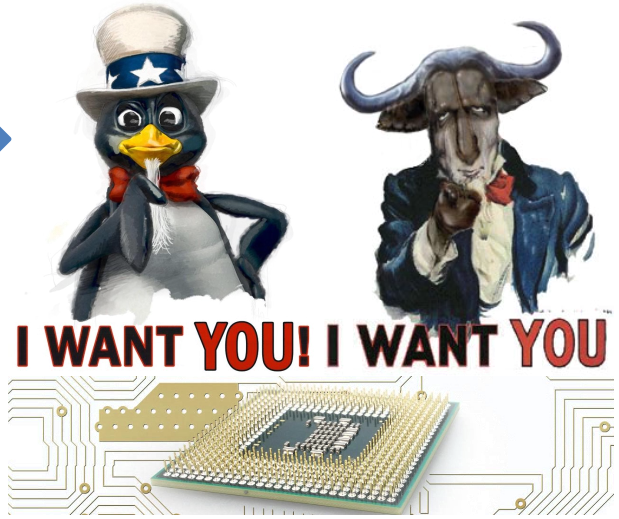
- **SMBIOS** 3.3.0 with new record type (type 44)
- **CIM** with RISC-V processor definitions
- **UEFI** spec

DMTF

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.**

Hewlett Packard Enterprise Red Hat

Linux distribution on RISC-V

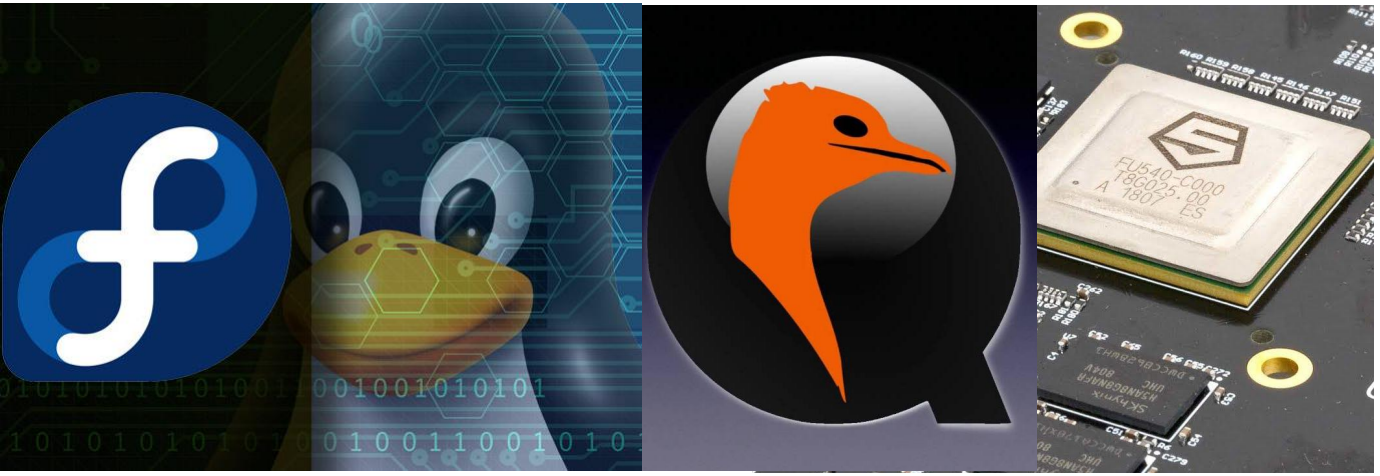


From www.codasip.com

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

Part III

Try Linux on QEMU user-mode



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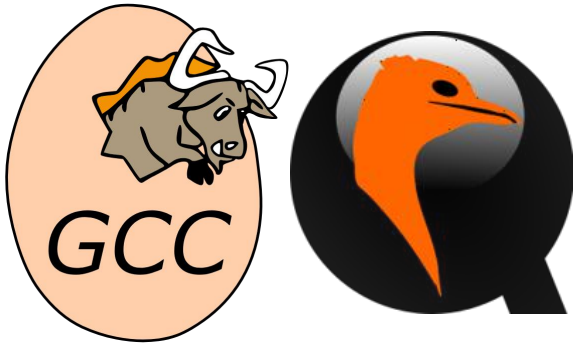
Enable binfmts (Tested on F31/F32)

Install qemu-user-static packages

"**sudo dnf install qemu-user-static**"

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:

```
#we need *--static*
./configure --target-list=riscv64-linux-user \
--disable-werror --disable-glusterfs \
--disable-tools --disable-capstone --disable-tools \
--static
```

If you use dated QEMU(<v4.1.15), it will be incompatible with the latest RISC-V Software(like edk2).

Enable binfmts (Tested on F31/F32)

Start systemd-binfmt Service

systemd-binfmt.service has been included in systemd package

“sudo systemctl start systemd-binfmt.service”

Verify binfmt support status

“ls /proc/sys/fs/binfmt_misc/”

#The binfmt of RISC-V 64 is ready, if qemu-riscv64 is listed.

Prepare Linux Distro rootfs(dir) (Fedora, for example)

Get Fedora Image for RISC-V

1. fedoraproject website
2. Koji for RISC-V

Please download the latest Fedora-Developer-Rawhide Image

Extract or Mount on a dir

guestfish -a $FEDORA_IMAGE run : download /dev/sda2 $FEDORA_IMAGE_ROOTFS

mkdir Fedora_rootfs

sudo mount -o loop ./$FEDORA_IMAGE_ROOTFS ./Fedora_rootfs

Try systemd-nspawn for RISC-V

Try QEMU user mode by systemd-nspawn

RV64_ROOTFS=Fedora_rootfs

sudo systemd-nspawn **-b**D ${RV64_ROOTFS}

systemd

For -b option

For some distro, The systemd package is still masked, and the OpenRC can not finish the boot flow in LXC, so we can NOT use -b option currently.

Red Hat

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Atish Kumar Patra

Felix Yan
Mikael Frykholm
Stefan O'Rear
Yixun Lan

RISC-V Day Vietnam 2020

RISC-V® AMBASSADOR

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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!

Red Hat

Alphabetical Listing by Company Name

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