About me

Carlos Eduardo
carlosedp

Check my articles on
https://medium.com/@carlosedp and
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👥 **182** followers · **49** following · ⭐ **153**

🏢 RISC-V Ambassador / Red Hat
📍 Sao Paulo/Brazil
✉️ me@carlosedp.com
🔗 twitter.com/carlosedp

All about multiarch open-source projects

RISC-V / ARM / PPC

- **Early posts about Kubernetes on ARM**
- **Started support for container runtimes like Docker on RISC-V**
- **Started project to bring cloud applications and containers for RISC-V**
- **Later, similar project for OpenPOWER**
- **Run Linux everywhere, from RISC-V Kendryte K210 to most recently the PS3**
- **Have been playing with FPGAs lately**

https://github.com/carlosedp

https://carlosedp.medium.com
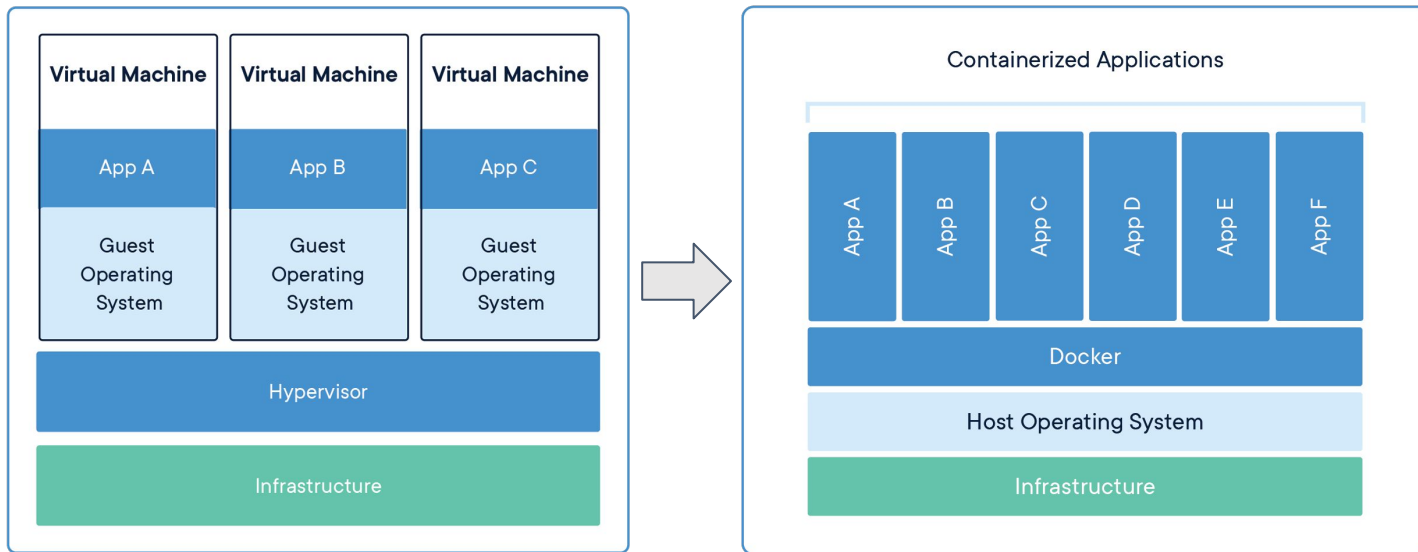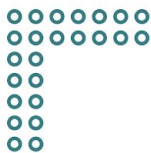
RISC-V® AMBASSADOR
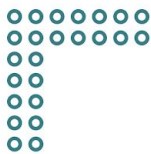
What are containers?

- **A standardized unit of software**
- **Packs all application requirements into a distribution image**
- **Runs everywhere. Developer laptop, QA server, production cloud with no changes**
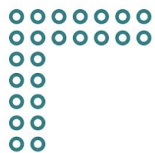
Containers on RISC-V


```
> ~/echo
> uname -a
Linux qemuriscv 5.3.0-rc4-g6c2a8bd-dirty #6 SMP Fri Nov 22 18:08:43 -02 2019 riscv64 GNU/Linux

> ~/echo
> DOCKER_BUILDKIT=1 docker build -t carlosedp/echo-riscv .
[+] Building 0.3s (5/5) FINISHED
 => [internal] load .dockerignore
 => => transferring context: 2B
 => [internal] load build definition from Dockerfile
 => => transferring dockerfile: 37B
 => [internal] load build context
 => => transferring context: 34B
 => CACHED [1/1] COPY echo-riscv /echo-riscv
 => exporting to image
 => => exporting layers
 => => writing image sha256:231b741f511088f6f3901b8877ba8130f8e14a0780fa5ae261dd1f1c4d6b81f2
 => => naming to docker.io/carlosedp/echo-riscv

> ~/echo
> docker run --name hello -d -p 8085:8080 carlosedp/echo-riscv
bf363e2f2b19a7171c88664e685289882a167d00c3118bfe77138ef11aae9899

> ~/echo
> curl localhost:8085
Hello, I'm running Echo inside a container on linux/riscv64%
```
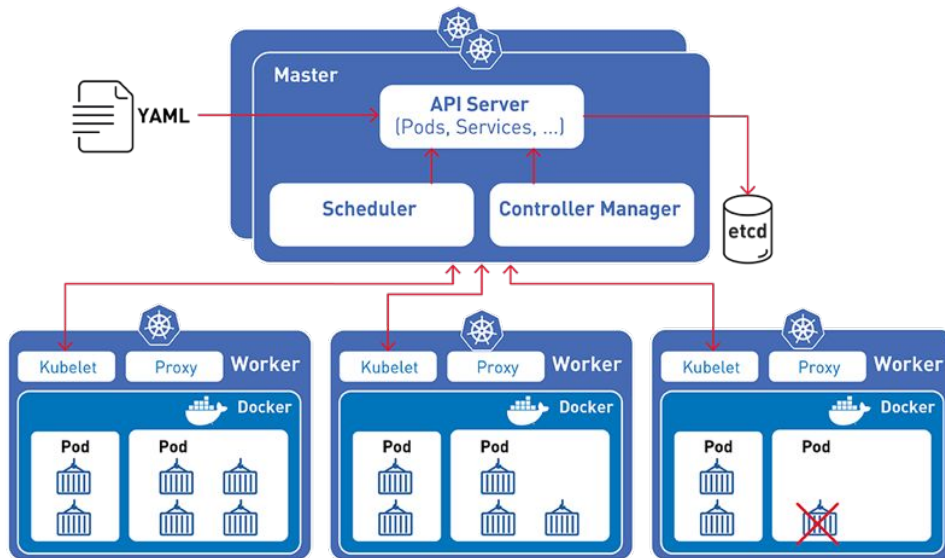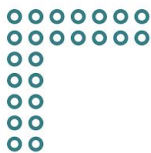
And Container Orchestration?

Kubernetes on RISC-V

No hardware? No problem

carlosedp Update kernel build and projects   b5ef04a on Aug 18   History

..

📁 patches   Add guide on creating the boot stack for Qemu   10 months ago

📄 Readme.md   Update kernel build and projects   3 months ago

RISC-V Qemu Virtual Machine

The objective of this guide is to provide an end-to-end solution on running a RISC-V Virtual machine and building the necessary packages to a fully-functional Qemu VM and it's boot requirements.

This is still a moving target so the process might change in the future. I confirm that with the versions used here, everything works.

The process is based on having OpenSBI (the second-stage boot loader) calling U-Boot and thru extlinux present a menu for available Kernel versions. Changing Kernel versions is a matter of adding Image and initrd to `extlinux.conf`.

There is also an alternative and simpler way to boot Qemu with by passing the Kernel image directly as a parameter bypassing U-Boot and the extlinux menu. More details in the section at the end of the guide.

Below is a diagram of the process:

```
+--------------------------+      extlinux.conf           Linux
|                          |                                                
|    SBL - FW_PAYLOAD      |      +----------------+     +------------------+
|                          |      |                |     |                  |
|  +---------+ +---------+ |      | Unleashed Menu |     | Starting kernel ...|
|  |         | |         | |      |                |     | [0.00] Linux versio|
|  |         | |         | |      | 1. Kernel 5.5  |     | [0.00] Kernel comma|
+  | OpenSBI +--->+ U-Boot |      +--->+ 2. Kernel 5.6 +--->+ ..               |
|  |         | | Payload | |      |                |     | ...              |
|  |         | |         | |      |                |     |                  |
|  +---------+ +---------+ |      +----------------+     +------------------+
|                          |                                                
+--------------------------+
```

Build your own Qemu RISC-V stack with the guide:
https://github.com/carlosedp/riscv-bringup/tree/master/Qemu

or download a pre-built image:

https://github.com/carlosedp/riscv-bringup/releases/download/v1.0/debian-riscv64-QemuVM-202002.tar.gz

https://github.com/carlosedp/riscv-bringup/releases/download/v1.0/UbuntuFocal-riscv64-QemuVM.tar.gz
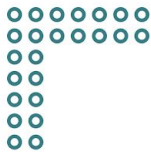
Distro build guide for Unleashed

Building the SiFive Unleashed RISC-V board boot requirements

The objective of this guide is to provide an end-to-end solution on building the necessary packages to boot the SiFive Unleashed RISC-V board boot requirements.

This is still a moving target so the process might change in the future. I confirm that with used versions everything works.

The process is based on having OpenSBI (the second-stage boot loader) call U-Boot and this load the boot config (from `extlinux.conf`) allowing one to add and change Kernel versions.

Below is a diagram of the process:

```
                                  +-------------------------------+      Extlinux.conf           Linux
                                  |                               |      +----------------+  +---------------------+
                                  |       SBL - FW_PAYLOAD         |      |                |  |                     |
  +---------------+  +----------+  |  +----------+  +----------+   |      | Unleashed Menu |  | Starting kernel ...|
  |               |  |          |  |  |          |  |          |   |      |                |  | [0.00] Linux versio|
  | ROM - ZSBL    |  | Loader   |  |  |          |  |          |   |      | 1. Kernel 5.5  |  | [0.00] Kernel comma|
  | In the SoC +-->+ FSBL   +---->+  | OpenSBI  +-->+ U-Boot   +--->+  +--->+ 2. Kernel 5.6 +--->+ ..                |
  |               |  |          |  |  |          |  | Payload  |   |      |                |  | ...                 |
  +---------------+  +----------+  |  +----------+  +----------+   |      +----------------+  +---------------------+
                                  |                               |
                                  +-------------------------------+
```
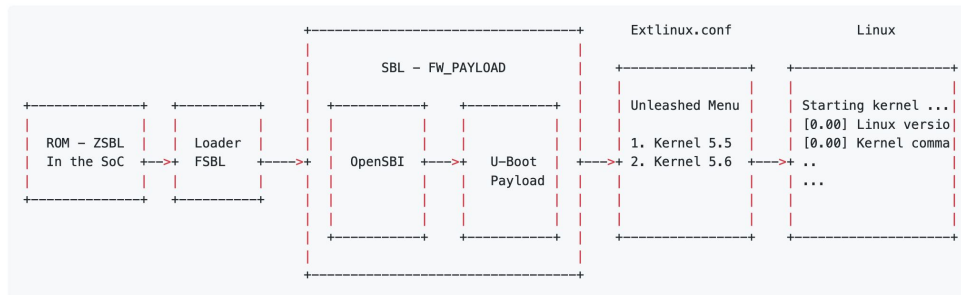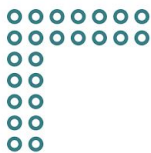
Build your own RISC-V distribution stack with the guide:

https://github.com/carlosedp/riscv-bringup/tree/master/unleashed

Golang

golang / go

<> Code   ① Issues 5k+   ⇅ Pull requests 243   ▶ Actions   ☐ Proj...
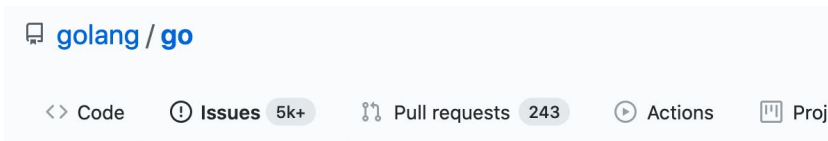
all: port to RISC-V #27532

⊘ Closed   219 comments

- Upstream on 1.15
- Passes all tests
- Still no official builds
- CGO already merged. Out on 1.16.
- Builder on CI already in place

Go Dashboard

master   ☐ show only first-class ports

Go

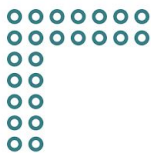| | | | darwin | | | | freebsd | | | | | | | | | | | | | ppc64le | ppc64le | riscv64 |
			amd64	amd64	amd64	amd64	386	386	amd64	amd64	arm	arm64	386	386	386	386	386	ppc64le		power9	jsing
			10_12	10_14	10_15	nocgo	11_2	12_0	11_2	12_0	paulzho	dmgk		clang	longtest	sid	softfloat	buildlet				
e5da18d	josh	30 Nov 03:18	os/exec: constrain thr...	ok	ok	ok	ok	ok	ok	ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok
4ce0a7c	Jason	28 Nov 18:42	runtime/pprof: ignore ...		fail		ok	ok	ok	ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok
358d354	aind...	28 Nov 03:50	bufio: make string(int)...	ok	ok	ok	ok	fail		ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok
b94346e	iant	28 Nov 02:31	test: match gofronten...	ok	ok	ok	ok	ok	ok	ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok
cb84d83	Jason	27 Nov 23:29	cmd/link: mark windo...	ok	ok	ok	ok	fail		ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok
0252cfd	Jason	27 Nov 22:28	runtime: adjust addre...	ok	ok	ok	ok	ok	ok	ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok
91f77ca	Jason	27 Nov 20:31	runtime: return 0 from...	ok	ok	ok	ok	fail		ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok
926994f	rhca...	26 Nov 21:10	log: make Default do...	ok	ok	ok	ok	fail		ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok
f0ff6d4	gri	26 Nov 05:00	reflect: fix Value.Con...	ok	ok	ok	ok	fail		ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok
4481ad6	dmit...	25 Nov 19:46	doc/go1.16: consolid...	ok	ok	ok	ok	fail		ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	fail
ef603be	mail	25 Nov 19:21	cmd/dist: restore GO...	ok	ok	ok	ok	fail		ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok
9dc2350	tklau...	25 Nov 16:36	doc/go1.16: add time...	ok	ok	ok	ok	ok	ok	ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok
b936548	mail	25 Nov 16:10	cmd/internal/objabi: a...	ok	ok	ok	ok	ok	ok	ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok
df68e01	dani...	25 Nov 15:59	runtime: check chann...	ok	ok	ok	ok	ok	ok	ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok
1d3baf2	twpa...	25 Nov 15:10	regexp/syntax: add n...	ok	ok	ok	ok	ok	ok	ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok
750b372	gri	25 Nov 04:48	go/constant: MakeFlo...	ok	ok	ok	ok	ok	ok	ok	ok	ok		ok	ok	fail		ok	ok	ok	ok
1308f11	eric...	25 Nov 02:51	cmd/link: add relocati...	ok	ok	ok	fail	ok	ok	ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok
f6dcc97	gri	25 Nov 02:18	go/constant: make co...	ok	ok	ok	ok	ok	ok	ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok
e8de596	austin	24 Nov 21:47	runtime: use inlined f...	ok	ok	ok	ok	fail		ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok
ba2adc2	austin	24 Nov 21:47	runtime/testdata/test...	ok	ok	ok	ok	ok	ok	ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok
65dcd15	dmit...	24 Nov 19:53	doc/go1.16: fill in Go ...	ok	ok	ok	ok	ok	ok	ok	ok	ok		ok	ok	ok	fail		ok	ok	ok
6965b01	alex...	24 Nov 07:07	runtime: allow for usl...	ok	ok	ok	ok	fail		ok	ok	ok		ok	ok	ok	fail		ok	ok	ok
7dc5d90	cuo...	24 Nov 03:06	cmd/compile: set Op...	fail		ok	ok	ok	ok	ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok
762eda3	gri	24 Nov 00:50	go/types: fix incorrect...	ok	ok	ok	ok	ok	ok	ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok
48a1a51	mkn...	23 Nov 19:58	runtime/metrics: twea...	ok	ok	ok	ok	ok	ok	ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok
d902791	moe...	23 Nov 05:57	sync: use 386 instea...	ok	ok	ok	ok	ok	ok	ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok
9ea6364	khr	21 Nov 16:46	cmd/compile: add tes...	ok	ok	ok	ok	ok	ok	ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok
f734259	Jason	21 Nov 07:37	syscall: add DLLError...	ok	ok	ok	ok	ok	ok	ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok
f93ef07	bcmills	21 Nov 03:29	cmd/go/internal/modl...	ok	ok	ok	ok	ok	ok	ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok
3f5a975	bcmills	21 Nov 03:28	cmd/go/internal/modl...	ok	ok	ok	ok	ok	ok	ok	ok	ok		ok	ok	ok	ok	ok	ok	ok	ok

newer   older   latest

Golang - Progress

Subject	Status	Owner	Reviewers	Repo	Branch	Updated
[dev.typeparams] merge dev.regabi 41f3af9d04 into dev.typeparams	Merged	Russ Cox	Matthew	go	dev.typeparams	Nov 25
[dev.regabi] cmd/compile: replace *Node type with an interface Node [generated]	Merged	Russ Cox	Matthew	go	dev.regabi	Nov 25
[dev.regabi] cmd/compile: introduce cmd/compile/internal/ir [generated]	Merged	Russ Cox	Matthew	go	dev.regabi	Nov 25
[dev.regabi] cmd/compile: introduce cmd/compile/internal/base [generated]	Merged	Russ Cox	Matthew	go	dev.regabi	Nov 25
[dev.regabi] cmd/compile: clean up debug flag (-d) handling [generated]	Merged	Russ Cox	Matthew	go	dev.regabi	Nov 25
[dev.boringcrypto] all: merge master into dev.boringcrypto	Merged	Roland Shoe…	Katie	go	dev.boringcrypto	Nov 18
[dev.boringcrypto] crypto/hmac: merge up to 2a206c7 and skip test	Merged	Katie Hockman	Dmitri, Roland	go	dev.boringcrypto	Nov 18
[dev.boringcrypto] all: merge master into dev.boringcrypto	Merged	Dmitri Shuraly…	Filippo, Roland	go	dev.boringcrypto	Nov 17
cmd/compile,cmd/dist,cmd/go: enable pie buildmode for linux/riscv64	Merged	Joel Sing	Cherry	go	master	Nov 04
[dev.typeparams] merge master into dev.typeparams	Merged	Robert Findley	Robert	go	dev.typeparams	Nov 03
cmd/dist,cmd/go,runtime: add support for cgo on linux/riscv64	Merged	Joel Sing	Cherry, Ian	go	master	Nov 03
cmd/compile: optimize small zeroing/moving on riscv64	Merged	Michał Derkacz	Cherry, Joel	go	master	Nov 01
cmd/compile: avoid unnecessary sign/zero extension for consts on riscv64	Merged	Joel Sing	Cherry	go	master	Oct 31
cmd/link: add loadelf support for riscv64	Merged	Joel Sing	Cherry, Ian	go	master	Oct 29
Revert "cmd/compile,cmd/internal/sys: enable additional build modes on linux/riscv64"	Merged	Joel Sing	Cherry, Ian	go	master	Oct 29
cmd/asm: remove X27 and S11 register names on riscv64	Merged	Joel Sing	Cherry	go	master	Oct 29
runtime: optimise gcWriteBarrier for riscv64	Merged	Joel Sing	Cherry	go	master	Oct 29
cmd/internal/obj/arm64: add CASx/CASPx instructions	Merged	fannie zhang	Cherry	go	master	Oct 29
cmd/compile: use magic multiply for unsigned values less than 1<<16 on 32-bit architectures	Merged	Rémy Oudom…	Emmanuel, Keith, +1	go	master	Oct 28
runtime: remove new g register (X27) from preempt save/restore	Merged	Joel Sing	Cherry	go	master	Oct 28
[dev.link] all: merge branch 'master' into dev.link	Merged	Cherry Zhang	Austin, Jeremy, +1	go	dev.link	Oct 28
cmd/compile,cmd/internal/obj/riscv,runtime: use Duff's devices on riscv64	Merged	Michał Derkacz	Austin, Cherry, +2	go	master	Oct 28
cmd/compile: eliminate unnecessary sign/zero extension for riscv64	Merged	Joel Sing	Cherry	go	master	Oct 27
cmd/compile: use MOV pseudo-instructions for sign/zero extension	Merged	Joel Sing	Cherry, Tobias	go	master	Oct 27
cmd/link,cmd/internal/obj/riscv: add TLS support for linux/riscv64	Merged	Joel Sing	Cherry	go	master	Oct 27

https://go-review.googlesource.com/q/(riscv+OR+riscv64)+AND+status:merged

NodeJS

NodeJS v14.8
- ● Passes most tests
- ● Lots of modules work
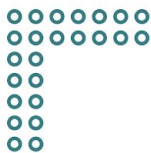- ● Still not upstream
- ● Still no official builds

Repository in:
https://github.com/v8-riscv/node

Docker image on
https://hub.docker.com/r/carlosedp/nodejs

Container images for RISC-V

OpenFaaS:

- faas-gateway - `carlosedp/faas-gateway:riscv64`
- faas-basic-auth-plugin - `carlosedp/faas-basic-auth-plugin:riscv64`
- faas-swarm - `carlosedp/faas-swarm:riscv64`
- faas-netes - `carlosedp/faas-netes:riscv64`
- nats-streaming - `carlosedp/faas-nats-streaming:riscv64`
- queue-worker - `carlosedp/faas-queue-worker:riscv64`
- watchdog - `carlosedp/faas-watchdog:riscv64`
- Function base - `carlosedp/faas-debianfunction:riscv64`
- Figlet - `carlosedp/faas-figlet:riscv64`
- MarkdownRender - `carlosedp/faas-markdownrender:riscv64`
- QRCode - `carlosedp/faas-qrcode:riscv64`

Prometheus:

- Prometheus - `carlosedp/prometheus:v2.11.1-riscv64`
- AlertManager - `carlosedp/alertmanager:v0.18.0-riscv64`

Traefik:

- traefik v2 - `carlosedp/traefik:v2.1-riscv64`
- whoami - `carlosedp/whoami:riscv64`

Kubernetes:

- kube-apiserver - `carlosedp/kube-apiserver:1.16.0`
- kube-scheduler - `carlosedp/kube-scheduler:1.16.0`
- kube-controller-manager - `carlosedp/kube-controller-manager:1.16.0`
- kube-proxy - `carlosedp/kube-proxy:1.16.0`
- pause - `carlosedp/pause:3.1`
- flannel - `carlosedp/flannel:v0.11.0`
- etcd (v3.5.0) - `carlosedp/etcd:3.3.10`
- CoreDNS (v1.6.3) - `carlosedp/coredns:v1.6.2`

Kubernetes images are multi-arch with manifests to `arm`, `arm64`, `amd64`, `riscv64` and `ppc64le`. Some version mismatches due to Kubernetes hard-coded version check for CoreDNS and etcd.

Misc Images:

- Echo demo - `carlosedp/echo-riscv`
- Whoami (Traefik demo) - `carlosedp/whoami:riscv64`
- Kubernetes Pause - `carlosedp/k8s-pause:riscv64`
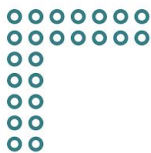- CoreDNS v1.3.0 - `carlosedp/coredns:v1.3.0-riscv64`
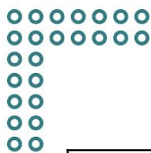
Lots of Pull Requests later

Project	Description	Pull Request	Upstream
go/net	ipv4, ipv6, internal/socket: add riscv64 support	https://github.com/golang/net/pull/43	✓
go/sys	unix: add riscv64 tag to endian_little.go	https://github.com/golang/sys/pull/38	✓
mattn/go-isatty	Update x/sys to support Risc-V	https://github.com/mattn/go-isatty/pull/39	✓
creack/pty	Add riscv64 support	https://github.co...	✓
docker/cli	Add riscv64 to manifest annotation and bash completion	https://github...	✓
opencontainers/runc	Bump x/sys and update syscall for initial Risc-V support	https://gith...	✓
moby/moby	bump x/sys to fix riscv64 epoll		
moby/moby	Update modules to support riscv64		
moby/moby	allow dockerd builds without cgo - Tonis		
containerd/containerd	bump x/sys to fix riscv64 epoll		
containerd/containerd	Update x/sys, x/net and bbolt modules to suppo...		
docker/cli	bump x/sys to fix riscv64 epoll		
docker/libnetwork	bridge: add riscv64 build tags - Tonis		
LK4D4/vndr	add riscv64 support		
vishvananda/netns	add riscv64 architecture		
containers/libpod	build: allow to build without cgo on RISC-V	...d/pull/3437	✓

20+ Projects
40+ PRs
6 CNCF Projects
95%+ Upstream

Still Pending in 2019

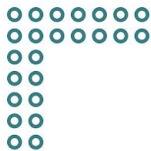| Project	Description	Status
Golang	Upstreaming language support for Risc-V	Planned for Go 1.14. Build box already been set.
SECCOMP	Add Risc-V Seccomp support to Linux Kernel	Planned for Kernel 5.5, already merged.
Libseccomp	Upstream libseccomp patch	Will be upstreamed soon.
Kubernetes	Have Kubernetes build on Risc-V	Already on master. Expected on 1.18 (next release)
Golang CGO	Go extension for importing C code	Pending implementation
Runc	Container Runtime in C	Depends on CGO. CRUN is an alternative now.
Golang SQLite	File database libraries	Depends on CGO
Official Images	Build and publish official images	Depends on distro support (Debian, Alpine, Fedora)
Most projects	Build and distribute binaries and/or images	Changes on CI/CD and official images

Huge leap on support

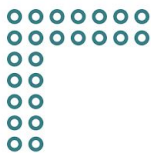| Project	Description	Status
Golang	Go programming language	✔️ Already upstream in 1.15. Pending binary distribution
SECCOMP	Risc-V Seccomp support to Linux Kernel	✔️ Upstream from Kernel 5.5
Libseccomp	Upstream libseccomp patch	✔️ Already upstream
Kubernetes	Have Kubernetes build on Risc-V	✔️ Builds on RISC-V. Still no officially supported.
Golang CGO	Go extension for importing C code	✔️ Already merged. Will be available on Go 1.16 (2021)
Runc	Container Runtime in C	✔️ Already can be built from Go master.
Golang SQLite	File database libraries	✔️ Already can be built from Go master.
Official Distros	Official Linux distributions	Still pending official support from most distros (Fedora, Ubuntu, Debian, Alpine)
Official Images	Build and publish official images	Depends on distro support (Debian, Alpine, Fedora)
Most projects	Build and distribute binaries and/or images	Changes on CI/CD and official images

Demo

Get your VM on: http://bit.ly/riscvdebianvm

Read more: http://bit.ly/riscvcontainers

Thanks!

Contact me:
https://twitter.com/carlosedp

Read me:
https://carlosedp.medium.com

Follow up progress on:
https://github.com/carlosedp/riscv-bringup
https://hub.docker.com/u/carlosedp