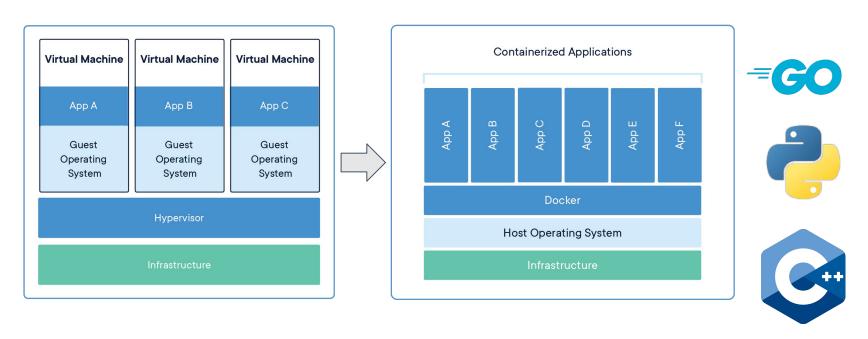# The Risc-V Journey Thru Containers to the Cloud

Carlos Eduardo de Paula
Cloud Architect
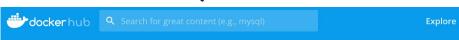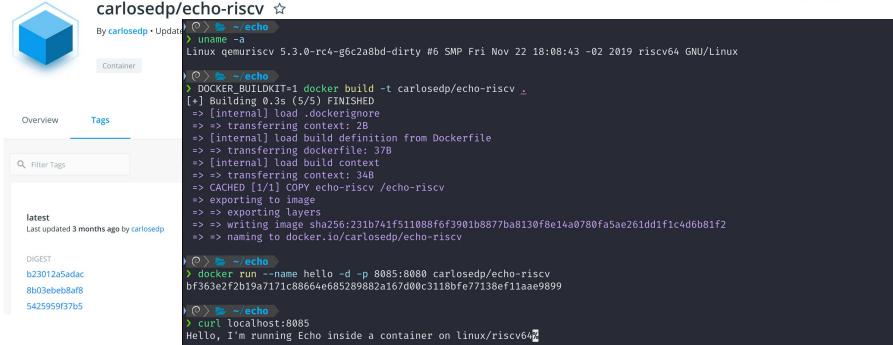**Red Hat**
@carlosedp

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**

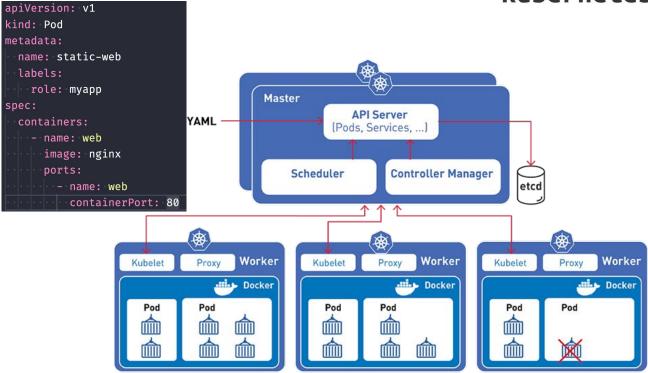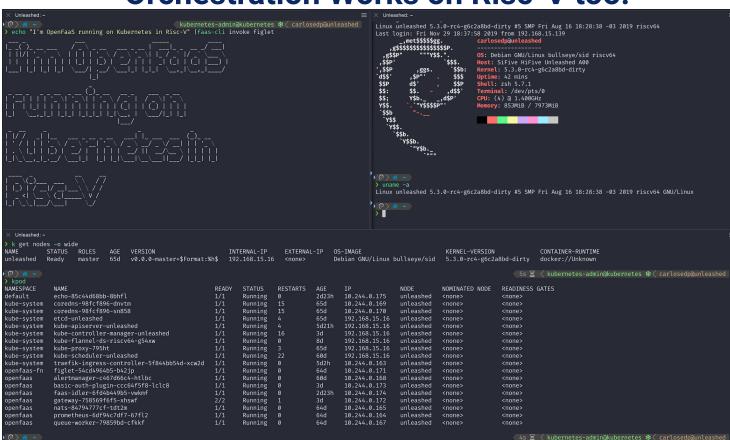# Can we have containers and cloud-native applications on Risc-V?

Yes, we can!

docker + RISC-V®

carlosedp/echo-riscv ☆

By carlosedp • Update

Container

Overview | Tags

🔍 Filter Tags

latest
Last updated 3 months ago by carlosedp

DIGEST

b23012a5adac

8b03ebeb8af8

5425959f37b5

```
⊙ ~/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?

```yaml
apiVersion: v1
kind: Pod
metadata:
  name: static-web
  labels:
    role: myapp
spec:
  containers:
    - name: web
      image: nginx
      ports:
        - name: web
          containerPort: 80
```


YAML → API Server (Pods, Services, ...)

Master

Scheduler   Controller Manager   etcd

Kubelet Proxy Worker   Docker   Pod Pod

Kubelet Proxy Worker   Docker   Pod Pod

Kubelet Proxy Worker   Docker   Pod Pod

Orchestration Works on Risc-V too!

How we got there? Golang first!

golang / **go**

<> Code | ⓘ Issues 4,952 | ⑂ Pull requests 127 | ▶ Actions | 📖 Wiki
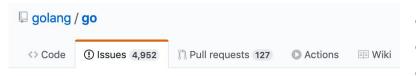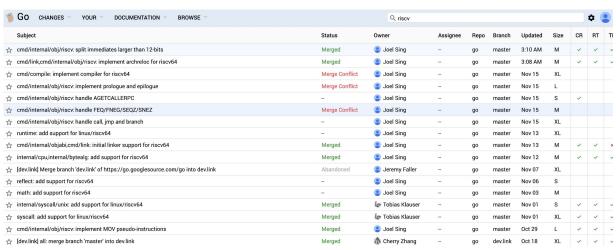
all: port to RISC-V #27532

ⓘ Open · **tklauser** opened this issue on Sep 6, 2018 · 165 comments

- First working version around may/19
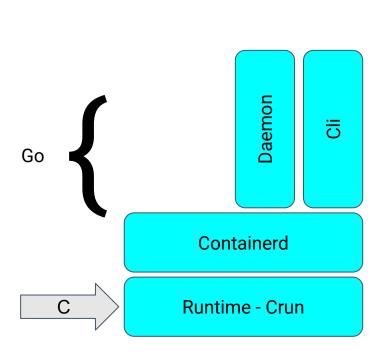- Passes all tests
- Expected upstreaming in 1.14
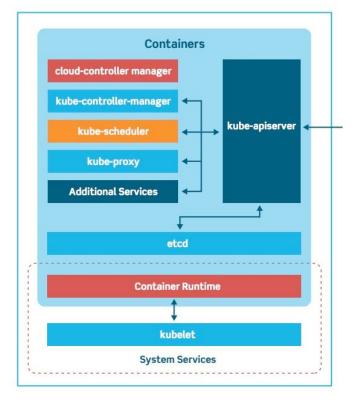
Tree kept in:
https://github.com/4a6f656c/riscv-go

Subject	Status	Owner	Assignee	Repo	Branch	Updated	Size	CR	RT	Tl
☆ cmd/internal/obj/riscv: split immediates larger than 12-bits	Merged	Joel Sing	--	go	master	3:10 AM	M	✓	✓	✓
☆ cmd/link,cmd/internal/obj/riscv: implement archreloc for riscv64	Merged	Joel Sing	--	go	master	3:08 AM	M	✓	✓	✓
☆ cmd/compile: implement compiler for riscv64	Merge Conflict	Joel Sing	--	go	master	Nov 15	XL			
☆ cmd/internal/obj/riscv: implement prologue and epilogue	Merge Conflict	Joel Sing	--	go	master	Nov 15	L			
☆ cmd/internal/obj/riscv: handle AGETCALLERPC	--	Joel Sing	--	go	master	Nov 15	S	✓		
☆ cmd/internal/obj/riscv: handle FEQ/FNEG/SEQZ/SNEZ	Merge Conflict	Joel Sing	--	go	master	Nov 15	M			
☆ cmd/internal/obj/riscv: handle call, jmp and branch	--	Joel Sing	--	go	master	Nov 15	XL			
☆ runtime: add support for linux/riscv64	--	Joel Sing	--	go	master	Nov 13	XL			
☆ cmd/internal/objabi,cmd/link: initial linker support for riscv64	Merged	Joel Sing	--	go	master	Nov 13	M	✓	✓	✗
☆ internal/cpu,internal/bytealg: add support for riscv64	Merged	Joel Sing	--	go	master	Nov 12	M	✓	✓	✓
☆ [dev.link] Merge branch 'dev.link' of https://go.googlesource.com/go into dev.link	Abandoned	Jeremy Faller	--	go	master	Nov 07	XL			
☆ reflect: add support for riscv64	--	Joel Sing	--	go	master	Nov 06	S			
☆ math: add support for riscv64	--	Joel Sing	--	go	master	Nov 03	M			
☆ internal/syscall/unix: add support for linux/riscv64	Merged	Tobias Klauser	--	go	master	Nov 01	S	✓	✓	✓
☆ syscall: add support for linux/riscv64	Merged	Tobias Klauser	--	go	master	Nov 01	XL	✓	✓	✓
☆ cmd/internal/obj/riscv: implement MOV pseudo-instructions	Merged	Joel Sing	--	go	master	Oct 29	L	✓	✓	✓
☆ [dev.link] all: merge branch 'master' into dev.link	Merged	Cherry Zhang	--	go	dev.link	Oct 18	XL	✓	✓	✓

Container Runtimes / Orchestrators

Docker / Podman

Kubernetes

Some 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.com/creack/pty/pull/81	✓
docker/cli	Add riscv64 to manifest annotation and bash completion	https://github.com/docker/cli/pull/2084	✓
opencontainers/runc	Bump x/sys and update syscall for initial Risc-V support	https://github.com/opencontainers/runc/pull/2123	✓
moby/moby	bump x/sys to fix riscv64 epoll	https://github.com/moby/moby/pull/39726	✓
moby/moby	Update modules to support riscv64	https://github.com/moby/moby/pull/39423	✓
moby/moby	allow dockerd builds without cgo - Tonis	https://github.com/moby/moby/pull/39327	✓
containerd/containerd	bump x/sys to fix riscv64 epoll	https://github.com/containerd/containerd/pull/3526	✓
containerd/containerd	Update x/sys, x/net and bbolt modules to support Risc-V architecture	https://github.com/containerd/containerd/pull/3328	✓
docker/cli	bump x/sys to fix riscv64 epoll	https://github.com/docker/cli/pull/2042	✓
docker/libnetwork	bridge: add riscv64 build tags - Tonis	https://github.com/docker/libnetwork/pull/2389	✓
LK4D4/vndr	add riscv64 support	https://github.com/LK4D4/vndr/pull/80	✓
vishvananda/netns	add riscv64 architecture	https://github.com/vishvananda/netns/pull/34	✓
containers/libpod	build: allow to build without cgo on RISC-V	https://github.com/containers/libpod/pull/3437	✓

And many more...

Project	Description	Pull Request	Upstream
kubernetes/kubernetes	Bump x/sys and opencontainers/runc to support Risc-V architecture	https://github.com/kubernetes/kubernetes/pull/82349	✗
kubernetes/kubernetes	Bump gonvml module and remove CGO dependency	https://github.com/kubernetes/kubernetes/pull/82342	✓
etcd-io/etcd	vendor: update x/sys and x/net modules to support Risc-V	https://github.com/etcd	✓
prometheus/prometheus	Riscv support	https://github.com/p	
prometheus/promu	Update x/sys and x/net modules to support Ris	https://github	
prometheus/alertmanager	Update x/sys and x/net modules to supp		
containous/traefik	Bump x/sys to support Risc-V architect		
nats-io/nats-streaming-server	Update x/sys and etcd/bbolt modules to		
openfaas/faas-swarm	Update x/sys and x/net modules to suppo		
alexellis/inlets	Update x/sys and x/net modules to support		
openfaas/faas-cli	Update x/sys module to support Risc-V		
debuerreotype/debuerreotype	Add support to debian ports by passing --port		
labstack/gommon	Update x/sys module to support Risc-V		
labstack/echo	Update x/sys and x/net modules to support Risc		
github/hub	Update x/sys module to support Risc-V		✓
google/go-jsonnet	Update x/sys to a newer version that supports Risc architecture	net/pull/284	✓

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

Container Image list is growing!

Base Container Images

- Debian Sid -> `carlosedp/debian:sid`
- Debian Sid Slim -> `carlosedp/debian:sid-slim`
- Busybox (1.31.0) -> `carlosedp/busybox:1.31`
- Go 1.13 (Multiarch) -> `carlosedp/golang:1.13`

Prometheus

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

Traefik

- traefik v2 - `carlosedp/traefik:v2.0-riscv64`
- Whoami (Traefik demo) - `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`.

Misc Images

- Echo demo - `carlosedp/echo-riscv`
- CoreDNS v1.3.0 - `carlosedp/coredns:v1.3.0-riscv64`

Still Pending

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

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://medium.com/@carlosedp

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