All about rkt: Containers and Kubernetes at CoreOS

Josh Wood

DocOps • CoreOS

@joshixisjosh9 | j@coreos.com | github.com/joshix

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CoreOS

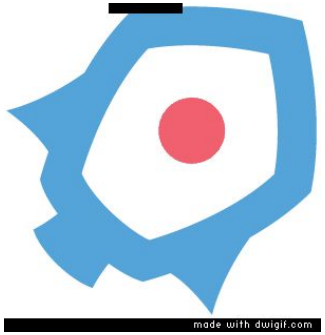
rkt + kubernetes

What’s it all about?

- Decouple the Application from the OS
  - Then you can upgrade them both -- independently
  - Containers: distribution and execution
- Automate OS upgrades - stay secure
- Orchestrate the result as a unified resource
  - Apps evolve -- are continuously deployed and scaled
- Democratize access to utility computing
  - #GIFEE

rkt

A CLI for running app containers on Linux.



Focuses on:

- Security
- Modularity
- Standards/Compatibility

rkt - a brief history

- **December 2014 - *v0.1.0***
  - Prototype
  - Drive conversation (security, standards) and competition (healthy OSS) in container ecosystem
- **February 2016 - *v1.0.0***
  - (already) used in production
  - API stability guarantees
- **~June 2016 - *v1.8.0+***
  - Packaged in Debian, Fedora, Arch, NixOS

rkt

A CLI for running app containers on Linux.

Focuses on:

- Not reinventing the wheel:
  - Systemd - init
  - Overlayfs
  - CNI networking

A CLI for running app containers on Linux.

Security:

- Signed images
- GPG detached sigs (ACI)
- DTC integration with TPM

A CLI for running app containers on Linux.

Modularity: External

- “Fits in”
- Systemd or other init
- CNI and plugins

rkt

A CLI for running app containers on Linux.

Modularity: Internal

- Stages of execution
- Fly, cgroups/ns, KVM vm
  - SAME CONTAINER

rkt

A CLI for running app containers on Linux.

Standards/Compatibility:

- Appc ACI format & sigs
- **rkt runs Docker images**
  - OCI support as develops

rkt run: default stage1

- Isolates containers with the linux container primitives (cgroups, ns), systemd-nspawn
- Container apps in a machine slice PID namespace
- Manage with standard init tools: systemd
- Network isolation

rkt run: KVM isolation

- Isolates containers with the linux KVM hypervisor
- Container apps in a machine slice PID namespace
- Manage with standard init tools: systemd
- Network isolation

rkt fly

- Leverages the packaging, discovery, distribution, and validation features of rkt/containers
- Reduced isolation for privileged components
- chroot file system isolation only
- Has access to host-level mount, network, PID namespaces
- Method for infra bootstrap in CoreOS Linux

rkt run: *your* stage1

- stage1 can be replaced with custom implementations for security, performance, architecture, …
- KVM stage1 originated with Intel ClearContainers project and has seen at least two alternate external implementations

rkt run (demo)

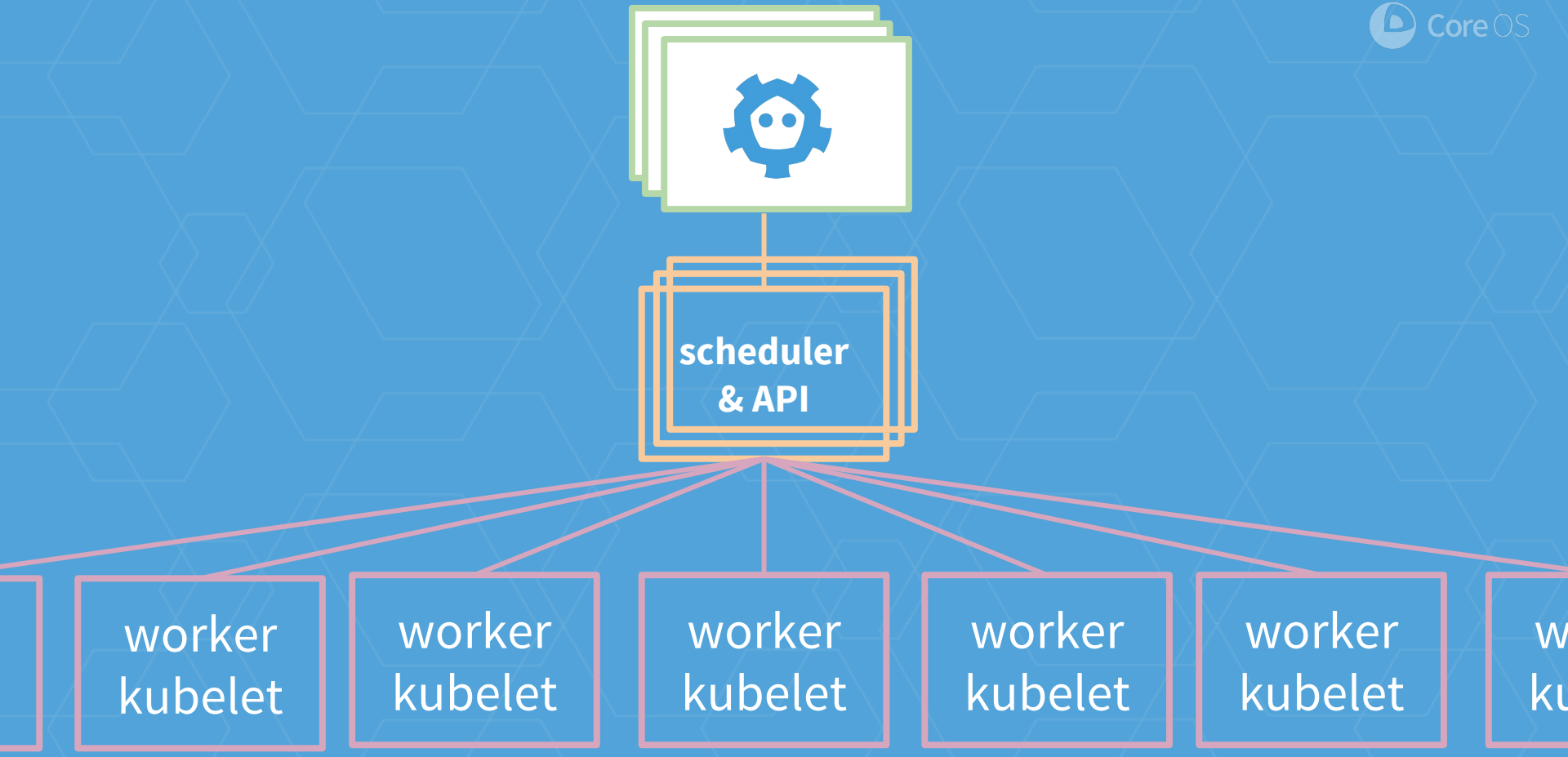
```
$ rkt run quay.io/josh_wood/caddy
rkt: using image from local store for image name
coreos.com/rkt/stage1-coreos:0.15.0
rkt: using image from local store for image name
quay.io/josh_wood/caddy
[ 1161.330635] caddy[4]: Activating privacy
features... done.
[ 1161.333482] caddy[4]: :2015
$
```

Kubernetes

Cluster-level container orchestration with #GIFEE baked in.

Handles:

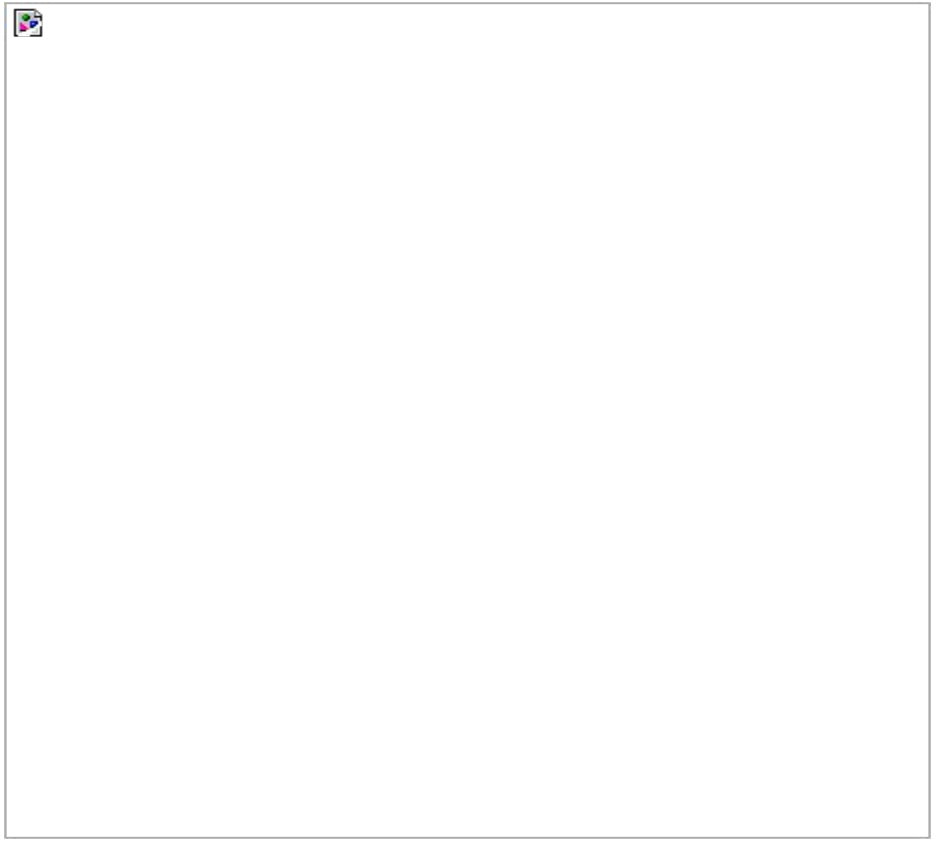
- Scheduling/Upgrades
- Failure recovery
- Scaling


scheduler
& API
worker
kubelet
worker
kubelet
worker
kubelet
worker
kubelet
worker
kubelet

What is rkt in Kubernetes?

- “Rktnetes” was a nickname for the work in both rkt and kubernetes
- rkt is container execution engine, runs cluster work on nodes
- Add configuration to declare a node uses the rkt engine, or that a pod executes with rkt

What is rkt in Kubernetes?



Why rkt in Kubernetes?

- Ensure cleanliness and modularity of the critical interface between the orchestrator and the execution engine
- Spur innovation through community effects
- In short: standards and interfaces

Why rkt in Kubernetes?

- Obtain unique rkt features
- Externally modular: Refine runtime interface: CRI
- Internally modular: Pluggable “stage1” isolation environments
- Run pods as software-isolated (cgroups, ns)
- Run pods as VMs with hypervisor isolation

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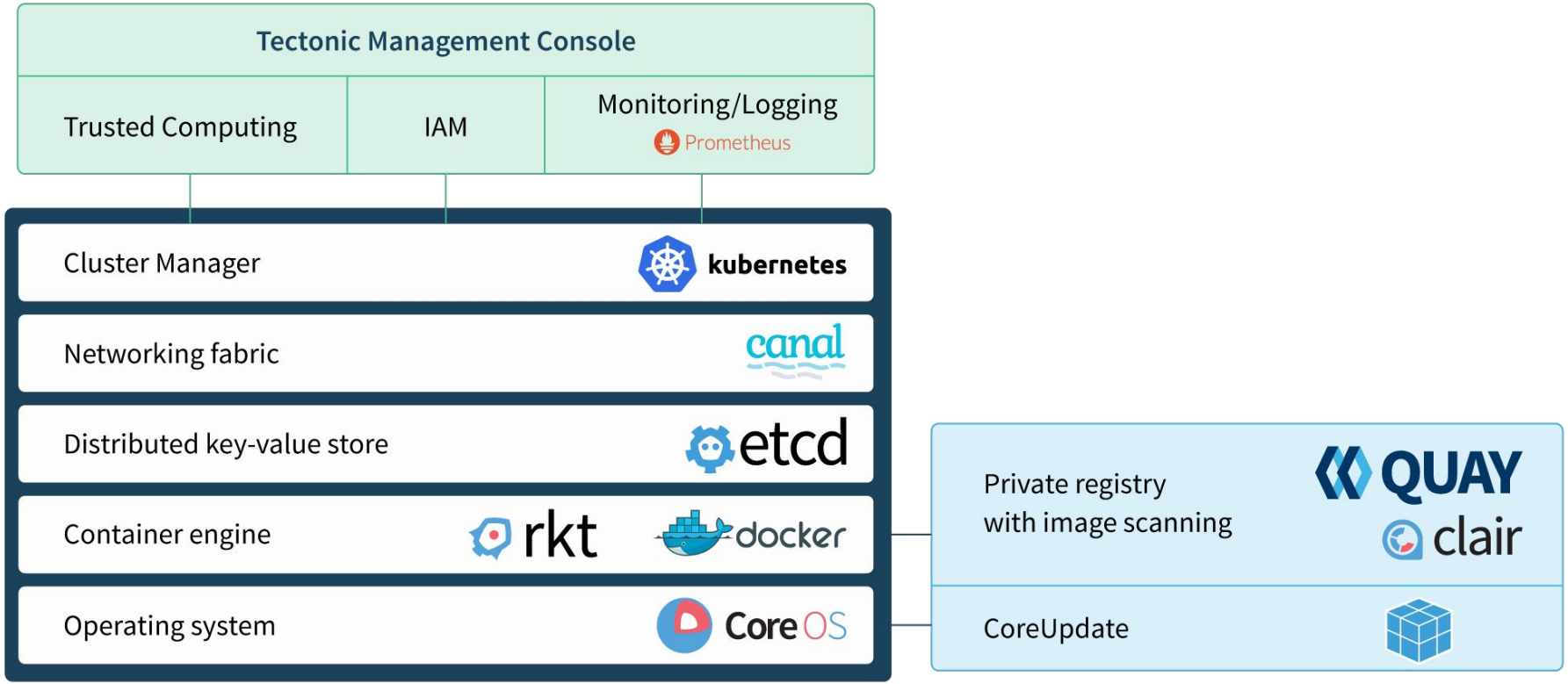
Markers

- CRI - Kubernetes Container Runtime Interface
- CNI as Kubernetes network plugin model
- Docker refactor: runc, containerd
- Appc -> OCI: Standard for container images
- Ocid, et al: Let 1000 runtimes bloom?
  - ocid: Inherits runc: Pro and Con


TECTONIC
by CoreOS

TECTONIC


Tectonic Management Console
Trusted Computing
IAM
Monitoring/Logging
Prometheus
Cluster Manager
kubernetes
Networking fabric
canal
Distributed key-value store
etcd
Container engine
rkt
docker
Operating system
CoreOS
Private registry
with image scanning
QUAY
clair
CoreUpdate

See also:

- coreos.com/rkt
- github.com/opencontainers/image-spec
- kubernetes.io/docs/getting-started-guides/rkt/
- blog.kubernetes.io/2016/07/rktnetes-brings-rkt-container-engine-to-Kubernetes.html

See also:

- speakerdeck.com/joshix (these slides)

May 31 - June 1, 2017
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Josh Wood

@joshixisjosh9 | j@coreos.com | github.com/joshix

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