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Build Secure Container Infrastructure with Kata Container

Simple Hardening for Docker Infrastructure

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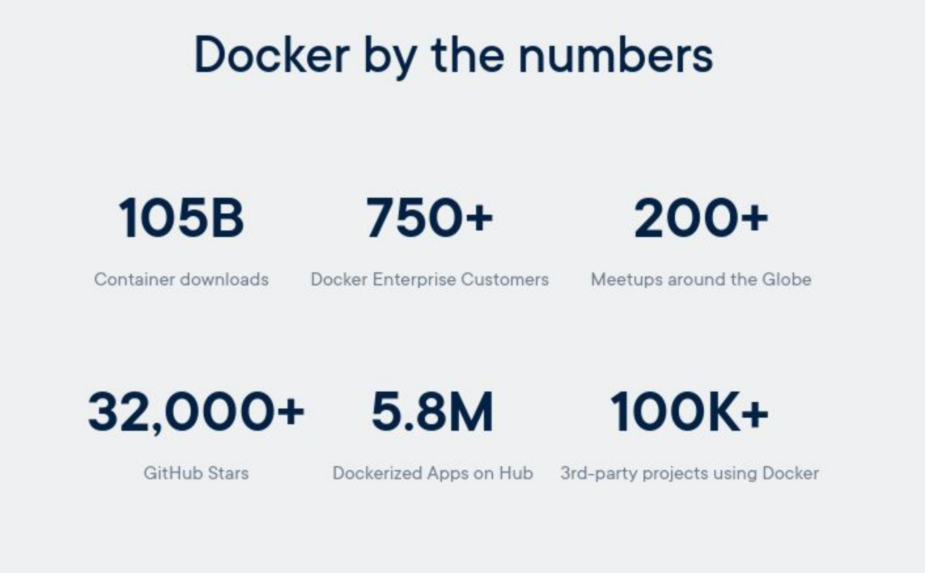
Today’s speak

Why Docker security is important?

How does Docker handle security?

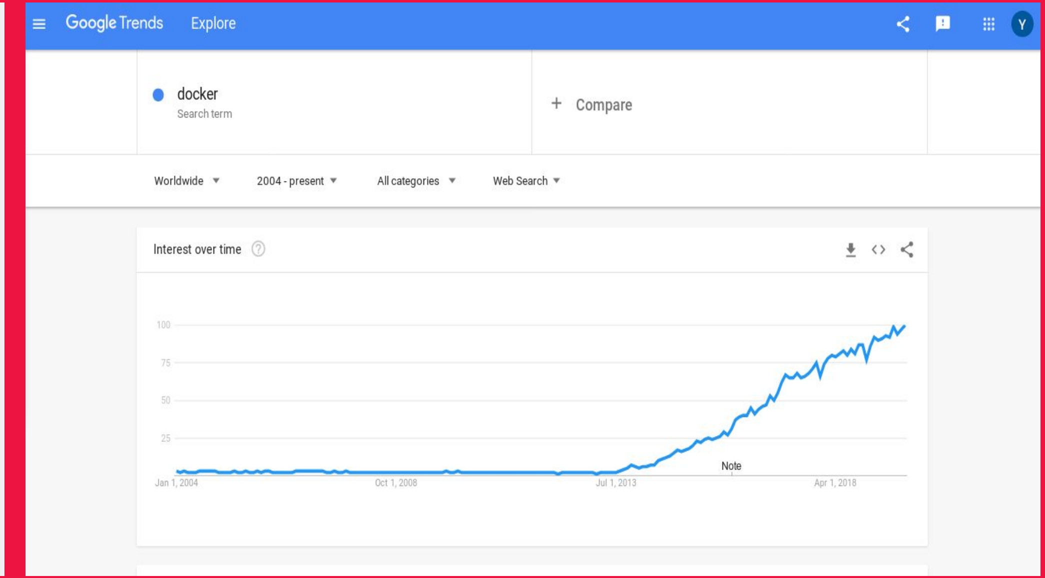
Introduction of Kata Container

Why Docker Security is important?



Docker by the numbers

105B Container downloads	750+ Docker Enterprise Customers	200+ Meetups around the Globe
32,000+ GitHub Stars	5.8M Dockerized Apps on Hub	100K+ 3rd-party projects using Docker



> “Gartner asserts that applications deployed in containers are more secure than applications deployed on the bare OS and, arguably, on a VM”

Joerg Fritsch | July 14, 2016

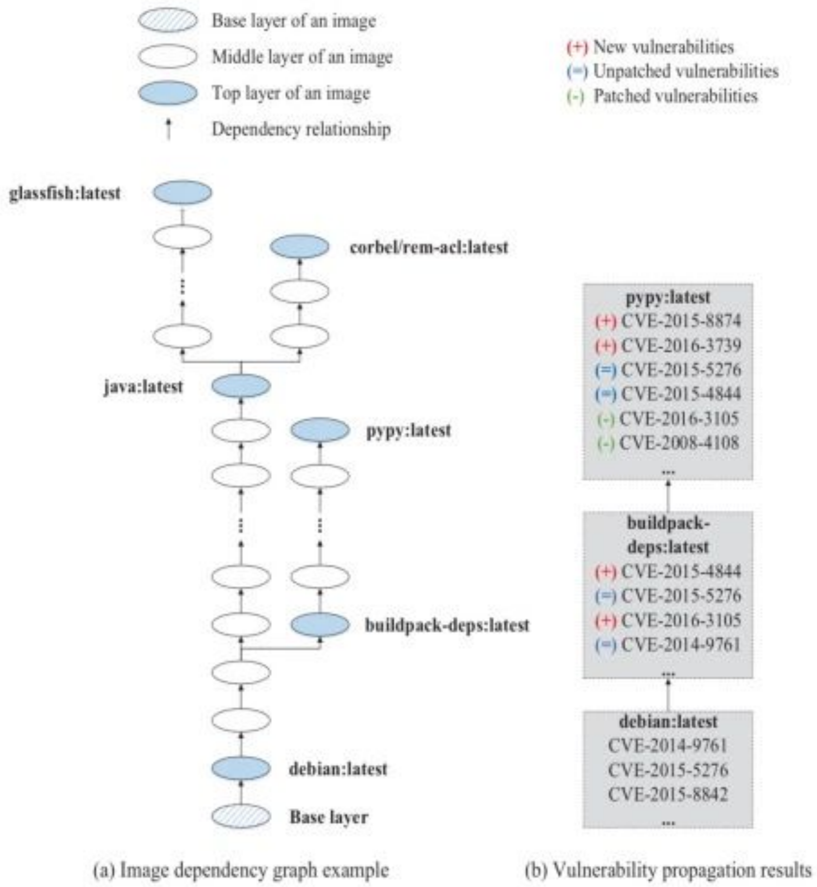
https://blogs.gartner.com/joerg-fritsch/can-you-operationalize-docker-containers/

But...

<>

Higher risk if multiple applications are run in shared host

- Escaping and Privilege Escalation
- Insecure Image
- Denial of Service
- Kernel Level Threats



(a) Image dependency graph example

(b) Vulnerability propagation results

Figure 3: Inter-image dependency analysis example.

A security vulnerability introduced at lower layers is propagated into all dependent layers

https://blog.acolyer.org/2017/04/03/a-study-of-security-vulnerabilities-on-docker-hub/

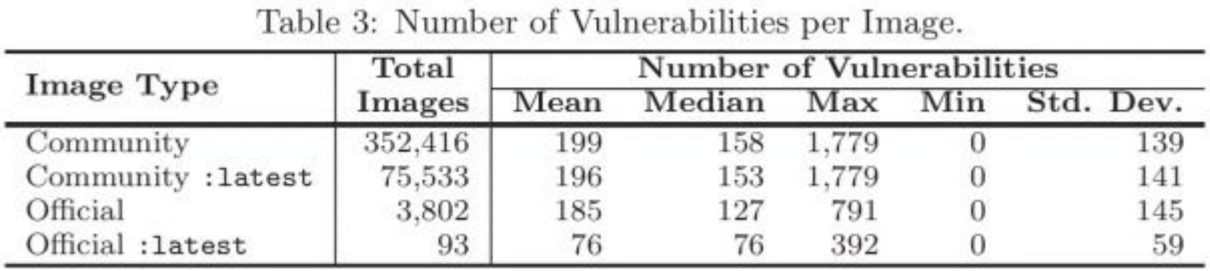


Table 3: Number of Vulnerabilities per Image.

Image Type	Total Images	Number of Vulnerabilities				
		Mean	Median	Max	Min	Std. Dev.
Community	352,416	199	158	1,779	0	139
Community :latest	75,533	196	153	1,779	0	141
Official	3,802	185	127	791	0	145
Official :latest	93	76	76	392	0	59

Docker Hub images contain ~180 vulnerabilities on average. Many images have not been updated for hundreds of days

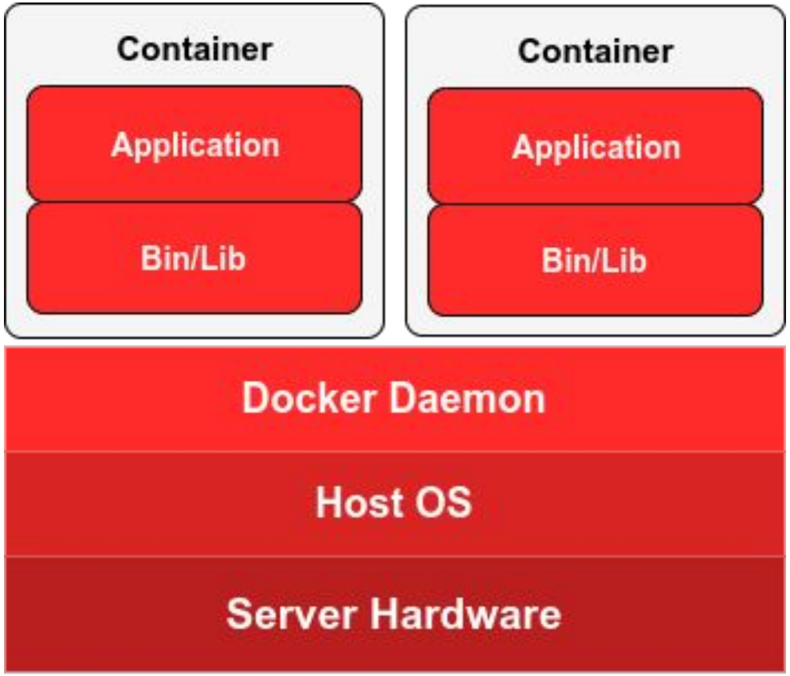
https://blog.acolyer.org/2017/04/03/a-study-of-security-vulnerabilities-on-docker-hub/

How Docker Handle Security?

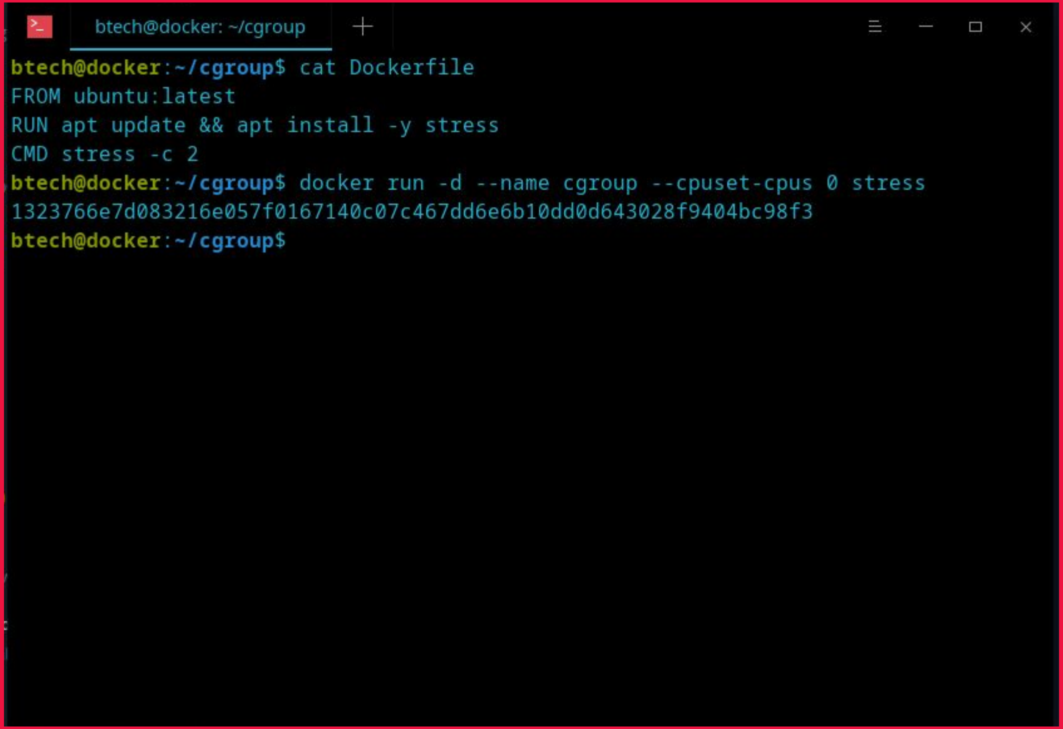
How Docker Handle Security

- ✓ Kernel Namespaces
- ✓ Control Groups
- ✓ Trusted Image
- ✓ Kernel Capabilities

Kernel Namespaces



Control Group



```
btech@docker:~/cgroup$ cat Dockerfile
FROM ubuntu:latest
RUN apt update && apt install -y stress
CMD stress -c 2
btech@docker:~/cgroup$ docker run -d --name cgroup --cpuset-cpus 0 stress
1323766e7d083216e057f0167140c07c467dd6e6b10dd0d643028f9404bc98f3
btech@docker:~/cgroup$
```

Trusted Image

✓

Pull Image with tags

Most common ways

✓

Pull image with digest

Make sure image version didn’t change

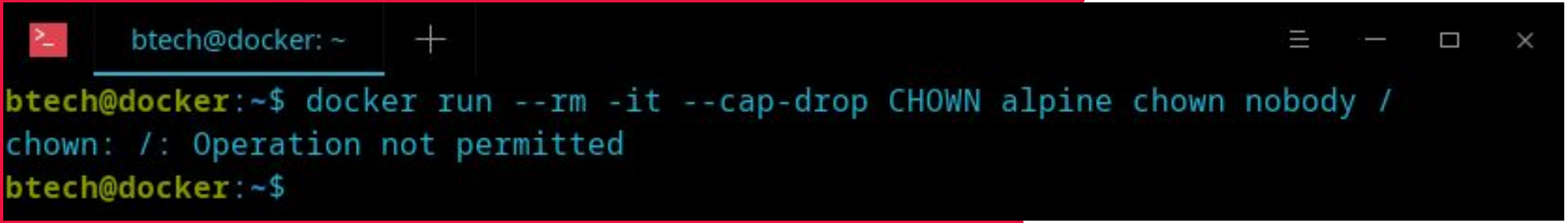
✓

Docker Content Trust

Use digital signatures for data sent to and received from remote Docker registries.

Kernel Capabilities

- Traditional UNIX systems have privileged processes (uid 0, root) and unprivileged processes (uid != 0, non-root). Root processes bypass all kernel permission checks
- In practice, if one gets into a container, limited capability possibilities make it harder to extend an attack



```
btech@docker:~$ docker run --rm -it --cap-drop CHOWN alpine chown nobody /
chown: /: Operation not permitted
btech@docker:~$
```

$ man capabilities

Increasing Docker Security

Docker Image Building

- Do not run software as root. Create an user instead
- Always build on fresh base image
- Use minimal base image
- Do not trust community images on docker hub
- Use specific version of base image
- Do not store secret into Dockerfile
- Do not install unnecessary software

Docker Runtime

- Use docker-compose instead of run container manually (multiple benefits: container linking, private network, etc)
- Drop unnecessary capabilities.

- Set read only flag
- Set memory and cpu limit

Docker Host

- Keep host kernel updated
- Use Centralized logging to monitor container logs (fluentd, splunk, etc)
- Keep Docker Update

The user who control docker daemon (docker group) effectively have root access on host

USE KATA CONTAINER

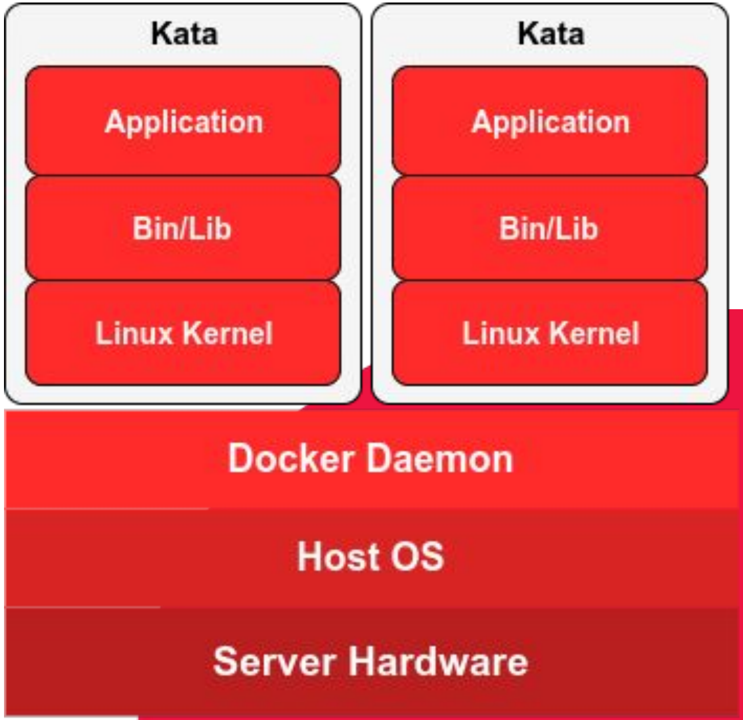
Introduction of Kata

$ history

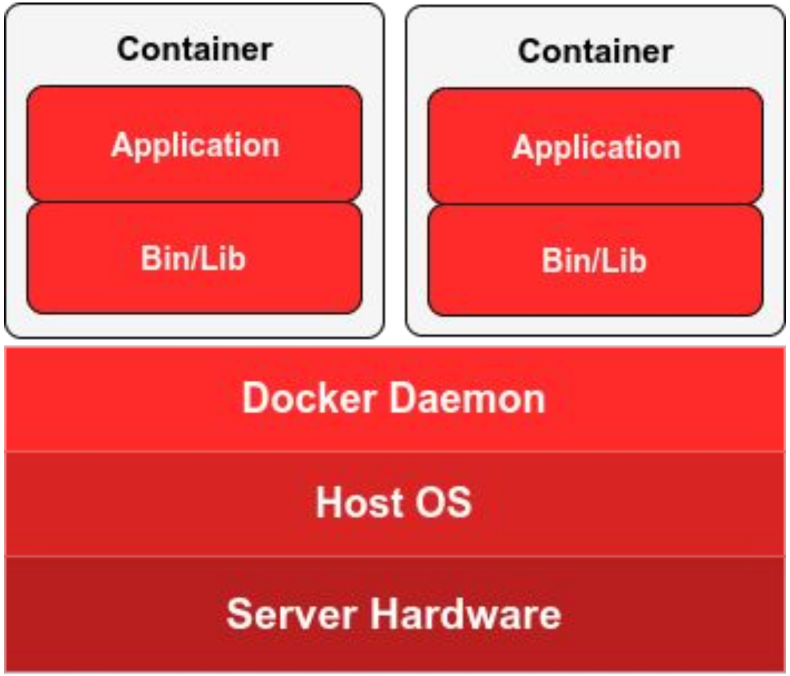
- Launch in December 2017
- Builds lightweight virtual machines that seamlessly plug into the containers ecosystem.
- Kata Containers combines technology from Intel® Clear Containers and Hyper runV to provide the speed of containers with the security of virtual machines.

Kata Container

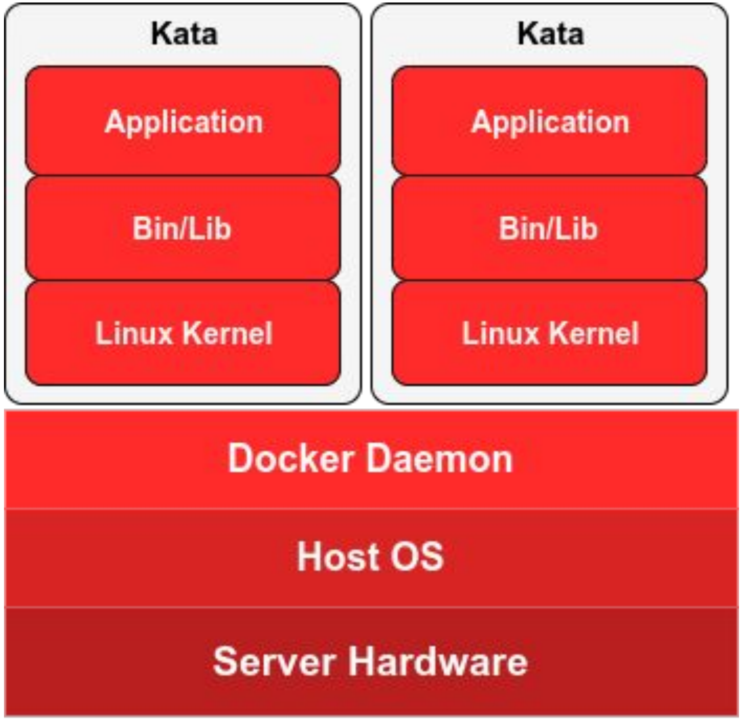
Each container/pods using hardware virtualization, to provide the speed of containers with the security of virtual machines (VMs).



Docker & Kata Container

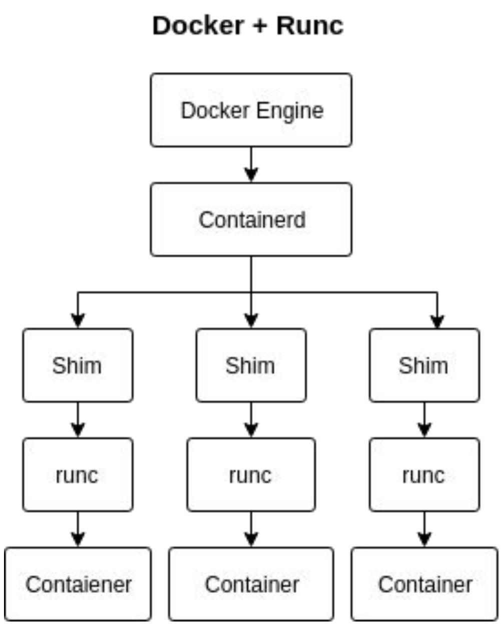


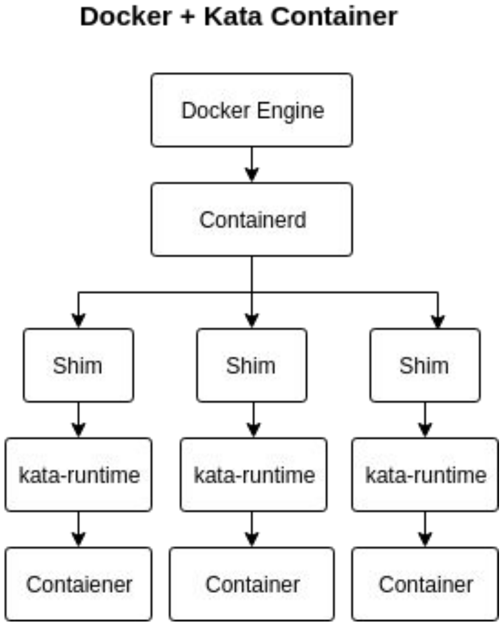
Docker



Docker with Kata

Docker & Kata Container





Thank you!