RSAConference2019
San Francisco | March 4 – 8 | Moscone Center

SESSION ID: CSV-R02

Kubernetes Runtime Security

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About me

Jen Tong
Security Advocate
Google Cloud Platform

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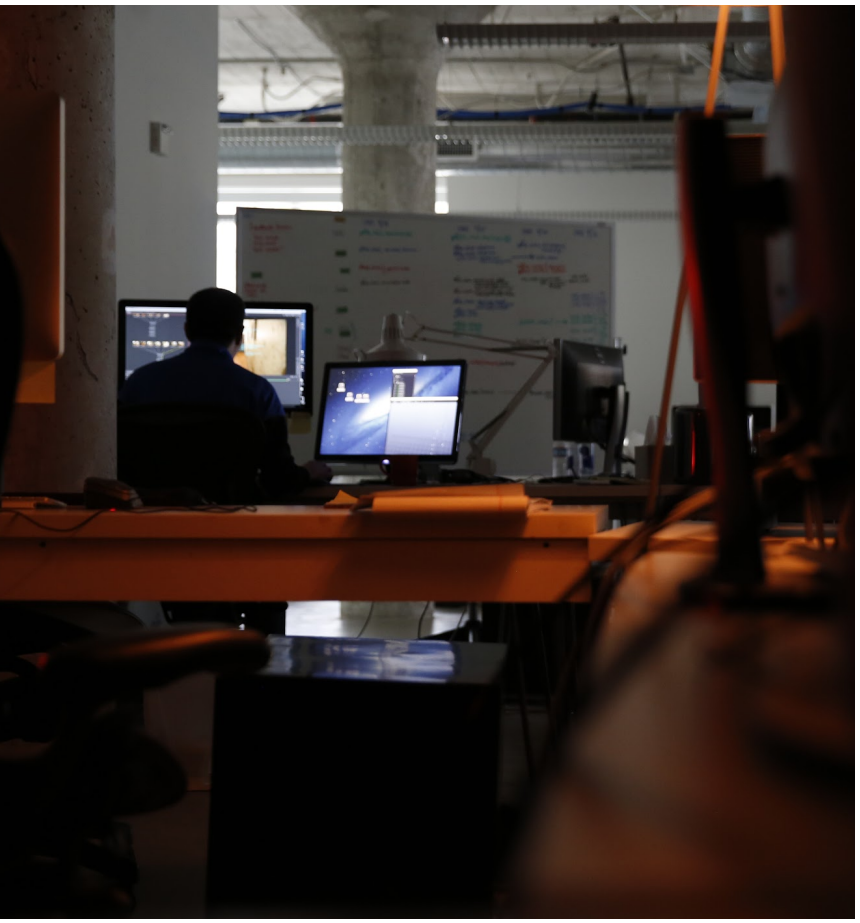
mimming.com

How many of you…



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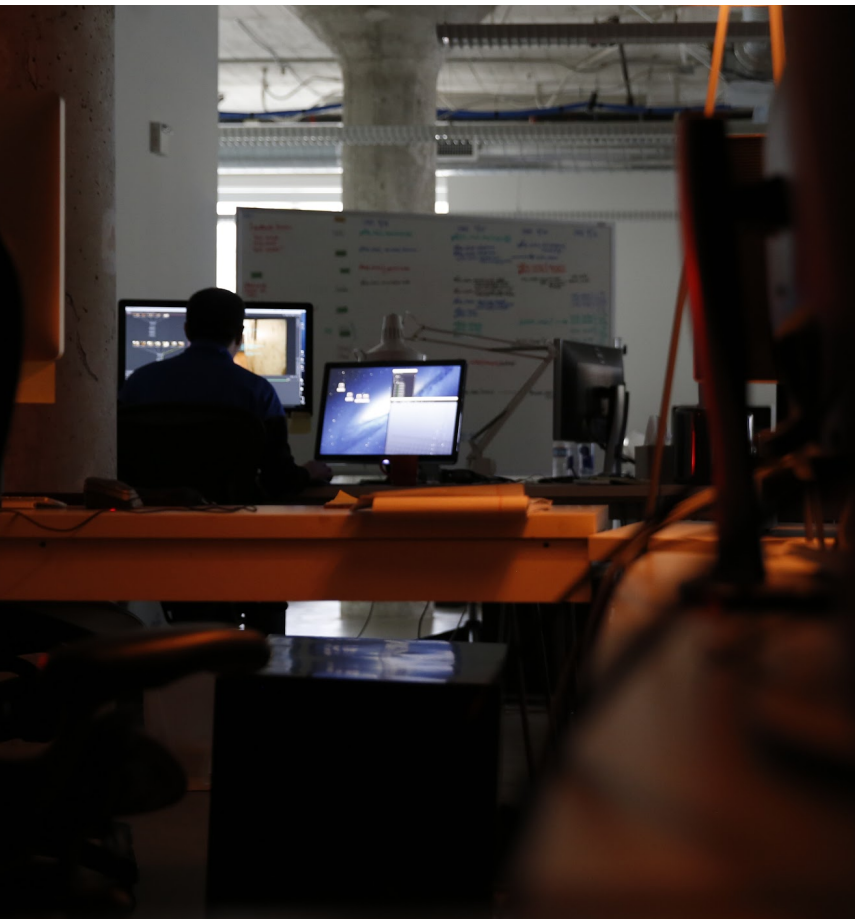

...are familiar with the NIST cybersecurity framework?

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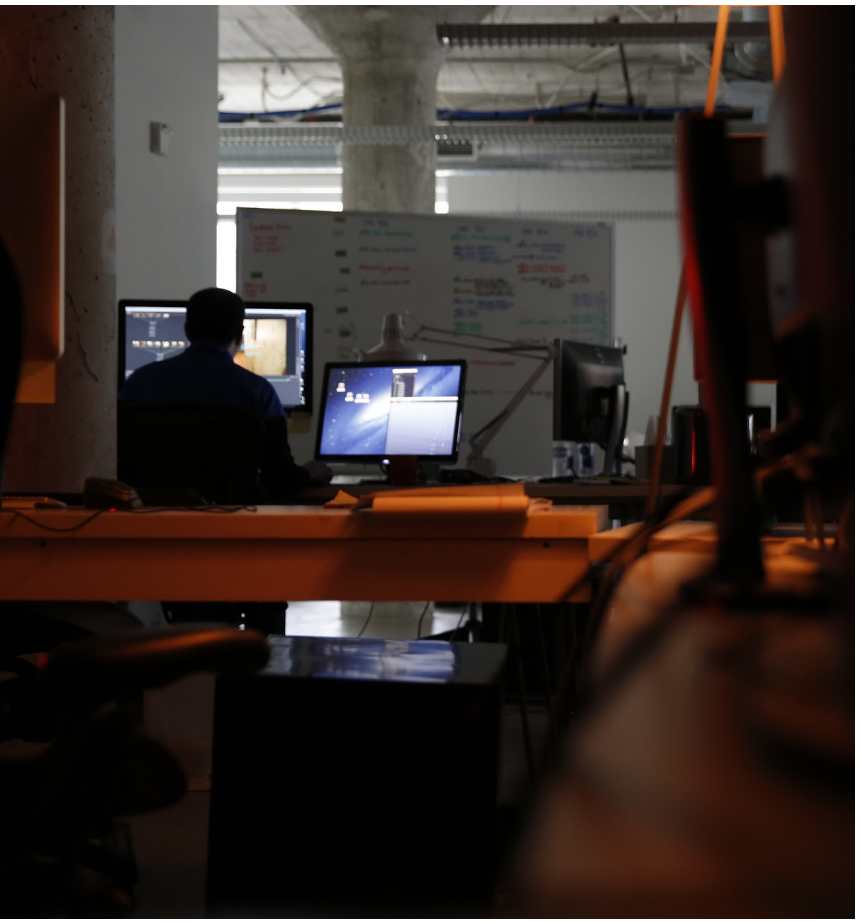

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...run containers in production?

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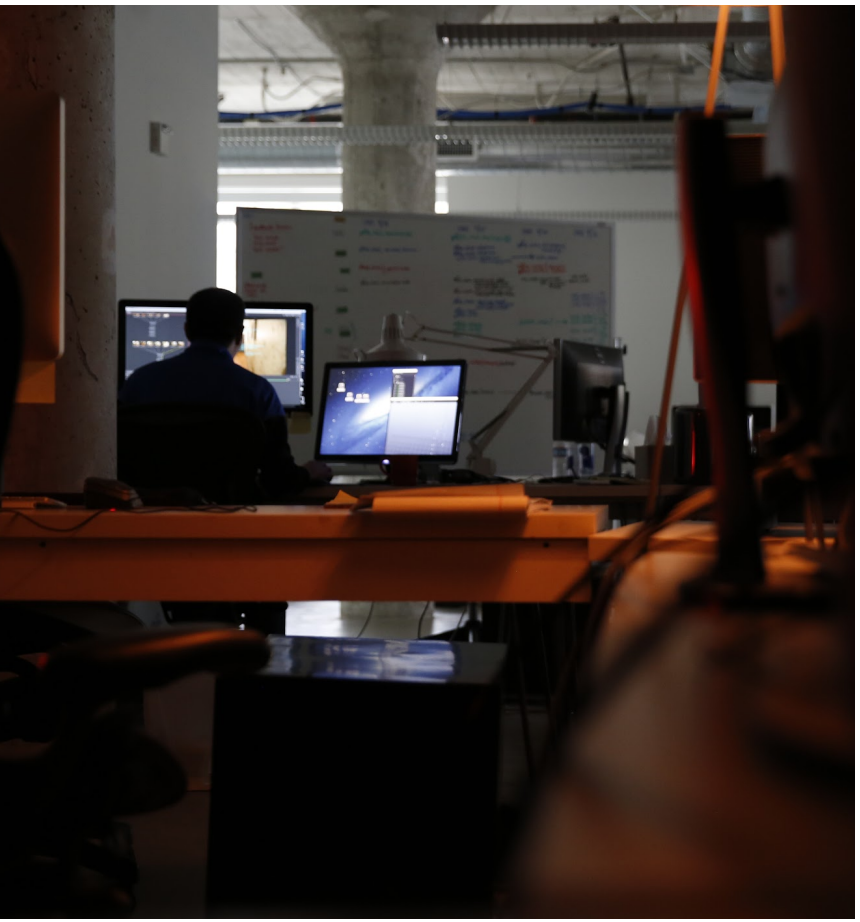

...are familiar with the NIST cybersecurity framework?

...run containers in production?

...monitor containers for security issues?

Agenda

Container security overview

Containers differ from VMs

How to detect bad things at runtime

Demo

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Container security overview

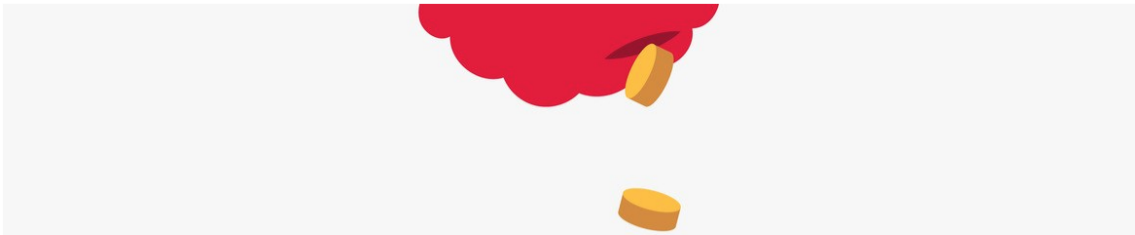
Kubernetes is so new that lots of practitioners don't know what security controls come with it.

> So one of the first things to do is study up on what controls are there and use them to strengthen your security posture
>
> *– Chenxi Wang, Jane Bond Project*

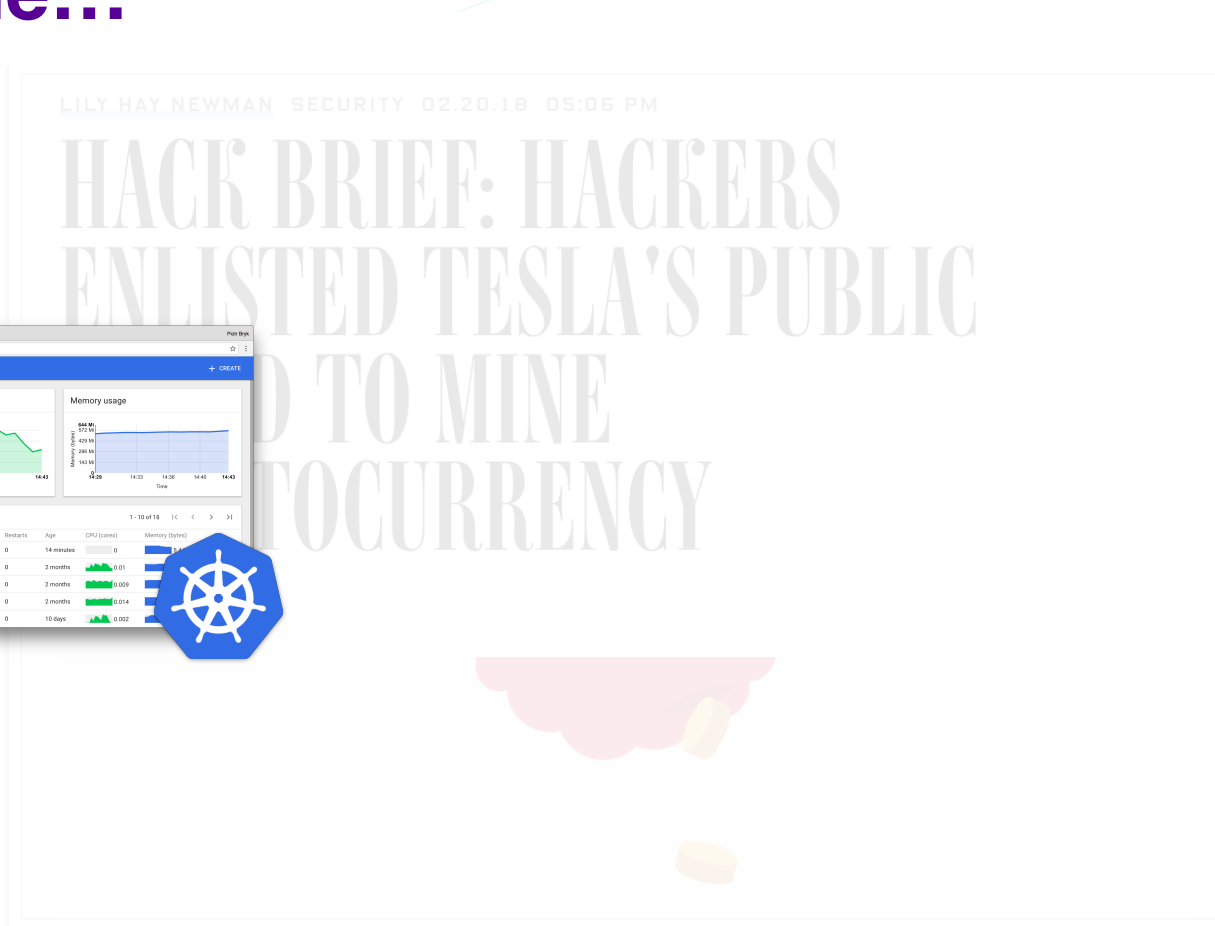
Story time…

LILY HAY NEWMAN SECURITY 02.20.18 05:06 PM

HACK BRIEF: HACKERS ENLISTED TESLA'S PUBLIC CLOUD TO MINE CRYPTOCURRENCY



Story time…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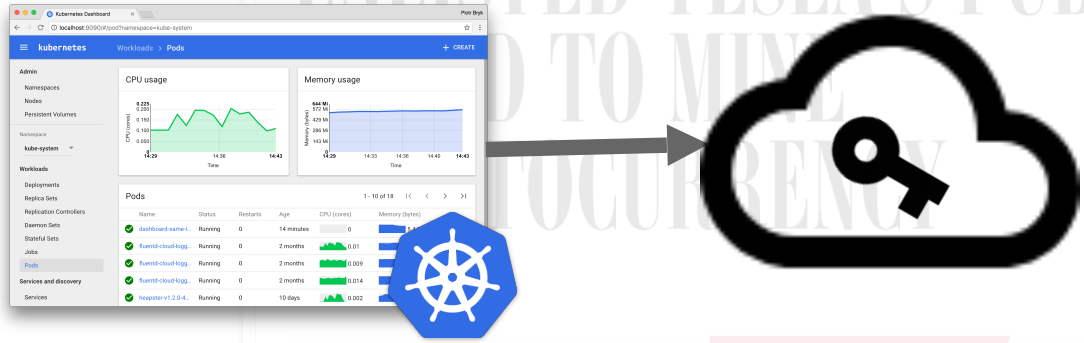
kubernetes
Workloads › Pods
CREATE
CPU usage
Memory usage
Pods

Story time…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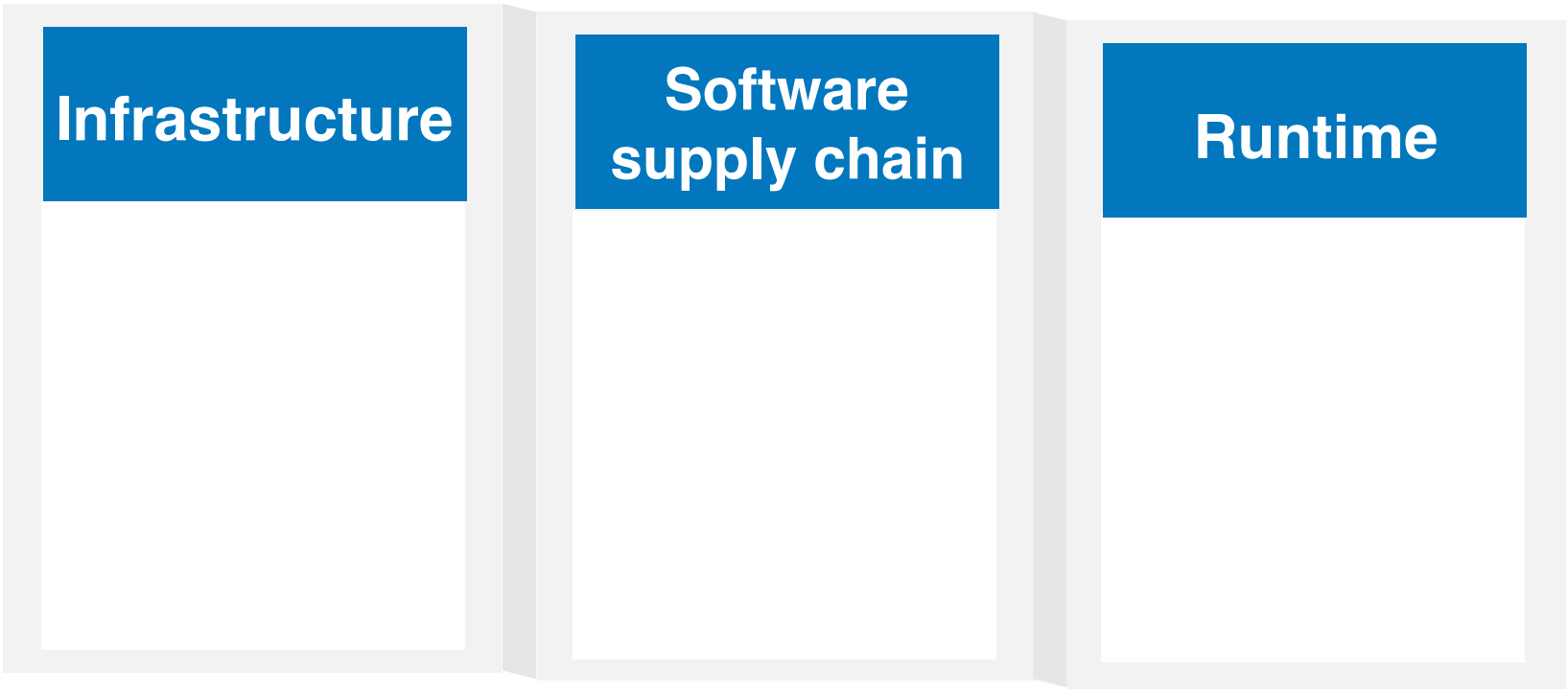
Threat grouping



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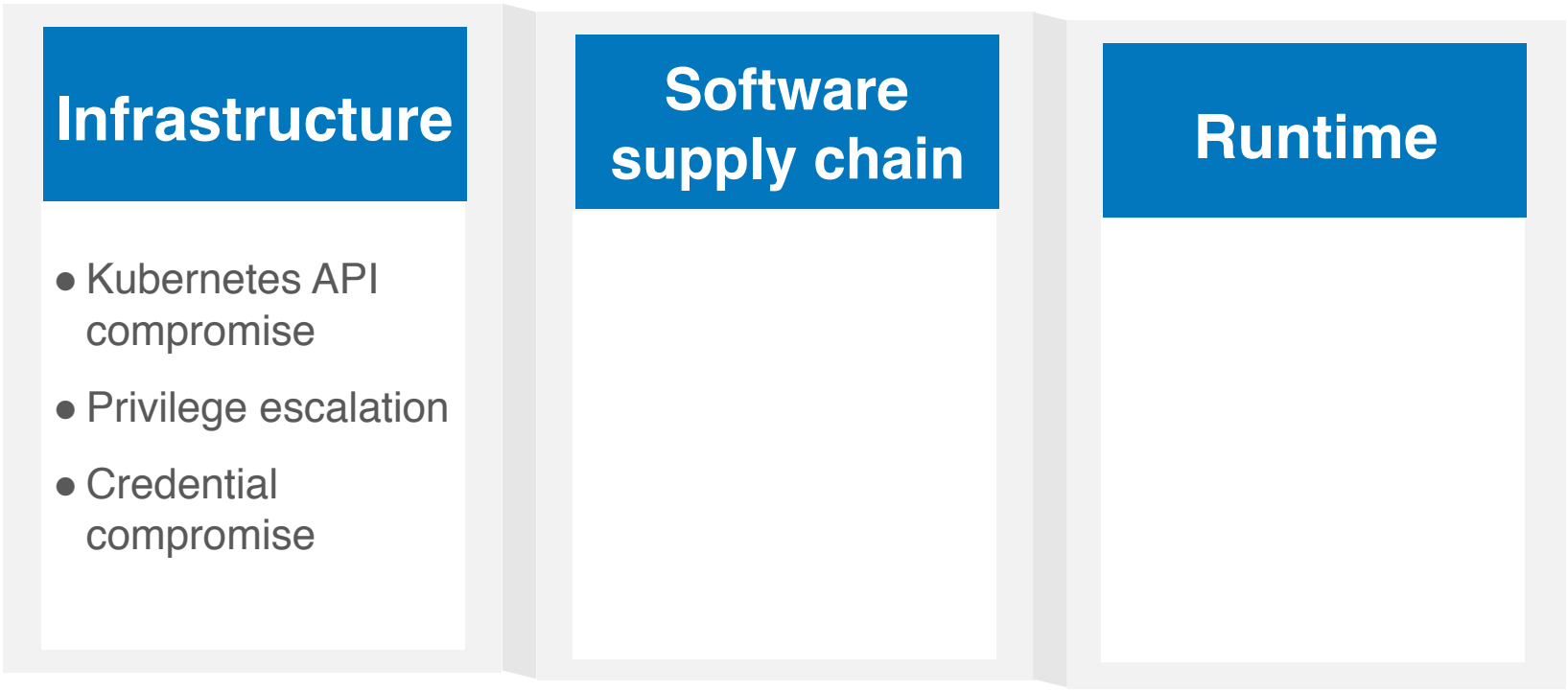

Threat grouping

Infrastructure

- Kubernetes API compromise
- Privilege escalation
- Credential compromise

Software supply chain

- Unpatched vulnerability
- Supply chain vulnerability

Runtime

Threat grouping

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Runtime

- DDoS
- Node compromise
- Container escape
- Zero day

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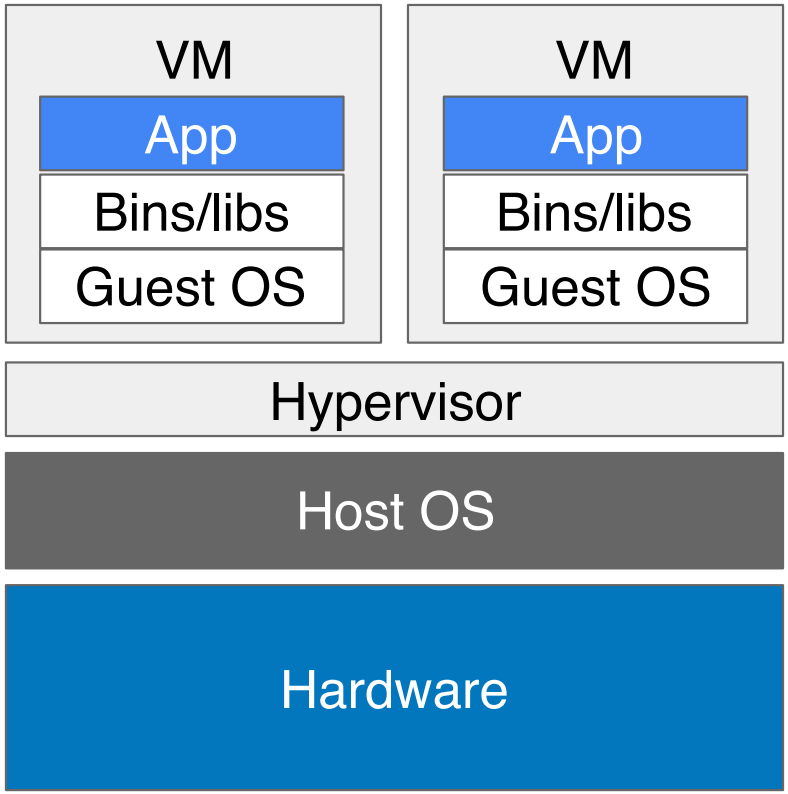
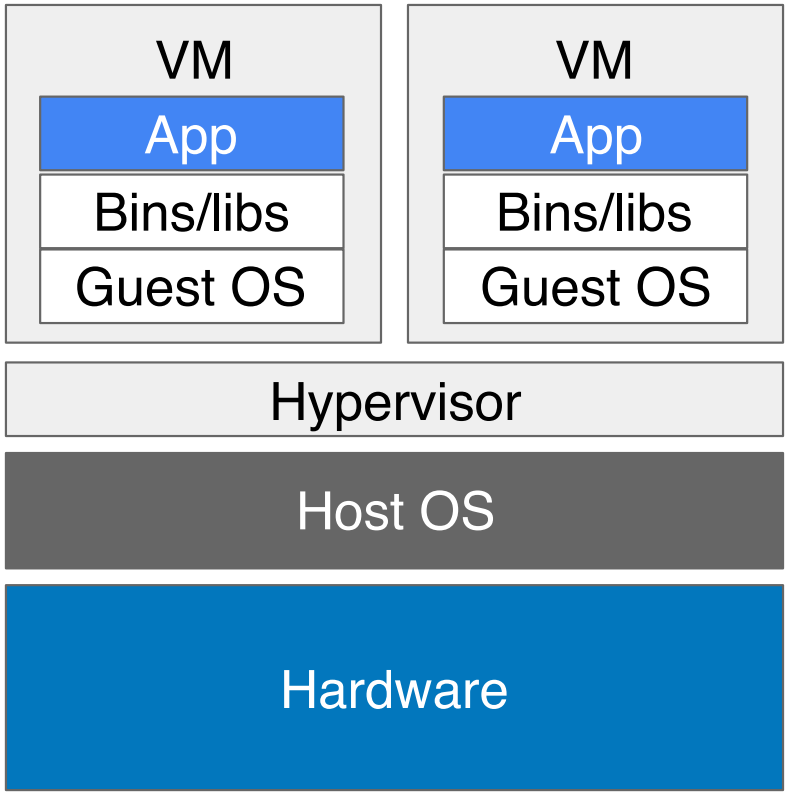
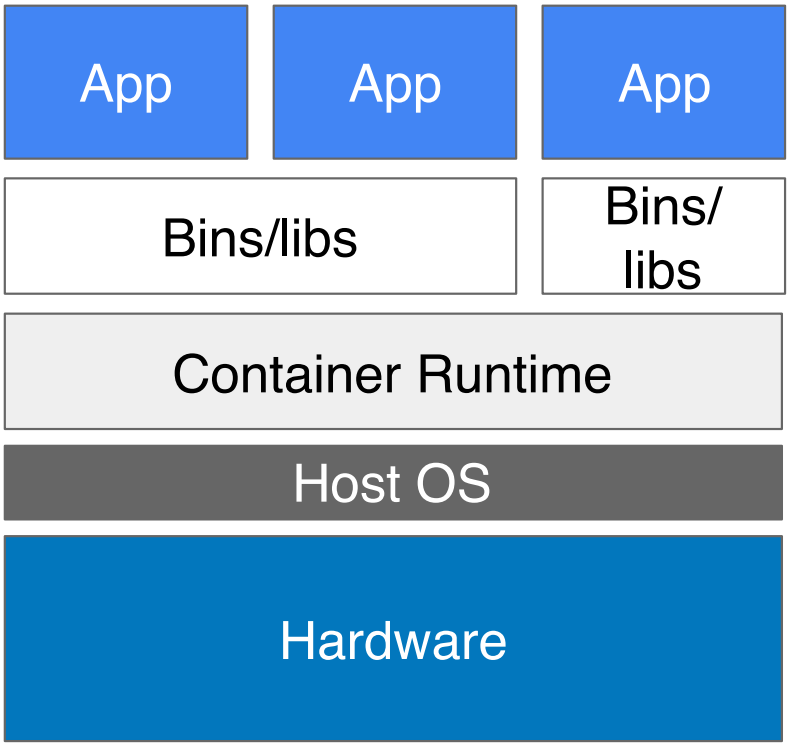
VMs vs Containers

Virtual machine

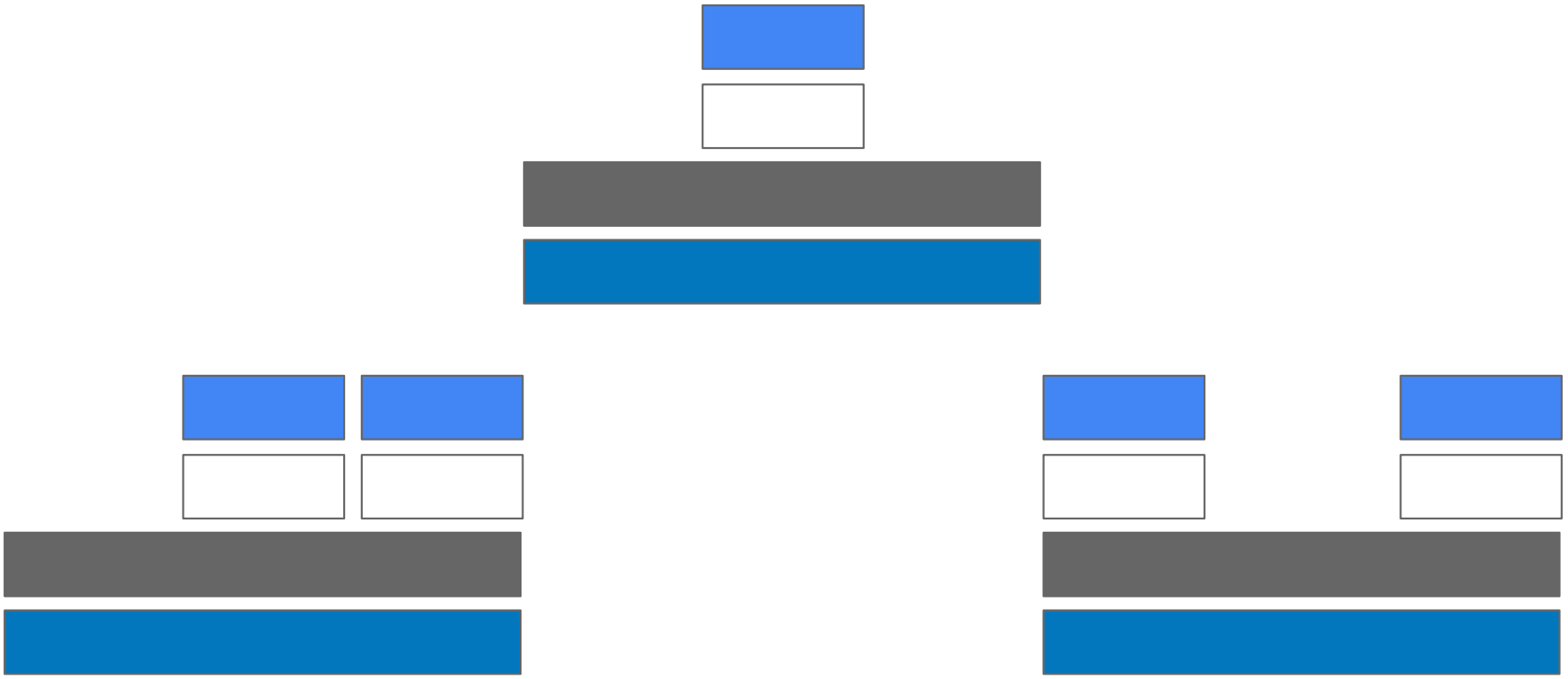


Virtual machine vs Container





Containers are dynamic



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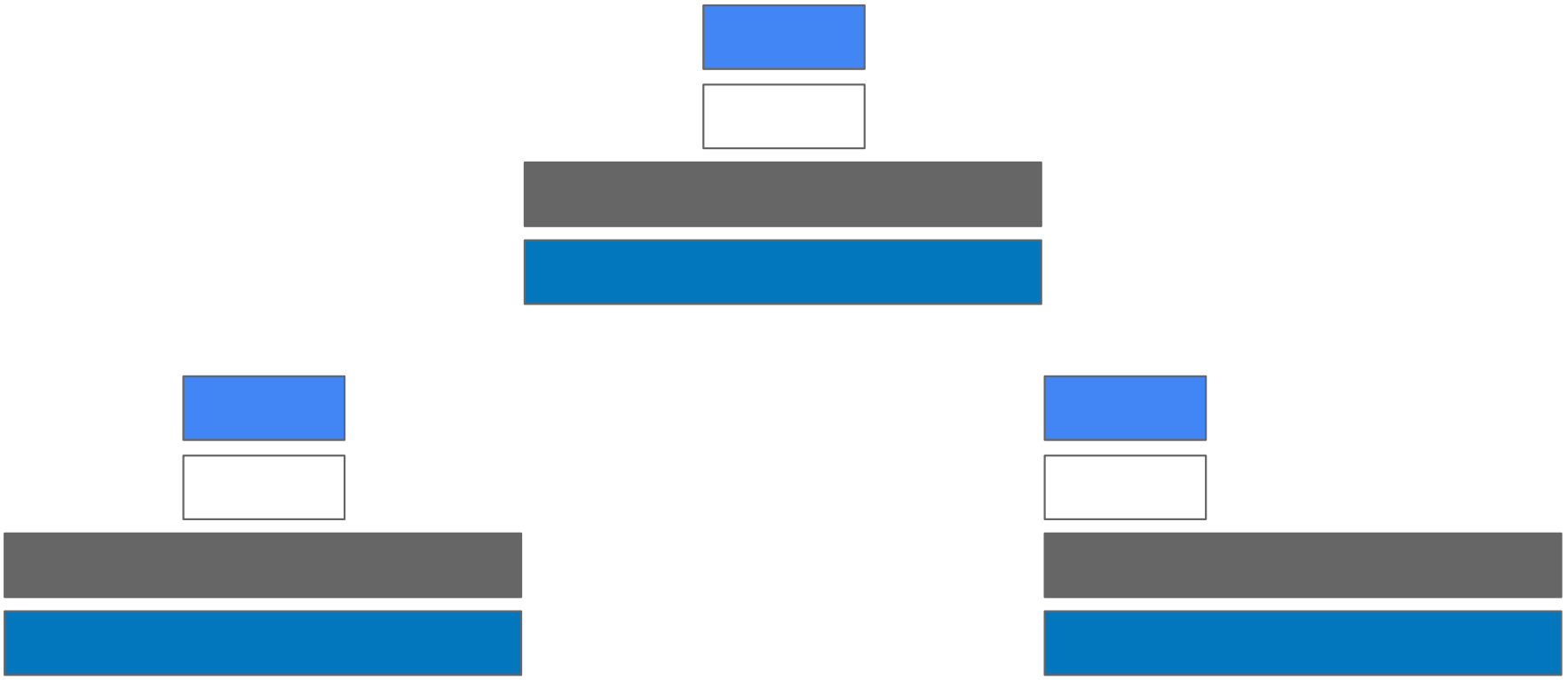

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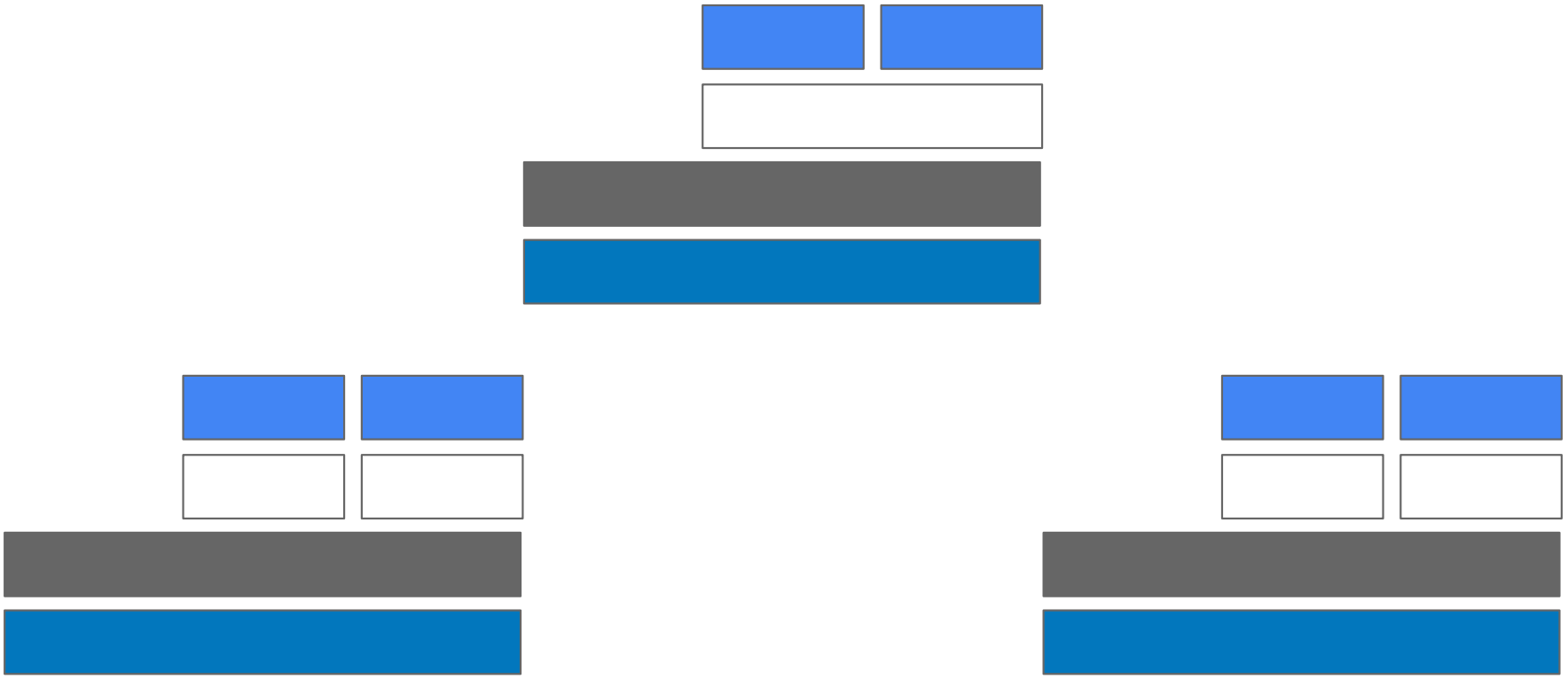

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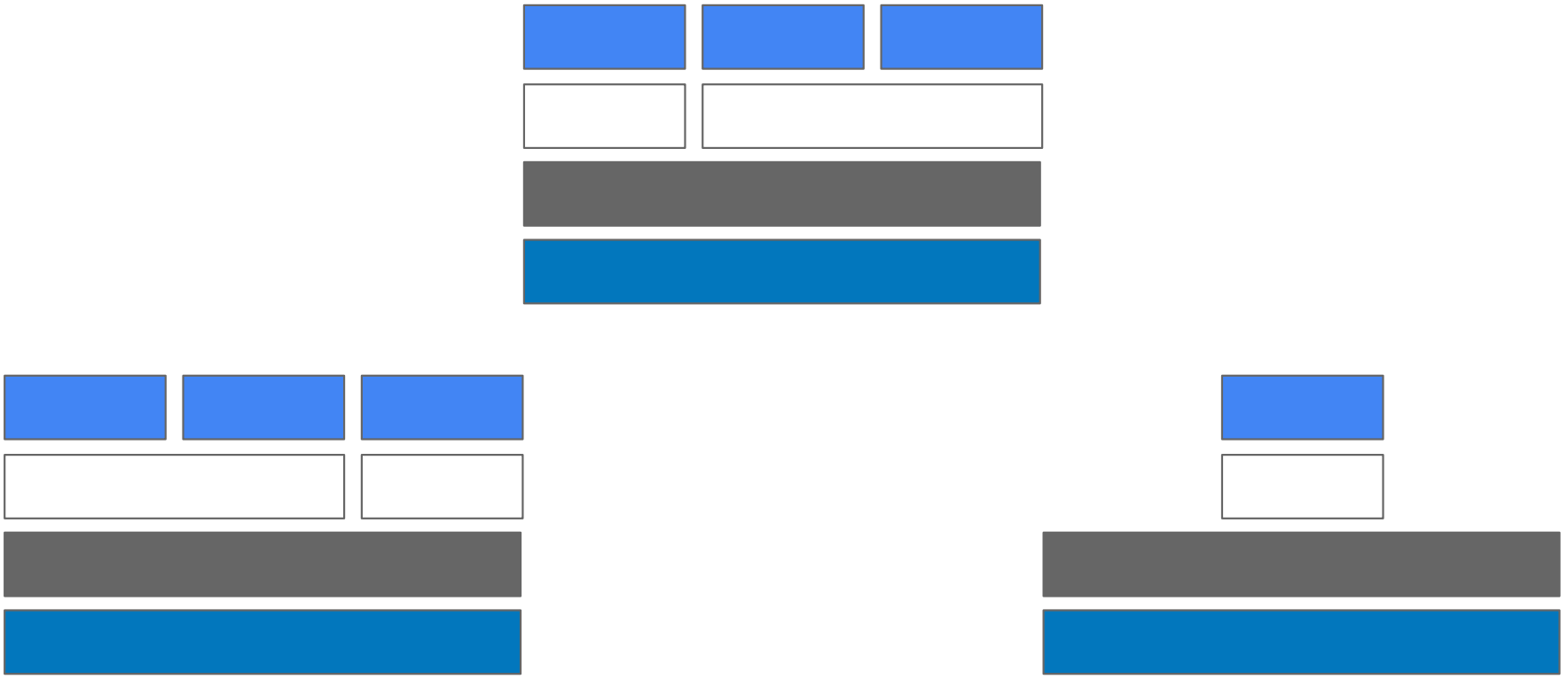

Security implications

	Better	Worse
Attack surface	**Minimalist host OS** limits the surface of attack	**Hypervisors** are a strong security boundary

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… but it's more the same than different

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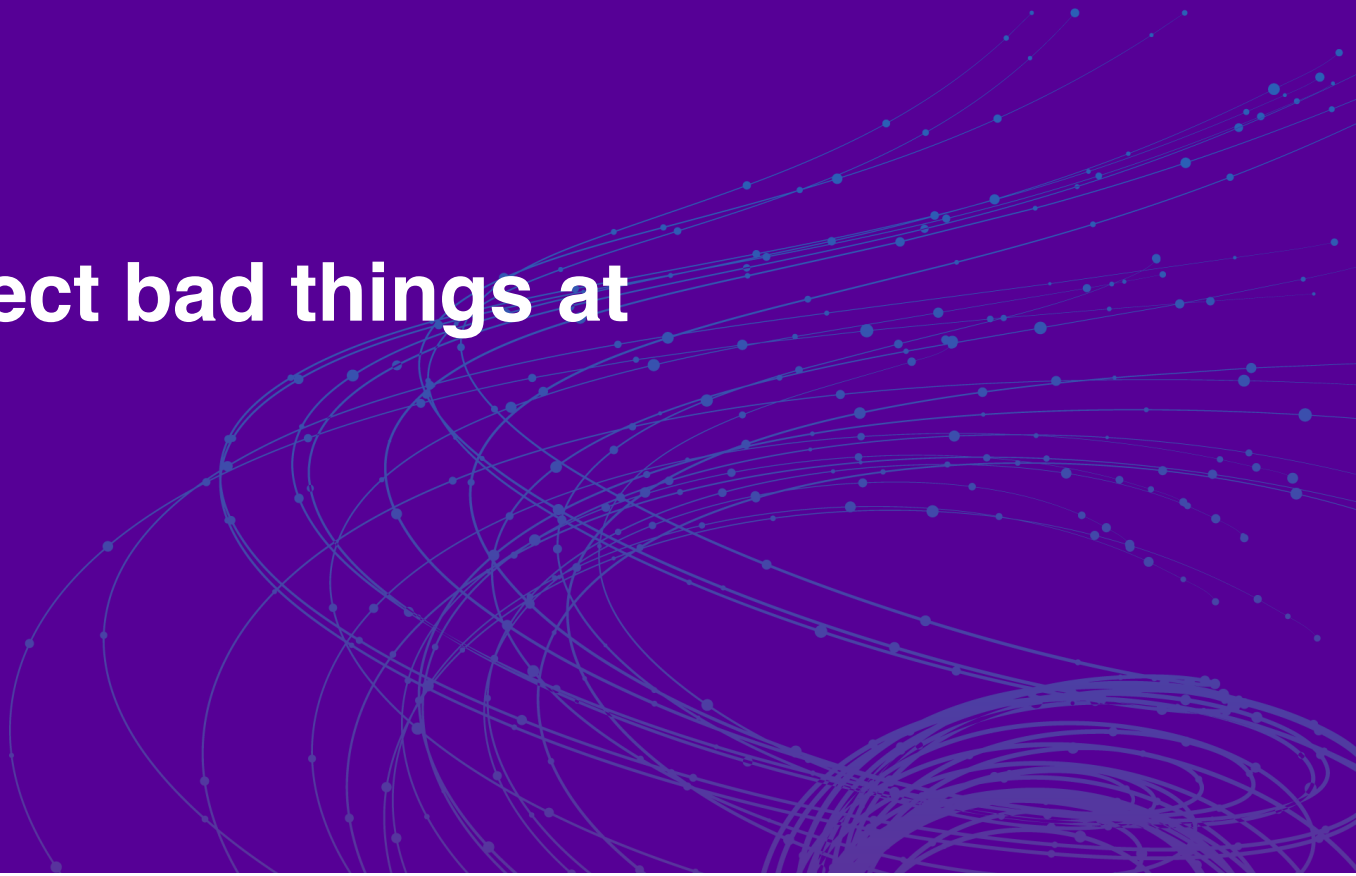
How to detect bad things at runtime



Why bother?

My secure supply chain prevents vulnerabilities!

But...

- Incomplete vuln scans
- Misconfigurations
- Zero days

Software supply chain is not perfect.
A fence is better than tall fence posts

NIST Cybersecurity Framework

Identify	Know your assets
Protect	Use security features and defaults
Detect	Detect unusual behavior
Respond	Respond to suspicious events
Recover	Figure out what happened and fix things

NIST Cybersecurity Framework

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Protect

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Recover

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NIST Cybersecurity Framework

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Detect: container monitoring designs

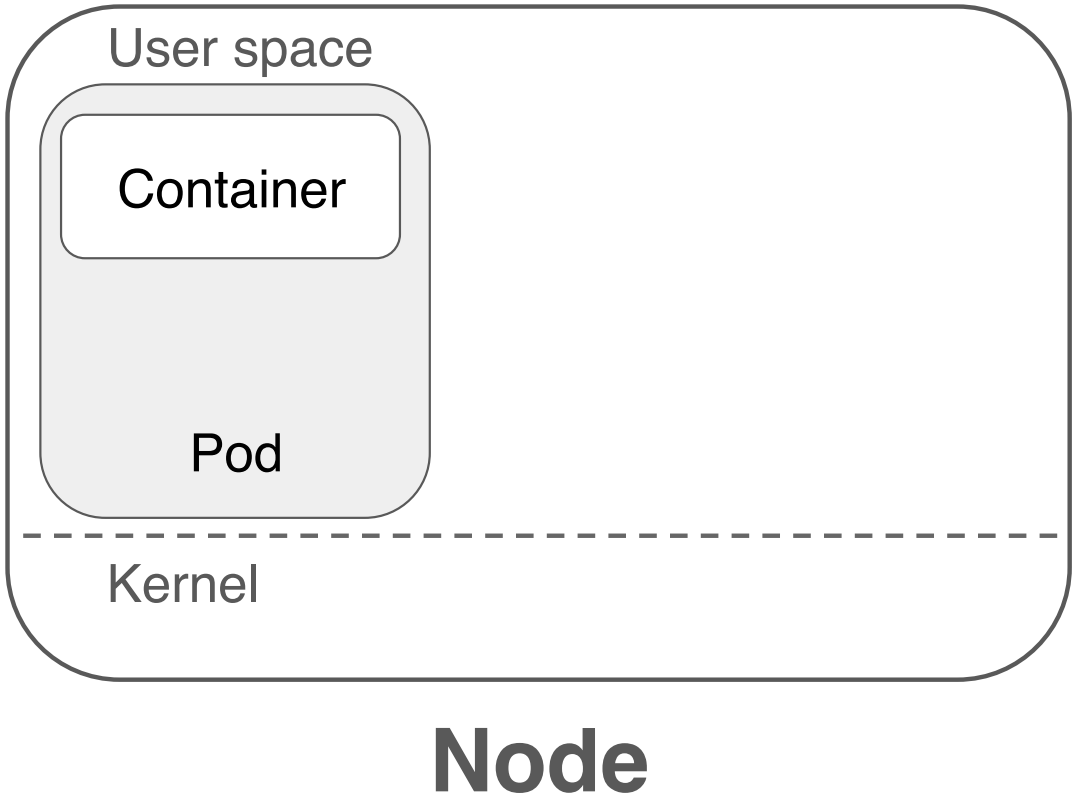
- Hook into your container
- **Log** a bunch of stuff
- **Policies** for:
  - alerts
  - automatic remediation
- **Allow forensics** afterwards

Detect options

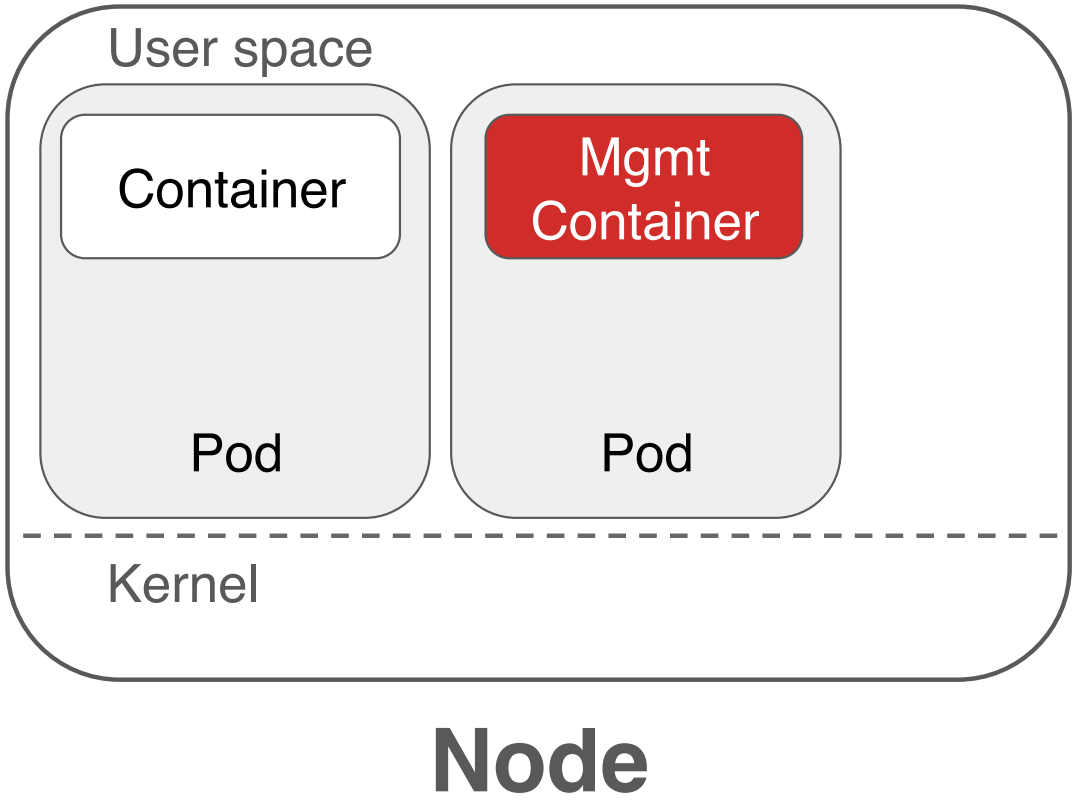
Examine process activity, network activity, file activity, … **HUGE VOLUME**

- **ptrace, kprobes, tracepoints**
- **Audit logs**
- **eBPF**: kernel introspection
- **XDP**: uses eBPF for filtering network packets
- **User-mode API**: for kernel events like inotify

Deployment models



Detect and capture



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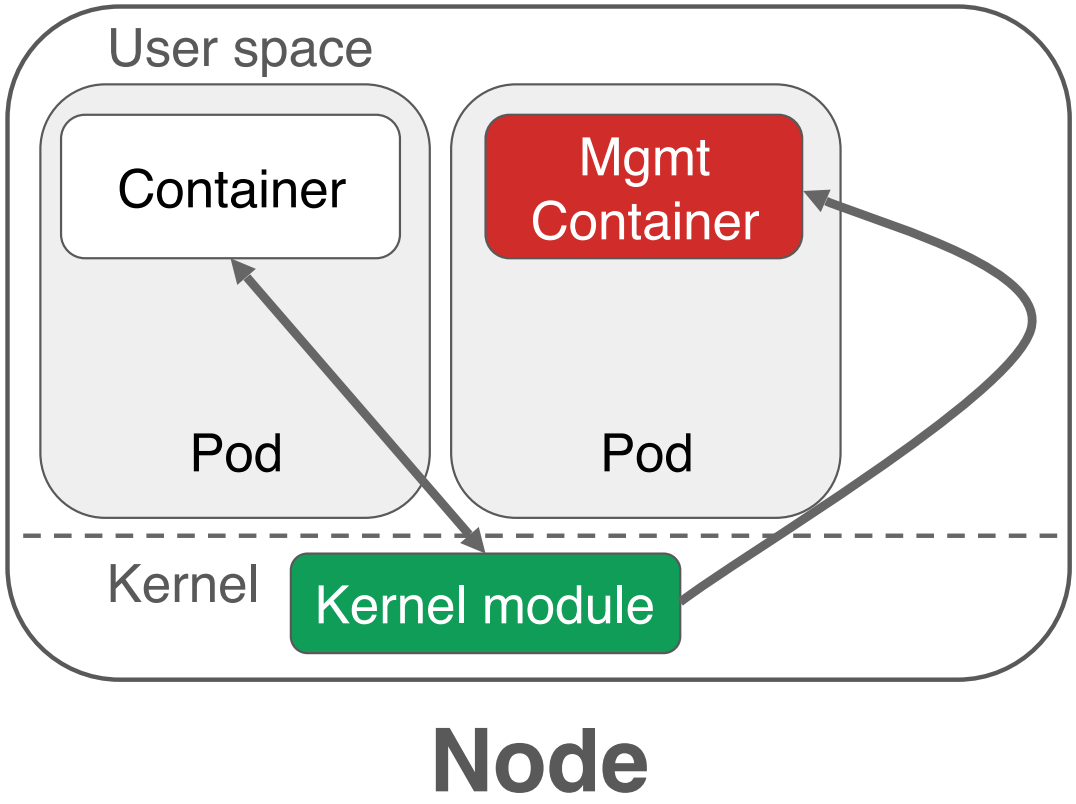

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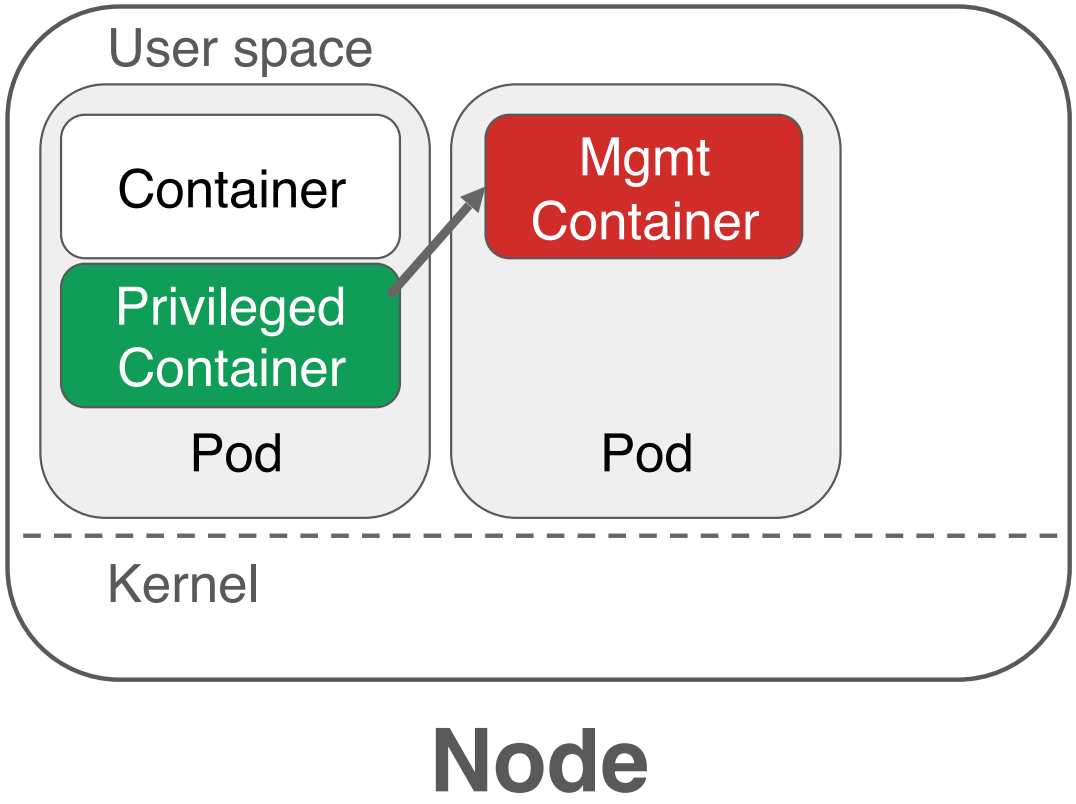
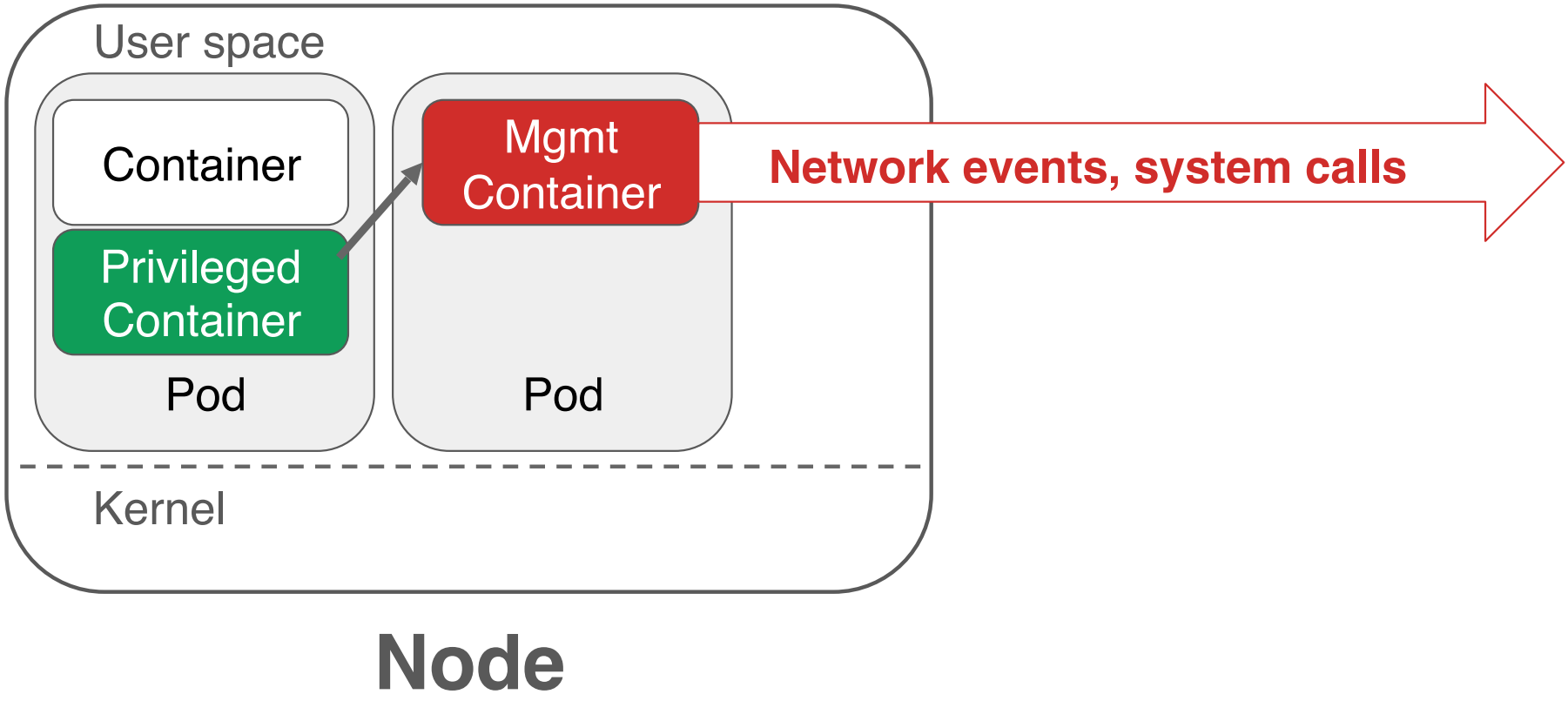
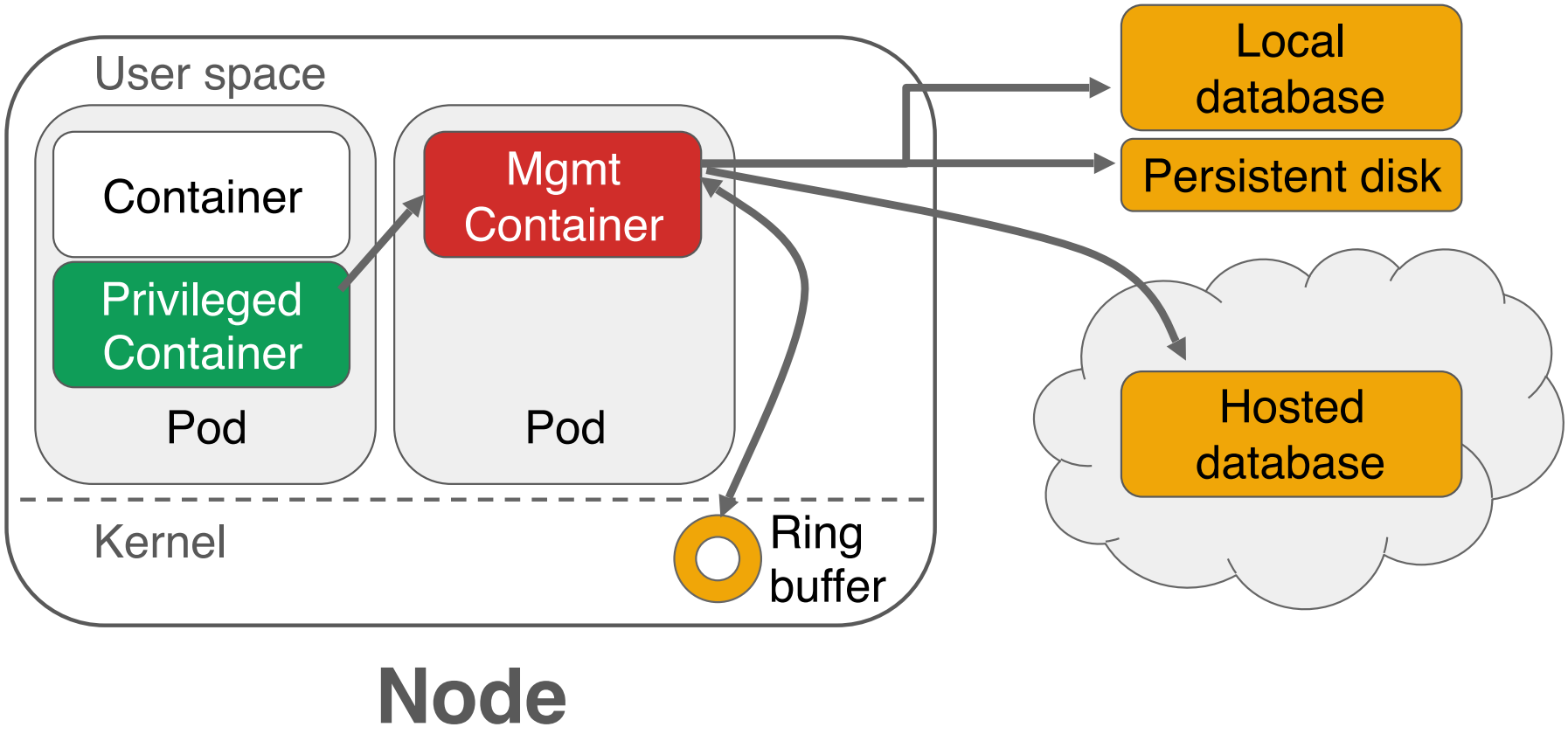


Manage


User space
Container
Privileged Container
Pod
Mgmt Container
Pod
Kernel
Network events, system calls
Node

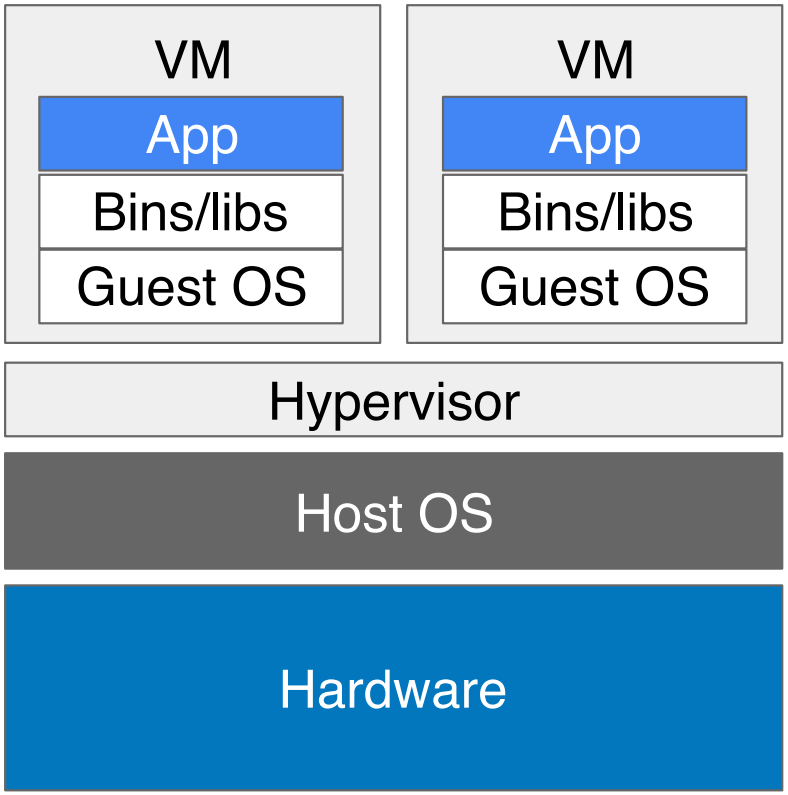
Store


User space
Container
Privileged Container
Pod
Mgmt Container
Pod
Kernel
Ring buffer
Local database
Persistent disk
Hosted database
Node

Respond

- **Send an alert**
- **Isolate a container**, i.e. move it to a new network
- **Pause a container**, i.e. stop all running processes
- **Restart a container**, i.e. kill and restart processes
- **Kill a container**, i.e. kill processes without restart

So, why are containers special again?



Virtual machine

Long lived systems

- Manual security patches and reviews

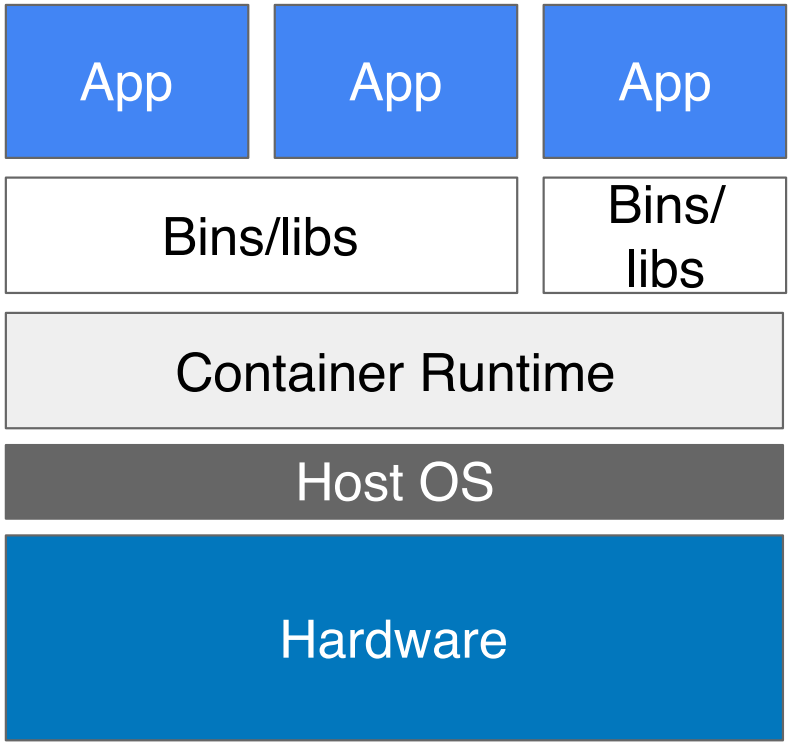
Per-host software

- IDS for host software

Shared, physical network

- Host-centric appliance for network traffic

So, why are containers special again?



Container

Dynamic short-lived containers

- Need to redeploy often

Load isolation by container

- Need container IDS

Overlay network

- Need container network monitoring

Apply slide - What you can do today

- Make it part of your security plan
  - Try out open source options
  - Evaluate commercial options
- Deploy early
  - Get baseline readings
  - Tune your signals
- Rehearse an event

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Demo

Demo on YouTube

http://jen.run/krs-demo

What we discussed

Container security overview

Containers differ from VMs

Don't build fence posts

What you can do today

Thank you!

Slides: https://mimming.com/krs