RSA Conference2019

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BETTER.

SESSION ID: CSV-R02

Kubernetes Runtime Security

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About me

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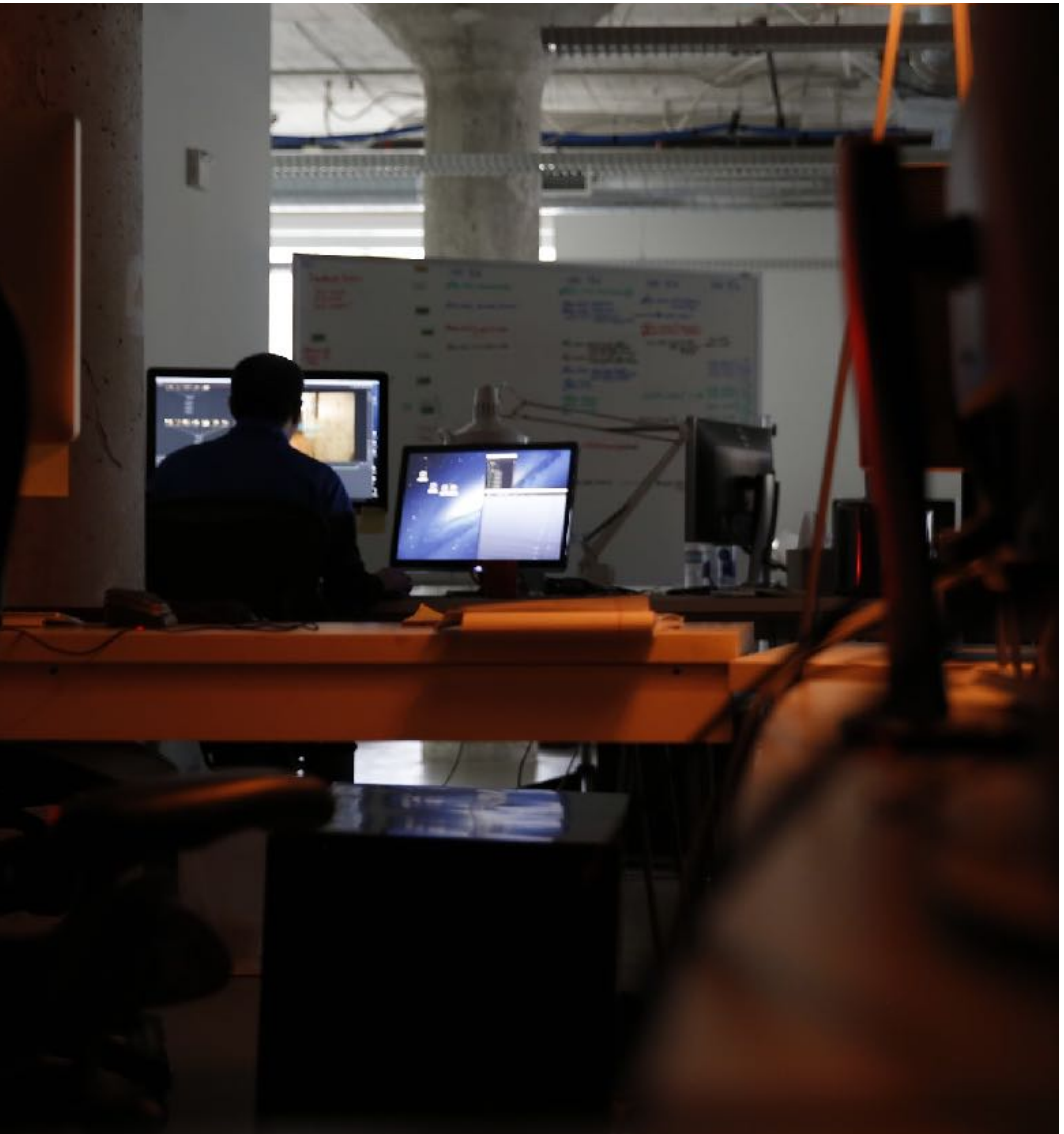
How many of you…



...are familiar with the NIST cybersecurity framework?

...are running containers in production?

...are monitoring containers for security issues?

Agenda

Container security overview

Containers differ from VMs

How to detect bad things at runtime

Demo

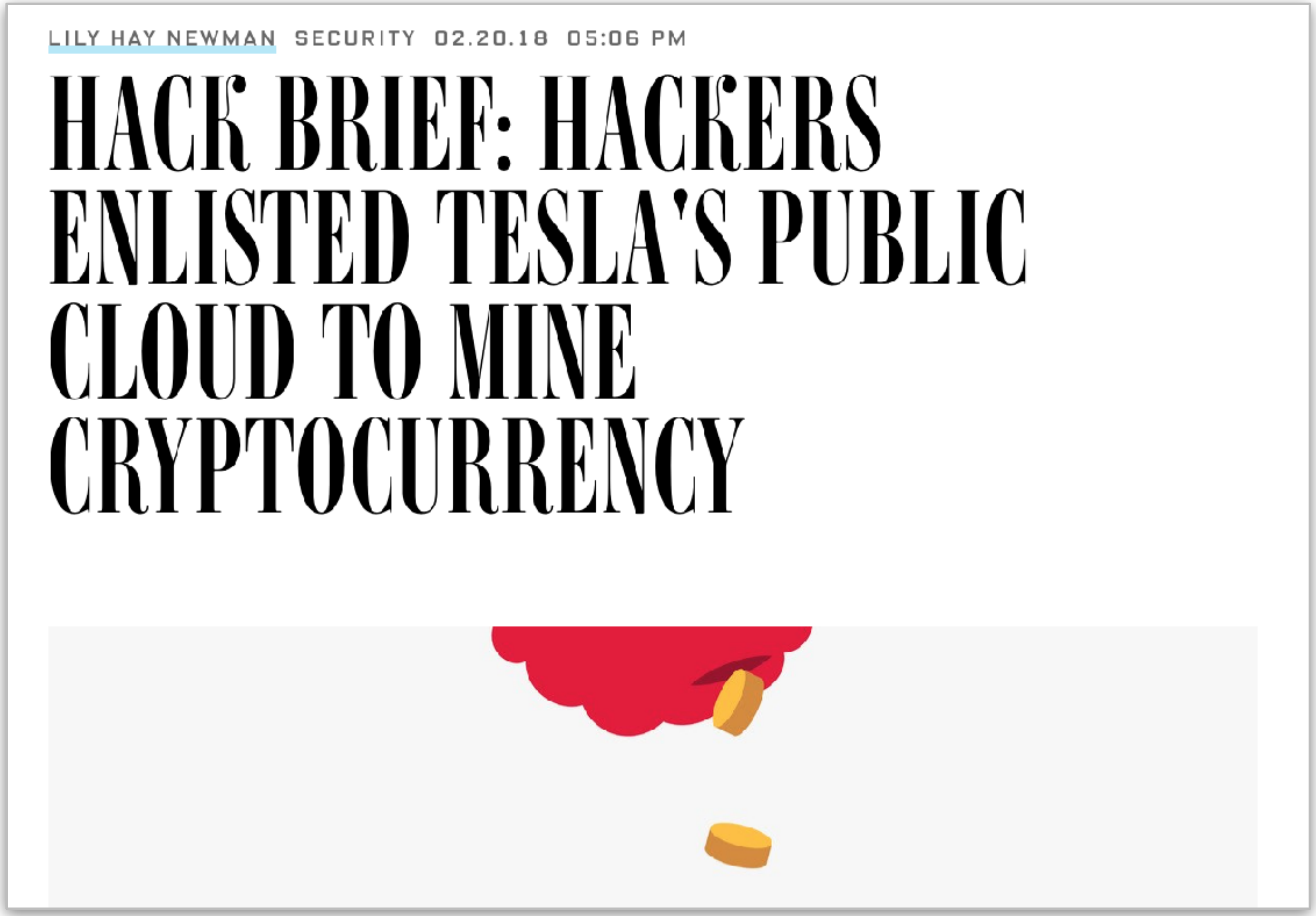
Container security overview

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

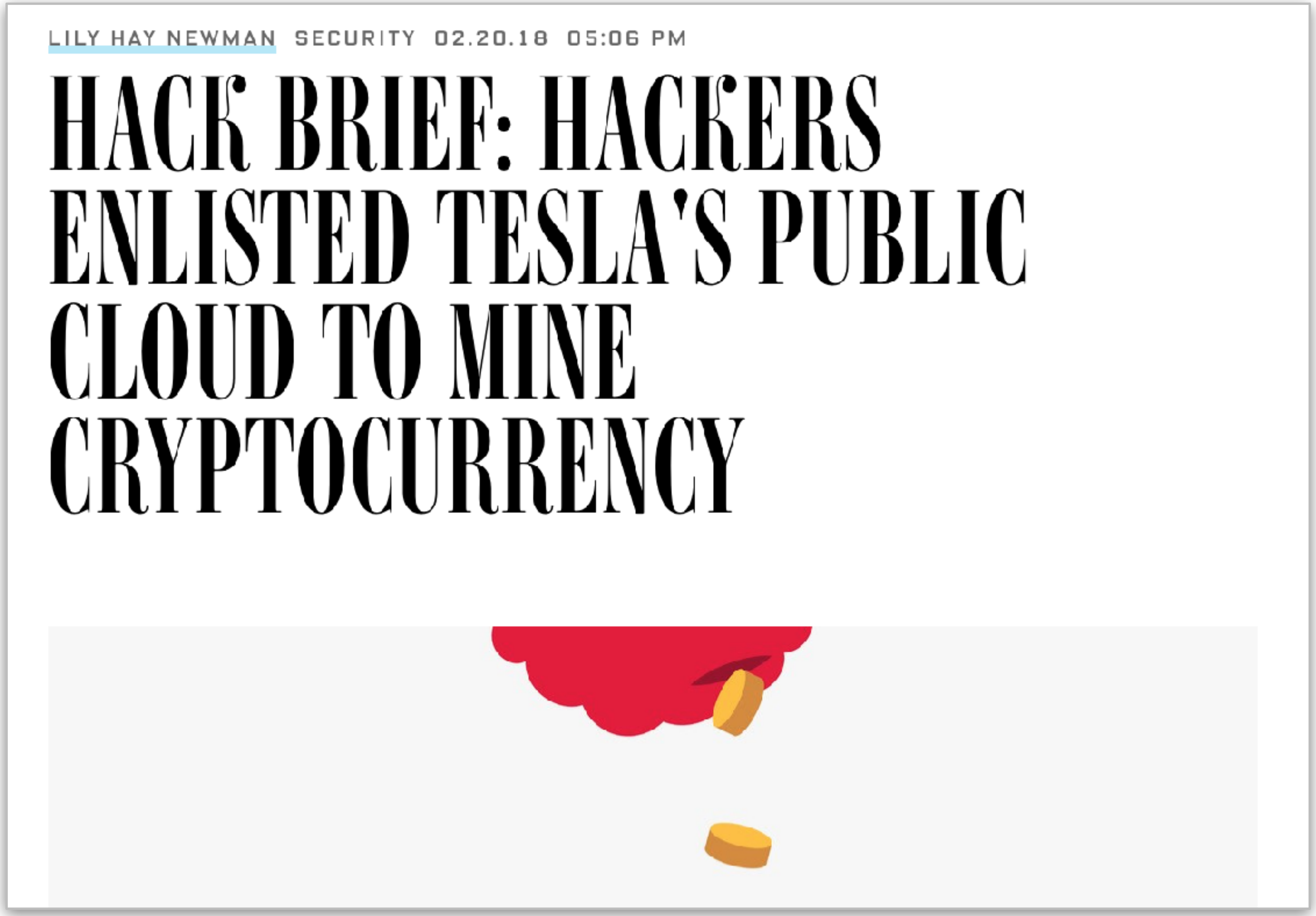
Threats to containers



LILY HAY NEWMAN SECURITY 02.20.18 05:06 PM

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

Threats to containers



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

Hackers accessed the Kubernetes console, which was **not password protected**

Console contained **privileged AWS account credentials**

Used credentials to access AWS resources and **mine cryptocurrency**

Threats to containers

secure infrastructure to develop containers

- Kubernetes API compromise
- Privilege escalation
- Credential compromise

build and deploy

- Unpatched vulnerability
- Supply chain vulnerability

runtime

- DDoS
- Node compromise and exploit
- Container escape
- Flood event pipeline
- Zero day

Container security

Infrastructure

development

Software supply chain

build and deploy

Runtime

running

Container security

Infrastructure	Software supply chain	Runtime
development	build and deploy	running

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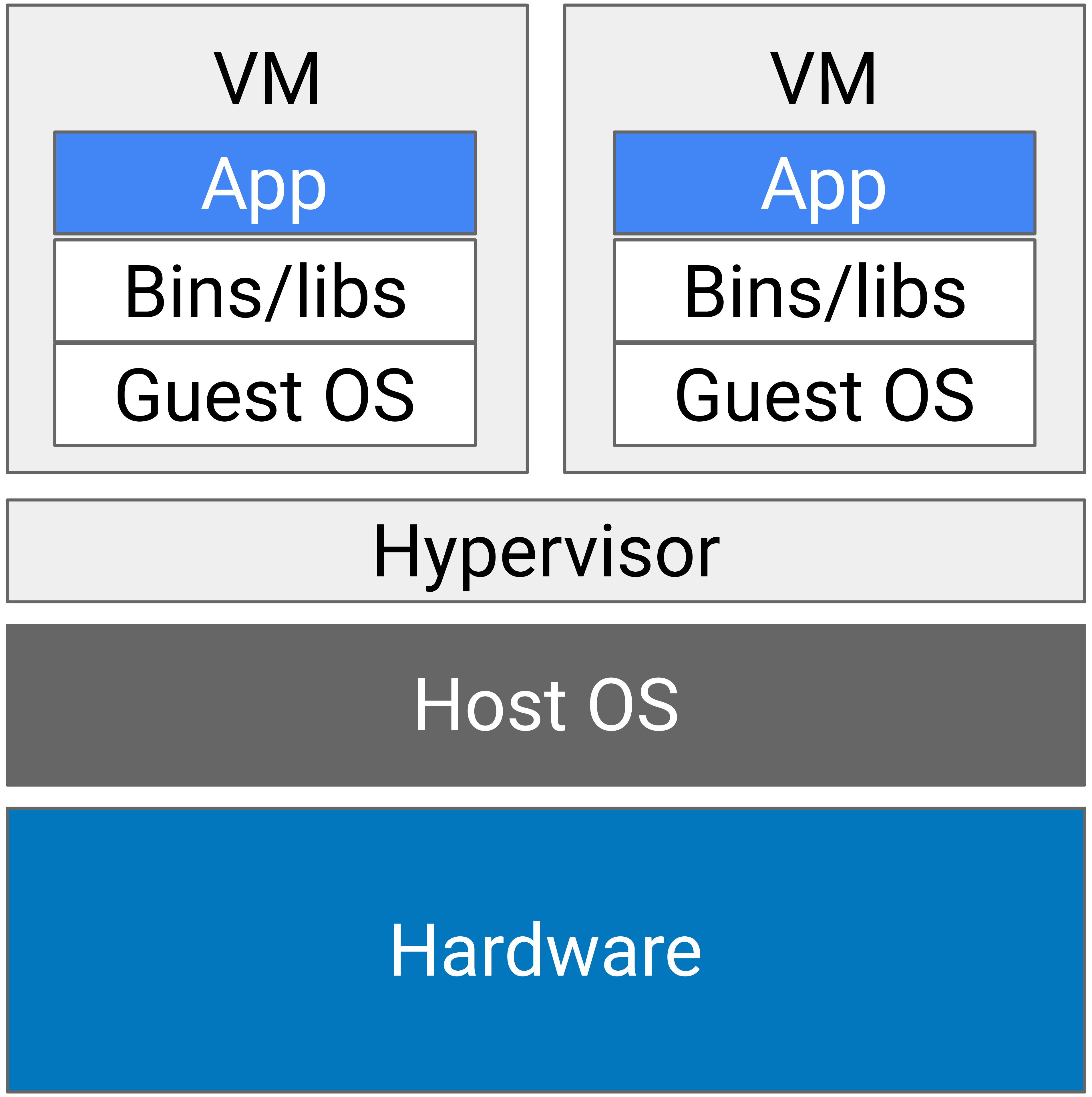
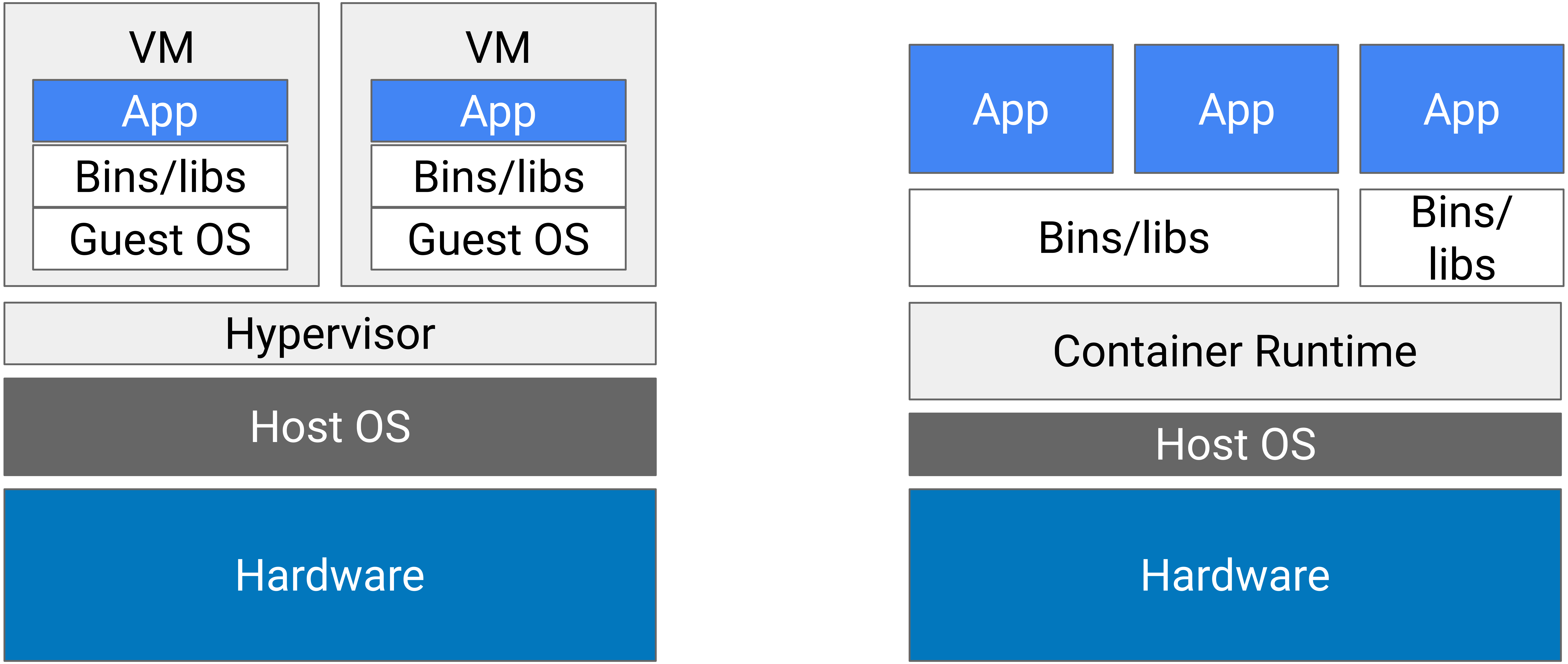
Containers are different from VMs

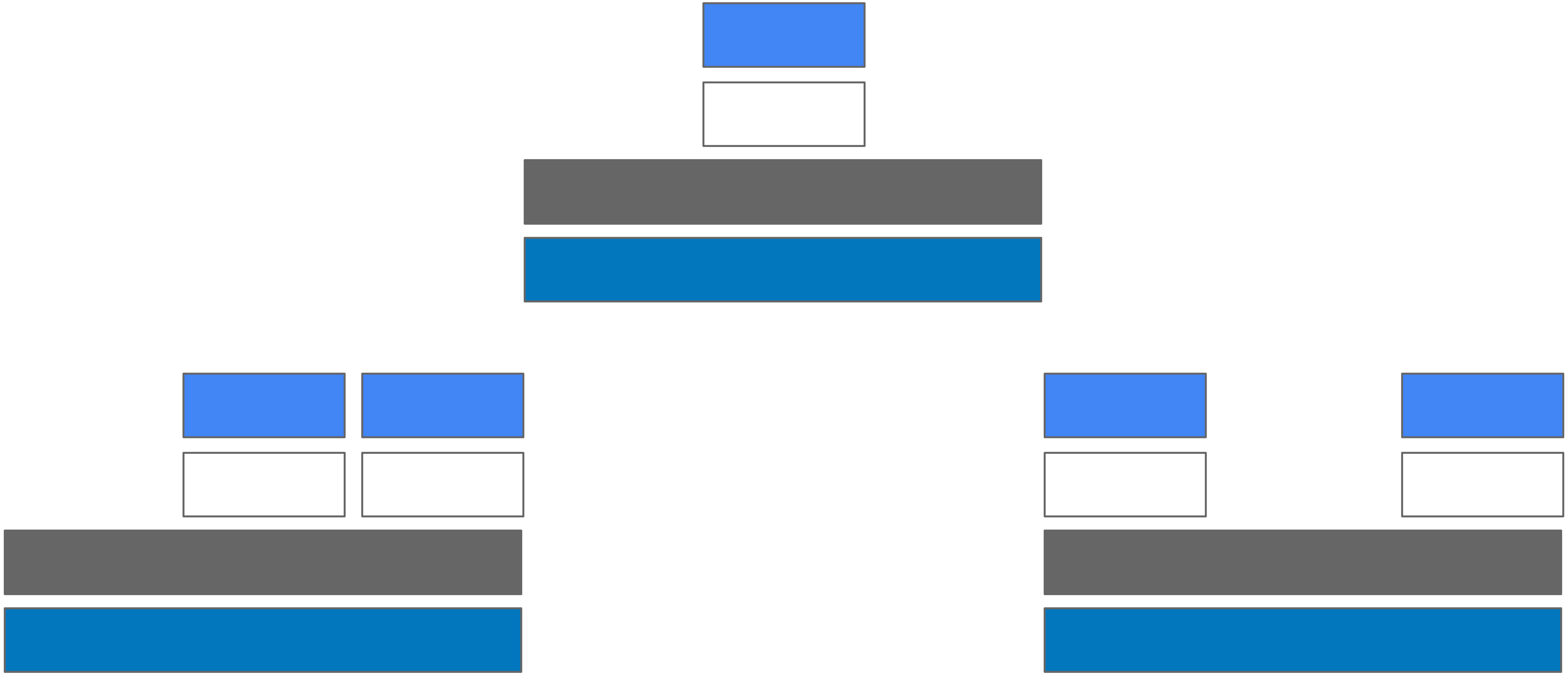
Virtual machine



Virtual machine vs Container



Containers are dynamic



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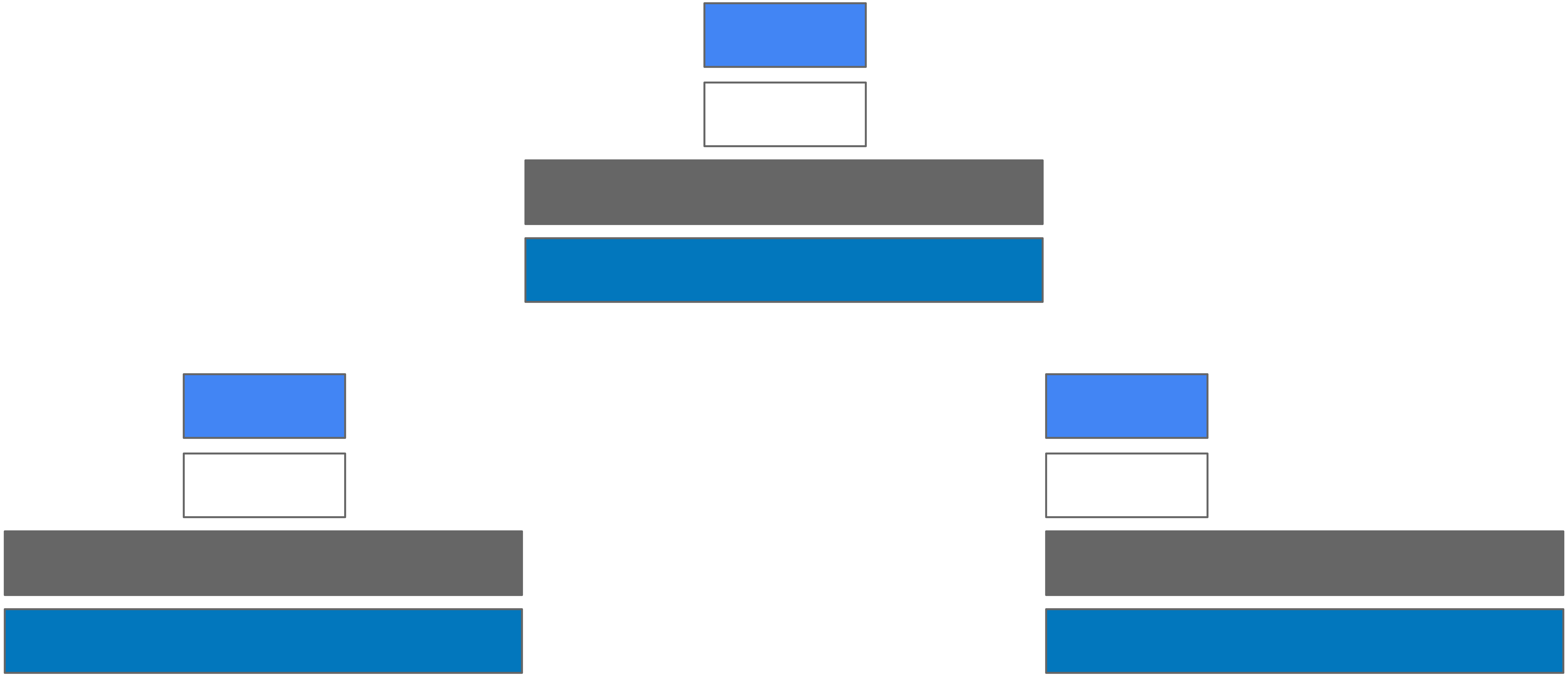

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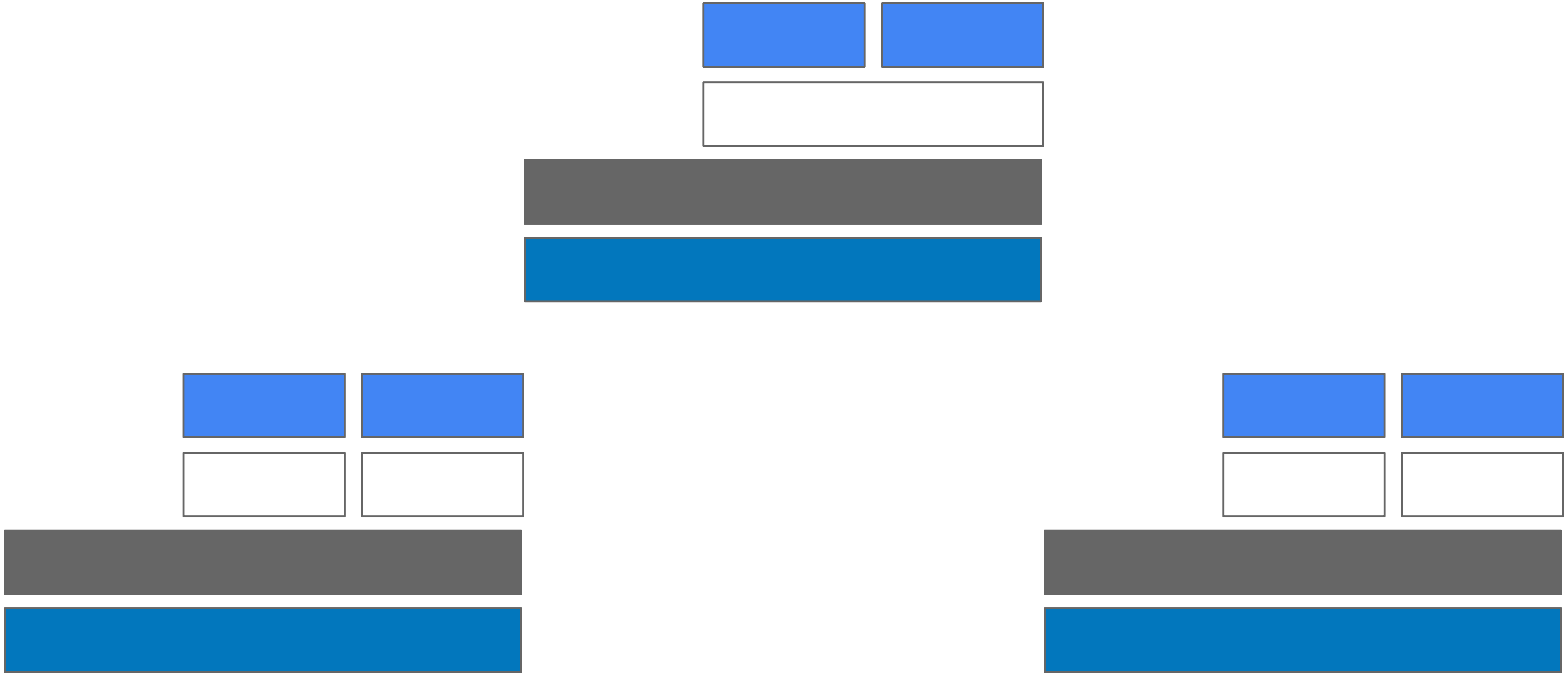

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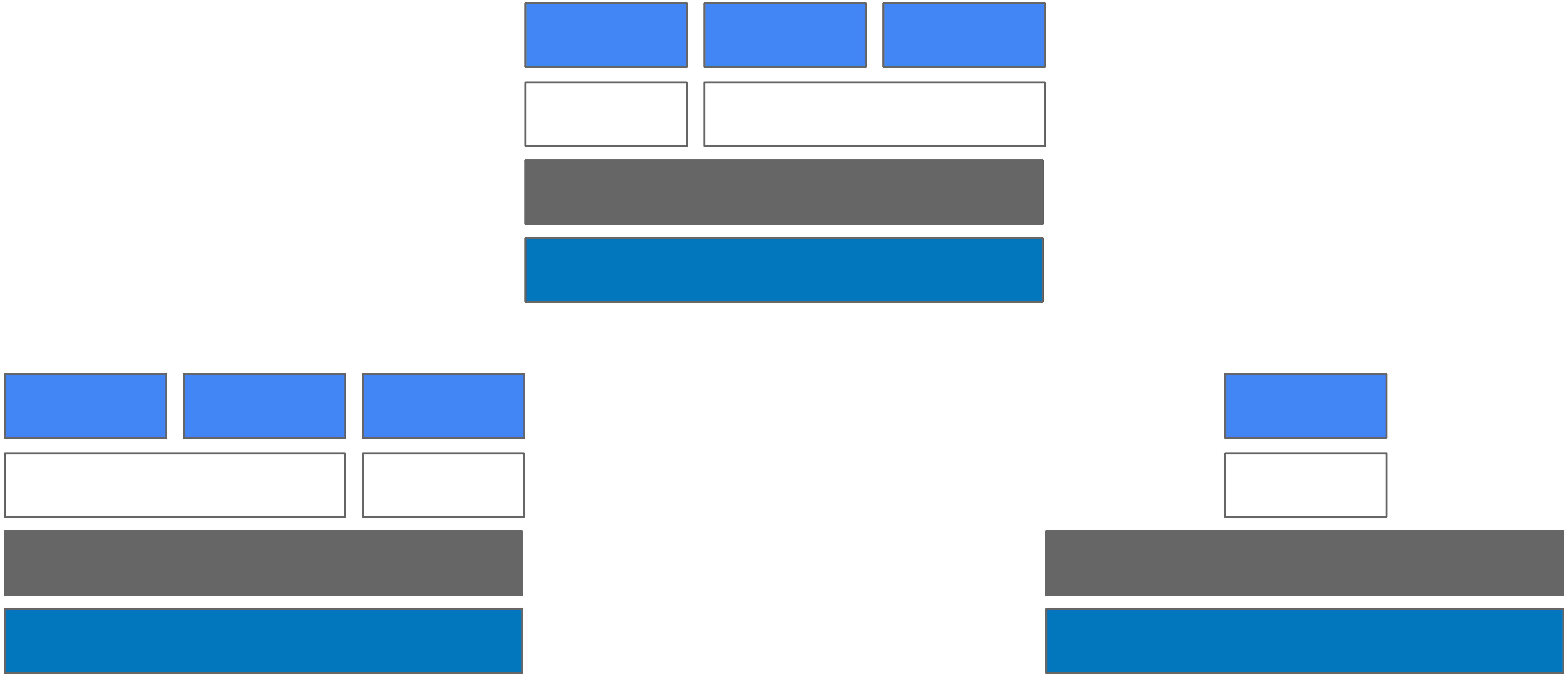

Security implications

	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

Identify

Protect

Detect

Respond

Recover

NIST Cybersecurity Framework

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Recover Complete forensics and fix things so this doesn’t happen to your container again

NIST Cybersecurity Framework

Identify Know what your ~~containers~~ assets are

Protect Use secure defaults to protect your ~~containers~~ applications

Detect Detect ~~container~~ behavior that deviates from the norm

Respond Respond to a suspicious event ~~in your container~~ and mitigate the threat

Recover Complete forensics and fix things so this doesn't happen ~~to your container~~ again

NIST Cybersecurity Framework

Identify	Know what your containers are
Protect	Use secure defaults to protect your containers
Detect	Detect container behavior that deviates from the norm
Respond	Respond to a suspicious event in your container and mitigate the threat
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Detect: container monitoring designs

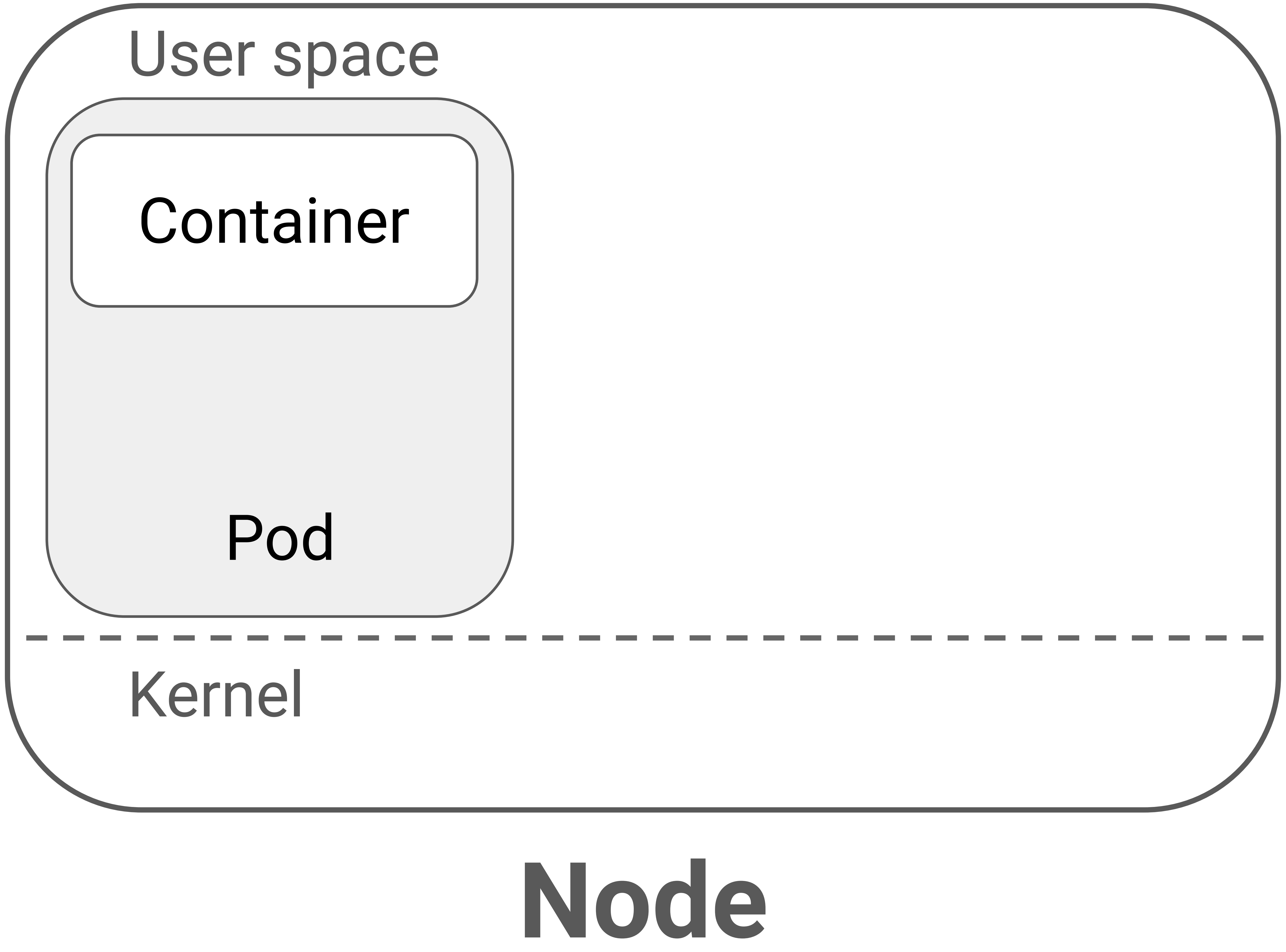
- Hook into your container
- **Log** a bunch of stuff
- **Policies** for:
  - alerts
  - automatic remediation
- **Allow forensics** afterwards

Detect options

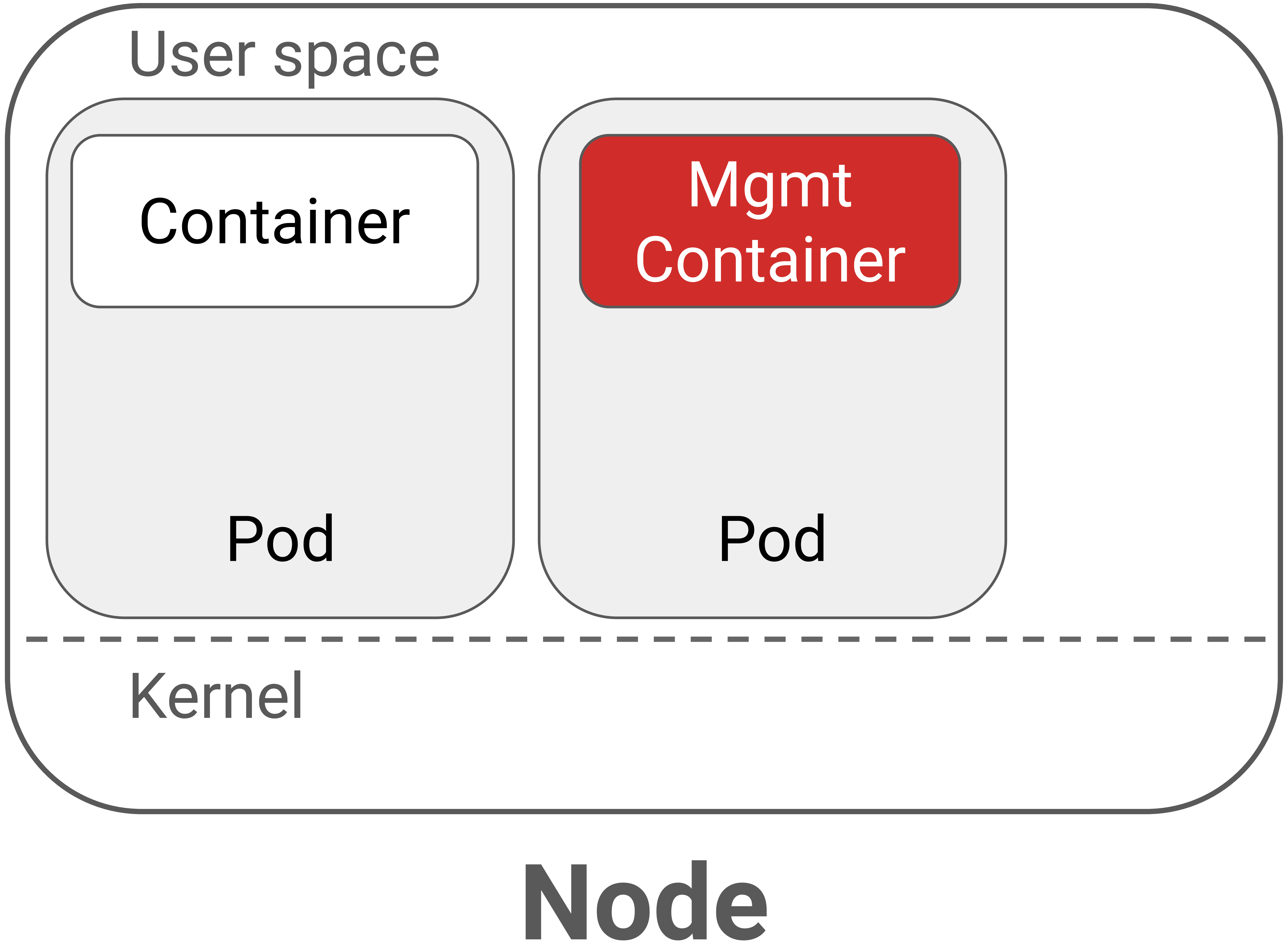
Examine process activity, network activity, file activity, ... **HUGE VOLUME**

- **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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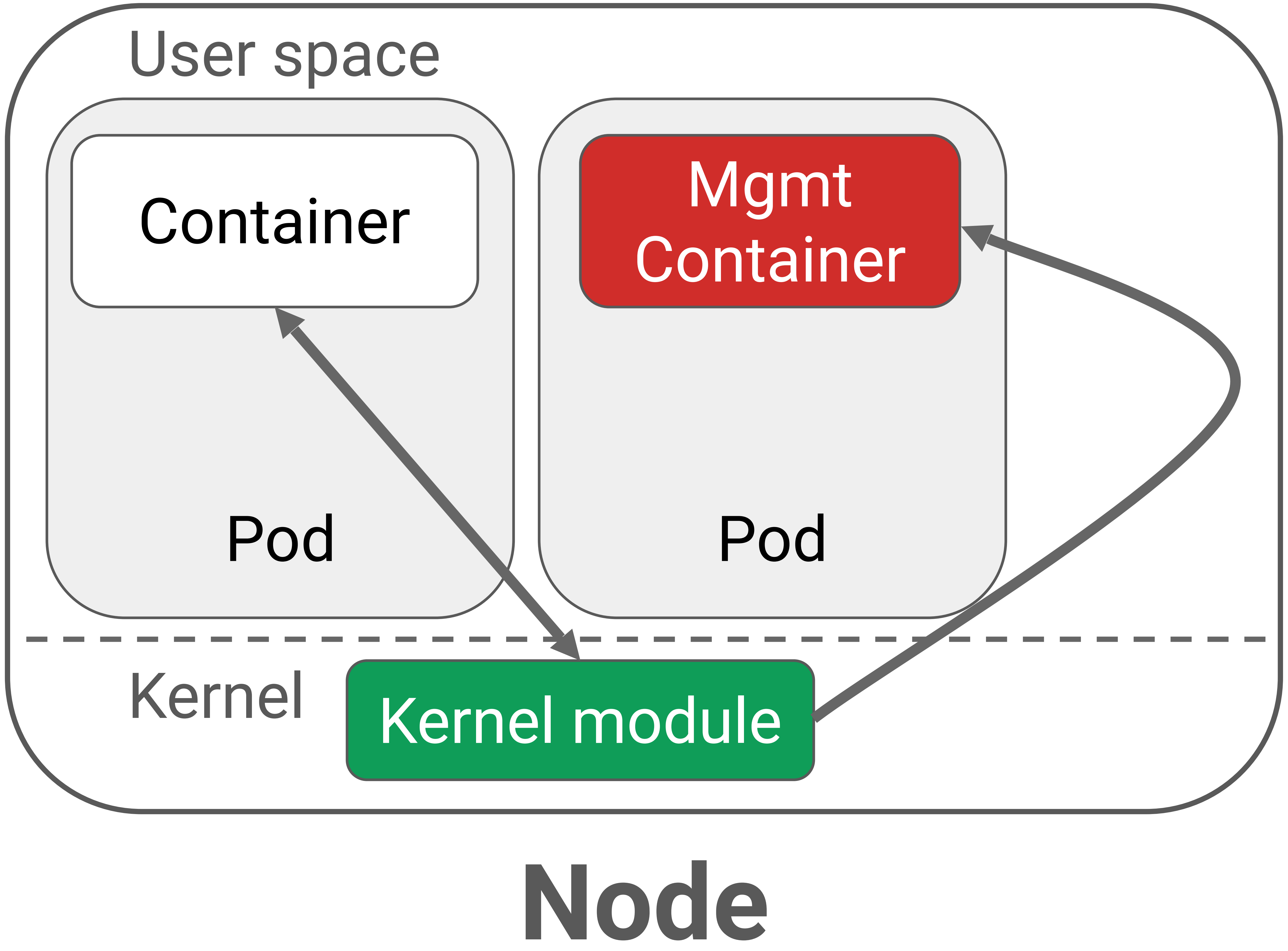

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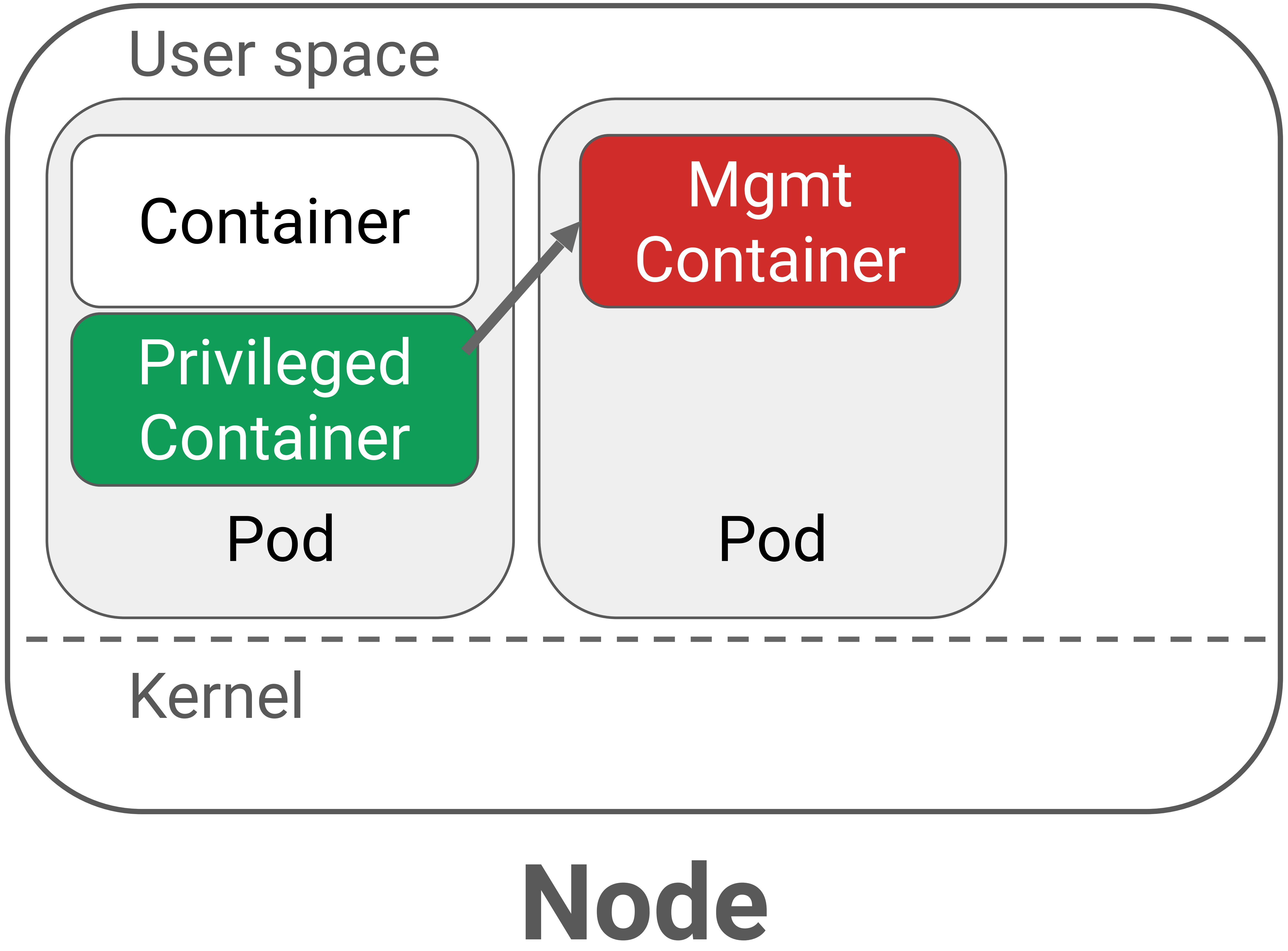
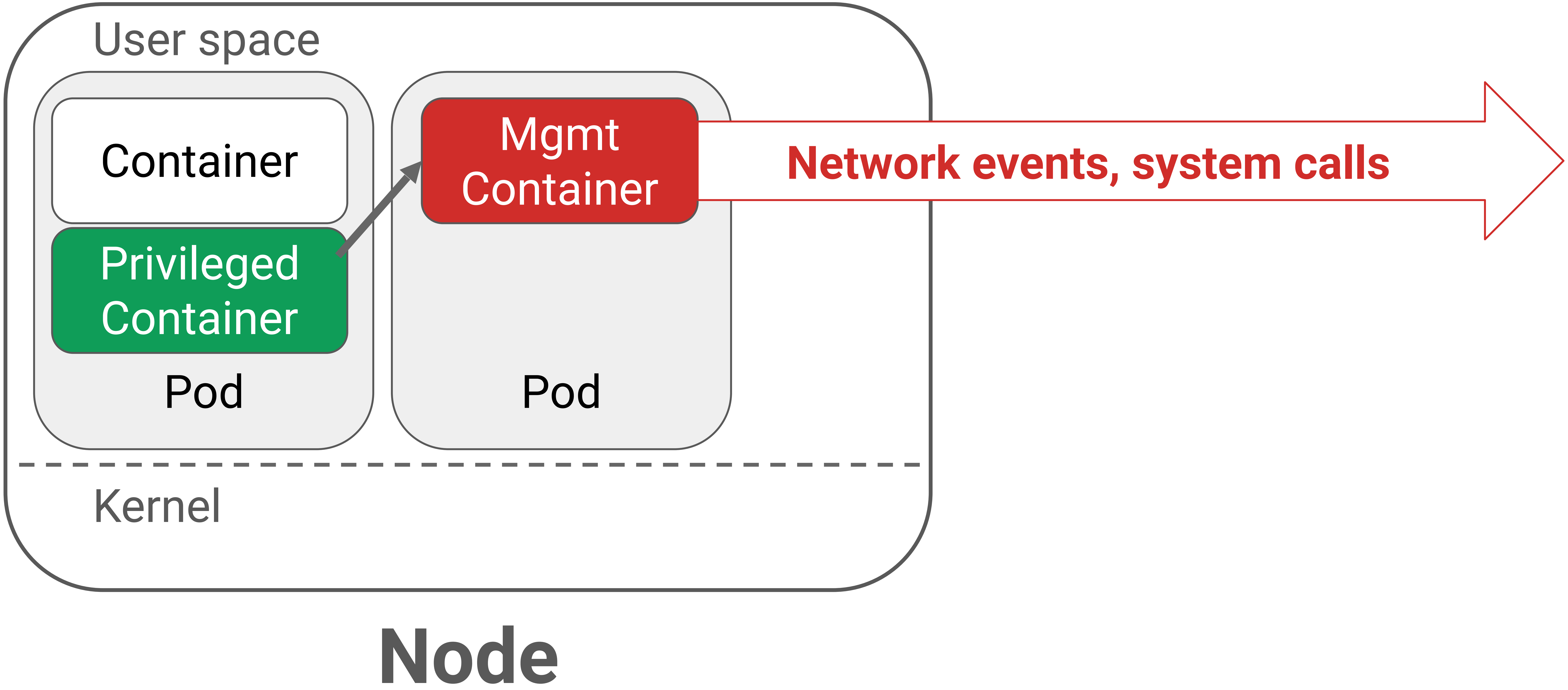
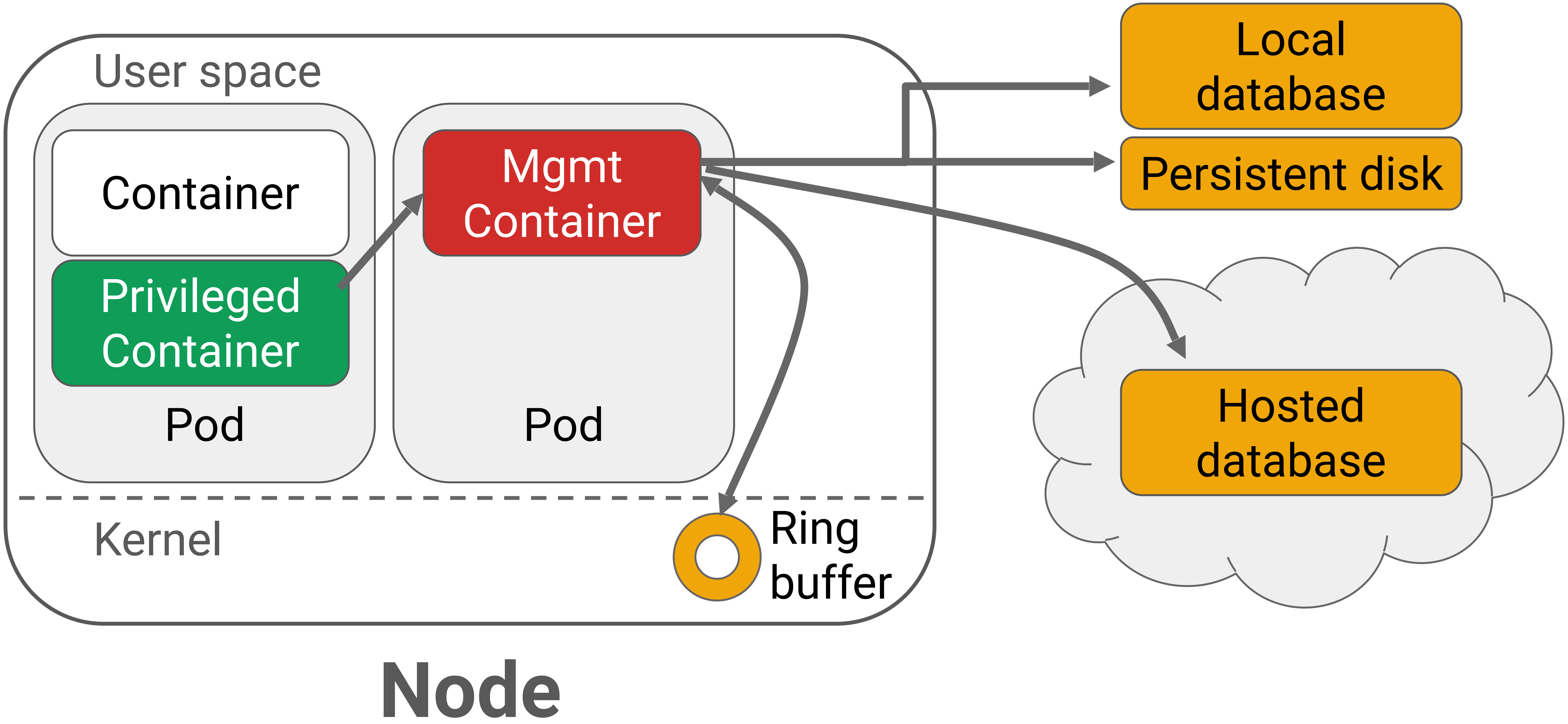


Manage


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

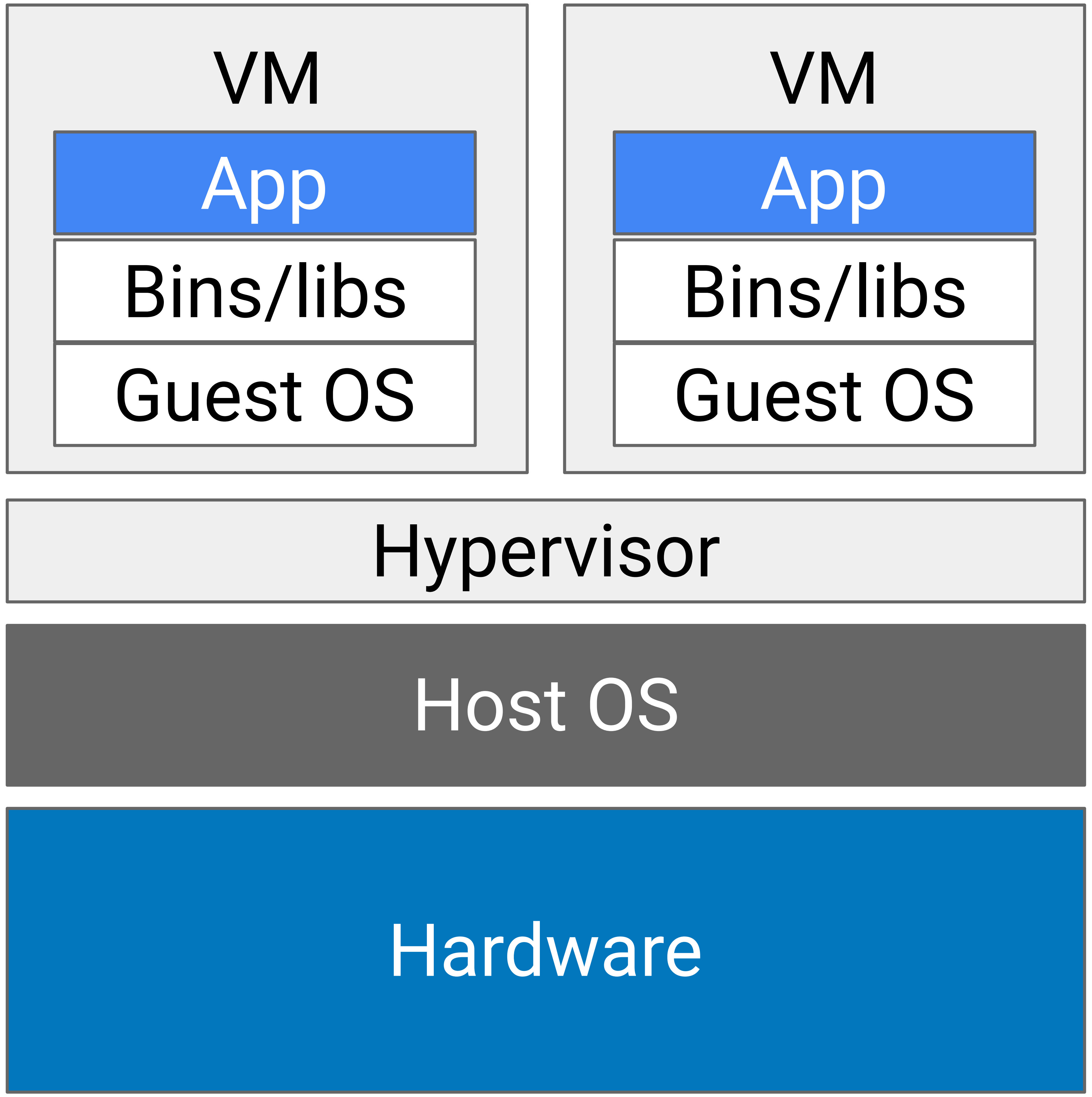
Store


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

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

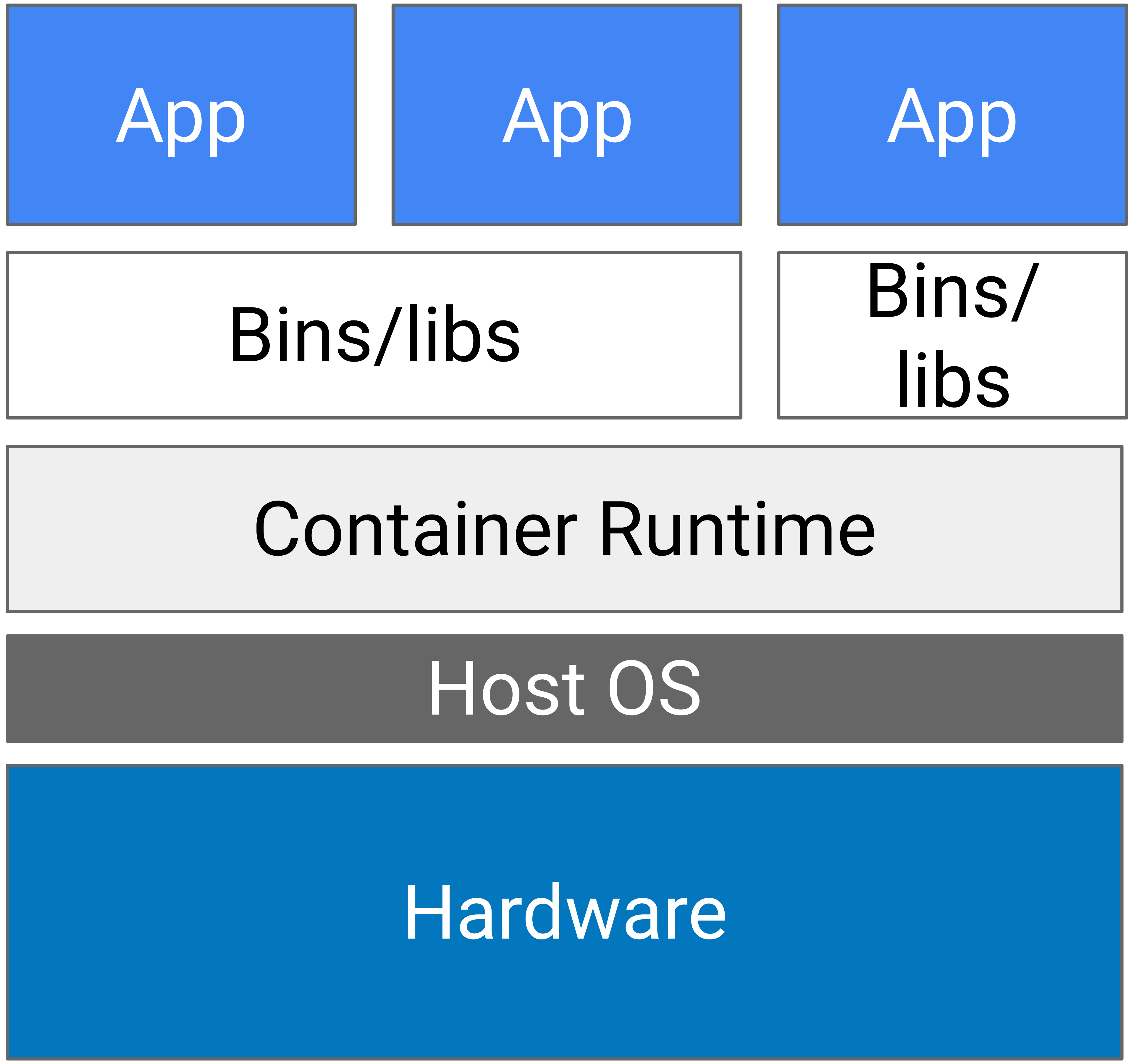
Per-host software

- 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

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