Containers should contain ...right?

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OpenStack Summit 2018

Google Cloud

What kinds of threats are there to containers?

- privilege escalation
- credential theft
- Unpatched vulnerability
- Zero day in open source library
- DDoS
- container escape

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So, what is container security?

Infrastructure security

Is my infrastructure secure for developing containers?

Software supply chain

Is my container image secure to build & deploy?

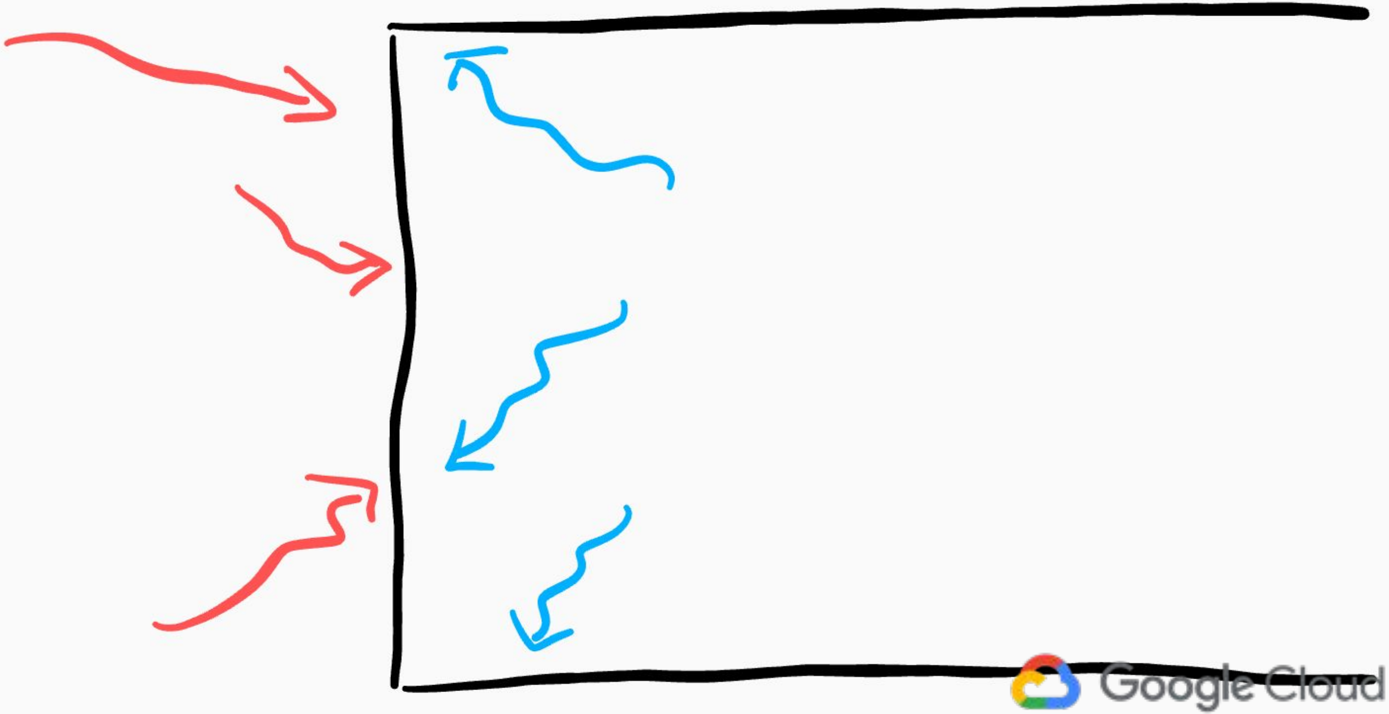
Runtime security

Is my container secure to run?

Threats

From the outside

From the inside



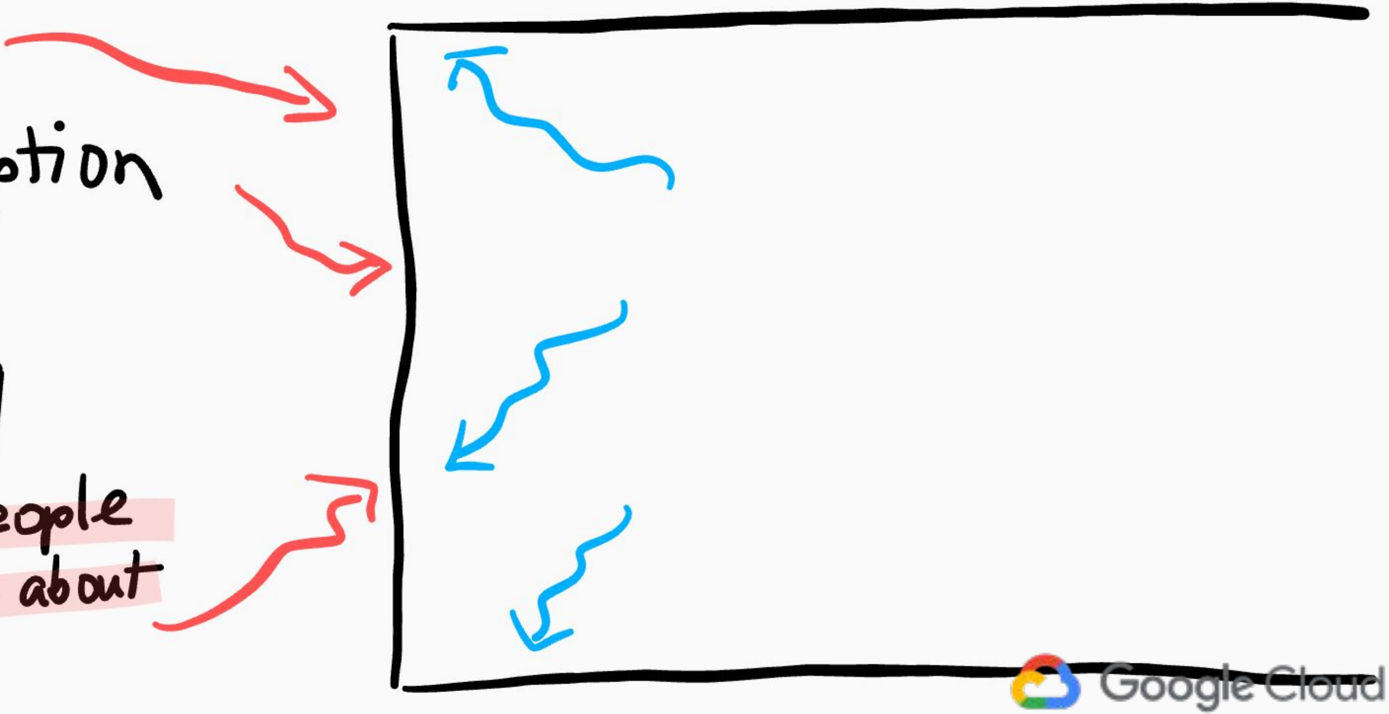
Threats

From the outside

- DDoS, disruption
- Data theft
- Cryptomining

...what most people typically think about

From the inside



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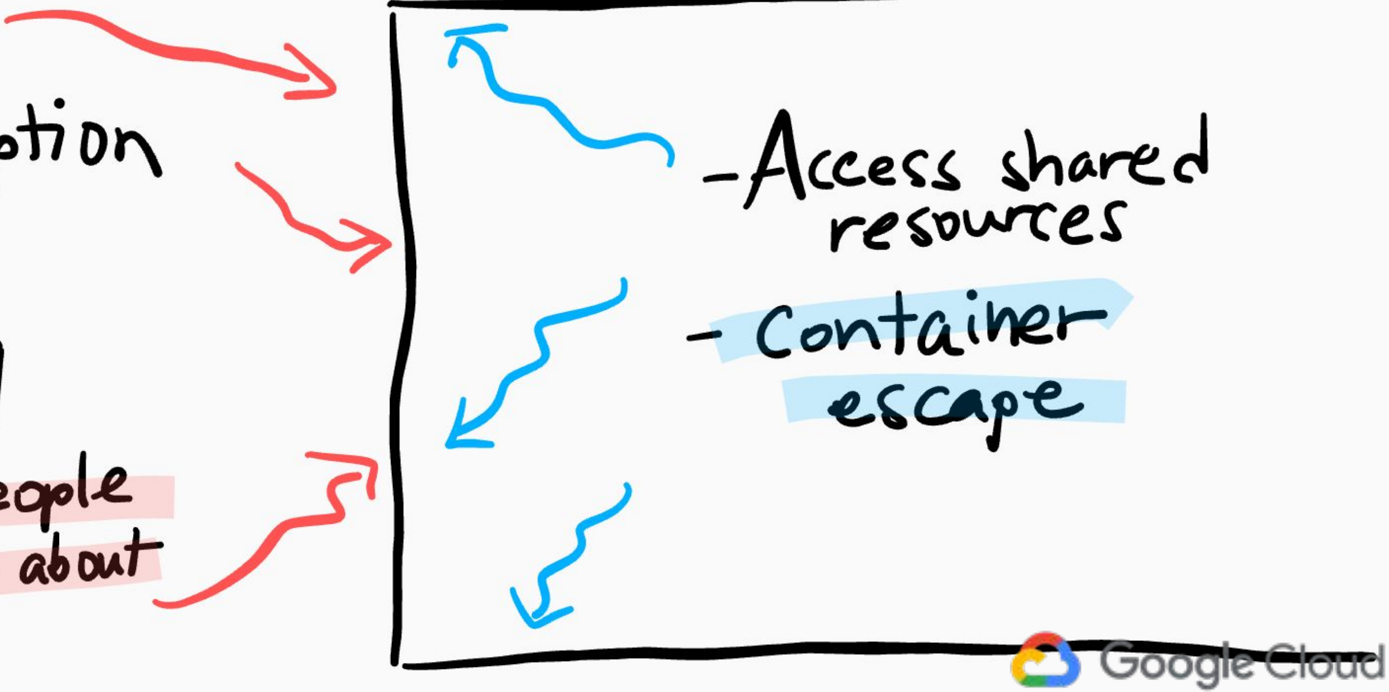
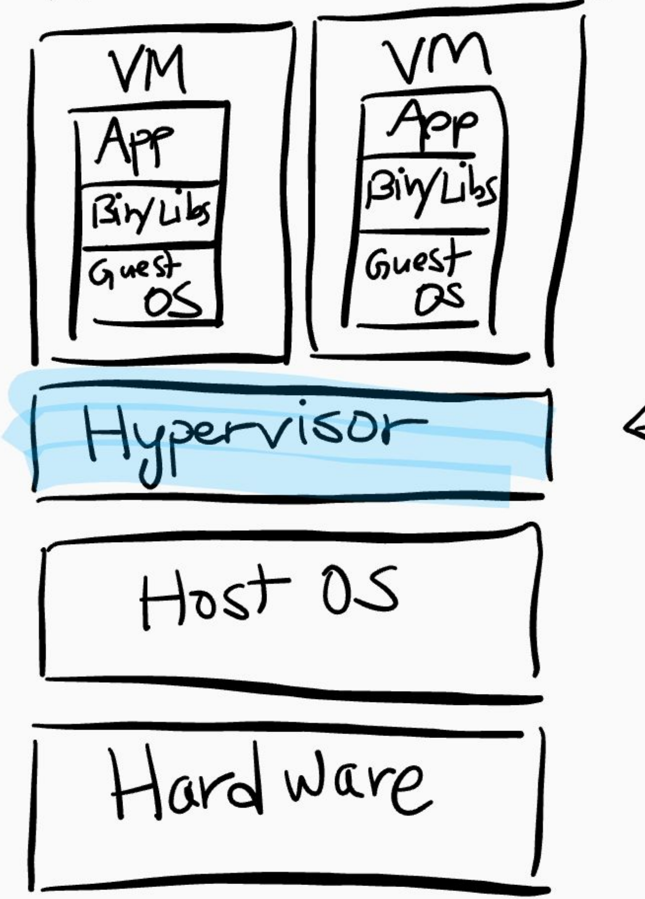


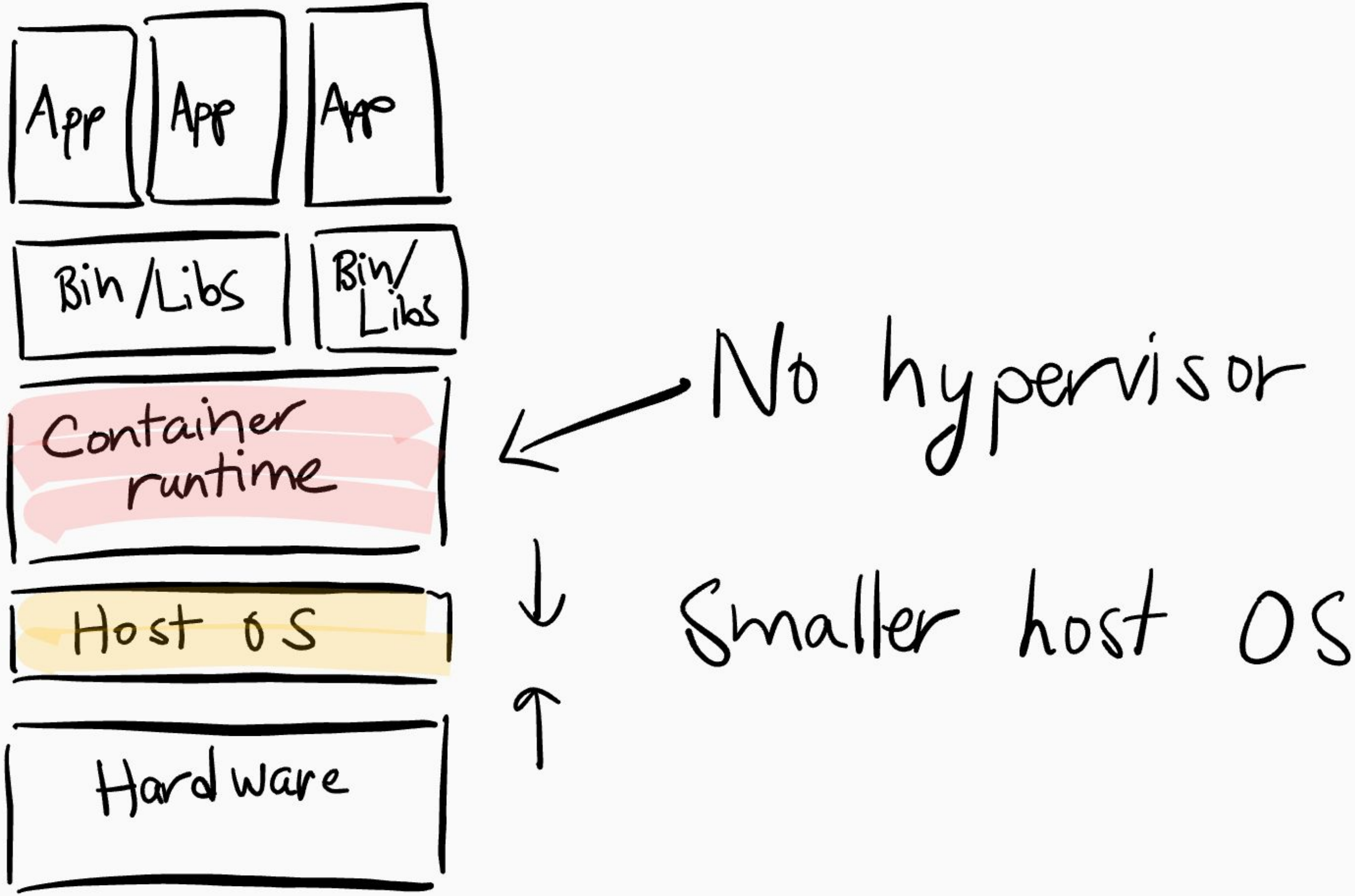
- Access shared resources
- Container escape

Virtual machine



The hypervisor isolates the virtual machines

Container


App
App
App
Bin/Libs
Bin/Libs
Container runtime
No hypervisor
Host OS
Smaller host OS
Hardware

	Virtual machine	Container
Surface of attack	Hypervisor + VMM	minimal host OS
Isolation	Software (hypervisor) + hardware (VMX/SVM)	????

PSA:

Containers don't contain!

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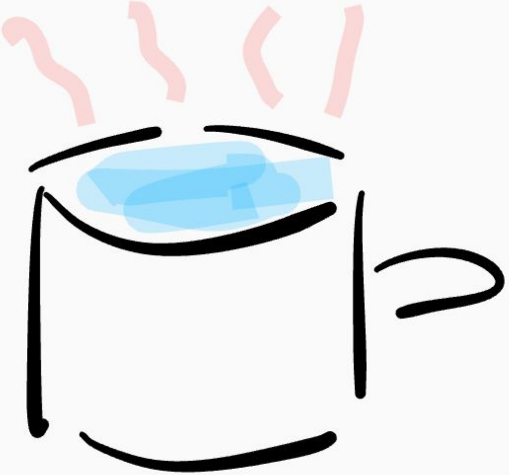
Containers contain ...

like a cup of water



NOT a thermos

Why do I need isolation?

- *untrusted code
  - third party
  - open source
  - known bad
- *surface of attack
  - runtime daemons
- *multi-tenancy
  - public cloud
  - aaS

Trust boundary

Point at which code changes levels of trust

Security boundary

Set of controls to prevent a process from elevating its trust level

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Trust boundary

Point at which code changes levels of trust

Security boundary

Set of controls to prevent a process from elevating its trust level

A security boundary is how you enforce a trust boundary

Trust boundary

A process on:

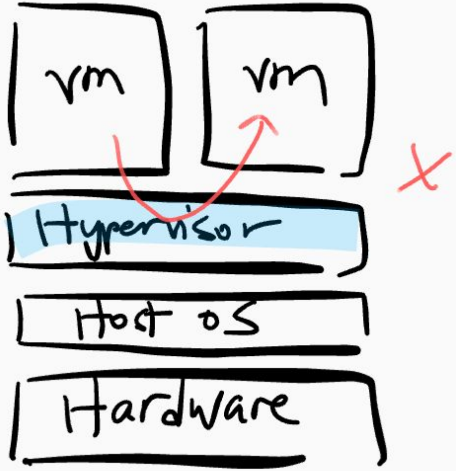
public data vs. user data

LOW TRUST

HIGH TRUST

Security boundary

Hypervisor:



Layers of isolation in Kubernetes

Network

Data

metadata

Control plane

Service account

Resource

Kernel security

Layers of isolation in Kubernetes

Network

Data

metadata

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Resource ☆

Kernel security ☆ ☆ ☆

Container

Layers of isolation in Kubernetes

- Network ☆
- Data
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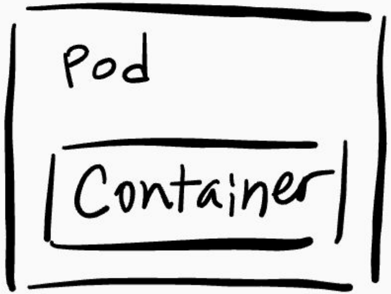
- Control plane
- Service account
- Resource ☆☆
- Kernel security ☆☆☆



Pod

Container

Layers of isolation in Kubernetes

Network ☆

Data

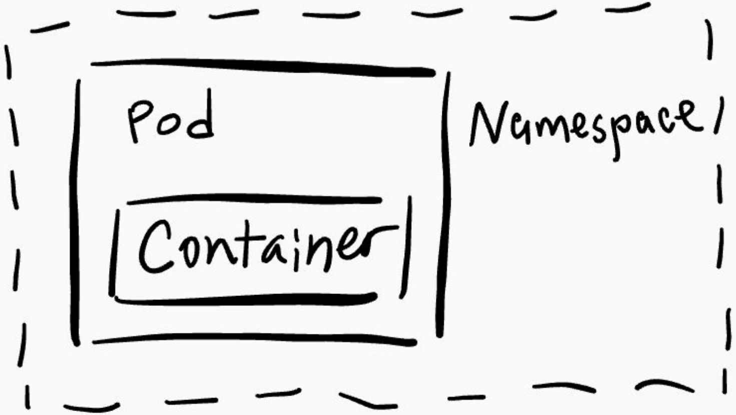
metadata

Control plane ★★

Service account ★★★

Resource ☆☆

Kernel security ☆☆☆



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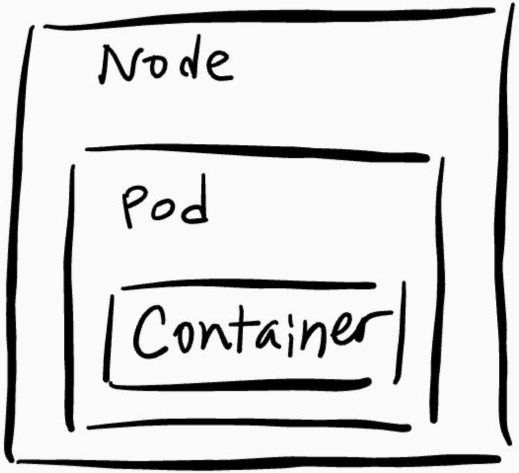
Layers of isolation in Kubernetes



- Network ☆
- Data ☆
- metadata
- Control plane ☆☆
- Service account ☆☆☆
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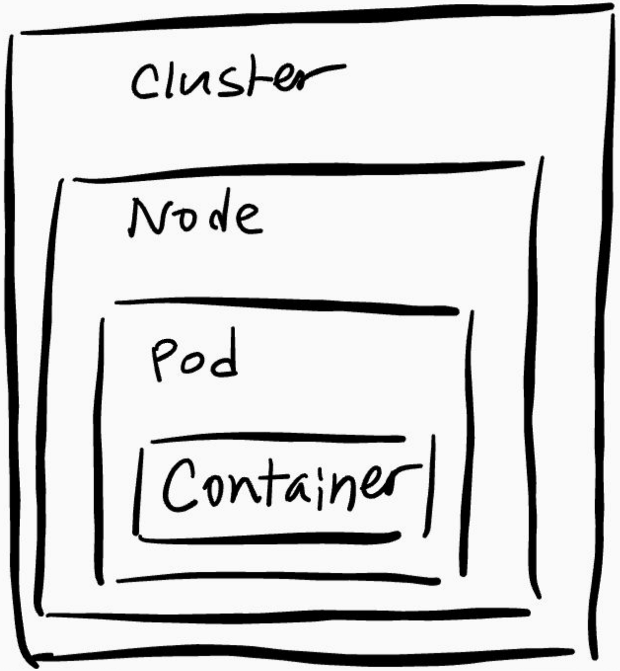
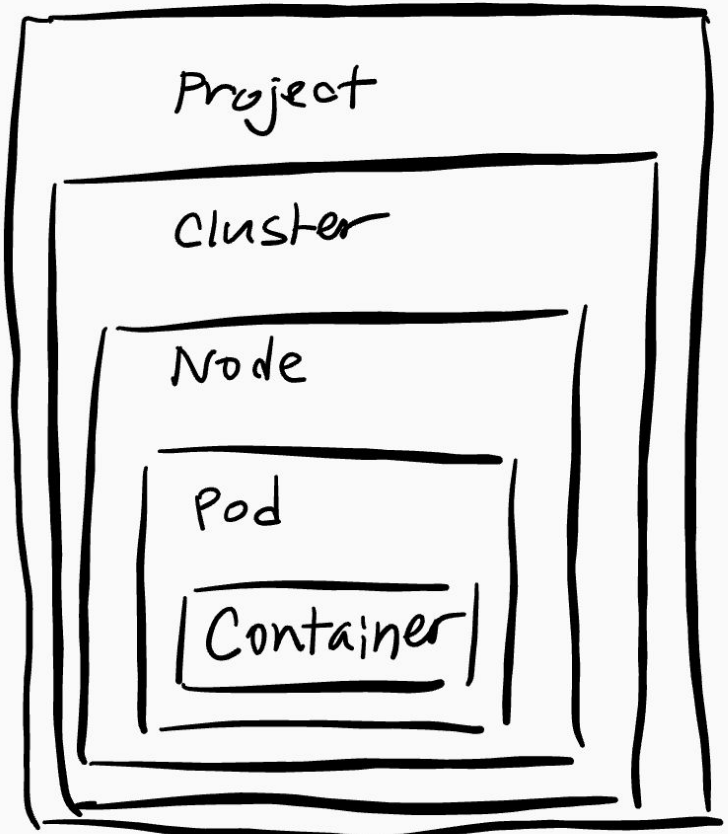
- Kernel security ☆☆☆

Layers of isolation in Kubernetes



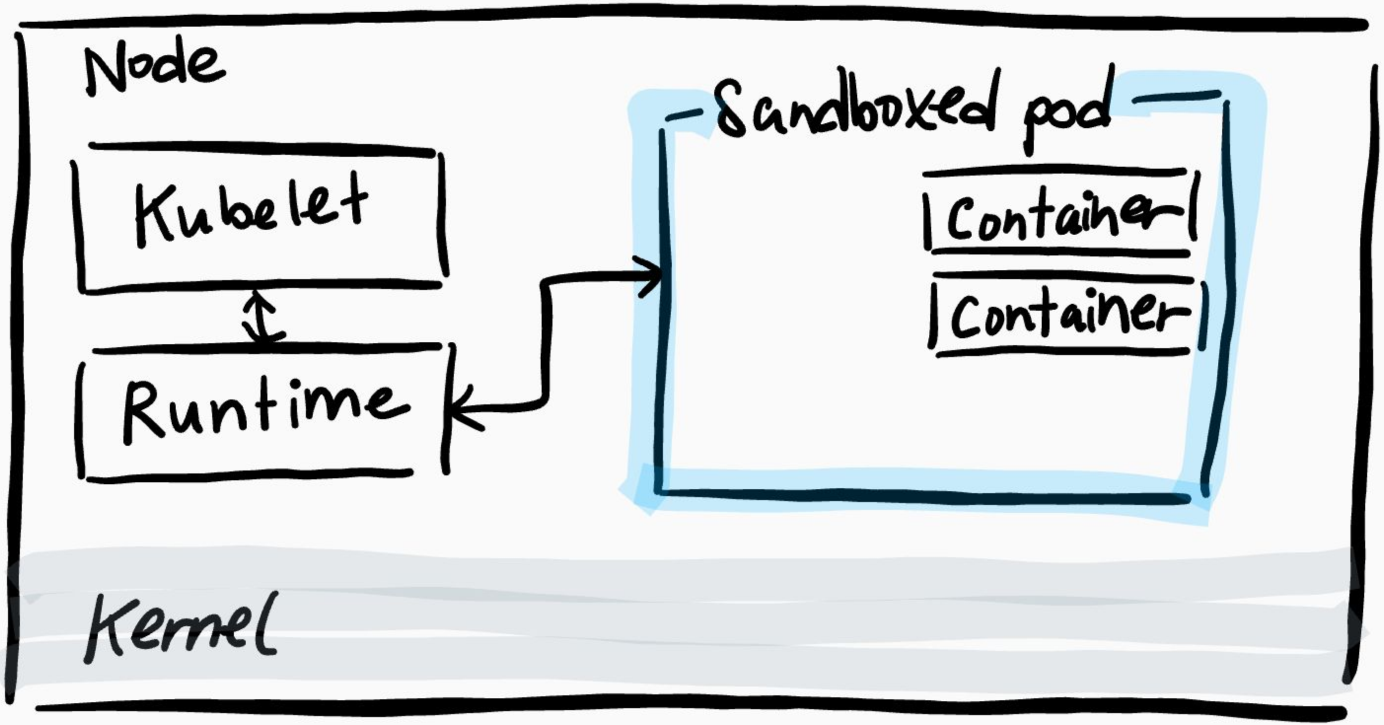
Network	☆ ★
Data	☆ ★
metadata	★ ★
Control plane	☆ ☆ ★
Service account	☆ ☆ ☆
Resource	☆ ☆ ☆
Kernel security	☆ ☆ ☆

Layers of isolation in Kubernetes



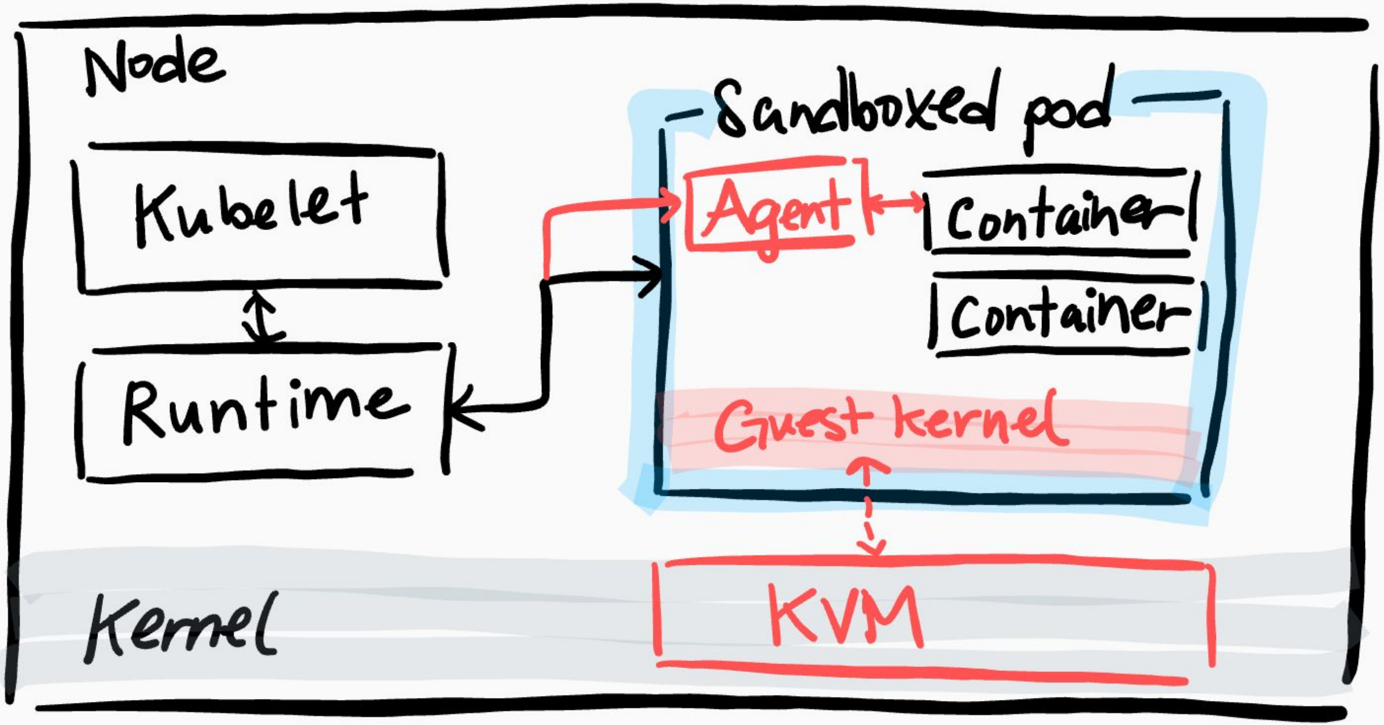
Network	☆ ☆ ★
Data	☆ ☆ ★
metadata	☆ ☆ ★
Control plane	☆ ☆ ☆
Service account	☆ ☆ ☆
Resource	☆ ☆ ☆
Kernel security	☆ ☆ ☆

What's a sandbox?



What's a sandbox?

Kata container



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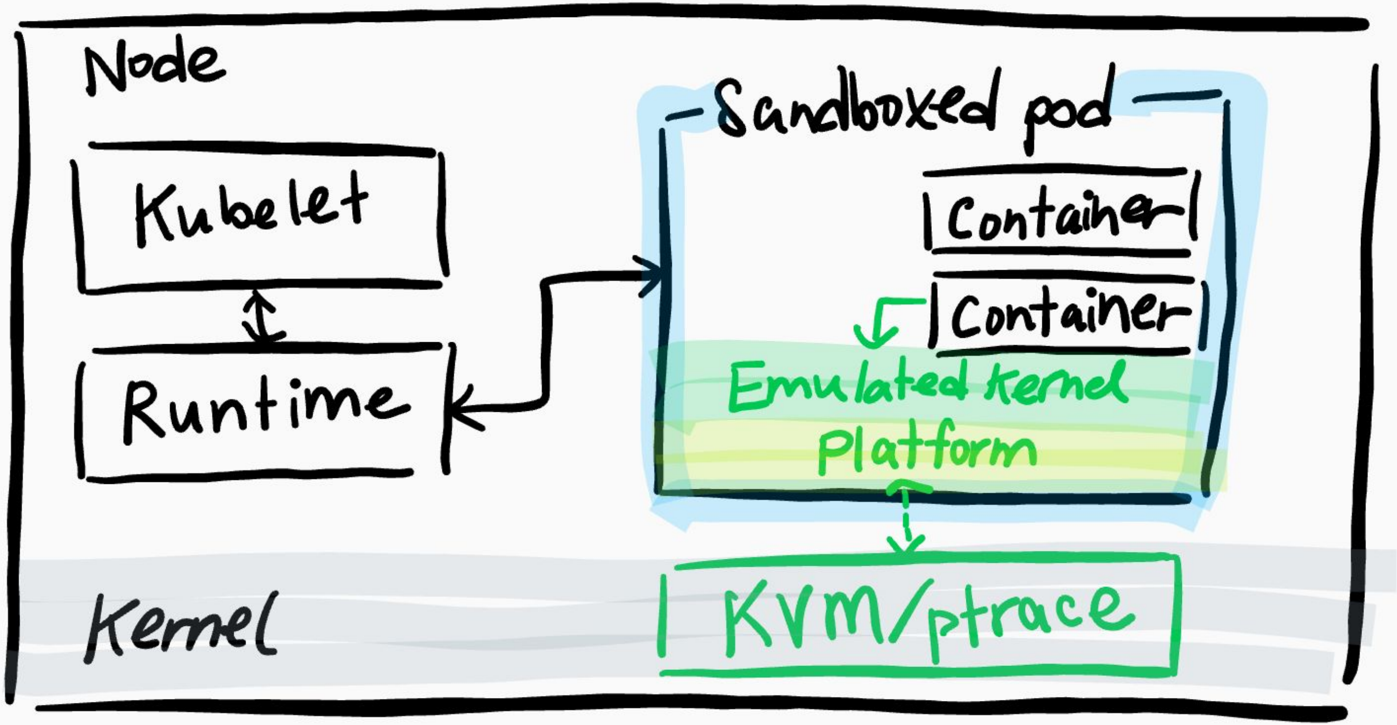
What's a sandbox?

gvisor



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Residual risks with sandboxes

Sandboxes don't solve all your problems!

Residual risks with sandboxes

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Attacks are still possible via...

Residual risks with sandboxes

Sandboxes don't solve all your problems!

Attacks are still possible via...

- storage
- network
- daemons
- hardware

etc.

Kubernetes
is a complex system
with many attack surfaces
exposed to internal threats

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- Pick the right layer of isolation
- Use sandboxes to mitigate risks