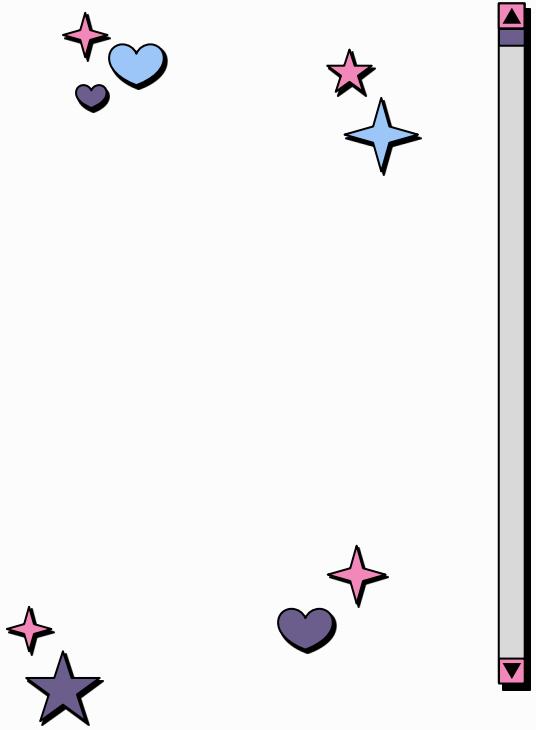
Minimalism:

Key to Cloud Security



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$ whoami

Barun Acharya (@daemon1024)

- Software Engineer @ Accuknox
- Maintainer and Tech Lead @ KubeArmor (CNCF Sandbox)
- CNCF Ambassador
- Google Summer of Code
- LFX Mentorship

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Container

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Container Security

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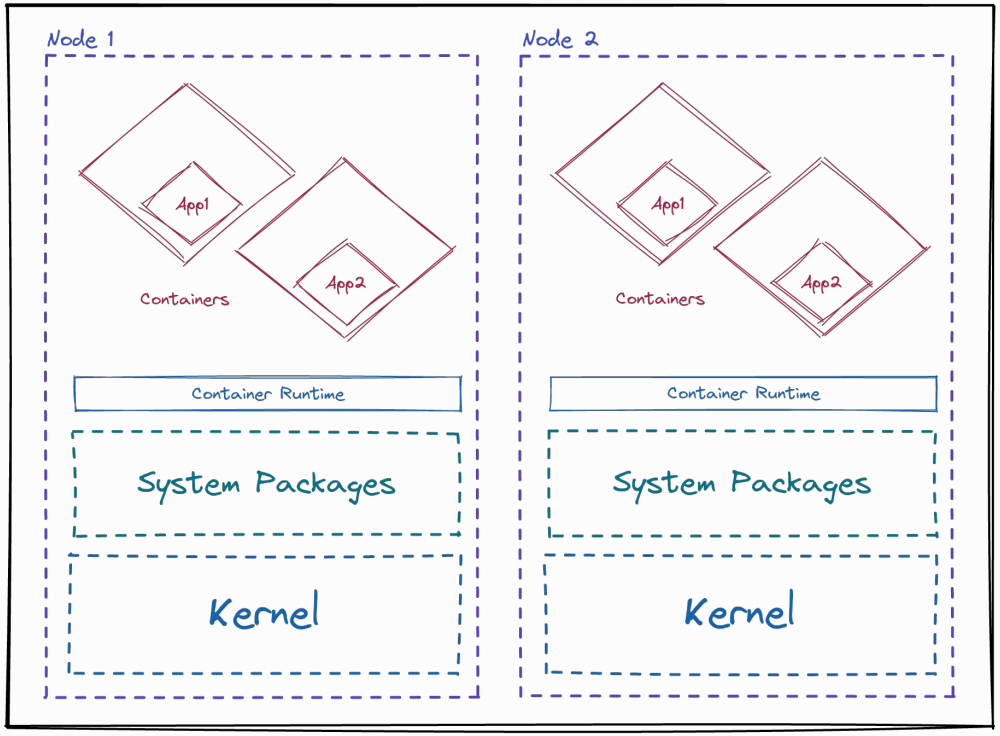
Kubernetes Cluster



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Malicious Actors

Kubernetes Cluster

Node 1

App1

App2

Containers

Container Runtime

System Packages

Kernel

Node 2

App1

App2

Containers

Container Runtime

System Packages

Kernel

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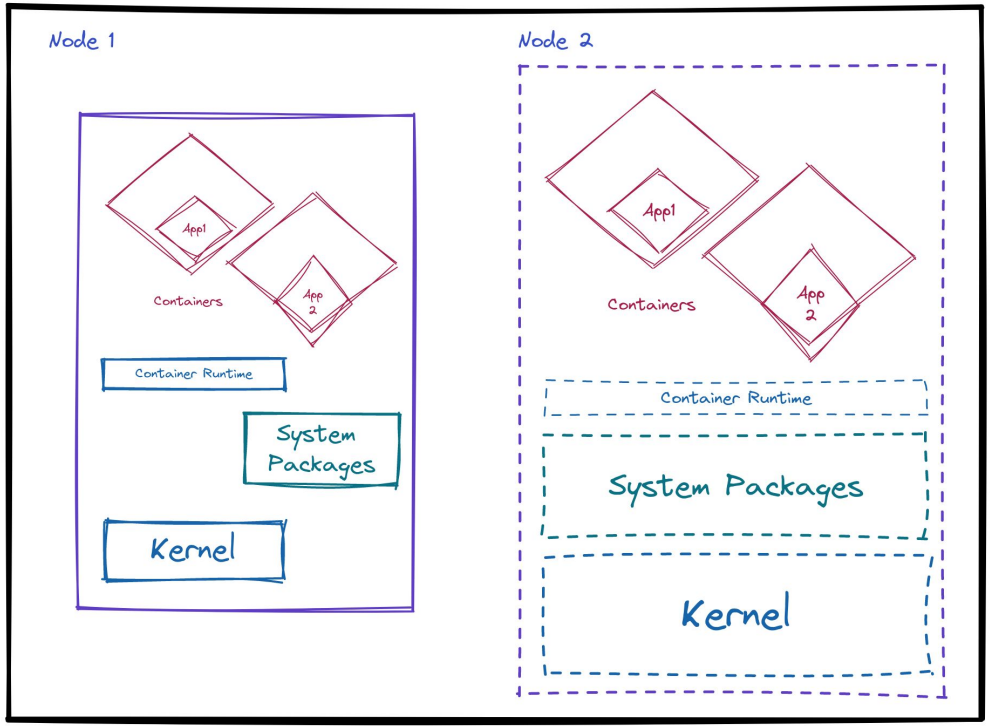
Node 1
App1
App 2
Containers
Container Runtime
System Packages
Kernel
Node 2
App1
App 2
Containers
Container Runtime
System Packages
Kernel

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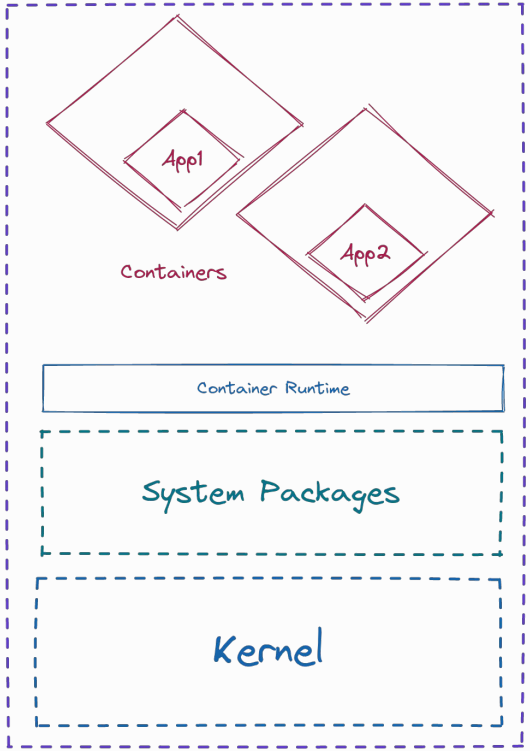
Minimal Node Images

- Container Optimized OS by Google Cloud
- BottleRocket by AWS
- Azure Linux (CBL Mariner) by AKS
- RancherOS
- .....



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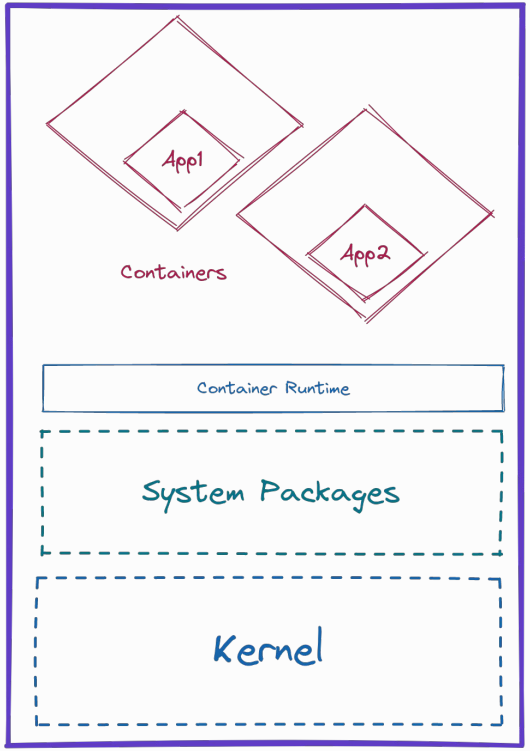
Minimal Node Images

- Immutable Root File System



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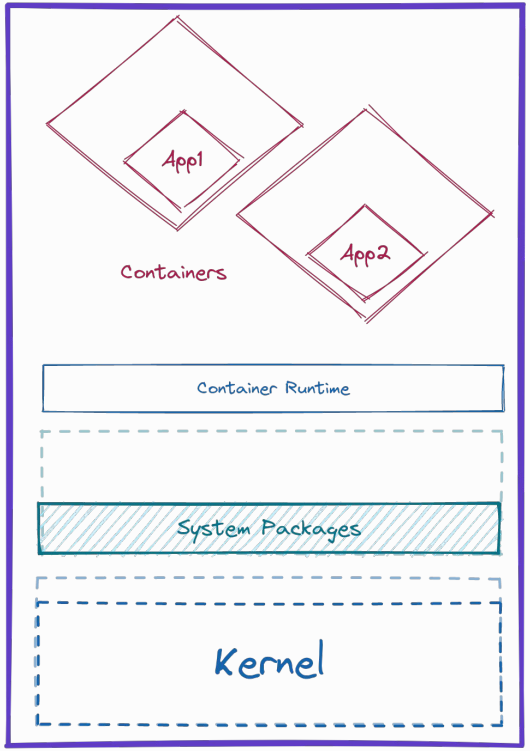
Minimal Node Images

- Immutable Root File System
- Reduced System Bloat



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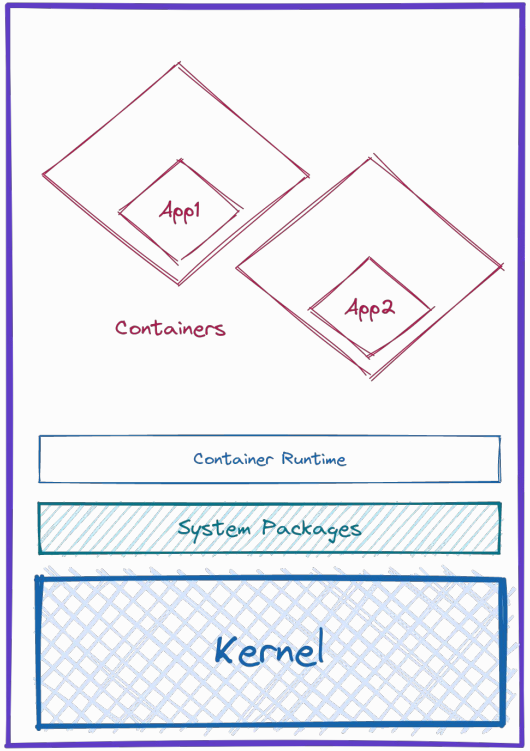
Minimal Node Images

- Immutable Root File System
- Reduced System Bloat
- Hardened Kernel



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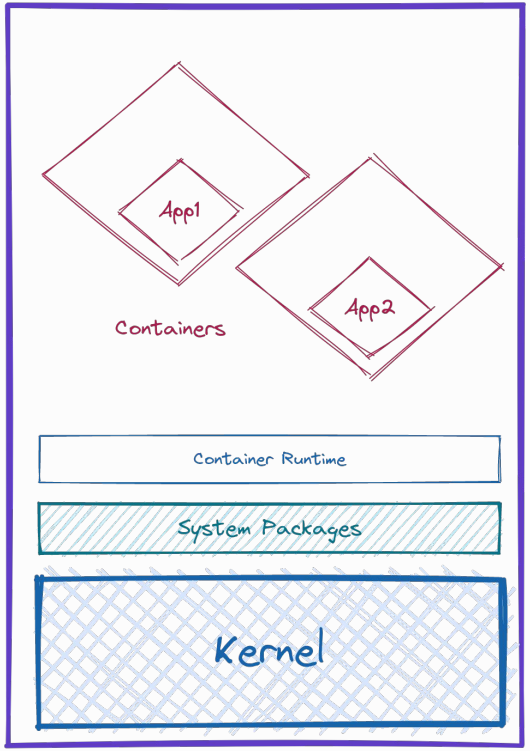
Minimal Node Images

- Immutable Root File System
- Reduced System Bloat
- Hardened Kernel
  - Integrity Measurement Architecture (IMA)



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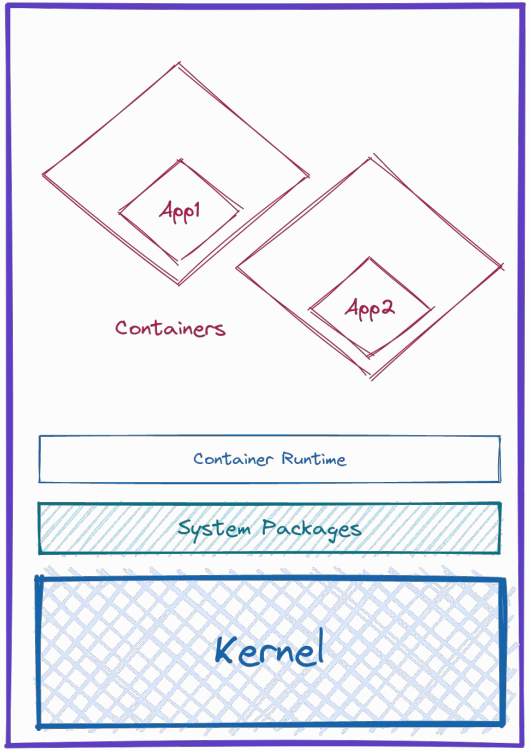
Minimal Node Images

- Immutable Root File System
- Reduced System Bloat
- Hardened Kernel
  - Integrity Measurement Architecture (IMA)
  - Secure Boot



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Rocke Malware

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https://www.anomali.com/blog/rocke-evolves-its-arsenal-with-a-new-malware-family-written-in-golang

Rocke Malware

- Self-Replication:
  - The malware copies itself from "/tmp/kthrotlds" to "/usr/sbin/kthrotlds."
  - It alters the modified time stamp of the copied file, setting it back 416 days.
- Shared Object Injection:
  - The malware writes code to "/usr/local/lib/libcset.c" and compiles it using GCC into a shared object at "/usr/local/lib/libcset.so."
  - If GCC is not installed, the malware attempts to install it and recompile.
- Startup Scripts:
  - The malware installs an "init.d" startup script at "/etc/init.d/netdns" and a systemd service script at "/usr/lib/systemd/system/netdns.service."
  - It changes the modified time of these files in a similar manner.

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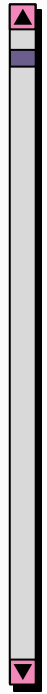
https://www.anomali.com/blog/rocke-evolves-its-arsenal-with-a-new-malware-family-written-in-golang

- ~~Self-Replication:~~
  - ~~The malware copies itself from "/tmp/kthrotlds" to "/usr/sbin/kthrotlds."~~
  - ~~It alters the modified time stamp of the copied file, setting it back 416 days.~~

    Immutable Root File System
- ~~Shared Object Injection:~~
  - ~~The malware writes code to "/usr/local/lib/libcset.c" and compiles it using GCC into a shared object at "/usr/local/lib/libcset.so."~~
  - ~~If GCC is not installed, the malware attempts to install it and recompile~~.

    No system packages/package managers and File Integrity
- ~~Startup Scripts:~~
  - ~~The malware installs an "init.d" startup script at "/etc/init.d/netdns" and a systemd service script at "/usr/lib/systemd/system/netdns.service."~~
  - ~~It changes the modified time of these files in a similar manner.~~

    Secure Boot



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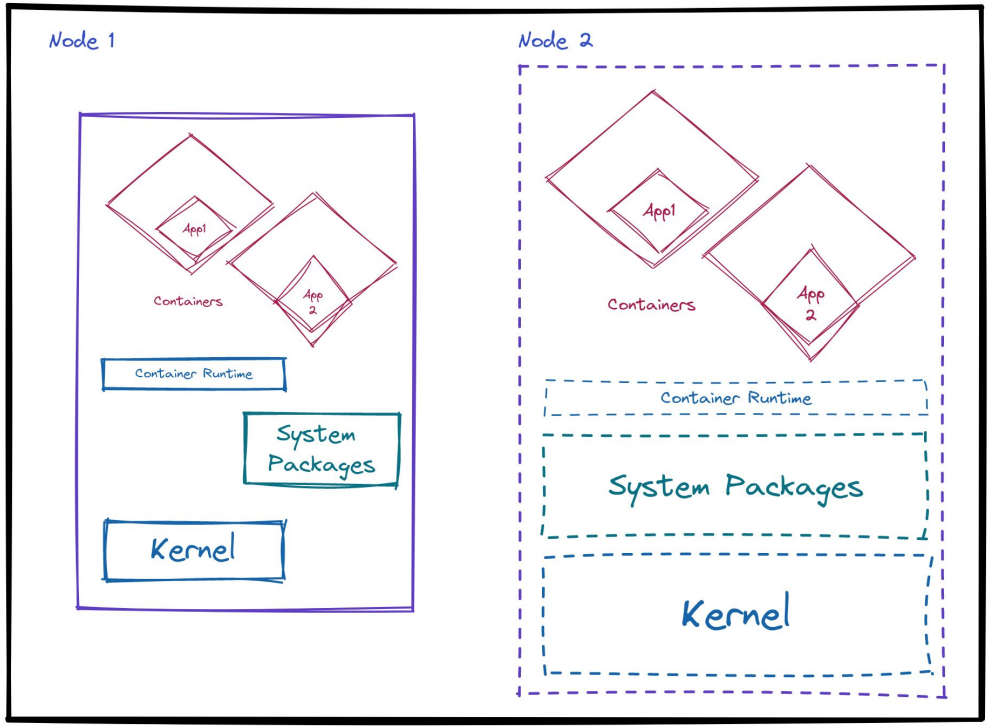
Node 1
App1
App 2
Containers
Container Runtime
System Packages
Kernel
Node 2
App1
App 2
Containers
Container Runtime
System Packages
Kernel

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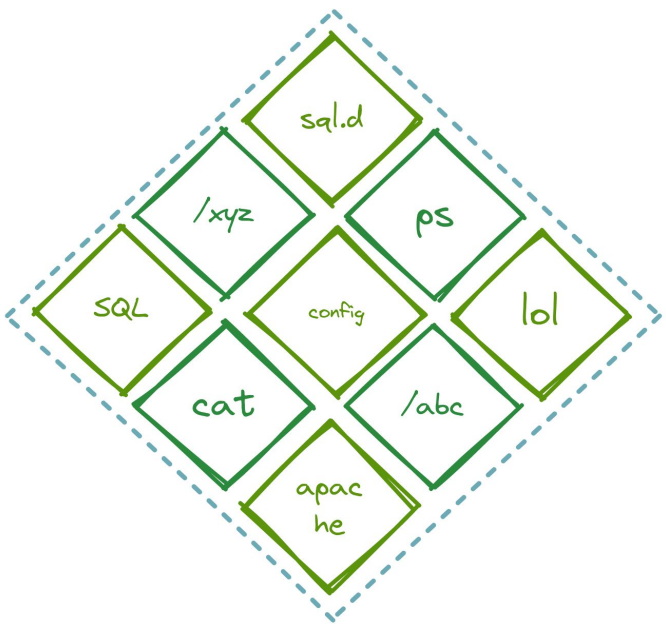
Containers



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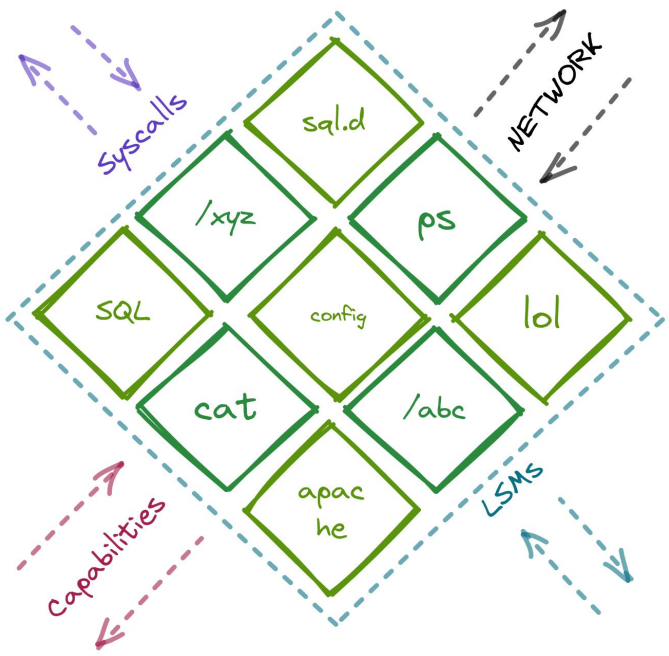
Containers



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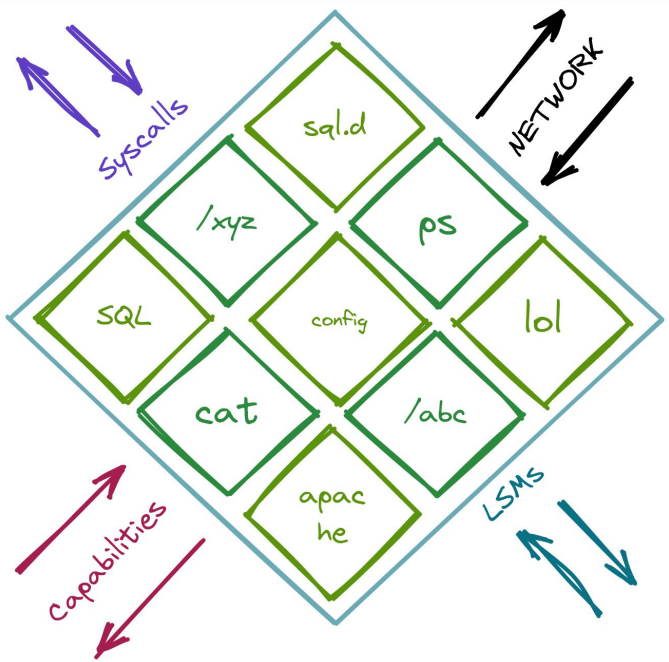
Containers



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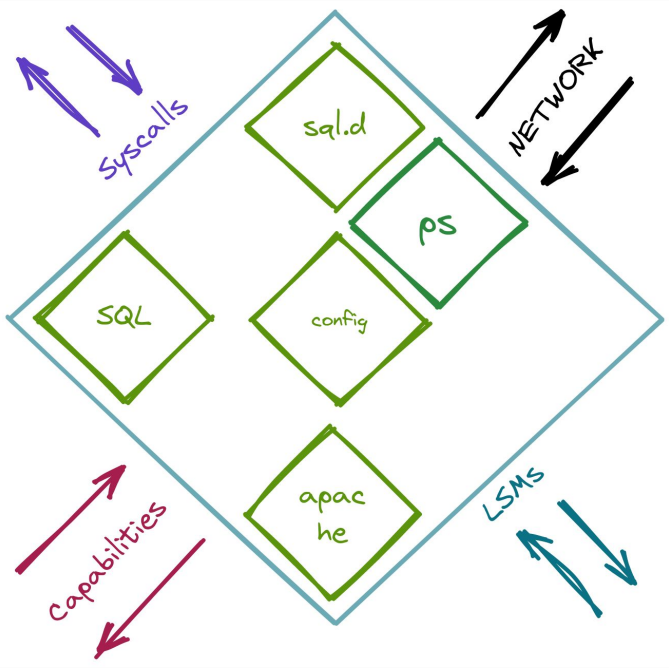
Lightweight Images



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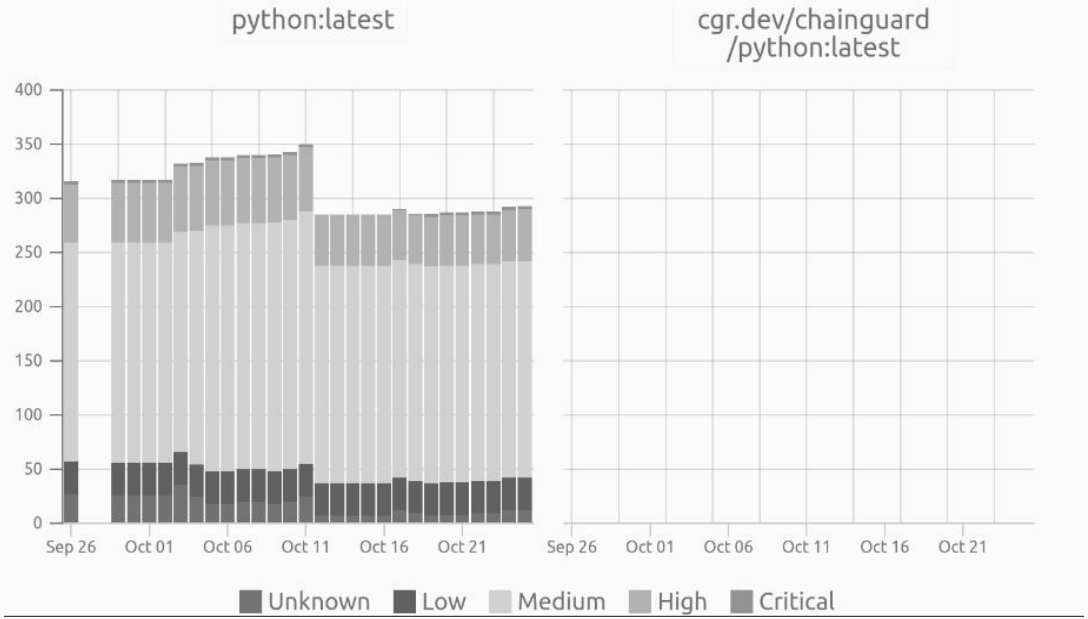
Lightweight Images

Comparing the latest official Python image with cgr.dev/chainguard/python



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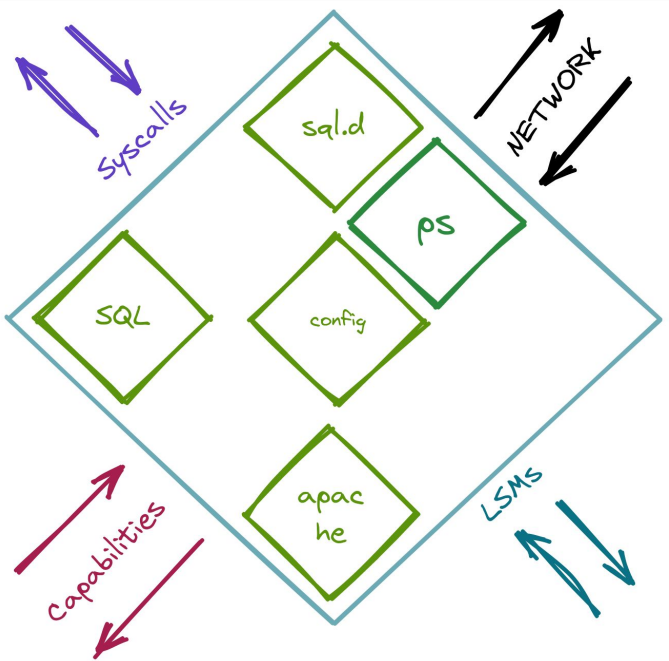
- Kubernetes Security Context
  - LSM Profiles/Labels
  - Seccomp
  - Capabilities
- Docker Security Opts
  - Other Container Runtimes Support this as well
- Proxy Filters/Service Mesh/Container Networking Interface Rules
- Docker Slim to trim down unnecessary filesystem
- Like Node Images use lighted base images for container like alpine, wolfi



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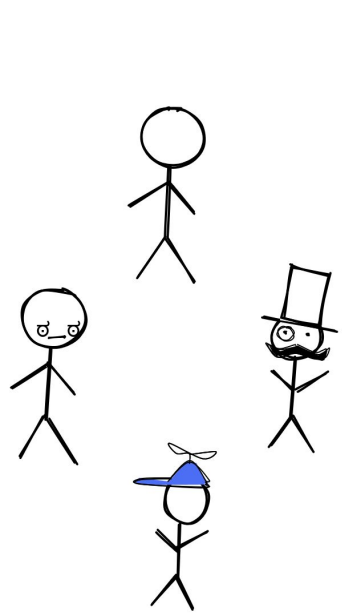
Role Based Access Control



Kubernetes API

Docker API

Production

Staging

Development

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Uber Social Engineering Attack

- Perimeter Security around Sensitive Files using VPN
- VPN Access protected through Multi Factor Authentication

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Uber Social Engineering Attack

- MFA breached through Social Engineering
- Attacker Scans Intranet for Sensitive Assets
  - Finds Shell Script with Admin Password to PAM
  - Finds secrets to all services through PAM

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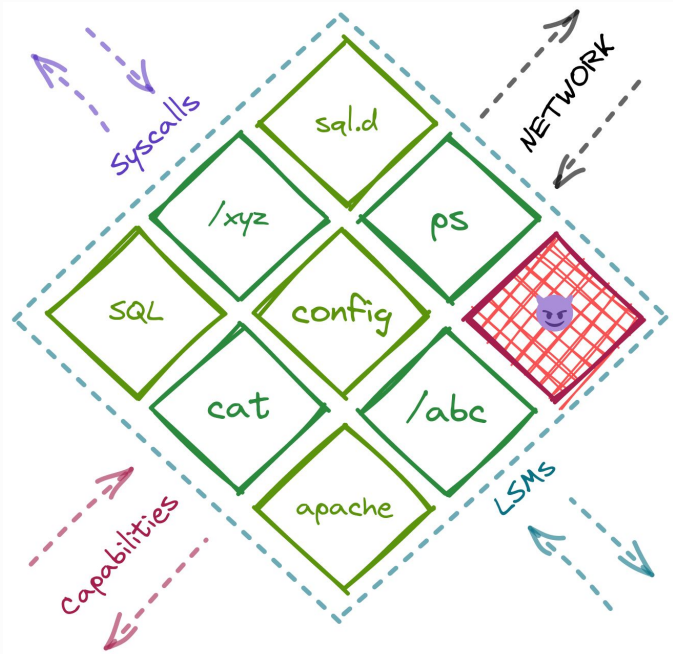
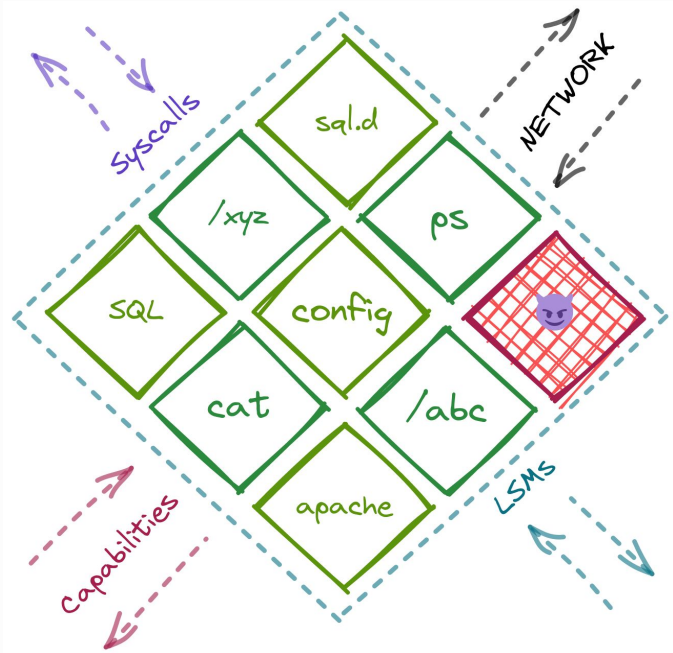
What if
we are already
compromised?



~~What if~~
we are already
compromised



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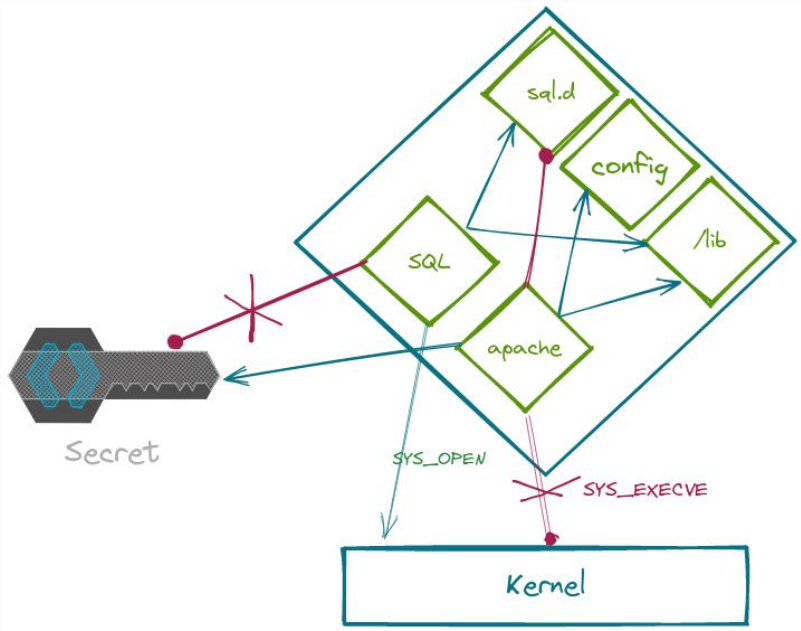
Access Control Inside Containers



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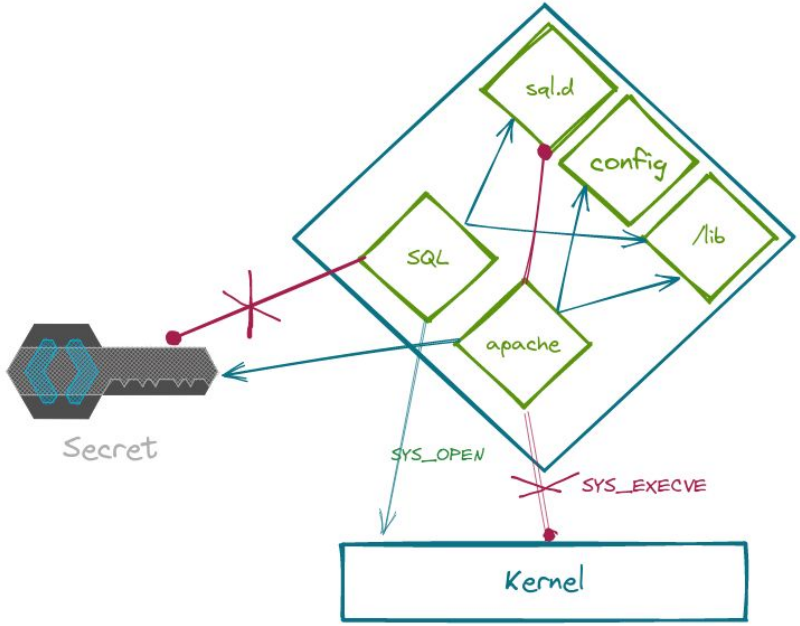
Access Control Inside Containers

- Setup Observability to gain visibility
- Linux Security Modules
- Userspace Interception
  - LD_PRELOAD
  - Ptrace



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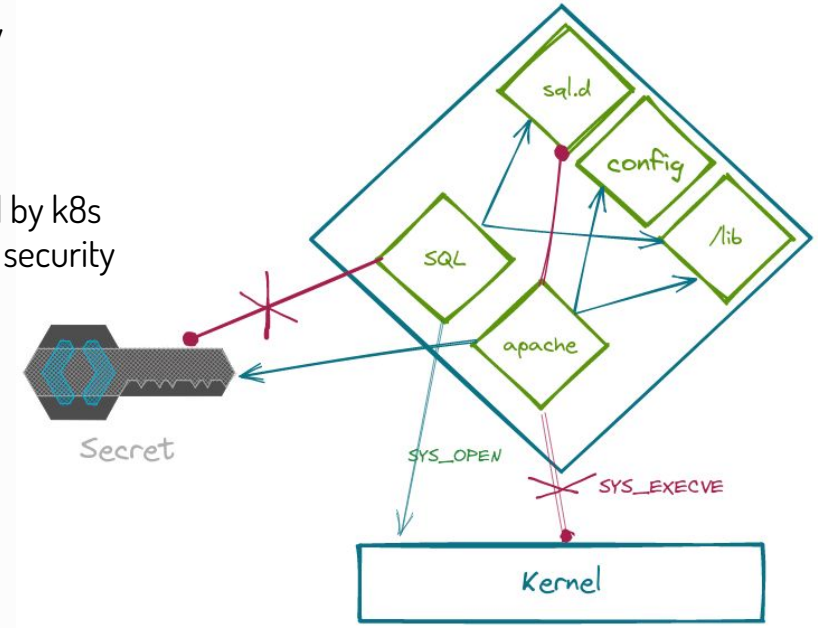
Access Control Inside Containers

- Setup Observability to gain visibility
  - Falco
  - Tracee
- Linux Security Modules
  - AppArmor Rules (supported by k8s security context and docker security opts)
- KubeArmor



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Conclusion

Minimalism : Key to Cloud Security

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Conclusion

Minimalism : Key to Cloud Security

- Need for Multi Layered Minimalistic Approach
- Minimal Node Images / Runtime Infrastructure
- Setup Perimeter Around Containers to minimize outside access
- Minimize Attack Surface Outside and Inside Containers by removing unnecessary dependencies
- Setup Perimeter Inside Containers to minimize unnecessary accesses
- Minimum Permissions to all users to prevent social engineering attacks

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ThankYou

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ThankYou

Questions (づ｡◕‿‿◕｡)づ

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kubearmor.io

ThankYou

barun.cc

Questions (づ｡◕‿‿◕｡)づ

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