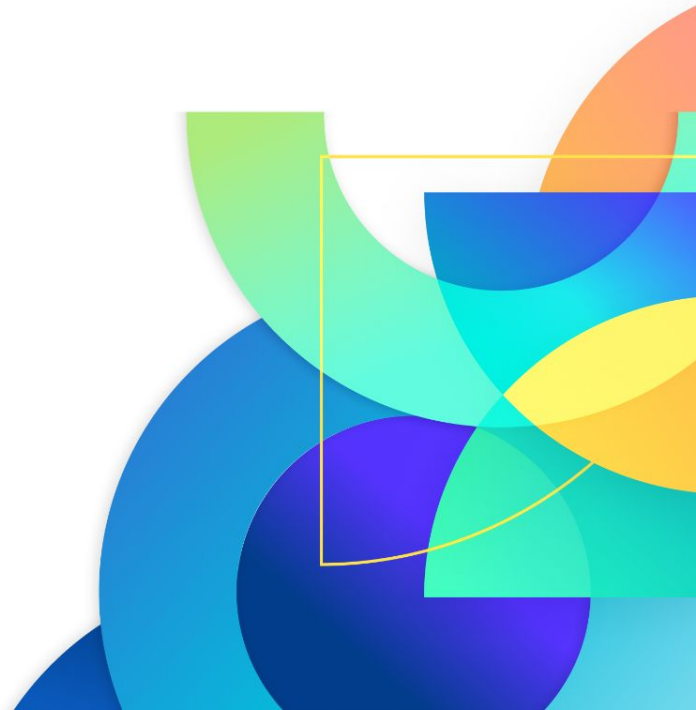
sysdig

Up and Running with Runtime Security



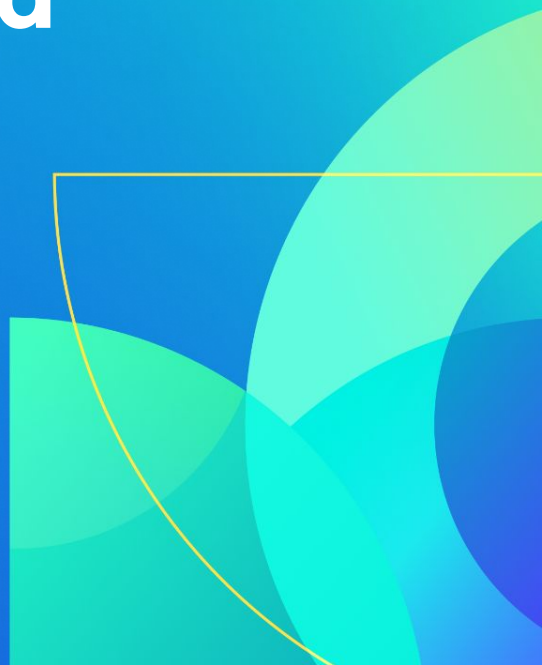
Logistics

- Slides: https://bit.ly/3L8BNW9
- Lab:
- Slack
- Length: 2h
- Three series of lecture and lab iteration

Agenda

- Cloud Threat Detection and Runtime Security
- Falco engine
- Falco ecosystem
- Closing remarks

Cloud Threat Detection and Runtime Security



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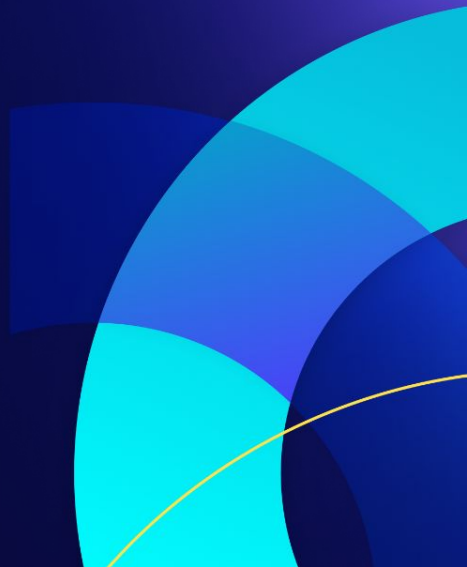
Microservices, Containers and Kubernetes



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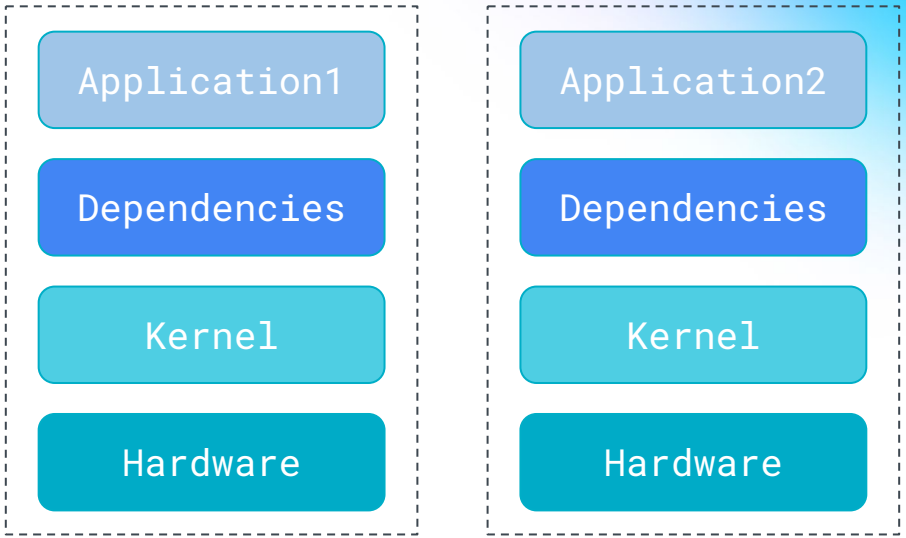
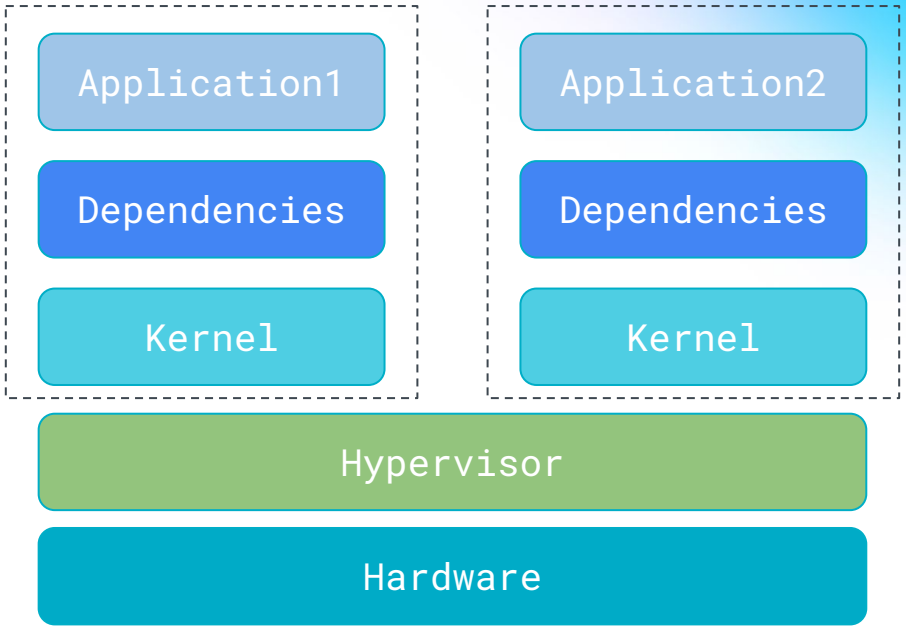
Once upon a time... dedicated servers

- Deployments took months
- Low utilization
- Not portable
- Hard to replicate



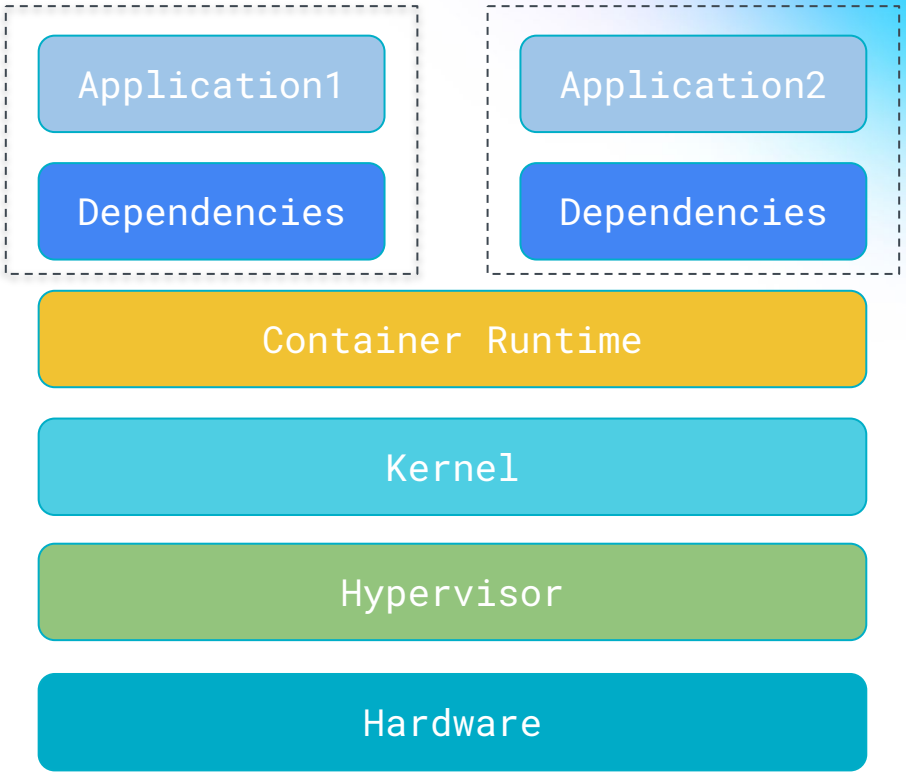
Virtualization

- Improved utilization
- Deployment took days
- Redundant kernel
- All bundled together
- Low app <-> kernel isolation



Containers

- Lightweight
- Stand-alone
- Resource efficient
- Portable execution packages
- Deploy within minutes/seconds



Rise of microservices and containers

- Need for greater flexibility, agility, scalability, and reliability
  - loosely coupled, fine-grained components.
- Microservices make it easier to:
  - build and maintain complex applications
  - scale individual services as needed, not scaling the entire system
  - adopt new technologies and tools as they become available.
  - implement changes and updates, without affecting the entire system
- Containers are a perfect fit.
- Cloud providers heavily support containers and microservices
  - easier and more cost-effective to build and scale applications.
- Containers are everywhere, but managing them at scale is challenging!

Kubernetes wins

- Kubernetes is an open-source container orchestration system
  - for automating software deployment, scaling, and management.
- Originally designed by Google,
  - the project is now maintained by the Cloud Native Computing Foundation.
  - there are a lot of companies offering custom K8s solutions.
- The name Kubernetes originates from Greek, meaning 'helmsman' or 'pilot'.
- Over 60% of orgs have adopted it already in 2022 (Statista research).

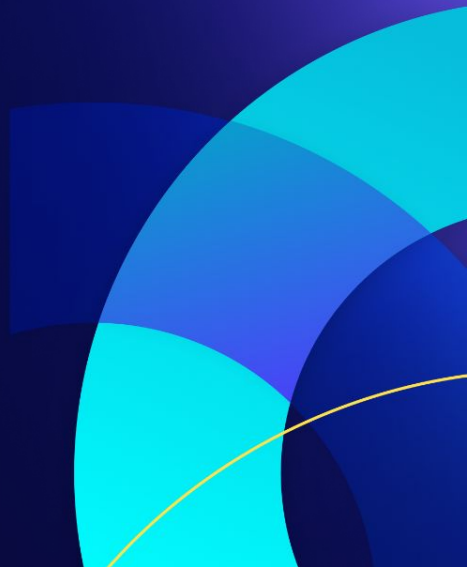
Linux Foundation

- The Linux Foundation is a non-profit technology consortium
- Founded in 2000 to support its growth, and promote commercial adoption.
  - merge of Open Source Development Labs and Free Standards Group
- Dedicated to building sustainable ecosystems around open source projects
  - Cloud Foundry, Delta Lake, FinOps Foundation, GraphQL Foundation, CNCF

CNCF - Cloud Native Computing Foundation

- Founded in 2015 to advance container technology
  - and align the tech industry around its evolution.
- Announced alongside Kubernetes 1.0
- Founding members include
  - Google, CoreOS, Red Hat, Twitter, Huawei, Intel, Cisco, IBM, Docker…
- Projects have a maturity level: Sandbox, Incubated, and Graduated
- Popular projects: containerd, etcd, Helm, Prometheus, CoreDNS

Cloud Native Security



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What is Cloud Native?

*"Cloud-native technologies empower organizations to build and run **scalable applications** in modern, **dynamic environments** such as public, private, and hybrid clouds. Containers, service meshes, microservices, immutable infrastructure, and declarative APIs exemplify this approach.",* **CNCF**

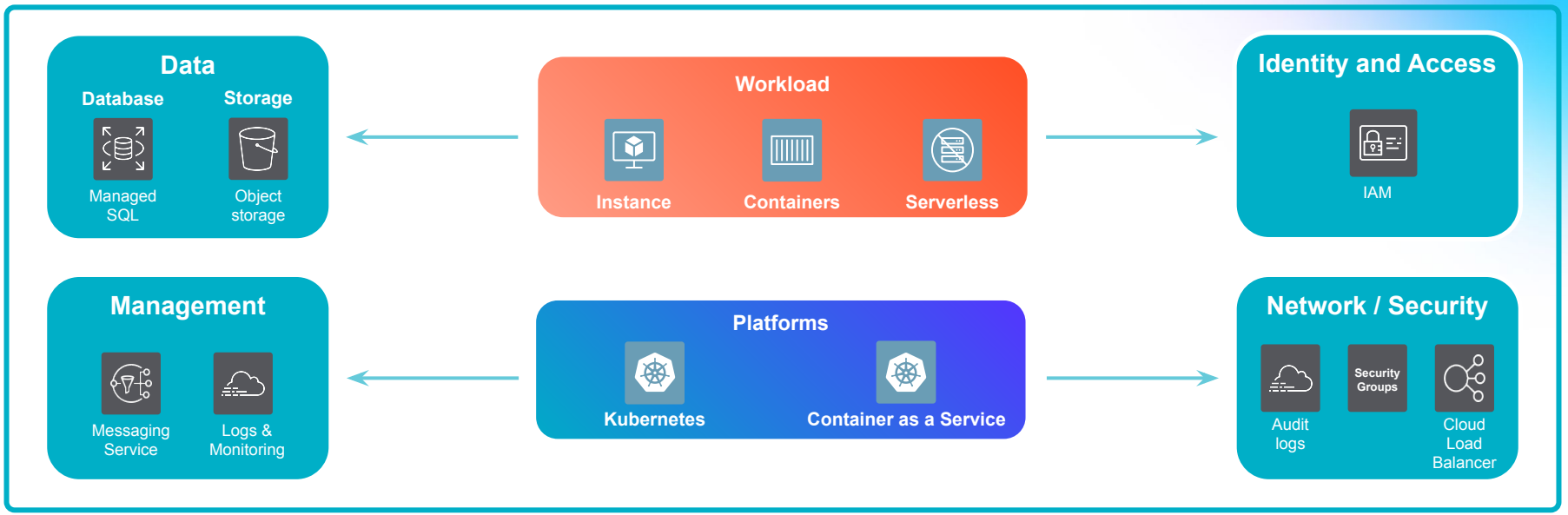
*"Increase **efficiency**; Reduce **cost**; Ensure **availability**.",* **AWS**

*"Cloud native means **adapting** to the many new possibilities—but very **different set of architectural constraints**—offered by the cloud compared to traditional on-premises infrastructure.",* **Google**

What is Cloud Native?

- Cloud computing environments
- Highly scalable, flexible, and resilient applications (quick updates)
- Modern tools and techniques that support development on cloud infrastructure.
- Fast and frequent changes to applications without impacting service delivery

Anatomy of Cloud Native Application



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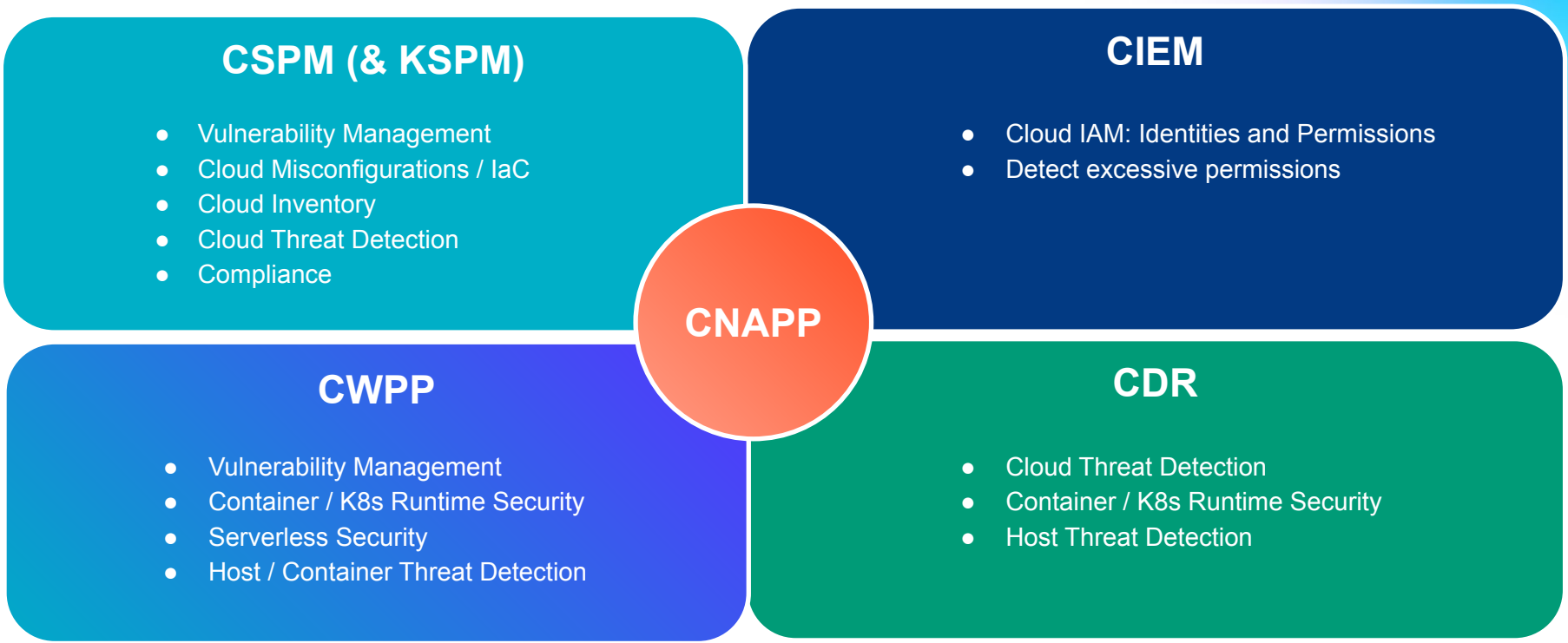
CNAPP Building Blocks



Cloud Threat Detection and Runtime Security

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Once, there was a perimeter

You had a perimeter **guarded by a firewall**

Detecting intrusions was your breach indicator

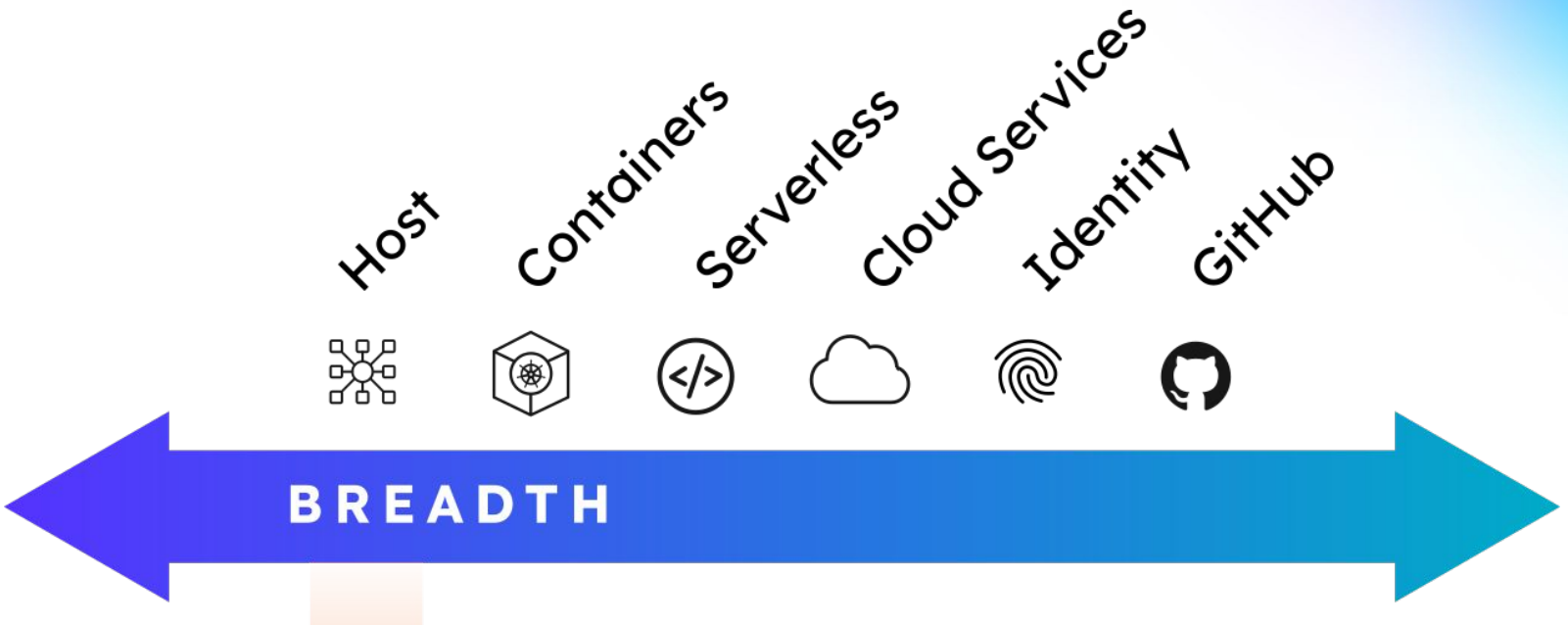
Now, there is no perimeter in the cloud

- Cloud providers own external connections
- Cloud is exposed to the outside world
- You need to control access to services your team uses
- You need to detect unusual activity

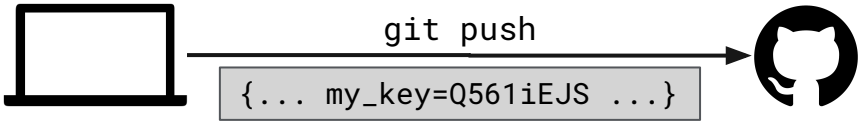
Without a perimeter, a security camera is more important than a good lock

- Watch for changes that create security gaps
- Identify intruders and suspicious insider behavior
- Send an alert and take immediate action

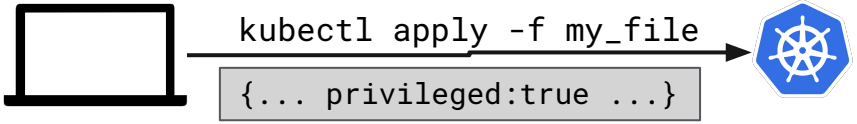
End-to-End Detection



Suspicious Activities

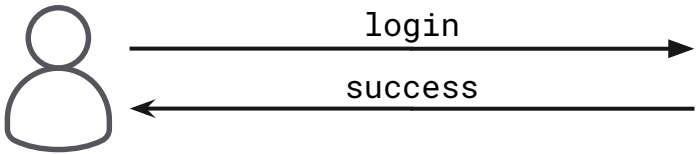


Secret pushed into a public repository.

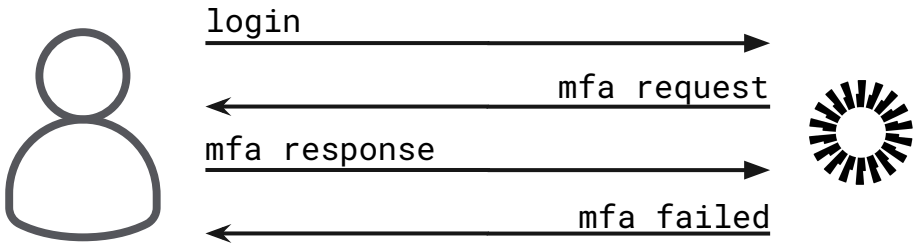


Create privileged pod.

Suspicious Activities

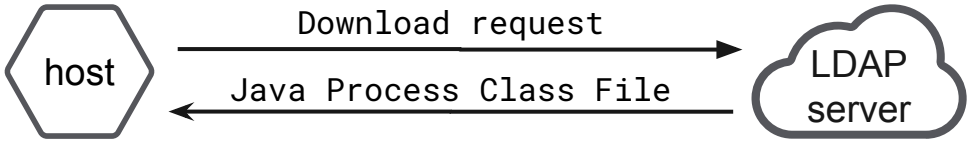


Console login without MFA



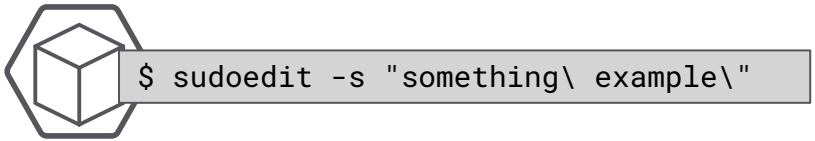
Too many failed MFA in the last 5m

Suspicious Activities



Java Process Class File Download

CVE-2021-4422



Sudo Potential Privilege Escalation

CVE-2021-3156

Falco

Falco is an **open source** runtime security solution for **threat detection** across **Kubernetes**, containers, hosts and **the cloud**.

CNCF Incubation-Level Project
(applied to graduation Nov 2022)

☆ **5.9k**

50M+ pulls

CLOUD NATIVE COMPUTING FOUNDATION

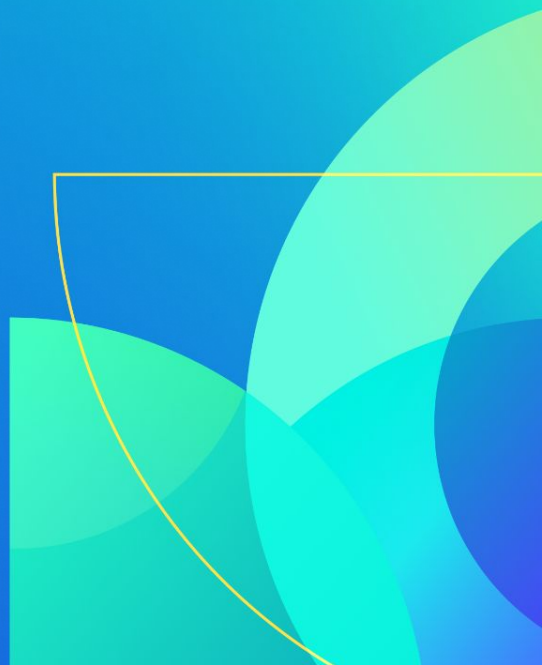
Falco

```
2022-04-07T12:51:08: Notice A shell was spawned in a container with an attached terminal (user=root
user_loginuid=-1 elastic_borg (id=a10bd3b1b2a8) shell=bash parent=<NA> cmdline=bash terminal=34816
container_id=a10bd3b1b2a8 image=ubuntu)
2022-04-07T12:51:41: Warning Netcat runs inside container that allows remote code execution
(user=root user_loginuid=-1 command=nc -e container_id=a10bd3b1b2a8 container_name=elastic_borg
image=ubuntu:latest)
```

Set up Falco

Lab time!

Falco engine



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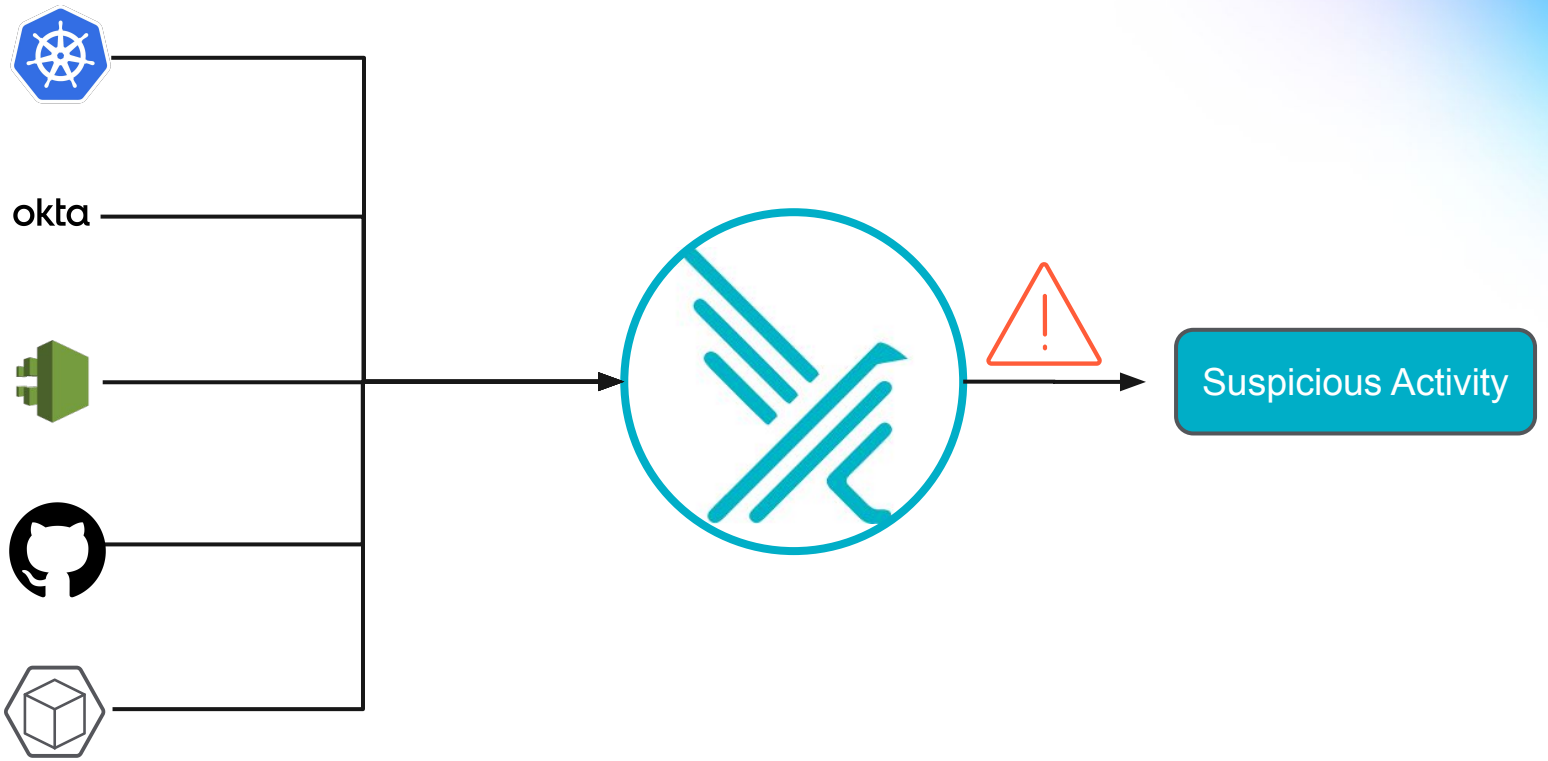
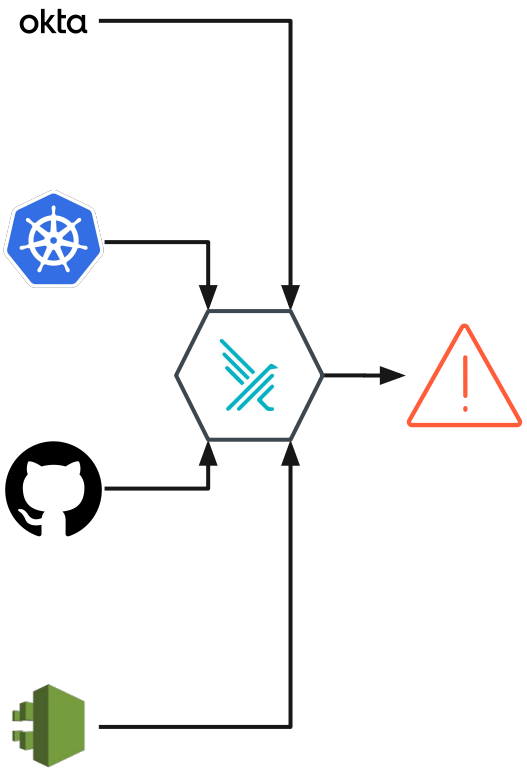
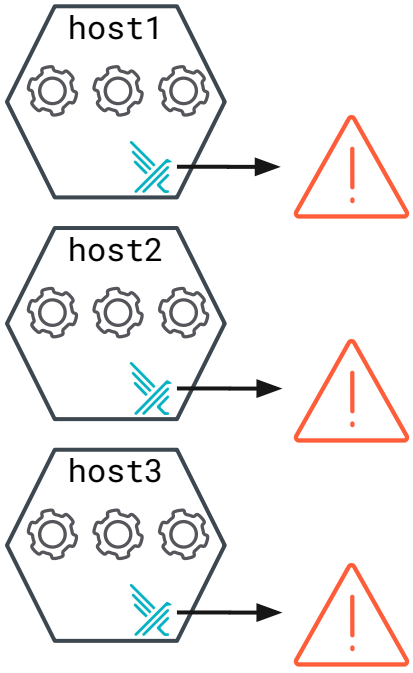
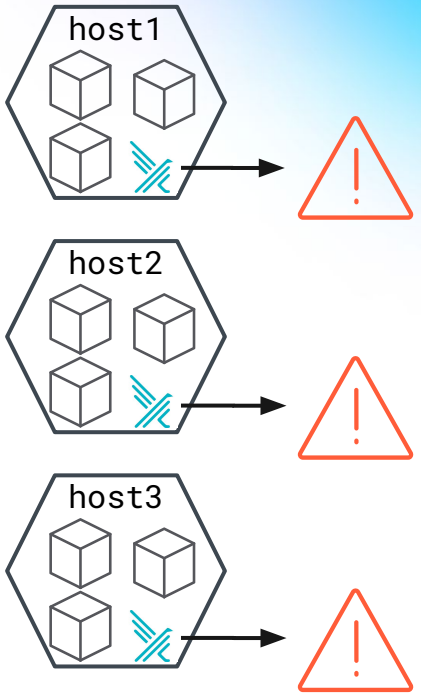
Falco overview



Falco deployment examples

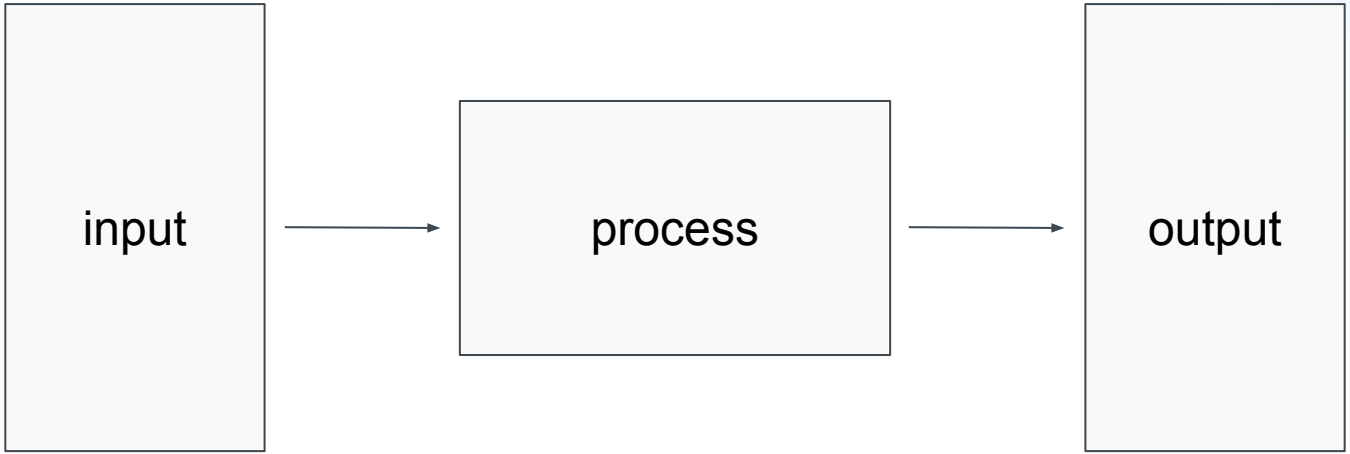




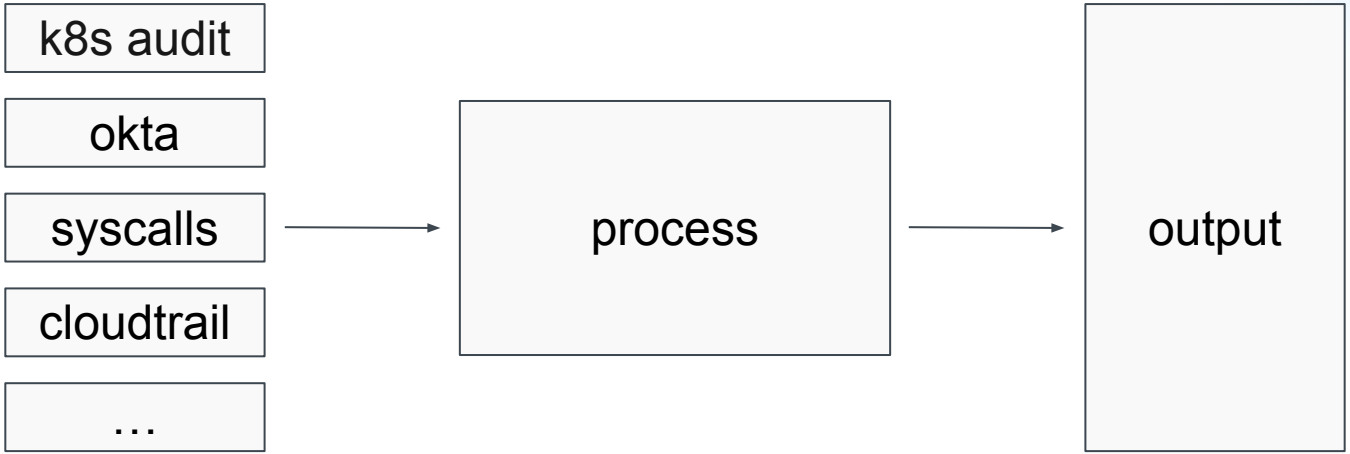


sysdig

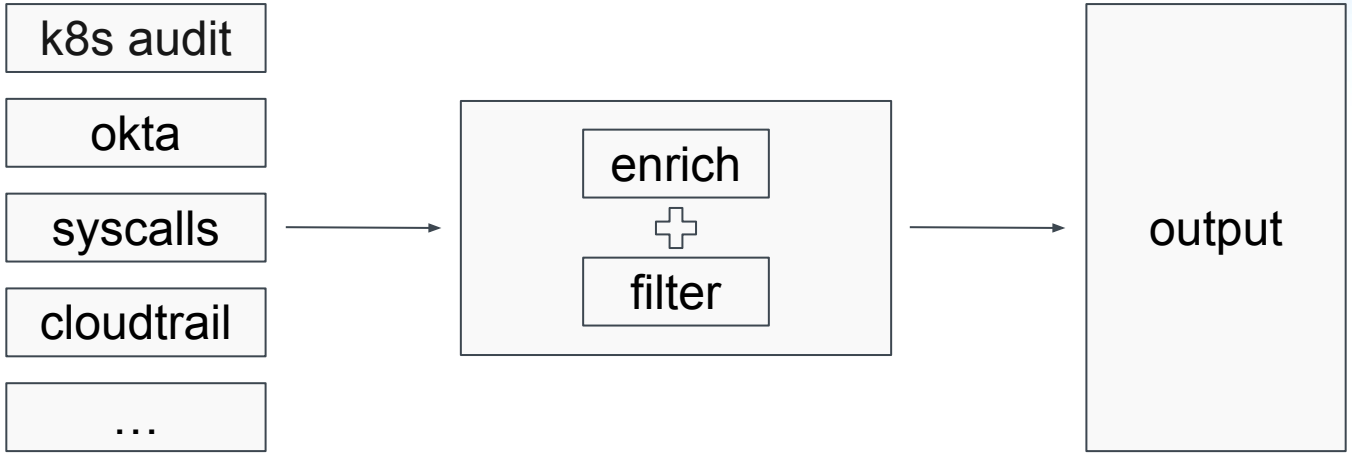
Falco architecture



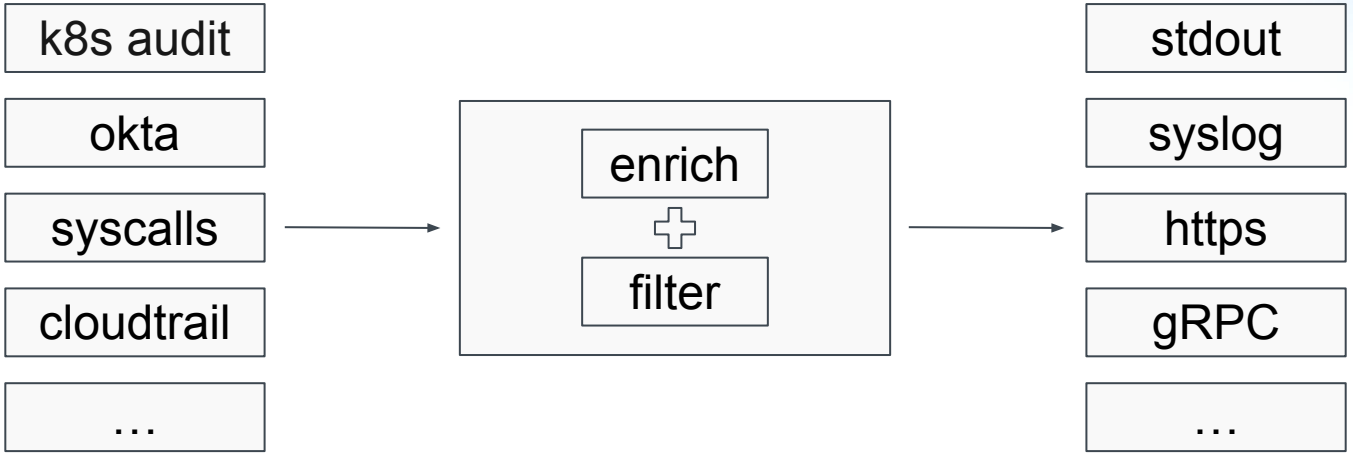
Falco architecture



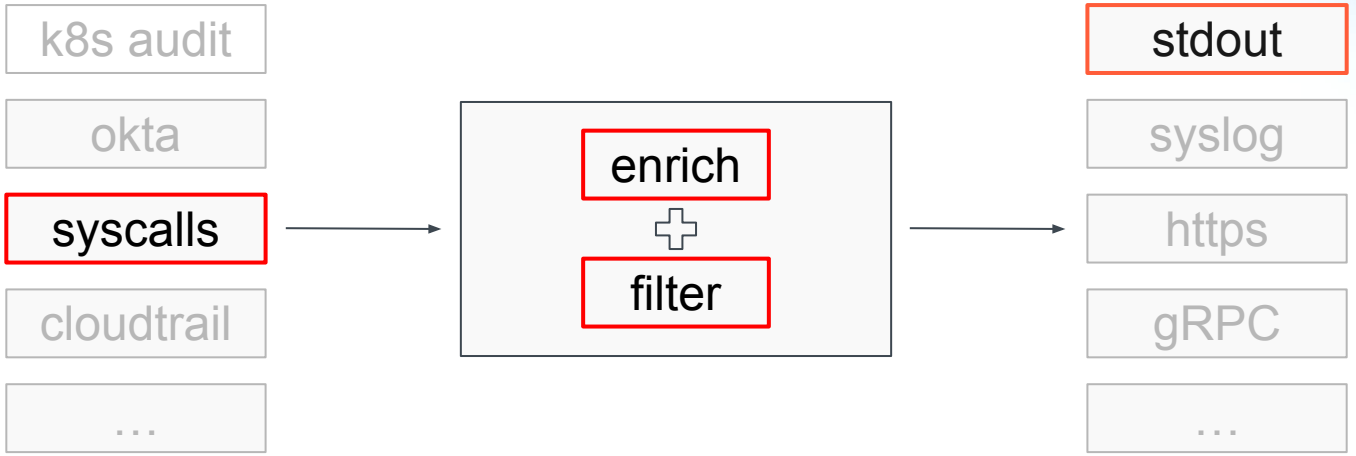
Falco architecture



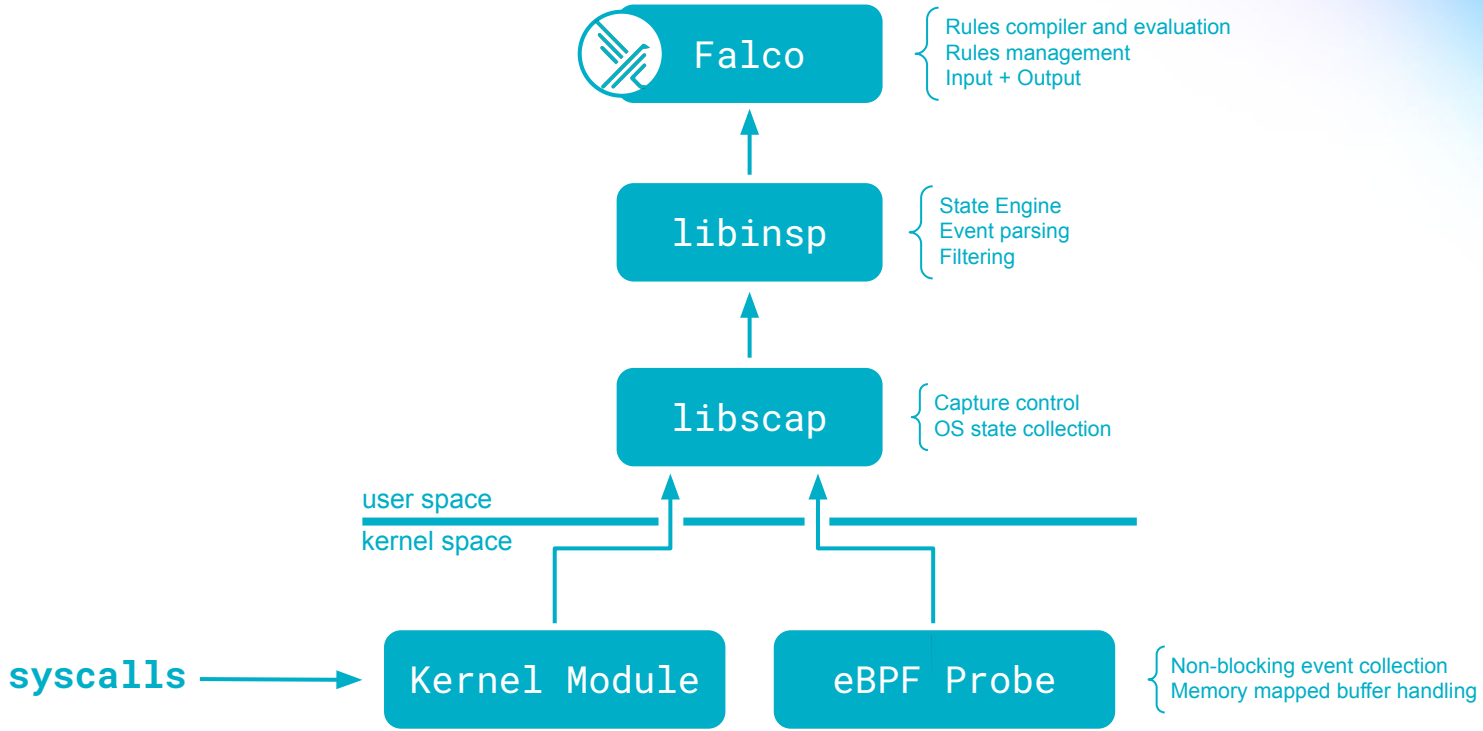
Falco architecture



Falco architecture



Falco architecture



eBPF

- Extended Berkeley Packet Filter.
- Extend the kernel capabilities safely and efficiently.
  - without changing kernel source code.
  - without loading kernel modules.

Kernel instrumentation made simple!

Modern, low-overhead, production-ready observability for monitoring and security in containers and Linux systems.

Falco default rules

- Falco ships with more than 70 default rules:
  - Privilege escalation
  - R/W to sensitive directories
  - Executing shell
  - Execute SSH binaries
  - Mutating binaries
  - Creating symlinks
  - …

Falco syntax

```
- rule: Terminal shell in container
  desc: A shell has been spawned in a container.
  condition: >
    spawned_process and container and shell_procs
  output: >
    A shell was spawned in a container (user=%user.name
user_loginuid=%user.loginuid %container.info shell=%proc.name
parent=%proc.pname cmdline=%proc.cmdline container_id=%container.id)
```

https://falco.org/docs/reference/rules/rule-fields/

Falco syntax

```
- rule: Terminal shell in container
  desc: A shell has been spawned in
  condition: >
    spawned_process and container ar
  output: >
    A shell was spawned in a contain
user_loginuid=%user.loginuid %contai
parent=%proc.pname cmdline=%proc.cmd
```

```
- list: shell_binaries
  items: [ash, bash, csh, ksh, sh,
tcsh, zsh, dash]

- macro: shell_procs
  condition: proc.name in
(shell_binaries)

- macro: container
  condition: (container.id != host)

- macro: spawned_process
  condition: >
        evt.type in (execve, execveat)
        and evt.dir=<
```

https://falco.org/docs/reference/rules/supported-fields/

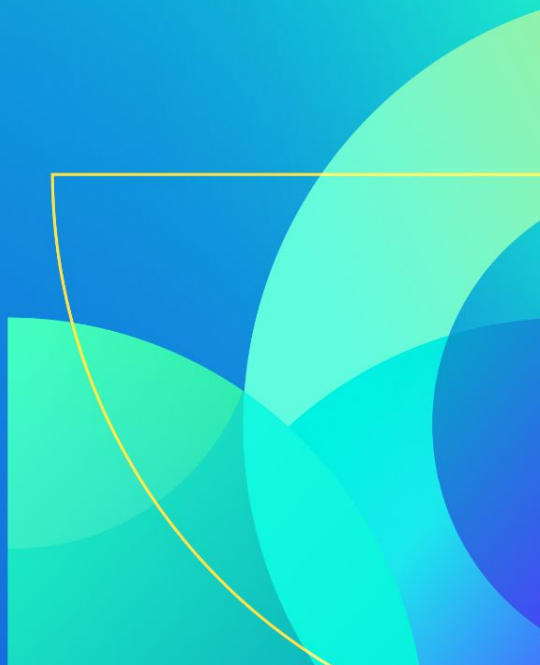
Macros and Lists

- **Macros** allow you to define conditions and reuse them wherever you want.
- **Lists** help you organize your rules files with naming and segmentation.
- They have four main benefits:
  - code reuse
  - avoid long strings of conditions
  - rules are easier to understand
  - easier to extend

Falco default rules

Lab time!

Falco ecosystem



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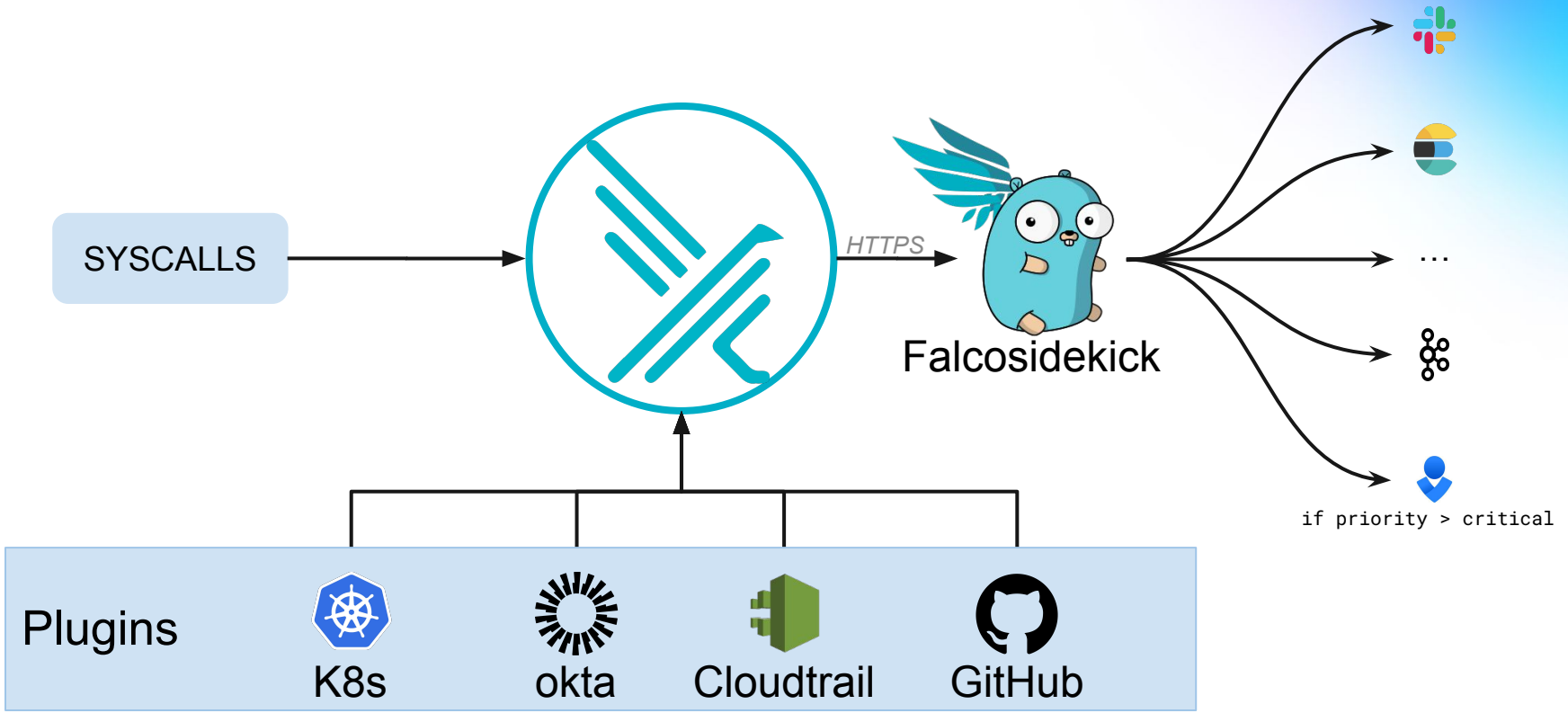
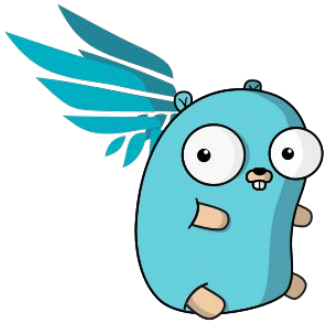
Falco ecosystem



Falcosidekick



chat

logs

queue/streaming

faas

metrics

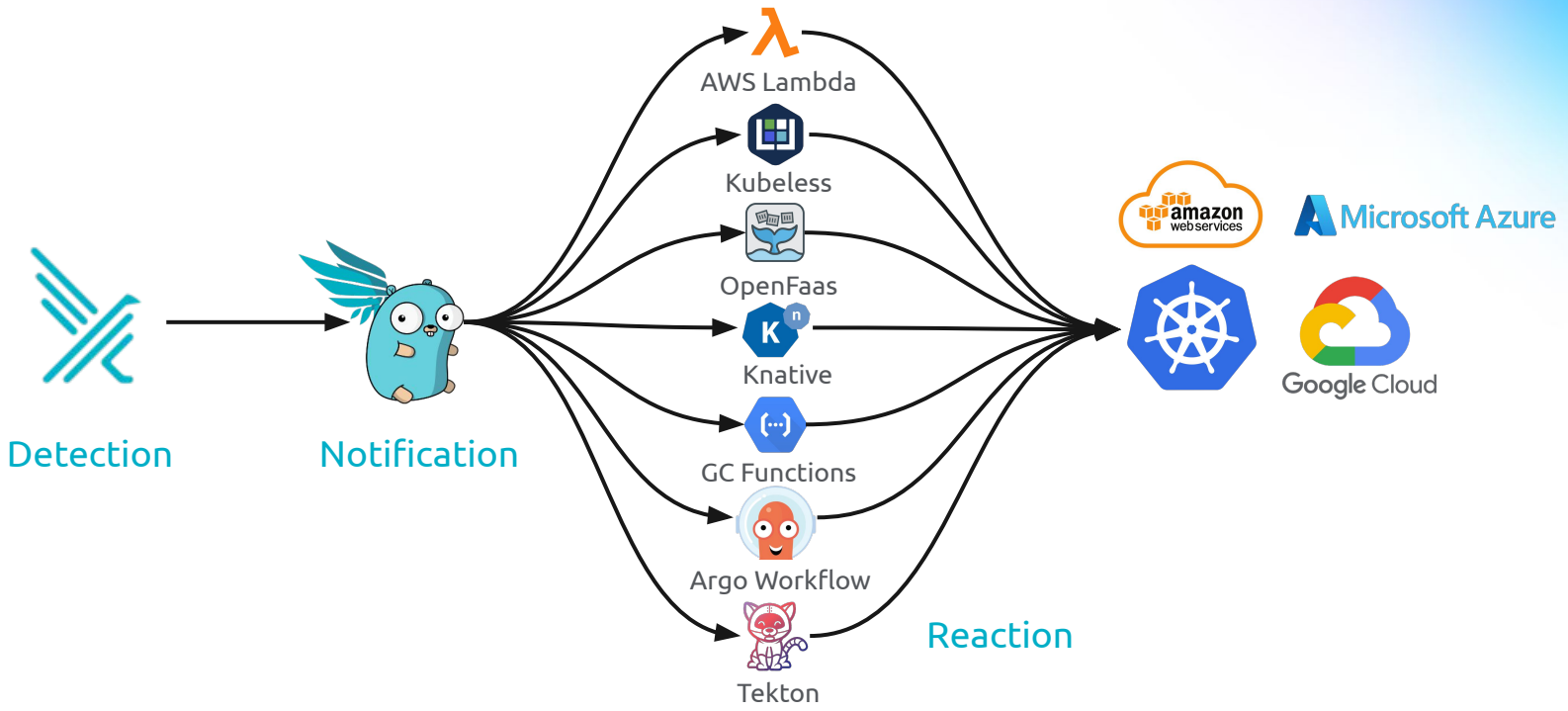
alerting

storage

and more ...

https://github.com/falcosecurity/falcosidekick

React to events



Falcosidekick install

Standalone:

```
helm repo add falcosecurity https://falcosecurity.github.io/charts
helm repo update

helm install falcosidekick -n falco --set config.debug=true falcosecurity/falcosidekick
```

With Falco:

```
helm install falco -n falco falcosecurity/falco \
  --set falcosidekick.enabled=true \
  --set falcosidekick.webui.enabled=true
```

Event generator

- Generates a variety of suspect actions that are detected by Falco rulesets.
- Good to test Falco rulesets:
  - syscalls
  - kubernetes audit
- Run it within Docker or Kubernetes,
  - as some commands might alter your system.

```
docker run -it --rm falcosecurity/event-generator run
```

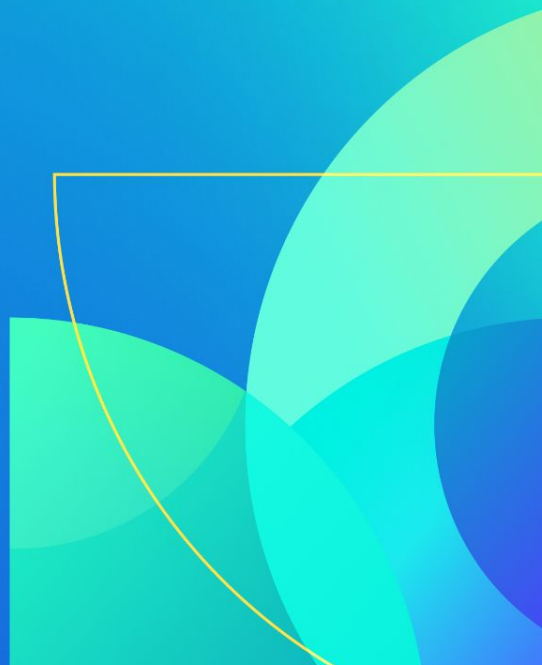
```
helm install event-generator falcosecurity/event-generator \
  --namespace event-generator \
  --create-namespace \
  --set config.actions=""
```

https://github.com/falcosecurity/event-generator

Falco ecosystem

Lab time!

Closing remarks



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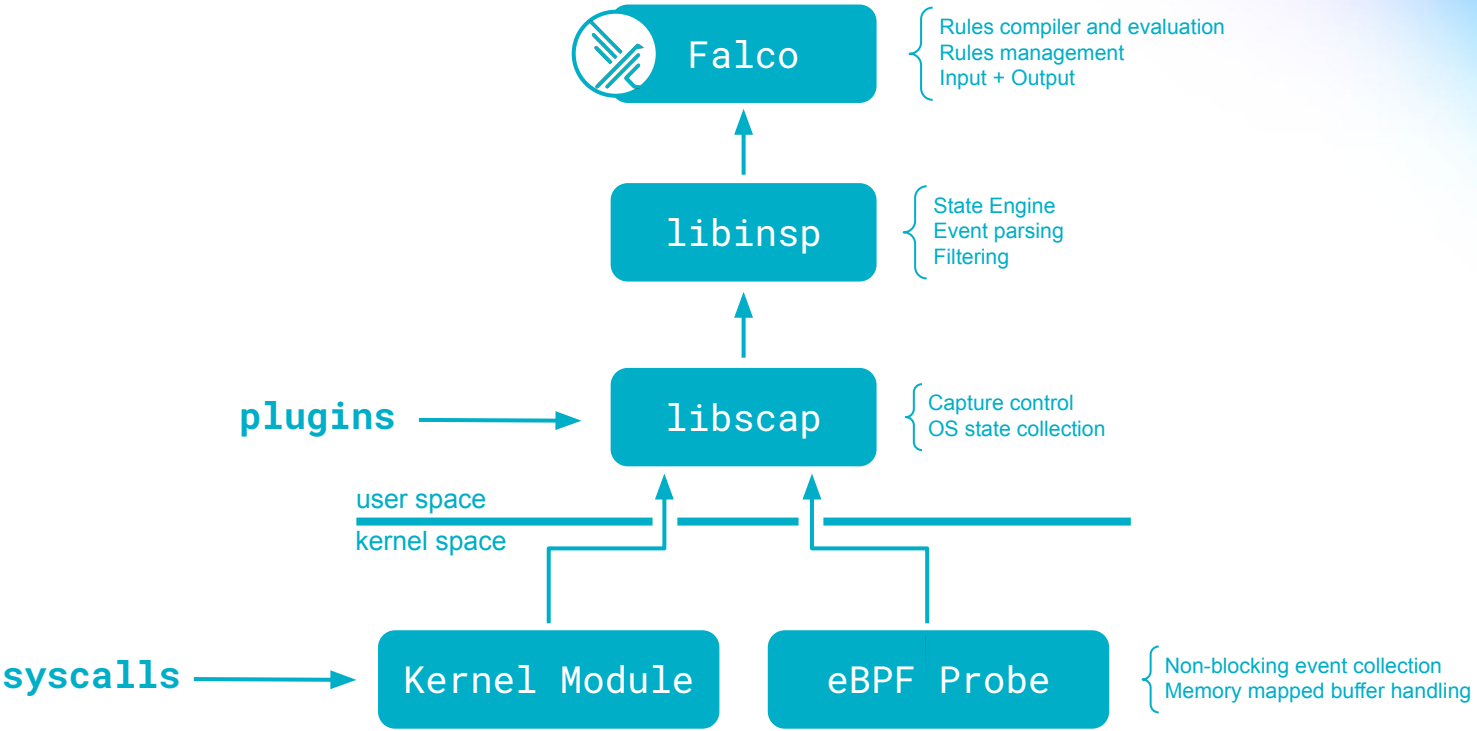
Runtime security

Guard perimeter

Detect unusual activities

Falco architecture



Falco rules

```
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  condition: >
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  output: >
    A shell was spawned in a container (user=%user.name
user_loginuid=%user.loginuid %container.info shell=%proc.name
parent=%proc.pname cmdline=%proc.cmdline container_id=%container.id)
  priority: WARNING
  tags: [container, shell, mitre_execution]
```
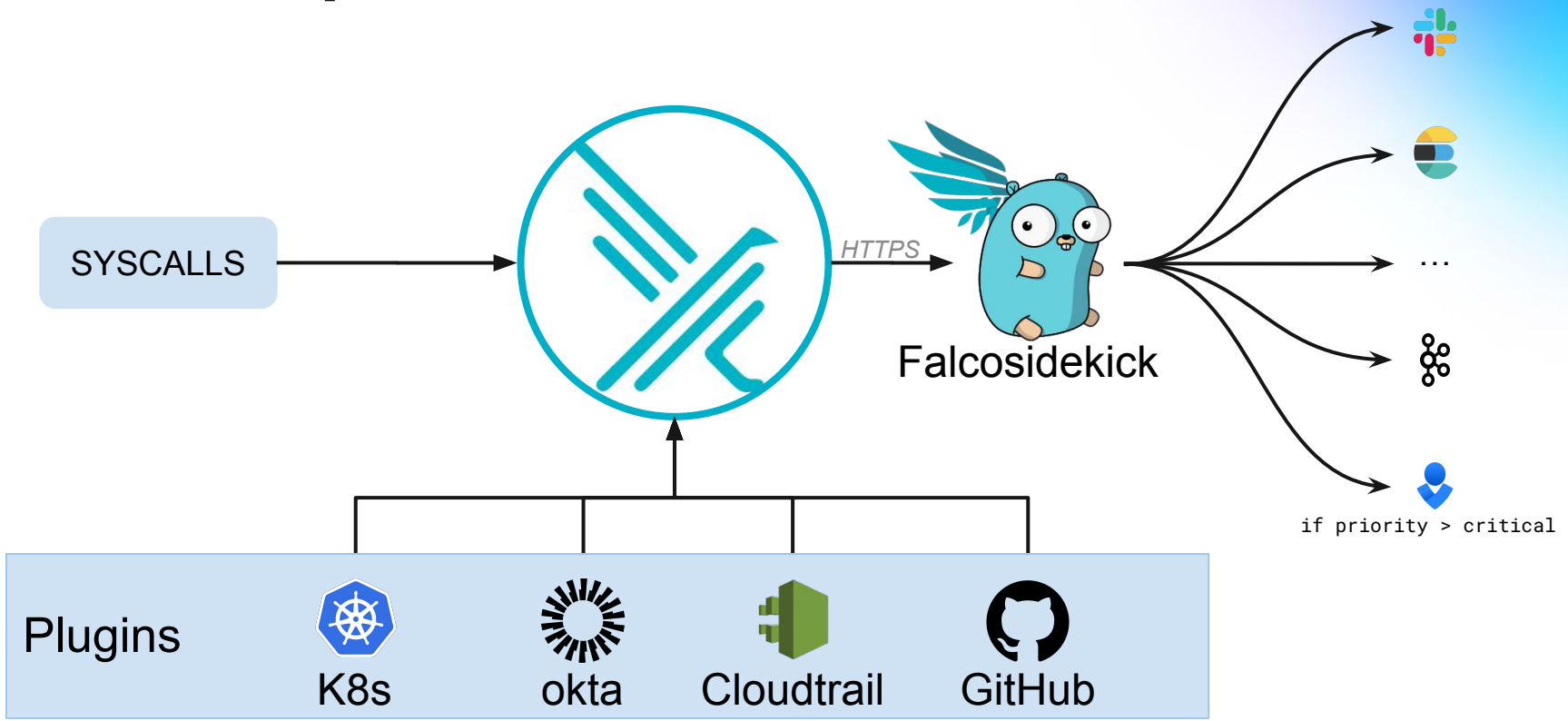

sysdig

Falco ecosystem



Reference

"Practical Cloud Native Security with Falco", O'Reilly book

https://falco.org/docs

https://falco.org/training

https://falco.org/blog/extend-falco-outputs-with-falcosidekick/

sysdig

Seeing is Securing