white duck

Hijack a Kubernetes Cluster – a Walkthrough

Microsoft Partner

Microsoft

Gold Cloud Platform
Gold DevOps
Silver Application Development
Silver Security
Silver Application Integration

GitHub

Nico Meisenzahl

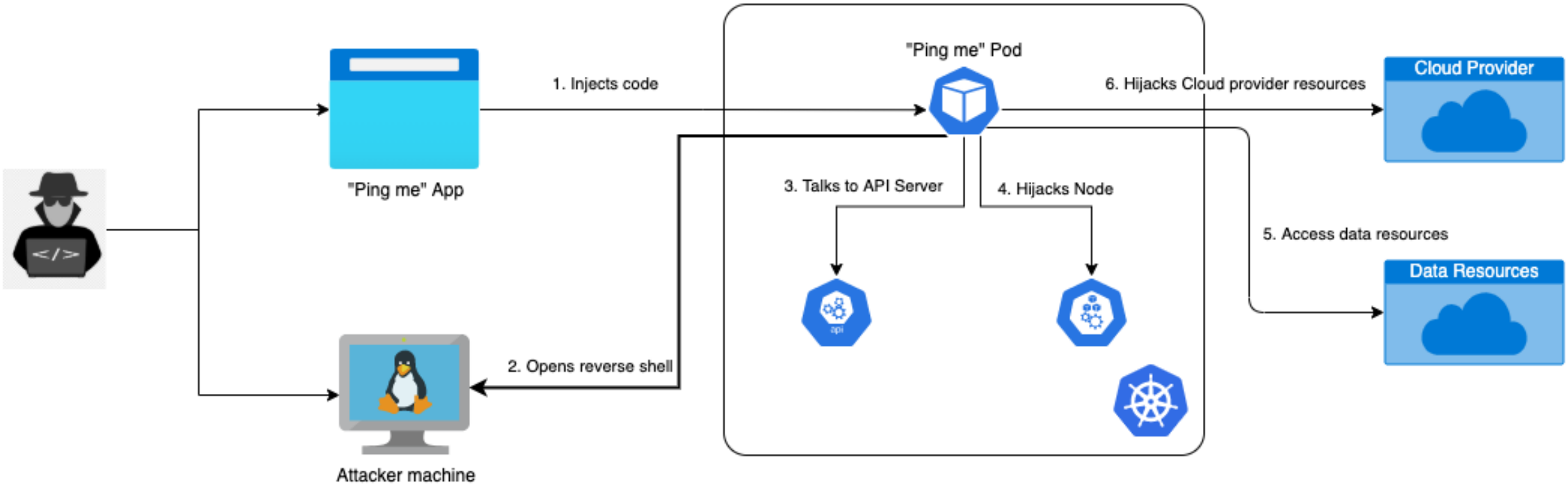
- Senior Cloud & DevOps Consultant at white duck
- Microsoft MVP, GitLab Hero
- Cloud Native, Kubernetes & Azure

Phone: +49 8031 230159 0
Email: nico.meisenzahl@whiteduck.de
Twitter: @nmeisenzahl
LinkedIn: https://www.linkedin.com/in/nicomeisenzahl
Blog: https://meisenzahl.org

About this talk

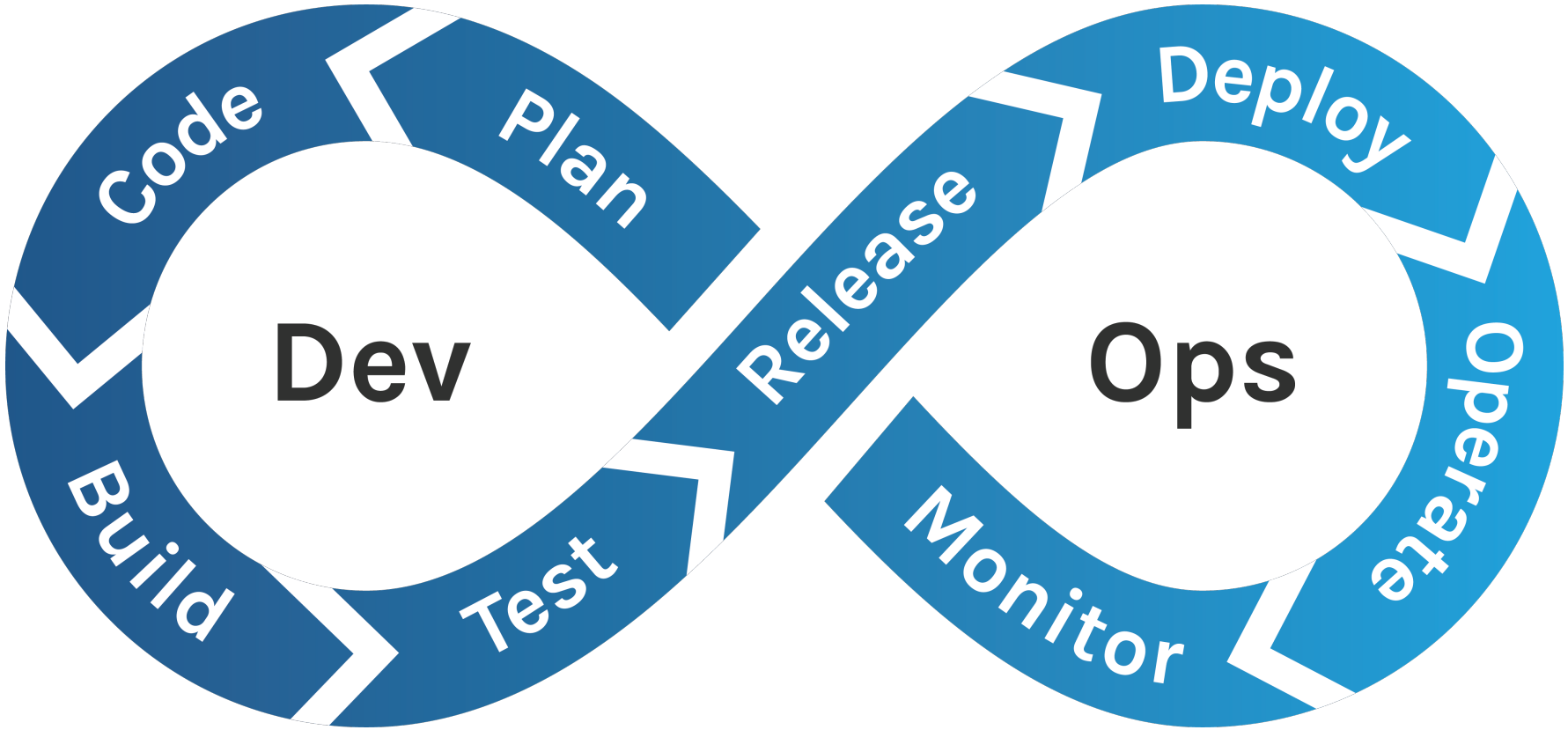
- this is not an in-depth security talk
- it should make you aware of common attack vectors and how to prevent them
  - you will see demos on how to hijack a cluster
  - you will learn how to prevent those with common best practices
- one more slide, then we will start hijacking (slideless)
  - https://github.com/nmeisenzahl/hijack-kubernetes

What we will do



white duck

Security quick wins through the DevOps cycle



Ensure secure application code

- automate and enforce code checks
- schedule dependency scanning
  - e.g. Dependabot
- enforce Static Application Security Testing (SAST) in PRs
  - scans your code to identify potential security vulnerabilities
  - more details: https://owasp.org/www-community/Source_Code_Analysis_Tools

Ensure secure application code

- automate and enforce code checks
- schedule dependency scanning
  - e.g. Dependabot
- enforce Static Application Security Testing (SAST) in PRs
  - scans your code to identify potential security vulnerabilities
  - more details: https://owasp.org/www-community/Source_Code_Analysis_Tools

Would have shown the possibility of code injection

Build secure container images

- build secure/small container images – less is more
  - do only include required dependencies (no debugging tools!)
  - use self-contained binaries or “distroless” if possible
    - https://github.com/GoogleContainerTools/distroless
  - otherwise, use a small and secure Linux distro
- use and enforce SAST for validating your Dockerfiles
- scan your container images (on build and regularly)

Build secure container images

- build secure/small container images – less
  - do only include required dependencies (no de
  - use self-contained binaries or “distroless” if possible
    - https://github.com/GoogleContainerTools/distroless
  - otherwise, use a small and secure Linux distro
- use and enforce SAST for validating your Dockerfiles
- scan your container images (on build and regularly)

Would have made it much harder to hijack the container

Ensure secure deployment code

- as important as secure application code and Dockerfiles
- validate your deployment manifests using SAST
  - and enforce them via PRs
- can help you to implement best practices like denying
  - containers running as root
  - mounting hostPath
  - …

SAST Tooling

- Source code
  - https://codeql.github.com
  - https://security-code-scan.github.io
  - https://securego.io
- Kubernetes manifests
  - https://kubesec.io
  - https://github.com/aquasecurity/trivy
- Dockerfiles
  - https://github.com/aquasecurity/trivy
- Terraform
  - https://github.com/tfsec/tfsec
  - https://github.com/aquasecurity/trivy

Kubernetes policies

- enforce compliance and governance within clusters
  - verifying manifests is not enough!
- examples include enforcement of
  - read-only filesystems
  - denying hostPath mounts
  - denying containers running as root
  - …

Kubernetes policies

- enforce compliance and governance within clusters
  - verifying manifests is not enough!
- examples include enforcement of
  - read-only filesystems
  - denying hostPath mounts
  - denying containers running as root
  - …

Would have made it much harder to further hijack the nodes and cloud resources

Kubernetes policy Tooling

- Open Policy Agent Gatekeeper
  - https://github.com/open-policy-agent/gatekeeper
- Kyverno
  - https://kyverno.io
- Azure Policies
  - based on Open Policy Agent Gatekeeper
  - https://docs.microsoft.com/azure/aks/use-azure-policy

Network Policies

- granular deny or explicitly allow between containers and ingress/egress of the cluster
  - limit egress access to the internet
  - limit access between applications/namespaces
  - deny access to the Cloud provider metadata service
- https://kubernetes.io/docs/concepts/services-networking/network-policies

Network Policies

- granular deny or explicitly allow b and ingress/egress of the cluster
  - limit egress access to the internet
  - limit access between applications/namespaces
  - deny access to the Cloud provider metadata service
- https://kubernetes.io/docs/concepts/services-networking/network-policies

Would have denied most network connections (reverse shell, internet, metadata service)

Container Runtime Security

- helps to detect malicious threads and workloads
  - untrusted process within container
  - a shell is running inside a container
  - container process mounting a sensitive path
  - a process making outbound network connections
- container runtime security tools like Falco can help
  - https://github.com/falcosecurity/falco

Container Runtime Security

- helps to detect malicious threads and v
  - untrusted process within container
  - a shell is running inside a container
  - container process mounting a sensitive path
  - a process making outbound network connections
- container runtime security tools like Falco can help
  - https://github.com/falcosecurity/falco

Would have detect all our “work” within the containers

Further best practises

- do not
  - share service accounts between applications
  - enable higher access levels for the default service account if not required
  - mount service account token if not required
    - https://kubernetes.io/docs/tasks/configure-pod-container/configure-service-account/#use-the-default-service-account-to-access-the-api-server
- review all third-party snippets before applying them
- implement a Web Application Firewall (WAF) to further secure your application

Further best practises

Wouldn't have allowed us to talk to the API server

- do not
  - share service accounts between applications
  - enable higher access levels for the default service account if not required
  - mount service account token if not required
    - https://kubernetes.io/docs/tasks/configure-pod-container/configure-service-account/#use-the-default-service-account-to-access-the-api-server
- review all third-party snippets before applying them
- implement a Web Application Firewall (WAF) to further secure your application

Would have denied our code injection

Questions?

- Slides: https://www.slideshare.net/nmeisenzahl
- Demo: https://github.com/nmeisenzahl/hijack-kubernetes

Phone: +49 8031 230159 0
Email: nico.meisenzahl@whiteduck.de
Twitter: @nmeisenzahl
LinkedIn: https://www.linkedin.com/in/nicomeisenzahl
Blog: https://meisenzahl.org