Attacking and Defending Kubernetes

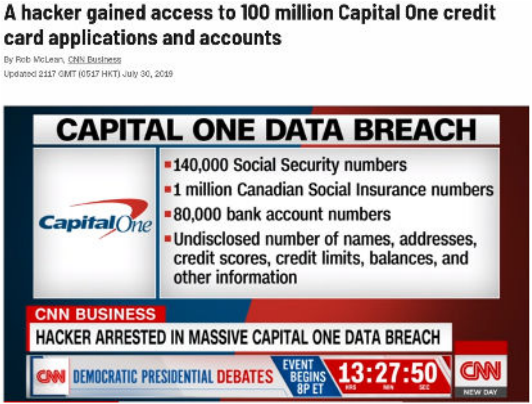
Linux Stammtisch

kubernetes

Andy Wirtz, ATIX AG

June 22nd, 2021

Capital One



A hacker gained access to 100 million Capital One credit card applications and accounts

By Rob McLean, CNN Business

Updated 2117 GMT (0517 HKT) July 30, 2019

CAPITAL ONE DATA BREACH

- 140,000 Social Security numbers
- 1 million Canadian Social Insurance numbers
- 80,000 bank account numbers
- Undisclosed number of names, addresses, credit scores, credit limits, balances, and other information

Capital One
CNN BUSINESS
HACKER ARRESTED IN MASSIVE CAPITAL ONE DATA BREACH
CNN
DEMOCRATIC PRESIDENTIAL DEBATES
EVENT BEGINS 8P ET
13:27:50
HRS MIN SEC
CNN
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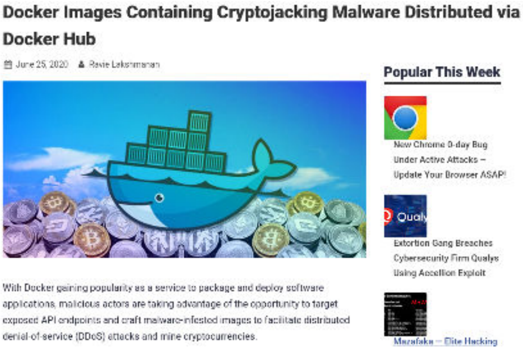
https://edition.cnn.com/2019/07/29/business/capital-one-data-breach/index.html

Docker Hub & Microsoft Azure



Docker Images Containing Cryptojacking Malware Distributed via Docker Hub

June 25, 2020 Ravie Lakshmanan

With Docker gaining popularity as a service to package and deploy software applications, malicious actors are taking advantage of the opportunity to target exposed API endpoints and craft malware-infested images to facilitate distributed denial-of-service (DDoS) attacks and mine cryptocurrencies.

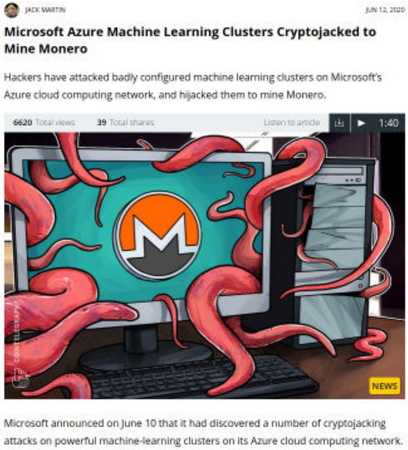
Popular This Week

New Chrome 0-day Bug Under Active Attacks – Update Your Browser ASAP!

Extortion Gang Breaches Cybersecurity Firm Qualys Using Accellion Exploit

Mazafaka — Elite Hacking

https://thehackernews.com/2020/06/cryptocurrency-docker-image.html



JACK MARTIN JUN 12, 2020

Microsoft Azure Machine Learning Clusters Cryptojacked to Mine Monero

Hackers have attacked badly configured machine learning clusters on Microsoft's Azure cloud computing network, and hijacked them to mine Monero.

6620 Total views 39 Total shares Listen to article ▶ 1:40

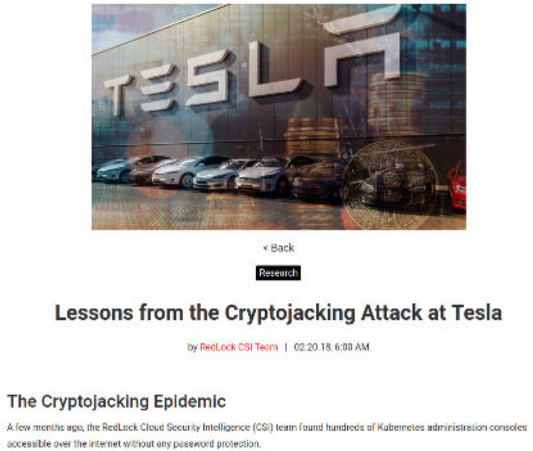
NEWS

Microsoft announced on June 10 that it had discovered a number of cryptojacking attacks on powerful machine-learning clusters on its Azure cloud computing network.

https://cointelegraph.com/news/microsoft-azure-machine-learning-clusters-cryptojacked-to-mine-monero

#kubernetes #security

Tesla & Jenkins



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Research

Lessons from the Cryptojacking Attack at Tesla

by RedLock CSI Team | 02.20.18, 6:00 AM

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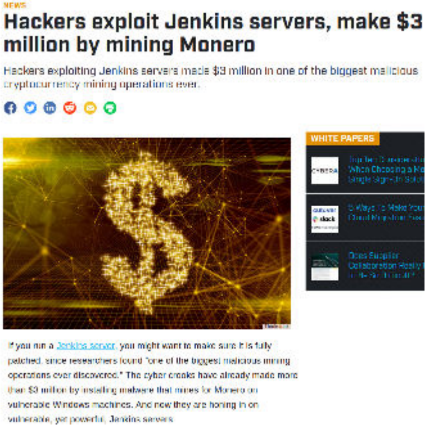

NEWS

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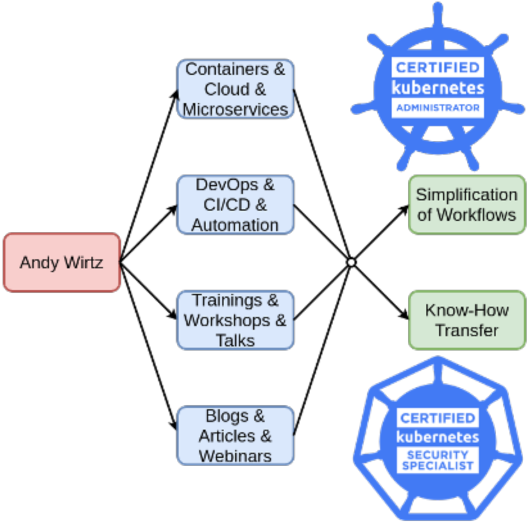
If you run a Jenkins server, you might want to make sure it is fully patched, since researchers found "one of the biggest malicious mining operations ever discovered." The cyber crooks have already made more than $3 million by installing malware that mines for Monero on vulnerable Windows machines. And now they are honing in on vulnerable, yet powerful, Jenkins servers.

https://www.csoonline.com/article/3256314/hackers-exploit-jenkins-servers-make-3-million-by-mining-monero.html

Andy Wirtz – Senior IT Consultant at ATIX AG, Germany



Andy Wirtz

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- Email: `wirtz@atix.de`
- `www.xing.com/profile/Andy_Wirtz2`
- `www.linkedin.com/in/andy-wirtz`

#kubernetes #security

Agenda

1 Attack Kubernetes

2 Demo of an Attack Path

3 Defend Kubernetes

4 Mitigate the Attack Path

5 Security Checklist

#kubernetes #security

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Kubernetes

Virtual data center

- for container apps
- manages compute resources

Wide spread use

- interesting for attackers
- various attack surfaces

API Server
Node
Network
Resources

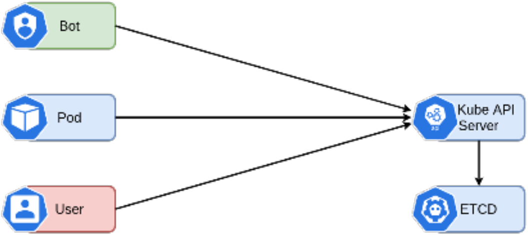
Kubernetes API Server

Access control

- to Kubernetes objects
- can be annulled

Unwarranted access

- read secrets, write workloads
- administer cluster



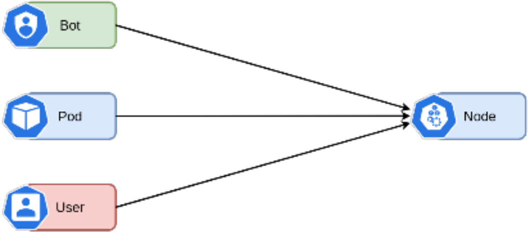
Container Hosts

Container isolation

- of process, network, filesystem
- can be softened

Container outbreak

- access host file system
- root in container = root on host



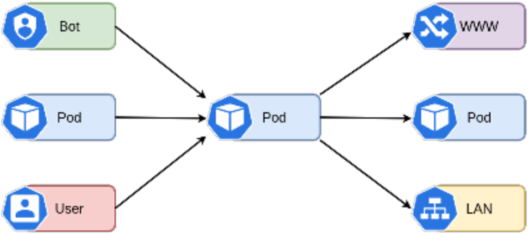
Container Network

Container communication

- in a flat network
- can be unlimited

Unwanted communication

- download malware
- talk to other apps



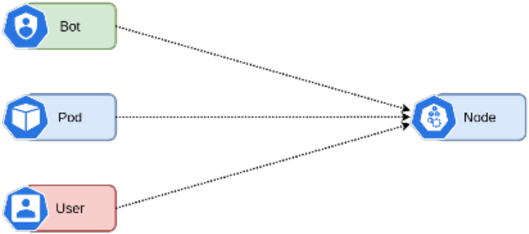
Compute Resources

Allocatable resources

- are CPU, memory, storage
- can be misused

Consume resources

- crypto mining
- fork bombs



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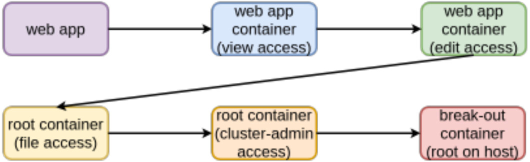
Goals

Privilege escalation to control

- Kubernetes
- container hosts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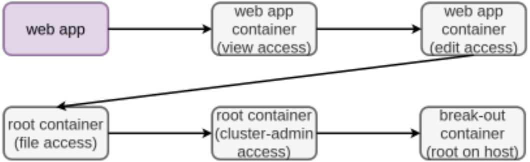
Crypto Mining without detection

- divert compute resources
- share over network

Web application

Command injection

- ping servers
- execute additional commands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Access via reverse shell

- target machine initiates connection
- user’s computer listens

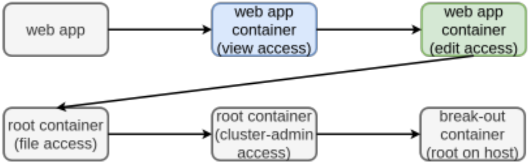
Web application container

View access to Kubernetes

- read ServiceAccounts
- read Secrets

Edit access to Kubernetes

- create root container on master
- log into new container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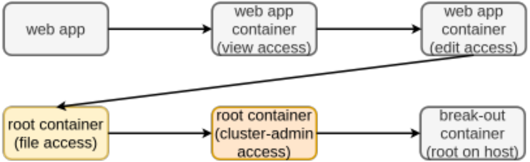
Root container

Root user in container on master

- use hostPath
- read admin.conf

Cluster-admin access to Kubernetes

- create break-out container
- log into new container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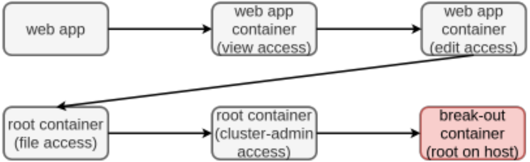
Break-out container

Root user on host

- create mining container
- use docker

Cleanup

- delete root container
- delete break-out container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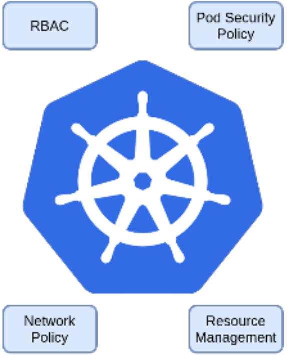
Security Basics

Defence in depth

- attackers pick their targets
- layered security needed

Best practices

- limit attack surface
- principle of least privilege



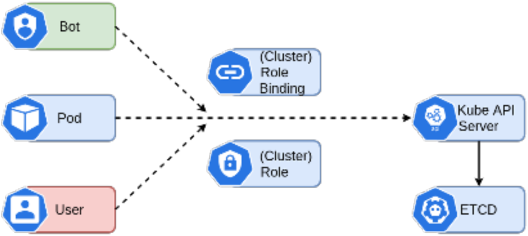
Role-Based Access Control

Kubernetes bouncer

- for Kubernetes resources and others
- namespace- or cluster-wide

Least privilege access

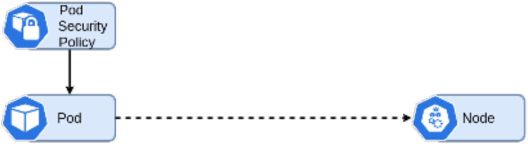
- no access for apps and humans
- access for tools (CD, monitoring)



PodSecurityPolicies

Container prison

- drop capabilities
- ensure separation



Prevent outbreak

- deny privileged/root/privilege escalation
- ensure isolation & RO root filesystem

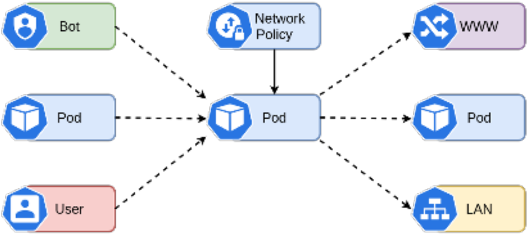
NetworkPolicy

Container firewall

- for ingress and egress
- with labels, namespaces, ip-blocks

Restrict communication

- default deny all
- allow-list specific traffic



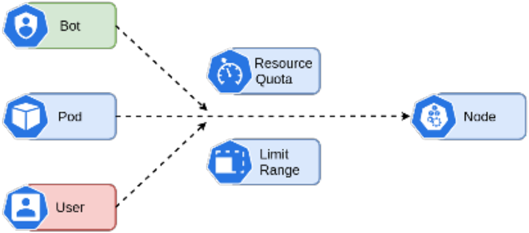
Resource Management

Kubernetes limiter

- quotas for namespaces
- limits for containers, pods, pvcs

Assign resources

- split resources for tenants
- define min, max, default resources



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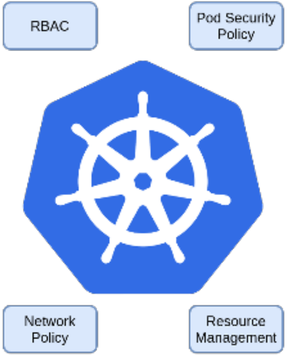
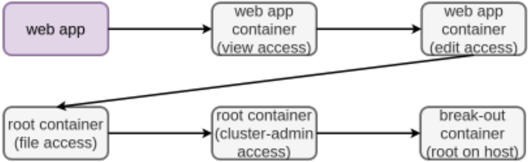


Mitigate 1

Mitigate reverse shell for container

- scan container images for vulnerabilities
- remove unnecessary software
- restrict traffic with NetworkPolicies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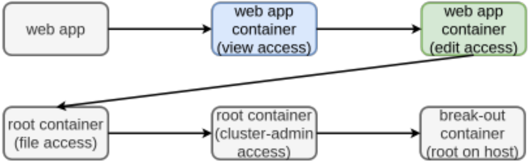
Mitigate installation of new software

- scan container images for vulnerabilities
- remove unnecessary software
- restrict traffic with NetworkPolicies

Mitigate 2

Mitigate privlige escalation to edit access

- avoid existence of unnecessary secrets
- restrict traffic with NetworkPolicies
- restrict access to API server with RBAC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Mitigate root container on master

- restrict with NetPol and RBAC
- don’t tolerate container on master
- forbid root container with PSP

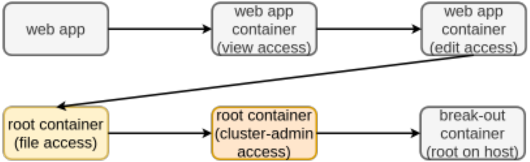
Mitigate 3

Mitigate shell for root container

- forbid root container with PSP
- restrict traffic with NetworkPolicies
- restrict access to API server with RBAC

Mitigate privlige escalation to cluster-admin

- don’t tolerate container on master
- forbid root container with PSP
- forbid hostPath with PSP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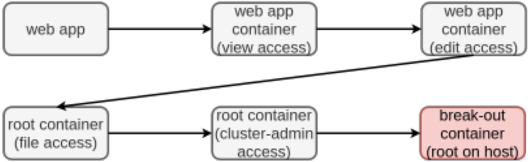
Mitigate 4

Mitigate break-out container

- restrict with NetPol and RBAC
- forbid privileged container with PSP
- forbid hostPID with PSP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Mitigate docker run

- restrict with NetPol and RBAC
- forbid privileged container with PSP
- forbid hostPID with PSP

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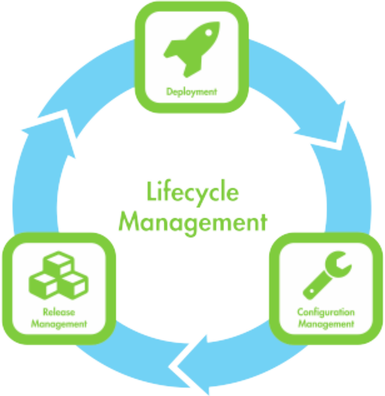
Container Hosts

Server Lifecycle Management

- dedicated container hosts
- reduction of the attack surface
- runtime security tools
- restriction of access to the container hosts

Orcharhino



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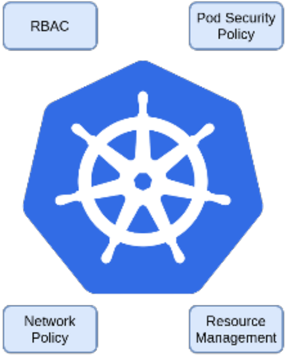
Kubernetes

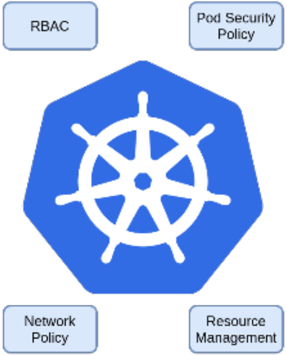
Kubernetes Lifecycle Management

- protection of the kubernetes components
- restriction of access to the kubernetes API
- usage of authentication and authorization
- usage of admission control
- enabling of audit logs
- checking via security benchmarking



Ecosystem

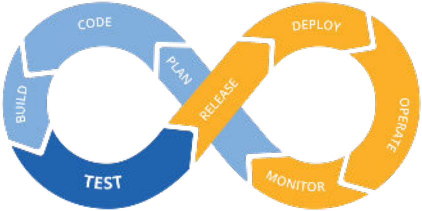
kube-bench


RBAC
Pod Security Policy
Network Policy
Resource Management

Container applications

Application Lifecycle Management

- seperation of code and data
- restriction of access to the kubernetes API
- container sandboxing
- container hardening
- vulnerability scanning of container images
- mutual TLS



Summary

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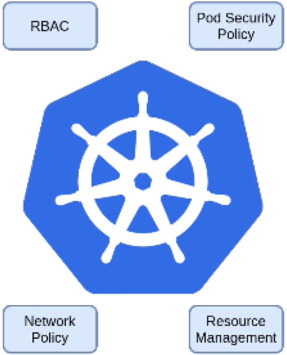
- layered security needed

Best practices

- limit attack surface
- principle of least privilege



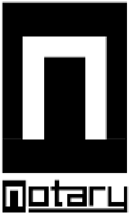
Outlook

Secure applications

- container image scanning and signing
- sandbox technologies

Use agents

- policy agent for compliance
- RT security agent for anomaly detection



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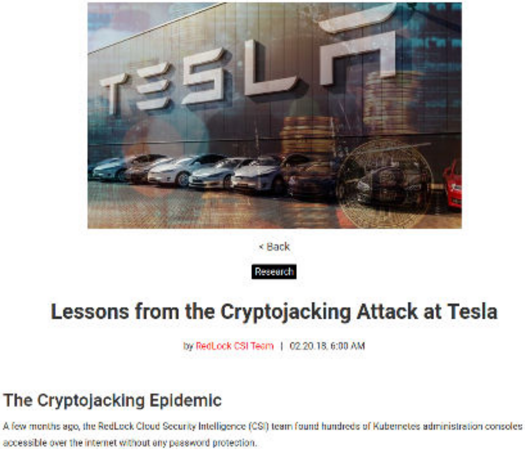

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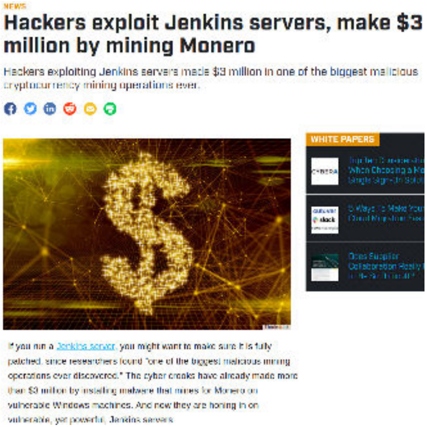

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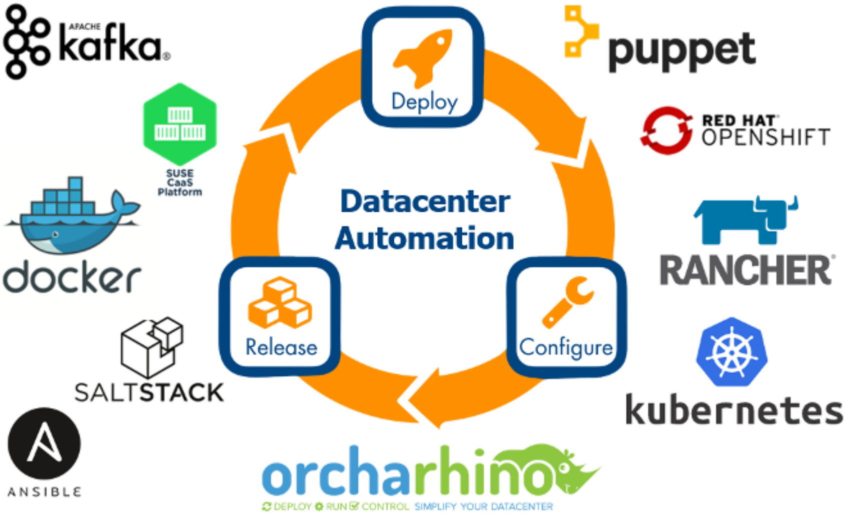

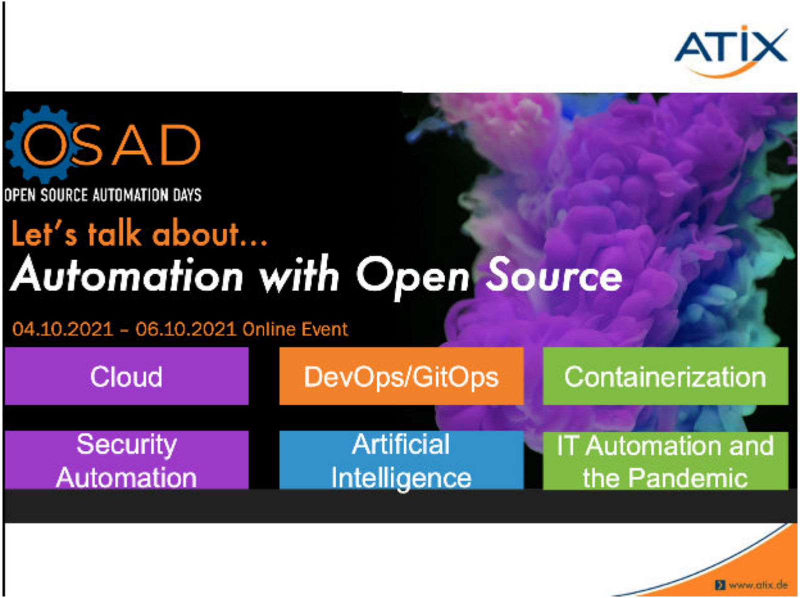

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