

Intro to Containers & Kubernetes

Who am I?

@AnnieTalvasto

Cloud native marketing manager



- Commercial Marketing Manager & Event MC – Microsoft (WT MAP)
- Kubernetes & CNCF meetup co-organizer
- Startup-coach
- Co-host of Cloudgossip podcast - cloudgossip.net

What value do you get by attending this talk?

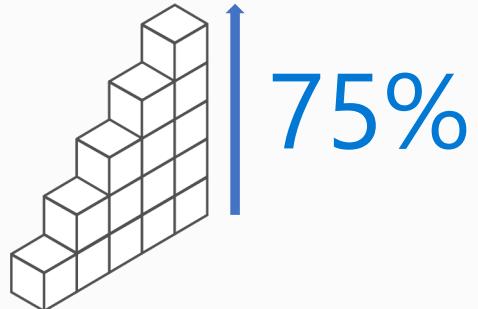
- Learn about one of the most influential technologies in the world

Containers **momentum**

"By 2020, more than **50%** of enterprises will run **mission-critical, containerized cloud-native applications** in production."

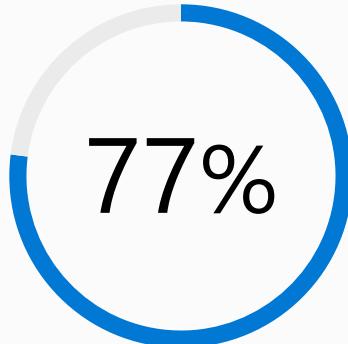
Gartner

The average size of a container deployment has grown 75% in one year.¹



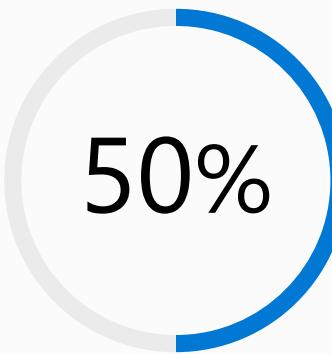
Half of container environment is orchestrated.¹

77% of companies² who use container orchestrators choose Kubernetes.



Larger companies are leading the adoption.¹

Nearly 50% of organizations¹ running 1000 or more hosts have adopted containers.



¹ Datadog report: 8 Surprising Facts About Real Docker Adoption

² CNCF survey: cloud-native-technologies-scaling-production-applications

Expectation management:

- Zero to hero session
- (Hopefully) simple and easy to approach
- Session has three parts:
 - Story & terminology
 - Kubernetes
 - Azure

A story

A team of developers have been preparing for a Demoday, to showcase their new applications to an excited audience. Luckily the team had already finished building their application.

During the evening before the Demoday, they started to prepare the application to be showcased in the demo. This meant moving the application into a server that was located on the second floor of the office. Yet, the size of the application was huge, so the file transfer took all night.

In the morning, half an hour before the demo, the project manager asked for a small change to the application: could the developers change the colour of one of the buttons from blue to green. This wasn't a hard task. The developer was able to make the change in a minute, and he could show the result on his computer to the project manager.

But how could they make the change apply to the server? They had no other solution than to grab a USB stick and start running.

The solution (without sweat & cardio): Containers.

Okay...

- let's go through the terminology
and explore why is it an issue

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In a nutshell:

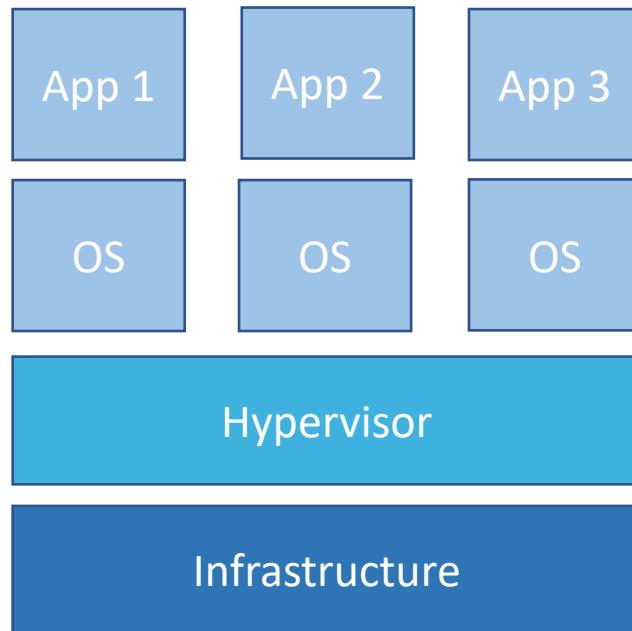
If an application has been built and is used in another system it might not function properly in the new environment

Solution:

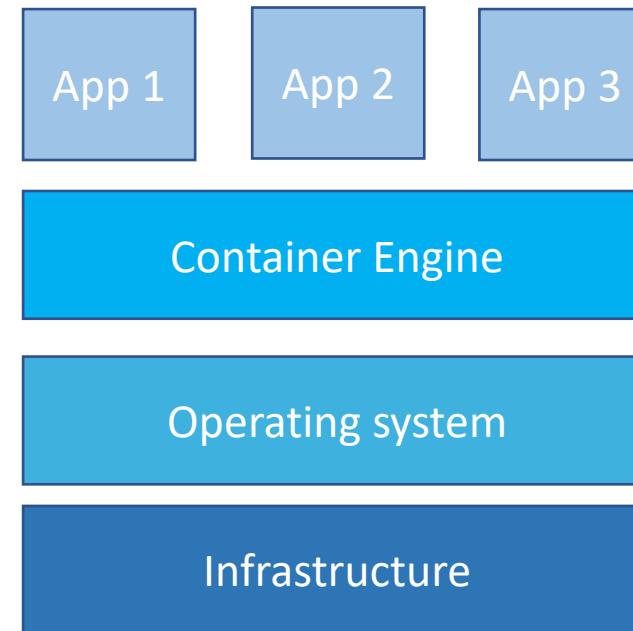
- Virtual machines, and eventually containers

The difference?

Virtual machines

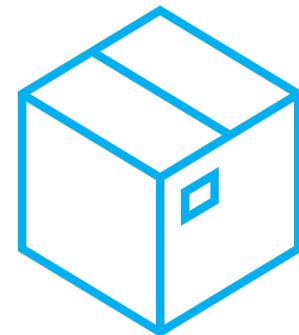


Containers

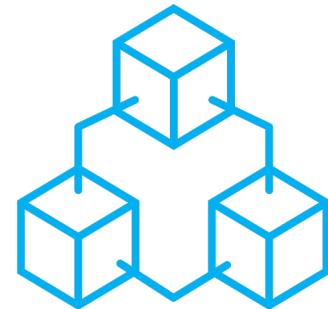


Virtual machines = boxes

Kind of at least



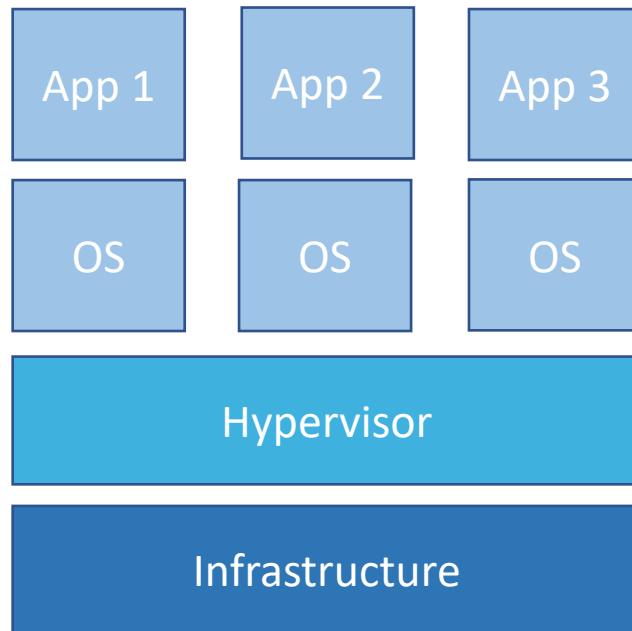
Problem with virtual machines



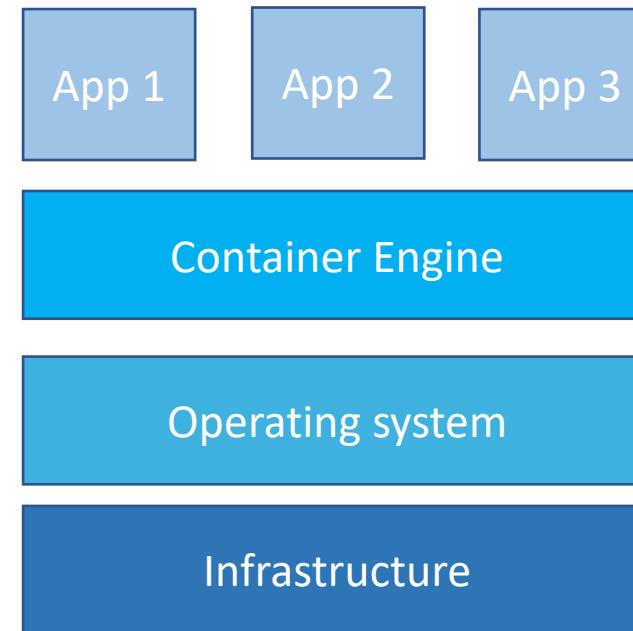
Final solution?
oContainers!

The difference?

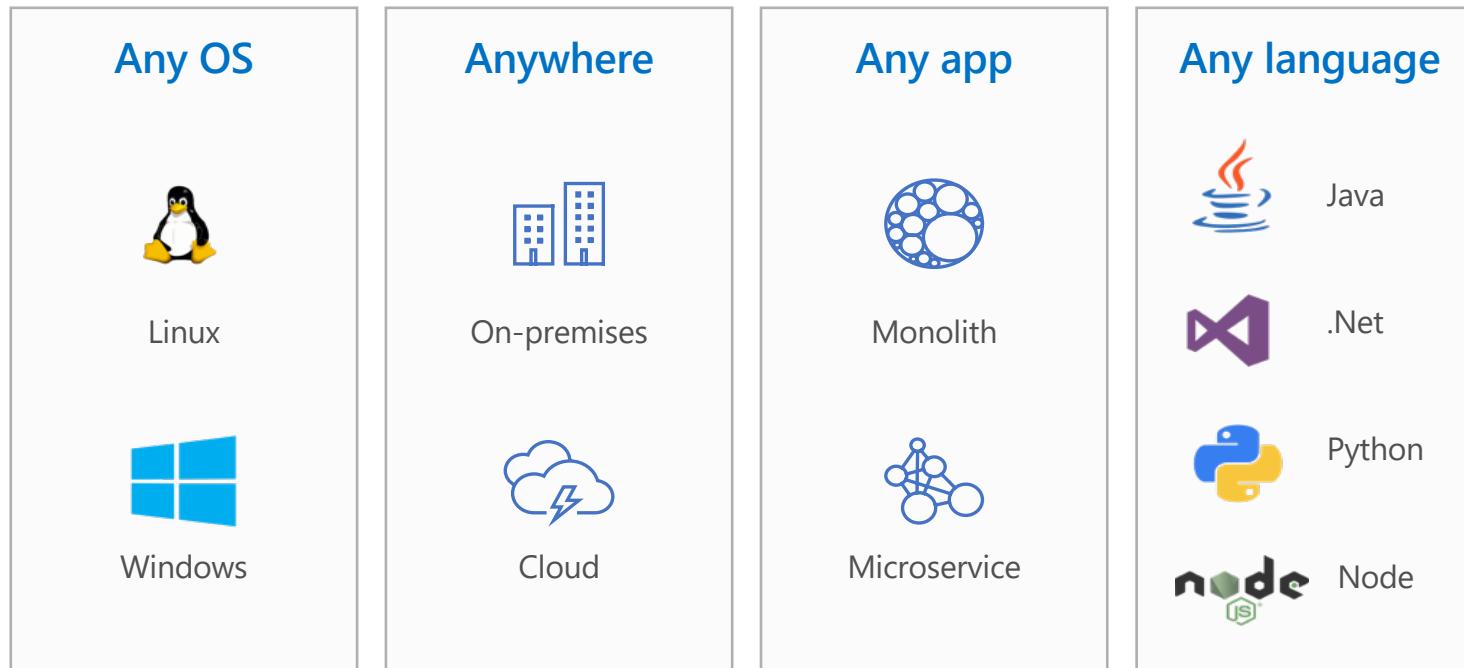
Virtual machines



Containers



The benefits of using containers



What is docker?

An open source container runtime
Mac, Windows and Linux support

```
# The world's simplest Dockerfile
$ cat Dockerfile
FROM scratch
COPY hello /
CMD ["/hello"]

# Let's create a docker image "tagged" hello-world
$ docker build -t hello-world .

# And run it...
$ docker run hello-world
```



kubernetes

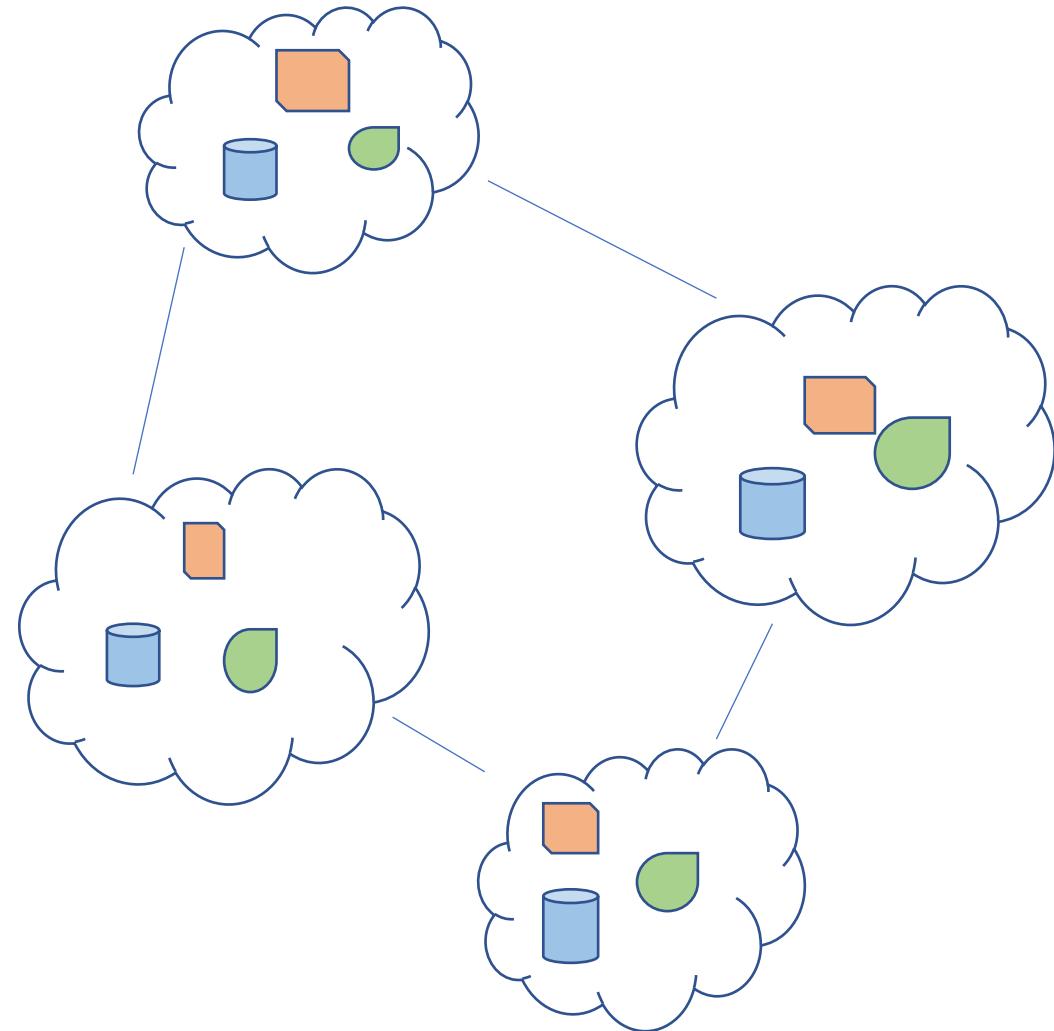
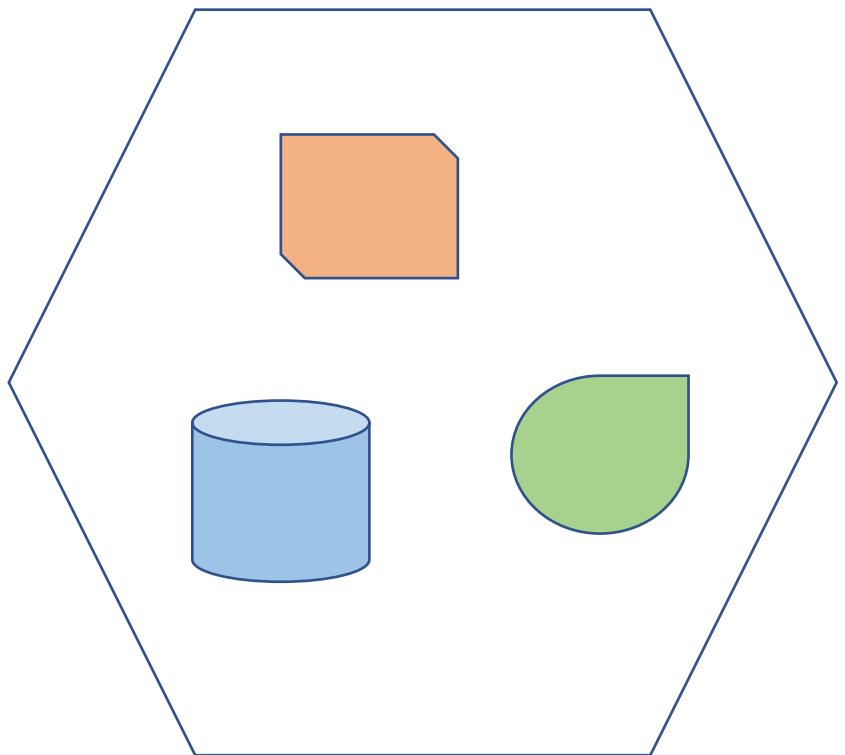


kubernetes

- Open source container orchestration tool
- Developed by Google
- Helps you manage containerized applications

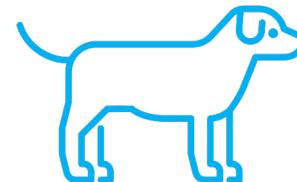
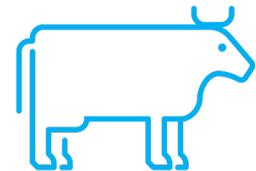
- Rise of microservices & increased use of containers

Monolith vs Microservice

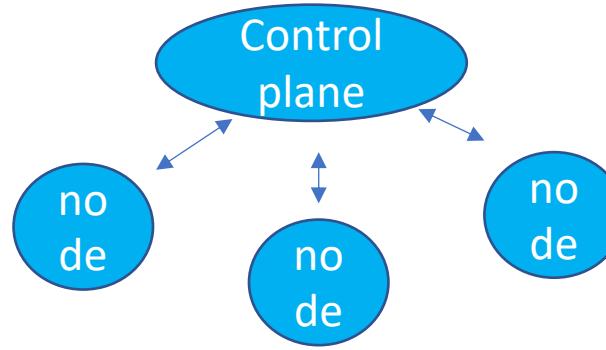


Kubernetes is an orchestration tool

- High availability or no downtime
- Scalability or high performance
- Disaster recovery – backup and restore
- Cattle vs pet



Basic architecture



- Control plane
- Node
 - Each node have docker containers – that is where the work is happening
- Control plane runs the cluster, and it includes:
 - API server – entrypoint to cluster
 - Controller manager – keeps track of what is happening
 - Scheduler – ensures Pod placement
 - Etcd – Kubernetes backing store
- Virtual network between the control plane & node

Pods, containers services

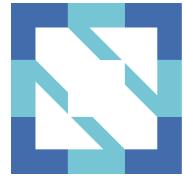
- Pod is the smallest unit to work with
- Each pod has IP address
- Each pod is it's own contained server
- Pod manages the containers inside itself, we only manage the pod
- Services & pods

Kubernetes / Helm Demo:

Easily deploy complex
application (WordPress) to
Kubernetes using a helm chart

Open source software

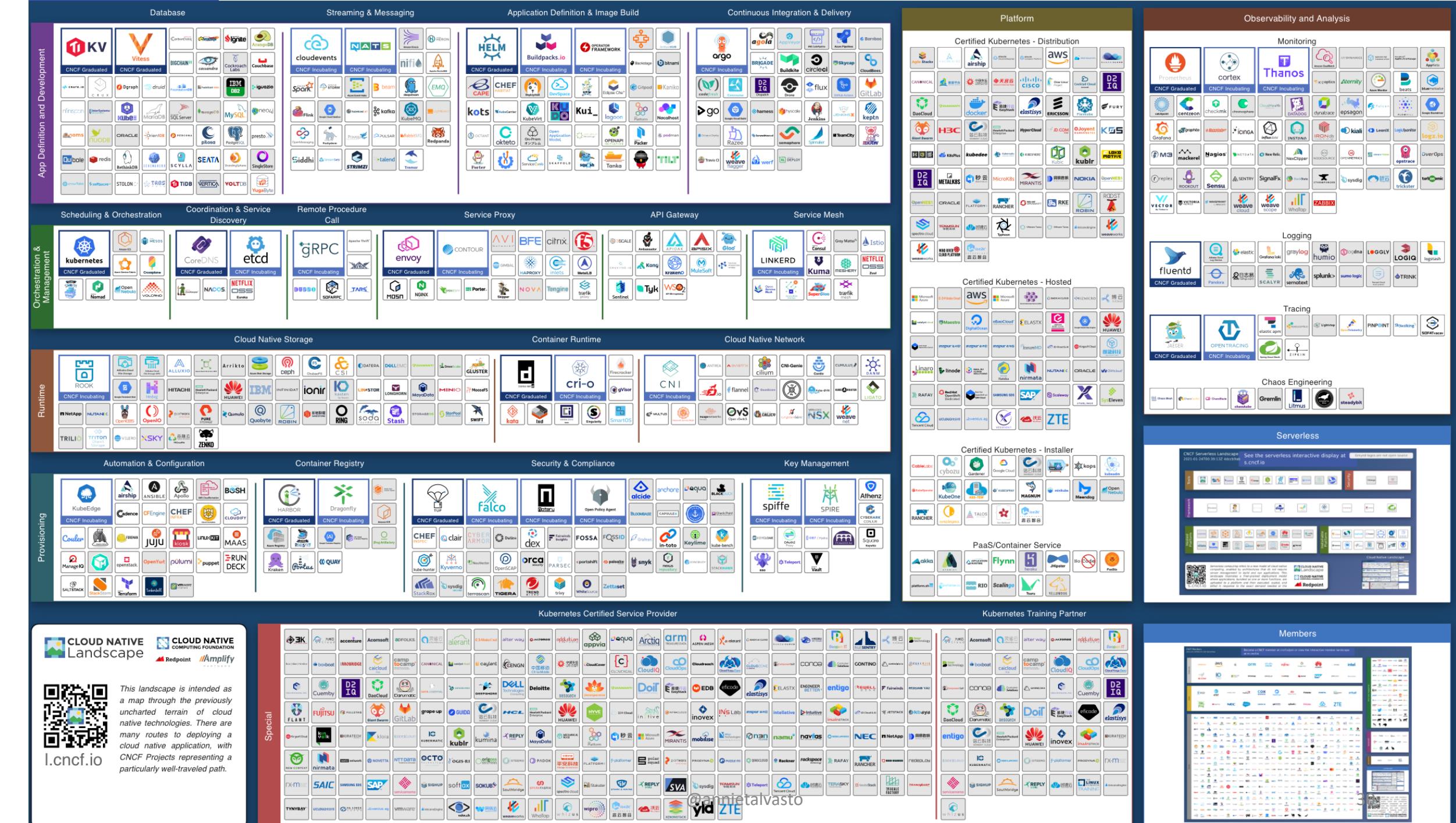
- Fundamentally: the code is available to all users to copy, modify or use in almost any way they like.
- Communities build things
- Kubernetes is built together



**CLOUD NATIVE
COMPUTING FOUNDATION**

Building sustainable ecosystems for cloud native software

The Cloud Native Computing Foundation (CNCF) hosts critical components of the global technology infrastructure. CNCF brings together the world's top developers, end users, and vendors and runs the largest open source developer conferences. CNCF is part of the nonprofit Linux Foundation.



CNCF helps you along the way



CLOUD NATIVE TRAIL MAP

The Cloud Native Landscape <https://cncf.io/> has a large number of options. This Cloud Native Trail Map is a recommended process for leveraging open source, cloud native technologies. At each step, you can choose a vendor-supported offering or do it yourself, and everything after step #3 is optional based on your circumstances.

HELP ALONG THE WAY

A. Training and Certification

Consider training offerings from CNCF and then take the exam to become a Certified Kubernetes Administrator or a Certified Kubernetes Application Developer cncf.io/training

B. Consulting Help

If you want assistance with Kubernetes and the surrounding ecosystem, consider leveraging a Kubernetes Certified Service Provider cncf.io/kcsp

C. Join CNCF's End User Community

For companies that don't offer cloud native services externally cncf.io/enduser

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.

These techniques enable loosely coupled systems that are resilient, manageable, and observable. Combined with robust automation, they allow engineers to make high-impact changes frequently and predictably with minimal toil.

The Cloud Native Computing Foundation seeks to drive adoption of this paradigm by fostering and sustaining an ecosystem of open source, vendor-neutral projects. We democratize state-of-the-art patterns to make these innovations accessible for everyone.

<https://cncf.io>

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1. CONTAINERIZATION

- Commonly done with Docker containers
- Any size application and dependencies (even PDP-11 code running on an emulator) can be containerized
- Over time, you should aspire towards splitting suitable applications and writing future functionality as microservices



3. ORCHESTRATION & APPLICATION DEFINITION

- Kubernetes is the market-leading orchestration solution
- You should select a Certified Kubernetes Distribution, Hosted Platform, or Installer: cncf.io/cck
- Helm Charts help you define, install, and upgrade even the most complex Kubernetes application



5. SERVICE PROXY, DISCOVERY, & MESH

- CoreDNS is a fast and flexible tool that is useful for service discovery
- Envoy and Linkerd each enable service mesh architectures
- They offer health checking, routing, and load balancing



7. DISTRIBUTED DATABASE & STORAGE

When you need more resiliency and scalability than you can get from a single database, Vitess is a good option for running MySQL at scale through sharding. Rook is a storage orchestrator that integrates a diverse set of storage solutions into Kubernetes. Serving as the 'brain' of Kubernetes, etcd provides a reliable way to store data across a cluster of machines. TiKV is a high performant distributed transactional key-value store written in Rust.



9. CONTAINER REGISTRY & RUNTIME

Harbor is a registry that stores, signs, and scans content. You can use alternative container runtimes. The most common, both of which are OCI-compliant, are containerd and CRI-O.



2. CI/CD

- Setup Continuous Integration/Continuous Delivery (CI/CD) so that changes to your source code automatically result in a new container being built, tested, and deployed to staging and eventually, perhaps, to production
- Set up automated rollouts, roll backs and testing
- Argo is a set of Kubernetes-native tools for deploying and running jobs, applications, workflows, and events using GitOps paradigms such as continuous and progressive delivery and MLOps



4. OBSERVABILITY & ANALYSIS

- Pick solutions for monitoring, logging and tracing
- Consider CNCF projects Prometheus for monitoring, Fluentd for logging and Jaeger for Tracing
- For tracing, look for an OpenTracing-compatible implementation like Jaeger



6. NETWORKING, POLICY, & SECURITY

To enable more flexible networking, use a CNI-compliant network project like Calico, Flannel, or Weave Net. Open Policy Agent (OPA) is a general-purpose policy engine with uses ranging from authorization and admission control to data filtering. Falco is an anomaly detection engine for cloud native.



8. STREAMING & MESSAGING

When you need higher performance than JSON-REST, consider using gRPC or NATS. gRPC is a universal RPC framework. NATS is a multi-modal messaging system that includes request/reply, pub/sub and load balanced queues. CloudEvents is a specification for describing event data in common ways.

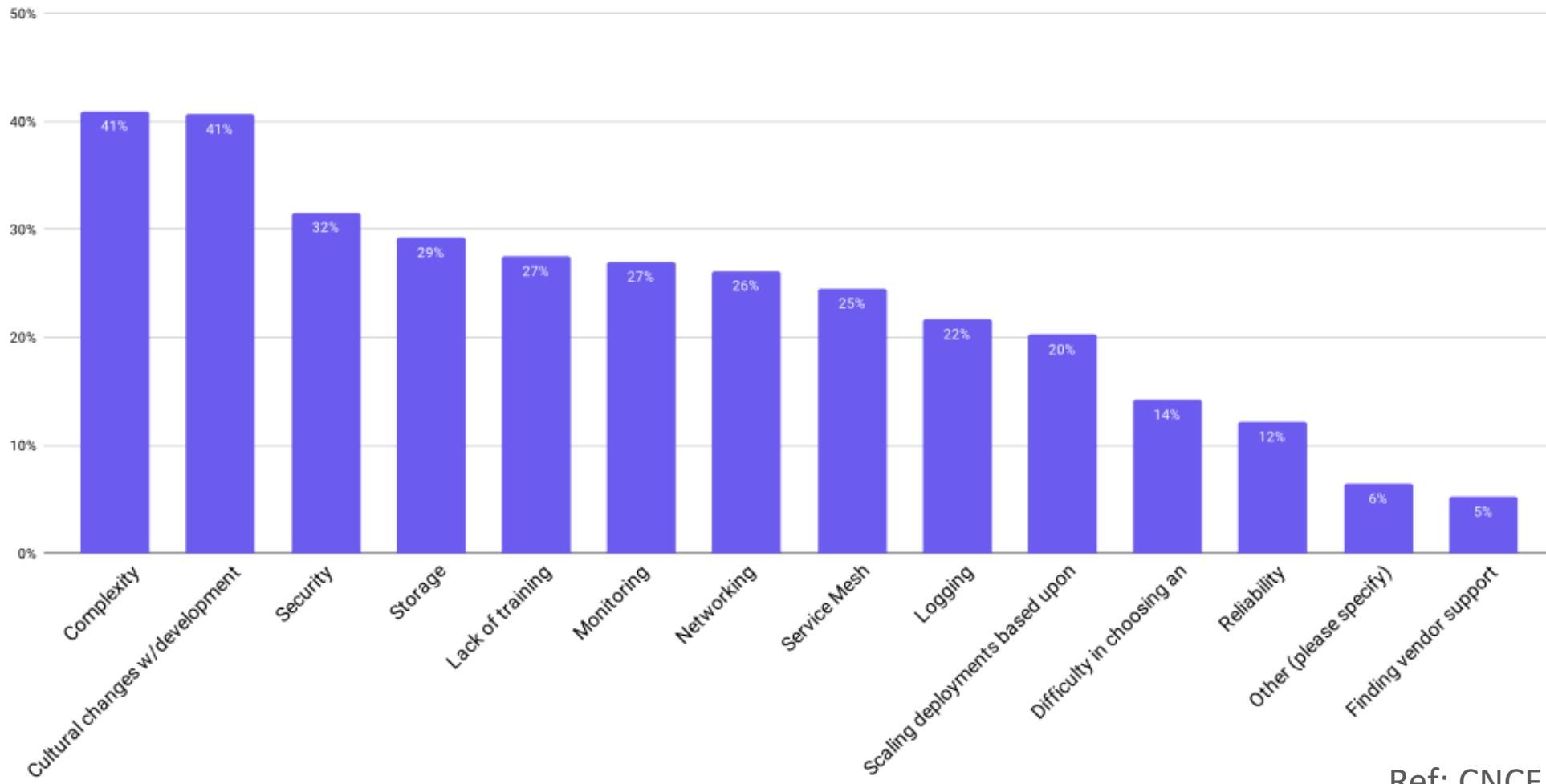


10. SOFTWARE DISTRIBUTION

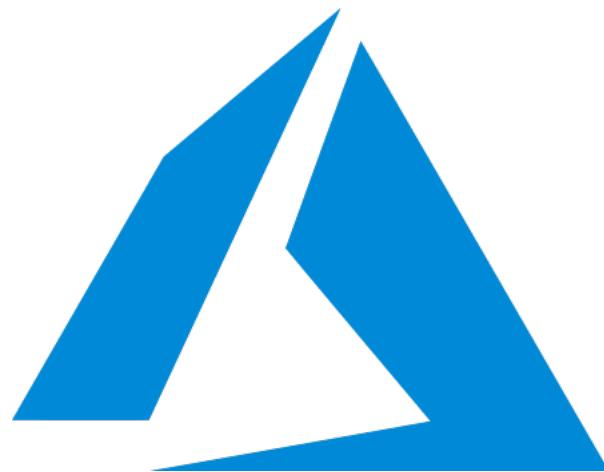
If you need to do secure software distribution, evaluate Notary, an implementation of The Update Framework.



What are your challenges in using/deploying containers? Please select all that apply



Ref: CNCF 2020 Survey



Azure



Azure Kubernetes
Service (AKS)



App Service



Azure Container
Instances (ACI)



Service Fabric



Azure Batch



Azure Container
Registry (ACR)

Azure Kubernetes Service (AKS)

Simplify the deployment, management, and operations of Kubernetes



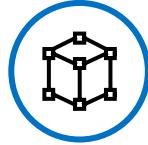
Deploy and
manage Kubernetes
with ease



Scale and run
applications with
confidence



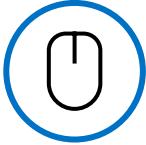
Secure your
Kubernetes
environment



Accelerate
containerized application
development



Work how you want
with open-source
tools & APIs



Set up
CI/CD in a
few clicks



Azure Kubernetes
Service (AKS)



App Service



Azure Container
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Service Fabric



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App Service

Easily deploy and run container-based web apps at scale

Accelerated outer loop



Tight integration w/ Docker Hub, Azure Container Registry

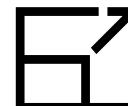


Built-in CI/CD w/
Deployment Slots



Intelligent diagnostics &
troubleshooting, remote debugging

Fully managed platform



Automatic scaling
and load balancing



High availability
w/ auto-patching

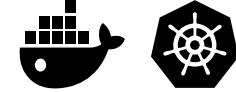


Backup &
recovery

Flexibility & choices



From CLI, portal, or
ARM template



Single Docker image, multi
container w/ Docker Compose



IntelliJ, Jenkins, Maven
Visual Studio family



Azure Kubernetes
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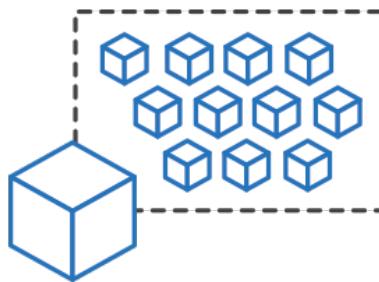
Azure Batch



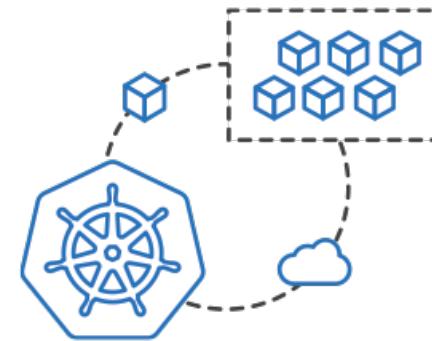
Azure Container
Registry (ACR)

Azure Container Instances (ACI)

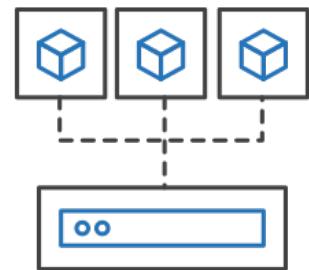
Easily run containers on Azure without managing servers



Run containers
without managing
servers



Increase agility
with containers on
demand



Secure applications
with hypervisor
isolation



Azure Kubernetes
Service (AKS)



App Service



Azure Container
Instances (ACI)



Service Fabric



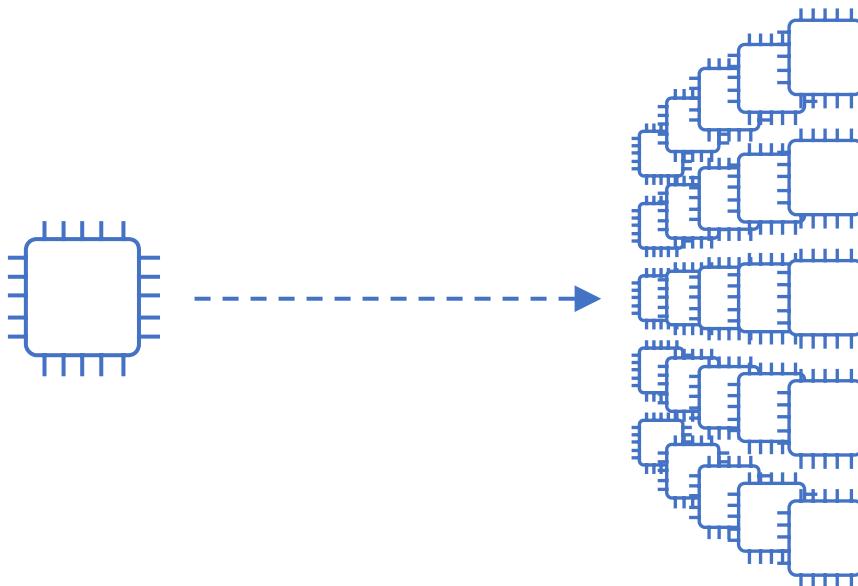
Azure Batch



Azure Container
Registry (ACR)

Azure Batch

Run repetitive compute jobs using containers



Enable applications and algorithms to easily and efficiently run in parallel at scale.

Run Batch tasks without having to manage an environment and dependencies.

Package, execute, and scale your High Performance Computing applications and batch workloads in a consistent, reproducible manner.



Azure Kubernetes
Service (AKS)



App Service



Azure Container
Instances (ACI)



Service Fabric



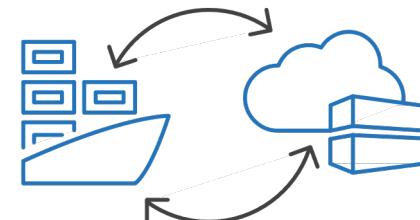
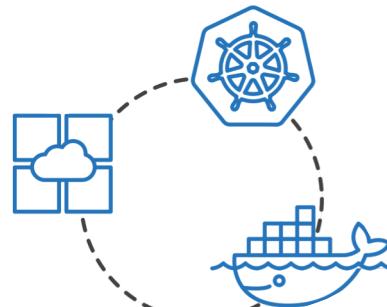
Azure Batch



Azure Container
Registry (ACR)

Azure Container Registry (ACR)

Manage a Docker private registry as a first-class Azure resource

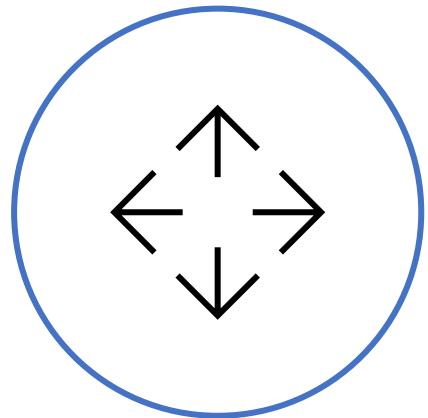


Manage images for all
types of containers

Use familiar, open-
source Docker CLI tools

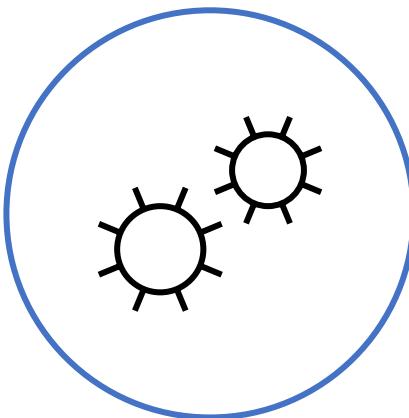
Azure Container Registry
geo-replication

Containers on Azure



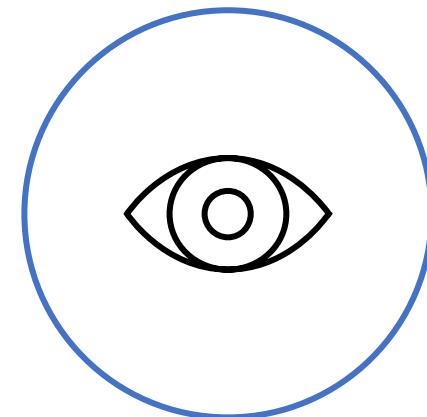
Flexibility

Deploy containerized applications in your **preferred environment**



Productivity

Accelerate containerized application development



Trust

Manage, monitor, and help secure your containers

Learn more

- Azure Virtual Training Days – aka.ms/TrainingDaysFI
- Mimmit Koodaa webinar & workshop
- CNCF survey -<https://www.cncf.io/blog/2020/11/17/cloud-native-survey-2020-containers-in-production-jump-300-from-our-first-survey/>
- Cncf youtube - <https://www.youtube.com/channel/UCvqbFHwN-nwalWPjPUKpvTA>
- Techworld with Nana - <https://www.youtube.com/channel/UCdngmbVKX1Tgre699-XLIUA>
- Links and slides: aka.ms/anniematerials



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Cloud Gossip

Evolution of DevOps with Martyn Coupland

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Cloud Gossip

Cloud Gossip is a cloud technology podcast. The first season of Cloud Gossip explains and helps people to understand the underlying terms, technologies & concepts that might be foreign in the cloud world. The second season delves deeper into the technology and features interviews with top industry experts. Hosted by Annie Talvasto & Karl Ots.

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Evolution of DevOps with Martyn Coupland

Today's guest on Cloud Gossip is Martyn Coupland! Martyn works as Principal Solution Architect at Ensono, and he's an Azure MVP and DevOps Ambassador at DevOps Institute. Martyn is going to talk about his role at Ensono and wha...

MARCH 8TH, 2021 | 57:34 | S2:E6

One thing to take away

Got questions later?
@annietalvasto

