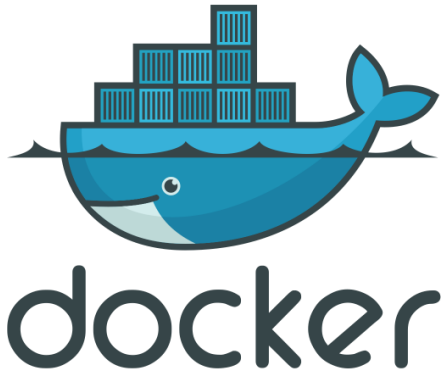

# Azure Container Hackfest

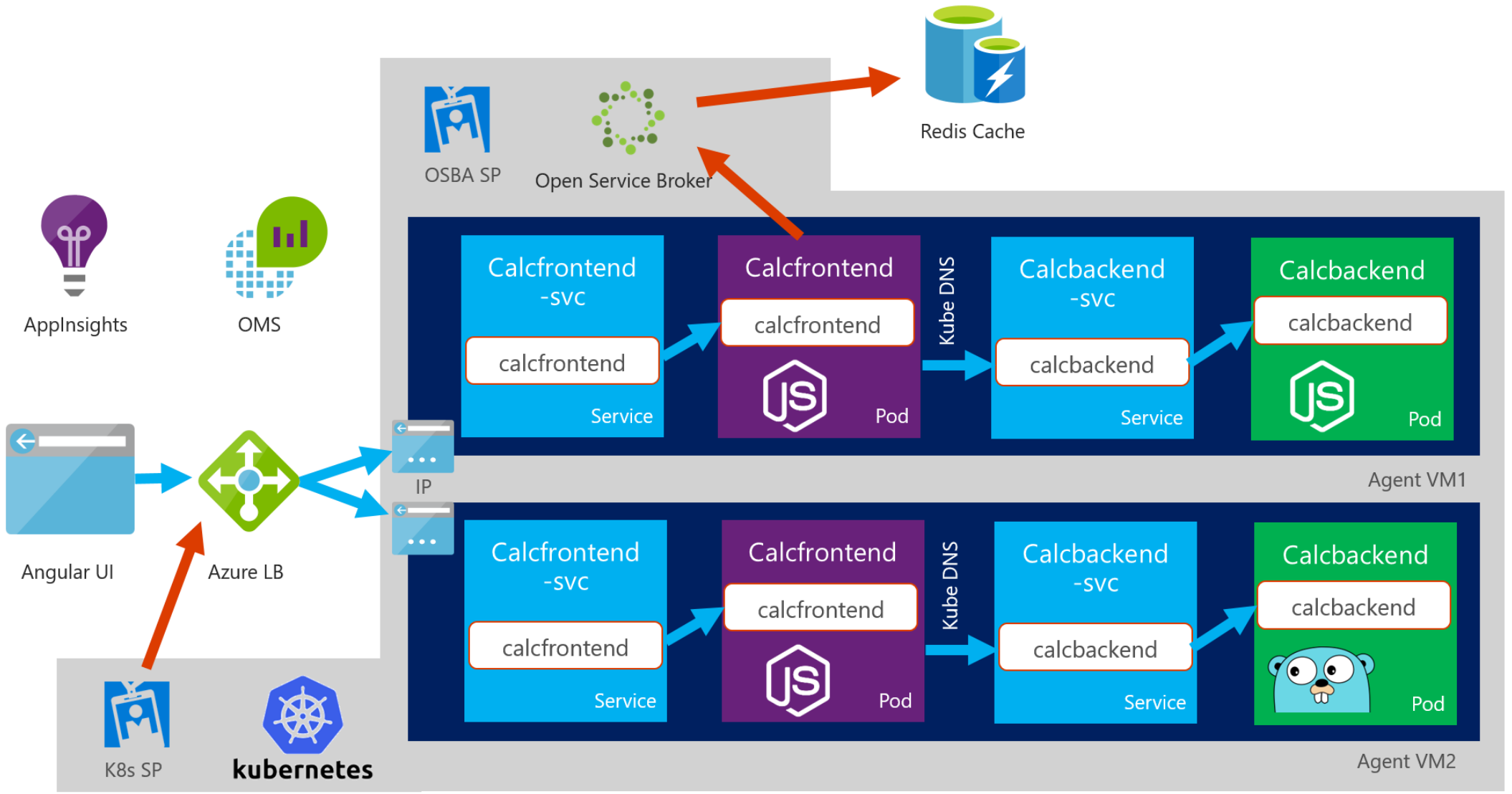
*Delivering modern cloud native applications with open source technologies on Azure*

# What we are going to learn today…



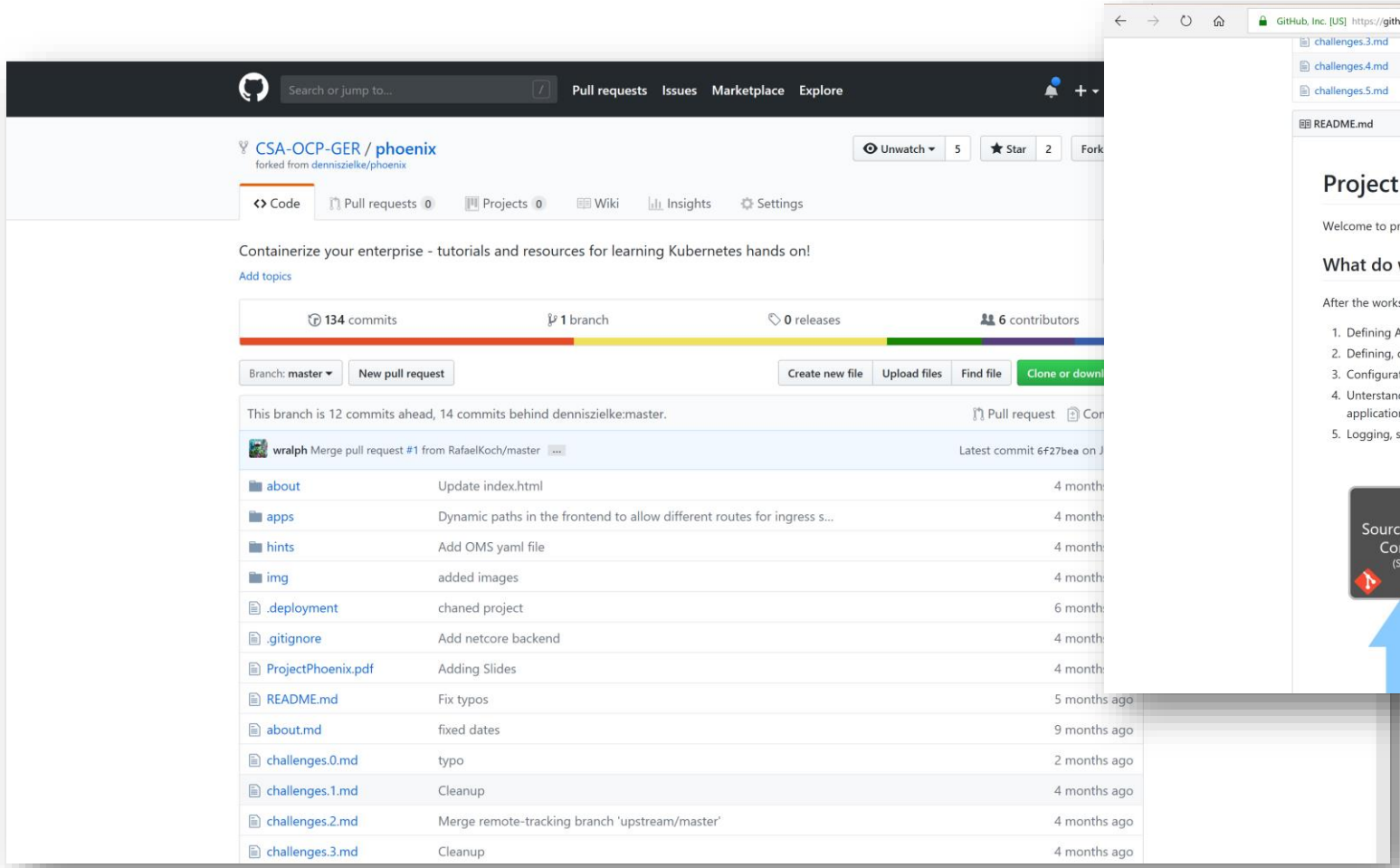

- Local container development / Docker 101
- Single container applications (on Azure)
- Multi container applications / Orchestration with Kubernets (AKS)
- DevOps: Continuous Integration & Contiuous Deployment with VST
- Networking / Ingress / Monitoring
- Application Packaging / Helm
- Open Service Broker for Azure

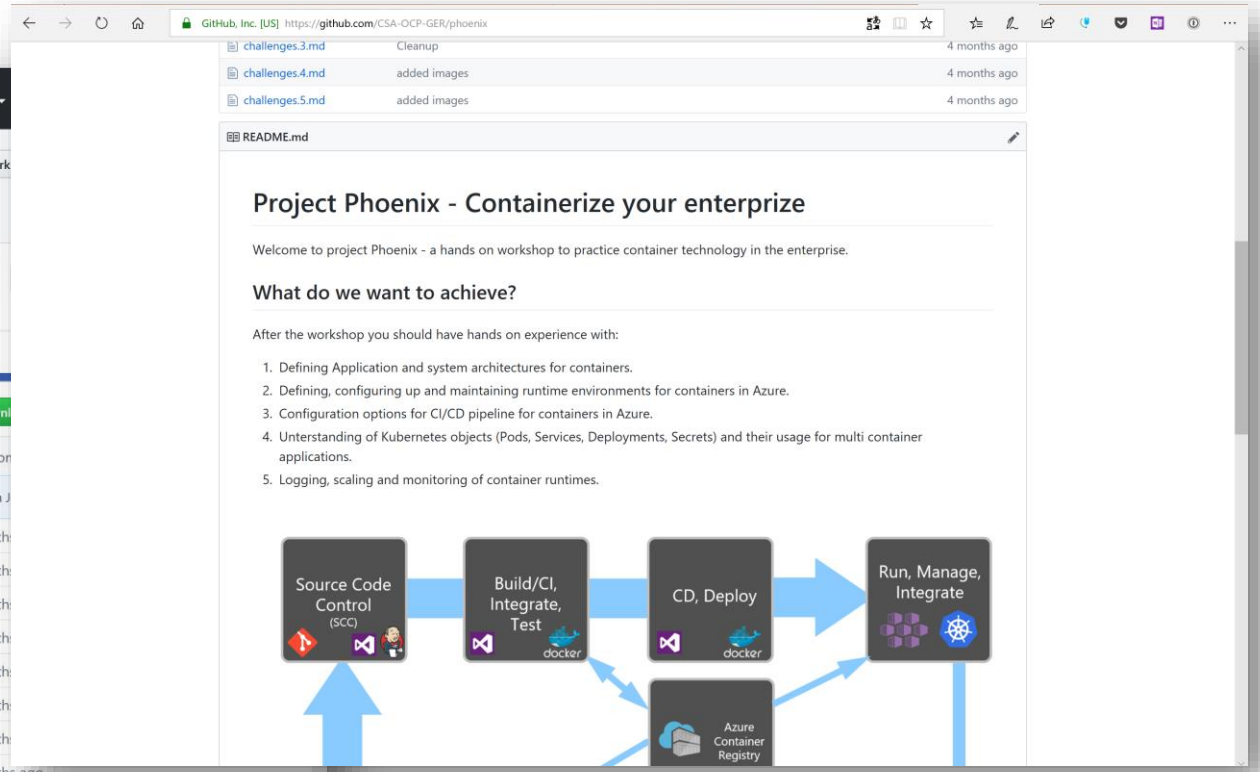
# What we are going to build today…



# Where to find everything…?

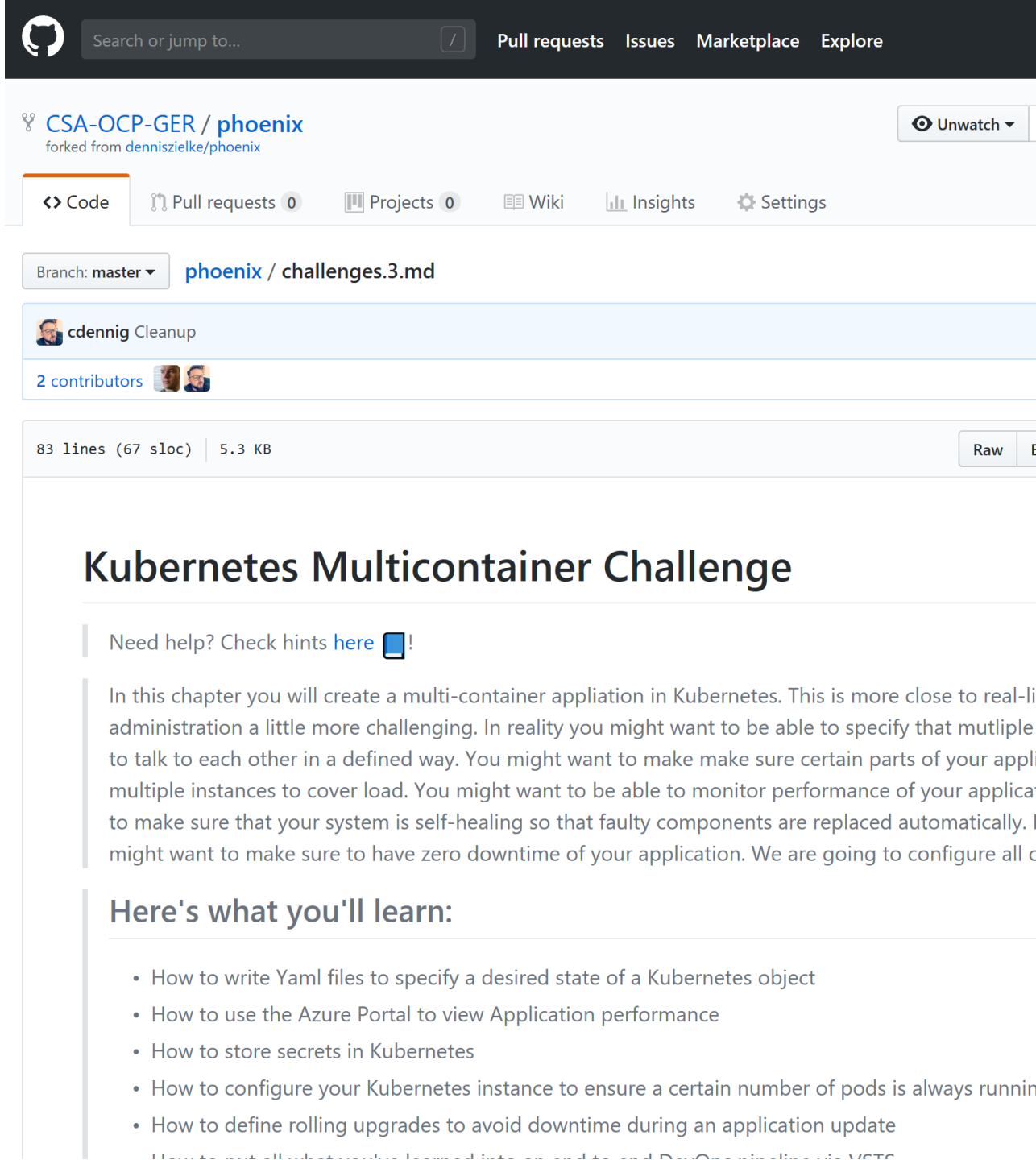
https://github.com/CSA-OCP-GER/phoenix



# Challenges

- Setup your system
- Single Loop Challenge
- Kubernetes 101
- Kubernetes Multi-Container
- Operations and Application Insights
- Integration



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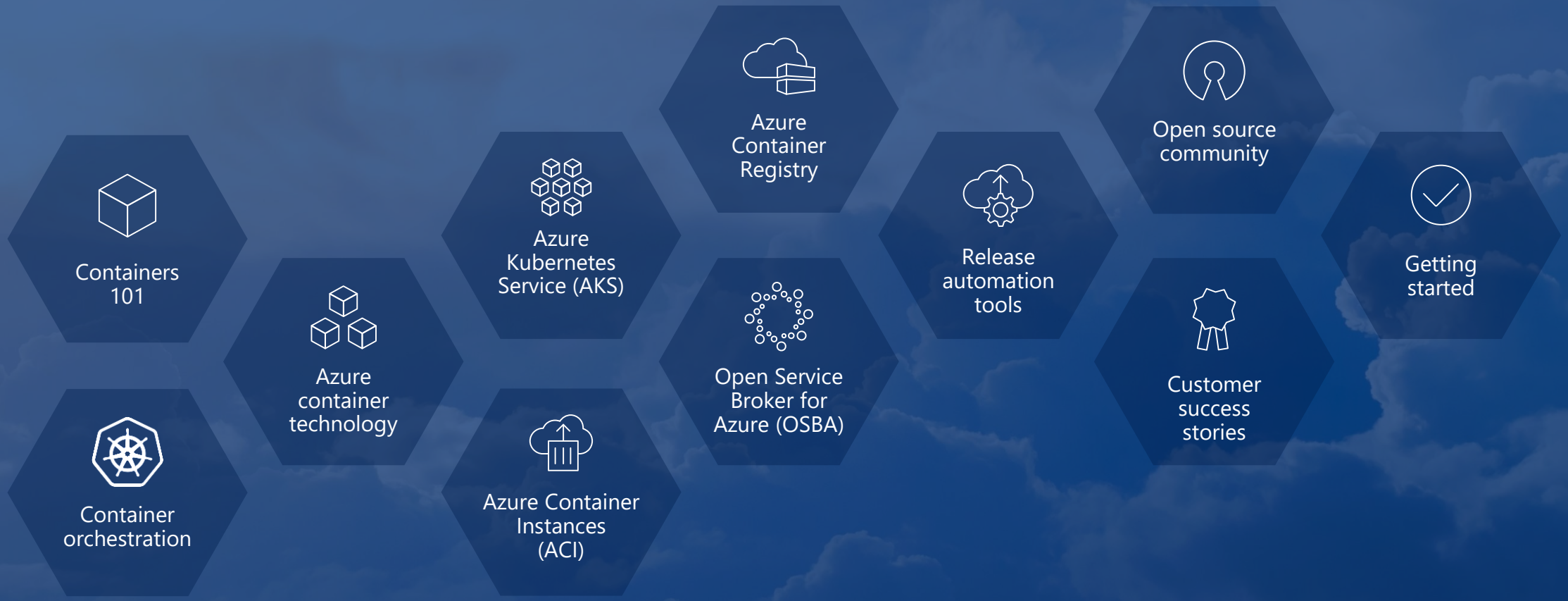
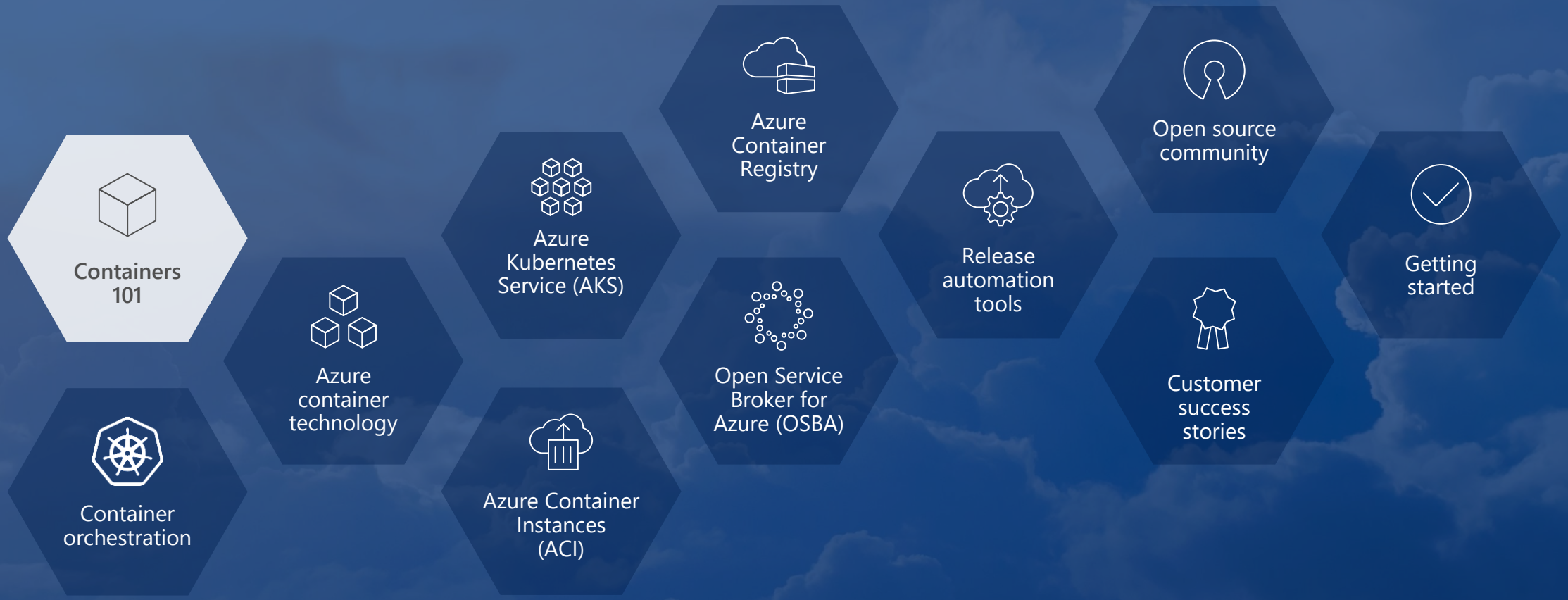


# Containers 101



# Why should customers care about **containers** and **microservices**?

In reality, they shouldn’t…

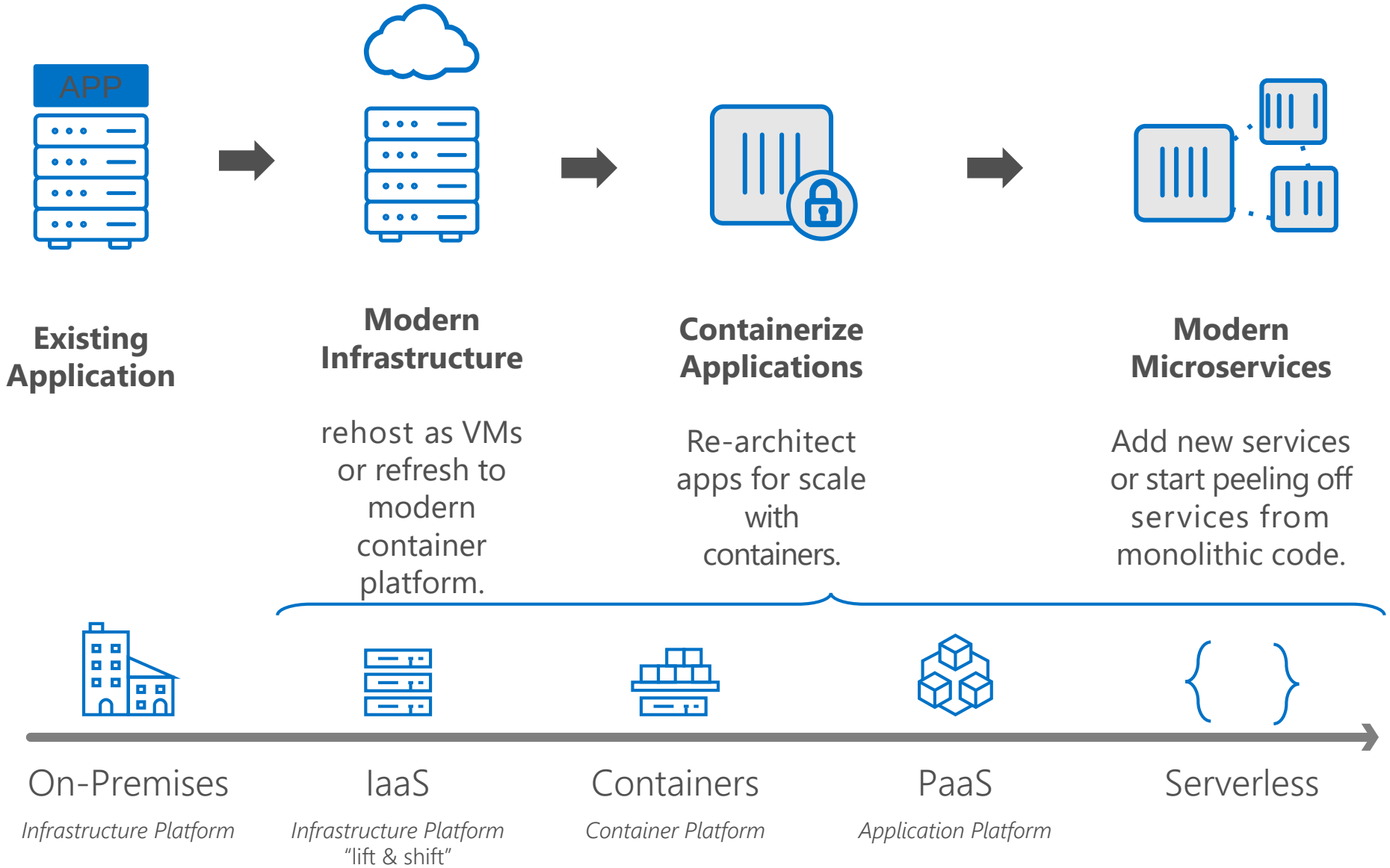
# They do care about cloud native applications

"Unlimited" Scale

Global reach

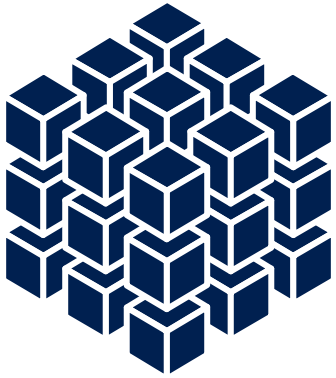
Rapid innovation -
> time to market

# From traditional app to modern app



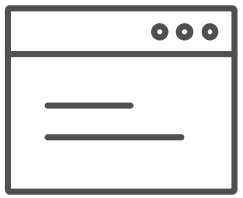
# Microservices ≠ Containers

"Microservices" is an architectural design approach



Containers are an implementation detail that often helps

# What we hear from **developers**



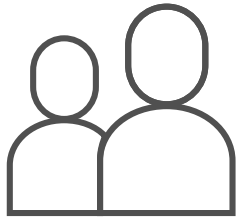
I need to create applications at a competitive rate without worrying about IT

New applications run smoothly on my machine but malfunction on traditional IT servers

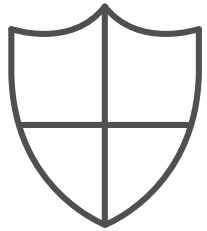
My productivity and application innovation become suspended when I have to wait on IT

# What we hear from **IT**

I need to manage servers and maintain compliance with little disruption



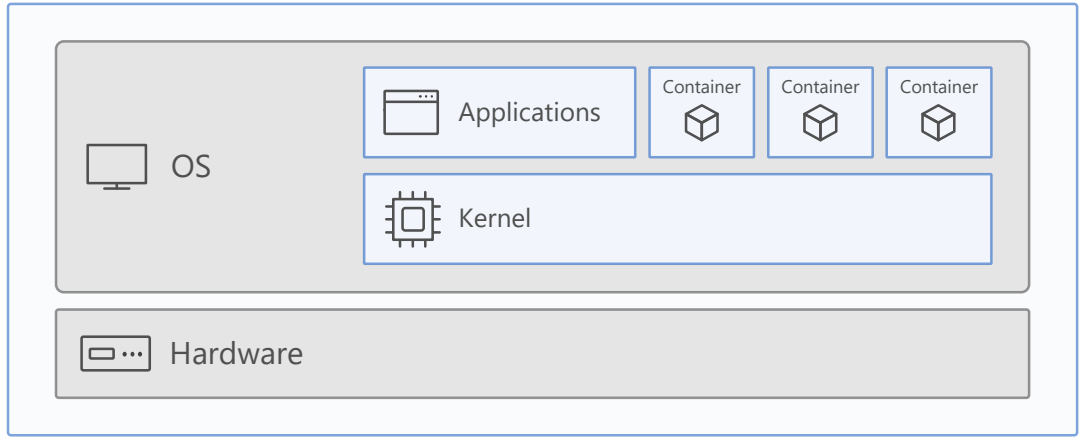
I'm unsure of how to integrate unfamiliar applications, and I require help from developers



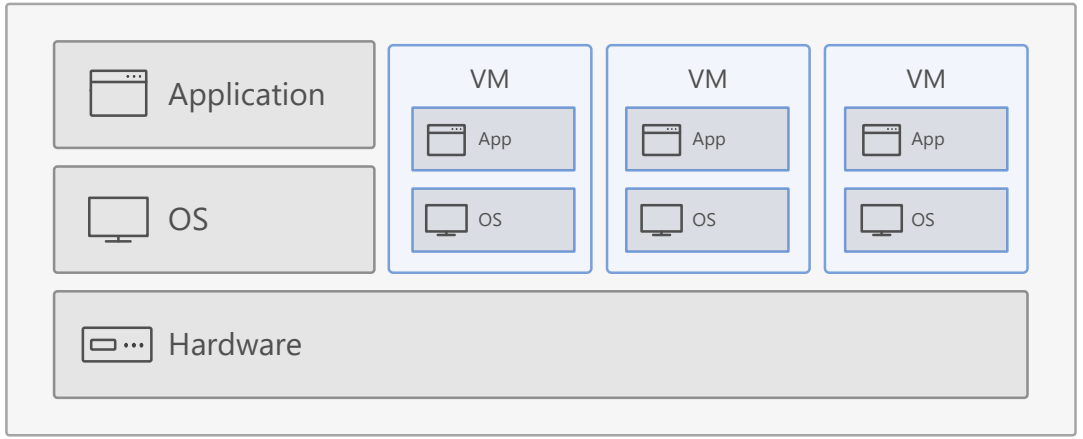
I'm unable to focus on both server protection and application compliance

# What is a **container**?

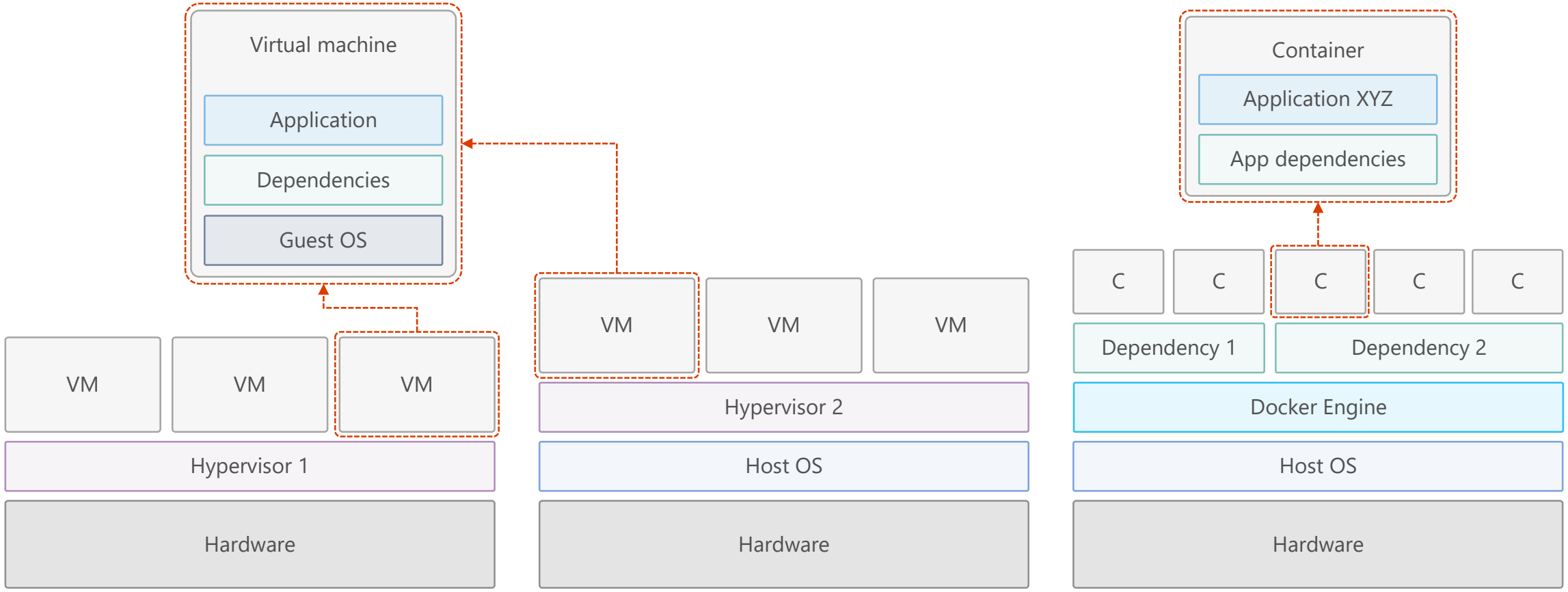
**Containers** = operating system virtualization




Traditional virtual machines = hardware virtualization



# Virtualization versus **containerization**

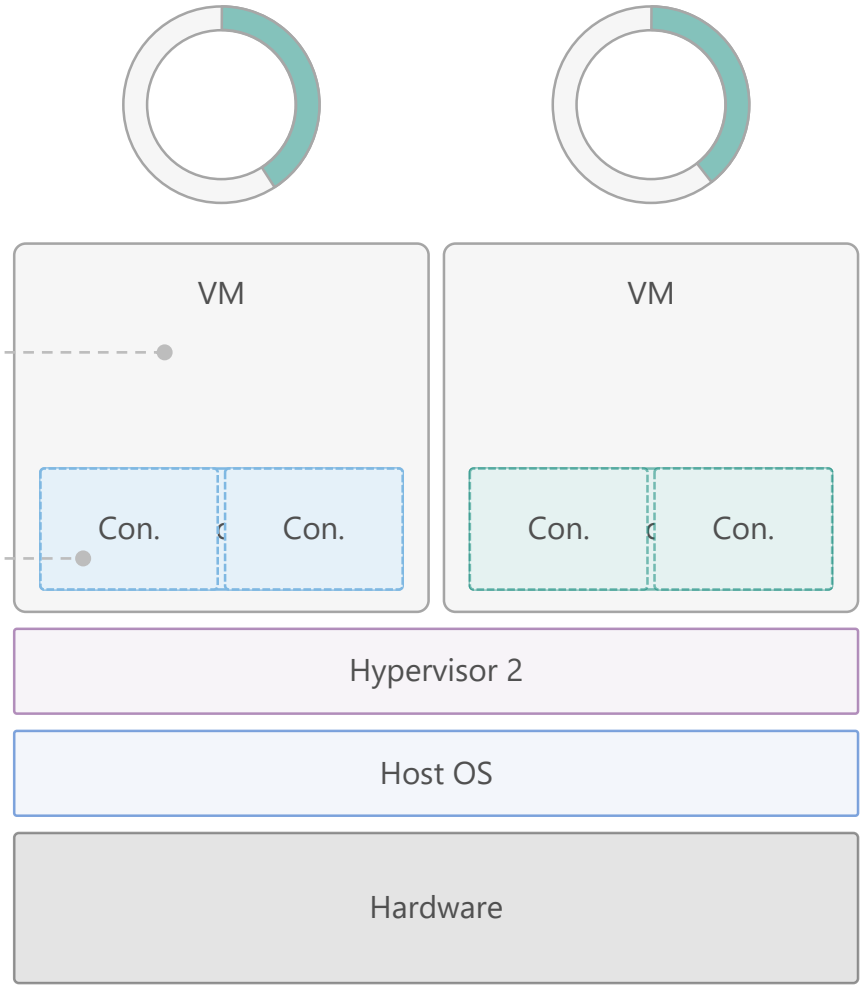


# The container **advantage**

## Traditional virtualized environment

Low utilization of container resources

Containerization of applications and their dependencies

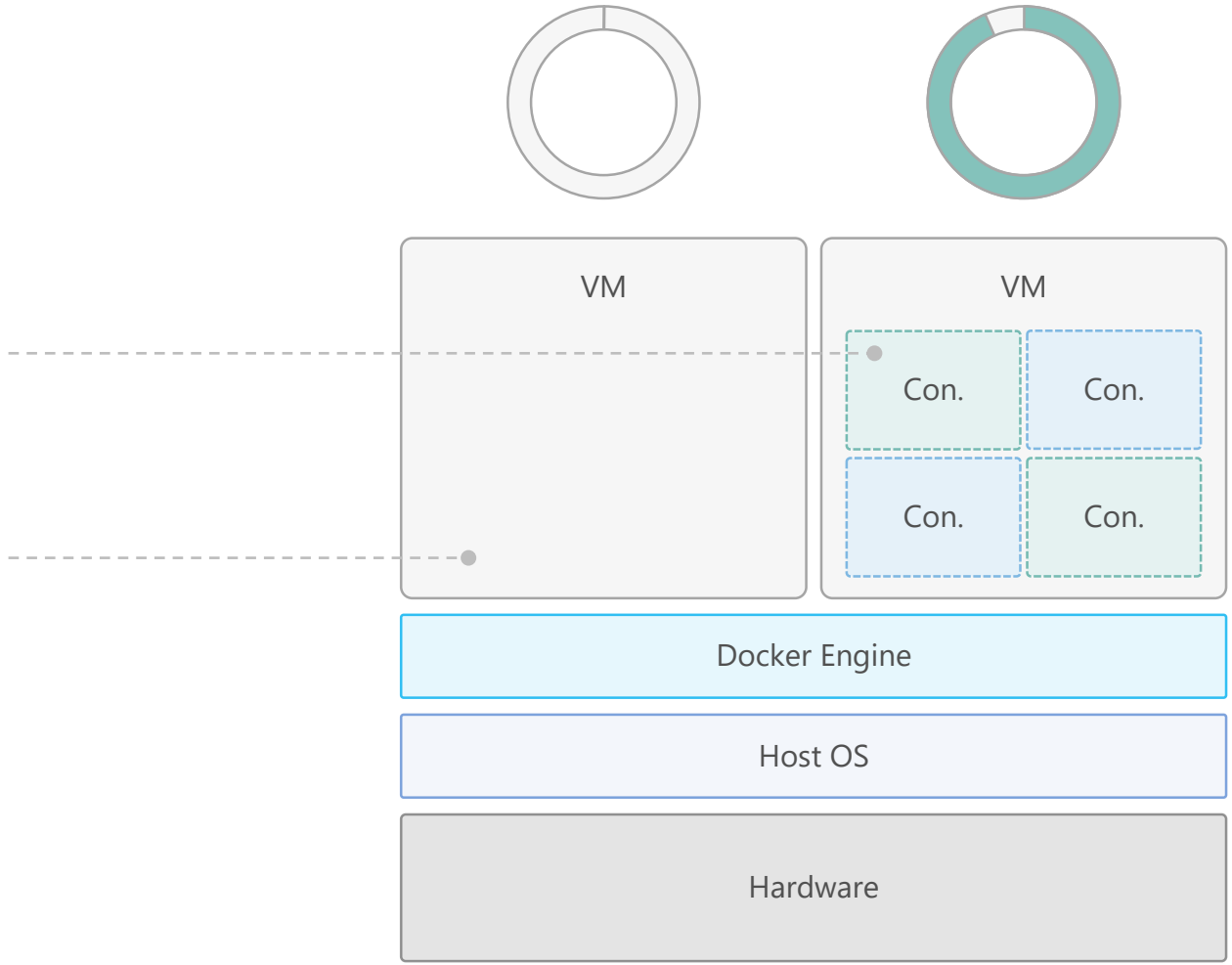


# The container **advantage**

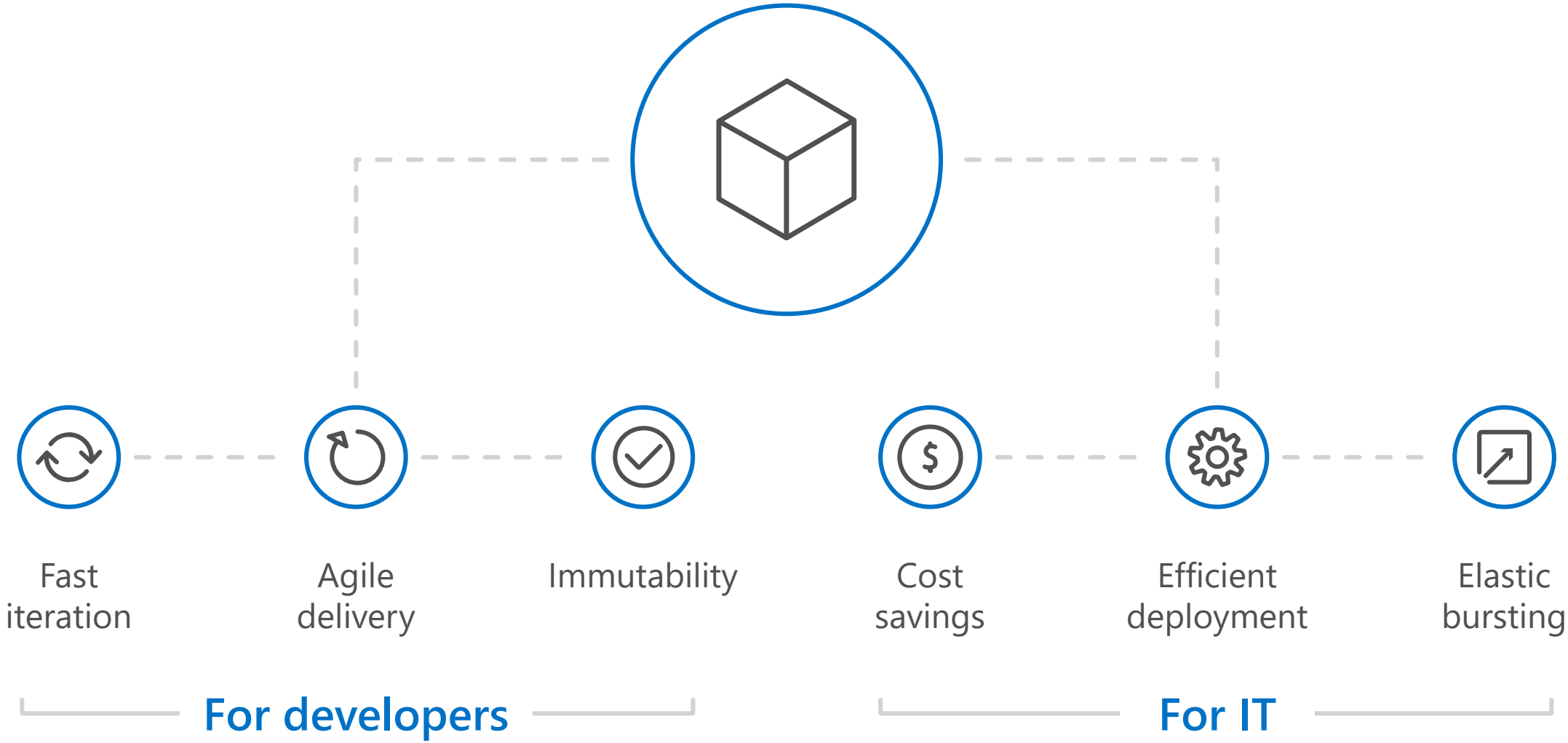
## Containerized environment

Migrate containers and their dependencies to underutilized VMs for improved density and isolation

Decommission unused resources for efficiency gains and cost savings



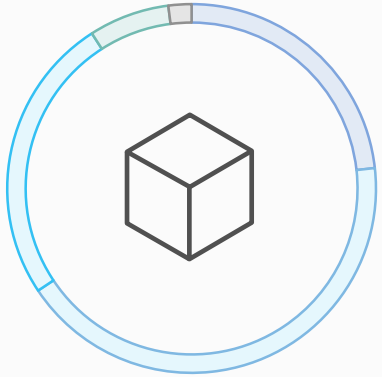
# The container **advantage**



# Containers are gaining **momentum**

## Does your organization currently use container technologies?[1]

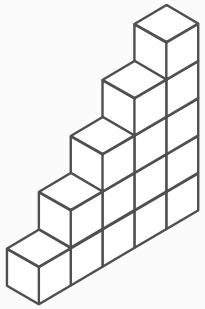
- 23% My org. is **evaluating** container technologies
- 42% **Yes**, my org. currently uses container technologies
- 25% **No**, my org. is not using container technologies
- 7% **Not sure**
- 2% **Not applicable**



## Larger companies are leading adoption.[2]

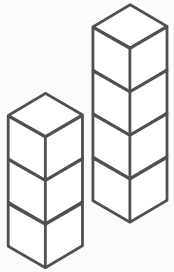
Nearly **60% percent** of organizations running 500 or more hosts are classified as **container dabblers** or adopters.


## The average company QUINTUPLES its container usage within 9 months.[1]



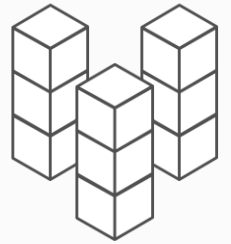
5X

## Container hosts often run SEVEN containers at a time.[1]



7X

## Containers churn 9 times FASTER than VMs.[1]

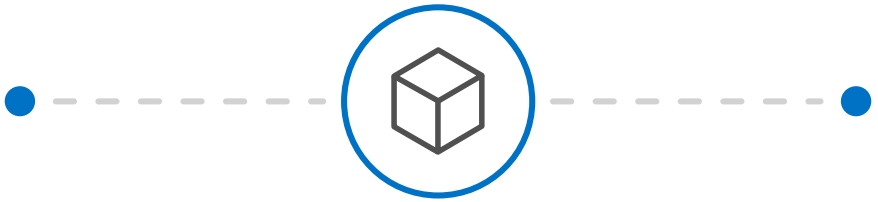


9X

Source:

1: Datadog: 8 Surprising Facts About Real Docker Adoption; 2: DZone: The DZone Guide to Deploying and Orchestrating Containers

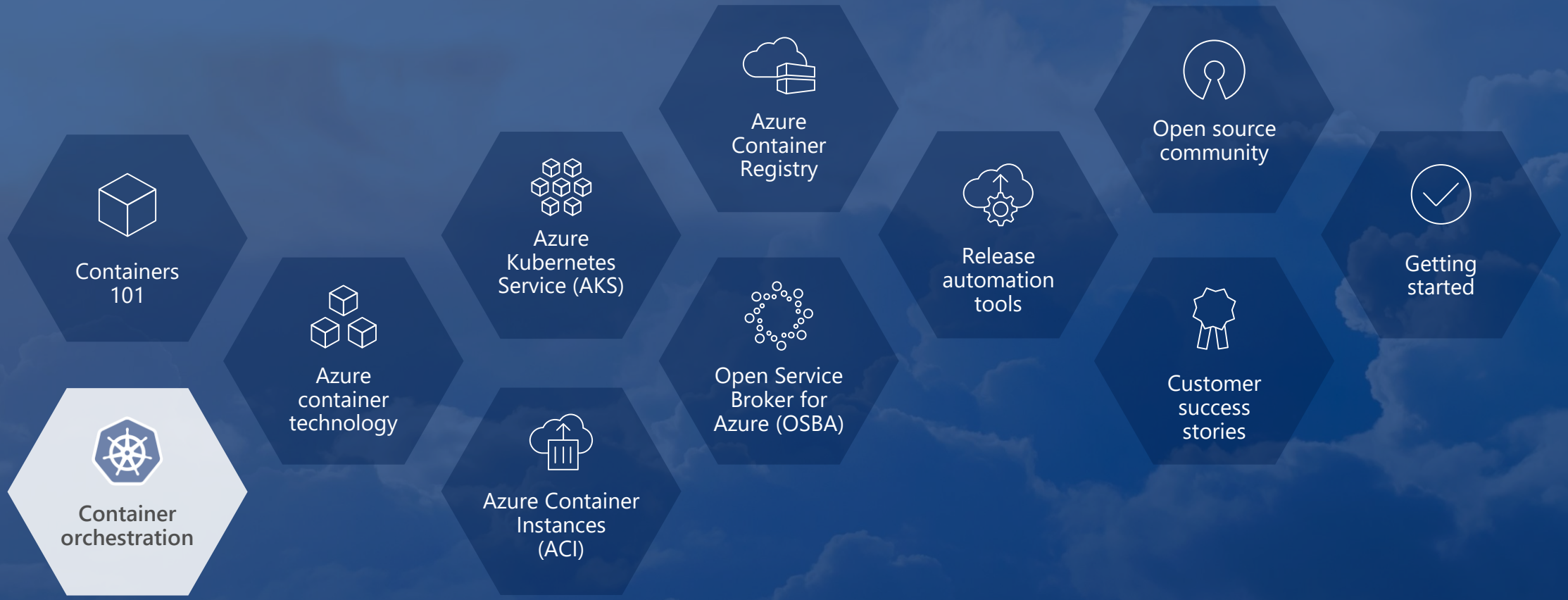
# Industry analysts **agree**



"By 2020, more than 50% of enterprises will run mission-critical, containerized cloud-native applications in production, up from less than 5% today."

Gartner®

# Container orchestration



# The elements of **orchestration**

Scheduling

Affinity/anti-affinity

Health monitoring

Failover

Scaling

Networking

Service discovery

Coordinated app upgrades

# **Kubernetes**: the de-facto orchestrator

**Portable**

Public, private, hybrid, multi-cloud

**Extensible**

Modular, pluggable, hookable, composable

**Self-healing**

Auto-placement, auto-restart, auto-replication, auto-scaling

# **Kubernetes**: empowering you to do more

Deploy your applications quickly and predictably

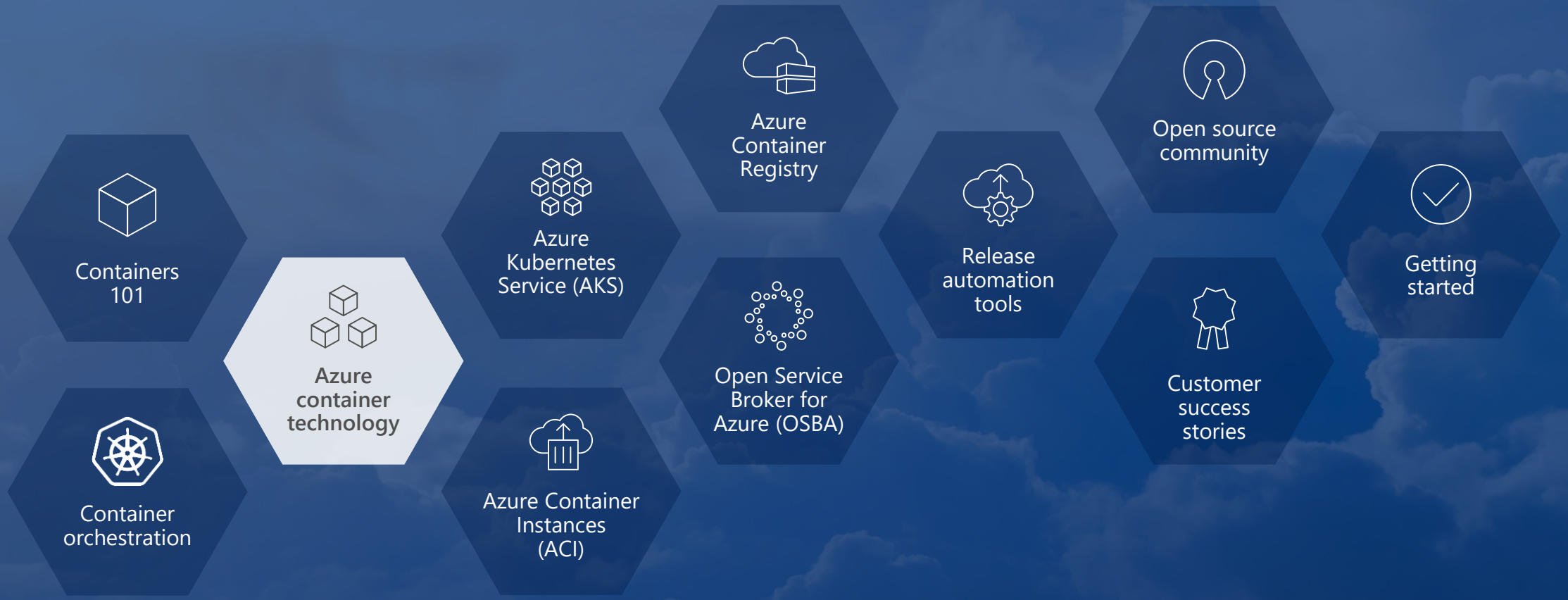
Scale your applications on the fly

Roll out new features seamlessly

Limit hardware usage to required resources only

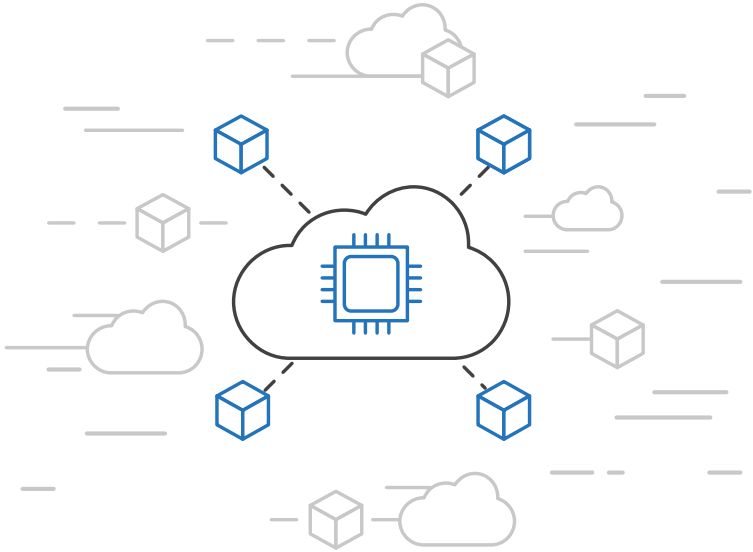

*"Distributed apps are sufficiently complicated that they need to be flown by the instruments"*

# Azure container technology

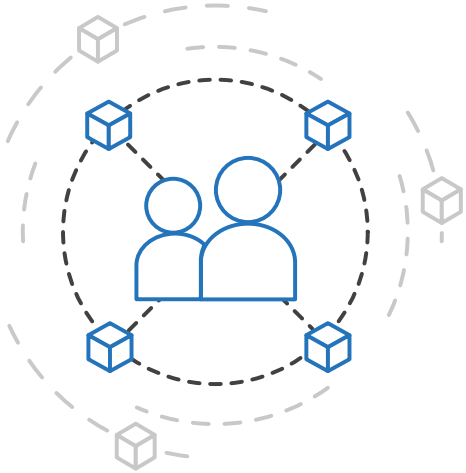


# Azure container **strategy**

Embrace containers as ubiquitous

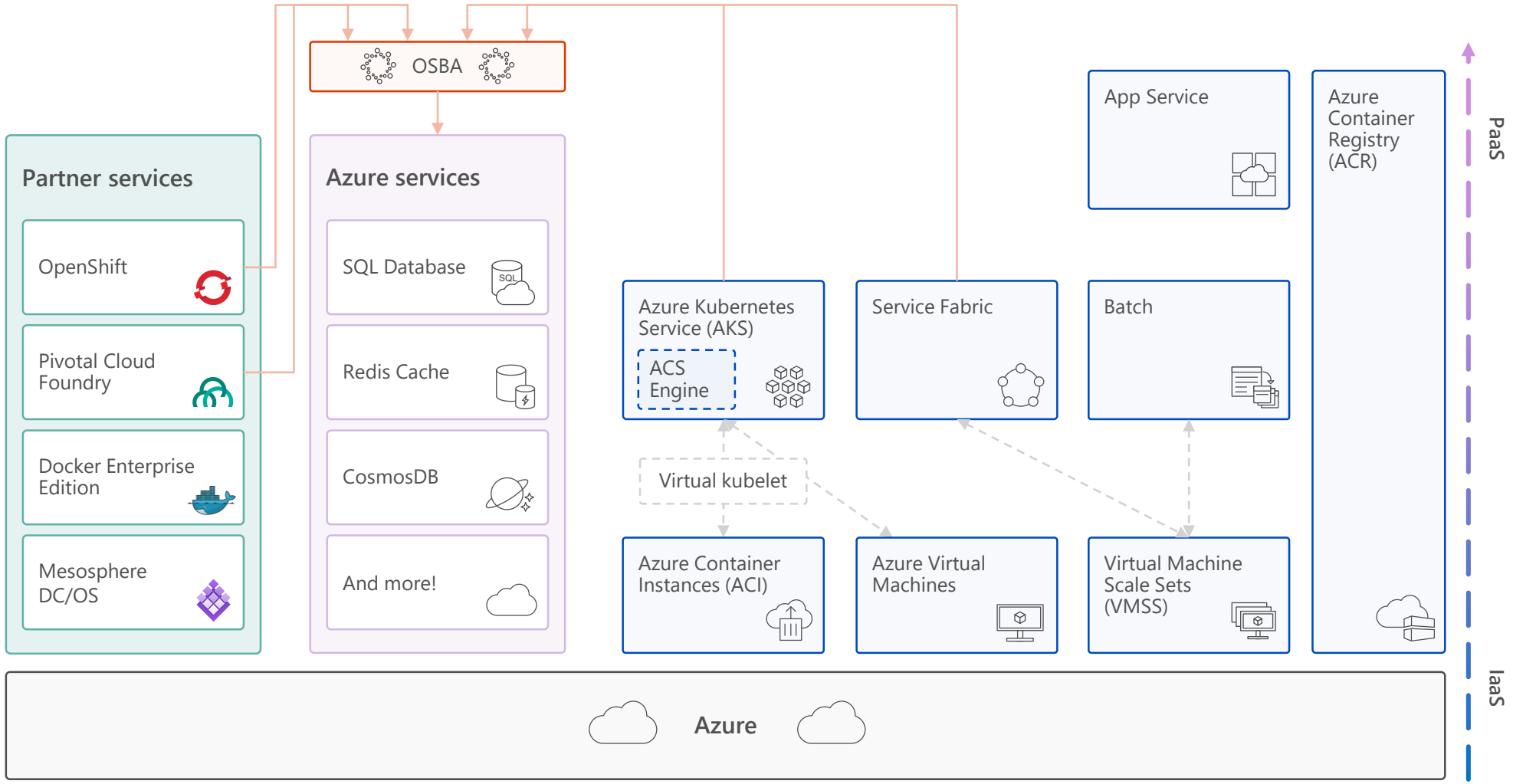


Support containers across the compute portfolio

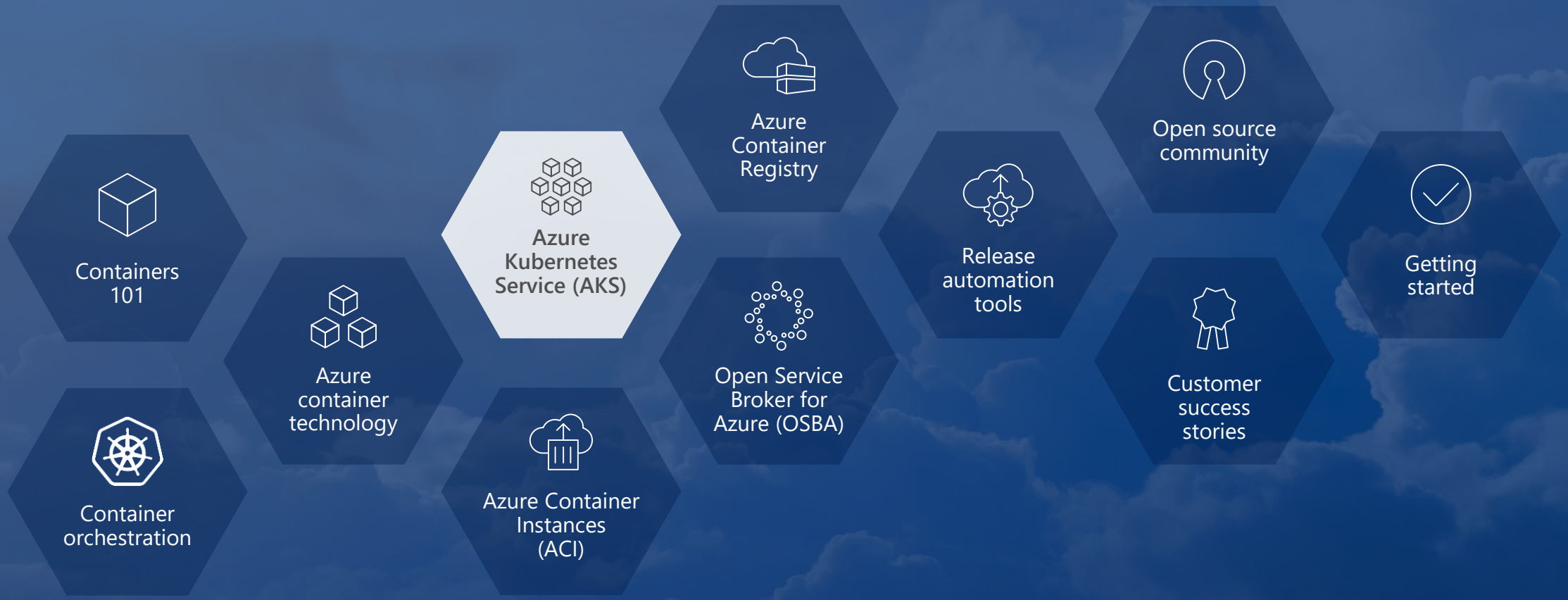


Democratize container technology

# Azure container **ecosystem**



# Azure Kubernetes Service (AKS)



# Azure Kubernetes Service (AKS)

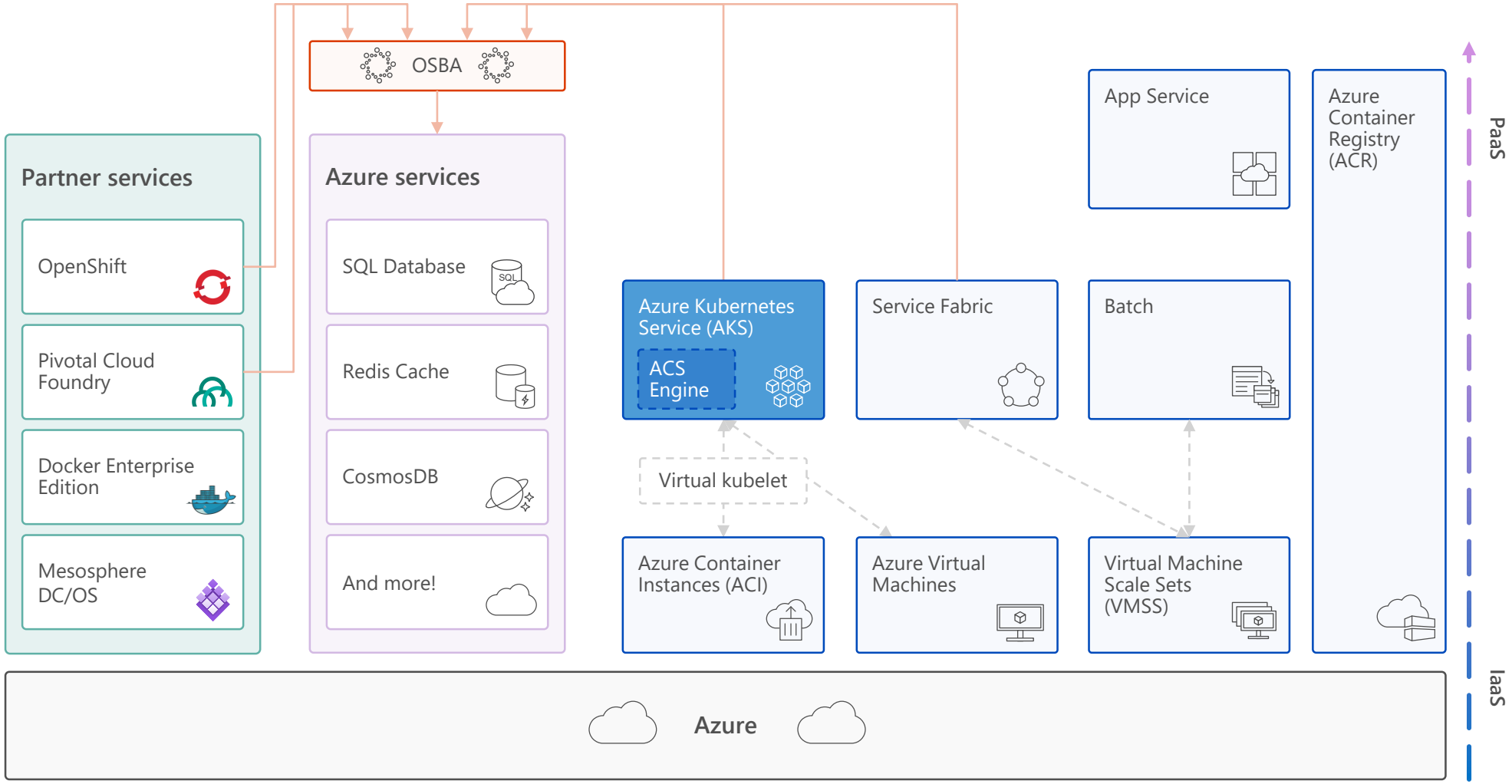
**Azure Kubernetes Service (AKS)**

Azure Container Instances (ACI)

Azure Container Registry

Open Service Broker API (OSBA)

Release Automation Tools



**Azure Kubernetes Service (AKS)**

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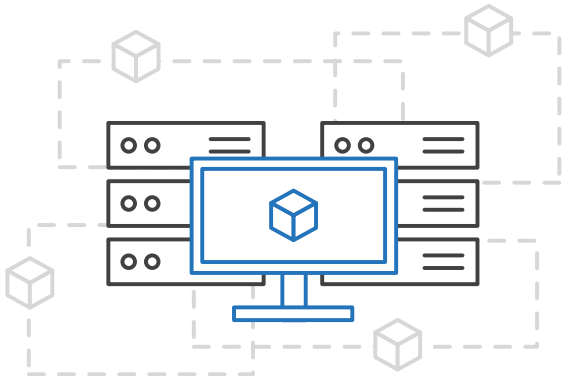
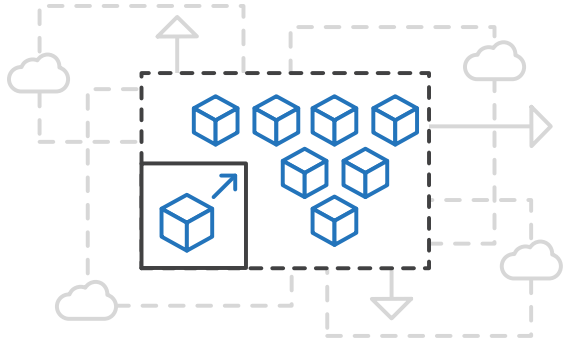
# Azure Kubernetes Service (AKS)

## Simplify the deployment, management, and operations of Kubernetes



Focus on your containers not the infrastructure

Work how you want with open-source APIs



Scale and run applications with confidence

**Azure Kubernetes Service (AKS)**

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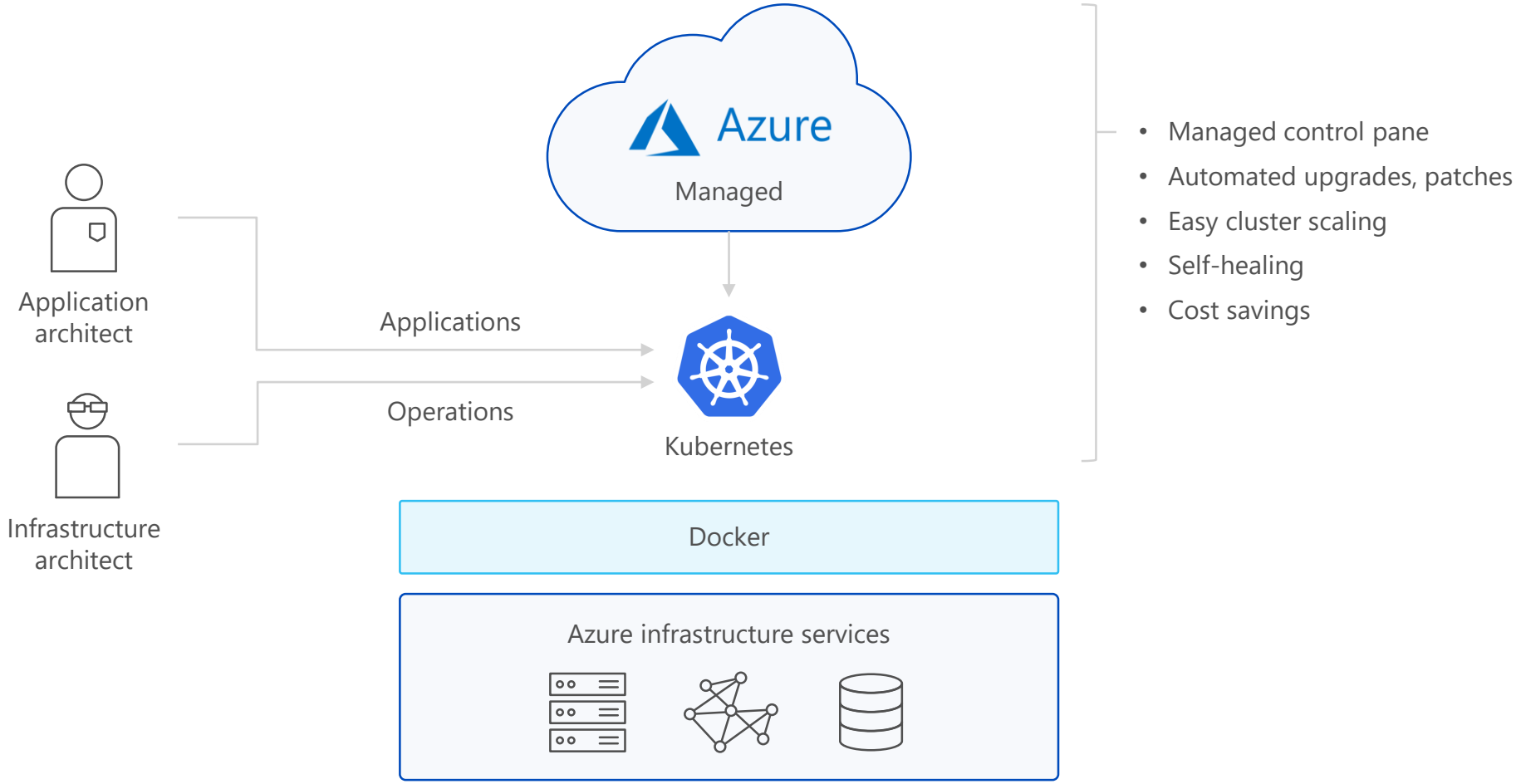
# Azure Kubernetes Service (AKS)

## A fully managed Kubernetes cluster



Azure Kubernetes Service (AKS)

Azure Container Instances (ACI)

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Open Service Broker API (OSBA)

Release Automation Tools

# Azure Kubernetes Service (AKS)

## Get started easily

```
$ az aks create -g myResourceGroup -n myCluster --generate-ssh-keys
\ Running ..

$ az aks install-cli
Downloading client to /usr/local/bin/kubectl ..

$ az aks get-credentials -g myResourceGroup -n myCluster
Merged "myCluster" as current context ..

$ kubectl get nodes
NAME                          STATUS    AGE       VERSION
aks-mycluster-36851231-0      Ready     4m        v1.8.1
aks-mycluster-36851231-1      Ready     4m        v1.8.1
aks-mycluster-36851231-2      Ready     4m        v1.8.1
```

Azure Kubernetes Service (AKS)

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Release Automation Tools

# Azure Kubernetes Service (AKS)

## Manage an AKS cluster

```
$ az aks list –o table
Name                Location    ResourceGroup     KubernetesRelease  ProvisioningState
------------------  ----------  --------------  -------------------  -------------------
myCluster           westus2     myResourceGroup               1.7.7  Succeeded
```

```
$ az aks upgrade -g myResourceGroup -n myCluster –-kubernetes-version 1.8.1
\ Running ..
```

```
$ kubectl get nodes
NAME                          STATUS    AGE       VERSION
aks-mycluster-36851231-0      Ready     12m       v1.8.1
aks-mycluster-36851231-1      Ready     8m        v1.8.1
aks-mycluster-36851231-2      Ready     3m        v1.8.1
```

```
$ az aks scale -g myResourceGroup -n myCluster --agent-count 10
\ Running ..
```

**Azure Kubernetes Service (AKS)**

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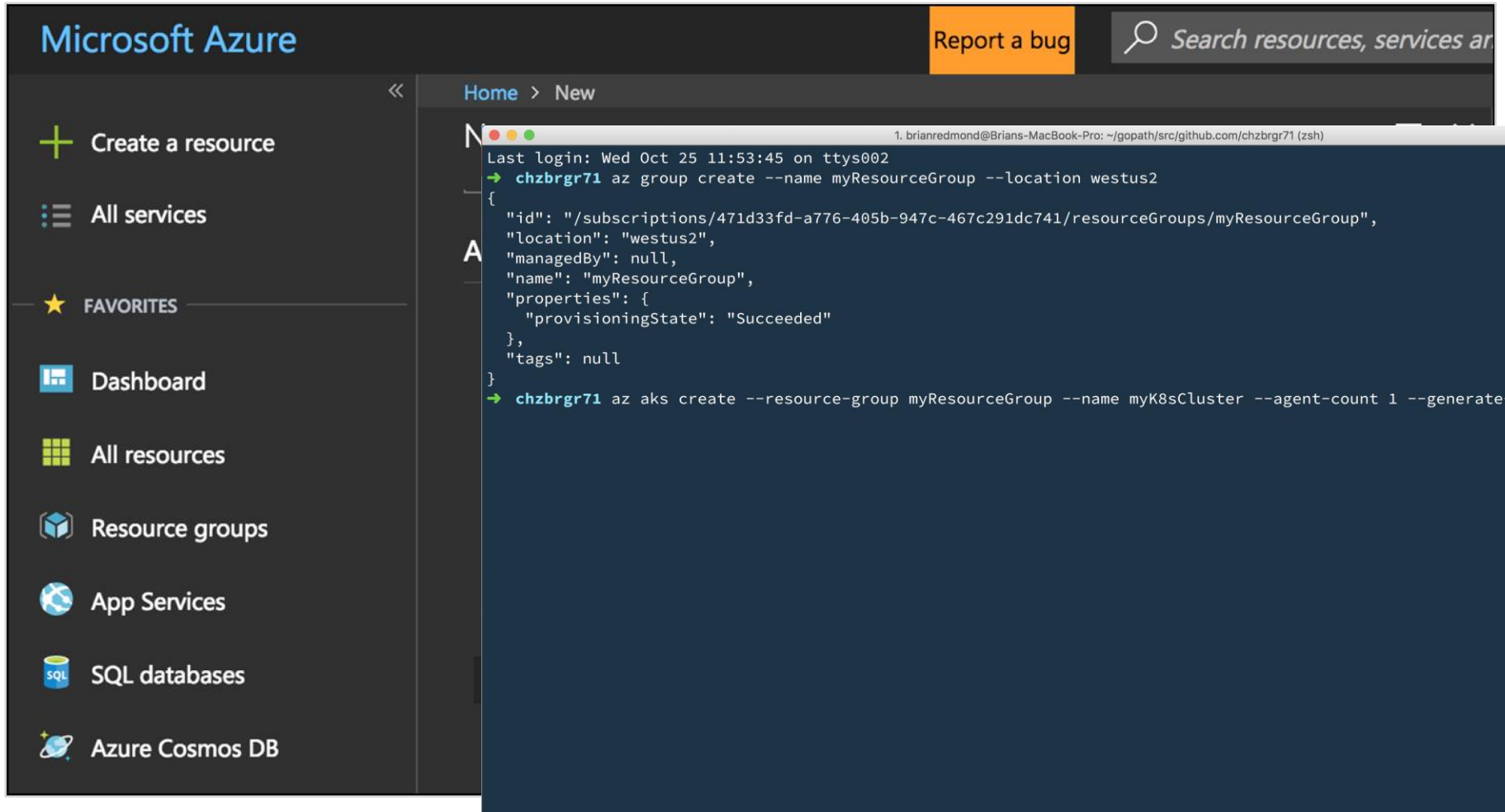
# Azure Kubernetes Service (AKS)

## Create AKS via Portal, Azure CLI, or ARM template



**Azure Kubernetes Service (AKS)**

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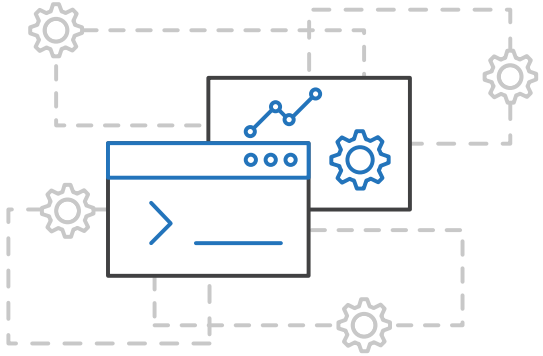
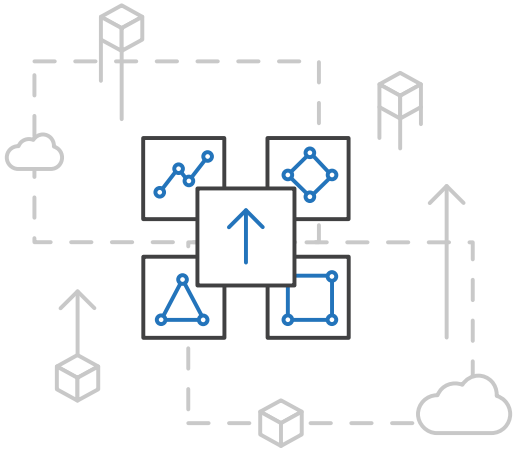
# ACS Engine

## Customized Kubernetes on Azure



A proving ground for new features

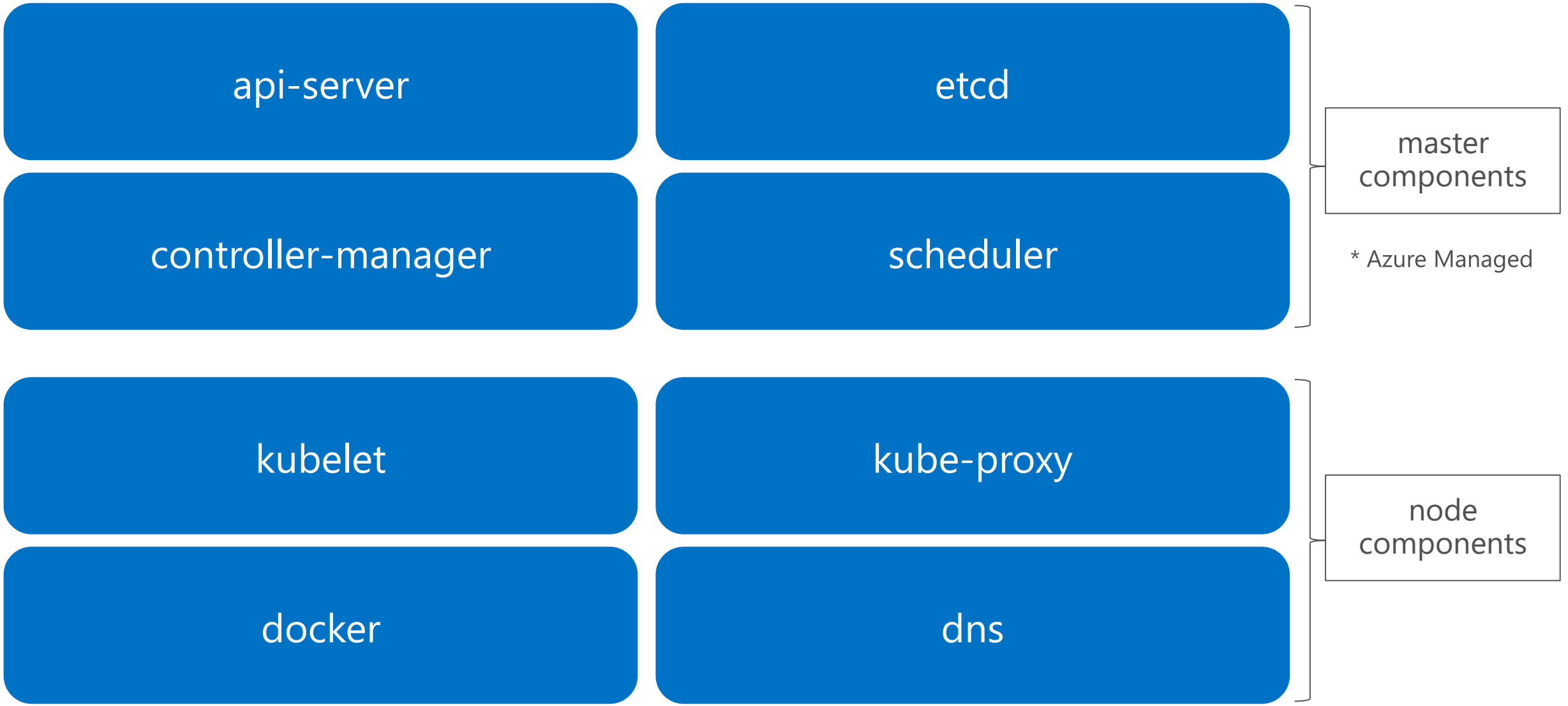


Enables custom deployments

Available on GitHub

# Kubernetes Concepts

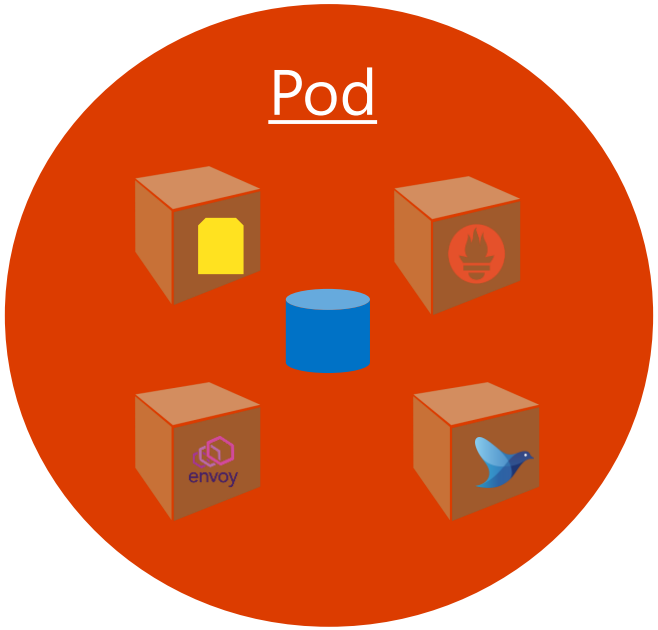
# Kubernetes Architecture Components

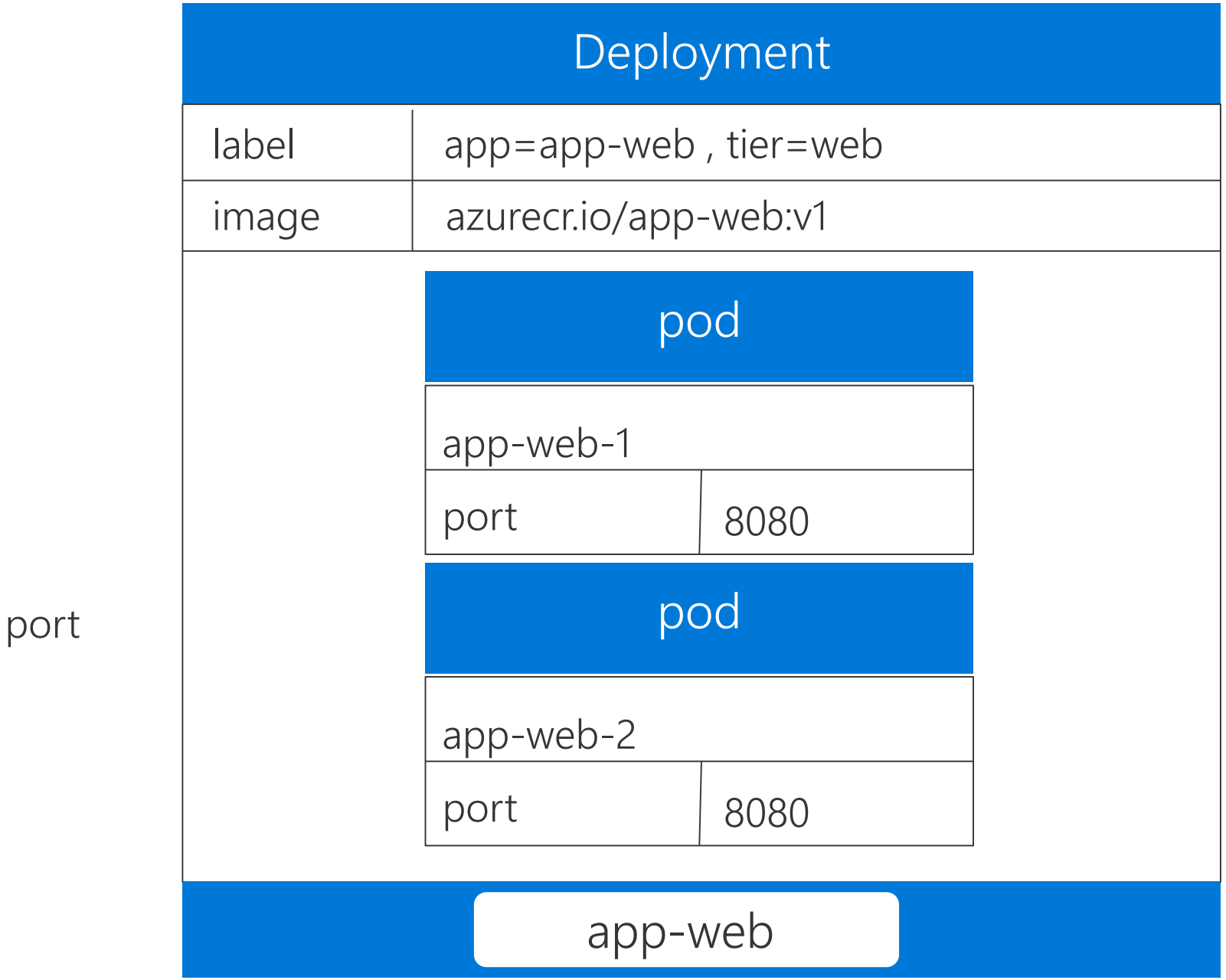


# Pods

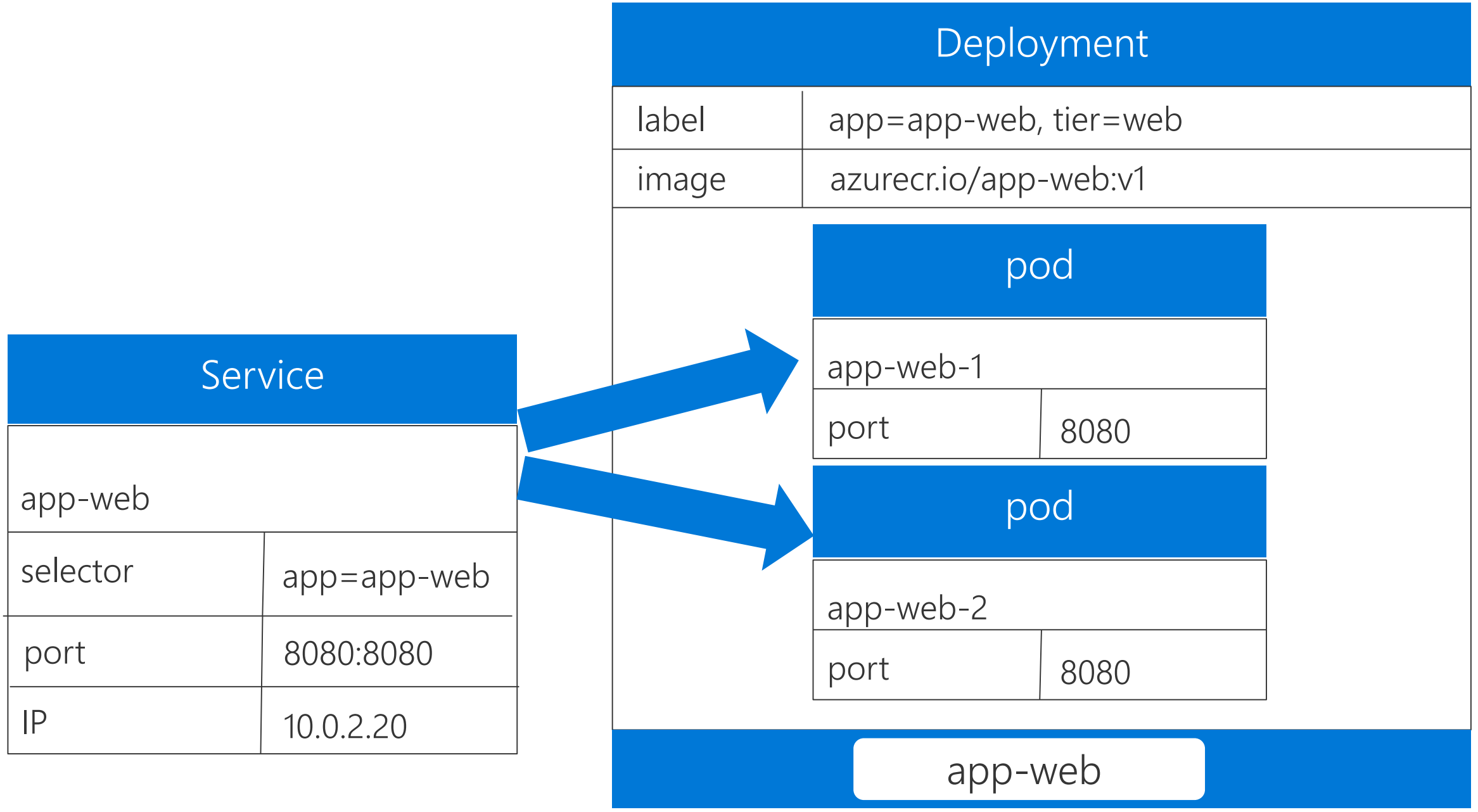
Pod is a set of containers that can run on a host

- Pod represents a logical construct to bundle one or more applications together
  - Sidecar Model
  - Pod resources deployed to a single agent
- An application-specific “logical host”
- Share:
  - Storage resources
  - Unique network IP
- Options to control how container(s) should run
- Most commonly Docker, but other runtimes are supported

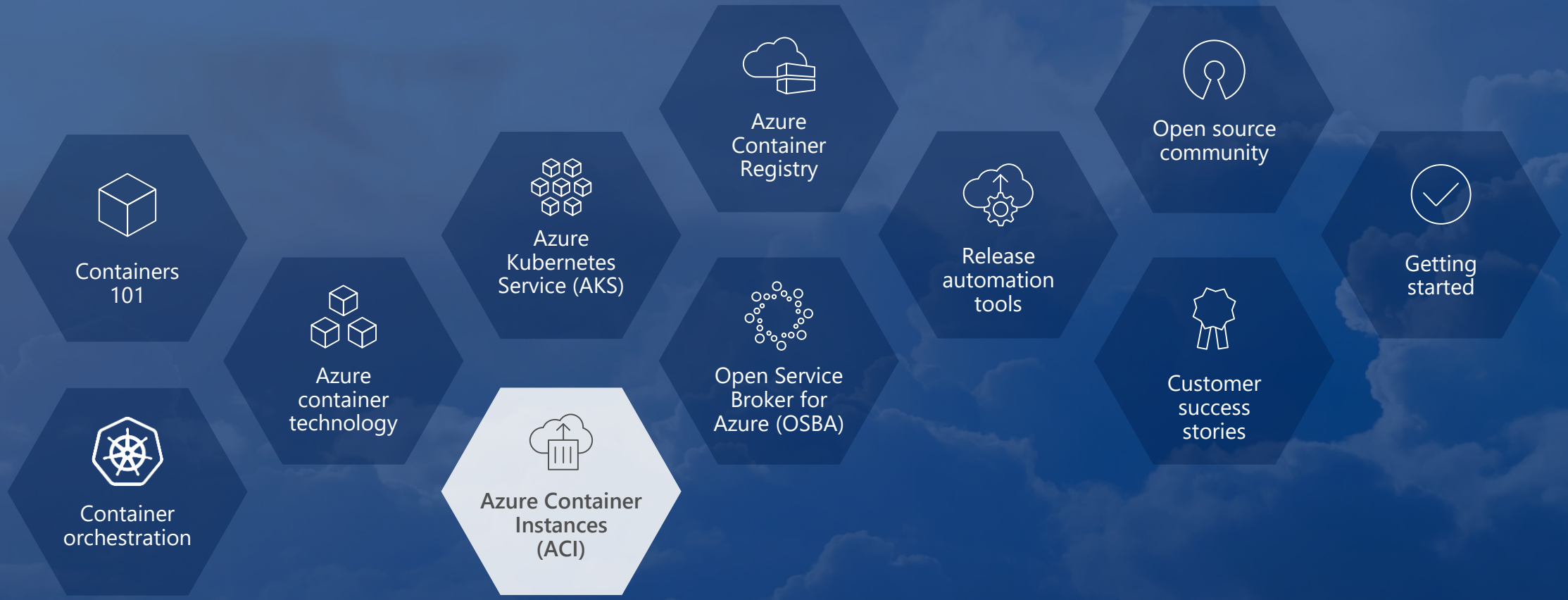



Deployment
label
app=app-web , tier=web
image
azurecr.io/app-web:v1
pod
app-web-1
port
8080
pod
app-web-2
port
8080
app-web

port


Deployment
label
app=app-web, tier=web
image
azurecr.io/app-web:v1
pod
app-web-1
port
8080
pod
app-web-2
port
8080
app-web
Service
app-web
selector
app=app-web
port
8080:8080
IP
10.0.2.20

# Azure Container Instances (ACI)



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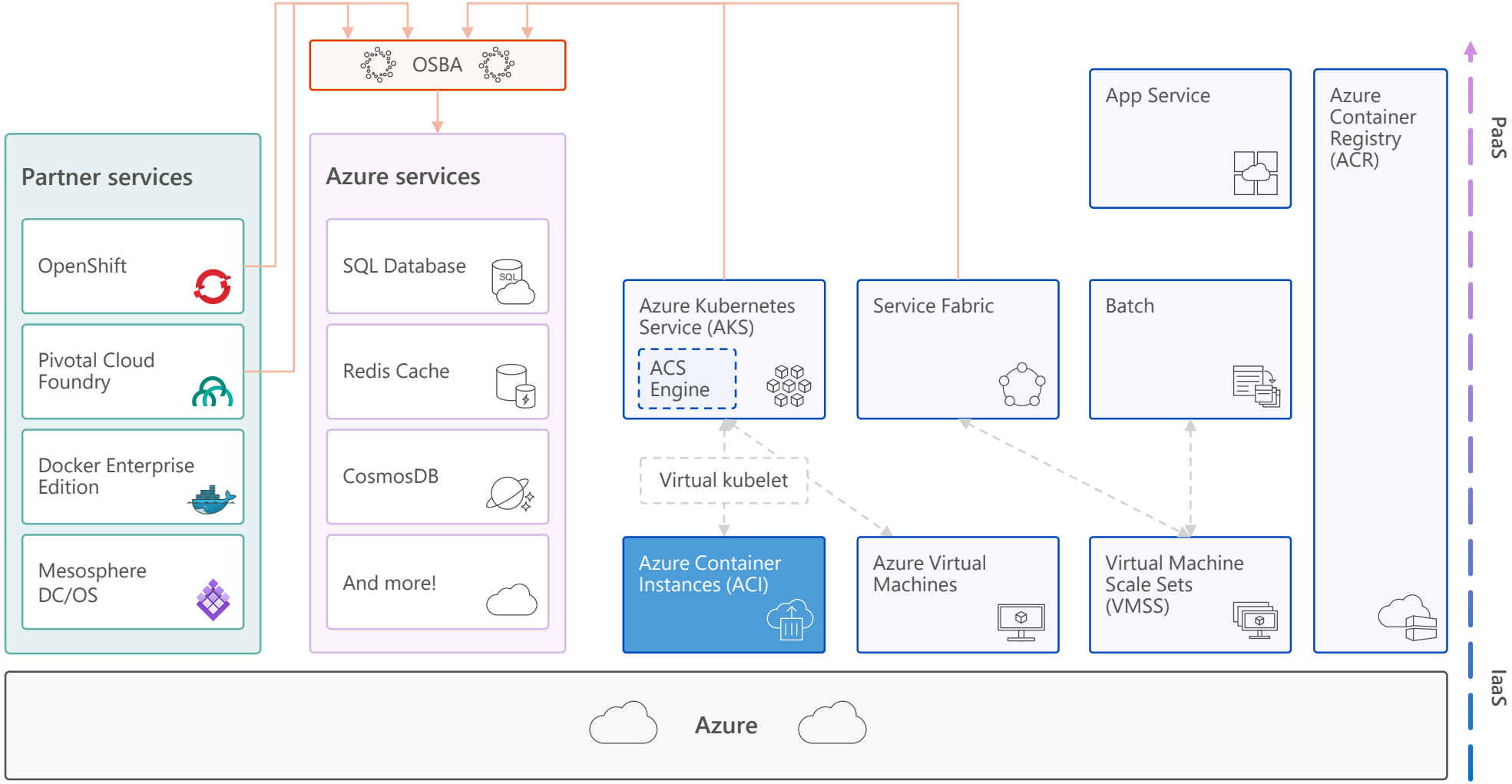
Azure Container Instances (ACI)

Azure Container Registry

Open Service Broker API (OSBA)

Release Automation Tools

# Azure Container Instances (ACI) PREVIEW



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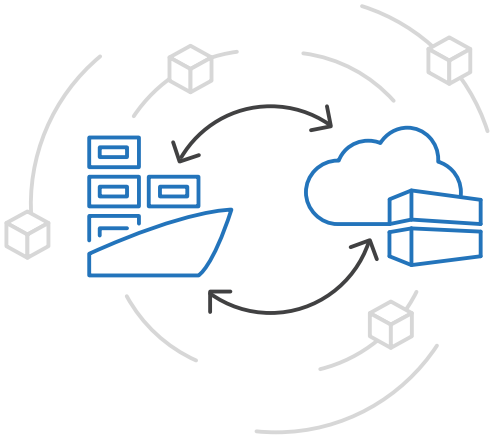
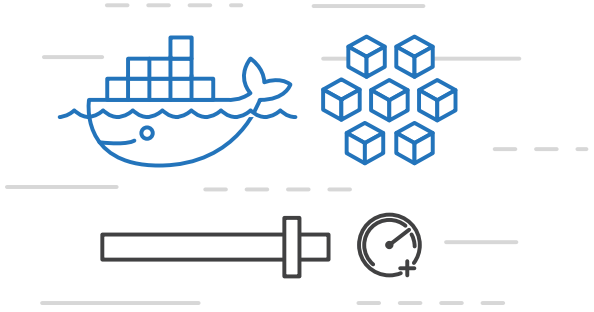
# Azure Container Instances (ACI) PREVIEW

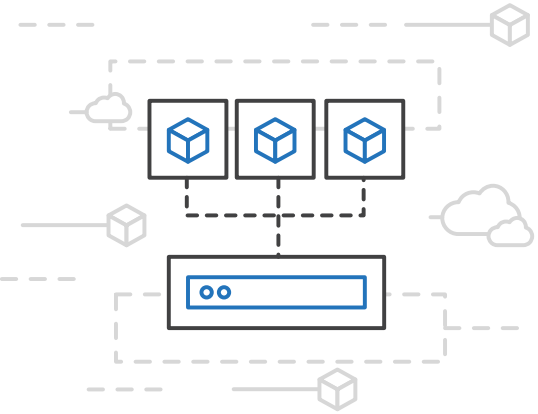
## Easily run containers on Azure with a single command



Start using containers right away



Cloud-scale container capacity



Hyper-visor isolation

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# Azure Container Instances (ACI) PREVIEW

## Get started easily

```
$ az container create --name mycontainer --image microsoft/aci-helloworld --
resource-group myResourceGroup --ip-address public
  "ipAddress": {
    "ip": "52.168.86.133",
    "ports": [...]
  },
  "location": "eastus",
  "name": "mycontainer",
  "osType": "Linux",
  "provisioningState": "Succeeded",

$ curl 52.168.86.133
<html>
<head>
  <title>Welcome to Azure Container Instances!</title>
</head>
```

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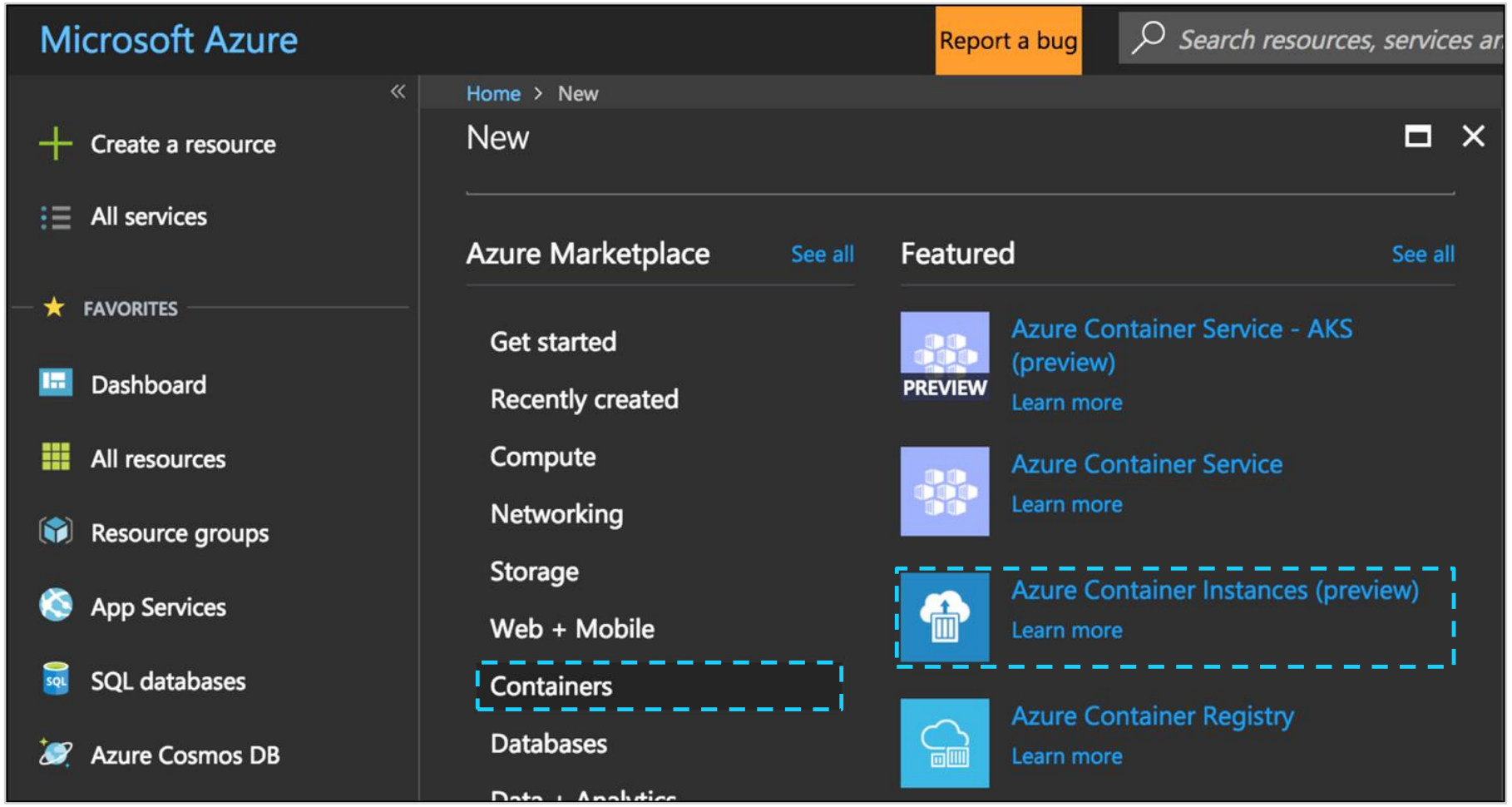
# Azure Container Instances (ACI) PREVIEW

## Create an Azure Container Instance quickly



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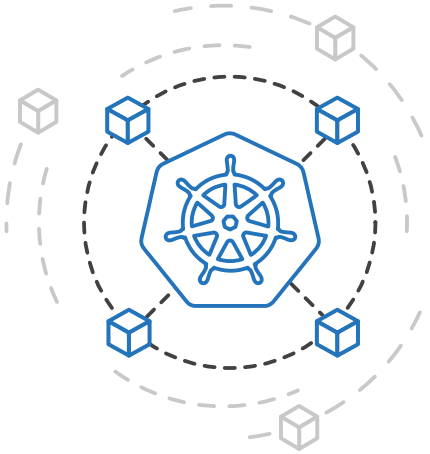
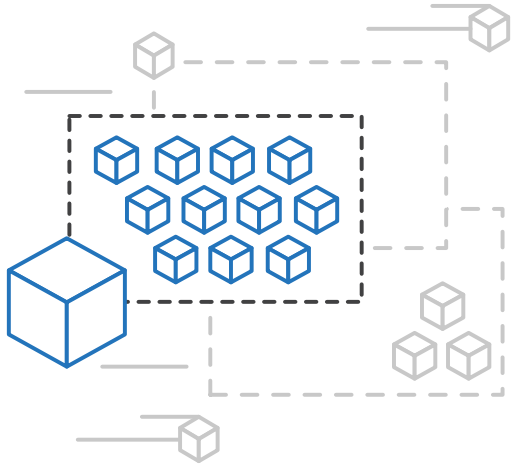
# Azure Container Instances (ACI) PREVIEW

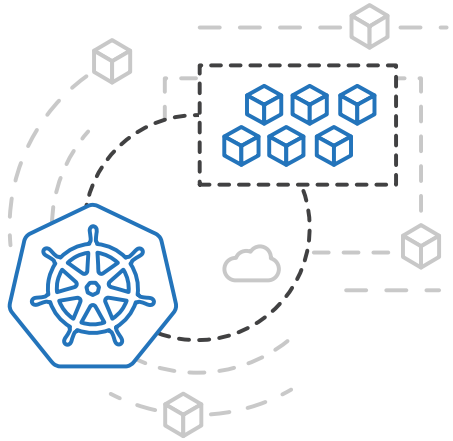
## ACI Connector for Kubernetes



Kubernetes provides rich orchestration capabilities



ACI provides infinite container-based scale



The ACI Connector for K8s brings them together

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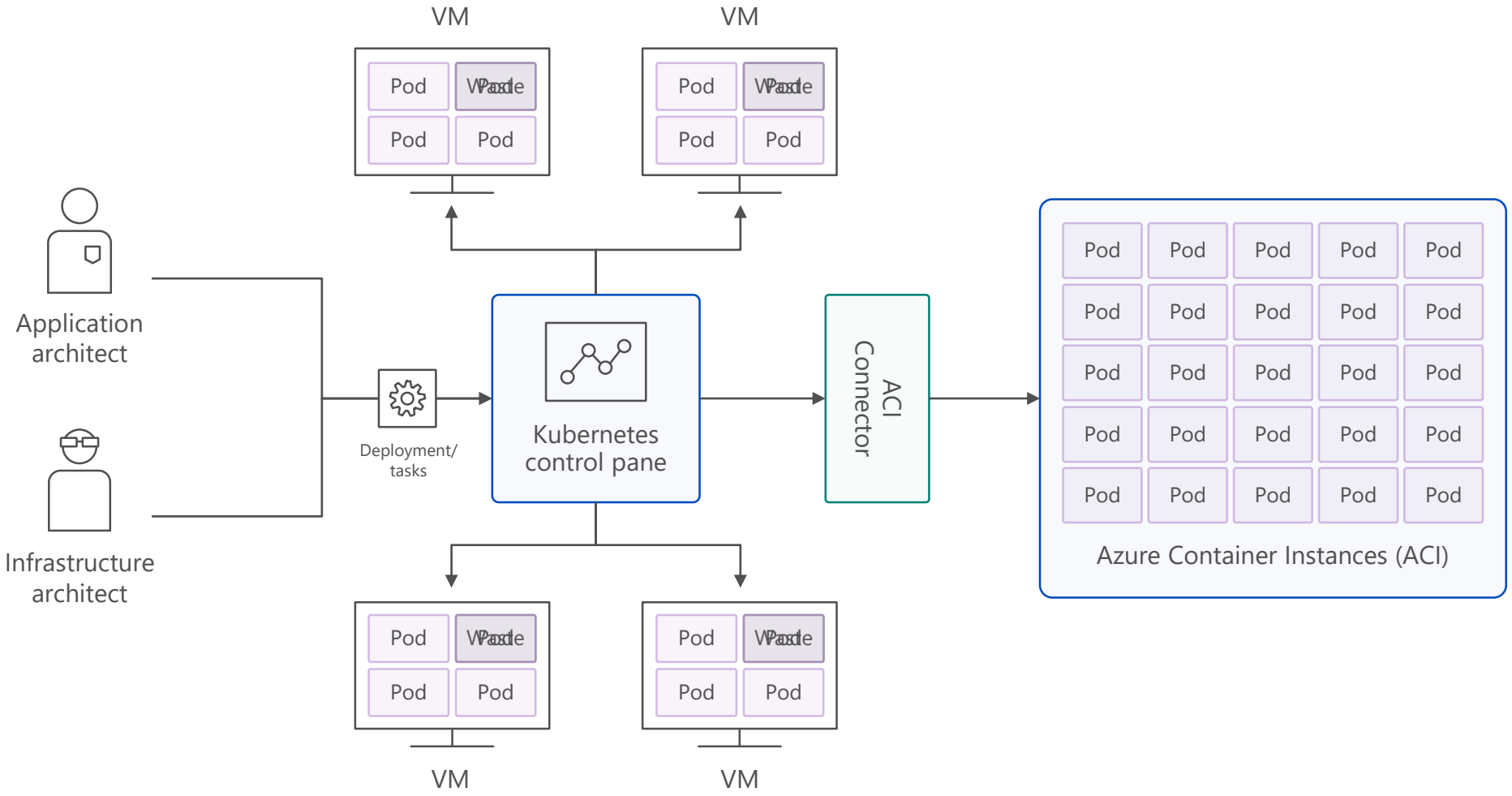
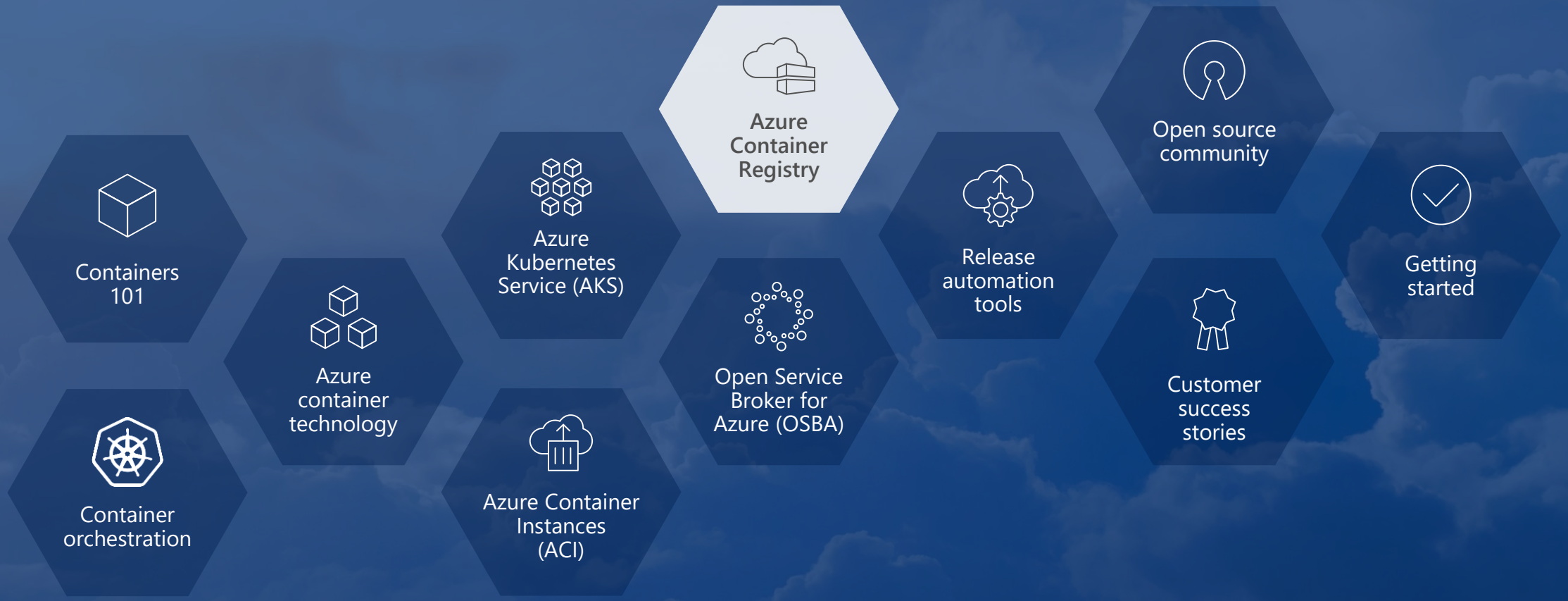
# Azure Container Instances (ACI) PREVIEW

## Bursting with the ACI Connector



# Azure Container Registry



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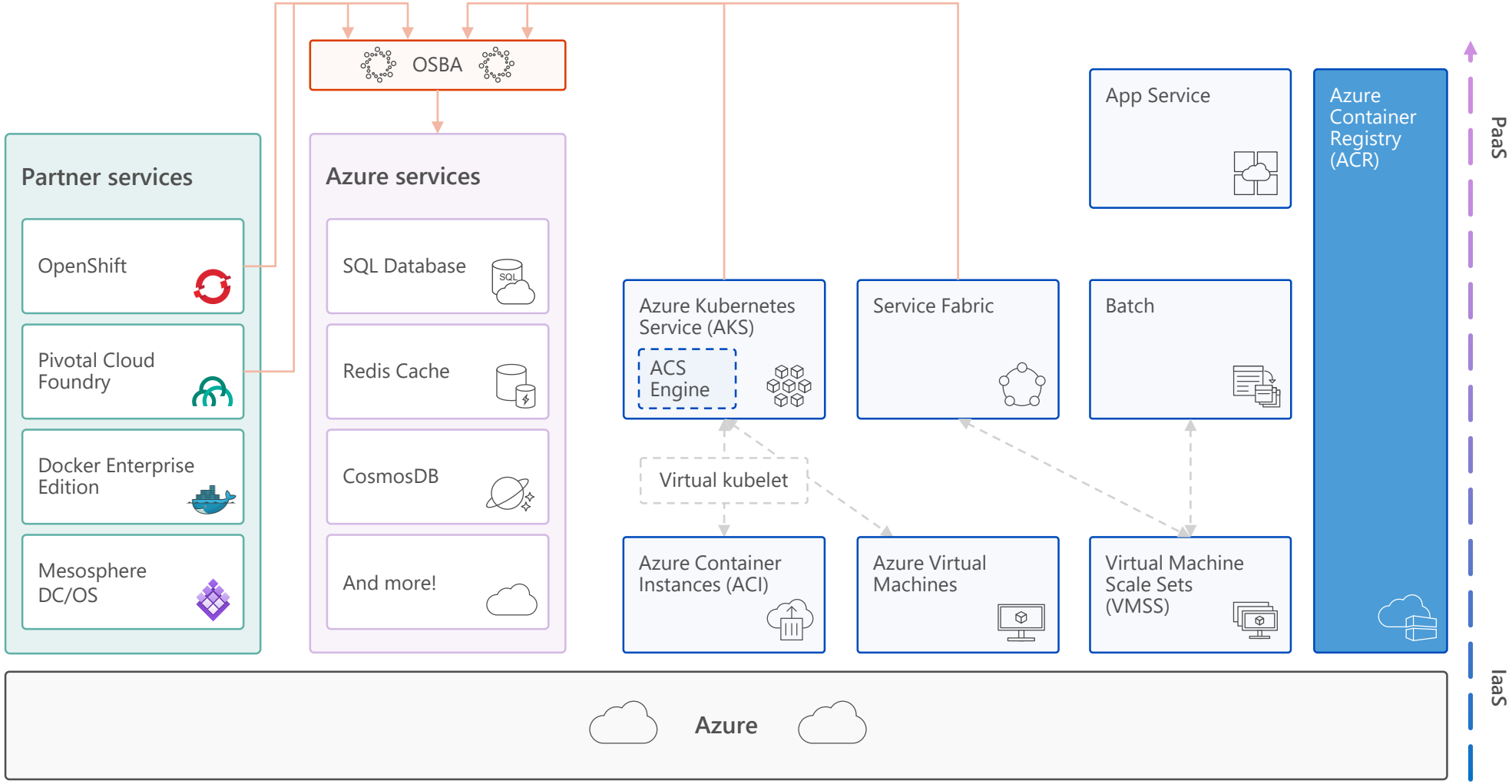
# Azure Container Registry



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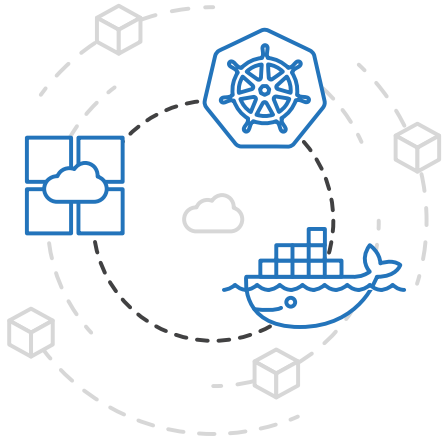
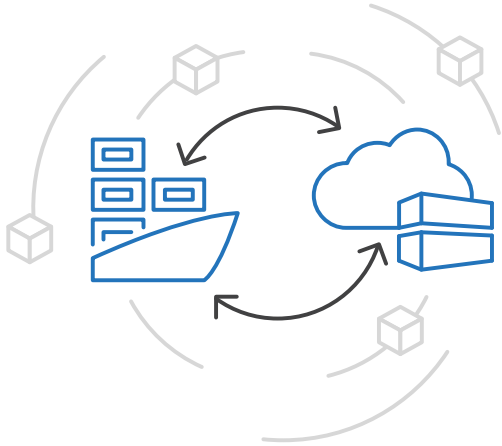
# Azure Container Registry

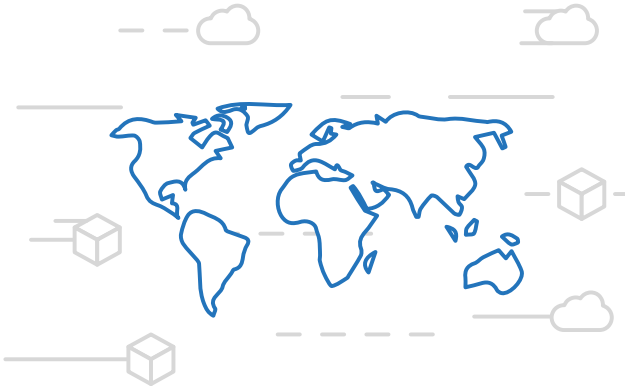
## Manage a Docker private registry as a first-class Azure resource



Manage images for all types of containers



Use familiar, open-source Docker CLI tools



Azure Container Registry geo-replication

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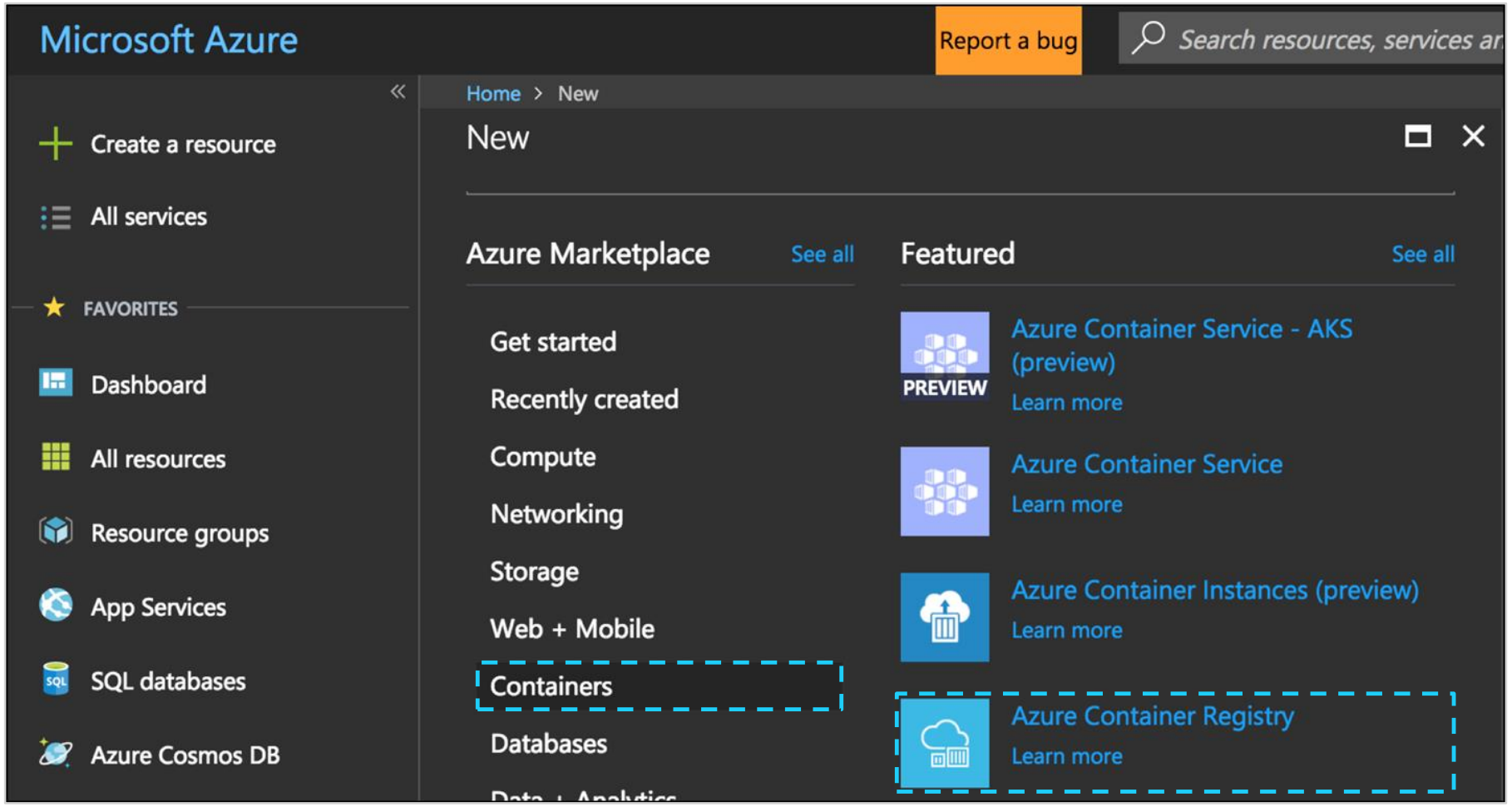
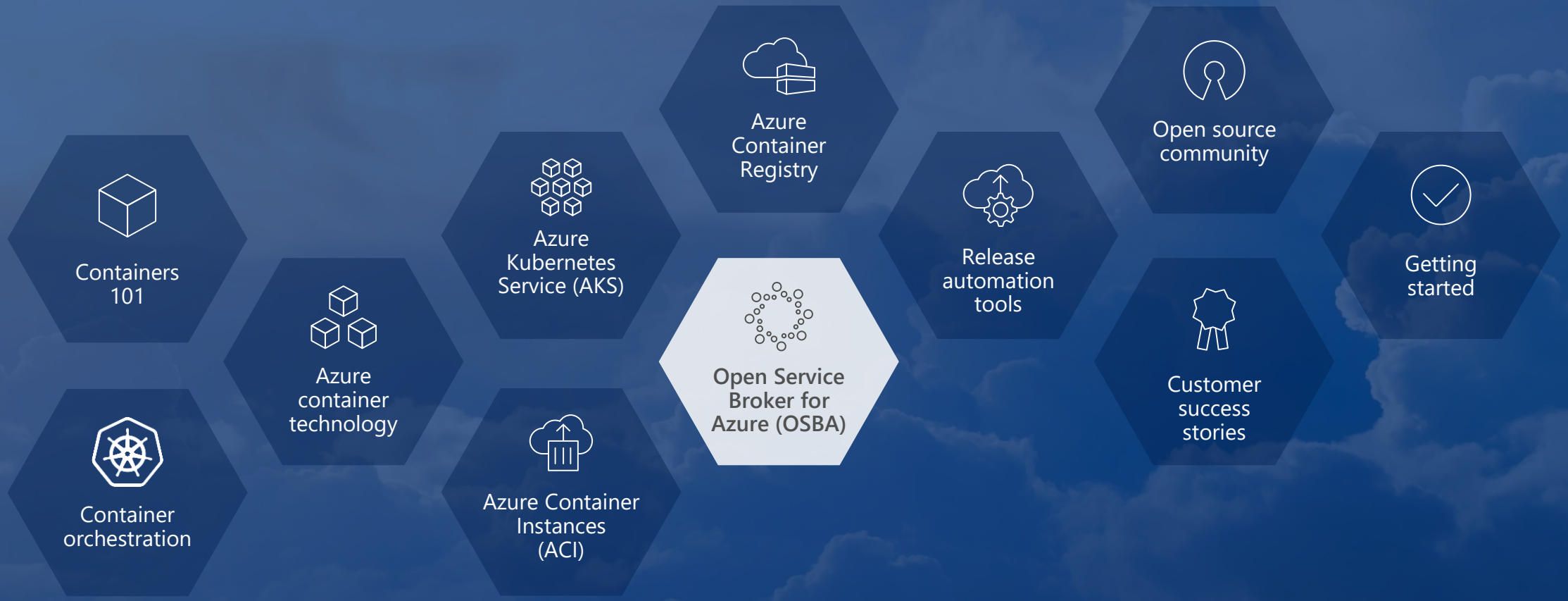
# Azure Container Registry

## Create a container in the Registry quickly



# Open Service Broker for Azure



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Azure Container Registry

**Open Service Broker API (OSBA)**

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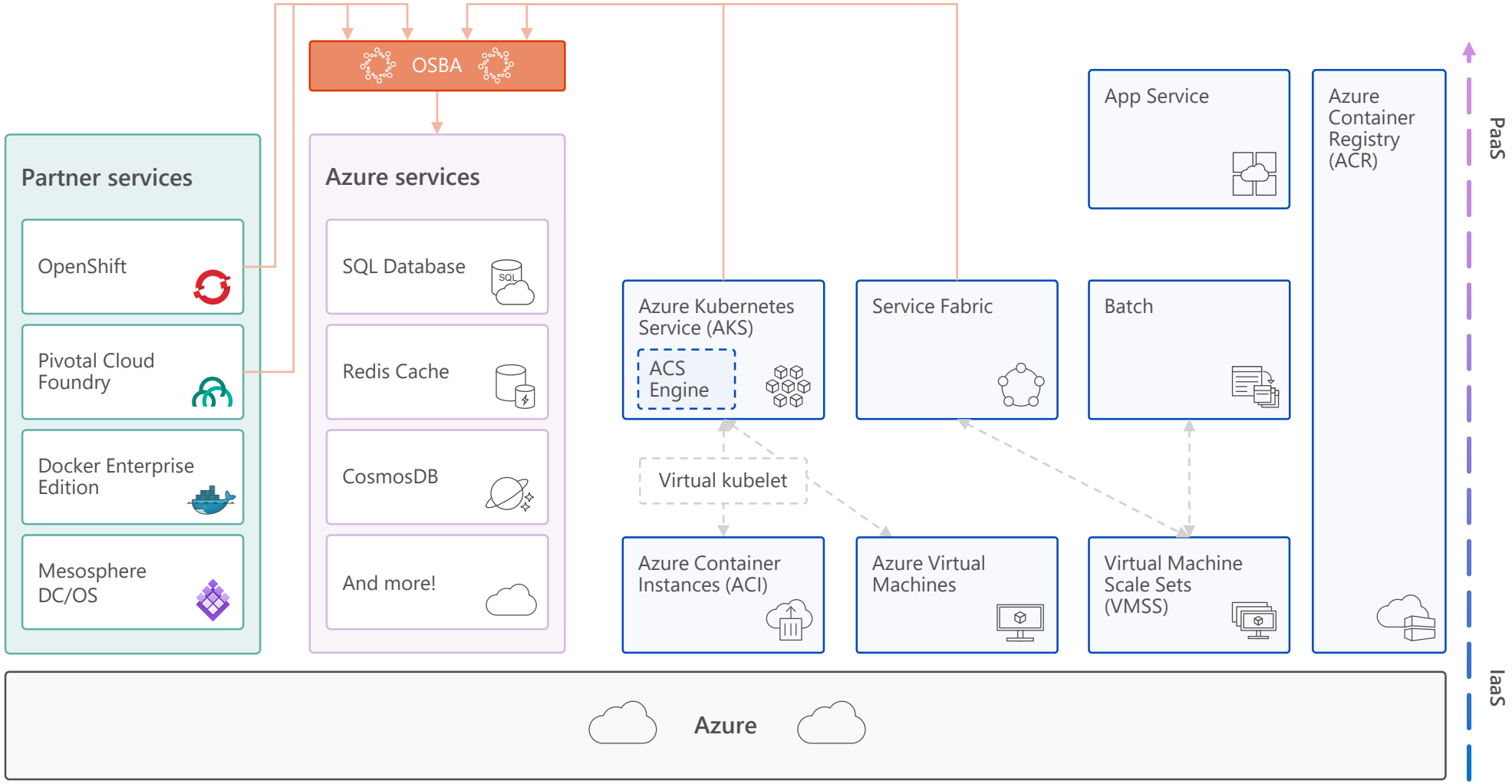
# Open Service Broker for Azure (OSBA)



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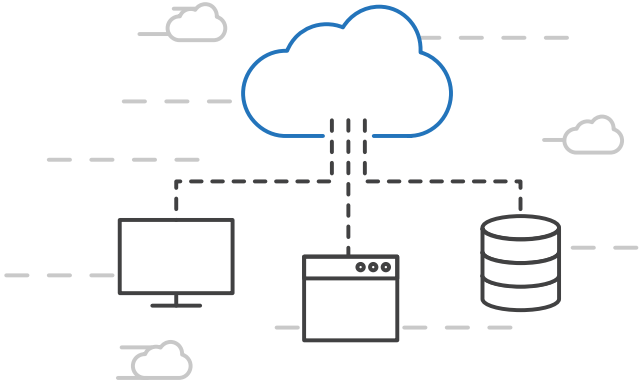
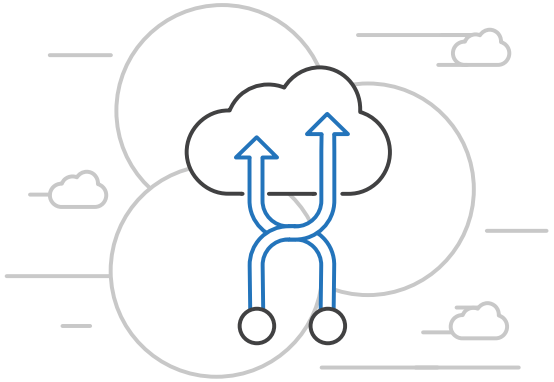
# Open Service Broker for Azure (OSBA)

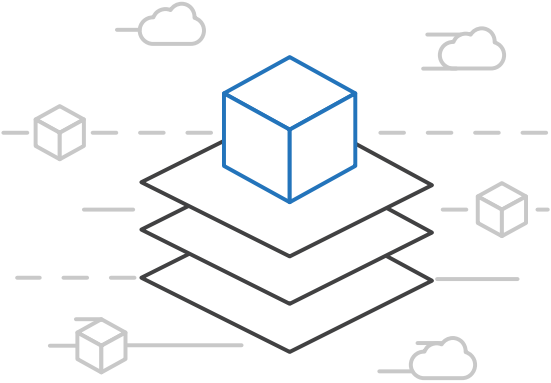
## Connecting containers to Azure services and platforms



A standardized way to connect with Azure services



Simple and flexible service integration



Compatible across numerous platforms

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**Open Service Broker API (OSBA)**

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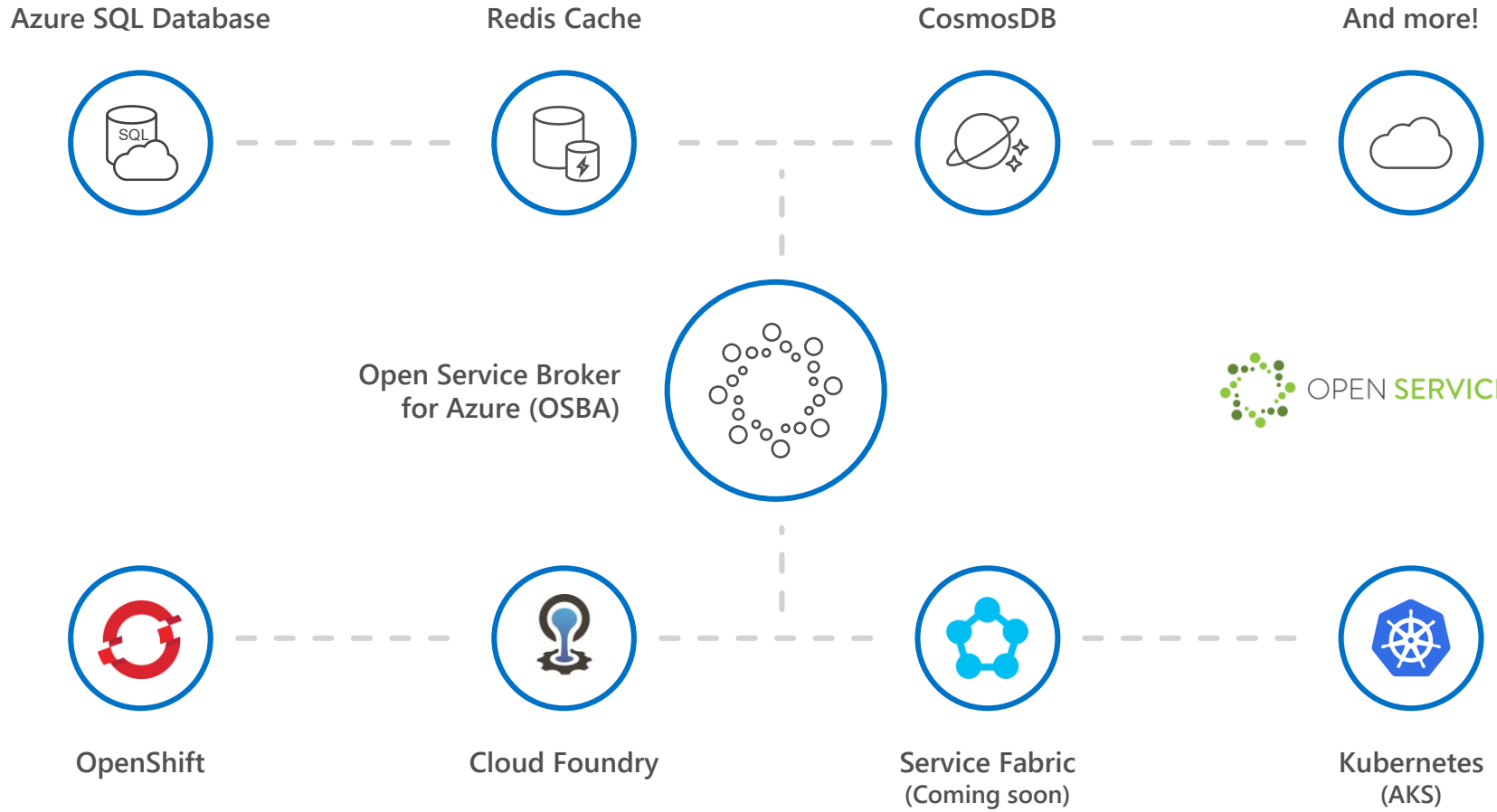
# Open Service Broker for Azure (OSBA)

## An implementation of the Open Service Broker API

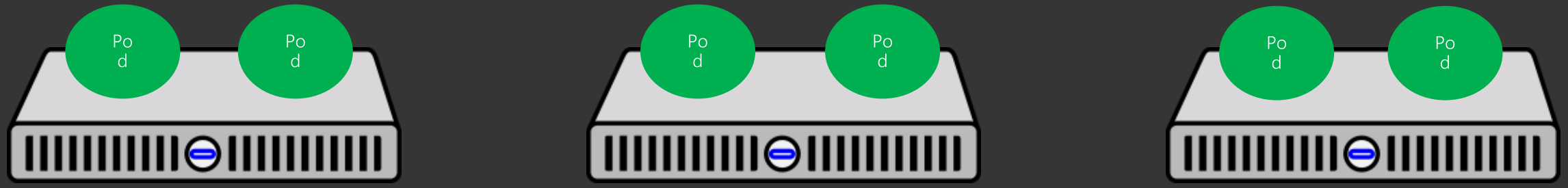


# Scaling Applications

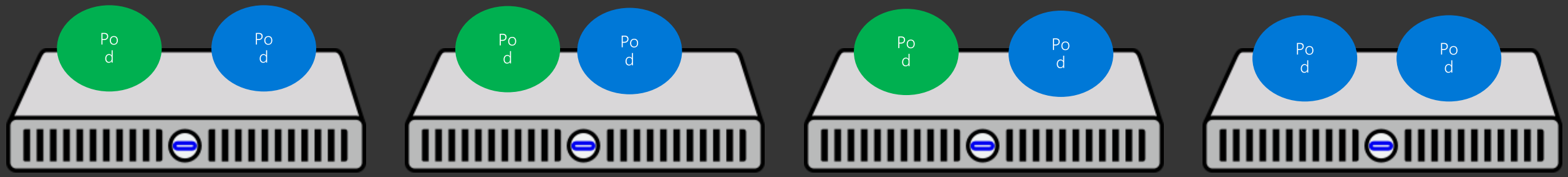
# Application Scaling Strategies

- Infrastructure Level
  - Increase/decrease the number of VM's running in the cluster
  - Azure infrastructure function
  - via AKS API/CLI (utilizes Azure Availability Sets)
  - Auto-scaling coming to AKS soon
- Application Level
  - Increase/decrease the number of pods for a given service
  - Handled by the orchestrator or the application itself
  - Kubernetes Horizontal Pod Autoscaling
- These functions should be coordinated

# Scaling Pods



# Scaling Host



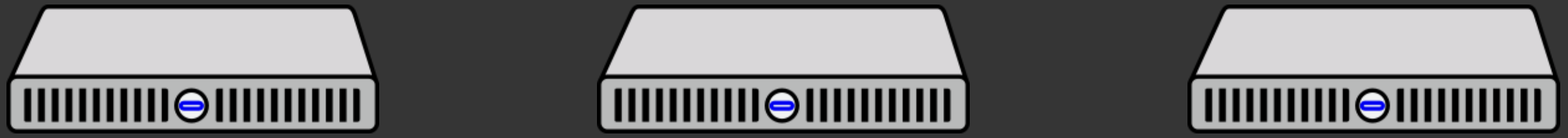
# Scaling the ACS Cluster

Azure CLI | Copy | Try It

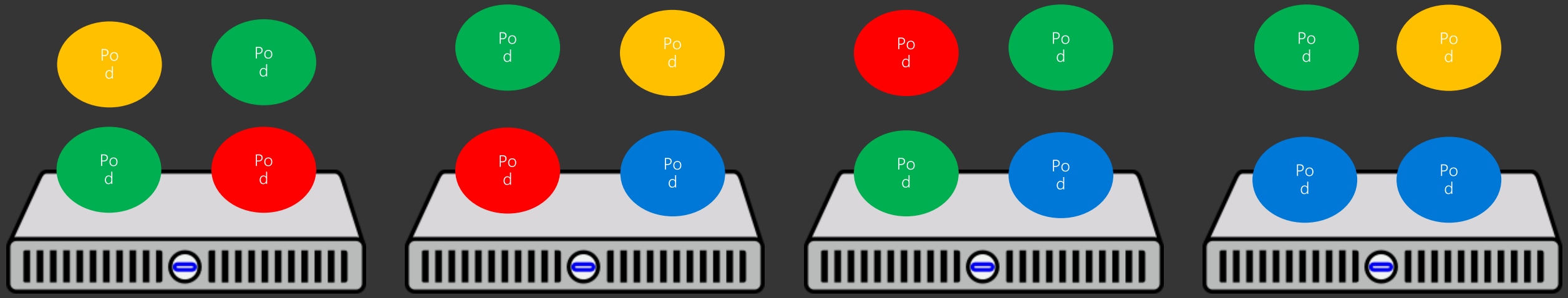
```
az aks scale --name myK8sCluster --resource-group myResourceGroup --agent-count 1
```

# Monitoring

# Current monitoring is static in nature



# Need to monitor for dynamic environments



# Application Health and Readiness

- Kubelets on workers use liveness and readiness probes to know when to restart a container or start directing traffic
  - Liveness check: when to restart
  - Readiness check: when to forward Service traffic to a pod

# Monitoring: What indicators matter in Kubernetes

- Cluster health: total number of nodes, pods, etc
- Node health: available compute resources, health
- Application health
- Tooling Examples
  - Datadog
  - Prometheus
  - InfluxData
  - Cloud-specific: OMS (Azure), CloudWatch (AWS)

# Logging

- Pod logs: applications must log to standard out!
- Cluster-wide event logs
- Logging forwarder solutions
  - fluentd
  - logstash
- Log indexers
  - OMS Log Analytics
  - Splunk
  - ELK stack

# Upgrading Kubernetes in AKS

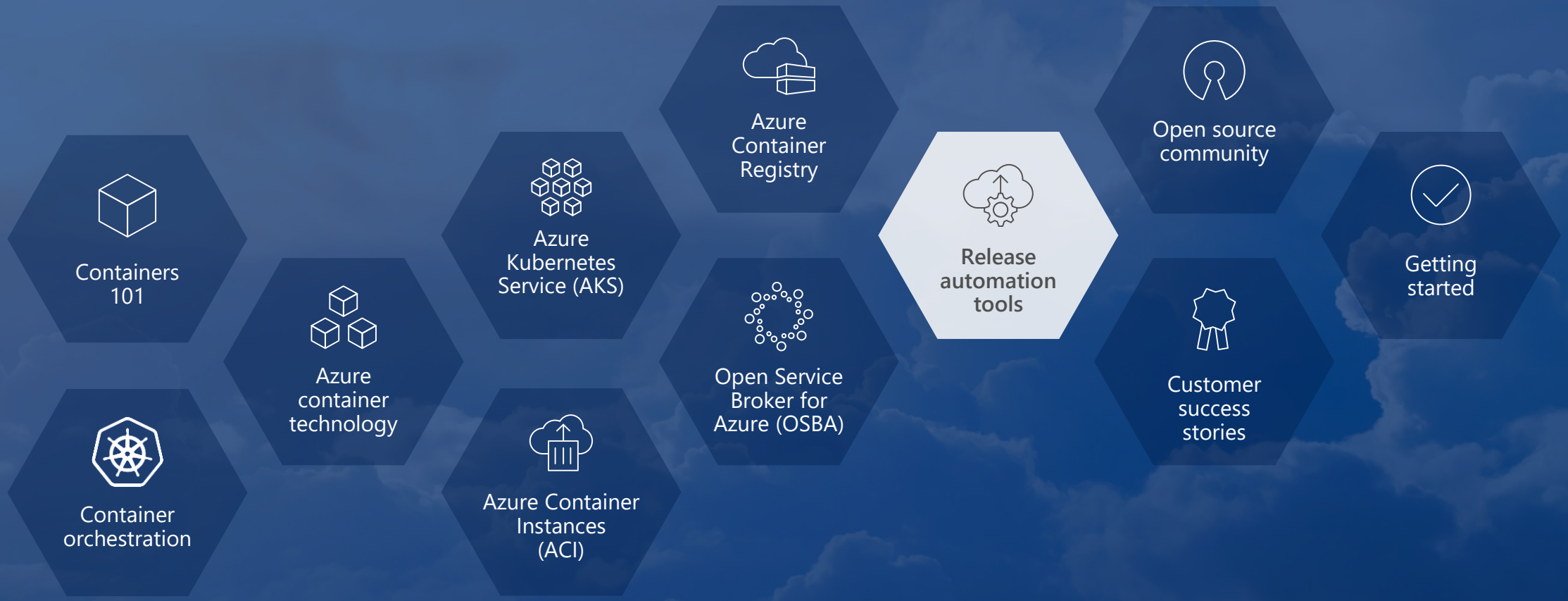
Azure CLI | Copy | Try It

```
az aks get-versions --name myK8sCluster --resource-group myResourceGroup --output table
```

Azure CLI | Copy | Try It

```
az aks upgrade --name myK8sCluster --resource-group myResourceGroup --kubernetes-version 1.8.1
```

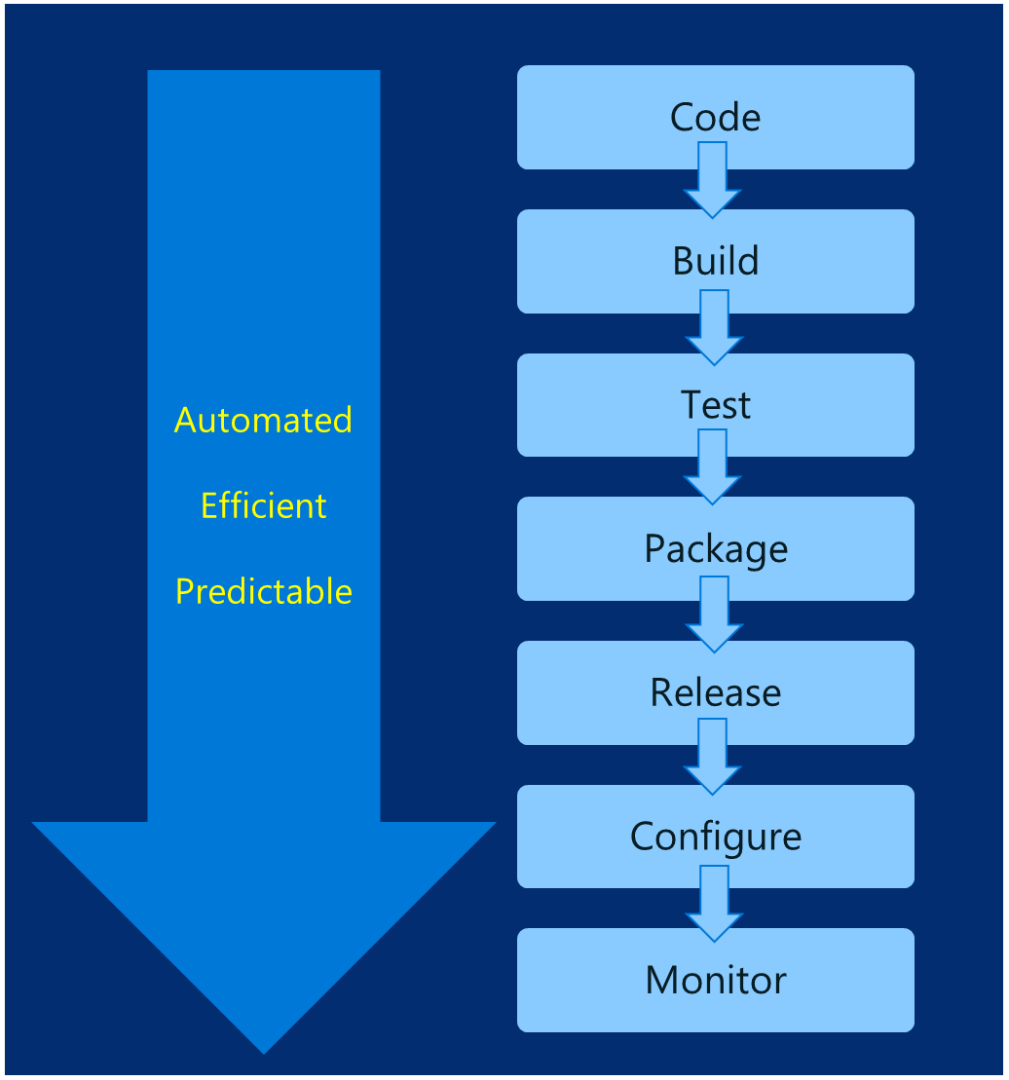
# Release automation tools



# DevOps Practices Arrive

- Developers: Test, Build, Code, Plan
- Operations: Monitor, Release, Deploy, Operate
- DevOps Features
  - Speed of application delivery/updates
  - Faster time to value
  - Repeatable/consistent
  - Automated testing
  - Traceability of process
  - Applying developer patterns to infrastructure
    - Infrastructure as code
    - Ops teams embracing source control
  - Centralized monitoring, logging, debugging
- CI / CD – key aspect of quality DevOps

# DevOps – Why?




Deploy 200 times more frequently

Go from code check-in to production 2,555 times faster

Recover from failure 24 times faster

Spent 50% less time remediating security challenges

Spent 22% less time on unplanned work

2.2 times more likely to believe their places a great place to work

*Source: https://puppet.com/resources/white-paper/2016-state-of-devops-report*

# Common Toolsets

- Jenkins
- Visual Studio Team Services
- Spinnaker and Netflix OSS
- Travis
- TeamCity
- CircleCI
- Additional utilities: code quality scanning, security, collaboration, etc.

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**Release Automation Tools**

# Release automation tools

## Simplifying the Kubernetes experience

DRAFT

Streamlined Kubernetes development

HELM

The package manager for Kubernetes

BRIGADE

Event-driven scripting for Kubernetes

KASHTI

Visualization dashboard for Brigade

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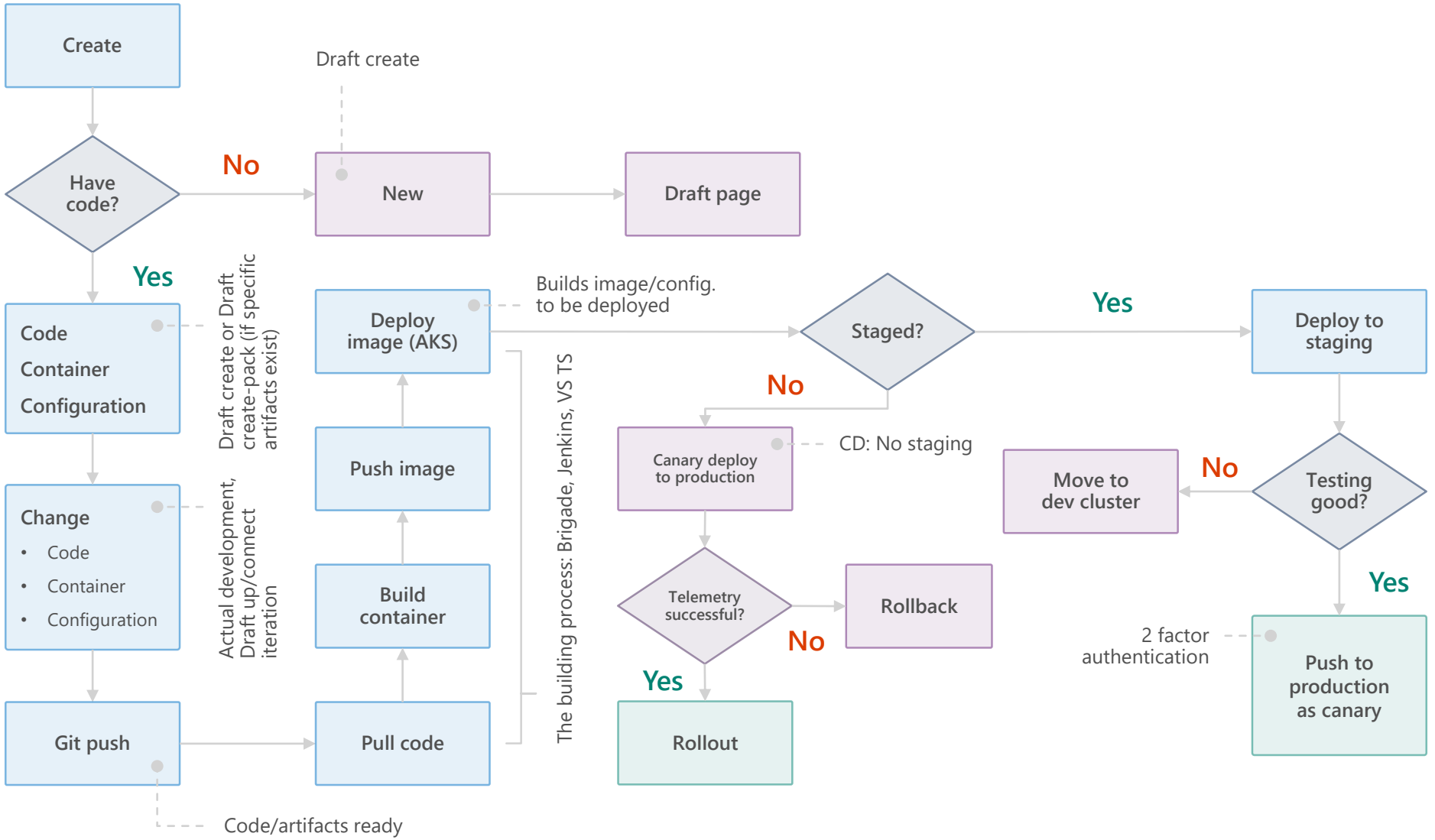
# Release automation workflow



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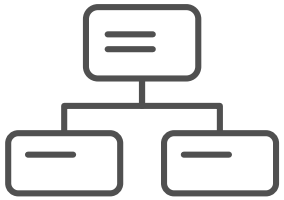
# Helm

## The best way to find, share, and use software built for Kubernetes



### Manage complexity

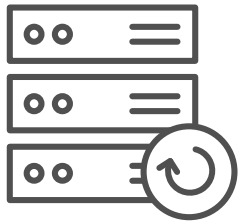
Charts can describe complex apps; provide repeatable app installs, and serve as a single point of authority

### Easy updates

Take the pain out of updates with in-place upgrades and custom hooks

### Simple sharing

Charts are easy to version, share, and host on public or private servers



### Rollbacks

Use `helm rollout` to roll back to an older version of a release with ease

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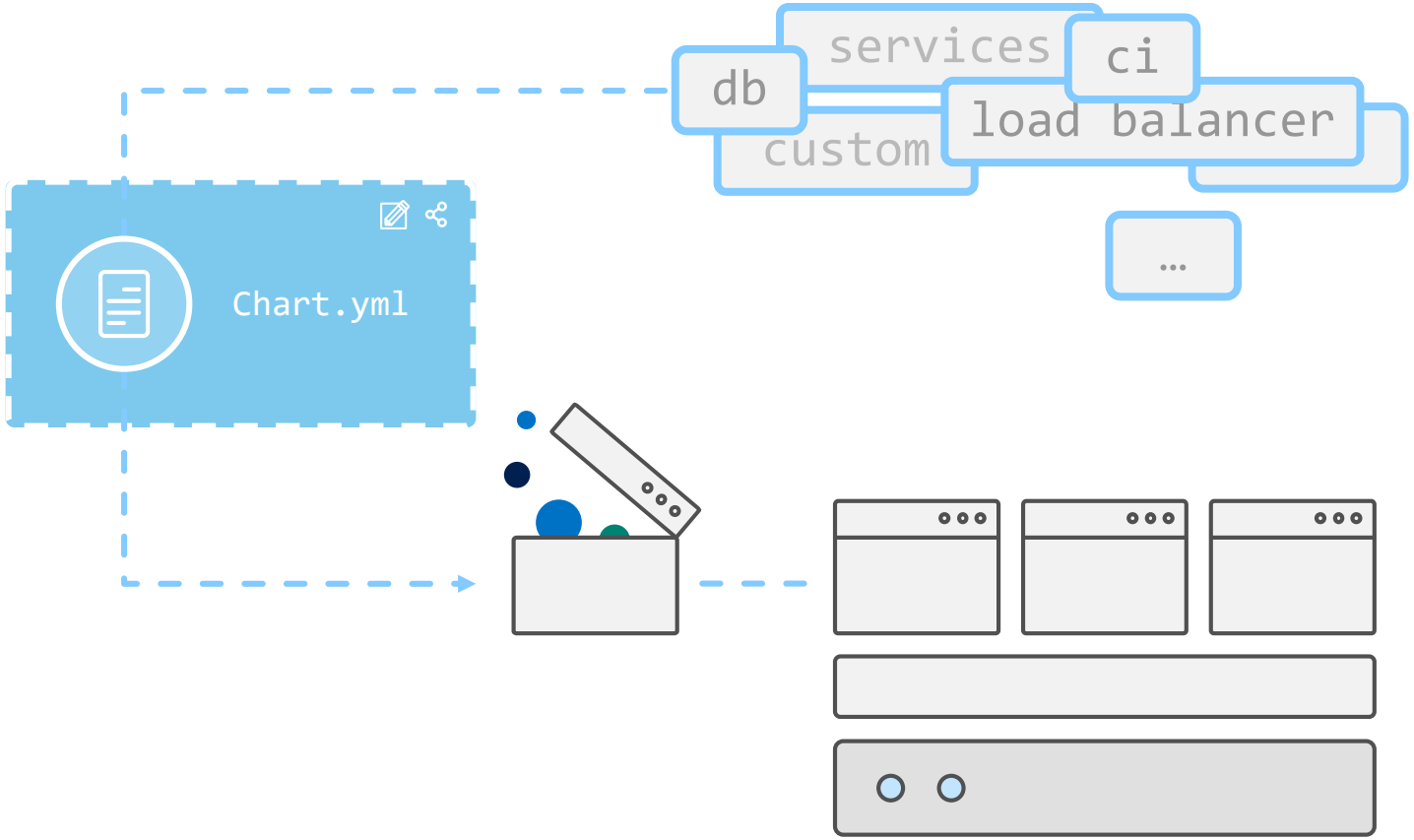
# Helm

## Helm Charts helps you define, install, and upgrade even the most complex Kubernetes application



# Helm Charts

Application definition

Consists of:

- Metadata
- Kubernetes resource definitions
- Configuration
- Documentation

Stored in chart repository

- Any HTTP server that can house YAML/tar files (Azure, GitHub pages, etc.)
- Public repo with community supported charts (eg – Jenkins, Mongo, etc.)

Helm (CLI) + Tiller (sever side)

Release:  Instance of chart + values -> Kubernetes

# Chart structure

- Layout
  - Helm expects a strict chart structure

```
wordpress/
  Chart.yaml          # A YAML file containing information about the chart
  LICENSE             # OPTIONAL: A plain text file containing the license for the chart
  README.md           # OPTIONAL: A human-readable README file
  values.yaml         # The default configuration values for this chart
  charts/             # OPTIONAL: A directory containing any charts upon which this chart depends.
  templates/          # OPTIONAL: A directory of templates that, when combined with values,
                      # will generate valid Kubernetes manifest files.
  templates/NOTES.txt # OPTIONAL: A plain text file containing short usage notes
```

# Helm values.yaml

- The knobs and dials:
  - A `values.yaml` file provided with the chart that contains **default** values
  - Use -f to provide your own values overrides
  - Use --set to override individual values

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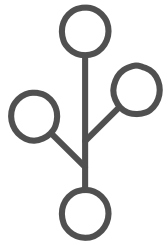
# Brigade

## Run scriptable, automated tasks in the cloud — as part of your Kubernetes cluster



### Simple, powerful pipes

Each project gets a `brigade.js` config file, which is where you can write dynamic, interwoven pipelines and tasks for your Kubernetes cluster

### Runs inside your cluster

By running Brigade as a service inside your Kubernetes cluster, you can harness the power of millions of available Docker images

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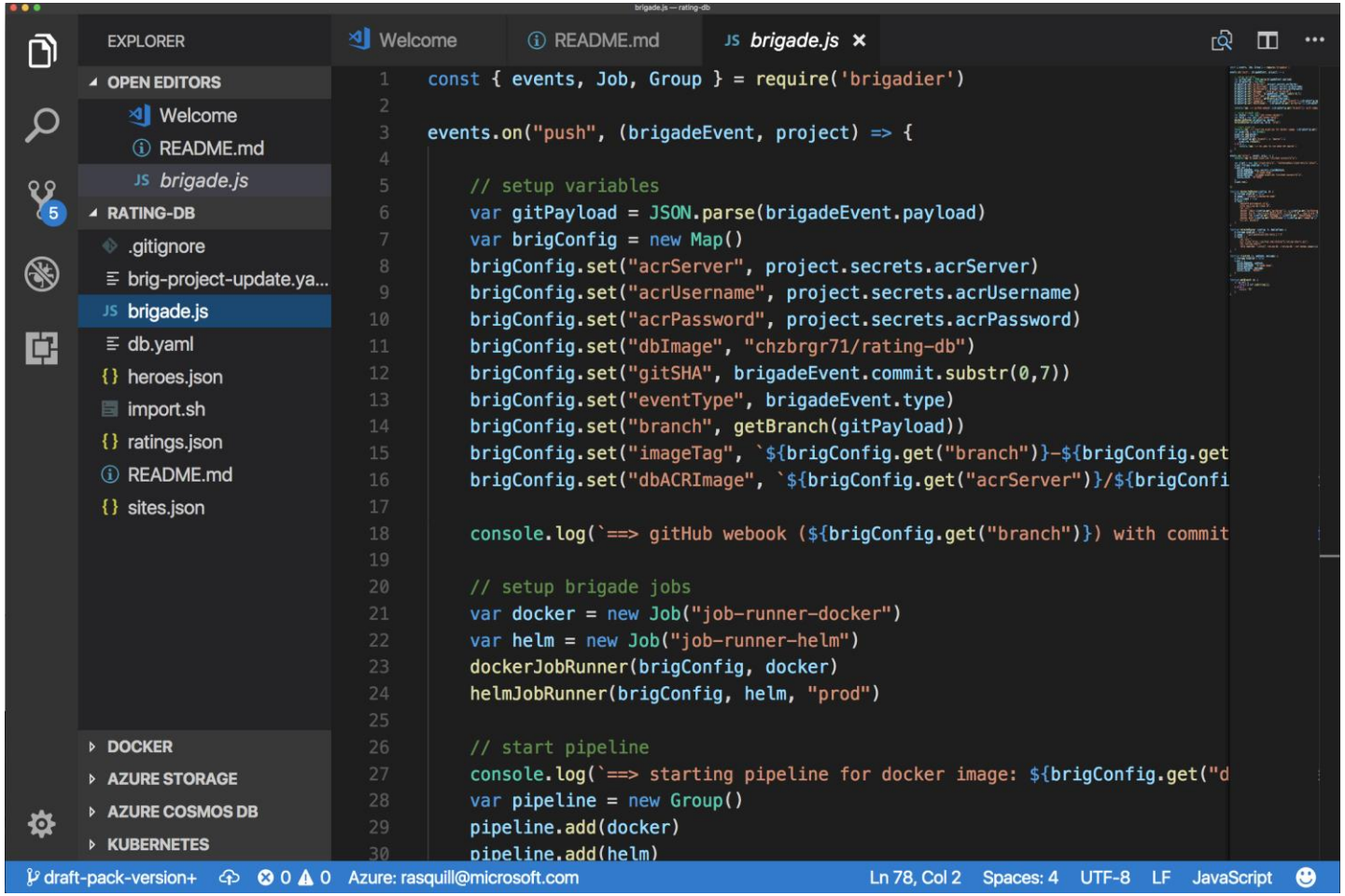
# Brigade

## Brigade in action



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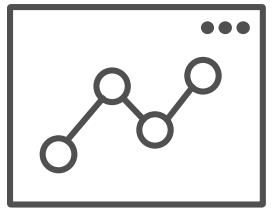
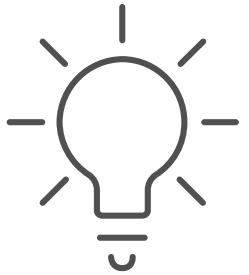
# Kashti

## A simple UI to display build results and logs



### Simple visualizations

A web dashboard for Brigade, helping to easily visualize and inspect your Brigade builds



### Driving deep insights

Make Brigade DevOps workflows—projects, scripts, and jobs—and their events visible instantly

Azure Kubernetes Service (AKS)

Azure Container Instances (ACI)

Azure Container Registry

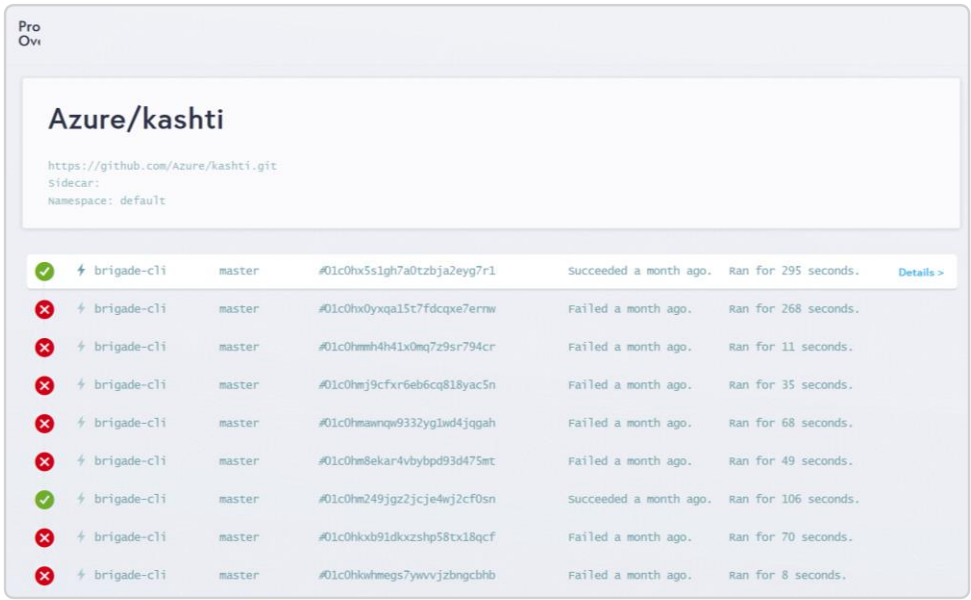
Open Service Broker API (OSBA)

**Release Automation Tools**

# Kashti

## Dashboards for Brigade pipelines

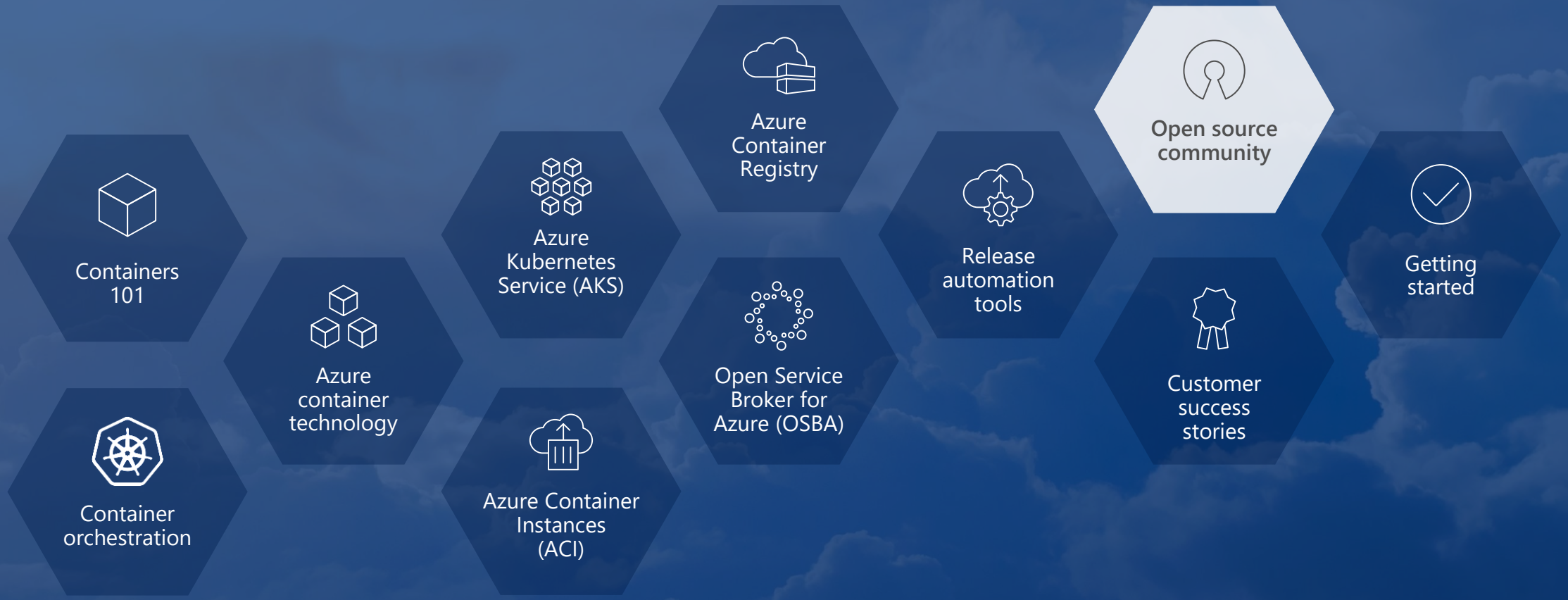

Builds dashboard



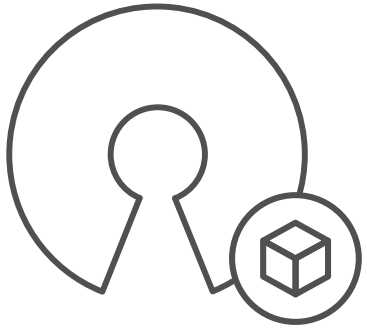

Events log

# Questions?

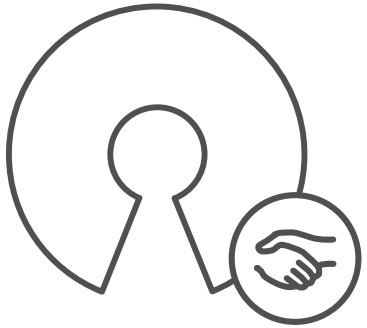
# Open source community



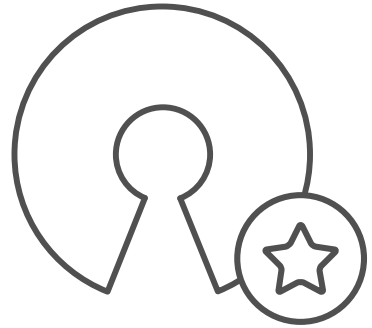
# **Community** culture



Open source container code contributions

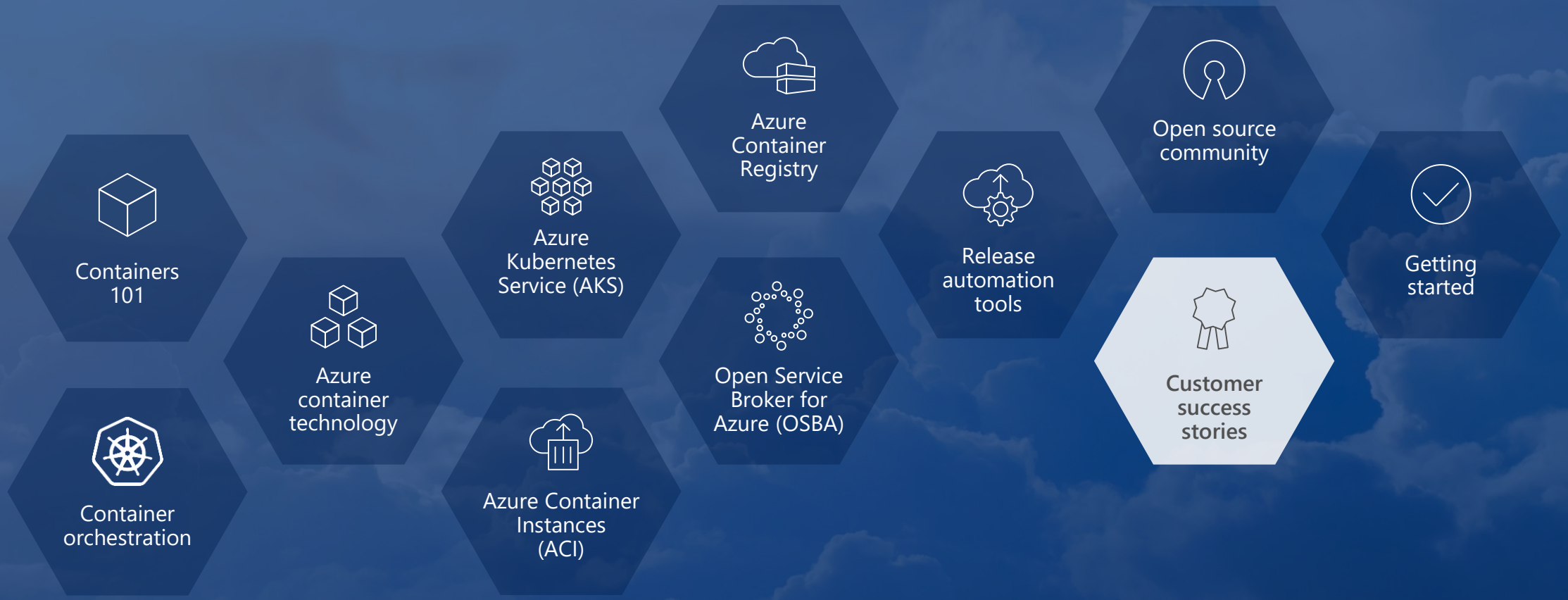


Numerous open source project builds



Open source community leadership

# Customer success stories




# Energy company electrifies pace of innovation and expansion

Ambit Energy provides electricity and natural-gas services in deregulated markets around the world. It uses technology as a competitive differentiator, employing microservices, DevOps, and continuous deployment to speed software development. To stand up infrastructure just as quickly, Ambit uses Microsoft Azure services such as Azure Container Service, together with infrastructure as code and open source technologies, to completely automate infrastructure provisioning. By implementing Azure, Ambit can move dramatically faster to enhance its services and enter new markets. Infrastructure redundancy is flexible and worry-free. And costs are 22 percent lower, which helps Ambit compete in the crowded electricity market. Because Ambit's cloud journey is gradual, it appreciates the fact that Azure is a great hybrid-cloud enabler, connecting easily to Ambit datacenters.

AMBIT ENERGY

**Products and services**

Microsoft Azure Container Service

**Organization size**

1,000 employees

**Industry**

Power and utilities

**Country**

United States

**Business need**

Optimize operational efficiency


# Siemens Health leverages technology to connect medical devices to the cloud through AKS

Digitization and networking between healthcare providers and software development companies are essential to value-based care. Moving from the development of value-added services into becoming more of a platform provider, it became important for Siemens to adopt a microservices approach to application delivery. To that end, Siemens adopted Azure Container Service (AKS) to run their microservices-based apps. AKS puts Siemens in a position not only to deploy business logic in Docker containers—including the orchestration—but also enables them to use an applicant gateway and API management to manage exposure, control, and to meter the access continuously. With their cloud-based development approach, Siemens has driven newfound product development agility. This project is already having a positive impact within the healthcare industry.

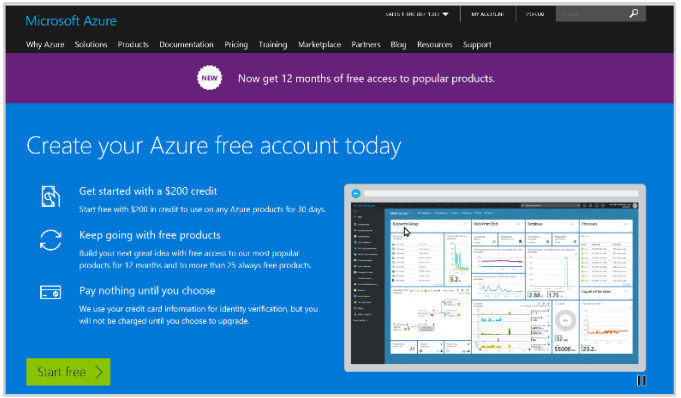
SIEMENS

| Products and services | Organization size | Industry | Country | Business need |
|---|---|---|---|---|
| Microsoft Azure Container Service | 100,000+ employees | Healthcare | Germany | Faster application development |

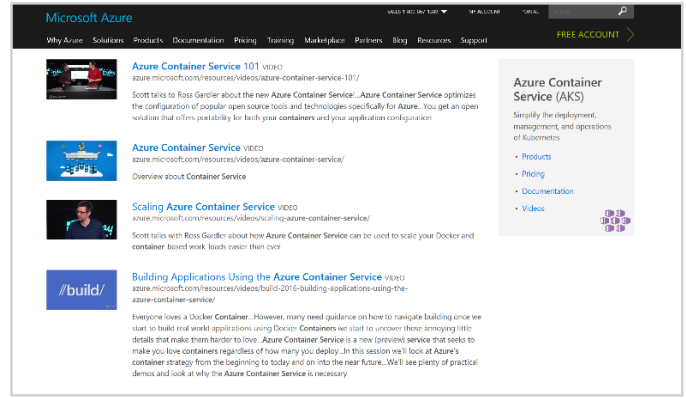
# Azure container **resources**

- Azure Kubernetes Service (AKS)
- Azure Container Instances (ACI)
- Azure Container Registry
- OSBA announcement blog
- Draft webpage
- Helm webpage
- Brigade webpage
- Kashti announcement blog

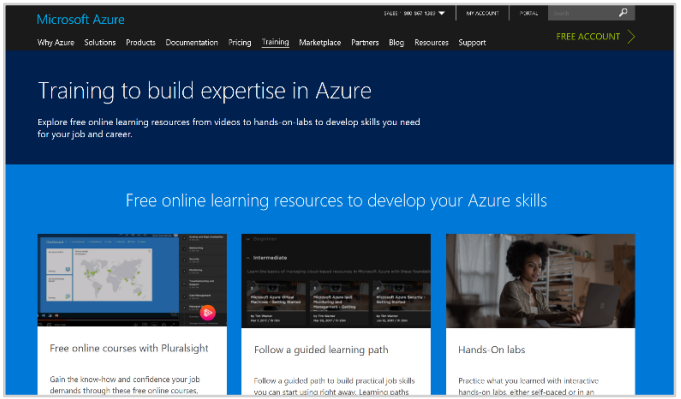
### Sign up for a free Azure account



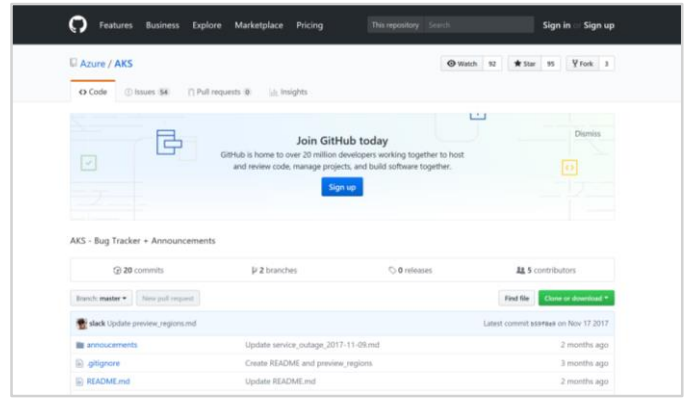

### Check out the Azure container videos page




### Hone your skills with Azure training




### Get the code from GitHub

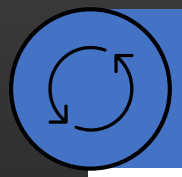


# Appendix Sections

# So many choices…

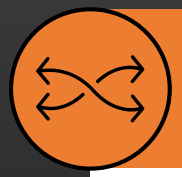
| Service | Sweet spot |
| --- | --- |
| Azure Web Apps | Deploy scalable web apps and services using containers |
| Service Fabric | Build microservice applications packaged in containers |
| Azure Kubernetes Service | Use OSS orchestrators to manage containers across VMs |
| Azure Batch | Schedule large scale batch processes deployed in containers |
| Azure Container Instances | Run individual containers with no VM management |

# Why Change?



## Aging infrastructure

- Aging hardware, operating systems, and business applications in the datacenter can impact:
- Operational costs, efficiency, and reliability
- Capital expenditure requirements
- Security, audit, and regulatory compliance



## Lack of agility

- Deployment time of new services
- Operation is time (and budget) consuming
- Innovation is happening outside IT inside business areas

## High Cost

- Longer release cycles, monolithic and highly coupled architecture
- Highly IT dependent
- Low application performance and time-to-market compromise business agility

# Why containers?

- Repeatable execution
  - immutable environment
  - reusable and portable code (“Build, Ship, and Run”)
- Consistency across development, test, & production
- Fast & agile app deployment; instant startup
- Cloud portability
- Density, partitioning, scale
- Diverse developer framework support
- Promotes microservices

# Docker, Docker, Docker


**Containers have been around for many years**
Linux kernel: cgroups, namespaces

**Docker Inc. did not invent them**
They created open source software to build and manage containers

**Docker makes containers easy**
Super easy. Fast learning curve

**Docker is a container format and a set of tools**
Docker CLI, Docker Engine, Docker Swarm, Docker Compose, Docker Machine

# What is a container?

Slice up the OS to run multiple apps on a single VM

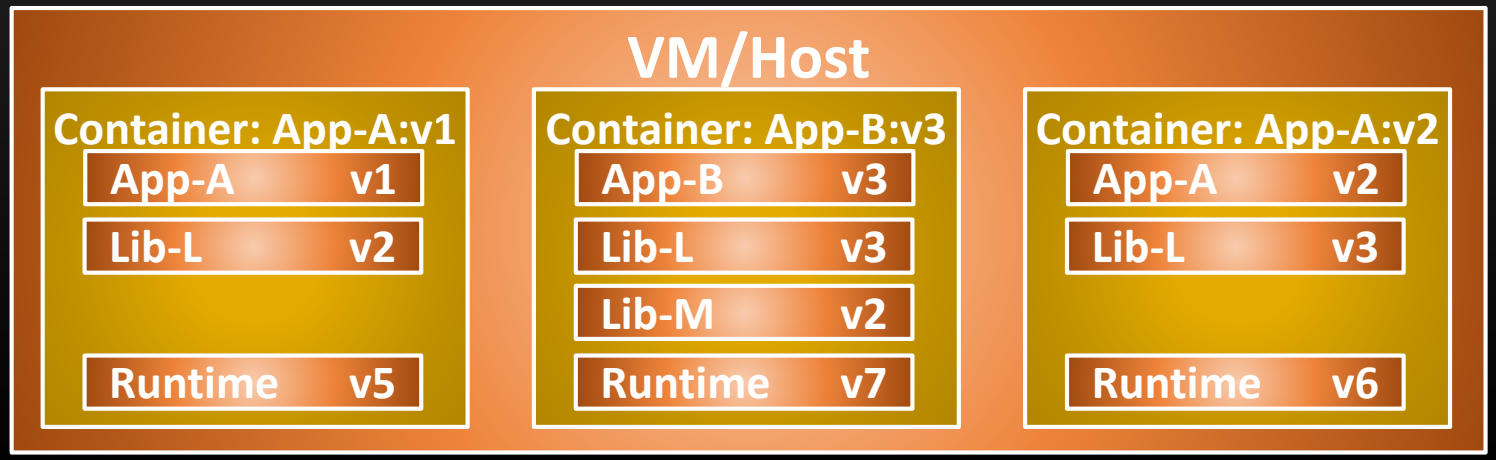
Every container has an isolated view and gets

- it's own file system
- it's own PID0 and eth0 network interface

Container and apps share lifecycle

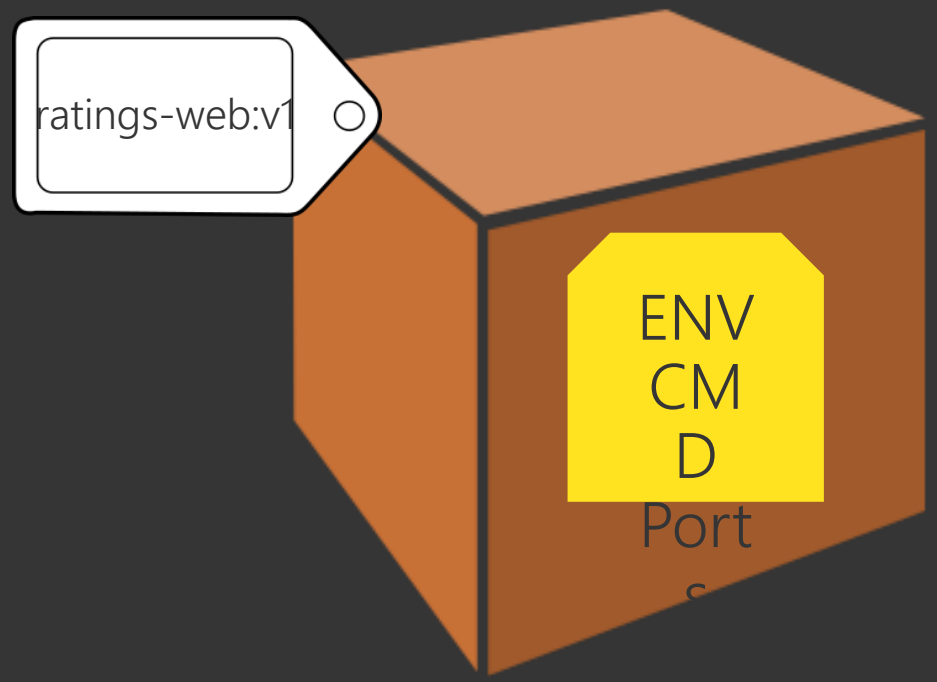
Shared kernel, very fast start-up, and repeatable execution

Cannot mix OS

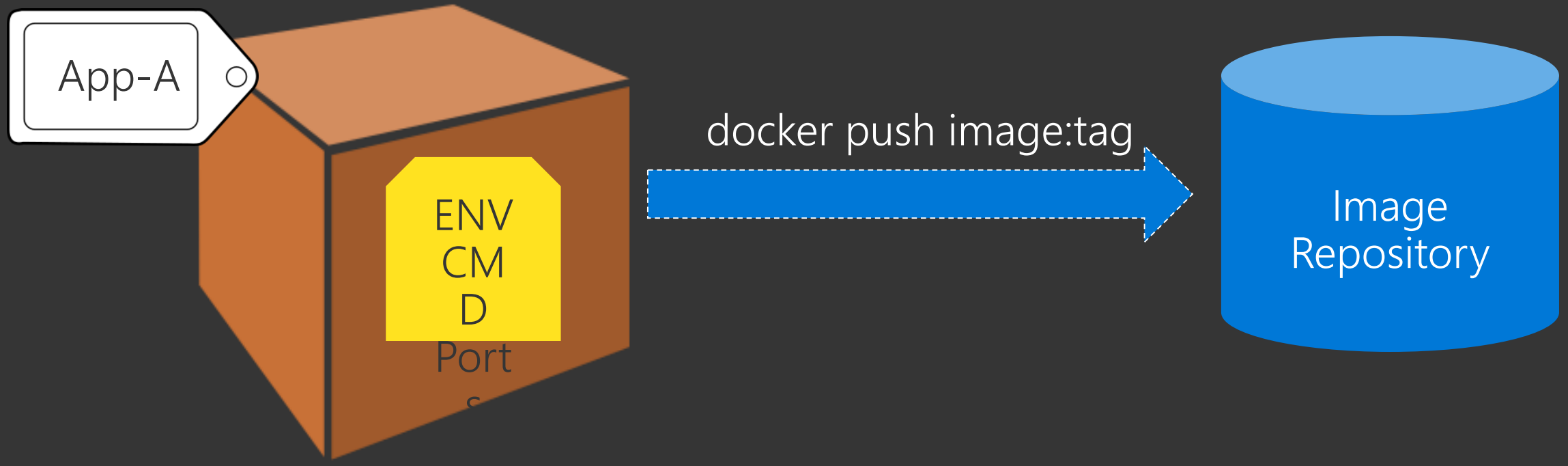



/lib
/src
/lib2
/config

# Package Container



# Push Container Image



# Azure Container Support

Pivotal Cloud Foundry

RED HAT® OPENSHIFT Container Platform

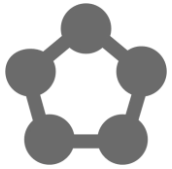
Mesos DC/OS

kubernetes

docker

Azure Container Instance

Azure Kubernetes Service (AKS)



Service Fabric

Web Apps

Batch

Azure Kubernetes Service (AKS)

Azure Container Instances (ACI)

Azure Container Registry

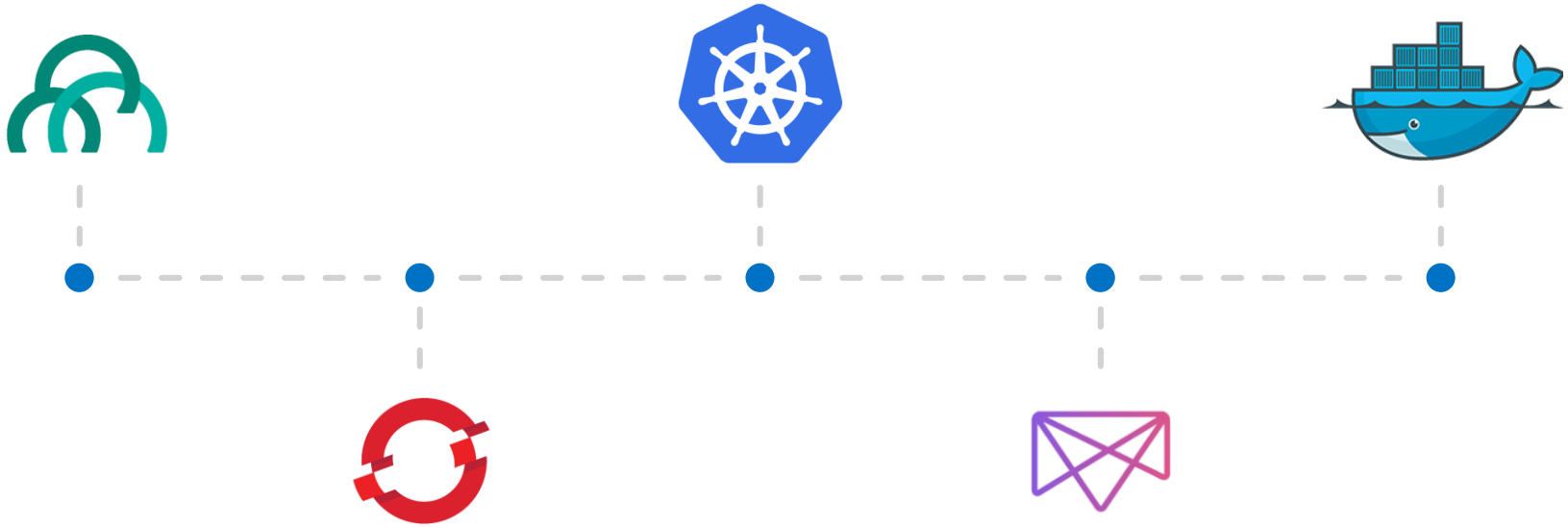
Open Service Broker API (OSBA)

Release Automation Tools

For customers with a preferred container platform

**Pivotal Cloud Foundry · Kubernetes · Docker Enterprise Edition**

**Red Hat OpenShift · Mesosphere DC/OS**



## Help them bring that platform to Azure

Azure Kubernetes Service (AKS)

Azure Container Instances (ACI)

Azure Container Registry

Open Service Broker API (OSBA)

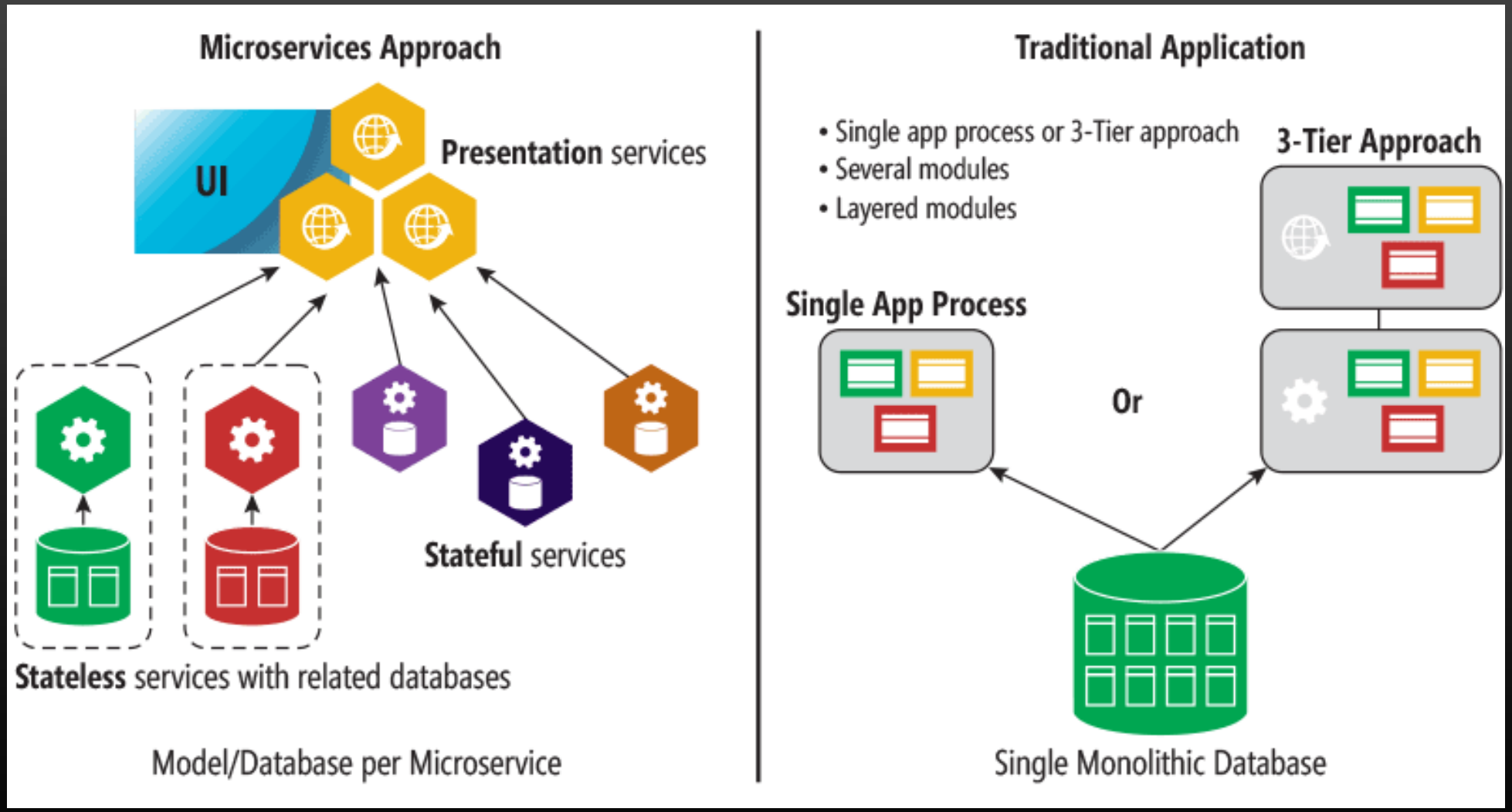
Release Automation Tools

# For customers without a preferred container platform…

**Lead with profiling questions, then make recommendations based on the customer profiles**

For more details, refer to the container cheat sheet

# Microservices



# microservices ≠ containers

microservices is an architectural design approach

containers are an implementation detail that often helps

# Microservices Benefits

- ✓ Independent deployments
- ✓ Enables continuous delivery
- ✓ No downtime upgrades
- ✓ Improved scale and resource utilization per service
- ✓ Fault isolation
- ✓ Security isolation
- ✓ Services can be distributed across multiple servers or environments
- ✓ Multiple languages / diversity
- ✓ Smaller, focused teams
- ✓ Code can be organized around business capabilities
- ✓ Autonomous developer teams

# Microservices – The Hard Part

- ✓ Deployment is complex
- ✓ Testing is difficult
- ✓ Debugging is difficult
- ✓ Monitoring/Logging is difficult
- ✓ New service versions must support old/new API contracts
- ✓ Distributed databases make transactions hard
- ✓ Cluster and orchestration tools overhead
- ✓ Distributed services adds more network communication
  - ✓ Increased network hops
  - ✓ Requires failure/recovery code
  - ✓ Need service discovery solution
- ✓ Advanced DevOps capability: short-term pain for long-term gain

# 12-Factor Apps


http://12factor.net

# 12-Factor Apps (1-5)

1. Single root repo; don’t share code with another app
2. Deploy dependent libs with app
3. No config in code; read from environment vars
4. Handle unresponsive app dependencies robustly
5. Strictly separate build, release, & run steps
   - Build: Builds a version of the code repo & gathers dependencies
   - Release: Combines build with config ReleaseId (immutable)
   - Run: Runs app in execution environment

# 12-Factor Apps (6-12)

6. App executes as 1+ stateless process & shares nothing
7. App listens on ports; avoid using (web) host
8. Use processes for isolation; multiple for concurrency
9. Processes can crash/be killed quickly & start fast
10. Keep dev, staging, & prod environments similar
11. Log to stdout (dev=console; prod=file & archived)
12. Deploy & run admin tasks (scripts) as processes

# ConfigMaps and Secrets

- Flexible configuration model for Kubernetes
- Both Secrets and ConfigMaps can be used as ENV vars or files
- Secrets
  - Use Secrets for things which are actually secret like API keys, credentials, etc
  - Secret values are base64 encoded and automatically decoded for pods
- ConfigMaps
  - ConfigMaps for configuration that doesn't have sensitive information. However, there are pros/cons with each
  - ConfigMaps designed to more conveniently support working with strings

# Namespaces

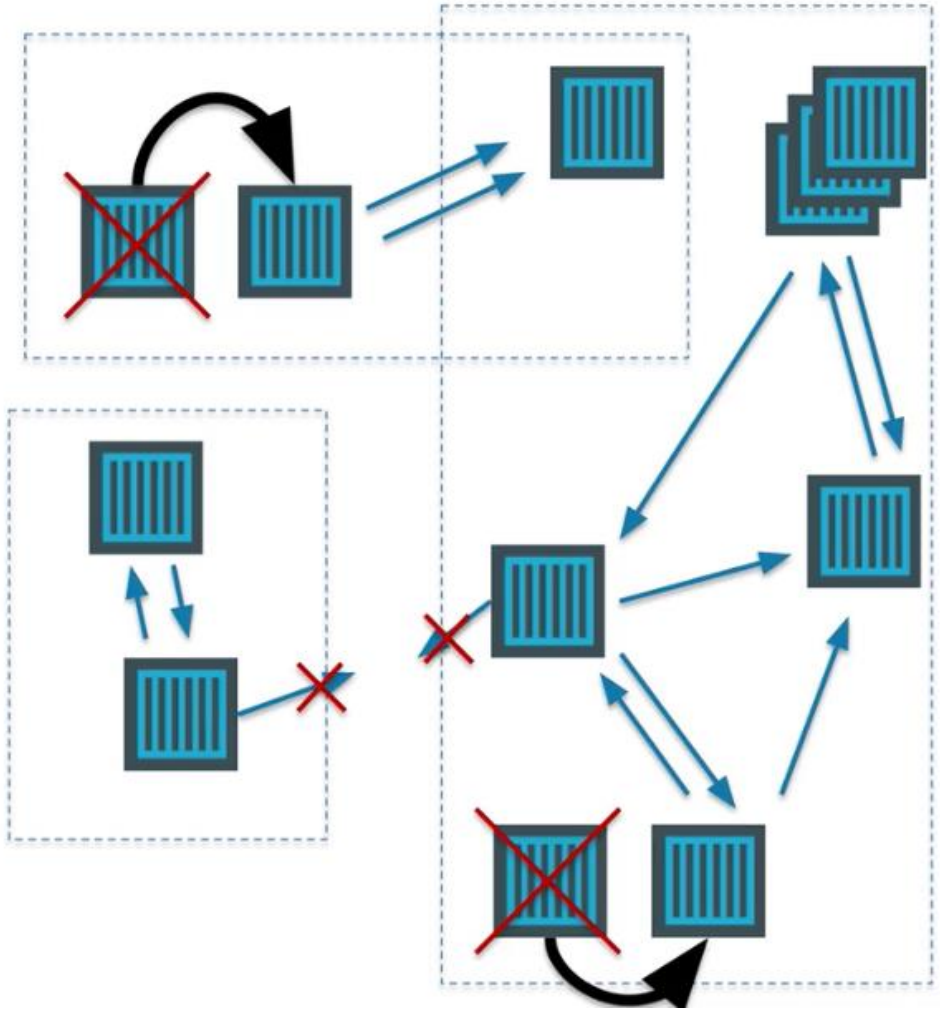
- Allow for multiple virtual clusters backed by the same physical cluster
- Logical separation
- Namespace used in FQDN of Kubernetes services
  - Eg - <service-name>.<namespace-name>.svc.cluster.local
- Every Kubernetes resource type is scoped to a namespace (except for nodes, persistentVolumes, etc.)
- Intended for environments with many users, teams, projects

# Role Based Access Control

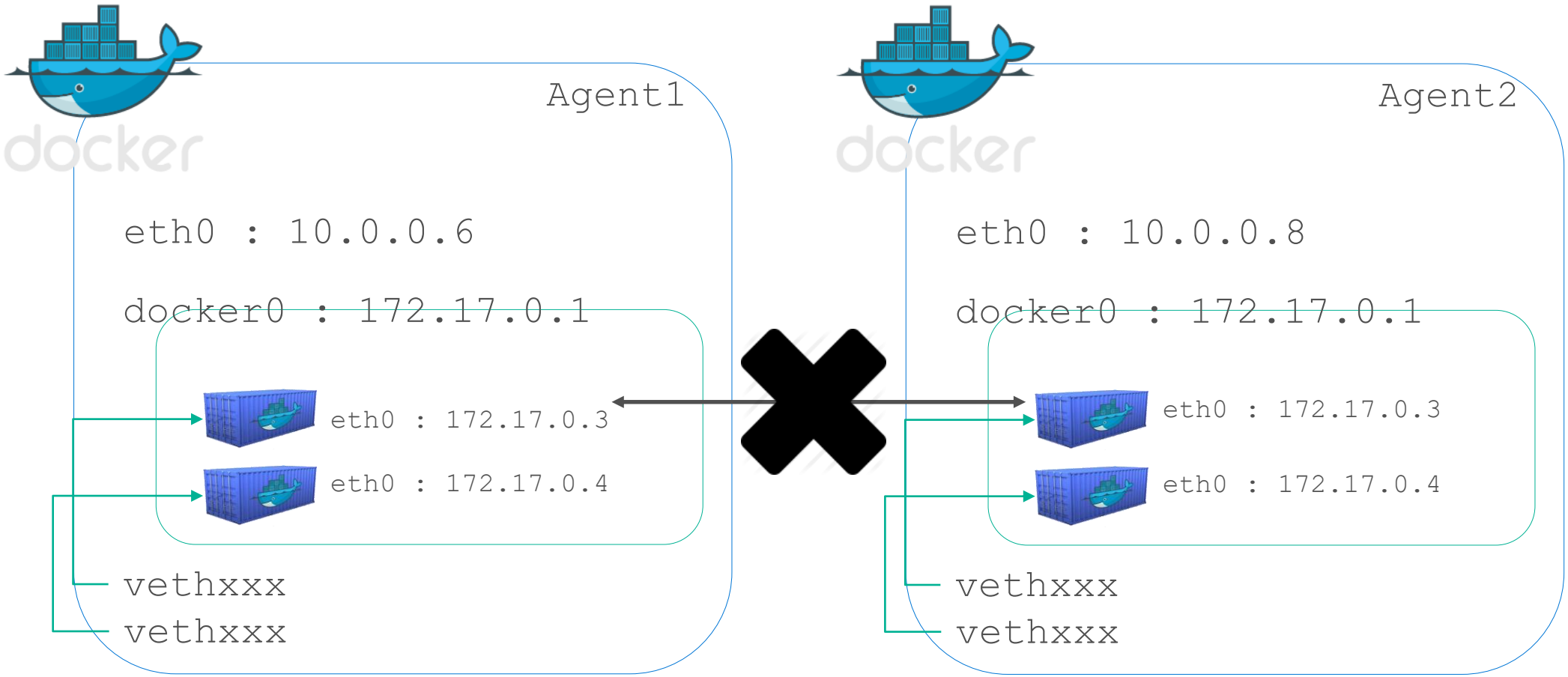
- Allows for dynamic policies against k8s API for authZ
- In version 1.6, this is a beta feature
- Can create both "Roles" and "ClusterRoles"
- Can configure api-server and kubectl to use Azure AD for access
- To grant permissions:
  - Use "RoleBindings" for within namespaces
  - Use "ClusterRoleBindings" for cluster-wide access
  - Can contain users, groups, service accounts
  - Control access to specific resources or API verbs

```
rules:
- apiGroups: [""]
  resources: ["pods"]
  verbs: ["get", "list", "watch"]
- apiGroups: ["batch", "extensions"]
  resources: ["jobs"]
  verbs: ["get", "list", "watch", "create", "update", "patch", "delete"]
```

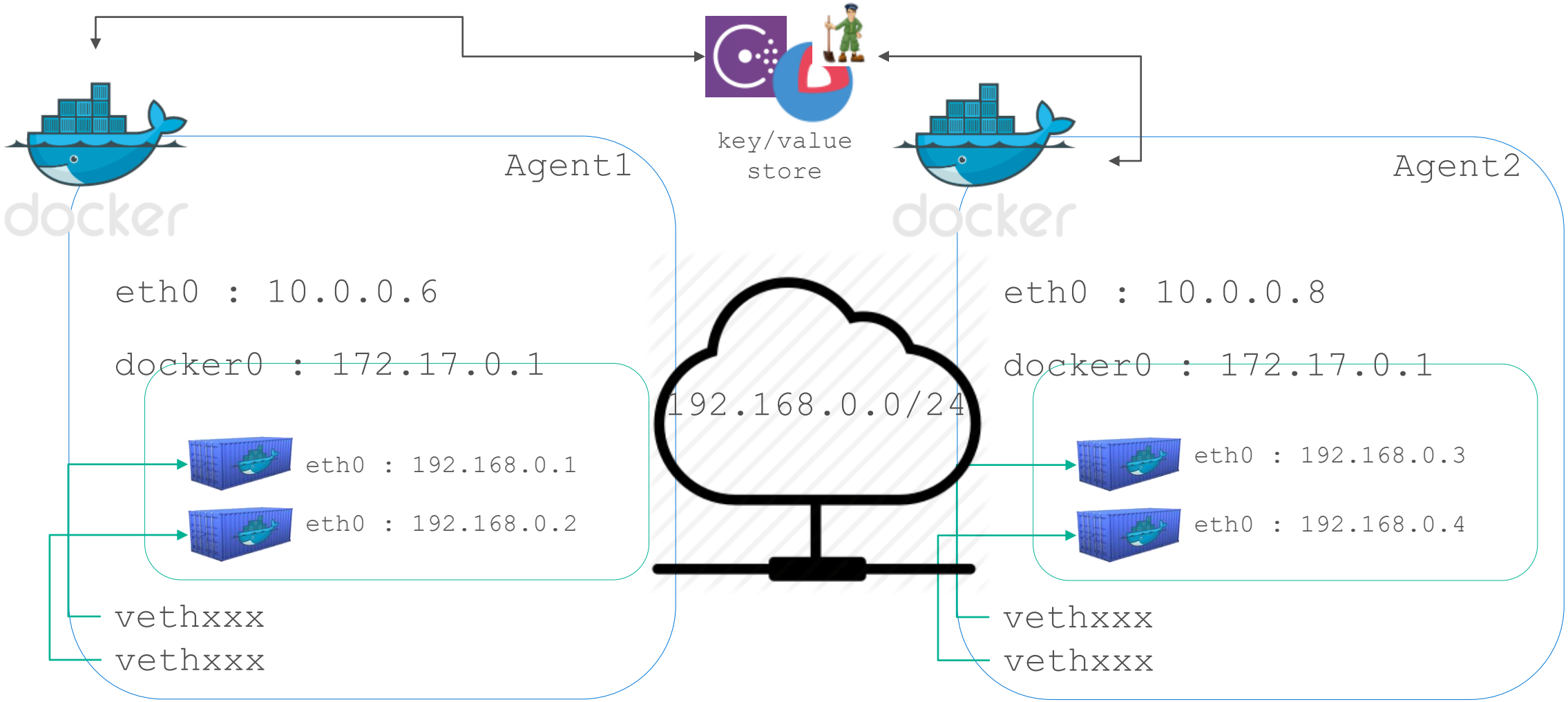
# Networking in the Container World



# Multi-Host Networking



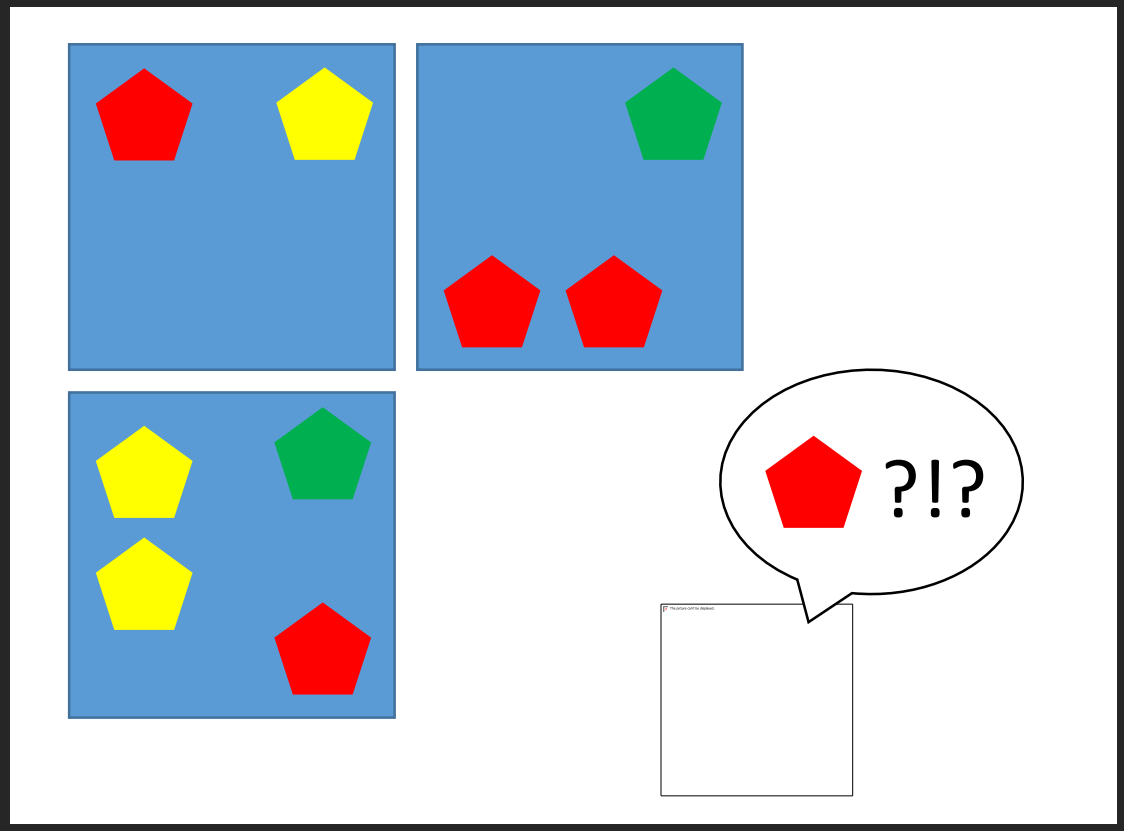
# Multi-Host Networking



# What is service discovery?

Problem: How service can find and communicate with another one running into the same cluster?

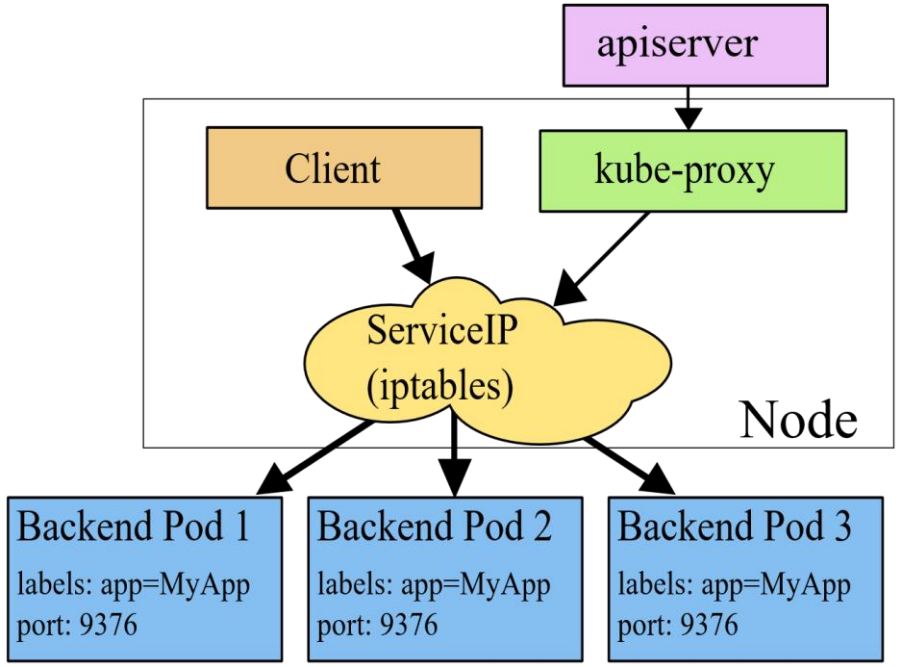
- Service Registry/Naming Service
- Service Announcement
- Lookup/Discovery
- Load Balancing



# Networking in Kubernetes

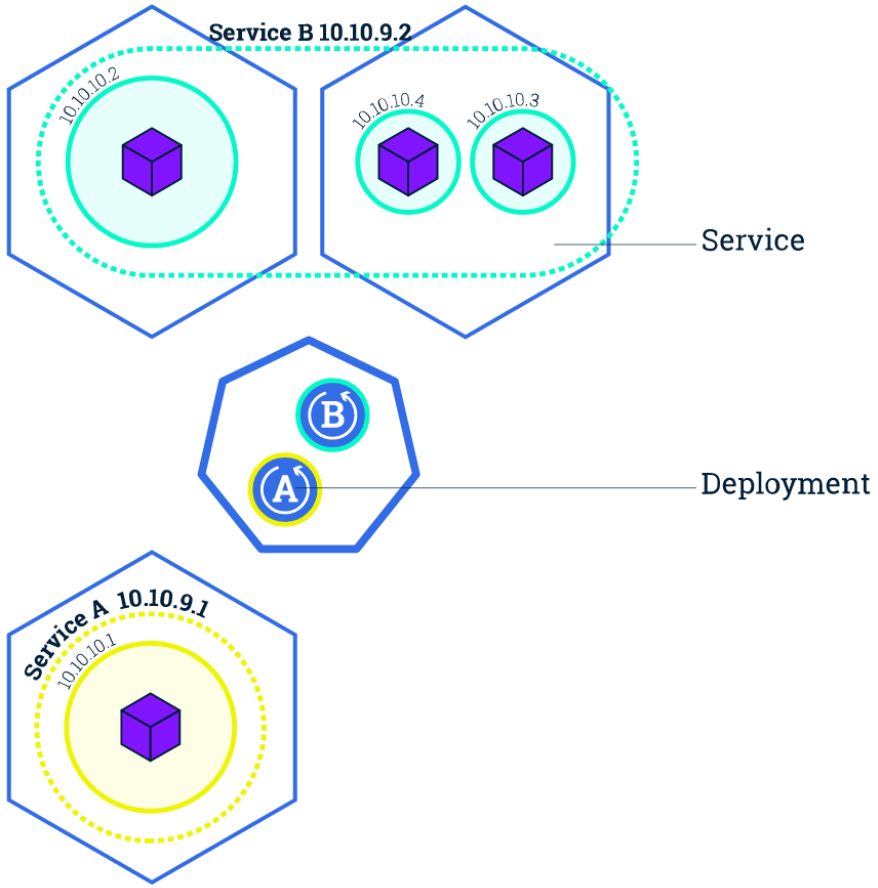
Kubernetes Networking model introduces 3 methods of communications:

- Pod-to-Pod communication directly by IP address. Kubernetes has a Pod-IP wide metric simplifying communication.
- Pod-to-Service Communication – Client traffic is directed to service virtual IP by iptables rules that are modified by the kub-proxy process (running on all hosts) and directed to the correct Pod.
- External-to-Internal Communication – external access is captured by an external load balancer which targets nodes in a cluster. The Pod-to-Service flow stays the same.



# Service Discovery with Kubernetes

- Nodes, Deployments, Pods, Services
- Services
  - Expose the services
  - Works with platform Load Balancers to get public IPs
  - Internal load balancing between pods
- kube-dns (preferred)
  - Name service enabled in Kubernetes (Default in ACS)
- Environment Variables
  - Every Service is assigned environment variables with information of the service
  - REDIS_MASTER_SERVICE_HOST=10.0.0.11
    REDIS_MASTER_SERVICE_PORT=6379
    REDIS_MASTER_PORT=tcp://10.0.0.11:6379
    REDIS_MASTER_PORT_6379_TCP=tcp://10.0.0.11:6379
    REDIS_MASTER_PORT_6379_TCP_PROTO=tcp
    REDIS_MASTER_PORT_6379_TCP_PORT=6379
    REDIS_MASTER_PORT_6379_TCP_ADDR=10.0.0.11



# Ingresses

- Typically, services and pods have IPs only routable by the cluster network
- All traffic that ends up at an edge router is either dropped or forwarded elsewhere
- Ingress is a collection of rules that allow inbound connections to reach the cluster services
- An Ingress controller is responsible for fulfilling the Ingress, usually with a loadbalancer, though it may also configure your edge router or additional frontends to help handle the traffic in an HA manner

# Container Network Interface (CNI)

- CNI (a CNCF project) is a spec for plugins to configure Linux container network interfaces
- Wide range of support
  - Kubernetes, OpenShift, Cloud Foundry, Mesos, rkt, etc.
- Examples
  - Calico, Weave, Contiv, etc.
- Azure CNI plug-in integrates Azure VNET into kubernetes clusters
- Use acs-engine

# Daemonsets

- Ensures that all (or some) nodes run a copy of a pod
- Doesn't care if a node is marked as unschedulable
- Can make pods even if the scheduler is not running

# StatefulSets

- Used for workloads that require consistent, persistent hostnames e.g. etcd-01, etcd-02
- One PersistentVolume storage per pod
- StatefulSet example - zookeeper
- StatefulSet example - cockroachdb

# Jobs

- Creates one or more pods and ensures that a specified number of them successfully terminate
- 3 types of jobs
  - Non-parallel Jobs - e.g. single pod done when exit is successful
  - Parallel Jobs with a fixed completion count - e.g. one successful pod for each value in the range 1 to .spec.completions
  - Parallel Jobs with a work queue that coordinate with each other and terminate when one pod exits successfully