# Kubernetes kubectl and Deployment

.NET 5

*The kubectl CLI tool allows for control of Kubernetes clusters.*

HTTPS://KUBERNETES.IO/DOCS/REFERENCE/KUBECTL/OVERVIEW/

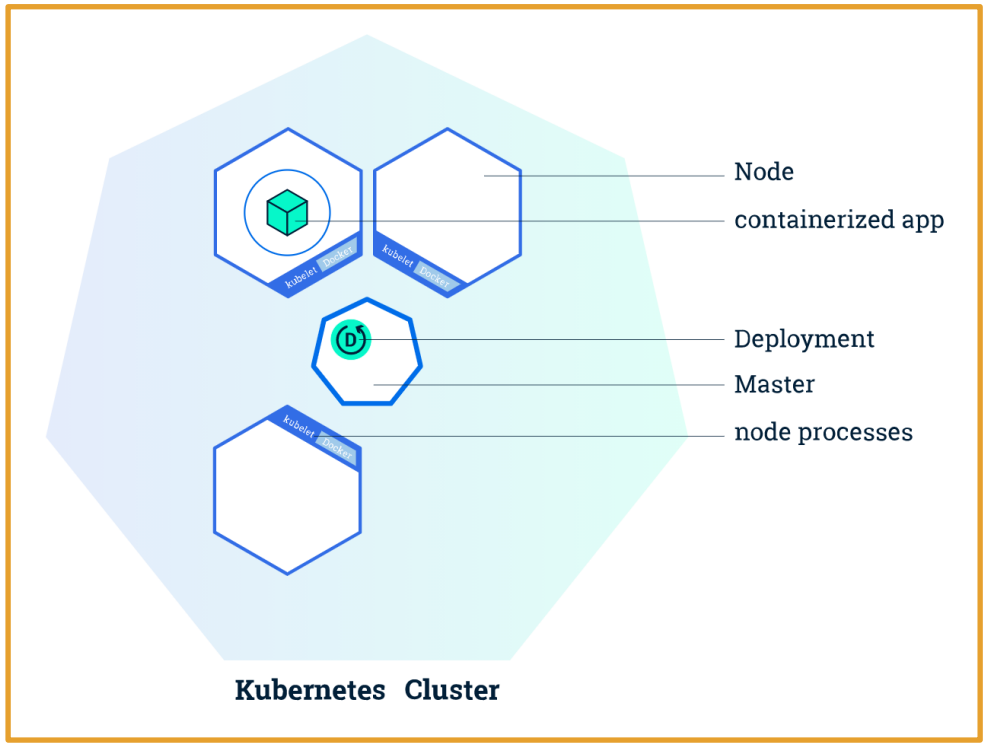
# Kubectl (“Cube CTL”)

https://kubernetes.io/docs/reference/kubectl/overview/

***Kubectl*** is the command line tool used to control Kubernetes clusters. ***Kubectl*** looks for a file named ***config*** in the $HOME/.kube directory. You can specify other ***kubeconfig*** files by setting the KUBECONFIG environment variable or by setting the --kubeconfig flag.

***Kubectl*** uses the ***Kubernetes API*** to interact with the cluster. The following syntax is used in command line to communicate through ***kubectl***:

- kubectl <command> <TYPE> <NAME> [flags]



# Kubectl (say, “Cube CTL”)

https://kubernetes.io/docs/tasks/kubectl/install/
https://kubernetes.io/docs/reference/kubectl/cheatsheet/

***Kubectl*** uses the ***Kubernetes API*** to interact with the cluster. The following syntax is used in command line to communicate through ***kubectl***:

•kubectl <command> <TYPE> <NAME> [flags]

| Command | Usage |
|---|---|
| command | Specifies the operation to perform on resources (create, get, describe, delete.) |
| type | Specifies the (case-insensitive) resource type. |
| name | Specifies the case-sensitive name of the resource. If the name is omitted, details for all resources are displayed. |
| flags | Specifies optional flags. |

# Deployment (1/2)

https://kubernetes.io/docs/tutorials/hello-minikube/

A ***Deployment*** is the recommended way to manage the creation and scaling of ***Pods***.

The ***Deployment Controller***:

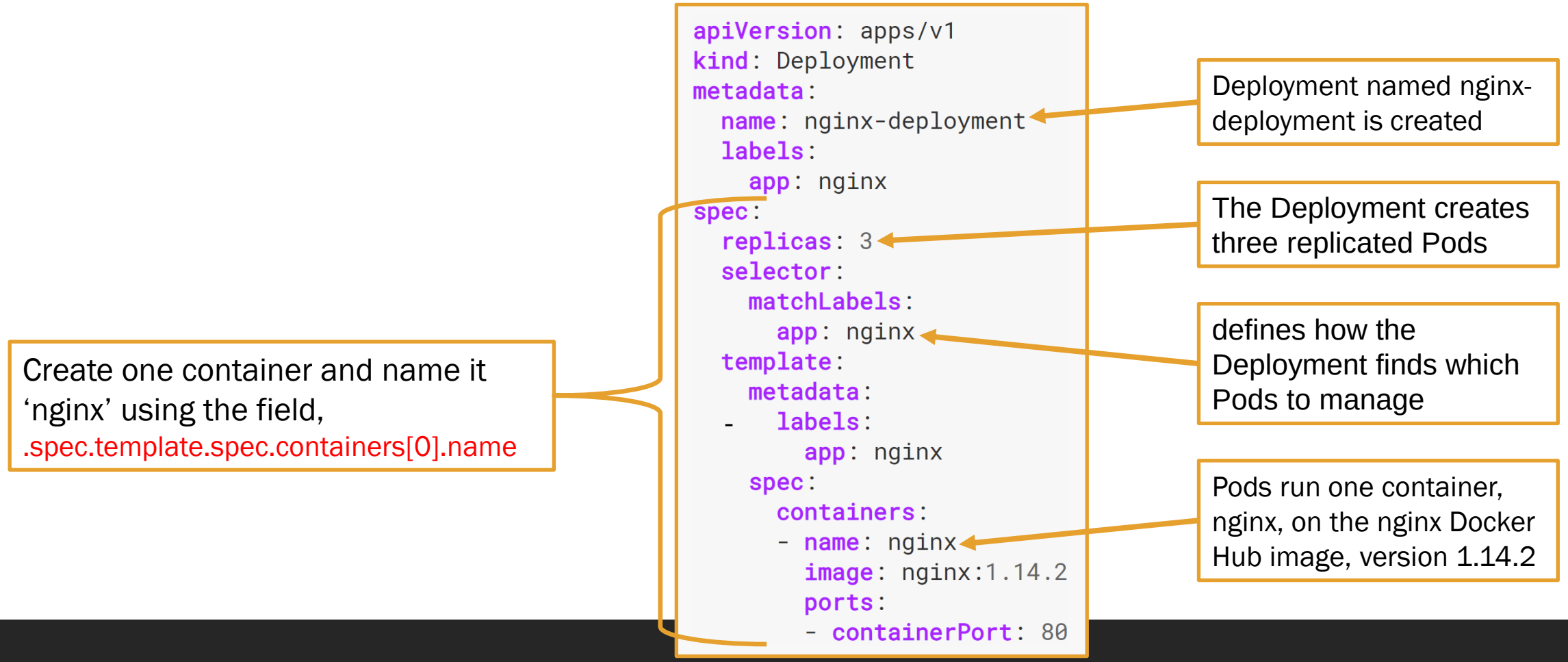
- uses a ***Deployment*** .yml to change an unacceptable state to a desired state at a controlled rate.
- manages ***ReplicaSets***,
- provides declarative updates to ***Pods***,
- checks on ***pod*** health
- restarts terminated ***pods***.

***Deployments*** should be used instead of directly using ***ReplicaSets*** unless custom update orchestration is not required or updates themselves are not required.

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: nginx-deployment
  labels:
    app: nginx
spec:
  replicas: 3
  selector:
    matchLabels:
      app: nginx
  template:
    metadata:
      labels:
        app: nginx
    spec:
      containers:
      - name: nginx
        image: nginx:1.14.2
        ports:
        - containerPort: 80
```

# Deployment Example (2/2)

https://kubernetes.io/docs/tutorials/hello-minikube/



# ReplicaSet

https://kubernetes.io/docs/concepts/workloads/controllers/replicaset/

The purpose of a ***ReplicaSet*** is to maintain a stable set of replica ***Pods*** running at a all times. It is often used to guarantee the availability of a specified number of identical ***Pods***.

A ***ReplicaSet*** will dynamically drive the ***cluster*** back to the predetermined desired state via creation of new ***Pods*** to keep an application running.

Use kubectl apply -f <URL> to apply a template.

***Pods*** can also be added without a template.

A ReplicaSet is defined with fields, including:

```yaml
apiVersion: apps/v1
kind: ReplicaSet
metadata:
  name: frontend
  labels:
    app: guestbook
    tier: frontend
spec:
  # modify replicas according to your case
  replicas: 3
  selector:
    matchLabels:
      tier: frontend
  template:
    metadata:
      labels:
        tier: frontend
    spec:
      containers:
      - name: php-redis
        image: gcr.io/google_samples/gb-frontend:v3
```

replicas indicate how many ***Pods*** should be maintained.

selector specifies how to identify ***Pods*** it can acquire.

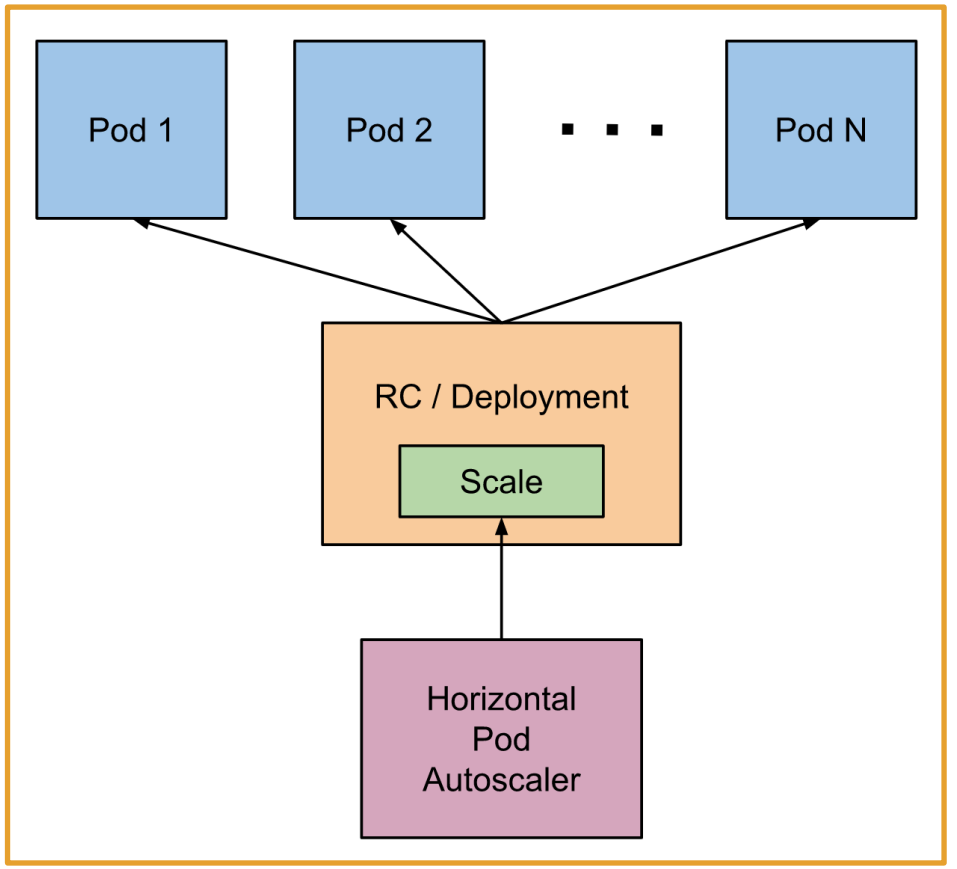
template specifies the data of the new ***Pods*** that should be created.

# AutoScaling

https://kubernetes.io/docs/tasks/run-application/horizontal-pod-autoscale/

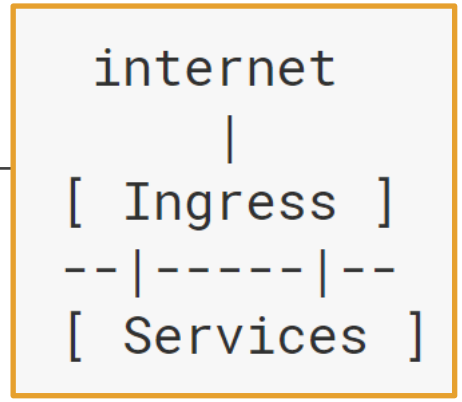
The ***Horizontal Pod Autoscaler*** is an API resource in the Kubernetes autoscaling API group which automatically scales the number of ***pods*** in a ***replication controller***, ***deployment***, ***replica set***, or ***stateful set*** based on CPU utilization.

The ***Horizontal Pod Autoscaler*** is implemented as a ***Kubernetes API*** resource and a ***controller*** in a control loop, with a ***period*** maintained by the ***controller manager***. The ***Kubernetes API*** resource determines the behavior of the ***controller***.



# Ingress (1/2)

https://kubernetes.io/docs/concepts/services-networking/ingress/




Linguistically, ***Ingress*** refers to the right to enter a property.

In Kubernetes, '***Ingress***' exposes HTTP routes from outside the ***cluster*** to services within the ***cluster***. It can give ***Services*** externally-reachable URLs, load balance traffic, terminate SSL/TLS, and offers name based virtual hosting.

Traffic routing is controlled by rules defined on the ***Ingress resource***. An ***Ingress Resource*** is (usually) a .yml file defining the rules for accessing structures in a ***cluster***.

```yaml
apiVersion: networking.k8s.io/v1beta1
kind: Ingress
metadata:
  name: test-ingress
  annotations:
    nginx.ingress.kubernetes.io/rewrite-target: /
spec:
  rules:
  - http:
      paths:
      - path: /testpath
        pathType: Prefix
        backend:
          serviceName: test
          servicePort: 80
```

# Ingress (2/2)

https://kubernetes.io/docs/concepts/services-networking/ingress/

As with all other Kubernetes resources, an *Ingress* needs *apiVersion*, *kind*, and *metadata* fields.

Each HTTP *rule* contains:

1. An optional *host*. If no *host* is specified, the rule applies to all inbound HTTP traffic through the IP address specified.
2. A list of *paths*.
3. A *backend* defines a *serviceName* and *servicePort* for each path. It is a combination of *Service* and *port* names.

```yaml
apiVersion: networking.k8s.io/v1beta1
kind: Ingress
metadata:
  name: test-ingress
  annotations:
    nginx.ingress.kubernetes.io/rewrite-target: /
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  - http:
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      - path: /testpath
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        backend:
          serviceName: test
          servicePort: 80
```

The name of an Ingress object must be a valid DNS subdomain name

Ingress frequently uses annotations to configure some options depending on the Ingress controller

The Ingress spec has all the information needed to configure a load balancer or proxy server.

# MiniKube

https://kubernetes.io/docs/setup/learning-environment/minikube/
https://kubernetes.io/docs/tasks/tools/install-minikube/
https://kubernetes.io/docs/tasks/tools/#minikube

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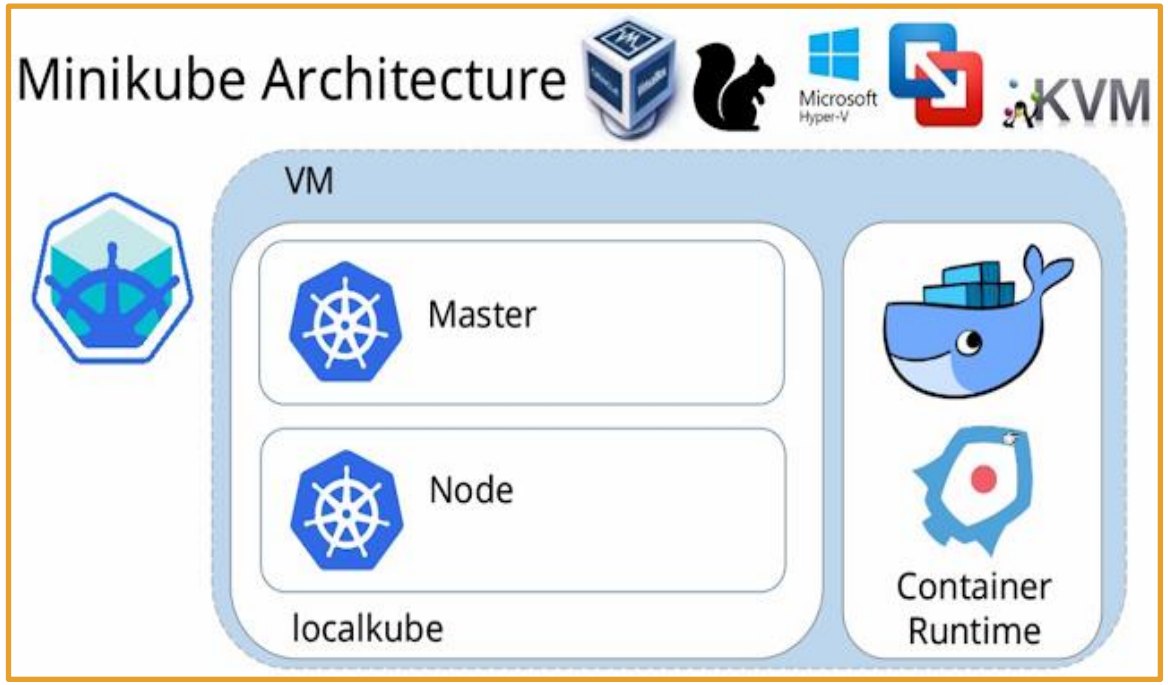
The ***Minikube CLI*** provides basic bootstrapping operations for working with your cluster, including ***start***, ***stop***, ***status***, and ***delete***.

***Minikube:***

- is a tool that lets you run Kubernetes locally.
- runs a single-node ***Kubernetes cluster***
- runs on your personal computer (Windows, macOS, Linux PC).
- is great for trying out Kubernetes, or for daily development work.



# Azure Kubernetes Service (AKS)

https://kubernetes.io/docs/setup/production-environment/turnkey/azure/#azure-kubernetes-service-aks
https://github.com/Azure/aks-engine/blob/master/docs/tutorials/README.md
https://docs.microsoft.com/en-us/azure/aks/intro-kubernetes

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- The Azure Kubernetes Service (AKS) offers simple deployments for Kubernetes clusters.
- AKS makes it simple to deploy a managed Kubernetes cluster in Azure.
- AKS handles much of the complexity and operational overhead of managing Kubernetes.
- Azure handles critical tasks like health monitoring.
- The Kubernetes masters are managed by Azure. You only manage and maintain the agent nodes.
- AKS lets you integrate with Azure Active Directory and use Kubernetes role-based access controls.

# Hello-Node Tutorial Step-By-Step(1/2)

https://kubernetes.io/docs/tutorials/hello-minikube/

- Create a Deployment that manages a Pod which will run a container based on the provided Docker Image with:
  - kubectl create deployment hello-node –image=k8s.gcr.io/echoserver:1.4
- See the deployment with:
  - kubectl get deployments.
- See the Pod with:
  - kubectl get pods.
- See cluster events with a:
  - kubectl get events.
- See the kubectl configuration with:
  - kubectl config view.
- Expose the ***Pod*** as a Kubernetes ***Service*** to make it visible from outside the ***Cluster*** with type=LoadBalancer as the expose keyword.
  - kubectl expose deployment hello-node --type=LoadBalancer --port=8080. (more on the next slide.)

# Hello-Node Tutorial Step-By-Step(2/2)

https://kubernetes.io/docs/tutorials/hello-minikube/

- View the service you just created with:
  - kubectl get services.
- External cloud providers get an external IP to access the service.
- Select + → Select Port to View on Host 1 → Enter the 5 digit port # after the:
- Take a look at available Add-Ons with:
  - minikube addons list.
- Enable the metrics-server add-on with:
  - minikube addons enable metrics-server.
- View the Pod with the service you just created with:
  - kubectl get pod, svc –n kube-system.

# Hello-Node Tutorial Step-By-Step(3/3)

https://kubernetes.io/docs/tutorials/hello-minikube/

- Disable the metrics-server with:
  - minikube addons disable metrics-server.
- Delete the service with:
  - kubectl delete service hello-node
- Delete the deployment with:
  - kubectl delete deployment hello-node
- (optional) stop Minikube with:
  - minikube stop
- (optional)Delete the Minikube VM with:
  - minikube delete

# More Tutorials

https://kubernetes.io/docs/tutorials/

- https://docs.microsoft.com/en-us/azure/aks/tutorial-kubernetes-prepare-app
- https://kubernetes.io/docs/tutorials/stateful-application/mysql-wordpress-persistent-volume/
- https://www.digitalocean.com/community/curriculums/kubernetes-for-full-stack-developers
- https://cloud.google.com/kubernetes-engine/kubernetes-comic/