

The background of the slide features a photograph of the Marina Bay Sands hotel in Singapore. The hotel's distinctive three-tower structure is visible against a cloudy sky. The central tower has a unique curved roof with a green roof garden, while the flanking towers are rectangular glass structures.

Azure Kubernetes Service (AKS) - Part 4

# Azure Kubernetes Service (AKS)

A dark blue rectangular box containing the author's name in a white, hand-drawn style font.

Nilesh Gule

# \$whoami



**Microsoft®**  
Most Valuable  
Professional



```
{
```

```
    "name": "Nilesh Gule",
    "title": "Architect | Microsoft Azure MVP",
    "website": "https://www.HandsOnArchitect.com",
    "github": "https://github.com/NileshGule"
    "twitter": "@nileshgule",
    "linkedin": "https://www.linkedin.com/in/nileshgule",
    "email": "nileshgule@gmail.com",
    "likes": "Technical Evangelism, Cricket"
}
```

# AKS learning series

- Part 1 - Getting started with Docker
- Part 2 - Stitch Multi-container apps with Docker Compose
- Part 3 - Container Orchestration using Kubernetes with Minikube
- **Part 4 - Deploy Multi-container apps to AKS**
- Part 5 - Debugging & Monitoring AKS using OMS
- Part 6 - CI CD with Docker & Kubernetes (Bonus)

# Application Overview

TechTalksWeb Home About Contact

Create New

**Id**

**Description**

**Category**

1 Scaling Docker Containers

Meetup

Edit

Details

Delete

2 Azure Container Services

Free Conference

Edit

Details

Delete

3 Kubernetes

Paid Conference

Edit

Details

Delete

4 Docker and kubernetes

Free Conference

Edit

Details

Delete

6 Modernize Docker and Azure

Paid Conference

Edit

Details

Delete

TechTalksWeb Home About Contact

Create New Tech Talk

TechTalkName

CategoryId

 Meetup

LevelId

 100 - Beginner

Create



# Recap - part 1 (Docker)

```
Dockerfile x
1  FROM microsoft/aspnetcore-build AS build-env
2
3  WORKDIR /TechTalksWeb
4
5  COPY TechTalksWeb.csproj ./
6  COPY NuGet.config ./
7  RUN dotnet restore
8
9  COPY . ./
10 RUN dotnet publish --configuration Release --output releaseOutput --no-restore
11
12 #build runtime image
13 FROM microsoft/aspnetcore
14
15 WORKDIR /TechTalksWeb
16
17 COPY --from=build-env /TechTalksWeb/releaseOutput ./
18
19 EXPOSE 80
20
21 ENTRYPOINT ["dotnet", "TechTalksWeb.dll"]
```



```
docker build --tag nileshgule/techtalksweb .
```

```
docker run -p 80:80 -d nileshgule/techtalksweb
```

```
docker push nileshgule/techtalksweb
```

<https://www.youtube.com/watch?v=fQymGm8Z85E>

# Recap - part 2 (Docker Compose)

```
version: '3'

services:
  sql.data.client:
    image: nileshgule/sqlclient

  techtalks.web:
    image: nileshgule/techtalksweb

  techtalks.api:
    image: nileshgule/techtalksapi
```

```
version: '3'

services:
  sql.data.client:
    build:
      context: ../src/TechTalksDB
      dockerfile: Dockerfile

  techtalks.web:
    build:
      context: ../src/TechTalksWeb
      dockerfile: Dockerfile
      depends_on:
        - techtalks.api

  techtalks.api:
    build:
      context: ../src/TechTalksAPI
      dockerfile: Dockerfile
```

```
version: '3'

services:
  sql.data:
    image: microsoft/mssql-server-linux:2017-latest
    container_name: sql1
    ports:
      - "1433:1433"
    environment:
      - ACCEPT_EULA=Y
      - SA_PASSWORD=June2018
    tty: true

  techtalks.web:
    ports:
      - "80:80"

  techtalks.api:
    ports:
      - "8080:80"
    environment:
      - ConnectionStrings__DefaultConnection=Data Source=sql1,1433;Initial Catalog=TechTalksDB;
    depends_on:
      - sql.data
```

`docker-compose -f docker-compose.yml -f docker-compose-build.yml build`

`docker-compose -f docker-compose.yml -f docker-compose-run.yml up`

`docker-compose -f docker-compose.yml -f docker-compose-run.yml down`

<https://www.youtube.com/watch?v=crjRSvPVIIE>

# Recap - part 3 (Container Orchestration - Minikube)

**kubernetes**

Overview

Cluster Workloads

Workloads Statuses

- Deployments: 50.00% (33.33%)
- Pods: 66.67%
- Replica Sets: 50.00% (50.00%)
- Stateful Sets: 100.00%

Deployments

Name	Labels	Pods	Age	Images
techtalksapi	run: techtalksapi	0 / 1	4 seconds	nileshgule/techtalksapi:v1 nileshgule/sqlclient
techtalksweb	run: webfront	1 / 1	4 seconds	nileshgule/techtalksweb

Pods

Name	Node	Status	Restarts	Age
techtalksapi-9c97f9cb9-fd9m6	minikube	Waiting: PodInitializing	0	4 seconds
techtalksweb-65cd99cc-n4xhl	minikube	Running	0	4 seconds
db-deployment-0	minikube	Running	0	5 seconds

Replica Sets

Name	Labels	Pods	Age	Images
rs/techtalksapi-9c97f9cb9	nodeTemplateHash: 575395765	1	23m	nileshgule/techtalksapi:v1
rs/techtalksweb-65cd99cc	nodeTemplateHash: 575395765	1	23m	nileshgule/techtalksweb

Containers:

```

techtalksapi:
  Container ID: docker://5fead6ba58cff9b509893c338a59ee172194af95bd68954bb0aa2f64bf77fd
  Image: nileshgule/techtalksapi:v1
  Image ID: docker-pullable://nileshgule/techtalksapi@sha256:fc6b0a97bd5a6ccfb6b2fb07b9e07ad873ad78ccbd6ce2e16b1f360b1b3d40
  Port: 8080/TCP
  State: Running
  Started: Wed, 15 Aug 2018 23:03:19 +0800
  Ready: True
  Restart Count: 0
  Environment:
    ASPNETCORE_URLS: http://0.0.0.0:8080
    ConnectionStrings__DefaultConnection: Data Source=db-deployment;Initial Catalog=TechTalksDB;User Id=SA;Password=January2018;MultipleActiveResultSets=True
  Mounts:
    /var/run/secrets/kubernetes.io/serviceaccount from default-token-drct7 (ro)
  Conditions:
    Type Status
    Initialized True
    Ready True
    PodScheduled True
  Volumes:
    default-token-drct7:
      Type: Secret (a volume populated by a Secret)
      SecretName: default-token-drct7
      Optional: False
    QoS Class: BestEffort
    Node-Selectors: <none>
    Tolerations: node.kubernetes.io/not-ready:NoExecute for 300s
                  node.kubernetes.io/unreachable:NoExecute for 300s
  Events:
    Type Reason Age From Message
    Normal Scheduled 22m default-scheduler Successfully assigned techtalksapi-9c97f9cb9-fd9m6 to minikube
    Normal SuccessfulMountVolume 22m kubelet, minikube MountVolume.SetUp succeeded for volume "default-token-drct7"
    Normal Pulled 22m (x2 over 22m) kubelet, minikube Container image "nileshgule/sqlclient" already present on machine
    Normal Created 22m (x2 over 22m) kubelet, minikube Created container
    Normal Started 22m kubelet, minikube Started container
    Normal Pulled 22m kubelet, minikube Container image "nileshgule/techtalksapi:v1" already present on machine
    Normal Created 22m kubelet, minikube Created container
    Normal Started 22m kubelet, minikube Started container
  
```

```

~/projects/AKS-...ries/k8s/Minikube/TechTalksWeb ➔ ⚡ master !?
└─ kubectl delete --filename web-service.yml
service "webfront" deleted
~/projects/AKS-...ries/k8s/Minikube/TechTalksWeb ➔ ⚡ master !?
└─ kubectl apply --filename web-service.yml
service "webfront" created
~/projects/AKS-...ries/k8s/Minikube/TechTalksWeb ➔ ⚡ master !?
└─ kubectl delete --recursive --filename .
deployment "techtalksweb" deleted
service "webfront" deleted

└─ kubectl --namespace aks-part3 get all
NAME          DESIRED   CURRENT  UP-TO-DATE  AVAILABLE   AGE
deploy/techtalksapi   1         1         1           1          23m
deploy/techtalksweb   1         1         1           1          23m

NAME          DESIRED   CURRENT  READY     AGE
rs/techtalksapi-9c97f9cb9   1         1         1          23m
rs/techtalksweb-65cd99cc   1         1         1          23m

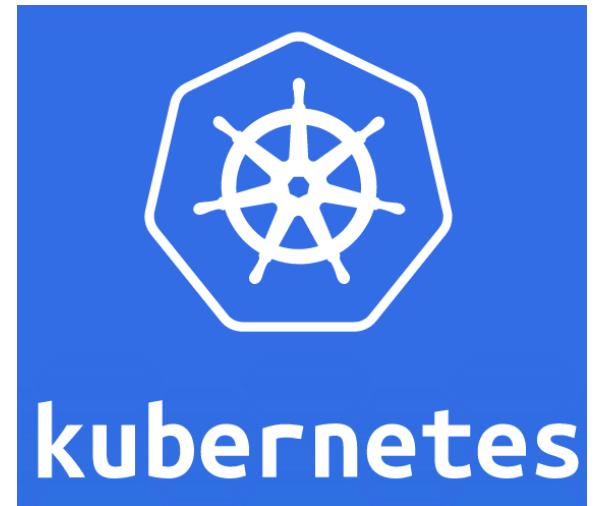
NAME          DESIRED   CURRENT  AGE
statefulsets/db-deployment   1         1         23m

NAME          READY   STATUS  RESTARTS  AGE
po/db-deployment-0           1/1    Running  0          23m
po/techtalksapi-9c97f9cb9-fd9m6  1/1    Running  0          23m
po/techtalksweb-65cd99cc-n4xhl  1/1    Running  0          23m

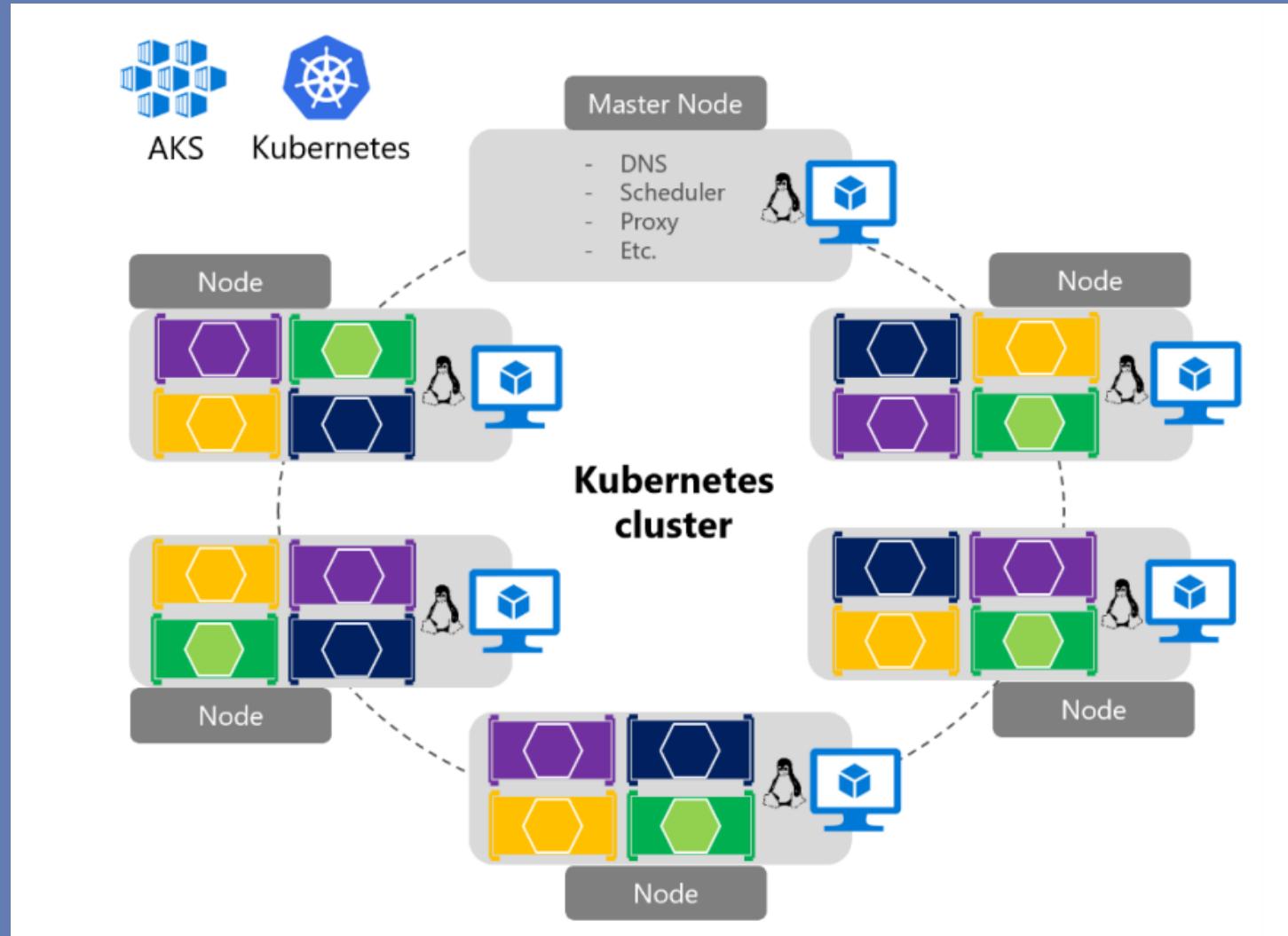
NAME          TYPE        CLUSTER-IP      EXTERNAL-IP      PORT(S)      AGE
svc/db-deployment  NodePort    10.98.207.218  <none>        1433:30813/TCP  23m
svc/techtalksapi   NodePort    10.96.44.19   <none>        8080:32448/TCP  23m
svc/webfront       NodePort    10.104.150.168 <none>        80:32534/TCP   23m
  
```

<https://www.youtube.com/watch?v=n2FPsunhuFc>

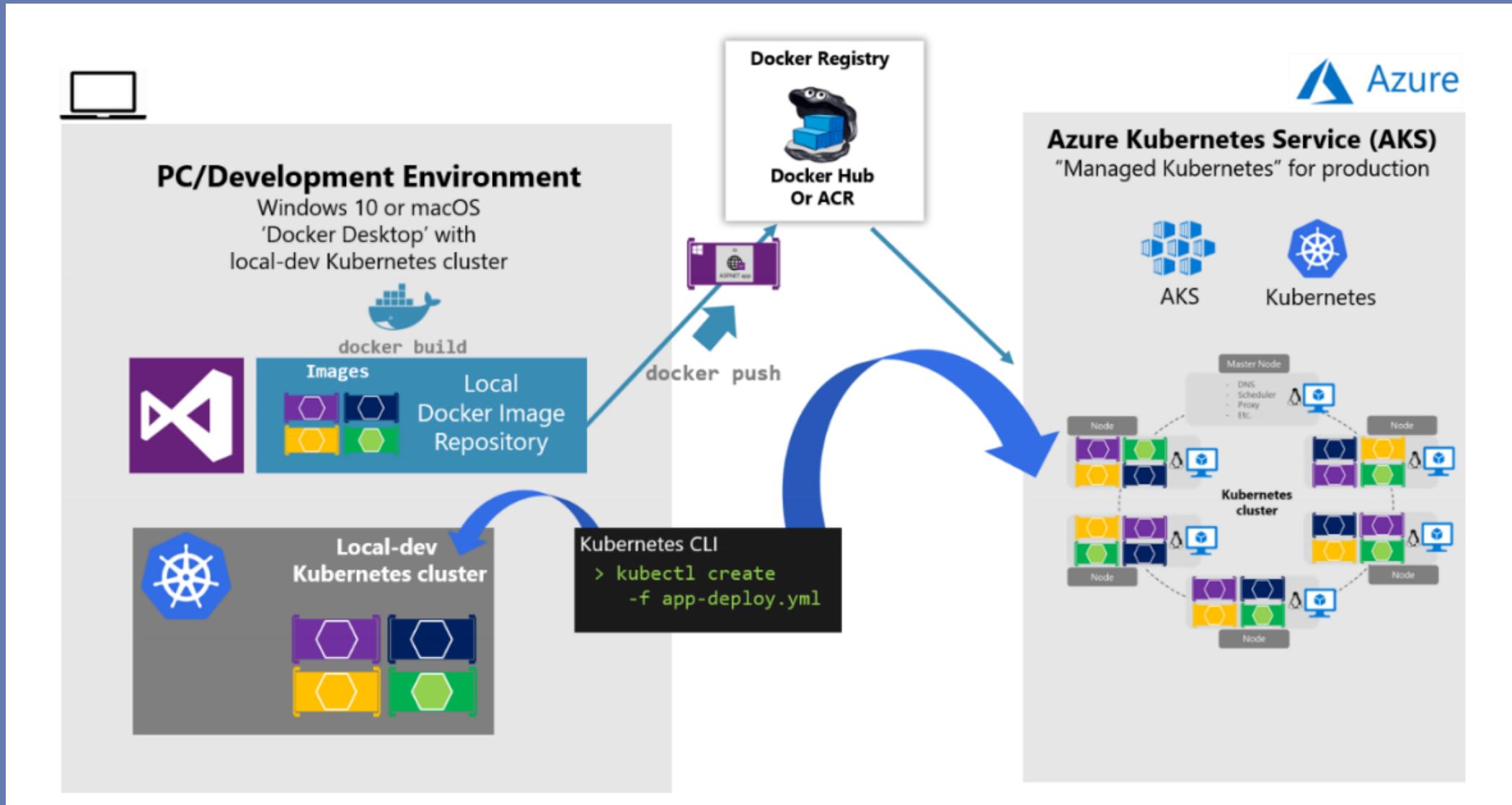
# Azure Kubernetes Service (AKS)

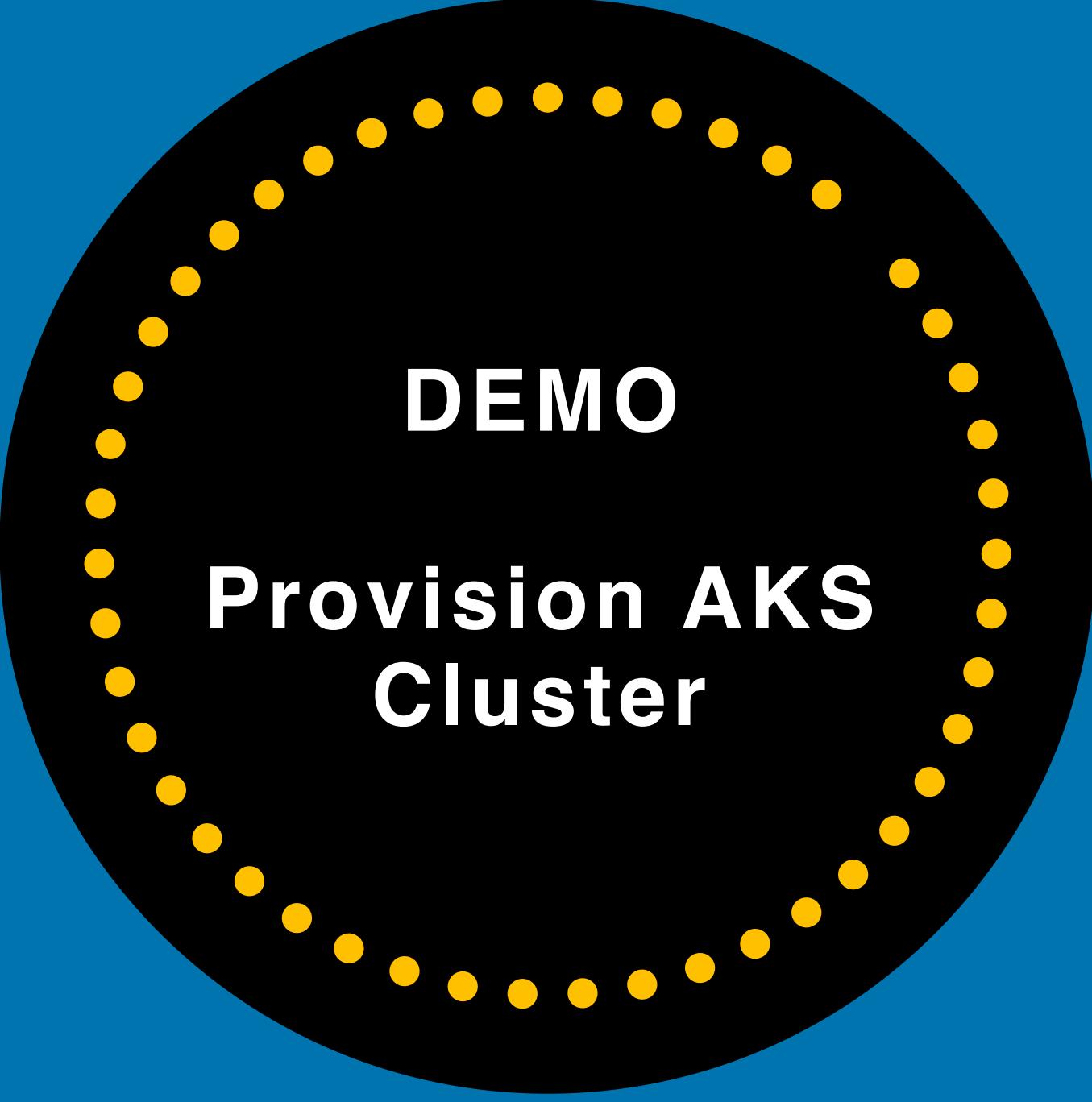


# Azure Kuberneete Service Cluster



# AKS Deployment





**DEMO**

**Provision AKS  
Cluster**

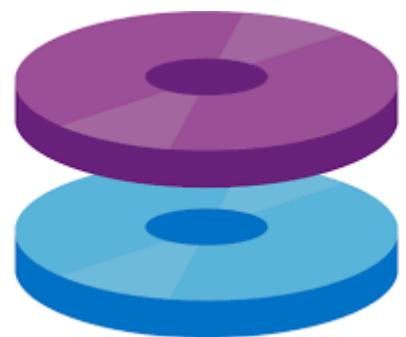
# AKS Resources

<input type="checkbox"/>	NAME ↑↓	TYPE ↑↓	RESOURCE GROUP ↑↓	LOCATION ↑↓	SUBSCRIPTION ↑↓	<input type="checkbox"/> Show hidden types
<input type="checkbox"/>	 nodepool1-availabilitySet-99012362	Availability set	MC_aksP4ResourceGroup_aksClus...	Southeast Asia	Microsoft Azure Sponsorship	<input type="checkbox"/>
<input type="checkbox"/>	 aks-nodepool1-99012362-0_OsDisk_1_bd07c90c54a140f29a1d00ae5...	Disk	MC_AKSP4RESOURCEGROUP_AKS...	Southeast Asia	Microsoft Azure Sponsorship	<input type="checkbox"/>
<input type="checkbox"/>	 aks-nodepool1-99012362-1_OsDisk_1_f1ac2f1491314a8481b70d84fab...	Disk	MC_AKSP4RESOURCEGROUP_AKS...	Southeast Asia	Microsoft Azure Sponsorship	<input type="checkbox"/>
<input type="checkbox"/>	 aks-nodepool1-99012362-2_OsDisk_1_e7486e434590447d8675a9a8...	Disk	MC_AKSP4RESOURCEGROUP_AKS...	Southeast Asia	Microsoft Azure Sponsorship	<input type="checkbox"/>
<input type="checkbox"/>	 aksCluster	Kubernetes service	aksP4ResourceGroup	Southeast Asia	Microsoft Azure Sponsorship	<input type="checkbox"/>
<input type="checkbox"/>	 aks-nodepool1-99012362-nic-0	Network interface	MC_aksP4ResourceGroup_aksClus...	Southeast Asia	Microsoft Azure Sponsorship	<input type="checkbox"/>
<input type="checkbox"/>	 aks-nodepool1-99012362-nic-1	Network interface	MC_aksP4ResourceGroup_aksClus...	Southeast Asia	Microsoft Azure Sponsorship	<input type="checkbox"/>
<input type="checkbox"/>	 aks-nodepool1-99012362-nic-2	Network interface	MC_aksP4ResourceGroup_aksClus...	Southeast Asia	Microsoft Azure Sponsorship	<input type="checkbox"/>
<input type="checkbox"/>	 aks-agentpool-99012362-nsg	Network security group	MC_aksP4ResourceGroup_aksClus...	Southeast Asia	Microsoft Azure Sponsorship	<input type="checkbox"/>
<input type="checkbox"/>	 aks-agentpool-99012362-routetable	Route table	MC_aksP4ResourceGroup_aksClus...	Southeast Asia	Microsoft Azure Sponsorship	<input type="checkbox"/>
<input type="checkbox"/>	 aks-nodepool1-99012362-0	Virtual machine	MC_aksP4ResourceGroup_aksClus...	Southeast Asia	Microsoft Azure Sponsorship	<input type="checkbox"/>
<input type="checkbox"/>	 aks-nodepool1-99012362-1	Virtual machine	MC_aksP4ResourceGroup_aksClus...	Southeast Asia	Microsoft Azure Sponsorship	<input type="checkbox"/>
<input type="checkbox"/>	 aks-nodepool1-99012362-2	Virtual machine	MC_aksP4ResourceGroup_aksClus...	Southeast Asia	Microsoft Azure Sponsorship	<input type="checkbox"/>
<input type="checkbox"/>	 aks-vnet-99012362	Virtual network	MC_aksP4ResourceGroup_aksClus...	Southeast Asia	Microsoft Azure Sponsorship	<input type="checkbox"/>

# Migration to Kubernetes cluster

Minikube	AKS
Single node cluster	Full fledge multi node cluster
Service Type NodePort	ServiceType <b>LoadBalancer</b> (for publicly exposed services)
Data persisted within container Can be persisted to host using Volume	Data persisted to <b>Azure Disk</b> using <b>Persistent Volumes (PV)</b>

# State Management with Persistent Volume

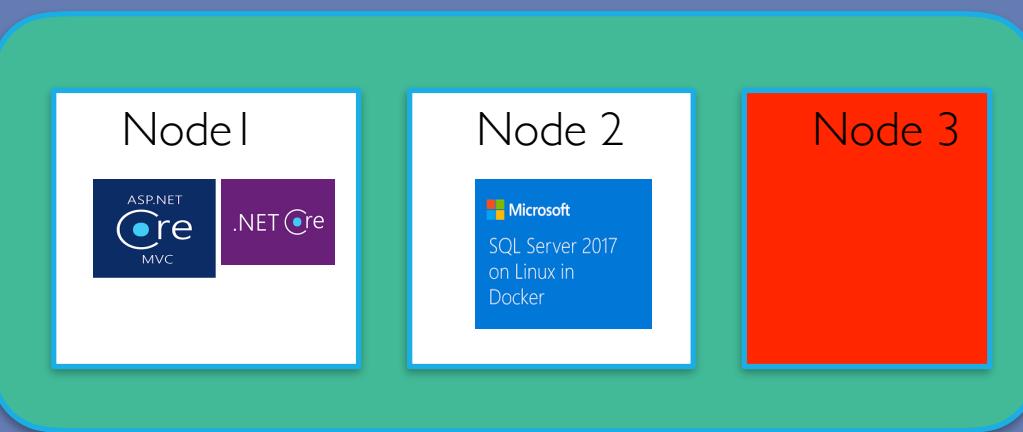
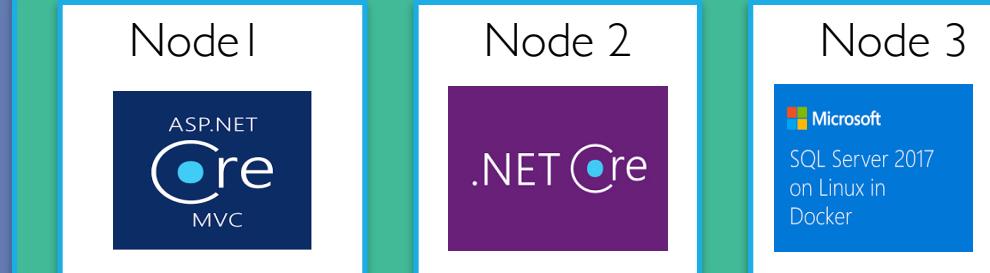


# Persistent Volumes

**Without PV**



**With PV**



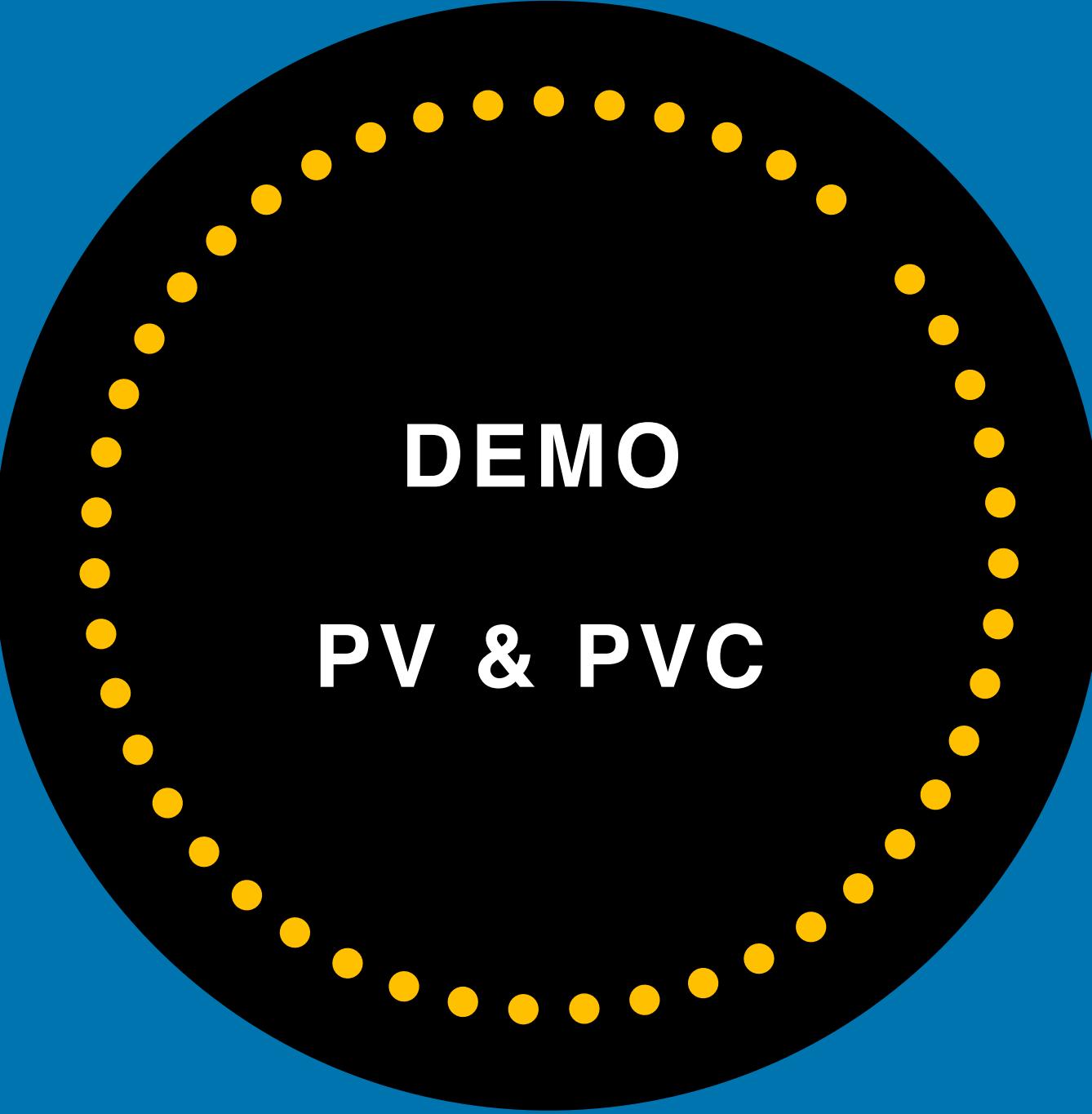
# Persistent Volume - Storage class & PVC



```
01_StorageClass.yml x
1  ---
2  kind: StorageClass
3  apiVersion: storage.k8s.io/v1beta1
4  metadata:
5    name: azure-disk
6    namespace: abc2018sg
7  provisioner: kubernetes.io/azure-disk
8  parameters:
9    storageaccounttype: Standard_LRS
10   kind: Managed
```

```
---
kind: PersistentVolumeClaim
apiVersion: v1
metadata:
  name: techtalksdb-data
  namespace: data-day-2018sg
  annotations:
    volume.beta.kubernetes.io/storage-class: azure-disk
spec:
  accessModes:
    - ReadWriteOnce
  resources:
    requests:
      storage: 1Gi
```

- **StorageClass** provides the specifications of the external persistent storage
- **PersistenceVolumeClaim** (PVC) ensures that data is stored on an external storage device outside the Kubernetes cluster



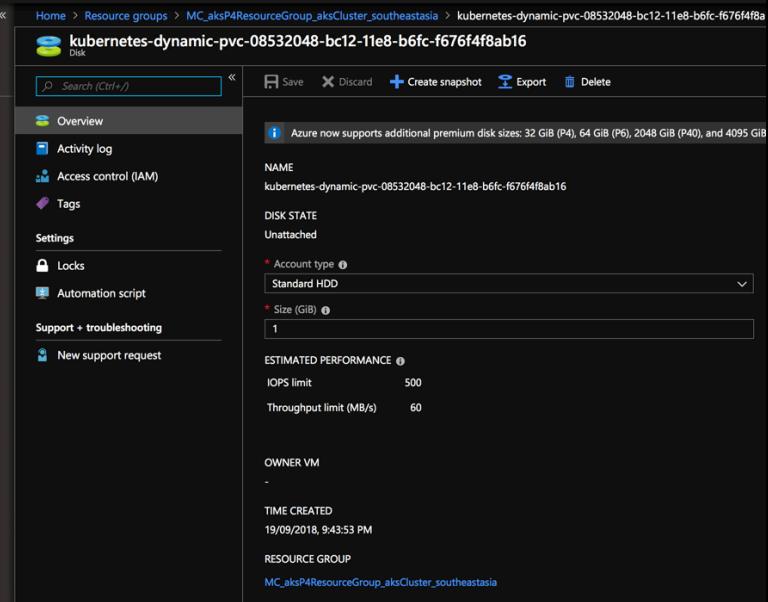
**DEMO**

**PV & PVC**

# AKS

PS /Users/nileshgule/projects/AKS-learning-series/Powershell> ./initializeAKS.ps1

```
Setting Azure subscription to Microsoft Azure Sponsorship
Creating resource group aksP4ResourceGroup in region South East Asia
{
  "id": "/subscriptions/065cf559-687c-4233-a331-564f10c8b9ed/resourceGroups/aksP4ResourceGroup",
  "location": "southeastasia",
  "managedBy": null,
  "name": "aksP4ResourceGroup",
  "properties": {
    "provisioningState": "Succeeded"
  },
  "tags": null
}
Creating AKS cluster aksCluster with resource group aksP4ResourceGroup in region South East Asia
{
  "aadProfile": null,
  "addonProfiles": null,
  "agentPoolProfiles": [
    {
      "count": 3,
      "maxPods": 110,
      "name": "nodepool1",
      "osDiskSizeGb": null,
      "osType": "Linux",
      "storageProfile": "ManagedDisks",
      "vmSize": "Standard_DS2_v2",
      "vnetSubnetId": null
    }
  ],
  "dnsPrefix": "MC_aksP4ResourceGroup_aksCluster_southeastasia",
  "enableHorizontalPodAutoscale": false,
  "enableNodePublicIP": false,
  "enableVirtualMachineScaleSets": false,
  "identity": null,
  "location": "southeastasia",
  "managedBy": null,
  "name": "aksCluster",
  "nodePools": [
    {
      "name": "nodepool1"
    }
  ],
  "nodeResourceGroup": "aksP4ResourceGroup",
  "nodeType": "Standard_DS2_v2",
  "osType": "Linux",
  "resourceGroup": "aksP4ResourceGroup",
  "servicePrincipalName": "a2a2a2a2-a2a2-a2a2-a2a2-a2a2a2a2a2a2",
  "tags": null,
  "upgradeSettings": null
}
```



The screenshot shows the Azure portal interface for managing a Kubernetes PVC. It displays the 'Overview' tab for the disk, which includes details like the name, disk state (Unattached), account type (Standard HDD), size (1 GiB), and estimated performance (IOPS limit: 500, Throughput limit: 60 MB/s). It also shows the owner VM information, time created (19/09/2018, 9:43:53 PM), and the resource group (MC\_aksP4ResourceGroup\_aksCluster\_southeastasia).

PS ~/projects/AKS-...ries/Powershell > kubectl --namespace aks-part4 get pods

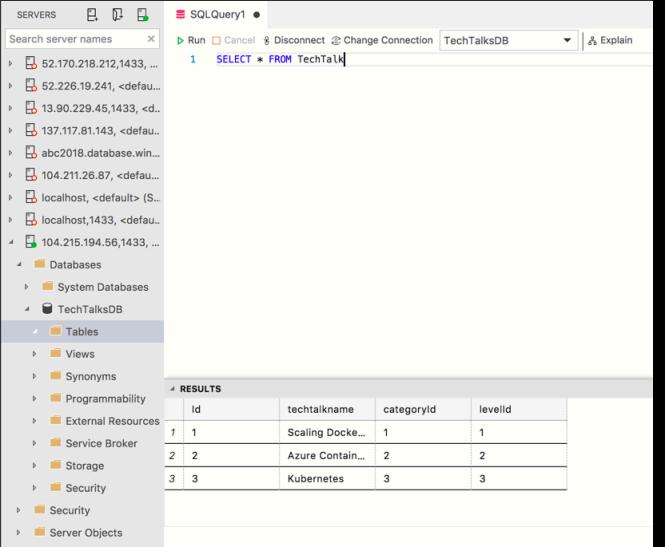
NAME	READY	STATUS	RESTARTS	AGE
db-deployment-0	1/1	Running	0	13m
techtalksapi-6f68c568c9-4lpgv	1/1	Running	0	13m
techtalksweb-6748bdc586-ll9vg	1/1	Running	0	13m

PS ~/projects/AKS-...ries/Powershell > kubectl --namespace aks-part4 describe service techtalksapi

```
Name: techtalksapi
Namespace: aks-part4
Labels: <none>
Annotations: kubectl.kubernetes.io/last-applied-configuration={"apiVersion":"v1", "kind":"Service", "metadata":{"name":"techtalksapi"}, "spec":{"ports":[{"port":8080}], "selector":{"run": "techtalksapi"}}, "version": "1.10.0+20180919.1343.1"
Selector: run=techtalksapi
Type: NodePort
IP: 10.0.21.23
Port: <unset> 8080/TCP
TargetPort: 8080/TCP
NodePort: <unset> 30360/TCP
Endpoints: 10.244.2.3:8080
Session Affinity: None
External Traffic Policy: Cluster
Events: <none>
```

PS ~/projects/AKS-...ries/Powershell > kubectl --namespace aks-part4 describe service webfront

```
Name: webfront
Namespace: aks-part4
Labels: <none>
Annotations: kubectl.kubernetes.io/last-applied-configuration={"apiVersion":"v1", "kind":"Service", "metadata":{"name":"webfront"}, "spec":{"ports":[{"port":80}], "selector":{"run": "webfront-deployment"}}, "version": "1.10.0+20180919.1343.1
Selector: run=webfront-deployment
Type: LoadBalancer
IP: 10.0.1.219
LoadBalancer Ingress: 13.67.34.227
Port: <unset> 80/TCP
TargetPort: 80/TCP
```



The screenshot shows an SSMS session titled 'SQLQuery1'. The query is: 'SELECT \* FROM TechTalks'. The results pane displays three rows of data from the 'TechTalks' table:

Id	techtalkname	categoryid	levelid
1	Scaling Docker	1	1
2	Azure Container	2	2
3	Kubernetes	3	3

# References - Links 1/3

[Demo code](#)

[Kubernetes playground](#)

[Kubernetes objects on Azure](#)

[Kubernetes Basics](#)

[Azure Kubernetes objects](#)

[Highly scalable apps](#)

[Kubernetes Persistent Volumes](#)

[Kubernetes Storage Classes](#)

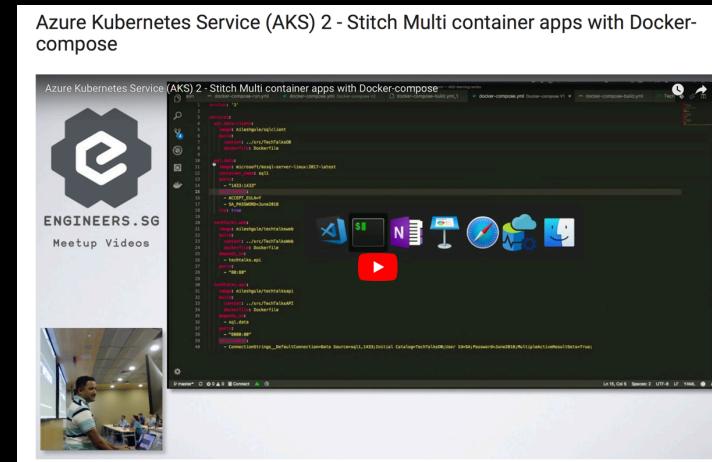
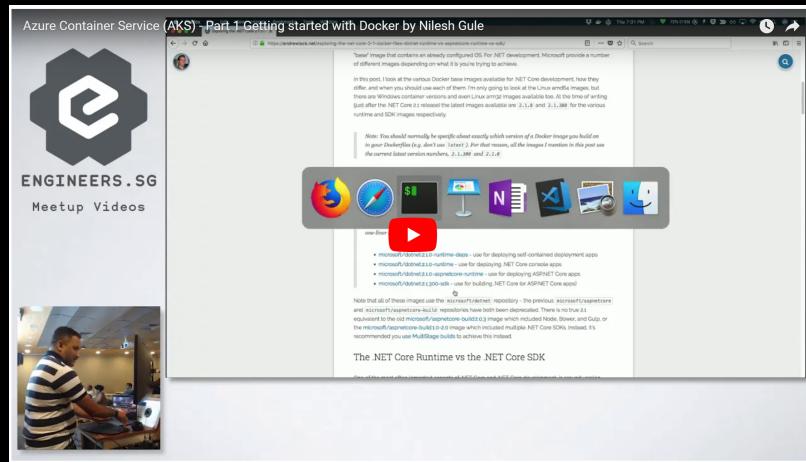
# References - Slides 2/3

Slide deck - Speakerdeck - <https://speakerdeck.com/nileshgule/>

Slide deck - Slideshare - <https://www.slideshare.net/nileshgule/>



# References - videos 3/3



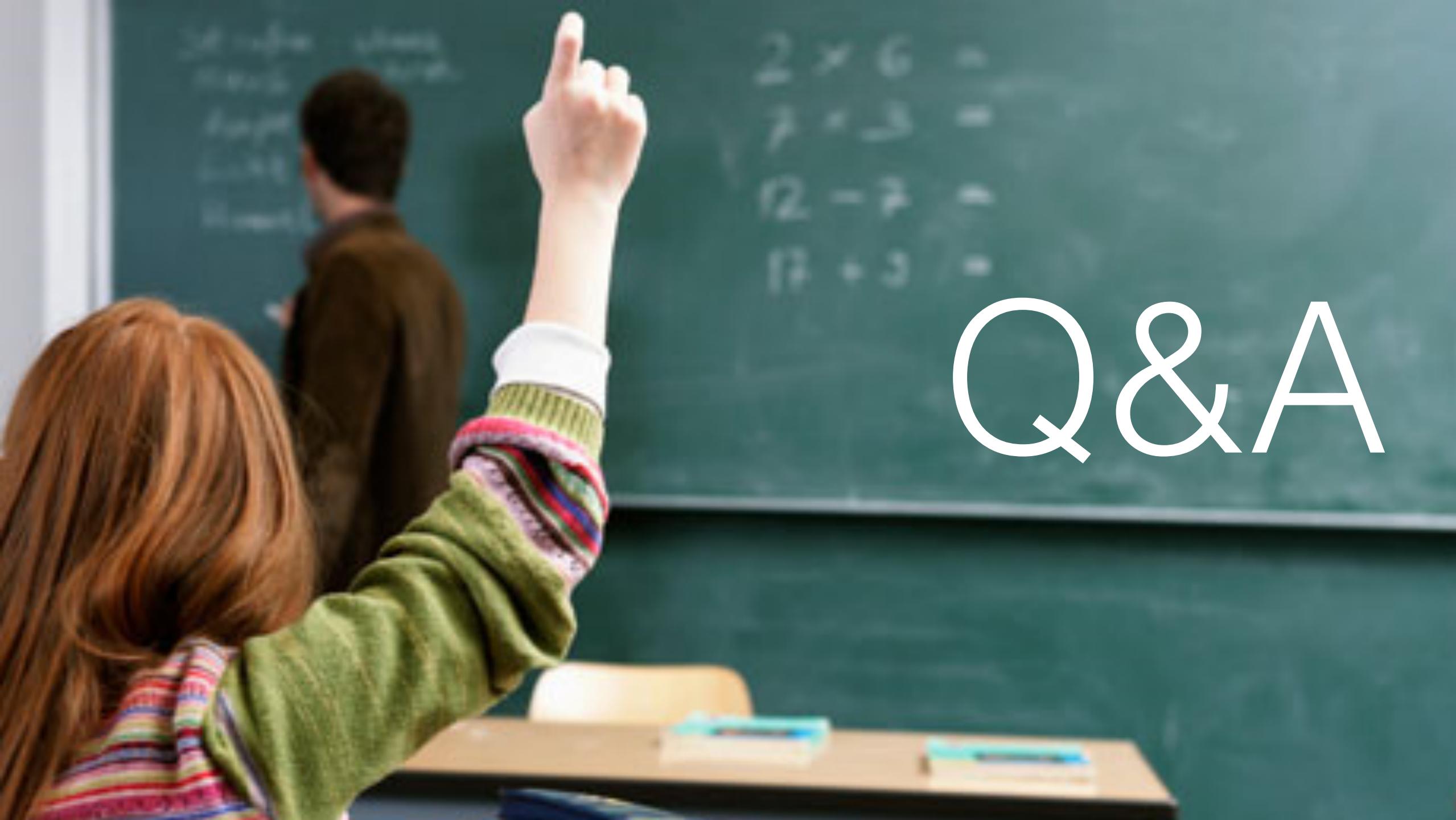
*Thank you very much*



<https://github.com/NileshGule/AKS-learning-series>

*Code with Passion and Strive for Excellence*

# Q&A



# *Feedback*



<http://bit.ly/AKSPart4Feedback>