

Kubernetes & IoT Edge

Manage your Azure IoT Edge deployments with AKS

Daniel Neumann

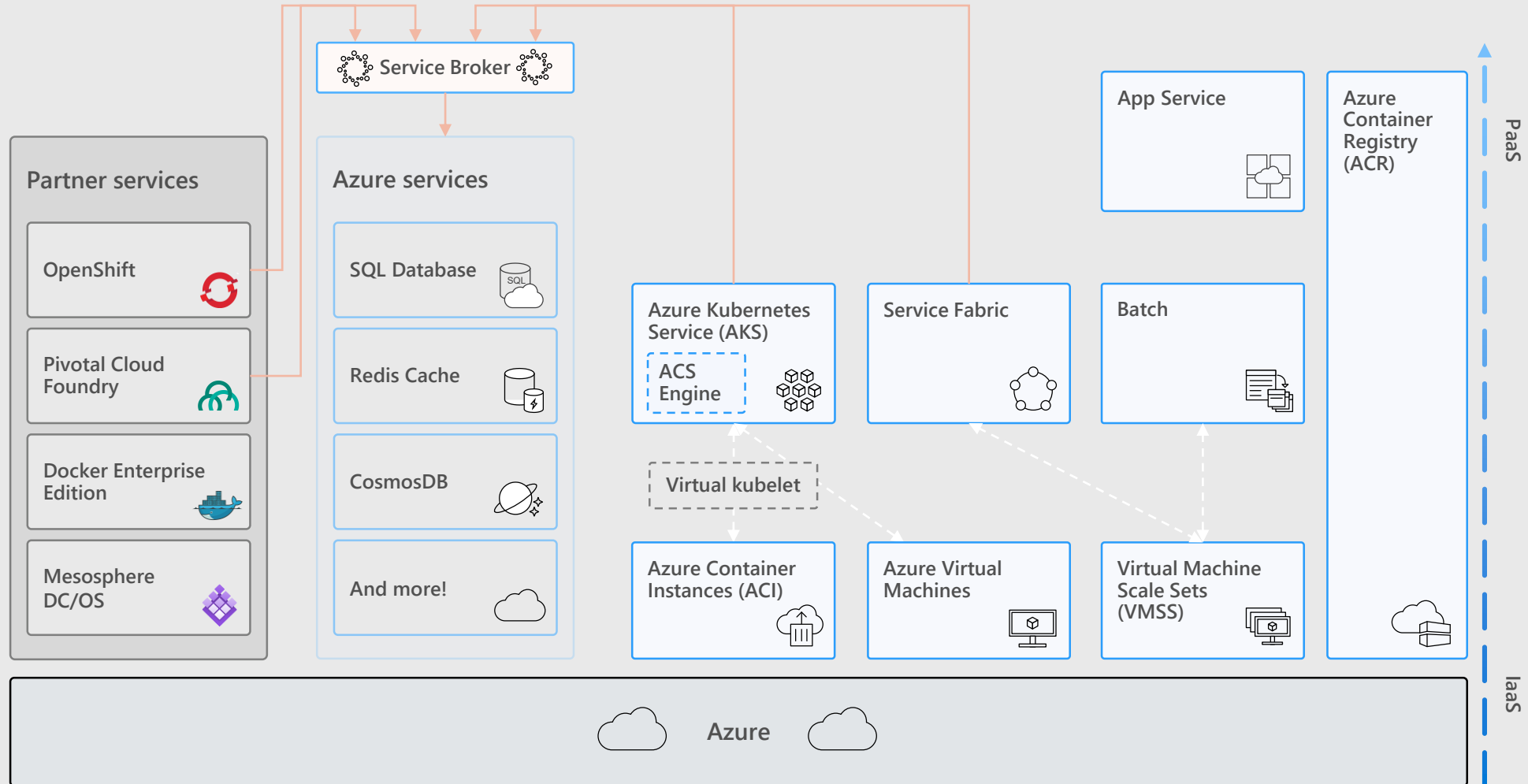
Technology Solutions Professional
Microsoft

Daniel.Neumann@microsoft.com
@neumannndaniel

Overview



Azure container ecosystem



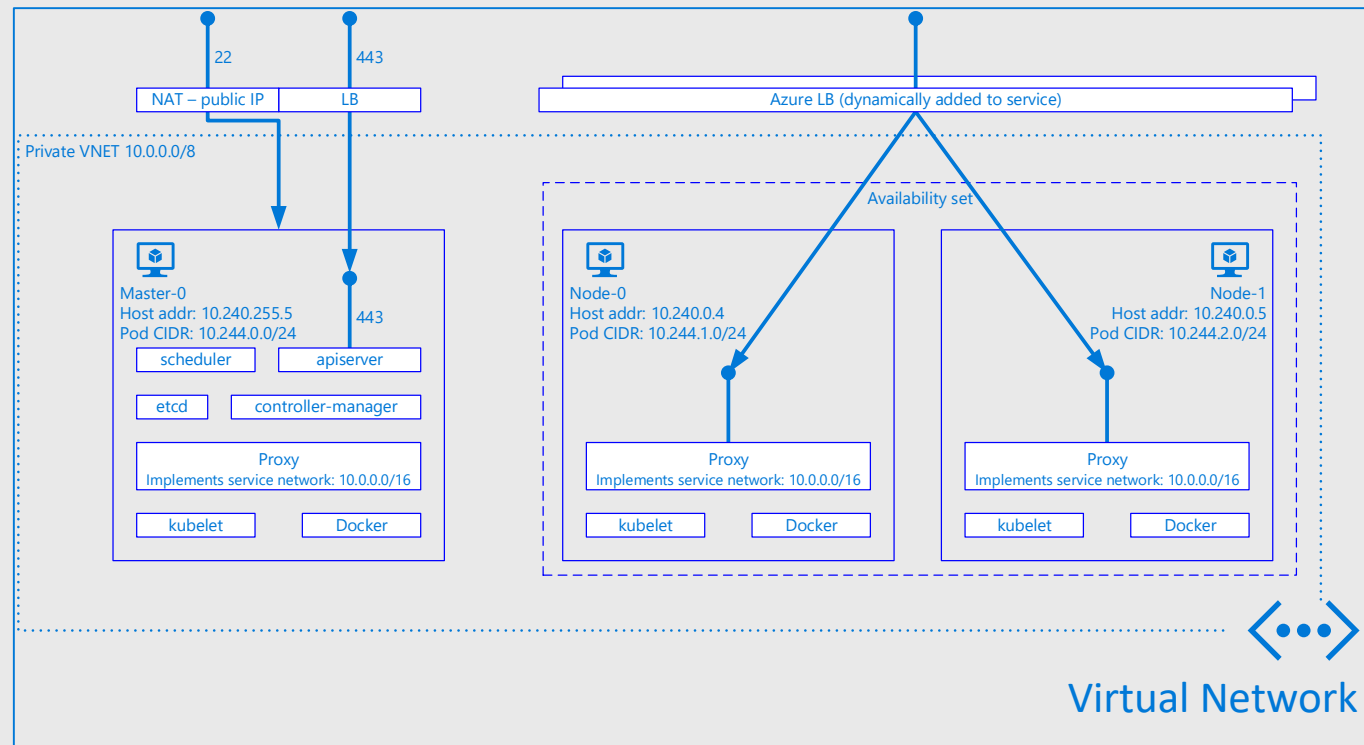
ACS Engine



Azure Container Service Engine

Creates a custom container hosting solution

- You select the size, number of hosts, and choice of orchestrator tools



Azure Container Service Engine

Multiple agent pools where each agent pool can specify:

- Standard or premium VM sizes
- Node count
- VM Scale Sets or Availability Sets
- Unmanaged Disks or Managed Disks

Custom VNET

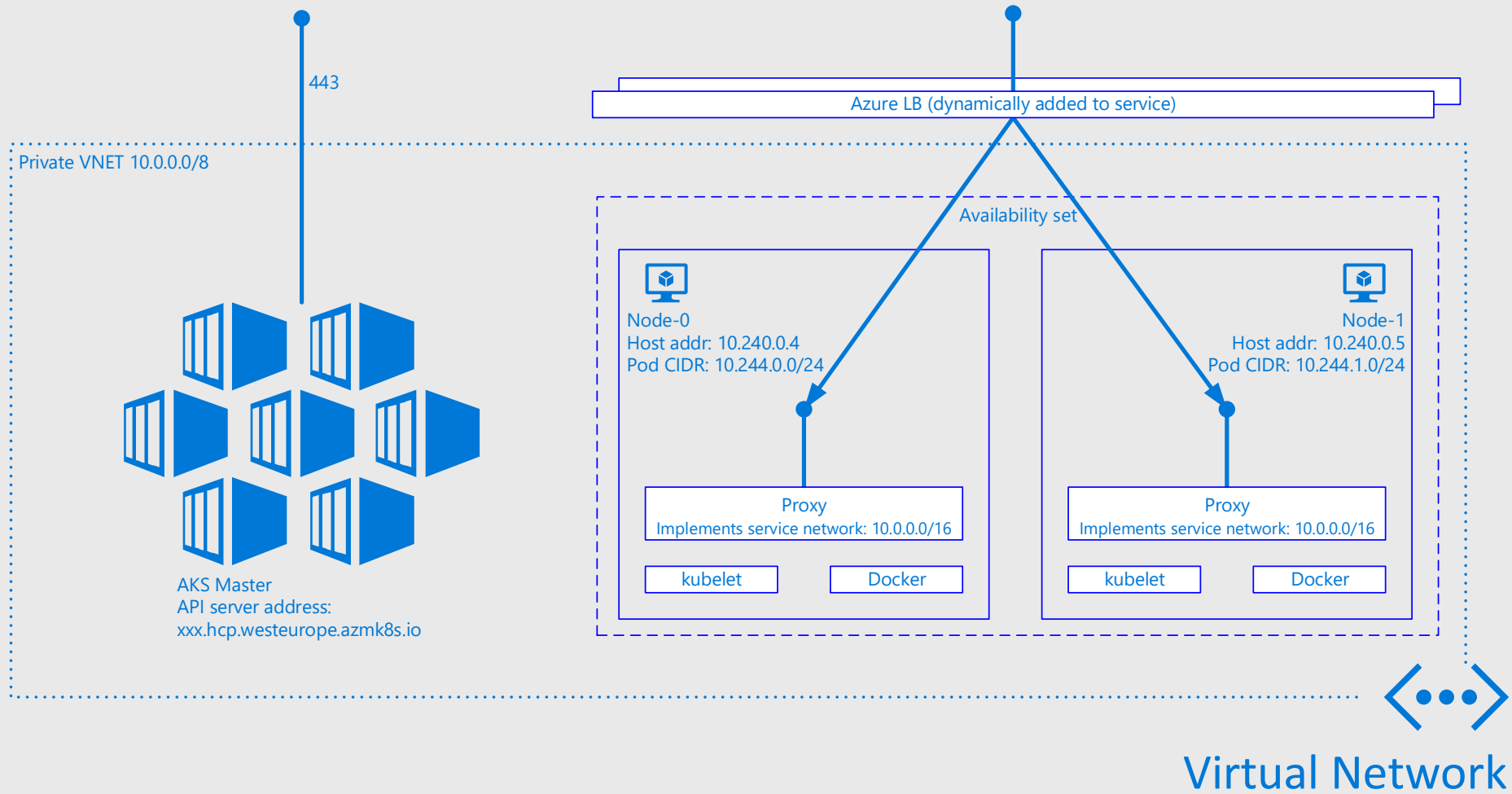
Support non-public Internet cluster deployments

<https://github.com/Azure/acs-engine>

Azure Kubernetes Service



Azure Kubernetes Service



Azure Kubernetes Service

Simplify the deployment, management, and operations of Kubernetes

Automated Kubernetes version upgrades and patching

- Automated reboot: <https://github.com/weaveworks/kured>

Easy cluster scaling

- Cluster Autoscaler
- Horizontal Pod Autoscaler

Self-healing hosted control plane (masters)

Cost savings – pay only for running agent pool nodes

Azure Kubernetes Service

A fully managed Kubernetes cluster

Custom VNET with Azure CNI

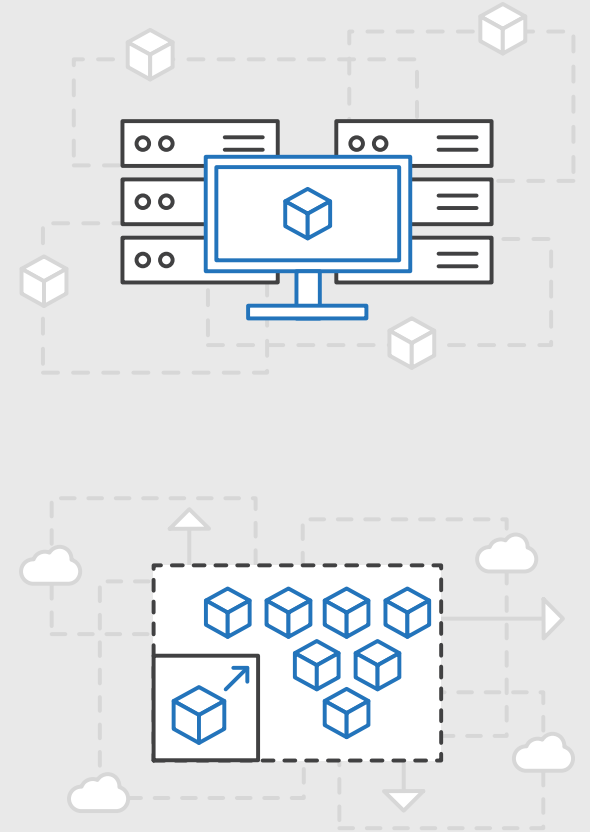
Integration with Azure Monitor

HTTP application routing

- Azure-integrated Kubernetes ingress controller
- Supports DNS endpoints for Kubernetes ingress resources

RBAC support

Azure Active Directory integration



Azure Kubernetes Service

Region availability

GA regions

- Australia East
- Canada Central / Canada East
- Central US
- East US / East US 2
- West US / West US 2
- Japan East
- Southeast Asia
- UK South
- North Europe / West Europe



Azure Kubernetes Service

Limits

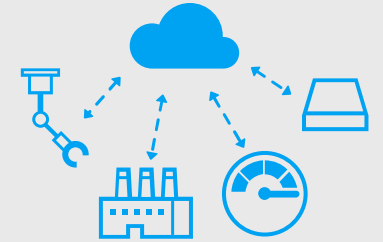
Resource	Default Limit
Max nodes per cluster	100
Max pods per node (basic networking with Kubenet)	110
Max pods per node (advanced networking with Azure CNI)	30*
Max cluster per subscription	100
▪ * This value can be customized through ARM template deployment.	

Azure IoT Hub & IoT Edge



Azure IoT Hub

Establish bidirectional communication with billions of IoT devices

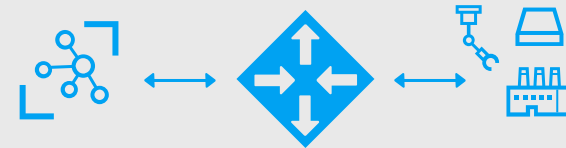


Authenticate per device for security-enhanced IoT solutions



Automate IoT device provisioning and registration to accelerate your IoT deployment

Extend the power of the cloud to your edge device



Azure IoT Edge

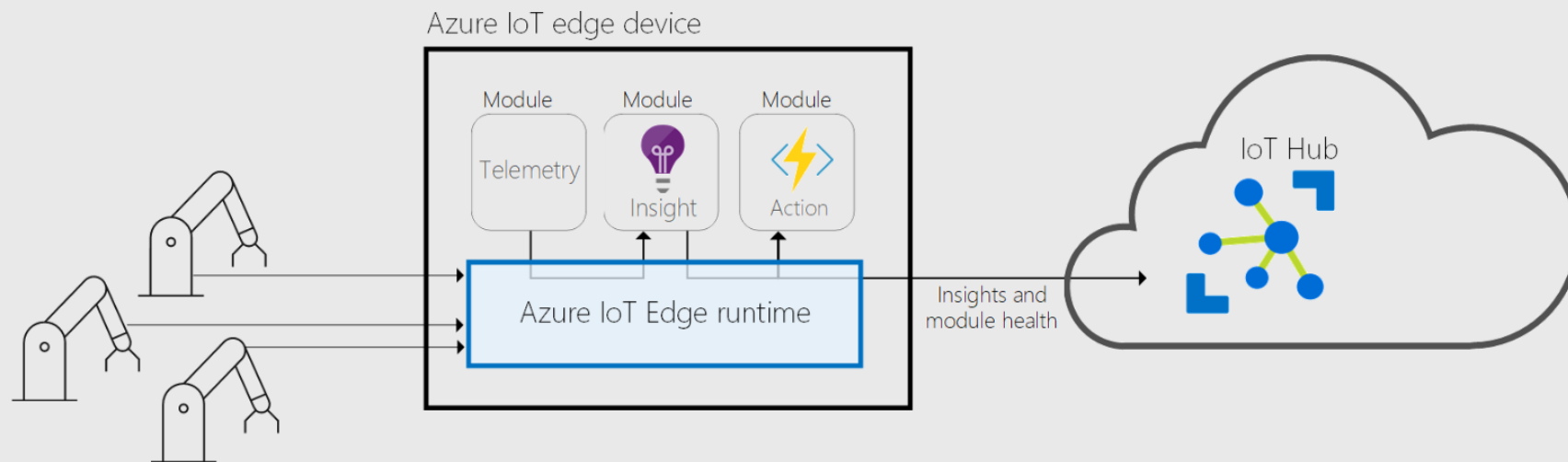
Respond in near-real time

Secure the intelligent edge

Reduce IoT solution costs

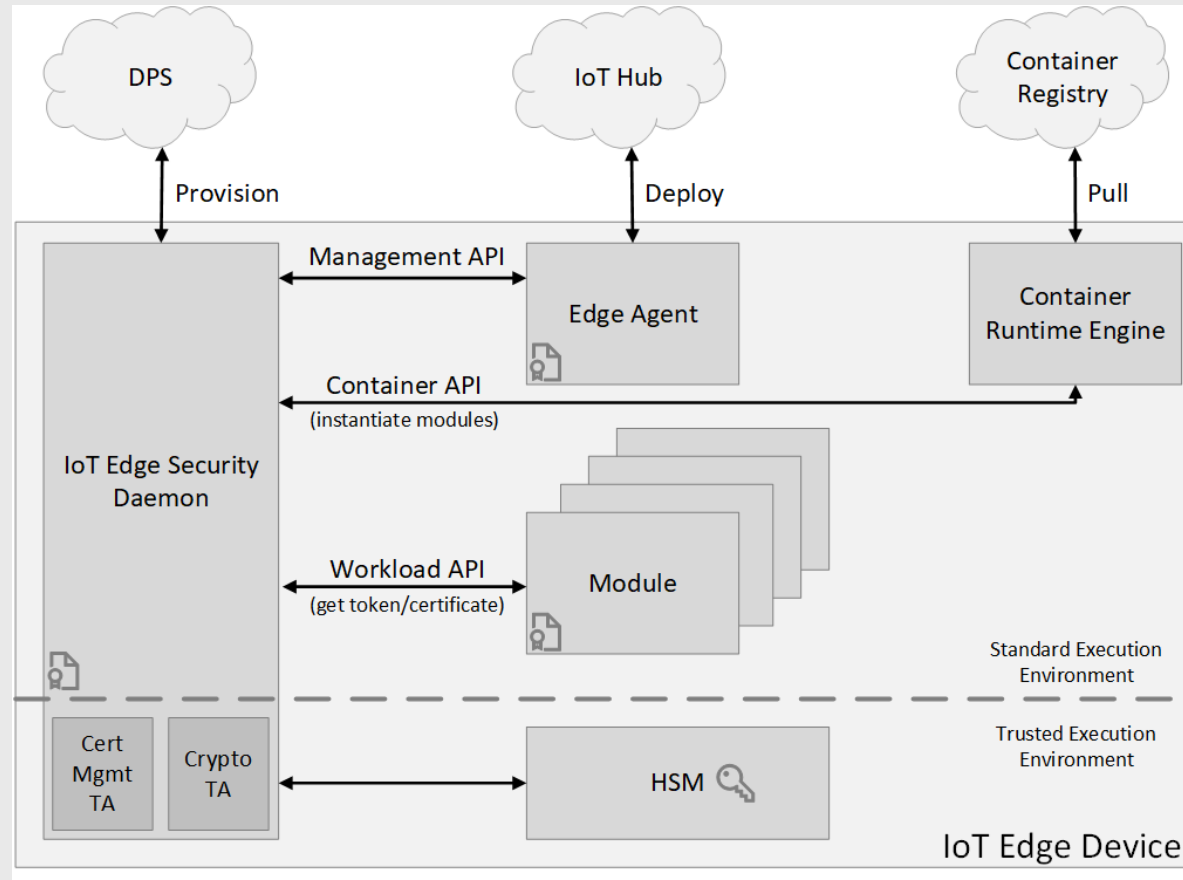
Deploy AI and analytics to the edge

Operate offline or with intermittent connectivity



Azure IoT Edge

Security Manager



<https://docs.microsoft.com/en-us/azure/iot-edge/iot-edge-security-manager>

Azure Container Registry

A faint, dark gray network diagram is visible in the background. It features a central large circle connected to several smaller circles, which are further connected to other circles, creating a web-like structure. The circles and lines are semi-transparent, allowing the text to be clearly visible over them.

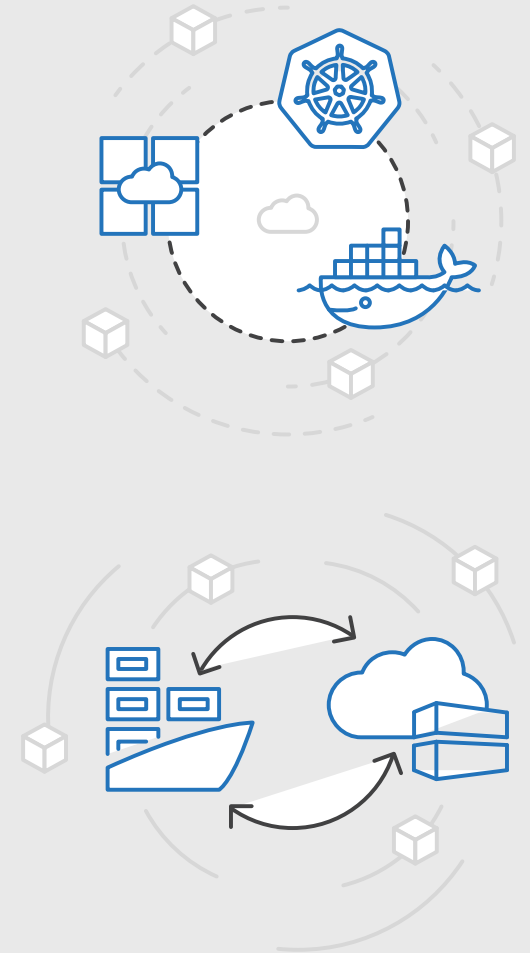
Azure Container Registry

Docker private registry

Maintain Windows and Linux container images in a single registry

Use familiar, open-source Docker command line interface (CLI) tools

Simplify registry access management with Azure Active Directory



Azure Container Registry

Encryption-at-rest

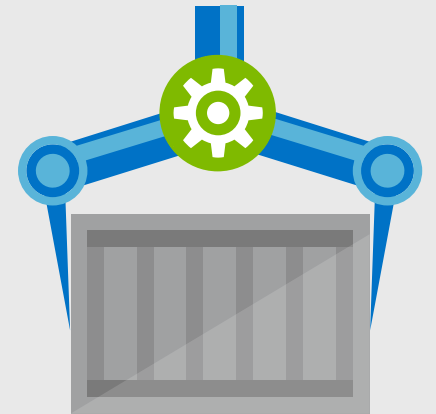
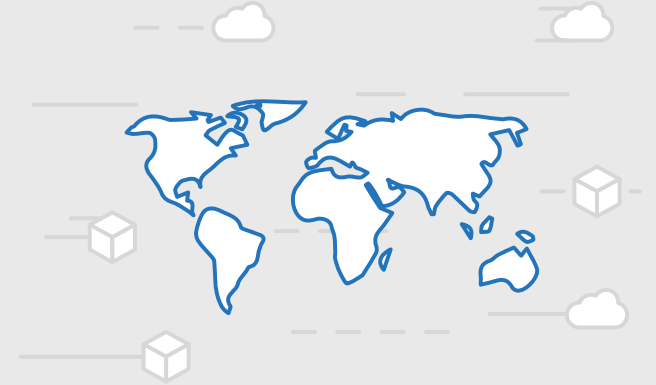
Geo-redundant storage

Geo-replication support

ACR Build - Lifecycle Management, OS & Framework Patching

Secure by default Container Registries

Trusted images support



Azure Container Registry

Limits

Resource	Basic	Standard	Premium
Storage	10 GB	100 GB	500 GB
ReadOps per minute* **	1,000	3,000	10,000
WriteOps per minute* ***	100	500	2,000
Download bandwidth MBps*	30	60	100
Upload bandwidth MBps*	10	20	50
Webhooks	2	10	100
Geo-replication	-	-	Supported
<ul style="list-style-type: none">* ReadOps, WriteOps, and Bandwidth are minimum estimates. ACR strives to improve performance as usage requires.** docker pull translates to multiple read operations based on the number of layers in the image, plus the manifest retrieval.*** docker push translates to multiple write operations, based on the number of layers that must be pushed. A docker push includes ReadOps to retrieve a manifest for an existing image.			

Visual Studio Team Services



Visual Studio Team Services

Unlimited free private code repositories – Git or TFVC

Track bugs, work items, feedback, and more

Cloud-powered continuous integration and deployment

Enterprise-grade services scale to any team size

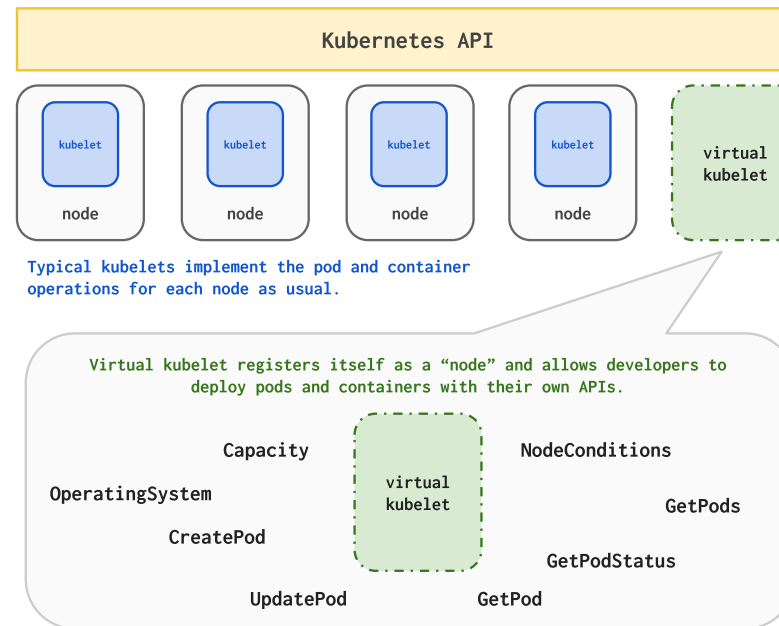
Free for up to five users

IoT Edge Virtual Kubelet Provider



Virtual Kubelet Project

Virtual Kubelet is an open source Kubernetes kubelet implementation that masquerades as a kubelet for the purposes of connecting Kubernetes to other APIs. This allows the nodes to be backed by other services like ACI, AWS Fargate, Hyper.sh, IoT Edge etc. The primary scenario for VK is enabling the extension of the Kubernetes API into serverless container platforms like ACI, Fargate, and Hyper.sh, though we are open to others.



Virtual Kubelet Project

Available provider

Azure Batch

Azure Container Instances

Azure IoT Edge

Azure Service Fabric Mesh

AWS Fargate

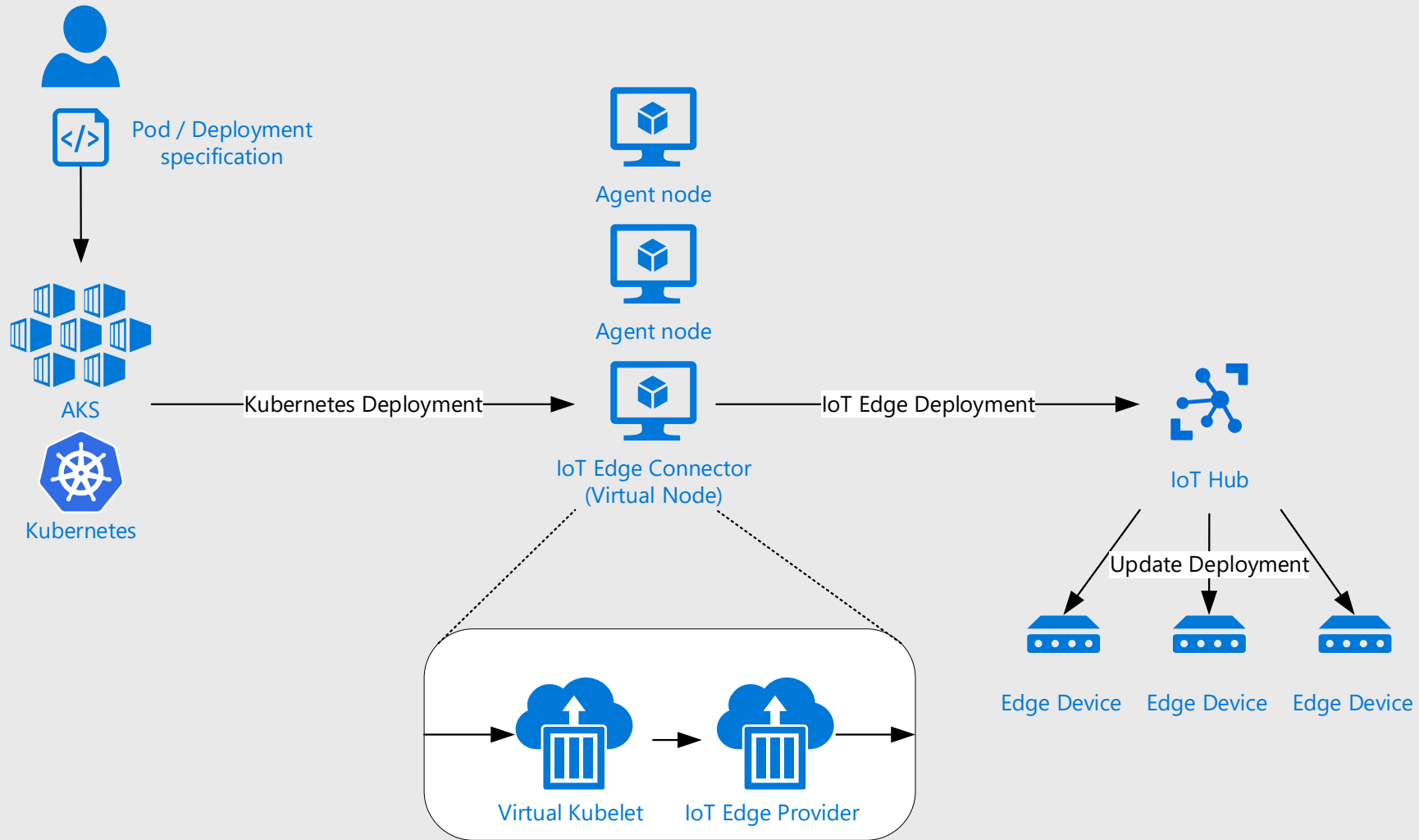
Huawei Cloud Container Instance

Hyper.sh

VMware vSphere Integrated
Containers

Virtual Kubelet

IoT Edge Connector



IoT Edge Connector – K8s deployment

...

annotations:

isEdgeDeployment: "true"

targetCondition: "tags.location.building='mobile' AND tags.environment='test'"

priority: "15"

loggingOptions: ""

...

IoT Edge Connector – K8s deployment

...

containers:

- name: tempsensor

- image: mcr.microsoft.com/azureiotedge-simulated-temperature-sensor:1.0

...

nodeSelector:

- type: virtual-kubelet

tolerations:

- key: azure.com/iotedge

- effect: NoSchedule

...

IoT Edge Connector – edgeAgent

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: edgeagent
data:
  desiredProperties: |
    {...}
```

IoT Edge Connector – edgeAgent

```
"runtime": {  
  "settings": {  
    "registryCredentials": {  
      "docker": {  
        "address": "azstcr1.azurecr.io",  
        "password": "{PASSWORD}",  
        "username": "{USERNAME}"  
      }  
    }  
  }  
},
```

IoT Edge Connector – edgeAgent

```
"systemModules": {  
  "edgeHub": {  
    "env": {  
      "OptimizeForPerformance": {  
        "value": "false"  
      }  
    }  
  }  
}
```

IoT Edge Connector – edgeHub

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: edgehub
data:
  desiredProperties: |
    {
      "routes": { "route": "FROM /* INTO $upstream" },
      "storeAndForwardConfiguration": { "timeToLiveSecs": 7200 }
    }
```


IoT Edge Connector – Modules

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: tempsensor
data:
  status: running
  restartPolicy: always
  version: "1.0"
  createOptions: |
    {
      "HostConfig": { "Memory": 20971520 }
    }
```

Links

Virtual Kubelet Project:

- <https://github.com/virtual-kubelet/virtual-kubelet>

IoT Edge Virtual Kubelet Provider:

- <https://github.com/Azure/iot-edge-virtual-kubelet-provider/>

Demo



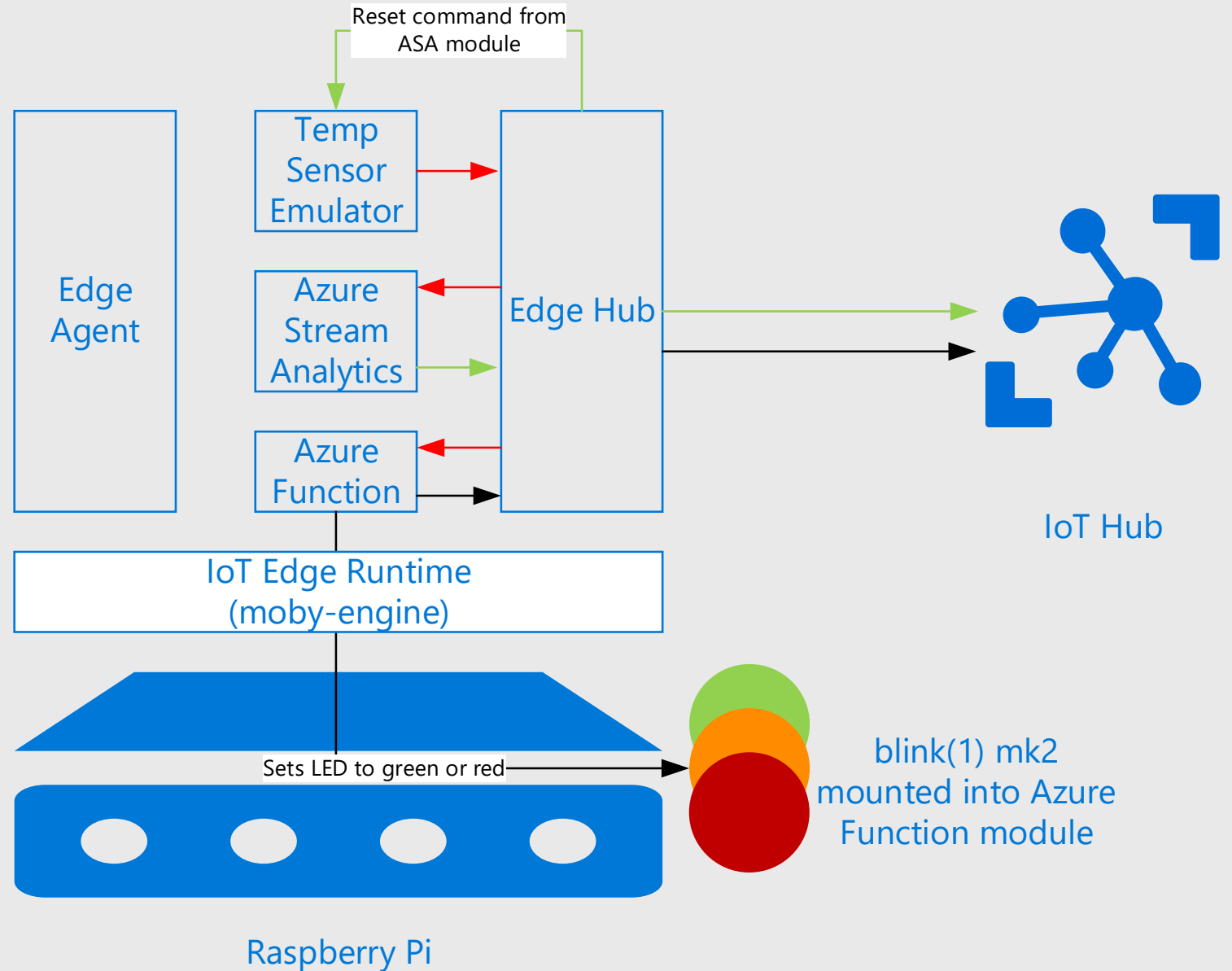
```
FROM /messages/modules/tempsensor/  
outputs/temperatureOutput INTO  
BrokeredEndpoint(\"/modules/function/  
inputs/input1\")
```

```
FROM /messages/modules/tempsensor/  
outputs/temperatureOutput INTO  
BrokeredEndpoint(\"/modules/  
streamanalytics/inputs/temperature\")
```

```
FROM /messages/modules/  
streamanalytics/* INTO  
BrokeredEndpoint(\"/modules/  
tempsensor/inputs/control\")
```

```
FROM /messages/modules/  
streamanalytics/* INTO $upstream
```

```
FROM /messages/modules/function/  
outputs/* INTO $upstream
```



Demo steps

Part 1

AKS and ACR deployment using a script in Azure Cloud Shell

- <https://github.com/neumanndaniel/kubernetes/tree/master/on-azure>

IoT Hub deployment

- <https://docs.microsoft.com/en-us/azure/iot-hub/quickstart-send-telemetry-node#create-an-iot-hub>

IoT Edge device provisioning

- <https://docs.microsoft.com/en-us/azure/iot-edge/how-to-register-device-cli>
- <https://docs.microsoft.com/en-us/azure/iot-edge/how-to-install-iot-edge-linux-arm>

Demo steps

Part 2

Building ARM-based container images with VSTS and Azure Container Registry Build

- <https://www.danielstechblog.io/building-arm-based-container-images-with-vsts-and-azure-container-registry-build/>

Deploy ARM-based container images with Azure Kubernetes Service on your Azure IoT Edge devices

- <https://www.danielstechblog.io/deploy-arm-based-container-images-with-azure-kubernetes-service-on-your-azure-iot-edge-devices/>

