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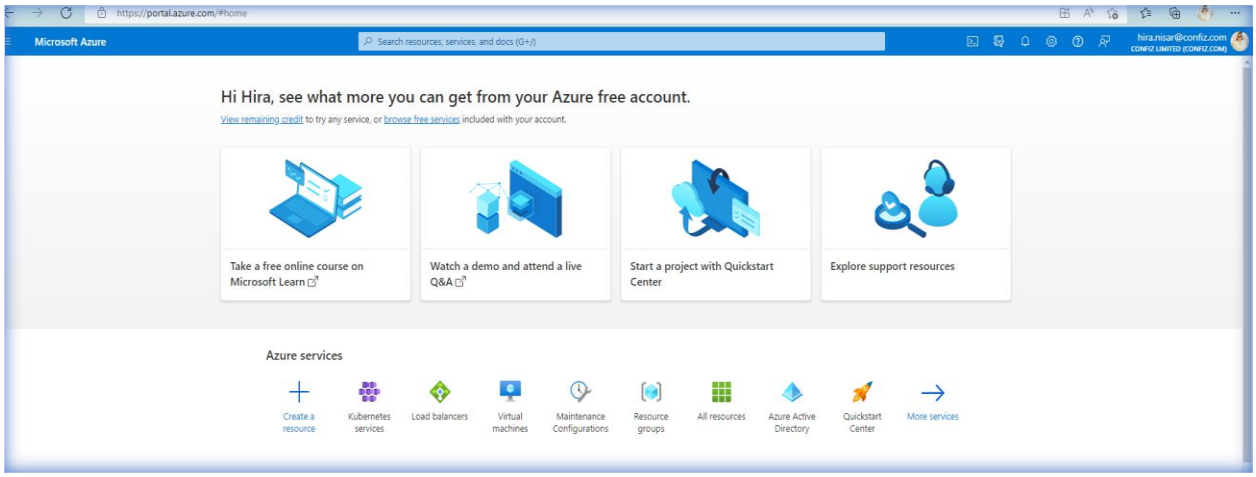
DOCUMENTATION

AZURE KUBEFLOW

AZURE QUICK SETUP

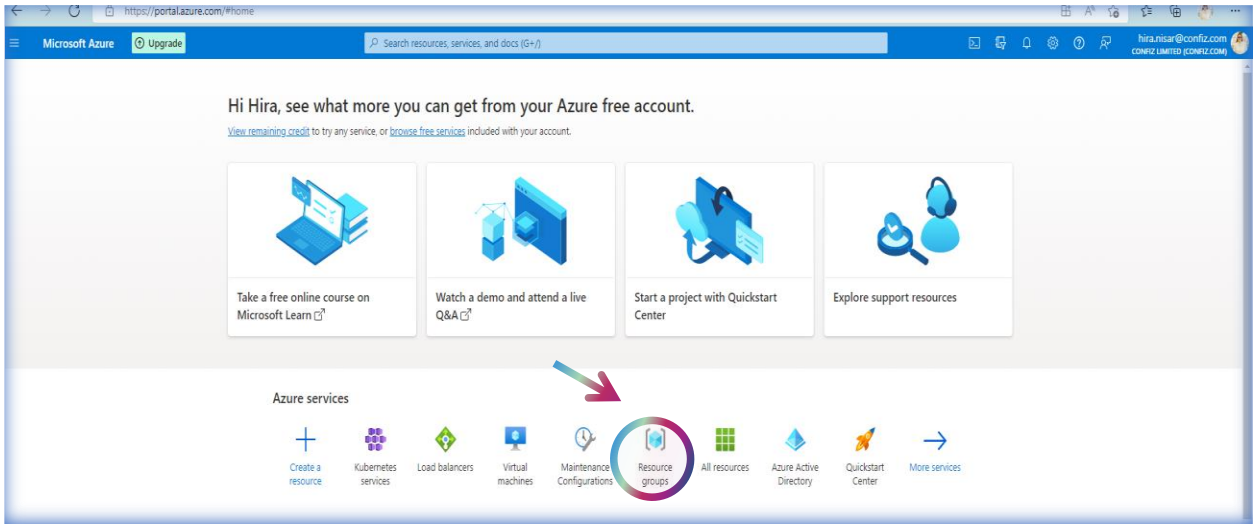
- ✓ Open the **Azure**: https://portal.azure.com

- ✓ Register for a **subscription of a free account**, create your free account and access the **portal home page**.

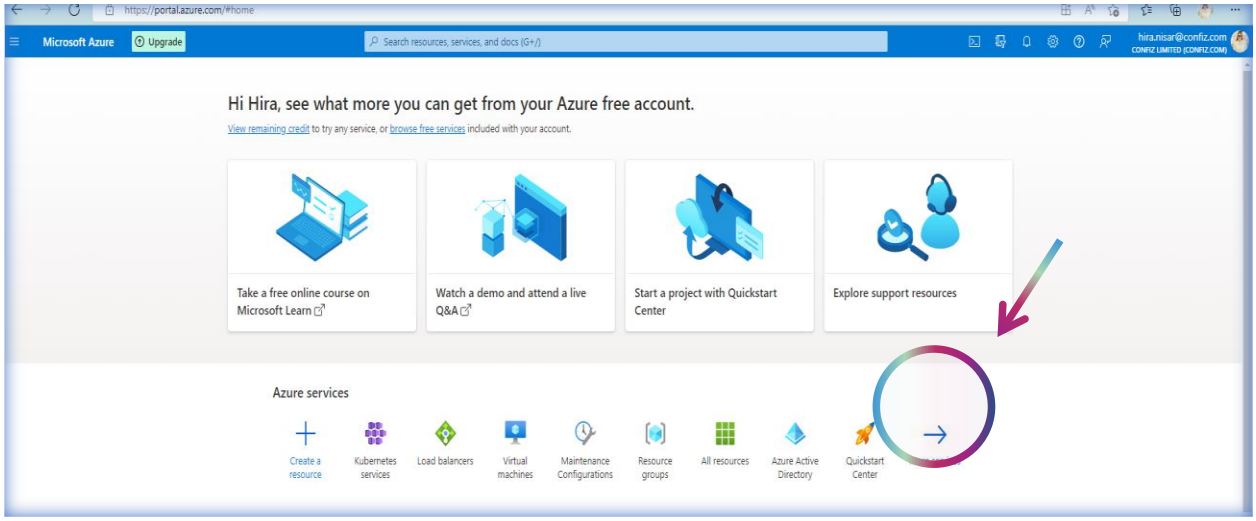


Resource group

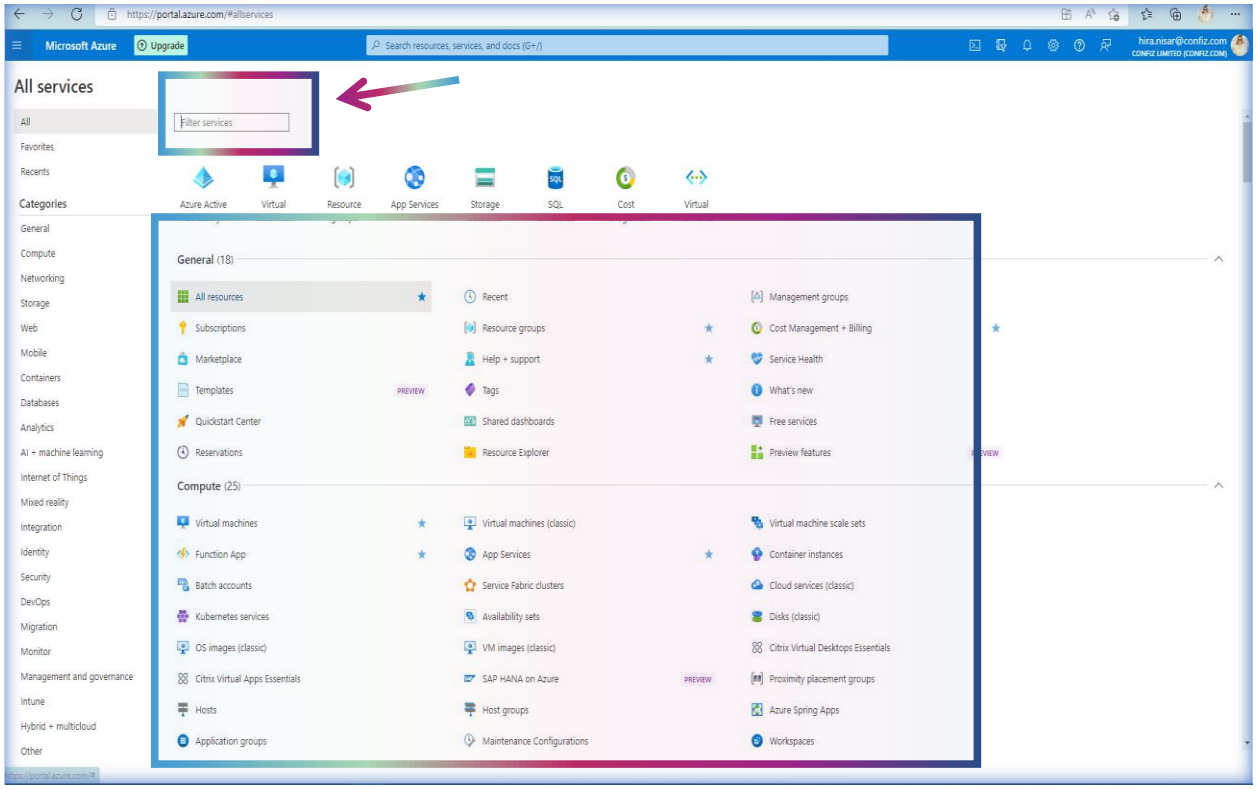
- ✓ Create a **resource group** with this **subscription**, with the highlighted icon on the screen.



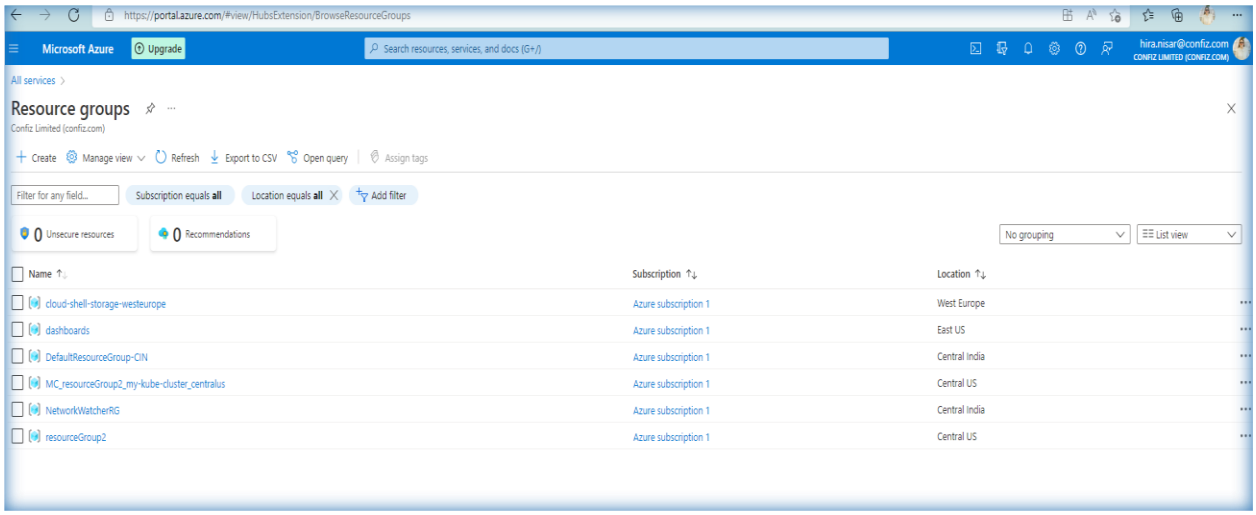
If you do not see that icon in the quick start icons, then browse the **“more services”** and manually create one.



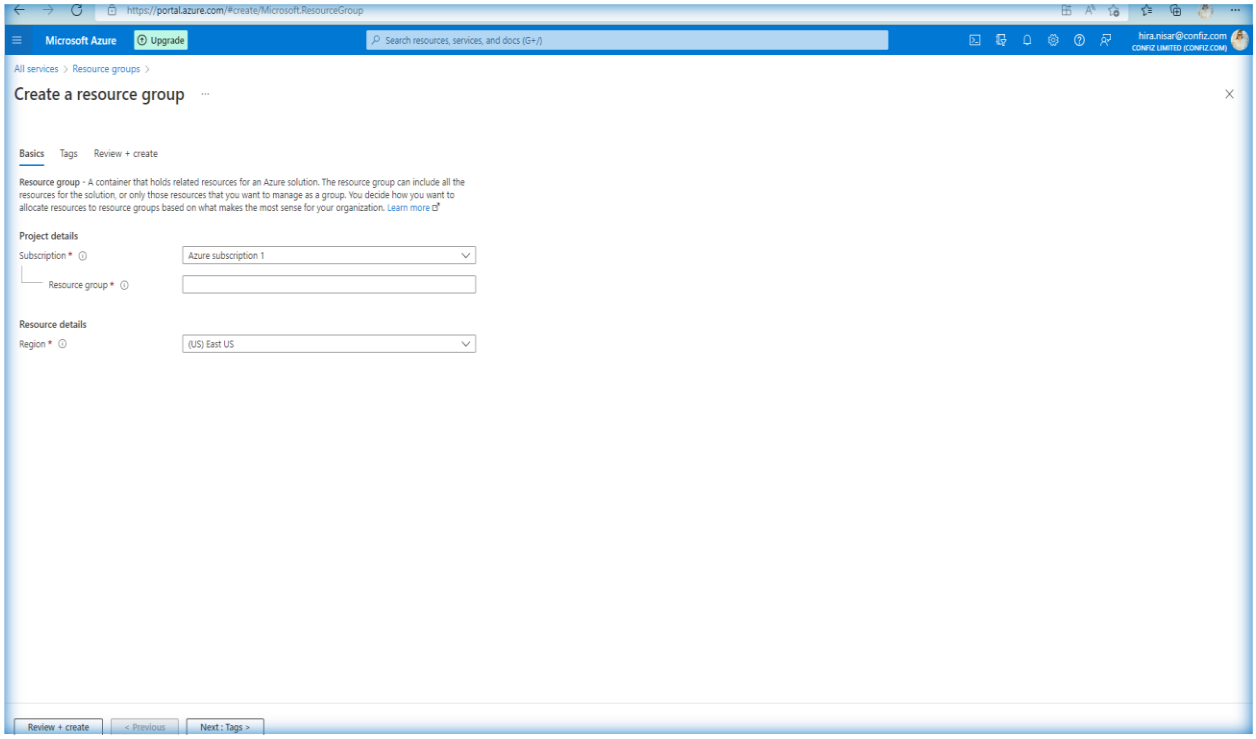
- ✓ Type in the field and search for a **“resource group”**.



✓ Here you can view and create your **resource group.**

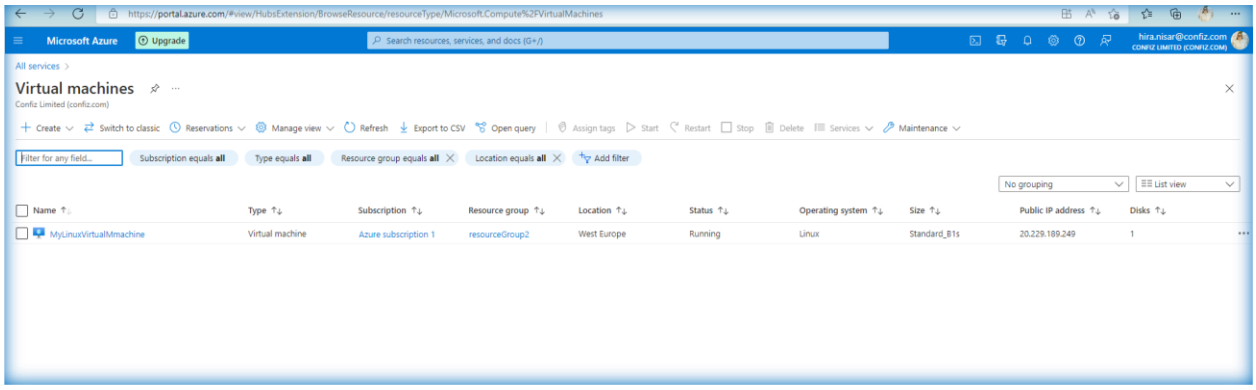


✓ Add in the details of your azure subscription and the name you want for your resource group and then follow the default settings.

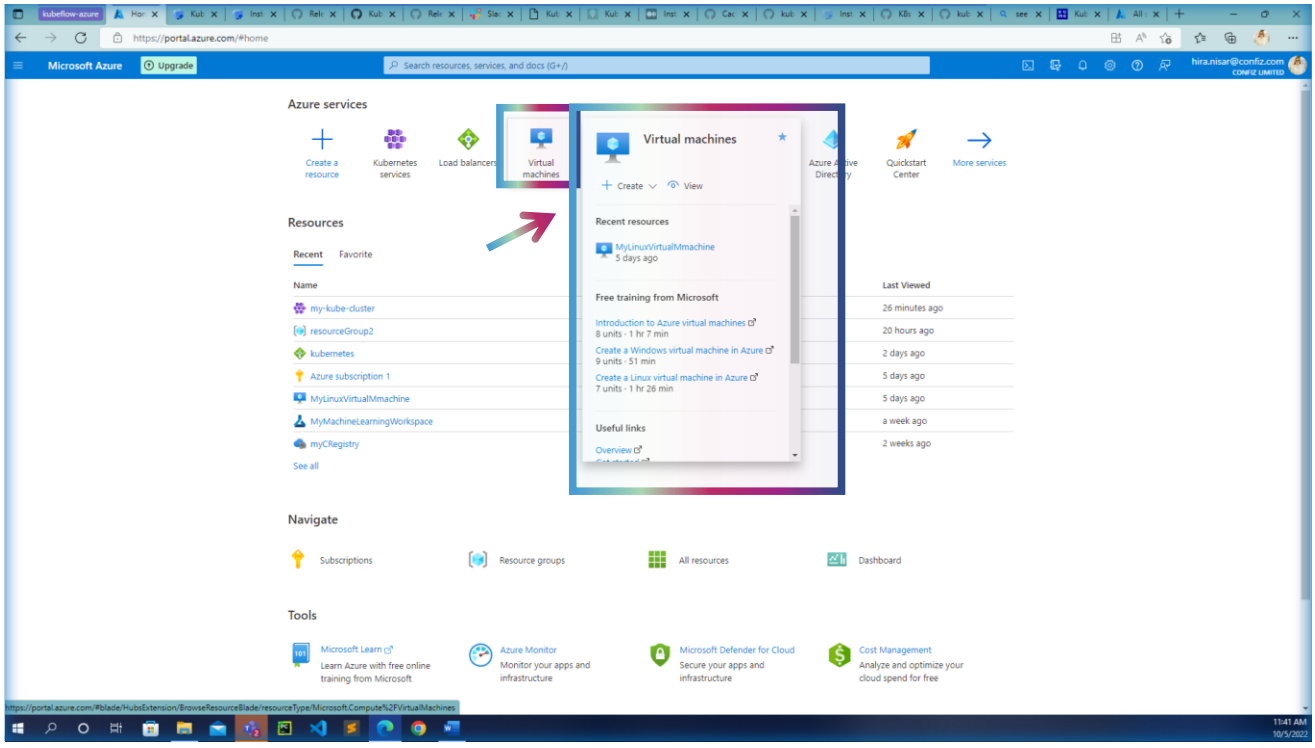


Virtual Machine

- ✓ Once its created and deployed, setup a **virtual machine** in the same way. You can view my virtual machine and itsb details below.

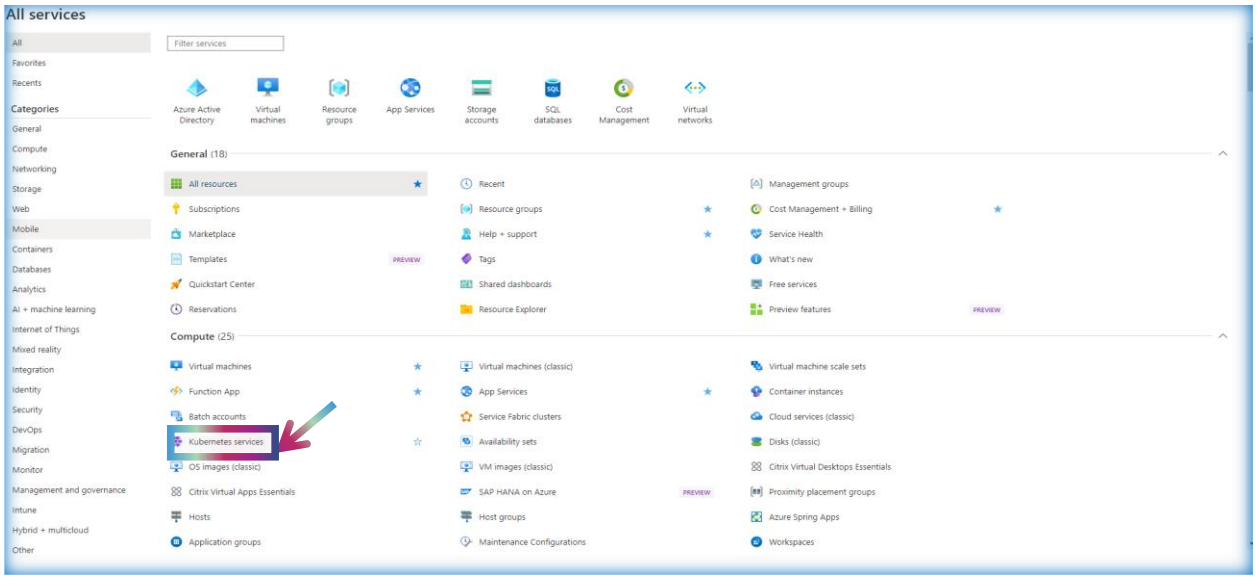


If you face any difficulty in creating a resource, just place the mouse over its icon and view the **documentation and tutorials** provided by azure.

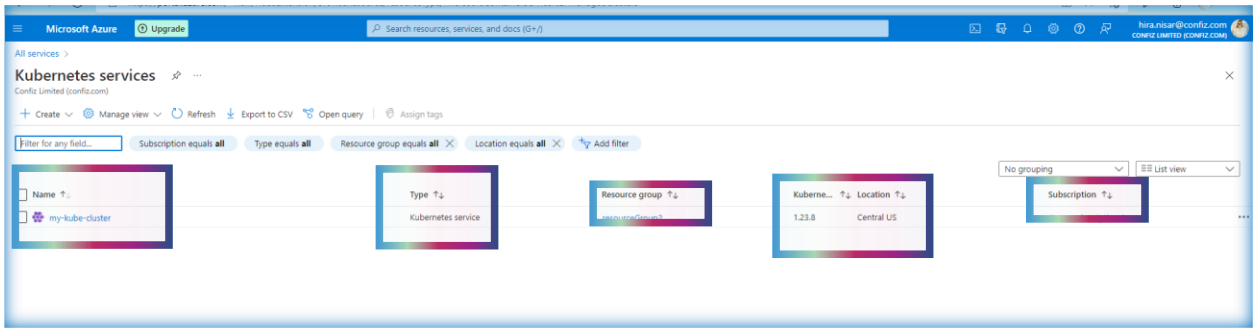


Kubernetes Service (Cluster)

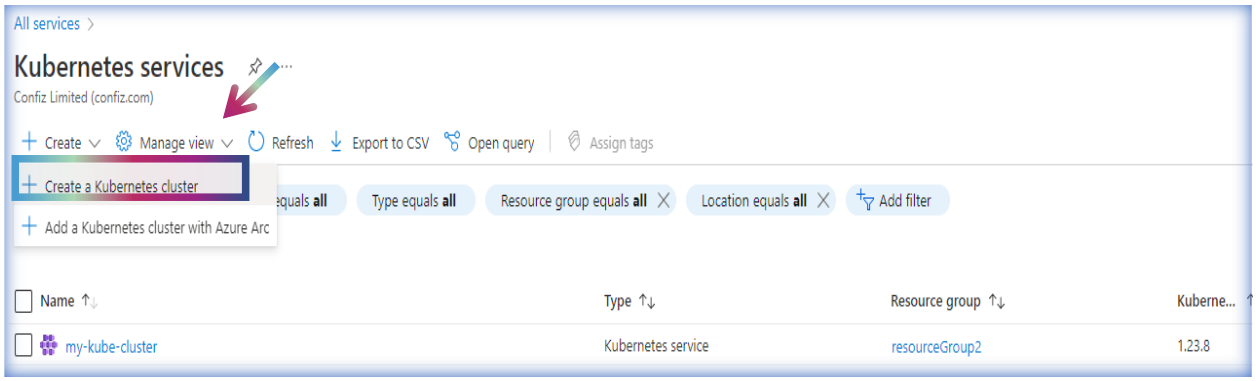
- ✓ Once done with these bacis resources, you now need to create a **kubernetes service.**



- ✓ Add the details as shown in the following snapshot of my kube cluster and follow the default settings.

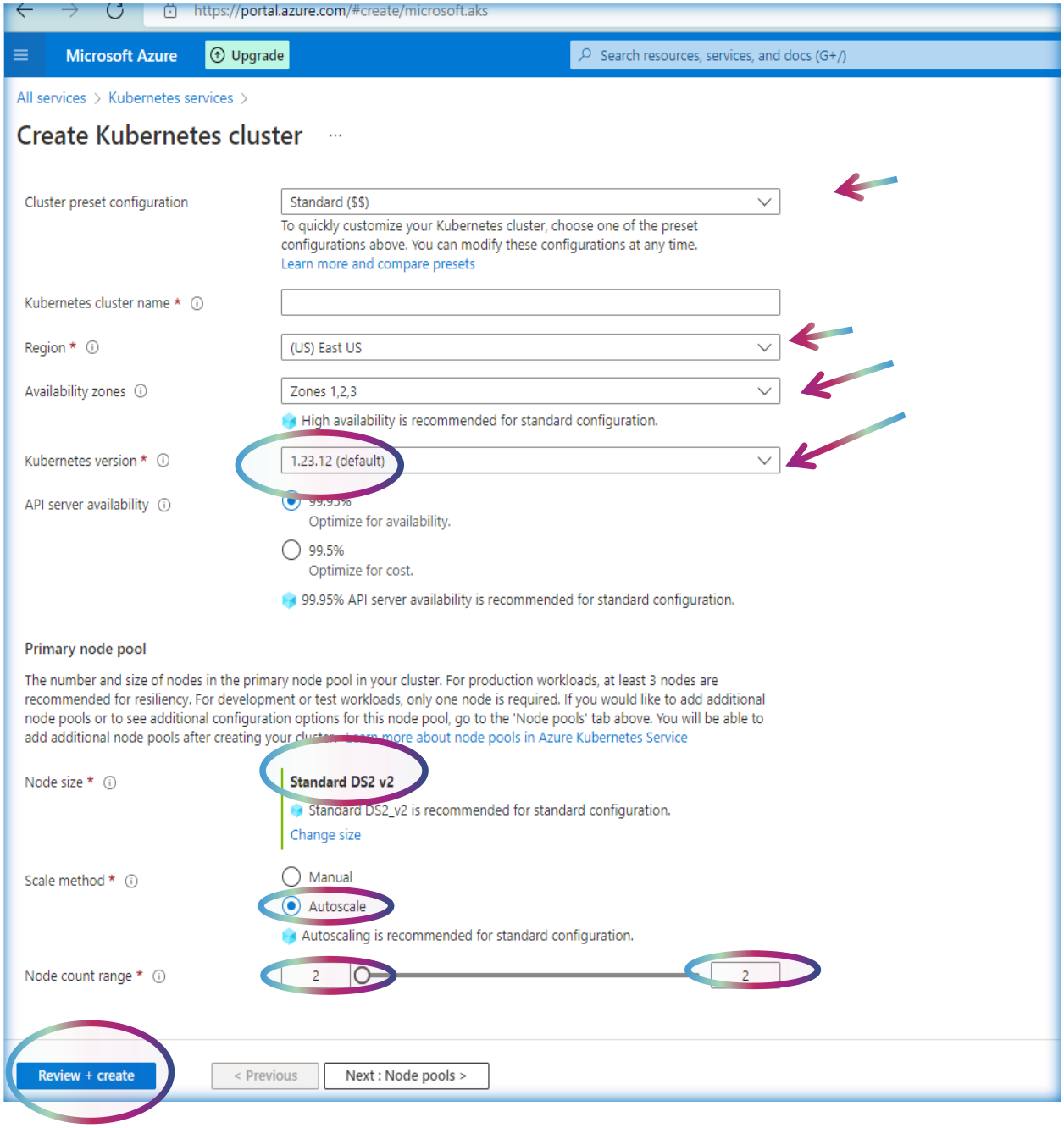


- ✓ You need to select the first option for this guide.

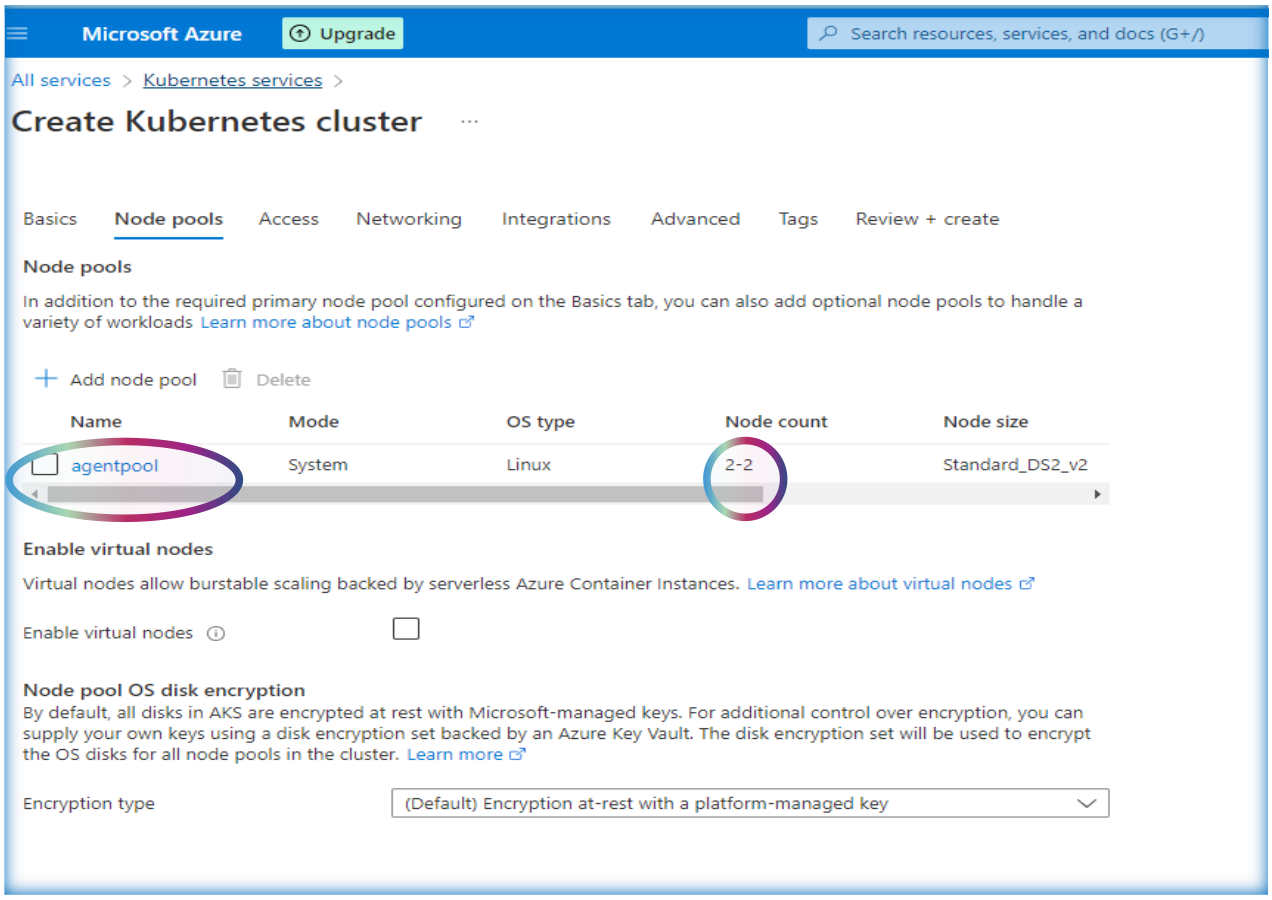


✓ Add 2 min and 2 max nodes.

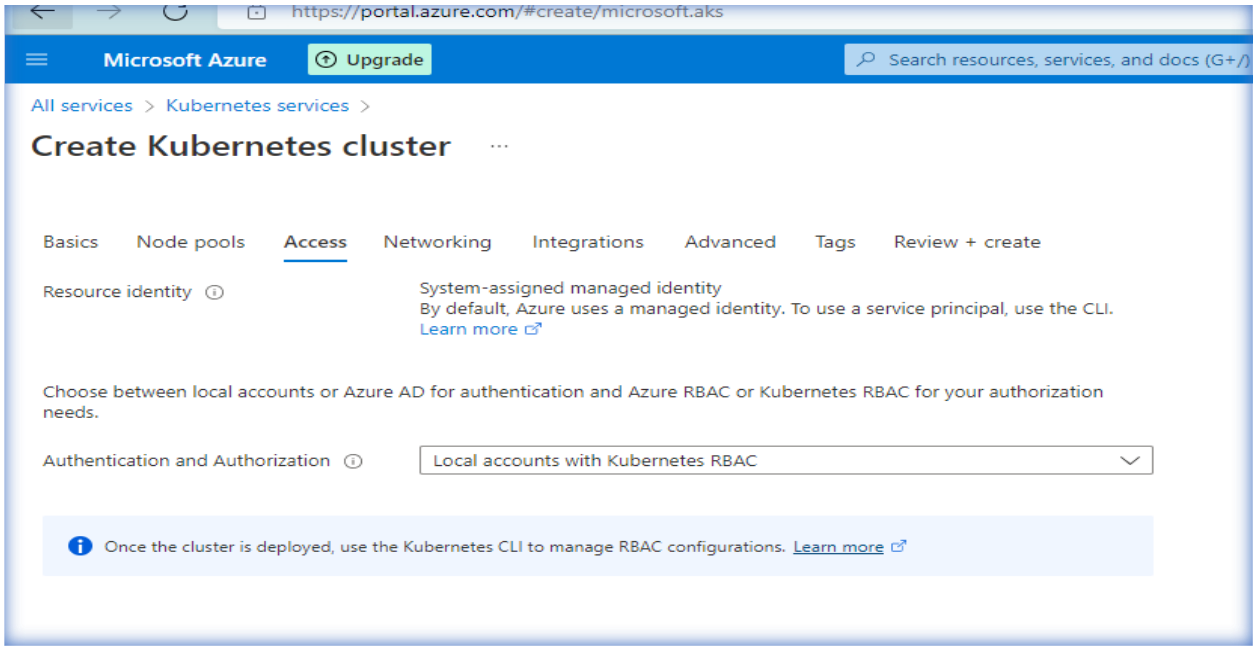
As it is the free trial, you will be able to creater only 2 nodes and with specific zones.



- ✓ After this "**Basics"** section, go to the nood pools section and create a node pool for 2 nodes and 110 pods for each node.



- ✓ For the access part



✓ For networking

All services > Kubernetes services >

Create Kubernetes cluster ...

Basics | Node pools | Access | **Networking** | Integrations | Advanced | Tags | Review + create

You can change networking settings for your cluster, including enabling HTTP application routing and configuring your network using either the 'Kubenet' or 'Azure CNI' options:

- The **kubenet** networking plug-in creates a new VNet for your cluster using default values.
- The **Azure CNI** networking plug-in allows clusters to use a new or existing VNet with customizable addresses. Application pods are connected directly to the VNet, which allows for native integration with VNet features.

Learn more about networking in Azure Kubernetes Service

Network configuration: (•) Kubenet ( ) Azure CNI

DNS name prefix *

Traffic routing

Load balancer: Standard

Enable HTTP application routing: [ ]

Security

Enable private cluster: [ ]

Set authorized IP ranges: [ ]

Network policy: (•) None ( ) Calico ( ) Azure

The Azure network policy is not compatible with kubenet networking.

All services > Kubernetes services >

Create Kubernetes cluster ...

Basics | Node pools | Access | Networking | **Integrations** | Advanced | Tags | Review + create

Connect your AKS cluster with additional services.

Azure Container Registry

Connect your cluster to an Azure Container Registry to enable seamless deployments from a private image registry. You can create a new registry or choose one you already have. Learn more about Azure Container Registry

Container registry: None

Create new

Azure Monitor

In addition to the CPU and memory metrics included in AKS by default, you can enable Container Insights for more comprehensive data on the overall performance and health of your cluster. Billing is based on data ingestion and retention settings.

Learn more about container performance and health monitoring

Learn more about pricing

Container monitoring: (•) Enabled ( ) Disabled

Azure monitor is recommended for standard configuration.

Log Analytics workspace: DefaultWorkspace-653c88c0-dff3-4b5c-b717-a78b8467fe1e-CIN

Create new

Use managed identity (preview): [ ]

Azure Policy

Apply at-scale enforcements and safeguards for AKS clusters in a centralized, consistent manner through Azure Policy.

Learn more about Azure Policy for AKS

Azure Policy: ( ) Enabled (•) Disabled

And then for all the sections follow the defaults.

Press "**Review and Create"** and wait for the service to be deployed.

Install Kubeflow

Prerequisites

Kubernetes compatible on k8s 1.22

Kustomize version 3.2.0

Install and configure the **Azure Command Line Interface** (Az)

Installations of Prerequisites

Logging in the Azure

According to this guide you are logged into Azure portal with the subscription you got from the free trail.

If you are working locally you need to follow:

Login to Azure

```
az login
```

Initial cluster setup for new cluster

Create a resource group:

```
az group create -n <RESOURCE_GROUP_NAME> -l <LOCATION>
```

Example variables:

- RESOURCE_GROUP_NAME=KubeTest
- LOCATION=westus

Create a specifically defined cluster:

```
az aks create -g <RESOURCE_GROUP_NAME> -n <NAME> -s <AGENT_SIZE> -c
<AGENT_COUNT> -l <LOCATION> --generate-ssh-keys
```

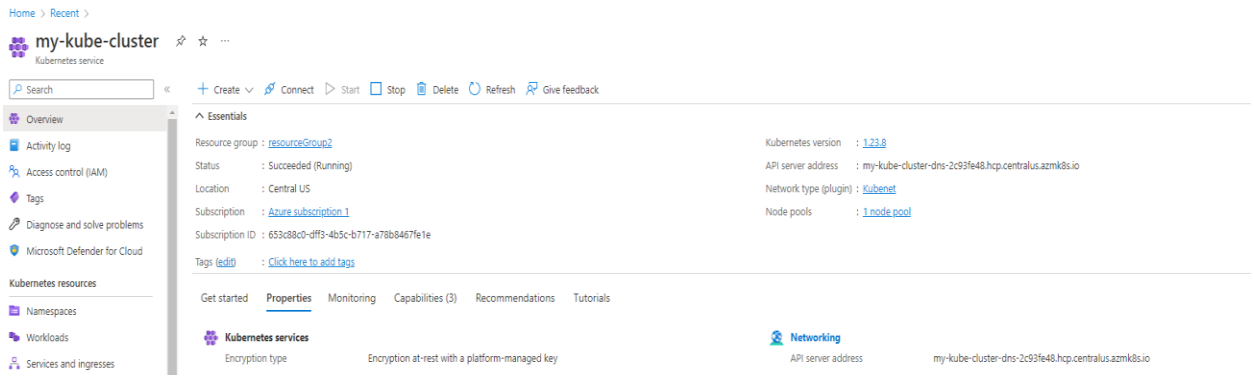
Example variables:

- NAME=KubeTestCluster
- AGENT_SIZE=Standard_D4_v3
- AGENT_COUNT=2
- Use the same resource group and name from the previous step

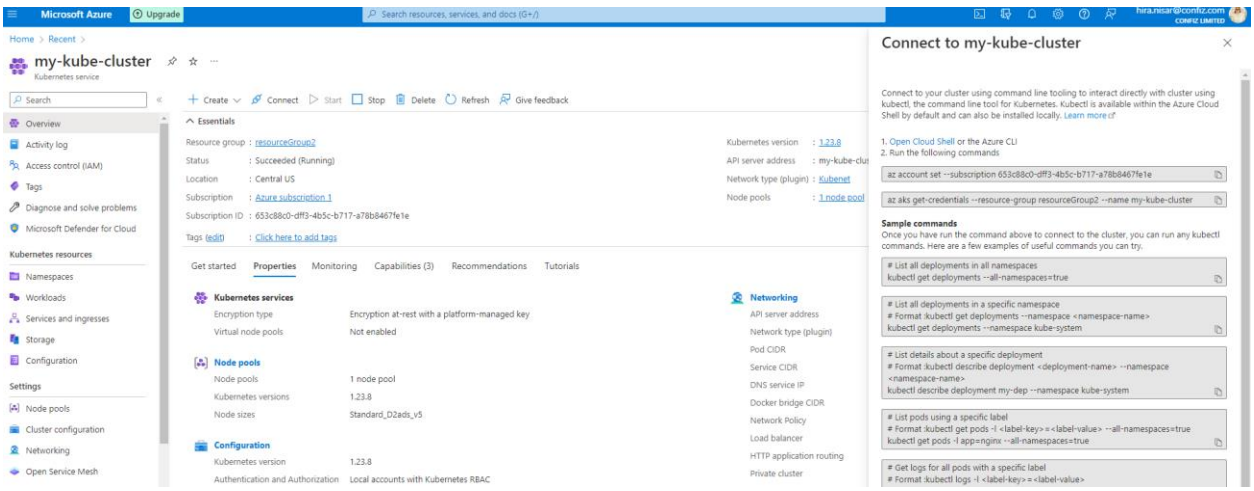
NOTE: If you are using a GPU based AKS cluster (For example: AGENT_SIZE=Standard_NC6), you also need to [install the NVidia drivers](#) on the cluster nodes before you can use GPUs with Kubeflow

Connecting to the cluster

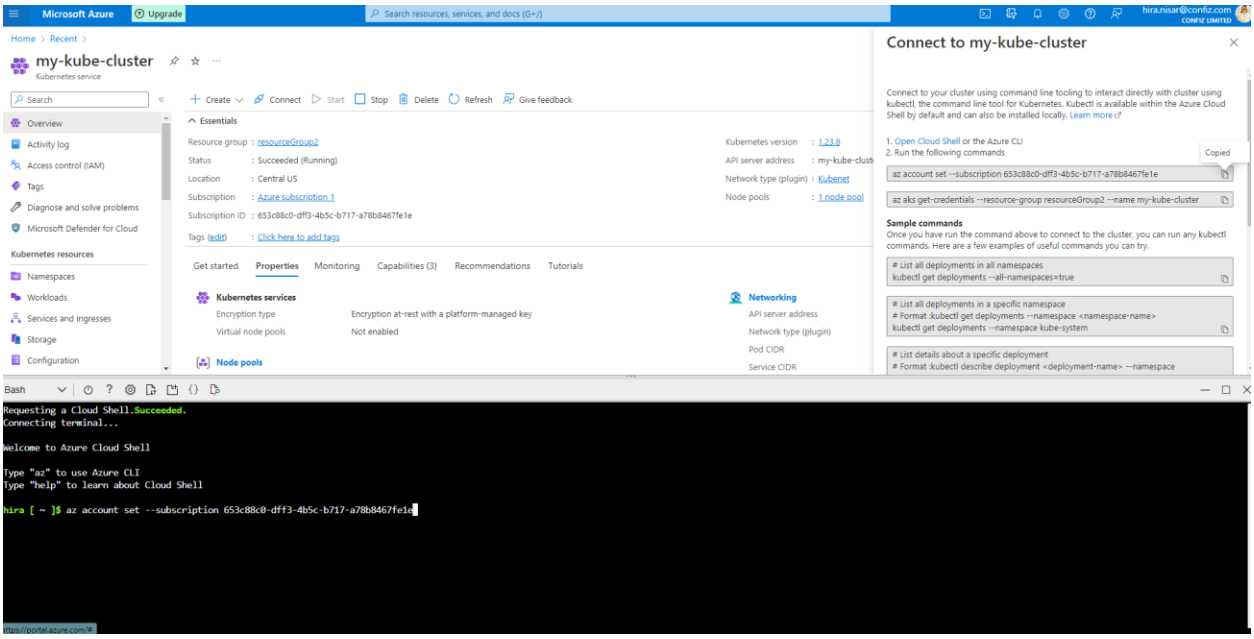
Open the cluster/ Kubernetes service you created, click on the **Connect** tab



Copy the first command from the pane that just opened.



Open the **Cloud Shell** and paste and run the command. Then do the same with the second command.



Now you have started your cluster service successfully.

Installation of prerequisites

Install kubectl

Install for Linux, as our virtual machine is Ubuntu.

[Install Tools | Kubernetes]

Download the latest release with the command:

```
curl -LO "https://dl.k8s.io/release/$(curl -L -s https://dl.k8s.io/release/stable.txt)/bin/linux/amd64/kubectl"
```

To download a specific version, replace the $(curl -L -s https://dl.k8s.io/release/stable.txt) portion of the command with the specific version.

For example, to download version v1.25.0 on Linux, type:

```
curl -LO https://dl.k8s.io/release/v1.25.0/bin/linux/amd64/kubectl
```

There are other methods too provided on the webpage:

[Install and Set Up kubectl on Linux | Kubernetes]

Now verify the kubectl configuration

In order for kubectl to find and access a Kubernetes cluster, it needs a [kubeconfig file], which is created automatically when you create a cluster. By default, kubectl configuration is located at ~/.kube/config. Check that kubectl is properly configured by getting the cluster state:

```
kubectl cluster-info
```

Install Azure Command Line Interface (Az)

As, we are already working on the azure cloud service, we are already logged in and Azure cli is already preinstalled.

If you are working locally you need to login with the command: `az login`

Install Docker (Optional)

As, this is optional, I am not providing the detailed procedure for this but if you like to install it, follow the following links.

[Setting Up Docker for Windows and WSL to Work Flawlessly — Nick Janetakis]

Kubeflow Installation

Set up and Kubeflow.

- ✓ Create user credentials. You only need to run this command once:
  - `az aks get-credentials -n <NAME> -g <RESOURCE_GROUP_NAME>`

- ✓ Download the kfctl v0.7.1 release from the Kubeflow releases page

- ✓ Unpack the tar ball:
  - `tar -xvf kfctl_v0.7.1_<platform>.tar.gz`

Deploy Kubeflow

The code below includes an optional command to add the binary kfctl to your path. If you don't add the binary to your path, you must use the full path to the kfctl binary each time you run it.

- ✓ The following command is optional, to make kfctl binary easier to use.
  - `export PATH=$PATH:<path to where kfctl was unpacked>`

- ✓ Set KF_NAME to the name of your Kubeflow deployment. This also becomes the of the directory containing your configuration. For example, your deployment name can be 'my-kubeflow' or 'kf-test'.
  - `export KF_NAME=<your choice of name for the Kubeflow deployment>`

- ✓ Set the path to the base directory where you want to store one or more Kubeflow deployments. For example, /opt/. Then set the Kubeflow application directory for this deployment.

- `export BASE_DIR=<path to a base directory>`
- `export KF_DIR=${BASE_DIR}/${KF_NAME}`

✓ Set the configuration file to use, such as the file specified below:

- `export CONFIG_URI=https://raw.githubusercontent.com/kubeflow/manifests/v0.7-branch/kfdef/kfctl_k8s_istio.0.7.1.yaml`

✓ Generate and deploy Kubeflow:

- `mkdir -p ${KF_DIR}`
- `cd ${KF_DIR}`
- `kfctl apply -V -f ${CONFIG_URI}`

Rules

${KF_NAME} - The name of your Kubeflow deployment. If you want a custom deployment name, specify that name here. For example, my-kubeflow or kf-test. The value of KF_NAME must consist of lower-case alphanumeric characters or '-', and must start and end with an alphanumeric character. The value of this variable cannot be greater than 25 characters. It must contain just a name, not a directory path. This value also becomes the name of the directory where your Kubeflow configurations are stored, that is, the Kubeflow application directory.

${KF_DIR} - The full path to your Kubeflow application directory.

Kustomization

The above process will not allow you to deploy kubeflow fully, so you need not to worry seeing the warning s and the errors in the above installations.

Configuring Kubeflow with kfctl and kustomize | Kubeflow

We will use **kustomize** to further complete our installations.

✓ Install kustomize version 3.2.0: Release v3.2.0 · kubernetes-sigs/kustomize (github.com)
Configuring Kubeflow with kfctl and kustomize | Kubeflow
Check the installed version with the command:

```
kustomize version
```

You can also use other methods to install "kustomize"
Kustomize | SIG CLI (kubernetes.io)

Easiest way to do it is to install the latest binaries using the command:

```
 curl -s "https://raw.githubusercontent.com/kubernetes-sigs/kustomize/master/hack/install_kustomize.sh"  | bash
```

or

```
curl -s https://api.github.com/repos/kubernetes-sigs/kustomize/releases
|\
grep browser_download |\
grep download/kustomize |\
grep -m 1 $opsys |\
cut -d '"' -f 4 |\
xargs curl -O -L
```

[Binaries | SIG CLI (kubernetes.io)]

If you want to install ARM binaries, visit the releases page: [Releases · kubernetes-sigs/kustomize (github.com)]

- ✓ Clone the manifest file:

```
git clone https://github.com/kubeflow/manifests.git

cd manifests
```

- ✓ In the manifest repo, navigate to:

```
common/istio-1-14/istio-install/base/install.yaml.
```

Go to:

```
apiVersion: admissionregistration.k8s.io/v1beta1
kind: MutatingWebhookConfiguration
metadata:
  name: istio-sidecar-injector
   labels:
     istio.io/rev: default
    install.operator.istio.io/owning-resource: unknown
    operator.istio.io/component: "Pilot"
    app: sidecar-injector
    release: istio
  ....
```

- ✓ And add notation:

```
admissions.enforcer/disabled: "true"
```

as follows:

```
apiVersion: admissionregistration.k8s.io/v1beta1
kind: MutatingWebhookConfiguration
metadata:
```

```
  name: istio-sidecar-injector
  annotations:
    admissions.enforcer/disabled: "true"
  labels:
    istio.io/rev: default
    install.operator.istio.io/owning-resource: unknown
    operator.istio.io/component: "Pilot"
    app: sidecar-injector
    release: istio
  ....
```

- ✓ Save your changes to yaml file and, now install Kubeflow:

```
while ! kustomize build example | kubectl apply -f -; do echo "Retrying
to apply resources"; sleep 10; done
```

- ✓ Run this command to check that the resources have been deployed correctly in namespace kubeflow:

```
kubectl get all -n kubeflow
```

- ✓ Expose load balancer

To expose Kubeflow with a load balancer service, change the type of the istio-ingressgateway service to LoadBalancer.

```
kubectl patch service -n istio-system istio-ingressgateway -p '{"spec":
{"type": "LoadBalancer"}}'
```

After that, obtain the LoadBalancer IP address (this may take more than 15 minutes)

```
kubectl get svc -n istio-system istio-ingressgateway -o
jsonpath='{.status.loadBalancer.ingress[0]}'
```

Running it should return you with a response containing loadbalancer IP where Kubeflow is running.

- ✓ create a self-signed certificate with cert-manager:

```
nano certificate.yaml:
```

This will open a GNU console within bash where you need to create a certificate by typing the following:

```
apiVersion: cert-manager.io/v1
kind: Certificate
metadata:
```

```
    name: istio-ingressgateway-certs
    namespace: istio-system
spec:
    commonName: istio-ingressgateway.istio-system.svc
    # Use ipAddresses if your LoadBalancer issues an IP address
    ipAddresses:
    - <LoadBalancer IP>
    isCA: true
    issuerRef:
        kind: ClusterIssuer
        name: kubeflow-self-signing-issuer
    secretName: istio-ingressgateway-certs
```

- ✓ After creating the certificate apply it:

```
kubectl apply -f certificate.yaml -n istio-system
```

So, now, Kubeflow has been deployed

To open the Kubeflow Dashboard, run the following command to get the dashboard IP:

```
kubectl get svc -n istio-system istio-ingressgateway -o
jsonpath='{.status.loadBalancer.ingress[0]}'
```

Next, open <loadbalancerip> in your browser.

Login to Kubeflow using default email: user@example.com and password: 12341234.