* Course Overview
  + Kubernetes building blocks
  + Role of pods
  + Services
  + Secrets
* Overview
  + Kubernetes from a developer perspective
  + Creating pods
  + Creating deployments
  + Creating services
  + Understanding storage options
  + Creating ConfigMaps and Secrets
* Introduction
  + Can use Kubernetes in non production environment
* Kubernetes Overview
  + Open source system for automating deployment, scaling and management of containerized applications
  + How are you managing containers
    - Load balance to server with containers
  + Can use docker compose to manage containers
    - Not meant for production but can be used
  + Kubernetes is the conductor of a container orchestra
  + Key Kubernetes Features
    - Service discovery, load balancing
    - Storage orchestration/volumes
    - Automate rollouts/rollbacks
    - Self healing
    - Secret and configuration management
    - Horizontal scaling
    - More features
* The Big Picture
  + Container and cluster management
  + Kubernetes open source project
  + Supported by all major cloud platforms
  + Provides a “declarative” way to define cluster’s state
  + One or more master nodes
    - Manage worker nodes
  + Together they create a cluster
  + Master will start a pod on each node
  + Pod is a way to host a container
  + Pod is suit and container is a person in the suit
  + Deployment and replicaset to deploy pods
  + Need service for pods to talk to each other and the outside world
  + Node is like a VM, can run one or more pods
  + Store and controller manager
    - Store is database for master node to track things
    - Controller manager deals with request scheduling
  + kubectl command line tool
  + kubelet registers node with cluster and talks to manager
  + container runtime
  + Kube-Proxy: unique ip address for pods
* Benefits and Use Cases
  + benefits
    - accelerate developer onboarding
    - eliminate app conflicts
    - environment consistency
    - ships software faster
  + Key Kubernetes benefits
    - orchestrate containers
    - zero downtime deployments
    - self healing
    - scale containers
  + develop use cases
    - emulate production locally
    - move from docker compose to kubernetes
    - create an end to end testing environment
    - ensure application scales properly
    - ensure secrets/config are working properly
    - performance testing scenarios
    - workload scenarios(CI/CD and more)
    - learn how to leverage deployment options
    - help devops create resources and solve problems
* Running Kubernetes Locally
  + Minikube
  + docker desktop
  + kind: kubernetes in docker
  + kubeadam: full kubernetes, administrators
  + click on docker desktop icon
    - click on on settings
    - click on kubernetes
    - check enable kubernetes
    - click apply & restart
  + if it doesnt work, click restart docker
* Getting Started with kubecti
  + kubectl command line tool
  + type ‘kubectl version’ to check kubernetes version
  + type ‘kubectl cluster-info’ to get cluster information
  + ‘kubectl get all’ retrieve information about kubernets pods, services, etc
  + ‘kubectl run [container-name] --image=[image-name]’ simple way to create a deployment for a pod
  + ‘kubectl port-forward [pod] [ports]’ to forward a port to allow external access
    - normally a pod has a cluster ip, so only items in cluster can talk to pod
    - port-forward to expose it to external items
  + ‘kubectl expose ..’ expose a port for a deployment/prod
  + ‘kubectl create [resource]’ create a resource
  + ‘kubectl apply [resource’ create or modify a resource
  + ‘kubectl get pods’ to get all the pods
  + ‘kubectl get services’ to get all the services
* Web UI Dashboard
  + Optional
  + Visual dashboard to inspect nodes, etc
  + Steps
    - ‘kubectl apply -f [dashboard-yaml-url]’
    - ‘kubectl describe secret -n kube-sytem’
    - Locate the Kubernetes.io/service-account-token and copy it
    - kubectl proxy
    - visit the dashboard url and login using the token
  + type ‘kubectl apply -f [dashboard yaml link]’ to apply yml to set up for dashboard
  + then type ‘kubectl describe secret -n kube-system’
    - copy the first token
  + then run ‘kubectl proxy’ opens port to connect to dashboard
  + then open the link they specify under the proxy command on the documentation
    - <http://localhost:8001/api/v1/namespaces/kubernetes-dashboard/services/https:kubernetes-dashboard:/proxy/>.
  + select token and paste in token you copied earlier
* Summary
  + Kubernetes provides container orchestration capabilities
  + Used for production, emulating production, testing and more
  + Several options to run Kubernetes locally
  + Interact with Kubernetes using kubectl
* Introduction
  + Pod core concepts
  + Create a pod
  + Kubectl and pods
  + Yaml fundamentals
  + Defining a pod with yaml
    - Declarative approach
  + Pod health
* Pod Core Concepts
  + Pod is the basic execution unit of a kubernetes application- the smallest and simplest unit in the Kubernetes object model that you create or deploy
  + Pods runs containers
    - Can have more than one container
  + Environment for containers
  + Organize application “parts” into pods(server, caching, APIs, database)
  + Pods have IP, memory, volumes, etc. shared across containers
  + Scale horizontally by adding pod replicas
  + Pods live and die but never come back to life
  + Master node schedules pod on a node
  + Pods can be scaled to have replicas
    - Kubernetes load balance between them
    - Kubernetes manages the health of the pods
  + Pods within a node have unique ip address, default is cluster ip
    - Containers within pods have their own unique ports
  + Pods containers share the same network namespace
  + Pods containers have the same loopback network interface
  + Containers processes need to bind to different ports within a pod
  + Ports can be reused by containers in separate pods
  + Pods do not span nodes
* Creating a Pod
  + There are several different ways to schedule a pod
    - kubectl run command
      * imperative way
    - kubectl create/apply command with a yaml file
      * declarative way
  + ‘kubectl run [podname] --image=nginx:alpine’ to run nginx:alpine container in a pod
  + ‘kubectl get pods’ list only pods
  + ‘kubectl get all’ list all resources
  + The ‘kubectl get’ command can be used to retrieve information about pods and many other Kubernetes objects
  + Pods and containers are only accessible within the Kubernetes cluster by default
    - Cluster ip address
  + One way to expose a container port externally: ‘kubectl port-forward’
  + ‘kubectl port-forward [name of pod] [host port/external port]:[container port/internal port]’
    - enables pod container to be called externally
  + ‘kubectl delete pod [name of pod]’ to delete pod
    - Pod will be delete but pod will be recreated
    - Kubernetes wants to maintain state
  + ‘kubectl delete deployment [name of deployment’ delete deployment that manages the pod
    - Pod will not be recreated
  + Running a pod will cause a deployment to be created
  + To delete a pod use kubectl delete pod or find the deployment and use kubectl delete deployment
* Kubectl and Pods
  + Deployment and replicas sets are responsible for actually deploying pods
  + A deployment is responsible for making sure that the current state is maintained
* YAML Fundamentals
  + Imperative: command centric approach to creating pods in Kubernetes cluster
  + Declarative: use language to define pods and other aspects of Kubernetes
  + YAML(yet another markup language)
  + Yaml files are text files composed of maps and lists
  + Similar to json
  + Key, value, sequence of items
  + Indentation matters
  + Always use spaces
  + Indentation determines when section ends and begins
  + Maps(key value pairs)
    - Can contain other maps for more complex data structures
  + Lists: sequence of items
    - Multiple maps can be defined in a list
  + Example
    - key:value
    - complexMap:
    - key1: value
    - key2:
    - subKey: value
    - items:
    - -item1
    - -item2
    - itemsMap:
    - -map1: value
    - map1Prop: value
    - -map2: value
    - map2Prop: value
* Defining a Pod with YAML
  + Run yaml file through kubectl will generate pod running in cluster
  + Ex yml file
    - apiVersion: v1 //kubernetes api version
    - kind: Pod //type of Kubernetes resource
    - metadata: //metadata about the pod
    - name: my-nginx
    - spec: //spec/blueprint for the pod
    - containers: //information about the containers that will run in the Pod
    - - name: my-nginx
    - image: nginx:alpine
  + ‘kubectl create -f [yml file] --dry-run --validate=true’
    - Perform a “trial” create and also validate the YAML
    - -f or --filename: specifies the file to use
    - --dry-run: try the command and see the output
    - --validate=true: default, perform validationa
  + ‘kubectl create -f [yml file]’
    - Create a pod from yaml
    - Will error if pod already exists
  + ‘kubectl apply -f [yml file]’
    - Create or apply changes to a pod using yaml
  + ‘kubectl create -f [yml file] --save-config’
    - Use --save-config when you want to sue kubectl apply in the future for updates
    - Store current properties in resource’s annotations
    - --save-config causes the resource’s configuration settings to be saved in the annotations
    - Having this allows in-place changes to be made to a pod in the future using kubectl apply
  + ‘kubectl delete pod [name of pod]’ to delete pod
  + ‘kubectl delete -f [yml file]’ delete the pod using the yaml file that created it
* Kubectl and YAML
  + Can link resources to each other through labels
  + Ex
    - labels:
    - app: nginx
    - rel: stable
  + Can define container port in yml file
  + Ex
    - …
    - containers:
    - …
    - ports:
    - - containerPort: 80
  + ‘kubectl get pod [pod name] -o yaml’ to output yaml file
    - -o: output flag
    - yaml: specifies output type of yaml
  + ‘kubectl describe pod [pod name]’ to get information about pod
    - Also about events that occur
  + ‘kubectl exec [pod name] -it sh’ to get into container of pod
  + ‘kubectl edit -f [yml file]’ opens editor
  + ‘kubectl delete -f [yml file]’
    - Since there is no deployment it will be deleted
* Pod Health
  + Kubernetes relies on probe to determine the health of a pod container
  + Probe: diagnostic performed periodically by the kubelet on a container
  + Liveness probe: is it alive
    - Used to determine if a pod is healthy and running as expected
  + Readiness probe
    - Can be used to determine if a pod should receive requests
  + failed pod containers are recreated by default(restartPolicy defaults to always)
    - if pod fails with a deployment it can recreated
    - if containers in pod fails health check it can be restarted
  + ExecAction: execute an action inside the container
  + TCPSocketAction: TCP check against the container’s IP address on a specified port
  + HTTPGetAction: Http Get request against containers
  + Probs can have the following results
    - success
    - failure
    - unknown
  + liveness probe example yml
    - apiVersion: v1
    - kind: Pod
    - ….
    - spec:
    - containers:
    - - name: my-nginx
    - image: nginx:alpine
    - livenessProbe: //livenessProbe, readinessProbe
    - httpGet:
    - path: /index.html
    - port: 80 //check /index.html on port 80
    - initialDelaySeconds: 15 //wait 15 seconds before
    - timeoutSeconds: 2 //timeout after 2 seconds
    - periodSeconds: 5 //check every 5 seconds
    - failureThreshold: 1 //allow 1 failure before failing pod
* Pod Health in Action
* Summary
  + pods are the smallest unit of kubernetes
  + containers run within pods
    - share a pod’s memory, IP, volumes and more
  + pods can be started using different kubectl commands
  + YAML can be used to create a pod
  + health checks provide a way to notify kubernetes when a pod has a problem
* Introduction
  + deployment core concepts, creating a deployment, kubectl and deployment, deployment options
* Deployments Core Concepts
  + ReplicaSet is declarative way to manage Pods
    - manages pods
  + Deployment is a declarative way to manage Pods using a ReplicaSet
  + Pods are created and destroyed but are never re-created
  + Deployments and ReplicaSets ensure pods stay running and can be used to scale pods
  + ReplicaSet
    - ReplicaSet -> pod -> container
    - acts as a pod manager
    - self-healing mechanism
    - ensure the requested number of pods are available
    - provide fault-tolerance
    - can be used to scale pods horizontally
    - relies on a pod template
    - no need create directly
    - used by deployments
  + Deployment
    - deployment -> ReplicaSet -> Pod -> Container
    - pods are managed using replicaset
    - scales replicaset, which scale pods
    - supports zero-downtime updates by creating and destroying replicasets
    - provides rollback functionality
    - creates a unique label that is assigned to the replicaset and generated pods
    - YAML is very similar to a ReplicaSet(different kind)
* Creating a Deployment
  + Define a deployment with YAML
  + Deployment yaml + kubectl
  + Ex yaml file
    - apiVersion: apps/v1 //find type in documentation
    - kind: Deployment //Pod, ReplicaSet, Deployment
    - metadata:
    - spec:
    - selector: //select pod template label(s)
    - template:
    - spec: //template used to crate the pods
    - containers:
    - - name: my-nginx
    - Image: nginx:alpine
  + Ex yaml file
    - apiVersion: apps/v1
    - kind: Deployment
    - metadata:
    - name: frontend
    - labels: //can be used to query and ties thing together
    - app: my-nginx
    - tier: frontend
    - spec:
    - selector: //used to select the template to use(based on labels)
    - matchLabels:
    - tier: frontend
    - template: //templated use to create the Pod/Containers
    - metadata:
    - labels:
    - tier: frontend
    - spec:
    - containers:
    - - name: my-nginx
    - image: nginx:alpine
* kubectl and Deployments
  + ‘kubectl create -f [deployment.yml]’ create a deployment
    - -f/--filename: specify file
  + ‘kubectl apply -f [deployment.yml]’ create or apply changes to deployment
  + ‘kubectl get deployments’ to get all deployments
  + ‘kubectl get deployment --show-labels’ list the labels for all deployments
    - Use -I switch to get information about a deployment with a specific label
  + ‘kubectl get deployment -l [name of label=value of label]’ to get all deployments with a specific label
  + ‘kubectl delete deployment [deployment-name]’ to delete a deployment
    - Will delete the deployment and all associated pods/containers
  + ‘kubectl delete -f [yaml file]’ to delete a deployment through using yaml file
  + ‘kubectl scale deployment [deployment-name] --replicas=[# of replicas]’ to scale the deployment pods to # of replicas
    - Can update the YAML file or use the kubectl scale command
  + ‘kubectl scale -f [deployment yaml] --replicas=[# of replicas]’ scale by referencing the yaml file
  + Update the YAML file
  + Ex
    - ….
    - spec:
    - replicas: 3
    - selector:
    - tier: frontend
* kubectl Deployments in Action
  + resources in yaml
  + ex
    - …
    - containers:
    - - name: …
    - ….
    - resources:
    - limits:
    - memory: “128Mi”
    - cpu: “200m”
  + Allows you to constrain what a given container is allowed to run inside of a pod
  + Containers without constraints can cause trouble
  + ‘kubectl scale -f [yml file] --replicas=[#]’ to scale from yml file
  + can also edit yml to scale
    - …
    - spec:
    - replicas: 4
    - selector: ….
  + ‘kubectl create -f [yml] --save.config’
  + ‘kubectl describe [pod | deployment] [pod-name | deployment-name]’
  + ‘kubectl apply -f [yml]’
  + ‘kubectl get deployments --show-lables’
  + ‘kubectl get deployments -l [label=labelVal]’
  + ‘kubectl scale -f [yml] --replicas=[#]’
* Deployments Options