Kubernetes

COMP260: Distributed Systems

9: Kubernetes

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Register Attendance

Figure 1: Attendance monitoring is in place. It is your responsability to ensure that you have signed yourself in.

Kubernetes

"Kubernetes is the operating system of the cloud native world, providing a reliable and scalable platform for running containerised workloads." (Arundel, Domingus, 2019)

Kubernetes

- Extremely popluar
- Connects many servers together (orchestration)
- There are managed versions of Kubernetes (good for most options)
- Can be quite difficult to get right
- Avoid vendor lock-in

Architecture - Cluster

"A Kubernetes cluster is a set of node machines for running containerized applications." (RedHat, 2019)

- Contains a worker node and a master node."
- Comprise of multiple nodes
- Nodes are basically just individual machines

Architecture - Master Node

- Control Plane (the brain of the cluster)
- Stores info about all **worker nodes**
- Multiple instances - highly available
- Manages **deployments**
- Doesn't **usually** run user workloads
- failure might cause eratic behavior

Architecture - Worker Nodes

- manages the container runtime (Docker)
- User workloads
- failure is acceptable

Fundamentals - Deployments

"For every program that Kubernetes has to supervise, it creates a corresponding Deployment object, which records some information about the program: the name of the container image, the number of replicas you want to run, and whatever else it needs to know to start the container."

(Arundel, Domingus, 2019)

- Supervising and scheduling
- The **Deployment Controller** maintains the desired spec
- Restart always by default
- Restart only on failure

```
kubectl get deployments
```

Fundamentals - Pods

"A **Pod** is the Kubernetes object that represents a group of one or more containers"

(Arundel, Domingus, 2019)

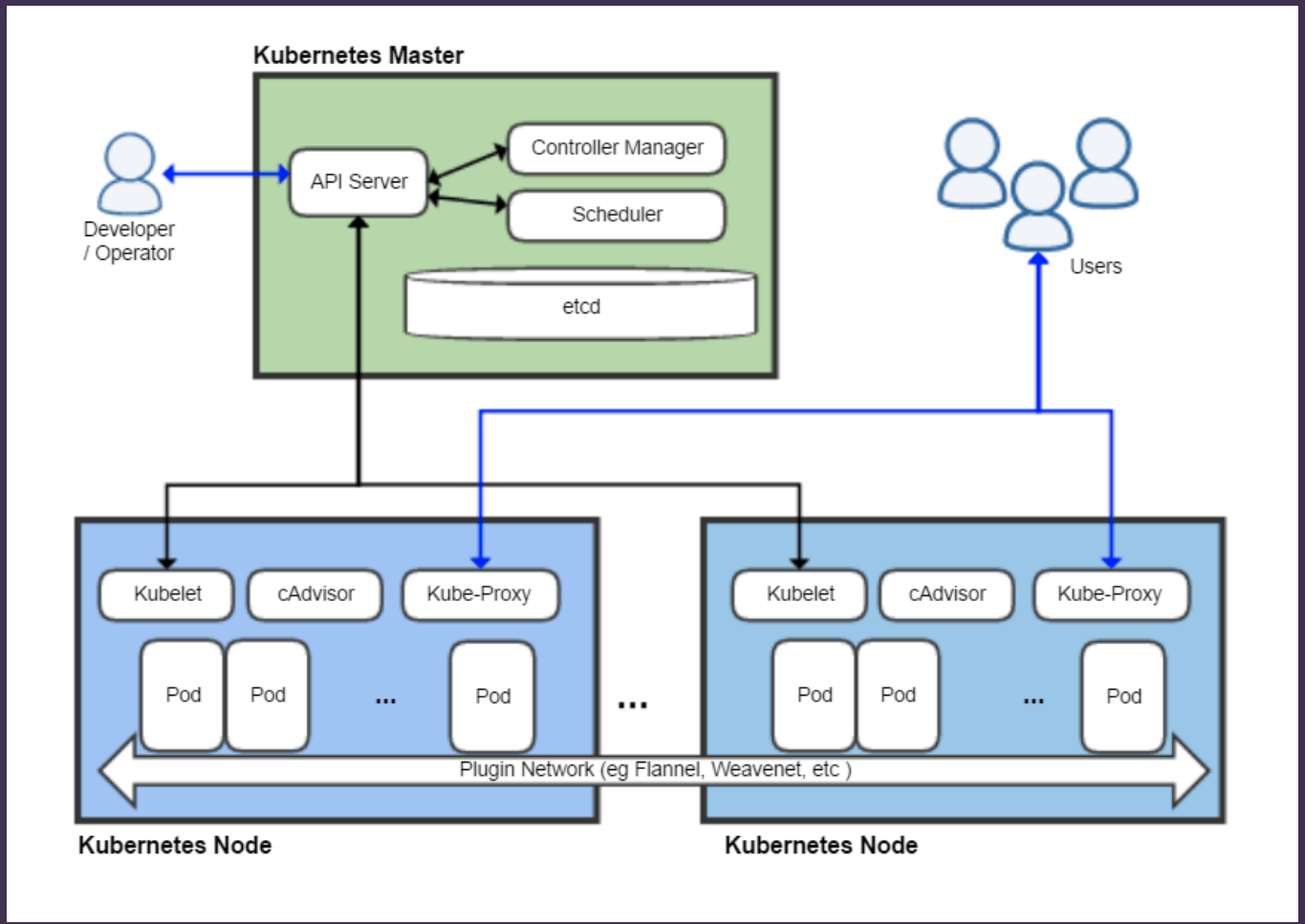
- Most Pods have one container
- dependant container should scheduled together and thus live in the same Pod
- Defined via Pod Specification
- When a deployment decides a new replica is needed, it creates a Pod resource in the Kubernetes database and the Pod is added to a queue for the Scheduler to handle

Fundamentals - Services

Services solve a fundamental issue by providing a single, unchanging IP address or DNS name to route traffic to the appropriate Pods.

- Think of a service as a web proxy of load balancer
- forwards requests to backend Pods
- Any ports not just web (80, 443)

Cluster Overview



Kubectl

Multipurpose tool for:

- Applying configurations
- Creating, deleting and modifying resources
- Querying the state of the Cluster

examples:

- `kubectl get nodes`
- `kubectl describe`

Helm Package Manager

Helm Package Manager

- Part of the Cloud Native Computing Foundation (CNCF) family
- Widespread
- Command line interface (CLI)
- **Helm Charts** contains resource definitions required to run app
- **Release** a particular instance of a chart running on a cluster
- **Helm repository** to host and share charts
- Charts are often stored in the application repo

Helm Charts

- Can be installed multiple times in the same cluster
- Each Helm Chart release has a unique name (-name flag)
- `helm list` output current releases
- `helm status [release name]` provides details about status of specific release
- Streamline the process of installing applications

Helm Chart Structure

`helm create helm-chart`

```
wordpress/
  Chart.yaml          # A YAML file containing information about the chart
  LICENSE             # OPTIONAL: A plain text file containing the license for the chart
  README.md           # OPTIONAL: A human-readable README file
  values.yaml         # The default configuration values for this chart
  values.schema.json  # OPTIONAL: A JSON Schema for imposing a structure on the values.yaml file
  charts/             # A directory containing any charts upon which this chart depends.
  crds/               # Custom Resource Definitions
  templates/          # A directory of templates that, when combined with values,
                      # will generate valid Kubernetes manifest files.
  templates/NOTES.txt # OPTIONAL: A plain text file containing short usage notes
```

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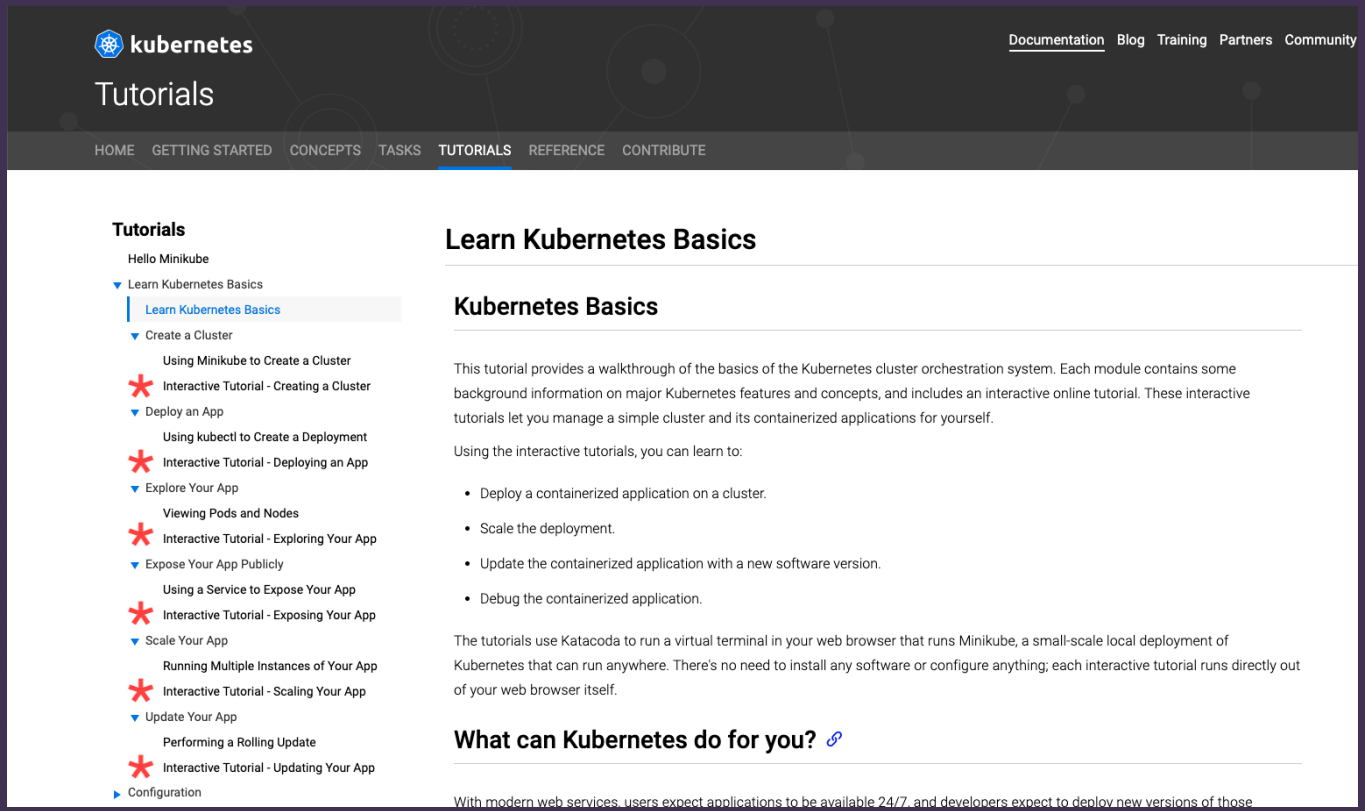
Activity: Kubernetes Bootcamp



* Official Kubernetes Interactive Tutorials