Section 11 -

2 Introduction to Kubernetes

Kubernetes

- Kubernetes is the most popular container orchestrator.
- Kubernetes is used to manage the multi-node cluster and the deployment of containers
- Released by Google in 2015. It's now maintained by an open source community that Google is a part of
- Runs on top of Docker (usually).
  - The Default [container runtime] is Docker
  - Other container runtime can be used instead such as *containerd* and *lxd*
- Provides a set of API, CLI tools to manage containers across servers
  - One of the main CLI tool used to manage Kubernetes is kubectl (kube control)

Options for running Kubernetes (1)

1. Cloud provider

2. Vendor *Distribution*

3. Manual Installation from packages

- Kubernetes is complex, and difficult to set up and configure.
- Therefore, the best approach, is to use a solution that includes Kubernetes as a supported, maintained component

Options for running Kubernetes (Cloud provider)

1. Cloud provider
    - Kubernetes is provided as a service. Each cloud provider has its own implementation of Kubernetes
    - Examples
        - AWS => EKS Amazon Elastic Kubernetes
        - Azure => AKS Azure Kubernetes Service
        - DigitalOcean => DigitalOcean Kubernetes

Options for running Kubernetes (Vendor)

1. Vendor *Distribution*
    - Most of the infrastructure vendors, that package their own Kubernetes *Distribution*
    - It is similar to the concept of Linux distributions
    - Can be "easily" installed on private data centers
    - Examples
        - Red Hat OpenShift
        - Docker Enterprise
        - Ubuntu Canonical
        - VMware Enterprise PKS

Options for running Kubernetes (Manual)

1. Manual Installation from the *raw* GitHub upstream version Kubernetes
    - It is complex and difficult to set up and configure.
    - It is generally recommended to avoid this type of installation unless you have a dedicated team of experts

Why Kubernetes ?

- It is important to understand if you really need to use an orchestrator and eventually which type of orchestration engine (k8s - Swarm) is best for your needs
- Kubernetes is used very much from the industry but not always is the best choice
- Not every solution needs an orchestrator
    - Some times Docker and docker-compose are enough

Kubernetes vs Swarm

- Kubernetes and Swarm are both container orchestrators based on Docker runtime
- Both are solid platforms with vendor backing
- Swarm: Easy to deploy and manage
- Swarm: does NOT cover all use cases
- Kubernetes: More features and flexible
- Kubernetes: complex and difficult

Swarm Advantages (1)

- Swarm is a orchestration solution built inside Docker (no need to install any additional tool other that Docker)
- Follows 80/20 rule, 20% of features for 80% of use cases
- Has less features compared to Kubernetes that cover the majority of use cases
- Swarm Run anywhere;
    - Linux, Windows
    - Raspberry Pi
    - ARM 64bit, ARM 32bit etc...

Swarm Advantages (2)

- Secure out-of-the-box
    - All nodes have mutual TLC authentication
    - The control plan is encrypted
    - Provides encrypted distributed DB (secrets)
- Easier to use and troubleshoot
- Swarm is the recommended starting point if you want to learn an container orchestration solution
- A small team of DevOps persons (even one person) could manage a swarm cluster

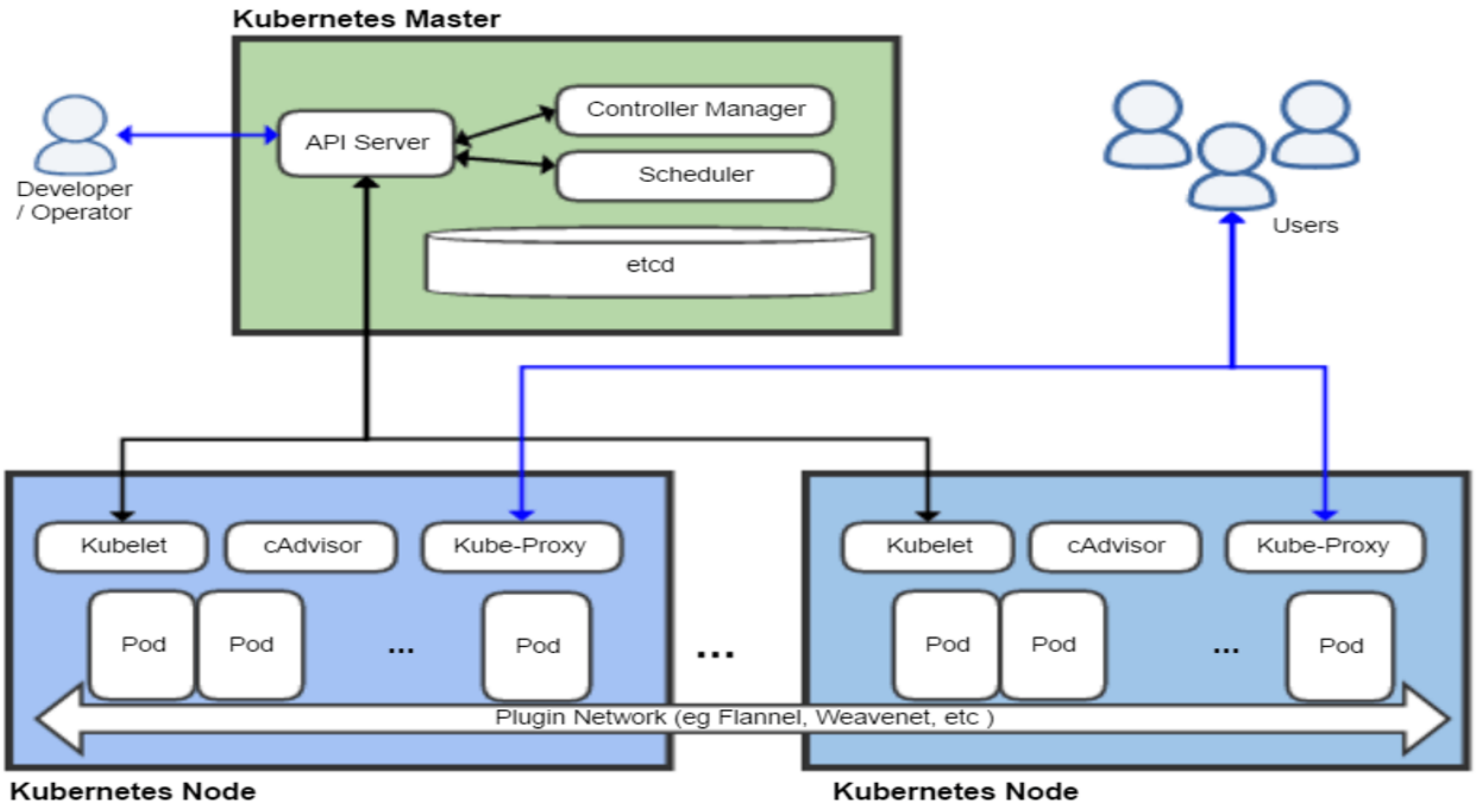
Kubernetes Advantages

- Kubernetes is the most popular orchestration solution
- Has the widest vendor support
- Has the widest community
- Flexible: Cover widest set of use cases
- A dedicated team of DevOps persons is needed to manage a Kubernetes cluster

Kubernetes Terminology

- k8s: abbreviation for Kubernetes, the whole orchestration system
- kubectl: the main CLI tool to configure and manage apps
- Node: Single server in the Kubernetes cluster
- kubelet: Kubernetes agent running on all nodes
- Control Plane: (The master nodes) Set of containers that manage the cluster (~ Swarm manager nodes)

Kubernetes Topology



Kubernetes Installation options for local dev

- Docker Desktop (Kubernetes is included as option)
- Minikube (Based on VirtualBox)
    - Portable executable: `kubectl.exe minikube.exe`
- MicroK8S for linux system `snap install microk8s --classic`

Kubernetes In a Browser

- play-with-k8s
- katacoda