Introduction to Kubernetes (K8s)

Kubernetes, often abbreviated as K8s, is an open-source container orchestration platform that automates the deployment, scaling, and management of containerized applications.

Originally developed by Google and now maintained by the Cloud Native Computing Foundation (CNCF), Kubernetes has become the de facto standard for container orchestration in cloud-native environments.

Core Concepts of Kubernetes

- **Pods**: The smallest deployable unit in Kubernetes, representing a single instance of a running process.
- **Nodes**: Machines (VMs or physical) where Kubernetes runs workloads. A cluster typically has multiple nodes.
- **Clusters**: A set of nodes managed by Kubernetes.
- **Deployments**: Manage the desired state of pods and allow rolling updates.
- **Services**: Expose applications running in pods to the network, either internally or externally.

Kubernetes Architecture

1. **Master Node (Control Plane)**:
   - API Server: Serves the Kubernetes API.
   - Scheduler: Assigns workloads to worker nodes.
   - Controller Manager: Manages controllers that regulate the state of the system.
   - etcd: A key-value store that maintains cluster state.

2. **Worker Nodes**:
   - kubelet: Ensures containers are running in a pod.
   - kube-proxy: Manages networking and communication.
   - Container runtime (e.g., containerd, Docker): Runs the containers.

Benefits and Use Cases of Kubernetes

Benefits:

- Automated scaling and self-healing
- Efficient resource utilization
- Portable and consistent across environments
- Declarative configuration using YAML
- Ecosystem integration (monitoring, CI/CD, security)

Use Cases:

- Microservices architecture
- Hybrid and multi-cloud deployments
- Continuous deployment pipelines
- High availability and fault-tolerant applications