Kubernetes, often referred to as “k8s”, is an open-source container orchestration platform that automates the deployment, scaling, and management of containerized applications. It was originally developed by Google and is now maintained by the Cloud Native Computing Foundation (CNCF).

Here are some fundamental concepts and components of Kubernetes:

Pods:

The smallest deployable unit in Kubernetes.

A Pod can contain one or multiple containers.

Each Pod has a unique IP address within the cluster.

Nodes:

Worker machines (VMs, physical servers, etc.) that run containers.

Managed by the master node(s).

Can be either a physical machine or a virtual machine.

Services:

Abstracts the way to access a set of Pods as a network service.

Useful when you want to expose your Pod to the network, either inside the cluster or externally.

ReplicaSets:

Ensures that a specific number of Pod replicas are maintained.

If a Pod dies, the ReplicaSet creates a new one to replace it.

Deployments:

Higher-level concept that manages ReplicaSets.

Provides declarative updates for Pods and ReplicaSets, such as rolling updates.

ConfigMaps and Secrets:

Allows separation of configuration and sensitive information from application code.

Labels and Selectors:

Key/value pairs attached to resources.

Useful for organizing resources and selecting subsets.

Volume:

Provides storage to Pods.

Can be local storage, cloud storage, or network storage.

Namespaces:

Allows partitioning of a Kubernetes cluster into sub-clusters.

Useful for multi-tenancy, isolating resources, and managing resource quotas.

Kubelet:

An agent that runs on each node and ensures that containers are running in a Pod.

kubectl:

Command-line tool to interact with the Kubernetes cluster.

API Server:

Serves the Kubernetes API and acts as the entry point for commands.

Control Plane:

Collection of components that manage the overall state of the cluster.

Includes the API Server, etcd, scheduler, and controller manager.

etcd:

Consistent and highly available key-value store that Kubernetes uses for all its cluster data.

Ingress:

Manages external access to services in a cluster, typically HTTP.

Can provide load balancing, SSL termination, and name-based virtual hosting.

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