Kubernetes Interview Questions and Answers

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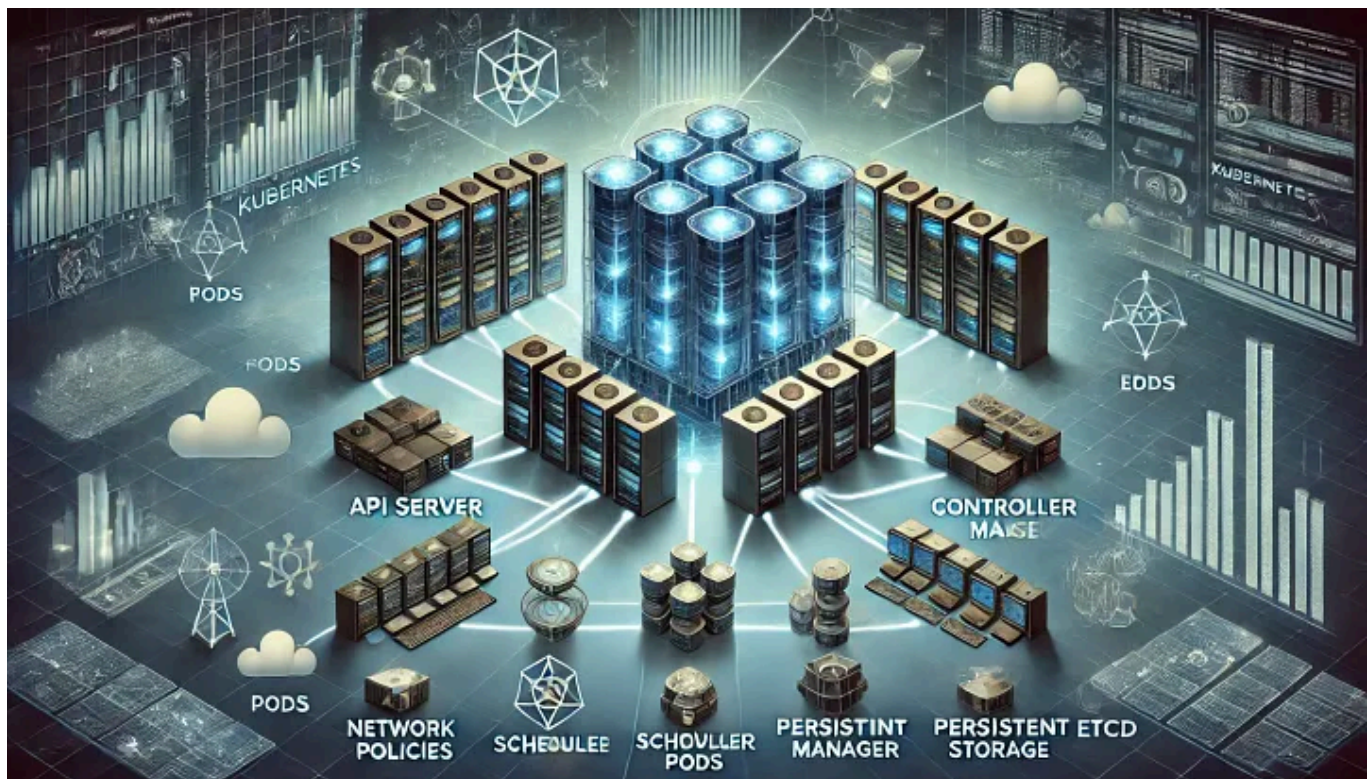
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1. What is Kubernetes, and why is it important?

Kubernetes (K8s) is an open-source **container orchestration platform** that automates the deployment, scaling, and management of containerized applications. It ensures that applications run **consistently across different environments**, making it essential for **modern cloud-native development**.

2. How are Kubernetes and Docker related?

Docker is a **containerization platform** that packages applications into lightweight, portable containers. Kubernetes is a **container orchestrator** that **manages, scales, and distributes** these containers efficiently. While Kubernetes initially supported **Docker,** it now works with multiple runtimes like **CRI-O** and **containerd.**

3. What is container orchestration?

Container orchestration is the process of **automating the management** of containerized applications across **multiple hosts**. It handles **deployment, scaling, networking, and availability** of containers. **Kubernetes, Docker Swarm, and Apache Mesos** are some popular container orchestration tools.

4. Why is container orchestration necessary?

Managing containers manually becomes complex when applications scale. Container orchestration provides:

- **Automated deployment and scaling**

- **Self-healing** (restarts failed containers)

- **Load balancing and traffic distribution**

- **Resource allocation and monitoring**

5. What are the key features of Kubernetes?

- **Automated Scheduling** — Allocates containers efficiently.

- **Self-healing** — Detects and restarts failed containers.

- **Auto-scaling** — Adjusts resources based on demand.

- **Load balancing** — Distributes traffic across pods.

- **Service discovery** — Simplifies inter-container communication.

- **Security & Compliance** — Implements access controls and policies.

Kubernetes Architecture and Components

6. What is a Kubernetes cluster?

A **Kubernetes cluster** is a group of interconnected nodes that run **containerized applications** in a **fault-tolerant and scalable manner**. It consists of:

- **Master Node (Control Plane)** — Manages scheduling, cluster state, and configurations.

- **Worker Nodes** — Execute containerized workloads.

7. What are nodes in Kubernetes?

A **node** is a physical or virtual machine in a Kubernetes cluster where **containers run**. Nodes contain:

- **Kubelet** — Manages pod lifecycle.

- **Container runtime** — Runs containers (Docker, containerd, CRI-O).

- **Kube-proxy** — Handles networking and service discovery.

8. What is the role of the Kubernetes Master Node?

The **Master Node** manages cluster-wide activities, including:

- **API Server** — The primary communication gateway.

- **Scheduler** — Assigns pods to worker nodes.

- **Controller Manager** — Manages controllers like Replication and Node Controllers.

- **Etcd** — A distributed key-value store for cluster state.

9. What is etcd in Kubernetes?

Etcd is a **highly available distributed key-value store** that **stores cluster data** such as configurations, secrets, and metadata. It is crucial for maintaining the **desired state** of Kubernetes clusters.

10. What is kube-proxy?

Kube-proxy is a **networking component** that routes traffic **between pods and services**. It ensures **reliable communication** inside the cluster.

Deployment and Management

11. How does Kubernetes handle containerized deployment?

Kubernetes **automates deployment** by:

- **Scaling up/down** pods based on traffic.

- **Rolling out updates** with rollback support.

- **Self-healing** failed containers.

12. What is a Pod in Kubernetes?

A **Pod** is the smallest deployable unit in Kubernetes. It encapsulates:

- One or more **containers** sharing **networking** and **storage**.

- **Configuration** files, environment variables, and secrets.

13. What are ReplicaSets in Kubernetes?

A **ReplicaSet** ensures that a **specified number of identical pods** are running at any given time, automatically replacing failed pods.

14. What is a DaemonSet?

A **DaemonSet** ensures that a specific **pod runs on all or selected nodes**. It is used for:

- **Monitoring and logging agents** (e.g., Fluentd, Prometheus).

- **Networking components** (e.g., Calico, Cilium).

15. What is a StatefulSet?

StatefulSets manage **stateful applications**, ensuring:

- **Stable network identities**.

- **Persistent storage** across restarts.

- **Ordered scaling and deployment** (e.g., for databases).

Networking and Load Balancing

16. What is Ingress in Kubernetes?

Ingress is an **API object** that **manages external access** to services, providing:

- **Traffic routing rules**

- **SSL/TLS termination**

- **Load balancing**

17. What are the different types of services in Kubernetes?

- **ClusterIP (default)** — Internal service within the cluster.

- **NodePort** — Exposes the service via a static port on each node.

- **LoadBalancer** — Creates an external load balancer.

- **ExternalName** — Maps services to an external DNS.

18. What is a Kubernetes Load Balancer?

A **Load Balancer** distributes incoming network traffic across multiple **pods** to:

- Optimize **resource utilization**.

- Enhance **fault tolerance**.

- Improve **application availability**.

19. How do pods communicate within a cluster?

Pods communicate via:

- **Localhost** (within the same pod).

- **Cluster DNS Service** (using Kubernetes Services).

- **Environment Variables** (auto-generated by Kubernetes).

Security and Access Control

20. What is Role-Based Access Control (RBAC) in Kubernetes?

RBAC restricts user access by defining:

- **Roles** (permissions for resources).

- **RoleBindings** (assign roles to users/groups).

- **ClusterRoles** (permissions for entire clusters).

21. How can you secure a Kubernetes cluster?

- **Limit access to etcd** (as it contains sensitive data).

- **Use Network Policies** to isolate workloads.

- **Enable role-based access control (RBAC).**

- **Monitor and log activity** using tools like **Prometheus.**

Monitoring, Scaling, and Maintenance

22. What are some Kubernetes monitoring tools?

- **Prometheus** — Metrics collection and alerting.

- **Grafana** — Interactive visualization dashboard.

- **cAdvisor** — Real-time container monitoring.

- **Fluentd** — Log processing and forwarding.

23. How do you ensure high availability in Kubernetes?

- Use **multiple master nodes** (HA setup).

- Enable **Pod Disruption Budgets (PDB)** to minimize downtime.

- Implement **rolling updates** instead of recreating pods.

24. How can you assign a Pod to a specific node?

By using **node affinity** or **taints & tolerations**, e.g.:

By using **node affinity** or **taints & tolerations**, e.g.:

```yaml
nodeSelector:
  disktype: ssd
```

25. What happens when a worker node fails?

- Kubernetes **detects failure** and marks the node as **NotReady**.

- The **scheduler moves pods** to other healthy nodes.

- If running on the cloud, **auto-scaling** may provision a new node.

26. How do you perform maintenance on a Kubernetes node?

Use the following commands:

Use the following commands:

```sh
kubectl cordon <node-name>    # Prevents scheduling new pods
kubectl drain <node-name> --ignore-daemonsets    # Evacuates existing pods
```

Kubernetes Advanced Interview Questions

Kubernetes Deployment and Management

1. What are the two types of Kubernetes pods?

- **Single-container pods**: Contain only one container (most common).

- **Multi-container pods**: Contain multiple containers that share storage and networking.

2. What is a Job in Kubernetes?

A **Job** ensures that a pod runs **to completion** and can restart failed tasks until completion. It is used for **batch processing tasks**.

3. What is a Persistent Volume (PV) in Kubernetes?

A **Persistent Volume** (PV) is a cluster-wide storage resource, separate from pods, that retains data even if a pod is deleted.

4. What is a Persistent Volume Claim (PVC)?

A **Persistent Volume Claim** (PVC) allows users to **request storage resources** dynamically from Persistent Volumes.

Networking in Kubernetes

5. How do you expose a Kubernetes service externally?

Use **NodePort, LoadBalancer, or Ingress** to expose services.

6. How does a Kubernetes Headless Service work?

A **Headless Service** does not assign a ClusterIP and provides direct DNS-based discovery to backend pods.

7. What is the difference between ClusterIP, NodePort, and LoadBalancer?

- **ClusterIP:** Accessible **only within** the cluster.

- **NodePort:** Opens a static port on all nodes for external access.

- **LoadBalancer:** Uses a cloud provider's external load balancer.

Scaling and Performance Optimization

8. How does Kubernetes handle auto-scaling?

- **Horizontal Pod Autoscaler (HPA):** Scales pods based on CPU/memory usage.

- **Vertical Pod Autoscaler (VPA):** Adjusts resource requests and limits for existing pods.

- **Cluster Autoscaler:** Adds/removes worker nodes.

9. How can you optimize workload distribution in Kubernetes?

- Use **Affinity and Anti-affinity rules** for node placement.

- Implement **Horizontal Pod Autoscaler (HPA).**

- Use **Resource Requests & Limits** to optimize CPU/memory usage.

10. What happens when a Kubernetes pod exceeds its memory limit?

- Kubernetes **terminates the pod** with an **OOM (Out of Memory) error.**

- The container receives a **SIGKILL signal**.

11. How do you achieve zero-downtime deployments in Kubernetes?

- Use **Rolling Updates** to update pods incrementally.

- Deploy **Canary releases** to test updates on a small subset of users.

- Implement **Readiness Probes** to ensure traffic is only sent to healthy pods.

12. What security best practices should be followed in Kubernetes?

- Enable **Role-Based Access Control (RBAC)**.

- Use **Network Policies** to isolate workloads.

- Enable **Pod Security Policies (PSP)**.

- **Restrict access to etcd.**

- Scan container images for vulnerabilities.

13. What are some challenges of running Kubernetes in production?

- **Security risks** (misconfigured RBAC, exposed APIs).

- **Complex networking** (Ingress, Load Balancing, Service Mesh).

- **Resource optimization** (CPU/memory utilization).

- **Monitoring and logging** at scale.

14. What happens when the Master Node fails?

- If HA (High Availability) is **not configured**, the cluster becomes unresponsive.

- In an HA setup, **another master node takes over.**

15. How do you upgrade a Kubernetes cluster?

- Backup cluster data.

- Upgrade **Control Plane (Master Node)** first.

- Upgrade **Worker Nodes** using a rolling update.

- Verify all components after the upgrade.

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Thanks it was informative ✨

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