What is Kubernetes, and what problem does it solve?

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Kubernetes is an open-source system for running and managing containers across many machines. You tell it what you want running, and it schedules the containers, restarts failures, scales them and routes traffic to them. It is a project of the Cloud Native Computing Foundation.

TL;DR The short version

- Kubernetes is an open-source CNCF system that runs and manages containers across many machines.
- You declare what should run, and it schedules, restarts, scales and routes traffic by constant reconciliation, with rolling updates and rollbacks.
- You do not always need it, and common pitfalls are missing resource limits, too many tiny clusters and open default permissions.

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What are the core building blocks?

A pod is the smallest unit and holds one or more containers. A deployment keeps a set number of identical pods running and manages updates. A service gives a group of pods a stable address, and a namespace divides a cluster between teams or environments.

How does Kubernetes keep things running?

It works by reconciliation. You declare the desired state, and controllers continually compare it with reality and correct the difference, for example starting a replacement pod when one dies. Health probes tell it when a container is ready or needs a restart.

How does it scale?

It can add or remove pods based on load, and a cluster autoscaler can add or remove machines. Resource requests and limits tell the scheduler how much each container needs, which is also what keeps one workload from starving another.

How do updates and rollbacks work?

A rolling update replaces pods gradually while checking they become ready, and a failed rollout can be reversed to the previous version. This lets teams release often without taking the service down.

Do you actually need it?

Not always. For a few services with steady traffic, a managed container service or plain virtual machines can be simpler and cheaper to run. Kubernetes pays off when you run many services, need fast scaling or want one consistent platform, and it needs people who can operate it.

What are the common pitfalls?

Teams often skip resource limits, run too many tiny clusters, leave default permissions open, or treat YAML as something to copy without review. Treat cluster configuration as code, restrict access by role, and watch cost per workload.

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Sources and further reading

1. Kubernetes. Kubernetes documentation, Concepts. kubernetes.io/docs/concepts/.
2. CNCF. Kubernetes project. cncf.io.

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