Kubernetes Installation and Configuration Fundamentals

INTRODUCTION AND EXPLORING KUBERNETES ARCHITECTURE

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Course Overview

Introduction

Exploring Kubernetes Architecture

Installing and Configuring Kubernetes

Working with Your Kubernetes Cluster

Overview

What is Kubernetes?

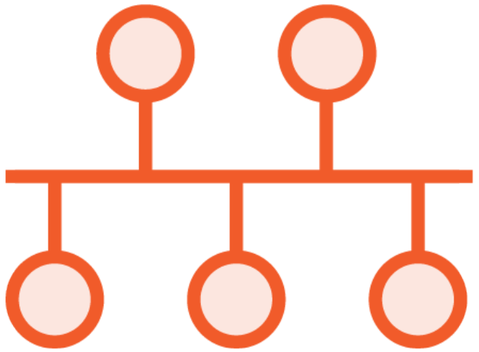
Exploring Kubernetes Architecture

- Cluster Components
- Networking Fundamentals

What Is Kubernetes?

Container Orchestrator

Workload Placement



Infrastructure Abstraction

Desired State

Benefits of Using Kubernetes

Speed of deployment

Ability to absorb change quickly

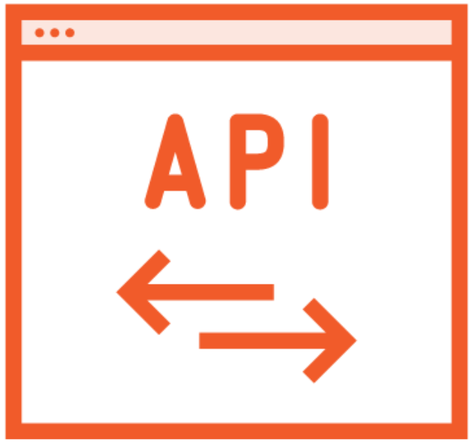
Ability to recover quickly

Hide complexity in the cluster

Kubernetes Principles

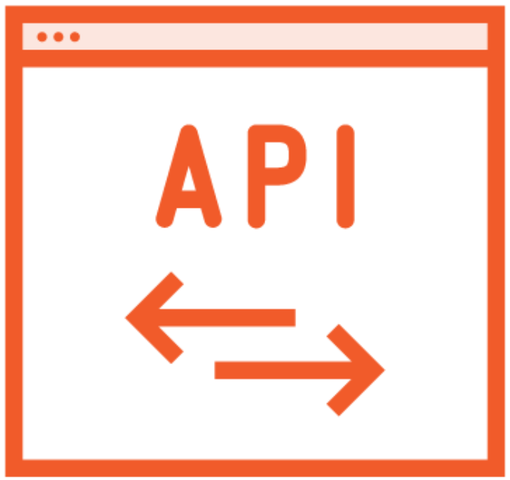
Desired State/
Declarative
Configuration

Controllers/
Control Loops



Kubernetes API/
The API Server

Kubernetes API



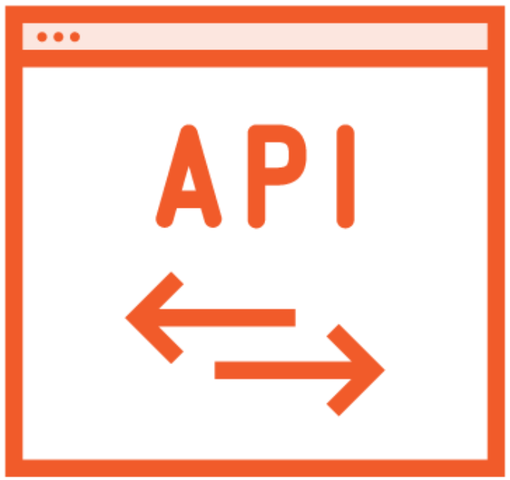
API Objects

- **Collection of primitives to represent your system's state**

Enables configuration of state

- **Declaratively**
- **Imperatively**

Kubernetes API Server



RESTful API over HTTP using JSON

The sole way to interact with your cluster

The sole way Kubernetes interacts with your cluster

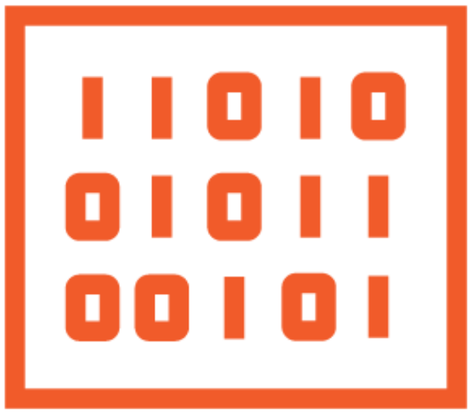
Serialized and persisted

Kubernetes API Objects

Pods

Controllers

Services



Storage

Not an exhaustive list, but these are the key players

Pods

One or more containers

It’s your application or service

The most basic unit of work

Unit of scheduling

Ephemeral - no Pod is ever “redeployed”

Atomicity - they’re there or NOT

Pods - Continued

Kubernetes' job is keeping your Pods running

More specifically keeping the desired state

State - is the Pod up and running

Health - is the application in the Pod running

Probes

So how does Kubernetes manage my Pods' state?

Controllers

Defines your desired state

Create and manage Pods for you

Respond to Pod state and health

`ReplicaSet`

- **Number of replicas**

`Deployment`

- **Manage rollout of `ReplicaSets`**

Many more...and not just Pods

So how does Kubernetes add persistency to all this ephemerality?

Services

Adds persistency to our ephemeral world

Networking abstraction for Pod access

IP and DNS name for the Service

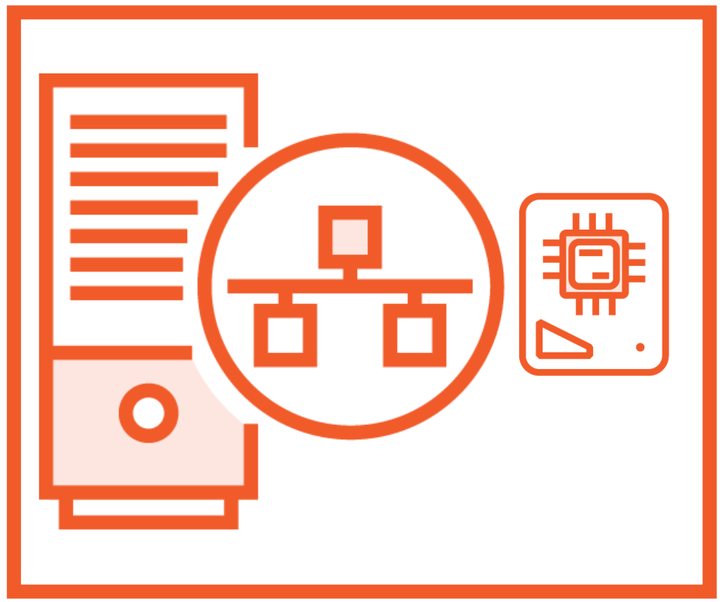
Dynamically updated based on Pod lifecycle

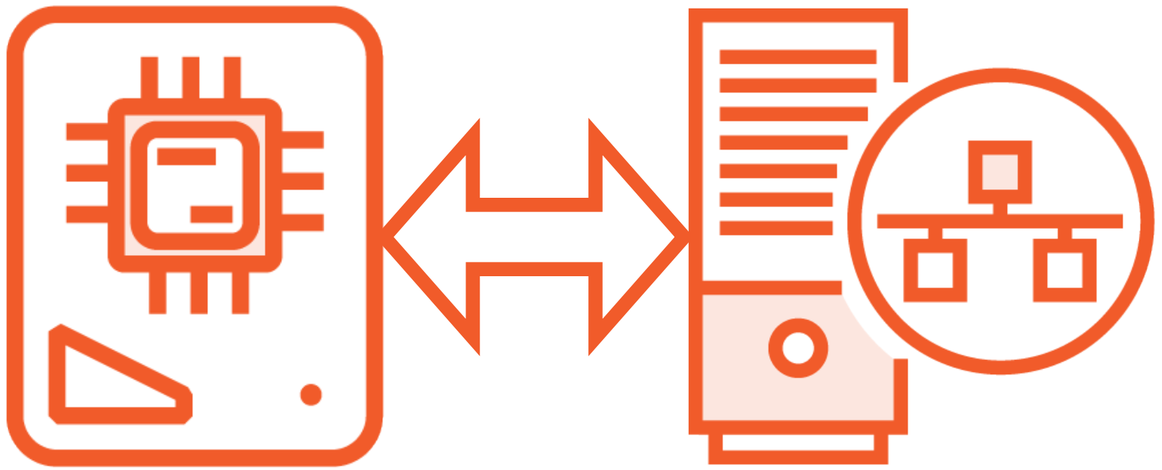
Scaled by adding/removing Pods

Load balancing

What about my data?
Where's that stored in Kubernetes?

Storage in Kubernetes





Volumes

Persistent Volume

Persistent Volume Claim

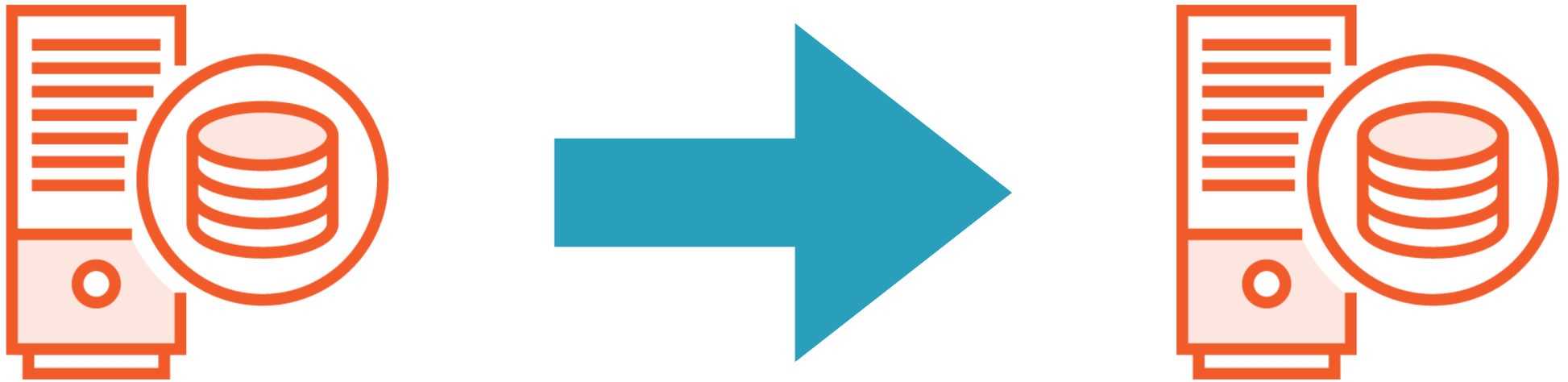
Exploring Kubernetes Architecture

Cluster Components

Control Plane Node

Node

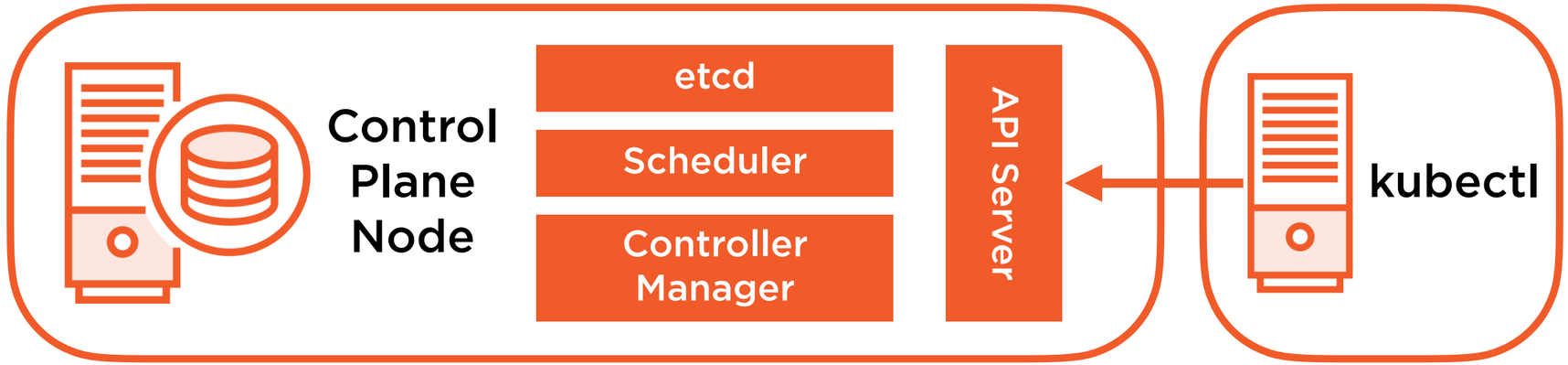
Control Plane Node



Master Node

Control Plane Node

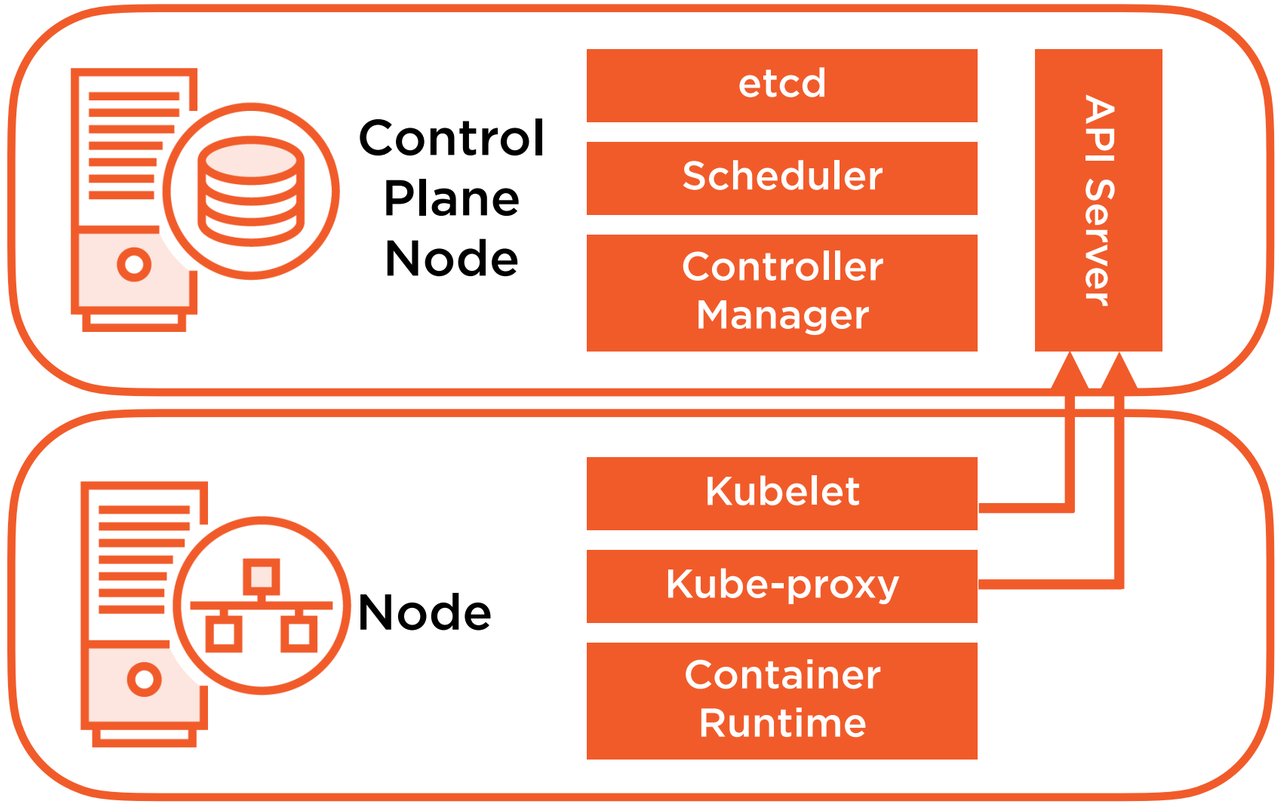
Control Plane Node



Control Plane Components

API Server	etcd	Scheduler	Controller Manager
Central	Persists State	Watches API Server	Controller Loops
Simple	API Objects	Schedules Pods	Lifecycle functions and desired state
RESTful	Key-value	Resources	Watch and update the API Server
Updates etcd		Respects contraints	ReplicaSet

Nodes


Control
Plane
Node
etcd
Scheduler
Controller
Manager
API Server
Node
Kubelet
Kube-proxy
Container
Runtime

On All Nodes!

Nodes

Kubelet

- Monitors API Server for changes
- Responsible for Pod Lifecycle
- Reports Node & Pod state
- Pod probes

kube-proxy

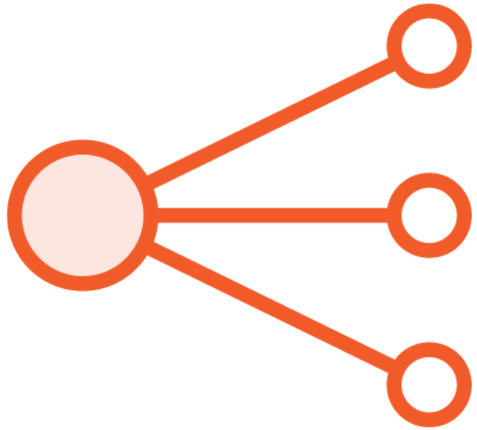
- iptables
- Implements Services
- Routing traffic to Pods
- Load Balancing

Container Runtime

- Downloads images & runs containers
- Container Runtime Interface (CRI)
- containerd
- Many others...

Cluster Add-on Pods

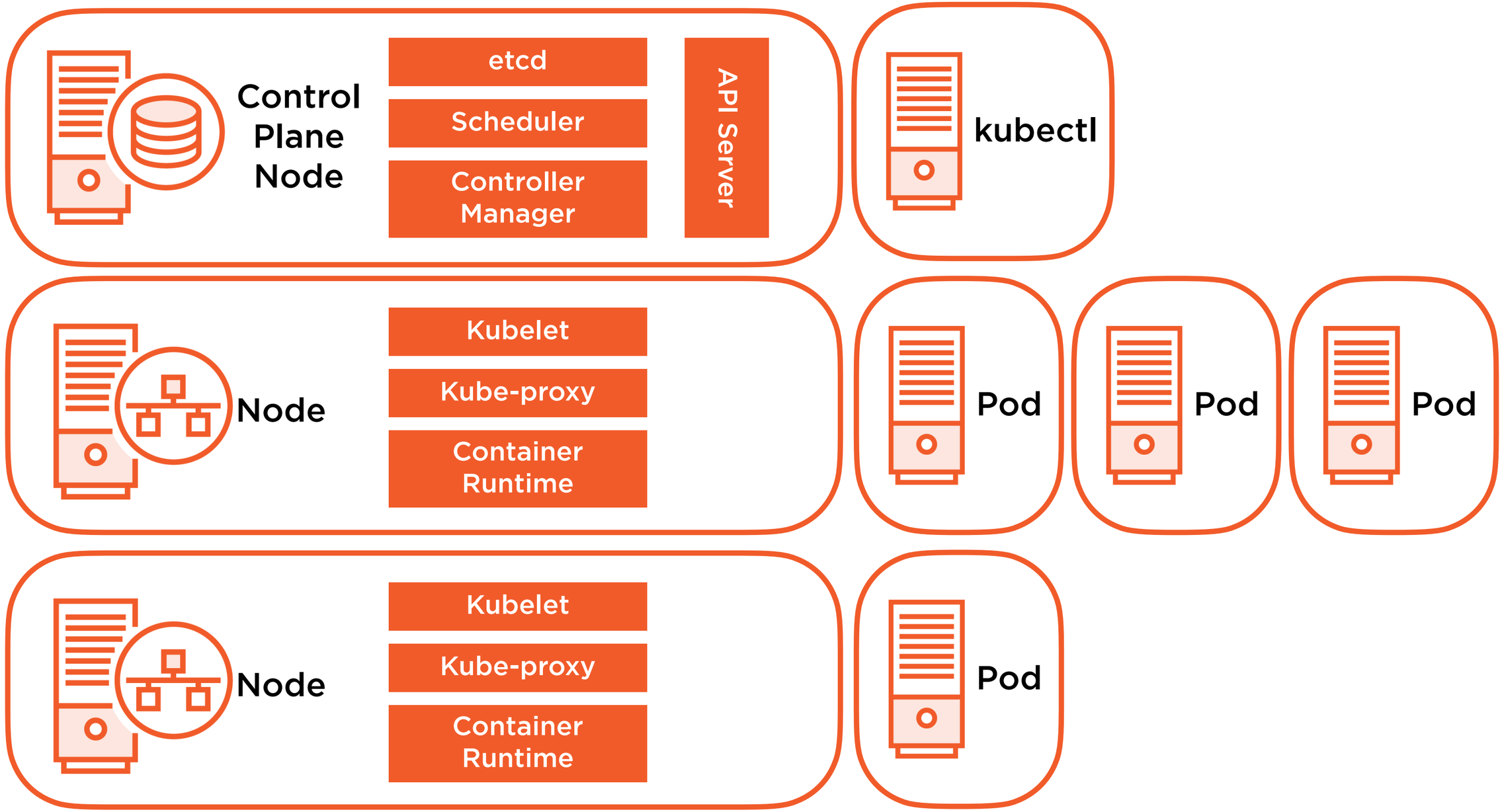
DNS



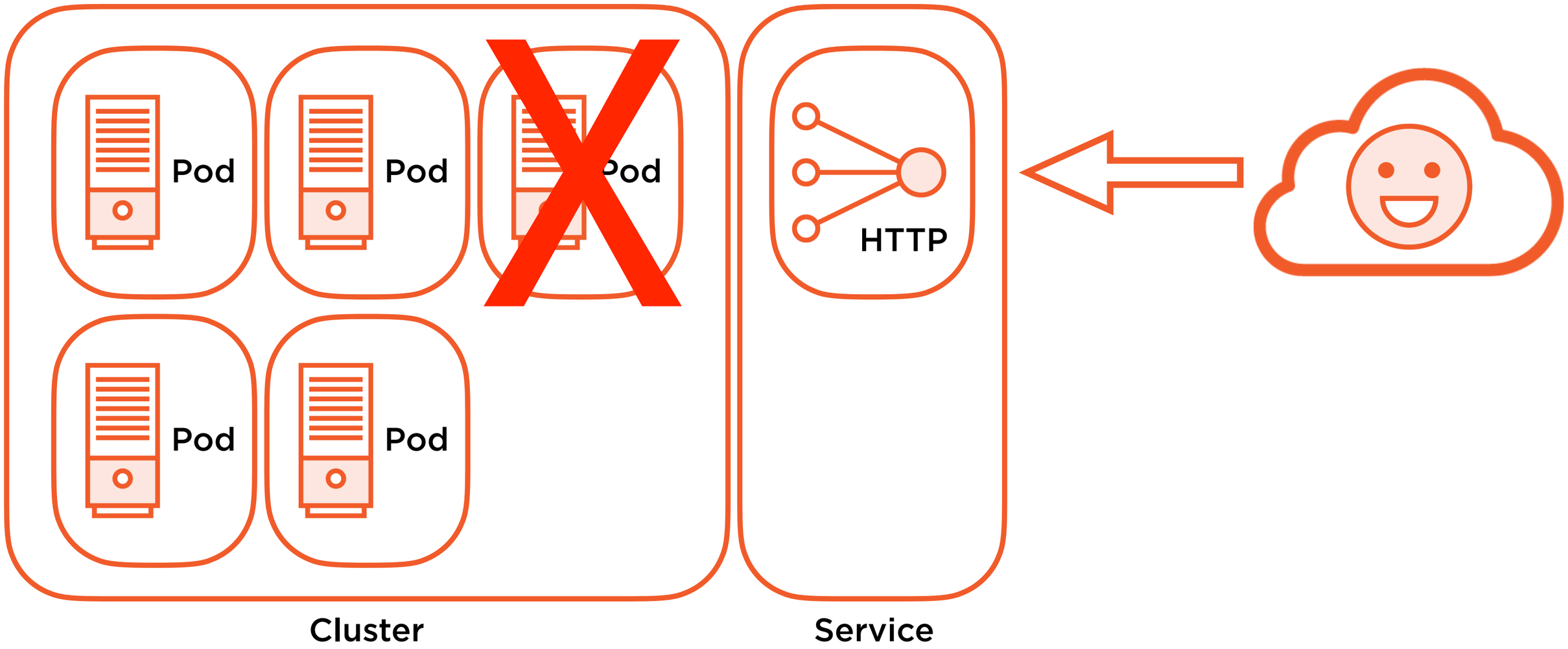
Ingress

Dashboard

Pod Operations



Services



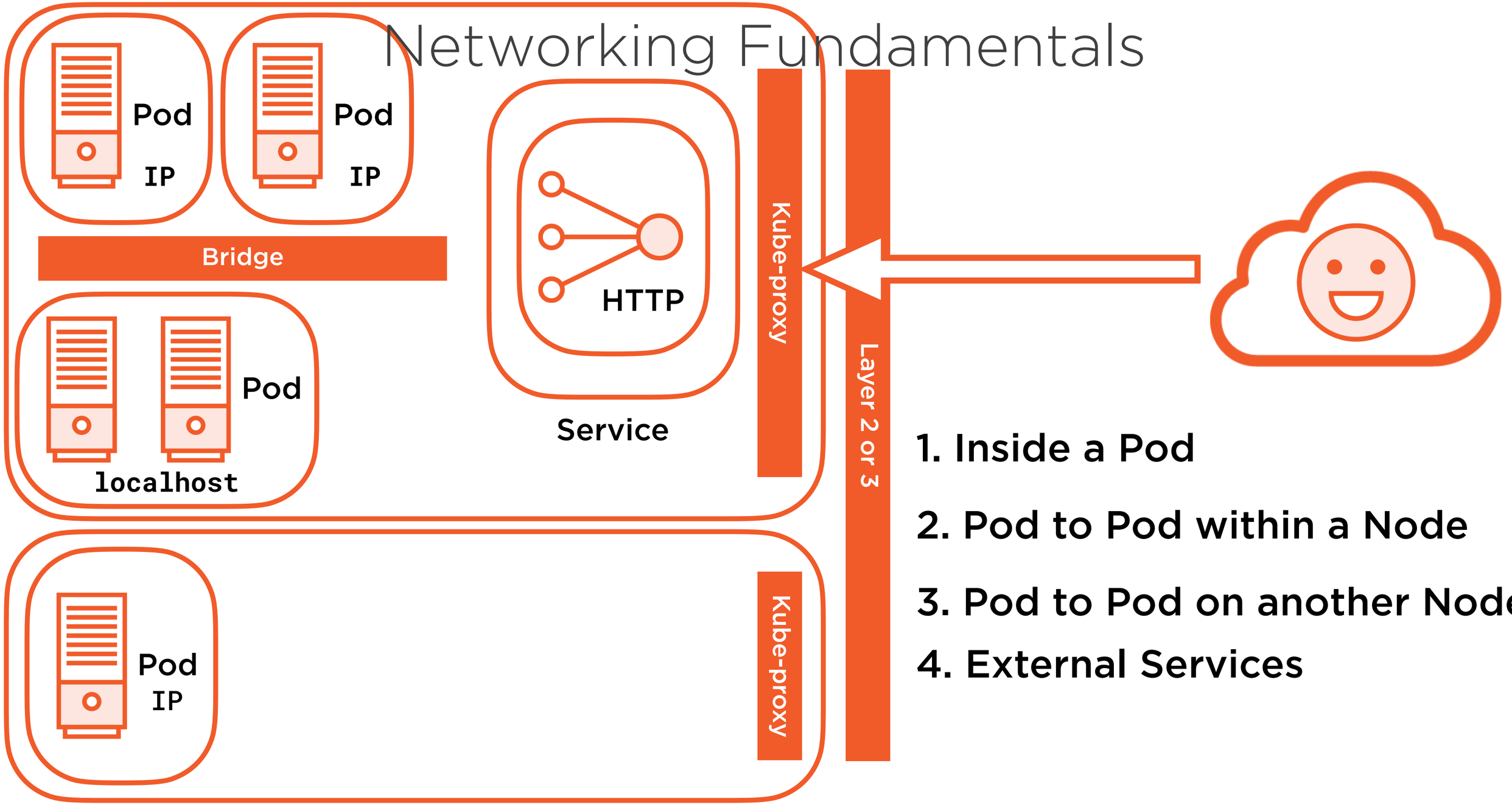
Kubernetes Networking Fundamentals

Kubernetes Networking Requirements

Pods on a Node can communicate with all Pods on all Nodes without Network Address Translation (NAT)

Agents on a Node can communicate with all Pods on that Node

Networking Fundamentals



1. Inside a Pod
2. Pod to Pod within a Node
3. Pod to Pod on another Node
4. External Services

Summary

What is Kubernetes?

Exploring Kubernetes Architecture

- Cluster Components
- Networking Fundamentals

What's Next!

Installing and Configuring Kubernetes