Kubernetes

- Understanding need of Kubernetes
- What is Kubernetes?
- Core Concepts & Architecture
- Kubernetes Cluster – Master & Worker nodes
- Kubernetes Setup
- Understanding Kubernetes Objects

We (May) Have A Problem

Manual deployment of Containers is hard to maintain, error-prone and annoying

(even beyond security and configuration concerns!)

Services Like AWS ECS / Azure AKS Can Help!

Manual deployment of Containers is hard to maintain, error-prone and annoying

(even beyond security and configuration concerns!)

Containers might crash /go down and need to be replaced	We might need more container instances upon traffic spikes	Incoming traffic should be distributed equally
Container health checks +automatic re-deployment	Autoscaling	Load balancer

Kubernetes To The Rescue

Kubernetes

An open-source system (and de-facto standard) for orchestrating container deployments

- Automatic Deployment
- Scaling & Load Balancing
- Management

Using Kubernetes

Kubernetes is like Docker-Compose for **multiple machines**

What Kubernetes IS and IS NOT

It's not a cloud service provider

It's an open-source project

It's not a service by a cloud service provider

It can be used with any provider

It's not restricted to any specific (cloud) service provider

It can be used with any provider

It's not just a software you run on some machine

It's a collection of concepts and tools

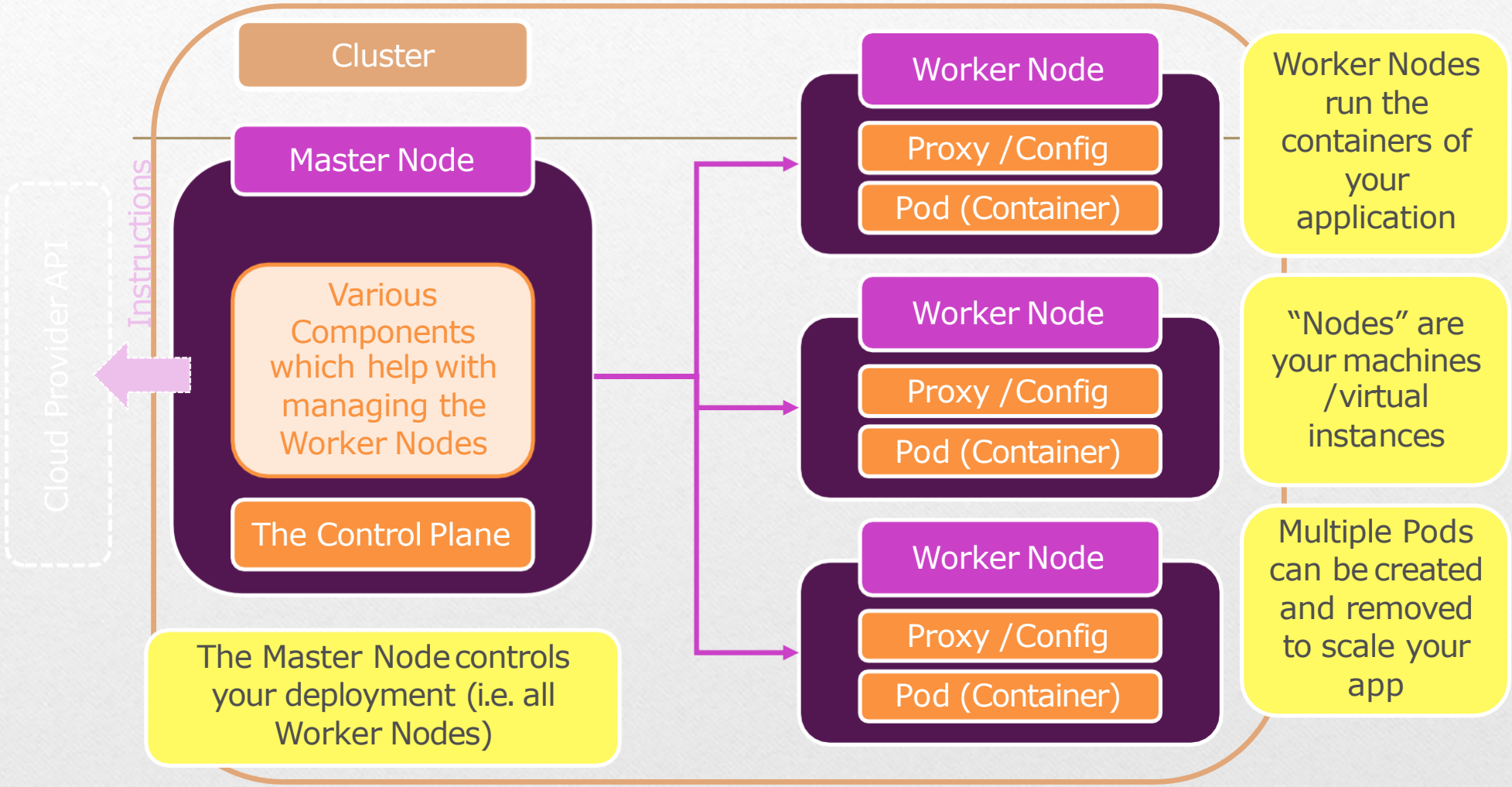
It's not an alternative to Docker

It works with (Docker) containers

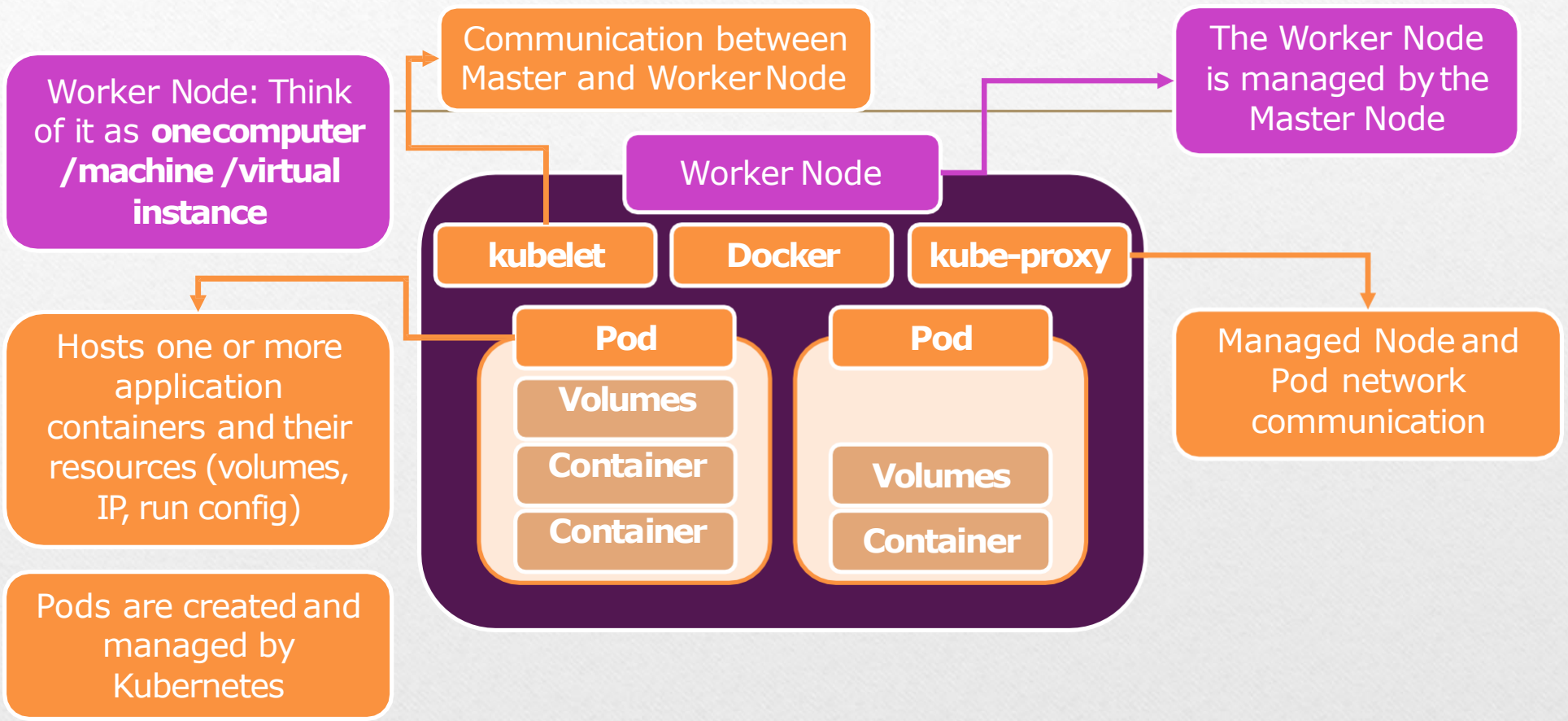
It's not a paid service

It's a free open-source project

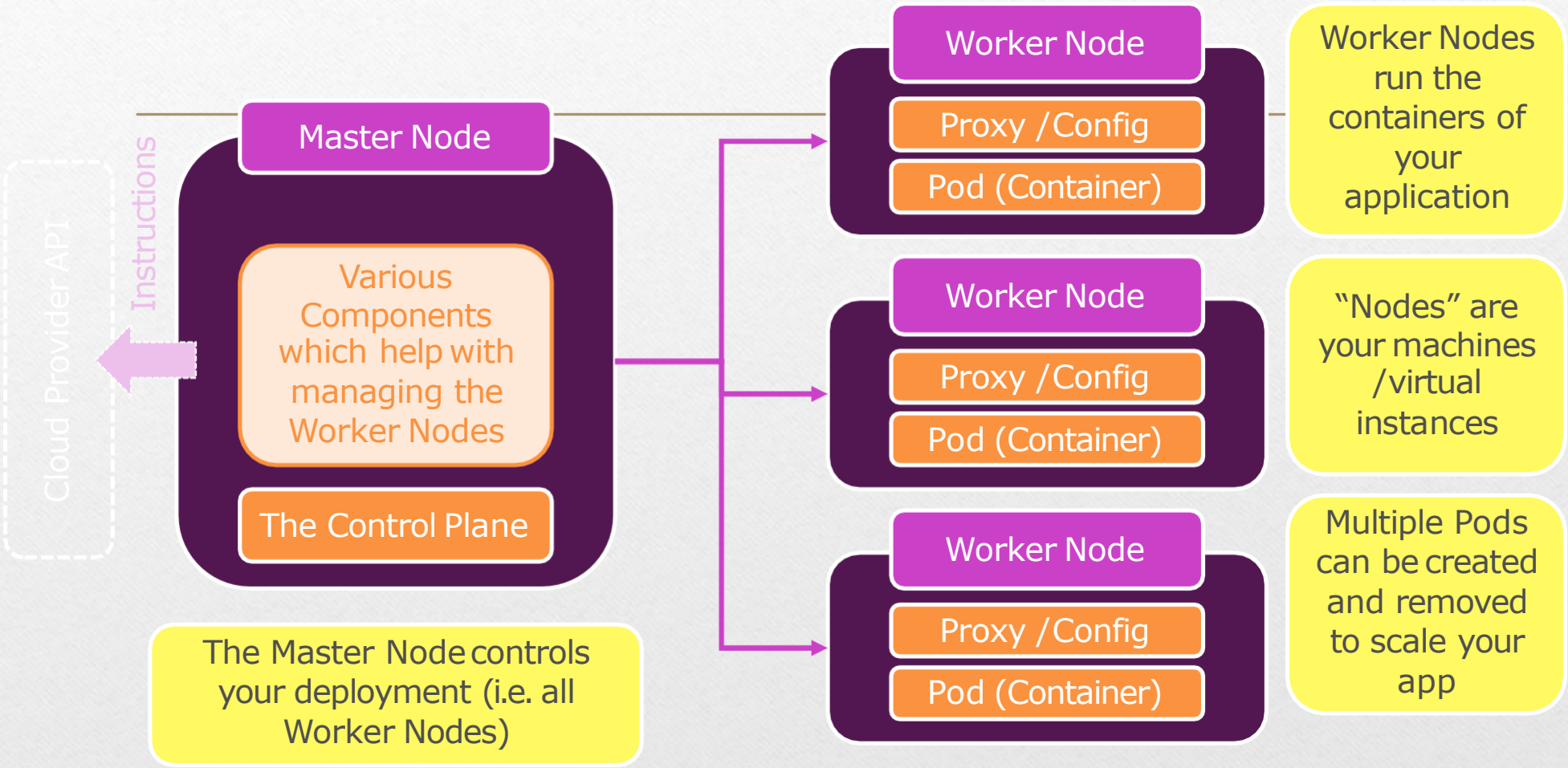
Core Kubernetes Concepts & Architecture



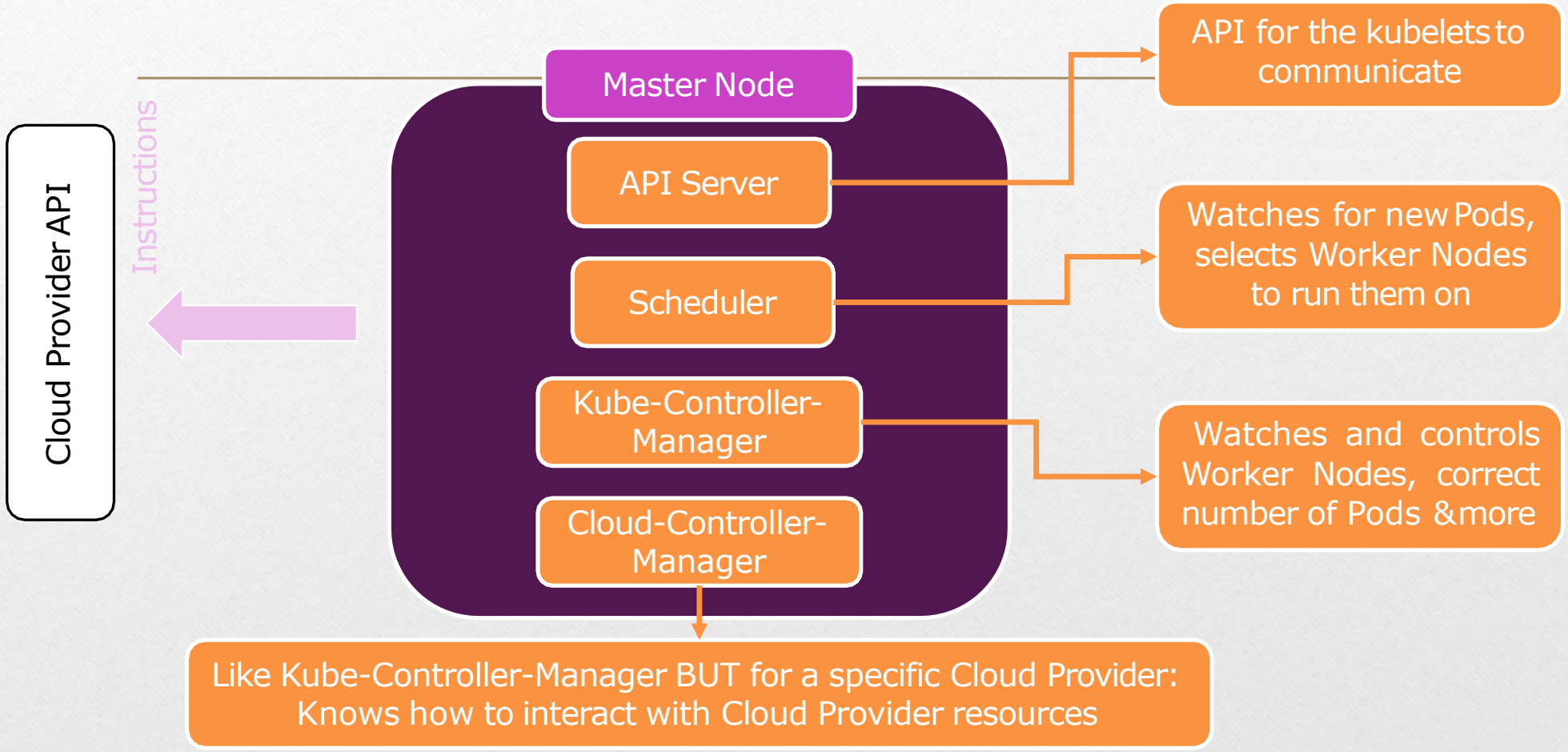
A Closer Look At The Worker Nodes



Core Kubernetes Concepts & Architecture



Core Kubernetes Concepts & Architecture



What Kubernetes Will Do

Create your objects (e.g. Pods) and manage them

Monitor Pods and re-create them, scale Pods etc.

Kubernetes utilizes the provided (cloud) resources to apply your configuration / goals

What You Need To Do /Setup
(i.e. what Kubernetes requires)

Create the Cluster and the Node Instances (Worker +Master Nodes)

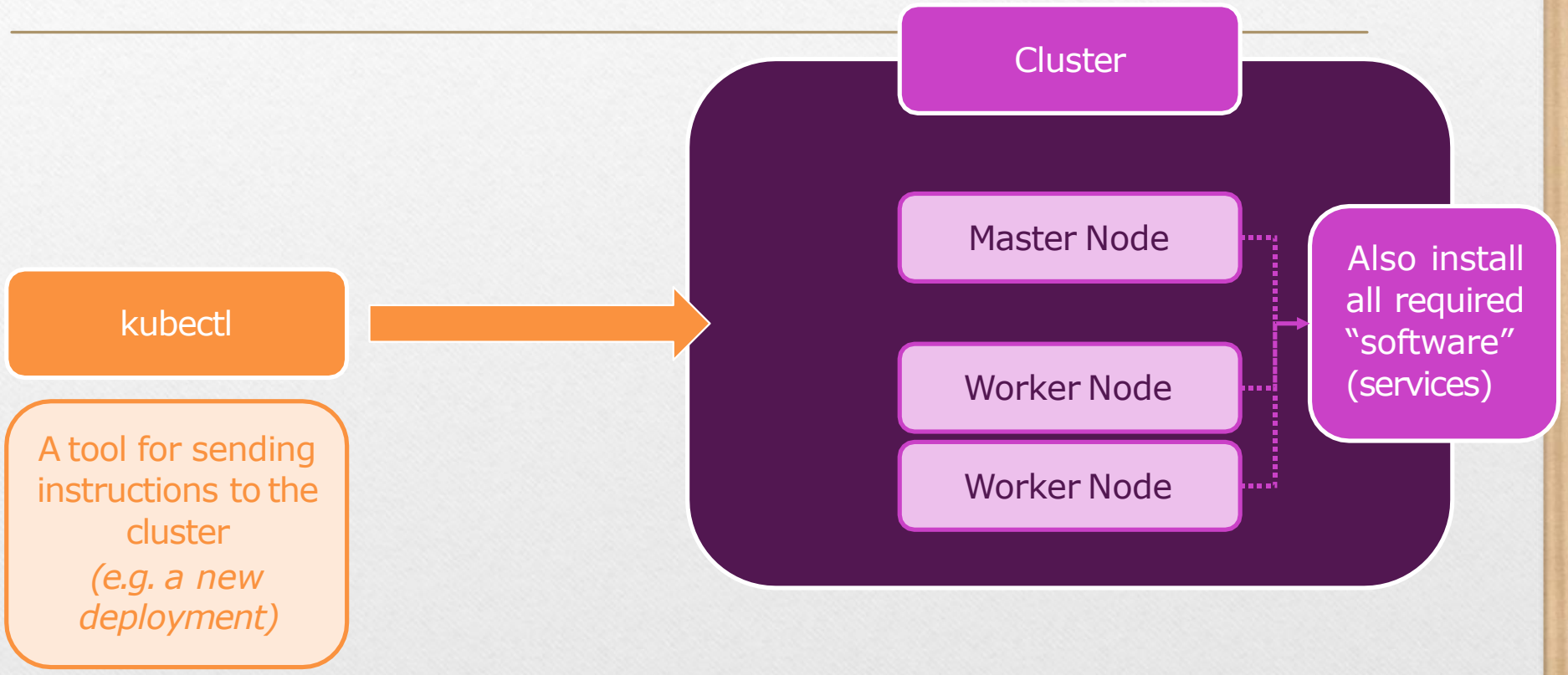
Setup API Server, kubelet and other Kubernetes services /software on Nodes

Create other (cloud) provider resources that might be needed (e.g. Load Balancer, Filesystems)

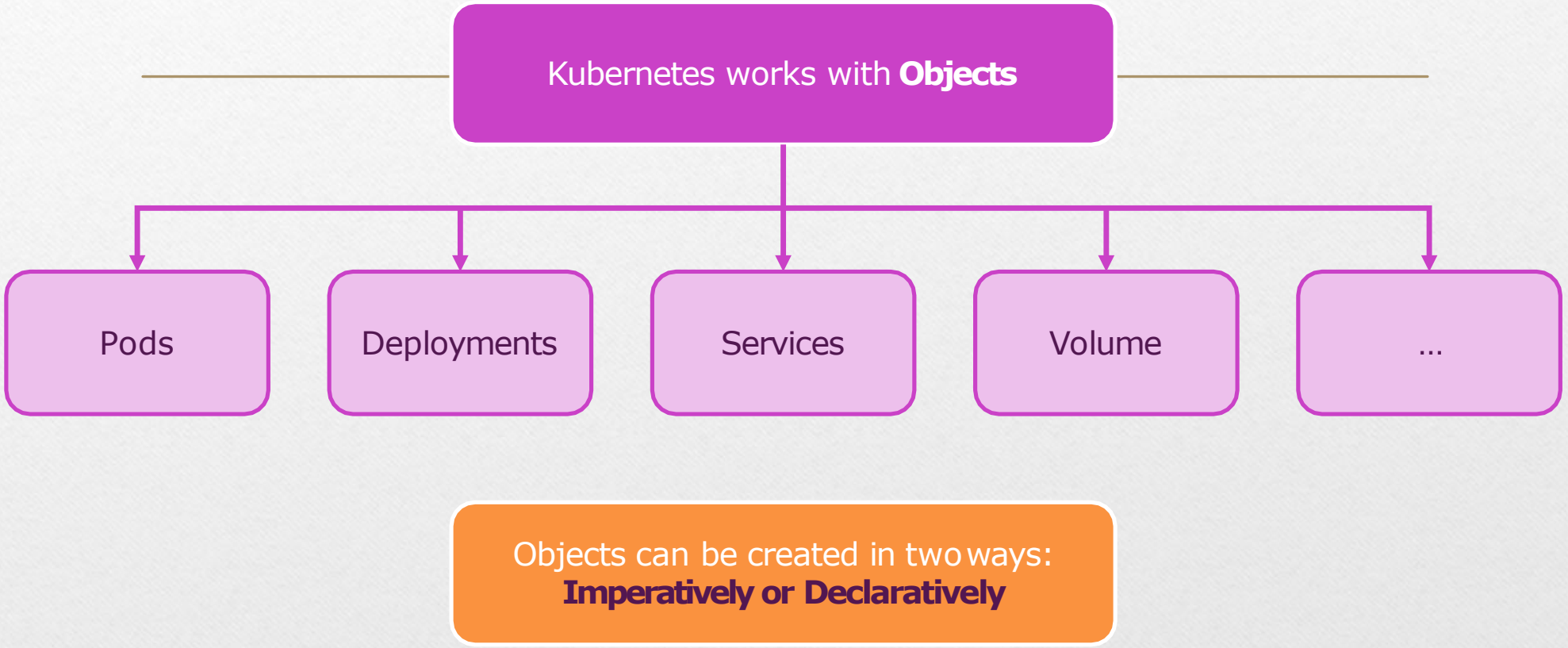
Core Components

Cluster	A set of Node machines which are running the Containerized Application (Worker Nodes) or control other Nodes (Master Node)
Nodes	Physical or virtual machine with a certain hardware capacity which hosts one or multiple Pods and communicates with the Cluster
Master Node	Cluster Control Plane, managing the Pods across Worker Nodes
Worker Node	Hosts Pods, running App Containers (+resources)
Pods	Pods hold the actual running App Containers +their required resources (e.g. volumes).
Containers	Normal (Docker) Containers
Services	A logical set (group) of Pods with a unique, Pod- and Container-independent IP address

Installation



Understanding Kubernetes Objects



The "Pod" Object

The smallest "unit" Kubernetes interacts with

Contains and runs one or multiple containers

Pods contain shared resources (e.g. volumes) for all Pod containers

Has a cluster-internal IP by default

The most common use-case is "one container per Pod"

Containers inside a Pod can communicate via localhost

Pods are designed to be **ephemeral**: Kubernetes will start, stop and replace them as needed.

For Pods to be managed for you, you need a "**Controller**" (e.g. a "Deployment")

The "Deployment" Object

Controls (multiple) Pods

You set a desired state, Kubernetes then changes the actual state

Deployments can be paused, deleted and rolled back

Deployments can be scaled dynamically (and automatically)

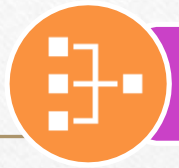
Define which Pods and containers to run and the number of instances

You can change the number of desired Pods as needed

Deployments manage a Pod for you, you can also create multiple Deployments

You therefore typically don't directly control Pods, instead you use Deployments to set up the desired end state

The "Service" Object



Exposes Pods to the Cluster or Externally

Pods have an internal IP by default – it changes when a Pod is replaced

Finding Pods is hard if the IP changes all the time

Services group Pods with a shared IP

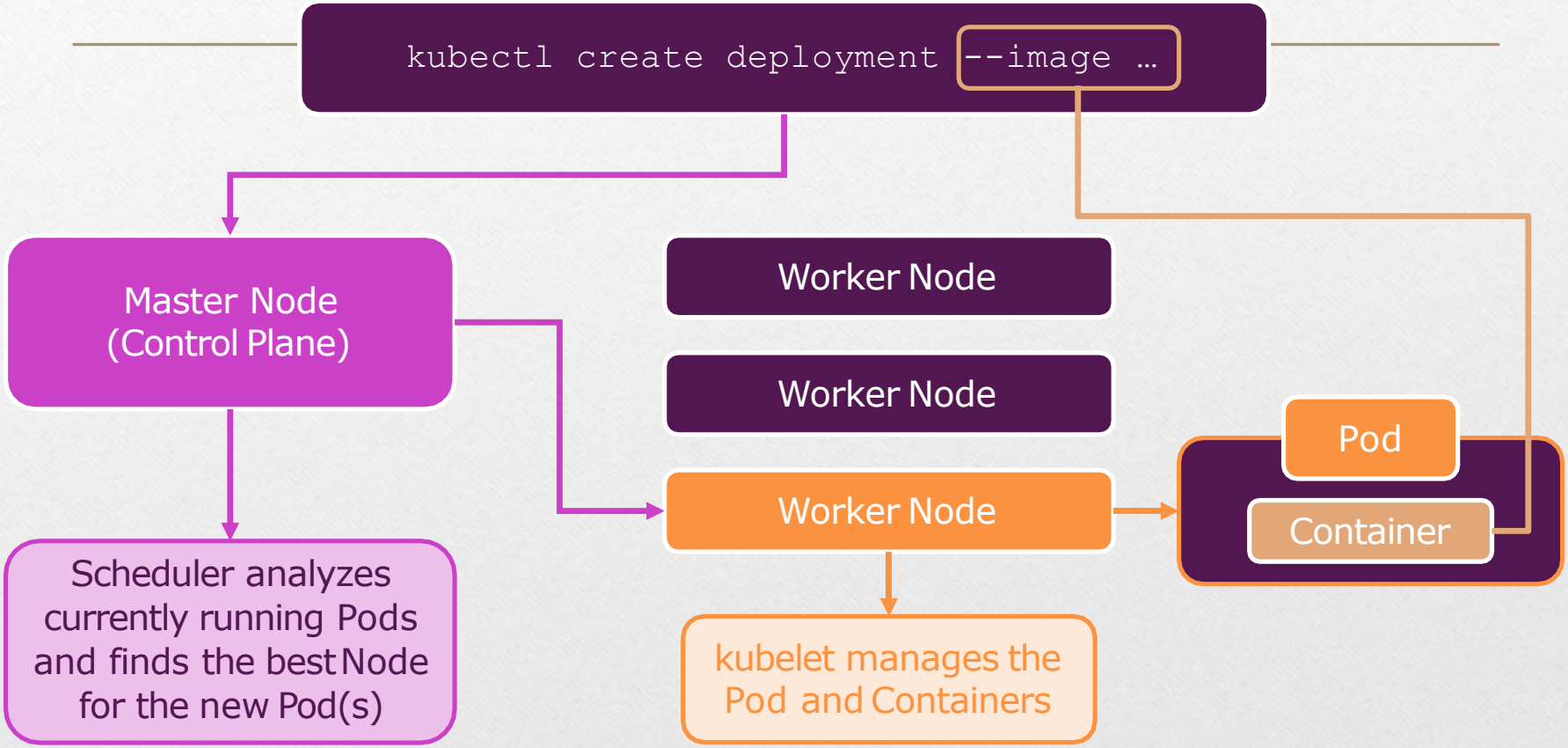
Services can allow external access to Pods

The default (internal only) can be overwritten

Without Services, Pods are very hard to reach and communication is difficult

Reaching a Pod from outside the Cluster is not possible at all without Services

Behind The Scenes



Configuring Kubernetes

Imperative

`kubectl create deployment …`

Individual commands are executed to trigger certain Kubernetes actions

Comparable to using `docker run` only

Declarative

`kubectl apply -f config.yaml`

A config file is defined and applied to change the desired state

Comparable to using **Docker Compose** with compose files

A Resource Definition

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: second-app
spec:
  selector:
    matchLabels:
      app: second-dummy
  replicas: 1
  template:
    metadata:
      labels:
        app: second-dummy
    spec:
      containers:
      - name: second-node
        image: bhoirmakarand/webgame
```

Thank You