

# Managing the Kubernetes API Server and Pods

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## INTRODUCTION AND USING THE KUBERNETES API



**Anthony E. Nocentino**

ENTERPRISE ARCHITECT @ CENTINO SYSTEMS

@nocentino [www.centinosystems.com](http://www.centinosystems.com)

# Course Overview



Using the Kubernetes API

Managing Objects with Labels, Annotations, and Namespaces

Running and Managing Pods

# Overview

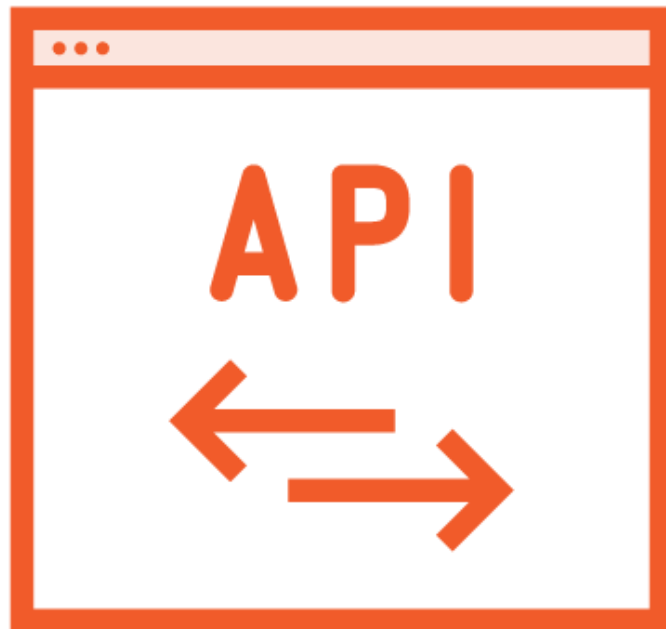
The Kubernetes API and API Server

Working with Kubernetes Objects

- Defining objects
- API Groups
- API Versioning

Anatomy of an API Request

# Kubernetes API and API Server



Single surface area over the resources in your data center

## API Objects

Collection of primitives to represent your system's state

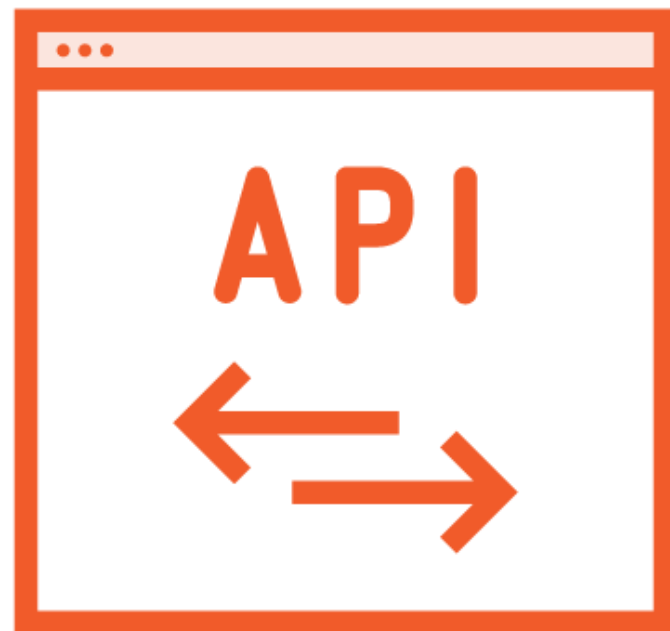
Enables configuration of state

## API Server

The sole way to interact with your cluster

The sole way Kubernetes interacts with your cluster

# Kubernetes API Server



Client/Server architecture

RESTful API over HTTP using JSON

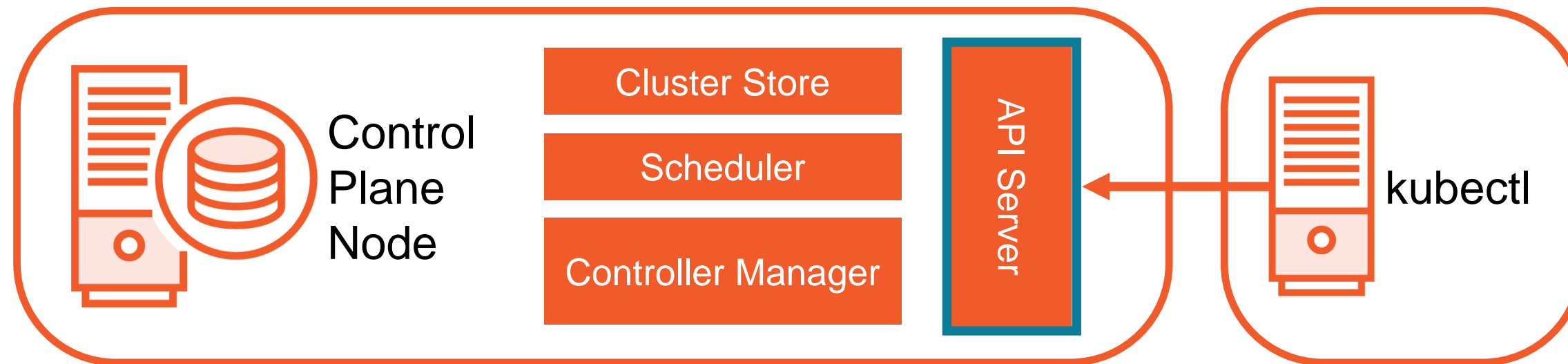
Client submits requests over HTTP/HTTPS

Server responds to the request

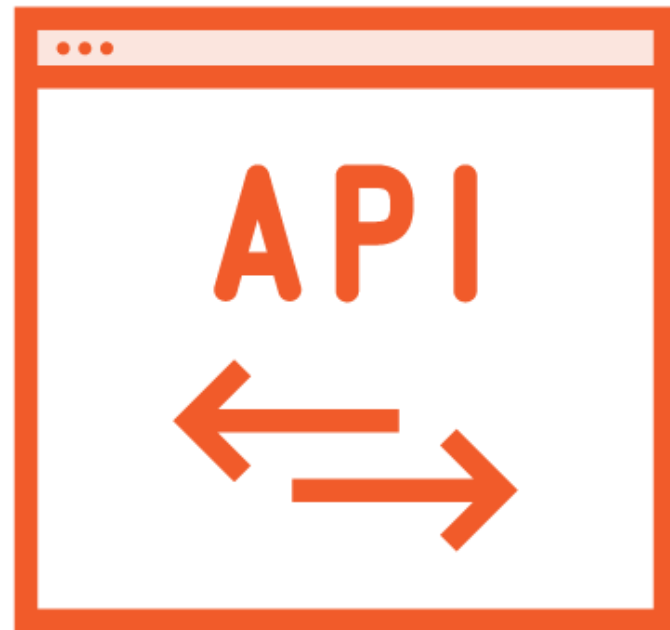
Stateless

Serialized and persisted in the cluster store

# Control Plane Node



# Kubernetes API Objects



Persistent entities in Kubernetes

Representing the state of your system

Objects are organized by

Kind - Pod, Service, Deployment

Group - core, apps, storage

Version - **v1**, **beta**, **alpha**

# Kubernetes API Objects (Kind)



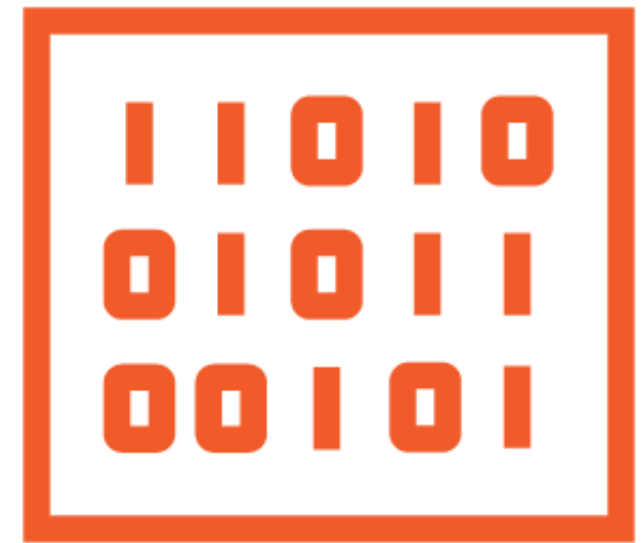
Pods



Deployments



Services



PersistentVolumes

Not an exhaustive list, but these are the key players



# Working with Kubernetes Objects



Imperative configuration

Declarative configuration

Define our desired state in code

Manifest

YAML or JSON

```
kubectl apply -f deployment.yaml
```

```
apiVersion: v1
kind: Pod
metadata:
  name: nginx-pod
spec:
  containers:
  - name: nginx
    image: nginx
```

## Basic Manifest - Pod

```
kubectl apply -f nginx.yaml
```

<https://kubernetes.io/docs/reference/kubernetes-api/>

# Working with kubectl dry-run



## Server-side

Processed as a typical request

Requests will NOT be persisted in storage

## Client-side

Writes the object to be created to stdout

Validate manifest syntax

Great for generating syntactically correct YAML manifests

# Using kubectl dry-run

```
kubectl apply -f deployment.yaml --dry-run=server
```

```
kubectl apply -f deployment.yaml --dry-run=client
```

```
kubectl create deployment nginx --image=nginx \
  --dry-run=client -o yaml
```

```
kubectl create deployment nginx --image=nginx \
  --dry-run=client -o yaml > deployment.new.yaml
```

# Working with kubectl diff



Generates the difference between

Resources running in the cluster

Resources defined in a manifest or `stdin`

Outputs the differences to `stdout`

Useful to help you understand what's going to change

```
kubectl diff -f newdeployment.yaml
```

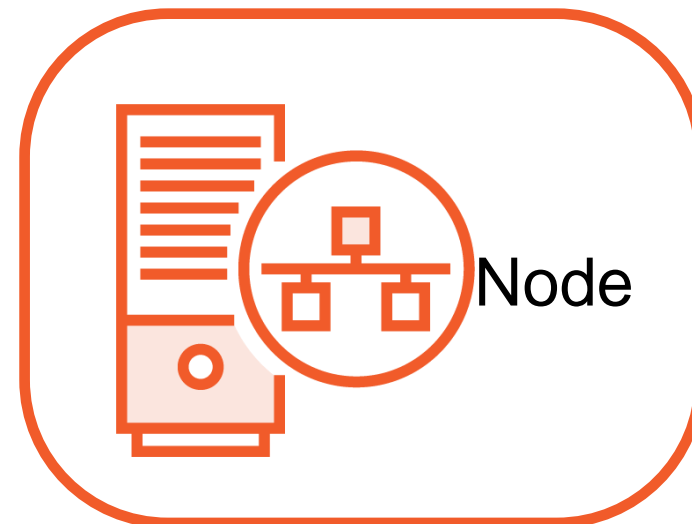
Hostnames set  
Host file on each

# Lab Environment

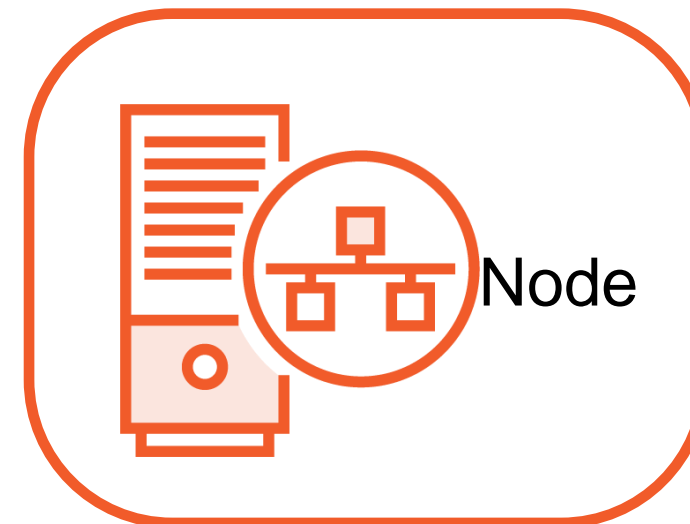
Ubuntu 18.0.4  
VMware Fusion VMs  
2vCPU  
2GB RAM  
100GB  
Swap Disabled



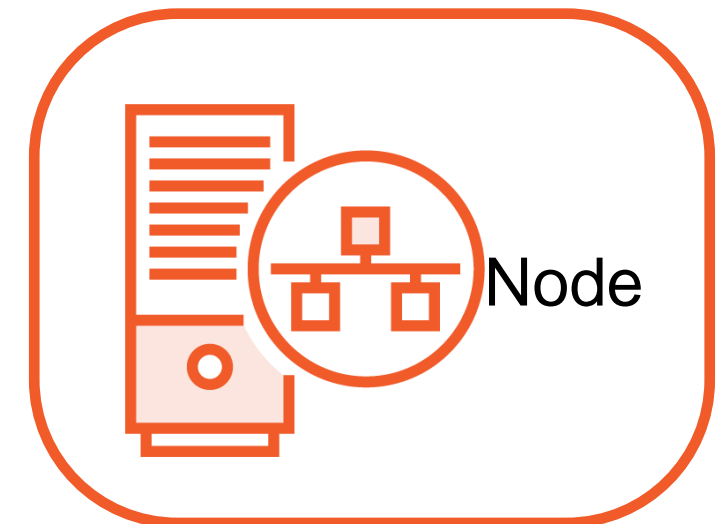
**c1-cp1**  
**172.16.94.10**



**c1-node1**  
**172.16.94.11**



**c1-node2**  
**172.16.94.12**



**c1-node3**  
**172.16.94.13**

# Demo

API Server Discovery

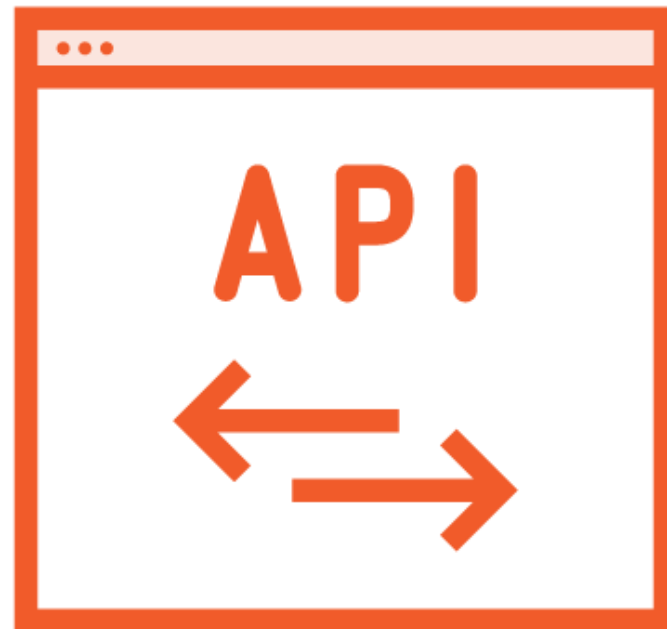
Listing Available API Resources

Using `kubectl explain`

Defining objects in YAML

Working with `kubectl dry-run` and `diff`

# API Groups



Organization of resources

API Groups

Core API (Legacy Group)

Named API Groups

Part of the API Object's URL in API Requests



# API Groups

Core (Legacy)

**Pod**

**Node**

**Namespace**

**PersistentVolume**

**PersistentVolumeClaim**

Named API Groups

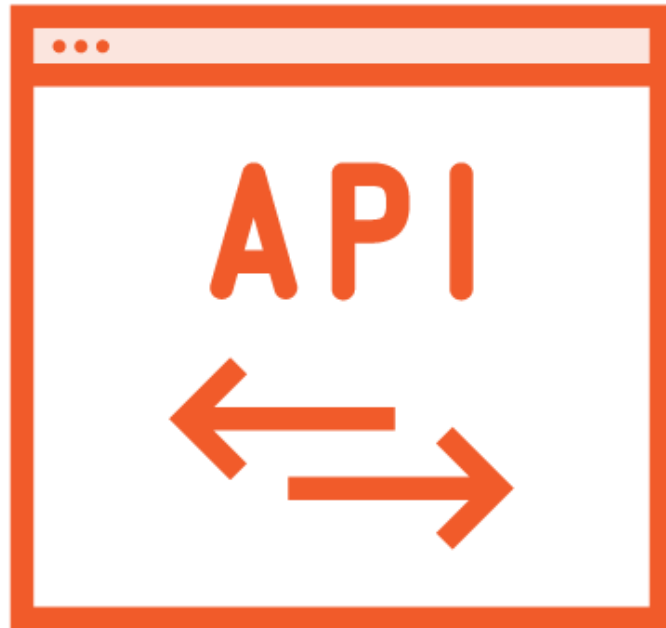
apps - **Deployment**

storage.k8s.io - **StorageClass**

rbac.authorization.k8s.io - **Role**

<https://kubernetes.io/docs/reference/kubernetes-api/>

# API Versioning



API is versioned

Provide stability for existing implementations

Enable forward change

Alpha -> Beta -> Stable

No direct relation to release versions

# API Versioning

## Alpha/Experimental

Alpha

V1alpha1

Early Release

Disabled by Default

For Testing Only

Breaking Changes

## Beta/Pre-release

Beta

V1beta1

Thoroughly Tested

Considered Safe, but Test

More Stable API Objects

Feedback Encouraged

## Stable/General Availability

Stable

v1

Backwards Compatible

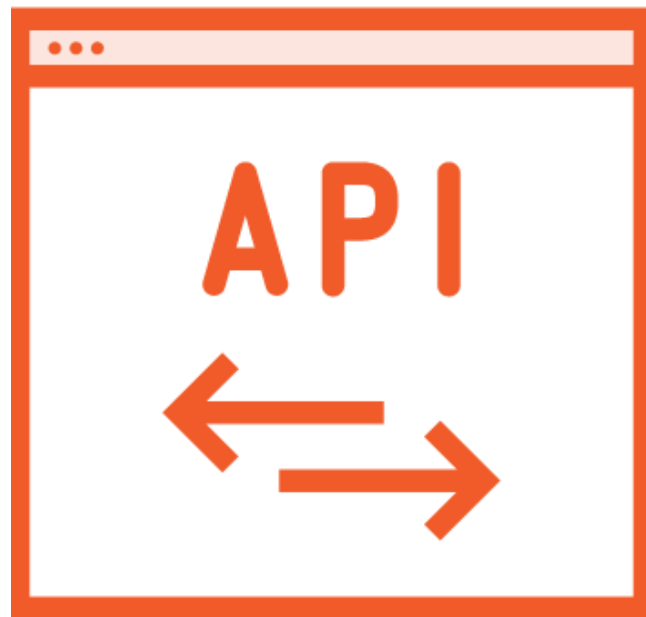
Production Ready

# Demo

## API Object Discovery

- Examining API Groups
- Examining specific API Versions

# Anatomy of an API Request



API Request



API Paths

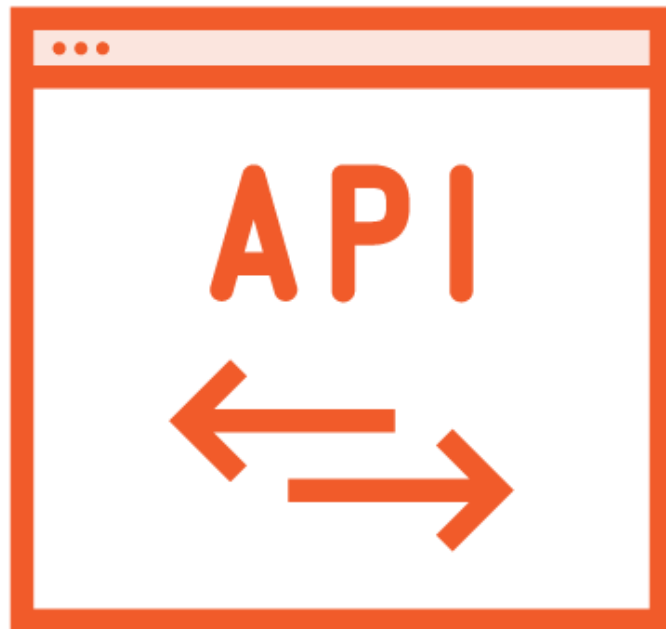


Read/Write Objects  
to/from Cluster  
Store



Send Response  
Back to the Client

# Anatomy of an API Request



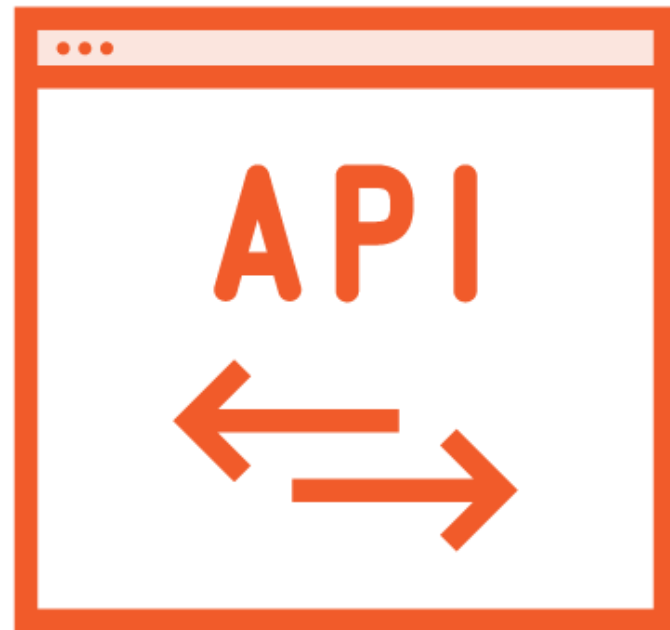
Client and Server architecture

`kubectl`

Any HTTP client that respects the API

`curl`

# Anatomy of an API Request



HTTP based RESTful API

HTTP Verb

Resource Location (URL/Path)

Request = Verb + Resource Location

Response Code

# RESTful API Verbs

GET

Get the data for a specified resource(s)

POST

Create a resource

DELETE

Delete a resource

PUT

Create or update entire existing resource

PATCH

Modify the specified fields of a resource



# Special API Requests

LOG	Retrieve logs from a container in a Pod
EXEC	Exec a command in a container get the output
WATCH	Change notifications on a resource with streaming output

Each resource has a resourceVersion

Watches are started on that version

Notifications are sent to clients watching that version

# API Resource Location (API Paths)

## Core API (Legacy)

`http://apiserver:port/api/$VERSION/$RESOURCE_TYPE`

`http://apiserver:port/api/$VERSION/namespaces/$NAMESPACE/$RESOURCE_TYPE/$RESOURCE_NAME`

## API Groups

`http://apiserver:port/apis/$GROUPNAME/$VERSION/$RESOURCE_TYPE`

`http://apiserver:port/apis/$GROUPNAME/$VERSION/namespaces/$NAMESPACE/$RESOURCE_TYPE/$RESOURCE_NAME`

# Response Codes from the API Server

Success (2xx)

Client Errors (4xx)

Server Errors (5xx)

**200 - OK**

**401 -  
Unauthorized**

**500 - Internal  
Server Error**

**201 - Created**

**403 - Access  
Denied**

**202 - Accepted**

**404 - Not Found**

# Anatomy of an API Request

Client Request

Connection

Authentication

Authorization

Admission Control

Server Response

Can you make a connection?

Are you valid user?

Can you perform the requested action?

Administrative control over request

HTTP over TCP

Authentication plugin

Verb on Resource

Additional code

TLS Encrypted

Modular

Default deny

May modify object

401

403

Validation

# Demo

Anatomy of an API Request

Special API Requests - Watch, Exec and Log

Authentication Failure and Missing Resources

Creating Objects

# Summary

The Kubernetes API and API Server

Working with Kubernetes Objects

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- API Groups
- API Versioning

Anatomy of an API Request

# What's Next!

Managing Objects with Labels, Annotations, and Namespaces