

Kubernetes

Что нужно знать каждому в 2020



Об авторе



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20 лет с компьютерами, МК, FPGA

10 лет Backend разработки

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- Эксперты в области облачных технологий
- На рынке с 2008 года
- Проекты по разработке и внедрению IaaS/PaaS
- Крупные российские и зарубежные заказчики



Заказчики и партнеры



Skoltech

Skolkovo Institute of Science and Technology

АЙТЕКО
технологии без пробелов



СБЕРБАНК



Кто у руля?





k8s



l10n

i18n

k8s

p13n

o11y

g11n



- From Google
- First announced in mid-2014
- Influenced by Borg
- Written in Go programming language
- No. 9 for commits on GitHub
- No. 2 for authors/issues on GitHub



Cloud Native Computing Foundation

Part of Linux Foundation

Projects:

- Kubernetes
- containerd
- Helm
- etcd
- CNI



Platform for managing containerized workloads and services.

- Automatic bin packing
- Automated rollouts and rollbacks
- Self-healing
- Service discovery and load balancing
- Secret and configuration management
- Storage orchestration

<https://kubernetes.io/docs/concepts/overview/what-is-kubernetes/>



- Does not deploy source code and does not build your application
- Does not provide application-level services
- Does not provide machine configuration

<https://kubernetes.io/docs/concepts/overview/what-is-kubernetes/#what-kubernetes-is-not>



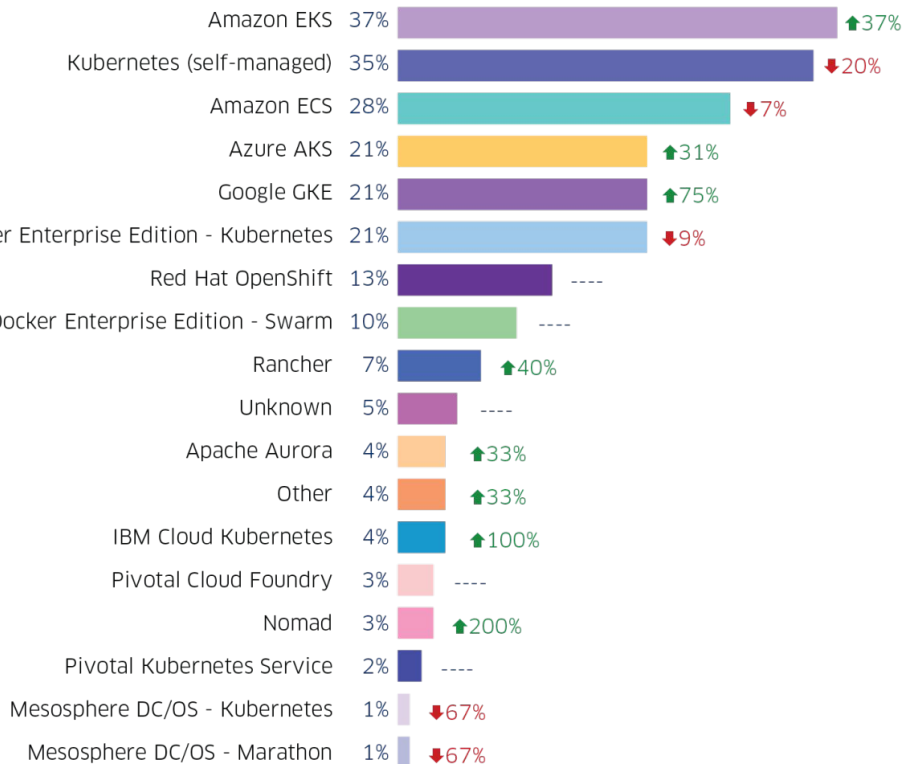
Kubernetes dominates the container orchestration market

Kubernetes adoption stands at 86%

Stackrox Report

Winter 2020

Which of the following container orchestrators do you use? (pick as many as apply)



- Preview in Nov-2014, GA in Apr-2015
- Free of charge
- Vendor lock-in
- Available in [Pro version of LocalStack](#)
- EKS (Kubernetes) introduced in Jun-2018
- EKS \$0.10 / hour / cluster



- V 0.4 was released in Aug-2015
- Become part of Docker-Engine in Jul-2016



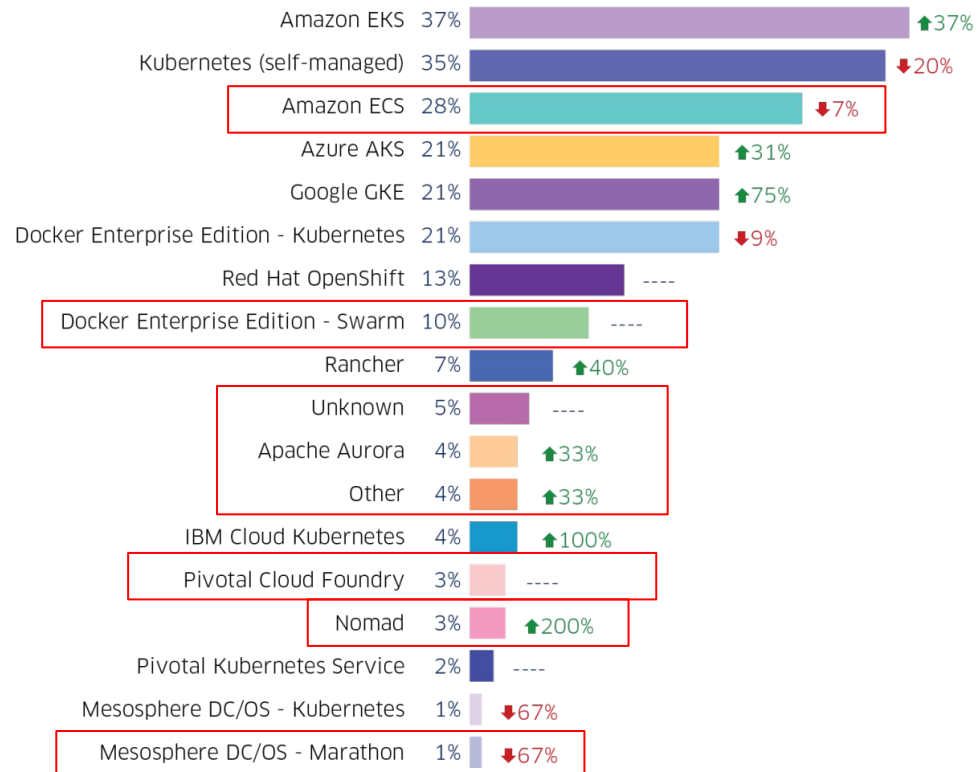
- Manages Computer Cluster
- Initially was a research project in the UC Berkeley
- Presented in 2009, v 1.0 in Jul-2016
- Marathon for container orchestration
- Suitable for large scale clusters
- DC/OS by Mesosphere, Inc
- Mesosphere commercially partnered with Microsoft Azure



- By HashiCorp (Vagrant, Consul, Terraform)
- Introduced Sep-2015
- Single binary file
- Runs: Docker, Qemu, Jar or execs binary



Which of the following container orchestrators do you use? (pick as many as apply)



- <https://github.com/kelseyhightower/kubernetes-the-hard-way>



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- RedHat OpenShift and <https://www.okd.io/>
- Rancher Kubernetes Engine
- Docker Kubernetes Service
- Apache Mesosphere Kubernetes Engine
- Canonical Charmed Kubernetes



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Helpers: Kubespray, Kops, CFQR (Kubo).



- Minikube <https://minikube.sigs.k8s.io/>
- Canonical MicroK8s <https://microk8s.io/>
- Rancher K3s <https://k3s.io/>
- Kubernetes IN Docker <https://kind.sigs.k8s.io/>



- <https://www.katacoda.com/courses/kubernetes>
- <https://www.katacoda.com/courses/kubernetes/playground>
- <https://labs.play-with-k8s.com/>



```
Memory usage: 3%          IP address for enp0s2: 192.168.64.9
Swap usage:  0%

26 packages can be updated.
5 updates are security updates.

ubuntu@k8s-2020:~$ # We have only localhost and one virtual Ethernet adapter
ubuntu@k8s-2020:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: enp0s2: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 4a:65:1c:14:b2:6c brd ff:ff:ff:ff:ff:ff
    inet 192.168.64.9/24 brd 192.168.64.255 scope global dynamic enp0s2
        valid_lft 85479sec preferred_lft 85479sec
    inet6 fe80::4865:1cff:fe14:b26c/64 scope link
        valid_lft forever preferred_lft forever
ubuntu@k8s-2020:~$ # Start install
ubuntu@k8s-2020:~$ time sudo snap install microk8s --classic
2020-06-04T18:21:41+03:00 INFO Waiting for restart...
Download snap "microk8s" (1378) from channel "stable" 28% 3.13MB/s 46.6s
```

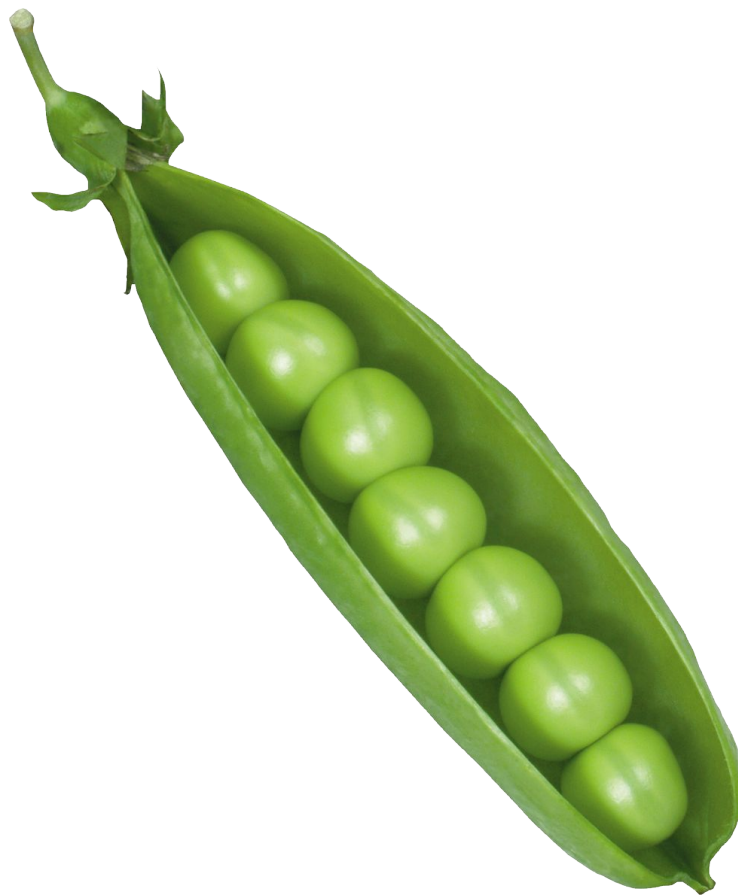
<https://asciinema.org/a/faH5OLtS6fMLshNSBboAhkQKn>

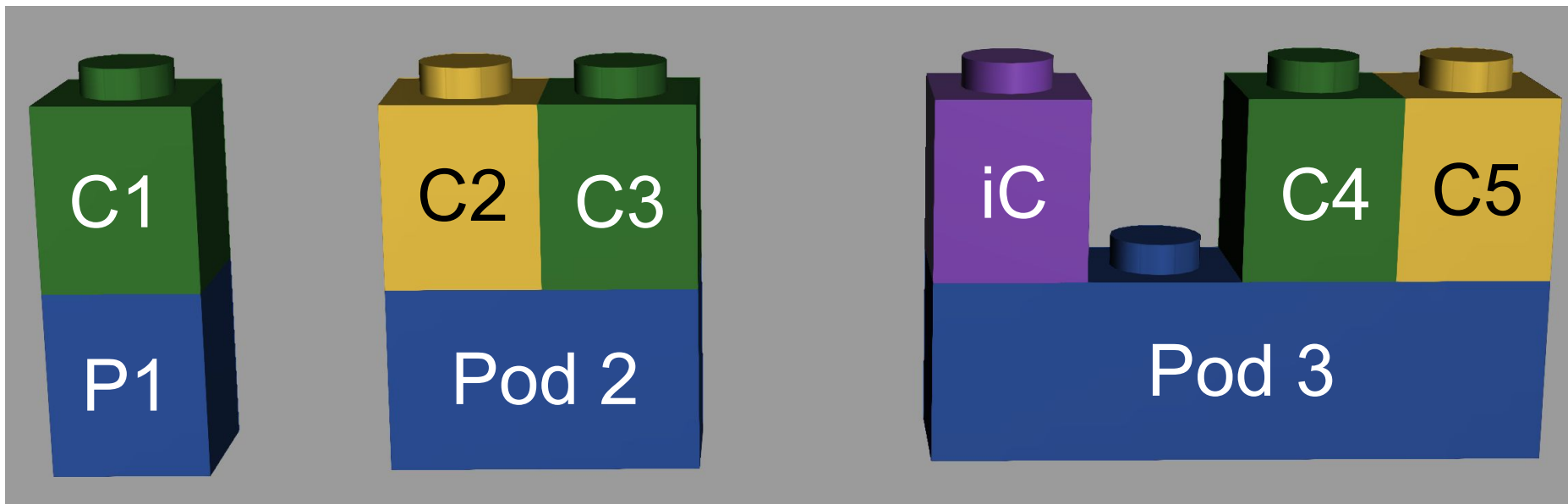


Запускаем первый ...



Запускаем первый Pod





P - Pod, C - Container, iC - init Container



- Состоит из 1 или более контейнеров
- У контейнеров общая сеть и тома
- Базовый строительный блок для других объектов
- Не создаются напрямую в рабочем окружении
- Содержит связанные контейнеры



Imperative vs Declarative



Imperative



Declarative



```
1  apiVersion: v1
2  kind: Pod
3  metadata:
4    name: first-pod
5  spec:
6    containers:
7    - name: main
8      image: "demosrv:latest"
```



Kubectl - наше всё! <https://kubectl.docs.kubernetes.io/>

- Imperative commands: run, create, expose, scale...
- Imperative object configuration: create -f, replace, delete -f.
- Declarative object configuration: apply, delete -f.
- Diagnose and debug: get, describe, logs, exec, port-forward.



```
$ kubectl run --generator=run-pod/v1
```

Flag `--generator` has been deprecated, has no effect and will be removed in the future.

```
$ kubectl run demo --image=demosrv --dry-run=client  
--command -o yaml -- sh
```

[medium - kubernetes-1-18-broke-kubectl-run](#)



Kubernetes objects



```
$ kubectl api-resources | head -n 1
```

```
NAME          SHORTNAMES  APIGROUP  NAMESPACE  KIND
```

```
$ kubectl api-resources | wc -l
```

```
55
```



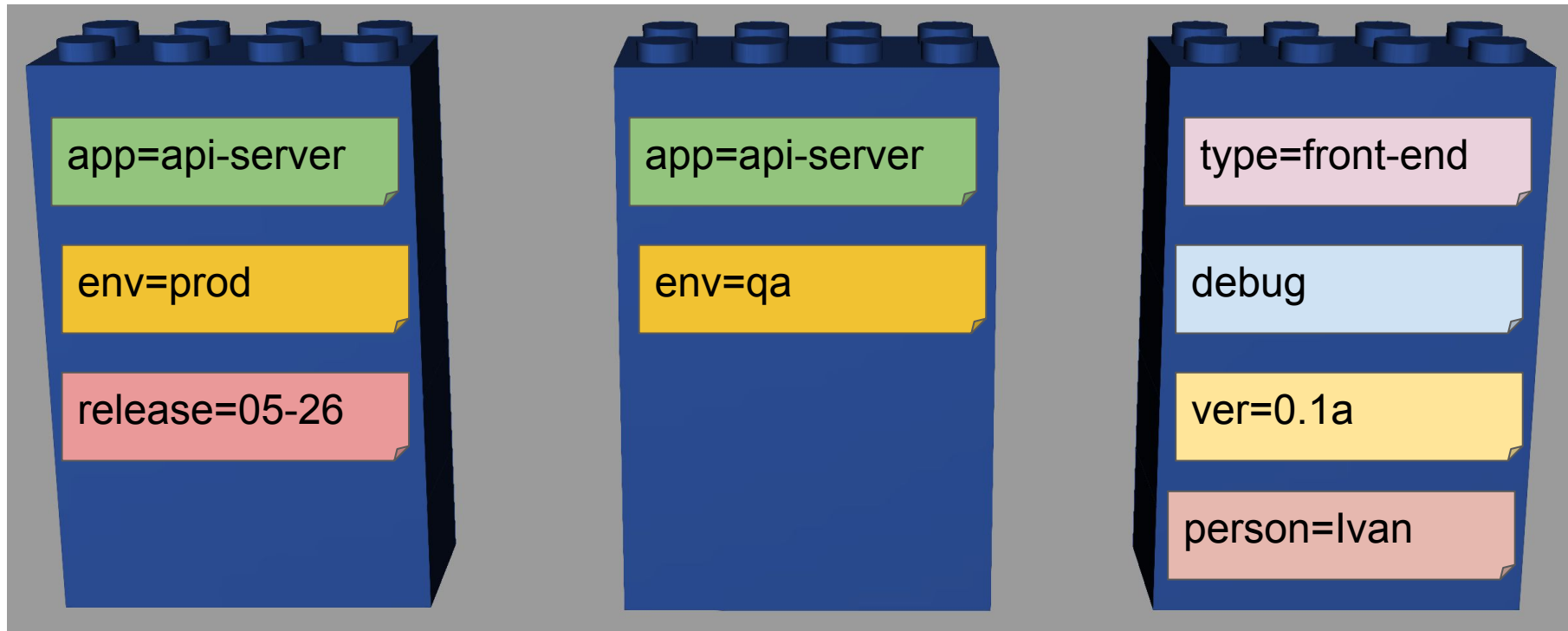
Namespace

```
$ kubectl get namespaces
```

NAME	STATUS	AGE
default	Active	37h
kube-node-lease	Active	37h
kube-public	Active	37h
kube-system	Active	37h

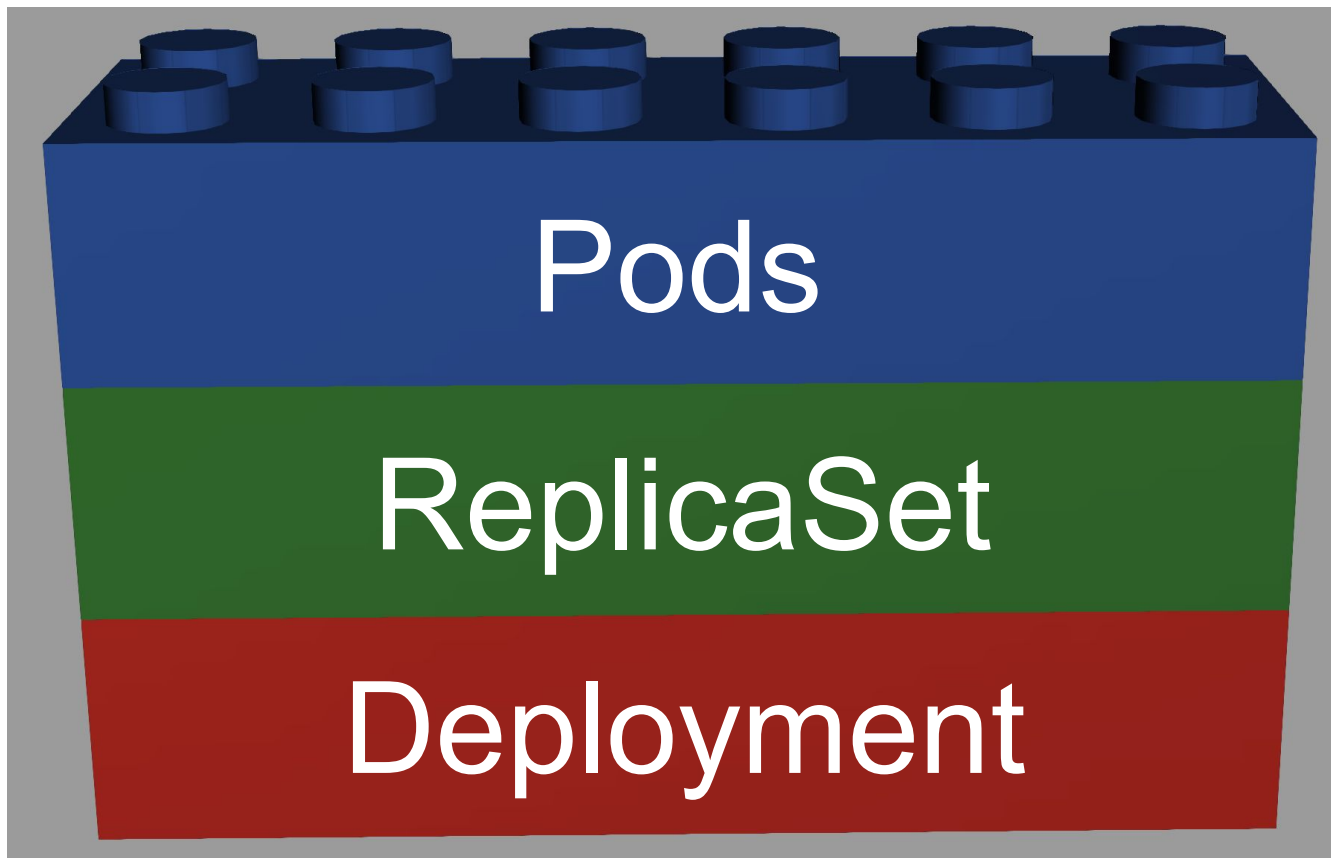


Label

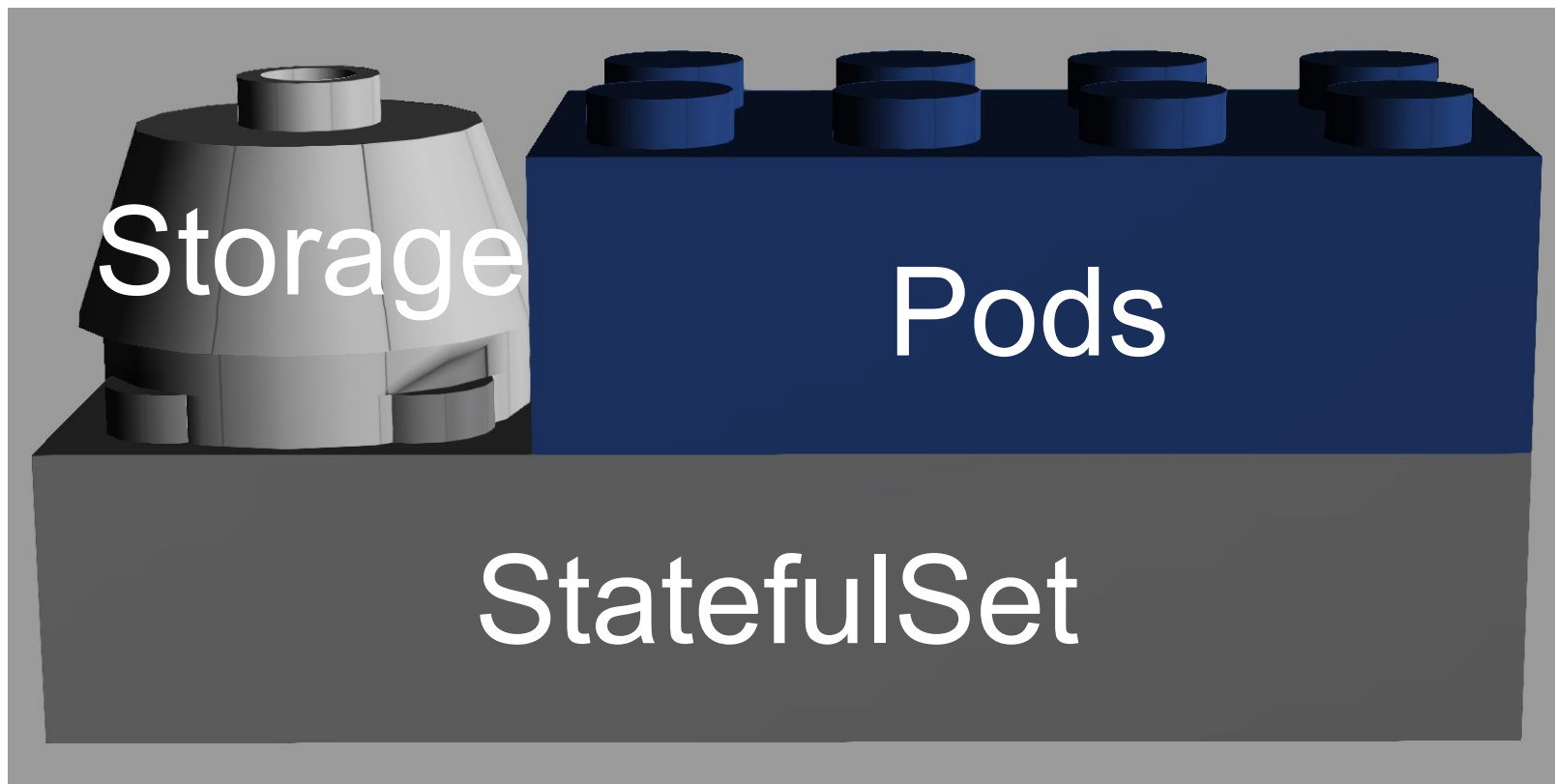


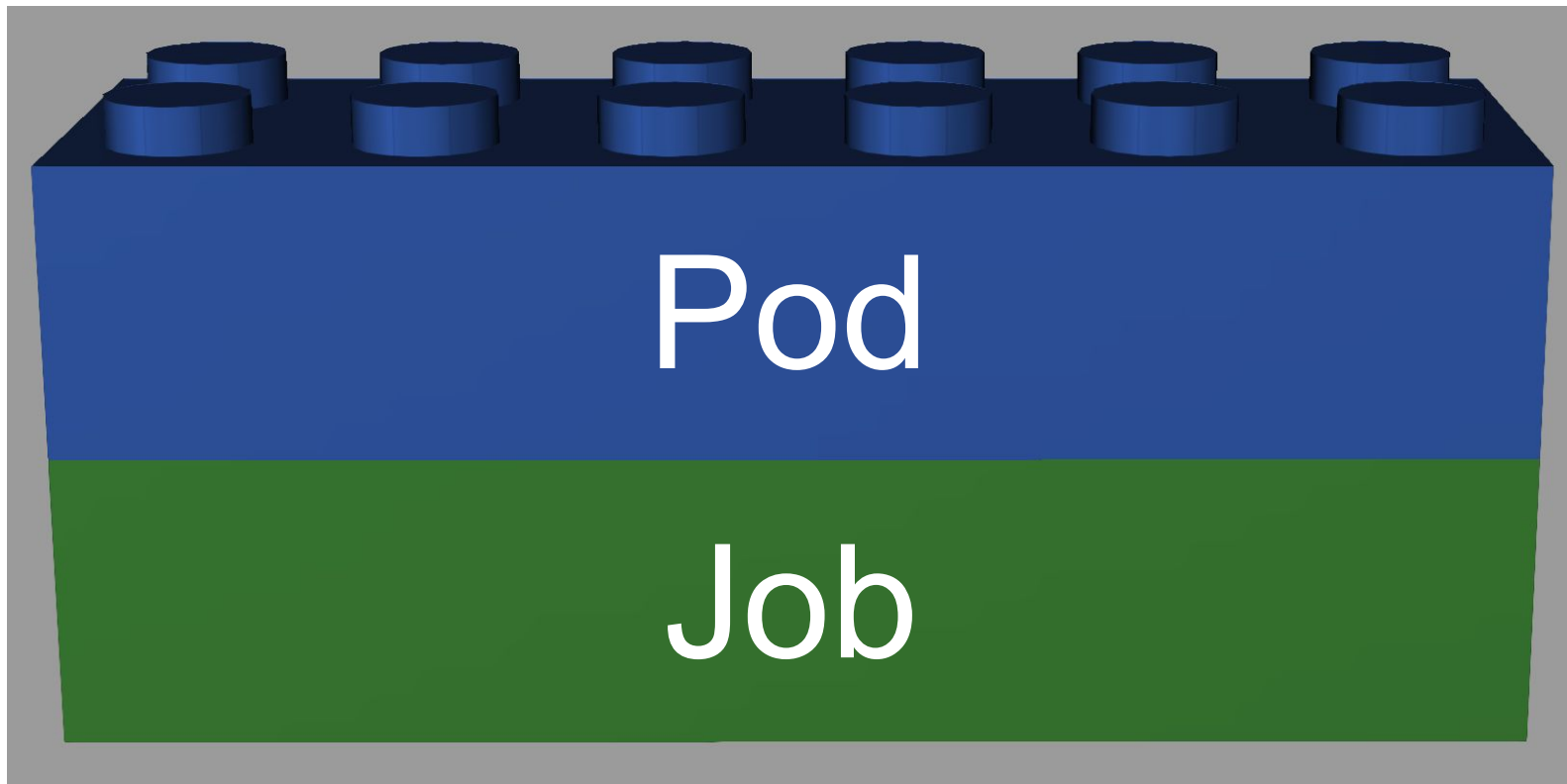


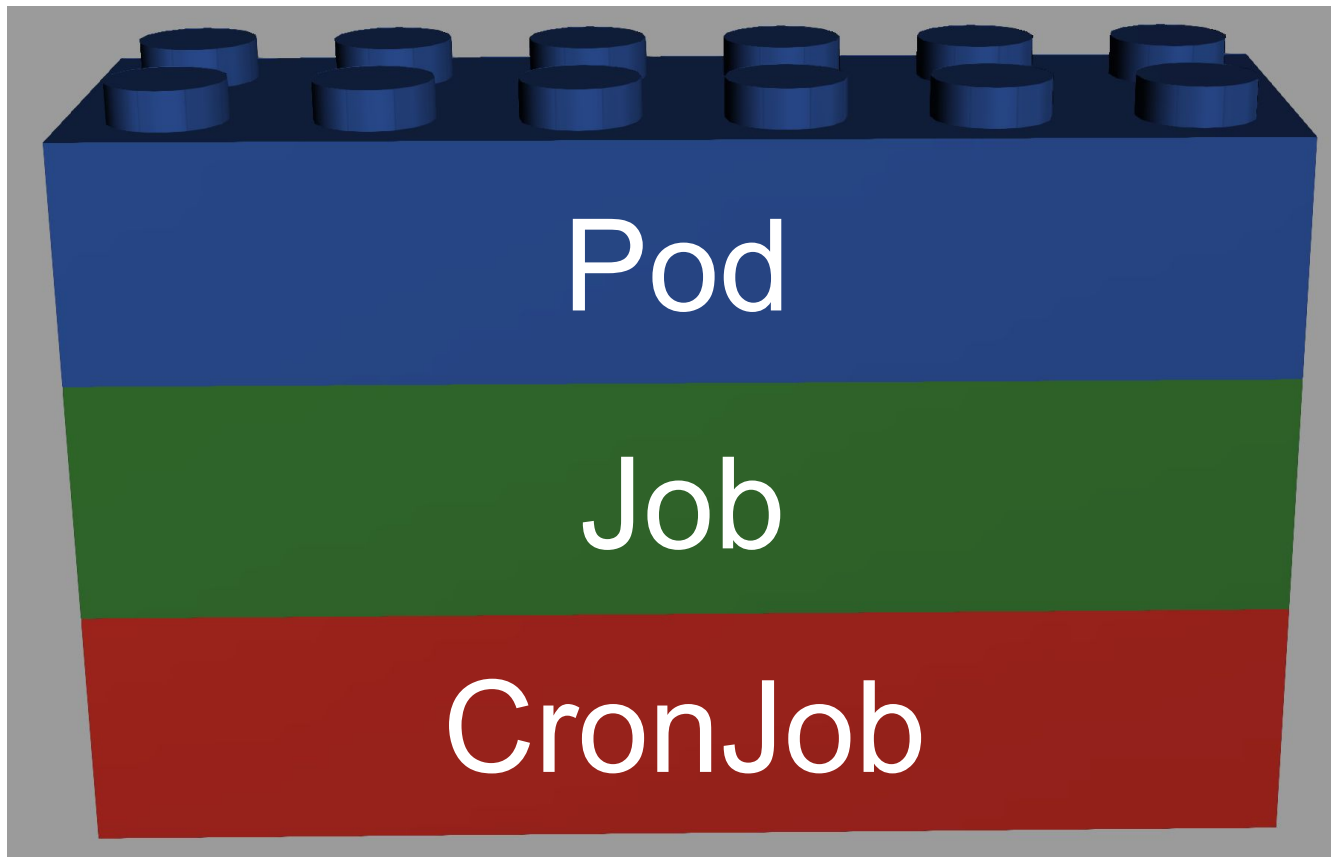


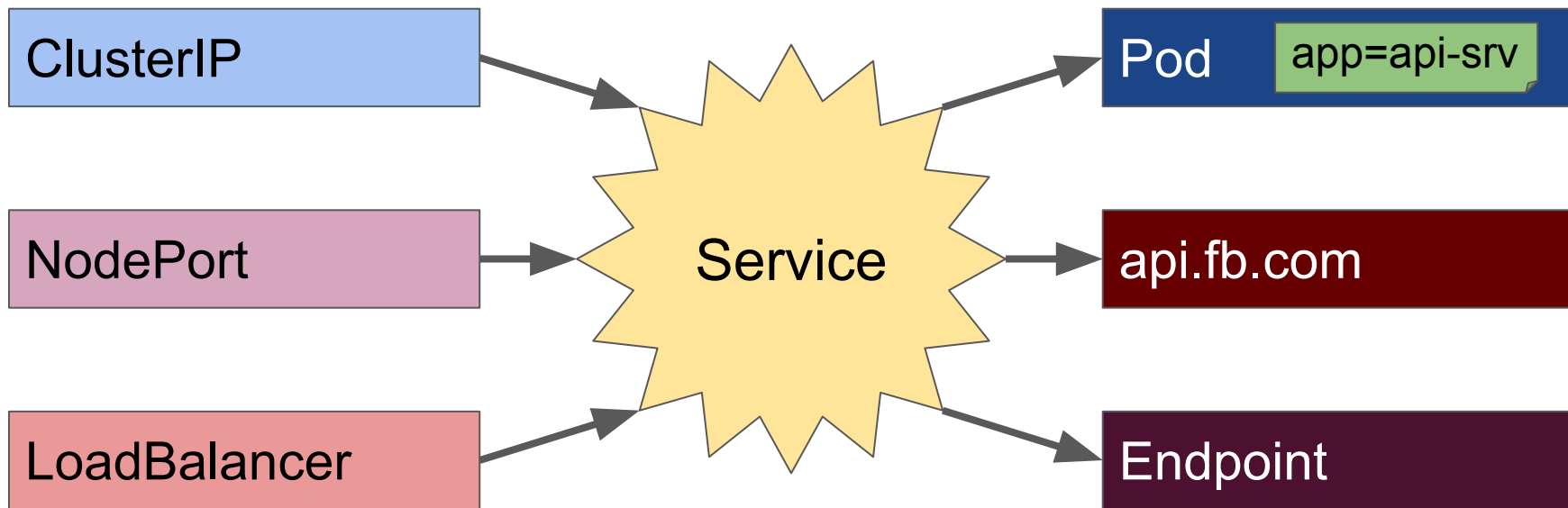






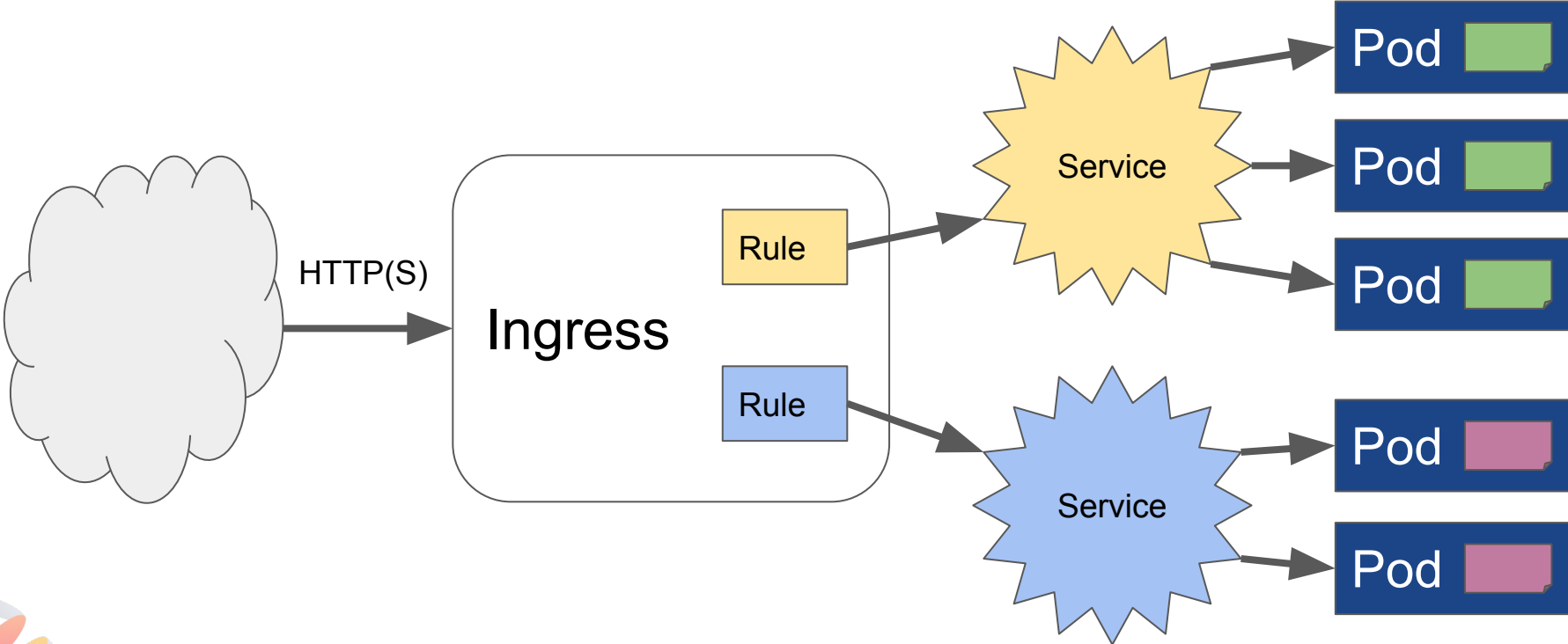




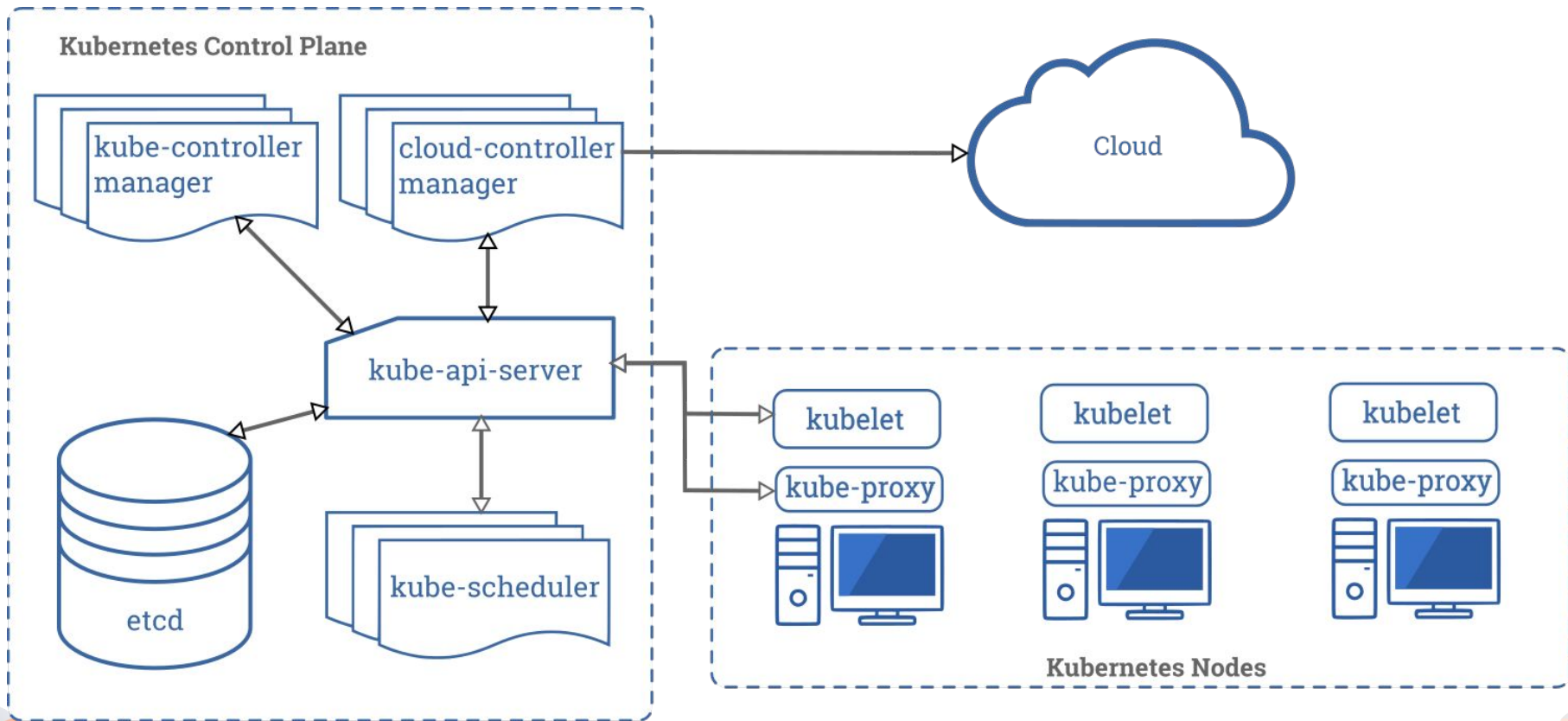


`<service-name>.<namespace>.svc.<cluster-domain.example>`

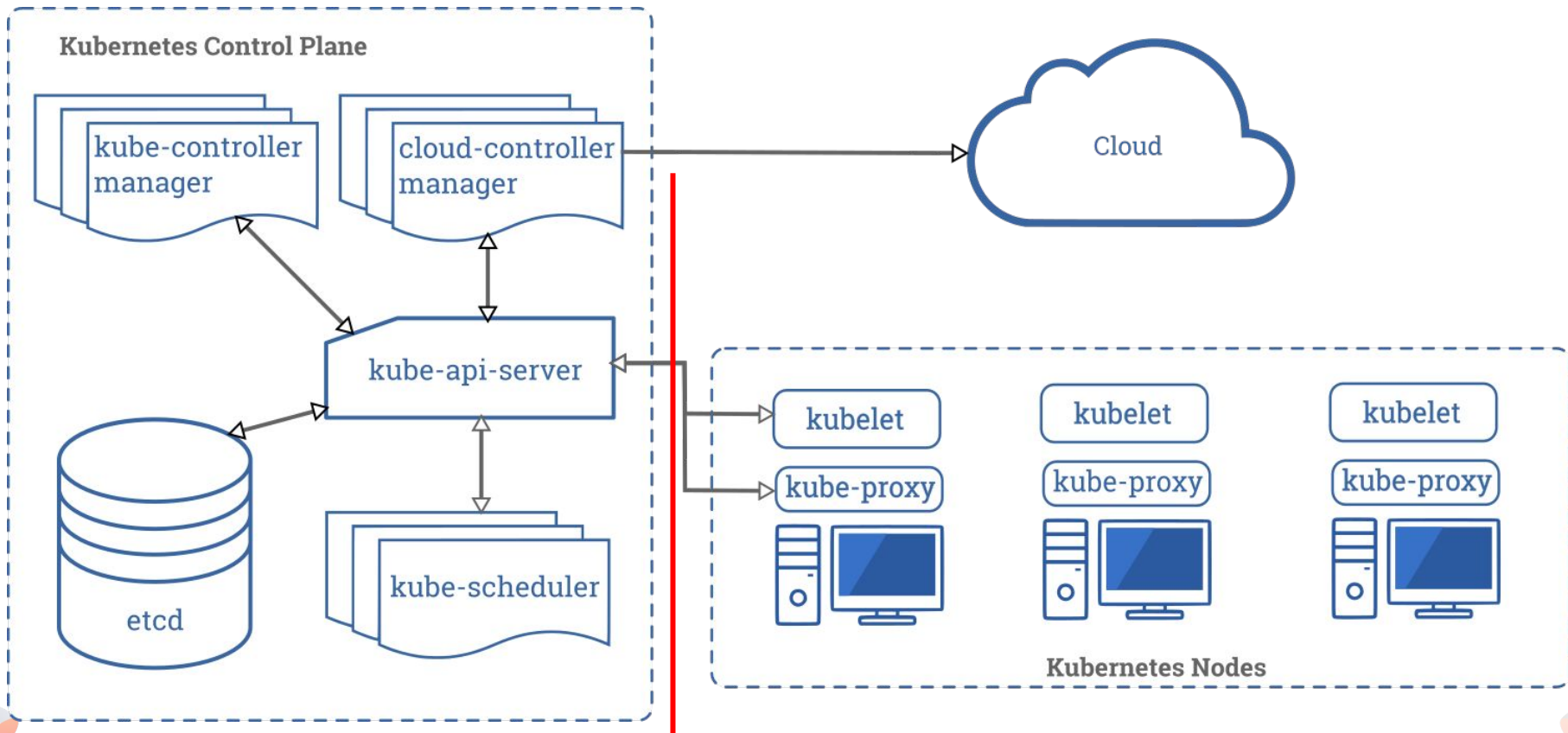




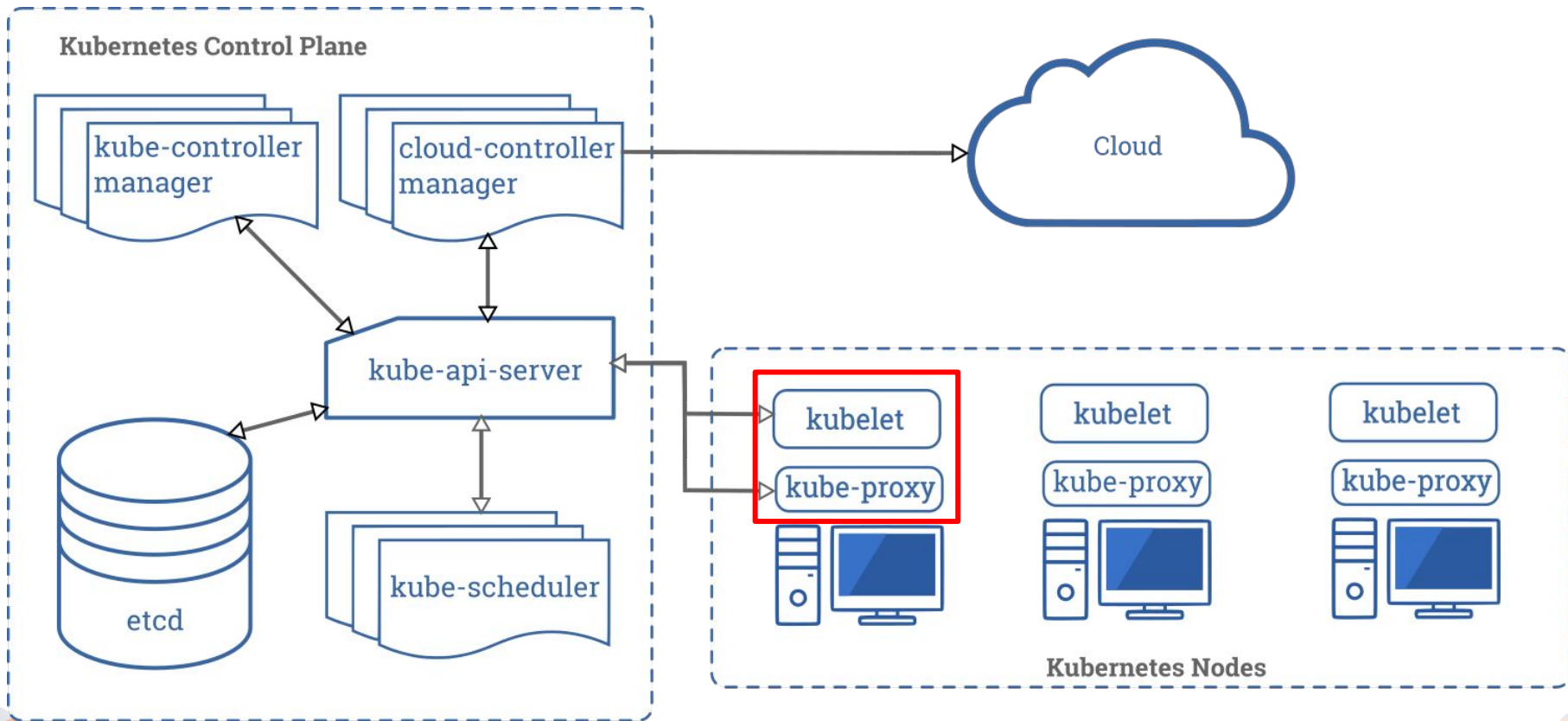
Архитектура Kubernetes



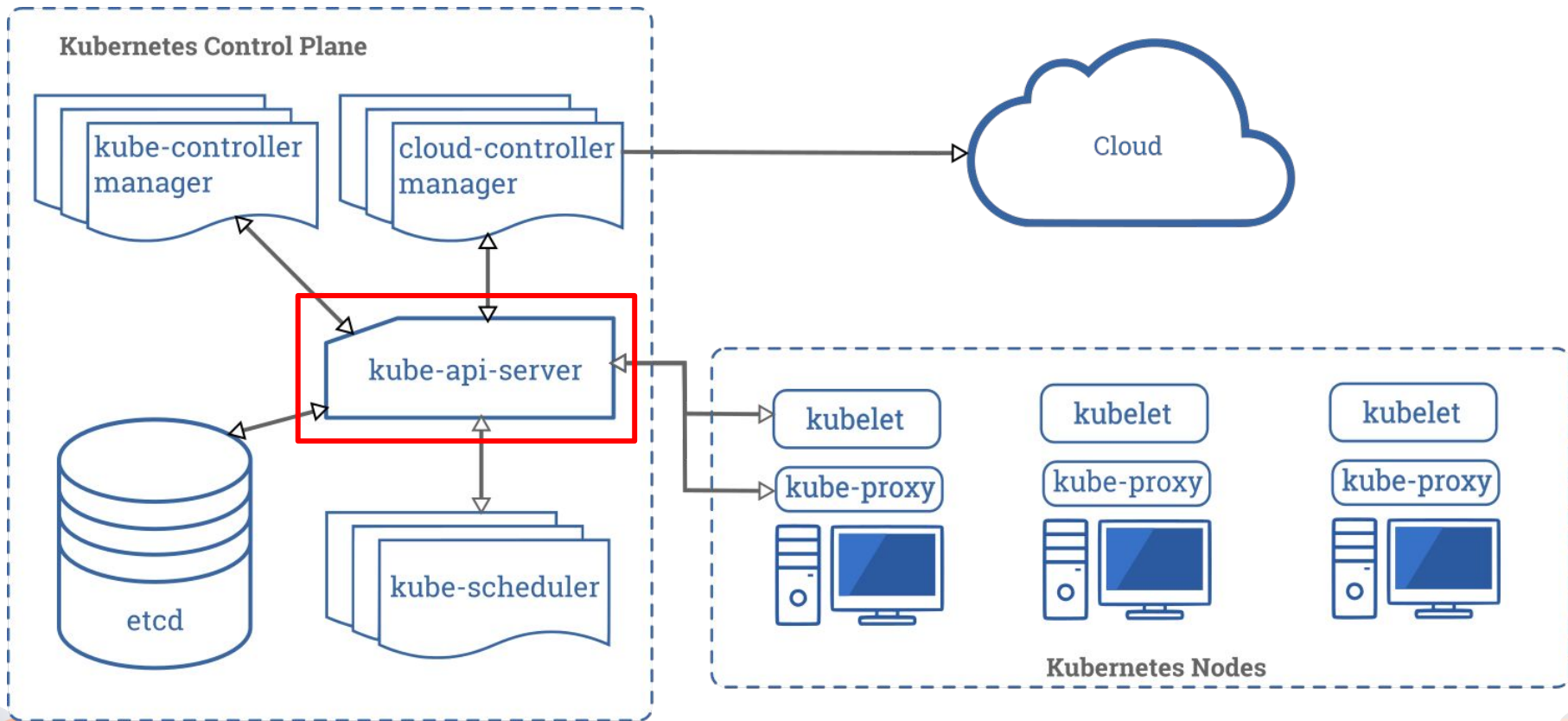
Архитектура Kubernetes



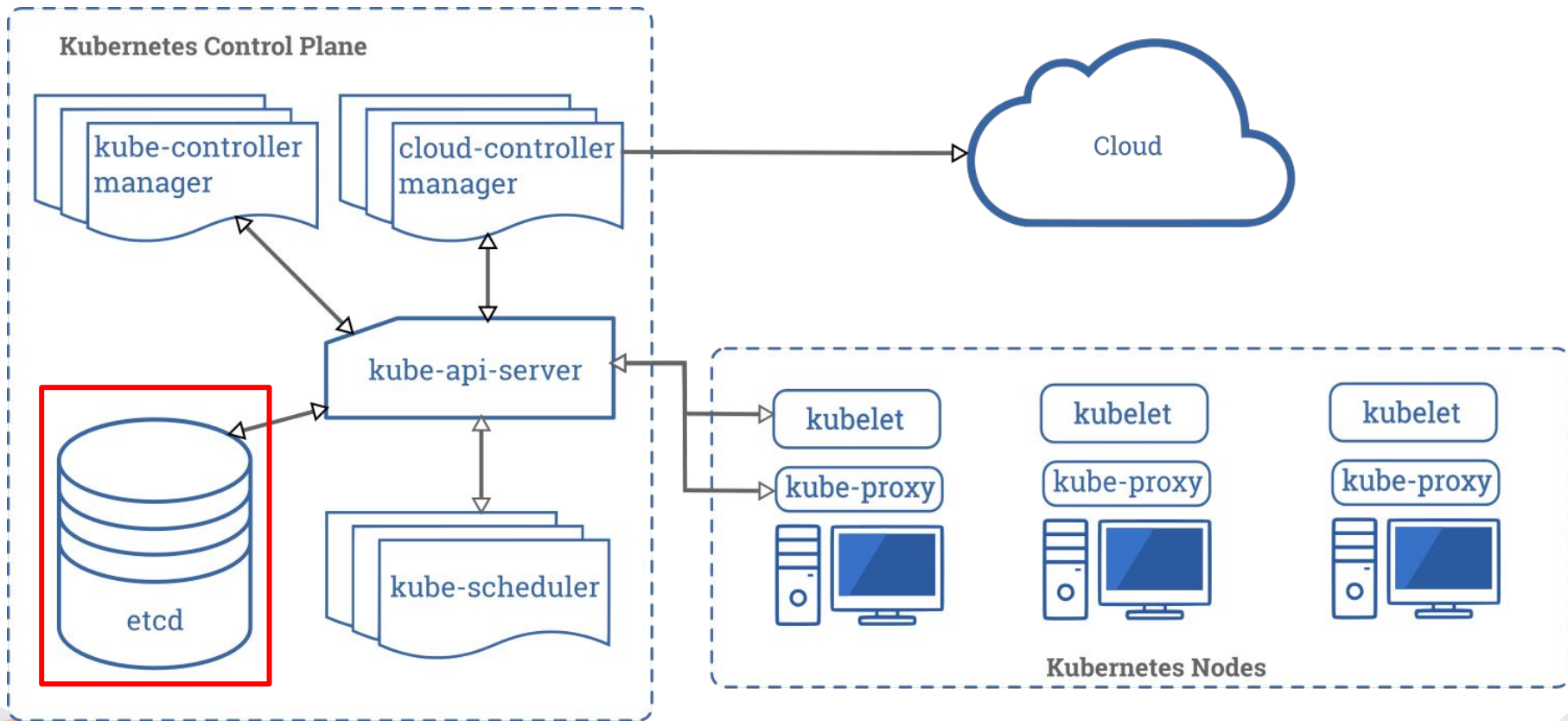
Архитектура Kubernetes



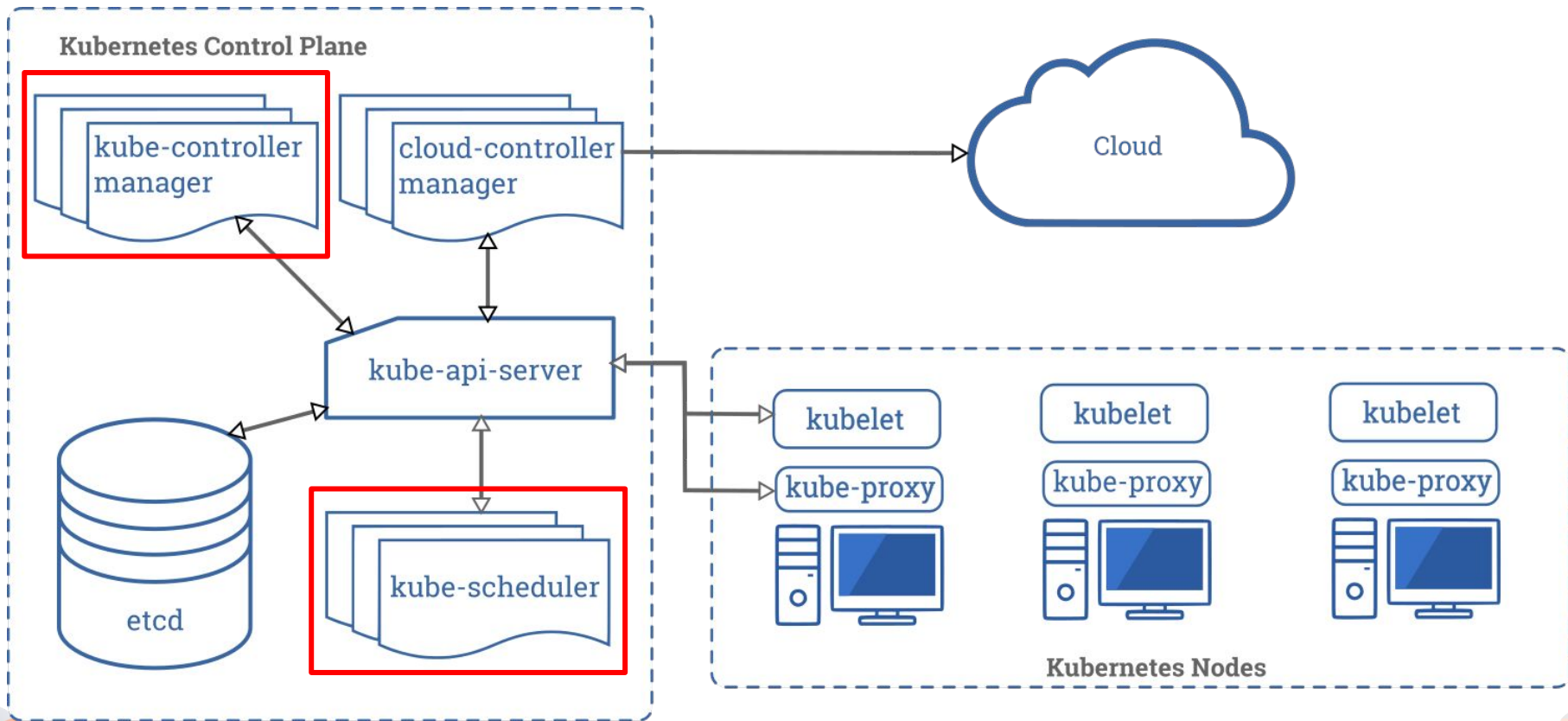
Архитектура Kubernetes



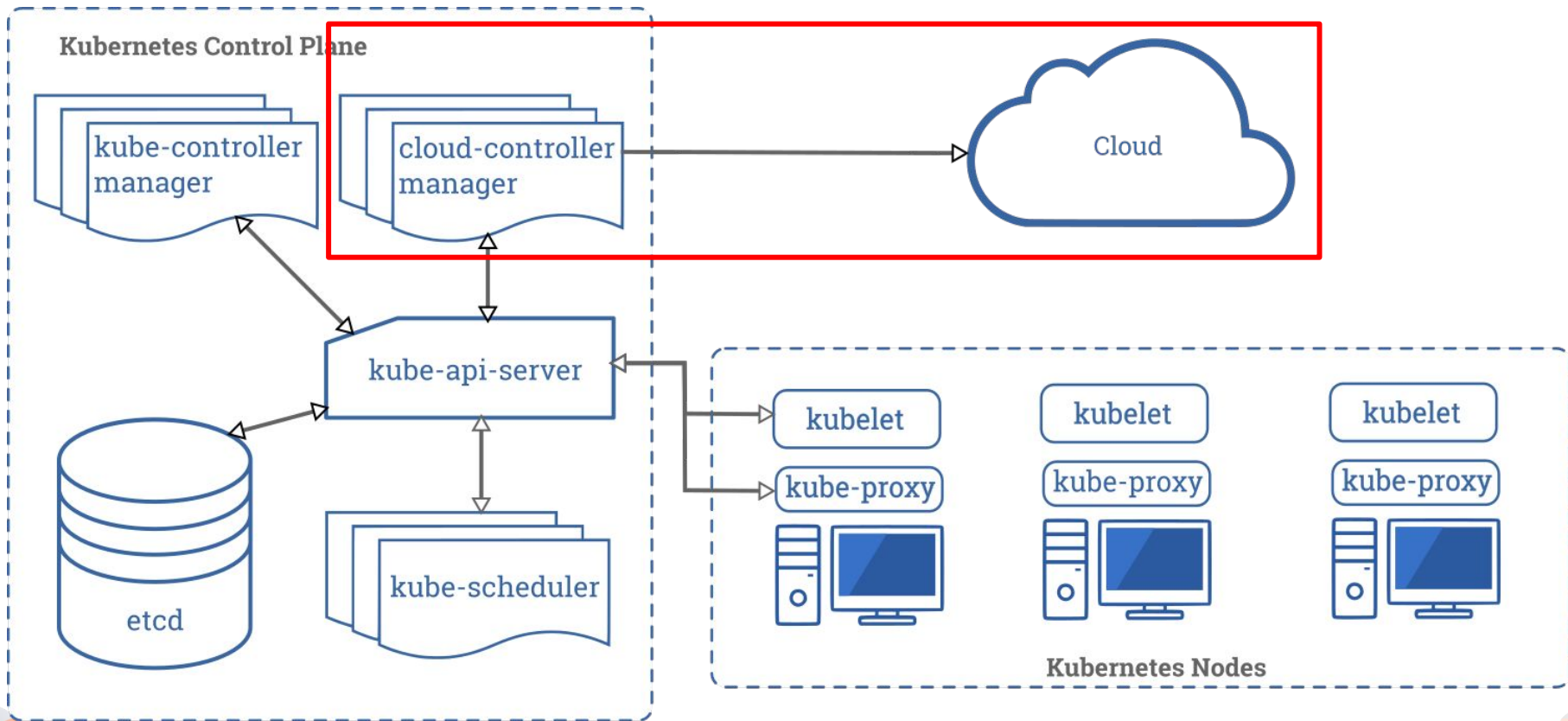
Архитектура Kubernetes



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Архитектура Kubernetes



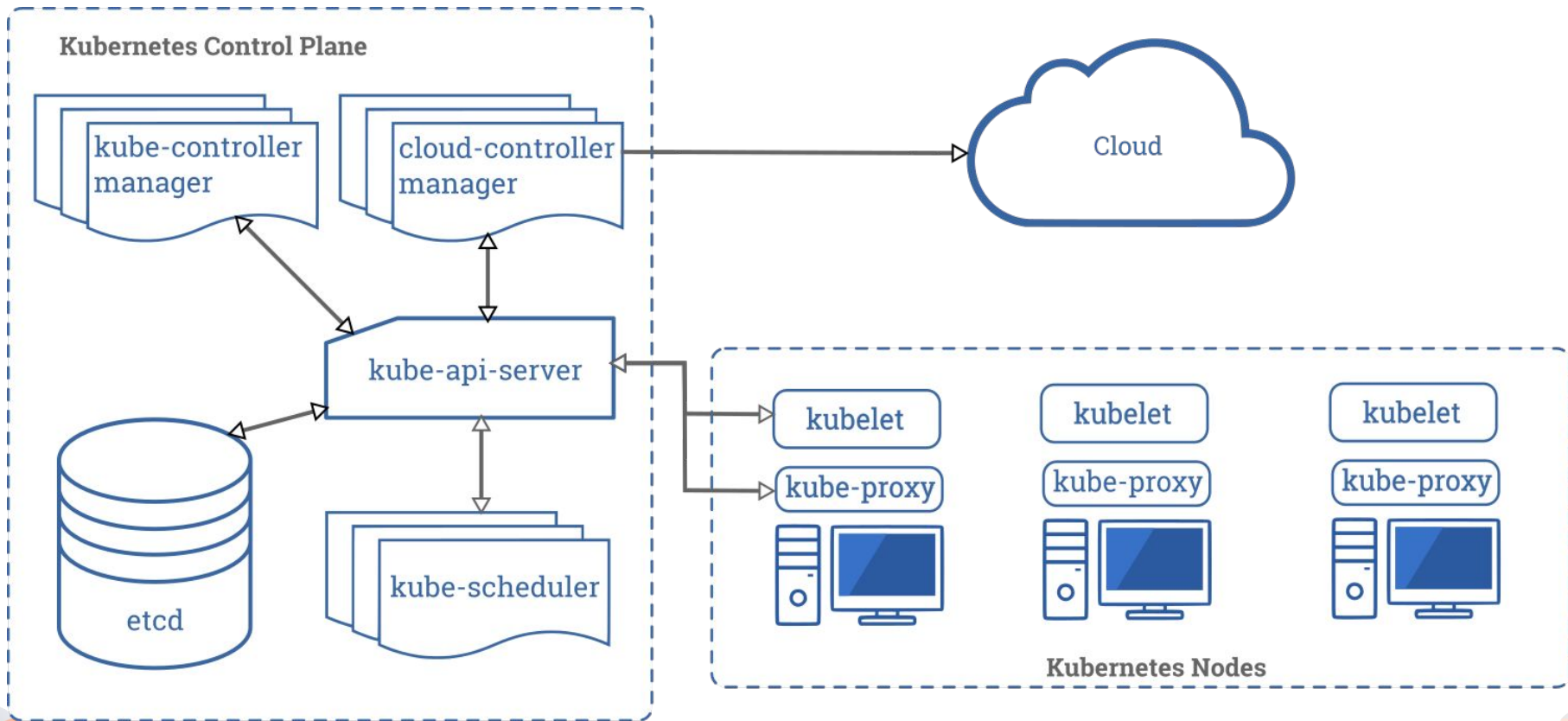
We need to go deeper

```
$ kubectl get pod --all-namespaces
```

NAMESPACE	NAME
kube-system	coredns-6955765f44-ht6mx
kube-system	coredns-6955765f44-wvzzc
kube-system	etcd-minikube
kube-system	kube-apiserver-minikube
kube-system	kube-controller-manager-minikube
kube-system	kube-proxy-twds5
kube-system	kube-scheduler-minikube
kube-system	storage-provisioner



Архитектура Kubernetes



- Extended Node Resources / Device Plugin



- Extended Node Resources / Device Plugin
- Custom Resource Definition (CRD)



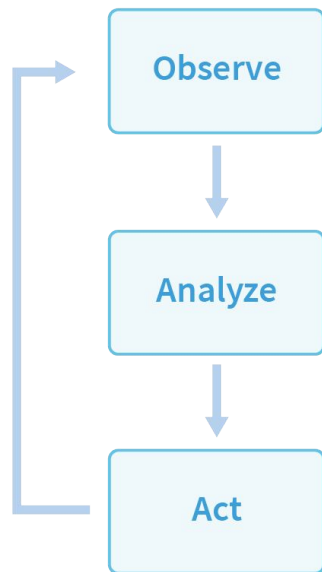
- Extended Node Resources / Device Plugin
- Custom Resource Definition (CRD)



- Extended Node Resources / Device Plugin
- Custom Resource Definition (CRD)
- Controllers



etcd Operator Logic



Cluster “A” has 2 running pods:

- name: A-000, version 3.0.9
- name: A-001, version 3.1.0

Differences from desired config:

- should be version 3.1.0
- should have 3 members

How to get to desired config:

- Recover 1 member
- Back up cluster
- Upgrade to 3.1.0

- Container Network Interface (CNI)
- Container Storage Interface (CSI)
- Container Runtime Interface (CRI)





The package manager for Kubernetes

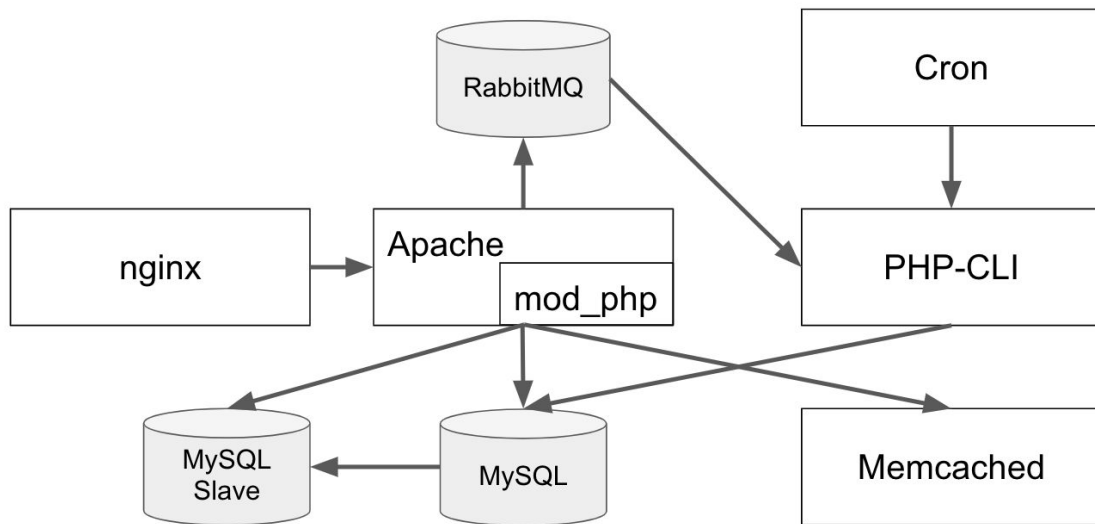
<https://helm.sh/>



```
metadata:
  {{- if .Values.server.deploymentAnnotations }}
    annotations:
      {{ toYaml .Values.server.deploymentAnnotations | indent 4 }}
  {{- end }}
  labels:
    {{- include "prometheus.server.labels" . | nindent 4 }}
  ...
  volumes:
    {{- range .Values.server.extraHostPathMounts }}
      - name: {{ .name }}
        hostPath:
          path: {{ .hostPath }}
    {{- end }}
```



1. Различие в Env или “У меня работает”
2. Разворачивание Env
3. Конфликты Env
4. Экзотический Env
5. Логи
6. Обновление кода
7. Обнаружение сервисов



Kubernetes решает проблемы

	Docker	Kubernetes
1. “У меня работает”	✓✓✓	
2. Развертывание Env	✓✓ <input checked="" type="checkbox"/>	
3. Конфликты Env	✓✓✓	
4. Экзотический Env	✓✓ <input checked="" type="checkbox"/>	
5. Логи	✓✓ <input checked="" type="checkbox"/>	
6. Обновление кода	✓ <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	
7. Обнаружение сервисов	✓ <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	

Kubernetes решает проблемы



	Docker	Kubernetes
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2. Развертывание Env	✓✓ <input checked="" type="checkbox"/>	✓✓✓
3. Конфликты Env	✓✓✓	✓✓✓
4. Экзотический Env	✓✓ <input checked="" type="checkbox"/>	✓✓✓
5. Логи	✓✓ <input checked="" type="checkbox"/>	✓✓✓
6. Обновление кода	✓ <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	✓✓✓
7. Обнаружение сервисов	✓ <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	✓✓✓

- Kubernetes доминирует в оркестрации контейнеров
- Декларативное описание предпочтительнее
- Pod - базовый блок, но не создаём его сами
- Kubernetes как интерфейс между облаком и своим железом
- Архитектура простая и расширяемая



Что было:

- Что делает Kubernetes
- Анализ конкурентов
- Виды Kubernetes
- Декларативное описание
- Поды и другие стандартные объекты
- Service, Ingress и работа в облаке
- Архитектура и расширение
- Helm Charts

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