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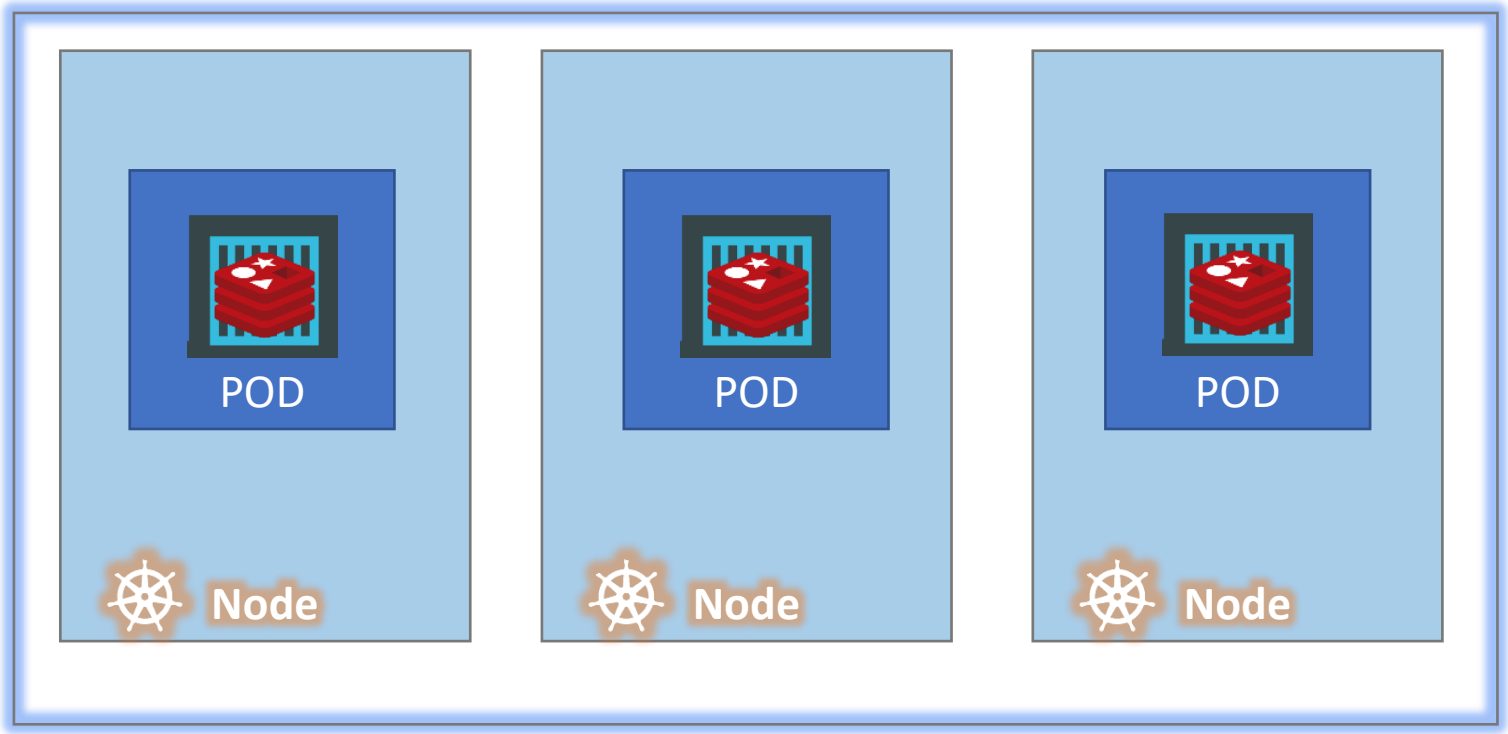
POD

Assumptions

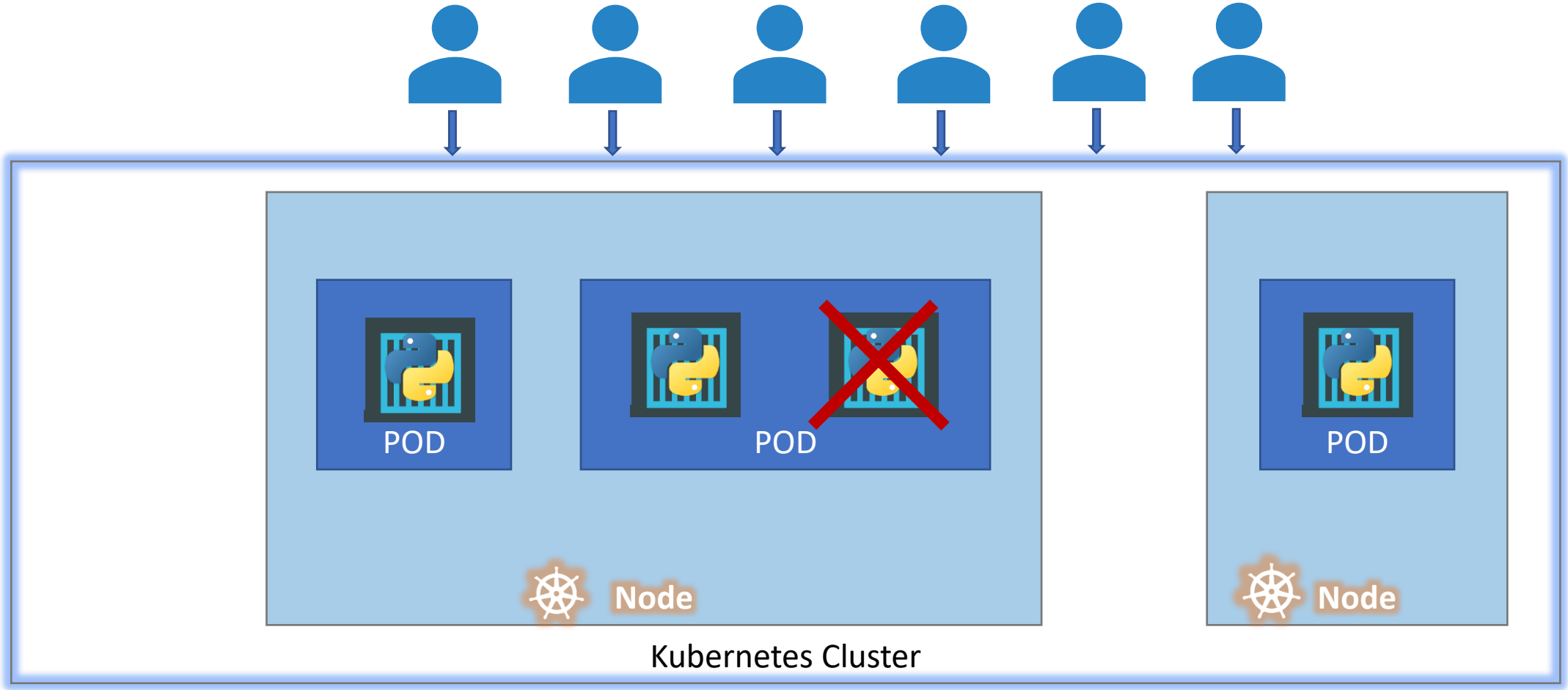
Docker Image

Kubernetes Cluster

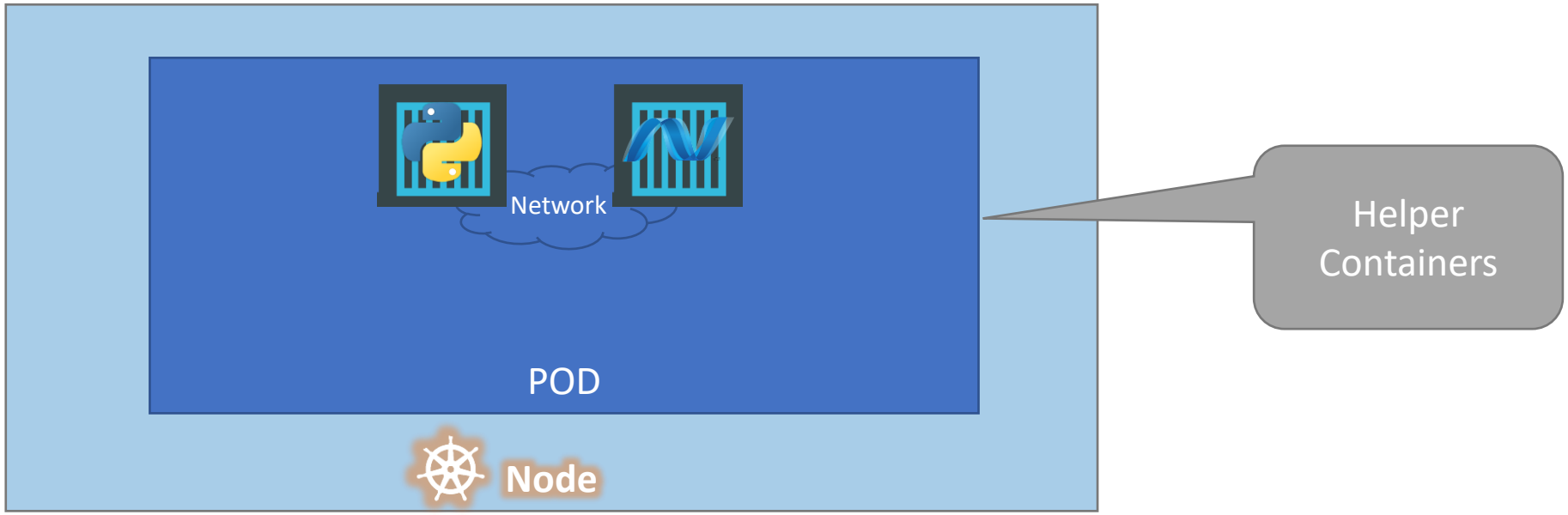
POD



POD



Multi-Container PODs



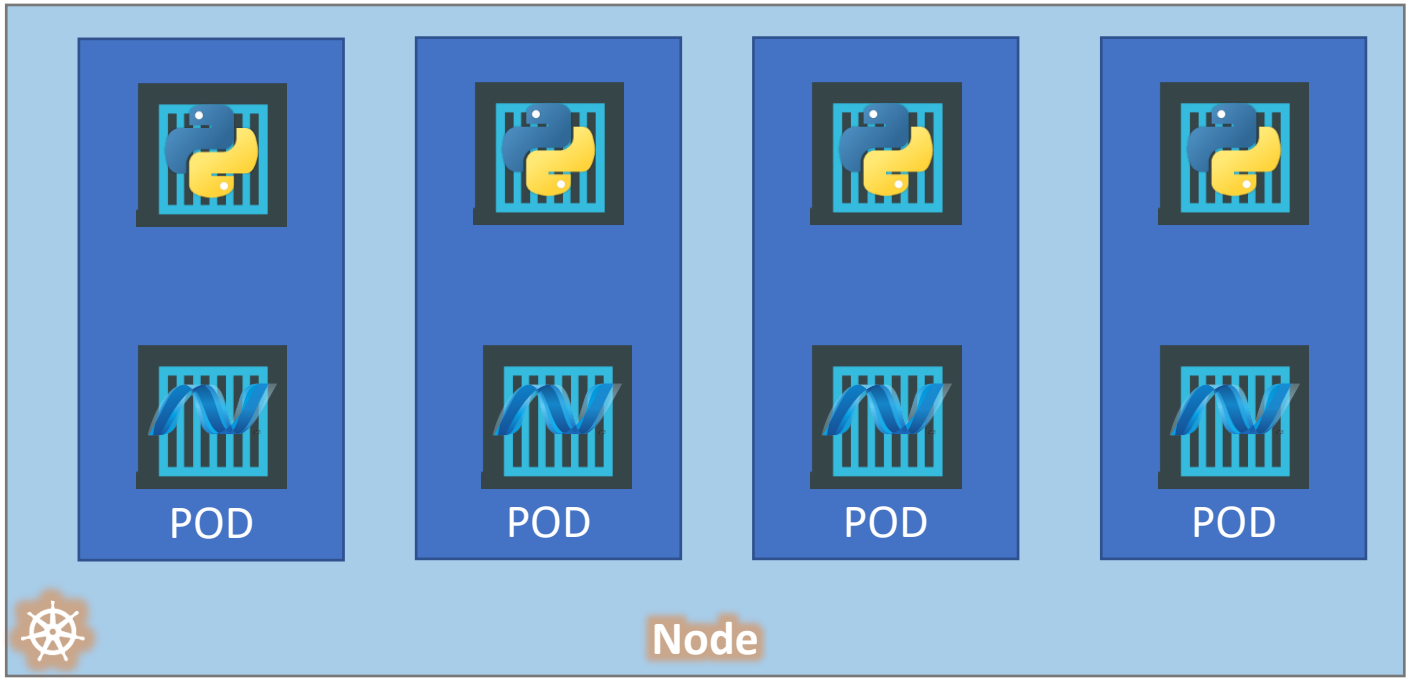
PODs Again!

```
docker run python-app
docker run python-app
docker run python-app
docker run python-app

docker run helper –link app1
docker run helper –link app2
docker run helper –link app3

docker run helper –link app4
```

App	Helper	Volume
Python1	App1	Vol1
Python2	App2	Vol2



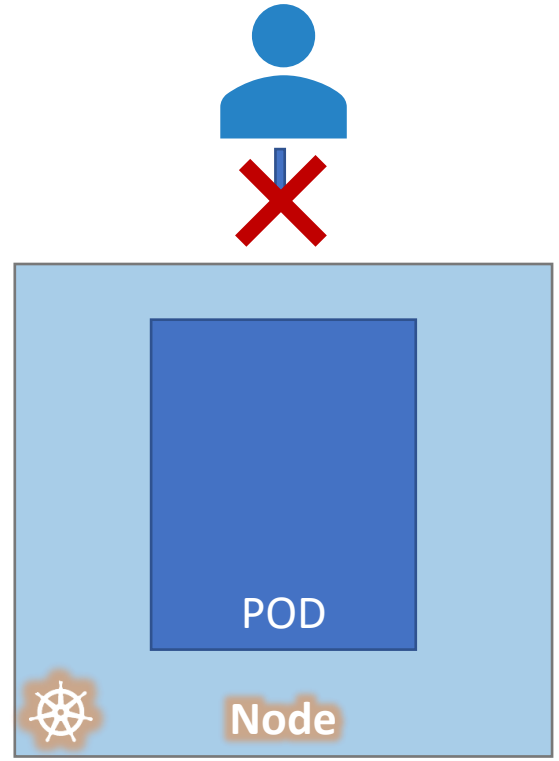
Note: I am avoiding networking and load balancing details to keep explanation simple.

kubectl

- `kubectl run nginx --image nginx`

```
kubectl get pods
NAME    READY   STATUS              RESTARTS   AGE
nginx   0/1     ContainerCreating   0          6s
```

```
NAME    READY   STATUS    RESTARTS   AGE
nginx   1/1     Running   0          34s
```

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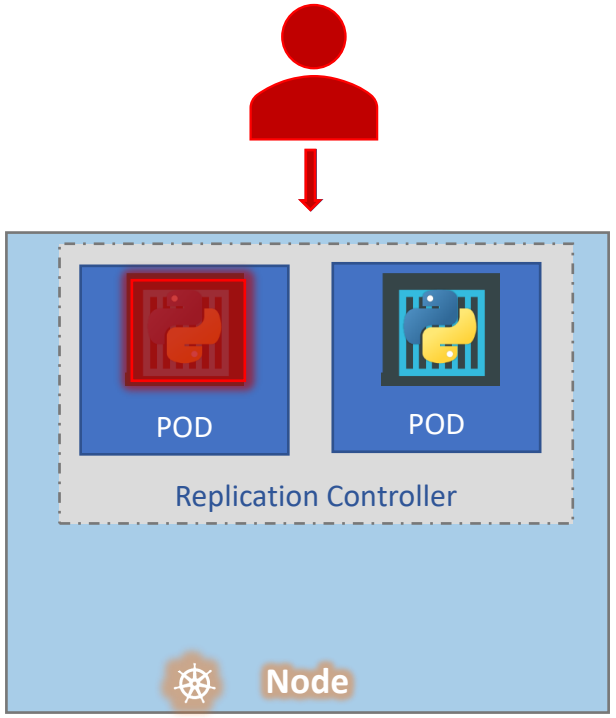
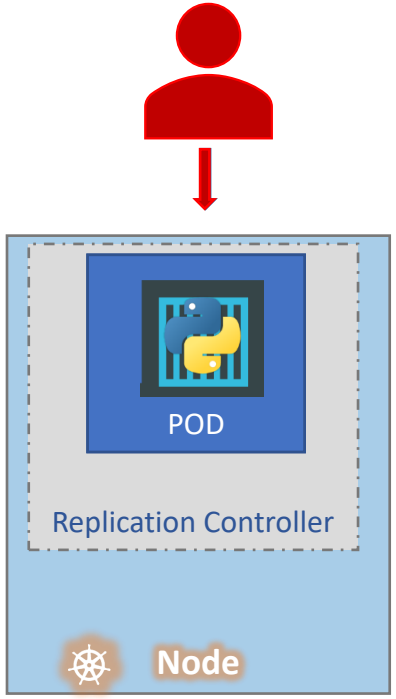
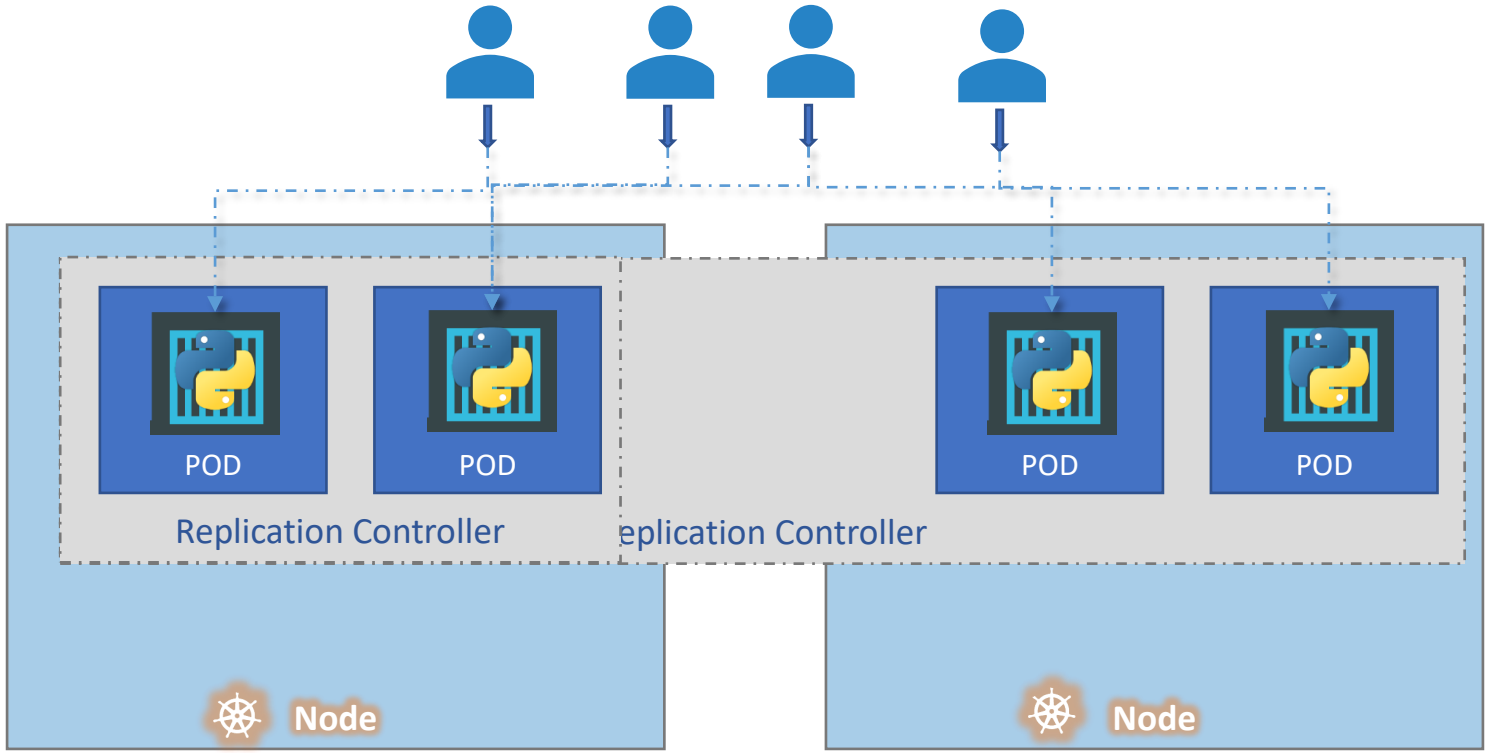
Replication Controller

High Availability





Load Balancing & Scaling



- Replication Controller

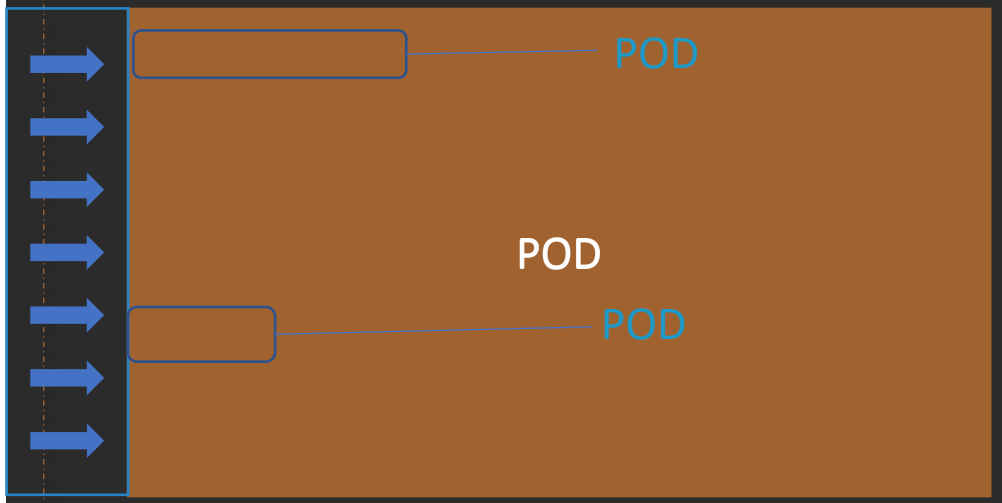
Replica Set

rc-definition.yml

```yaml
apiVersion: v1
kind: ReplicationController
metadata:
  name: myapp-rc
  labels:
      app: myapp
      type: front-end
spec:
  template:
    replicas: 3
```

Replication Controller

Replication Controller



pod-definition.yml

```yaml
apiVersion: v1
kind: Pod

metadata:
  name: myapp-pod
  labels:
     app: myapp
     type: front-end
spec:
  containers:
  - name: nginx-container
    image: nginx
```

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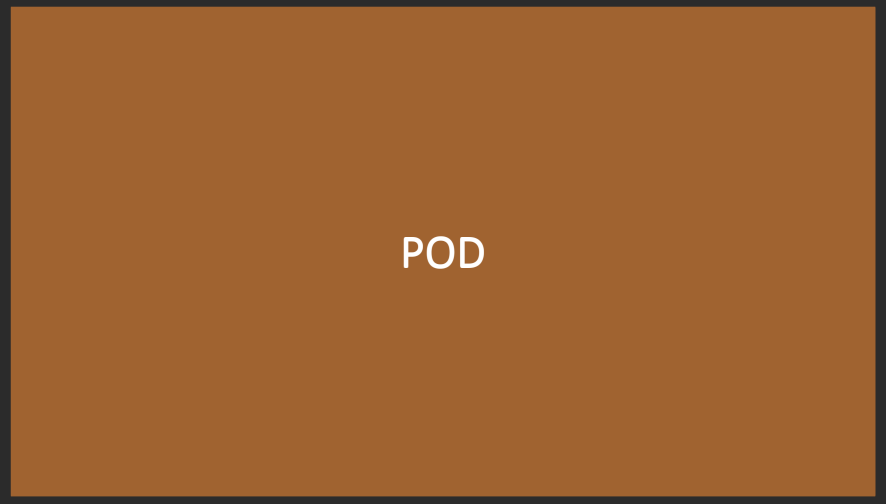
```
> kubectl create -f rc-definition.yml
replicationcontroller "myapp-rc" created
```

```
> kubectl get replicationcontroller
NAME       DESIRED   CURRENT   READY     AGE
myapp-rc   3         3         3         19s
```

```
> kubectl get pods
NAME             READY     STATUS    RESTARTS   AGE
myapp-rc-4lvk9   1/1       Running   0          20s
myapp-rc-mc2mf   1/1       Running   0          20s
myapp-rc-px9pz   1/1       Running   0          20s
```

replicaset-definition.yml

```yaml
apiVersion: apps/v1
kind: ReplicaSet
metadata:
  name: myapp-repl
  labels:
      app: myapp
      type: front-end
spec:
  template:
      
  replicas: 3
  selector:
     matchLabels:
        type: front-end
```



```
error: unable to recognize "replicaset-
definition.yml": no matches for /, Kind=ReplicaSet
```

pod-definition.yml

```yaml
apiVersion: v1
kind: Pod
 labels:
    app: myapp
    type: front-end
spec:
  containers:
  - name: nginx-container
    image: nginx
```

- > kubectl create –f replicaset-definition.yml

```
replicaset "myapp-replicaset" created
```

> kubectl get replicaset

```
NAME            DESIRED   CURRENT    READY       AGE
myapp-replicaset   3         3          3         19s
```

> kubectl get pods

```
NAME                    READY      STATUS    RESTARTS   AGE
myapp-replicaset-9ddl9   1/1       Running   0          45s
myapp-replicaset-9jtpx   1/1       Running   0          45s
myapp-replicaset-hq84m   1/1       Running   0          45s
```

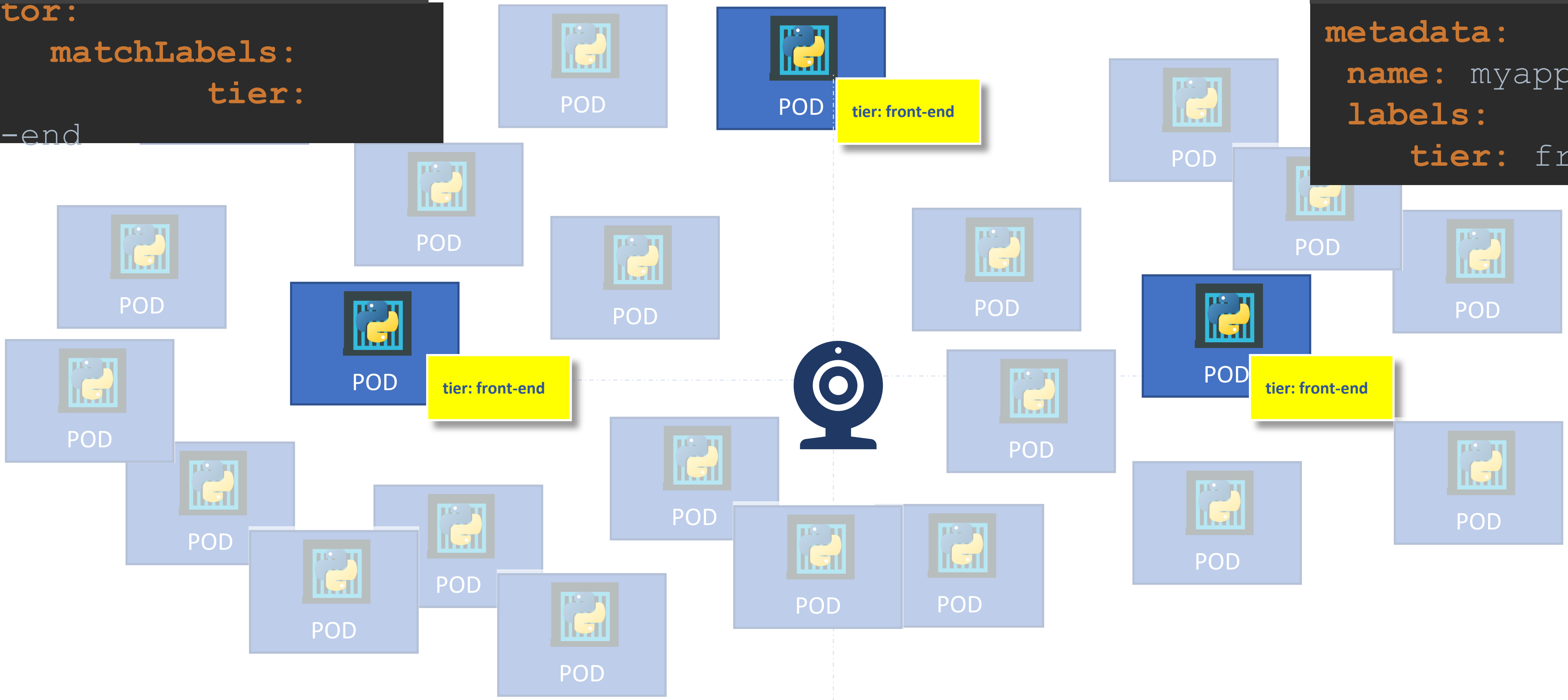
Labels and Selectors

replicaset-definition.yml

```
selector:
    matchLabels:
        tier: front-end
```

pod-definition.yml

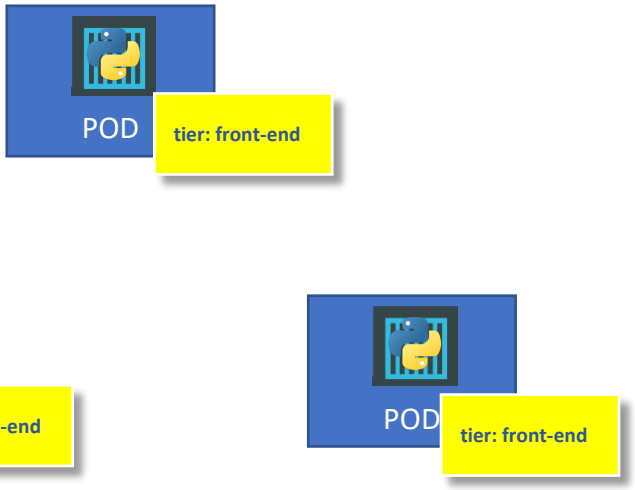
```
metadata:
  name: myapp-pod
  labels:
    tier: front-end
```



replicaset-definition.yml

```yaml
apiVersion: apps/v1
kind: ReplicaSet
metadata:
  name: myapp-replicaset
  labels:
      app: myapp
      type: front-end
spec:
  template:
    metadata:
      name: myapp-pod
      labels:
        app: myapp
        type: front-end
    spec:
      containers:
      - name: nginx-container
        image: nginx
  replicas: 3
  selector:
    matchLabels:
      type: front-end
```

Template



Scale

```
> kubectl replace -f replicaset-definition.yml
```

```
> kubectl scale --replicas=6 -f replicaset-definition.yml
```

```
> kubectl scale --replicas=6 replicaset myapp-replicaset
```

TYPE NAME

replicaset-definition.yml

```yaml
apiVersion: apps/v1
kind: ReplicaSet
metadata:
  name: myapp-replicaset
  labels:
      app: myapp
      type: front-end
spec:
  template:
    metadata:
      name: myapp-pod
      labels:
        app: myapp
        type: front-end
    spec:
      containers:
      - name: nginx-container
        image: nginx
  replicas: 6
  selector:
    matchLabels:
      type: front-end
```

commands

```
> kubectl create –f replicaset-definition.yml
```

```
> kubectl get replicaset
```

```
> kubectl delete replicaset myapp-replicaset
```

*Also deletes all underlying PODs

```
> kubectl replace -f replicaset-definition.yml
```

```
> kubectl scale –replicas=6 -f replicaset-definition.yml
```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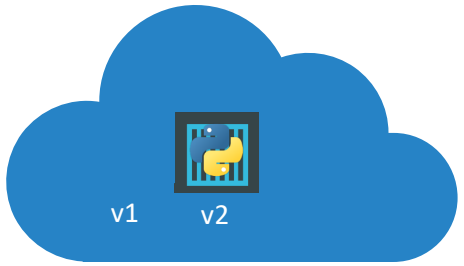
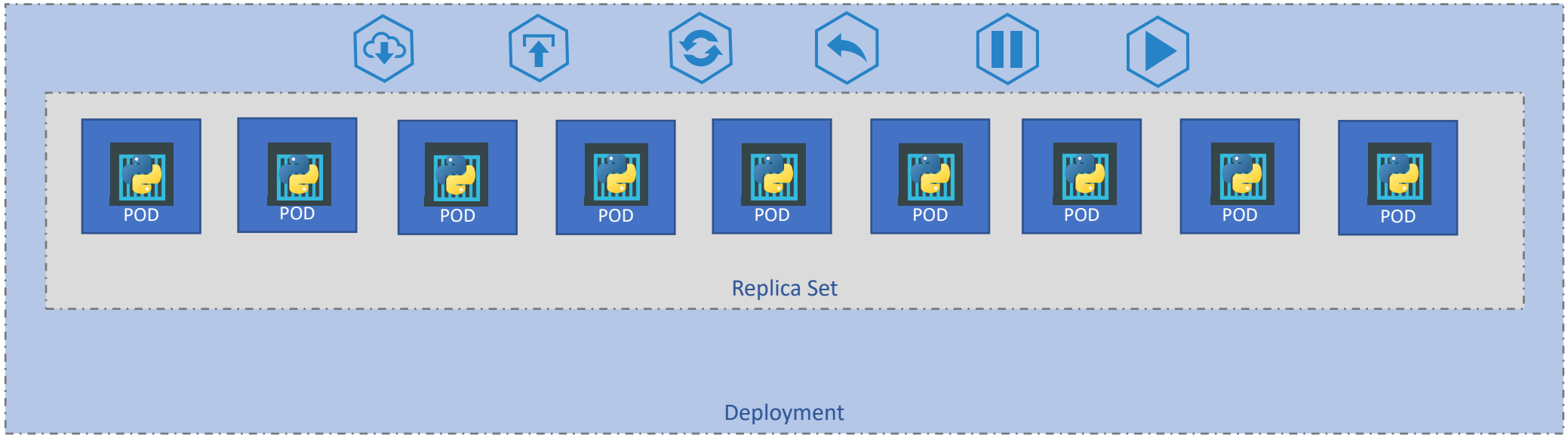
Deployment

Deployment


v1
v2


POD
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POD
POD
POD
POD
POD
Replica Set
Deployment

Definition

```
> kubectl create -f deployment-definition.yml
deployment "myapp-deployment" created
```

```
> kubectl get deployments
NAME              DESIRED   CURRENT   UP-TO-DATE   AVAILABLE   AGE
myapp-deployment  3         3         3            3           21s
```

```
> kubectl get replicaset
NAME                        DESIRED   CURRENT   READY     AGE
myapp-deployment-6795844b58 3         3         3         2m
```

```
> kubectl get pods
NAME                              READY     STATUS    RESTARTS   AGE
myapp-deployment-6795844b58-5rbjl 1/1       Running   0          2m
myapp-deployment-6795844b58-h4w55 1/1       Running   0          2m
myapp-deployment-6795844b58-lfjhv 1/1       Running   0          2m
```

deployment-definition.yml

```yaml
apiVersion: apps/v1
kind: ReplicaSet
metadata:
  name: myapp-deployment
  labels:
      app: myapp
      type: front-end
spec:
  template:
    metadata:
      name: myapp-pod
      labels:
         app: myapp
         type: front-end
    spec:
      containers:
      - name: nginx-container
        image: nginx

  replicas: 3
  selector:
    matchLabels:
       type: front-end
```

commands

```
> kubectl get all
NAME                     DESIRED   CURRENT   UP-TO-DATE   AVAILABLE   AGE
deploy/myapp-deployment   3         3         3            3           9h

NAME                               DESIRED   CURRENT   READY     AGE
rs/myapp-deployment-6795844b58   3         3         3         9h

NAME                                    READY     STATUS    RESTARTS   AGE
po/myapp-deployment-6795844b58-5rbjl   1/1       Running   0          9h
po/myapp-deployment-6795844b58-h4w55   1/1       Running   0          9h
po/myapp-deployment-6795844b58-lfjhv   1/1       Running   0          9h
```


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Deployment

Updates and Rollback

Rollout and Versioning

Revision 1

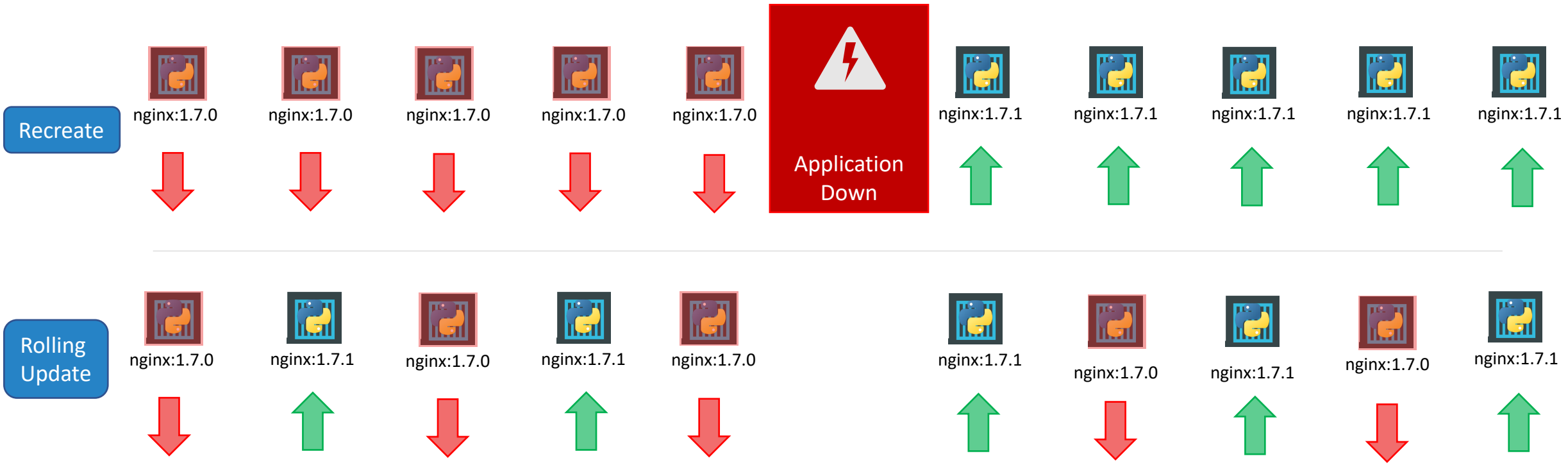
Revision 2

Rollout Command

```
> kubectl rollout status deployment/myapp-deployment
Waiting for rollout to finish: 0 of 10 updated replicas are available...
Waiting for rollout to finish: 1 of 10 updated replicas are available...
Waiting for rollout to finish: 2 of 10 updated replicas are available...
Waiting for rollout to finish: 3 of 10 updated replicas are available...
Waiting for rollout to finish: 4 of 10 updated replicas are available...
Waiting for rollout to finish: 5 of 10 updated replicas are available...
Waiting for rollout to finish: 6 of 10 updated replicas are available...
Waiting for rollout to finish: 7 of 10 updated replicas are available...
Waiting for rollout to finish: 8 of 10 updated replicas are available...
Waiting for rollout to finish: 9 of 10 updated replicas are available...
deployment "myapp-deployment" successfully rolled out
```

```
> kubectl rollout history deployment/myapp-deployment
deployments "myapp-deployment"
REVISION  CHANGE-CAUSE
1         <none>
2         kubectl apply --filename=deployment-definition.yml --record=true
```

Deployment Strategy



Kubectl apply

```
> kubectl apply -f deployment-definition.yml
```

```
deployment "myapp-deployment" configured
```

```
> kubectl set image deployment/myapp-deployment \
                  nginx=nginx:1.9.1
```

```
deployment "myapp-deployment" image is updated
```

deployment-definition.yml

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: myapp-deployment
  labels:
      app: myapp
      type: front-end
spec:
  template:
    metadata:
      name: myapp-pod
      labels:
         app: myapp
         type: front-end
    spec:
      containers:
      - name: nginx-container
        image: nginx:1.7.1
  replicas: 3
  selector:
    matchLabels:
       type: front-end
```

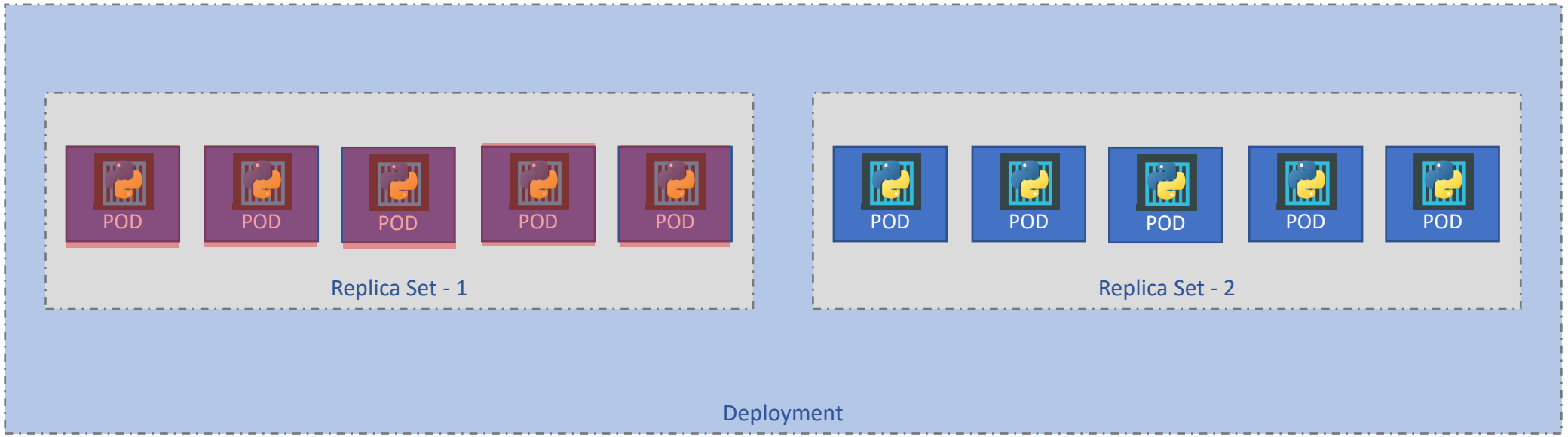
```
C:\Kubernetes>kubectl describe deployment myapp-deployment
Name:                   myapp-deployment
Namespace:              default
CreationTimestamp:      Sat, 03 Mar 2018 17:01:55 +0800
Labels:                 app=myapp
                        type=front-end
Annotations:            deployment.kubernetes.io/revision=2
                        kubectl.kubernetes.io/last-applied-configuration={"apiVersion":"apps/v1","kind":"Deployment","me
s\\Google...
                        kubernetes.io/change-cause=kubectl apply --filename=d:\Mumshad Files\Google Drive\Udemy\Kubernet
Selector:               type=front-end
Replicas:               5 desired | 5 updated | 5 total | 5 available | 0 unavailable
StrategyType:           Recreate
MinReadySeconds:        0
Pod Template:
  Labels:  app=myapp
           type=front-end
  Containers:
   nginx-container:
    Image:        nginx:1.7.1
    Port:         <none>
    Environment:  <none>
    Mounts:       <none>
  Volumes:        <none>
Conditions:
  Type           Status  Reason
  ----           ------  ------
  Available      True    MinimumReplicasAvailable
  Progressing    True    NewReplicaSetAvailable
OldReplicaSets:  <none>
NewReplicaSet:   myapp-deployment-54c7d6ccc (5/5 replicas created)
Events:
  Type    Reason             Age   From                   Message
  ----    ------             ----  ----                   -------
  Normal  ScalingReplicaSet  11m   deployment-controller  Scaled up replica set myapp-deployment-6795844b58 to 5
  Normal  ScalingReplicaSet  1m    deployment-controller  Scaled down replica set myapp-deployment-6795844b58 to 0
  Normal  ScalingReplicaSet  56s   deployment-controller  Scaled up replica set myapp-deployment-54c7d6ccc to 5
```

Recreate

```
C:\Kubernetes>kubectl describe deployment myapp-deployment
Name:                   myapp-deployment
Namespace:              default
CreationTimestamp:      Sat, 03 Mar 2018 17:16:53 +0800
Labels:                 app=myapp
                        type=front-end
Annotations:            deployment.kubernetes.io/revision=2
                        kubectl.kubernetes.io/last-applied-configuration={"apiVersion":"apps/v1","kind":"Deployment","metadata
Files\\Google...
                        kubernetes.io/change-cause=kubectl apply --filename=d:\Mumshad Files\Google Drive\Udemy\Kubernetes\De
Selector:               type=front-end
Replicas:               5 desired | 5 updated | 6 total | 4 available | 2 unavailable
StrategyType:           RollingUpdate
MinReadySeconds:        0
RollingUpdateStrategy:  25% max unavailable, 25% max surge
Pod Template:
  Labels:  app=myapp
           type=front-end
  Containers:
   nginx-container:
    Image:        nginx
    Port:         <none>
    Environment:  <none>
    Mounts:       <none>
  Volumes:        <none>
Conditions:
  Type           Status  Reason
  ----           ------  ------
  Available      True    MinimumReplicasAvailable
  Progressing    True    ReplicaSetUpdated
OldReplicaSets:  myapp-deployment-67c749c58c (1/1 replicas created)
NewReplicaSet:   myapp-deployment-7d57dbdb8d (5/5 replicas created)
Events:
  Type    Reason             Age   From                   Message
  ----    ------             ----  ----                   -------
  Normal  ScalingReplicaSet  1m    deployment-controller  Scaled up replica set myapp-deployment-67c749c58c to 5
  Normal  ScalingReplicaSet  1s    deployment-controller  Scaled up replica set myapp-deployment-7d57dbdb8d to 2
  Normal  ScalingReplicaSet  1s    deployment-controller  Scaled down replica set myapp-deployment-67c749c58c to 4
  Normal  ScalingReplicaSet  1s    deployment-controller  Scaled up replica set myapp-deployment-7d57dbdb8d to 3
  Normal  ScalingReplicaSet  0s    deployment-controller  Scaled down replica set myapp-deployment-67c749c58c to 3
  Normal  ScalingReplicaSet  0s    deployment-controller  Scaled up replica set myapp-deployment-7d57dbdb8d to 4
  Normal  ScalingReplicaSet  0s    deployment-controller  Scaled down replica set myapp-deployment-67c749c58c to 2
  Normal  ScalingReplicaSet  0s    deployment-controller  Scaled up replica set myapp-deployment-7d57dbdb8d to 5
  Normal  ScalingReplicaSet  0s    deployment-controller  Scaled down replica set myapp-deployment-67c749c58c to 1
```

RollingUpdate

Upgrades

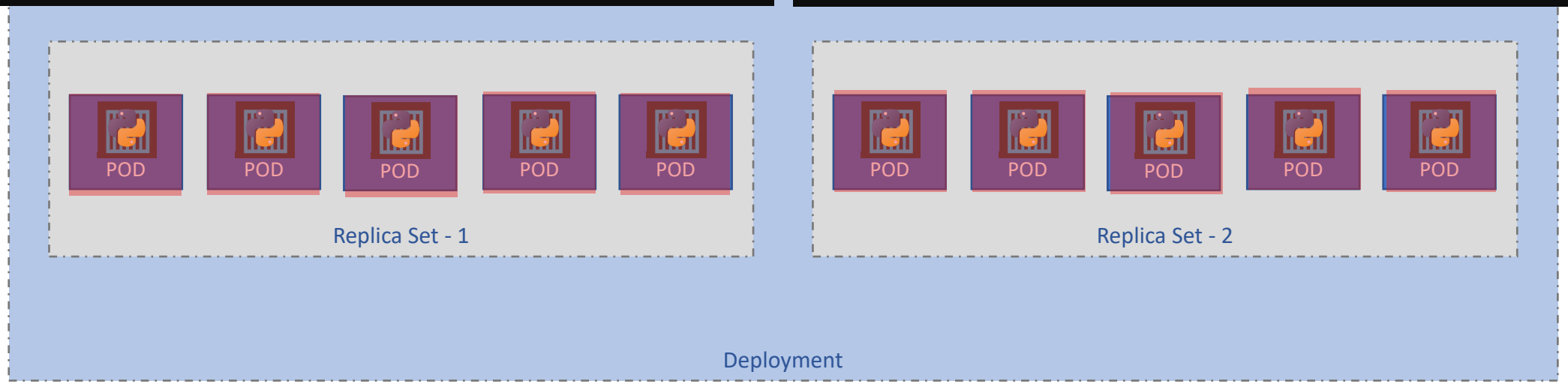



```
> kubectl get replicasets
NAME                          DESIRED   CURRENT   READY     AGE
myapp-deployment-67c749c58c   0         0         0         22m
myapp-deployment-7d57dbdb8d   5         5         5         20m
```

Rollback

```
> kubectl get replicasets
NAME                          DESIRED   CURRENT   READY   AGE
myapp-deployment-67c749c58c   0         0         0       22m
myapp-deployment-7d57dbdb8d   5         5         5       20m
```

```
> kubectl get replicasets
NAME                          DESIRED   CURRENT   READY   AGE
myapp-deployment-67c749c58c   5         5         5       22m
myapp-deployment-7d57dbdb8d   0         0         0       20m
```




```
> kubectl rollout undo deployment/myapp-deployment
deployment “myapp-deployment” rolled back
```

kubectl run

```
> kubectl run nginx --image=nginx
deployment "nginx" created
```

Summarize Commands

Create	`> kubectl create –f deployment-definition.yml`
Get	`> kubectl get deployments`
Update	`> kubectl apply –f deployment-definition.yml`
	`> kubectl set image deployment/myapp-deployment nginx=nginx:1.9.1`
Status	`> kubectl rollout status deployment/myapp-deployment`
	`> kubectl rollout history deployment/myapp-deployment`
Rollback	`> kubectl rollout undo deployment/myapp-deployment`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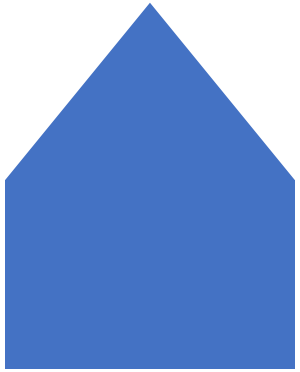
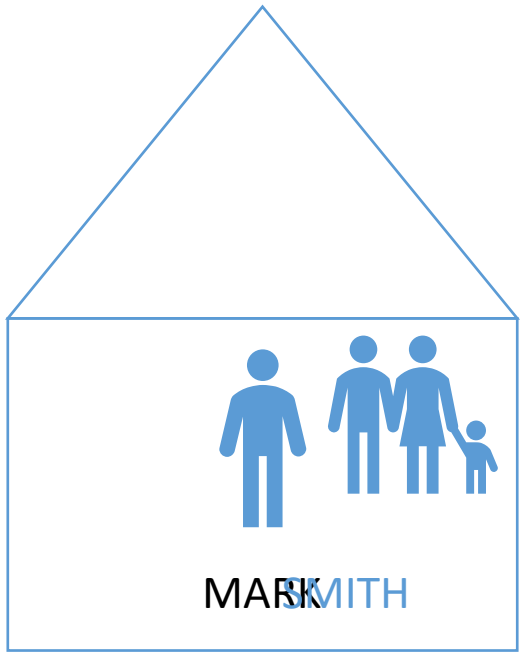
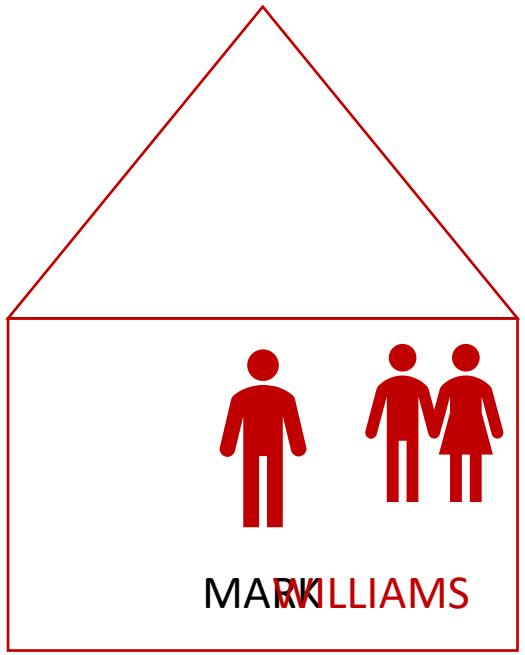
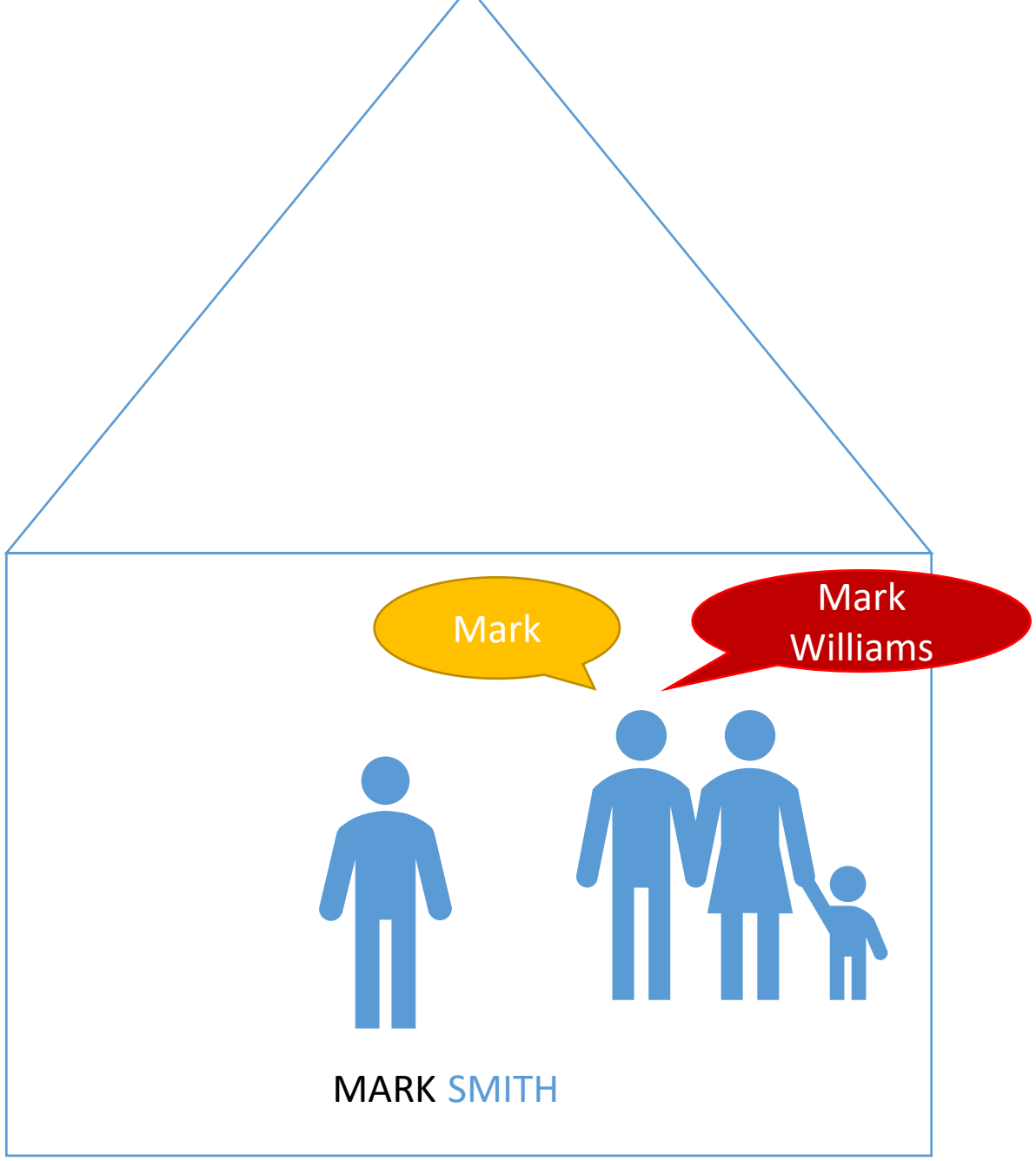
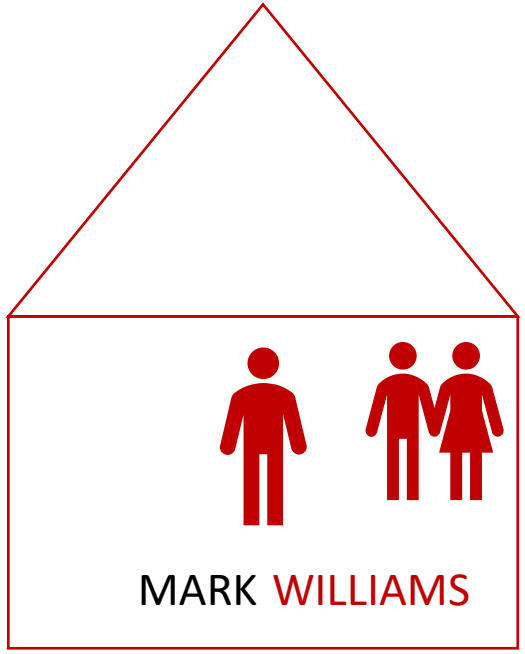
Namespaces

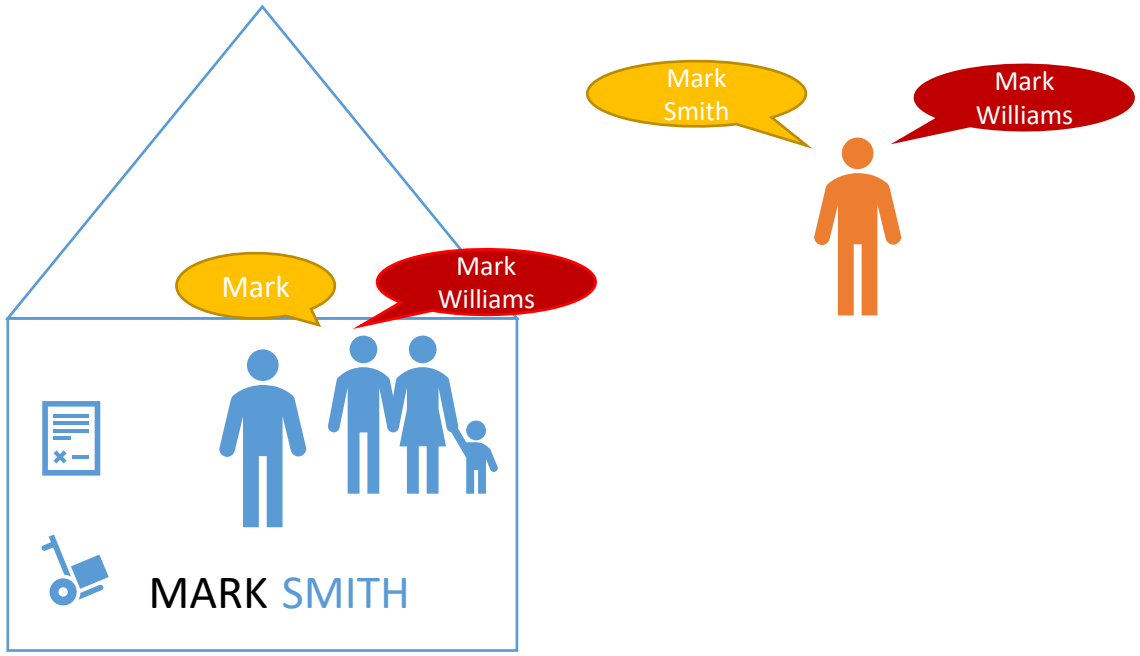


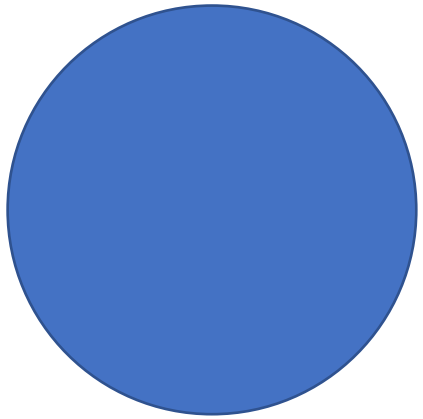


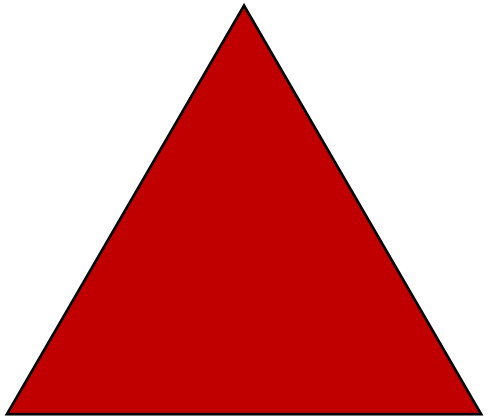


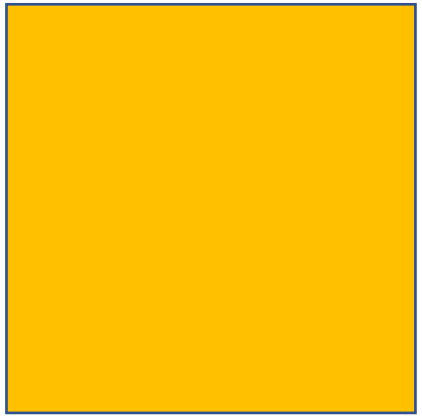

Mark
Mark
Williams
MARK SMITH

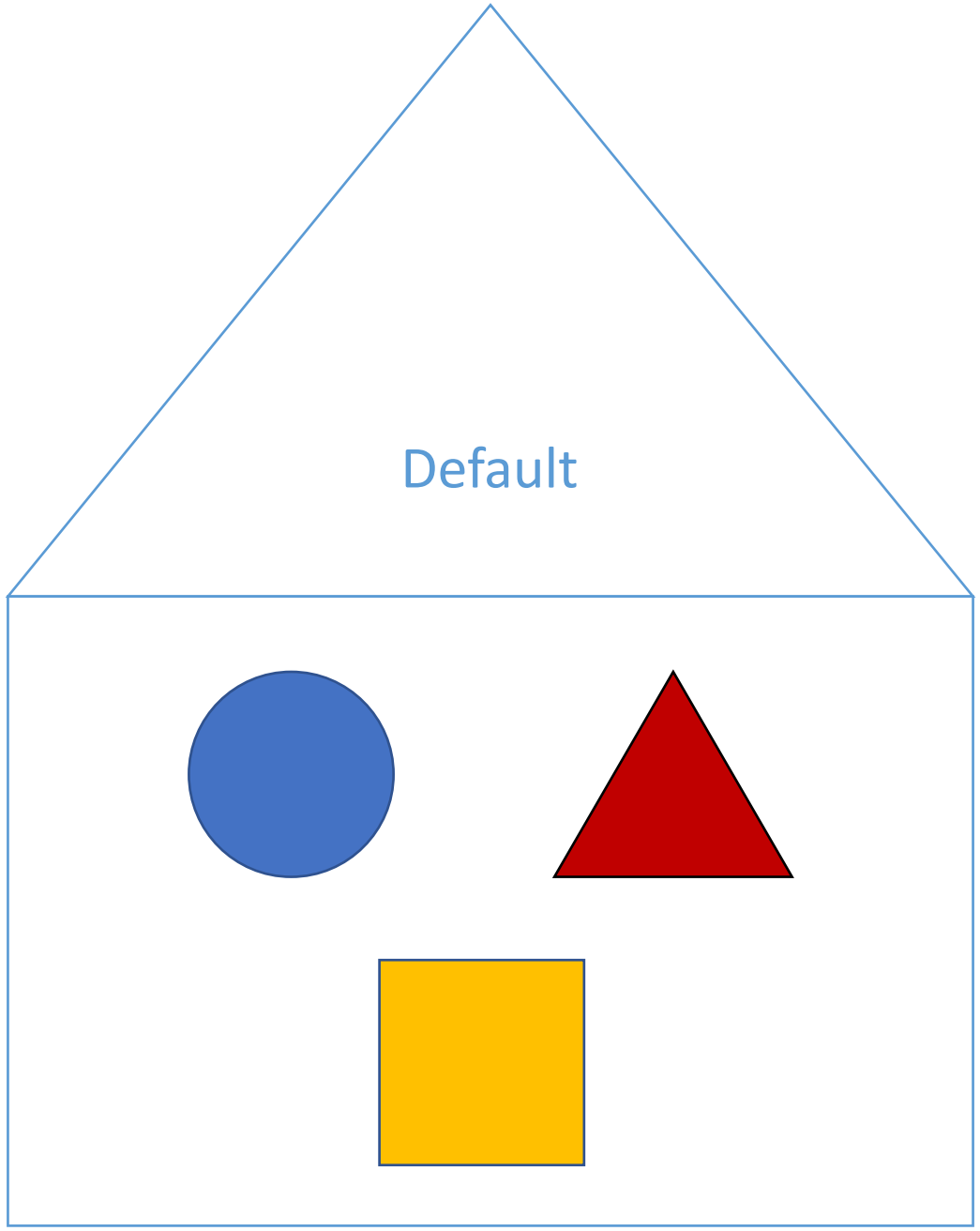

MARK WILLIAMS

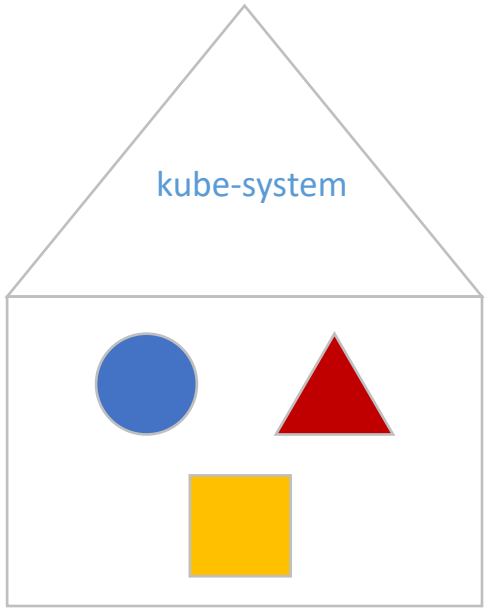

Mark
Mark Williams
MARK SMITH
NAMESPACE
Mark Smith
Mark Williams
MARK WILLIAMS
NAMESPACE

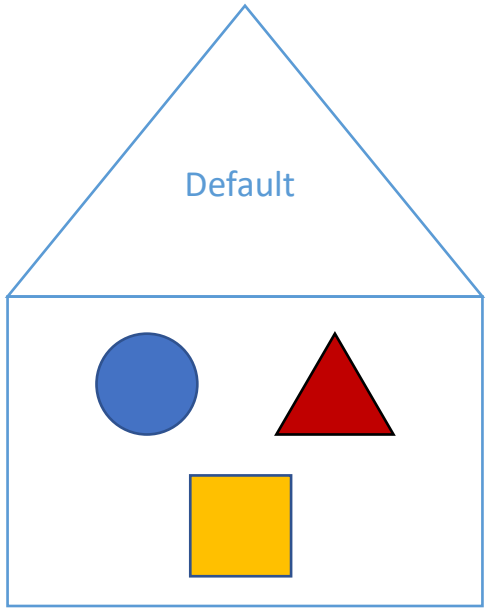


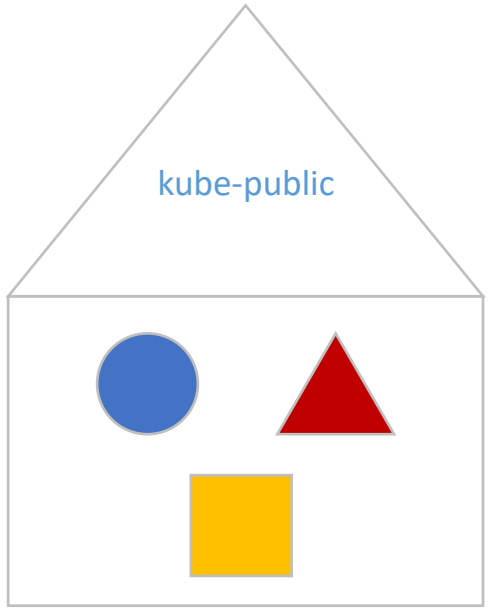




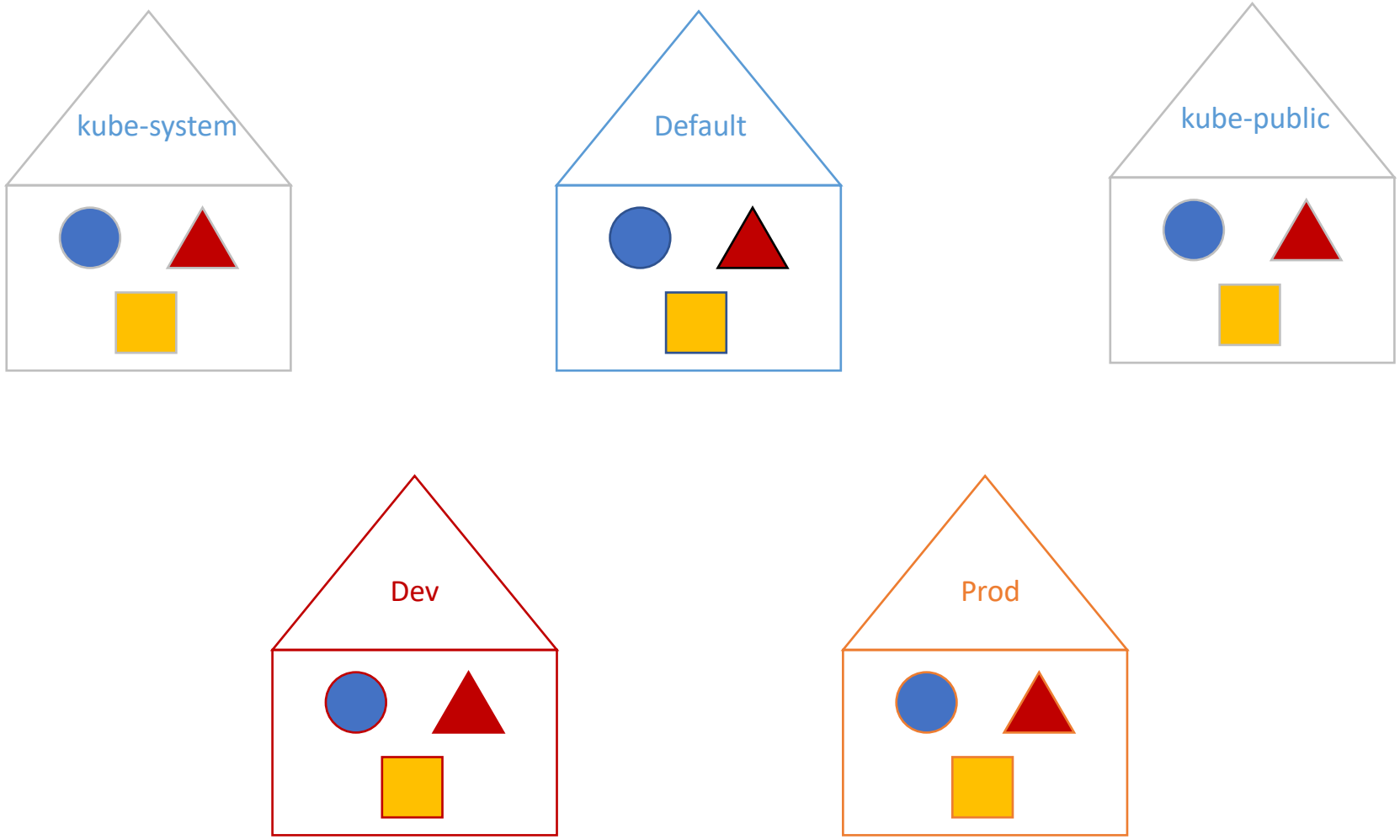

Default



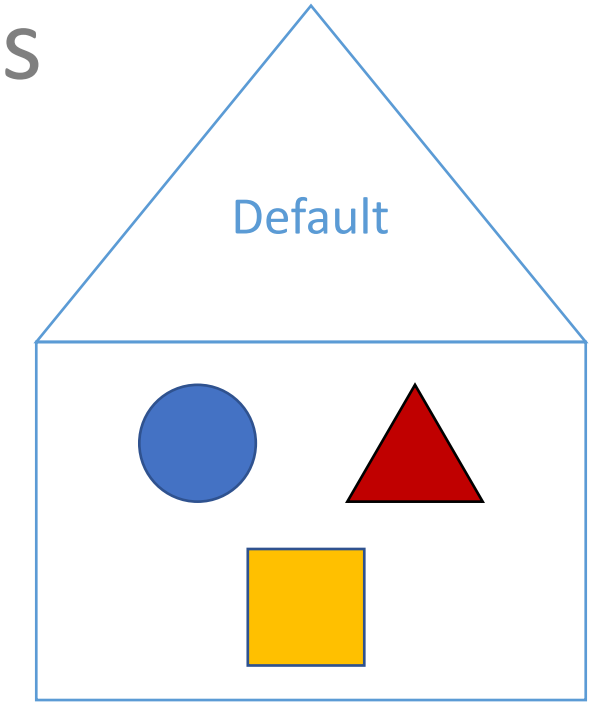


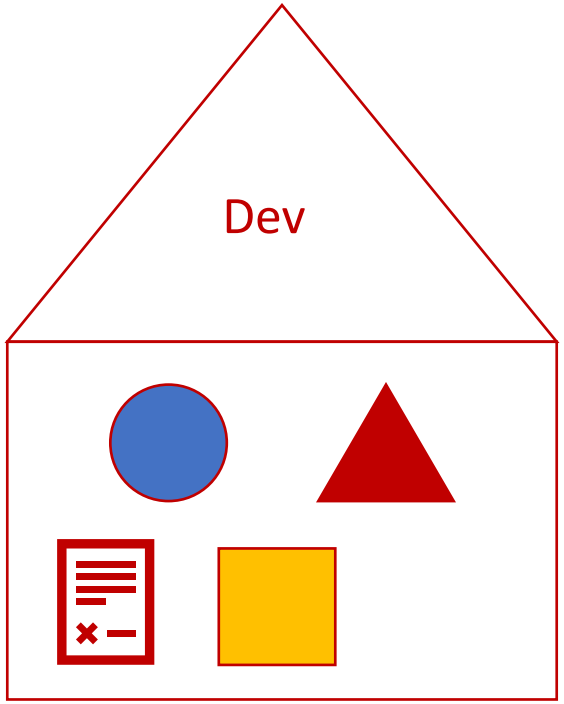


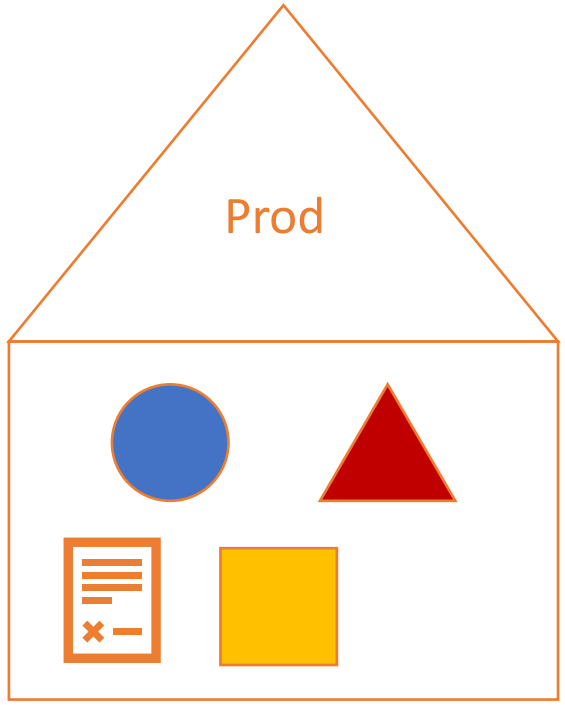
Namespace - Isolation



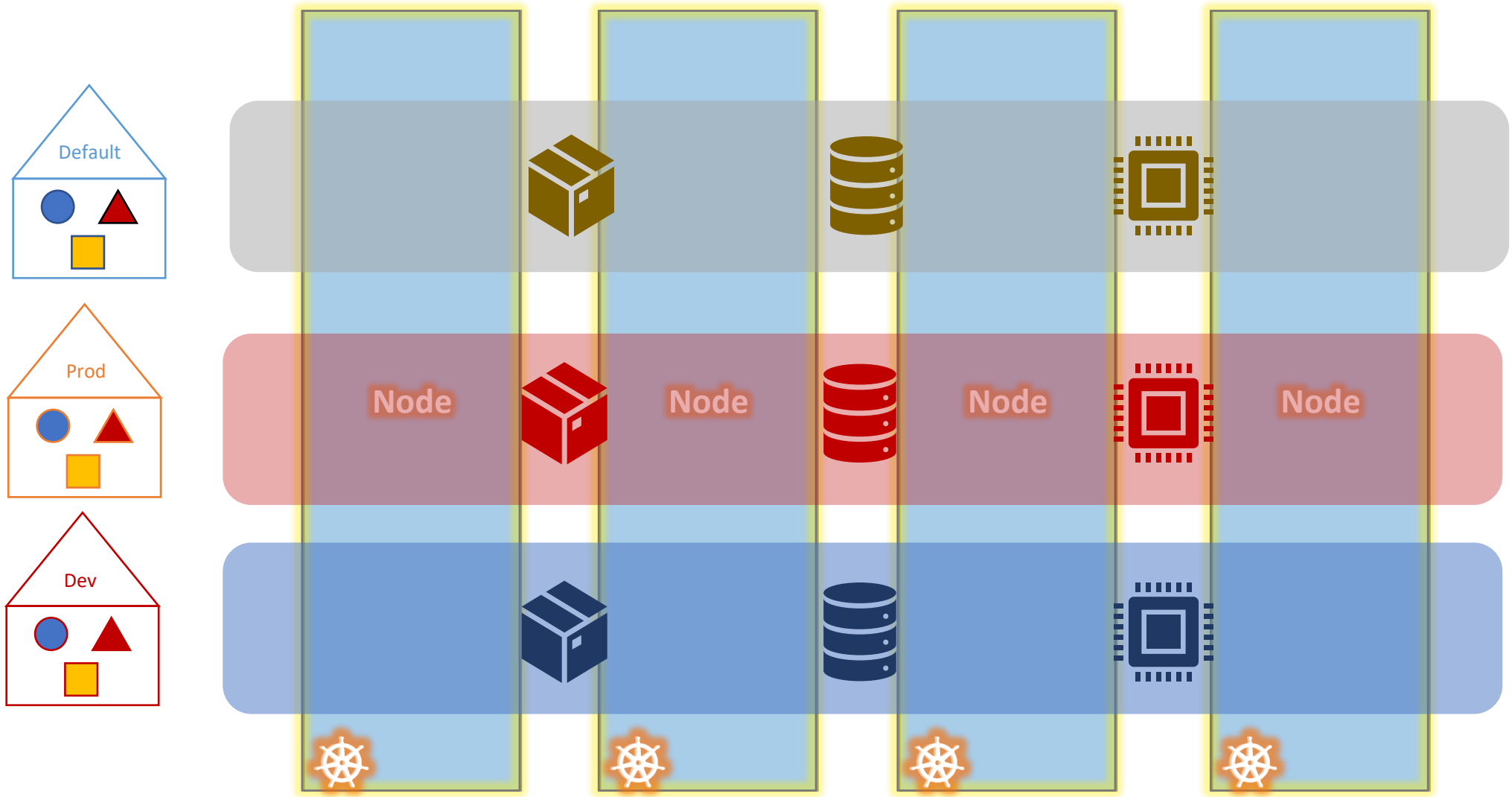
Namespace - Policies



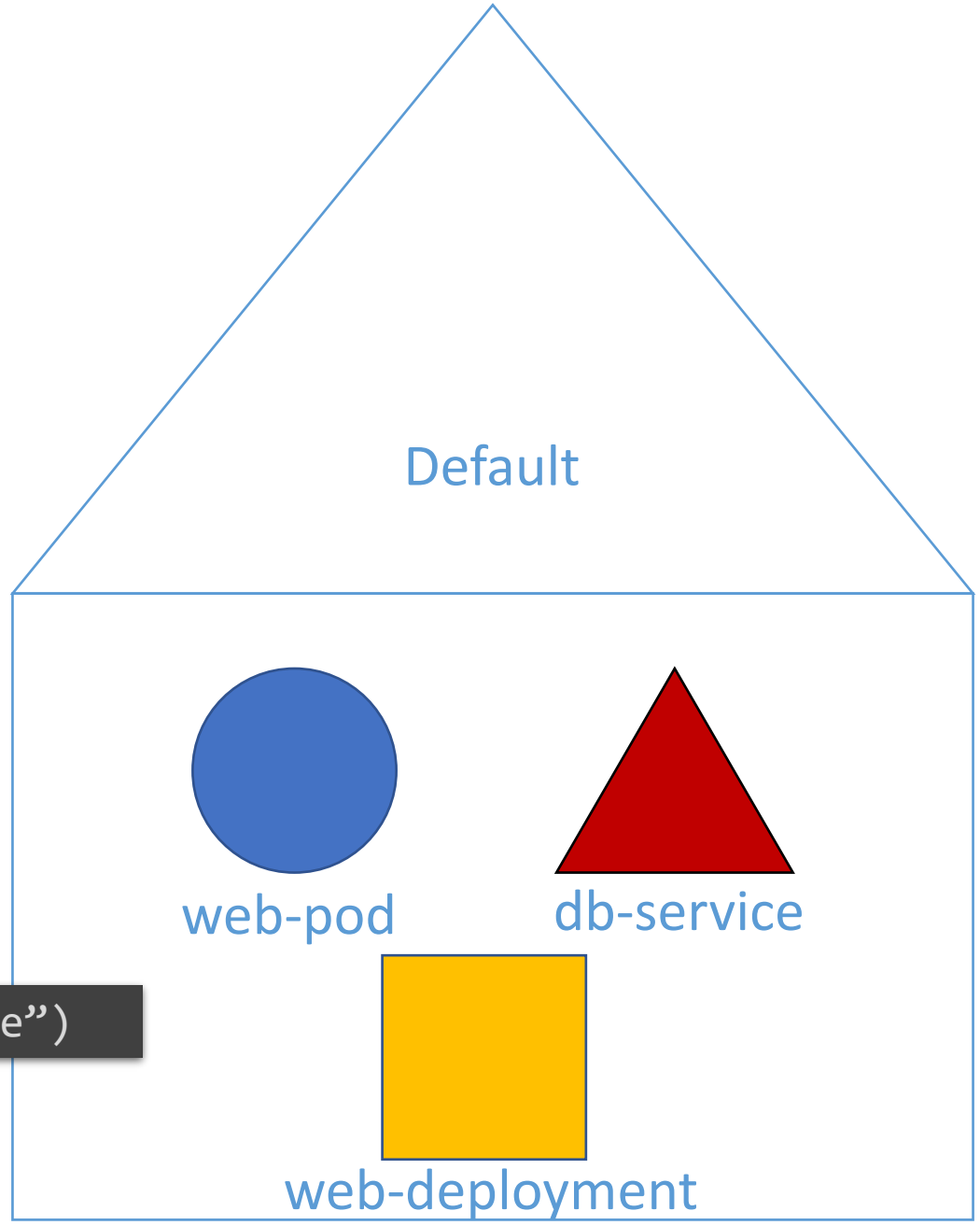




Namespace – Resource Limits

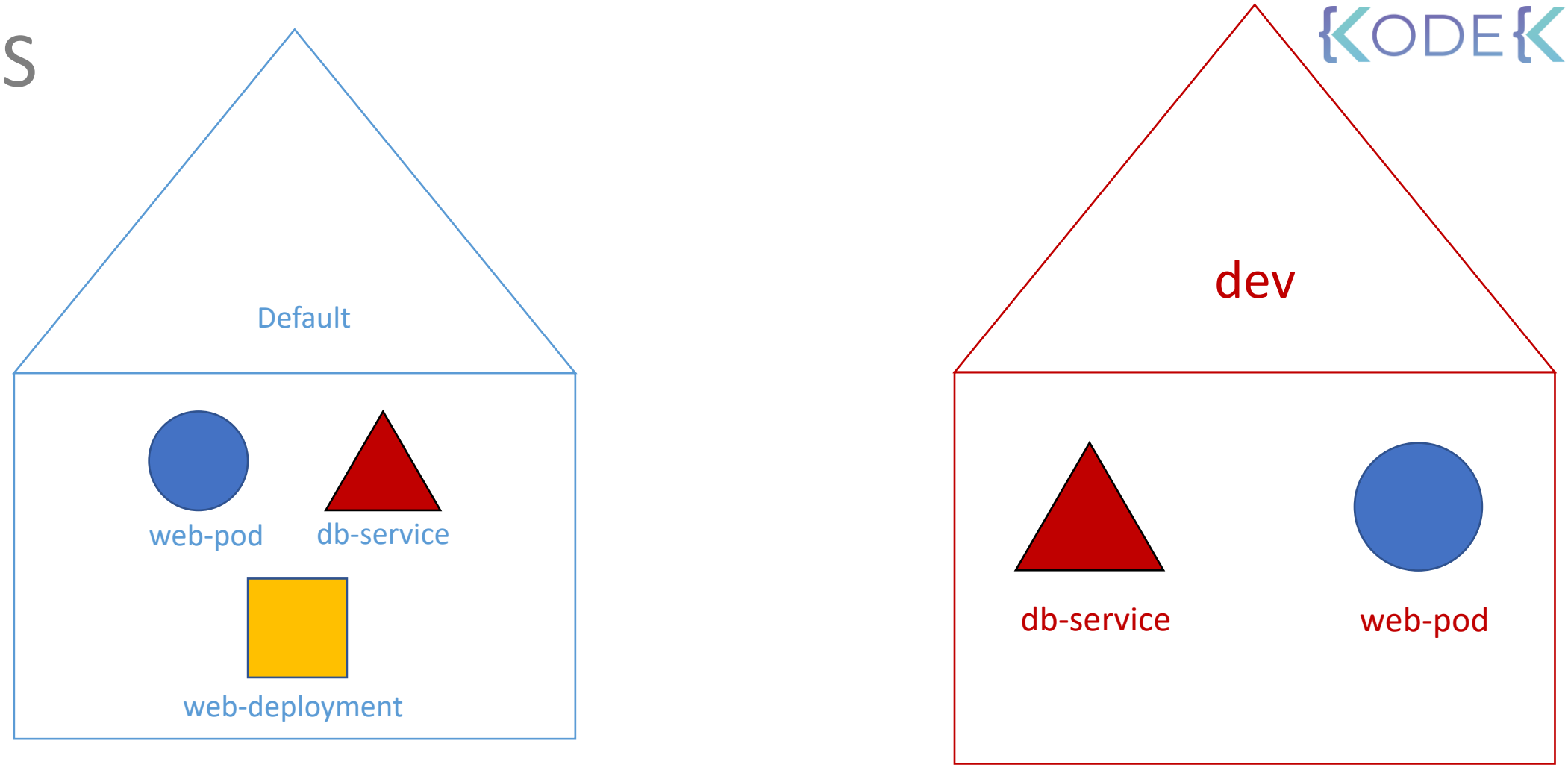


DNS




```
mysql.connect("db-service")
```

DNS




```
mysql.connect("db-service")
```

```
mysql.connect("db-service.dev.svc.cluster.local")
```

DNS

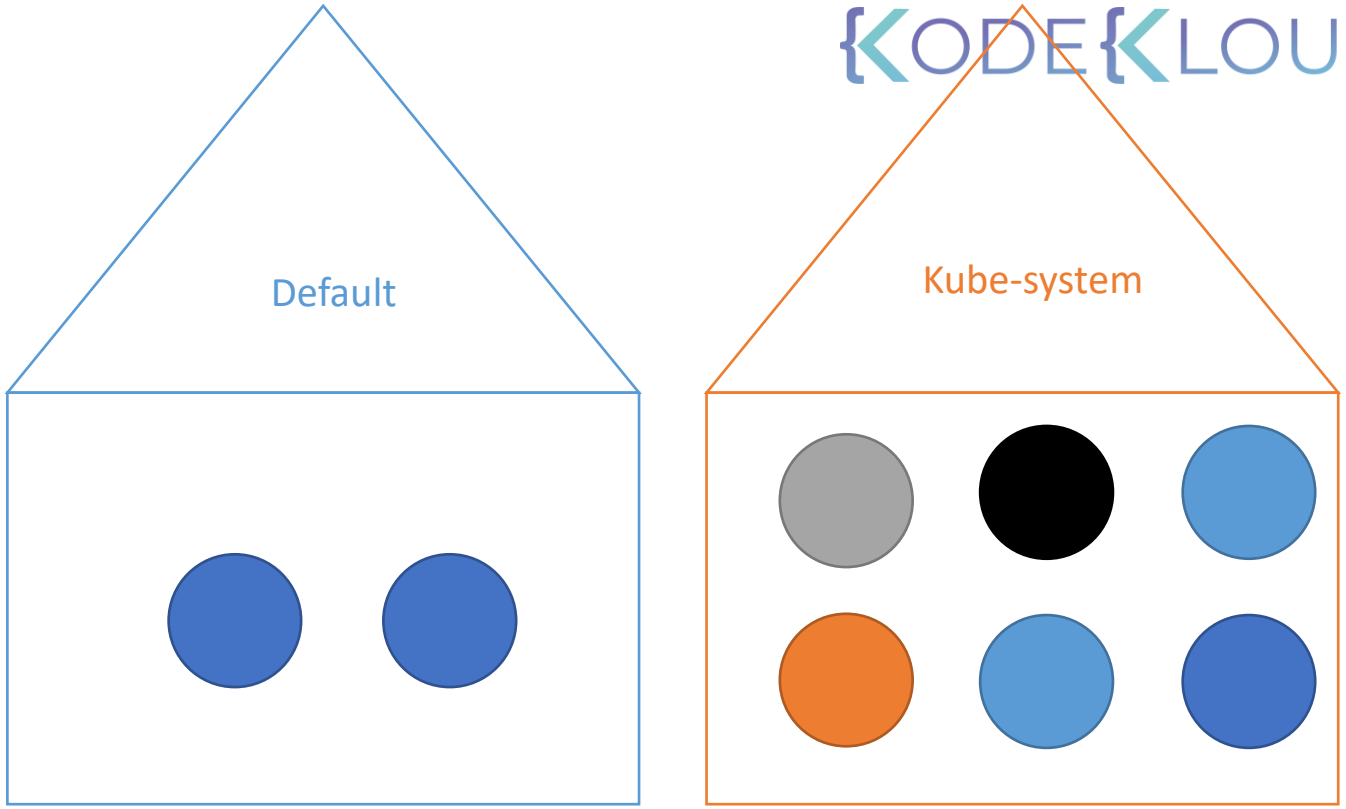
```
mysql.connect("db-service.dev.svc.cluster.local")
```

```
> kubectl get pods
```

NAME	READY	STATUS	RESTARTS	AGE
Pod-1	1/1	Running	0	3d
Pod-2	1/1	Running	0	3d

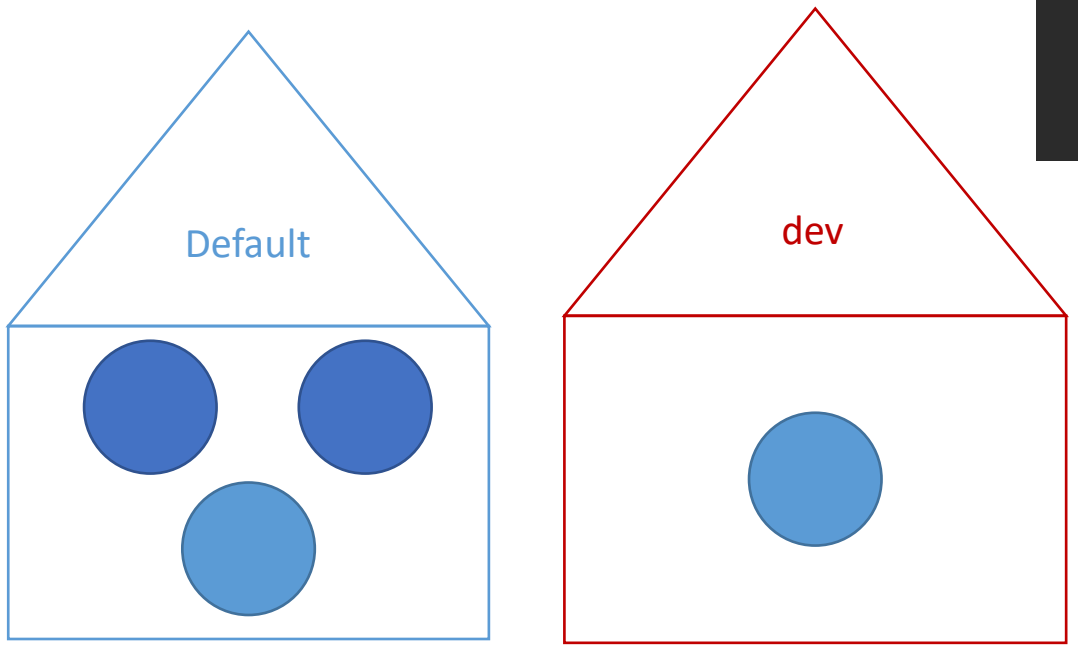
```
> kubectl get pods --namespace=kube-system
```

NAME	READY	STATUS	RESTAR
coredns-78fcdf6894-92d52	1/1	Running	7
coredns-78fcdf6894-jx25g	1/1	Running	7
etcd-master	1/1	Running	7
kube-apiserver-master	1/1	Running	7
kube-controller-manager-master	1/1	Running	7
kube-flannel-ds-amd64-hz4cf	1/1	Running	14
kube-proxy-4b8tn	1/1	Running	7
kube-proxy-98db4	1/1	Running	7
kube-proxy-jjrbs	1/1	Running	7
kube-scheduler-master	1/1	Running	7



```
> kubectl create -f pod-definition.yml
pod/myapp-pod created
```

```
> kubectl create -f pod-definition.yml --namespace=dev
pod/myapp-pod created
```



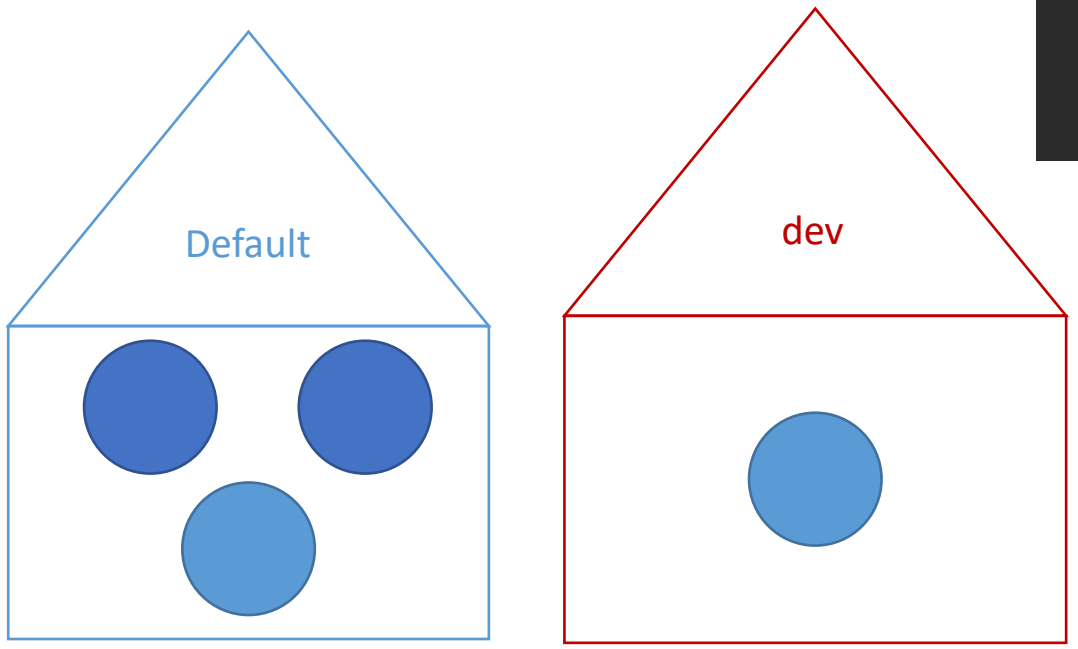
pod-definition.yml

```yaml
apiVersion: v1
kind: Pod

metadata:
 name: myapp-pod
 labels:
    app: myapp
    type: front-end
spec:
  containers:
  - name: nginx-container
    image: nginx
```

```
> kubectl create -f pod-definition.yml
pod/myapp-pod created
```

```
> kubectl create -f pod-definition.yml --namespace=dev
pod/myapp-pod created
```



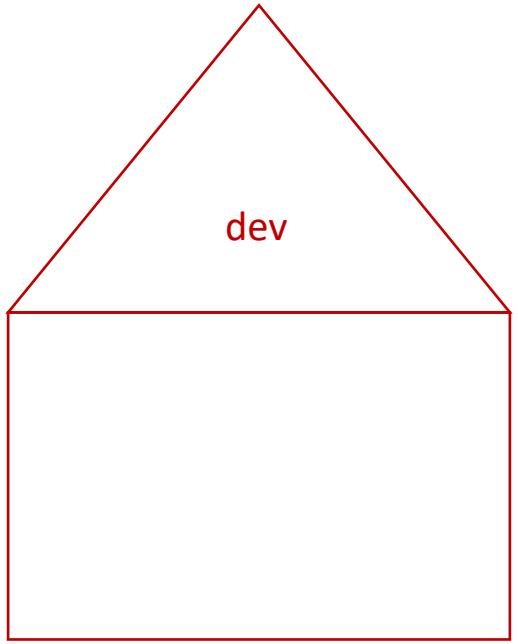
pod-definition.yml

```yaml
apiVersion: v1
kind: Pod

metadata:
 name: myapp-pod
 namespace: dev

 labels:
    app: myapp
    type: front-end
spec:
  containers:
  - name: nginx-container
    image: nginx
```

Create Namespace



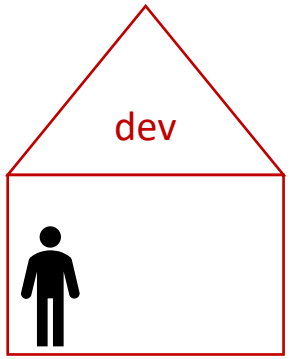
namespace-dev.yml

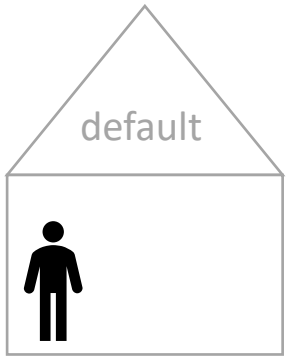
```yaml
apiVersion: v1
kind: Namespace
metadata:
    name: dev
```

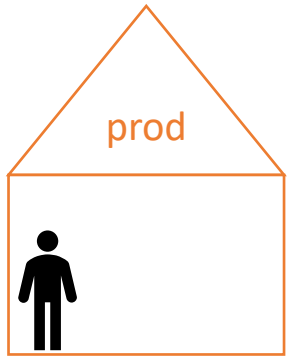
```
> kubectl create -f namespace-dev.yml
namespace/dev created
```

```
> kubectl create namespace dev
namespace/dev created
```

Switch








```
> kubectl get pods --namespace=dev
```

```
> kubectl get pods
```

```
> kubectl get pods --namespace=prod
```

```
> kubectl config set-context $(kubectl config current-context) --namespace=dev
```

```
> kubectl get pods
```

```
> kubectl get pods --namespace=default
```

```
> kubectl get pods --namespace=prod
```

```
> kubectl config set-context $(kubectl config current-context) --namespace=prod
```

```
> kubectl get pods --namespace=dev
```

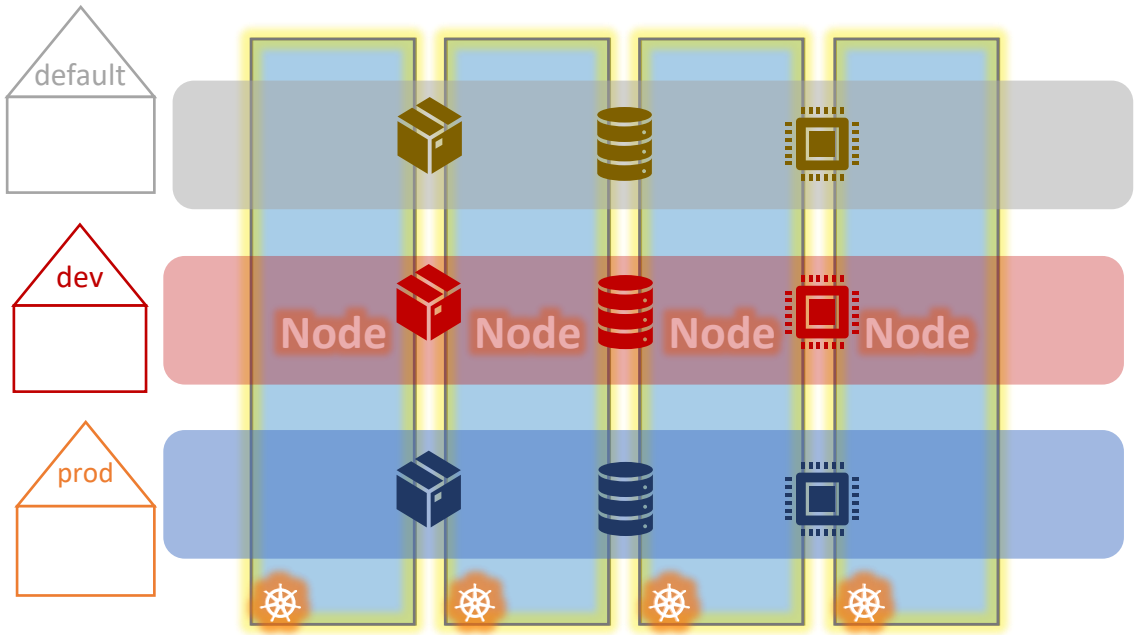
```
> kubectl get pods --namespace=default
```

```
> kubectl get pods
```

```
> kubectl get pods --all-namespaces
```

```
> kubectl config set-context $(kubectl config current-context) --namespace=dev
```

Resource Quota



Compute-quota.yaml

```yaml
apiVersion: v1
kind: ResourceQuota
metadata:
    name: compute-quota
    namespace: dev

spec:
  hard:
    pods: "10"
    requests.cpu: "4"
    requests.memory: 5Gi
    limits.cpu: "10"
    limits.memory: 10Gi
```

```
> kubectl create -f compute-quota.yaml
```

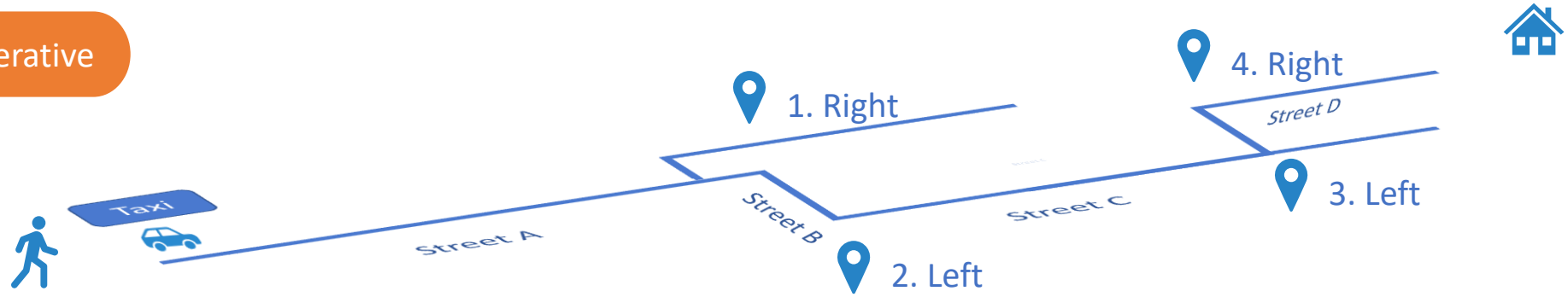

KODEKLOUD

Imperative

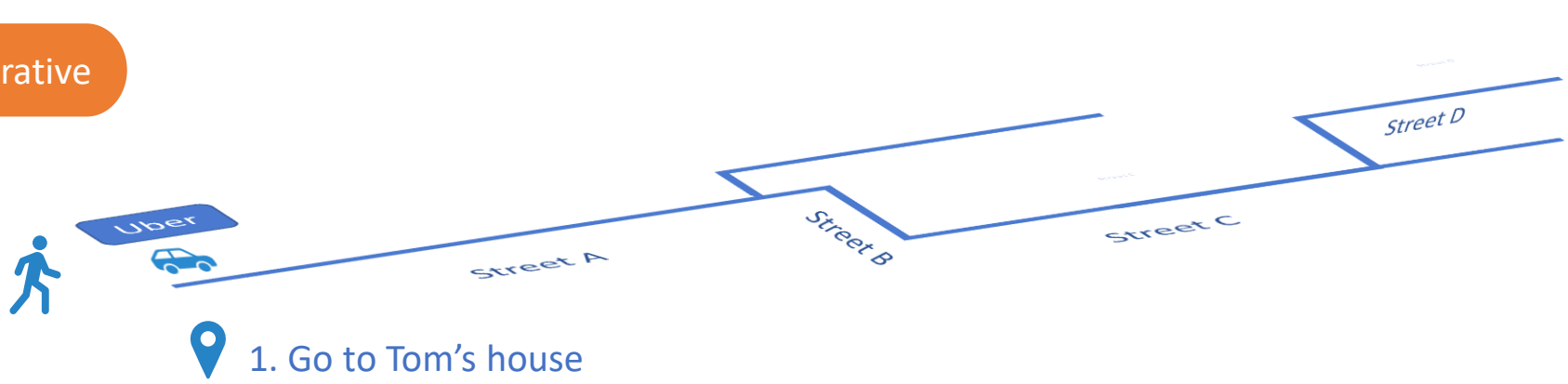
vs

Declarative

Imperative



Declarative



Infrastructure as Code

KODEKLOUD

Imperative

```
1. Provision a VM by the name ‘web-server’
2. Install NGINX Software on it
3. Edit configuration file to use port ‘8080’
4. Edit configuration file to web path ‘/var/www/nginx’
5. Load web pages to ‘/var/www/nginx’ from GIT Repo - X
6. Start NGINX server
```

Declarative

```
VM Name: web-server
Package: nnginx:1.18
Port: 8080
Path: /var/www/nginx
Code: GIT Repo - X
```

Kubernetes

KODEKLOUD

Imperative

```
> kubectl run --image=nginx nginx
```

```
> kubectl create deployment --image=nginx nginx
```

```
> kubectl expose deployment nginx --port 80
```

```
> kubectl edit deployment nginx
```

```
> kubectl scale deployment nginx --replicas=5
```

```
> kubectl set image deployment nginx nginx=nginx:1.18
```

```
> kubectl create –f nginx.yaml
```

```
> kubectl replace –f nginx.yaml
```

```
> kubectl delete –f nginx.yaml
```

Declarative

```
> kubectl apply –f nginx.yaml
```

Imperative Commands

Create Objects

```
> kubectl run --image=nginx nginx
```

```
> kubectl create deployment --image=nginx nginx
```

```
> kubectl expose deployment nginx --port 80
```

Update Objects

```
> kubectl edit deployment nginx
```

```
> kubectl scale deployment nginx --replicas=5
```

```
> kubectl set image deployment nginx nginx=nginx:1.18
```

Imperative Object Configuration Files

Create Objects

```
> kubectl create -f nginx.yaml
```

Update Objects

```
> kubectl edit deployment nginx
```

nginx.yaml

```yaml
apiVersion: v1
kind: Pod

metadata:
 name: myapp-pod
 labels:
    app: myapp
    type: front-end
spec:
  containers:
  - name: nginx-container
    image: nginx
```

Imperative Object Configuration Files

Create Objects

```
> kubectl create -f nginx.yaml
```

Update Objects

```
> kubectl edit deployment nginx
```

nginx.yaml

```yaml
apiVersion: v1
kind: Pod

metadata:
 name: myapp-pod
 labels:
    app: myapp
    type: front-end
spec:
  containers:
  - name: nginx-container
    image: nginx
```

pod-definition

```yaml
apiVersion: v1
kind: Pod

metadata:
 name: myapp-pod
 labels:
    app: myapp
    type: front-end
spec:
  containers:
  - name: nginx-container
    image: nginx:1.18
status:
  conditions:
  - lastProbeTime: null
    status: "True"
    type: Initialized
```

Local file

Kubernetes Memory

Imperative Object Configuration Files

KODEKLOUD

Create Objects

```
> kubectl create -f nginx.yaml
```

nginx.yaml

```yaml
apiVersion: v1
kind: Pod

metadata:
 name: myapp-pod
 labels:
    app: myapp
    type: front-end-service
spec:
  containers:
  - name: nginx-container
    image: nginx:1.18
```

Update Objects

```
> kubectl edit deployment nginx
```

```
> kubectl replace -f nginx.yaml
```

```
> kubectl replace --force -f nginx.yaml
```

```
> kubectl create -f nginx.yaml
Error from server (AlreadyExists): error when creating "nginx.yaml": pods ”myapp-pod" already exists
```

```
> kubectl replace -f nginx.yaml
Error from server (Conflict): error when replacing "nginx.yaml": Operation cannot be fulfilled on pods
”myapp-pod"
```

Declarative

KODEKLOUD

Create Objects

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

```
> kubectl apply -f /path/to/config-files
```

Update Objects

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

nginx.yaml

```yaml
apiVersion: v1
kind: Pod

metadata:
  name: myapp-pod
  labels:
    app: myapp
    type: front-end-service
spec:
  containers:
  - name: nginx-container
    image: nginx:1.18
```

Exam Tips

KODEKLOUD

Create Objects

```
> kubectl apply –f nginx.yaml
```

```
> kubectl run --image=nginx nginx
```

```
> kubectl create deployment --image=nginx nginx
```

```
> kubectl expose deployment nginx --port 80
```

Update Objects

```
> kubectl apply –f nginx.yaml
```

```
> kubectl edit deployment nginx
```

```
> kubectl scale deployment nginx --replicas=5
```

```
> kubectl set image deployment nginx nginx=nginx:1.18
```

Manage Kubernetes Objects

Declarative and imperative paradigms for interacting with the Kubernetes API.


KODEKLOUD