ESCOLA SUPERIOR DE REDES

Orquestração de Containers

Gestão do ciclo de vida de aplicações

Tópicos abordados

- Rollout e rollbacks (rollout undo)
- Alterando o CMD e ENTRYPOINT de containers
- Exportando variáveis de ambiente
- ConfigMaps
- Secrets
- Init-Containers
- HPA - Horizontal POD Autoscaler

Revisando *Deployments*

Como vimos, *Deployments* possibilitam uma forma ***declarativa de atualização para Pods e ReplicaSets***

Deployments são o construto padrão a ser utilizado ao ***disponibilizar aplicações***

Porque oferece o recurso de ***rollout*** e ***rollback***

Visualizando o *status* de *rollouts*

vagrant@s2-master-1: ~ | fbs@DESKTOP-A1M9PI8: ~

```
root@s2-master-1:~# kubectl apply -f deploy-nginx.yaml ; while true ; do kubectl rollout status de
ployment/deploy-nginx ; sleep 3 ; done
deployment.apps/deploy-nginx created
Waiting for deployment "deploy-nginx" rollout to finish: 0 of 4 updated replicas are available...
Waiting for deployment "deploy-nginx" rollout to finish: 1 of 4 updated replicas are available...
Waiting for deployment "deploy-nginx" rollout to finish: 2 of 4 updated replicas are available...
Waiting for deployment "deploy-nginx" rollout to finish: 3 of 4 updated replicas are available...
deployment "deploy-nginx" successfully rolled out
deployment "deploy-nginx" successfully rolled out
^C
root@s2-master-1:~#
```

Atualizando a imagem de *deployments*

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: deploy-nginx
spec:
  replicas: 4
  selector:
    matchLabels:
      app: deploy-nginx
  template:
    metadata:
      labels:
        app: deploy-nginx
    spec:
      containers:
      - name: deploy-nginx
        image: nginx:latest
```

Registrando o histórico com a flag --record

```
root@s2-master-1:~# k apply -f manifests/deploy-nginx.yaml --record
Flag --record has been deprecated, --record will be removed in the future
deployment.apps/deploy-nginx configured
```

Usando o comando set image

```
root@s2-master-1:~# k set image deploy/deploy-nginx deploy-nginx=nginx:1.15.1 --record
Flag --record has been deprecated, --record will be removed in the future
deployment.apps/deploy-nginx image updated
```

Visualizando o histórico de *deployments*

```
root@s2-master-1:~# k rollout history deployment deploy-nginx
deployment.apps/deploy-nginx
REVISION  CHANGE-CAUSE
1         kubectl apply --filename=manifests/deploy-nginx.yaml --record=true
2         kubectl set image deploy/deploy-nginx deploy-nginx=nginx:1.15.1 --record=true
```

Visualizando os detalhes de cada revisão

```
root@s2-master-1:~# k rollout history deployment deploy-nginx --revision=1
deployment.apps/deploy-nginx with revision #1
Pod Template:
  Labels:       app=deploy-nginx
        pod-template-hash=5c646dc86b
  Annotations:  kubernetes.io/change-cause: kubectl apply --filename=manifests/deploy-nginx.yaml --record=true
  Containers:
   deploy-nginx:
    Image:      nginx:latest
    Port:       <none>
    Host Port:  <none>
    Environment:        <none>
    Mounts:     <none>
  Volumes:      <none>

root@s2-master-1:~# k rollout history deployment deploy-nginx --revision=2
deployment.apps/deploy-nginx with revision #2
Pod Template:
  Labels:       app=deploy-nginx
        pod-template-hash=5bb9649cdc
  Annotations:  kubernetes.io/change-cause: kubectl set image deploy/deploy-nginx deploy-nginx=nginx:1.15.1 --record=true
  Containers:
   deploy-nginx:
    Image:      nginx:1.15.1
    Port:       <none>
    Host Port:  <none>
    Environment:        <none>
    Mounts:     <none>
  Volumes:      <none>
```

Realizando o *rollback* para um versão anterior

revison = 3

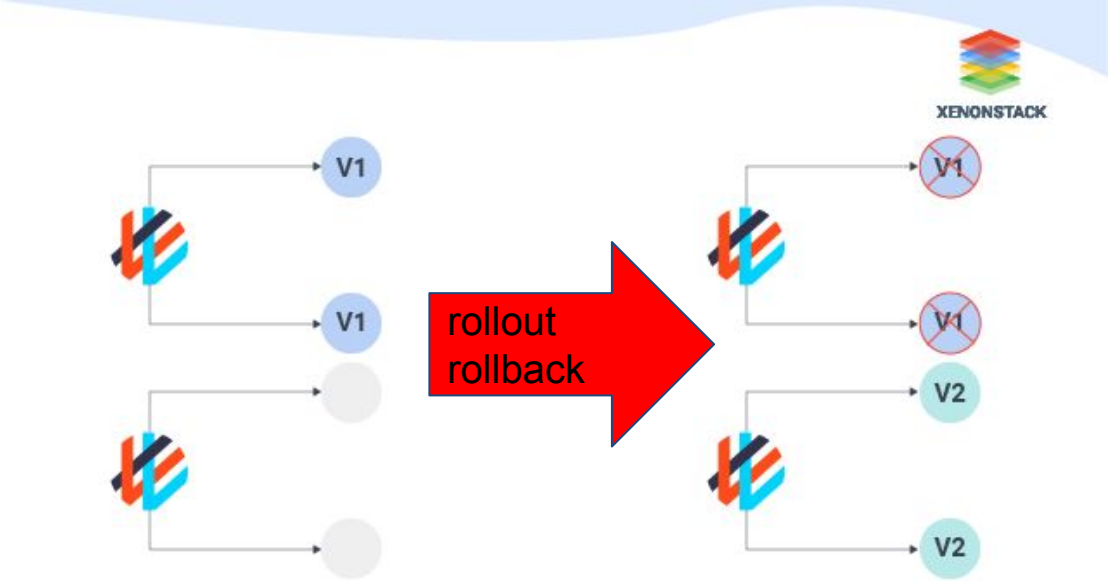
```
root@s2-master-1:~# k apply -f manifests/deploy-nginx.yaml --record
Flag --record has been deprecated, --record will be removed in the future
deployment.apps/deploy-nginx configured
root@s2-master-1:~# k rollout history deployment deploy-nginx
deployment.apps/deploy-nginx
REVISION  CHANGE-CAUSE
1         kubectl apply --filename=manifests/deploy-nginx.yaml --record=true
2         kubectl set image deploy/deploy-nginx deploy-nginx=nginx:1.15.1 --record=true
3         kubectl apply --filename=manifests/deploy-nginx.yaml --record=true

root@s2-master-1:~# k set image deploy/deploy-nginx deploy-nginx=nginx:1.17.1 --record
Flag --record has been deprecated, --record will be removed in the future
deployment.apps/deploy-nginx image updated
root@s2-master-1:~# k rollout history deployment deploy-nginx
deployment.apps/deploy-nginx
REVISION  CHANGE-CAUSE
1         kubectl apply --filename=manifests/deploy-nginx.yaml --record=true
2         kubectl set image deploy/deploy-nginx deploy-nginx=nginx:1.15.1 --record=true
3         kubectl apply --filename=manifests/deploy-nginx.yaml --record=true
4         kubectl set image deploy/deploy-nginx deploy-nginx=nginx:1.17.1 --record=true

root@s2-master-1:~# k describe deployment deploy-nginx | grep Image
    Image:        nginx:1.17.1
root@s2-master-1:~# k rollout undo deployment deploy-nginx
deployment.apps/deploy-nginx rolled back
root@s2-master-1:~# k describe deployment deploy-nginx | grep Image
    Image:        nginx:1.16.1
root@s2-master-1:~# k rollout history deployment deploy-nginx
deployment.apps/deploy-nginx
REVISION  CHANGE-CAUSE
1         kubectl apply --filename=manifests/deploy-nginx.yaml --record=true
2         kubectl set image deploy/deploy-nginx deploy-nginx=nginx:1.15.1 --record=true
4         kubectl set image deploy/deploy-nginx deploy-nginx=nginx:1.17.1 --record=true
5         kubectl apply --filename=manifests/deploy-nginx.yaml --record=true
```

Estratégias de *rollout*

Recreate

RollingUpdate

Recreate

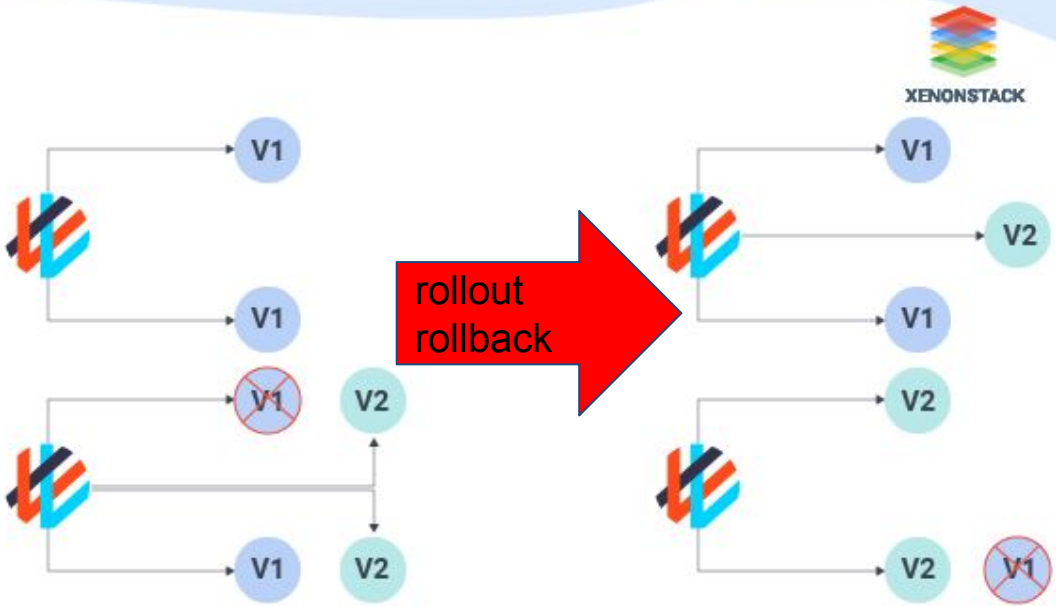


Fácil configuração

Estado renovado ao final do processo

Alto impacto ao usuário, ocasionando ***downtime***

RollingUpdate - PADRÃO



Atualização sem ***downtime***

Mantém duas versões da app ao mesmo tempo

Mais demorada

Configuração do *RollingUpdate*

MaxSurge

Máximo número de *pods* que podem ser criados acima do valor desejado

MaxUnavailable

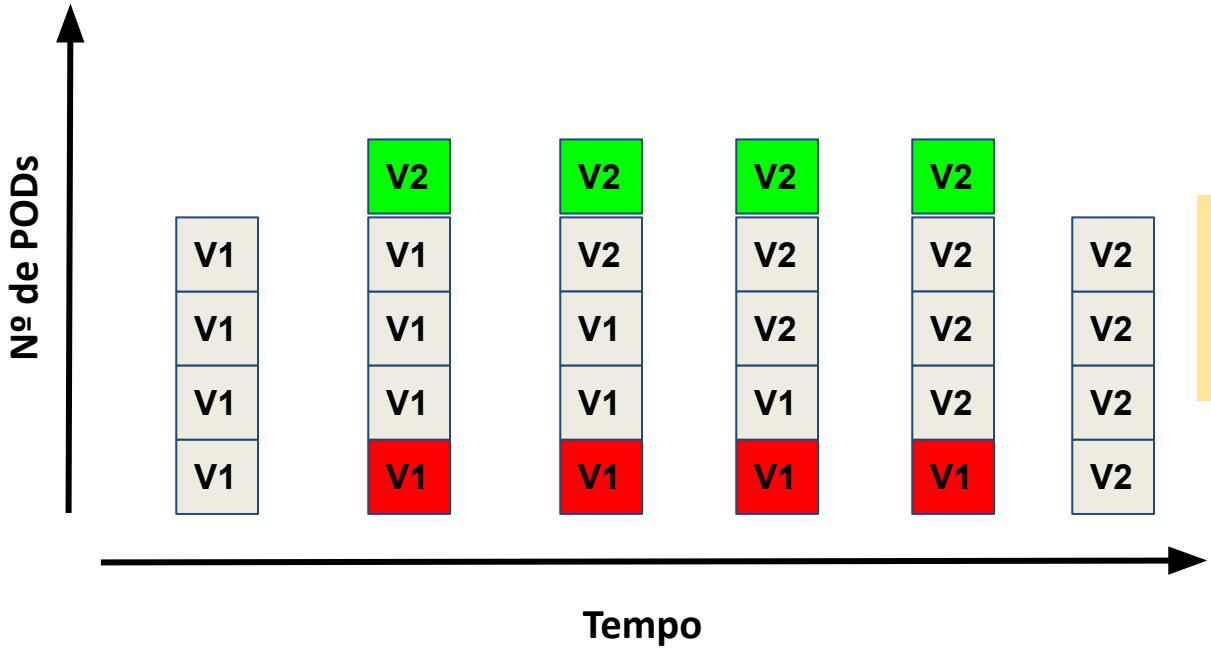
Máximo número de *pods* indisponíveis durante o *rollout*

Configuração do *RollingUpdate*

PODs = 4

MaxSurge = 25% -> 1

MaxUnavaiable = 25% -> 1



No máximo 5 PODs (4 desired + 1 surge)

No mínimo 3 PODs (4 desired - 1 unavailable)

Outras estratégias de rolling deployment

https://www.weave.works/blog/kubernetes-deployment-strategies

Configuração do *RollingUpdate*

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: deploy-nginx-rollingupdate
spec:
  replicas: 4
  strategy:
    type: RollingUpdate
    rollingUpdate:
      maxSurge: 25%
      maxUnavailable: 25%
  selector:
    matchLabels:
      app: deploy-nginx-rollingupdate
  template:
    metadata:
      labels:
        app: deploy-nginx-rollingupdate
    spec:
      containers:
      - name: deploy-nginx
        image: nginx:latest
```

Configuração do *RollingUpdate*

```
root@s2-master-1:~# k apply -f manifests/deploy-nginx-rollingupdate.yaml ; while true ; do k rollout status deployme
nt deploy-nginx-rollingupdate ; sleep 1 ; done
deployment.apps/deploy-nginx-rollingupdate configured
Waiting for deployment spec update to be observed...
Waiting for deployment "deploy-nginx-rollingupdate" rollout to finish: 0 out of 4 new replicas have been updated...
Waiting for deployment "deploy-nginx-rollingupdate" rollout to finish: 0 out of 4 new replicas have been updated...
Waiting for deployment "deploy-nginx-rollingupdate" rollout to finish: 1 out of 4 new replicas have been updated...
Waiting for deployment "deploy-nginx-rollingupdate" rollout to finish: 2 out of 4 new replicas have been updated...
Waiting for deployment "deploy-nginx-rollingupdate" rollout to finish: 2 out of 4 new replicas have been updated...
Waiting for deployment "deploy-nginx-rollingupdate" rollout to finish: 2 out of 4 new replicas have been updated...
Waiting for deployment "deploy-nginx-rollingupdate" rollout to finish: 2 out of 4 new replicas have been updated...
Waiting for deployment "deploy-nginx-rollingupdate" rollout to finish: 2 out of 4 new replicas have been updated...
Waiting for deployment "deploy-nginx-rollingupdate" rollout to finish: 3 out of 4 new replicas have been updated...
Waiting for deployment "deploy-nginx-rollingupdate" rollout to finish: 3 out of 4 new replicas have been updated...
Waiting for deployment "deploy-nginx-rollingupdate" rollout to finish: 3 out of 4 new replicas have been updated...
Waiting for deployment "deploy-nginx-rollingupdate" rollout to finish: 3 out of 4 new replicas have been updated...
Waiting for deployment "deploy-nginx-rollingupdate" rollout to finish: 1 old replicas are pending termination...
Waiting for deployment "deploy-nginx-rollingupdate" rollout to finish: 1 old replicas are pending termination...
Waiting for deployment "deploy-nginx-rollingupdate" rollout to finish: 1 old replicas are pending termination...
Waiting for deployment "deploy-nginx-rollingupdate" rollout to finish: 3 of 4 updated replicas are available...
deployment "deploy-nginx-rollingupdate" successfully rolled out
```

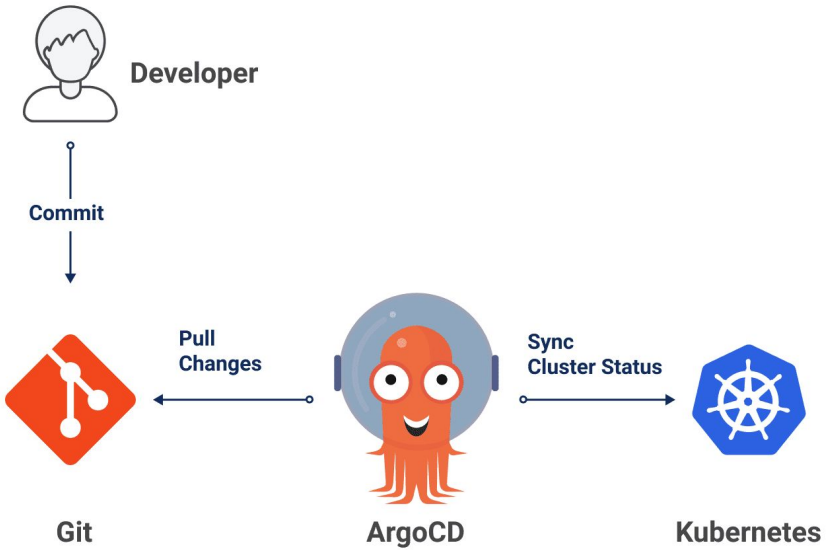
O que acharam do rollout/rollback do k8s?

Quanto tempo demoraria um rollout/rollback sem k8s mas com container?

Quanto tempo demoraria um rollout/rollback sem k8s e sem container?

Acharam que isso é tudo?

Acharam que isso é tudo no k8s?



GitOps
git repo é a fonte da verdade

https://argo-cd.readthedocs.io

Alterando o CMD de containers

```
root@s2-master-1:~# k run alpine-1 --image=alpine
pod/alpine-1 created
root@s2-master-1:~# k get pod
NAME       READY   STATUS      RESTARTS   AGE
alpine-1   0/1     Completed   0          8s
root@s2-master-1:~# k get pod
NAME       READY   STATUS             RESTARTS      AGE
alpine-1   0/1     CrashLoopBackOff   1 (7s ago)    15s
```

```
root@s2-master-1:~# k run alpine-2 --image=alpine -- sleep 360
pod/alpine-2 created
root@s2-master-1:~# k get pod
NAME       READY   STATUS      RESTARTS      AGE
alpine-1   0/1     Completed   4 (49s ago)   103s
alpine-2   1/1     Running     0             11s
root@s2-master-1:~# k exec alpine-2 -- ps aux
PID   USER     TIME  COMMAND
    1 root      0:00 sleep 360
    7 root      0:00 ps aux
```

```
FROM scratch
ADD alpine-minirootfs-3.18.2-x86_64.tar.gz /
CMD ["/bin/sh"]
```

altera o CMD do container

Alterando o ENTRYPOINT de containers

```
root@s2-master-1:~# k run nginx --image=nginx:alpine
pod/nginx created
root@s2-master-1:~# k get pod
NAME    READY   STATUS    RESTARTS   AGE
nginx   1/1     Running   0          8s
root@s2-master-1:~# k exec nginx -- ps aux
PID   USER     TIME  COMMAND
    1 root      0:00 nginx: master process nginx -g daemon off;
   30 nginx     0:00 nginx: worker process
   31 root      0:00 ps aux
```

```
ENTRYPOINT ["/docker-entrypoint.sh"]

EXPOSE 80

STOPSIGNAL SIGQUIT

CMD ["nginx", "-g", "daemon off;"]
```

```
root@s2-master-1:~# k run nginx-2 --image=nginx:alpine --command -- sleep 360
pod/nginx-2 created
root@s2-master-1:~# k get pod
NAME      READY   STATUS    RESTARTS   AGE
nginx     1/1     Running   0          2m46s
nginx-2   1/1     Running   0          10s
root@s2-master-1:~# k exec nginx-2 -- ps aux
PID   USER     TIME  COMMAND
    1 root      0:00 sleep 360
    7 root      0:00 ps aux
```

altera o ENTRYPOINT do container

Via kubectl - forma imperativa

```
root@s2-master-1:~# k run app-color --image=fbscarel/myapp-color -l app=app-color --port=80 --env="COLOR=red"
pod/app-color created
root@s2-master-1:~# k get pod
NAME        READY   STATUS              RESTARTS   AGE
app-color   0/1     ContainerCreating   0          4s
root@s2-master-1:~# k create service nodeport app-color --tcp=80 --node-port=31000
service/app-color created
root@s2-master-1:~# k get svc
NAME        TYPE       CLUSTER-IP      EXTERNAL-IP   PORT(S)        AGE
app-color   NodePort   10.111.106.38   <none>        80:31000/TCP   5s
root@s2-master-1:~# curl localhost:31000/color; echo
Hostname: app-color ; Color: red
root@s2-master-1:~# k delete pod app-color --force
Warning: Immediate deletion does not wait for confirmation that the running resource has been terminated. The resour
ce may continue to run on the cluster indefinitely.
pod "app-color" force deleted
root@s2-master-1:~# k run app-color --image=fbscarel/myapp-color -l app=app-color --port=80 --env="COLOR=blue"
pod/app-color created
root@s2-master-1:~# curl localhost:31000/color; echo
Hostname: app-color ; Color: blue
```

Via YAML

```
root@s2-master-1:~# k run app-color --image=fbscarel/myapp-color -l app=app-color --port=80 --env="COLOR=blue" --dry-run=client -o yaml > manifests/app-color.yaml
root@s2-master-1:~# cat manifests/app-color.yaml
apiVersion: v1
kind: Pod
metadata:
  creationTimestamp: null
  labels:
    app: app-color
  name: app-color
spec:
  containers:
  - env:
    - name: COLOR
      value: blue
    image: fbscarel/myapp-color
    name: app-color
    ports:
    - containerPort: 80
    resources: {}
  dnsPolicy: ClusterFirst
  restartPolicy: Always
status: {}
```

Variáveis de ambiente no kubernetes

https://kubernetes.io/docs/tasks/inject-data-application/define-environment-variable-container/

ConfigMaps

Objeto utilizado para armazenar dados não-confidenciais em pares ***chave-valor***

Podem ser consumidos como variáveis de ambiente, argumentos CLI ou arquivos montados em ***volumes***

Permitem desacoplar a configuração da imagem do container, facilitando ***portabilidade***

Para dados sensíveis, deve-se utilizar ***Secrets***

Criando *ConfigMaps* via YAML

```yaml
apiVersion: v1
kind: ConfigMap
metadata:
  name: app-color-cm
data:
  COLOR: pink
```

Criando *ConfigMaps* via imperativa

```
root@s2-master-1:~# k create cm app-color-cm --from-literal="COLOR=pink"
configmap/app-color-cm created
root@s2-master-1:~# k describe cm app-color-cm
Name:         app-color-cm
Namespace:    lab
Labels:       <none>
Annotations:  <none>

Data
====
COLOR:
----
pink

BinaryData
====

Events:  <none>
```

Utilizando *ConfigMaps* na configuração de *Pods*

```yaml
apiVersion: v1
kind: Pod
metadata:
  labels:
    app: app-color
  name: app-color
spec:
  containers:
  - env:
    - name: COLOR
      valueFrom:
        configMapKeyRef:
          name: app-color-cm
          key: COLOR
    image: fbscarel/myapp-color
    name: app-color
    ports:
    - containerPort: 80
```

```yaml
apiVersion: v1
kind: Pod
metadata:
  labels:
    app: app-color-envfrom
  name: app-color-envfrom
spec:
  containers:
  - name: app-color
    image: fbscarel/myapp-color
    ports:
    - containerPort: 80
    envFrom:
    - configMapRef:
        name: app-color-cm
```

Utilizando *ConfigMaps* na configuração de *Pods*

```
root@s2-master-1:~# k get pod
NAME                  READY   STATUS    RESTARTS   AGE
app-color-envfrom     1/1     Running   0          2m51s
app-color-valuefrom   1/1     Running   0          12m
root@s2-master-1:~# k get cm
NAME               DATA   AGE
app-color-cm       1      69m
kube-root-ca.crt   1      10d
root@s2-master-1:~# k describe cm app-color-cm
Name:         app-color-cm
Namespace:    lab
Labels:       <none>
Annotations:  <none>

Data
====
COLOR:
----
pink

BinaryData
====

Events:  <none>
```

Utilizando *ConfigMaps* na configuração de *Pods*

```
root@s2-master-1:~# k create service nodeport app-color-envfrom --tcp=80 --node-port=31000
service/app-color-envfrom created
root@s2-master-1:~# k create service nodeport app-color-valuefrom --tcp=80 --node-port=32000
service/app-color-valuefrom created
root@s2-master-1:~# k get svc
NAME                  TYPE        CLUSTER-IP      EXTERNAL-IP   PORT(S)        AGE
app-color-envfrom     NodePort    10.111.88.157   <none>        80:31000/TCP   18s
app-color-valuefrom   NodePort    10.111.3.238    <none>        80:32000/TCP   5s
root@s2-master-1:~# curl localhost:31000/color; echo
Hostname: app-color-envfrom ; Color: pink
root@s2-master-1:~#
root@s2-master-1:~# curl localhost:32000/color; echo
Hostname: app-color-valuefrom ; Color: pink
```

Secrets

Objetos utilizados para armazenar informações ***sensíveis***

P.ex.: senhas, *tokens* Oauth ou chaves SSH

Armazenados em codificação ***base64*** (i.e. não cifrados)

Segurança baseada na visibilidade dos elementos (opcionalmente, **criptografia**/**RBAC**)

Tipos de *Secrets*

Builtin Type	Usage
`Opaque`	arbitrary user-defined data
`kubernetes.io/service-account-token`	service account token
`kubernetes.io/dockercfg`	serialized `~/.dockercfg` file
`kubernetes.io/dockerconfigjson`	serialized `~/.docker/config.json` file
`kubernetes.io/basic-auth`	credentials for basic authentication
`kubernetes.io/ssh-auth`	credentials for SSH authentication
`kubernetes.io/tls`	data for a TLS client or server
`bootstrap.kubernetes.io/token`	bootstrap token data

Criando *Secrets* via YAML

```
root@s2-master-1:~# k apply -f manifests/daytona-secret.yaml
secret/daytona-secret-yaml created
root@s2-master-1:~# k describe secrets daytona-secret-yaml
Name:         daytona-secret-yaml
Namespace:    lab
Labels:       <none>
Annotations:  <none>

Type:  Opaque

Data
====
DBPASS:  5 bytes
DBUSER:  4 bytes
```

```yaml
apiVersion: v1
kind: Secret
metadata:
  name: daytona-secret-yaml
data:
  DBPASS: YmVhY2g=
  DBUSER: cm9vdA==
```

Criando *Secrets* via imperativa

```
root@s2-master-1:~# k create secret generic secret-teste --from-literal="user=fulano" --from-literal="password=senha"
secret/secret-teste created
root@s2-master-1:~# k get secrets
NAME                  TYPE     DATA   AGE
daytona-secret-yaml   Opaque   2      3m30s
secret-teste          Opaque   2      7s
```

Visualizando *Secrets*

```
root@s2-master-1:~# k get secrets secret-teste -o json
{
    "apiVersion": "v1",
    "data": {
        "password": "c2VuaGE=",
        "user": "ZnVsYW5v"
    },
    "kind": "Secret",
    "metadata": {
        "creationTimestamp": "2023-08-04T08:15:52Z",
        "name": "secret-teste",
        "namespace": "lab",
        "resourceVersion": "297408",
        "uid": "f7518b03-70f8-4239-9cf2-8486af16fd87"
    },
    "type": "Opaque"
}
root@s2-master-1:~# echo c2VuaGE= | base64 -d; echo
senha
root@s2-master-1:~# echo ZnVsYW5v | base64 -d; echo
fulano
```

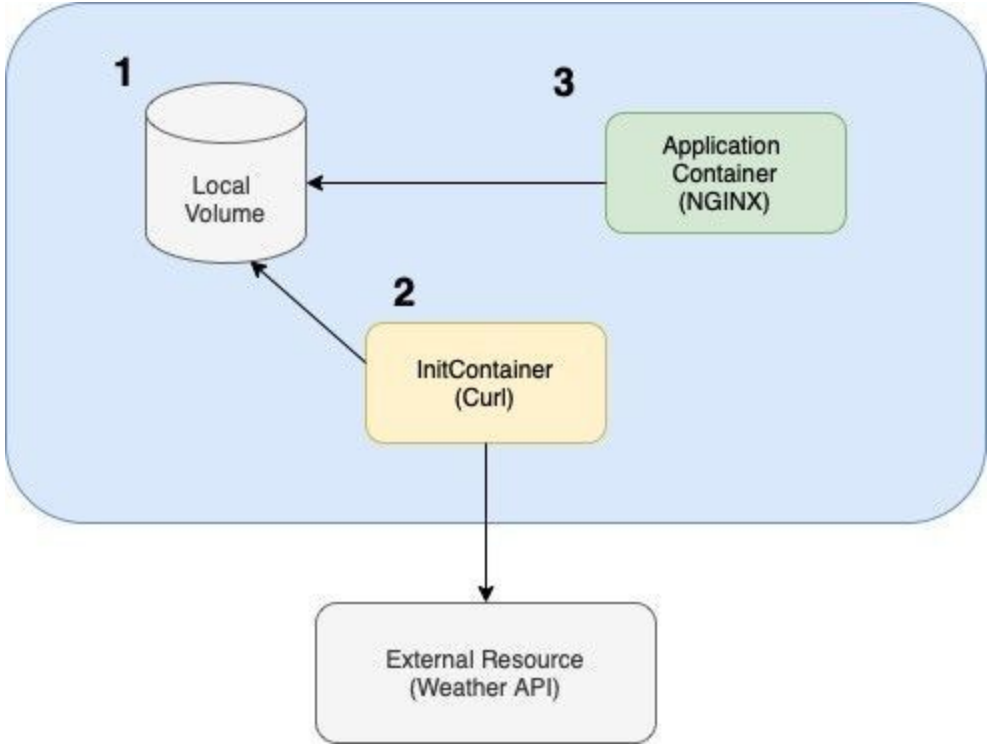
Visualizando *Secrets*

```
root@s2-master-1:~# k get secrets secret-teste -o json | jq '.data | map_values(@base64d)'
{
  "password": "senha",
  "user": "fulano"
}
```

Utilizando *Secrets* na configuração de *Pods*

```yaml
apiVersion: v1
kind: Pod
metadata:
  labels:
    app: daytona-app
  name: daytona-app
spec:
  containers:
  - image: fbscarel/myapp-mysql
    name: daytona-app
    env:
      - name: DBHOST
        valueFrom:
          configMapKeyRef:
            name: daytona-cm
            key: DBHOST
    envFrom:
    - secretRef:
        name: daytona-secret-yaml
```

Init-container



Init Containers

Containers especializados que executam antes de containers de aplicação em um *pod*

Executados antes dos containers “normais”, até sua conclusão

Em havendo mais de um *init container*, executam sequencialmente

O próximo *init container* é iniciado apenas se o anterior obteve suceso

Init Containers: por quê usar?

Podem conter utilitários ou código especializado para configuração do ambiente

Podem fazer a função de *builder* e/ou *deployer*

Podem ter uma visão diferenciada do *filesystem*, acessando *secrets* invisíveis aos outros containers

Permitem a introdução de bloqueio/*delay* para checagem de pré-condições

Init Containers: exemplo

vagrant@s2-master-1: ~ | fbs@DESKTOP-A1M9PI8: ~

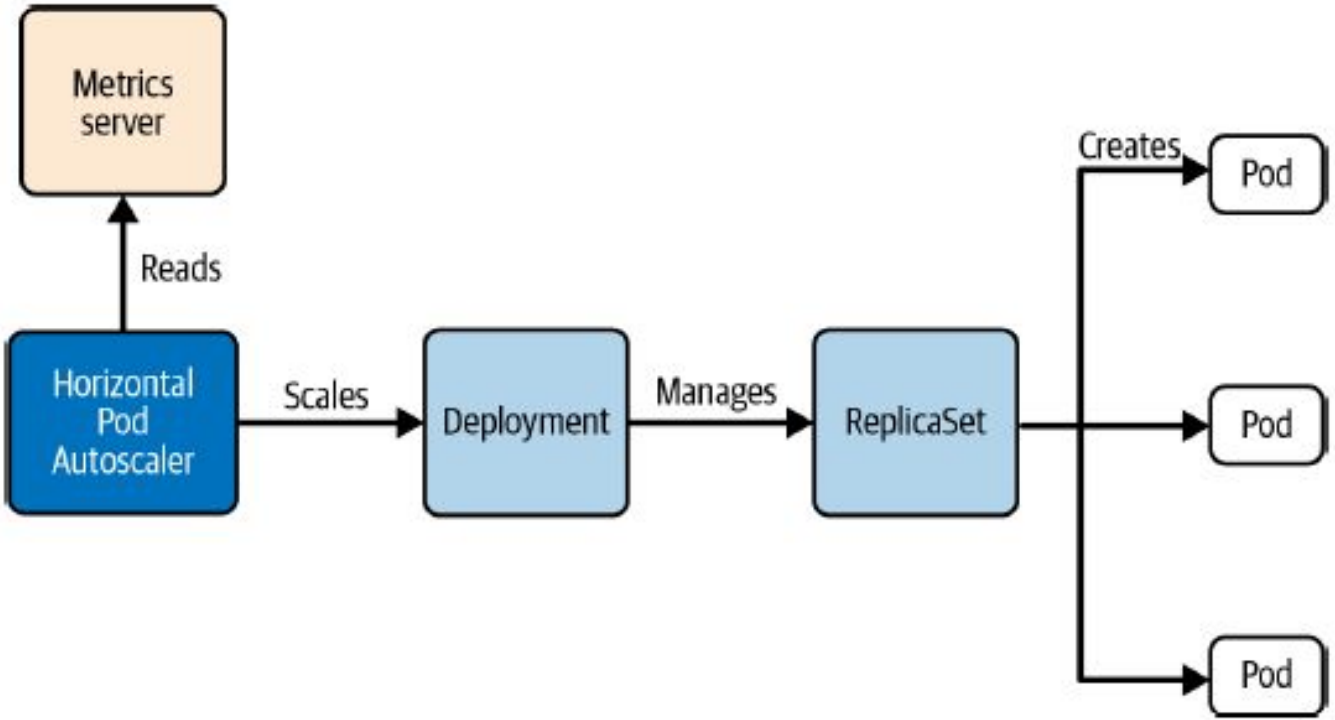
```
apiVersion: v1
kind: Pod
metadata:
  name: myapp-pod
  labels:
    app: myapp
spec:
  containers:
  - name: myapp-container
    image: busybox:1.28
    command: ['sh', '-c', 'echo The app is running! && sleep 3600']
  initContainers:
  - name: init-myservice
    image: busybox:1.28
    command: ['sh', '-c', "until nslookup myservice.$(cat /var/run/secrets/kubernetes.io/serviceac
count/namespace).svc.cluster.local; do echo waiting for myservice; sleep 2; done"]
  - name: init-mydb
    image: busybox:1.28
    command: ['sh', '-c', "until nslookup mydb.$(cat /var/run/secrets/kubernetes.io/serviceaccount
/namespace).svc.cluster.local; do echo waiting for mydb; sleep 2; done"]
~
~
                                                                    19,0-1        All
```

Horizontal Pod Autoscaler

Escala automaticamente o número de *pods* em um ***deployment, replicaset ou statefulset***

Observa métricas de uso de CPU ou outras para determinar demanda

HPA - Horizontal POD Autoscaler



Exemplo:

```yaml
apiVersion: autoscaling/v1
kind: HorizontalPodAutoscaler
metadata:
  name: php-hpa
spec:
  maxReplicas: 5
  minReplicas: 1
  scaleTargetRef:
    apiVersion: apps/v1
    kind: Deployment
    name: php-hpa
  targetCPUUtilizationPercentage: 50
```

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: php-hpa
spec:
  selector:
    matchLabels:
      app: php-hpa
  replicas: 1
  template:
    metadata:
      labels:
        app: php-hpa
    spec:
      containers:
      - name: php-hpa
        image: fbscarel/php-sqrt
        resources:
          limits:
            cpu: 200m
          requests:
            cpu: 100m
```

Exemplo:

```
root@s2-master-1:~# k apply -f manifests/php-deploy.yaml
deployment.apps/php-hpa created
root@s2-master-1:~# k autoscale deploy php-hpa --cpu-percent=50 --min=1 --max=5 --dry-run=client -o yaml > manifests/php-hpa.y
aml
root@s2-master-1:~# k apply -f manifests/php-hpa.yaml
horizontalpodautoscaler.autoscaling/php-hpa created
root@s2-master-1:~# k get hpa
NAME      REFERENCE            TARGETS         MINPODS   MAXPODS   REPLICAS   AGE
php-hpa   Deployment/php-hpa   <unknown>/50%   1         5         0          13s
root@s2-master-1:~# k get deployments.apps php-hpa
NAME      READY   UP-TO-DATE   AVAILABLE   AGE
php-hpa   1/1     1            1           4m12s
root@s2-master-1:~#
root@s2-master-1:~# k run load-generator --image=busybox -- /bin/sh -c 'while true; do wget -q -O- http://php-hpa; done'
pod/load-generator created
```

Exemplo:

```
root@s2-master-1:~# k get hpa
NAME      REFERENCE             TARGETS   MINPODS   MAXPODS   REPLICAS   AGE
php-hpa   Deployment/php-hpa    1%/50%    1         5         1          3m36s
root@s2-master-1:~#
root@s2-master-1:~# k get hpa
NAME      REFERENCE             TARGETS    MINPODS   MAXPODS   REPLICAS   AGE
php-hpa   Deployment/php-hpa    187%/50%   1         5         1          3m51s
root@s2-master-1:~#
root@s2-master-1:~# k get hpa
NAME      REFERENCE             TARGETS    MINPODS   MAXPODS   REPLICAS   AGE
php-hpa   Deployment/php-hpa    119%/50%   1         5         4          4m7s
root@s2-master-1:~#
root@s2-master-1:~# k get hpa
NAME      REFERENCE             TARGETS   MINPODS   MAXPODS   REPLICAS   AGE
php-hpa   Deployment/php-hpa    57%/50%   1         5         4          4m23s
root@s2-master-1:~#
root@s2-master-1:~# k get hpa
NAME      REFERENCE             TARGETS   MINPODS   MAXPODS   REPLICAS   AGE
php-hpa   Deployment/php-hpa    42%/50%   1         5         5          4m46s
root@s2-master-1:~#
root@s2-master-1:~# k get hpa
NAME      REFERENCE             TARGETS   MINPODS   MAXPODS   REPLICAS   AGE
php-hpa   Deployment/php-hpa    45%/50%   1         5         5          5m7s
root@s2-master-1:~#
root@s2-master-1:~# k get hpa
NAME      REFERENCE             TARGETS   MINPODS   MAXPODS   REPLICAS   AGE
php-hpa   Deployment/php-hpa    45%/50%   1         5         5          5m34s
```

Exemplo:

```
root@s2-master-1:~# k delete pod load-generator
pod "load-generator" deleted
^Croot@s2-master-1:~k get pod
NAME                     READY   STATUS        RESTARTS   AGE
load-generator           1/1     Terminating   0          2m50s
php-hpa-b89f98cf7-fxnnq  1/1     Running       0          2m21s
php-hpa-b89f98cf7-nsrj7  1/1     Running       0          25m
php-hpa-b89f98cf7-ntzzq  1/1     Running       0          2m21s
php-hpa-b89f98cf7-sxr2d  1/1     Running       0          2m21s
php-hpa-b89f98cf7-z7nsb  1/1     Running       0          96s
root@s2-master-1:~# k get pod
NAME                     READY   STATUS    RESTARTS   AGE
php-hpa-b89f98cf7-fxnnq  1/1     Running   0          2m36s
php-hpa-b89f98cf7-nsrj7  1/1     Running   0          25m
php-hpa-b89f98cf7-ntzzq  1/1     Running   0          2m36s
php-hpa-b89f98cf7-sxr2d  1/1     Running   0          2m36s
php-hpa-b89f98cf7-z7nsb  1/1     Running   0          111s
```

Exemplo:

```
root@s2-master-1:~# while true; do k get hpa; echo '----'; sleep 20; done
NAME      REFERENCE            TARGETS   MINPODS   MAXPODS   REPLICAS   AGE
php-hpa   Deployment/php-hpa   18%/50%   1         5         5          21m
----
NAME      REFERENCE            TARGETS   MINPODS   MAXPODS   REPLICAS   AGE
php-hpa   Deployment/php-hpa   1%/50%    1         5         5          22m
----
NAME      REFERENCE            TARGETS   MINPODS   MAXPODS   REPLICAS   AGE
php-hpa   Deployment/php-hpa   1%/50%    1         5         5          22m
----
NAME      REFERENCE            TARGETS   MINPODS   MAXPODS   REPLICAS   AGE
php-hpa   Deployment/php-hpa   1%/50%    1         5         5          22m
----
NAME      REFERENCE            TARGETS   MINPODS   MAXPODS   REPLICAS   AGE
php-hpa   Deployment/php-hpa   1%/50%    1         5         5          23m
```

```
NAME      REFERENCE            TARGETS   MINPODS   MAXPODS   REPLICAS   AGE
php-hpa   Deployment/php-hpa   1%/50%    1         5         5          24m
----
NAME      REFERENCE            TARGETS   MINPODS   MAXPODS   REPLICAS   AGE
php-hpa   Deployment/php-hpa   1%/50%    1         5         5          24m
----
NAME      REFERENCE            TARGETS   MINPODS   MAXPODS   REPLICAS   AGE
php-hpa   Deployment/php-hpa   1%/50%    1         5         5          24m
----
NAME      REFERENCE            TARGETS   MINPODS   MAXPODS   REPLICAS   AGE
php-hpa   Deployment/php-hpa   1%/50%    1         5         5          25m
```

```
NAME      REFERENCE            TARGETS   MINPODS   MAXPODS   REPLICAS   AGE
php-hpa   Deployment/php-hpa   1%/50%    1         5         2          26m
----
NAME      REFERENCE            TARGETS   MINPODS   MAXPODS   REPLICAS   AGE
php-hpa   Deployment/php-hpa   1%/50%    1         5         1          27m
```

Tarefa 5

As atividades práticas desta sessão podem ser obtidas em formato HTML via:

https://bit.ly/ads19-tarefas-s5

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