```yaml
apiVersion: v1
kind: Pod
metadata:
  name: example-pod
spec:
  containers:
  - name: container
    image: nginx
    ports:
    - containerPort: 80
    livenessProbe:
      httpGet:
        path: /index.html
        port: 80
      initialDelaySeconds: 15
      periodSeconds: 15
    readinessProbe:
      httpGet:
        path: /index.html
        port: 80
      initialDelaySeconds: 5
      periodSeconds: 10
```

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```
controlplane:~$ ls
filesystem  liveness_readiness.yaml
controlplane:~$ vi liveness_readiness.yaml
controlplane:~$ kubectl apply -f liveness_readiness.yaml
pod/example-pod created
controlplane:~$ kubectl get pods
NAME          READY   STATUS             RESTARTS   AGE
example-pod   0/1     ContainerCreating  0          6s
controlplane:~$ kubectl get pods
NAME          READY   STATUS    RESTARTS   AGE
example-pod   0/1     Running   0          12s
controlplane:~$ kubectl get pods
NAME          READY   STATUS    RESTARTS   AGE
example-pod   0/1     Running   0          14s
controlplane:~$ kubectl get pods
NAME          READY   STATUS    RESTARTS   AGE
example-pod   0/1     Running   0          17s
controlplane:~$ kubectl get pods
NAME          READY   STATUS    RESTARTS   AGE
example-pod   1/1     Running   0          25s
controlplane:~$ kubectl exec -it example-pod -- bin/bash
root@example-pod:/# cls
bash: cls: command not found
root@example-pod:/# ls
bin   dev                 docker-entrypoint.sh  home   lib64   mnt   proc   run    srv   tmp   var
boot  docker-entrypoint.d  etc                         lib    media  opt    root   sbin  sys   usr
root@example-pod:/# cd usr
root@example-pod:/usr# ls
bin  games  include  lib  lib64  libexec  local  sbin  share  src
root@example-pod:/usr# cd share
root@example-pod:/usr/share# ls
X11              bug              debianutils  dpkg        gdb       libc-bin     man          nginx        pixmaps    util-linux
base-files       ca-certificates  dict         fontconfig  info      libgcrypt20  maven-repo   pam          polkit-1   xml
base-passwd      common-licenses  doc          fonts       java      lintian      menu         pam-configs  tabset     zoneinfo
bash-completion  debconf          doc-base     gcc         keyrings  locale       misc         perl5        terminfo   zsh
```

```
root@example-pod:/usr/share# cd nginx
root@example-pod:/usr/share/nginx# ls
html
root@example-pod:/usr/share/nginx# cd html
root@example-pod:/usr/share/nginx/html# ls
50x.html  index.html
root@example-pod:/usr/share/nginx/html# rm index.html
root@example-pod:/usr/share/nginx/html# ls
50x.html
root@example-pod:/usr/share/nginx/html# exit
exit
controlplane:~$ kubectl get pods
NAME          READY   STATUS    RESTARTS   AGE
example-pod   1/1     Running   0          2m15s
controlplane:~$ kubectl get pods
NAME          READY   STATUS    RESTARTS   AGE
example-pod   1/1     Running   0          2m19s
controlplane:~$ kubectl get pods
NAME          READY   STATUS    RESTARTS   AGE
example-pod   1/1     Running   0          2m26s
controlplane:~$ kubectl get pods
NAME          READY   STATUS    RESTARTS   AGE
example-pod   0/1     Running   0          2m38s
controlplane:~$ kubectl get pods
NAME          READY   STATUS    RESTARTS   AGE
example-pod   0/1     Running   0          2m43s
controlplane:~$ kubectl get pods
NAME          READY   STATUS    RESTARTS     AGE
example-pod   0/1     Running   1 (9s ago)   2m54s
controlplane:~$ kubectl get pods
NAME          READY   STATUS    RESTARTS      AGE
example-pod   1/1     Running   1 (15s ago)   3m
controlplane:~$ kubectl exec -it example-pod --bin/bash
error: unknown flag: --bin/bash
See 'kubectl exec --help' for usage.
```

```
example-pod   1/1      Running   1 (15s ago)   3m
controlplane:~$ kubectl exec -it example-pod --bin/bash
error: unknown flag: --bin/bash
See 'kubectl exec --help' for usage.
controlplane:~$ kubectl exec -it example-pod -- bin/bash
root@example-pod:/# cd usr/share/nginx/html
root@example-pod:/usr/share/nginx/html# ls
50x.html   index.html
root@example-pod:/usr/share/nginx/html#
```

Horizontal Pod Autoscaling

```
apiVersion: autoscaling/v2
kind: HorizontalPodAutoscaler
metadata:
  name: php-apache
spec:
  scaleTargetRef:
    apiVersion: apps/v1
    kind: Deployment
    name: nginx-deployment
  minReplicas: 1
  maxReplicas: 10
  metrics:
  - type: Resource
    resource:
      name: cpu
      target:
        type: Utilization
        averageUtilization: 50
~
~
```

```
apiservice.apiregistration.k8s.io/v1beta1.metrics.k8s.io created
controlplane:~/kubernetes-training/k8-manifests/metrics_server$ kubectl top pods
error: Metrics API not available
controlplane:~/kubernetes-training/k8-manifests/metrics_server$ vi metrics-server.yaml
controlplane:~/kubernetes-training/k8-manifests/metrics_server$ kubectl top pods
NAME          CPU(cores)   MEMORY(bytes)
example-pod   1m           2Mi
controlplane:~/kubernetes-training/k8-manifests/metrics_server$ kubectl get nodes
NAME          STATUS   ROLES           AGE    VERSION
controlplane  Ready    control-plane   22d    v1.32.1
node01        Ready    <none>          22d    v1.32.1
controlplane:~/kubernetes-training/k8-manifests/metrics_server$ kubectl top nodes
NAME          CPU(cores)   CPU(%)   MEMORY(bytes)   MEMORY(%)
controlplane  101m         10%      1134Mi          60%
node01        120m         12%      907Mi           48%
controlplane:~/kubernetes-training/k8-manifests/metrics_server$ vi deploy.yaml
controlplane:~/kubernetes-training/k8-manifests/metrics_server$ kubectl apply -f deploy.yaml
deployment.apps/nginx-deployment created
controlplane:~/kubernetes-training/k8-manifests/metrics_server$ kubectl get pods
NAME                                READY   STATUS             RESTARTS        AGE
example-pod                         1/1     Running            1 (27m ago)     30m
nginx-deployment-59cf44d54c-c4c4s   0/1     ContainerCreating  0               5s
nginx-deployment-59cf44d54c-n6cbt   0/1     ContainerCreating  0               5s
nginx-deployment-59cf44d54c-vnr8x   0/1     ContainerCreating  0               5s
controlplane:~/kubernetes-training/k8-manifests/metrics_server$ kubectl get pods
NAME                                READY   STATUS    RESTARTS       AGE
example-pod                         1/1     Running   1 (27m ago)    30m
nginx-deployment-59cf44d54c-c4c4s   1/1     Running   0              9s
nginx-deployment-59cf44d54c-n6cbt   1/1     Running   0              9s
nginx-deployment-59cf44d54c-vnr8x   1/1     Running   0              9s
controlplane:~/kubernetes-training/k8-manifests/metrics_server$ vi hps.yaml
controlplane:~/kubernetes-training/k8-manifests/metrics_server$ vi hps.yaml
controlplane:~/kubernetes-training/k8-manifests/metrics_server$ kubcetl  apply -f hps.yaml
kubcetl: command not found
controlplane:~/kubernetes-training/k8-manifests/metrics_server$ kubectl  apply -f hps.yaml
```

```
kubcetl: command not found
controlplane:~/kubernetes-training/k8-manifests/metrics_server$ kubectl  apply -f hps.yaml
horizontalpodautoscaler.autoscaling/php-apache created
controlplane:~/kubernetes-training/k8-manifests/metrics_server$ kubectl get hpa
NAME         REFERENCE                   TARGETS      MINPODS   MAXPODS   REPLICAS   AGE
php-apache   Deployment/nginx-deployment cpu: 0%/50%  1         10        3          20s
controlplane:~/kubernetes-training/k8-manifests/metrics_server$ kubectl get pods
NAME                                READY   STATUS    RESTARTS       AGE
example-pod                         1/1     Running   1 (38m ago)    40m
nginx-deployment-59cf44d54c-c4c4s   1/1     Running   0              10m
nginx-deployment-59cf44d54c-n6cbt   1/1     Running   0              10m
nginx-deployment-59cf44d54c-vnr8x   1/1     Running   0              10m
controlplane:~/kubernetes-training/k8-manifests/metrics_server$ kubectl describe pod php-apache
Error from server (NotFound): pods "php-apache" not found
controlplane:~/kubernetes-training/k8-manifests/metrics_server$ kubectl describe hpa php-apache
Name:                                                     php-apache
Namespace:                                                default
Labels:                                                   <none>
Annotations:                                              <none>
CreationTimestamp:                                        Mon, 14 Apr 2025 14:35:23 +0000
Reference:                                                Deployment/nginx-deployment
Metrics:                                                  ( current / target )
  resource cpu on pods  (as a percentage of request):    0% (0) / 50%
Min replicas:                                             1
Max replicas:                                             10
Deployment pods:                                          3 current / 3 desired
Conditions:
  Type            Status   Reason                Message
  ----            ------   ------                -------
  AbleToScale     True     ScaleDownStabilized   recent recommendations were higher than current one, applying the highest recent recommendation
  ScalingActive   True     ValidMetricFound      the HPA was able to successfully calculate a replica count from cpu resource utilization (percen
ge of request)
  ScalingLimited  False    DesiredWithinRange    the desired count is within the acceptable range
Events:           <none>
controlplane:~/kubernetes-training/k8-manifests/metrics_server$
```

```
          memory: "64Mi"
          cpu: "250m"
        limits:
          memory: "128Mi"
          cpu: "500m"

ontrolplane:~/kubernetes-training/k8-manifests/metrics_server$ ^C
ontrolplane:~/kubernetes-training/k8-manifests/metrics_server$ kubectl get pods
AME                              READY   STATUS    RESTARTS      AGE
xample-pod                       1/1     Running   1 (42m ago)   45m
ginx-deployment-59cf44d54c-vnr8x 1/1     Running   0             14m
ontrolplane:~/kubernetes-training/k8-manifests/metrics_server$ kubectl describe hpa php-apache
ame:                                                  php-apache
amespace:                                             default
abels:                                                <none>
nnotations:                                           <none>
reationTimestamp:                                     Mon, 14 Apr 2025 14:35:23 +0000
eference:                                             Deployment/nginx-deployment
etrics:                                               ( current / target )
  resource cpu on pods  (as a percentage of request): 0% (0) / 50%
in replicas:                                          1
ax replicas:                                          10
eployment pods:                                       1 current / 1 desired
onditions:
  Type           Status   Reason             Message
  ----           ------   ------             -------
  AbleToScale    True     ReadyForNewScale   recommended size matches current size
  ScalingActive  True     ValidMetricFound   the HPA was able to successfully calculate a replica count from cpu resource utilization (percentage
f request)
  ScalingLimited True     TooFewReplicas     the desired replica count is less than the minimum replica count
vents:
  Type    Reason            Age   From                     Message
  ----    ------            ----  ----                     -------
  Normal  SuccessfulRescale 40s   horizontal-pod-autoscaler New size: 1; reason: All metrics below target
ontrolplane:~/kubernetes-training/k8-manifests/metrics_server$
```

```
          memory: "64Mi"
          cpu: "250m"
        limits:
          memory: "128Mi"
          cpu: "500m"

ontrolplane:~/kubernetes-training/k8-manifests/metrics_server$ ^C
ontrolplane:~/kubernetes-training/k8-manifests/metrics_server$ kubectl get pods
AME                              READY   STATUS    RESTARTS      AGE
xample-pod                       1/1     Running   1 (42m ago)   45m
ginx-deployment-59cf44d54c-vnr8x 1/1     Running   0             14m
ontrolplane:~/kubernetes-training/k8-manifests/metrics_server$ kubectl describe hpa php-apache
ame:                                                  php-apache
amespace:                                             default
abels:                                                <none>
nnotations:                                           <none>
reationTimestamp:                                     Mon, 14 Apr 2025 14:35:23 +0000
eference:                                             Deployment/nginx-deployment
etrics:                                               ( current / target )
  resource cpu on pods  (as a percentage of request): 0% (0) / 50%
in replicas:                                          1
ax replicas:                                          10
eployment pods:                                       1 current / 1 desired
onditions:
  Type           Status   Reason             Message
  ----           ------   ------             -------
  AbleToScale    True     ReadyForNewScale   recommended size matches current size
  ScalingActive  True     ValidMetricFound   the HPA was able to successfully calculate a replica count from cpu resource utilization (percentage
f request)
  ScalingLimited True     TooFewReplicas     the desired replica count is less than the minimum replica count
vents:
  Type    Reason            Age   From                     Message
  ----    ------            ----  ----                     -------
  Normal  SuccessfulRescale 40s   horizontal-pod-autoscaler New size: 1; reason: All metrics below target
ontrolplane:~/kubernetes-training/k8-manifests/metrics_server$
```