K21Academy
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Linux Foundation

CKAD Mock Question

1 INTRODUCTION

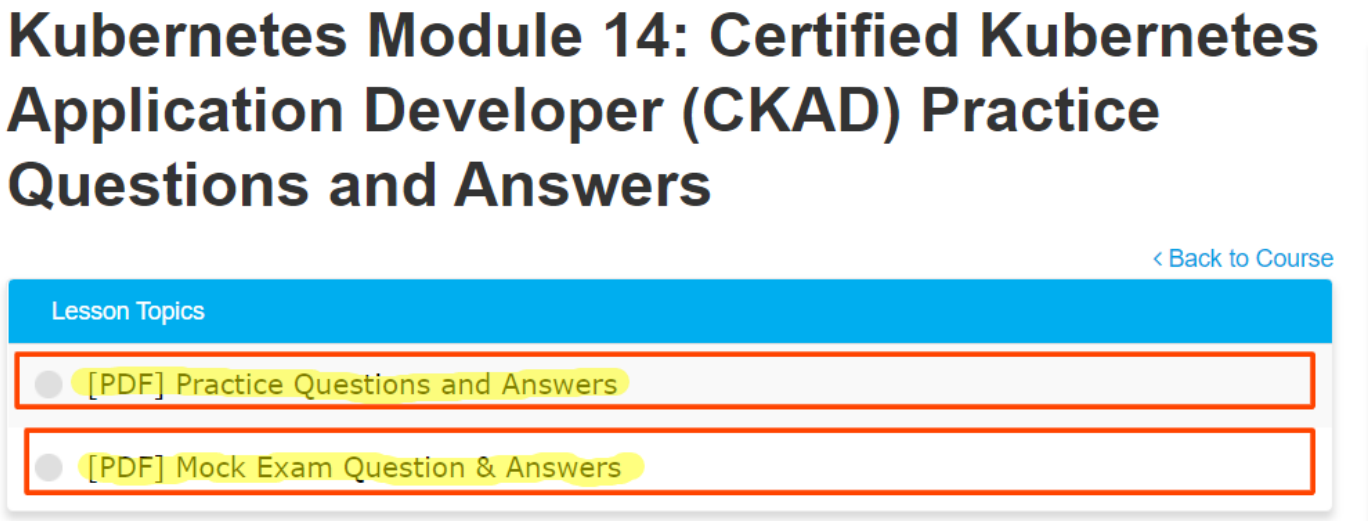
In this guide there are mock questions for CKAD exam from **Linux Foundation**. These questions are just to give you an overview about what kind of questions you can expect in the CKAD exam.

Also we have practice and mock questions for CKAD exam on our portal. You can access them by going to the portal.

Please refer to the below images and links to find the Practice questions.

1. **Easy remember link for the portal:** https://k21academy.com/kubernetesdevself

2. **Kubernetes Module 14: Certified Kubernetes Application Developer (CKAD) Practice Questions and Answers:** https://k21academy.com/ckadm14



Q1 | Namespaces

The DevOps team would like to get the list of all Namespaces in the cluster. Get the list and save it to **/opt/course/1/namespaces.**

Ans.

```
$ k get ns > /opt/course/1/namespaces
```

The content should then look like:

```
# /opt/course/1/namespaces
NAME          STATUS   AGE
default       Active   150m
earth         Active   76m
jupiter       Active   76m
kube-public   Active   150m
kube-system   Active   150m
mars          Active   76m
mercury       Active   76m
moon          Active   76m
neptune       Active   76m
pluto         Active   76m
saturn        Active   76m
shell-intern  Active   76m
sun           Active   76m
venus         Active   76m
```

Q2 | Pods

Create a single Pod of image **httpd:2.4.41-alpine** in Namespace **default**. The Pod should be named **pod1** and the container should be named **pod1-container**.

Your manager would like to run a command manually on occasion to output the status of that exact Pod. Please write a command that does this into **/opt/course/2/pod1-status-command.sh.** The command should use **kubectl**.

Ans.

```
$ k run # help
# check the export on the very top of this document so we can use $do
$ k run pod1 --image=httpd:2.4.41-alpine $do > 2.yaml
```

```
$ vim 2.yaml
```

Change the container name in **2.yaml** to **pod1-container**:

```
# 2.yaml
apiVersion: v1
kind: Pod
metadata:
  creationTimestamp: null
  labels:
    run: pod1
  name: pod1
spec:
  containers:
  - image: httpd:2.4.41-alpine
    name: pod1-container # change
    resources: {}
  dnsPolicy: ClusterFirst
  restartPolicy: Always
status: {}
```

Then run:

```
$ k create -f 2.yaml
pod/pod1 created
```

```
$ k get pod
NAME   READY   STATUS              RESTARTS   AGE
pod1   0/1     ContainerCreating   0          6s
```

```
$ k get pod
NAME   READY   STATUS    RESTARTS   AGE
pod1   1/1     Running   0          30s
```

Next create the requested command:

```
vim /opt/course/2/pod1-status-command.sh
```

The content of the command file could look like:

```
# /opt/course/2/pod1-status-command.sh
kubectl -n default describe pod pod1 | grep -i status:
```

Another solution would be using jsonpath:

```
# /opt/course/2/pod1-status-command.sh
kubectl -n default get pod pod1 -o jsonpath="{.status.phase}"
```

To test the command:

```
$ sh /opt/course/2/pod1-status-command.sh
Running
```

Q3 | Job

Team Neptune needs a Job template located at **/opt/course/3/job.yaml**. This Job should run image **busybox:1.31.0** and execute **sleep 2 && echo done**. It should be in namespace **neptune**, run a total of 3 times and should execute 2 runs in parallel.

Start the Job and check its history. Each pod created by the Job should have the label **id: awesome-job**. The job should be named **neb-new-job** and the container **neb-new-job-container**.

Ans.

```
$ k -n neptun create job -h
# check the export on the very top of this document so we can use $do
```

```
$ k -n neptune create job neb-new-job --image=busybox:1.31.0 $do > /opt/course/3/job.yaml -- sh -c "sleep 2 && echo done"
```

```
$ vim /opt/course/3/job.yaml
```

Note: Before v1.18 it used to be possible to create a Job with k -n neptune run neb-new-job --image=busybox:1.31.0 --restart=OnFailure, but not any longer.

Make the required changes in the yaml:

```
# /opt/course/3/job.yaml
apiVersion: batch/v1
kind: Job
metadata:
  creationTimestamp: null
  name: neb-new-job
  namespace: neptune      # add
spec:
  completions: 3          # add
  parallelism: 2          # add
  template:
    metadata:
      creationTimestamp: null
      labels:             # add
        id: awesome-job   # add
    spec:
      containers:
      - command:
        - sh
        - -c
        - sleep 2 && echo done
        image: busybox:1.31.0
        name: neb-new-job-container # update
        resources: {}
      restartPolicy: Never
status: {}
```

Then to create it:

```
$ k -f /opt/course/3/job.yaml create
# namespace already set in yaml
```

Check Job and Pods, you should see two running parallel at most but three in total:

```
$  k -n neptune get pod,job | grep neb-new-job
pod/neb-new-job-jhq2g          0/1     ContainerCreating   0          4s
pod/neb-new-job-vf6ts          0/1     ContainerCreating   0          4s

job.batch/neb-new-job          0/3                         4s         5s
```

```
$ k -n neptune get pod,job | grep neb-new-job
pod/neb-new-job-gm8sz          0/1     ContainerCreating   0          0s
pod/neb-new-job-jhq2g          0/1     Completed           0          10s
pod/neb-new-job-vf6ts          1/1     Running             0          10s

job.batch/neb-new-job          1/3                         10s        11s
```

```
$ k -n neptune get pod,job | grep neb-new-job
pod/neb-new-job-gm8sz          0/1     ContainerCreating   0          5s

pod/neb-new-job-jhq2g          0/1     Completed           0          15s
pod/neb-new-job-vf6ts          0/1     Completed           0          15s
job.batch/neb-new-job          2/3                         15s        16s
```

```
$ k -n neptune get pod,job | grep neb-new-job
pod/neb-new-job-gm8sz          0/1     Completed           0          12s
pod/neb-new-job-jhq2g          0/1     Completed           0          22s
pod/neb-new-job-vf6ts          0/1     Completed           0          22s

job.batch/neb-new-job          3/3                         21s        23s
```

Check history:

```
$ k -n neptune describe job neb-new-job
...
Events:
  Type            Reason            Age   From                Message
  ----            ------            ----  ----                -------
  Normal  SuccessfulCreate  2m52s  job-controller  Created pod: neb-new-job-jhq2g
  Normal  SuccessfulCreate  2m52s  job-controller  Created pod: neb-new-job-vf6ts
```

```
Normal  SuccessfulCreate  2m42s  job-controller  Created pod: neb-new-job-gm8sz
```

Note: At the age column we can see that two pods run parallel and the third one after that. Just as it was required in the task.

Q4 | Requests and Limits, ServiceAccount

Team Neptune needs 3 Pods of image **httpd:2.4-alpine**, create a Deployment named **neptune-10ab** for this. The containers should be named **neptune-pod-10ab**. Each container should have a memory request of 20Mi and a memory limit of 50Mi.

Team Neptune has its own ServiceAccount **neptune-sa-v2** under which the Pods should run. The Deployment should be in Namespace **neptune**.

Ans.

```
$ k -n neptune create deployment -h
# help
```

```
$ k -n neptune create deploy -h
# deploy is short for deployment
```

```
# check the export on the very top of this document so we can use $do
$ k -n neptune create deploy neptune-10ab --image=httpd:2.4-alpine $do > 4.yaml
```

```
vim 4.yaml
```

Note: Before 1.18 it used to be possible to use the kubectl run to create a deployment with any attributes, but not any longer**.**

Now make the required changes using vim:

```
# 4.yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  creationTimestamp: null
  labels:
    app: neptune-10ab
  name: neptune-10ab
  namespace: neptune
spec:
  replicas: 3                  # change
  selector:
    matchLabels:
      app: neptune-10ab
  strategy: {}
  template:
    metadata:
      creationTimestamp: null
      labels:
        app: neptune-10ab
    spec:
      serviceAccountName: neptune-sa-v2 # add
      containers:
      - image: httpd:2.4-alpine
        name: neptune-pod-10ab  # change
        resources:              # add
          limits:               # add
            memory: 50Mi        # add
          requests:             # add
            memory: 20Mi        # add
status: {}
```

If we don't want to write the resources section manually we could run the following command and copy it manually into our yaml file:

```
$ k run tmp --image=busybox $do --requests=memory=20Mi --limits=memory=50Mi
```

Then create the yaml:

```
$ k create -f 4.yaml
# namespace already set in yaml
```

To verify all Pods are running we do:

```
$ k -n neptune get pod | grep neptune-10ab
neptune-10ab-7d4b8d45b-4nzj5   1/1   Running   0   57s
neptune-10ab-7d4b8d45b-lzwrf   1/1   Running   0   17s
neptune-10ab-7d4b8d45b-z5hcc   1/1   Running   0   17s
```

Q5 | ServiceAccount, Secret

Team Neptune has its own ServiceAccount named **neptune-sa-v2** in Namespace **neptune**. A coworker needs the token from the Secret that belongs to that ServiceAccount. Write the base64 decoded token to file **/opt/course/5/token**.

Ans.

```
$ k -n neptune get sa  # get overview
```

```
$ k -n neptune get secrets  # shows all secrets of namespace
```

```
$ k -n neptune get sa neptune-sa-v2 -o yaml | grep secret -A 2  # shows the secret name
```

```
$ k -n neptune get secret neptune-sa-v2-token-lwhhl -o yaml  # shows the secret content
apiVersion: v1
data:
...
  token:
ZXlKaGJHY2lPaUpTVXpJMU5pSXNJbXRwWkNJNkltNWFaRmRxWkRKMmFHTnZRM0JxV0haT
1IxZzFiM3BJY201SlowaEhOV3hUWmt3elFuRmFhVEZhZDJNaWZRLmV5SnBjM01pT2lKcmRXS
mxjbTVsZEdWekwzTmxjblpwWTJWaFkyTnZkVzUwSWl3aWEzVmlaWEp1WlhSbGN5NXBieTl6W
lhKMmFXTmxZV05qYjNWdWRDOXVZVzFsYzNCaFkyVWlPaUp1WlhCMGRXNWxJaXdpYTNWa
VpYSnVaWFJsY3k1cGJ5OXpaWEoyYVdOblpXTmpiM1Z1ZEM5elpXTnlaWFF1Ym1GdFpTSTZJ
bTVsY0hSMWJtVXRjMkV0ZGpJdGRHOXJaVzR0Wm5FNU1tb2lMQ0pyZFdKbGNtNWxkR1Z6TG
```

```
1sdkwzTmxjblpwWTJWaFkyTnZkVzUwTDNObGNuWnBZMlV0WVdOamIzVnVkQzV1WVcxbElqb
2libVZ3ZEhWdVpTMXpZUzEyTWlJc0ltdDFZbVZ5Ym1WMFpYTXVhVzh2YzJWeWRtbGpaV0Zq
WTI5MWJuUXZjMlZ5ZG1salpTMWhZMk52ZFc1MExuVnBaQ0k2SWpZMlltUmpOak0yTFRKbFl6
TXRORElpoWkMwNE9HRTFMV0ZoWXpGbFpqWmxPVFpsTlNJc0luTjFZaUk2SW5ONWMzUmxi
VHB6WlhKMmFXTmxZV05qYjNWdWREcHVaWEIwZFc1bE9tNWxjSFIxYm1VdGMyRXRkaklpZlE
uVllnYm9NNENUZDBwZENKNzh3alV3bXRhbGgtMnZzS2pBTnlQc2gtNmd1RXdPdFdFcTVGYnc
1WkhQdHZBZHJMbFB6cE9IRWJBZTRlVU05NUJSR1diWUlkd2p1Tjk1SjBENFJORmtWVXQ0OH
R3b2FrUlY3aC1hUHV3c1FYSGhaWnp5NHlpbUZIRzlVZm1zazVZcjRSVmNHNm4xMzd5LUZIMD
hLOHpaaklQQXNLRHFOQlF0eGctbFp2d1ZNaTZ2aUlocnJ6QVFzME1CT1Y4Mk9KWUd5Mm8tV
1FWYzBVVWFuQ2Y5NFkzZ1QwWVRpcVF2Y3pZTXM2bno5dXQtWGd3aXRyQlk2VGo5QmdQc
HJBOWtfajVxRXhfTFVVWlVwUEFpRU43T3pka0pzSThjdHRoMTBseXBJMUFlRnI0M3Q2QUx5cl
FvQk0zOWFiRGZxM0Zrc1Itb2NfV013
kind: Secret
...
```

This shows the base64 encoded token. To get the encoded one we could pipe it manually through **base64 -d** or we simply do:

```
$ k -n neptune describe secret neptune-sa-v2-token-lwhhl
```

```
...
Data
====
token:
eyJhbGciOiJSUzI1NiIsImtpZCI6Im5aZFdqZDJ2aGNvQ3BqWHZOR1g1b3pIcm5JZ0hHNWxTZkw
zQnFaaTFad2MifQ.eyJpc3MiOiJrdWJlcm5ldGVzL3NlcnZpY2VhY2NvdW50Iiwia3ViZXJuZXRlcy5
pby9zZXJ2aWNlYWNjb3VudC9uYW1lc3BhY2UiOiJuZXB0dW5lIiwia3ViZXJuZXRlcy5pby9zZXJ2a
WNlYWNjb3VudC9zZWNyZXQubmFtZSI6Im5lcHR1bmUtc2EtdjItdG9rZW4tZnE5MmoiLCJrdWJlc
m5ldGVzLmlvL3NlcnZpY2VhY2NvdW50L3NlcnZpY2UtYWNjb3VudC5uYW1lIjoibmVwdHVuZS1z
YS12MiIsImt1YmVybmV0ZXMuaW8vc2VydmljZWFjY291bnQvc2VydmljZS1hY2NvdW50LnVpZCI
6IjY2YmRjNjM2LTJlYzMtNDJhZC04OGE1LWFhYzFlZjZlOTZlNSIsInN1YiI6InN5c3RlbTpzZXJ2a
WNlYWNjb3VudDpuZXB0dW5lOm5lcHR1bmUtc2EtdjIifQ.VYgboM4CTd0pdCJ78wjUwmtalh-
2vsKjANyPsh-
6guEwOtWEq5Fbw5ZHPtvAdrLlPzpOHEbAe4eUM95BRGWbYIdwjuN95J0D4RNFkVUt48twoakR
V7h-aPuwsQXHhZZzy4yimFHG9Ufmsk5Yr4RVcG6n137y-FH08K8zZjIPAsKDqNBQtxg-
lZvwVMi6viIhrrzAQs0MBOV82OJYGy2o-WQVc0UUanCf94Y3gT0YTiqQvczYMs6nz9ut-
XgwitrBY6Tj9BgPprA9k_j5qEx_LUUZUpPAiEN7OzdkJsI8ctth10lypI1AeFr43t6ALyrQoBM39abDfq
3FksR-oc_WMw
ca.crt:     1066 bytes
namespace:  7 bytes
```

Copy the token (part under **token:**) and paste it using vim.

```
vim /opt/course/5/token
```

File **/opt/course/5/token** should contain the token:

```
# /opt/course/5/token
eyJhbGciOiJSUzI1NiIsImtpZCI6Im5aZFdqZDJ2aGNvQ3BqWHZOR1g1b3pIcm5JZ0hHNWxTZkwzQnFaaTFad2MifQ.eyJpc3MiOiJrdWJlcm5ldGVzL3NlcnZpY2VhY2NvdW50Iiwia3ViZXJuZXRlcy5pby9zZXJ2aWNlYWNjb3VudC9uYW1lc3BhY2UiOiJuZXB0dW5lIiwia3ViZXJuZXRlcy5pby9zZXJ2aWNlYWNjb3VudC9zZWNyZXQubmFtZSI6Im5lcHR1bmUtc2VjcmV0LTZnE5MmoiLCJrdWJlcm5ldGVzLmlvL3NlcnZpY2VhY2NvdW50L3NlcnZpY2UtYWNjb3VudC5uYW1lIjoibmVwdHVuZS1zYS12MiIsImt1YmVybmV0ZXMuaW8vc2VydmljZWFjY291bnQvc2VydmljZS1hY2NvdW50LnVpZCI6IjY2YmRjNjM2LTJlYzMtNDJhZC04OGE1LWFhYzFlZjZlOTZlNSIsInN1YiI6InN5c3RlbTpzZXJ2aWNlYWNjb3VudDpuZXB0dW5lOm5lcHR1bmUtc2VjcmV0LTZnE5MmoifQ.VYgboM4CTd0pdCJ78wjUwmtalh-2vsKjANyPsh-6guEwOtWEq5Fbw5ZHPtvAdrLlPzpOHEbAe4eUM95BRGWbYIdwjuN95J0D4RNFkVUt48twoakRV7h-aPuwsQXHhZZzy4yimFHG9Ufmsk5Yr4RVcG6n137y-FH08K8zZjIPAsKDqNBQtxg-lZvwVMi6viIhrrzAQs0MBOV82OJYGy2o-WQVc0UUanCf94Y3gT0YTiqQvczYMs6nz9ut-XgwitrBY6Tj9BgPprA9k_j5qEx_LUUZUpPAiEN7OzdkJsI8ctth10lypI1AeFr43t6ALyrQoBM39abDfq3FksR-oc_WMw
```

Q6 | ReadinessProbe

Create a single Pod named pod6 in Namespace default of image **busybox:1.31.0**. The Pod should have a readiness-probe executing **cat /tmp/ready**. It should initially wait 5 and periodically wait 10 seconds. This will set the container ready only if the file **/tmp/ready** exists.

The Pod should run the command touch **/tmp/ready && sleep 1d**, which will create the necessary file to be ready and then idles. Create the Pod and confirm it starts.

Ans.

```
$ k run pod6 --image=busybox:1.31.0 $do --command -- sh -c "touch /tmp/ready && sleep 1d" > 6.yaml
```

```
$ vim 6.yaml
```

Search for a readiness-probe example on https://kubernetes.io/docs, then copy and alter the relevant section for the task:

```
# 6.yaml
apiVersion: v1
kind: Pod
metadata:
  creationTimestamp: null
  labels:
    run: pod6
  name: pod6
spec:
  containers:
  - args:
    - sh
    - -c
    - touch /tmp/ready && sleep 1d
    image: busybox:1.31.0
    name: pod6
    resources: {}
    readinessProbe:                    # add
      exec:                            # add
        command:                       # add
        - sh                           # add
        - -c                           # add
        - cat /tmp/ready               # add
      initialDelaySeconds: 5           # add
      periodSeconds: 10                # add
  dnsPolicy: ClusterFirst
  restartPolicy: Always
status: {}
```

Then:

```
$ k -f 6.yaml create
```

Running k get pod6 we should see the job being created and completed:

```
$ k get pod pod6
NAME   READY   STATUS              RESTARTS   AGE
pod6   0/1     ContainerCreating   0          2s
```

```
$ k get pod pod6
NAME   READY   STATUS    RESTARTS   AGE
pod6   0/1     Running   0          7s
```

```
$ k get pod pod6
NAME   READY   STATUS    RESTARTS   AGE
pod6   1/1     Running   0          15s
```

We see that the Pod is finally ready.

Q7 | Pods, Namespaces

The board of Team Neptune decided to take over control of one e-commerce webserver from Team Saturn. The administrator who once setup this webserver is not part of the organisation any longer. All information you could get was that the e-commerce system is called **my-happy-shop**.

Search for the correct Pod in Namespace **saturn** and move it to Namespace **neptune**. It doesn't matter if you shut it down and spin it up again, it probably hasn't any customers anyways.

Ans.

Let's see all those Pods:

```
$ k -n saturn get pod
NAME              READY   STATUS    RESTARTS   AGE
webserver-sat-001   1/1     Running   0          111m
webserver-sat-002   1/1     Running   0          111m
webserver-sat-003   1/1     Running   0          111m
webserver-sat-004   1/1     Running   0          111m
webserver-sat-005   1/1     Running   0          111m
webserver-sat-006   1/1     Running   0          111m
```

The Pod names don't reveal any information. We assume the Pod we are searching has a label or annotation with the name **my-happy-shop**, so we search for it:

```
$ k -n saturn describe pod
# describe all pods, then manually look for it
```

Or

```
$ k -n saturn get pod -o yaml | grep my-happy-shop -A10
```

We see the webserver we're looking for is **webserver-sat-003**

```
$ k -n saturn get pod webserver-sat-003 -o yaml > 7_webserver-sat-003.yaml # export
$ vim 7_webserver-sat-003.yaml
```

Change the Namespace to **neptune**, also remove the status: section, the token volume, the token **volumeMount** and the **nodeName**, else the new Pod won't start. The final file could look as clean like this:

```
# 7_webserver-sat-003.yaml
apiVersion: v1
kind: Pod
metadata:
  annotations:
    description: this is the server for the E-Commerce System my-happy-shop
  labels:
    id: webserver-sat-003
  name: webserver-sat-003
  namespace: neptune # new namespace here
spec:
  containers:
  - image: nginx:1.16.1-alpine
    imagePullPolicy: IfNotPresent
    name: webserver-sat
  restartPolicy: Always
```

Then we execute:

```
$ k -n neptune create -f 7_webserver-sat-003.yaml
$ k -n neptune get pod | grep webserver
webserver-sat-003            1/1     Running            0          22s
```

It seems the server is running in Namespace **neptune**, so we can do:

```
$ k -n saturn delete pod webserver-sat-003 --force --grace-period=0
```

Let's confirm only one is running:

```
$ k get pod -A | grep webserver-sat-003
neptune       webserver-sat-003          1/1     Running            0          6s
```

This should list only one pod called **webserver-sat-003** in Namespace **neptune**, status running.

Q8 | Deployment, Rollouts

There is an existing Deployment named **api-new-c32** in Namespace **neptune**. A developer did make an update to the Deployment but the updated version never came online. Check the Deployment history and find a revision that works, then rollback to it. Could you tell Team Neptune what the error was so it doesn't happen again?

Ans.

```
$ k -n neptune get deploy # overview
$ k -n neptune rollout -h
$ k -n neptune rollout history -h
```

```
$ k -n neptune rollout history deploy api-new-c32
deployment.extensions/api-new-c32
REVISION    CHANGE-CAUSE
1           <none>
2           kubectl edit deployment api-new-c32 --namespace=neptune
3           kubectl edit deployment api-new-c32 --namespace=neptune
4           kubectl edit deployment api-new-c32 --namespace=neptune
5           kubectl edit deployment api-new-c32 --namespace=neptune
```

We see 5 revisions, let's check Pod and Deployment status:

```
$ k -n neptune get deploy,pod | grep api-new-c32
deployment.extensions/api-new-c32    3/3     1            3           141m

pod/api-new-c32-65d998785d-jtmqq     1/1     Running            0          141m
pod/api-new-c32-686d6f6b65-mj2fp     1/1     Running            0          141m
pod/api-new-c32-6dd45bdb68-2p462     1/1     Running            0          141m
pod/api-new-c32-7d64747c87-zh648     0/1     ImagePullBackOff   0          141m
```

Let's check the pod for errors:

```
$ k -n neptune describe pod api-new-c32-7d64747c87-zh648 | grep -i error
  ...  Error: ImagePullBackOff
```

```
$ k -n neptune describe pod api-new-c32-7d64747c87-zh648 | grep -i image
    Image:          ngnix:1.16.3
    Image ID:
      Reason:       ImagePullBackOff
  Warning  Failed  4m28s (x616 over 144m)  kubelet, gke-s3ef67020-28c5-45f7--default-pool-248abd4f-s010  Error: ImagePullBackOff
```

Someone seems to have added a new image with a spelling mistake in the name ngnix:1.16.3, that's the reason we can tell Team Neptune!

Now let's revert to the previous version:

```
$ k -n neptune rollout undo deploy api-new-c32
```

Does this one work?

```
$ k -n neptune get deploy api-new-c32
NAME         READY   UP-TO-DATE   AVAILABLE   AGE
api-new-c32  3/3     3            3           146m
```

Yes! All up-to-date and available.

Also a fast way to get an overview of the ReplicaSets of a Deployment and their images could be done with:

```
$ k -n neptune get rs -o wide | grep api-new-c32
```

Q9 | Pod -> Deployment

In Namespace pluto there is single Pod named **holy-api**. It has been working okay for a while now but Team Pluto needs it to be more reliable. Convert the Pod into a Deployment with 3 replicas and name holy-api. The raw Pod template file is available at **/opt/course/9/holy-api-pod.yaml**.

Please create the Deployment and save its yaml under **/opt/course/9/holy-api-deployment.yaml**.

Ans.

There are multiple ways to do this, one is to copy an Deployment example from https://kubernetes.io/docs and then merge it with the existing Pod yaml. That's what we will do now:

```
$ cp /opt/course/9/holy-api-pod.yaml /opt/course/9/holy-api-deployment.yaml # make a copy!
$ vim /opt/course/9/holy-api-deployment.yaml
```

Now copy/use a Deployment example yaml and put the Pod's metadata: and spec: into the Deployment's template: section:

```
# /opt/course/9/holy-api-deployment.yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: holy-api        # name stays the same
  namespace: pluto      # important
spec:
  replicas: 3           # 3 replicas
  selector:
    matchLabels:
      id: holy-api      # set the correct selector
  template:
    # => from here down its the same as the pods metadata: and spec: sections
    metadata:
      labels:
        id: holy-api
      name: holy-api
    spec:
      containers:
      - env:
        - name: CACHE_KEY_1
          value: b&MTCi0=[T66RXm!jO@
        - name: CACHE_KEY_2
          value: PCAILGej5Ld@Q%{Q1=#
        - name: CACHE_KEY_3
          value: 2qz-]2OJlWDSTn_;RFQ
        image: nginx:1.17.3-alpine
        name: holy-api-container
        volumeMounts:
        - mountPath: /cache1
```

```
      name: cache-volume1
    - mountPath: /cache2
      name: cache-volume2
    - mountPath: /cache3
      name: cache-volume3
  volumes:
  - emptyDir: {}
    name: cache-volume1
  - emptyDir: {}
    name: cache-volume2
  - emptyDir: {}
    name: cache-volume3
```

To indent multiple lines using vim you should set the shiftwidth using **:set shiftwidth=2**. Then mark multiple lines using **Shift v** and the up/down keys.

To then indent the marked lines press > or < and to repeat the action press .

Next create the new Deployment:

```
$ k -f /opt/course/9/holy-api-deployment.yaml create
```

and confirm its running:

```
$ k -n pluto get pod | grep holy
NAME                     READY   STATUS    RESTARTS   AGE
holy-api                 1/1     Running   0          19m
holy-api-5dbfdb4569-8qr5x   1/1     Running   0          30s
holy-api-5dbfdb4569-b5clh   1/1     Running   0          30s
holy-api-5dbfdb4569-rj2gz   1/1     Running   0          30s
```

Finally delete the single Pod:

```
$ k -n pluto delete pod holy-api --force --grace-period=0
```

```
$ k -n pluto get pod,deployment | grep holy
pod/holy-api-5dbfdb4569-8qr5x   1/1     Running   0          2m4s
pod/holy-api-5dbfdb4569-b5clh   1/1     Running   0          2m4s
pod/holy-api-5dbfdb4569-rj2gz   1/1     Running   0          2m4s

deployment.extensions/holy-api   3/3     3            3           2m4s
```

Q10 | Service, Logs

Team Pluto needs a new cluster internal Service. Create a ClusterIP Service named project-plt-6cc-svc in Namespace pluto. This Service should expose a single Pod named project-plt-6cc-api of image **nginx:1.17.3-alpine**, create that Pod as well. The Pod should be identified by label project: plt-6cc-api. The Service should use tcp port redirection of **3333:80.**

Finally use for example curl from a temporary nginx:alpine Pod to get the response from the Service. Write the response into **/opt/course/10/service_test.html**. Also check if the logs of Pod **project-plt-6cc-api** show the request and write those **into /opt/course/10/service_test.log**.

Ans.

```
$ k -n pluto run project-plt-6cc-api --image=nginx:1.17.3-alpine --labels project=plt-6cc-api
```

This will create the requested Pod. In yaml it would look like this:

```
apiVersion: v1
kind: Pod
metadata:
  creationTimestamp: null
  labels:
    project: plt-6cc-api
  name: project-plt-6cc-api
spec:
  containers:
  - image: nginx:1.17.3-alpine
    name: project-plt-6cc-api
    resources: {}
  dnsPolicy: ClusterFirst
  restartPolicy: Always
status: {}
```

Next we create the service:

```
$ k -n pluto expose pod -h # help
$ k -n pluto expose pod project-plt-6cc-api --name project-plt-6cc-svc --port 3333 --target-port 80
```

Expose will create a yaml where everything is already set for our case and no need to change anything:

```
apiVersion: v1
```

```
kind: Service
metadata:
  creationTimestamp: null
  labels:
    project: plt-6cc-api
  name: project-plt-6cc-svc   # good
  namespace: pluto            # great
spec:
  ports:
  - port: 3333               # awesome
    protocol: TCP
    targetPort: 80           # nice
  selector:
    project: plt-6cc-api     # beautiful
status:
  loadBalancer: {}
```

We could also use create service but then we would need to change the yaml afterwards:

```
$ k -n pluto create service -h # help
$ k -n pluto create service clusterip -h #help
$ k -n pluto create service clusterip project-plt-6cc-svc --tcp 3333:80 $do
# now we would need to set the correct selector labels
```

Check the Service is running:

```
$ k -n pluto get pod,svc | grep 6cc
pod/project-plt-6cc-api        1/1     Running   0          9m42s

service/project-plt-6cc-svc    ClusterIP   10.31.241.234   <none>       3333/TCP   2m24s
```

Does the Service has one Endpoint?

```
$ k -n pluto describe svc project-plt-6cc-svc
Name:              project-plt-6cc-svc
Namespace:         pluto
Labels:            project=plt-6cc-api
Annotations:       <none>
Selector:          project=plt-6cc-api
Type:              ClusterIP
```

```
IP:                10.3.244.240
Port:              <unset>  3333/TCP
TargetPort:        80/TCP
Endpoints:         10.28.2.32:80
Session Affinity:  None
Events:            <none>
```

```
k -n pluto get ep
```

```
NAME                ENDPOINTS       AGE
project-plt-6cc-svc   10.28.2.32:80   84m
```

Yes, endpoint there! Finally we check the connection using a temporary Pod:

```
k run tmp --restart=Never --rm --image=nginx:alpine -i -- curl http://project-plt-6cc-svc.pluto:3333
```

```
  % Total    % Received % Xferd  Average Speed    Time    Time     Time  Current
                                 Dload    Upload   Total   Spent    Left     Speed
100   612  100   612    0     0          32210         0 --:--:-- --:--:-- --:--:-- 32210
<!DOCTYPE html>
<html>
<head>
<title>Welcome to nginx!</title>
<style>
    body {
        width: 35em;
        margin: 0 auto;
        font-family: Tahoma, Verdana, Arial, sans-serif;
    }
</style>
</head>
<body>
<h1>Welcome to nginx!</h1>
...
```

Great! Notice that we use the Kubernetes Namespace dns resolving (project-plt-6cc-svc.pluto) here. We could only use the Service name if we would also spin up the temporary Pod in Namespace pluto .

And now really finally copy or pipe the html content into **/opt/course/10/service_test.html**.

```
# /opt/course/10/service_test.html
```

```
<!DOCTYPE html>
<html>
<head>
<title>Welcome to nginx!</title>
<style>
    body {
        width: 35em;
        margin: 0 auto;
        font-family: Tahoma, Verdana, Arial, sans-serif;
    }
...
```

Also the requested logs:

```
$ k -n pluto logs project-plt-6cc-api > /opt/course/10/service_test.log
```

```
# /opt/course/10/service_test.log
10.44.0.0 - - [22/Jan/2021:23:19:55 +0000] "GET / HTTP/1.1" 200 612 "-" "curl/7.69.1" "-"
```

Q11 | Labels, Annotations

Team Sunny needs to identify some of their Pods in namespace sun. They ask you to add a new label **protected: true** to all Pods with an existing label **type: worker** or **type: runner**. Also add an annotation **protected: do not delete this pod** to all Pods having the new label **protected: true**.

Ans.

```
$ k -n sun get pod --show-labels
```

```
NAME          READY   STATUS    RESTARTS   AGE   LABELS
0509649a      1/1     Running   0          25s   type=runner,type_old=messenger
0509649b      1/1     Running   0          24s   type=worker
1428721e      1/1     Running   0          23s   type=worker
1428721f      1/1     Running   0          22s   type=worker
43b9a         1/1     Running   0          22s   type=test
4c09          1/1     Running   0          21s   type=worker
4c35          1/1     Running   0          20s   type=worker
4fe4          1/1     Running   0          19s   type=worker
5555a         1/1     Running   0          19s   type=messenger
86cda         1/1     Running   0          18s   type=runner
8d1c          1/1     Running   0          17s   type=messenger
a004a         1/1     Running   0          16s   type=runner
a94128196     1/1     Running   0          15s   type=runner,type_old=messenger
afd79200c56a  1/1     Running   0          15s   type=worker
b667          1/1     Running   0          14s   type=worker
fdb2          1/1     Running   0          13s   type=worker
```

If we would only like to get pods with certain labels we can run:

```
$ k -n sun get pod -l type=runner # only pods with label runner
```

We can use this label filtering also when using other commands, like setting new labels:

```
$ k label -h # help
$ k -n sun label pod -l type=runner protected=true # run for label runner
$ k -n sun label pod -l type=worker protected=true # run for label worker
```

Or we could run:

```
$ k -n sun label pod -l "type in (worker,runner)" protected=true
```

Let's check the result:

```
k -n sun get pod --show-labels
NAME          ...   AGE   LABELS
0509649a      ...    56s   protected=true,type=runner,type_old=messenger
0509649b      ...    55s   protected=true,type=worker
1428721e      ...    54s   protected=true,type=worker
1428721f      ...    53s   protected=true,type=worker
43b9a         ...    53s   type=test
4c09          ...    52s   protected=true,type=worker
4c35          ...    51s   protected=true,type=worker
4fe4          ...    50s   protected=true,type=worker
5555a         ...    50s   type=messenger
86cda         ...    49s   protected=true,type=runner
8d1c          ...    48s   type=messenger
a004a         ...    47s   protected=true,type=runner
a94128196     ...    46s   protected=true,type=runner,type_old=messenger
afd79200c56a  ...    46s   protected=true,type=worker
b667          ...    45s   protected=true,type=worker
fdb2          ...    44s   protected=true,type=worker
```

Looking good. Finally we set the annotation using the newly assigned label **protected: true**:

```
$ k -n sun annotate pod -l protected=true protected="do not delete this pod"
```

Not requested in the task but for your own control you could run:

```
$ k -n sun get pod -l protected=true -o yaml | grep -A 8 metadata:
```

Q12 | Storage, PV, PVC, Pod volume

Create a new PersistentVolume named **earth-project-earthflower-pv**. It should have a capacity of 2Gi, accessMode ReadWriteOnce, hostPath /Volumes/Data and no storageClassName defined.

Next create a new PersistentVolumeClaim in Namespace earth named earth-project-earthflower-pvc . It should request 2Gi storage, accessMode ReadWriteOnce and should not define a storageClassName. The PVC should bound to the PV correctly.

Finally create a new Deployment project-earthflower in Namespace earth which mounts that volume at **/tmp/project-data**. The Pods of that Deployment should be of image **httpd:2.4.41-alpine**.

Ans.

```
$ vim 12_pv.yaml
```

Find an example from https://kubernetes.io/docs and alter it:

```
# 12_pv.yaml
kind: PersistentVolume
apiVersion: v1
metadata:
 name: earth-project-earthflower-pv
spec:
 capacity:
  storage: 2Gi
 accessModes:
  - ReadWriteOnce
 hostPath:
  path: "/Volumes/Data"
```

Then create it:

```
$ k -f 12_pv.yaml create
```

Next the PersistentVolumeClaim:

```
$ vim 12_pvc.yaml
```

Find an example from https://kubernetes.io/docs and alter it:

```
# 12_pvc.yaml
kind: PersistentVolumeClaim
apiVersion: v1
metadata:
  name: earth-project-earthflower-pvc
  namespace: earth
spec:
  accessModes:
    - ReadWriteOnce
  resources:
    requests:
     storage: 2Gi
```

Then create:

```
$ k -f 12_pvc.yaml create
```

And check that both have the status Bound:

```
$ k -n earth get pv,pvc
NAME                              CAPACITY   ACCESS MODES   ...  STATUS   CLAIM
persistentvolume/...earthflower-pv   2Gi        RWO            ...  Bound    ...er-pvc

NAME                                    STATUS   VOLUME                      CAPACITY
persistentvolumeclaim/...earthflower-pvc   Bound    earth-project-earthflower-pv   2Gi
```

Next we create a Deployment and mount that volume:

```
$ k -n earth create deploy project-earthflower --image=httpd:2.4.41-alpine $do > 12_dep.yaml
$ vim 12_dep.yaml
```

Alter the yaml to mount the volume:

```
# 12_dep.yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  creationTimestamp: null
  labels:
    app: project-earthflower
  name: project-earthflower
  namespace: earth
spec:
  replicas: 1
```

```
  selector:
    matchLabels:
      app: project-earthflower
  strategy: {}
  template:
    metadata:
      creationTimestamp: null
      labels:
        app: project-earthflower
    spec:
      volumes:                                  # add
      - name: data                               # add
        persistentVolumeClaim:                        # add
          claimName: earth-project-earthflower-pvc  # add
      containers:
      - image: httpd:2.4.41-alpine
        name: container
        volumeMounts:                             # add
        - name: data                             # add
          mountPath: /tmp/project-data                # add
```

```
$ k -f 12_dep.yaml create
```

We can confirm its mounting correctly:

```
$ k -n earth describe pod project-earthflower-d6887f7c5-pn5wv | grep -A2 Mounts:
    Mounts:
      /tmp/project-data from data (rw) # there it is
      /var/run/secrets/kubernetes.io/serviceaccount from default-token-n2sjj (ro)
```

Q13 | Storage, StorageClass, PVC

Team Moonpie, which has the Namespace moon, needs more storage. Create a new PersistentVolumeClaim named moon-pvc-126 in that namespace. This claim should use a new StorageClass moon-retain with the provisioner set to moon-retainer and the reclaimPolicy set to Retain. The claim should request storage of 3Gi, an accessMode of ReadWriteOnce and should use the new StorageClass.

The provisioner moon-retainer will be created by another team, so it's expected that the PVC will not boot yet. Confirm this by writing the log message from the PVC into **file /opt/course/13/pvc-126-reason**.

Ans.

```
vim 13_sc.yaml
```

Head to https://kubernetes.io/docs , search for "storageclass" and alter the example code to this:

```
# 13_sc.yaml
apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  name: moon-retain
provisioner: moon-retainer
reclaimPolicy: Retain
```

```
$ k -f 13_pvc.yaml create
```

Next we check the status of the PVC :

```
$ k -n moon get pvc
NAME          STATUS    VOLUME   CAPACITY   ACCESS MODES   STORAGECLASS   AGE
moon-pvc-126  Pending                                      moon-retain    2m57s
```

```
$ k -n moon describe pvc moon-pvc-126
Name:          moon-pvc-126
...
Status:        Pending
...
Events:
...
waiting for a volume to be created, either by external provisioner "moon-retainer" or manually created by system administrator
```

This confirms that the PVC waits for the provisioner moon-retainer to be created. Finally we copy or write the event message into the requested location:

```
# /opt/course/13/pvc-126-reason
```

```
waiting for a volume to be created, either by external provisioner "moon-retainer" or manually created by system administrator
```

Q14 | Secret, Secret-Volume, Secret-Env

You need to make changes on an existing Pod in Namespace moon called secret-handler. Create a new Secret secret1 which contains user=test and pass=pwd. The *Secret*'s content should be available in *Pod* secret-handler as environment variables **SECRET1_USER** and **SECRET1_PASS**. The yaml for *Pod* secret-handler is available at **/opt/course/14/secret-handler.yaml**.

There is existing yaml for another Secret at **/opt/course/14/secret2.yaml**, create this *Secret* and mount it inside the same *Pod* at /tmp/secret2. Your changes should be saved under **/opt/course/14/secret-handler-new.yaml**. Both *Secrets* should only be available in Namespace moon.

Ans.

```
$ k -n moon get pod # show pods
$ k -n moon create secret -h # help
$ k -n moon create secret generic -h # help
$ k -n moon create secret generic secret1 --from-literal user=test --from-literal pass=pwd
```

The last command would generate this yaml:

```
apiVersion: v1
data:
  pass: cHdk
  user: dGVzdA==
kind: Secret
metadata:
  creationTimestamp: null
  name: secret1
  namespace: moon
```

Next we create the second Secret from the given location, making sure it'll be created in Namespace moon:

```
$ k -n moon -f /opt/course/14/secret2.yaml create
$ k -n moon get secret
NAME                  TYPE                                  DATA   AGE
```

```
default-token-rvzcf   kubernetes.io/service-account-token   3      66m
secret1               Opaque                               2      4m3s
secret2               Opaque                               1      8s
```

We will now edit the Pod yaml:

```
$ cp /opt/course/14/secret-handler.yaml /opt/course/14/secret-handler-new.yaml
$ vim /opt/course/14/secret-handler-new.yaml
```

Add the following to the yaml:

```
# /opt/course/14/secret-handler-new.yaml
apiVersion: v1
kind: Pod
metadata:
  labels:
    id: secret-handler
    uuid: 1428721e-8d1c-4c09-b5d6-afd79200c56a
    red_ident: 9cf7a7c0-fdb2-4c35-9c13-c2a0bb52b4a9
    type: automatic
  name: secret-handler
  namespace: moon
spec:
  volumes:
  - name: cache-volume1
    emptyDir: {}
  - name: cache-volume2
    emptyDir: {}
  - name: cache-volume3
    emptyDir: {}
  - name: secret2-volume              # add
    secret:                         # add
      secretName: secret2           # add
  containers:
  - name: secret-handler
    image: bash:5.0.11
    args: ['bash', '-c', 'sleep 2d']
    volumeMounts:
    - mountPath: /cache1
      name: cache-volume1
    - mountPath: /cache2
      name: cache-volume2
    - mountPath: /cache3
```

```
    name: cache-volume3
  - name: secret2-volume          # add
    mountPath: /tmp/secret2       # add
  env:
  - name: SECRET_KEY_1
    value: ">8$kH#kj..i8}HImQd{"
  - name: SECRET_KEY_2
    value: "IO=a4L/XkRdvN8jM=Y+"
  - name: SECRET_KEY_3
    value: "-7PA0_Z]>{pwa43r)__"
  - name: SECRET1_USER            # add
    valueFrom:                    # add
      secretKeyRef:               # add
        name: secret1             # add
        key: user                 # add
  - name: SECRET1_PASS            # add
    valueFrom:                    # add
      secretKeyRef:               # add
        name: secret1             # add
        key: pass                 # add
```

Then we apply the changes:

```
$ k -f /opt/course/14/secret-handler.yaml delete --force --grace-period=0
$ k -f /opt/course/14/secret-handler-new.yaml create
```

Instead of running delete and create we can also use recreate:

```
$ k -f /opt/course/14/secret-handler-new.yaml replace --force --grace-period=0
```

It was not requested directly, but you should always confirm its working:

```
k -n moon exec secret-handler -- env | grep SECRET1
SECRET1_USER=test
SECRET1_PASS=pwd
```

```
$ k -n moon exec secret-handler -- find /tmp/secret2
/tmp/secret2
/tmp/secret2/..data
/tmp/secret2/key
```

```
/tmp/secret2/..2019_09_11_09_03_08.147048594
/tmp/secret2/..2019_09_11_09_03_08.147048594/key
```

```
$ k -n moon exec secret-handler -- cat /tmp/secret2/key
12345678
```

Q15 | ConfigMap, Configmap-Volume

Team Moonpie has a nginx server Deployment called web-moon in Namespace moon. Someone started configuring it but it was never completed. To complete please create a ConfigMap called configmap-web-moon-html containing the content of **file /opt/course/15/web-moon.html** under the data key-name **index.html**.

The Deployment web-moon is already configured to work with this ConfigMap and serve its content. Test the nginx configuration for example using curl from a temporary nginx:alpine Pod.

Ans.

Let's check the existing Pods:

```
$ k -n moon get pod
NAME                        READY   STATUS              RESTARTS   AGE
secret-handler              1/1     Running             0          55m
web-moon-847496c686-2rzj4   0/1     ContainerCreating   0          33s
web-moon-847496c686-9nwwj   0/1     ContainerCreating   0          33s
web-moon-847496c686-cxdbx   0/1     ContainerCreating   0          33s
web-moon-847496c686-hvqlw   0/1     ContainerCreating   0          33s
web-moon-847496c686-tj7ct   0/1     ContainerCreating   0          33s
```

```
$ k -n moon describe pod web-moon-847496c686-2rzj4
...
Warning  FailedMount  31s (x7 over 63s)  kubelet, gke-test-default-pool-ce83a51a-p6s4
MountVolume.SetUp failed for volume "html-volume" : configmaps "configmap-web-moon-html"
not found
```

Good so far, now let's create the missing ConfigMap:

```
$ k -n moon create configmap -h  # help
```

```
$ k -n moon create configmap configmap-web-moon-html --from-
file=index.html=/opt/course/15/web-moon.html  # important to set the index.html key
```

This should create a ConfigMap with yaml like:

```
apiVersion: v1
data:
  index.html: |     # notice the key index.html, this will be the filename when mounted
    <!DOCTYPE html>
    <html lang="en">
    <head>
        <meta charset="UTF-8">
        <title>Web Moon Webpage</title>
    </head>
    <body>
    This is some great content.
    </body>
    </html>
kind: ConfigMap
metadata:
  creationTimestamp: null
  name: configmap-web-moon-html
  namespace: moon
```

After waiting a bit or deleting/recreating (**k -n moon rollout restart deploy web-moon**) the Pods we should see:

```
$ k -n moon get pod
NAME                          READY   STATUS    RESTARTS   AGE
secret-handler                1/1     Running   0          59m
web-moon-847496c686-2rzj4     1/1     Running   0          4m28s
web-moon-847496c686-9nwwj     1/1     Running   0          4m28s
web-moon-847496c686-cxdbx     1/1     Running   0          4m28s
web-moon-847496c686-hvqlw     1/1     Running   0          4m28s
web-moon-847496c686-tj7ct     1/1     Running   0          4m28s
```

Looking much better. Finally we check if the nginx returns the correct content:

```
$ k -n moon get pod -o wide # get pod cluster IPs
```

Then use one IP to test the configuration:

```
$ k run tmp --restart=Never --rm -i --image=nginx:alpine -- curl 10.44.0.78
```

```
% Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100   161  100   161    0     0  80500      0 --:--:-- --:--:-- --:--:--  157k
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <title>Web Moon Webpage</title>
</head>
<body>
This is some great content.
</body>
```

For debugging or further checks we could find out more about the Pods volume mounts:

```
$ k -n moon describe pod web-moon-c77655cc-dc8v4 | grep -A2 Mounts:
```

```
    Mounts:
      /usr/share/nginx/html from html-volume (rw)
      /var/run/secrets/kubernetes.io/serviceaccount from default-token-rvzcf (ro)
```

And check the mounted folder content:

```
$  k -n moon exec web-moon-c77655cc-dc8v4 find /usr/share/nginx/html
```

```
/usr/share/nginx/html
/usr/share/nginx/html/..2019_09_11_10_05_56.336284411
/usr/share/nginx/html/..2019_09_11_10_05_56.336284411/index.html
/usr/share/nginx/html/..data
/usr/share/nginx/html/index.html
```

Here it was important that the file will have the name index.html and not the original one web-moon.html which is controlled through the ConfigMap data key.

Q16 | Logging sidecar

The Tech Lead of Mercury2D decided its time for more logging, to finally fight all these missing data incidents. There is an existing container named cleaner-con in Deployment cleaner in Namespace mercury. This container mounts a volume and writes logs into a file called cleaner.log.

The yaml for the existing Deployment is available at **/opt/course/16/cleaner.yaml**. Persist your changes at /opt/course/16/cleaner-new.yaml but also make sure the Deployment is running.

Create a sidecar container named logger-con, image busybox:1.31.0, which mounts the same volume and writes the content of cleaner.log to stdout, you can use the tail **-f** command for this. This way it can be picked up by kubectl logs.

Check if the logs of the new container reveal something about the missing data incidents.

Ans.

```
$ cp /opt/course/16/cleaner.yaml /opt/course/16/cleaner-new.yaml
$ vim /opt/course/16/cleaner-new.yaml
```

Add a sidecar container which outputs the log file to stdout:

```
# /opt/course/16/cleaner-new.yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  creationTimestamp: null
  name: cleaner
  namespace: mercury
spec:
  replicas: 2
  selector:
    matchLabels:
      id: cleaner
  template:
    metadata:
      labels:
        id: cleaner
    spec:
      volumes:
      - name: logs
        emptyDir: {}
      initContainers:
      - name: init
        image: bash:5.0.11
```

```
        command: ['bash', '-c', 'echo init > /var/log/cleaner/cleaner.log']
        volumeMounts:
        - name: logs
          mountPath: /var/log/cleaner
      containers:
      - name: cleaner-con
        image: bash:5.0.11
        args: ['bash', '-c', 'while true; do echo `date`: "remove random file" >>
/var/log/cleaner/cleaner.log; sleep 1; done']
        volumeMounts:
        - name: logs
          mountPath: /var/log/cleaner
      - name: logger-con                                    # add
        image: busybox:1.31.0                               # add
        command: ["sh", "-c", "tail -f /var/log/cleaner/cleaner.log"]   # add
        volumeMounts:                                       # add
        - name: logs                                        # add
          mountPath: /var/log/cleaner                       # add
```

Then apply the changes and check the logs of the sidecar:

```
$ k -f /opt/course/16/cleaner-new.yaml apply
```

This will cause a deployment rollout of which we can get more details:

```
$ k -n mercury rollout history deploy cleaner
$ k -n mercury rollout history deploy cleaner --revision 1
$ k -n mercury rollout history deploy cleaner --revision 2
```

Check Pod statuses:

```
$ k -n mercury get pod
NAME                       READY   STATUS       RESTARTS   AGE
cleaner-86b7758668-9pw6t   2/2     Running      0          6s
cleaner-86b7758668-qgh4v   0/2     Init:0/1     0          1s
```

```
$ k -n mercury get pod
```

```
NAME                       READY   STATUS      RESTARTS   AGE
cleaner-86b7758668-9pw6t   2/2     Running     0          14s
cleaner-86b7758668-qgh4v   2/2     Running     0          9s
```

Finally check the logs of the logging sidecar container:

```
$ k -n mercury logs cleaner-576967576c-cqtgx -c logger-con
init
Wed Sep 11 10:45:44 UTC 2099: remove random file
Wed Sep 11 10:45:45 UTC 2099: remove random file
...
```

Mystery solved, something is removing files at random. It's important to understand how containers can communicate with each other using volumes.

Q17 | InitContainer

Last lunch you told your coworker from department Mars Inc how amazing InitContainers are. Now he would like to see one in action. There is a Deployment yaml at **/opt/course/17/test-init-container.yaml**. This Deployment spins up a single Pod of image nginx:1.17.3-alpine and serves files from a mounted volume, which is empty right now.

Create an InitContainer named init-con which also mounts that volume and creates a file index.html with content check this out! in the root of the mounted volume. For this test we ignore that it doesn't contain valid html.

The InitContainer should be using image **busybox:1.31.0**. Test your implementation for example using curl from a temporary **nginx:alpine Pod**.

Ans.

```
$ cp /opt/course/17/test-init-container.yaml ~/17_test-init-container.yaml
$ vim 17_test-init-container.yaml
```

Add the InitContainer:

```
# 17_test-init-container.yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: test-init-container
```

```
  namespace: mars
spec:
  replicas: 1
  selector:
    matchLabels:
      id: test-init-container
  template:
    metadata:
      labels:
        id: test-init-container
    spec:
      volumes:
      - name: web-content
        emptyDir: {}
      initContainers:                # initContainer start
      - name: init-con
        image: busybox:1.31.0
        command: ['sh', '-c', 'echo "check this out!" > /tmp/web-content/index.html']
        volumeMounts:
        - name: web-content
          mountPath: /tmp/web-content # initContainer end
      containers:
      - image: nginx:1.17.3-alpine
        name: nginx
        volumeMounts:
        - name: web-content
          mountPath: /usr/share/nginx/html
        ports:
        - containerPort: 80
```

Then we create the Deployment:

```
$ k -f 17_test-init-container.yaml create
```

Finally, we test the configuration:

```
$ k -n mars get pod -o wide # to get the cluster IP
```

```
$ k run tmp --restart=Never --rm -i --image=nginx:alpine -- curl 10.0.0.67
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
```

```
                 Dload  Upload   Total   Spent    Left  Speed
check this out!
```

Q18 | Service misconfiguration

There seems to be an issue in Namespace mars where the ClusterIP service **manager-api-svc** should make the Pods of Deployment **manager-api-deployment** available inside the cluster.

You can test this with curl **manager-api-svc.mars:4444** from a temporary **nginx:alpine** Pod. Check for the misconfiguration and apply a fix.

Ans.

First let's get an overview:

```
$ k -n mars get all
NAME                                             READY   STATUS    RESTARTS   AGE
pod/manager-api-deployment-dbcc6657d-bg2hh   1/1     Running   0          98m
pod/manager-api-deployment-dbcc6657d-f5fv4   1/1     Running   0          98m
pod/manager-api-deployment-dbcc6657d-httjv   1/1     Running   0          98m
pod/manager-api-deployment-dbcc6657d-k98xn   1/1     Running   0          98m
pod/test-init-container-5db7c99857-htx6b         1/1     Running   0          2m19s

NAME                          TYPE        CLUSTER-IP      EXTERNAL-IP   PORT(S)    AGE
service/manager-api-svc   ClusterIP   10.15.241.159   <none>        4444/TCP   99m

NAME                                  READY   UP-TO-DATE   AVAILABLE   AGE
deployment.apps/manager-api-deployment   4/4     4            4           98m
deployment.apps/test-init-container      1/1     1            1           2m19s
...
```

Everything seems to be running, but we can't seem to get a connection:

```
$ k -n mars run tmp --restart=Never --rm -i --image=nginx:alpine -- curl -m 5 manager-api-svc:4444
If you don't see a command prompt, try pressing enter.
  0     0    0     0    0     0      0      0 --:--:--  0:00:01 --:--:--     0
curl: (28) Connection timed out after 1000 milliseconds
pod "tmp" deleted
pod mars/tmp terminated (Error)
```

Ok, let's try to connect to one pod directly:

```
$ k -n mars get pod -o wide       # get cluster IP
```

```
$ k -n mars run tmp --restart=Never --rm -i --image=nginx:alpine -- curl -m 5 10.0.1.14
 % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
<!DOCTYPE html>
<html>
<head>
<title>Welcome to nginx!</title>
...
```

The Pods itself seem to work. Let's investigate the Service a bit:

```
$ k -n mars describe service manager-api-svc
Name:              manager-api-svc
Namespace:         mars
Labels:            app=manager-api-svc
...
Endpoints:         <none>
...
```

Endpoint inspection is also possible using:

```
$ k -n mars get ep
```

No endpoints - No good. We check the Service yaml:

```
$ k -n mars edit service manager-api-svc
apiVersion: v1
kind: Service
metadata:
...
  labels:
    app: manager-api-svc
  name: manager-api-svc
  namespace: mars
...
spec:
  clusterIP: 10.3.244.121
  ports:
  - name: 4444-80
```

```
    port: 4444
    protocol: TCP
    targetPort: 80
  selector:
    #id: manager-api-deployment # wrong selector, needs to point to pod!
    id: manager-api-pod
  sessionAffinity: None
  type: ClusterIP
```

Though Pods are usually never created without a Deployment or ReplicaSet, Services always select for Pods directly. This gives great flexibility because Pods could be created through various customized ways. After saving the new selector we check the Service again for endpoints:

```
$ k -n mars get ep
NAME                ENDPOINTS                                      AGE
manager-api-svc   10.0.0.30:80,10.0.1.30:80,10.0.1.31:80 + 1 more...   41m
```

Endpoints - Good! Now we try connecting again:

```
$ k -n mars run tmp --restart=Never --rm -i --image=nginx:alpine -- curl -m 5 manager-api-svc:4444
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100   612  100   612    0     0    99k      0 --:--:-- --:--:-- --:--:--   99k
<!DOCTYPE html>
<html>
<head>
<title>Welcome to nginx!</title>
...
```

And we fixed it. Good to know is how to be able to use Kubernetes DNS resolution from a different Namespace. Not necessary, but we could spin up the temporary Pod in default Namespace:

```
$ k run tmp --restart=Never --rm -i --image=nginx:alpine -- curl -m 5 manager-api-svc:4444
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
  0     0    0     0    0     0      0      0 --:--:-- --:--:-- --:--:--     0curl: (6) Could not resolve host: manager-api-svc
pod "tmp" deleted
pod default/tmp terminated (Error)
```

```
$ k run tmp --restart=Never --rm -i --image=nginx:alpine -- curl -m 5 manager-api-svc.mars:4444
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100   612  100   612    0     0  68000      0 --:--:-- --:--:-- --:--:-- 68000
<!DOCTYPE html>
<html>
<head>
<title>Welcome to nginx!</title>
```

Short **manager-api-svc.mars** or long **manager-api-svc.mars.svc.cluster.local** work.

Q19 | Service ClusterIP->NodePort

In Namespace **jupiter** you'll find an apache Deployment (with one replica) named **jupiter-crew-deploy** and a ClusterIP Service called jupiter-crew-svc which exposes it. Change this service to a NodePort one to make it available on all nodes on port 30100.

Test the NodePort Service using the internal IP of all available nodes and the port 30100 using curl, you can reach the internal node IPs directly from your main terminal. On which nodes is the Service reachable? On which node is the Pod running?

Ans.

First, we get an overview:

```
$ k -n jupiter get all
NAME                                 READY   STATUS    RESTARTS   AGE
pod/jupiter-crew-deploy-8cdf99bc9-klwqt   1/1     Running   0          34m

NAME                     TYPE        CLUSTER-IP     EXTERNAL-IP   PORT(S)    AGE
service/jupiter-crew-svc   ClusterIP   10.100.254.66   <none>        8080/TCP   34m
...
```

(Optional) Next, we check if the ClusterIP Service actually works:

```
$ k -n jupiter run tmp --restart=Never --rm -i --image=nginx:alpine -- curl -m 5 jupiter-crew-svc:8080
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100    45  100    45    0     0   5000      0 --:--:-- --:--:-- --:--:--  5000
<html><body><h1>It works!</h1></body></html>
```

The Service is working great. Next we change the Service type to NodePort and set the port:

```
$ k -n jupiter edit service jupiter-crew-svc
```

```
apiVersion: v1
kind: Service
metadata:
  name: jupiter-crew-svc
  namespace: jupiter
...
spec:
  clusterIP: 10.3.245.70
  ports:
  - name: 8080-80
    port: 8080
    protocol: TCP
    targetPort: 80
    nodePort: 30100 # add the nodePort
  selector:
    id: jupiter-crew
  sessionAffinity: None
  #type: ClusterIP
  type: NodePort    # change type
status:
  loadBalancer: {}
```

We check if the Service type was updated:

```
$ k -n jupiter get svc
```

```
NAME              TYPE       CLUSTER-IP    EXTERNAL-IP   PORT(S)          AGE
jupiter-crew-svc  NodePort   10.3.245.70   <none>        8080:30100/TCP   3m52s
```

(Optional) And we confirm that the service is still reachable internally:

```
$ k -n jupiter run tmp --restart=Never --rm -i --image=nginx:alpine -- curl -m 5 jupiter-crew-svc:8080
```

```
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
<html><body><h1>It works!</h1></body></html>
```

Nice. A NodePort Service kind of lies on top of a ClusterIP one, making the ClusterIP Service reachable on the Node IPs (internal and external). Next we get the internal IPs of all nodes to check the connectivity:

```
$ k get nodes -o wide
NAME              STATUS   ROLES    AGE   VERSION   INTERNAL-IP     ...
cluster1-master1  Ready    master   18h   v1.21.0   192.168.100.11  ...
cluster1-worker1  Ready    <none>   18h   v1.21.0   192.168.100.12  ...
```

On which nodes is the Service reachable?

```
$ curl 192.168.100.11:30100
<html><body><h1>It works!</h1></body></html>
```

```
$ curl 192.168.100.12:30100
<html><body><h1>It works!</h1></body></html>
```

On both, even the master. On which node is the Pod running?

```
$ k -n jupiter get pod jupiter-crew-deploy-8cdf99bc9-klwqt -o yaml | grep nodeName
    nodeName: cluster1-worker1
```

```
$ k -n jupiter get pod -o wide # or even shorter
```

In our case on cluster1-worker1, but could be any other worker if more available. Here we hopefully gained some insight into how a NodePort Service works. Although the Pod is just running on one specific node, the Service makes it available through port 30100 on the internal and external IP addresses of all nodes. This is at least the common/default behaviour but can depend on cluster configuration.

Q20 | Network Policy

In Namespace venus you'll find two Deployments named api and frontend. Both Deployments are exposed inside the cluster using Services. Create a NetworkPolicy named np1 which restricts outgoing tcp connections from Deployment frontend and only allows those going to Deployment api. Make sure the NetworkPolicy still allows outgoing traffic on UDP/TCP ports 53 for DNS resolution.

Test using: wget www.google.com and wget api:2222 from a Pod of Deployment frontend.

Ans.

First, we get an overview:

```
k -n venus get all
```

```
NAME                        READY   STATUS    RESTARTS   AGE
pod/api-5979b95578-gktxp    1/1     Running   0          57s
pod/api-5979b95578-lhcl5    1/1     Running   0          57s
pod/frontend-789cbdc677-c9v8h   1/1     Running   0          57s
pod/frontend-789cbdc677-npk2m   1/1     Running   0          57s
pod/frontend-789cbdc677-pl67g   1/1     Running   0          57s
pod/frontend-789cbdc677-rjt5r   1/1     Running   0          57s
pod/frontend-789cbdc677-xgf5n   1/1     Running   0          57s

NAME             TYPE        CLUSTER-IP     EXTERNAL-IP   PORT(S)    AGE
service/api      ClusterIP   10.3.255.137   <none>        2222/TCP   37s
service/frontend   ClusterIP   10.3.255.135   <none>        80/TCP     57s
...
```

(Optional) This is not necessary but we could check if the Services are working inside the cluster:

```
k -n venus run tmp --restart=Never --rm -i --image=busybox -i -- wget -O- frontend:80
```

```
Connecting to frontend:80 (10.3.245.9:80)
<!DOCTYPE html>
<html>
<head>
<title>Welcome to nginx!</title>
...
```

```
$ k -n venus run tmp --restart=Never --rm --image=busybox -i -- wget -O- api:2222
```

```
Connecting to api:2222 (10.3.250.233:2222)
<html><body><h1>It works!</h1></body></html>
```

Then we use any frontend Pod and check if it can reach external names and the api Service:

```
$ k -n venus exec frontend-789cbdc677-c9v8h -- wget -O- www.google.com
```

```
Connecting to www.google.com (216.58.205.227:80)
-                    100% |*******************************| 12955  0:00:00 ETA
<!doctype html><html itemscope="" itemtype="http://schema.org/WebPage" lang="en"><head>
...
```

```
$ k -n venus exec frontend-789cbdc677-c9v8h -- wget -O- api:2222
<html><body><h1>It works!</h1></body></html>
Connecting to api:2222 (10.3.255.137:2222)
-                    100% |********************************|    45  0:00:00 ETA
...
```

We see Pods of frontend can reach the api and external names.

```
$ vim 20_np1.yaml
```

Now we head to https://kubernetes.io/docs , search for NetworkPolicy, copy the example code and adjust it to:

```
# 20_np1.yaml
apiVersion: networking.k8s.io/v1
kind: NetworkPolicy
metadata:
  name: np1
  namespace: venus
spec:
  podSelector:
    matchLabels:
      id: frontend          # label of the pods this policy should be applied on
  policyTypes:
  - Egress                  # we only want to control egress
  egress:
  - to:                   # 1st egress rule
    - podSelector:            # allow egress only to pods with api label
        matchLabels:
          id: api
  - ports:                  # 2nd egress rule
    - port: 53                # allow DNS UDP
      protocol: UDP
    - port: 53                # allow DNS TCP
      protocol: TCP
```

Notice that we specify two egress rules in the yaml above. If we specify multiple egress rules then these are connected using a logical OR. So in the example above we do:

```
allow outgoing traffic if
  (destination pod has label id:api) OR ((port is 53 UDP) OR (port is 53 TCP))
```

Let's have a look at example code which wouldn't work in our case:

```
# this example does not work in our case
...
  egress:
  - to:                    # 1st AND ONLY egress rule
    - podSelector:           # allow egress only to pods with api label
        matchLabels:
          id: api
    ports:                 # STILL THE SAME RULE but just an additional selector
    - port: 53               # allow DNS UDP
      protocol: UDP
    - port: 53               # allow DNS TCP
      protocol: TCP
```

In the yaml above we only specify one egress rule with two selectors. It can be translated into:

```
allow outgoing traffic if
  (destination pod has label id:api) AND ((port is 53 UDP) OR (port is 53 TCP))
```

```
$ k -f 20_np1.yaml create
```

And try again, external is not working any longer:

```
k -n venus exec frontend-789cbdc677-c9v8h -- wget -O- www.google.de
Connecting to www.google.de:2222 (216.58.207.67:80)
^C
```

```
$ k -n venus exec frontend-789cbdc677-c9v8h -- wget -O- -T 5 www.google.de:80
Connecting to www.google.com (172.217.203.104:80)
wget: download timed out
command terminated with exit code 1
```

Internal connection to api work as before:

```
$ k -n venus exec frontend-789cbdc677-c9v8h -- wget -O- api:2222
<html><body><h1>It works!</h1></body></html>
Connecting to api:2222 (10.3.255.137:2222)
-                    100% |*******************************|    45  0:00:00 ETA
```

Preview Question 1

In Namespace pluto there is a Deployment named project-23-api. It has been working okay for a while but Team Pluto needs it to be more reliable. Implement a liveness-probe which checks the container to be reachable on port 80. Initially the probe should wait 10, periodically 15 seconds.

The original Deployment yaml is available at /opt/course/p1/project-23-api.yaml. Save your changes at /opt/course/p1/project-23-api-new.yaml and apply the changes.

Ans.

First, we get an overview:

```
$ k -n pluto get all -o wide
NAME                                READY   STATUS    ... IP           ...
pod/holy-api                        1/1     Running   ... 10.12.0.26   ...
pod/project-23-api-784857f54c-dx6h6 1/1     Running   ... 10.12.2.15   ...
pod/project-23-api-784857f54c-sj8df 1/1     Running   ... 10.12.1.18   ...
pod/project-23-api-784857f54c-t4xmh 1/1     Running   ... 10.12.0.23   ...

NAME                           READY   UP-TO-DATE   AVAILABLE   ...
deployment.apps/project-23-api 3/3     3            3           ...
```

To note: we see another Pod here called holy-api which is part of another section. This is often the case in the provided scenarios, so be careful to only manipulate the resources you need to. Just like in the real world and in the exam.

Next we use nginx:alpine and curl to check if one Pod is accessible on port 80:

```
$ k run tmp --restart=Never --rm -i --image=nginx:alpine -- curl -m 5 10.12.2.15
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
<!DOCTYPE html>
<html>
<head>
<title>Welcome to nginx!</title>
...
```

We could also use busybox and wget for this:

```
$ k run tmp --restart=Never --rm --image=busybox -i -- wget -O- 10.12.2.15
Connecting to 10.12.2.15 (10.12.2.15:80)
writing to stdout
-                    100% |*******************************|   612  0:00:00 ETA
written to stdout
<!DOCTYPE html>
<html>
<head>
<title>Welcome to nginx!</title>
```

Now that we're sure the Deployment works we can continue with altering the provided yaml:

```
$ cp /opt/course/p1/project-23-api.yaml /opt/course/p1/project-23-api-new.yaml
$ vim /opt/course/p1/project-23-api-new.yaml
```

Add the liveness-probe to the yaml:

```
# /opt/course/p1/project-23-api-new.yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: project-23-api
  namespace: pluto
spec:
  replicas: 3
  selector:
    matchLabels:
      app: project-23-api
  template:
    metadata:
      labels:
        app: project-23-api
    spec:
      volumes:
      - name: cache-volume1
        emptyDir: {}
      - name: cache-volume2
        emptyDir: {}
      - name: cache-volume3
        emptyDir: {}
      containers:
      - image: httpd:2.4-alpine
```

```
      name: httpd
      volumeMounts:
      - mountPath: /cache1
        name: cache-volume1
      - mountPath: /cache2
        name: cache-volume2
      - mountPath: /cache3
        name: cache-volume3
      env:
      - name: APP_ENV
        value: "prod"
      - name: APP_SECRET_N1
        value: "IO=a4L/XkRdvN8jM=Y+"
      - name: APP_SECRET_P1
        value: "-7PA0_Z]>{pwa43r)__"
      livenessProbe:                # add
        tcpSocket:                  # add
          port: 80                  # add
        initialDelaySeconds: 10     # add
        periodSeconds: 15           # add
```

Then let's apply the changes:

```
$ k -f /opt/course/p1/project-23-api-new.yaml apply
```

Next we wait 10 seconds and confirm the Pods are still running:

```
$ k -n pluto get pod
NAME                          READY   STATUS    RESTARTS   AGE
holy-api                      1/1     Running   0          144m
project-23-api-5b4579fd49-8knh8   1/1     Running   0          90s
project-23-api-5b4579fd49-cbgph   1/1     Running   0          88s
project-23-api-5b4579fd49-tcfq5   1/1     Running   0          86s
```

We can also check the configured liveness-probe settings on a Pod or the Deployment:

```
$ k -n pluto describe pod project-23-api-5b4579fd49-8knh8 | grep Liveness
    Liveness:   tcp-socket :80 delay=10s timeout=1s period=15s #success=1 #failure=3
```

```
$ k -n pluto describe deploy project-23-api | grep Liveness
    Liveness:   tcp-socket :80 delay=10s timeout=1s period=15s #success=1 #failure=3
```

Preview Question 2

Team Sun needs a new Deployment named sunny with 4 replicas of image nginx:1.17.3-alpine in Namespace sun. The Deployment and its Pods should use the existing ServiceAccount sa-sun-deploy.

Expose the Deployment internally using a ClusterIP Service named sun-srv on port 9999. The nginx containers should run as default on port 80. The management of Team Sun would like to execute a command to check that all Pods are running on occasion. Write that command into file /opt/course/p2/sunny_status_command.sh. The command should use kubectl.

Ans.

```
$ k -n sun create deployment -h #help
# check the export on the very top of this document so we can use $do
```

```
$ k -n sun create deployment sunny --image=nginx:1.17.3-alpine $do > p2_sunny.yaml
```

```
$ vim p2_sunny.yaml
```

Then alter its yaml to include the requirements:

```
# p2_sunny.yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  creationTimestamp: null
  labels:
    app: sunny
  name: sunny
  namespace: sun
spec:
  replicas: 4                    # change
  selector:
    matchLabels:
```

```
      app: sunny
  strategy: {}
  template:
    metadata:
      creationTimestamp: null
      labels:
        app: sunny
    spec:
      serviceAccountName: sa-sun-deploy     # add
      containers:
      - image: nginx:1.17.3-alpine
        name: nginx
        resources: {}
status: {}
```

Now create the yaml and confirm its running:

```
k create -f p2_sunny.yaml
deployment.apps/sunny created
```

```
$ k -n sun get pod
NAME                 READY   STATUS      RESTARTS   AGE
0509649a             1/1     Running     0          149m
0509649b             1/1     Running     0          149m
1428721e             1/1     Running     0          149m
...
sunny-64df8dbdbb-9mxbw   1/1     Running     0          10s
sunny-64df8dbdbb-mp5cf   1/1     Running     0          10s
sunny-64df8dbdbb-pggdf   1/1     Running     0          6s
sunny-64df8dbdbb-zvqth   1/1     Running     0          7s
```

Confirmed, the AGE column is always in important information about if changes were applied.
Next we expose the Pods by created the Service:

```
$ k -n sun expose -h # help
$ k -n sun expose deployment sunny --name sun-srv --port 9999 --target-port 80
```

Using expose instead of kubectl create service clusterip is faster because it already sets the correct selector-labels. The previous command would produce this yaml:

```
# k -n sun expose deployment sunny --name sun-srv --port 9999 --target-port 80
apiVersion: v1
kind: Service
metadata:
  creationTimestamp: null
  labels:
    app: sunny
  name: sun-srv         # required by task
spec:
  ports:
  - port: 9999          # service port
    protocol: TCP
    targetPort: 80      # target port
  selector:
    app: sunny          # selector is important
status:
  loadBalancer: {}
```

Let's test the Service using wget from a temporary Pod:

```
$ k run tmp --restart=Never --rm -i --image=nginx:alpine -- curl -m 5 sun-srv.sun:9999
Connecting to sun-srv.sun:9999 (10.23.253.120:9999)
<!DOCTYPE html>
<html>
<head>
<title>Welcome to nginx!</title>
...
```

Because the Service is in a different Namespace as our temporary Pod, it is reachable using the names sun-srv.sun or fully: sun-srv.sun.svc.cluster.local.

Finally we need a command which can be executed to check if all Pods are runing, this can be done with:

```
$ vim /opt/course/p2/sunny_status_command.sh
```

```
# /opt/course/p2/sunny_status_command.sh
$ kubectl -n sun get deployment sunny
```

To run the command:

```
$ sh /opt/course/p2/sunny_status_command.sh
NAME    READY   UP-TO-DATE   AVAILABLE   AGE
sunny   4/4     4            4           13m
```

Preview Question 3

Management of EarthAG recorded that one of their Services stopped working. Dirk, the administrator, left already for the long weekend. All the information they could give you is that it was located in Namespace earth and that it stopped working after the latest rollout. All Services of EarthAG should be reachable from inside the cluster.

Find the Service, fix any issues and confirm its working again. Write the reason of the error into file /opt/course/p3/ticket-654.txt so Dirk knows what the issue was.

Ans.

First we get an overview of the resources in Namespace earth:

```
$ k -n earth get all
NAME                                READY   STATUS    RESTARTS   AGE
pod/earth-2x3-api-584df69757-ngnwp          1/1     Running   0          116m
pod/earth-2x3-api-584df69757-ps8cs          1/1     Running   0          116m
pod/earth-2x3-api-584df69757-ww9q8          1/1     Running   0          116m
pod/earth-2x3-web-85c5b7986c-48vjt          1/1     Running   0          116m
pod/earth-2x3-web-85c5b7986c-6mqmb          1/1     Running   0          116m
pod/earth-2x3-web-85c5b7986c-6vjll          1/1     Running   0          116m
pod/earth-2x3-web-85c5b7986c-fnkbp          1/1     Running   0          116m
pod/earth-2x3-web-85c5b7986c-pjm5m          1/1     Running   0          116m
pod/earth-2x3-web-85c5b7986c-pwfvj          1/1     Running   0          116m
pod/earth-3cc-runner-6cb6cc6974-8wm5x       1/1     Running   0          116m
pod/earth-3cc-runner-6cb6cc6974-9fx8b       1/1     Running   0          116m
pod/earth-3cc-runner-6cb6cc6974-b9nrv       1/1     Running   0          116m
pod/earth-3cc-runner-heavy-6bf876f46d-b47vq   1/1     Running   0          116m
pod/earth-3cc-runner-heavy-6bf876f46d-mrzqd   1/1     Running   0          116m
pod/earth-3cc-runner-heavy-6bf876f46d-qkd74   1/1     Running   0          116m
pod/earth-3cc-web-6bfdf8b848-f74cj          0/1     Running   0          116m
pod/earth-3cc-web-6bfdf8b848-n4z7z          0/1     Running   0          116m
pod/earth-3cc-web-6bfdf8b848-rcmxs          0/1     Running   0          116m
pod/earth-3cc-web-6bfdf8b848-xl467          0/1     Running   0          116m
```

```
NAME                        TYPE       CLUSTER-IP     EXTERNAL-IP   PORT(S)    AGE
service/earth-2x3-api-svc   ClusterIP  10.3.241.242   <none>        4546/TCP   116m
service/earth-2x3-web-svc   ClusterIP  10.3.250.247   <none>        4545/TCP   116m
service/earth-3cc-web       ClusterIP  10.3.243.24    <none>        6363/TCP   116m


NAME                                  READY   UP-TO-DATE   AVAILABLE   AGE
deployment.apps/earth-2x3-api         3/3     3            3           116m
deployment.apps/earth-2x3-web         6/6     6            6           116m
deployment.apps/earth-3cc-runner      3/3     3            3           116m
deployment.apps/earth-3cc-runner-heavy  3/3   3            3           116m
deployment.apps/earth-3cc-web         0/4     4            0           116m

NAME                                             DESIRED   CURRENT   READY   AGE
replicaset.apps/earth-2x3-api-584df69757         3         3         3       116m
replicaset.apps/earth-2x3-web-85c5b7986c         6         6         6       116m
replicaset.apps/earth-3cc-runner-6cb6cc6974      3         3         3       116m
replicaset.apps/earth-3cc-runner-heavy-6bf876f46d  3       3         3       116m
replicaset.apps/earth-3cc-web-6895587dc7         0         0         0       116m
replicaset.apps/earth-3cc-web-6bfdf8b848         4         4         0       116m
replicaset.apps/earth-3cc-web-d49645966          0         0         0       116m
```

First impression could be that all Pods are in status RUNNING. But looking closely we see that some of the Pods are not ready, which also confirms what we see about one Deployment and one replicaset. This could be our error to further investigate.

Another approach could be to check the Services for missing endpoints:

```
k -n earth get ep
NAME              ENDPOINTS                                        AGE
earth-2x3-api-svc   10.0.0.10:80,10.0.1.5:80,10.0.2.4:80             116m
earth-2x3-web-svc   10.0.0.11:80,10.0.0.12:80,10.0.1.6:80 + 3 more...   116m
earth-3cc-web
```

Service earth-3cc-web doesn't have endpoints. This could be a selector/label misconfiguration or the endpoints are actually not available/ready.

Checking all Services for connectivity should show the same (this step is optional and just for demonstration:

```
k run tmp --restart=Never --rm -i --image=nginx:alpine -- curl -m 5 earth-2x3-api-svc.earth:4546
```

```
...
<html><body><h1>It works!</h1></body></html>
```

```
$ k run tmp --restart=Never --rm -i --image=nginx:alpine -- curl -m 5 earth-2x3-web-svc.earth:4545
```

```
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100    45  100    45    0     0   5000      0 --:--:-- --:--:-- --:--:--  5000
<html><body><h1>It works!</h1></body></html>
```

```
$ k run tmp --restart=Never --rm -i --image=nginx:alpine -- curl -m 5 earth-3cc-web.earth:6363
```

```
If you don't see a command prompt, try pressing enter.
  0     0    0     0    0     0      0      0 --:--:--  0:00:05 --:--:--     0
curl: (28) Connection timed out after 5000 milliseconds
pod "tmp" deleted
pod default/tmp terminated (Error)
```

Notice that we use here for example earth-2x3-api-svc.earth. We could also spin up a temporary Pod in Namespace earth and connect directly to earth-2x3-api-svc.

We get no connection to earth-3cc-web.earth:6363. Let's look at the Deployment earth-3cc-web. Here we see that the requested amount of replicas is not available/ready:

```
$ k -n earth get deploy earth-3cc-web
```

```
NAME          READY   UP-TO-DATE   AVAILABLE   AGE
earth-3cc-web   0/4     4            0           7m18s
```

To continue we check the Deployment yaml for some misconfiguration:

```
$ k -n earth edit deploy earth-3cc-web
```

```
# k -n earth edit deploy earth-3cc-web
apiVersion: extensions/v1beta1
kind: Deployment
metadata:
...
  generation: 3                    # there have been rollouts
  name: earth-3cc-web
  namespace: earth
...
spec:
```

```
...
  template:
    metadata:
      creationTimestamp: null
      labels:
        id: earth-3cc-web
    spec:
      containers:
      - image: nginx:1.16.1-alpine
        imagePullPolicy: IfNotPresent
        name: nginx
        readinessProbe:
          failureThreshold: 3
          initialDelaySeconds: 10
          periodSeconds: 20
          successThreshold: 1
          tcpSocket:
            port: 82              # this port doesn't seem to be right, should be 80
          timeoutSeconds: 1
...
```

We change the readiness-probe port, save and check the Pods:

```
$ k -n earth get pod -l id=earth-3cc-web
NAME                       READY   STATUS    RESTARTS   AGE
earth-3cc-web-d49645966-52vb9   0/1     Running   0          6s
earth-3cc-web-d49645966-5tts6   0/1     Running   0          6s
earth-3cc-web-d49645966-db5gp   0/1     Running   0          6s
earth-3cc-web-d49645966-mk7gr   0/1     Running   0          6s
```

Running, but still not in ready state. Wait 10 seconds (initialDelaySeconds of readinessProbe) and check again:

```
$ k -n earth get pod -l id=earth-3cc-web
NAME                       READY   STATUS    RESTARTS   AGE
earth-3cc-web-d49645966-52vb9   1/1     Running   0          32s
earth-3cc-web-d49645966-5tts6   1/1     Running   0          32s
earth-3cc-web-d49645966-db5gp   1/1     Running   0          32s
earth-3cc-web-d49645966-mk7gr   1/1     Running   0          32s
```

Let's check the service again:

```
$ k run tmp --restart=Never --rm -i --image=nginx:alpine -- curl -m 5 earth-3cc-web.earth:6363
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100   612  100   612    0     0  55636      0 --:--:-- --:--:-- --:--:-- 55636
<!DOCTYPE html>
<html>
<head>
<title>Welcome to nginx!</title>
<style>
    body {
        width: 35em;
        margin: 0 auto;
        font-family: Tahoma, Verdana, Arial, sans-serif;
    }
</style>
</head>
<body>
<h1>Welcome to nginx!</h1>
...
```

We did it! Finally we write the reason into the requested location:

```
$ vim /opt/course/p3/ticket-654.txt
# /opt/course/p3/ticket-654.txt
yo Dirk, wrong port for readinessProbe defined!
```