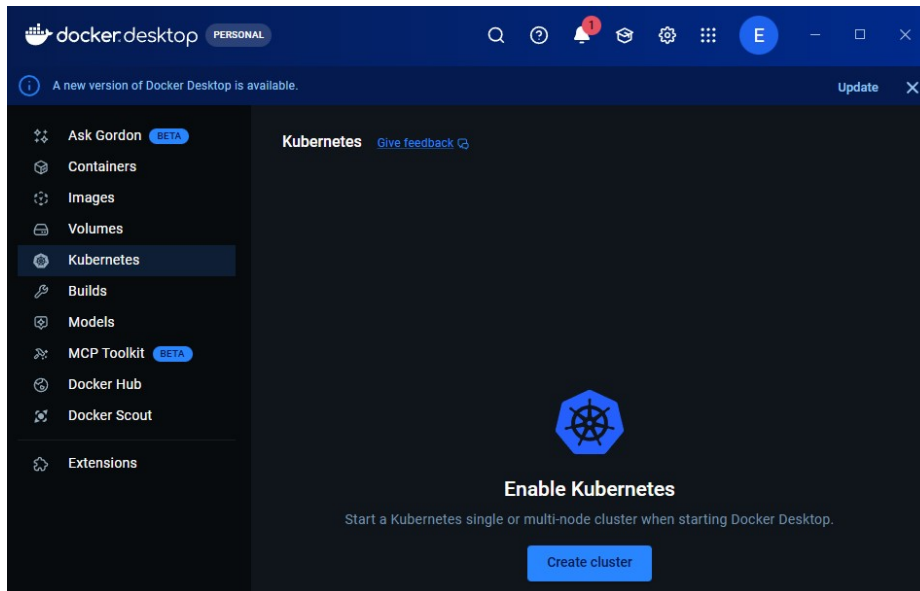
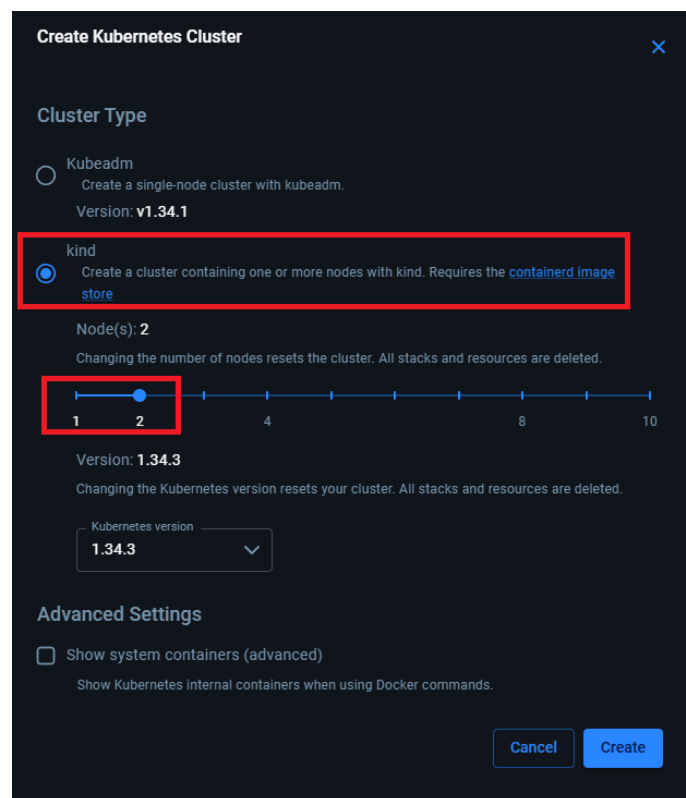


Chapitre 5 – Kubernetes : plateforme de déploiement des applications conteneurisées

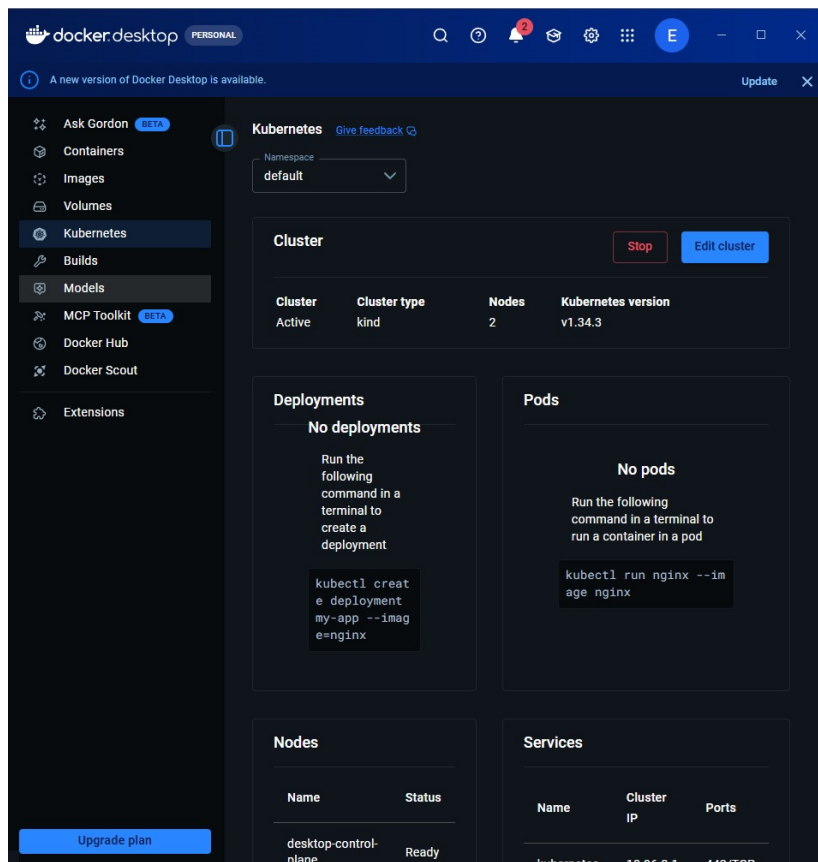
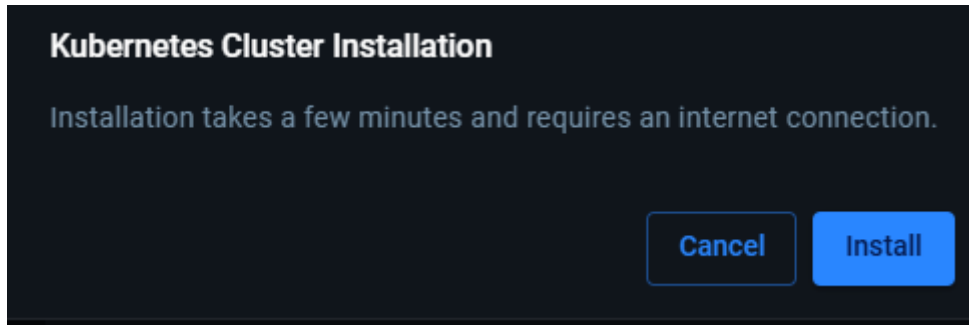
→ Affichage du panel Kubernetes :



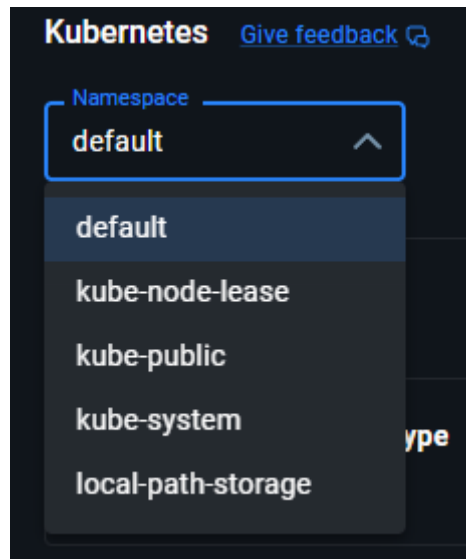
→ Cluster kind avec deux notes :



→ Installation de Kubernetes :



→ Namespace par défaut :



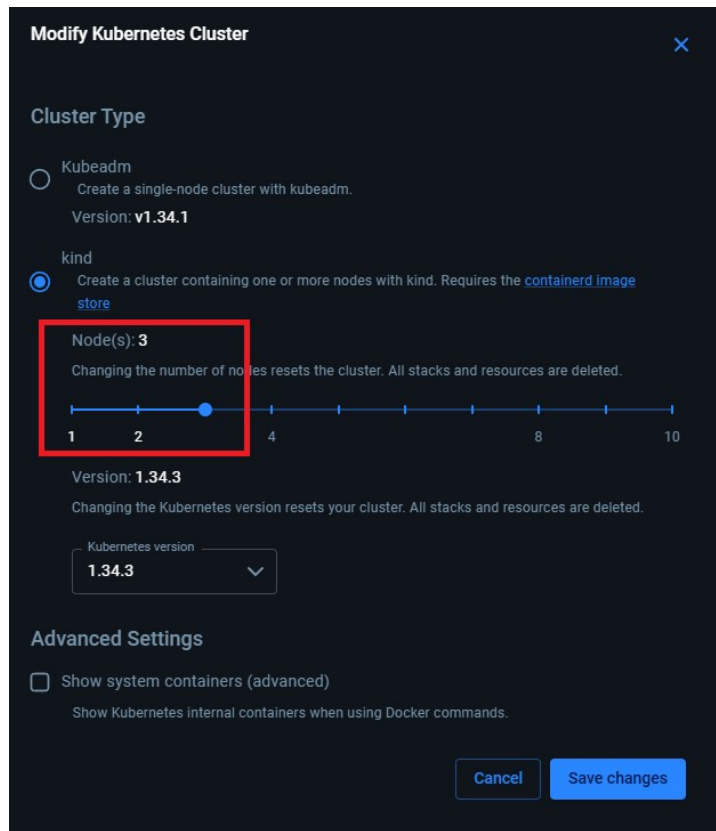
→ Affichage des nodes dans un terminal Powershell :

```
Administrateur : Windows PowerShell
Windows PowerShell
Copyright (C) Microsoft Corporation. Tous droits réservés.

Installez la dernière version de PowerShell pour de nouvelles fonctionnalités.

PS C:\WINDOWS\system32> kubectl get nodes
NAME                STATUS    ROLES    AGE     VERSION
desktop-control-plane  Ready    control-plane  2m12s  v1.34.3
desktop-worker        Ready    <none>      116s   v1.34.3
PS C:\WINDOWS\system32>
```

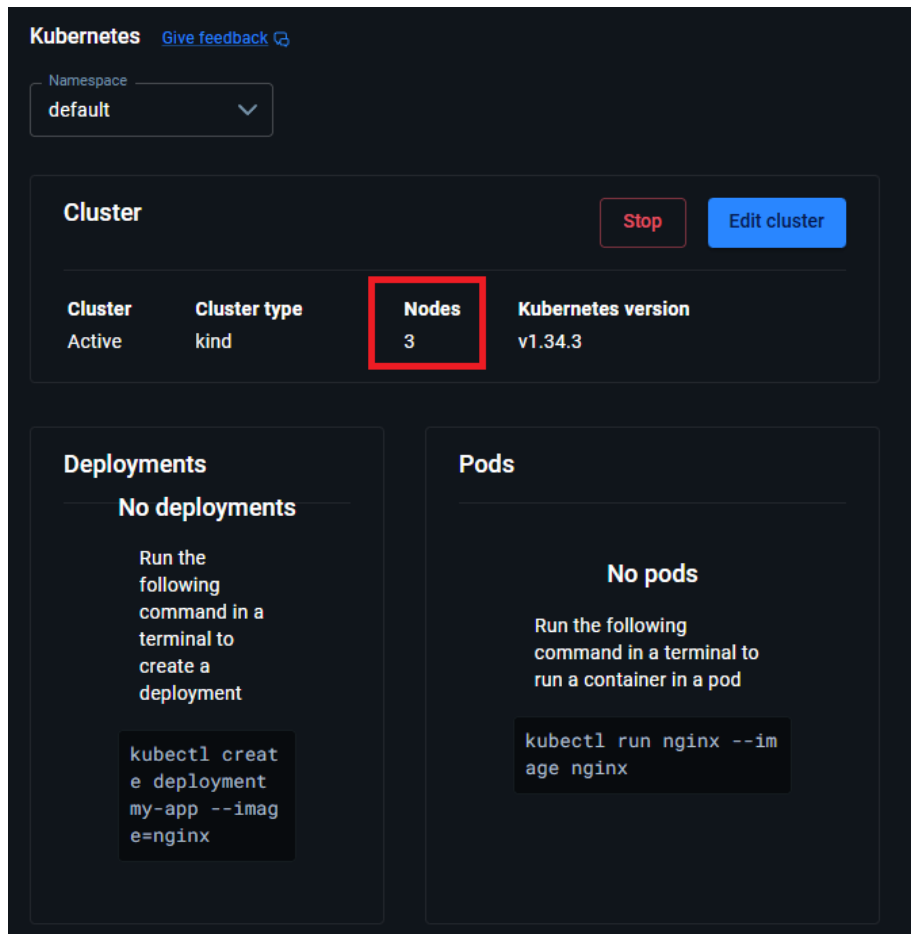
→ Modification de deux à trois nodes :



→ Case « show advanced systems » cochée :



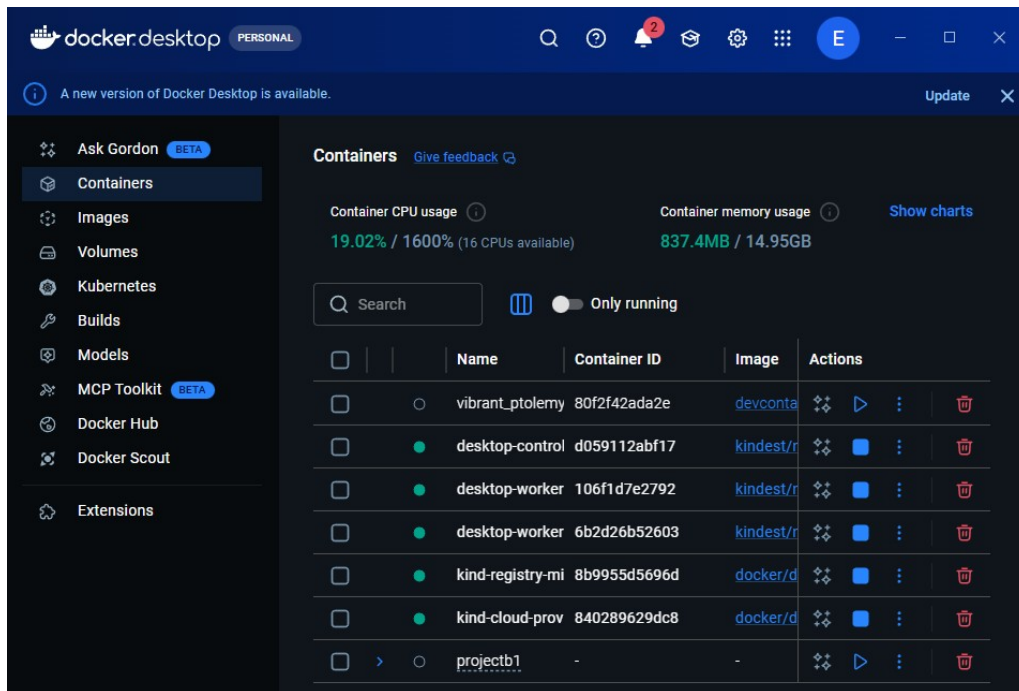
→ Conteneur redémarré avec 3 nodes :



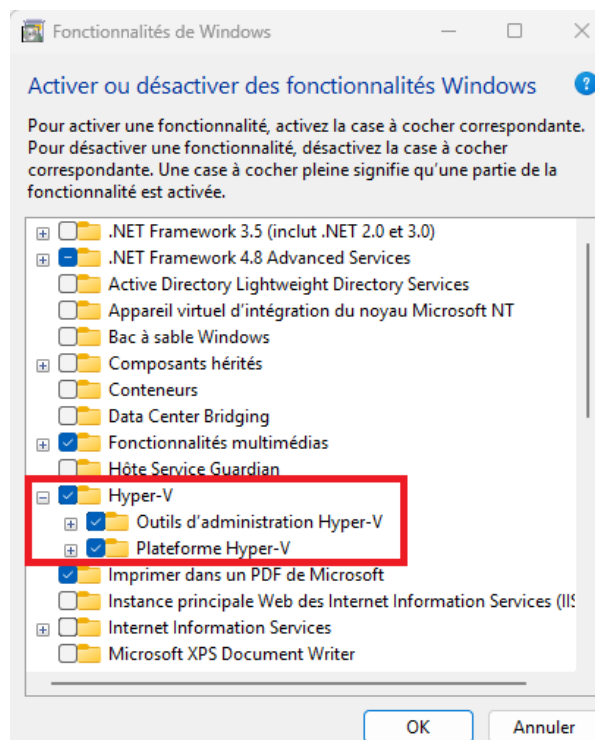
→ Affichage des 3 nodes dans Powershell :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get nodes
NAME                 STATUS    ROLES    AGE   VERSION
desktop-control-plane Ready    control-plane  2m   v1.34.3
desktop-worker       Ready    <none>    110s v1.34.3
desktop-worker2      Ready    <none>    110s v1.34.3
PS C:\WINDOWS\system32>
```

→ Affichage des conteneurs dans Docker Desktop :



→ Activation des fonctionnalités de Hyper V :



→ Copie des commandes du site de minikube :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> New-Item -Path 'c:\' -Name 'minikube' -ItemType Directory -Force

Répertoire : C:\

Mode                LastWriteTime         Length Name
----                -
d-----          29/04/2026   15:34             minikube

PS C:\WINDOWS\system32> $ProgressPreference = 'SilentlyContinue'; Invoke-WebRequest -OutFile 'c:\minikube\minikube.exe'
-Uri 'https://github.com/kubernetes/minikube/releases/latest/download/minikube-windows-amd64.exe' -UseBasicParsing
PS C:\WINDOWS\system32> $oldPath = [Environment]::GetEnvironmentVariable('Path', [EnvironmentVariableTarget]::Machine)
PS C:\WINDOWS\system32> if ($oldPath.Split(';') -notincontains 'C:\minikube'){
>> [Environment]::SetEnvironmentVariable('Path', $('{0};C:\minikube' -f $oldPath), [EnvironmentVariableTarget]::Machin
e)
>> }
PS C:\WINDOWS\system32>
```

→ Démarrage de minikube :

```
Administrateur : Windows PowerShell
Windows PowerShell
Copyright (C) Microsoft Corporation. Tous droits réservés.

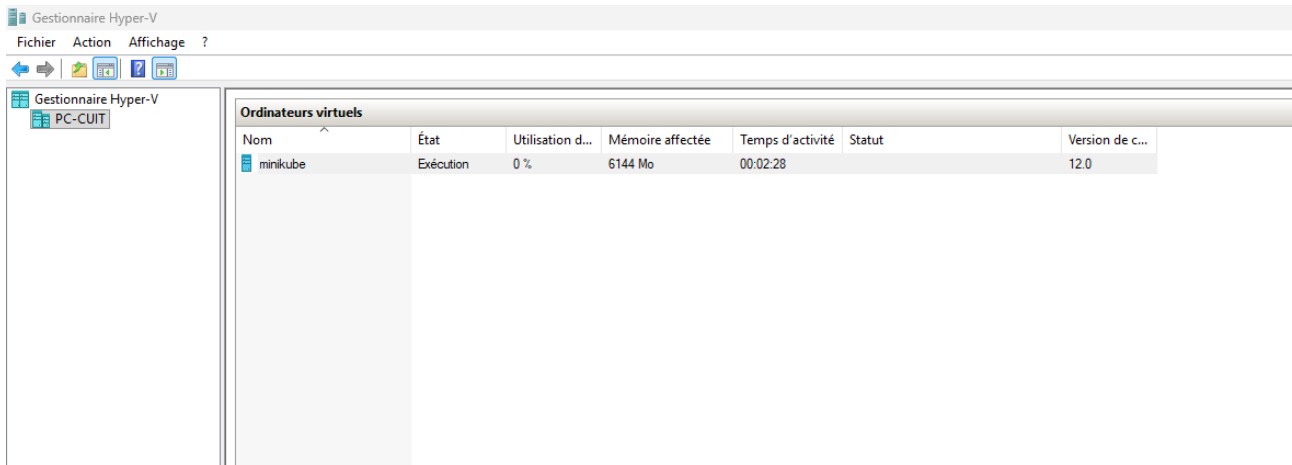
Installez la dernière version de PowerShell pour de nouvelles fonctionnalités et améliorations ! https://aka.ms/PSWindow
S

PS C:\WINDOWS\system32> minikube start
* minikube v1.38.1 sur Microsoft Windows 11 Pro Education 25H2
* Choix automatique du pilote docker. Autres choix: hyperv, virtualbox, ssh
! Starting v1.39.0, minikube will default to "containerd" container runtime. See #21973 for more info.
* Utilisation du pilote Docker Desktop avec le privilège root
* Démarrage du nœud "minikube" primary control-plane dans le cluster "minikube"
* Extraction de l'image de base v0.0.50...
* Téléchargement du préchargement de Kubernetes v1.35.1...
  > preloaded-images-k8s-v18-v1...: 272.45 MiB / 272.45 MiB 100.00% 39.31 M
  > gcr.io/k8s-minikube/kicbase...: 519.58 MiB / 519.58 MiB 100.00% 21.33 M
* Création de docker container (CPU=2, Memory=8000Mo) ...
* Préparation de Kubernetes v1.35.1 sur Docker 29.2.1...
* Configuration de bridge CNI (Container Networking Interface)...
* Vérification des composants Kubernetes...
  - Utilisation de l'image gcr.io/k8s-minikube/storage-provisioner:v5
* Modules activés: storage-provisioner, default-storageclass
* Terminé ! kubectl est maintenant configuré pour utiliser "minikube" cluster et espace de noms "default" par défaut.
PS C:\WINDOWS\system32>
```

→ Affichage du node minikube :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get nodes
NAME        STATUS    ROLES    AGE   VERSION
minikube    Ready    control-plane  35s   v1.35.1
PS C:\WINDOWS\system32>
```

→ Affichage de la nouvelle VM minikube créée dans le gestionnaire Hyper V :



→ Affichage de tout les objets :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get all
NAME                                TYPE          CLUSTER-IP    EXTERNAL-IP    PORT(S)    AGE
service/kubernetes                  ClusterIP     10.96.0.1     <none>         443/TCP    2m23s
PS C:\WINDOWS\system32>
```

→ Création du pod monpod :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl run monpod --image=nginx:latest
pod/monpod created
PS C:\WINDOWS\system32>
```

→ Affichage des pods :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get pods
NAME    READY   STATUS    RESTARTS   AGE
monpod  1/1     Running   0          19s
PS C:\WINDOWS\system32>
```

→ Affichage de tout les objets :

```

Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get all
NAME                READY   STATUS    RESTARTS   AGE
pod/monpod          1/1     Running   0           34s

NAME                TYPE          CLUSTER-IP   EXTERNAL-IP   PORT(S)    AGE
service/kubernetes  ClusterIP    10.96.0.1    <none>        443/TCP    4m5s
PS C:\WINDOWS\system32>

```

→ Affichage des logs du pod :

```

Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl logs pod/monpod
/docker-entrypoint.sh: /docker-entrypoint.d/ is not empty, will attempt to perform configuration
/docker-entrypoint.sh: Looking for shell scripts in /docker-entrypoint.d/
/docker-entrypoint.sh: Launching /docker-entrypoint.d/10-listen-on-ipv6-by-default.sh
10-listen-on-ipv6-by-default.sh: info: Getting the checksum of /etc/nginx/conf.d/default.conf
10-listen-on-ipv6-by-default.sh: info: Enabled listen on IPv6 in /etc/nginx/conf.d/default.conf
/docker-entrypoint.sh: Sourcing /docker-entrypoint.d/15-local-resolvers.envsh
/docker-entrypoint.sh: Launching /docker-entrypoint.d/20-envsubst-on-templates.sh
/docker-entrypoint.sh: Launching /docker-entrypoint.d/30-tune-worker-processes.sh
/docker-entrypoint.sh: Configuration complete; ready for start up
2026/04/29 13:44:22 [notice] 1#1: using the "epoll" event method
2026/04/29 13:44:22 [notice] 1#1: nginx/1.29.8
2026/04/29 13:44:22 [notice] 1#1: built by gcc 14.2.0 (Debian 14.2.0-19)
2026/04/29 13:44:22 [notice] 1#1: OS: Linux 6.6.87.2-microsoft-standard-WSL2
2026/04/29 13:44:22 [notice] 1#1: getrlimit(RLIMIT_NOFILE): 1048576:1048576
2026/04/29 13:44:22 [notice] 1#1: start worker processes
2026/04/29 13:44:22 [notice] 1#1: start worker process 29
2026/04/29 13:44:22 [notice] 1#1: start worker process 30
2026/04/29 13:44:22 [notice] 1#1: start worker process 31
2026/04/29 13:44:22 [notice] 1#1: start worker process 32
2026/04/29 13:44:22 [notice] 1#1: start worker process 33
2026/04/29 13:44:22 [notice] 1#1: start worker process 34
2026/04/29 13:44:22 [notice] 1#1: start worker process 35
2026/04/29 13:44:22 [notice] 1#1: start worker process 36
2026/04/29 13:44:22 [notice] 1#1: start worker process 37
2026/04/29 13:44:22 [notice] 1#1: start worker process 38
2026/04/29 13:44:22 [notice] 1#1: start worker process 39
2026/04/29 13:44:22 [notice] 1#1: start worker process 40
2026/04/29 13:44:22 [notice] 1#1: start worker process 41
2026/04/29 13:44:22 [notice] 1#1: start worker process 42
2026/04/29 13:44:22 [notice] 1#1: start worker process 43
2026/04/29 13:44:22 [notice] 1#1: start worker process 44
PS C:\WINDOWS\system32>

```

→ Affichage des espaces de noms :

```

Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get namespace
NAME                STATUS    AGE
default             Active   4m57s
kube-node-lease     Active   4m57s
kube-public         Active   4m57s
kube-system         Active   4m57s
PS C:\WINDOWS\system32>

```

→ La commande fonctionne aussi bien avec « pod » que « pods » :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get pods
NAME          READY   STATUS    RESTARTS   AGE
monpod        1/1     Running   0           105s
PS C:\WINDOWS\system32> kubectl get pod
NAME          READY   STATUS    RESTARTS   AGE
monpod        1/1     Running   0           105s
PS C:\WINDOWS\system32>
```

→ De même pour les commandes nodes :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get nodes
NAME          STATUS    ROLES    AGE     VERSION
minikube      Ready    control-plane  5m43s   v1.35.1
PS C:\WINDOWS\system32> kubectl get node
NAME          STATUS    ROLES    AGE     VERSION
minikube      Ready    control-plane  5m44s   v1.35.1
PS C:\WINDOWS\system32>
```

→ Affichage des champs supplémentaires :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get node -o wide
NAME          STATUS    ROLES    AGE     VERSION    INTERNAL-IP    EXTERNAL-IP    OS-IMAGE                                     KERNEL-VERSION    CONTAINER-RUNTIME
minikube      Ready    control-plane  6m9s    v1.35.1    192.168.49.2   <none>         Debian GNU/Linux 12 (bookworm)            6.6.87.2-microsoft-standard-WSL2    docker://29.2.1
PS C:\WINDOWS\system32>
```

→ Connexion en SSH sur le cluster et affichage des conteneurs dans l'espace de noms par défaut moby :

```
docker@minikube: ~
PS C:\WINDOWS\system32> minikube ssh
Linux minikube 6.6.87.2-microsoft-standard-WSL2 #1 SMP PREEMPT_DYNAMIC Thu Jun  5 18:30:46 UTC 2025 x86_64

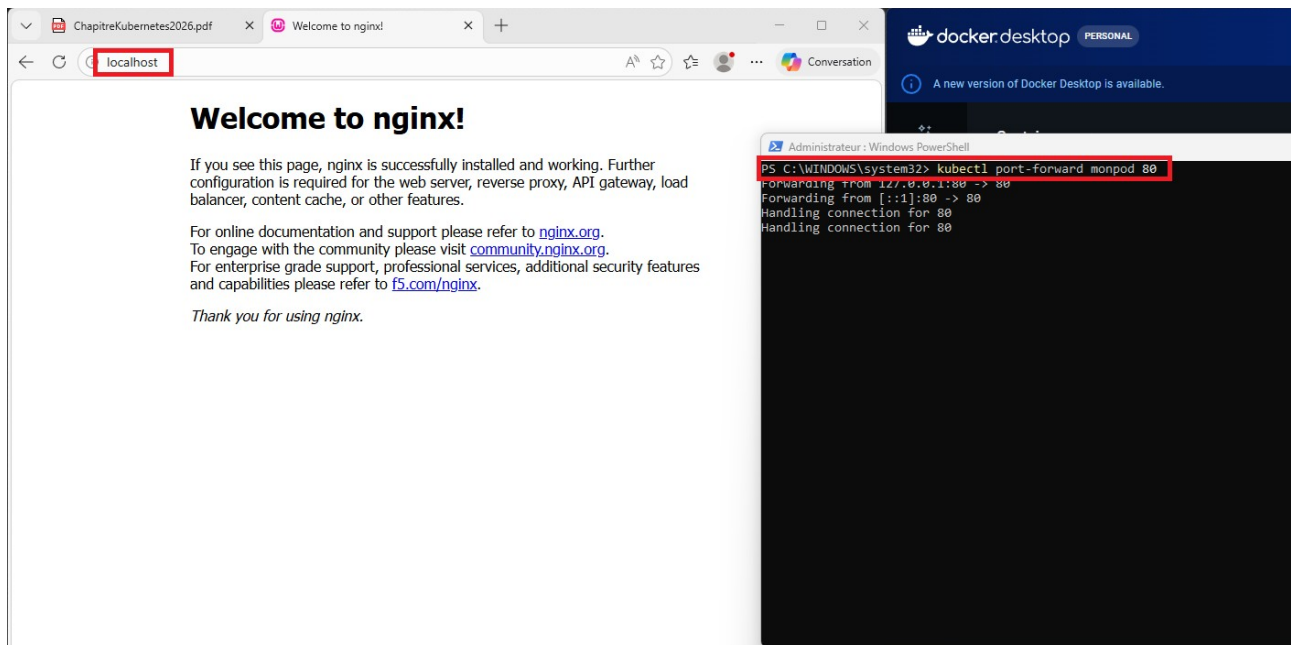
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
docker@minikube:~$ sudo ctr namespace ls
NAME LABELS
moby
docker@minikube:~$ sudo ctr -n moby container ls
CONTAINER          IMAGE          RUNTIME
13f105777efee9efa9559b2b983c3dc4a5969f4a0d057312572bcee1559bebd - io.containerd.runc.v2
157004cd597fa0fc7b879fe8959e4d7564e5b71b9d9bbf1c9fa356d118ab0427 - io.containerd.runc.v2
29b82691ce6680242b2fe50e9c544580e7620634a0e63d96c54011eb1ab42309 - io.containerd.runc.v2
3902c403672c4a6754c24e1580c691a983ad7770ac98291b6094eafede9f73fe - io.containerd.runc.v2
427e2c700f600d0f345261645de44bee7ffad9bb6c8203629e0db117c4010c3 - io.containerd.runc.v2
4f3e7baf4d8920d400f9d0d7d41333ff0e2d822de75edbe5af82e8d2a795631f - io.containerd.runc.v2
548816c767b14ea5de96b753d613e68773bb4009984d1f393b402359282a5579 - io.containerd.runc.v2
61f644aaf353988296fd42ea4cf99a8fef44f86d822ac36457bbb9808089f26 - io.containerd.runc.v2
6aee210ecd8bd03fe7ca0e097bb1af85466bbda9186b337918c78a509a47aa73 - io.containerd.runc.v2
8b6462b8a4c0a2e4ebd620463dc984ea983a0f99ce48bfff8bf0588dd504c03b4 - io.containerd.runc.v2
a90d6a3cc6c3c85a731a33e829a33b3a8635351c58abe7c9633c99a8b555f67 - io.containerd.runc.v2
ac1983bc30bcc8fd2f91ebf75d5615c6ed99904a43497d8a5b435e9746498c85 - io.containerd.runc.v2
ad25f606759677069c2a8e88287a3f2170cd305282d7f6939eb2a54369ab17d9 - io.containerd.runc.v2
b13c919394b03df9274d0b71a5c485e52896655021ae8700fca53b38b1e18eb4 - io.containerd.runc.v2
cfb851707d8a8650c50ccc40eb9b76aa885f9b3f56c759919231dd8a9508fe4b - io.containerd.runc.v2
fb618fe83f9b639e0c554d4f58a319dc1b228141b8bdd13ec7a6b5d8a7fcbef2 - io.containerd.runc.v2
docker@minikube:~$
```

→ Affichage de la description du pod monpod :

```
Administrateur: Windows PowerShell
PS C:\WINDOWS\system32> kubectl describe pod/monpod
Name:          monpod
Namespace:    default
Priority:      0
Service Account: default
Node:         minikube/192.168.49.2
Start Time:   Wed, 29 Apr 2026 15:44:15 +0200
Labels:       run=monpod
Annotations:  <none>
Status:       Running
IP:          10.244.0.3
IPs:         IP: 10.244.0.3
Containers:
  monpod:
    Container ID:   docker://157004cd597fa0fc7b879fe8959e4d7564e5b71b9d9bbf1c9fa356d118ab0427
    Image:          nginx:latest
    Image ID:       docker-pullable://nginx@sha256:6e23479198b998e5e25921dff8455837c7636a67111a04a635cf1bb363d199dc
    Port:          <none>
    Host Port:     <none>
    State:         Running
      Started:     Wed, 29 Apr 2026 15:44:22 +0200
    Ready:         True
    Restart Count: 0
    Environment:   <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-f6777 (ro)
Conditions:
  Type              Status
  PodReadyToStartContainers  True
  Initialized         True
  Ready               True
  ContainersReady     True
  PodScheduled       True
Volumes:
  kube-api-access-f6777:
    Type:          Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds: 3607
    ConfigMapName:  kube-root-ca.crt
    Optional:      false
    DownwardAPI:   true
  QoS Class:       BestEffort
  Node-Selectors:  <none>
  Tolerations:     node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
                  node.kubernetes.io/unreachable:NoExecute op=Exists for 300s
Events:
  Type    Reason      Age   From              Message
  ----    -
  Normal  Scheduled   4m28s  default-scheduler  Successfully assigned default/monpod to minikube
  Normal  Pulling     4m28s  kubelet            Pulling image "nginx:latest"
  Normal  Pulled      4m22s  kubelet            Successfully pulled image "nginx:latest" in 6.394s (6.394s including waiting). Image size: 160939956 bytes.
  Normal  Created     4m21s  kubelet            Container created
  Normal  Started     4m21s  kubelet            Container started
PS C:\WINDOWS\system32>
```

→ Accès au site web Nginx du pod :



→ Suppression du pod monpod :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl delete pod/monpod
pod "monpod" deleted from default namespace
PS C:\WINDOWS\system32> kubectl get pod
No resources found in default namespace.
PS C:\WINDOWS\system32>
```

→ Activation de l'add-on dashboard :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> minikube addons enable dashboard
* dashboard est un add-on maintenu par Kubernetes. Pour toute question, contactez minikube sur GitHub.
Vous pouvez consulter la liste des mainteneurs de minikube sur : https://github.com/kubernetes/minikube/blob/master/OWNERS
- Utilisation de l'image docker.io/kubernetes/metrics-scraper:v1.0.8
- Utilisation de l'image docker.io/kubernetes/dashboard:v2.7.0
* Certaines fonctionnalités du tableau de bord nécessitent le module complémentaire metrics-server. Pour activer toutes les fonctionnalités, veuillez exécuter :

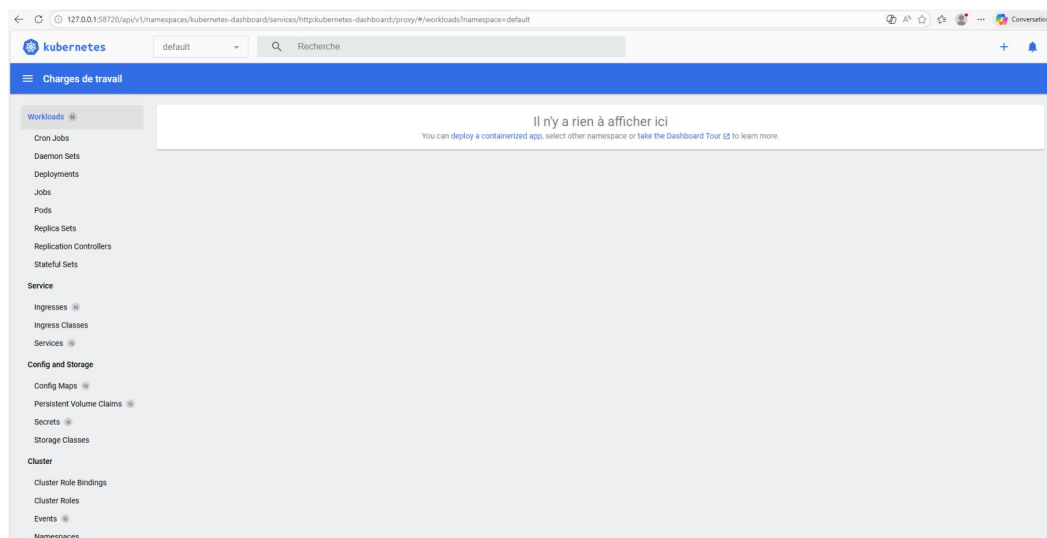
    minikube addons enable metrics-server

* Le module 'dashboard' est activé
PS C:\WINDOWS\system32>
```

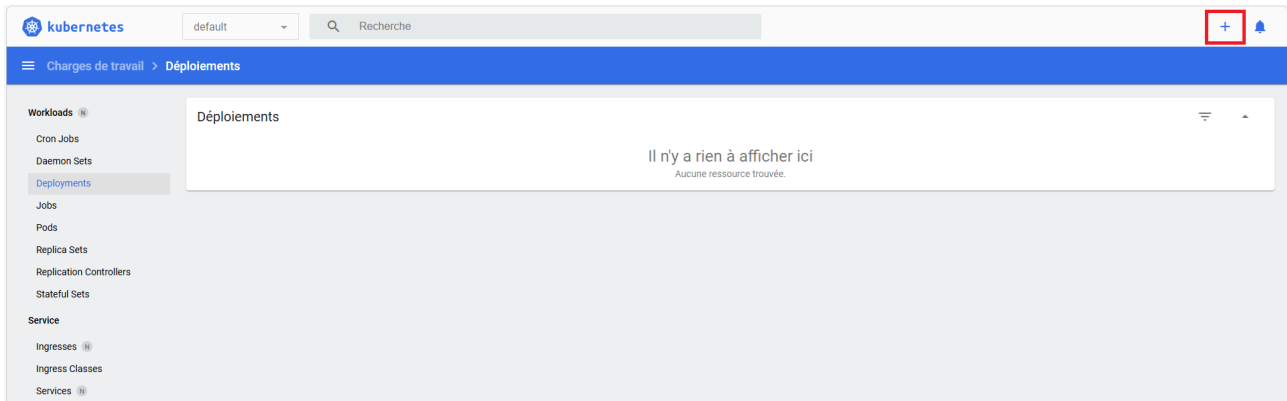
→ Activation de l'add-on metrics-server :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> minikube addons enable metrics-server
* metrics-server est un add-on maintenu par Kubernetes. Pour toute question, contactez minikube sur GitHub.
Vous pouvez consulter la liste des mainteneurs de minikube sur : https://github.com/kubernetes/minikube/blob/master/OWNERS
- Utilisation de l'image registry.k8s.io/metrics-server/metrics-server:v0.8.1
* Le module 'metrics-server' est activé
PS C:\WINDOWS\system32>
```

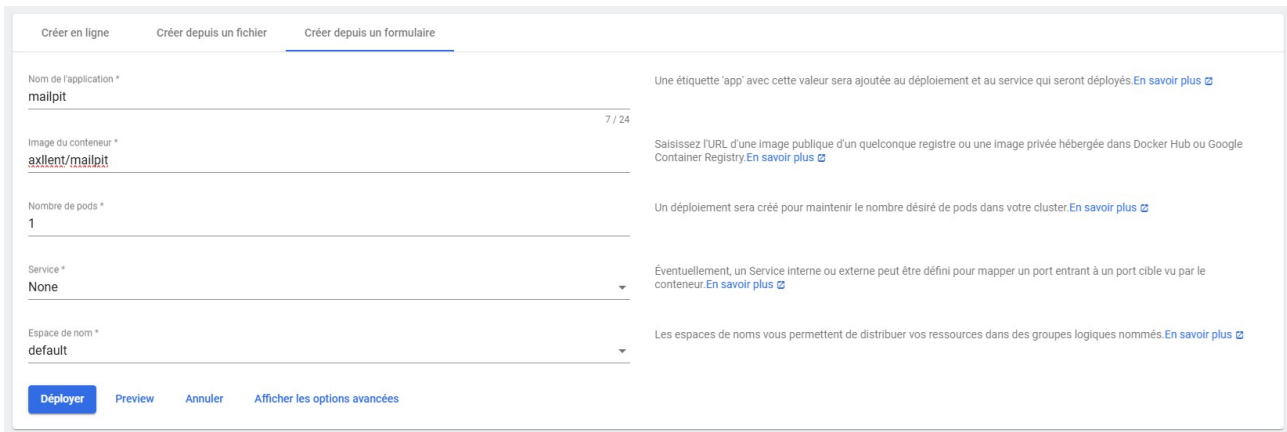
→ Affichage du dashboard (n'affiche pas toutes les métriques dû à un problème) :



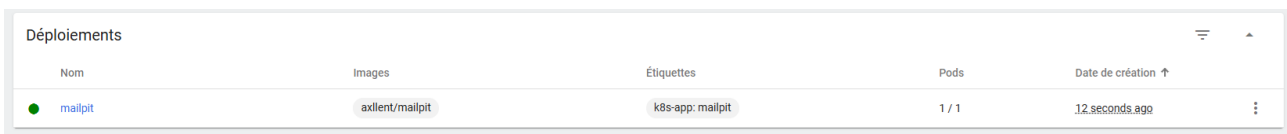
→ Nouveau déploiement :



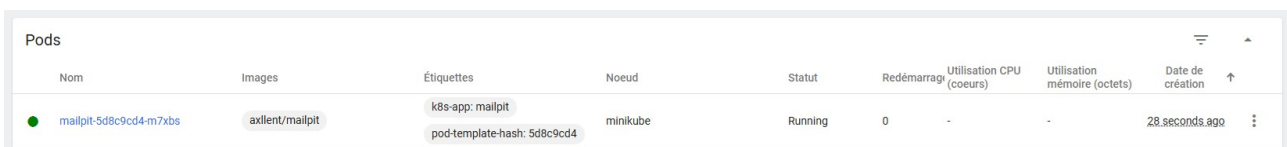
→ Création à partir d'un formulaire :



→ Affichage du nouveau déploiement :



→ Affichage du nouveau pod :



→ Affichage complet du dashboard avec les déploiements, pods, etc... :

The screenshot shows the 'Charges de travail' (Workloads) page in the Kubernetes dashboard. At the top, there are three green circles representing the status of Deployments, Pods, and Replica Sets, each with 'Running: 1' below it. Below this are three sections: 'Déploiements', 'Pods', and 'Replica Sets', each with a table of resources.

Nom	Images	Étiquettes	Pods	Date de création
mailpit	axilent/mailpit	k8s-app: mailpit	1 / 1	59 seconds ago

Nom	Images	Étiquettes	Noeud	Statut	Redémarrages	Utilisation CPU (coeurs)	Utilisation mémoire (octets)	Date de création
mailpit-5d8c9cd4-m7xbs	axilent/mailpit	k8s-app: mailpit pod-template-hash: 5d8c9cd4	minikube	Running	0	0.00m	7.44Mi	59 seconds ago

Nom	Images	Étiquettes	Pods	Date de création
mailpit-5d8c9cd4	axilent/mailpit	k8s-app: mailpit pod-template-hash: 5d8c9cd4	1 / 1	59 seconds ago

→ Affichage de l'onglet déploiement :

The screenshot shows the 'Déploiements' (Deployments) tab selected in the dashboard. At the top, there are two charts for 'CPU Usage' and 'Memory Usage', both displaying 'Waiting for more data to display chart...'. Below the charts is a table for the deployment 'mailpit'.

Nom	Images	Étiquettes	Pods	Date de création
mailpit	axilent/mailpit	k8s-app: mailpit	1 / 1	2 minutes ago

→ Affichage des métadonnées et autres :

The screenshot shows the detailed view of a deployment. It includes sections for 'Métadonnées' (Metadata), 'Informations sur la ressource' (Resource Information), 'Statut des pods' (Pod Status), and 'Pods'.

Métadonnées

Nom	Espace de nom	Date de création	Âge	UID
mailpit-5d8c9cd4	default	29. avr., 2026	3 minutes ago	e900b757-e8b1-4142-9048-b0f00f38e5e8

Étiquettes: k8s-app: mailpit, pod-template-hash: 5d8c9cd4

Annotations: deployment.kubernetes.io/desired-replicas: 1, deployment.kubernetes.io/max-replicas: 2, deployment.kubernetes.io/revision: 1

Informations sur la ressource

Sélecteur	Images
k8s-app: mailpit, pod-template-hash: 5d8c9cd4	axilent/mailpit

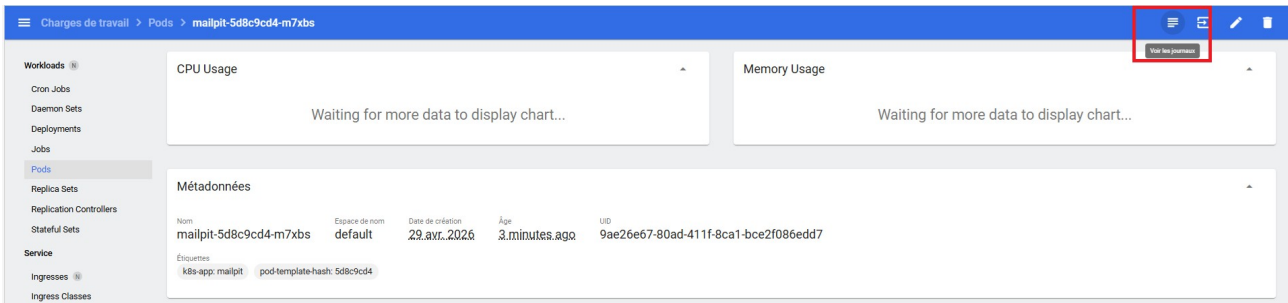
Statut des pods

En fonctionnement	Désirés
1	1

Pods

Nom	Images	Étiquettes	Noeud	Statut	Redémarrages	Utilisation CPU (coeurs)	Utilisation mémoire (octets)	Date de création
mailpit-5d8c9cd4-m7xbs	axilent/mailpit	k8s-app: mailpit pod-template-hash: 5d8c9cd4	minikube	Running	0	1.00m	8.13Mi	3 minutes ago

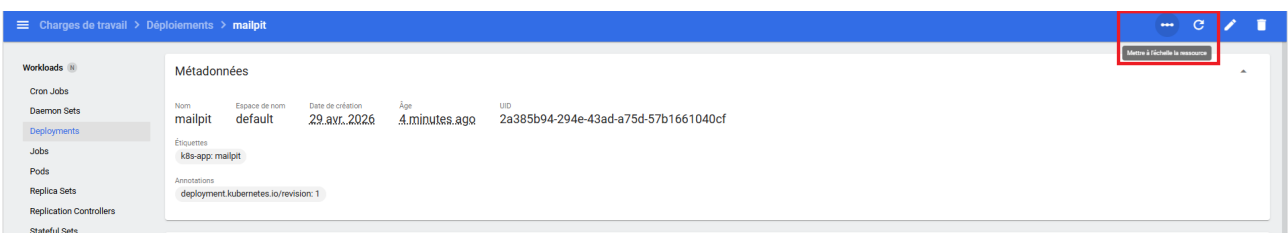
→ Affichage des logs du pod :



→ Logs depuis le terminal du dashboard :



→ Mise à l'échelle :



→ 2 réplicas :

Mettre à l'échelle une ressource

Deployment mailpit will be updated to reflect the desired replicas count.

Répliques désirées *	Répliques actuelles
2	1

i Cette action est équivalente à : `kubectl scale -n default deployment mailpit --replicas=2`

[Mettre à l'échelle](#) [Annuler](#)

→ Affichage des deux réplicas :

Nom	Images	Étiquettes	Noeud	Statut	Redémarrages	Utilisation CPU (coeurs)	Utilisation mémoire (octets)	Date de création
mailpit-5d8c9cd4-z8kj2	axilent/mailpit	k8s-app: mailpit pod-template-hash: 5d8c9cd4	minikube	Running	0	-	-	39.seconds ago
mailpit-5d8c9cd4-m7jbs	axilent/mailpit	k8s-app: mailpit pod-template-hash: 5d8c9cd4	minikube	Running	0	1.00m	7.83M	2.minutes ago

→ Modification :

Métadonnées

Nom	Espace de nom	Date de création	Âge	UID
mailpit	default	29.avr. 2026	8.minutes.ago	2a385b94-294e-43ad-a75d-57b1661040cf

Étiquettes: k8s-app: mailpit

Annotations: deployment.kubernetes.io/revision: 1

→ Modification du code yaml :

Éditer une ressource

```
YAML  JSON
1 kind: Deployment
2 apiVersion: apps/v1
3 metadata:
4   name: mailpit
5   namespace: default
6   uid: 2a385b94-294e-43ad-a75d-57b1661040cf
7   resourceVersion: '1629'
8   generation: 2
9   creationTimestamp: '2026-04-29T13:55:32Z'
10 labels:
11   k8s-app: mailpit
12 annotations:
13   deployment.kubernetes.io/revision: '1'
14 managedFields:
15 - manager: dashboard
16   operation: Update
17   apiVersion: apps/v1
18   fieldsType: FieldsV1
19   fieldsV1:
20     f:spec:
21       f:replicas: {}
```

i Cette action est équivalente à : `kubectl apply -f <spec.yaml>`

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→ Modification de la ligne d'image en rajoutant le latest :

Éditer une ressource

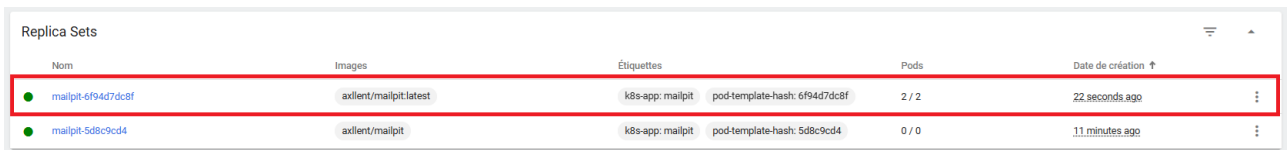
```
YAML  JSON
111 labels:
112   k8s-app: mailpit
113 spec:
114   containers:
115     - name: mailpit
116       image: axllent/mailpit:latest
117     resources: {}
118     terminationMessagePath: /dev/termination-log
119     terminationMessagePolicy: File
120     imagePullPolicy: Always
121     securityContext:
122       privileged: false
123     restartPolicy: Always
124     terminationGracePeriodSeconds: 30
125     dnsPolicy: ClusterFirst
126     securityContext: {}
127     schedulerName: default-scheduler
128 strategy:
129   type: RollingUpdate
130   rollingUpdate:
131     maxUnavailable: 25%
```

i Cette action est équivalente à : `kubectl apply -f <spec.yaml>`

[Mettre à jour](#)

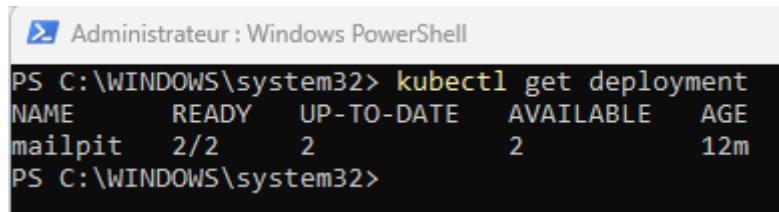
[Annuler](#)

→ Recréation d'un nouveau ReplicaSet :



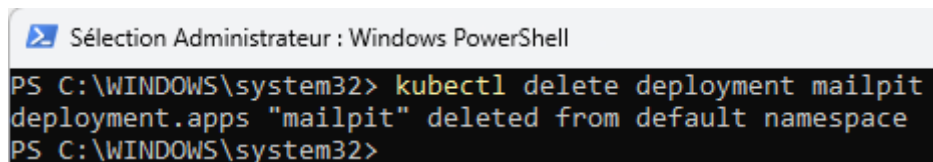
Nom	Images	Étiquettes	Pods	Date de création ↑
mailpit-6f94d7dc8f	axllent/mailpit:latest	k8s-app: mailpit pod-template-hash: 6f94d7dc8f	2 / 2	22 seconds ago
mailpit-5d8c9cd4	axllent/mailpit	k8s-app: mailpit pod-template-hash: 5d8c9cd4	0 / 0	11 minutes ago

→ Affichage des déploiements :



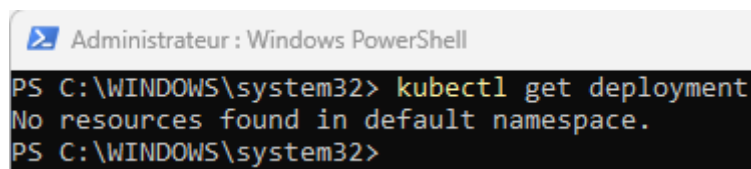
```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get deployment
NAME      READY   UP-TO-DATE   AVAILABLE   AGE
mailpit   2/2     2            2           12m
PS C:\WINDOWS\system32>
```

→ Suppression du déploiement mailpit :



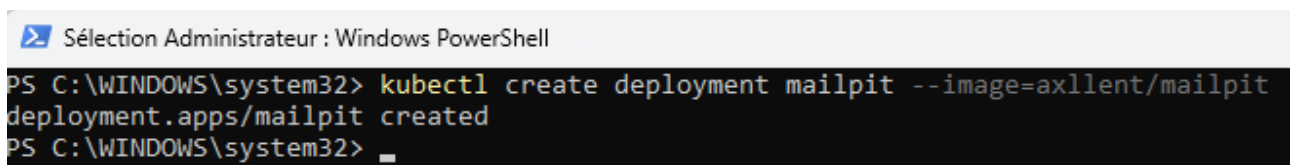
```
Sélection Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl delete deployment mailpit
deployment.apps "mailpit" deleted from default namespace
PS C:\WINDOWS\system32>
```

→ Affichage de la liste des déploiements pour le moment vide :



```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get deployment
No resources found in default namespace.
PS C:\WINDOWS\system32>
```

→ Création d'un nouveau déploiement mailpit :



```
Sélection Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl create deployment mailpit --image=axllent/mailpit
deployment.apps/mailpit created
PS C:\WINDOWS\system32>
```

→ Affichage des déploiements :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get deployment
NAME      READY   UP-TO-DATE   AVAILABLE   AGE
mailpit   1/1     1            1           28s
PS C:\WINDOWS\system32> kubectl get deployment -o wide
NAME      READY   UP-TO-DATE   AVAILABLE   AGE   CONTAINERS   IMAGES           SELECTOR
mailpit   1/1     1            1           31s   mailpit      axllent/mailpit  app=mailpit
PS C:\WINDOWS\system32>
```

→ Affichage de la description du déploiement mailpit :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl describe deployment mailpit
Name: mailpit
Namespace: default
CreationTimestamp: Wed, 29 Apr 2026 16:10:18 +0200
Labels: app=mailpit
Annotations: deployment.kubernetes.io/revision: 1
Selector: app=mailpit
Replicas: 1 desired | 1 updated | 1 total | 1 available | 0 unavailable
StrategyType: RollingUpdate
MinReadySeconds: 0
RollingUpdateStrategy: 25% max unavailable, 25% max surge
Pod Template:
  Labels: app=mailpit
  Containers:
    mailpit:
      Image: axllent/mailpit
      Port: <none>
      Host Port: <none>
      Environment: <none>
      Mounts: <none>
      Volumes: <none>
      Node-Selectors: <none>
      Tolerations: <none>
Conditions:
  Type           Status  Reason
  ----           -
  Available      True    MinimumReplicasAvailable
  Progressing    True    NewReplicaSetAvailable
OldReplicaSets: <none>
NewReplicaSet: mailpit-7b96b48c5d (1/1 replicas created)
Events:
  Type     Reason             Age   From              Message
  ----     -
  Normal   ScalingReplicaSet  59s   deployment-controller  Scaled up replica set mailpit-7b96b48c5d from 0 to 1
PS C:\WINDOWS\system32>
```

→ Affichage de la liste de réplicas et de la description du ReplicaSet mailpit :

```

Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get replicaset
NAME                DESIRED  CURRENT  READY  AGE
mailpit-7b96b48c5d  1         1         1       100s
PS C:\WINDOWS\system32> kubectl describe rs mailpit-7b96b48c5d
Name:                mailpit-7b96b48c5d
Namespace:           default
Selector:             app=mailpit,pod-template-hash=7b96b48c5d
Labels:               app=mailpit
                     pod-template-hash=7b96b48c5d
Annotations:          deployment.kubernetes.io/desired-replicas: 1
                     deployment.kubernetes.io/max-replicas: 2
                     deployment.kubernetes.io/revision: 1
Controlled By:        Deployment/mailpit
Replicas:             1 current / 1 desired
Pods Status:          1 Running / 0 Waiting / 0 Succeeded / 0 Failed
Pod Template:
  Labels:              app=mailpit
                     pod-template-hash=7b96b48c5d
  Containers:
    mailpit:
      Image:            axllent/mailpit
      Port:             <none>
      Host Port:        <none>
      Environment:     <none>
      Mounts:           <none>
      Volumes:          <none>
      Node-Selectors:   <none>
      Tolerations:      <none>
Events:
  Type     Reason          Age   From                    Message
  ----     -
  Normal   SuccessfulCreate 2m3s  replicaset-controller  Created pod: mailpit-7b96b48c5d-j7wqp
PS C:\WINDOWS\system32>

```

→ Affichage de la liste des pods et de la description du pod mailpit :

```

Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get pods
NAME                READY  STATUS   RESTARTS  AGE
mailpit-7b96b48c5d-j7wqp  1/1    Running  0          2m37s
PS C:\WINDOWS\system32> kubectl describe pods mailpit-7b96b48c5d-j7wqp
Name:                mailpit-7b96b48c5d-j7wqp
Namespace:           default
Priority:             0
Service Account:     default
Node:                minikube/192.168.49.2
Start Time:          Wed, 29 Apr 2026 16:10:18 +0200
Labels:              app=mailpit
                     pod-template-hash=7b96b48c5d
Annotations:         <none>
Status:              Running
IP:                  10.244.0.11
IPs:                 <none>
IP:                  10.244.0.11
Controlled By:       ReplicaSet/mailpit-7b96b48c5d
Containers:
  mailpit:
    Container ID:     docker://90336bfc34150d8b7a6e28c0584a1814aded935db7aa86e52068ac7a0fcc988a
    Image:             axllent/mailpit
    Image ID:          docker-pullable://axllent/mailpit@sha256:757f22b56c1da03570a8fdb3d259effe5091018008a81bbdc8158cee7e16fdb
    Port:             <none>
    Host Port:        <none>
    State:            Running
      Started:        Wed, 29 Apr 2026 16:10:19 +0200
      Ready:          True
      Restart Count:  0
    Environment:     <none>
    Mounts:           /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-9zflf (ro)
Conditions:
  Type              Status
  PodReadyToStartContainers  True
  Initialized        True
  Ready              True
  ContainersReady    True
  PodScheduled       True
Volumes:
  kube-api-access-9zflf:
    Type:              Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds: 3607
    ConfigMapName:      kube-root-ca.crt
    Optional:           false
    DownwardAPI:       true
QoS Class:           BestEffort
Node-Selectors:     <none>
Tolerations:         node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
                     node.kubernetes.io/unreachable:NoExecute op=Exists for 300s
Events:
  Type     Reason          Age   From                    Message
  ----     -
  Normal   Scheduled       3m9s  default-scheduler      Successfully assigned default/mailpit-7b96b48c5d-j7wqp to minikube
  Normal   Pulling         3m9s  kubelet                 Pulling image "axllent/mailpit"
  Normal   Pulled          3m8s  kubelet                 Successfully pulled image "axllent/mailpit" in 961ms (961ms including waiting). Image size: 36229179 bytes.
  Normal   Created         3m8s  kubelet                 Container created
  Normal   Started         3m8s  kubelet                 Container started
PS C:\WINDOWS\system32>

```

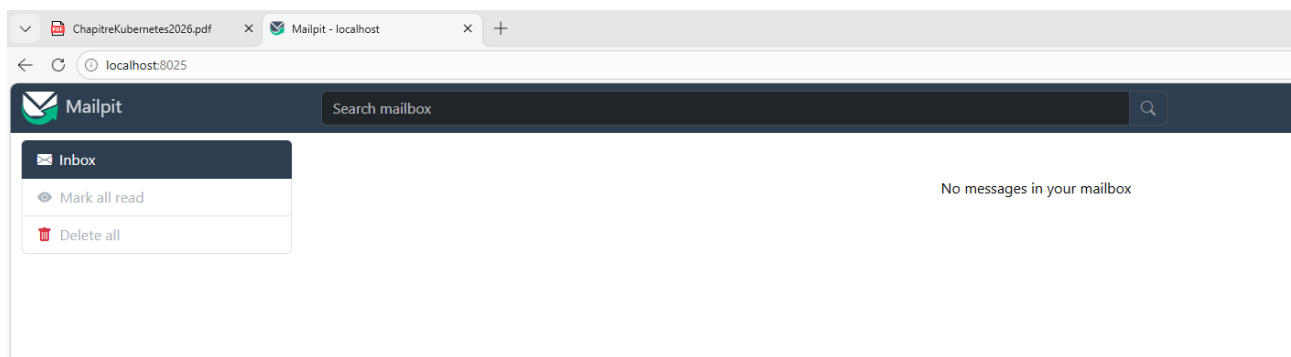
→ Affichage des logs du pod et conteneur :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl logs mailpit-7b96b48c5d-j7wqp
time="2026/04/29 14:10:19" level=info msg="[smtpd] starting on [::]:1025 (no encryption)"
time="2026/04/29 14:10:19" level=info msg="[cors] allowed API origins: "
time="2026/04/29 14:10:19" level=info msg="[http] starting on [::]:8025"
time="2026/04/29 14:10:19" level=info msg="[http] accessible via http://localhost:8025/"
PS C:\WINDOWS\system32> ^C
PS C:\WINDOWS\system32> kubectl logs mailpit-7b96b48c5d-j7wqp -c mailpit
time="2026/04/29 14:10:19" level=info msg="[smtpd] starting on [::]:1025 (no encryption)"
time="2026/04/29 14:10:19" level=info msg="[cors] allowed API origins: "
time="2026/04/29 14:10:19" level=info msg="[http] starting on [::]:8025"
time="2026/04/29 14:10:19" level=info msg="[http] accessible via http://localhost:8025/"
PS C:\WINDOWS\system32>
```

→ Accès à l'application mailpit :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl port-forward mailpit-7b96b48c5d-j7wqp 8025
Forwarding from 127.0.0.1:8025 -> 8025
Forwarding from [::1]:8025 -> 8025
```

→ Accès à la page web mailpit :



→ Création d'une entrée DNS stable pour mailpit :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl expose deployment/mailpit --port 1025,8025
service/mailpit exposed
PS C:\WINDOWS\system32>
```

→ Lancement du pod mailpit en mode interactif :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl exec -it mailpit-7b96b48c5d-j7wqp -- sh
/ # getent hosts mailpit
10.106.104.106 mailpit.default.svc.cluster.local mailpit.default.svc.cluster.local mailpit
/ #
```

→ Lancement d'un pod de test pour vérifier la connectivité DNS :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl run -it --rm pod-test --image=alpine sh
All commands and output from this session will be recorded in container logs, including credentials and sensitive information passed through the command prompt.
If you don't see a command prompt, try pressing enter.
/ # nslookup mailpit
Server: 10.96.0.10
Address: 10.96.0.10:53

** server can't find mailpit.cluster.local: NXDOMAIN
** server can't find mailpit.svc.cluster.local: NXDOMAIN
** server can't find mailpit.svc.cluster.local: NXDOMAIN

Name: mailpit.default.svc.cluster.local
Address: 10.106.104.106

** server can't find mailpit.cluster.local: NXDOMAIN

/ # exit
Session ended, resume using 'kubectl attach pod-test -c pod-test -i -t' command when the pod is running
pod "pod-test" deleted from default namespace
PS C:\WINDOWS\system32>
```

→ Scalabilité de 2 rélicas sur le pod mailpit :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl scale deployment mailpit --replicas=2
deployment.apps/mailpit scaled
PS C:\WINDOWS\system32>
```

→ Affichage du nouveau pod créé grâce au ReplicaSet :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get deployment mailpit
NAME      READY   UP-TO-DATE   AVAILABLE   AGE
mailpit   2/2     2            2          11m
PS C:\WINDOWS\system32> kubectl get pods -l app=mailpit
NAME                                READY   STATUS    RESTARTS   AGE
mailpit-7b96b48c5d-75255            1/1     Running   0          48s
mailpit-7b96b48c5d-j7wqp            1/1     Running   0          11m
PS C:\WINDOWS\system32>
```

→ Activation du module ingress :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> minikube addons enable ingress
* ingress est un addon maintenu par Kubernetes. Pour toute question, contactez minikube sur GitHub.
Vous pouvez consulter la liste des mainteneurs de minikube sur : https://github.com/kubernetes/minikube/blob/master/OWNERS
* Après que le module est activé, veuillez exécuter "minikube tunnel" et vos ressources ingress seront disponibles à "127.0.0.1"
- Utilisation de l'image registry.k8s.io/ingress-nginx/controller:v1.14.3
- Utilisation de l'image registry.k8s.io/ingress-nginx/kube-webhook-certgen:v1.6.7
- Utilisation de l'image registry.k8s.io/ingress-nginx/kube-webhook-certgen:v1.6.7
* Vérification du module ingress...
* Le module 'ingress' est activé
PS C:\WINDOWS\system32>
```

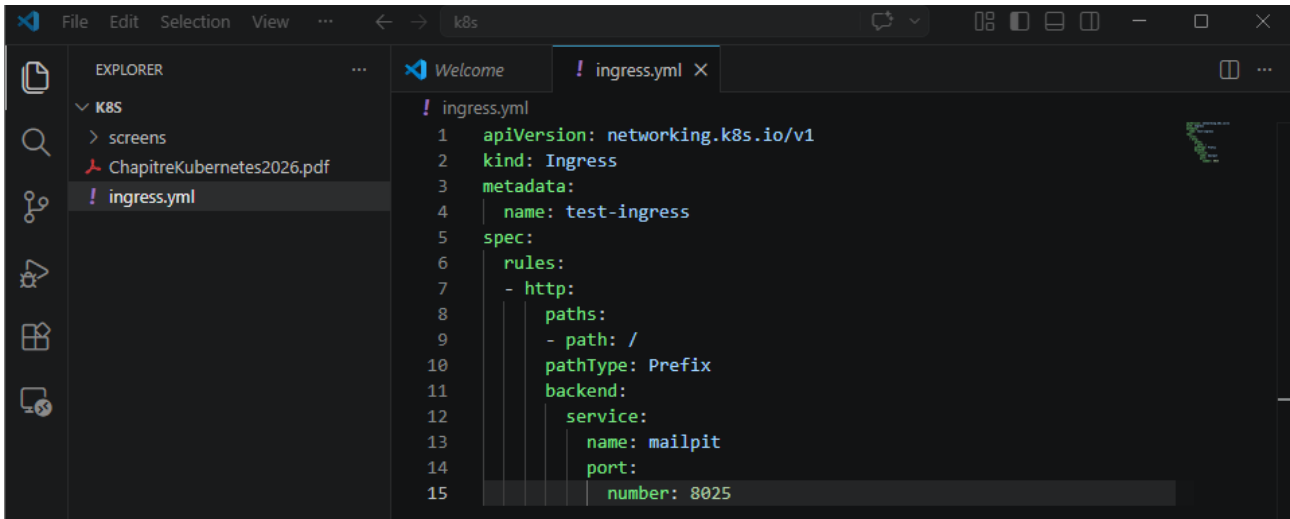
→ Affichage du namespace ingress :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get namespace
NAME          STATUS   AGE
default       Active  42m
ingress-nginx Active  49s
kube-node-lease Active  42m
kube-public   Active  42m
kube-system   Active  42m
kubernetes-dashboard Active  32m
PS C:\WINDOWS\system32>
```

→ Affichage des pods ingress-nginx :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl -n ingress-nginx get pods -l app.kubernetes.io/name
NAME                                                    READY   STATUS    RESTARTS   AGE
ingress-nginx-admission-create-zzqdf                   0/1     Completed 0           96s
ingress-nginx-admission-patch-mprwd                    0/1     Completed 0           96s
ingress-nginx-controller-596f8778bc-9zpmk             1/1     Running   0           96s
PS C:\WINDOWS\system32>
```

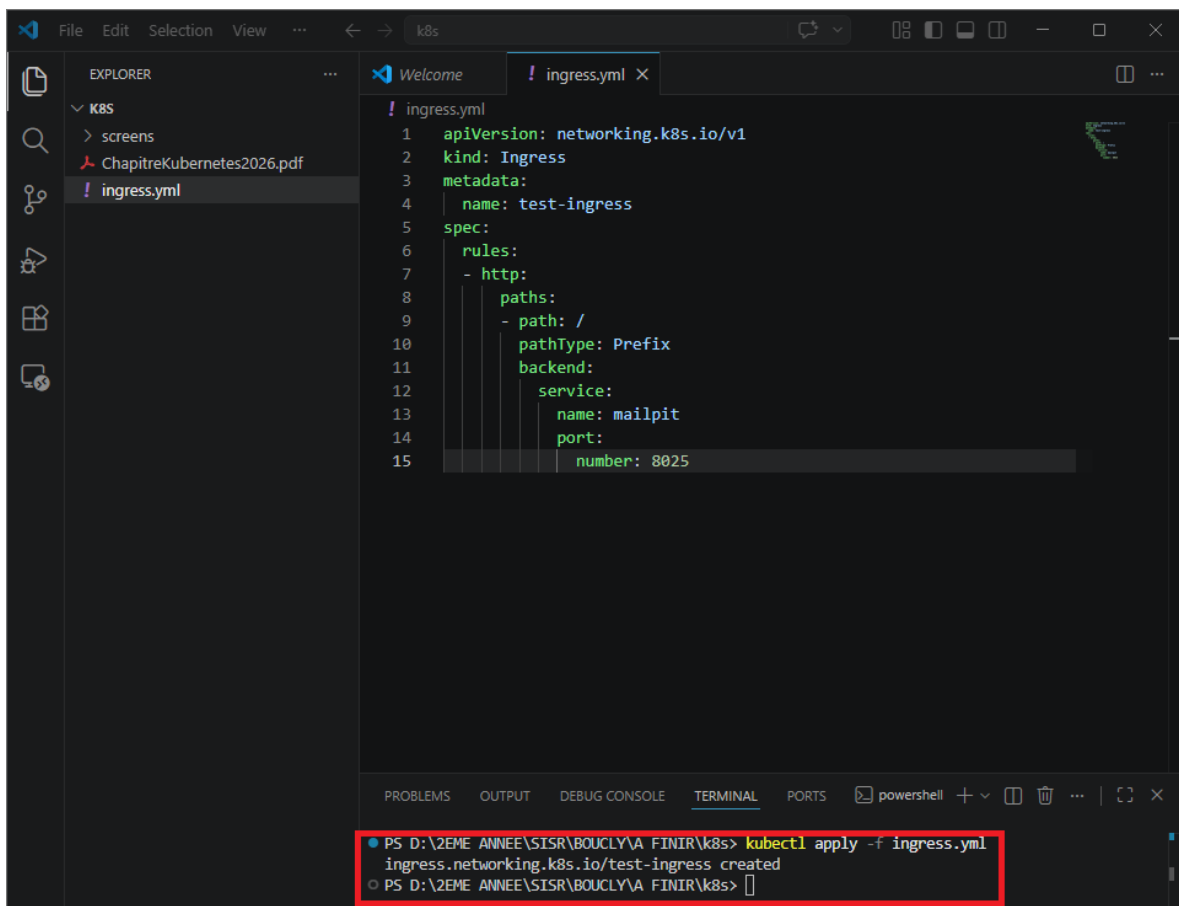
→ Création d'un fichier ingress.yaml :



The screenshot shows the Visual Studio Code editor with a file named 'ingress.yaml' open. The file content is as follows:

```
1 apiVersion: networking.k8s.io/v1
2 kind: Ingress
3 metadata:
4   name: test-ingress
5 spec:
6   rules:
7   - http:
8     paths:
9     - path: /
10      pathType: Prefix
11      backend:
12        service:
13          name: mailpit
14          port:
15            number: 8025
```

→ Application des modifications du fichier :



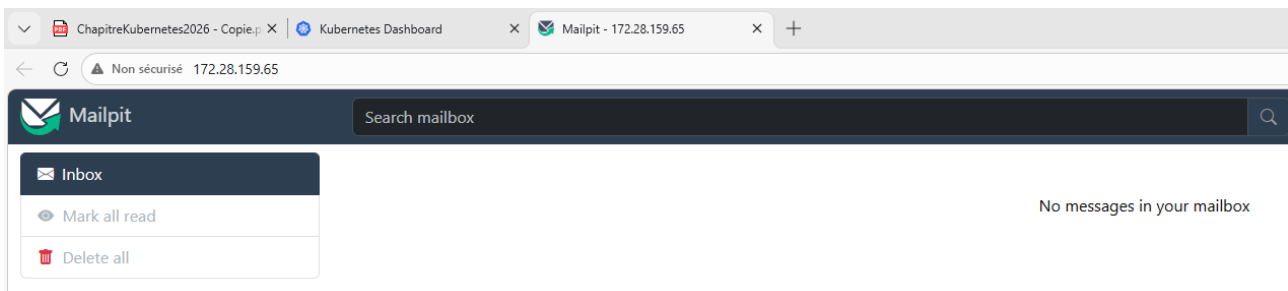
The screenshot shows the Visual Studio Code editor with the 'ingress.yaml' file open. The file content is the same as in the previous screenshot. Below the editor, the terminal window shows the following command and output:

```
PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> kubectl apply -f ingress.yaml
ingress.networking.k8s.io/test-ingress created
PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s>
```

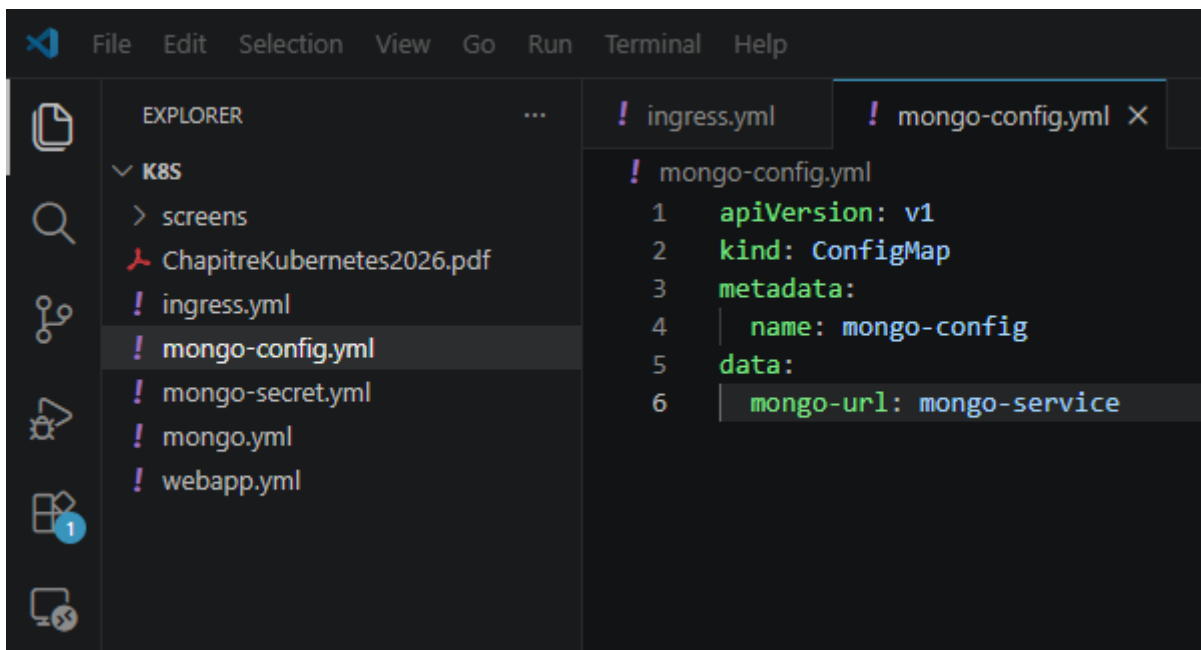
→ Affichage de la liste ingress et de l'adresse IP utilisée par minikube :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get ingress
NAME          CLASS  HOSTS  ADDRESS          PORTS  AGE
test-ingress  nginx  *      172.28.159.65    80     106s
PS C:\WINDOWS\system32> minikube ip
172.28.159.65
PS C:\WINDOWS\system32>
```

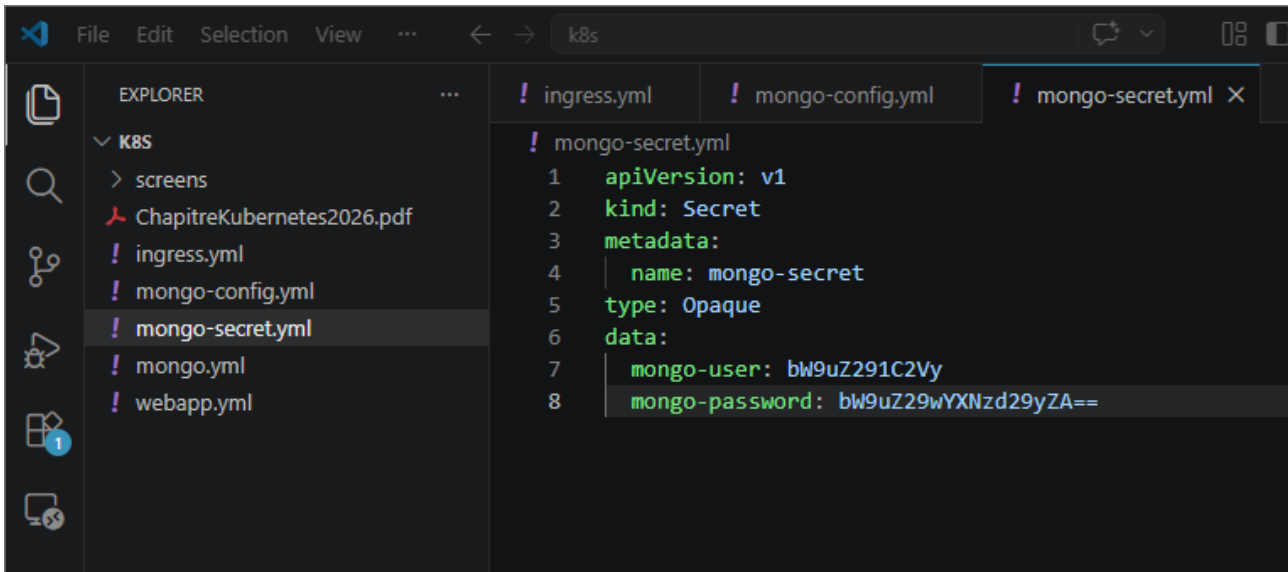
→ Connexion au mailpit depuis l'adresse IP :



→ Création du fichier mongo-config.yaml :



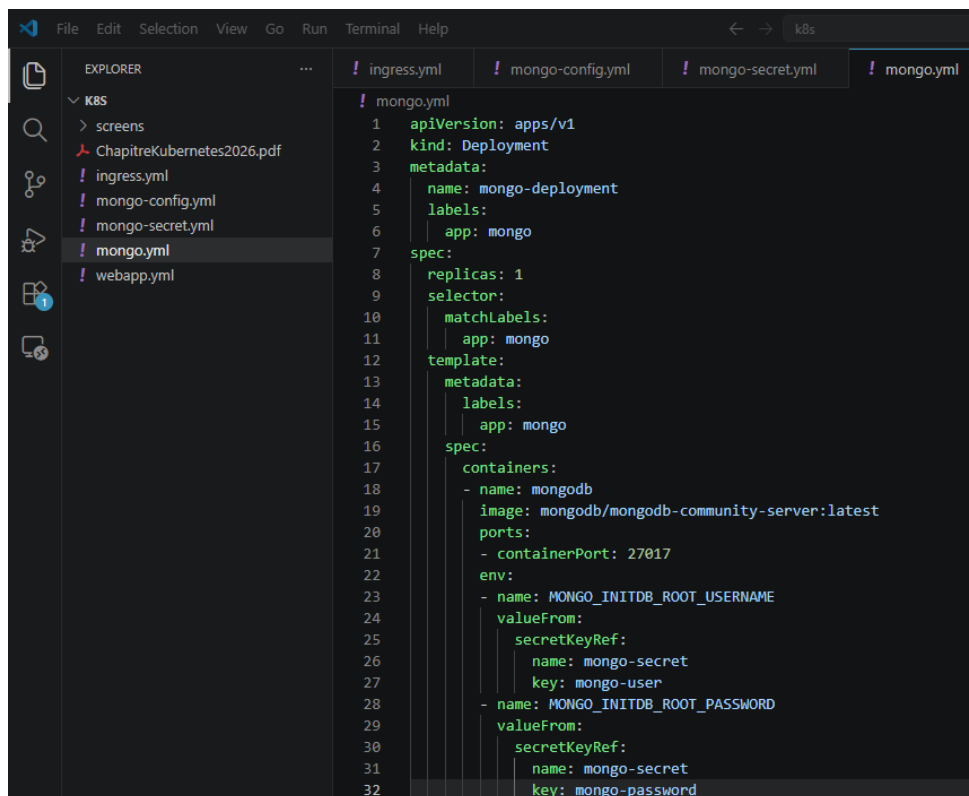
→ Création du fichier mongo-secret :



The screenshot shows the Visual Studio Code editor with the Explorer sidebar on the left and the Editor view on the right. The Explorer sidebar shows a project named 'k8s' with a folder 'screens' containing a PDF file 'ChapitreKubernetes2026.pdf' and several YAML files: 'ingress.yml', 'mongo-config.yml', 'mongo-secret.yml' (selected), 'mongo.yml', and 'webapp.yml'. The Editor view shows the content of 'mongo-secret.yml' with the following YAML code:

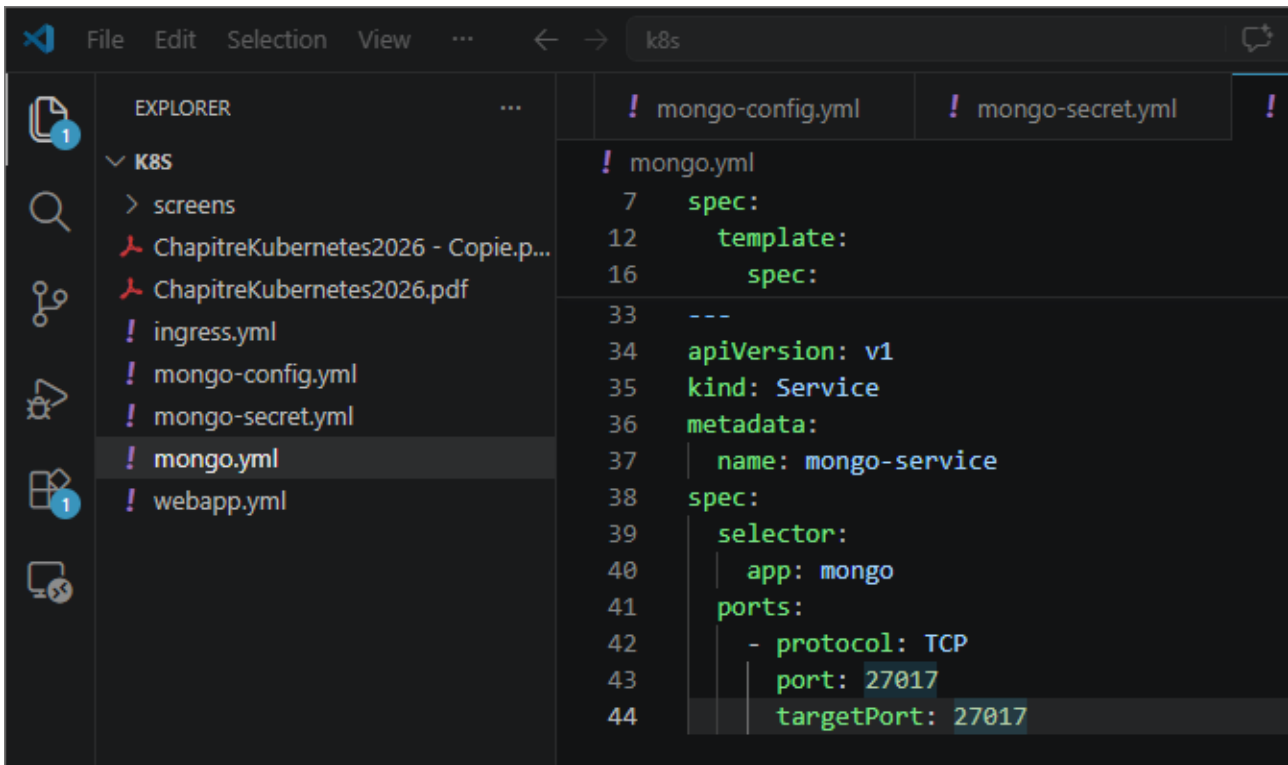
```
! mongo-secret.yml
1  apiVersion: v1
2  kind: Secret
3  metadata:
4    name: mongo-secret
5  type: Opaque
6  data:
7    mongo-user: bw9uZ291C2Vy
8    mongo-password: bw9uZ29wYXNzd29yZA==
```

→ Création du fichier mongo.yaml :



The screenshot shows the Visual Studio Code editor with the Explorer sidebar on the left and the Editor view on the right. The Explorer sidebar shows the same project 'k8s' with the same files as the previous screenshot, plus 'mongo.yaml' (selected). The Editor view shows the content of 'mongo.yaml' with the following YAML code:

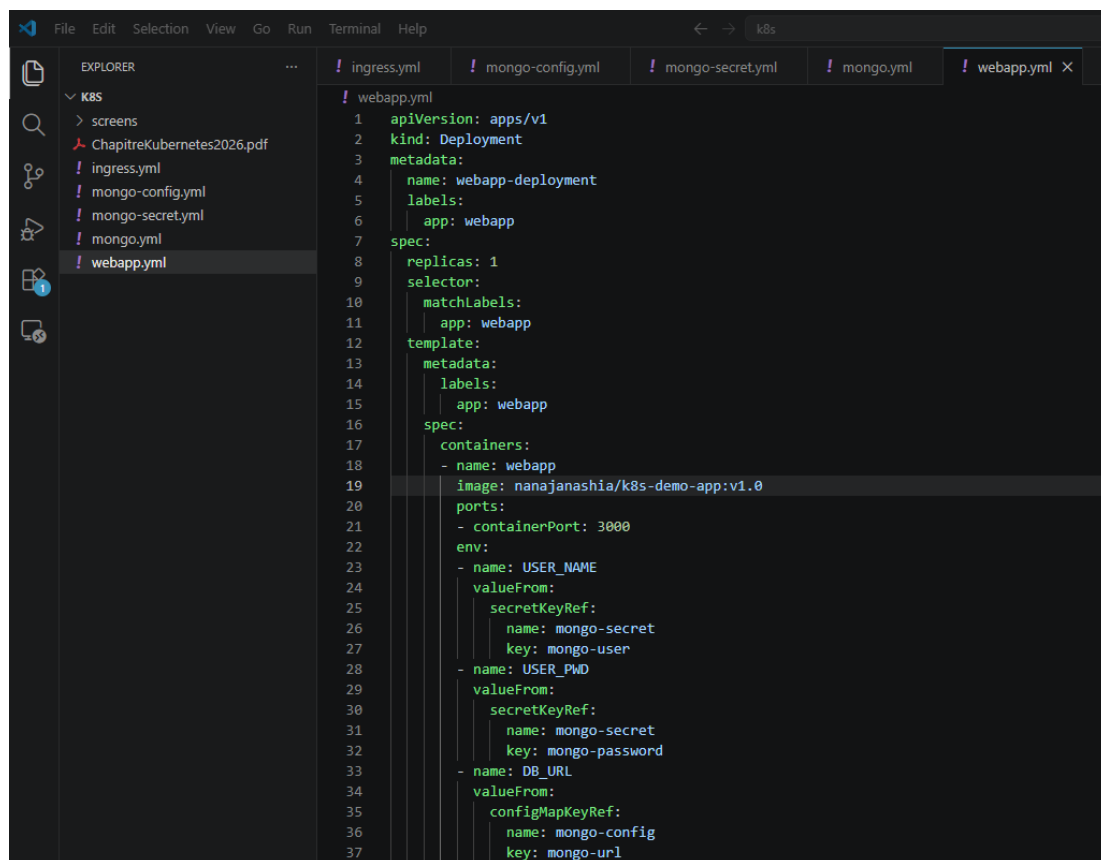
```
! mongo.yaml
1  apiVersion: apps/v1
2  kind: Deployment
3  metadata:
4    name: mongo-deployment
5  labels:
6    app: mongo
7  spec:
8    replicas: 1
9    selector:
10     matchLabels:
11       app: mongo
12   template:
13     metadata:
14       labels:
15         app: mongo
16     spec:
17       containers:
18         - name: mongodb
19           image: mongodb/mongodb-community-server:latest
20           ports:
21             - containerPort: 27017
22           env:
23             - name: MONGO_INITDB_ROOT_USERNAME
24               valueFrom:
25                 secretKeyRef:
26                   name: mongo-secret
27                   key: mongo-user
28             - name: MONGO_INITDB_ROOT_PASSWORD
29               valueFrom:
30                 secretKeyRef:
31                   name: mongo-secret
32                   key: mongo-password
```



The screenshot shows the Visual Studio Code interface with a file explorer on the left and a code editor on the right. The file explorer shows a directory named 'K8S' containing several files: 'screens', 'ChapitreKubernetes2026 - Copie.p...', 'ChapitreKubernetes2026.pdf', 'ingress.yml', 'mongo-config.yml', 'mongo-secret.yml', 'mongo.yml', and 'webapp.yml'. The code editor displays the content of 'mongo.yml', which is a Kubernetes Service manifest. The manifest includes a spec with a selector for 'app: mongo' and a port configuration for '27017' using TCP protocol.

```
7 spec:
12   template:
16     spec:
33   ---
34   apiVersion: v1
35   kind: Service
36   metadata:
37     name: mongo-service
38   spec:
39     selector:
40       app: mongo
41     ports:
42     - protocol: TCP
43       port: 27017
44       targetPort: 27017
```

→ Création du fichier webapp.yaml :



The screenshot shows the Visual Studio Code interface with a file explorer on the left and a code editor on the right. The file explorer shows the 'K8S' directory with files: 'screens', 'ChapitreKubernetes2026.pdf', 'ingress.yml', 'mongo-config.yml', 'mongo-secret.yml', 'mongo.yml', and 'webapp.yml'. The code editor displays the content of 'webapp.yml', which is a Kubernetes Deployment manifest. The manifest includes a spec with a selector for 'app: webapp', a template with a container named 'webapp' using the image 'nanajanashia/k8s-demo-app:v1.0', and environment variables for 'USER_NAME', 'USER_PWD', and 'DB_URL'.

```
1 apiVersion: apps/v1
2 kind: Deployment
3 metadata:
4   name: webapp-deployment
5   labels:
6     app: webapp
7 spec:
8   replicas: 1
9   selector:
10     matchLabels:
11       app: webapp
12   template:
13     metadata:
14       labels:
15         app: webapp
16     spec:
17       containers:
18       - name: webapp
19         image: nanajanashia/k8s-demo-app:v1.0
20         ports:
21         - containerPort: 3000
22         env:
23         - name: USER_NAME
24           valueFrom:
25             secretKeyRef:
26               name: mongo-secret
27               key: mongo-user
28         - name: USER_PWD
29           valueFrom:
30             secretKeyRef:
31               name: mongo-secret
32               key: mongo-password
33         - name: DB_URL
34           valueFrom:
35             configMapKeyRef:
36               name: mongo-config
37               key: mongo-ur1
```

```
! mongo-config.yml | ! mongo-secret.yml | ! mongo-
! webapp.yml
7 spec:
12   template:
16     spec:
33       - name: DB_URL
38   ---
39   apiVersion: v1
40   kind: Service
41   metadata:
42     name: webapp-service
43   spec:
44     type: NodePort
45     selector:
46       app: webapp
47     ports:
48       - protocol: TCP
49         port: 3000
50         targetPort: 3000
51         nodePort: 30100
```

→ Applicatif des composants :

```
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> kubectl apply -f mongo-config.yml
● PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> kubectl apply -f mongo-secret.yml
secret/mongo-secret unchanged
● PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> kubectl apply -f mongo.yml
deployment.apps/mongo-deployment unchanged
service/mongo-service unchanged
● PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> kubectl apply -f webapp.yml
deployment.apps/webapp-deployment unchanged
service/webapp-service unchanged
○ PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> █
```

→ Affichage de la liste des objets créés :

```

PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS

● PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> kubectl get all
NAME                                     READY   STATUS    RESTARTS   AGE
pod/mailpit-7b96b48c5d-6htkw            1/1     Running   0           16m
pod/mongo-deployment-744864fdd7-2s659   1/1     Running   0           115s
pod/webapp-deployment-857fd5c54d-185nf   0/1     ImagePullBackOff  0           51s

NAME                TYPE          CLUSTER-IP      EXTERNAL-IP   PORT(S)          AGE
service/kubernetes  ClusterIP     10.96.0.1       <none>        443/TCP          25m
service/mailpit     ClusterIP     10.96.179.223   <none>        1025/TCP,8025/TCP 14m
service/mongo-service ClusterIP     10.110.132.250  <none>        27017/TCP        4m3s
service/webapp-service NodePort      10.104.232.222  <none>        3000:30100/TCP   51s

NAME                READY   UP-TO-DATE   AVAILABLE   AGE
deployment.apps/mailpit  1/1     1             1           16m
deployment.apps/mongo-deployment  1/1     1             1           115s
deployment.apps/webapp-deployment  0/1     1             0           51s

NAME                DESIRED   CURRENT   READY   AGE
replicaset.apps/mailpit-7b96b48c5d  1         1         1       16m
replicaset.apps/mongo-deployment-744864fdd7  1         1         1       115s
replicaset.apps/webapp-deployment-857fd5c54d  1         1         0       51s

```

```

● PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> kubectl get configmap
NAME          DATA   AGE
kube-root-ca.crt  1       26m
mongo-config    1       6m23s
● PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> kubectl get secret
NAME          TYPE     DATA   AGE
mongo-secret  Opaque   2       6m2s
○ PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> 

```

→ Description du service webapp-service :

```

PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> kubectl describe service webapp-service
Name:                webapp-service
Namespace:           default
Labels:              <none>
Annotations:         <none>
Selector:            app=webapp
Type:                NodePort
IP Family Policy:    SingleStack
IP Families:         IPv4
IP:                  10.104.232.222
IPs:                 10.104.232.222
Port:                <unset> 3000/TCP
TargetPort:          3000/TCP
NodePort:            <unset> 30100/TCP
Endpoints:           <none>
Session Affinity:    None
External Traffic Policy: Cluster
Internal Traffic Policy: Cluster
Events:              <none>
PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s>

```

→ Description du pod associé :

```

PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> kubectl describe pod webapp-deployment-5766fd95c7-j7kr9
Name:                webapp-deployment-5766fd95c7-j7kr9
Namespace:           default
Priority:             0
Service Account:     default
Node:                minikube/172.28.159.65
Start Time:          Thu, 30 Apr 2026 11:47:50 +0200
Labels:              app=webapp
                    pod-template-hash=5766fd95c7
Annotations:         <none>
Status:              Running
IP:                  10.244.0.14
IPs:                 10.244.0.14
Controlled By:       ReplicaSet/webapp-deployment-5766fd95c7
Containers:
  webapp:
    Container ID:    docker://2e3283fbc88e3a7dffa3d3e21163bd2edb0c8eb80a445905997e771f98da33c
    Image:           nanajanashia/k8s-demo-app:v1.0
    Image ID:        docker-pullable://nanajanashia/k8s-demo-app@sha256:6f554135da39ac00a1c2f43e44c2b0b54ca13d3d8044da969361e7781adb7f95
    Port:            3000/TCP
    Host Port:       0/TCP
    State:           Running
      Started:       Thu, 30 Apr 2026 11:47:51 +0200
    Ready:           True
    Restart Count:   0
    Environment:
      USER_NAME:    <set to the key 'mongo-user' in secret 'mongo-secret'>   Optional: false
      USER_PWD:     <set to the key 'mongo-password' in secret 'mongo-secret'> Optional: false
      DB_URL:        <set to the key 'mongo-url' of config map 'mongo-config'> Optional: false
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-ftx6v (ro)
Conditions:
  Type              Status
  PodReadyToStartContainers  True
  Initialized        True
  Ready              True
  ContainersReady    True
  PodScheduled       True
Volumes:
  kube-api-access-ftx6v:
    Type:              Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds: 3607
    ConfigMapName:     kube-root-ca.crt
    Optional:          false
    DownwardAPI:       true
  QoS Class:           BestEffort
  Node-Selectors:     <none>
  Tolerations:        node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
                    node.kubernetes.io/unreachable:NoExecute op=Exists for 300s

```

→ Affichage des logs du pod webapp :

```
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS powershell + - [ ] [ ] ... | [ ] [ ] X
```

```
● PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> kubectl get pods
NAME                                READY STATUS RESTARTS AGE
mailpit-7b96b48c5d-6htkw            1/1   Running 0       27m
mongo-deployment-744864fdd7-2s659  1/1   Running 0       12m
webapp-deployment-5766fd95c7-j7kr9  1/1   Running 0       111s
● PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> kubectl logs webapp-deployment-5766fd95c7-j7kr9
app listening on port 3000!
● PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> kubectl logs webapp-deployment-5766fd95c7-j7kr9
app listening on port 3000!
○ PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> [ ]
```

→ Affichage des services :

```
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS powershell + - [ ] [ ] ... | [ ] [ ] X
```

```
● PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> kubectl get service
NAME            TYPE        CLUSTER-IP      EXTERNAL-IP  PORT(S)          AGE
kubernetes     ClusterIP   10.96.0.1       <none>       443/TCP          36m
mailpit        ClusterIP   10.96.179.223   <none>       1025/TCP,8025/TCP 25m
mongo-service  ClusterIP   10.110.132.250  <none>       27017/TCP        15m
webapp-service NodePort    10.104.232.222  <none>       3000:30100/TCP   12m
○ PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> [ ]
```

→ Affichage de l'ip utilisée pas minikube :

```
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS powershell + - [ ] [ ] ... | [ ] [ ] X
```

```
● PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> minikube ip
172.28.159.65
○ PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> [ ]
```

→ Le node minikube a bien la même adresse IP :

```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
● PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> kubectl get node
NAME STATUS ROLES AGE VERSION
minikube Ready control-plane 39m v1.35.1
● PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> kubectl get node -o wide
NAME STATUS ROLES AGE VERSION INTERNAL-IP EXTERNAL-IP OS-IMAGE KERNEL-VERSION CONTAINER-RUNTIME
minikube Ready control-plane 39m v1.35.1 172.28.159.65 <none> Buildroot 2025.02 6.6.95 docker://28.5.2
○ PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s>

```

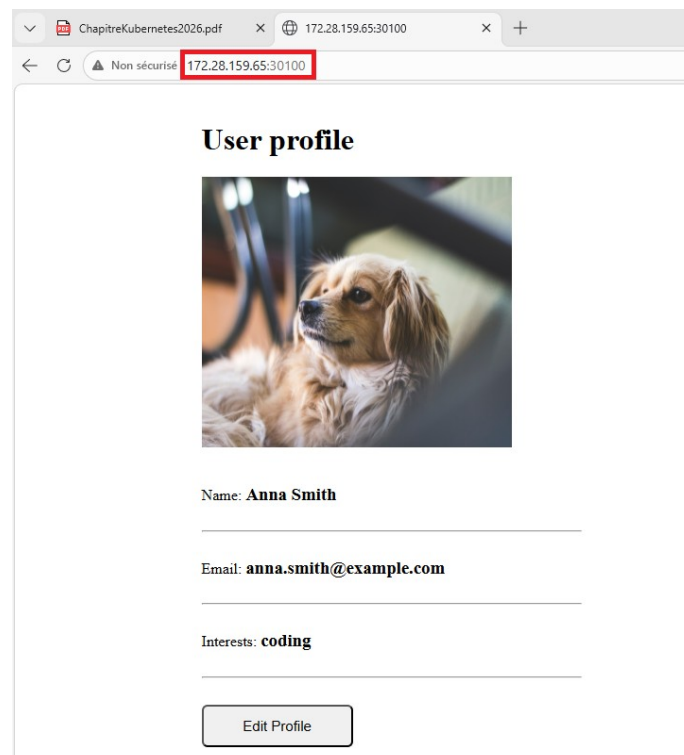
→ Affichage des services et des pods actifs :

```

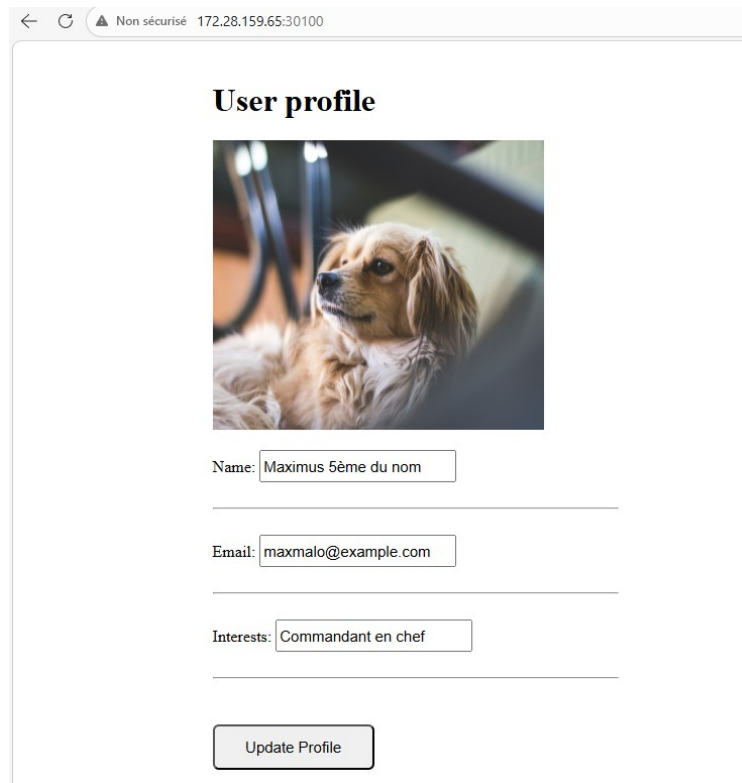
● PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> kubectl get svc -o wide
NAME TYPE CLUSTER-IP EXTERNAL-IP PORT(S) AGE SELECTOR
kubernetes ClusterIP 10.96.0.1 <none> 443/TCP 40m <none>
mailpit ClusterIP 10.96.179.223 <none> 1025/TCP,8025/TCP 29m app=mailpit
mongo-service ClusterIP 10.110.132.250 <none> 27017/TCP 19m app=mongo
webapp-service NodePort 10.104.232.222 <none> 3000:30100/TCP 15m app=webapp
● PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> kubectl get pod -o wide
NAME READY STATUS RESTARTS AGE IP NODE NOMINATED NODE READINESS GATES
mailpit-7b96b48c5d-6htkw 1/1 Running 0 31m 10.244.0.10 minikube <none> <none>
mongo-deployment-744864fdd7-2s659 1/1 Running 0 16m 10.244.0.11 minikube <none> <none>
webapp-deployment-5766fd95c7-j7kr9 1/1 Running 0 6m7s 10.244.0.14 minikube <none> <none>
○ PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s>

```

→ Connexion à la page web :




→ Modification des champs depuis le site :



Non sécurisé 172.28.159.65:30100

User profile

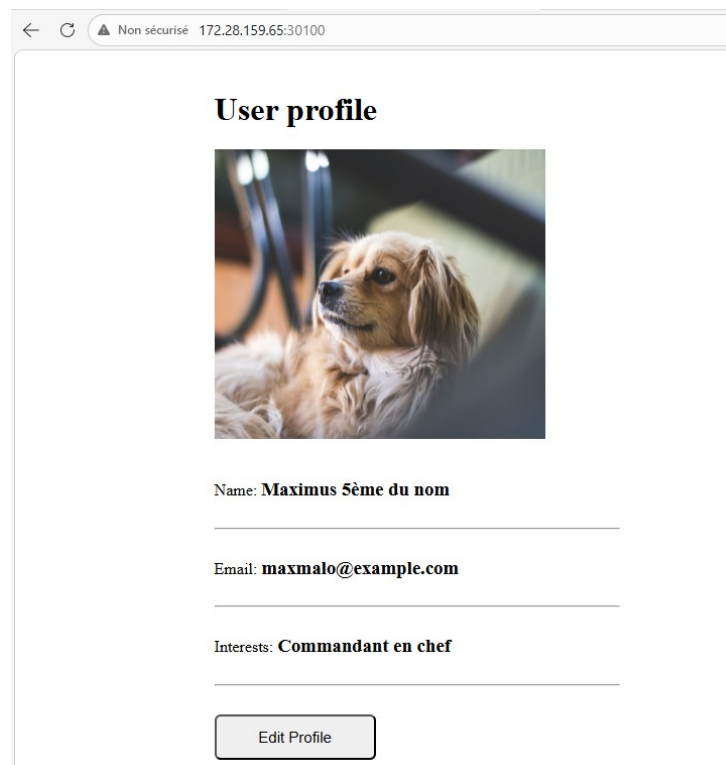


Name:

Email:


Interests:

→ Les modifications sont bien prises en compte :



Non sécurisé 172.28.159.65:30100

User profile



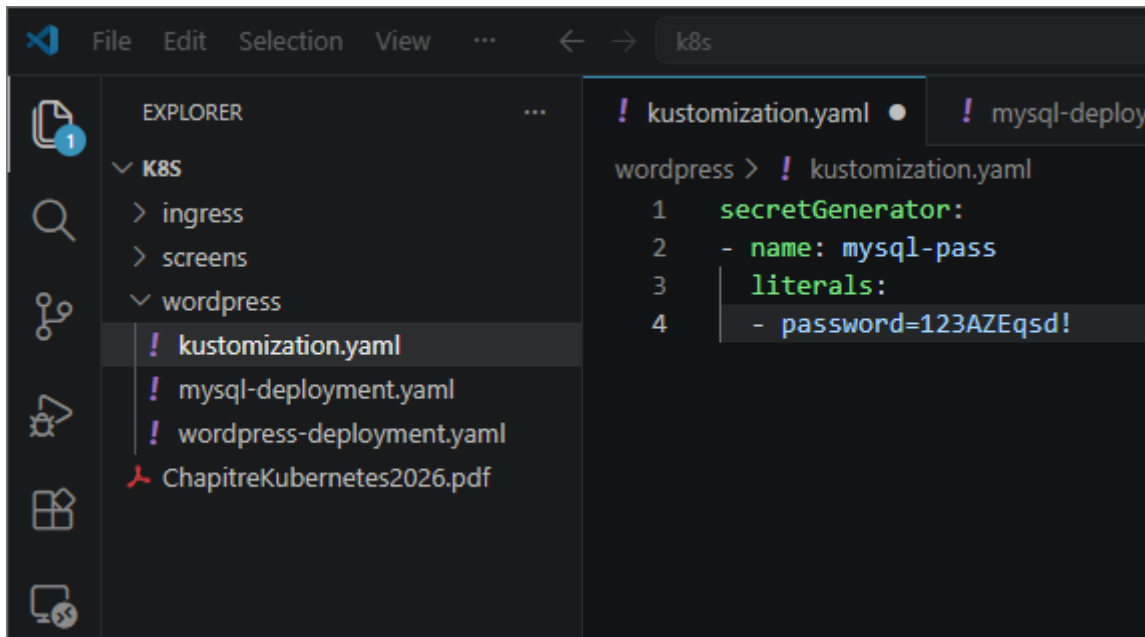
Name: **Maximus 5ème du nom**

Email: **maxmalo@example.com**

Interests: **Commandant en chef**

PARTIE WORDPRESS

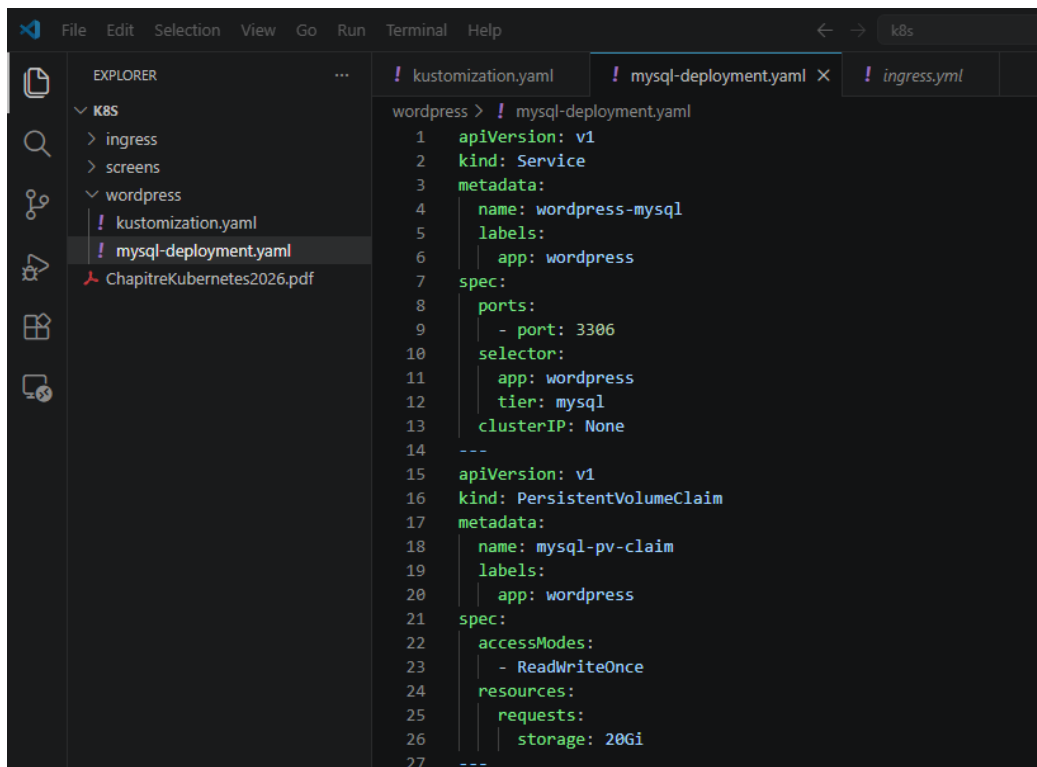
→ Création d'un fichier kustomization.yaml :



```
File Edit Selection View ... k8s
EXPLORER
K8S
  ingress
  screens
  wordpress
    ! kustomization.yaml
    ! mysql-deployment.yaml
    ! wordpress-deployment.yaml
  ChapitreKubernetes2026.pdf

! kustomization.yaml
wordpress > ! kustomization.yaml
1  secretGenerator:
2  - name: mysql-pass
3    literals:
4  - password=123AZEqs!
```

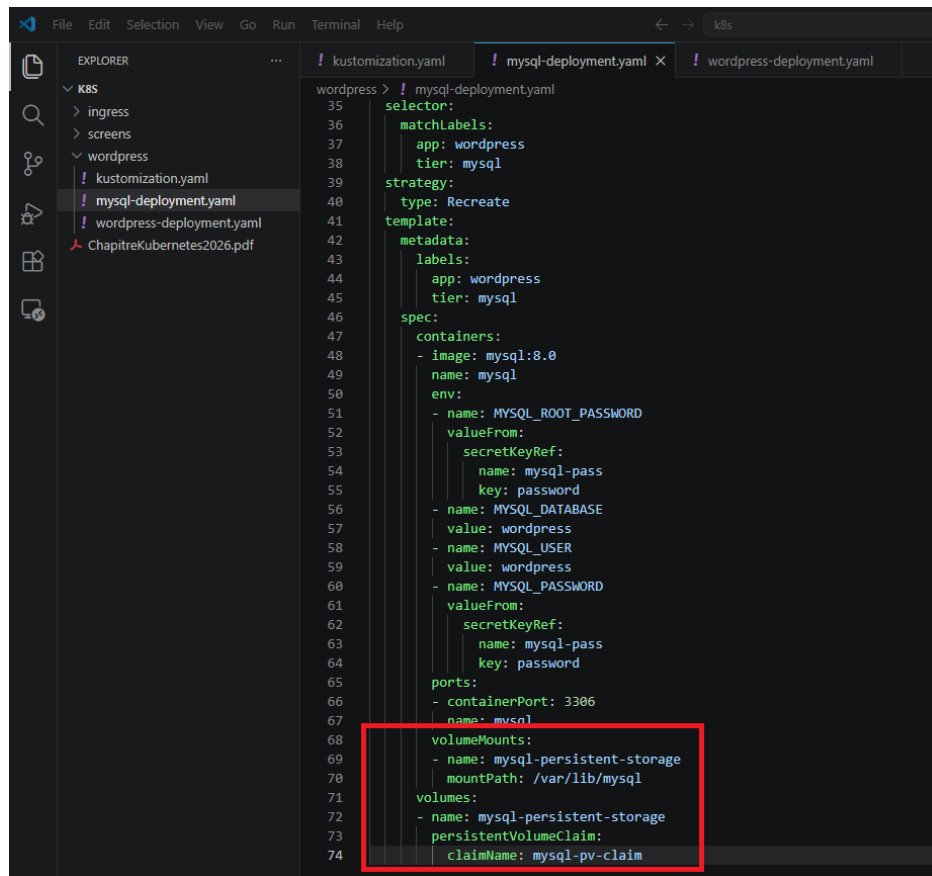
→ Création d'un fichier mysql-deployment.yaml :



```
File Edit Selection View Go Run Terminal Help k8s
EXPLORER
K8S
  ingress
  screens
  wordpress
    ! kustomization.yaml
    ! mysql-deployment.yaml
  ChapitreKubernetes2026.pdf

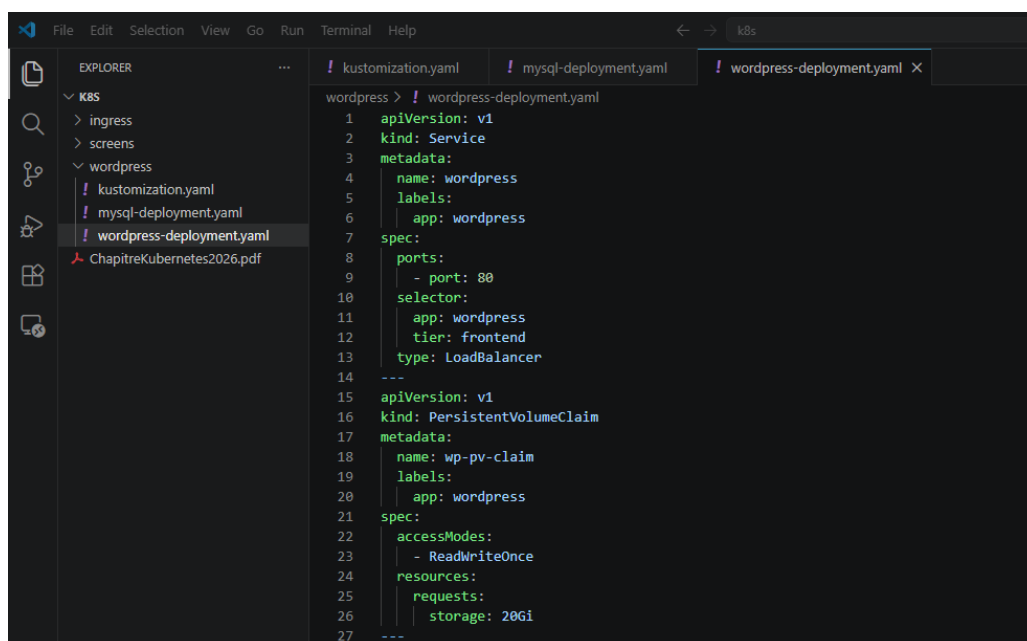
! kustomization.yaml ! mysql-deployment.yaml ! ingress.yml
wordpress > ! mysql-deployment.yaml
1  apiVersion: v1
2  kind: Service
3  metadata:
4  name: wordpress-mysql
5  labels:
6  app: wordpress
7  spec:
8  ports:
9  - port: 3306
10 selector:
11 app: wordpress
12 tier: mysql
13 clusterIP: None
14 ---
15 apiVersion: v1
16 kind: PersistentVolumeClaim
17 metadata:
18 name: mysql-pv-claim
19 labels:
20 app: wordpress
21 spec:
22 accessModes:
23 - ReadWriteOnce
24 resources:
25 requests:
26 storage: 20Gi
27 ---
```

→ Indication de la création des volumes persistants :



```
wordpres > ! mysql-deployment.yaml
35 selector:
36   matchLabels:
37     app: wordpress
38     tier: mysql
39 strategy:
40   type: Recreate
41 template:
42   metadata:
43     labels:
44       app: wordpress
45       tier: mysql
46   spec:
47     containers:
48     - image: mysql:8.0
49       name: mysql
50       env:
51       - name: MYSQL_ROOT_PASSWORD
52         valueFrom:
53           secretKeyRef:
54             name: mysql-pass
55             key: password
56       - name: MYSQL_DATABASE
57         value: wordpress
58       - name: MYSQL_USER
59         value: wordpress
60       - name: MYSQL_PASSWORD
61         valueFrom:
62           secretKeyRef:
63             name: mysql-pass
64             key: password
65     ports:
66     - containerPort: 3306
67       name: mysql
68     volumeMounts:
69     - name: mysql-persistent-storage
70       mountPath: /var/lib/mysql
71   volumes:
72   - name: mysql-persistent-storage
73     persistentVolumeClaim:
74       claimName: mysql-pv-claim
```

→ Création d'un fichier wordpress-customisation.yaml :



```
wordpres > ! wordpress-deployment.yaml
1  apiVersion: v1
2  kind: Service
3  metadata:
4    name: wordpress
5    labels:
6      app: wordpress
7  spec:
8    ports:
9      - port: 80
10   selector:
11     app: wordpress
12     tier: frontend
13   type: LoadBalancer
14 ---
15 apiVersion: v1
16 kind: PersistentVolumeClaim
17 metadata:
18   name: wp-pv-claim
19   labels:
20     app: wordpress
21 spec:
22   accessModes:
23     - ReadWriteOnce
24   resources:
25     requests:
26       storage: 20Gi
27 ---
```

→ Indication des volumes persistants :

```
21 spec:
22   resources:
23     ---
24   ---
25   ---
26   ---
27   ---
28   apiVersion: apps/v1
29   kind: Deployment
30   metadata:
31     name: wordpress
32     labels:
33       app: wordpress
34   spec:
35     selector:
36       matchLabels:
37         app: wordpress
38         tier: frontend
39     strategy:
40       type: Recreate
41     template:
42       metadata:
43         labels:
44           app: wordpress
45           tier: frontend
46       spec:
47         containers:
48         - image: wordpress:6.2.1-apache
49           name: wordpress
50           env:
51             - name: WORDPRESS_DB_HOST
52               value: wordpress-mysql
53             - name: WORDPRESS_DB_PASSWORD
54               valueFrom:
55                 secretKeyRef:
56                   name: mysql-pass
57                   key: password
58             - name: WORDPRESS_DB_USER
59               value: wordpress
60           ports:
61             - containerPort: 80
62               name: wordpress
63         volumeMounts:
64         - name: wordpress-persistent-storage
65           mountPath: /var/www/html
66       volumes:
67       - name: wordpress-persistent-storage
68         persistentVolumeClaim:
69           claimName: wp-pv-claim
```

→ Ajout des fichiers dans les ressources du fichier kustomization.yaml :

```
1 secretGenerator:
2   - name: mysql-pass
3     literals:
4       - password=123AZEqs!
5 resources:
6   - mysql-deployment.yaml
7   - wordpress-deployment.yaml
```

→ Applicatif des fichiers de configuration :

```

● PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> kubectl apply -k .\wordpress\
secret/mysql-pass-67ffctdkmh created
service/wordpress created
service/wordpress-mysql created
persistentvolumeclaim/mysql-pv-claim created
persistentvolumeclaim/wp-pv-claim created
deployment.apps/wordpress created
deployment.apps/wordpress-mysql created
○ PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> █

```

→ Affichage du secret de mysql :

```

● PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> kubectl get secrets
NAME                                TYPE      DATA  AGE
mongo-secret                        Opaque   2      36m
mysql-pass-67ffctdkmh              Opaque   1      33s
○ PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> █

```

→ Affichage des volumes dynamiques :

```

● PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> kubectl get pvc
NAME          STATUS  VOLUME                                     CAPACITY  ACCESS MODES  STORAGECLASS  VOLUMEATTRIBUTESCLASS  AGE
mysql-pv-claim  Bound  pvc-7319c2ba-9079-4d1f-a3b7-0cd11955cacf  20Gi      RWO           standard     <unset>                74s
wp-pv-claim    Bound  pvc-7649b4cd-5219-4d88-bc9f-762d888f874e  20Gi      RWO           standard     <unset>                74s
○ PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> █

```

→ Affichage des pods Wordpress :

```

● PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> kubectl get pods
NAME                                READY  STATUS   RESTARTS  AGE
mailpit-7b96b48c5d-6htkw            1/1    Running  0          50m
mongo-deployment-744864fdd7-2s659  1/1    Running  0          35m
webapp-deployment-5766fd95c7-j7kr9  1/1    Running  0          24m
wordpress-7546459c86-tcnmj          1/1    Running  0          108s
wordpress-mysql-f5b7865ff-d5xjv     1/1    Running  0          108s
○ PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> █

```

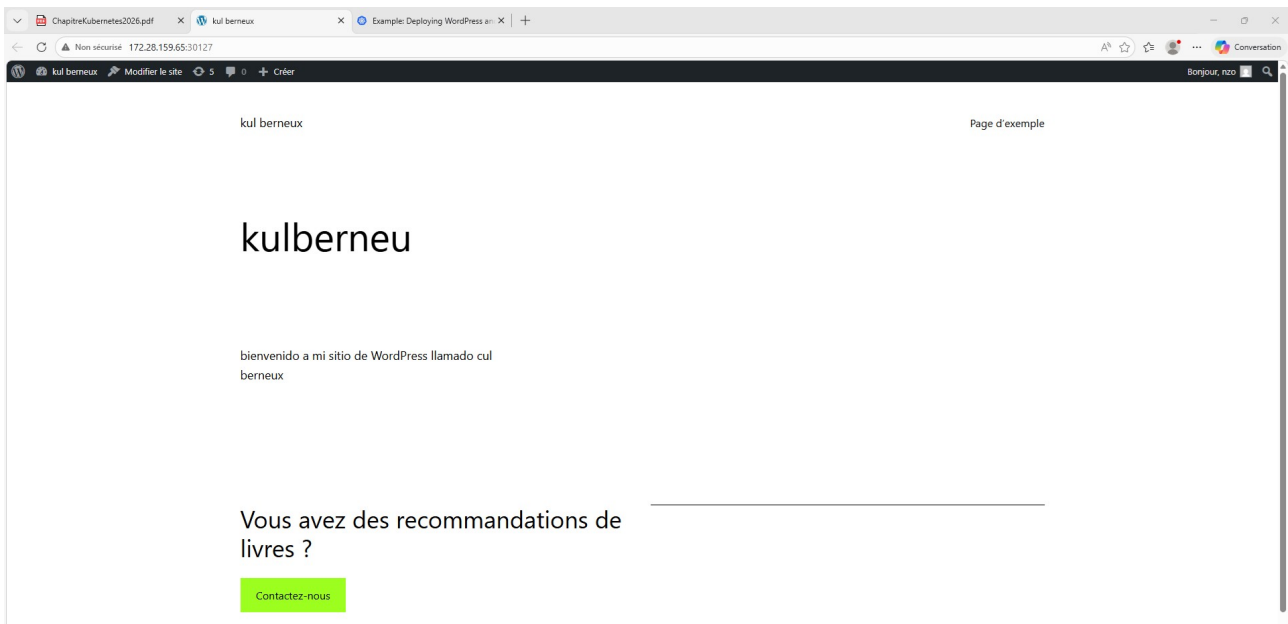
→ Affichage du service Wordpress :

```
PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> kubectl get services wordpress
NAME          TYPE          CLUSTER-IP    EXTERNAL-IP    PORT(S)          AGE
wordpress    LoadBalancer  10.107.26.33  <pending>      80:30127/TCP     2m35s
PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> █
```

→ Utilisation de la commande qui affiche l'url précise du Wordpress :

```
PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> minikube service wordpress --url
http://172.28.159.65:30127
PS D:\2EME ANNEE\SISR\BOUCLY\A FINIR\k8s> █
```

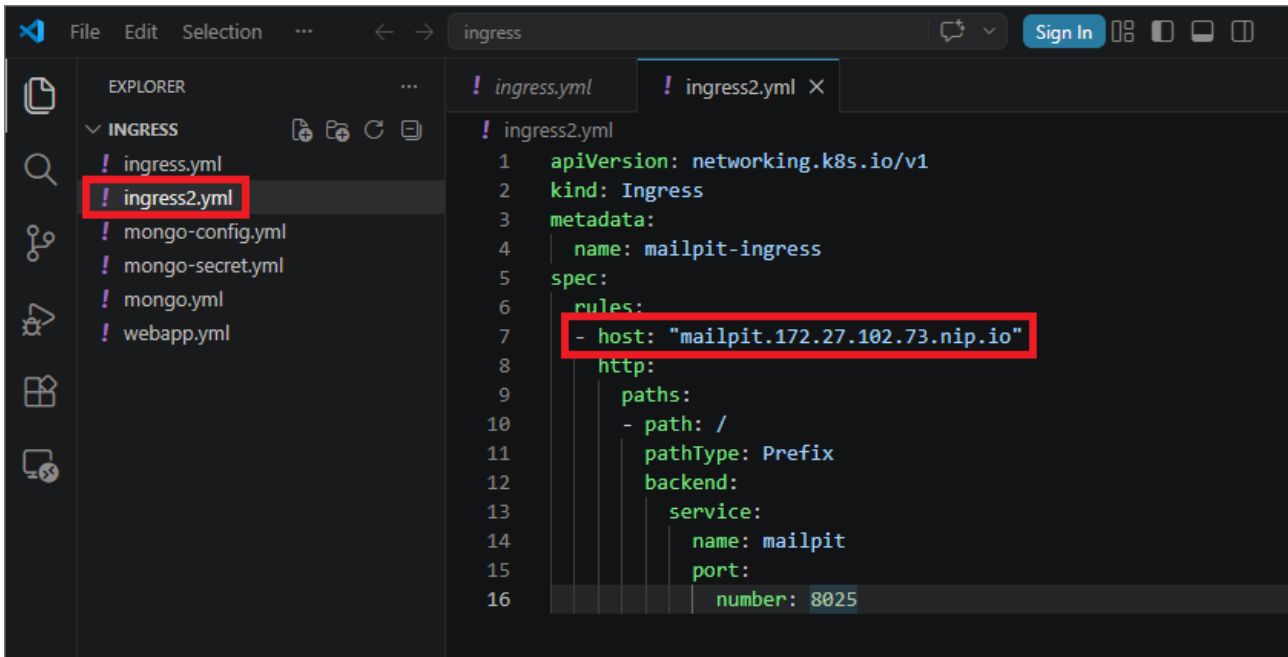
→ Connexion au site Wordpress et customisation rapide de la page d'accueil :



→ Informations du ingress mailpit :

```
PS C:\WINDOWS\system32> kubectl get ingress
NAME          CLASS    HOSTS    ADDRESS          PORTS    AGE
test-ingress  nginx   *        172.27.102.73   80      36s
PS C:\WINDOWS\system32> minikube ip
172.27.102.73
PS C:\WINDOWS\system32>
```

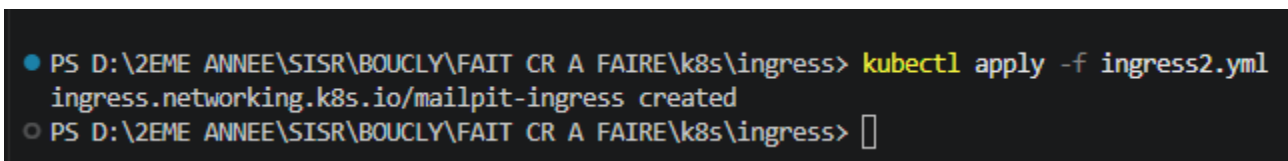
→ Création d'un nouveau fichier ingress mailpit ingress2.yml :



The screenshot shows the Visual Studio Code interface. On the left, the Explorer sidebar shows a folder named 'INGRESS' containing several files: ingress.yml, ingress2.yml (highlighted with a red box), mongo-config.yml, mongo-secret.yml, mongo.yml, and webapp.yml. The main editor area shows the content of ingress2.yml:

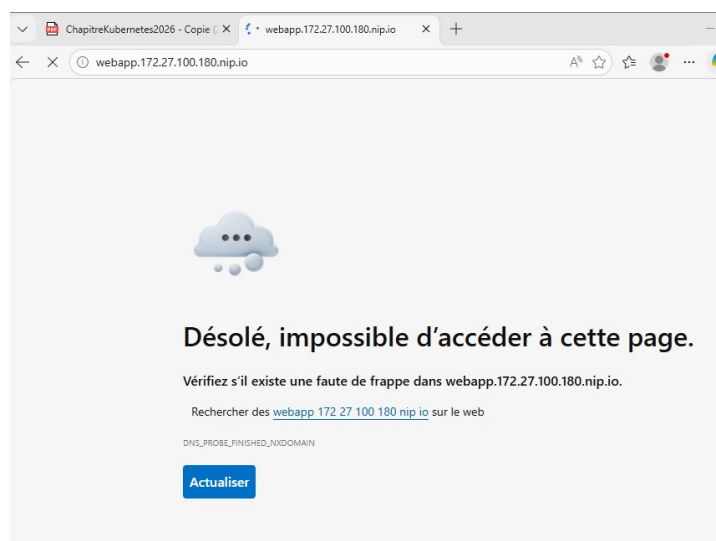
```
1  apiVersion: networking.k8s.io/v1
2  kind: Ingress
3  metadata:
4    name: mailpit-ingress
5  spec:
6    rules:
7    - host: "mailpit.172.27.102.73.nip.io"
8      http:
9        paths:
10       - path: /
11         pathType: Prefix
12         backend:
13           service:
14             name: mailpit
15             port:
16               number: 8025
```

→ Applicatif du fichier :

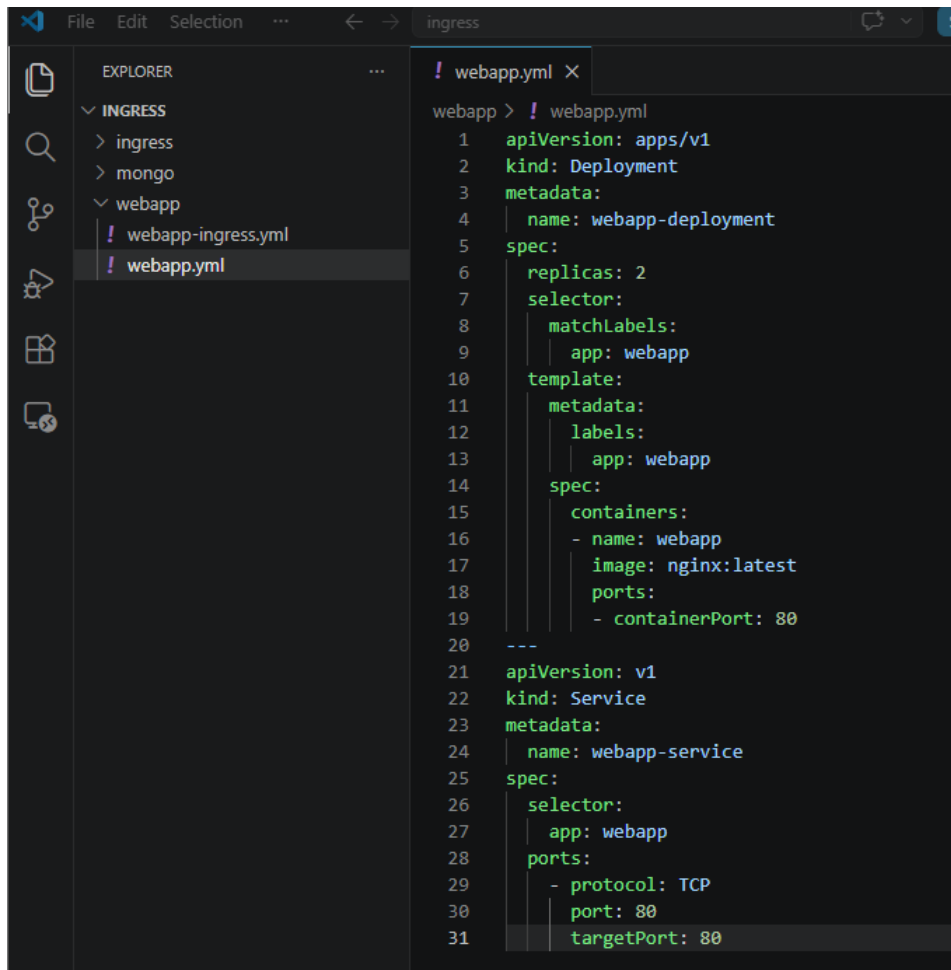


```
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\ingress> kubectl apply -f ingress2.yml
ingress.networking.k8s.io/mailpit-ingress created
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\ingress> 
```

→ Site non joignable dû au problème de résolution DNS interne :

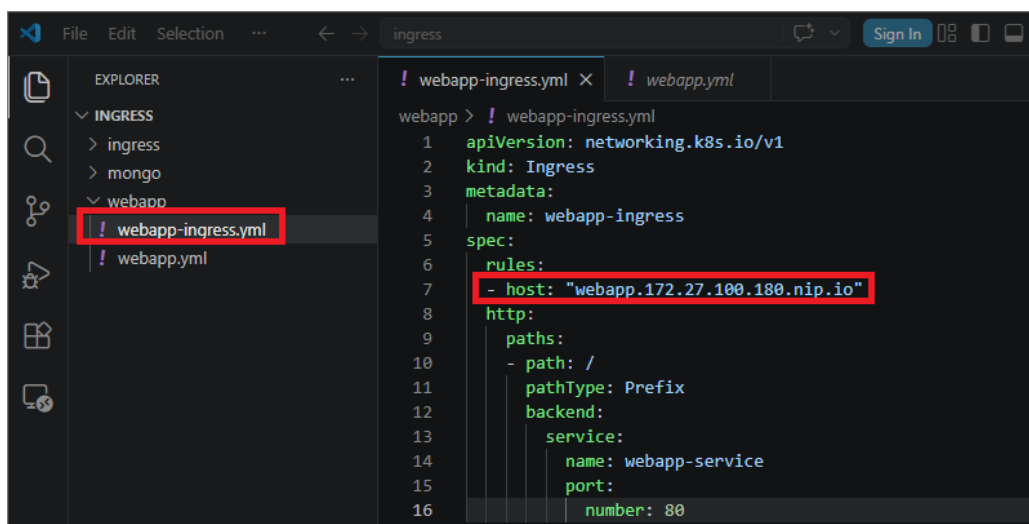


→ Création d'un objet deployment et service dans le fichier webapp.yml :



```
webapp > ! webapp.yml
1  apiVersion: apps/v1
2  kind: Deployment
3  metadata:
4    name: webapp-deployment
5  spec:
6    replicas: 2
7    selector:
8      matchLabels:
9        app: webapp
10   template:
11     metadata:
12       labels:
13         app: webapp
14     spec:
15       containers:
16       - name: webapp
17         image: nginx:latest
18         ports:
19         - containerPort: 80
20   ---
21   apiVersion: v1
22   kind: Service
23   metadata:
24     name: webapp-service
25   spec:
26     selector:
27       app: webapp
28     ports:
29     - protocol: TCP
30       port: 80
31     targetPort: 80
```

→ Création du fichier webapp-ingress.yml :

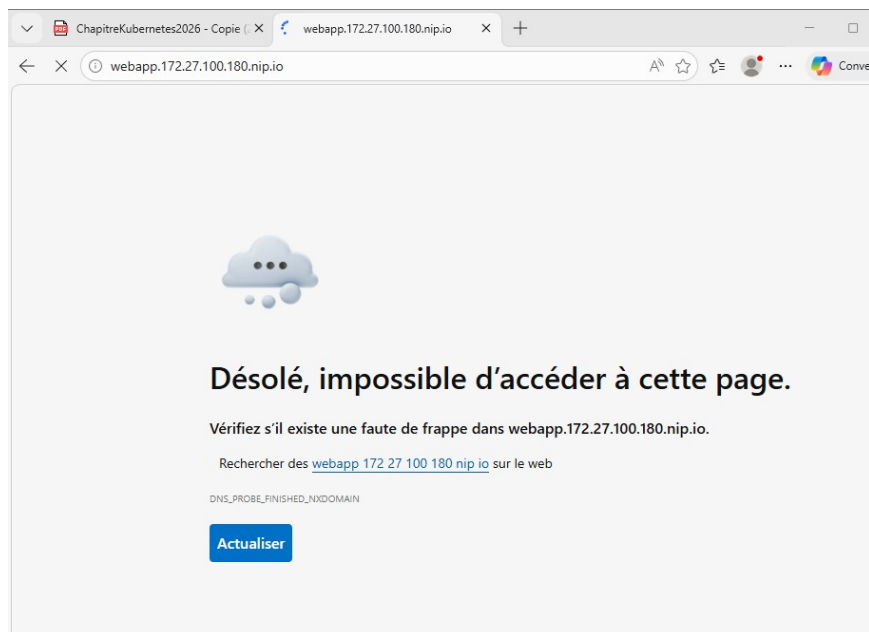


```
webapp > ! webapp-ingress.yml
1  apiVersion: networking.k8s.io/v1
2  kind: Ingress
3  metadata:
4    name: webapp-ingress
5  spec:
6    rules:
7    - host: "webapp.172.27.100.180.nip.io"
8    http:
9      paths:
10     - path: /
11       pathType: Prefix
12       backend:
13         service:
14           name: webapp-service
15           port:
16             number: 80
```

→ Applicatif des deux fichiers yml :

```
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS powershell - webapp + - - - |
● PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\ingress\webapp> kubectl apply -f webapp.yml
deployment.apps/webapp-deployment unchanged
service/webapp-service unchanged
● PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\ingress\webapp> kubectl apply -f webapp-ingress.yml
ingress.networking.k8s.io/webapp-ingress unchanged
○ PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\ingress\webapp> |
```

→ Site également non joignable dû au problème de résolution DNS interne :



→ Vérification de l'état des pods :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get pods -l app=mailpit
NAME                                READY   STATUS    RESTARTS   AGE
mailpit-7b96b48c5d-ccc14            1/1     Running   0           5s
mailpit-7b96b48c5d-kbqkk            1/1     Running   0          106s
PS C:\WINDOWS\system32>
```

→ Connexion au pod mailpit et création d'un dossier test puis processus mailpit tué :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl exec -it deployment/mailpit -- sh
/ # ps -ef
PID    USER      TIME  COMMAND
   1   root          0:00 /mailpit
  13   root          0:00 sh
  19   root          0:00 ps -ef
/ # mkdir /tmp/test
/ # ls -ld /tmp/test
drwxr-xr-x  2 root    root      4096 May  6 13:39 /tmp/test
/ # kill 1
/ # command terminated with exit code 137
PS C:\WINDOWS\system32>
```

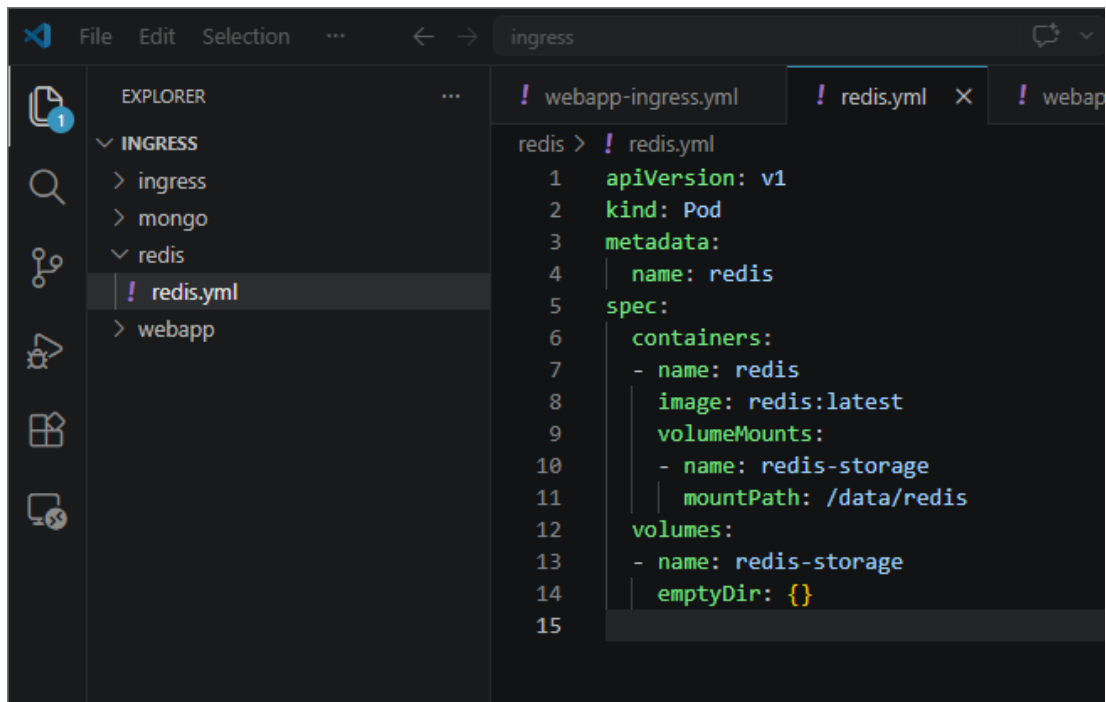
→ Le pod a redémarré automatiquement en créant un nouveau pod :

```
Sélection Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get pods -l app=mailpit
NAME                                READY   STATUS    RESTARTS   AGE
mailpit-7b96b48c5d-cccl4            1/1    Running   0           99s
mailpit-7b96b48c5d-kbqkk            1/1    Running   1 (42s ago) 3m20s
PS C:\WINDOWS\system32>
```

→ Le dossier test n'existe plus sur le nouveau pod :

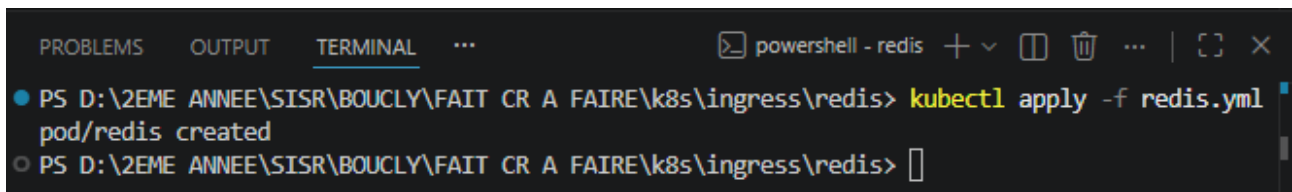
```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl exec -it deployment/mailpit -- sh
/ # ls -ld /tmp/test
ls: /tmp/test: No such file or directory
/ # exit
command terminated with exit code 1
PS C:\WINDOWS\system32>
```

→ Création du fichier redis.yaml :



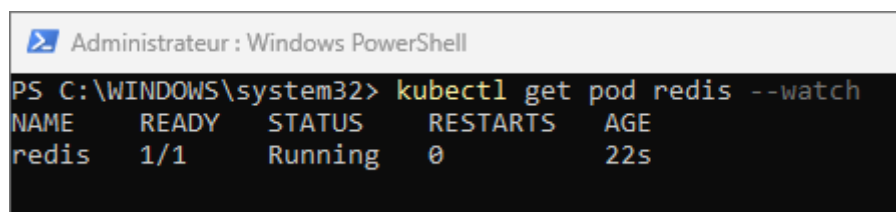
```
redis > ! redis.yaml
1  apiVersion: v1
2  kind: Pod
3  metadata:
4    name: redis
5  spec:
6    containers:
7      - name: redis
8        image: redis:latest
9        volumeMounts:
10       - name: redis-storage
11         mountPath: /data/redis
12    volumes:
13      - name: redis-storage
14        emptyDir: {}
15
```

→ Création du pod redis :



```
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\ingress\redis> kubectl apply -f redis.yaml
pod/redis created
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\ingress\redis>
```

→ Pod bien créé et en cours d'exécution :



```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get pod redis --watch
NAME      READY   STATUS    RESTARTS   AGE
redis     1/1     Running   0           22s
```

→ Création d'un fichier test dans dossier redis du pod redis :

```
Sélection Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl exec -it redis -- /bin/bash
root@redis:/data# cd /data/redis/
root@redis:/data/redis# echo Hello > test-file
root@redis:/data/redis#
```

→ Mise à jour des paquets du pod :

```
Administrateur : Windows PowerShell
root@redis:/data/redis# apt-get update
Get:1 http://deb.debian.org/debian trixie InRelease [140 kB]
Get:2 http://deb.debian.org/debian trixie-updates InRelease [47.3 kB]
Get:3 http://deb.debian.org/debian-security trixie-security InRelease [43.4 kB]
Get:4 http://deb.debian.org/debian trixie/main amd64 Packages [9671 kB]
Get:5 http://deb.debian.org/debian trixie-updates/main amd64 Packages [5412 B]
Get:6 http://deb.debian.org/debian-security trixie-security/main amd64 Packages [130 kB]
Fetched 10.0 MB in 7s (1412 kB/s)
Reading package lists... Done
root@redis:/data/redis#
```

→ Installation du paquet procps :

```
root@redis:/data/redis# apt-get install procps
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  libgpm2 libncursesw6 libproc2-0 linux-sysctl-defaults psmisc
Suggested packages:
  gpm
The following NEW packages will be installed:
  libgpm2 libncursesw6 libproc2-0 linux-sysctl-defaults procps psmisc
0 upgraded, 6 newly installed, 0 to remove and 0 not upgraded.
Need to get 1370 kB of archives.
After this operation, 4163 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
```

→ Affichage des processus en cours :

```
Administrateur : Windows PowerShell
root@redis:/data/redis# ps aux
USER      PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
redis     1  0.1  0.3 160376 23424 ?        Ssl  13:44   0:00 redis-server *:6379
root      29  0.0  0.0   4320  3584 pts/0    Ss   13:52   0:00 /bin/bash
root      70  0.0  0.0     0     0 pts/0    Z    13:53   0:00 [dpkg-preconfig] <defunct>
root     161  0.0  0.0   6388  3712 pts/0    R+   13:53   0:00 ps aux
root@redis:/data/redis#
```

→ Arrêt du processus redis :

```
root@redis:/data/redis# kill 1
root@redis:/data/redis# command terminated with exit code 137
PS C:\WINDOWS\system32>
```

→ Le pod a été recréé et redémarré :

```
Sélection Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get pod redis --watch
NAME      READY   STATUS    RESTARTS   AGE
redis     1/1     Running   1 (47s ago) 18m
```

→ Le fichier test-file dans le pod est encore présent :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl exec -it redis -- /bin/bash
root@redis:/data# cd /data/redis
root@redis:/data/redis# ls
test-file
root@redis:/data/redis# exit
exit
PS C:\WINDOWS\system32>
```

→ Suppression du pod redis :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl delete pod redis
pod "redis" deleted from default namespace
PS C:\WINDOWS\system32>
```

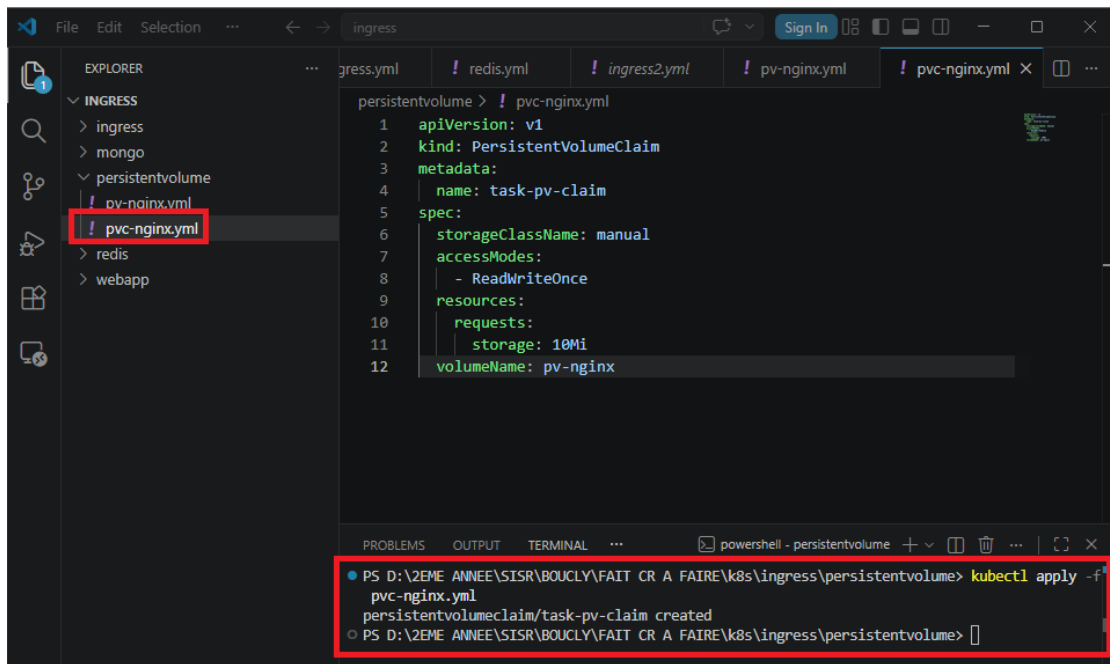
→ Le pod n'est maintenant plus accessible :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get pod redis --watch
Error from server (NotFound): pods "redis" not found
PS C:\WINDOWS\system32>
```


→ Le volume est bien créé :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get pv pv-nginx
NAME          CAPACITY  ACCESS MODES  RECLAIM POLICY  STATUS   CLAIM          STORAGECLASS  VOLUMEATTRIBUTESCLASS  REASON  AGE
pv-nginx      10Mi     RWO           Retain          Available  default/task-pv-claim  manual        <unset>                49s
PS C:\WINDOWS\system32>
```

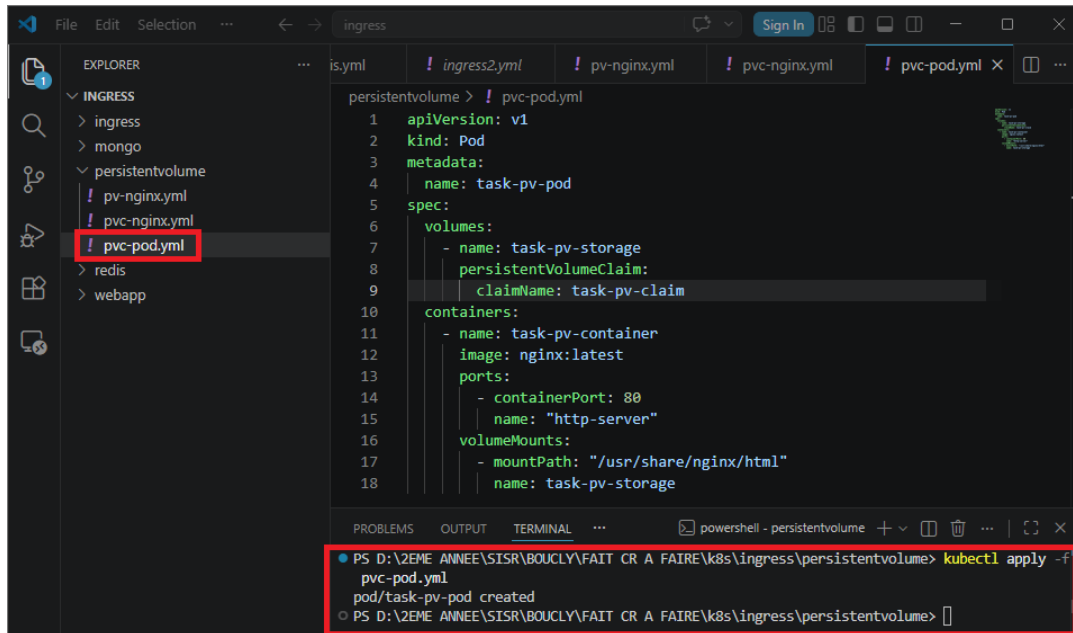
→ Création du fichier pvc-nginx.yml et applicatif :



→ Affichage du volume persistant et du claim :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get pv pv-nginx
NAME          CAPACITY  ACCESS MODES  RECLAIM POLICY  STATUS   CLAIM          STORAGECLASS  VOLUMEATTRIBUTESCLASS  REASON  AGE
pv-nginx      10Mi     RWO           Retain          Bound    default/task-pv-claim  manual        <unset>                3m59s
PS C:\WINDOWS\system32> kubectl get pvc
NAME          STATUS  VOLUME  CAPACITY  ACCESS MODES  STORAGECLASS  VOLUMEATTRIBUTESCLASS  AGE
task-pv-claim Bound   pv-nginx  10Mi     RWO           manual        <unset>                58s
PS C:\WINDOWS\system32>
```

→ Création du fichier pvc-pod.yml et intégration du fichier :

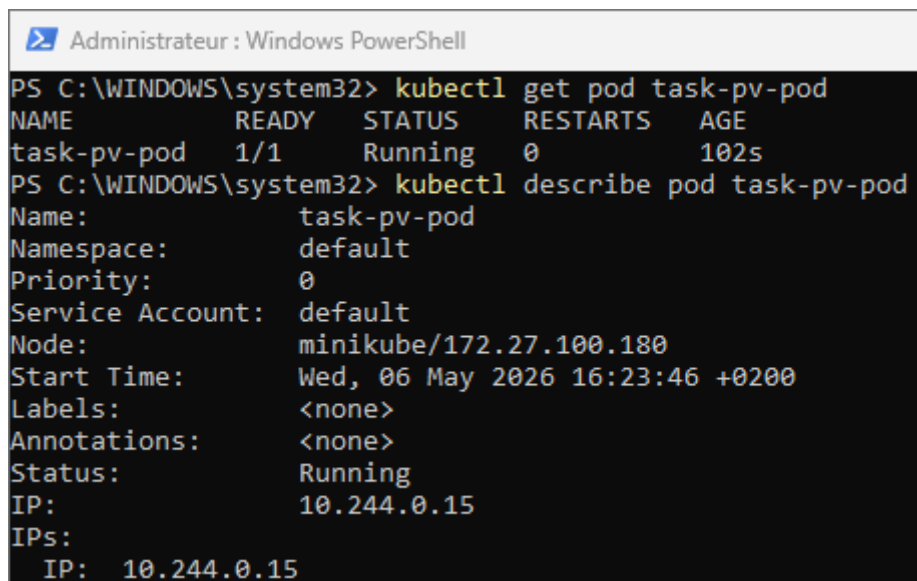


The screenshot shows a Visual Studio Code editor window with a file explorer on the left and a code editor on the right. The file explorer shows a directory structure with files like pv-nginx.yml, pvc-nginx.yml, and pvc-pod.yml. The code editor shows the content of pvc-pod.yml, which is a Kubernetes pod manifest. The terminal at the bottom shows the command `kubectl apply -f pvc-pod.yml` being executed, resulting in the pod `pod/task-pv-pod` being created.

```
1  apiVersion: v1
2  kind: Pod
3  metadata:
4    name: task-pv-pod
5  spec:
6    volumes:
7      - name: task-pv-storage
8        persistentVolumeClaim:
9          claimName: task-pv-claim
10   containers:
11     - name: task-pv-container
12       image: nginx:latest
13       ports:
14         - containerPort: 80
15           name: "http-server"
16       volumeMounts:
17         - mountPath: "/usr/share/nginx/html"
18           name: task-pv-storage
```

```
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\ingress\persistentvolume> kubectl apply -f pvc-pod.yml
pod/task-pv-pod created
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\ingress\persistentvolume>
```

→ Affichage du pod et de ses détails :



The screenshot shows a Windows PowerShell terminal window with the following output:

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get pod task-pv-pod
NAME          READY   STATUS    RESTARTS   AGE
task-pv-pod   1/1     Running   0           102s
PS C:\WINDOWS\system32> kubectl describe pod task-pv-pod
Name:         task-pv-pod
Namespace:    default
Priority:      0
Service Account: default
Node:         minikube/172.27.100.180
Start Time:   Wed, 06 May 2026 16:23:46 +0200
Labels:       <none>
Annotations:  <none>
Status:       Running
IP:           10.244.0.15
IPs:
  IP: 10.244.0.15
```

→ Détails du pod :

```

Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl describe pod task-pv-pod
Name:          task-pv-pod
Namespace:    default
Priority:      0
Service Account: default
Node:         minikube/172.17.100.180
Start Time:   Wed, 06 May 2026 16:23:46 +0200
Labels:       <none>
Annotations:  <none>
Status:       Running
IP:           10.244.0.15
IPs:
  IP: 10.244.0.15
Containers:
  task-pv-container:
    Container ID:   docker://c90e6ccf49fe64c6d5f0baf4b927a3303a13f3ac09ad48c2a5bfdbee195b87c8
    Image:          nginx:latest
    Image ID:      docker-pullable://nginx@sha256:6e23479198b998e5e25921dff8455837c7636a6711a04a635cf1bb363d199dc
    Port:          80/TCP (http-server)
    Host Port:     0/TCP (http-server)
    State:         Running
      Started:    Wed, 06 May 2026 16:23:47 +0200
    Ready:         True
    Restart Count: 0
    Environment:   <none>
    Mounts:
      /usr/share/nginx/html from task-pv-storage (rw)
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-w5n8 (ro)
Conditions:
  Type              Status
  PodReadyToStartContainers  True
  Initialized        True
  Ready              True
  ContainersReady    True
  PodScheduled       True
Volumes:
  task-pv-storage:
    Type:          PersistentVolumeClaim (a reference to a PersistentVolumeClaim in the same namespace)
    ClaimName:    task-pv-claim
    ReadOnly:     false
  kube-api-access-w5n8:
    Type:          Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds: 3607
    ConfigMapName: kube-root-ca.crt
    Optional:      false
    DownwardAPI:  true
QoS Class:       BestEffort
Node-Selectors:  <none>
Tolerations:    node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
                 node.kubernetes.io/unreachable:NoExecute op=Exists for 300s
Events:
  Type     Reason      Age   From          Message
  ----     -
  Normal   Scheduled   3m19s default-scheduler Successfully assigned default/task-pv-pod to minikube
  Normal   Pulling    3m19s kubelet       Pulling image "nginx:latest"
  Normal   Pulled     3m18s kubelet       Successfully pulled image "nginx:latest" in 872ms (872ms including wait
king). Image size: 160939956 bytes.
  Normal   Created    3m18s kubelet       Container created
  Normal   Started    3m18s kubelet       Container started
PS C:\WINDOWS\system32>

```

→ Connexion au pod en mode interactif :

```

Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl exec -it task-pv-pod -- /bin/bash
root@task-pv-pod:/#

```

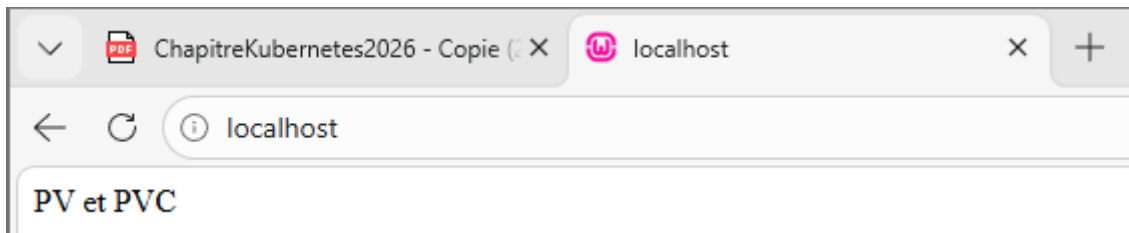
→ Port forward sur le port 80 :

```

Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl port-forward task-pv-pod 80
Forwarding from 127.0.0.1:80 -> 80
Forwarding from [::1]:80 -> 80
Handling connection for 80
Handling connection for 80

```

→ Connexion en HTTP au localhost :



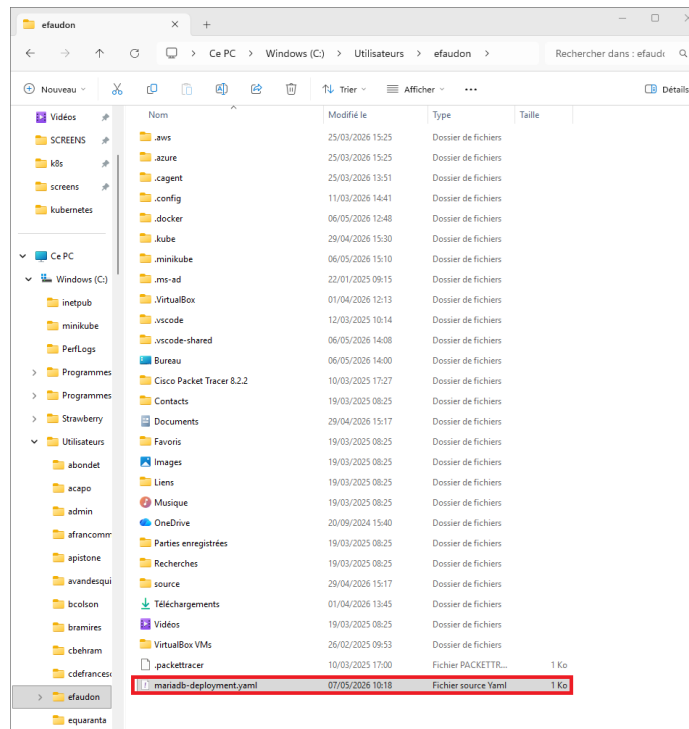
→ Mise à jour des paquets du pod et curl du site localhost :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl exec -it task-pv-pod -- /bin/bash
root@task-pv-pod:/# apt-get update
Get:1 http://deb.debian.org/debian trixie InRelease [140 kB]
Get:2 http://deb.debian.org/debian trixie-updates InRelease [47.3 kB]
Get:3 http://deb.debian.org/debian-security trixie-security InRelease [43.4 kB]
Get:4 http://deb.debian.org/debian trixie/main amd64 Packages [9671 kB]
Get:5 http://deb.debian.org/debian trixie-updates/main amd64 Packages [5412 B]
Get:6 http://deb.debian.org/debian-security trixie-security/main amd64 Packages [130 kB]
Fetched 10.0 MB in 1s (9203 kB/s)
Reading package lists... Done
root@task-pv-pod:/# apt-get install curl
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
curl is already the newest version (8.14.1-2+deb13u2).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
root@task-pv-pod:/# curl http://localhost
PV et PVC
root@task-pv-pod:/#
```

→ Déploiement pas créé directement et qui met le output dans un fichier mariadb-deployment.yaml :

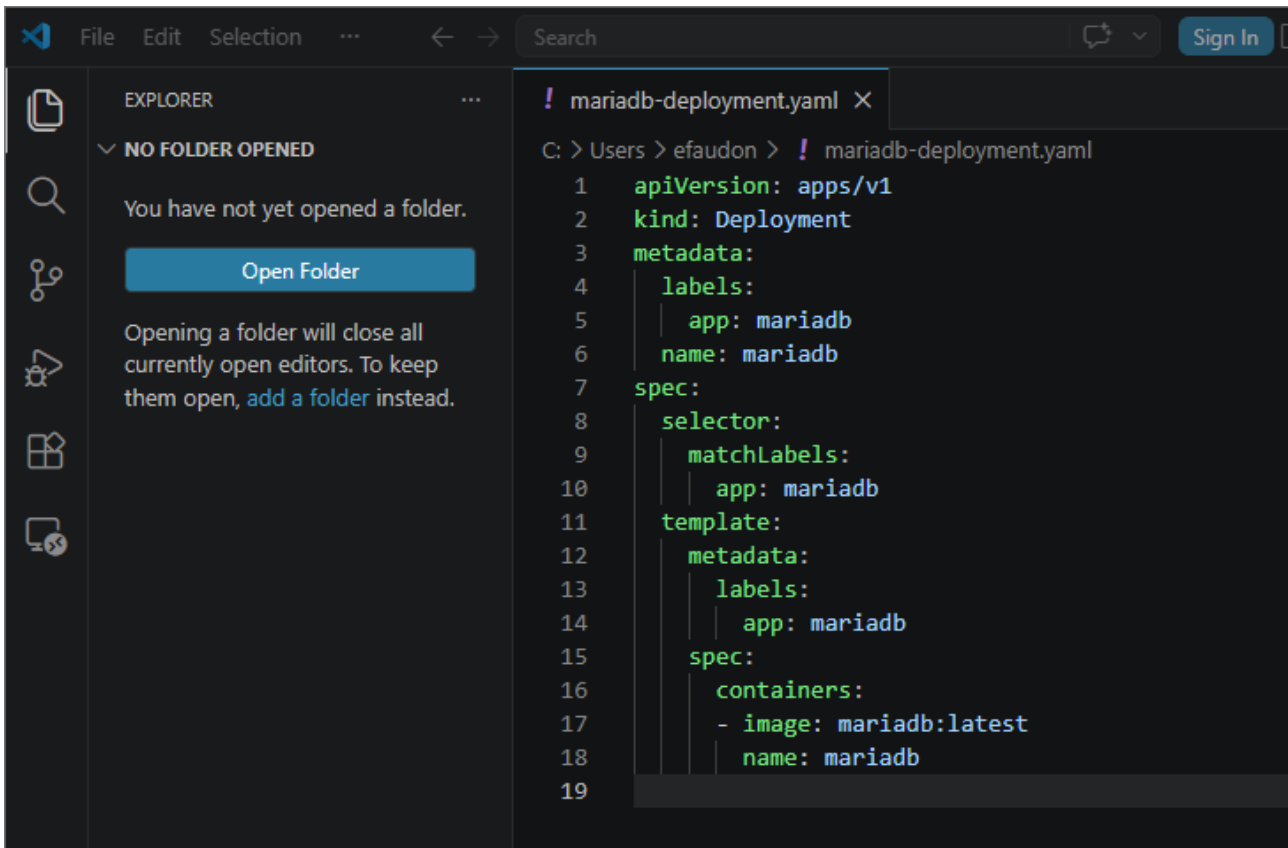
```
Windows PowerShell
PS C:\Users\efaudon> kubectl create deployment mariadb --image=mariadb:latest --dry-run=client --output yml > mariadb-deployment.yaml
PS C:\Users\efaudon>
```

→ Affichage du fichier yaml dans l'explorateur de fichier :



→ Suppression des lignes replicas strategy et resources status dans le fichier :

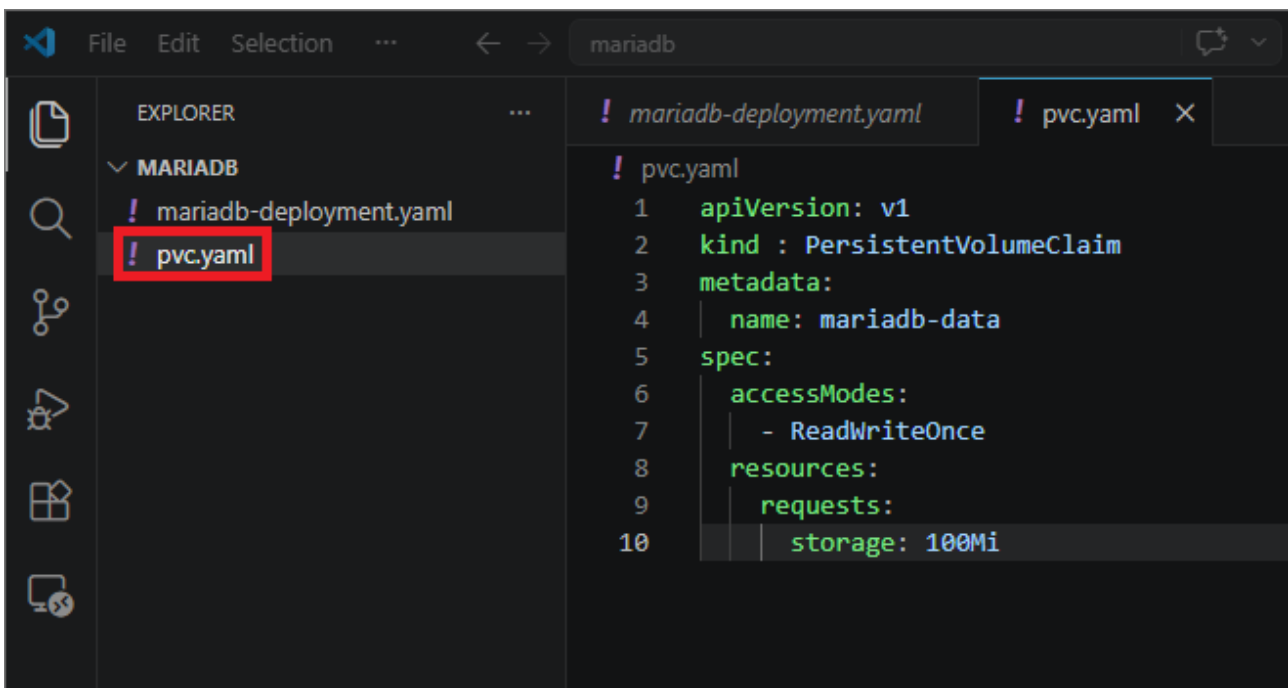
```
1  apiVersion: apps/v1
2  kind: Deployment
3  metadata:
4    labels:
5      app: mariadb
6    name: mariadb
7  spec:
8    replicas: 1
9    selector:
10     matchLabels:
11       app: mariadb
12     strategy: {}
13   template:
14     metadata:
15       labels:
16         app: mariadb
17     spec:
18       containers:
19         - image: mariadb:latest
20           name: mariadb
21         resources: {}
22     status: {}
23
```



The screenshot shows the Visual Studio Code editor with a file named `mariadb-deployment.yaml` open. The Explorer sidebar on the left shows "NO FOLDER OPENED" and a button to "Open Folder". The main editor area displays the following YAML content:

```
1  apiVersion: apps/v1
2  kind: Deployment
3  metadata:
4    labels:
5      app: mariadb
6      name: mariadb
7  spec:
8    selector:
9      matchLabels:
10       app: mariadb
11   template:
12     metadata:
13       labels:
14         app: mariadb
15     spec:
16       containers:
17         - image: mariadb:latest
18           name: mariadb
19
```

→ Création d'un fichier de demande de volume :



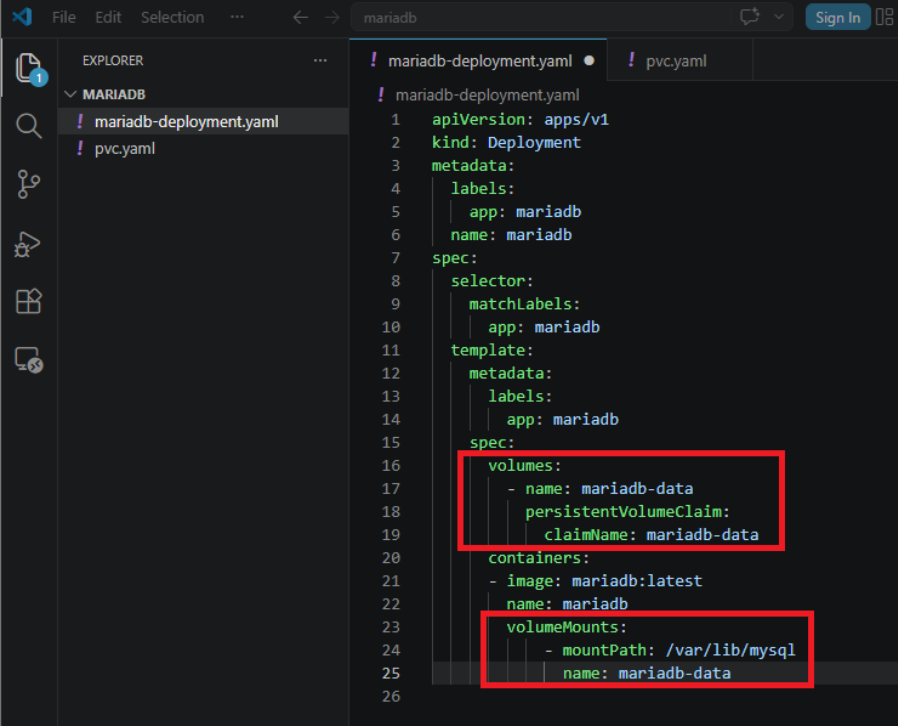
The screenshot shows the Visual Studio Code editor with a folder named "MARIADB" open in the Explorer sidebar. The Explorer sidebar shows two files: `mariadb-deployment.yaml` and `pvc.yaml`, with `pvc.yaml` highlighted in red. The main editor area displays the following YAML content for `pvc.yaml`:

```
1  apiVersion: v1
2  kind: PersistentVolumeClaim
3  metadata:
4    name: mariadb-data
5  spec:
6    accessModes:
7      - ReadWriteOnce
8    resources:
9      requests:
10       storage: 100Mi
```

→ Intégration du fichier :

```
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl apply -f pvc.yaml
persistentvolumeclaim/mariadb-data created
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> 
```

→ Indication des volumes dans le fichier déploiement mariadb :



```
! mariadb-deployment.yaml
1  apiVersion: apps/v1
2  kind: Deployment
3  metadata:
4    labels:
5      app: mariadb
6      name: mariadb
7  spec:
8    selector:
9      matchLabels:
10       app: mariadb
11   template:
12     metadata:
13       labels:
14         app: mariadb
15     spec:
16       volumes:
17         - name: mariadb-data
18           persistentVolumeClaim:
19             claimName: mariadb-data
20     containers:
21       - image: mariadb:latest
22         name: mariadb
23       volumeMounts:
24         - mountPath: /var/lib/mysql
25           name: mariadb-data
26
```

→ Intégration du fichier déploiement :

```
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl apply -f mariadb-deployment.yaml
deployment.apps/mariadb created
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> 
```

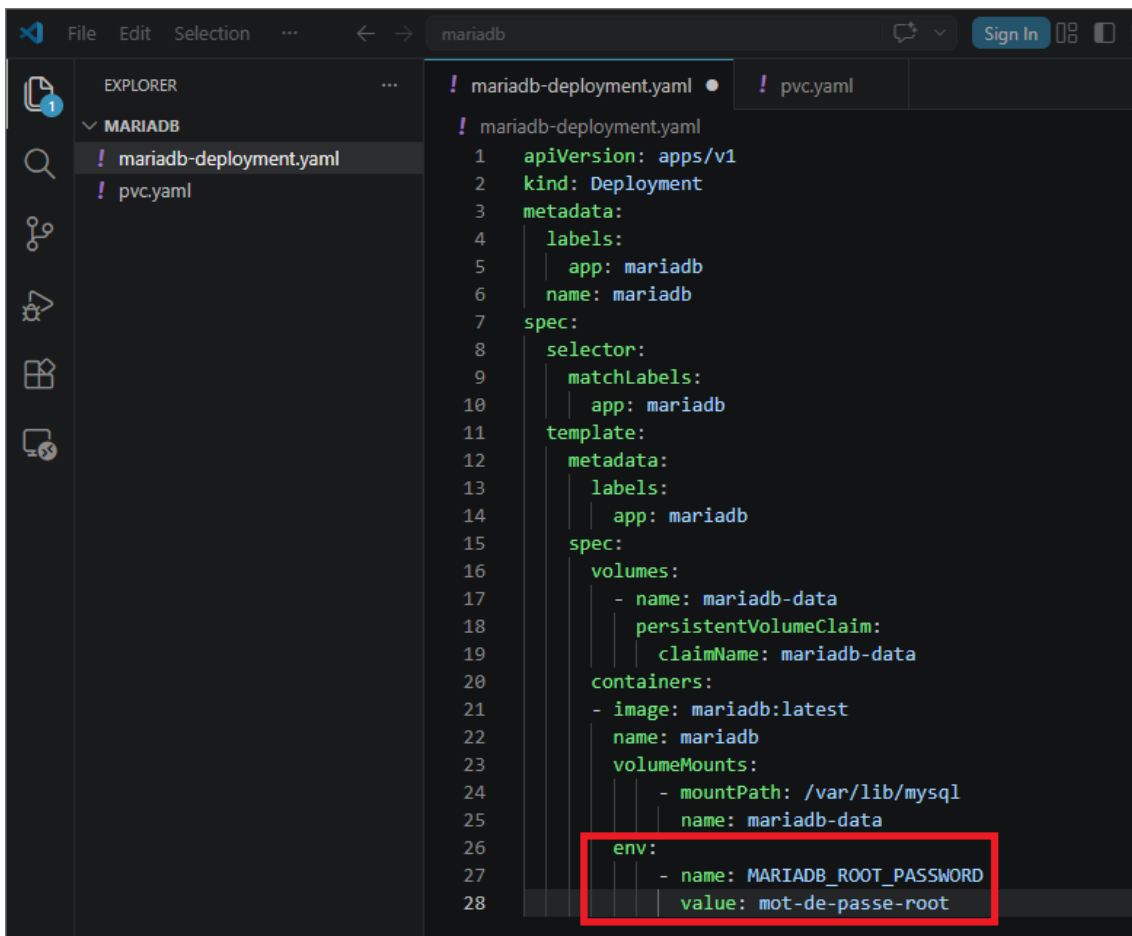
→ Erreur lors du démarrage du pod :

```
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl get pod -l app=mariadb
NAME                                READY  STATUS   RESTARTS   AGE
mariadb-5c476b5c79-c78x8            0/1    Error    2 (21s ago)  31s
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> 
```

→ Les variables d'identifiants ne sont pas indiquées :

```
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl logs -l app=mariadb
2026-05-07 08:45:44+00:00 [Note] [Entrypoint]: Entrypoint script for MariaDB Server 1:12.2.2+maria-ubu2404 started.
2026-05-07 08:45:44+00:00 [Warn] [Entrypoint]: /sys/fs/cgroup//memory.pressure not writable, functionality unavailable to MariaDB
2026-05-07 08:45:44+00:00 [Note] [Entrypoint]: Switching to dedicated user 'mysql'
2026-05-07 08:45:44+00:00 [Note] [Entrypoint]: Entrypoint script for MariaDB Server 1:12.2.2+maria-ubu2404 started.
2026-05-07 08:45:45+00:00 [ERROR] [Entrypoint]: Database is uninitialized and password option is not specified
You need to specify one of MARIADB_ROOT_PASSWORD, MARIADB_ROOT_PASSWORD_HASH, MARIADB_ALLOW_EMPTY_ROOT_PASSWORD and MARIADB_RANDOM_ROOT_PASSWORD
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb>
```

→ Indication des variables d'environnement du mot de passe :



```
File Edit Selection ... mariadb Sign In
EXPLORER
MARIADB
! mariadb-deployment.yaml
! pvc.yaml
! mariadb-deployment.yaml
1 apiVersion: apps/v1
2 kind: Deployment
3 metadata:
4   labels:
5     app: mariadb
6     name: mariadb
7 spec:
8   selector:
9     matchLabels:
10      app: mariadb
11  template:
12    metadata:
13      labels:
14        app: mariadb
15    spec:
16      volumes:
17        - name: mariadb-data
18          persistentVolumeClaim:
19            claimName: mariadb-data
20    containers:
21      - image: mariadb:latest
22        name: mariadb
23        volumeMounts:
24          - mountPath: /var/lib/mysql
25            name: mariadb-data
26      env:
27        - name: MARIADB_ROOT_PASSWORD
28          value: mot-de-passe-root
```

→ Reconfiguration du déploiement :

```
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl apply -f mariadb-deployment.yaml
deployment.apps/mariadb configured
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb>
```

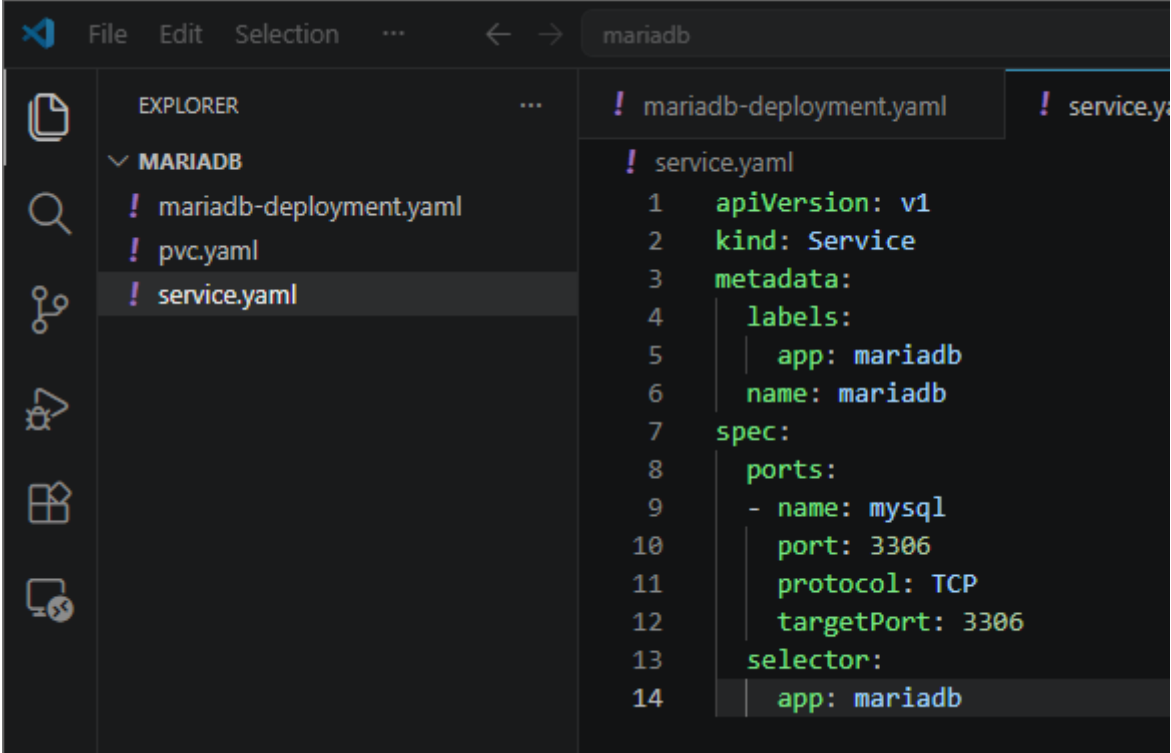
→ Pod maintenant opérationnel :

```
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl get pod -l app=mariadb
NAME                                READY   STATUS    RESTARTS   AGE
mariadb-5bbb9c9b6d-z48nd            1/1     Running   0           27s
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb>
```

→ Connexion au conteneur et test de la connectivité :

```
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl exec -it deployment/mariadb -- bash
root@mariadb-5bbb9c9b6d-z48nd:/# mariadb-admin status -p$MARIADB_ROOT_PASSWORD
Uptime: 113 Threads: 1 Questions: 1 Slow queries: 0 Opens: 17 Open tables: 10 Queries per second avg: 0.008
root@mariadb-5bbb9c9b6d-z48nd:/# exit
exit
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb>
```

→ Création du fichier service.yaml :



```
File Edit Selection ... mariadb
EXPLORER
MARIADB
! mariadb-deployment.yaml
! pvc.yaml
! service.yaml
! mariadb-deployment.yaml
! service.yaml
1 apiVersion: v1
2 kind: Service
3 metadata:
4   labels:
5     app: mariadb
6   name: mariadb
7 spec:
8   ports:
9     - name: mysql
10     port: 3306
11     protocol: TCP
12     targetPort: 3306
13 selector:
14   app: mariadb
```

→ Intégration du service :

```
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl apply -f service.yaml
service/mariadb created
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb>
```

→ Modification du fichier de déploiement en ajoutant la surveillance de la BDD :

```

1  apiVersion: apps/v1
2  kind: Deployment
3  metadata:
4    labels:
5      app: mariadb
6      name: mariadb
7  spec:
8    selector:
9      matchLabels:
10       app: mariadb
11   template:
12     metadata:
13       labels:
14         app: mariadb
15     spec:
16       volumes:
17         - name: mariadb-data
18           persistentVolumeClaim:
19             claimName: mariadb-data
20       containers:
21         - image: mariadb:latest
22           name: mariadb
23           volumeMounts:
24             - mountPath: /var/lib/mysql
25               name: mariadb-data
26           env:
27             - name: MARIADB_ROOT_PASSWORD
28               value: mot-de-passe-root
29           startupProbe: &probe
30           exec:
31             command:
32               - "sh"
33               - "-c"
34               - "mariadb-admin status p$MARIADB_ROOT_PASSWORD"
35           livenessProbe: *probe
36           readinessProbe: *probe

```

→ Applicatif des modifications :

```

● PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl apply -f mariadb-deployment.yaml
deployment.apps/mariadb configured
○ PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> 

```

→ Un deuxième pod est créé :

```

● PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl get pods -l app=mariadb
NAME                                READY   STATUS    RESTARTS   AGE
mariadb-5bbb9c9b6d-z48nd            1/1     Running   0          8m35s
mariadb-7865c7bbf8-mlr26            0/1     Running   0          32s
○ PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> 

```

→ Description du nouveau pod :

```
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl describe pods mariadb-7865c7bbf8-mlr26
Name:          mariadb-7865c7bbf8-mlr26
Namespace:    default
Priority:      0
Service Account: default
Node:         minikube/172.31.117.198
Start Time:   Thu, 07 May 2026 10:58:29 +0200
Labels:       app=mariadb
              pod-template-hash=7865c7bbf8
Annotations:  <none>
Status:       Running
IP:           10.244.0.32
IPs:          <none>
Controlled By: ReplicaSet/mariadb-7865c7bbf8
Containers:
  mariadb:
    Container ID:  docker://fcbedbf7b0e3fbc0206cb4113912a3b08ac47f3313ed8af1db3a22e0ebef19f9
    Image:         mariadb:latest
    Image ID:      docker-pullable://mariadb@sha256:e0236fc6386e7eacd9359e59d0a078bd7aa0d1828d36d13061121bedeae903
    Port:          <none>
    Host Port:     <none>
    State:         Running
      Started:     Thu, 07 May 2026 10:59:34 +0200
      Last State:  Terminated
        Reason:    Error
        Exit Code:  1
        Started:   Thu, 07 May 2026 10:59:02 +0200
        Finished:  Thu, 07 May 2026 10:59:33 +0200
    Ready:         False
    Restart Count: 2
    Liveness:      exec [sh -c mariadb-admin status p$MARIADB_ROOT_PASSWORD] delay=0s timeout=1s period=10s #success=1 #failure=3
    Readiness:     exec [sh -c mariadb-admin status p$MARIADB_ROOT_PASSWORD] delay=0s timeout=1s period=10s #success=1 #failure=3
    Startup:       exec [sh -c mariadb-admin status p$MARIADB_ROOT_PASSWORD] delay=0s timeout=1s period=10s #success=1 #failure=3
    Environment:  MARIADB_ROOT_PASSWORD: mot-de-passe-root
    Mounts:
      /var/lib/mysql from mariadb-data (rw)
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-xm8xh (ro)
    Conditions:
      Type           Status
      PodReadyToStartContainers True
      Initialized     True
      Ready           False
      ContainersReady False
      PodScheduled    True
    Volumes:
      mariadb-data:
        Type:          PersistentVolumeClaim (a reference to a PersistentVolumeClaim in the same namespace)
        ClaimName:     mariadb-data
        ReadOnly:      false
      kube-api-access-xm8xh:
        Type:          Projected (a volume that contains injected data from multiple sources)
        TokenExpirationSeconds: 3607
        ConfigMapName:  kube-root-ca.crt
```

→ Erreur de connexion au serveur mariaDB :

```
Optional:      false
DownwardAPI:  true
QoS Class:    BestEffort
Node-Selectors: <none>
Tolerations:  node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
              node.kubernetes.io/unreachable:NoExecute op=Exists for 300s

Events:
Type Reason Age From Message
----
Normal Scheduled 75s default-scheduler Successfully assigned default/mariadb-7865c7bbf8-mlr26 to minikube
Normal Pulled 74s kubelet Successfully pulled image "mariadb:latest" in 857ms (857ms including waiting). Image size: 335568219 bytes.
Normal Pulled 42s kubelet Successfully pulled image "mariadb:latest" in 869ms (869ms including waiting). Image size: 335568219 bytes.
Normal Killing 15s (x2 over 45s) kubelet Container mariadb failed startup probe, will be restarted
Normal Pulling 11s (x3 over 74s) kubelet Pulling image "mariadb:latest"
Normal Created 10s (x3 over 74s) kubelet Container created
Normal Started 10s (x3 over 74s) kubelet Container started
Normal Pulled 10s kubelet Successfully pulled image "mariadb:latest" in 862ms (862ms including waiting). Image size: 335568219 bytes.
Warning Unhealthy 5s (x7 over 65s) kubelet Startup probe failed: mariadb-admin: connect to server at 'localhost' failed
error: 'Can't connect to local server through socket '/run/mysqld/mysqld.sock' (2)'
Check that mariadb is running and that the socket: '/run/mysqld/mysqld.sock' exists!
```

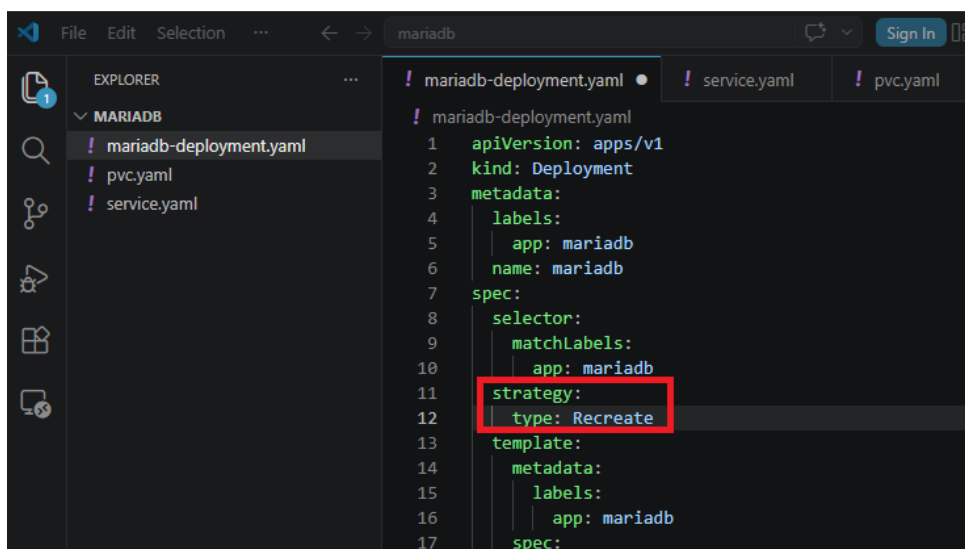
→ Le deuxième pod n'est pas actif :

```
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl get pod -l app=mariadb
NAME                                READY STATUS RESTARTS AGE
mariadb-5bbb9c9b6d-z48nd            1/1 Running 0 11m
mariadb-7865c7bbf8-mlr26            0/1 CrashLoopBackOff 4 (25s ago) 3m4s
```

→ Affichage des logs du pod qui montre que le fichier de lock est déjà utilisé par le premier pod :

```
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl logs mariadb-7865c7bbf8-mlr26
2026-05-07 09:02:07+00:00 [Note] [Entrypoint]: Entrypoint script for MariaDB Server 1:12.2.2+maria-ubu2404 started.
2026-05-07 09:02:07+00:00 [Warn] [Entrypoint]: /sys/fs/cgroup///memory.pressure not writable, functionality unavailable to MariaDB
2026-05-07 09:02:07+00:00 [Note] [Entrypoint]: Switching to dedicated user 'mysql'
2026-05-07 09:02:07+00:00 [Note] [Entrypoint]: Entrypoint script for MariaDB Server 1:12.2.2+maria-ubu2404 started.
2026-05-07 09:02:08+00:00 [Note] [Entrypoint]: MariaDB upgrade not required
2026-05-07 9:02:08 0 [Note] Starting MariaDB 12.2.2-MariaDB-ubu2404 source revision d26a6f441f2119377e79a9548886c6d8c01472f server uid 1b1c4edc60d5890d1e6f10101e-as-process-1
2026-05-07 9:02:08 0 [ERROR] mariadbd: Can't lock aria control file '/var/lib/mysql/aria_log_control' for exclusive use, error: 11. Will retry for 30 seconds
2026-05-07 9:02:38 0 [ERROR] mariadbd: Got error 'Could not get an exclusive lock; file is probably in use by another process' when trying to use aria control file '/var/lib/mysql/aria_log_control'
2026-05-07 9:02:38 0 [ERROR] Plugin 'Aria' registration as a STORAGE ENGINE failed.
2026-05-07 9:02:38 0 [Note] InnoDB: Compressed tables use zlib 1.3
2026-05-07 9:02:38 0 [Note] InnoDB: Number of transaction pools: 1
2026-05-07 9:02:38 0 [Note] InnoDB: Using crc32 + pclmulqdq instructions
2026-05-07 9:02:38 0 [Note] mariadbd: O_TMPFILE is not supported on /tmp (disabling future attempts)
2026-05-07 9:02:38 0 [Note] InnoDB: Using io_uring
2026-05-07 9:02:38 0 [Note] InnoDB: innodb_buffer_pool_size_max=128m, innodb_buffer_pool_size=128m
2026-05-07 9:02:38 0 [Note] InnoDB: Completed initialization of buffer pool
2026-05-07 9:02:38 0 [Note] InnoDB: File system buffers for log disabled (block size=512 bytes)
2026-05-07 9:02:38 0 [ERROR] InnoDB: Unable to lock ./ibdata1 error: 11
2026-05-07 9:02:38 0 [Note] InnoDB: Check that you do not already have another mariadbd process using the same InnoDB data or log files.
2026-05-07 9:02:38 0 [ERROR] InnoDB: Plugin initialization aborted with error Generic error
2026-05-07 9:02:38 0 [Note] InnoDB: Starting shutdown...
2026-05-07 9:02:38 0 [ERROR] Plugin 'InnoDB' registration as a STORAGE ENGINE failed.
2026-05-07 9:02:38 0 [Note] Plugin 'FEEDBACK' is disabled.
2026-05-07 9:02:38 0 [Note] Plugin 'wsrep-provider' is disabled.
2026-05-07 9:02:38 0 [ERROR] could not open mysql.plugin table: 'Unknown storage engine 'Aria''. Some plugins may be not loaded
2026-05-07 9:02:38 0 [ERROR] Failed to initialize plugins.
2026-05-07 9:02:38 0 [ERROR] Aborting
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> 
```

→ Indicaion de la variable strategy recreate dans le fichier de déploiement :



```
File Edit Selection ... mariadb Sign In
EXPLORER
MARIADB
! mariadb-deployment.yaml
! pvc.yaml
! service.yaml
! mariadb-deployment.yaml
! mariadb-deployment.yaml
1 apiVersion: apps/v1
2 kind: Deployment
3 metadata:
4   labels:
5     app: mariadb
6   name: mariadb
7 spec:
8   selector:
9     matchLabels:
10      app: mariadb
11   strategy:
12     type: Recreate
13 template:
14   metadata:
15     labels:
16       app: mariadb
17   spec:
```

→ Prise en compte de modifications :

```
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl apply -f mariadb-deployment.yaml
deployment.apps/mariadb configured
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> 
```

→ Le pod reste en CrashLoopBackOff :

```
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl get pod -l app=mariadb --watch
NAME          READY   STATUS             RESTARTS   AGE
mariadb-7865c7bbf8-mlr26  0/1    CrashLoopBackOff   7 (5s ago)  8m16s
[]
```

→ Suppression du pod :

```
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl delete pods -l app=mariadb
pod "mariadb-7865c7bbf8-mlr26" deleted from default namespace
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> []
```

→ Le pod a été automatiquement recréé et est fonctionnel :

```
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl get pod -l app=mariadb
NAME          READY   STATUS    RESTARTS   AGE
mariadb-7865c7bbf8-pjnfq  0/1    Running   0           28s
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> []
```

→ Augmentation du nombre de pods et montée en charge mais le pod n'arrive toujours pas démarrer :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl scale deployment mariadb --replicas=2
deployment.apps/mariadb scaled
PS C:\WINDOWS\system32> kubectl get pods -l app=mariadb --watch
NAME          READY   STATUS             RESTARTS   AGE
mariadb-7865c7bbf8-pjnfq  0/1    Running            2 (20s ago)  81s
mariadb-7865c7bbf8-r9sjz  0/1    Running            0           12s
mariadb-7865c7bbf8-pjnfq  0/1    Running            3 (1s ago)   92s
mariadb-7865c7bbf8-r9sjz  0/1    Running            1 (2s ago)   32s
mariadb-7865c7bbf8-pjnfq  0/1    Running            4 (1s ago)   2m2s
mariadb-7865c7bbf8-r9sjz  0/1    Running            2 (2s ago)   62s
mariadb-7865c7bbf8-pjnfq  0/1    CrashLoopBackOff   4 (1s ago)   2m32s
```

→ Affichage des détails du pod :

```
PS C:\WINDOWS\system32> kubectl describe pods mariadb-7865c7bbf8-pjnfq
Name:          mariadb-7865c7bbf8-pjnfq
Namespace:    default
Priority:      0
Service Account: default
Node:         minikube/172.31.117.198
Start Time:   Thu, 07 May 2026 11:08:13 +0200
Labels:       app=mariadb
              pod-template-hash=7865c7bbf8
Annotations:  <none>
Status:       Running
IP:           10.244.0.33
IPs:          <none>
Controlled By: ReplicaSet/mariadb-7865c7bbf8
Containers:
  mariadb:
    Container ID:  docker://bb5d78c104cb07ac6c8d8229612b9b21328c8f545692c6604a44c6b3c98e1068
    Image:         mariadb:latest
    Image ID:      docker-pullable://mariadb@sha256:e0236fc6386e7eacd9359e59d0a078bd7aa0d1828d36d13061121bedeae903
    Port:          <none>
    Host Port:     <none>
    State:         Running
      Started:     Thu, 07 May 2026 11:11:39 +0200
      Last State:  Terminated
        Reason:    Completed
        Exit Code:  0
        Started:   Thu, 07 May 2026 11:10:15 +0200
        Finished:  Thu, 07 May 2026 11:10:44 +0200
    Ready:         False
    Restart Count:  5
    Liveness:      exec [sh -c mariadb-admin status p$MARIADB_ROOT_PASSWORD] delay=0s timeout=1s period=10s #success=1 #failure=3
    Readiness:     exec [sh -c mariadb-admin status p$MARIADB_ROOT_PASSWORD] delay=0s timeout=1s period=10s #success=1 #failure=3
    Startup:       exec [sh -c mariadb-admin status p$MARIADB_ROOT_PASSWORD] delay=0s timeout=1s period=10s #success=1 #failure=3
    Environment:
      MARIADB_ROOT_PASSWORD: mot-de-passe-root
    Mounts:
      /var/lib/mysql from mariadb-data (rw)
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-svjfz (ro)
Conditions:
  Type              Status
  PodReadyToStartContainers  True
  Initialized          True
  Ready                False
  ContainersReady       False
  PodScheduled         True
Volumes:
  mariadb-data:
    Type:          PersistentVolumeClaim (a reference to a PersistentVolumeClaim in the same namespace)
    ClaimName:     mariadb-data
    ReadOnly:      false
  kube-api-access-svjfz:
    Type:          Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds: 3607
    ConfigMapName:  kube-root-ca.crt
    Optional:      false
    DownwardAPI:   true
  QoS Class:       BestEffort
  Node-Selectors:  <none>
```

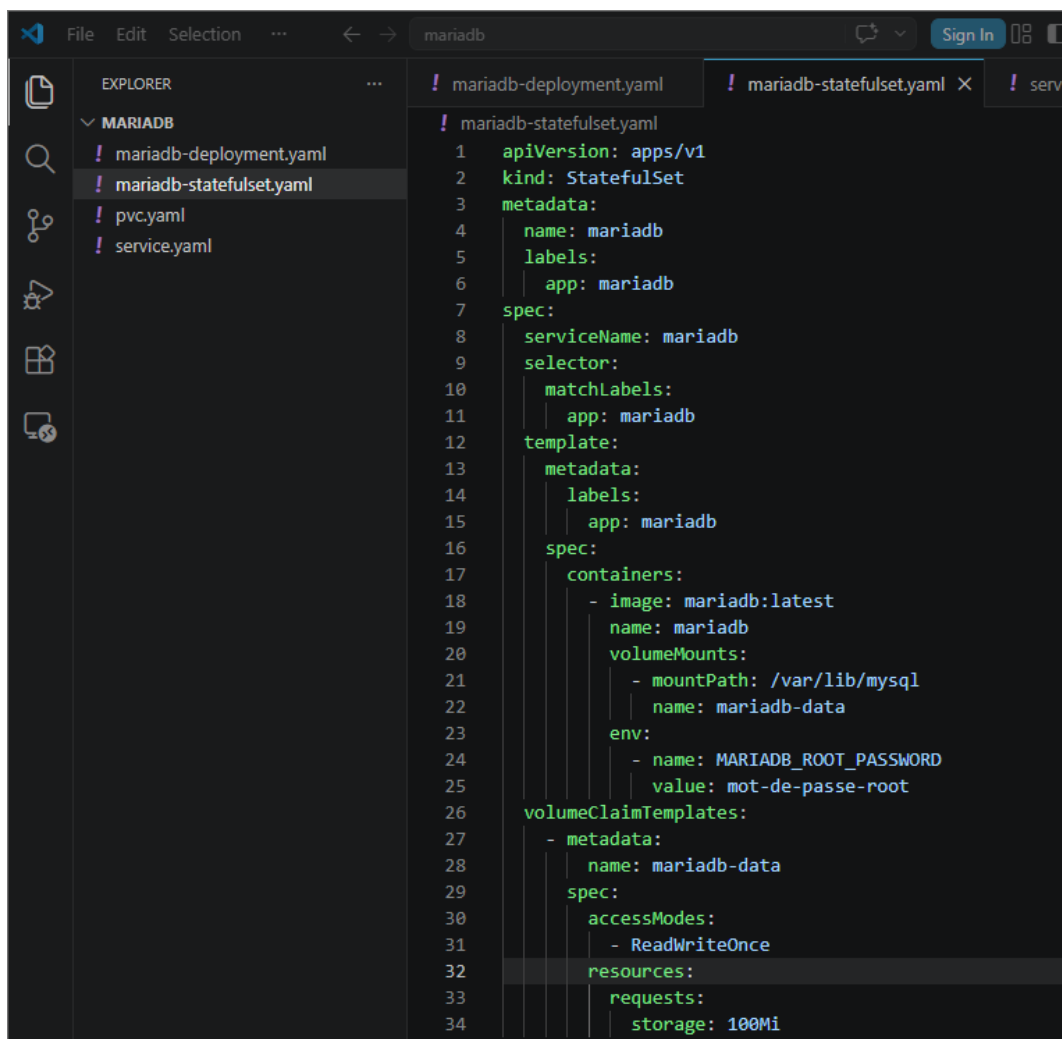
→ Même erreur avec le fichier sock :

```
Tolerations: node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
             node.kubernetes.io/unreachable:NoExecute op=Exists for 300s
Events:
  Type     Reason      Age      From      Message
  ----     -
  Normal   Scheduled   3m45s   default-scheduler   Successfully assigned default/mariadb-7865c7bbf8-pjnfq to minikube
  Normal   Pulled      3m44s   kubelet    Successfully pulled image "mariadb:latest" in 857ms (857ms including waiting). Image size: 335568219 bytes.
  Normal   Pulled      3m44s   kubelet    Successfully pulled image "mariadb:latest" in 819ms (819ms including waiting). Image size: 335568219 bytes.
  Normal   Pulled      2m44s   kubelet    Successfully pulled image "mariadb:latest" in 844ms (844ms including waiting). Image size: 335568219 bytes.
  Normal   Pulled      2m44s   kubelet    Successfully pulled image "mariadb:latest" in 836ms (836ms including waiting). Image size: 335568219 bytes.
  Normal   Pulling    104s (x5 over 3m45s) kubelet    Pulling image "mariadb:latest"
  Normal   Created    103s (x5 over 3m44s) kubelet    Container created
  Normal   Started    103s (x5 over 3m44s) kubelet    Container started
  Normal   Pulled     103s     kubelet    Successfully pulled image "mariadb:latest" in 873ms (873ms including waiting). Image size: 335568219 bytes.
  Normal   Killing    75s (x5 over 3m15s) kubelet    Container mariadb failed startup probe, will be restarted
  Warning  Unhealthy  75s (x13 over 3m35s) kubelet    Startup probe failed: mariadb-admin: connect to server at 'localhost' failed
error: 'Access denied for user 'root'@'localhost' (using password: NO)'
Warning  BackOff    65s (x3 over 74s) kubelet    Back-off restarting failed container mariadb in pod mariadb-7865c7bbf8-pjnfq_default(673f3e71-44af-432e-b5ca-49875b21f6fc)
Warning  Unhealthy  5s (x4 over 2m5s) kubelet    Startup probe failed: mariadb-admin: connect to server at 'localhost' failed
error: 'Can't connect to local server through socket '/run/mysqld/mysqld.sock' (2)'
check that mariadb is running and that the socket: '/run/mysqld/mysqld.sock' exists!
```

→ Suppression de déploiement mariaDB :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl delete deployment mariadb
deployment.apps "mariadb" deleted from default namespace
PS C:\WINDOWS\system32> kubectl get pods -l app=mariadb
No resources found in default namespace.
PS C:\WINDOWS\system32>
```

→ Création du fichier mariadb-statefulset.yaml :



The screenshot shows the Visual Studio Code editor with a file explorer on the left and a code editor on the right. The file explorer shows a folder named 'MARIADB' containing several files: 'mariadb-deployment.yaml', 'mariadb-statefulset.yaml', 'pvc.yaml', and 'service.yaml'. The code editor displays the content of 'mariadb-statefulset.yaml' with the following YAML configuration:

```
1  apiVersion: apps/v1
2  kind: StatefulSet
3  metadata:
4    name: mariadb
5    labels:
6      app: mariadb
7  spec:
8    serviceName: mariadb
9    selector:
10     matchLabels:
11       app: mariadb
12   template:
13     metadata:
14       labels:
15         app: mariadb
16     spec:
17       containers:
18         - image: mariadb:latest
19           name: mariadb
20           volumeMounts:
21             - mountPath: /var/lib/mysql
22               name: mariadb-data
23           env:
24             - name: MARIADB_ROOT_PASSWORD
25               value: mot-de-passe-root
26     volumeClaimTemplates:
27       - metadata:
28           name: mariadb-data
29         spec:
30           accessModes:
31             - ReadWriteOnce
32           resources:
33             requests:
34               storage: 100Mi
```

→ Applicatif du fichier :

```
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl apply -f mariadb-statefulset.yaml
statefulset.apps/mariadb created
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> █
```

→ Affichage du pod qui est fonctionnel :

```
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl apply -f mariadb-statefulset.yaml
statefulset.apps/mariadb created
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl get pods -l app=mariadb --watch
NAME          READY   STATUS    RESTARTS   AGE
mariadb-0     1/1    Running   0          75s
█
```

→ Affichage des volumes persistants :

```
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl get pvc
NAME          STATUS   VOLUME                                     CAPACITY   ACCESS MODES   STORAGECLASS   VOLUMEATTRIBUTESCLASS   AGE
mariadb-data Bound    pvc-93ac3a01-6f43-432e-80fb-29751de3425d  100Mi      RWO            standard      <unset>                 44m
mariadb-data-mariadb-0 Bound    pvc-d0f471a3-8cdd-40c5-8384-595ca3c90567  100Mi      RWO            standard      <unset>                 3m49s
task-pv-claim Bound    pv-nginx                                   10Mi       RWO            manual        <unset>                 19h
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> █
```

→ Scalabilité du statefulset :

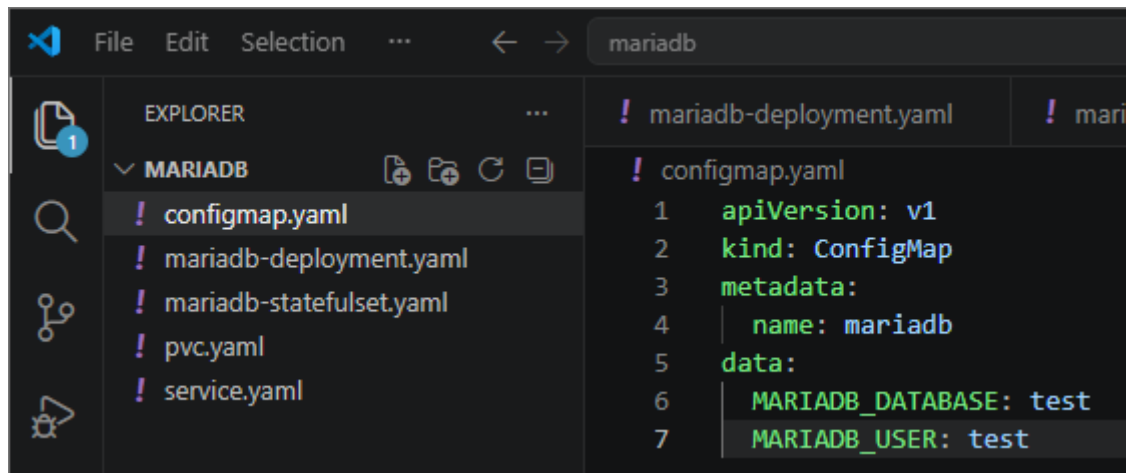
```
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl scale sts mariadb --replicas=2
statefulset.apps/mariadb scaled
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> █
```

→ Affichage des volumes et des pods :

```
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl get pvc -l app=mariadb
NAME          STATUS   VOLUME                                     CAPACITY   ACCESS MODES   STORAGECLASS   VOLUMEATTRIBUTESCLASS   AGE
mariadb-data-mariadb-0 Bound    pvc-d0f471a3-8cdd-40c5-8384-595ca3c90567  100Mi      RWO            standard      <unset>                 5m42s
mariadb-data-mariadb-1 Bound    pvc-02a67912-0ef0-4bc3-9fd2-db75856d7137  100Mi      RWO            standard      <unset>                 32s
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl get pods -l app=mariadb
NAME          READY   STATUS    RESTARTS   AGE
mariadb-0     1/1    Running   0          5m49s
mariadb-1     1/1    Running   0          39s
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl get pods,pvc -l app=mariadb
NAME          READY   STATUS    RESTARTS   AGE
pod/mariadb-0 1/1    Running   0          5m59s
pod/mariadb-1 1/1    Running   0          49s

NAME          STATUS   VOLUME                                     CAPACITY   ACCESS MODES   STORAGECLASS   VOLUMEATTRIBUTESCLASS   AGE
persistentvolumeclaim/mariadb-data-mariadb-0 Bound    pvc-d0f471a3-8cdd-40c5-8384-595ca3c90567  100Mi      RWO            standard      <unset>                 5m59s
persistentvolumeclaim/mariadb-data-mariadb-1 Bound    pvc-02a67912-0ef0-4bc3-9fd2-db75856d7137  100Mi      RWO            standard      <unset>                 49s
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> █
```

→ Création du fichier configmap.yaml :

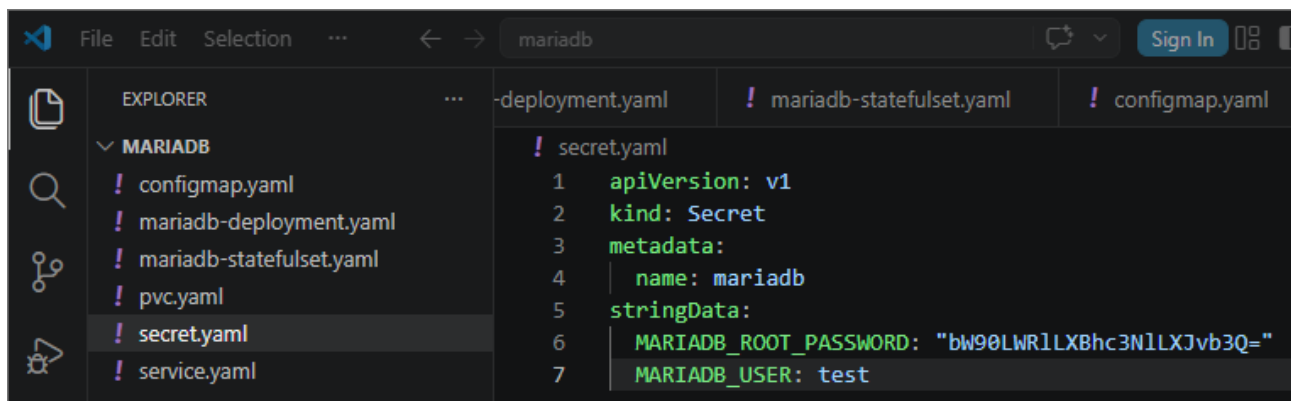


```
1  apiVersion: v1
2  kind: ConfigMap
3  metadata:
4    name: mariadb
5  data:
6    MARIADB_DATABASE: test
7    MARIADB_USER: test
```

→ Application du fichier :

```
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl apply -f configmap.yaml
configmap/mariadb created
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> 
```

→ Création du fichier secret.yaml :

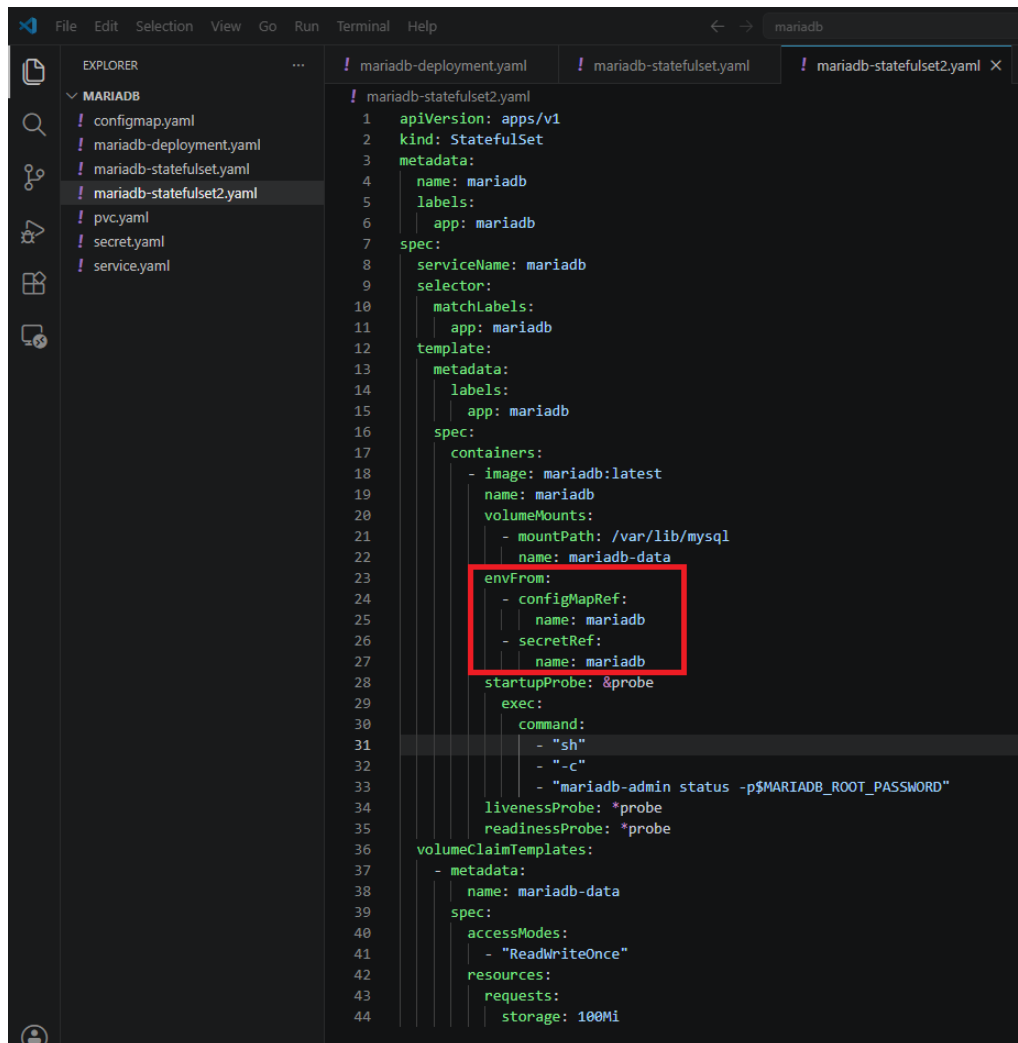


```
1  apiVersion: v1
2  kind: Secret
3  metadata:
4    name: mariadb
5  stringData:
6    MARIADB_ROOT_PASSWORD: "bw90LWR1LXBhc3N1LXJvb3Q="
7    MARIADB_USER: test
```

→ Application du fichier :

```
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl apply -f secret.yaml
secret/mariadb created
PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> 
```

→ Création d'un nouveau fichier statefulset avec la nouvelle variable envFrom :



```
1 apiVersion: apps/v1
2 kind: StatefulSet
3 metadata:
4   name: mariadb
5   labels:
6     app: mariadb
7 spec:
8   serviceName: mariadb
9   selector:
10    matchLabels:
11      app: mariadb
12   template:
13     metadata:
14       labels:
15         app: mariadb
16     spec:
17       containers:
18         - image: mariadb:latest
19           name: mariadb
20           volumeMounts:
21             - mountPath: /var/lib/mysql
22               name: mariadb-data
23           envFrom:
24             - configMapRef:
25                 name: mariadb
26             - secretRef:
27                 name: mariadb
28           startupProbe: &probe
29           exec:
30             command:
31               - "sh"
32               - "-c"
33               - "mariadb-admin status -p$MARIADB_ROOT_PASSWORD"
34           livenessProbe: *probe
35           readinessProbe: *probe
36     volumeClaimTemplates:
37       - metadata:
38           name: mariadb-data
39         spec:
40           accessModes:
41             - "ReadWriteOnce"
42           resources:
43             requests:
44               storage: 100Mi
```

→ Applicatif du fichier, la base est maintenant opérationnelle :

```
● PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> kubectl apply -f mariadb-statefulset2.yaml
statefulset.apps/mariadb configured
○ PS D:\2EME ANNEE\SISR\BOUCLY\FAIT CR A FAIRE\k8s\scripts\mariadb> []
```