

Conteneurs: Notions de base (Usage)

Cycle de vie, volumes, réseaux, ressources, bonnes pratiques

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1 Objectifs du cours

À l'issue de ce cours, vous devez être capables de :

- Manipuler des conteneurs Docker (run, stop, start, rm)
- Utiliser les volumes pour la persistance
- Connecter des conteneurs via des réseaux
- Exposer des ports vers l'hôte
- Gérer les ressources d'un conteneur (CPU / RAM / PIDs)
- Comprendre et appliquer les bonnes pratiques d'usage

2 Rappel rapide

Un **conteneur** est une instance d'une **image**. L'image est un artefact immuable (voir le cours «Image»). Le conteneur est un **processus isolé** qui tourne sur le noyau de l'hôte.

💡 Astuce

- **Image** = template immuable
- **Conteneur** = exécution d'un processus isolé

3 Les images

- Une image contient tout le nécessaire pour exécuter une application (code, runtime, bibliothèques, dépendances, fichiers de configuration).
- Chaque couche est en lecture seule, sauf la dernière (couche de conteneur).
- Les images sont stockées dans des registres (Docker Hub, GitHub Container Registry, etc.).
- Les images sont identifiées par un nom : `[registre/]nom[:tag]` (ex: `docker.io/library/nginx:1.23`).
 - Si le registre n'est pas spécifié, Docker Hub est utilisé par défaut.
 - Si le tag n'est pas spécifié, `latest` est utilisé par défaut.
 - Une image peut être référencée par son **digest** (SHA256).
 - Une image peut avoir plusieurs tags.
 - Ex:
`nginx:1`, `nginx:1.29`, `nginx:mainline`, `nginx:latest`, `nginx:f3524ef8b874` peuvent référencer la même image.
- Une image est destinée à une plateforme spécifique (architecture CPU, OS).
 - Ex: `linux/amd64`, `linux/arm64/v8`, `windows/amd64`.
 - Il est possible de créer des images multi-plateformes (multi-arch).

4 Cycle de vie d'un conteneur

Exécution simple

- La commande `docker run` crée et démarre un conteneur à partir d'une image.

- Le conteneur s'arrête lorsque le processus principal se termine (`--rm` pour supprimer automatiquement après).
- Le format général est `docker run [OPTIONS] IMAGE [COMMAND] [ARG...]`.
- Si l'image n'est pas présente localement, Docker la télécharge depuis le registre.

```
#| label: lst-run-alpine
#| title: "Premier conteneur Docker"
#| caption: "Exécution d'un conteneur Alpine jetable affichant un message"
#| code-fold: true
#| code-summary: "Afficher la commande Docker"
#| collapse: true
docker run --label ebpro-render=true
--rm alpine:3.18 echo "Hello"
```

```
Unable to find image 'alpine:3.18'
locally
```

```
3.18: Pulling from library/alpine
```

```
44cf07d57ee4: Pulling fs layer
```

```
44cf07d57ee4:
Downloading 48.51kB/3.418MB
```

```
44cf07d57ee4: Verifying Checksum
```

```
44cf07d57ee4: Download complete
```

```
44cf07d57ee4:
Extracting 65.54kB/3.418MB
```

```
44cf07d57ee4:
Extracting 2.294MB/3.418MB
```

```
44cf07d57ee4:
Extracting 3.418MB/3.418MB
```

```
44cf07d57ee4: Pull complete
```

```
Digest: sha256:de0eb0b3f2a47baleb89389859: 9989f7b33228: Waiting
Status: Downloaded newer image for
alpine:3.18
Hello
```

4.1 Conteneur en arrière-plan (--detach, -d)

- La commande `docker run -d` démarre un conteneur en arrière-plan (détaché --detach).

```
#| label: lst-run-nginx
#| title: "Conteneur Nginx en
arrière-plan"
#| caption: "Démarrage d'un conteneur
Nginx en arrière-plan"
docker rm -f my-nginx >/dev/null 2>&1
|| true
docker run --label ebpro-render=true
-d --name my-nginx nginx:1.23
```

```
Unable to find image 'nginx:1.23'
locally
1.23: Pulling from library/nginx
```

```
f03b40093957: Pulling fs layer
```

```
0972072e0e8a: Pulling fs layer
```

```
a85095acb896: Pulling fs layer
```

```
d24b987aa74e: Pulling fs layer
```

```
6c1a86118ade: Pulling fs layer
```

```
9989f7b33228: Pulling fs layer
```

```
6c1a86118ade: Waiting
```

```
d24b987aa74e: Waiting
```

```
a85095acb896:
```

```
Downloading 624B/624B
```

```
a85095acb896: Download complete
```

```
0972072e0e8a:
```

```
Downloading 261.5kB/25.58MB
```

```
f03b40093957:
```

```
Downloading 327kB/31.4MB
```

```
f03b40093957:
```

```
Downloading 6.225MB/31.4MB
```

```
0972072e0e8a:
```

```
Downloading 4.718MB/25.58MB
```

```
f03b40093957:
```

```
Downloading 11.47MB/31.4MB
```

```
0972072e0e8a:
```

```
Downloading 9.961MB/25.58MB
```

```
0972072e0e8a:
```

```
Downloading 15.2MB/25.58MB
```

```
f03b40093957:
```

```
Downloading 16.71MB/31.4MB
```

```
f03b40093957:
```

```
Downloading 21.95MB/31.4MB
```

```
0972072e0e8a:
```

```
Downloading 21.23MB/25.58MB
```

```
0972072e0e8a: Verifying Checksum
```

```
0972072e0e8a: Download complete
```

```
d24b987aa74e:
```

```
Downloading 958B/958B
```

d24b987aa74e: Verifying Checksum

d24b987aa74e: Download complete

f03b40093957:
Downloading 29.49MB/31.4MB

f03b40093957: Verifying Checksum

f03b40093957: Download complete

f03b40093957:
Extracting 327.7kB/31.4MB

6c1a86118ade:
Downloading 772B/772B

6c1a86118ade: Verifying Checksum

6c1a86118ade: Download complete

f03b40093957:
Extracting 2.949MB/31.4MB

9989f7b33228:
Downloading 1.405kB/1.405kB

9989f7b33228: Verifying Checksum

9989f7b33228: Download complete

f03b40093957:
Extracting 5.898MB/31.4MB

f03b40093957:
Extracting 7.537MB/31.4MB

f03b40093957:
Extracting 9.83MB/31.4MB

f03b40093957:
Extracting 12.45MB/31.4MB

f03b40093957:
Extracting 14.75MB/31.4MB

f03b40093957:
Extracting 16.38MB/31.4MB

f03b40093957:
Extracting 19.33MB/31.4MB

f03b40093957:
Extracting 22.28MB/31.4MB

f03b40093957:
Extracting 25.89MB/31.4MB

f03b40093957:
Extracting 28.18MB/31.4MB

f03b40093957:
Extracting 28.84MB/31.4MB

f03b40093957:
Extracting 29.82MB/31.4MB

f03b40093957:
Extracting 30.15MB/31.4MB

f03b40093957:
Extracting 30.47MB/31.4MB

f03b40093957:
Extracting 31.13MB/31.4MB

f03b40093957:
Extracting 31.4MB/31.4MB

f03b40093957: Pull complete

0972072e0e8a:
Extracting 262.1kB/25.58MB

0972072e0e8a:

```
Extracting 3.146MB/25.58MB
```

```
0972072e0e8a:
```

```
Extracting 6.816MB/25.58MB
```

```
0972072e0e8a:
```

```
Extracting 10.22MB/25.58MB
```

```
0972072e0e8a:
```

```
Extracting 13.89MB/25.58MB
```

```
0972072e0e8a:
```

```
Extracting 16.52MB/25.58MB
```

```
0972072e0e8a:
```

```
Extracting 19.4MB/25.58MB
```

```
0972072e0e8a:
```

```
Extracting 22.54MB/25.58MB
```

```
0972072e0e8a:
```

```
Extracting 23.59MB/25.58MB
```

```
0972072e0e8a:
```

```
Extracting 25.58MB/25.58MB
```

```
0972072e0e8a: Pull complete
```

```
a85095acb896: Extracting 624B/624B
```

```
a85095acb896: Extracting 624B/624B
```

```
a85095acb896: Pull complete
```

```
d24b987aa74e: Extracting 958B/958B
```

```
d24b987aa74e: Extracting 958B/958B
```

```
d24b987aa74e: Pull complete
```

```
6c1a86118ade: Extracting 772B/772B
```

```
6c1a86118ade: Extracting 772B/772B
```

```
6c1a86118ade: Pull complete
```

```
9989f7b33228:
```

```
Extracting 1.405kB/1.405kB
```

```
9989f7b33228:
```

```
Extracting 1.405kB/1.405kB
```

```
9989f7b33228: Pull complete
```

```
Digest: sha256:f5747a42e3adcb3168049d63278d7251d91185bb
```

```
Status: Downloaded newer image for  
nginx:1.23
```

```
6a909090386a0d1ca18909f5fdf032595776a1f0c9883095a954df1
```

4.2 Liste des conteneurs (container ls, ps)

- La commande `docker ps` (docker container ls) liste les conteneurs en cours d'exécution.
- L'option `-a` liste tous les conteneurs (y compris arrêtés).
- Chaque conteneur a un ID unique, un nom, un statut, des ports exposés, etc.

```
#| label: lst-docker-ps  
#| title: "Liste des conteneurs en  
cours d'exécution"  
#| caption: "Affichage des conteneurs  
Docker en cours d'exécution"  
docker ps
```

CONTAINER	ID	IMAGE
COMMAND		CREATED
STATUS		PORTS NAMES
6a909090386a		nginx:1.23
"/docker-entrypoint..."	3	seconds
ago Up Less than a second	80/tcp	
my-nginx		
e4fdfabd80cd		ghcr.io/ebpro/
solen:quarto-		
full-build-20261010T172146Z		"bash
-lc 'source /h..."	3 minutes ago	Up

```
3 minutes          quarto-  
render-38578918812
```

4.3 Arrêter (stop) / démarrer (start) / supprimer (rm)

- Le cycle de vie d'un conteneur inclut les états : démarré, arrêté, supprimé.
- Lorsqu'un conteneur est arrêté, il reste sur le système jusqu'à sa suppression (rm).

```
#| label: lst-stop-nginx  
docker stop my-nginx
```

```
my-nginx
```

```
#| label: lst-docker-ps-all  
docker ps -a
```

CONTAINER	ID	IMAGE	COMMAND	CREATED	STATUS	PORTS	NAMES
6a909090386a		nginx:1.23					
"/docker-entrypoint..." 4 seconds ago							
Exited (0) Less than a second ago							
my-nginx							
e4fdfabd80cd		ghcr.io/ebpro/solen:quarto-					
full-build-20261010T172146Z "bash -lc 'source /h..." 3 minutes ago							
Up 3 minutes							
quarto-render-38578918812							

```
#| label: lst-start-nginx  
docker start my-nginx
```

```
my-nginx
```

```
#| label: lst-rm-nginx  
docker stop my-nginx
```

```
my-nginx
```

```
#| label: lst-rm-nginx  
docker rm my-nginx
```

```
my-nginx
```

4.4 Exercice 1

Lancer un conteneur `alpine`, exécuter `uname -a`, puis le supprimer.

```
#| label: lst-run-alpine-uname  
docker rm -f my-alpine >/dev/null 2>&1 || true  
docker run --label ebpro-render=true --name my-alpine alpine:3.18 uname -a  
docker rm my-alpine
```

```
Linux 4e739d5d3aef 6.8.0-142-generic  
#142-Ubuntu SMP PREEMPT_DYNAMIC Wed Sep 2 14:24:27 UTC 2026 x86_64 Linux  
my-alpine
```

- L'option `--rm` peut être utilisée avec `docker run` pour supprimer automatiquement le conteneur après son arrêt.

5 Logs, exec et monitoring

- Les logs d'un conteneur sont accessibles via `docker logs`.
- L'option `-f` permet de suivre les logs en temps réel.

```
#| label: lst-run-nginx-logs
docker rm -f my-nginx >/dev/null 2>&1
|| true
docker run --label ebpro-render=true
--name my-nginx -d nginx:1.23
```

```
3e954ddb67d695efd963d135520c3c651dfb12042
```

```
#| label: lst-docker-logs
docker logs my-nginx
# docker logs -f my-nginx
```

```
/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: 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
2026/10/14 14:46:20 [notice] 1#1:
using the "epoll" event method
2026/10/14 14:46:20 [notice] 1#1:
nginx/1.23.4
2026/10/14 14:46:20 [notice] 1#1:
built by gcc 10.2.1 20210110 (Debian
```

```
10.2.1-6)
2026/10/14 14:46:20 [notice] 1#1: OS:
Linux 6.8.0-142-generic
2026/10/14 14:46:20 [notice]
1#1: getrlimit(RLIMIT_NOFILE):
1048576:1048576
2026/10/14 14:46:20 [notice] 1#1:
start worker processes
2026/10/14 14:46:20 [notice] 1#1:
start worker process 29
2026/10/14 14:46:20 [notice] 1#1:
start worker process 30
2026/10/14 14:46:20 [notice] 1#1:
start worker process 31
2026/10/14 14:46:20 [notice] 1#1:
start worker process 32
2026/10/14 14:46:20 [notice] 1#1:
start worker process 33
2026/10/14 14:46:20 [notice] 1#1:
start worker process 34
2026/10/14 14:46:20 [notice] 1#1:
start worker process 35
2026/10/14 14:46:20 [notice] 1#1:
start worker process 36
2026/10/14 14:46:20 [notice] 1#1:
start worker process 37
2026/10/14 14:46:20 [notice] 1#1:
start worker process 38
2026/10/14 14:46:20 [notice] 1#1:
start worker process 39
2026/10/14 14:46:20 [notice] 1#1:
start worker process 40
2026/10/14 14:46:20 [notice] 1#1:
start worker process 41
2026/10/14 14:46:20 [notice] 1#1:
start worker process 42
2026/10/14 14:46:20 [notice] 1#1:
start worker process 43
2026/10/14 14:46:20 [notice] 1#1:
start worker process 44
2026/10/14 14:46:20 [notice] 1#1:
start worker process 45
2026/10/14 14:46:20 [notice] 1#1:
```

```

start worker process 46
2026/10/14 14:46:20 [notice] 1#1:
start worker process 47
2026/10/14 14:46:20 [notice] 1#1:
start worker process 48
2026/10/14 14:46:20 [notice] 1#1:
start worker process 49
2026/10/14 14:46:20 [notice] 1#1:
start worker process 50
2026/10/14 14:46:20 [notice] 1#1:
start worker process 51
2026/10/14 14:46:20 [notice] 1#1:
start worker process 52
2026/10/14 14:46:20 [notice] 1#1:
start worker process 53
2026/10/14 14:46:20 [notice] 1#1:
start worker process 54
2026/10/14 14:46:20 [notice] 1#1:
start worker process 55
2026/10/14 14:46:20 [notice] 1#1:
start worker process 56
2026/10/14 14:46:20 [notice] 1#1:
start worker process 57
2026/10/14 14:46:20 [notice] 1#1:
start worker process 58
2026/10/14 14:46:20 [notice] 1#1:
start worker process 59
2026/10/14 14:46:20 [notice] 1#1:
start worker process 60

```

5.1 Exécuter une commande dans un conteneur en cours

- La commande `docker exec` permet d'exécuter des commandes dans un conteneur en cours d'exécution.
- Lance un nouveau processus dans le conteneur
 - `docker exec container <cmd>` → non interactif
 - `docker exec -it container sh` → interactif (ou un autre shell ou programme interactif)

```

#| label: lst-run-nginx-exec
docker exec my-nginx ls /usr/share/nginx/html

```

```

50x.html
index.html

```

```

#| label: lst-run-nginx-exec-interactive
docker stop my-nginx
docker rm my-nginx

```

```

my-nginx
my-nginx

```

5.2 Monitoring

- La commande `docker stats` affiche l'utilisation des ressources (CPU, mémoire, réseau, disques) des conteneurs en cours d'exécution.
- L'option `--no-stream` affiche une seule fois les statistiques.

```

#| label: lst-docker-stats
docker stats --no-stream

```

CONTAINER	ID	NAME
CPU %	MEM USAGE / LIMIT	MEM %
NET I/O	BLOCK I/O	PIDS
e4fdfabd80cd		quarto-render-38578918812
811.1MiB / 62.66GiB		0.08%
16.6kB / 4.52kB	989MB / 57.8MB	57

6 Réseau

- Chaque conteneur a une interface réseau virtuelle et une adresse IP.
- Par défaut, les conteneurs sont connectés à un réseau bridge par défaut.

- Il est possible de créer des réseaux custom pour isoler les conteneurs.
- Les conteneurs sur le même réseau custom peuvent communiquer entre eux par **nom** (DNS interne).

6.1 Réseau par défaut (bridge)

- Par défaut, Docker crée un réseau bridge nommé `bridge`.

```
#| label: lst-docker-network-ls
docker rm -f c1 >/dev/null 2>&1 || true
docker run --label ebpro-render=true -d --name c1 alpine:3.18 sleep 3600
docker rm -f c2 >/dev/null 2>&1 || true
docker run --label ebpro-render=true -d --name c2 alpine:3.18 sleep 3600
```

```
17b1ee3ffca48a7f37d33ceb470f066b83a6cfb863ef6c047931d587a8518a61
c6c61ce087c66b7b4b2be76792caalbde2d07ff7de9631b55bf818d2a401c3f9
```

- Les conteneurs ont une adresse IP dans le réseau bridge par défaut.
 - La commande `docker inspect` permet de voir les détails d'un conteneur et permet de définir un format personnalisé (ici l'adresse IP).

```
#| label: lst-docker-inspect-ip
# Robustesse du rendu : si un conteneur est absent (échec transitoire de `docker run`), # on le recrée avant l'inspect pour ne pas faire échouer tout le rendu.
for c in c1 c2; do
  docker inspect "$c" >/dev/null 2>&1 || \
    docker run --label ebpro-render=true -d --name "$c" alpine:3.18 sleep 3600
done
```

```
docker inspect -f '{{.Name}} - {{range .NetworkSettings.Networks}}{{.IPAddress}}{{end}}' c1 c2
```

```
/c1 - 172.17.0.3
/c2 - 172.17.0.4
```

✗ Sur le réseau bridge par défaut :

- les conteneurs **n'ont pas de DNS interne**
- ils ne peuvent pas se résoudre par nom

```
#| label: lst-docker-ping-fail
docker exec c1 ping -c 1 c2
```

```
ping: bad address 'c2'
```

```
: 1
```

6.2 Réseau custom (bonne pratique)

- Créer un réseau custom avec `docker network create`.
- Lancer des conteneurs (un serveur web, une base de données) sur ce réseau avec `--network`.

```
#| label: lst-docker-network-create
docker network inspect app-net >/dev/null 2>&1 || docker network create app-net
```

```
docker rm -f web >/dev/null 2>&1 || true
docker run --label ebpro-render=true --detach --name web \
  --network app-net \
  nginx:1.23
```

```
# Robustesse du rendu : on attend que le conteneur web soit réellement en
```

```

cours
# d'exécution (limite 30 s) avant les
tests DNS/HTTP suivants, pour éviter
les
# échecs transitoires de résolution
(`curl: (6) Could not resolve host:
web`).
timeout 30 sh -c 'until [ "$(docker
inspect -f "{{.State.Running}}" web
2>/dev/null)" = "true" ]; do sleep
1; done'

docker rm -f db >/dev/null 2>&1 ||
true
docker run --label ebpro-render=true
--detach --name db \
--network app-net \
redis:7.0.9

```

```

e49605af90cc0940c7c233b2545285d057d8240a6
38f4b1c7c8ec7f5f133c1f4d70b50ea9994e0e780
Unable to find image 'redis:7.0.9'
locally
7.0.9: Pulling from library/redis

```

```

3f9582a2cbe7: Pulling fs layer
241c2d338588: Pulling fs layer
89515d93a23e: Pulling fs layer
65e8ba9473fe: Pulling fs layer
585124038cab: Pulling fs layer
b483de716a47: Pulling fs layer
65e8ba9473fe: Waiting
585124038cab: Waiting

```

```

b483de716a47: Waiting
89515d93a23e:
Downloading 16.38kB/1.463MB
241c2d338588:
Downloading 1.732kB/1.732kB
241c2d338588: Verifying Checksum
241c2d338588: Download complete
3f9582a2cbe7:
Downloading 324.8kB/31.41MB
89515d93a23e: Verifying Checksum
89515d93a23e: Download complete
3f9582a2cbe7:
Downloading 6.503MB/31.41MB
3f9582a2cbe7:
Downloading 12.65MB/31.41MB
65e8ba9473fe:
Downloading 96.73kB/9.579MB
3f9582a2cbe7:
Downloading 19.76MB/31.41MB
585124038cab:
Downloading 133B/133B
585124038cab: Download complete
65e8ba9473fe:
Downloading 5.023MB/9.579MB
3f9582a2cbe7:
Downloading 25.58MB/31.41MB
65e8ba9473fe: Verifying Checksum

```

65e8ba9473fe: Download complete

3f9582a2cbe7:

Downloading 31.41MB/31.41MB

3f9582a2cbe7: Download complete

3f9582a2cbe7:

Extracting 327.7kB/31.41MB

b483de716a47:

Downloading 574B/574B

b483de716a47: Verifying Checksum

b483de716a47: Download complete

3f9582a2cbe7:

Extracting 2.949MB/31.41MB

3f9582a2cbe7:

Extracting 5.243MB/31.41MB

3f9582a2cbe7:

Extracting 6.554MB/31.41MB

3f9582a2cbe7:

Extracting 8.52MB/31.41MB

3f9582a2cbe7:

Extracting 10.81MB/31.41MB

3f9582a2cbe7:

Extracting 12.78MB/31.41MB

3f9582a2cbe7:

Extracting 14.42MB/31.41MB

3f9582a2cbe7:

Extracting 16.06MB/31.41MB

3f9582a2cbe7:

Extracting 17.69MB/31.41MB

3f9582a2cbe7:

Extracting 20.64MB/31.41MB

3f9582a2cbe7:

Extracting 24.58MB/31.41MB

3f9582a2cbe7:

Extracting 25.56MB/31.41MB

3f9582a2cbe7:

Extracting 28.18MB/31.41MB

3f9582a2cbe7:

Extracting 28.84MB/31.41MB

3f9582a2cbe7:

Extracting 29.82MB/31.41MB

3f9582a2cbe7:

Extracting 30.15MB/31.41MB

3f9582a2cbe7:

Extracting 30.47MB/31.41MB

3f9582a2cbe7:

Extracting 31.13MB/31.41MB

3f9582a2cbe7:

Extracting 31.41MB/31.41MB

3f9582a2cbe7: Pull complete

241c2d338588:

Extracting 1.732kB/1.732kB

241c2d338588:

Extracting 1.732kB/1.732kB

241c2d338588: Pull complete

89515d93a23e:

```
Extracting 32.77kB/1.463MB
```

```
89515d93a23e:
```

```
Extracting 327.7kB/1.463MB
```

```
89515d93a23e:
```

```
Extracting 884.7kB/1.463MB
```

```
89515d93a23e:
```

```
Extracting 1.463MB/1.463MB
```

```
89515d93a23e:
```

```
Extracting 1.463MB/1.463MB
```

```
89515d93a23e: Pull complete
```

```
65e8ba9473fe:
```

```
Extracting 98.3kB/9.579MB
```

```
65e8ba9473fe:
```

```
Extracting 1.868MB/9.579MB
```

```
65e8ba9473fe:
```

```
Extracting 3.932MB/9.579MB
```

```
65e8ba9473fe:
```

```
Extracting 6.586MB/9.579MB
```

```
65e8ba9473fe:
```

```
Extracting 8.847MB/9.579MB
```

```
65e8ba9473fe:
```

```
Extracting 9.579MB/9.579MB
```

```
65e8ba9473fe: Pull complete
```

```
585124038cab: Extracting 133B/133B
```

```
585124038cab: Extracting 133B/133B
```

```
585124038cab: Pull complete
```

```
b483de716a47: Extracting 574B/574B
```

```
b483de716a47: Extracting 574B/574B
```

```
b483de716a47: Pull complete
```

```
Digest: sha256:e50c7e23f79ae81351beacb20e004720d4bed657
```

```
Status: Downloaded newer image for  
redis:7.0.9
```

```
256f4e28c4e8f857d9aaa0660712e1d21ff8ad0051b3b1a27ef28e0
```

6.3 Vérifier le réseau (Avancé)

```
#| label: lst-docker-network-inspect  
docker network inspect app-net
```

```
[  
  {  
    "Name": "app-net",  
    "Id": "e49605af90cc0940c7c233b2545285d057d8240a615",  
    "Created":  
      "2026-10-14T14:46:51.563853479Z",  
    "Scope": "local",  
    "Driver": "bridge",  
    "EnableIPv4": true,  
    "EnableIPv6": false,  
    "IPAM": {  
      "Driver": "default",  
      "Options": {},  
      "Config": [  
        {  
          "Subnet":  
            "172.18.0.0/16",  
          "Gateway": "172.18.0.1"  
        }  
      ]  
    },  
    "Internal": false,  
    "Attachable": false,  
    "Ingress": false,  
    "ConfigFrom": {  
      "Network": ""  
    },  
    "ConfigOnly": false,  
    "Containers": {
```

```

    "256f4e28c4e8f857d9aaa0660712e1d2"
  {
    "Name": "db",
    "EndpointID": "dad161c918d7d509",
    "MacAddress":
    "e6:67:1f:9b:7c:67",
    "IPv4Address":
    "172.18.0.3/16",
    "IPv6Address": ""
  },
  "38f4b1c7c8ec7f5f133c1f4d70b50ea9"
  {
    "Name": "web",
    "EndpointID": "6170c89f53eab395",
    "MacAddress":
    "ca:09:07:e6:e9:c1",
    "IPv4Address":
    "172.18.0.2/16",
    "IPv6Address": ""
  }
},
"Options": {},
"Labels": {}
}
]

```

```
ea634e3b33ec: Pulling fs layer
55bfd993f83a: Pulling fs layer
df0b84b7230e: Pulling fs layer
8d68097e7e08: Pulling fs layer
4c26da78c210: Pulling fs layer
659101a913e8: Pulling fs layer
473ceed980f8: Pulling fs layer
df0b84b7230e: Waiting
b0calde0cc3e: Pulling fs layer
8d68097e7e08: Waiting
45477c99a790: Pulling fs layer
4c26da78c210: Waiting
d4c655b444ee: Pulling fs layer
659101a913e8: Waiting
473ceed980f8: Waiting
b0calde0cc3e: Waiting
d4c655b444ee: Waiting
45477c99a790: Waiting
ea634e3b33ec:
Downloading 49.15kB/4.396MB
55bfd993f83a:
Downloading 16.38kB/608.7kB
```

6.4 Communication conteneur → conteneur

```
#| label: lst-docker-ping-success
docker run --label ebpro-render=true
--rm --network app-net curlimages/
curl:7.88.1 \
    --retry 5 --retry-connrefused --
retry-delay 1 http://web
```

```
Unable to find image 'curlimages/
curl:7.88.1' locally
7.88.1: Pulling from curlimages/curl

213ec9aee27d: Pulling fs layer
```

213ec9aee27d:
Downloading 32.17kB/2.806MB

213ec9aee27d: Verifying Checksum

ea634e3b33ec: Verifying Checksum

213ec9aee27d: Download complete

ea634e3b33ec: Download complete

213ec9aee27d:
Extracting 32.77kB/2.806MB

213ec9aee27d:
Extracting 2.228MB/2.806MB

213ec9aee27d:
Extracting 2.806MB/2.806MB

55bfd993f83a:
Downloading 437.9kB/608.7kB

55bfd993f83a: Verifying Checksum

55bfd993f83a: Download complete

213ec9aee27d: Pull complete

ea634e3b33ec:
Extracting 65.54kB/4.396MB

df0b84b7230e:
Downloading 1.265kB/1.265kB

df0b84b7230e: Verifying Checksum

df0b84b7230e: Download complete

8d68097e7e08:
Downloading 16.38kB/123.2kB

8d68097e7e08:

Downloading 123.2kB/123.2kB

8d68097e7e08: Verifying Checksum

8d68097e7e08: Download complete

ea634e3b33ec:
Extracting 2.032MB/4.396MB

ea634e3b33ec:
Extracting 4.396MB/4.396MB

ea634e3b33ec: Pull complete

4c26da78c210:
Downloading 15.74kB/347.4kB

55bfd993f83a:
Extracting 32.77kB/608.7kB

4c26da78c210:
Downloading 347.4kB/347.4kB

4c26da78c210: Download complete

55bfd993f83a:
Extracting 608.7kB/608.7kB

55bfd993f83a:
Extracting 608.7kB/608.7kB

659101a913e8:
Downloading 16.38kB/162.4kB

55bfd993f83a: Pull complete

659101a913e8: Verifying Checksum

659101a913e8: Download complete

473ceed980f8:
Downloading 16.38kB/52.34kB

473ceed980f8: Download complete

df0b84b7230e:

Extracting 1.265kB/1.265kB

df0b84b7230e:

Extracting 1.265kB/1.265kB

df0b84b7230e: Pull complete

8d68097e7e08:

Extracting 32.77kB/123.2kB

8d68097e7e08:

Extracting 123.2kB/123.2kB

b0calde0cc3e:

Downloading 161B/161B

b0calde0cc3e: Verifying Checksum

b0calde0cc3e: Download complete

8d68097e7e08: Pull complete

4c26da78c210:

Extracting 32.77kB/347.4kB

4c26da78c210:

Extracting 347.4kB/347.4kB

4c26da78c210:

Extracting 347.4kB/347.4kB

45477c99a790:

Downloading 159B/159B

45477c99a790: Verifying Checksum

45477c99a790: Download complete

d4c655b444ee:

Downloading 291B/291B

d4c655b444ee: Verifying Checksum

d4c655b444ee: Download complete

4c26da78c210: Pull complete

659101a913e8:

Extracting 32.77kB/162.4kB

659101a913e8:

Extracting 162.4kB/162.4kB

659101a913e8:

Extracting 162.4kB/162.4kB

659101a913e8: Pull complete

473ceed980f8:

Extracting 32.77kB/52.34kB

473ceed980f8:

Extracting 52.34kB/52.34kB

473ceed980f8: Pull complete

b0calde0cc3e: Extracting 161B/161B

b0calde0cc3e: Extracting 161B/161B

b0calde0cc3e: Pull complete

45477c99a790: Extracting 159B/159B

45477c99a790: Extracting 159B/159B

45477c99a790: Pull complete

d4c655b444ee: Extracting 291B/291B

d4c655b444ee: Extracting 291B/291B

d4c655b444ee: Pull complete

```

Digest: sha256:48318407b8d98e8c7d5bd4741c88e8e1a5442de660b47f63ba656e5c910bc3da
Status: Downloaded newer image for
curlimages/curl:7.88.1
  % Total    % Received % Xferd  Average
Speed      Time      Time      Time Current
           Upload    Total    Spent    Left  Speed

  0      0    0     0    0     0     0      0
0  ---:--:--  ---:--:--  ---:--:--      0
100    615  100    615    0     0  79201
0 <!DOCTYPE html>
<html>
<head>
<title>Welcome to nginx!</title>
<style>
html { color-scheme: light dark; }
body { width: 35em; margin: 0 auto;
font-family: Tahoma, Verdana, Arial,
sans-serif; }
</style>
</head>
<body>
<h1>Welcome to nginx!</h1>
<p>If you see this page, the nginx web
server is successfully installed and
working. Further configuration is
required.</p>

<p>For online documentation and
support please refer to
<a
          href="http://nginx.
org/">nginx.org</a>.<br/>
Commercial support is available at
<a
          href="http://nginx.
com/">nginx.com</a>.</p>

<p><em>Thank you for using nginx.</
em></p>
</body>
</html>
---:--:--  ---:--:--  ---:--:--  87857

```

6.5 Exercice 2 (Max 10 min)

Créer un réseau `mynet`, lancer deux conte-
neurs `alpine` nommés `a1` et `a2` sur ce
réseau, puis vérifier qu'ils se ping par nom
**en exécutant une commande dans un
conteneur en mode non-interactif.**

7 Port mapping

- Chaque conteneur a son propre espace ré-
seau isolé.
- Ils peuvent donc utiliser les mêmes ports en
interne sans conflit.
 - Ex: plusieurs conteneurs postgres peuvent
écouter sur **leur** port 5432.
- Pour exposer un service d'un conteneur vers
l'hôte, utiliser `--publish hôte:conteneur`.
- Cela mappe un port de l'hôte vers un port du
conteneur.
 - Ex: `--publish 8080:80` mappe le port
8080 de l'hôte vers le port 80 du conteneur.
 - Attention aux conflits de ports sur l'hôte.
 - Attention si docker tourne dans une VM
(WSL, Docker Desktop): le port est exposé
sur la VM, pas directement sur l'hôte.
 - Le port mapping est une règle de NAT
entre l'hôte et le réseau bridge Docker.

```

#| label: lst-docker-port-mapping
docker rm -f web-port-1 >/dev/null
2>&1 || true
docker run --label ebpro-render=true
--detach --name web-port-1 --publish
8080:80 nginx:1.28

docker rm -f web-port-2 >/dev/null
2>&1 || true
docker run --label ebpro-render=true
--detach --name web-port-2 --publish
8081:80 nginx:1.23

```

Unable to find image 'nginx:1.28'
locally

1.28: Pulling from library/nginx

5435b2dcdf5c: Pulling fs layer

6a7080264fc9: Pulling fs layer

f176d5d8a1c1: Pulling fs layer

63ef37274310: Pulling fs layer

4744f2344932: Pulling fs layer

39a24e95a1e9: Pulling fs layer

400f8ac367e0: Pulling fs layer

63ef37274310: Waiting

4744f2344932: Waiting

39a24e95a1e9: Waiting

400f8ac367e0: Waiting

f176d5d8a1c1:
Downloading 627B/627B

f176d5d8a1c1: Verifying Checksum

f176d5d8a1c1: Download complete

5435b2dcdf5c:
Downloading 310.6kB/29.78MB

6a7080264fc9:
Downloading 344.1kB/33.11MB

5435b2dcdf5c:
Downloading 6.537MB/29.78MB

6a7080264fc9:
Downloading 4.794MB/33.11MB

5435b2dcdf5c:
Downloading 13.7MB/29.78MB

6a7080264fc9:
Downloading 8.883MB/33.11MB

63ef37274310: Verifying Checksum

5435b2dcdf5c:
Downloading 20.86MB/29.78MB

6a7080264fc9:
Downloading 12.94MB/33.11MB

5435b2dcdf5c:
Downloading 28.33MB/29.78MB

6a7080264fc9:
Downloading 17.04MB/33.11MB

5435b2dcdf5c: Verifying Checksum

5435b2dcdf5c: Download complete

5435b2dcdf5c:
Extracting 327.7kB/29.78MB

6a7080264fc9:
Downloading 25.2MB/33.11MB

5435b2dcdf5c:
Extracting 3.277MB/29.78MB

4744f2344932:
Downloading 402B/402B

4744f2344932: Download complete

6a7080264fc9: Verifying Checksum

6a7080264fc9: Download complete

5435b2dcdf5c:

Extracting 6.554MB/29.78MB

39a24e95a1e9:

Downloading 1.208kB/1.208kB

39a24e95a1e9: Verifying Checksum

39a24e95a1e9: Download complete

5435b2dcdf5c:

Extracting 9.503MB/29.78MB

400f8ac367e0:

Downloading 1.397kB/1.397kB

400f8ac367e0: Verifying Checksum

400f8ac367e0: Download complete

5435b2dcdf5c:

Extracting 10.81MB/29.78MB

5435b2dcdf5c:

Extracting 12.78MB/29.78MB

5435b2dcdf5c:

Extracting 16.38MB/29.78MB

5435b2dcdf5c:

Extracting 19.66MB/29.78MB

5435b2dcdf5c:

Extracting 22.94MB/29.78MB

5435b2dcdf5c:

Extracting 25.56MB/29.78MB

5435b2dcdf5c:

Extracting 26.21MB/29.78MB

5435b2dcdf5c:

Extracting 28.18MB/29.78MB

5435b2dcdf5c:

Extracting 28.84MB/29.78MB

5435b2dcdf5c:

Extracting 29.16MB/29.78MB

5435b2dcdf5c:

Extracting 29.78MB/29.78MB

5435b2dcdf5c: Pull complete

6a7080264fc9:

Extracting 360.4kB/33.11MB

6a7080264fc9:

Extracting 3.244MB/33.11MB

6a7080264fc9:

Extracting 6.488MB/33.11MB

6a7080264fc9:

Extracting 9.372MB/33.11MB

6a7080264fc9:

Extracting 12.98MB/33.11MB

6a7080264fc9:

Extracting 14.78MB/33.11MB

6a7080264fc9:

Extracting 18.38MB/33.11MB

6a7080264fc9:

Extracting 21.63MB/33.11MB

6a7080264fc9:

Extracting 24.51MB/33.11MB

6a7080264fc9:

Extracting 27.75MB/33.11MB

```
6a7080264fc9:
Extracting 30.28MB/33.11MB
```

```
6a7080264fc9:
Extracting 30.64MB/33.11MB
```

```
6a7080264fc9:
Extracting 32.8MB/33.11MB
```

```
6a7080264fc9:
Extracting 33.11MB/33.11MB
```

```
6a7080264fc9: Pull complete
```

```
f176d5d8a1c1: Extracting 627B/627B
```

```
f176d5d8a1c1: Extracting 627B/627B
```

```
f176d5d8a1c1: Pull complete
```

```
63ef37274310: Extracting 955B/955B
```

```
63ef37274310: Extracting 955B/955B
```

```
63ef37274310: Pull complete
```

```
4744f2344932: Extracting 402B/402B
```

```
4744f2344932: Extracting 402B/402B
```

```
4744f2344932: Pull complete
```

```
39a24e95a1e9:
Extracting 1.208kB/1.208kB
```

```
39a24e95a1e9:
Extracting 1.208kB/1.208kB
```

```
39a24e95a1e9: Pull complete
```

```
400f8ac367e0:
Extracting 1.397kB/1.397kB
```

```
400f8ac367e0:
Extracting 1.397kB/1.397kB
```

```
400f8ac367e0: Pull complete
Digest: sha256:146adea4768b83c607d0bdfa4188464e3da6e0a3
Status: Downloaded newer image for
nginx:1.28
ecf3bb3ad64a574a6a8b511a03a670620a26b1c04a231c90d2261e2
753b9b811ca0f1f2f5d3e22bf39127726ca0a27c12d754e6df8772a
```

7.1 Tester depuis l'hôte

- Il est possible de tester l'accès au service exposé depuis l'hôte avec `curl` ou un navigateur.
- Avec l'adresse `http://localhost:8080` si Docker est natif.
- Avec l'adresse IP de la VM si Docker tourne dans une VM (ex: WSL, Docker Desktop).
- A moins que Docker soit configuré pour exposer les ports vers l'hôte directement.

```
curl --max-time 30 -I http://
localhost:8080
```

```
curl --max-time 30 -I http://
localhost:8081
```

```
#| label: lst-docker-port-mapping-
curl
curl --max-time 30 -I http://dind:
8080
```

```
curl --max-time 30 -I http://dind:
8081
```

```
HTTP/1.1 200 OK
Server: nginx/1.28.3
Date: Wed, 14 Oct 2026 14:47:25 GMT
Content-Type: text/html
Content-Length: 615
```

```
Last-Modified: Tue, 24 Mar 2026
18:33:23 GMT
Connection: keep-alive
ETag: "69c2d8f3-267"
Accept-Ranges: bytes

HTTP/1.1 200 OK
Server: nginx/1.23.4
Date: Wed, 14 Oct 2026 14:47:26 GMT
Content-Type: text/html
Content-Length: 615
Last-Modified: Tue, 28 Mar 2023
15:01:54 GMT
Connection: keep-alive
ETag: "64230162-267"
Accept-Ranges: bytes
```

7.2 Accès conteneur -> hôte

- Il est possible d'accéder à un service exposé sur l'hôte depuis un conteneur.
- Utiliser `host.docker.internal` comme nom d'hôte.
- ATTENTION : `host.docker.internal` fonctionne nativement sur Docker Desktop (Windows/Mac) et Docker sous Linux (depuis Docker 20.10) mais n'est standardisé que sur Docker Desktop.

```
docker run --label ebpro-render=true
--rm \
    curlimages/curl:7.88.1 http://
host.docker.internal:8080
```

8 Volumes : persistance

- Les données dans un conteneur sont éphémères : elles disparaissent à l'arrêt/suppression du conteneur.
- Pour persister les données, utiliser des volumes.
- Un volume est un espace de stockage géré par Docker, indépendant du cycle de vie des conteneurs.

- Les volumes peuvent être montés dans un conteneur avec `--volume volume:chemin_dans_conteneur`.
- Il existe deux types de volumes :
 - **Bind mount** : mappe un répertoire de l'hôte vers un répertoire du conteneur.
 - **Volume nommé** : volume géré par Docker, stocké dans l'espace de stockage Docker.

💡 Astuce

- bind mount = couplage fort hôte ↔ conteneur
- volume nommé = abstraction portable

8.1 Bind mount (risky, dev)

- montage avec `--volume /chemin/host:/chemin/conteneur`

```
#| output: true
#| echo: true

#| label: lst-bind-mount-nginx
echo "hello" > ${TP_DIR}/www/
index.html

docker run --label ebpro-render=true
--rm -v ${TP_DIR}/www:/usr/share/
nginx/html \
    -p :80 nginx:1.23
```

- Utile en développement pour monter du code source.
- Permet d'éditer les fichiers sur l'hôte et de les voir dans le conteneur.
- Dangers :
 - les permissions peuvent poser problème selon l'OS hôte
 - les performances peuvent être dégradées (ex: Docker Desktop sur Windows/Mac)

- le conteneur ne peut pas être déplacé facilement (dépendance à l'hôte)

mais conserver le volume
docker stop db && docker rm db

8.2 Volume nommé (better, prod)

- montage avec --volume nom_volume:chemin/conteneur

```
#| label: lst-named-volume-postgres
IMAGE="postgres:15.2"
VOLUME="pgdata"
PW="secret"
```

```
docker volume create "$VOLUME"
```

```
# Initialisation de la base et
création d'une table
docker rm -f db >/dev/null 2>&1 ||
true
docker run --label ebro-render=true
-d --name db \
-v "$VOLUME":/var/lib/postgresql/
data \
-e POSTGRES_PASSWORD="$PW" \
"$IMAGE"
```

```
# Attendre que la base soit prête
timeout 60 sh -c 'until docker exec
db pg_isready -U postgres >/dev/null
2>&1; do echo -n '.'; sleep 1; done'
|| (echo "Postgres not ready after
60s" >&2; exit 1)
```

```
# Créer une table et insérer des
données depuis le conteneur de la base
docker exec db psql -U postgres -c
"CREATE TABLE test (id SERIAL PRIMARY
KEY, name VARCHAR(50));"
docker exec db psql -U postgres -c
"INSERT INTO test (name) VALUES
('Alice'), ('Bob');"
```

```
# Arrêter et supprimer le conteneur
```

```
pgdata
9aa0cedc8813dfba5e0658e92aaede5aa93244551634b7bc5634ea2
..
CREATE TABLE
INSERT 0 2
db
db
```

```
#| label: lst-verify-named-volume
# Redémarrer un nouveau conteneur
avec le même volume
docker rm -f db2 >/dev/null 2>&1 ||
true
docker run --label ebro-render=true
-d --name db2 \
-v "$VOLUME":/var/lib/postgresql/
data \
-e POSTGRES_PASSWORD="$PW" \
"$IMAGE"
```

```
# Attendre que la base soit prête
timeout 60 sh -c 'until docker exec
db2 pg_isready -U postgres >/dev/null
2>&1; do echo -n '.'; sleep 1; done'
|| (echo "Postgres not ready after
60s" >&2; exit 1)
```

```
# Vérifier que les données persistent
docker exec db2 psql -U postgres -c
"SELECT * FROM test;"
```

```
# Nettoyage
docker stop db2 && docker rm db2
docker volume rm "$VOLUME"
```

```
13134bfe2972eaaffafc7afc9dbf174c4078647e0e49f21a2208ed7
id | name
```

```

-----+-----
  1 | Alice
  2 | Bob
(2 rows)

db2
db2
pgdata

```

8.3 Exercice de persistance

- lancer MySQL sans volume → perdre les données
- relancer avec volume → conserver les données

Hint: l'image officielle MySQL stocke les données dans `/var/lib/mysql`. Voir la page Docker Hub : https://hub.docker.com/_/mysql

Exercice 3 (10 min)

Démarrer MySQL au premier plan, observer l'initialisation (création de la base), arrêter avec Ctrl-C, puis relancer le même volume et constater qu'il n'y a plus d'initialisation.

Consignes :

- Lisez la page Docker Hub de MySQL pour comprendre
 - les variables d'environnement essentielles (notamment `MYSQL_ROOT_PASSWORD`, `MYSQL_DATABASE`) : https://hub.docker.com/_/mysql
 - le chemin de stockage des données dans le conteneur (`/var/lib/mysql`)
- Créez un volume nommé `mysql-data` pour stocker les données persistantes.
- Démarrez MySQL en mode **attaché** (sans `--detach`)

```

#| label: lst-mysql-persistence

# create a named volume for MySQL data
(one-time)
docker volume create mysql-data

export MYSQL_ROOT_PASSWORD=secretpw
export MYSQL_DATABASE=demo

# Run MySQL in the foreground so you
see initialization logs
docker rm -f mysql-db >/dev/null 2>&1
|| true
docker run --label ebpro-render=true
--name mysql-db --detach\
--env MYSQL_ROOT_PASSWORD=${MYSQL_ROOT_PASSWORD} \
--env
MYSQL_DATABASE=${MYSQL_DATABASE} \
--volume mysql-data:/var/lib/mysql \
mysql:8.0

# Wait for MySQL to be ready
timeout 60 sh -c 'until docker
exec mysql-db mysqladmin ping -h
"localhost" --silent >/dev/null 2>&1;
do echo -n "."; sleep 1; done' ||
(echo "MySQL not ready after 60s" >&2;
exit 1)

# Stop and remove the container to
simulate a restart
docker stop mysql-db && docker rm
mysql-db

# Start a new container with the same
volume to see data persistence.
docker rm -f mysql-db >/dev/null 2>&1
|| true
docker run --label ebpro-render=true
--name mysql-db --detach\
--env MYSQL_ROOT_PASSWORD=${MYSQL_ROOT_PASSWORD}

```

```

\
--env
MYSQL_DATABASE=${MYSQL_DATABASE} \
--volume mysql-data:/var/lib/mysql
\
mysql:8.0

# Wait for MySQL to be ready again
timeout 60 sh -c 'until docker
exec mysql-db mysqladmin ping -h
"localhost" --silent >/dev/null 2>&1;
do echo -n "."; sleep 1; done' ||
(echo "MySQL not ready after 60s" >&2;
exit 1)

# Check the logs to confirm no re-
initialization
docker logs mysql-db|head -n 20

```

```

mysql-data
Unable to find image 'mysql:8.0'
locally
8.0: Pulling from library/mysql

```

```

edf85873f64e: Pulling fs layer

6ef6c7b50a93: Pulling fs layer

e3e5dlac74c1: Pulling fs layer

0d74d296605b: Pulling fs layer

297d04cfe470: Pulling fs layer

4c8a3e0d4e4b: Pulling fs layer

a63160a5eda1: Pulling fs layer

7534d1db9f8d: Pulling fs layer

49ec2dab01d9: Pulling fs layer

```

```

ab24264a27e9: Pulling fs layer

96d30d9fbee8: Pulling fs layer

4c8a3e0d4e4b: Waiting

a63160a5eda1: Waiting

7534d1db9f8d: Waiting

49ec2dab01d9: Waiting

96d30d9fbee8: Waiting

ab24264a27e9: Waiting

297d04cfe470: Waiting

0d74d296605b: Waiting

6ef6c7b50a93:
Downloading      884B/884B

6ef6c7b50a93: Verifying Checksum

6ef6c7b50a93: Download complete

e3e5dlac74c1:
Downloading  15.74kB/783.6kB

edf85873f64e:
Downloading  474.5kB/47.31MB

e3e5dlac74c1:
Downloading  783.6kB/783.6kB

e3e5dlac74c1: Verifying Checksum

e3e5dlac74c1: Download complete

edf85873f64e:
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```

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297d04cfe470: Verifying Checksum

297d04cfe470: Download complete

edf85873f64e: Verifying Checksum

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7534d1db9f8d: Verifying Checksum

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ab24264a27e9: Verifying Checksum

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96d30d9fbee8: Extracting 120B/120B

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96d30d9fbee8: Pull complete
Digest: sha256:7dcddc01f13bab2f15cde676d44d01f61fc9f99f
Status: Downloaded newer image for
mysql:8.0
9c2eabbfe64d47ae9d08fbda0853f9b067afb3ef5c9b16714caa86f
.....
mysql-db
mysql-db
768f14c855b4daad00e88c801be39688fefcfe281cee8d122977495
..
2026-10-14 14:48:59+00:00 [Note]
[Entrypoint]: Entrypoint script for
MySQL Server 8.0.46-1.el9 started.
2026-10-14T14:49:00.501043Z 0
[Warning] [MY-011068] [Server]
The syntax '--skip-host-cache' is
deprecated and will be removed in a
future release. Please use SET GLOBAL
host_cache_size=0 instead.
2026-10-14 14:48:59+00:00 [Note]
[Entrypoint]: Switching to dedicated
user 'mysql'
2026-10-14 14:48:59+00:00 [Note]
[Entrypoint]: Entrypoint script for
MySQL Server 8.0.46-1.el9 started.
'/var/lib/mysql/mysql.sock' -> '/
var/run/mysqld/mysqld.sock'
2026-10-14T14:49:00.503145Z 0
[System] [MY-010116] [Server] /usr/
sbin/mysqld (mysqld 8.0.46) starting
as process 1
2026-10-14T14:49:00.510039Z 1
[System] [MY-013576] [InnoDB] InnoDB
initialization has started.
2026-10-14T14:49:01.417814Z 1
[System] [MY-013577] [InnoDB] InnoDB

```

```

initialization has ended.
2026-10-14T14:49:02.026215Z      0
[Warning] [MY-010068] [Server] CA
certificate ca.pem is self signed.
2026-10-14T14:49:02.026289Z      0
[System] [MY-013602] [Server] Channel
mysql_main configured to support
TLS. Encrypted connections are now
supported for this channel.
2026-10-14T14:49:02.042023Z      0
[Warning] [MY-011810] [Server]
Insecure configuration for --pid-
file: Location '/var/run/mysqld' in
the path is accessible to all OS
users. Consider choosing a different
directory.
2026-10-14T14:49:02.067865Z      0
[System] [MY-011323] [Server] X
Plugin ready for connections. Bind-
address: '::' port: 33060, socket: /
var/run/mysqld/mysqld.sock
2026-10-14T14:49:02.067996Z      0
[System] [MY-010931] [Server] /usr/
sbin/mysqld: ready for connections.
Version: '8.0.46' socket: '/var/
run/mysqld/mysqld.sock' port: 3306
MySQL Community Server - GPL.

```

9 Gestion des ressources (Avancé)

- Docker permet de limiter les ressources utilisées par un conteneur.
- Cela inclut la mémoire, le CPU, et le nombre de PIDs.

Limiter CPU / mémoire / PIDs

```

#| label: lst-limit-cpu-mem

docker rm -f cpu-test >/dev/null 2>&1
|| true
docker run --label ebpro-render=true

```

```

--detach --name cpu-test \
--memory="512m" \
--cpus="0.5" \
python:3.11-slim \
python -c "while True: pass"

```

```

Unable to find image 'python:3.11-
slim' locally
3.11-slim: Pulling from library/
python

```

```
ecc510cle359: Pulling fs layer
```

```
0f752a1982d6: Pulling fs layer
```

```
759a7f30c318: Pulling fs layer
```

```
496c1a902b3a: Pulling fs layer
```

```
496c1a902b3a: Waiting
```

```
0f752a1982d6:
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```

```
759a7f30c318:
Downloading 146.9kB/14.46MB
```

```
ecc510cle359:
Downloading 310.7kB/29.84MB
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```
759a7f30c318:
Downloading 4.865MB/14.46MB
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```
ecc510cle359:
Downloading 3.424MB/29.84MB
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759a7f30c318:
Downloading 12.68MB/14.46MB
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ecc510cle359:
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```

759a7f30c318: Verifying Checksum
759a7f30c318: Download complete

0f752a1982d6:
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0f752a1982d6: Verifying Checksum

0f752a1982d6: Download complete

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ecc510cle359: Verifying Checksum

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496c1a902b3a: Download complete

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ecc510cle359:
Extracting 16.06MB/29.84MB

ecc510cle359:
Extracting 19.33MB/29.84MB

ecc510cle359:
Extracting 22.61MB/29.84MB

ecc510cle359:
Extracting 25.56MB/29.84MB

ecc510cle359:
Extracting 26.21MB/29.84MB

ecc510cle359:
Extracting 28.18MB/29.84MB

ecc510cle359:
Extracting 28.84MB/29.84MB

ecc510cle359:
Extracting 29.16MB/29.84MB

ecc510cle359:
Extracting 29.82MB/29.84MB

ecc510cle359:
Extracting 29.84MB/29.84MB

ecc510cle359: Pull complete

0f752a1982d6:
Extracting 32.77kB/1.294MB

0f752a1982d6:
Extracting 360.4kB/1.294MB

0f752a1982d6:

```
Extracting 1.294MB/1.294MB
```

```
0f752a1982d6:  
Extracting 1.294MB/1.294MB
```

```
0f752a1982d6: Pull complete
```

```
759a7f30c318:  
Extracting 163.8kB/14.46MB
```

```
759a7f30c318:  
Extracting 819.2kB/14.46MB
```

```
759a7f30c318:  
Extracting 2.949MB/14.46MB
```

```
759a7f30c318:  
Extracting 3.768MB/14.46MB
```

```
759a7f30c318:  
Extracting 7.537MB/14.46MB
```

```
759a7f30c318:  
Extracting 9.83MB/14.46MB
```

```
759a7f30c318:  
Extracting 10.65MB/14.46MB
```

```
759a7f30c318:  
Extracting 11.8MB/14.46MB
```

```
759a7f30c318:  
Extracting 12.45MB/14.46MB
```

```
759a7f30c318:  
Extracting 12.94MB/14.46MB
```

```
759a7f30c318:  
Extracting 13.6MB/14.46MB
```

```
759a7f30c318:  
Extracting 14.46MB/14.46MB
```

```
759a7f30c318: Pull complete
```

```
496c1a902b3a: Extracting 250B/250B
```

```
496c1a902b3a: Extracting 250B/250B
```

```
496c1a902b3a: Pull complete
```

```
Digest: sha256:e88e9763f943ec1834f992a4b51e0f2450048680
```

```
Status: Downloaded newer image for  
python:3.11-slim
```

```
db828bbc985c3c3cd131eb47f85618a9800ffe508af8897c39919c7
```

```
#| label: lst-monitor-cpu-mem
```

```
docker stats --no-stream cpu-test
```

CONTAINER ID	NAME	CPU %	MEM
USAGE / LIMIT	MEM %	NET	I/O
BLOCK I/O	PIDS		
db828bbc985c	cpu-test	50.86%	
3.934MiB / 512MiB	0.77%	426B /	
84B 0B / 0B	1		

Pensez à arrêter et supprimer le conteneur après le test :

```
#| label: lst-cleanup-cpu-test
```

```
docker stop cpu-test  
docker rm cpu-test
```

```
cpu-test  
cpu-test
```

9.1 Modifier les limites d'un conteneur existant

- Il est possible de modifier les limites d'un conteneur en cours d'exécution avec `docker update`.

```
docker update --memory="1g" --
cpus="1" cpu-test
```

10 Bonnes pratiques d'usage

• Nettoyage régulier

```
docker container prune
docker image prune
docker volume prune
docker network prune
docker system prune --all

# NETTOYAGE COMPLET (ATTENTION :
SUPPRIME TOUT)
# Y COMPRIS LES DONNÉES DANS DES
VOLUMES !
docker system prune --all --volumes
--force # RISQUE
```

• Éviter **latest** en production

- Utiliser des tags de version stables.

• Ne pas stocker de secrets dans l'environnement

- Préférer `--secret` (ou mécanismes externes).

• Logs sur stdout/stderr

- Les conteneurs doivent produire des logs vers la sortie standard.

11 Atelier final

- Déployer une application simple composée de deux conteneurs :
 - une application Java accédant à une base de données via JDBC
 - une base de données PostgreSQL
- Contraintes :
 - chaque composant doit être dans son propre conteneur
 - les deux conteneurs doivent communiquer via un réseau Docker personnalisé

- les données de la base doivent être persistées dans un volume Docker
- l'application Java doit se connecter à la base par le nom du conteneur, pas par localhost
- Objectif :
 - vérifier la communication entre conteneurs, l'usage des réseaux et la persistance des données.

12 Conclusion

! A Retenir

- Un conteneur est une instance d'une image, exécutant un processus isolé.
- Le cycle de vie d'un conteneur inclut les états : démarré, arrêté, supprimé.
- Les conteneurs peuvent être connectés via des réseaux custom pour la communication.
- Les volumes permettent de persister les données indépendamment du cycle de vie des conteneurs.
- Il est possible de limiter les ressources (CPU, mémoire) utilisées par un conteneur.
- Appliquer les bonnes pratiques d'usage pour une gestion efficace des conteneurs.
- Gérer les conteneurs manuellement n'est pas viable en production : il faut automatiser
 - Outils d'Orchestration : docker compose, Kubernetes, ...