

Repo git du projet : [repo tp docker](#)

1) Installation de docker

```
Administrator: Windows PowerShell
Windows PowerShell
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Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\Administrator> docker -v
Docker version 24.0.7, build afdd53b
PS C:\Users\Administrator> docker-compose -v
Docker Compose version v2.23.3-desktop.2
PS C:\Users\Administrator>
```

2) commandes à tester

docker run hello-world

```
Administrator: Windows PowerShell
Docker Compose version v2.23.3-desktop.2
PS C:\Users\Administrator> docker run hello-world
Unable to find image 'hello-world:latest' locally
latest: Pulling from library/hello-world
c1ec31eb5944: Pull complete
Digest: sha256:4bd78111b6914a99dbc560e6a20eab57ff6655aea4a80c50b0c5491968cbc2e6
Status: Downloaded newer image for hello-world:latest

Hello from Docker!
This message shows that your installation appears to be working correctly.

To generate this message, Docker took the following steps:
1. The Docker client contacted the Docker daemon.
2. The Docker daemon pulled the "hello-world" image from the Docker Hub.
   (amd64)
3. The Docker daemon created a new container from that image which runs the
   executable that produces the output you are currently reading.
4. The Docker daemon streamed that output to the Docker client, which sent it
   to your terminal.

To try something more ambitious, you can run an Ubuntu container with:
$ docker run -it ubuntu bash

Share images, automate workflows, and more with a free Docker ID:
https://hub.docker.com/

For more examples and ideas, visit:
https://docs.docker.com/get-started/
PS C:\Users\Administrator>
```

docker run -it ubuntu bash

```
PS C:\Users\Administrator> docker run -it ubuntu bash
Unable to find image 'ubuntu:latest' locally
latest: Pulling from library/ubuntu
29202e855b20: Pull complete
Digest: sha256:e6173d4dc55e76b87c4af8db8821b1feae4146dd47341e4d431118c7dd060a74
Status: Downloaded newer image for ubuntu:latest
root@ab0cbad6ba9d:/#
```

docker images

```

exit
PS C:\Users\Administrator> docker images
REPOSITORY          TAG                 IMAGE ID            CREATED             SIZE
ubuntu               latest              e34e831650c1       2 weeks ago        77.9MB
hello-world          latest              d2c94e258dcb       9 months ago       13.3kB
PS C:\Users\Administrator>

```

docker ps -a

```

PS C:\Users\Administrator> docker ps -a
CONTAINER ID   IMAGE     COMMAND                  CREATED        STATUS        PORTS   NAMES
ab0cbad6ba9d   ubuntu    "bash"                   2 minutes ago   Exited (0)    About a minute ago   distracted_visvesvaray
a
82865f832e61   hello-world  "/hello"                 4 minutes ago   Exited (0)    4 minutes ago       wonderful_vaughan
PS C:\Users\Administrator>

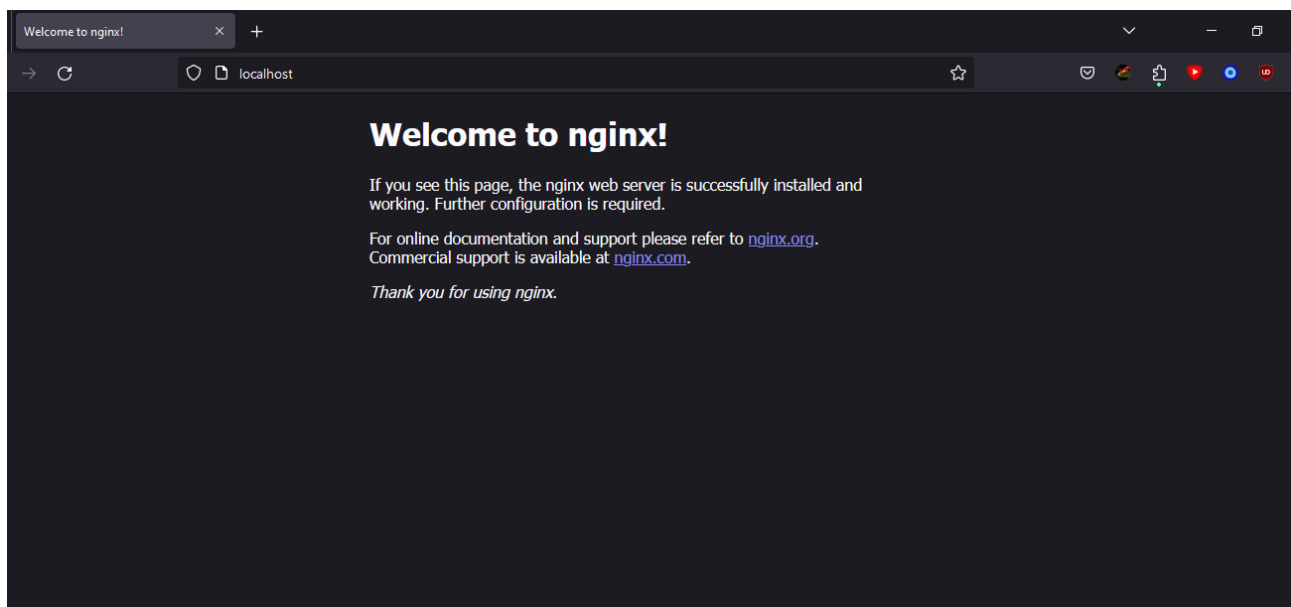
```

docker run -p 80:80 nginx

```

PS C:\Users\Administrator> docker run -p 80:80 nginx
Unable to find image 'nginx:latest' locally
latest: Pulling from library/nginx
2f44b7a888fa: Pull complete
8b7dd3ed1dc3: Pull complete
35497dd96569: Pull complete
36664b6ce66b: Pull complete
2d455521f76c: Pull complete
dc9c4fdb83d6: Pull complete
8056d2bcf3b6: Pull complete
Digest: sha256:4c0fd8a8b6341bfdeca5f18f7837462c80cff90527ee35ef185571e1c327beac
Status: Downloaded newer image for nginx:latest
/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
2024/02/01 09:24:27 [notice] 1#1: using the "epoll" event method
2024/02/01 09:24:27 [notice] 1#1: nginx/1.25.3
2024/02/01 09:24:27 [notice] 1#1: built by gcc 12.2.0 (Debian 12.2.0-14)
2024/02/01 09:24:27 [notice] 1#1: OS: Linux 5.15.133.1-microsoft-standard-WSL2
2024/02/01 09:24:27 [notice] 1#1: getrlimit(RLIMIT_NOFILE): 1048576:1048576
2024/02/01 09:24:27 [notice] 1#1: start worker processes
2024/02/01 09:24:27 [notice] 1#1: start worker process 30
2024/02/01 09:24:27 [notice] 1#1: start worker process 31
2024/02/01 09:24:27 [notice] 1#1: start worker process 32
2024/02/01 09:24:27 [notice] 1#1: start worker process 33

```



5) executer un serveur web

a) récupérer l'image :

l'image récupérée précédemment est utilisée

b) vérifier que l'image est présente en local

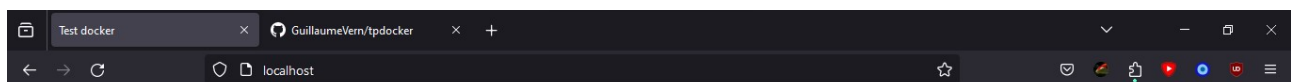
```
PS C:\Users\Administrator> docker images
REPOSITORY      TAG         IMAGE ID      CREATED        SIZE
ubuntu          latest      e34e831650c1 2 weeks ago    77.9MB
nginx           latest      a8758716bb6a 3 months ago   187MB
hello-world     latest      d2c94e258dcb 9 months ago   13.3kB
PS C:\Users\Administrator>
```

c) créer un fichier index.html simple

```
<> index.html U x
<> index.html > html > body > p
1  <!DOCTYPE html>
2  <html lang="en">
3  <head>
4      <meta charset="UTF-8">
5      <meta name="viewport" content="width=device-width, initial-scale=1.0">
6      <title>Test docker</title>
7  </head>
8  <body>
9      <h1>Docker</h1>
10     <p>page affichée à partir d'un serveur web hébergé sur un conteneur docker</p>
11 </body>
12 </html>
```

d) démarrer un conteneur avec une page html custom

```
PS C:\Users\Administrator> docker run -p 80:80 -v //c:/Docker/web:/usr/share/nginx/html 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: 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
2024/02/01 10:08:27 [notice] 1#1: using the "epoll" event method
2024/02/01 10:08:27 [notice] 1#1: nginx/1.25.3
2024/02/01 10:08:27 [notice] 1#1: built by gcc 12.2.0 (Debian 12.2.0-14)
2024/02/01 10:08:27 [notice] 1#1: OS: Linux 5.15.133.1-microsoft-standard-WSL2
2024/02/01 10:08:27 [notice] 1#1: getrlimit(RLIMIT_NOFILE): 1048576:1048576
2024/02/01 10:08:27 [notice] 1#1: start worker processes
2024/02/01 10:08:27 [notice] 1#1: start worker process 29
2024/02/01 10:08:27 [notice] 1#1: start worker process 30
2024/02/01 10:08:27 [notice] 1#1: start worker process 31
2024/02/01 10:08:27 [notice] 1#1: start worker process 32
```



Docker

page affichée à partir d'un serveur web hébergé sur un conteneur docker

e) suppression des conteneurs

```
PS C:\Users\Administrator> docker container ls -a
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
PS C:\Users\Administrator>
```

création du nouveau conteneur vierge

```
PS C:\Users\Administrator> docker create -p 80:80 nginx
d558c28b56c9c1da76eace2f70b1d48792dfa552780e774a74d3e78b6aa22646
PS C:\Users\Administrator> docker container ls -a
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
d558c28b56c9   nginx     "/docker-entrypoint..."  5 seconds ago  Created             objective_banzai
PS C:\Users\Administrator>
```

copie des fichiers dans le conteneur

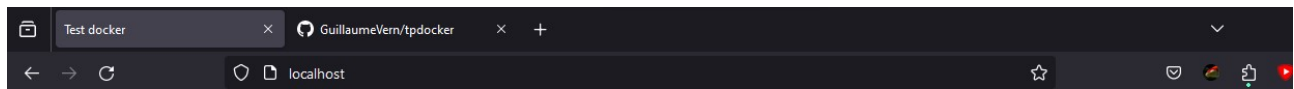
```
PS C:\Users\Administrator> docker cp C:\Docker\web\index.html objective_banzai:/usr/share/nginx/html
Successfully copied 2.05kB to objective_banzai:/usr/share/nginx/html
PS C:\Users\Administrator> docker start objective_banzai
```

démarrage du conteneur

```
PS C:\Users\Administrator> docker start objective_banzai
objective_banzai
PS C:\Users\Administrator> docker container ls
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
d558c28b56c9   nginx     "/docker-entrypoint..."  2 minutes ago  Up 11 seconds      0.0.0.0:80->80/tcp  objective_banzai
PS C:\Users\Administrator>
```

6) builder une image

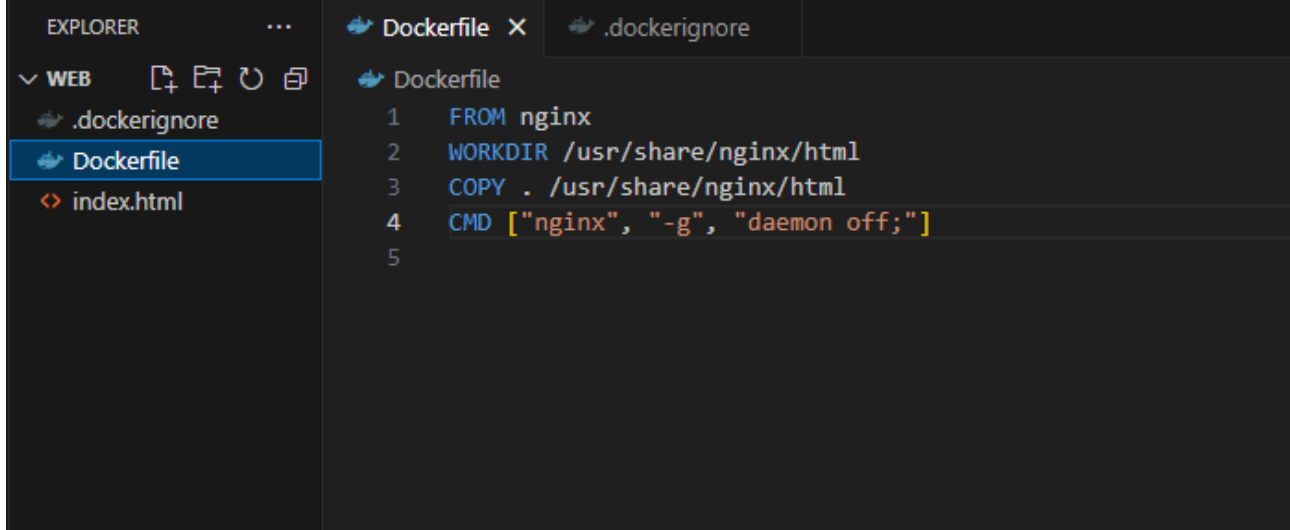
a)



Docker

page affichée à partir d'un serveur web hébergé sur un conteneur docker

dockerfile :



build de l'image

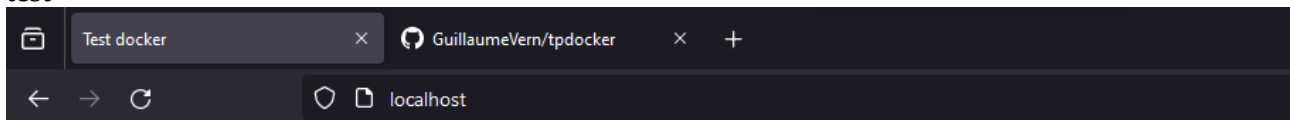
```
PS C:\docker\web> docker build . --tag my-nginx
[+] Building 0.3s (8/8) FINISHED
=> [internal] load build definition from Dockerfile
=> => transferring dockerfile: 146B
=> [internal] load .dockerignore
=> => transferring context: 50B
=> [internal] load metadata for docker.io/library/nginx:latest
=> [1/3] FROM docker.io/library/nginx
=> [internal] load build context
=> => transferring context: 64B
=> CACHED [2/3] WORKDIR /usr/share/nginx/html
=> CACHED [3/3] COPY . /usr/share/nginx/html
=> exporting to image
=> => exporting layers
=> => writing image sha256:cfc2918bf8d12a7f22e8cd6a957037e2dedb83d5f33f74497905523d542524b
=> => naming to docker.io/library/my-nginx

What's Next?
View a summary of image vulnerabilities and recommendations → docker scout quickview
```

b) démarrage du conteneurs

```
PS C:\docker\web> docker run -p 80:80 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: 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
2024/02/01 10:50:43 [notice] 1#1: using the "epoll" event method
2024/02/01 10:50:43 [notice] 1#1: nginx/1.25.3
2024/02/01 10:50:43 [notice] 1#1: built by gcc 12.2.0 (Debian 12.2.0-14)
2024/02/01 10:50:43 [notice] 1#1: OS: Linux 5.15.133.1-microsoft-standard-WSL2
2024/02/01 10:50:43 [notice] 1#1: getrlimit(RLIMIT_NOFILE): 1048576:1048576
2024/02/01 10:50:43 [notice] 1#1: start worker processes
2024/02/01 10:50:43 [notice] 1#1: start worker process 29
2024/02/01 10:50:43 [notice] 1#1: start worker process 30
2024/02/01 10:50:43 [notice] 1#1: start worker process 31
2024/02/01 10:50:43 [notice] 1#1: start worker process 32
172.17.0.1 - - [01/Feb/2024:10:50:50 +0000] "GET / HTTP/1.1" 200 321 "-" "Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:122.0) Gecko/2010101 Firefox/122.0" "-"
2024/02/01 10:50:50 [error] 29#29: *1 open() "/usr/share/nginx/html/favicon.ico" failed (2: No such file or directory), client: 172.17.0.1, server: localhost, request: "GET /favicon.ico HTTP/1.1", host: "localhost", referer: "http://localhost/"
172.17.0.1 - - [01/Feb/2024:10:50:50 +0000] "GET /favicon.ico HTTP/1.1" 404 153 "http://localhost/" "Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:122.0) Gecko/2010101 Firefox/122.0" "-"
```

test



Docker

page affichée à partir d'un serveur web hébergé sur un conteneur docker

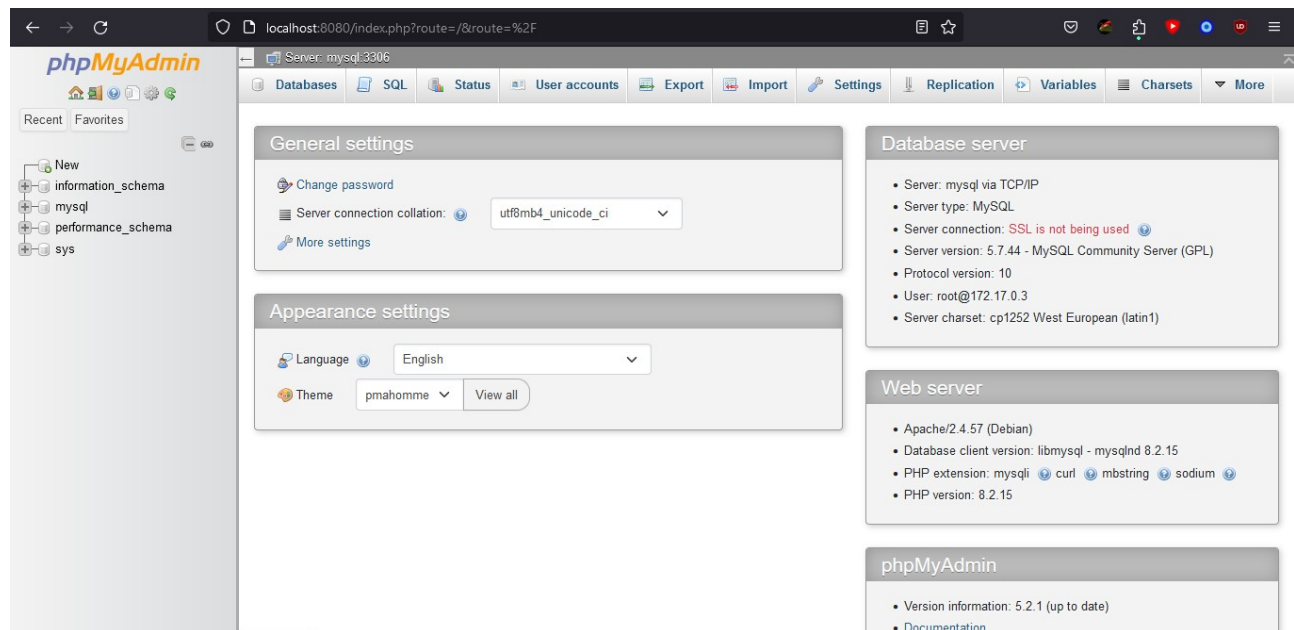
c)
une différence observée est que la méthode 5) est plus rapide pour faire des tests rapides mais la méthode 6) est automatisée après l'avoir fait une fois il n'y a plus besoin d'y toucher

la méthode 6) correspond plus à une pratique devops car il est préférable de réduire au maximum les tâches répétitives, il faut donc chercher à automatiser au maximum.

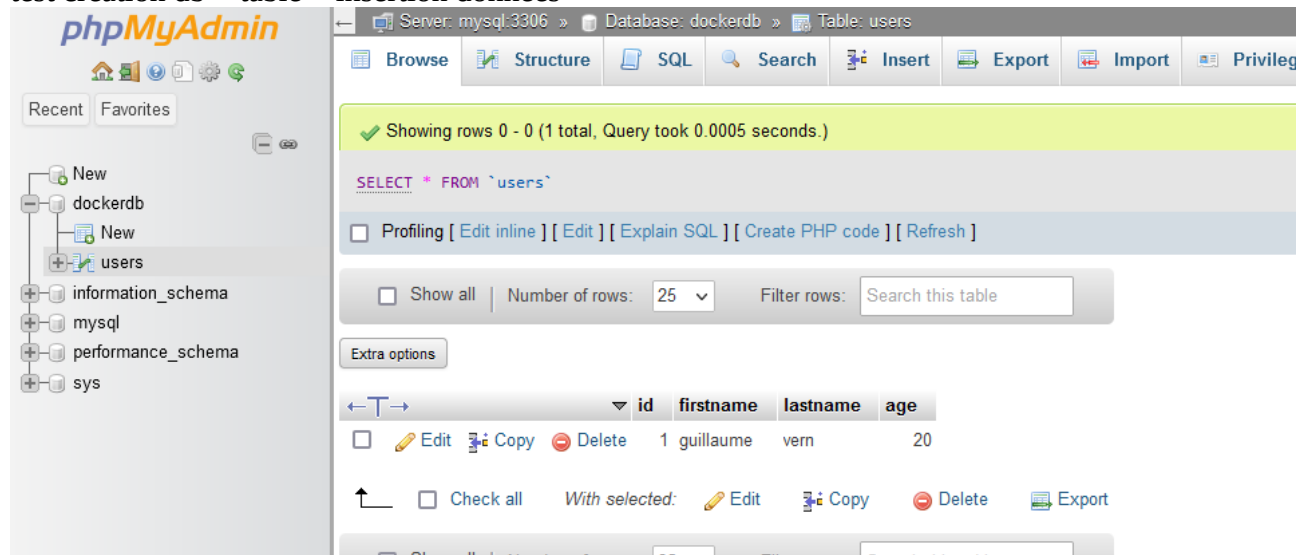
7) utiliser une base de données dans un conteneur docker

```
PS C:\docker\web> docker run --name mysql -e MYSQL_ROOT_PASSWORD=azerty2qwerty -d mysql:5.7
476afde42116ce15fde5f3590618d05004f7a2f57ff72a53504a28dddc527260
PS C:\docker\web>
```

```
PS C:\docker\web> docker run --name phpmyadmin -p 8080:80 --link mysql -e PMA_HOST=mysql -e PMA_PORT=3306 -d phpmyadmin
d7500be9b6d67a0ac5939cce2bacadfe01a9de5d8233923ea1174acf7dfe60e6
PS C:\docker\web>
```



test creation db + table + insertion données



8) pareil avec docker compose

suppression des conteneurs


```

PS C:\docker\web> docker container ls -a
CONTAINER ID   IMAGE          COMMAND                  CREATED        STATUS        PORTS                    NAMES
d7500be9b6d6   phpmyadmin    "/docker-entrypoint...." 17 minutes ago Up 17 minutes   0.0.0.0:8080->80/tcp      phpmyadmin
476afde42116   mysql:5.7     "docker-entrypoint.s..." 25 minutes ago Up 25 minutes   3306/tcp, 33060/tcp      mysql
PS C:\docker\web> docker stop d75 476
d75
476
PS C:\docker\web> docker rm d75 476
d75
476
PS C:\docker\web> docker container ls -a
CONTAINER ID   IMAGE          COMMAND                  CREATED        STATUS        PORTS                    NAMES
PS C:\docker\web>

```

docker compose file

EXPLORER

WEB

.dockerignore

compose.yaml

Dockerfile

index.html

Dockerfile

compose.yaml X

.dockerignore

compose.yaml > {} services > {} phpmyadmin > [] links > 0

docker-compose.yml - The Compose specification establishes a standard for the definition

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```

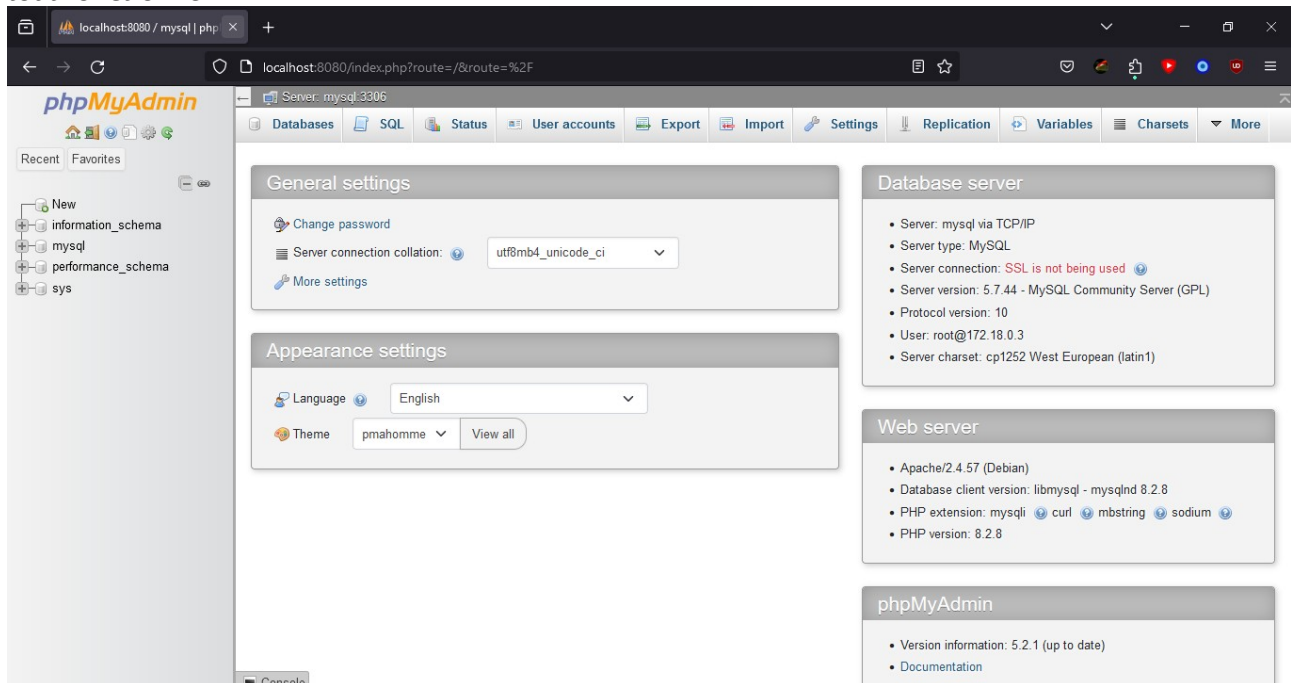
services:
  mysql:
    image: mysql:5.7
    container_name: mysql
    restart: always
    environment:
      MYSQL_ROOT_PASSWORD: azerty2qwerty
    ports:
      - 3306:3306
    volumes:
      - ./mysql:/var/lib/mysql

  phpmyadmin:
    image: phpmyadmin/phpmyadmin
    container_name: phpmyadmin
    ports:
      - 8080:80
    restart: always
    environment:
      PMA_HOST: mysql
      PMA_PORT: 3306
      MYSQL_ROOT_PASSWORD: azerty2qwerty
    depends_on:
      - mysql
    links:
      - mysql

```

```
CONTAINER ID   IMAGE      COMMAND                  CREATED        STATUS        PORTS        NAMES
PS C:\docker\web> docker compose up
[+] Running 19/19
✔ phpmyadmin 18 layers [.....] 0B/0B      Pulled          73.3s
✔ faef57eae888 Pull complete      22.0s
✔ 989a1d6c052e Pull complete      0.8s
✔ 0705c9c2f22d Pull complete      35.1s
✔ 621478e043ce Pull complete      2.3s
✔ 98246dcca987 Pull complete      9.1s
✔ bfed8c155cb6 Pull complete      10.0s
✔ 7a7c2e908867 Pull complete      10.8s
✔ d176994b625c Pull complete      15.1s
✔ 2d8ace6a2716 Pull complete      16.2s
✔ c70df516383c Pull complete      19.8s
✔ 15e1b44fe4c7 Pull complete      20.6s
✔ 65e50d44e95a Pull complete      21.9s
✔ 77f68910bc0a Pull complete      22.6s
✔ 605dd3a6e332 Pull complete      23.6s
✔ 99ce27188f07 Pull complete      23.7s
✔ 74d64e32c5d5 Pull complete      27.2s
✔ ef5fc9928b9f Pull complete      24.5s
✔ 163f3256e112 Pull complete      26.0s
[+] Running 3/3
✔ Network web_default Created          0.4s
✔ Container mysql      Created          1.5s
✔ Container phpmyadmin Created          0.5s
Attaching to mysql, phpmyadmin
mysql | 2024-02-01 13:26:30+00:00 [Note] [Entrypoint]: Entrypoint script for MySQL Server 5.7.44-1.el7 started.
phpmyadmin | AH00558: apache2: Could not reliably determine the server's fully qualified domain name, using 172.18.0.3. Set the 'ServerName' directive globally to suppress this message
phpmyadmin | AH00558: apache2: Could not reliably determine the server's fully qualified domain name, using 172.18.0.3. Set the 'ServerName' directive globally to suppress this message
mysql | 2024-02-01 13:26:33+00:00 [Note] [Entrypoint]: Switching to dedicated user 'mysql'
phpmyadmin | [Thu Feb 01 13:26:33.141992 2024] [mpm_prefork:notice] [pid 1] AH00163: Apache/2.4.57 (Debian) PHP/8.2.8 configured -- resuming normal operations
phpmyadmin | [Thu Feb 01 13:26:33.144228 2024] [core:notice] [pid 1] AH00094: Command line: 'apache2 -D FOREGROUND'
mysql | 2024-02-01 13:26:33+00:00 [Note] [Entrypoint]: Entrypoint script for MySQL Server 5.7.44-1.el7 started.
mysql | 2024-02-01 13:26:34+00:00 [Note] [Entrypoint]: Initializing database files
mysql | 2024-02-01T13:26:34.073711Z 0 [Warning] TIMESTAMP with implicit DEFAULT value is deprecated. Please use --explicit_defaults_for_timestamp server option (see documentation for more details).
mysql | 2024-02-01T13:26:34.110226Z 0 [Warning] Setting lower_case_table_names=2 because file system for /var/lib/mysql/ is case insensitive
mysql | 2024-02-01T13:26:36.470751Z 0 [Warning] InnoDB: New log files created, LSN=45790
mysql | 2024-02-01T13:26:36.888521Z 0 [Warning] InnoDB: Creating foreign key constraint system tables.
mysql | 2024-02-01T13:26:37.022699Z 0 [Warning] No existing UUID has been found, so we assume that this is the first time that this server has been started. Generating a new UUID: 867a5907-c105-11ee-a230-0242ac120002.
```

tout fonctionne



a) docker compose est intéressant car il permet de facilement sauvegarder et déployer toute une infrastructure plutôt qu'un seul conteneur unique.

b) les variables d'environnement permettent de configurer l'utilisateur (MYSQL_USER), la première base (MYSQL_DATABASE), le mot de passe root (MYSQL_ROOT_PASSWORD), etc...

9) observation de l'isolation réseau entre 3 conteneurs

a)
fichier docker compose :


```

30
31  services:
32    web:
33      image: wbitt/network-multitool
34    networks:
35      - frontend
36      command: sleep 3600
37    app:
38      image: wbitt/network-multitool
39    networks:
40      - frontend
41      - backend
42      command: sleep 3600
43    db:
44      image: wbitt/network-multitool
45    networks:
46      - backend
47      command: sleep 3600
48  networks:
49    frontend:
50    backend:

```

tests des différents réseaux :

```

Administrator: Windows PowerShell
PS C:\docker\web> docker-compose exec web ip addr show
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
16: eth0@if17: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP group default
    link/ether 02:42:ac:12:00:03 brd ff:ff:ff:ff:ff:ff link-netnsid 0
    inet 172.18.0.3/16 brd 172.18.255.255 scope global eth0
        valid_lft forever preferred_lft forever
PS C:\docker\web> docker-compose exec app ip addr show
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
12: eth1@if13: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP group default
    link/ether 02:42:ac:12:00:02 brd ff:ff:ff:ff:ff:ff link-netnsid 0
    inet 172.18.0.2/16 brd 172.18.255.255 scope global eth1
        valid_lft forever preferred_lft forever
18: eth0@if19: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP group default
    link/ether 02:42:ac:13:00:03 brd ff:ff:ff:ff:ff:ff link-netnsid 0
    inet 172.19.0.3/16 brd 172.19.255.255 scope global eth0
        valid_lft forever preferred_lft forever
PS C:\docker\web> docker-compose exec db ip addr show
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
14: eth0@if15: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP group default
    link/ether 02:42:ac:13:00:02 brd ff:ff:ff:ff:ff:ff link-netnsid 0
    inet 172.19.0.2/16 brd 172.19.255.255 scope global eth0
        valid_lft forever preferred_lft forever
PS C:\docker\web>

```

web sur 172.18

app sur 172.18 et 172.19

db sur 172.19

```

PS C:\docker\web> docker-compose exec web ping app
PING app (172.18.0.2) 56(84) bytes of data.
64 bytes from web-app-1.web_frontend (172.18.0.2): icmp_seq=1 ttl=64 time=0.193 ms
^C
--- app ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.193/0.193/0.193/0.000 ms
PS C:\docker\web> docker-compose exec web ping db
ping: db: Try again
PS C:\docker\web> docker-compose exec db ping app
PING app (172.19.0.3) 56(84) bytes of data.
64 bytes from web-app-1.web_backend (172.19.0.3): icmp_seq=1 ttl=64 time=2.81 ms
^C
--- app ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 3ms
rtt min/avg/max/mdev = 2.814/2.814/2.814/0.000 ms
PS C:\docker\web>

```

web ne peut pas ping db mais db et web peuvent ping app

b)

la ligne NetworkID dans NetworkSettings justifie ce comportement

NetworkID de web : (réseau frontend)

```

},
"NetworkSettings": {
  "Bridge": "",
  "SandboxID": "d598b82616913ae7db271c5191b72c4ab0c8ad6bed06d05c52811360c4bfa529",
  "HairpinMode": false,
  "LinkLocalIPv6Address": "",
  "LinkLocalIPv6PrefixLen": 0,
  "Ports": {},
  "SandboxKey": "/var/run/docker/netns/d598b8261691",
  "SecondaryIPAddresses": null,
  "SecondaryIPv6Addresses": null,
  "EndpointID": "",
  "Gateway": "",
  "GlobalIPv6Address": "",
  "GlobalIPv6PrefixLen": 0,
  "IPAddress": "",
  "IPPrefixLen": 0,
  "IPv6Gateway": "",
  "MacAddress": "",
  "Networks": {
    "web_frontend": {
      "IPAMConfig": null,
      "Links": null,
      "Aliases": [
        "web-web-1",
        "web",
        "6d93b69fc295"
      ],
      "MacAddress": "",
      "NetworkID": "64f247568bc40420973976220287f61dc13f2b6ff9e6dbd6e1c636a6d4a4489f",
      "EndpointID": "",
      "Gateway": "",
      "IPAddress": "",
      "IPPrefixLen": 0,
      "IPv6Gateway": "",
      "GlobalIPv6Address": "",
      "GlobalIPv6PrefixLen": 0,
      "DriverOpts": null
    }
  }
}

```

NetworkID de app (2 network id qui correspondent au réseau frontend et backend)

```

    "Networks": {
      "web_backend": {
        "IPAMConfig": null,
        "Links": null,
        "Aliases": [
          "web-app-1",
          "app",
          "0b3354b9ebf5"
        ],
        "MacAddress": "",
        "NetworkID": "157d3b83747ec3bf5db97a7141367963ee2ec5bbb8db2a338dfd64c677fbab53",
        "EndpointID": "",
        "Gateway": "",
        "IPAddress": "",
        "IPPrefixLen": 0,
        "IPv6Gateway": "",
        "GlobalIPv6Address": "",
        "GlobalIPv6PrefixLen": 0,
        "DriverOpts": null
      },
      "NetworkID de app (2 network id)
      "web_frontend": {
        "IPAMConfig": null,
        "Links": null,
        "Aliases": [
          "web-app-1",
          "app",
          "0b3354b9ebf5"
        ],
        "MacAddress": "",
        "NetworkID": "64f247568bc40420973976220287f61dc13f2b6ff9e6dbd6e1c636a6d4a4489f",
        "EndpointID": "",
        "Gateway": "",
        "IPAddress": "",
        "IPPrefixLen": 0,
        "IPv6Gateway": "",
        "GlobalIPv6Address": "",
        "GlobalIPv6PrefixLen": 0,
        "DriverOpts": null
      }
    }
  }
}

```

NetworkID de db : (réseau backend)

```

{
  "NetworkSettings": {
    "Bridge": "",
    "SandboxID": "22becd2ba7c9eadc9fdbb9d58e45727aee1203dd53811a2d01db7bb135b804af",
    "HairpinMode": false,
    "LinkLocalIPv6Address": "",
    "LinkLocalIPv6PrefixLen": 0,
    "Ports": {},
    "SandboxKey": "/var/run/docker/netns/22becd2ba7c9",
    "SecondaryIPAddresses": null,
    "SecondaryIPv6Addresses": null,
    "EndpointID": "",
    "Gateway": "",
    "GlobalIPv6Address": "",
    "GlobalIPv6PrefixLen": 0,
    "IPAddress": "",
    "IPPrefixLen": 0,
    "IPv6Gateway": "",
    "MacAddress": "",
    "Networks": {
      "web_backend": {
        "IPAMConfig": null,
        "Links": null,
        "Aliases": [
          "web-db-1",
          "db",
          "af6ba8588650"
        ],
        "MacAddress": "",
        "NetworkID": "157d3b83747ec3bf5db97a7141367963ee2ec5bbb8db2a338dfd64c677fbab53",
        "EndpointID": "",
        "Gateway": "",
        "IPAddress": "",
        "IPPrefixLen": 0,
        "IPv6Gateway": "",
        "GlobalIPv6Address": "",
        "GlobalIPv6PrefixLen": 0,
        "DriverOpts": null
      }
    }
  }
}

```

c)

on pourrait vouloir cette configuration réseau pour installer un pare feu sur app afin de protéger les données de la base de données

on pourrait utiliser nginx pour le conteneur web, node pour le conteneur app et mysql pour le conteneur db.

