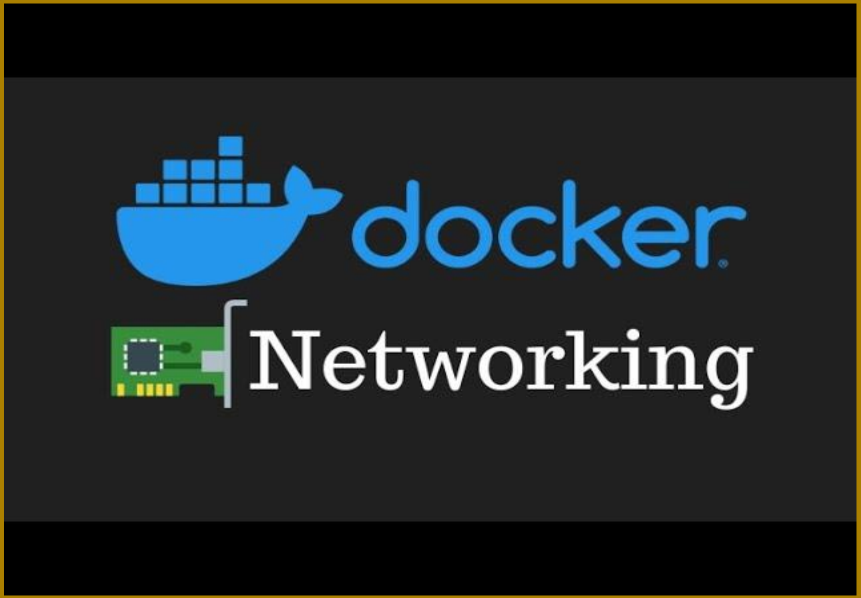
Docker - Networking



Multi-Container Apps

- The power of containerization is realized when you decompose an app into microservices, where each runs in its own container – multi-container.

- Container engines provides networking support that allows **complex network namespace setup.**

Docker Networking

- By default Docker comes with the following networks:

```
$ docker network ls
NETWORK ID    NAME      DRIVER
7fca4eb8c647  bridge    bridge
9f904ee27bf5   none     null
cf03ee007fb4   host     host
```

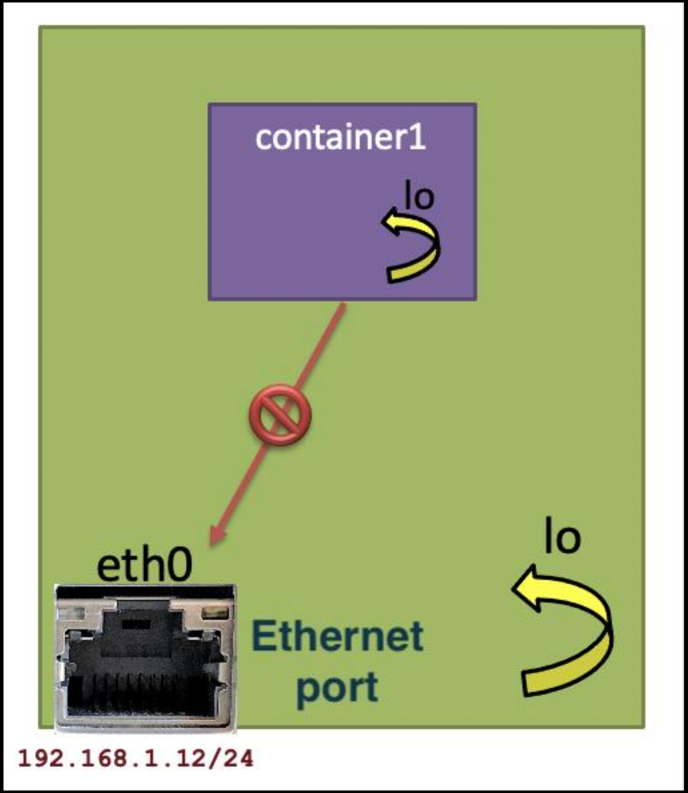
- Network Driver (Types):

1. **Bridge (default) – its container are attached to a “bridge” (virtual bridge interface).**
2. None - Its **container has no networking capabilities.**
3. Host - Its **containers are not placed in a new network namespace.**

The “none” Network

```
$ docker run \
    --network=none ...
```

- **Container is in a new network namespace.**
- **Local loopback is enabled.**
- **No other network interfaces are supplied.**

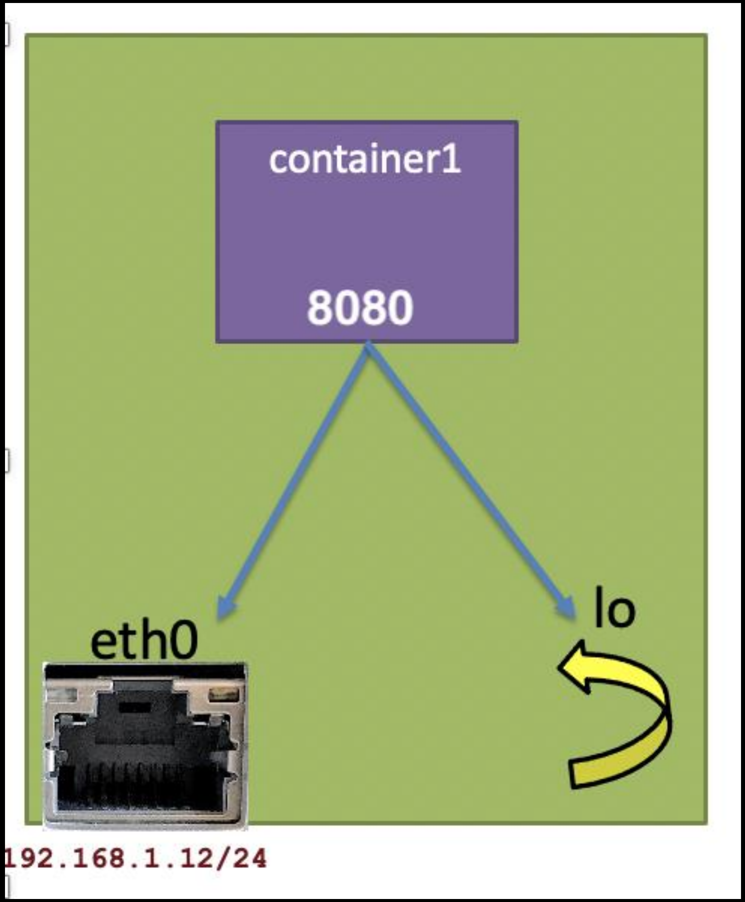


The “host” Network

- Used to add a custom service to the host machine.

```
$ docker run \
    --network=host ...
```

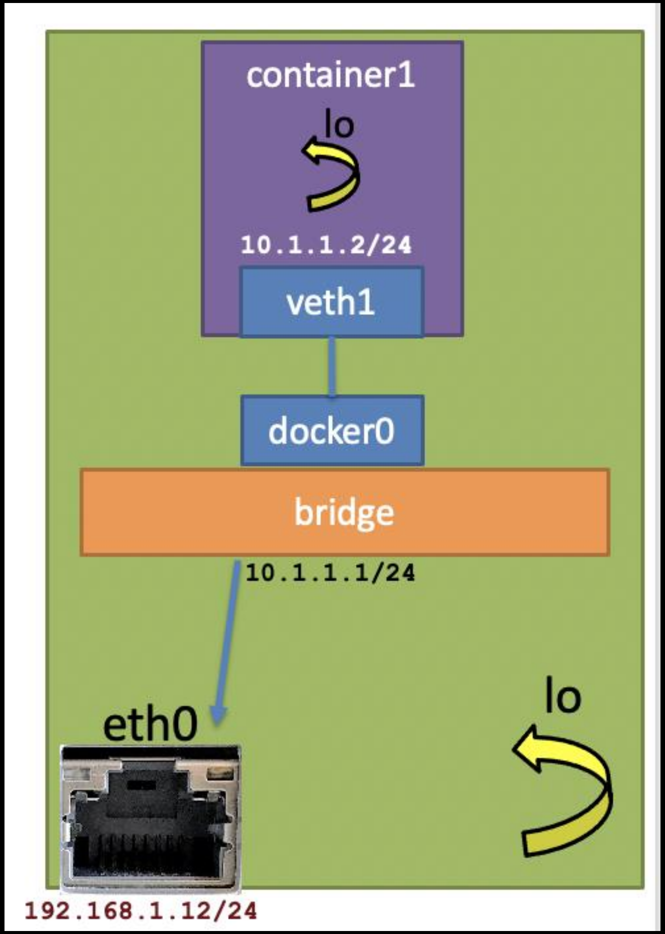
- **Container is in the host’s network namespace.**
- **Processes inside container have same access to network resources as those outside.**



A “bridge” Network

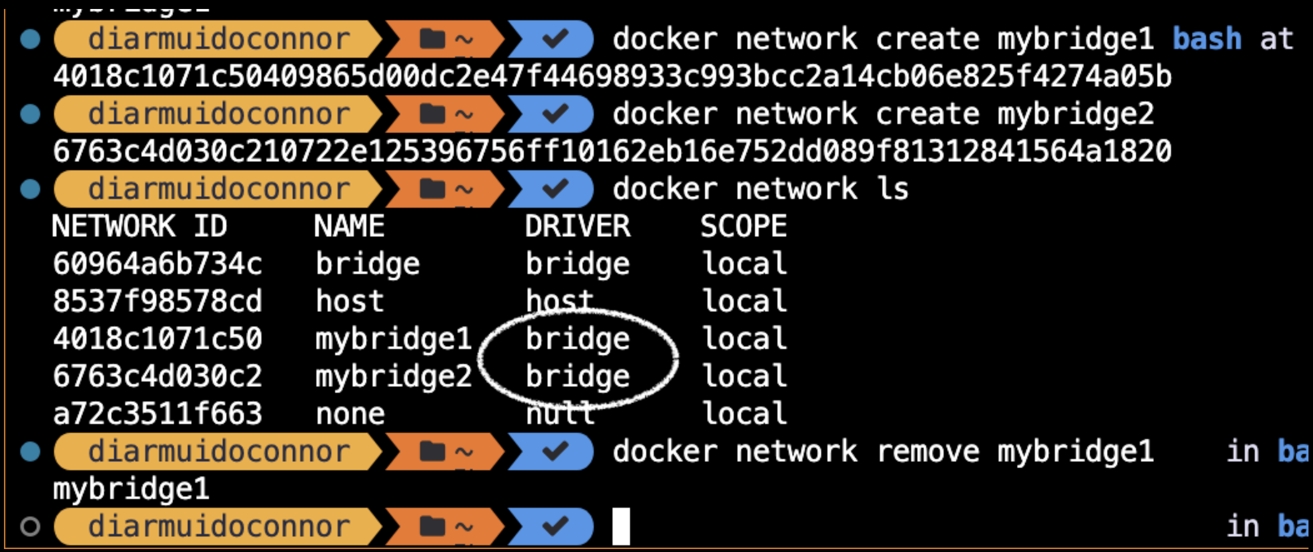
```
$ docker run -it --rm
    --network=bridge …
```

- **Default network type.**
- **Assigned a subnet IP address range.**
- **Sets up with NAT with a virtual bridge (bridge0) as a gateway.**
- **This enables a container to access the outside network**
- **Each container has a virtual ethernet i/f.**



Docker Network

- There can be multiple bridge networks.
  - Each assigned a different IP subnet range



```
● diarmuidoconnor  ~  ✓  docker network create mybridge1 bash at
4018c1071c50409865d00dc2e47f44698933c993bcc2a14cb06e825f4274a05b
● diarmuidoconnor  ~  ✓  docker network create mybridge2
6763c4d030c210722e125396756ff10162eb16e752dd089f81312841564a1820
● diarmuidoconnor  ~  ✓  docker network ls
NETWORK ID     NAME        DRIVER    SCOPE
60964a6b734c   bridge      bridge    local
8537f98578cd   host        host      local
4018c1071c50   mybridge1   bridge    local
6763c4d030c2   mybridge2   bridge    local
a72c3511f663   none        null      local
● diarmuidoconnor  ~  ✓  docker network remove mybridge1     in ba
mybridge1
○ diarmuidoconnor  ~  ✓                                       in ba
```

- Inspect a network:

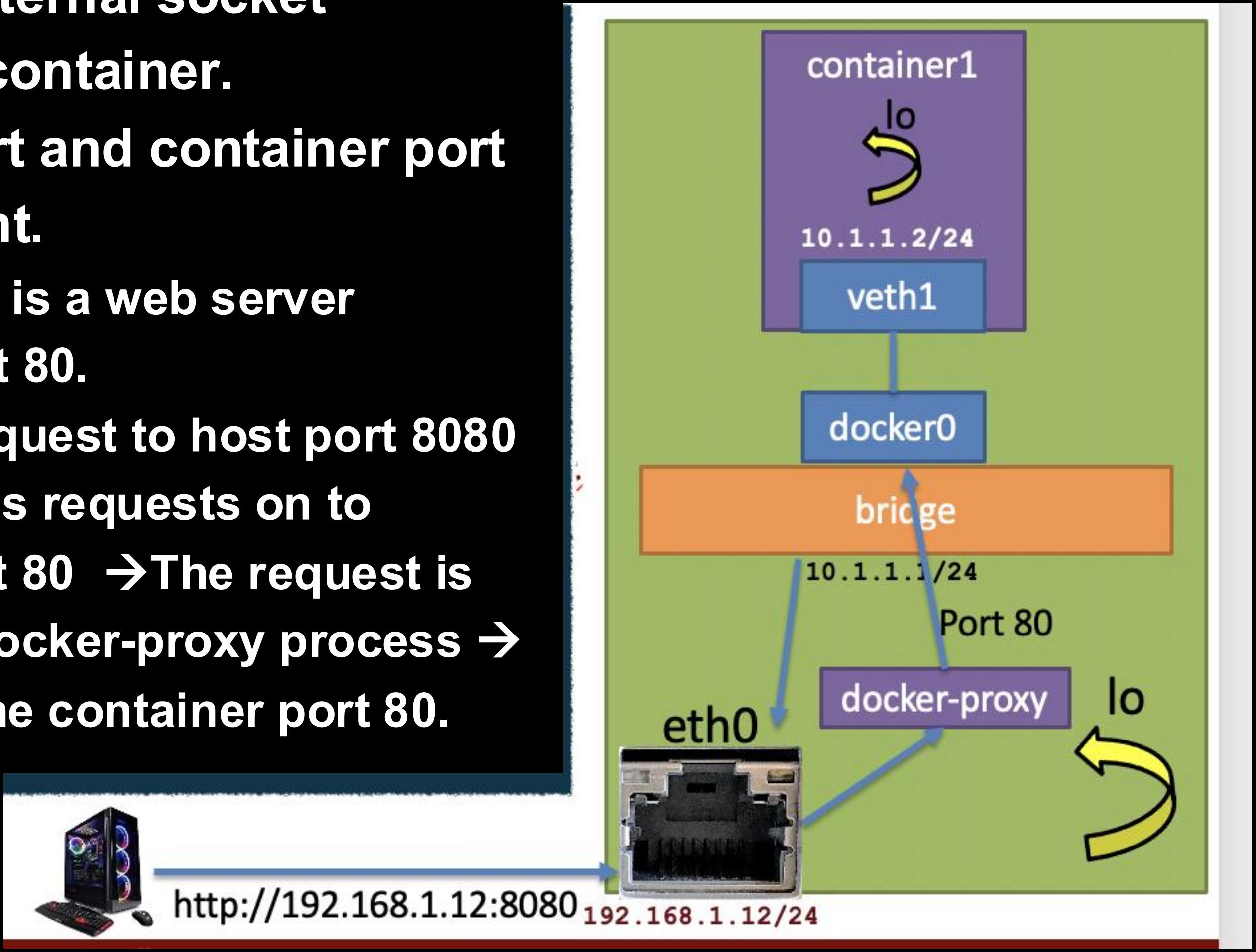
  $ docker network inspect <net_name>

  - Returns Lots of JSON-formatted information.

Port Forwarding.

- Forwarding external socket requests to a container.
- Requested port and container port can be different.
- Ex.: Container1 is a web server listening on port 80.

  Client sends request to host port 8080 → Host forwards requests on to container's port 80 →The request is received by a docker-proxy process → Forwarded to the container port 80.



Volumes

Volumes (General).

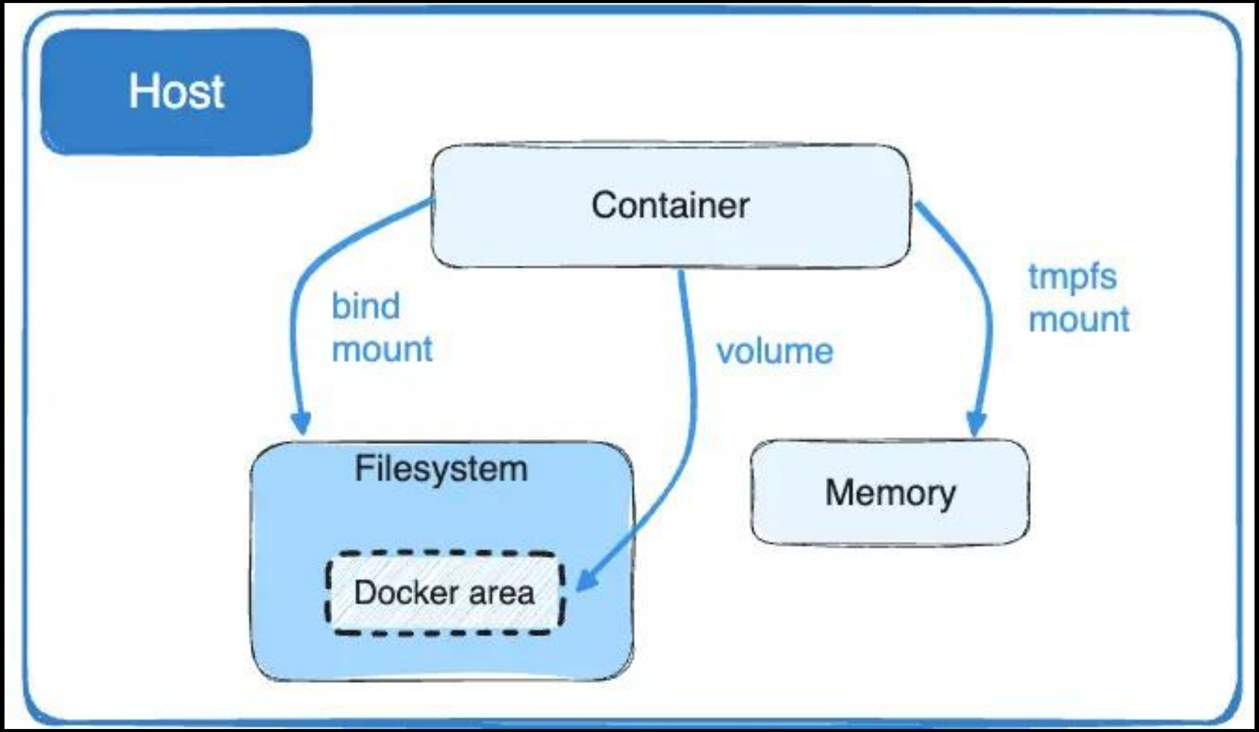
- A Volumes maps a part of the host's filesystems on to the container's filesystems, e.g.

  $ docker run … **-v host-path:container-path** …

- It allows data to persist longer than the lifecycle of the container, e.g. databases, configuration.
  - When a container is removed, its local filesystem is lost.

Bind mounts

- Two types:
  1. Bind mount (Original).
  2. Named volume.



Bind mounts

- A file or directory on the host is mounted into a container.
  - Host folder is created on demand if inecessary.
- Advantages:
  - Convenient when debugging, due to their accessibility
- Disadvantages:
  - They rely on the host filesystem having a specific structure.
  - Can’t manage them directly with Docker CLI commands.
  - Break the isolation .principle.

Creating Bind mounts

- Two formats

  (1) $ docker run -d ***-v source-path:target-path:ro*** \
  --name mycontainer image-name

  - Creates the source (host) file/folder if it does not exist.
  - Target-path – container path
  - Options, e.g. ro (read only).

  (2) $ docker run -d --name mycontainer \
  --mount type=bind,source=source-path,
  target=target-path,readonly \
  image-name

  - **Throws an error if source path does not exist.**

Named Volumes.

- Volumes live inside Docker; they're not visible on the host filesystem.

- Advantages:
  1. Can be managed with Docker CLI commands.
  2. Higher performance than bind mounts on Docker Desktop.
  3. Volume drivers let you store volumes on remote hosts or cloud providers, and support encryption.

Managing Named Volumes.

- Created and managed using the CLI.

  $ docker volume create my-vol

  – Anonymous volume – name generated by Docker deamon.

  $ `docker volume ls – list all volumes.`

  $ docker volume inspect my-vol

  $ docker volume rm my-vol - remove/delete

  $ docker volume prune – delete all unused volumes (not linked to a container).

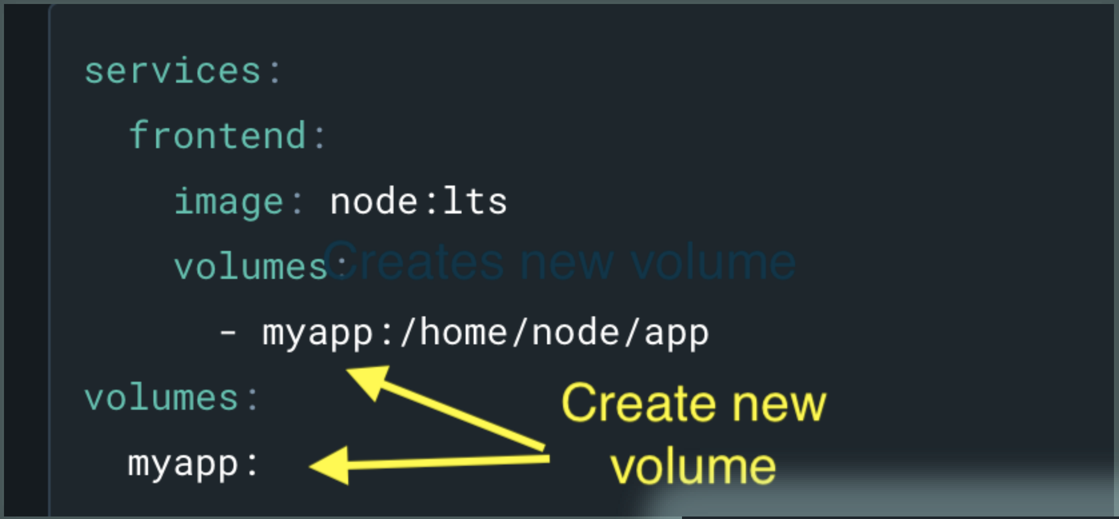
- **Start a container that uses a named volume**

  $ docker run -d --name devtest \

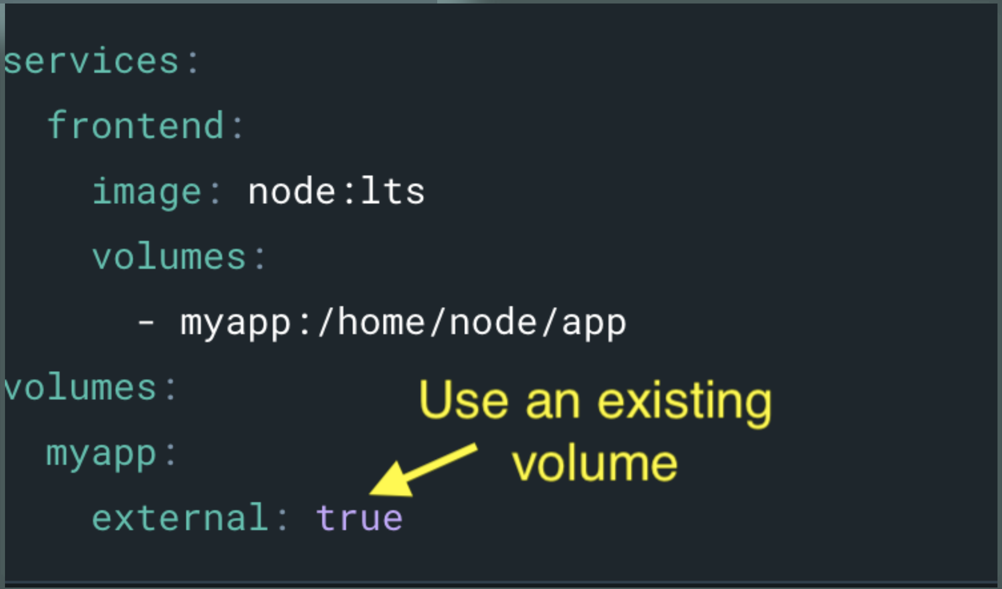
  -v my-vol:target-path image-name

  – **Can use the –mount form as well.**

Named Volumes in Compose.



```
services:
  frontend:
    image: node:lts
    volumes:
      - myapp:/home/node/app
volumes:
  myapp:
```



```
services:
  frontend:
    image: node:lts
    volumes:
      - myapp:/home/node/app
volumes:
  myapp:
    external: true
```