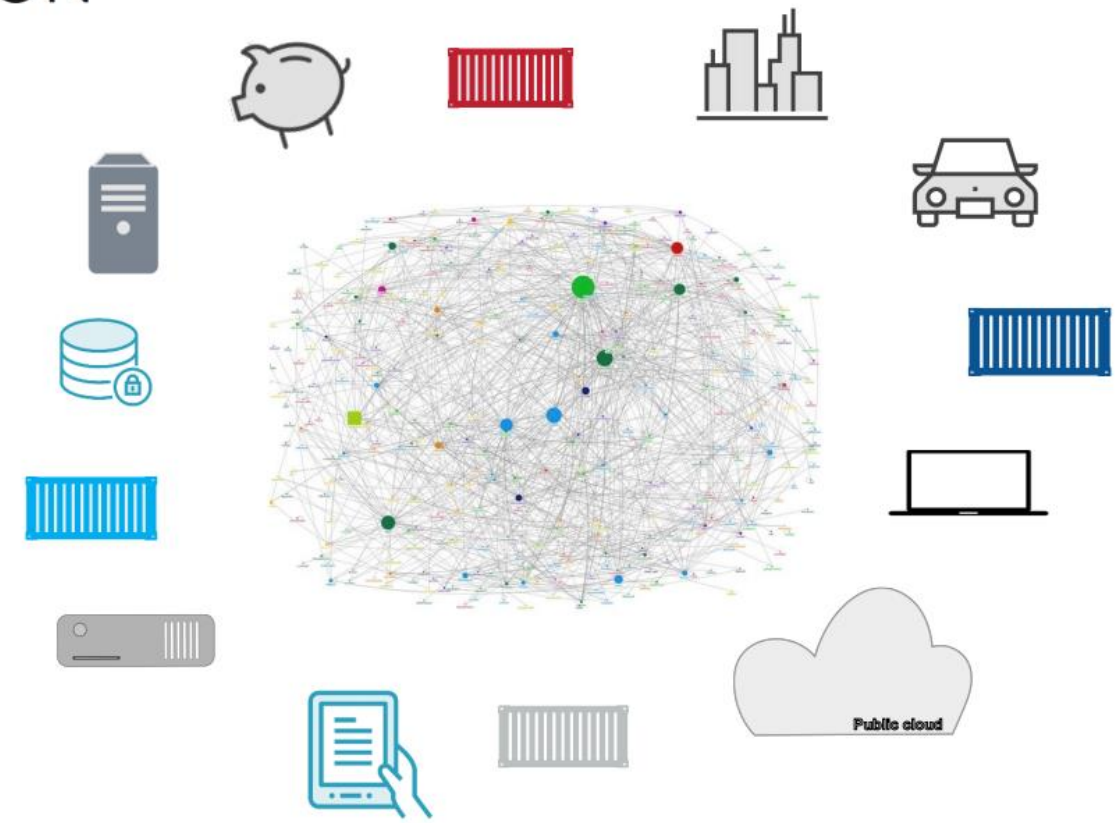
NETWORKING

COURSE INTRODUCTION

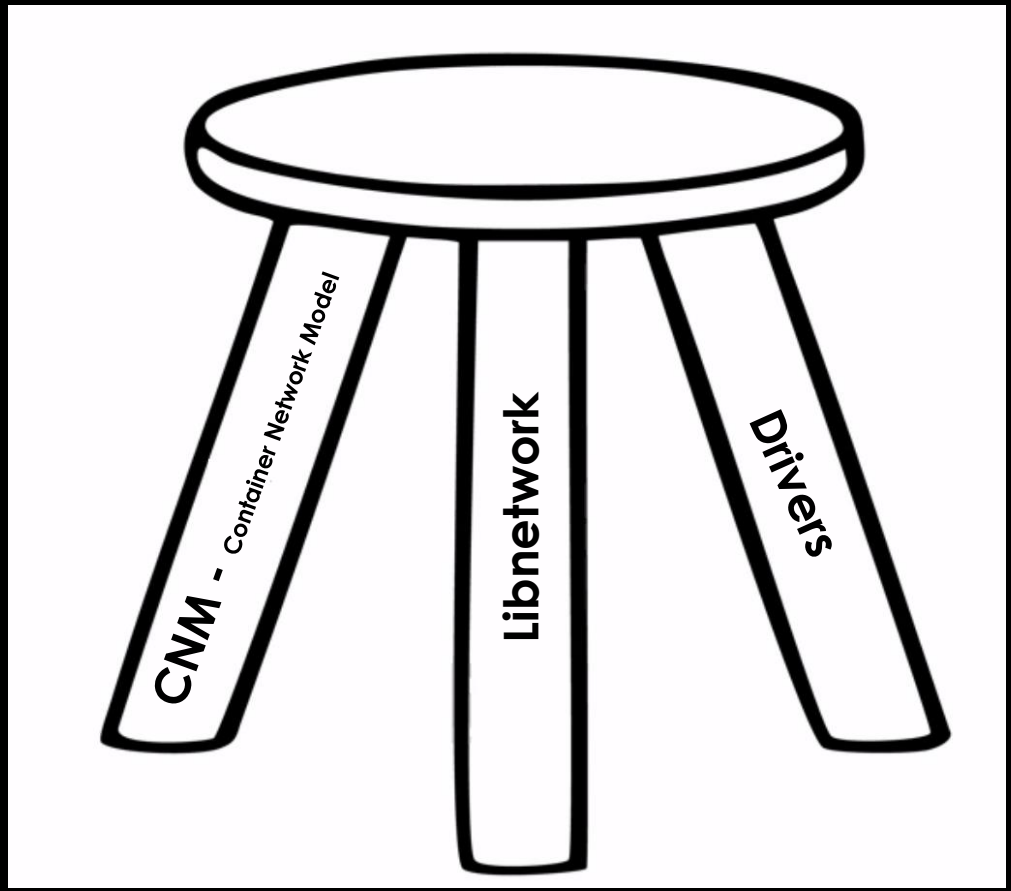
Networks are complex

Networks are huge

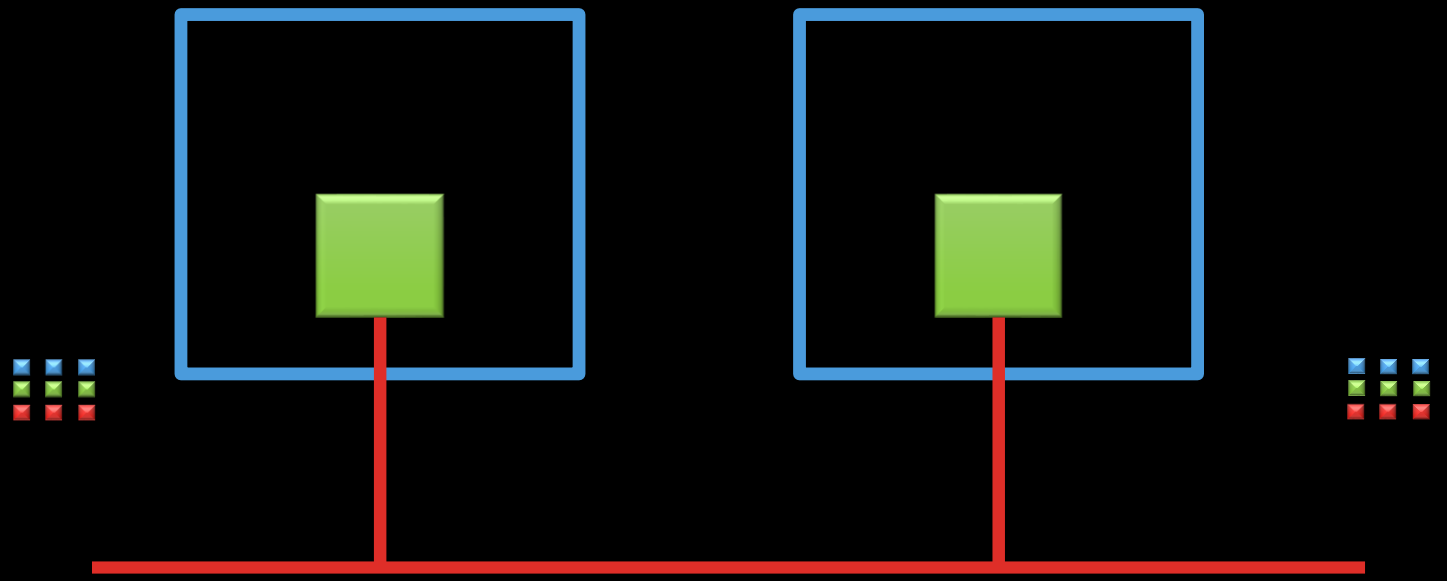
Networks are central



THE THREE PILLARS OF DOCKER NETWORKING



NETWORK - CNM



Sandbox

Isolated area of OS
Containers full network stack

Endpoint

Network interface like eth0

Network

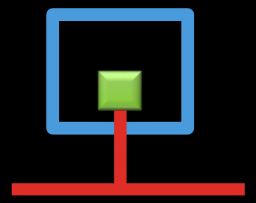
Connected Endpoint

NETWORK

Master plan / Design

CNM

DNA:
- **Sandbox**
- **Endpoint**
- **Network**



Control plane

Libnetwork

Central place for
all docker networking
logic ,API ,UX etc…
Real-world implantation of CNM

Data plane

Drivers

Network-specific detail
- Overlay
- MACVLAN
- IPVLAN
- Bridge

NETWORK – BASIC CLI

```
C:\Users\Administrator>docker network

Usage:  docker network COMMAND

Manage networks

Commands:
  connect     Connect a container to a network
  create      Create a network
  disconnect  Disconnect a container from a network
  inspect     Display detailed information on one or more networks
  ls          List networks
  prune       Remove all unused networks
  rm          Remove one or more networks

Run 'docker network COMMAND --help' for more information on a command.
```

NETWORKING: SINGLE - HOST

NETWORKING: SINGLE – HOST CLI

- Create bridge

```
docker network create -d bridge --subnet 10.0.0.1/24 ps-bridge
```

- More information about bridge

```
docker inspect ps-bridge
```

CONNECT BETWEEN CONTAINER

- Create Container name C1 with ps-bridge

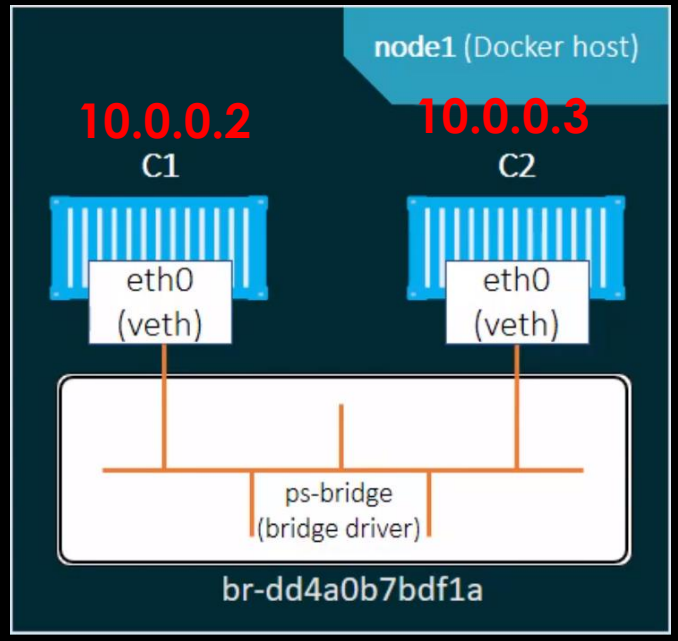
```
docker run -dt --name c1 --network ps-bridge alpine sleep 1d
```

Create Container name C2 with ps-bridge

```
docker run -dt --name c1 --network ps-bridge alpine sleep 1d
```

inspect network

```
docker inspect ps-bridge
```



CONNECT BETWEEN CONTAINER

- Check container C1 and C2 with ps-bridge

```
docker exec -it c1 sh
```

- Check ip

```
/# ip a
```

```
/ # ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue
    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
2: tunl0@NONE: <NOARP> mtu 1480 qdisc noop state DOWN
    link/ipip 0.0.0.0 brd 0.0.0.0
3: ip6tnl0@NONE: <NOARP> mtu 1452 qdisc noop state DOW
    link/tunnel6 00:00:00:00:00:00:00:00:00:00:00:00:0
8: eth0@if9: <BROADCAST,MULTICAST,UP,LOWER_UP,M-DOWN>
    link/ether 02:42:0a:00:00:02 brd ff:ff:ff:ff:ff:ff
    inet 10.0.0.2/24 brd 10.0.0.255 scope global eth0
       valid_lft forever preferred_lft forever
```

- Check connoting to C2

```
/# ping 10.0.0.3
```

By Name

```
/# ping C2
```

CONNECT BETWEEN CONTAINER MORE THEN ONE NETWORK

Create networks bridge1 and bridge2:

```
docker network create -d bridge --subnet 11.1.0.1/24 bridge1
docker network create -d bridge --subnet 11.2.0.1/24 bridge2
```

- Create Container name C1 with bridge1

```
docker run --rm -dt --name C1 --network bridge1 alpine sleep 1d
```

Create Container name C2 with bridge1

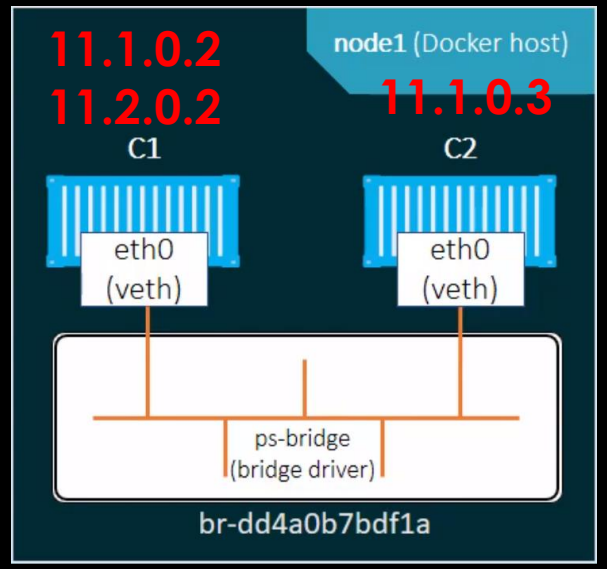
```
docker run --rm -dt --name C2 --network bridge1 alpine sleep 1d
```

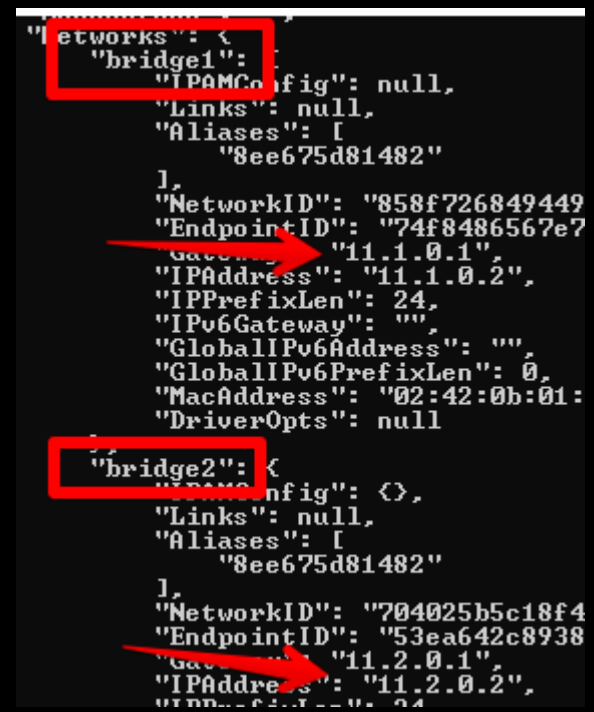
Connect bridge2 to Container C1

```
docker network connect bridge2 C1
```

inspect network

```
docker inspect bridge2
```

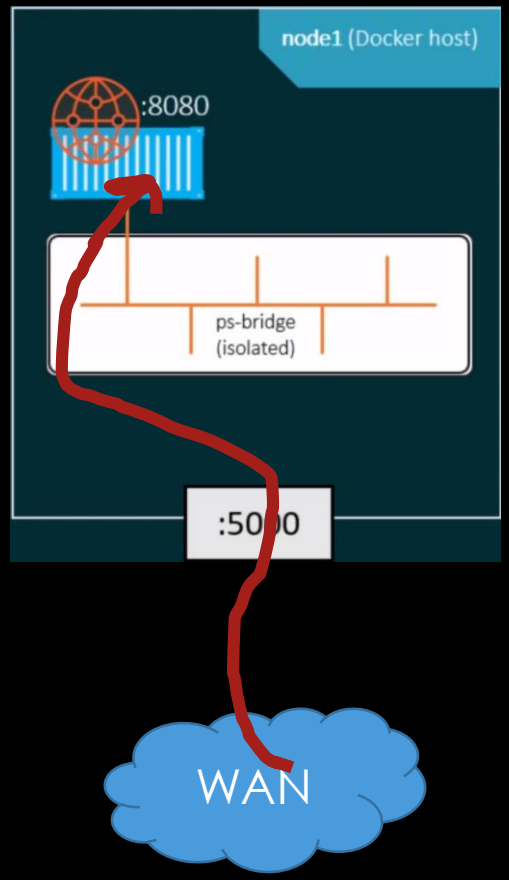




EXPOSE PORT

(host) (container)

-p 5000:8080



תרגיל 7

1. ייצר Bridge בשם first-Bridge למרחב כתובות 10.0.0.1/24
2. תבדוק באמצעות פקודה inspect את המידע על ה Bridge
3. הרם container שירוץ ברקע של alpine בשם C100 שמחובר לרשת first-Bridge
4. הרם container שירוץ ברקע של alpine בשם C200 שמחובר לרשת first-Bridge
5. תבדוק שוב באמצעות פקודה inspect את המידע על ה Bridge
    1. בדוק ש C100 ו C200 משויכים אליו, תרשום את הכתובות IP שקיבלו בצד.
6. כנס באמצעות bash ל C100
7. בדוק איזה כתובת קיבלת
8. בצע Ping ל C200 באמצעות כתובת IP
9. בצע Ping ל C200 באמצעות שם

תרגיל 8

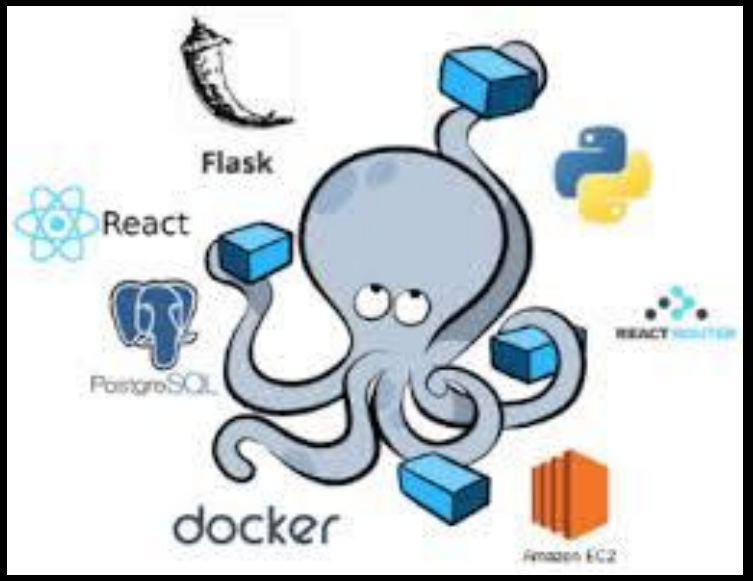
1. ייצר תיקיות
   C:\logs
   C:\sqlvolume\log
   C:\sqlvolume\data
2. ייצר שני רשתות:
   db-layer ב subnet 10.100.0.1/24
   app-layer ב subnet 10.200.0.1/24
4. הרם container של mssl,שייך אותו ל db-layer.
   השלם את הפרטים על הפקודה הבאה : (הפקודה בשורה אחת)

```
docker run --rm --name my-db -e 'ACCEPT_EULA=Y' -e 'MSSQL_SA_PASSWORD=SecretP@ssw0rd' –d
 -v c:/sqlvolume/data:/var/opt/mssql/data
 -v c:/sqlvolume/log:/var/opt/mssql/log mcr.microsoft.com/mssql/server
```

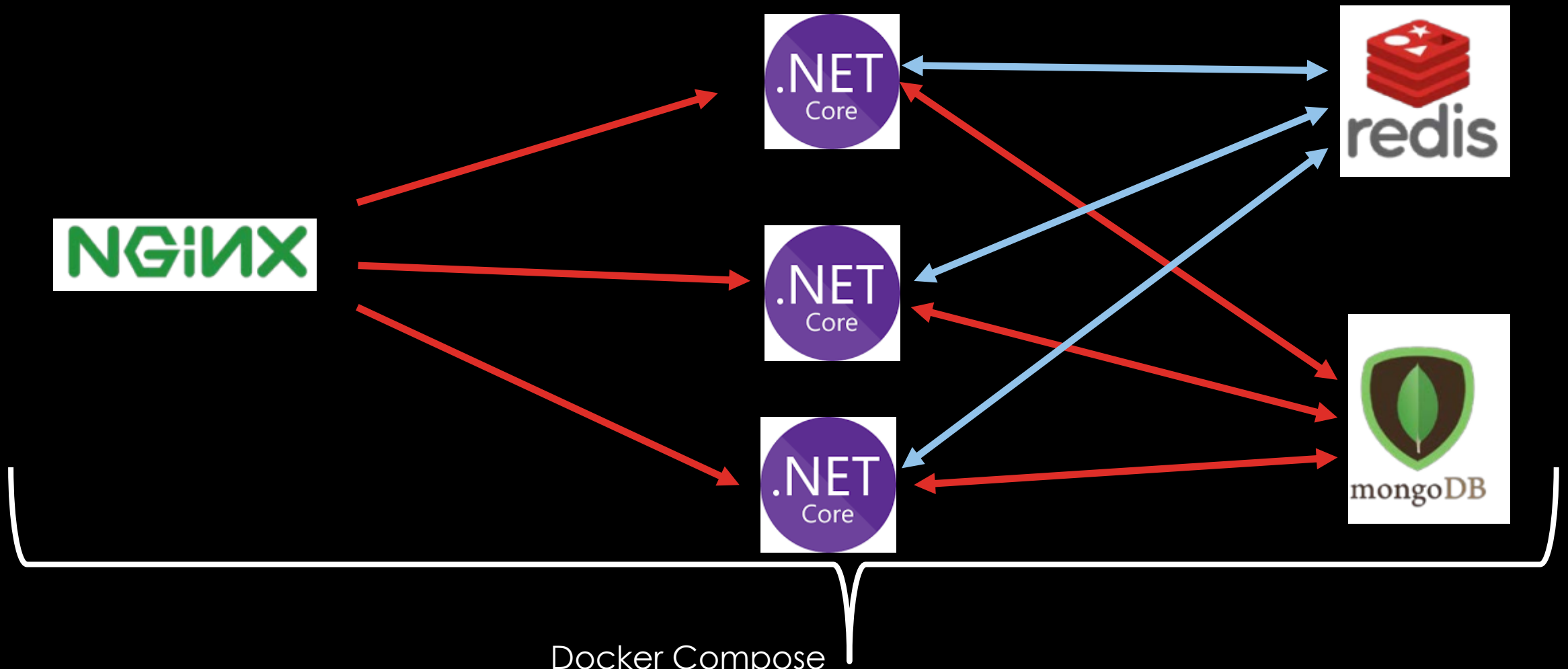
5. הורד את הפרויקט או ייצר BUILD מ
   https://github.com/shaloml/docker-network-sample.git בשם app-net
6. צור container שחשוף בפורט 8000 מ app-net בשם my-app, צרף אותו לשני הרשתות
7. גלוש לדף
8. חקור את my-app , בדוק איזה כתובות קיבל.

DOCKER COMPOSE

- Start, stop , rebuild of our services
- View status of our running services
- Stream the log output of running services
- Run a one-off command on a service

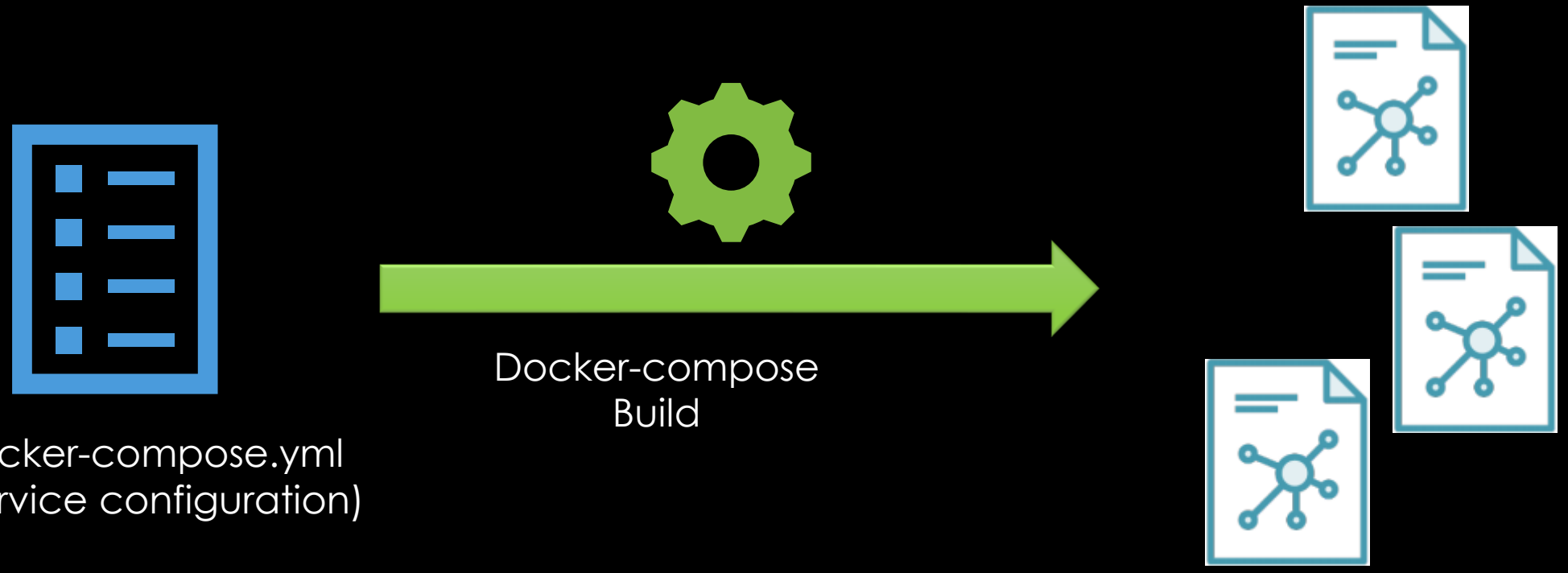


THE NEED FOR DOCKER COMPOSE



DOCKER COMPOSE WORKFLOW

THE DOCKER-COMPOSE.YML FILE



THE DOCKER-COMPOSE.YML FILE

version: '2'

services:

docker-compose.yml

KEY SERVICE CONFIGURATION OPTIONS

build

environment

image

networks

ports

volumes

DOCKER-COMPOSE.YML EXAMPLE

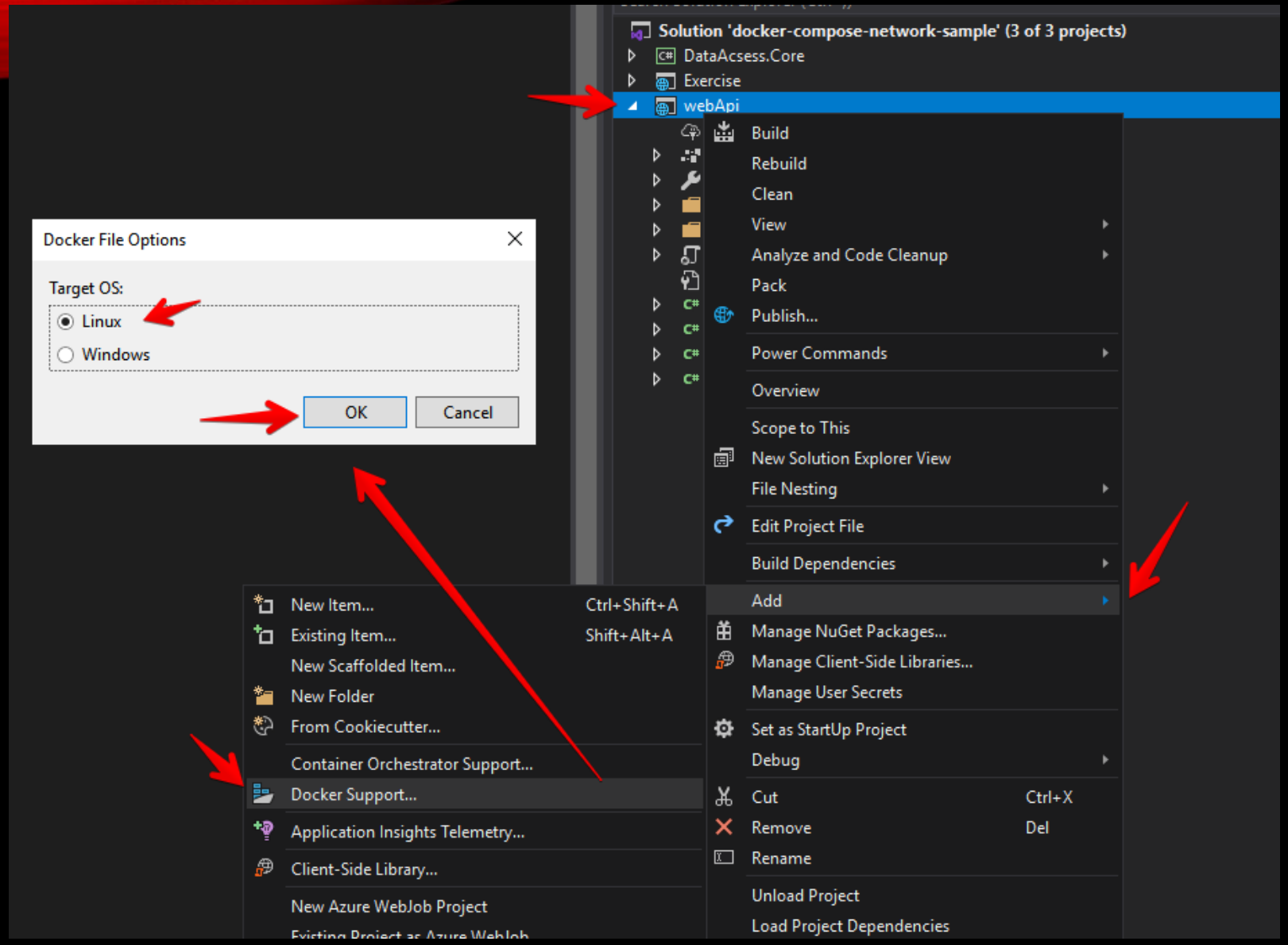
```
Version:'3.4'
services:
    node:
        build:
    context: .
        dockerfile: node.dockerfile
    networks:
        -nodeapp-network

    mongodb:
        image: mongo
        networks:
         - nodeapp-network
    networks:
        nodeapp-network
        driver: bridge
```

```yaml
version: '3' # Docker-compose yml version for docker compose builder
services: # Here we define our architecture services / roles
 nginx: # or web_role  , api_role , db_mysql , db_redis ....
   build:  # Dockerfile to build or use image:
           #to pull from DockerHub (public/private) or git
     context: . # folder where the dockerfile is located
     dockerfile: #[dockerfile-name]
   ports: # Ports we wish to expose source:target
     - 8080:8080
   volumes: # Which Bind mounts or Volumes to mount source:target
     - type: bind        # Shortsyntax -> ./source:/code
       source: /source
       target: /code
     -type: volume     # Shortsyntax ->logicalVolume01:/var/log
       source: logicalVoloume01
       target: /var/log
   network: # Define netwroks per service / role
     - db_layer
     - app_layer
 services: #.....
   image: redis
networks: # custome configuration per network defined
 db_layer:
 app_layer:

volumes:
 logicalVoloume01:
```

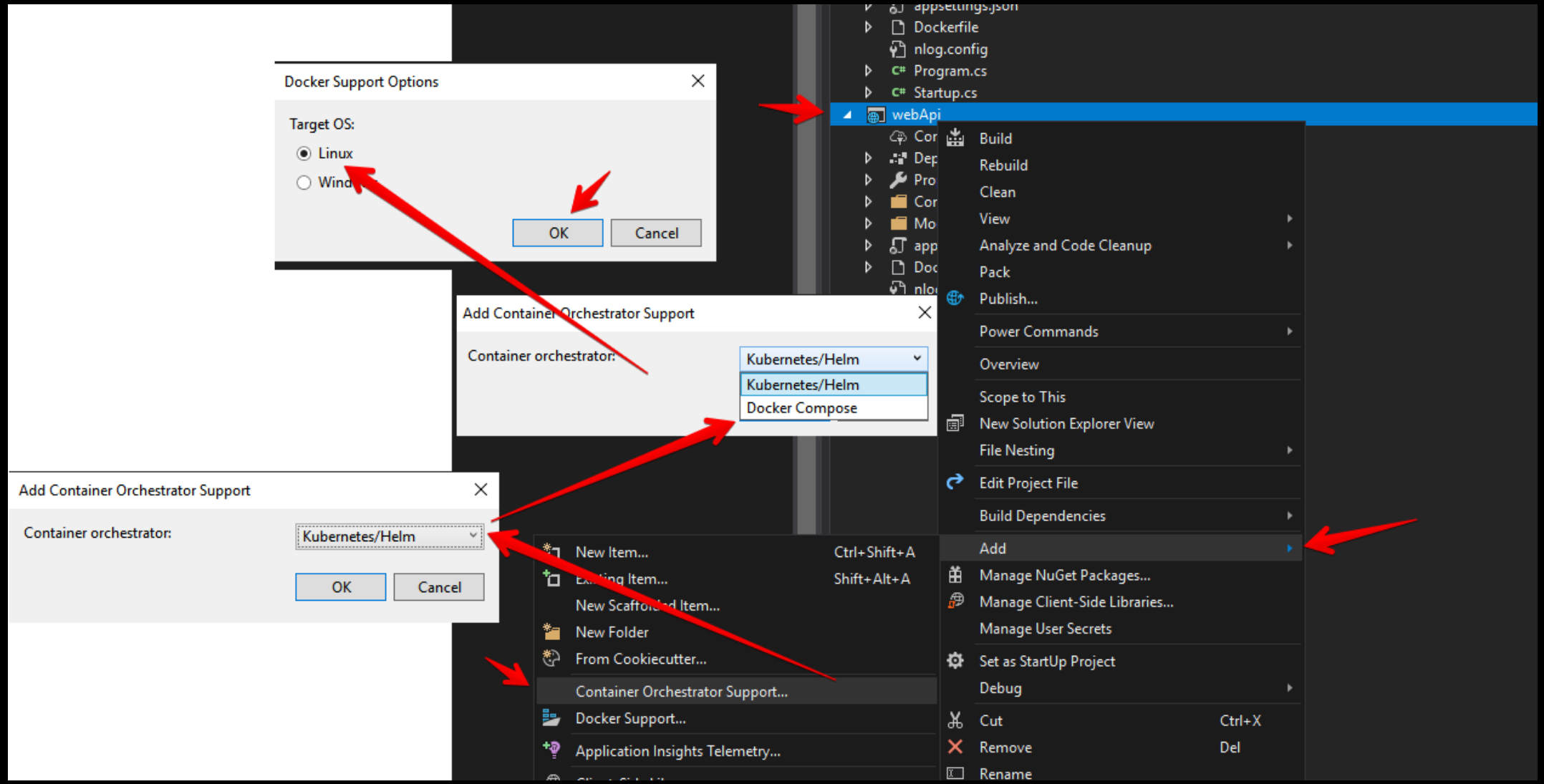
DOCKER ON VISUAL STUDIO



Add Dockerfile

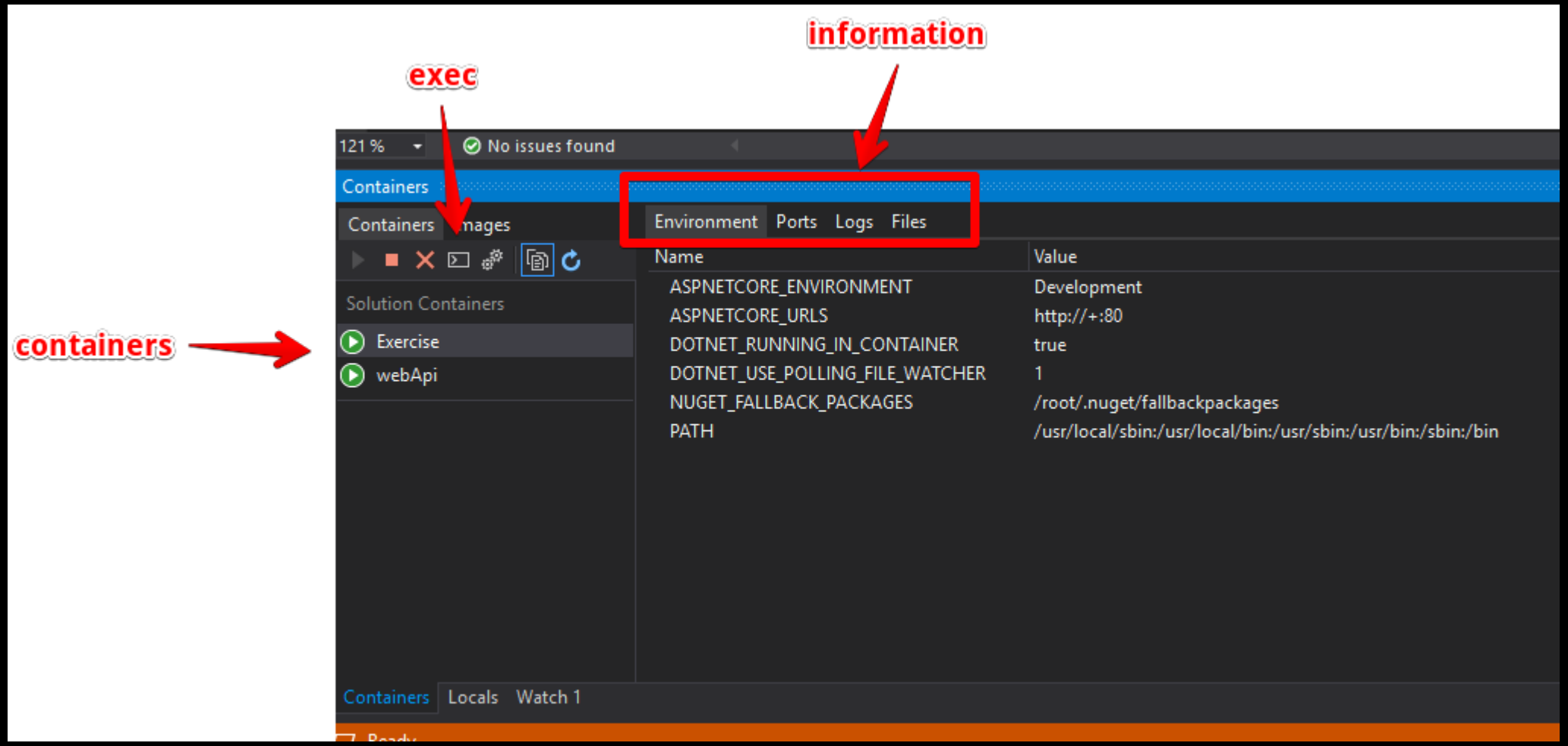
DOCKER ON VISUAL STUDIO

Add docker-compose



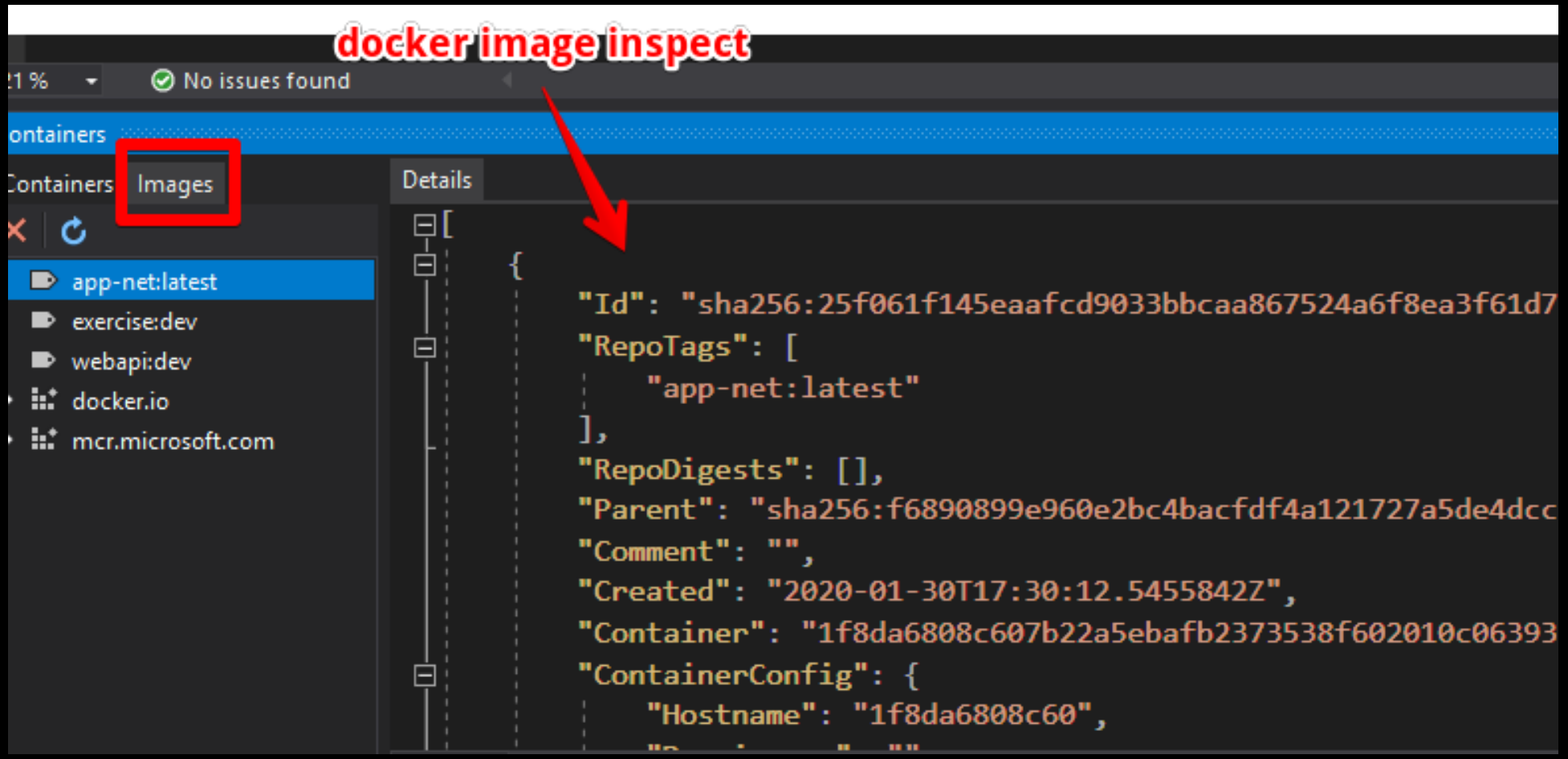
DOCKER ON VISUAL STUDIO

management



DOCKER ON VISUAL STUDIO

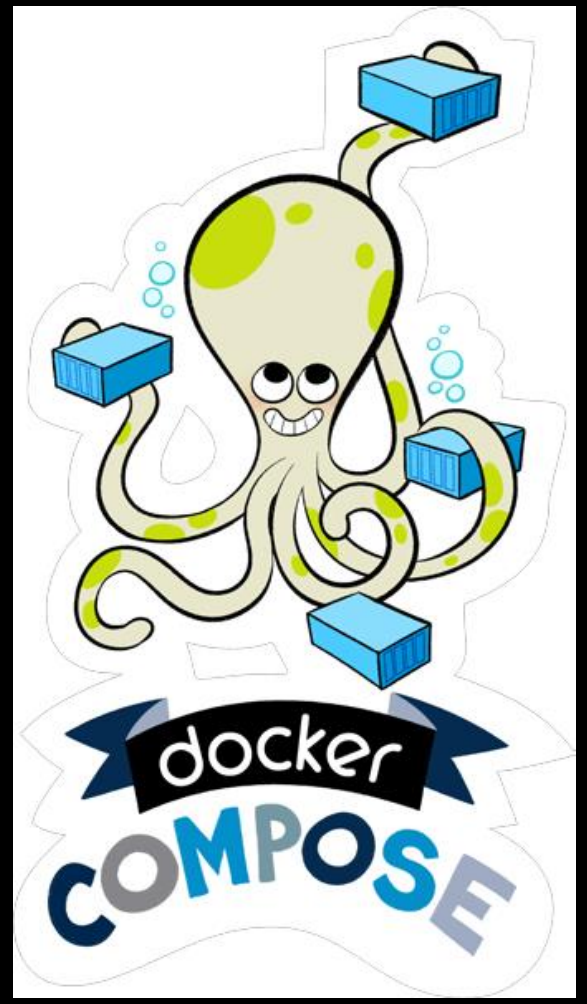
management



DEMO

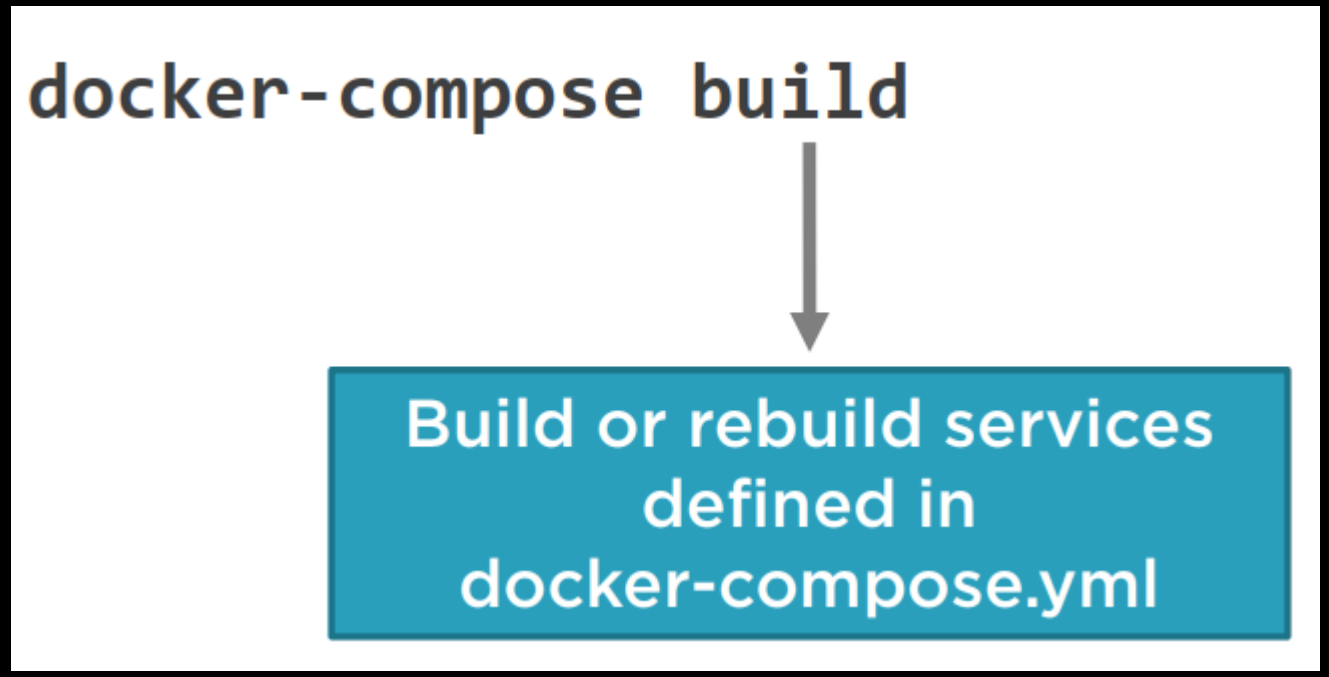
KEY DOCKER COMPOSE COMMANDS

- docker-compose build
- docker-compose up
- docker-compose down
- docker-compose logs
- docker-compose ps
- docker-compose stop
- docker-compose start
- docker-compose rm



BUILDING SERVICES

```
docker-compose build
```

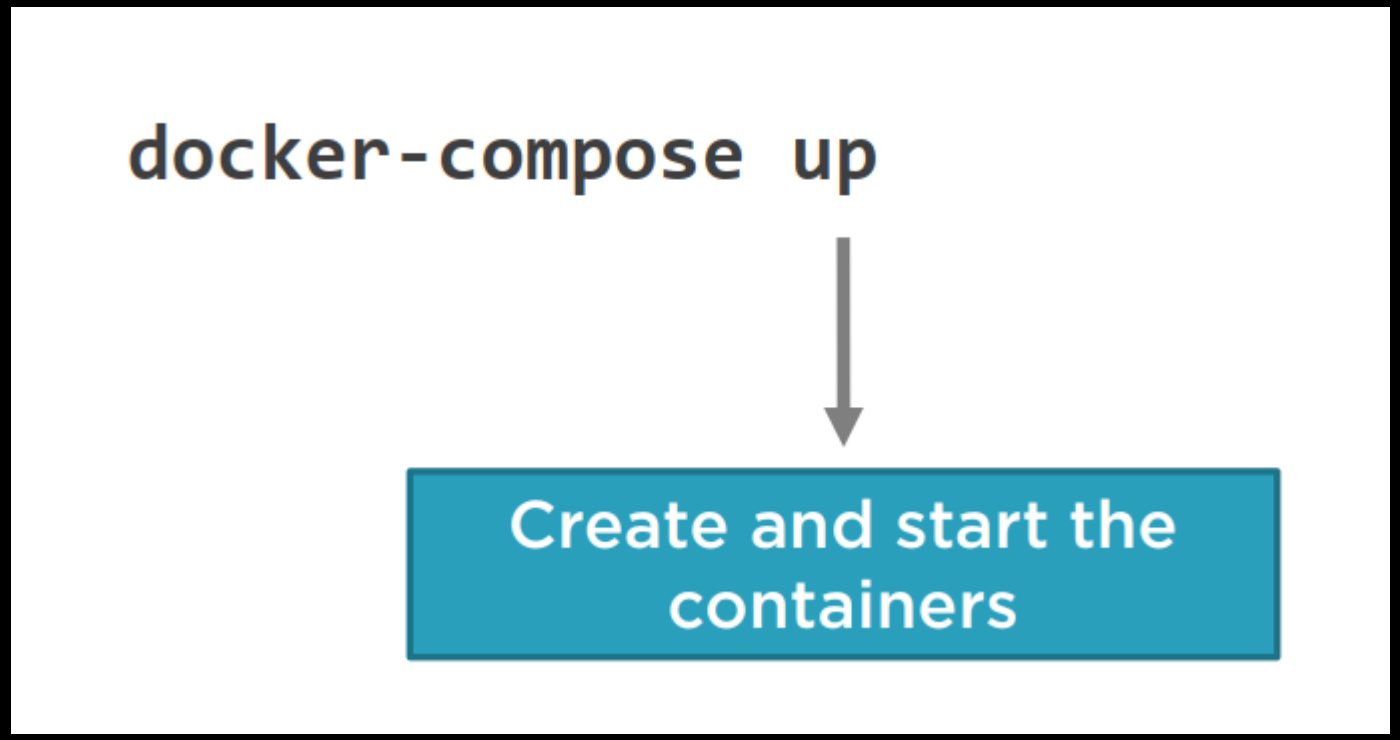


BUILDING SPECIFIC SERVICES

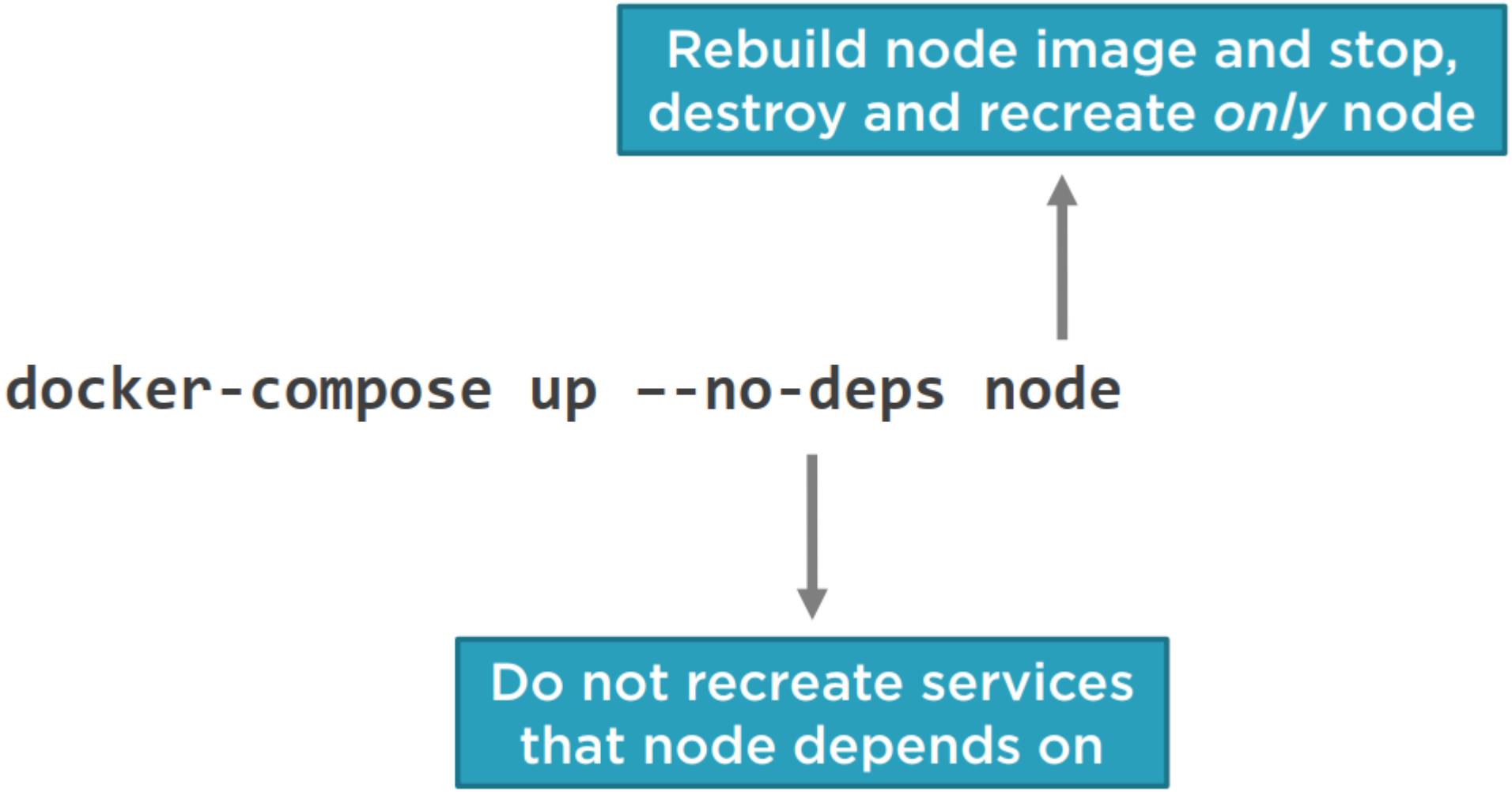
```
docker-compose build mongo
```


Only build/rebuild mongo service

CREATING AND STARTING CONTAINERS



CREATING AND STARTING CONTAINERS

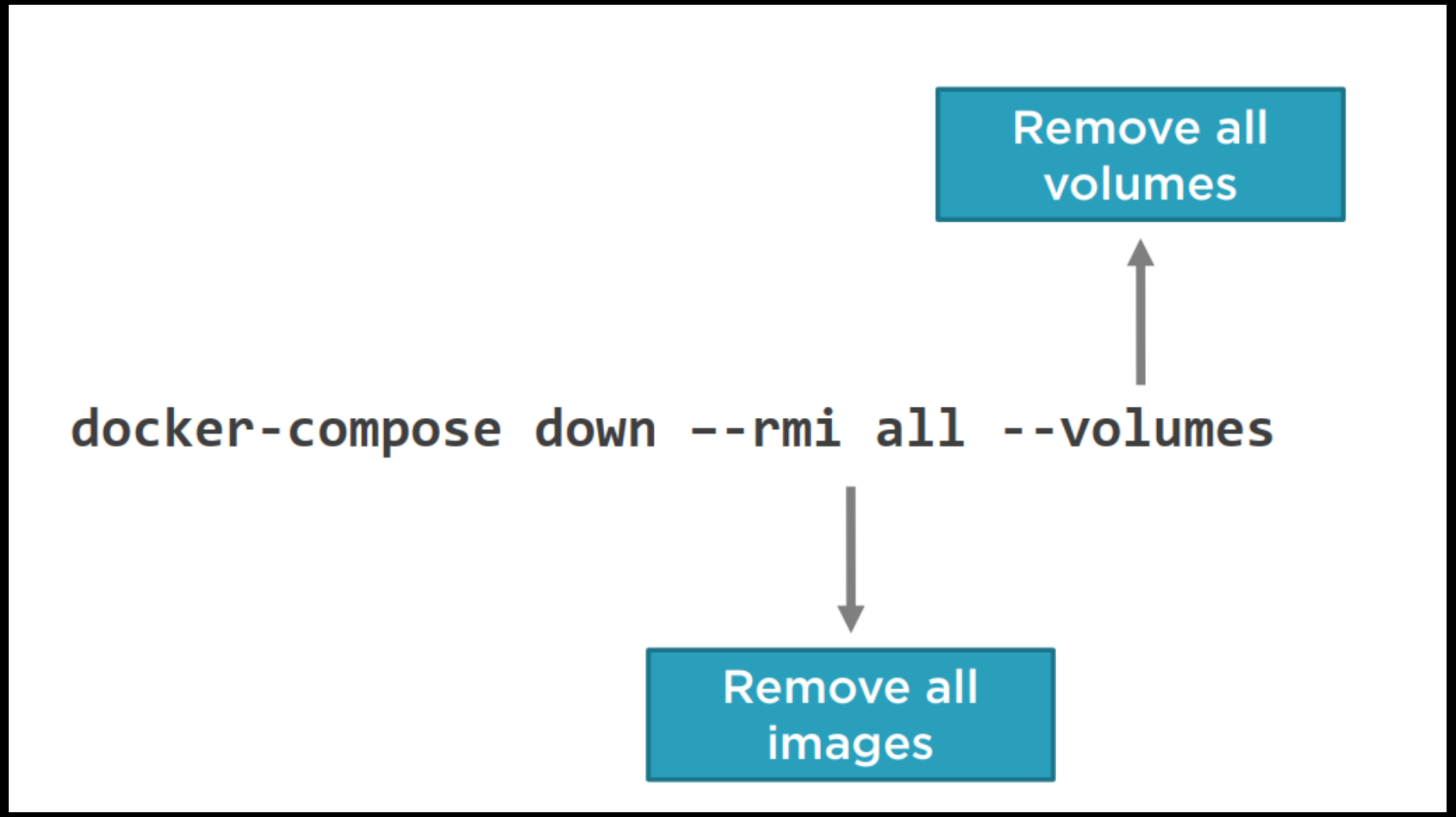


STOP AND REMOVE CONTAINERS

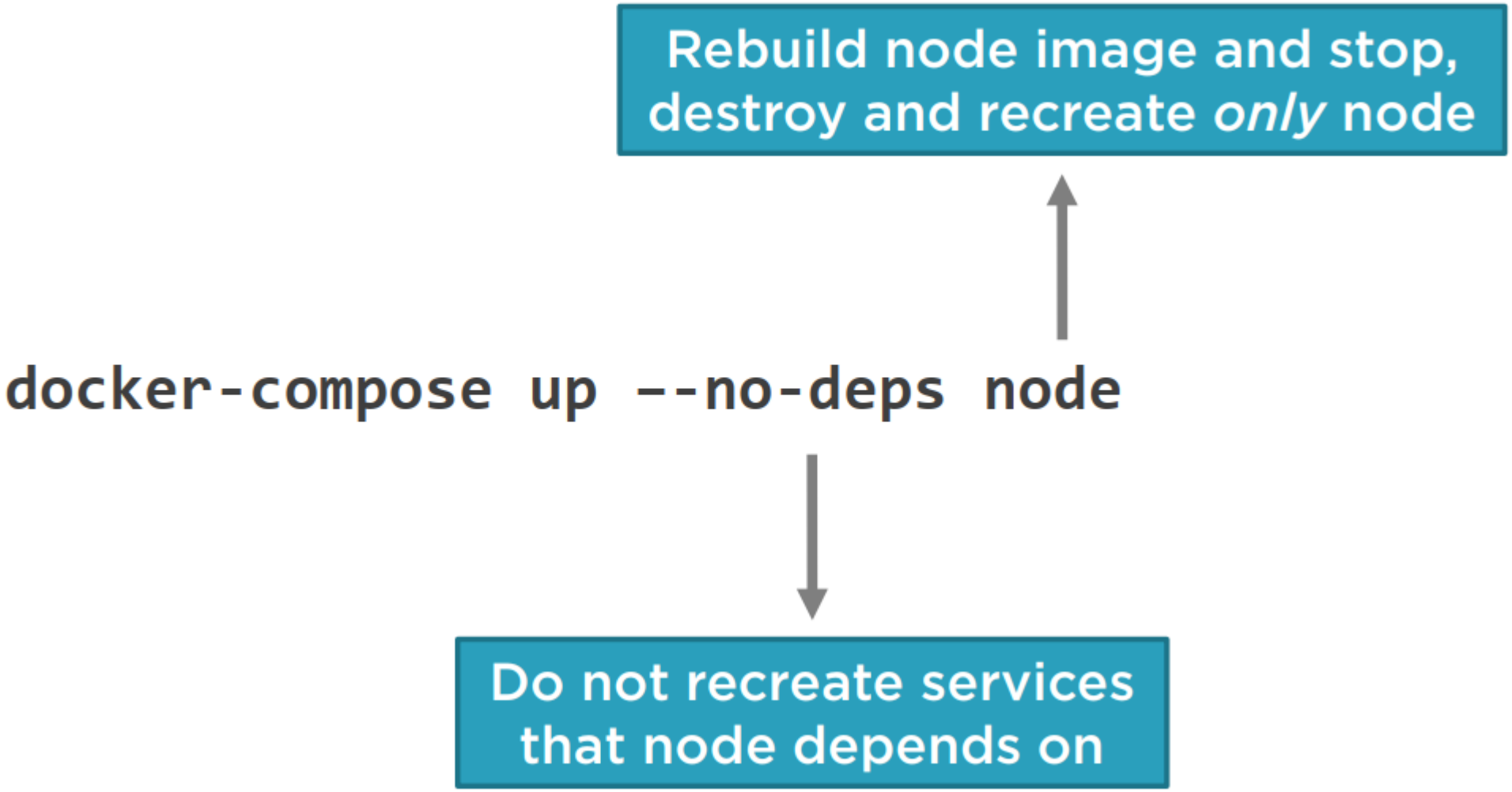
```
docker-compose down
```

Take all of the containers down (stop and remove)

STOP AND REMOVE CONTAINERS, IMAGES, VOLUMES



CREATING AND STARTING CONTAINERS



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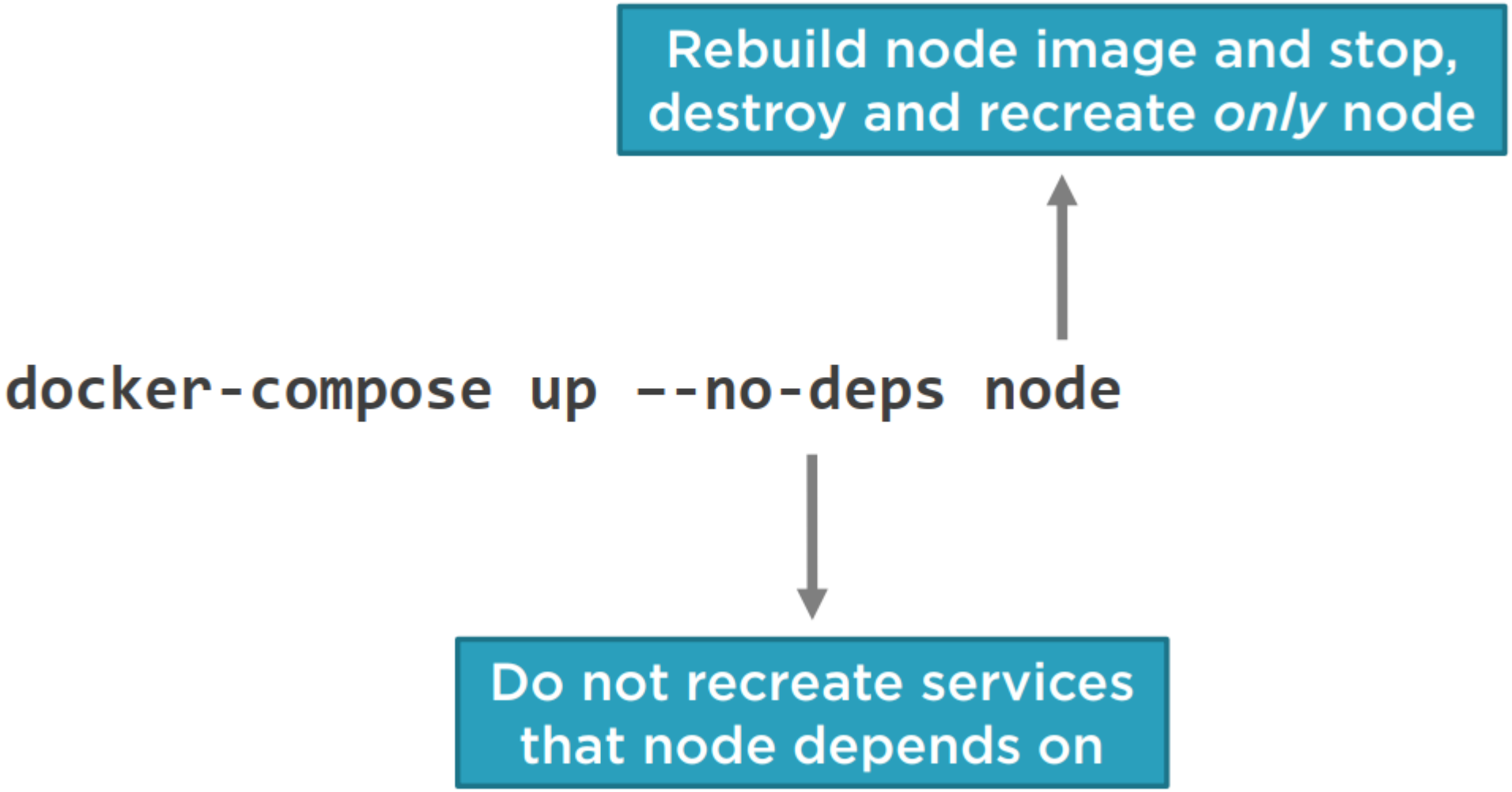

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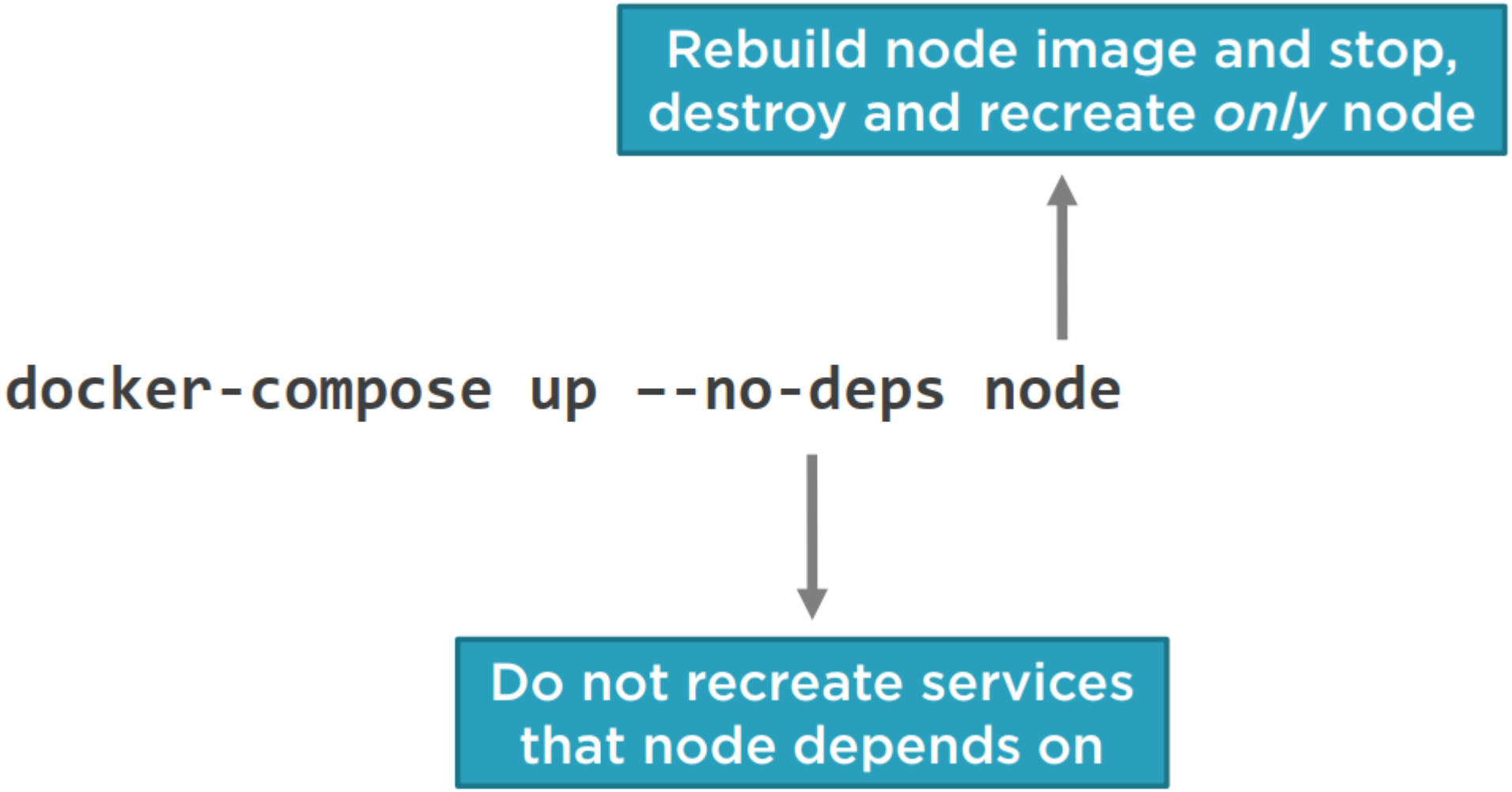

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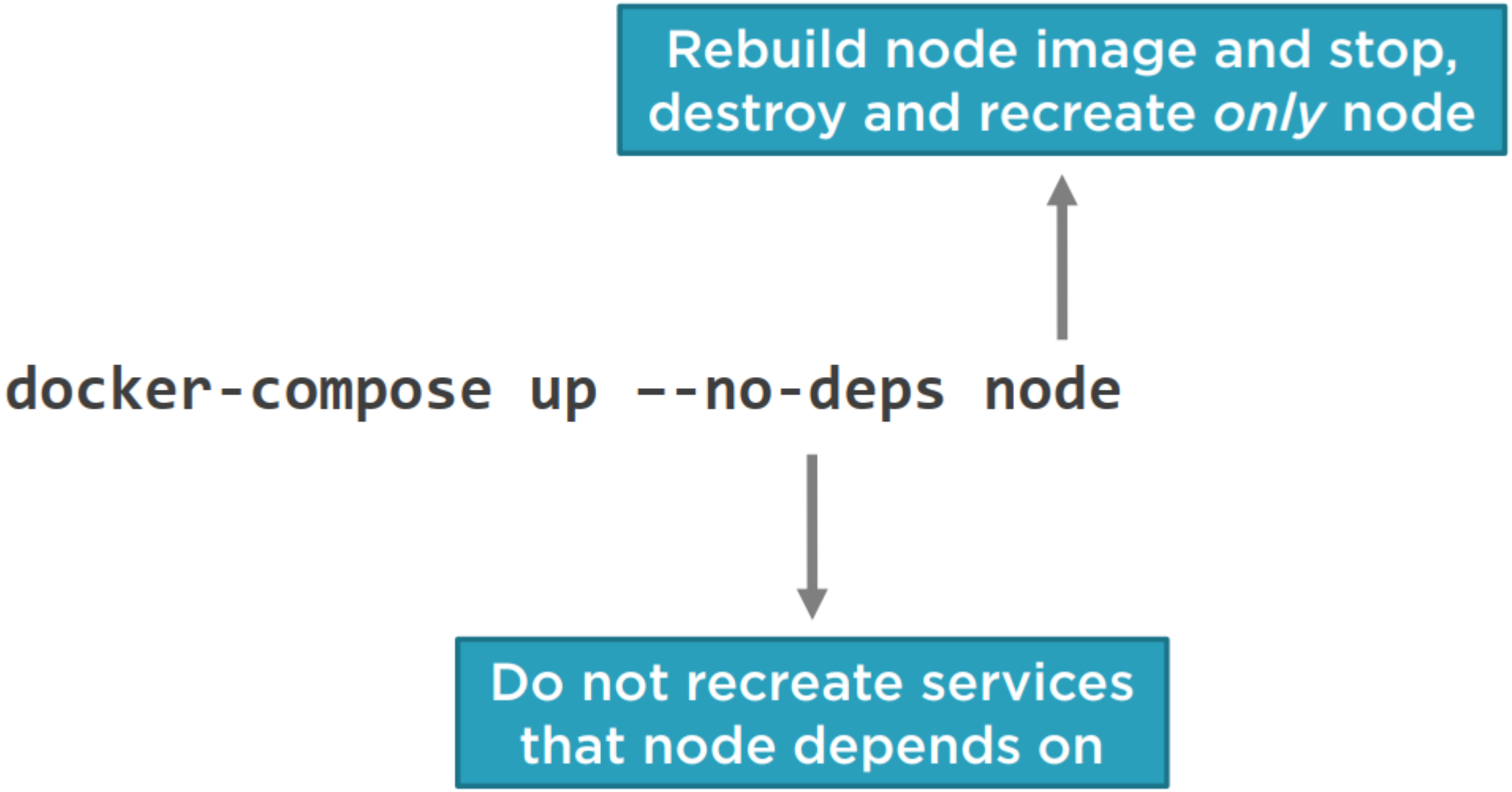

DOCKER-COMPOSE - TIPS

- How to keep your images small
- Store data on volumes
- **use bind mounts is during development**, when you may want to mount your source directory or a binary you just built into your container. For production, use a volume instead, mounting it into the same location as you mounted a bind mount during development.
-

DOCKER-COMPOSE - TIPS

- **Use name of container**
  use the name of the service as your dns and you will be able to talk to other containers without the need to create a network. That's a better option to keep your docker-compose files as simple as possible.
- **Use a .env file to replace variables in your docker-compose.yml file**
- **Assign an ip to your container**

```
version: '3.7'
services:
 redis:
   image: redis:4.0.9-alpine
   init: true
   container_name: redis
   networks:
     dockernet:
      ipv4_address: 172.20.0.2
networks:
 dockernet:
  driver: bridge
  ipam:
   config:
   - subnet: 172.20.0.0/16
```

- **Use the build flag to rebuild your containers**
  Sometimes you want to force a rebuild of your containers with docker-compose, do it like this:

```
docker-compose up -d –build

# Ignore the cache:
docker-compose build --no-cache
```

-

DOCKER-COMPOSE - TIPS

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-

תרגיל DOCKER-COMPOSE

הורד תרגיל מ :

https://github.com/shaloml/Course-docker.git

Thanks