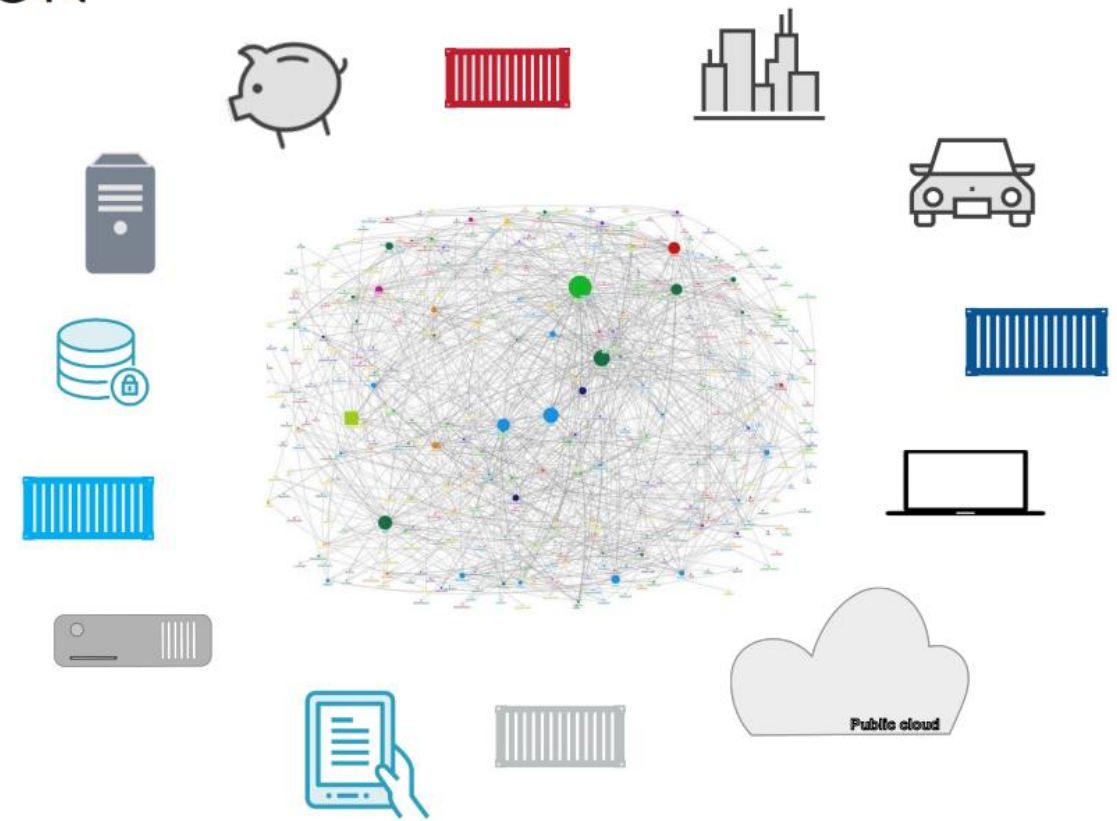
NETWORKING

COURSE INTRODUCTION

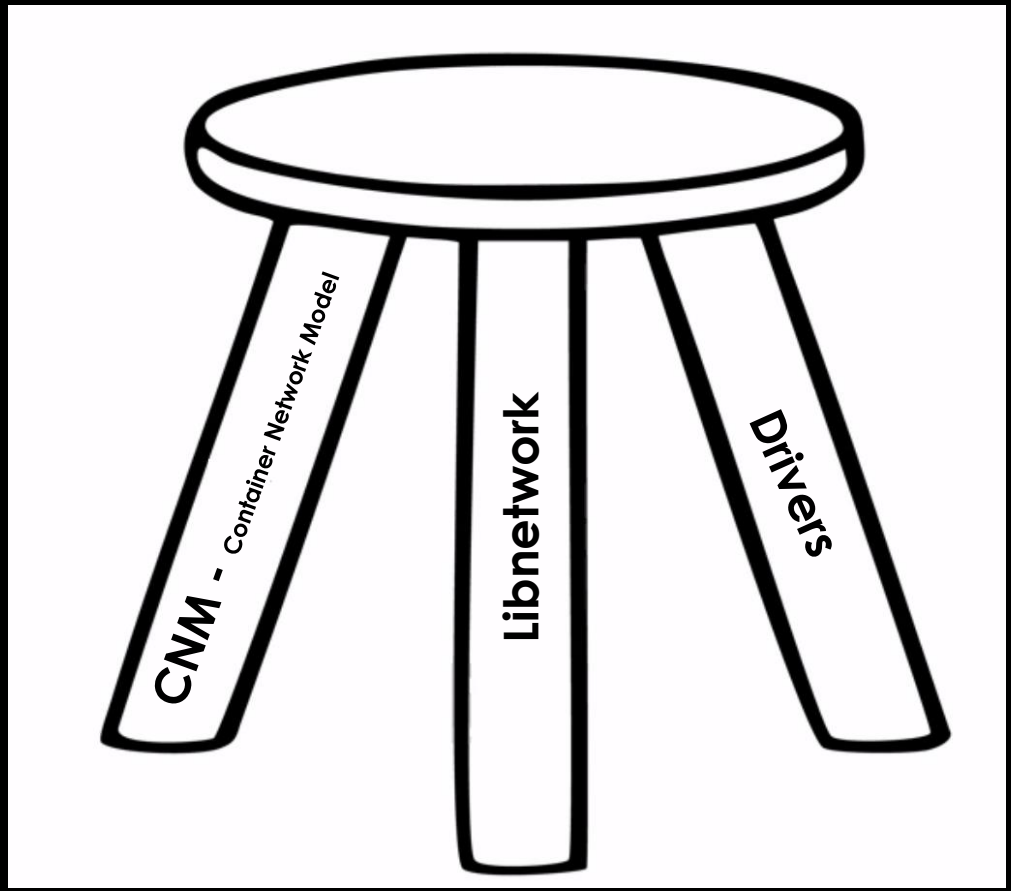
Networks are complex

Networks are huge

Networks are central



THE THREE PILLARS OF DOCKER NETWORKING

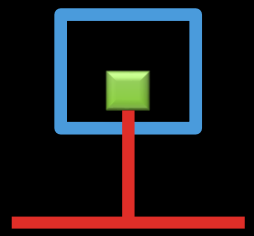


NETWORK

Master plan / Design

CNM

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



Control plane

Libnetwork

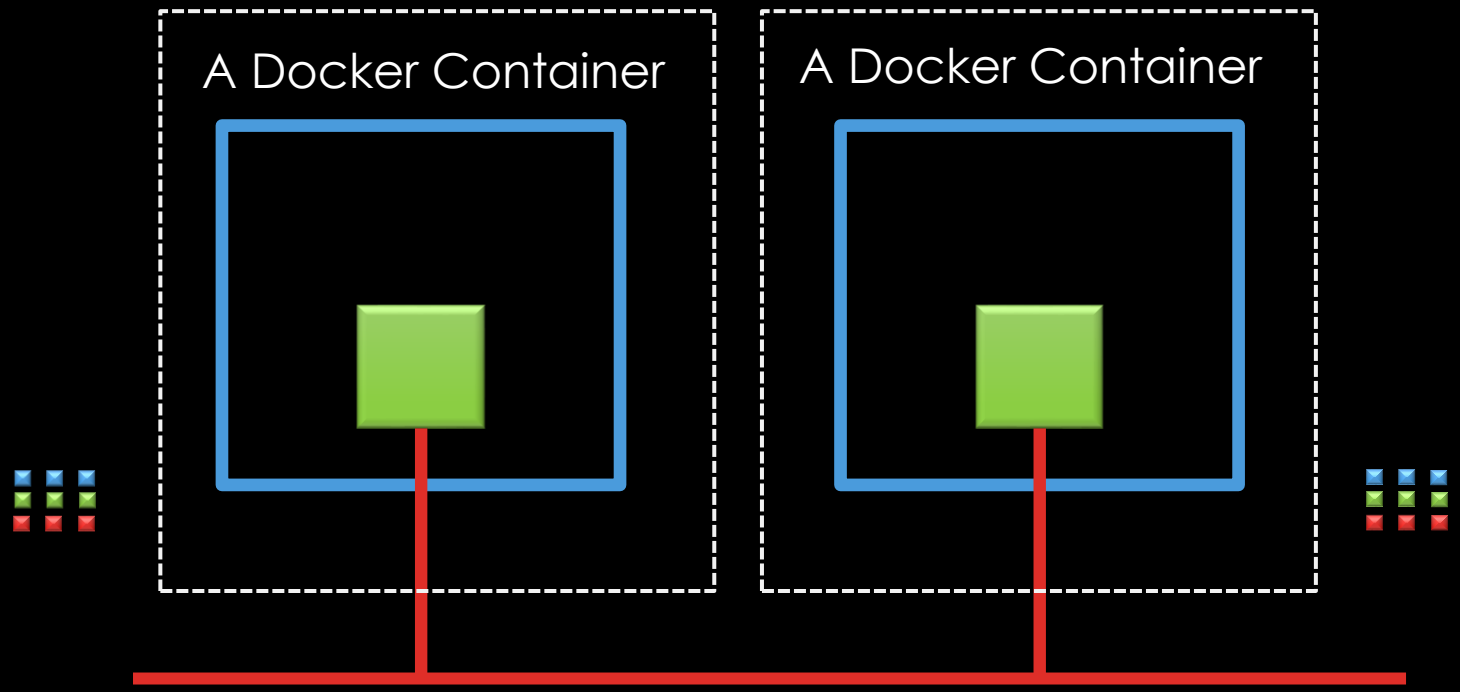
Central place for
all docker networking
logic ,API ,UX etc…
Real-world implantation of CNM

Data plane

Drivers

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

NETWORK - CNM



Sandbox Network

Isolated area of OS
Containers full network stack

Endpoint

Network interface like eth0

Network

Connected Endpoint

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 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

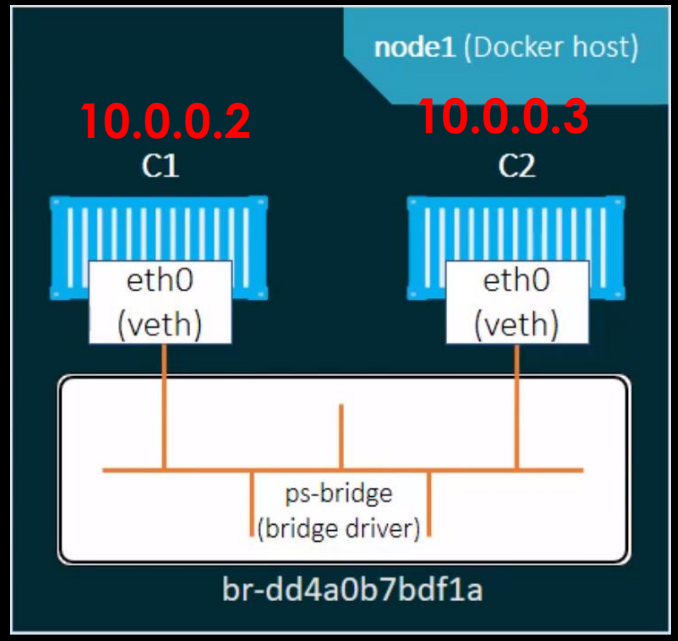
```
docker run -dt --name c1 --network ps-bridge alpine sleep 1d
```

Create Container name C2 with ps-bridge

```
docker run -dt --name c2 --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

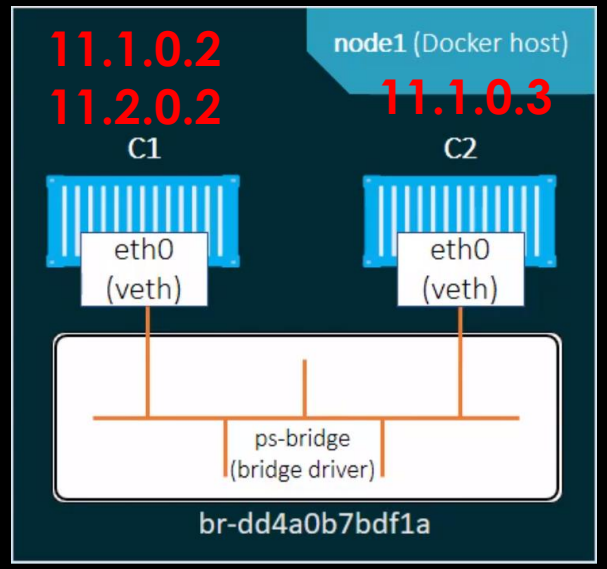
```
docker run --rm -dt --name C2 --network bridge1 alpine sleep 1d
```

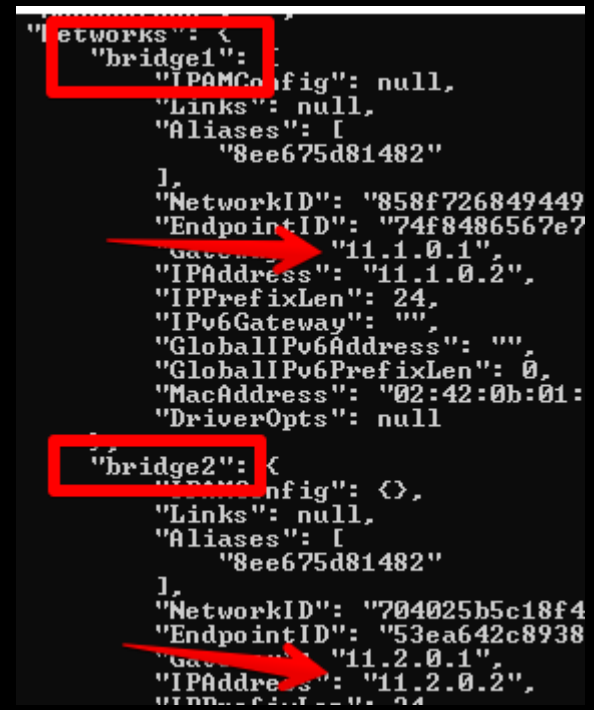
Connect bridge2 to Container C1

```
docker network connect bridge2 C1
```

inspect network

```
docker inspect bridge2
```

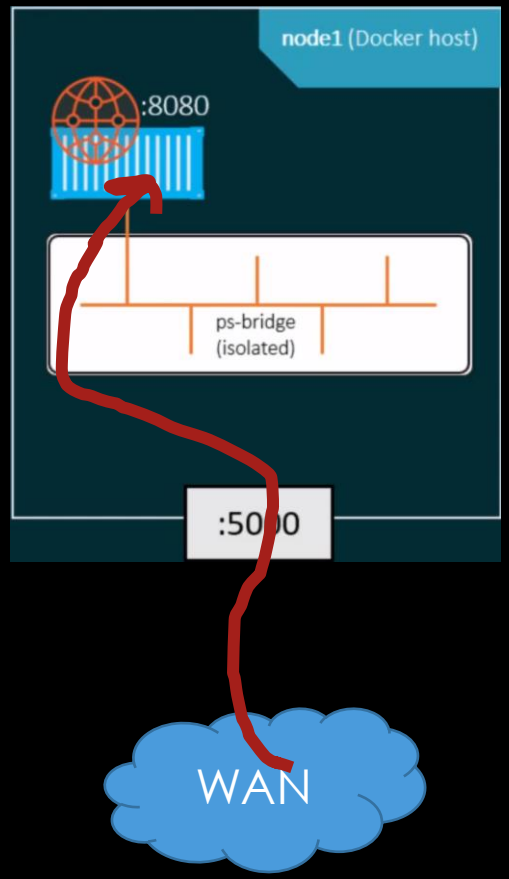




EXPOSE PORT

(host) (container)

-p 5000:8080



תרגיל 4

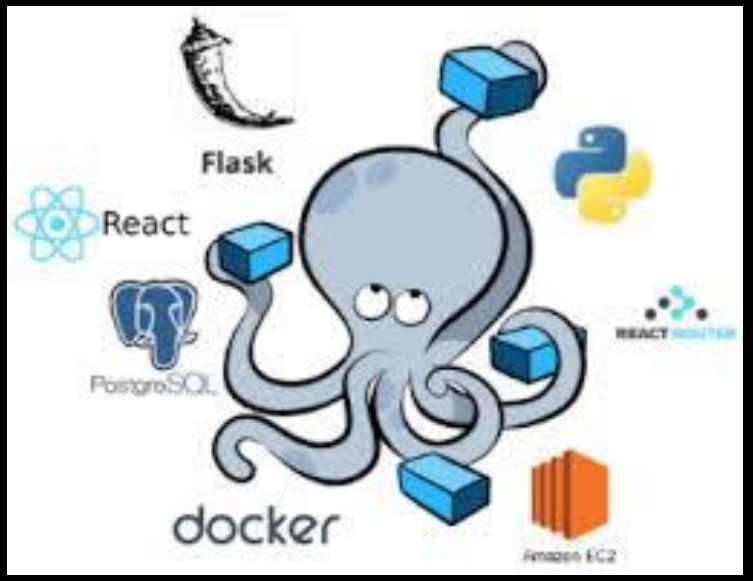
1. ייצר Bridge בשם first-Bridge למרחב כתובות 10.0.0.1/24
2. תבדוק באמצעות פקודה inspect את המידע על ה Bridge
3. הרם container שירוץ ברקע של alpine בשם C100 שמחובר לרשת first-Bridge
4. הרם container שירוץ ברקע של alpine בשם C200 שמחובר לרשת first-Bridge
5. תבדוק שוב באמצעות פקודה inspect את המידע על ה 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 5

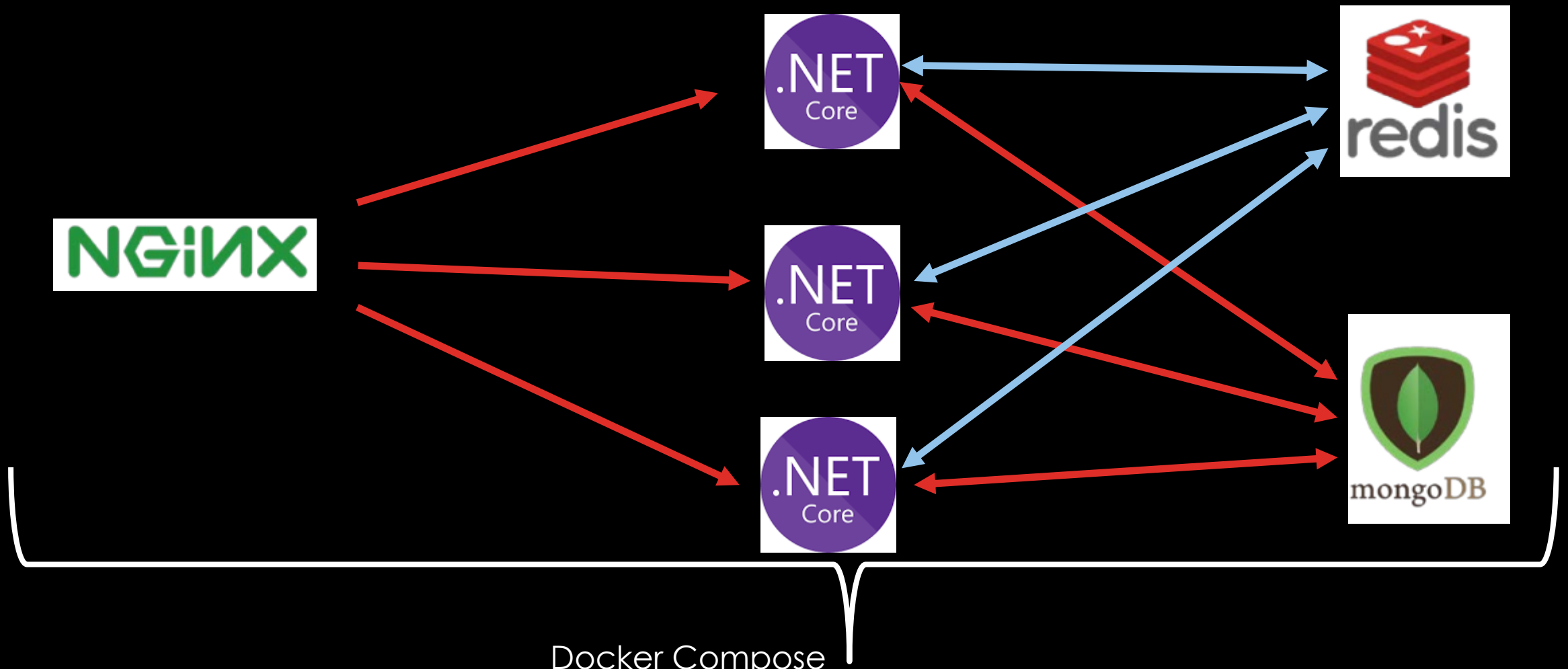
https://github.com/shaloml/docker-network-sample/blob/master/README.md

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

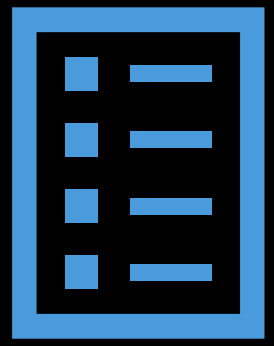


THE NEED FOR DOCKER COMPOSE



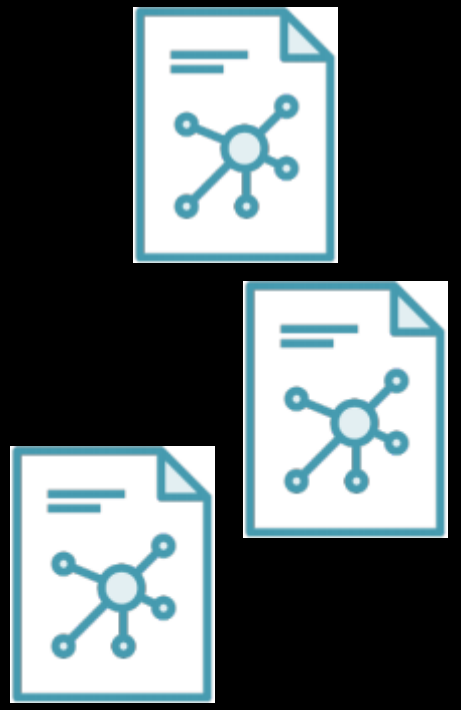
DOCKER COMPOSE WORKFLOW

THE DOCKER-COMPOSE.YML FILE



Docker-compose.yml
(service configuration)

Docker-compose
Build



Docker Images
(Services)

THE DOCKER-COMPOSE.YML FILE

version: '2'

services:

mongoDB

docker-compose.yml

KEY SERVICE CONFIGURATION OPTIONS

build

environment

image

networks

ports

volumes

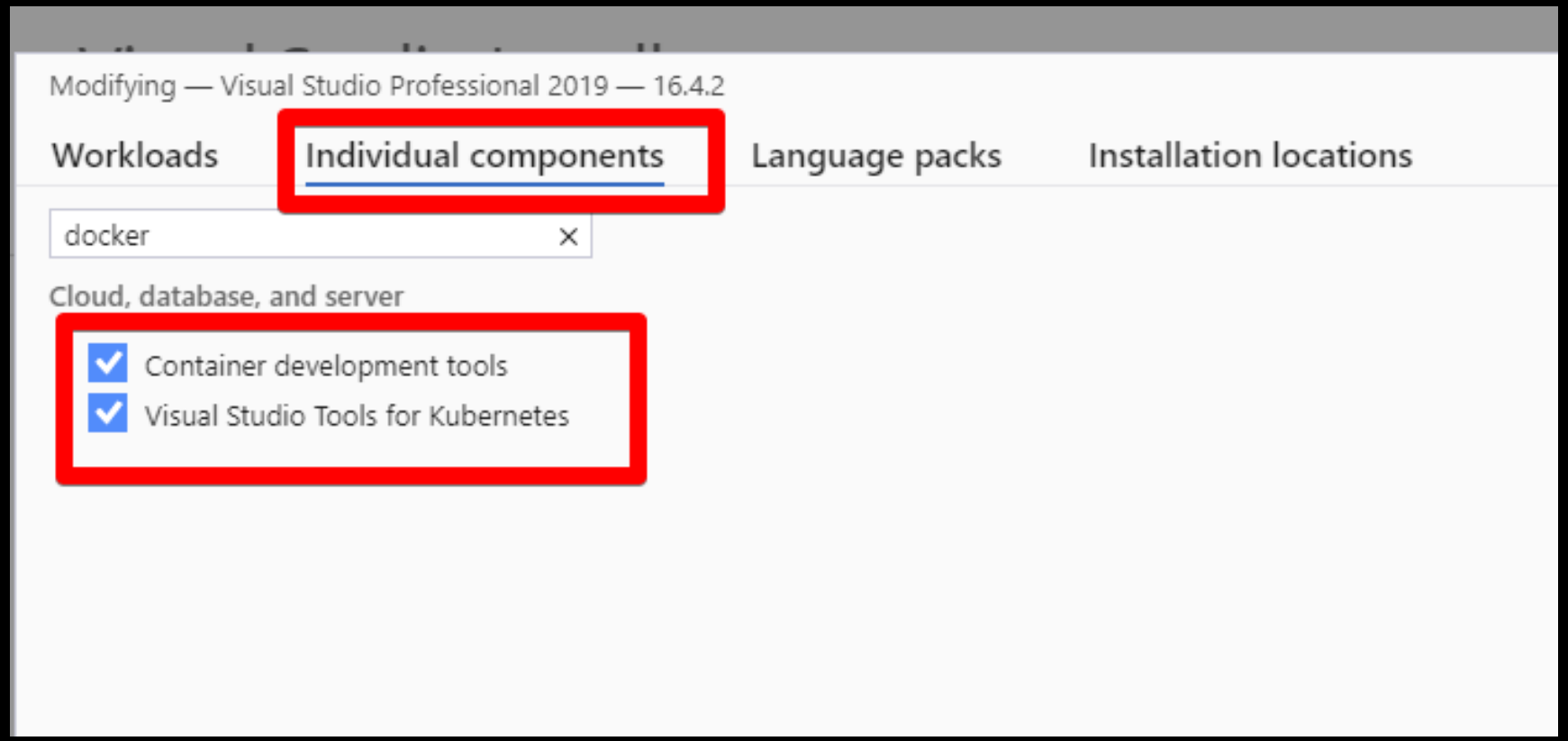
DOCKER-COMPOSE.YML EXAMPLE

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

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

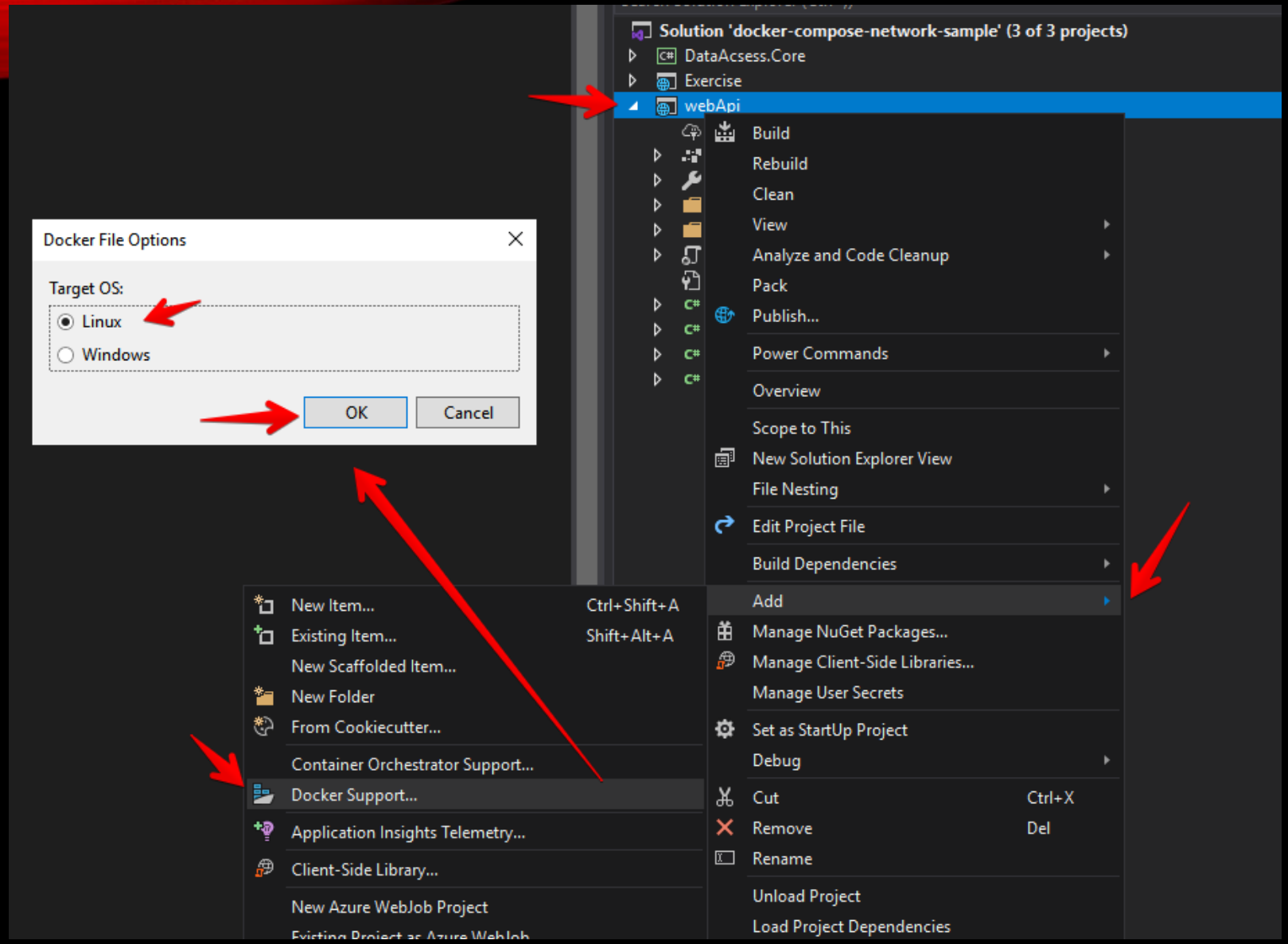
```yaml
version: '3' # Docker-compose yml version for docker compose builder
services: # Here we define our architecture services / roles
 nginx: # or web_role  , api_role , db_mysql , db_redis ....
   build:  # Dockerfile to build or use image:
           #to pull from DockerHub (public/private) or 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 TOOL - VISUAL STUDIO

Open Microsoft visual studio installer



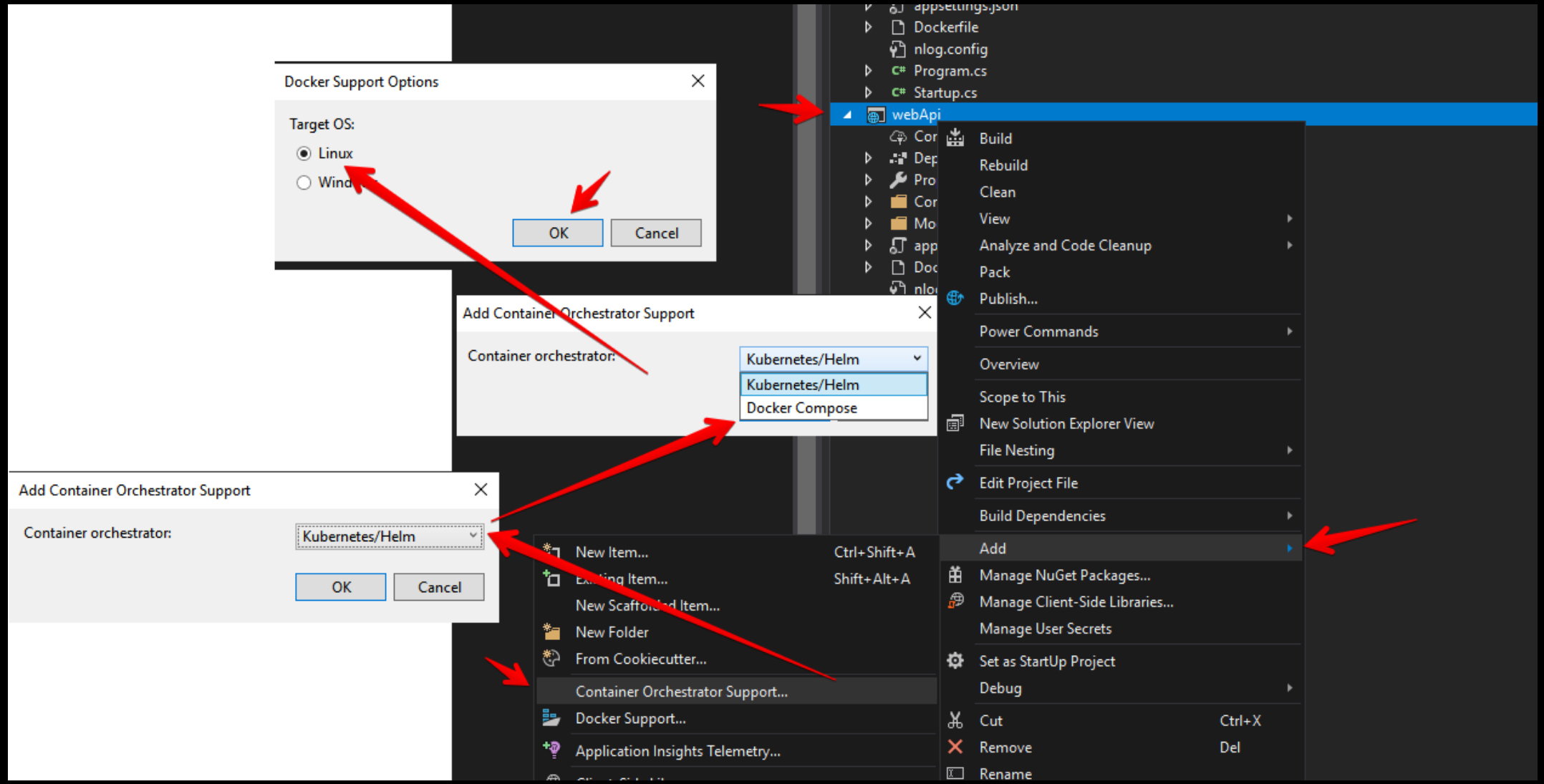
DOCKER ON VISUAL STUDIO



Add Dockerfile

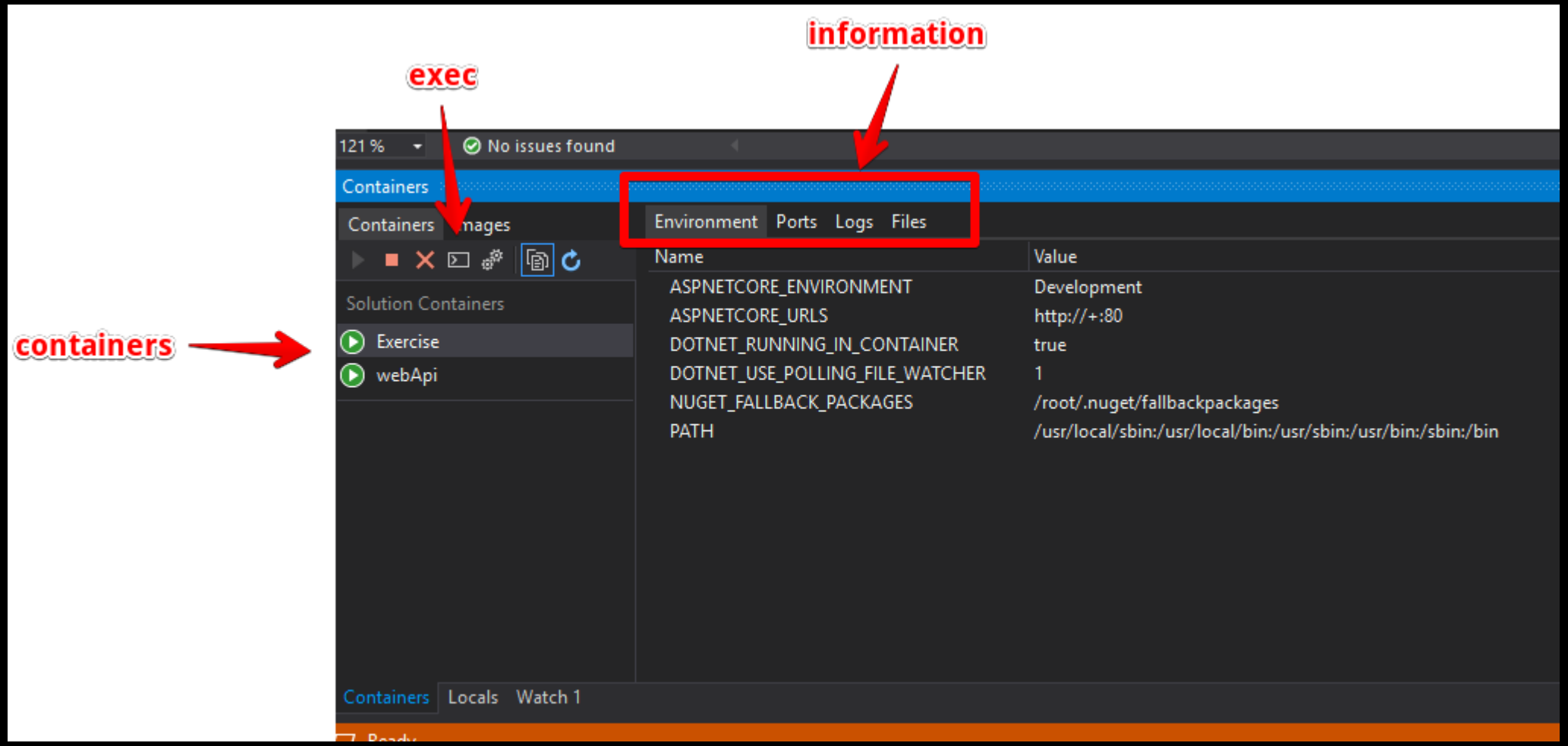
DOCKER ON VISUAL STUDIO

Add docker-compose



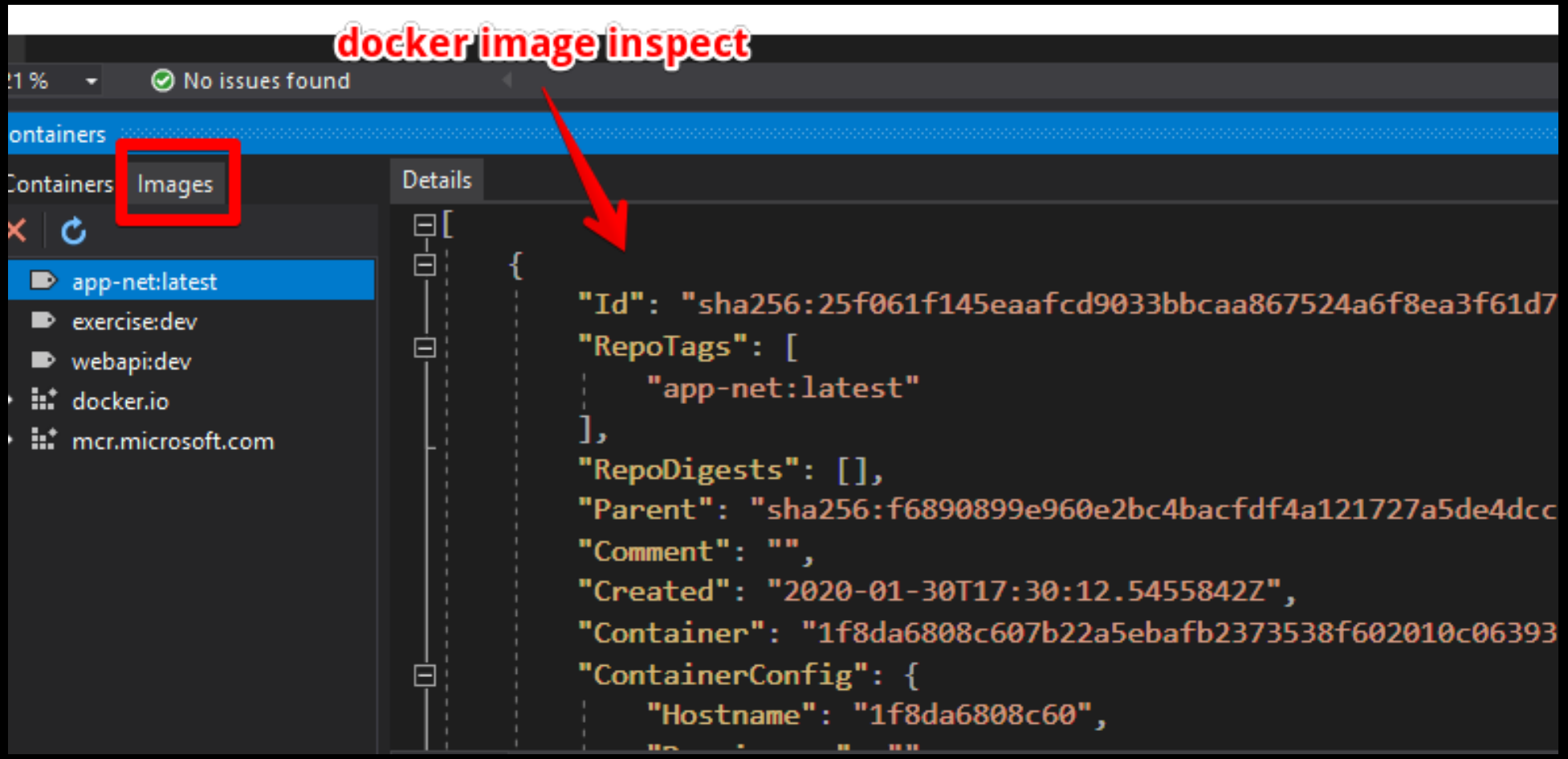
DOCKER ON VISUAL STUDIO

management



DOCKER ON VISUAL STUDIO

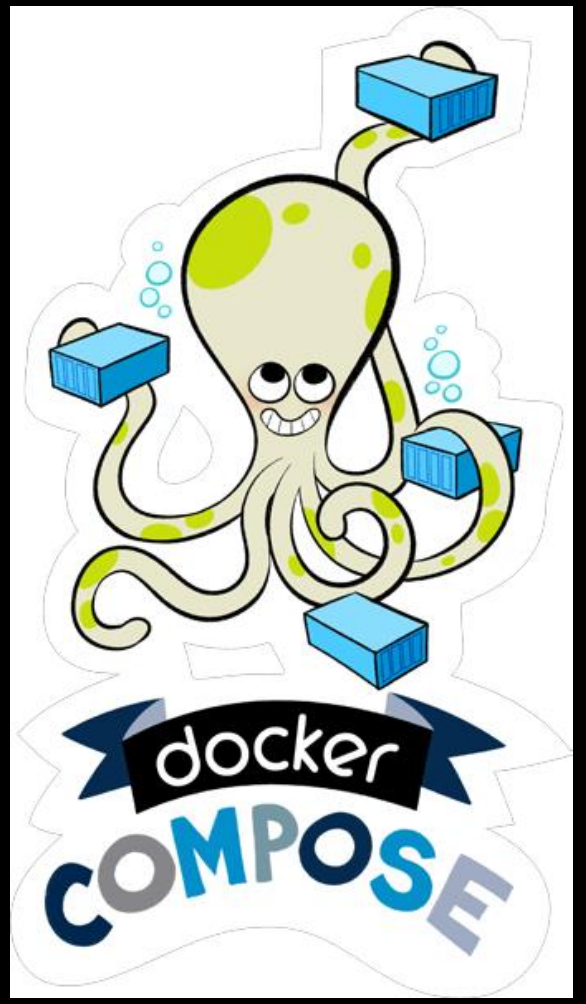
management



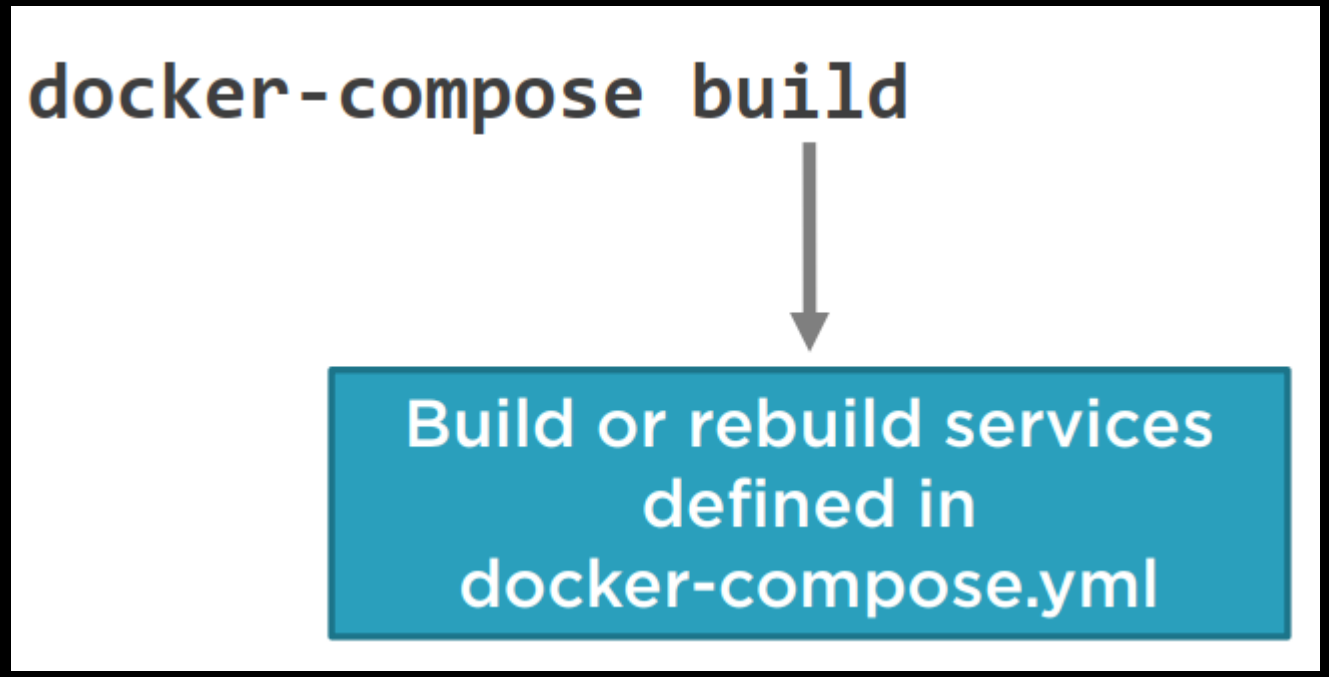
DEMO

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

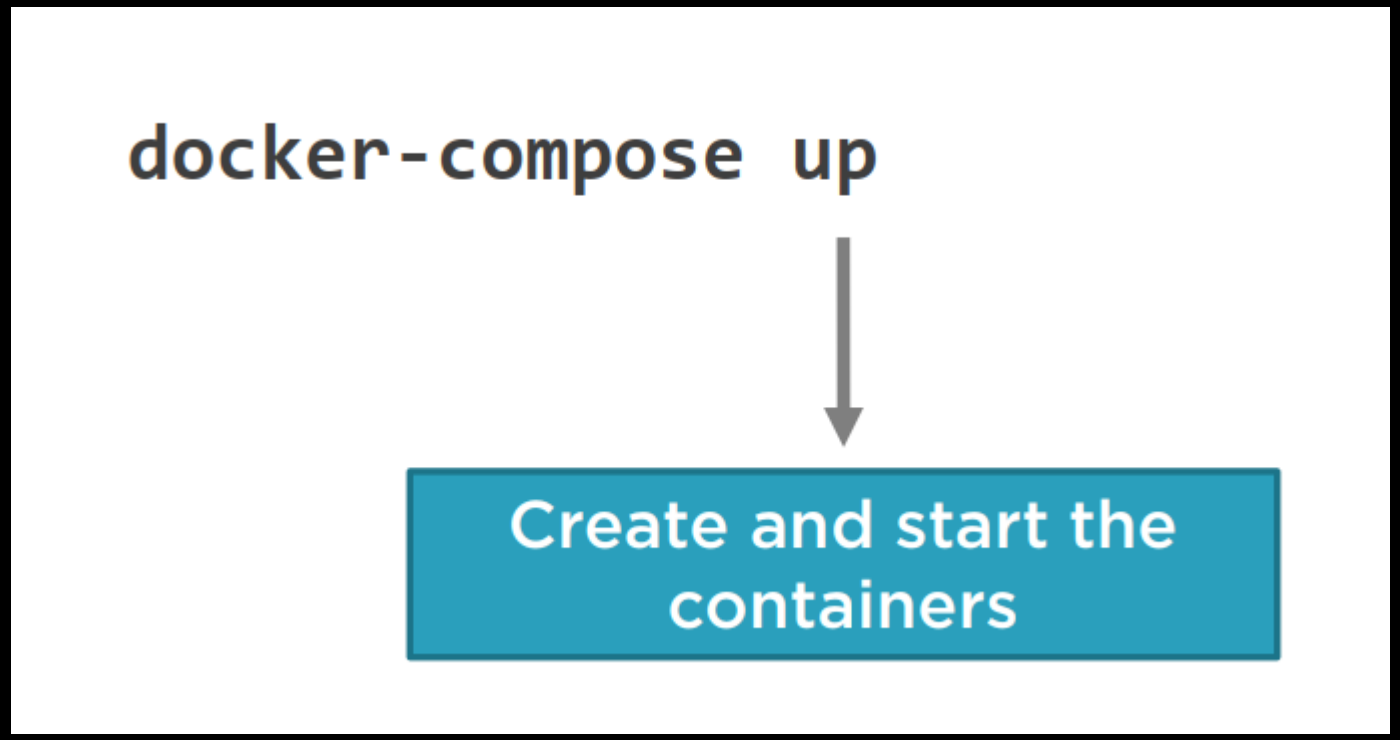


BUILDING SPECIFIC SERVICES

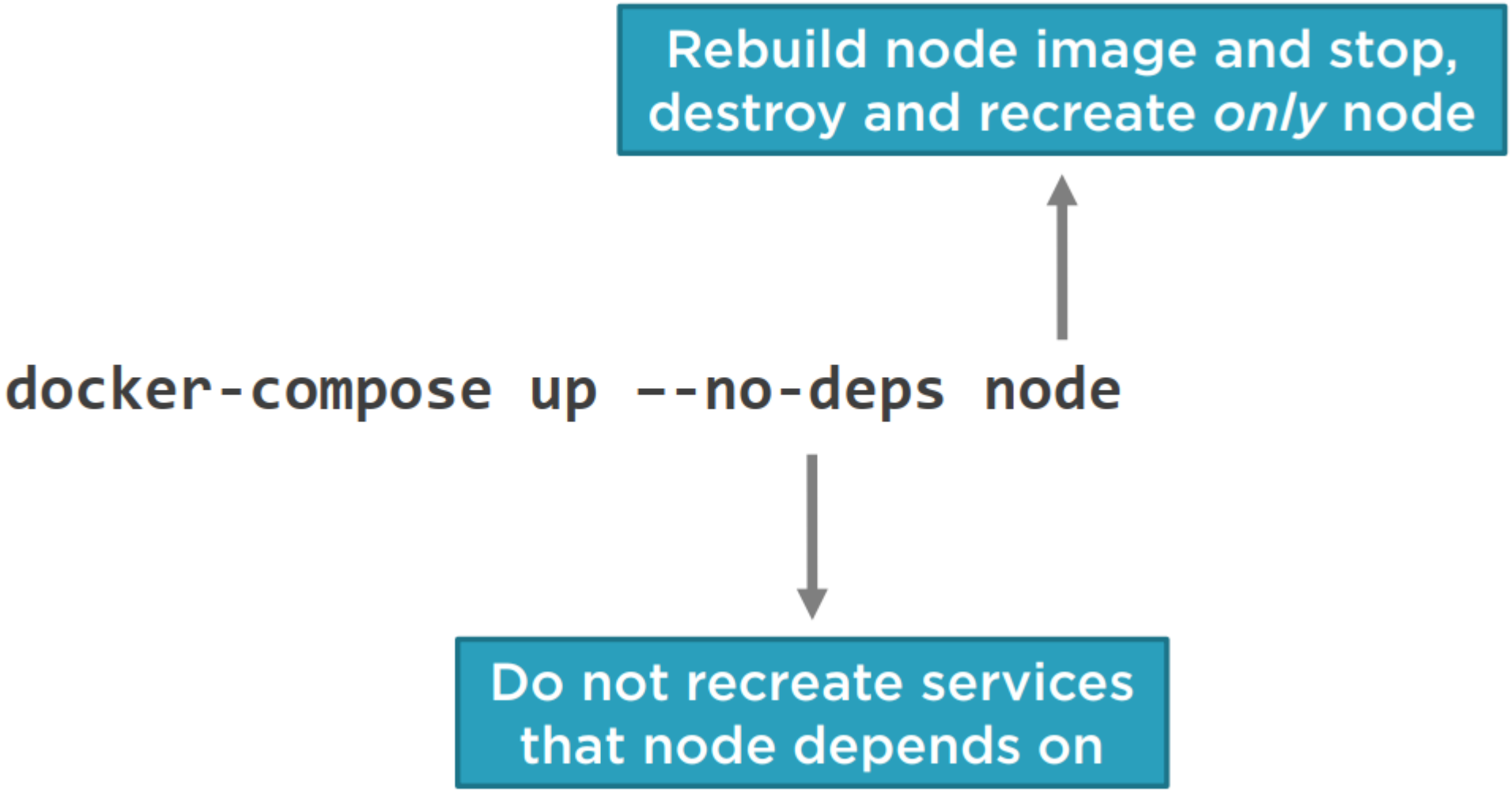
```
docker-compose build mongo
```


Only build/rebuild mongo service

CREATING AND STARTING CONTAINERS



CREATING AND STARTING CONTAINERS

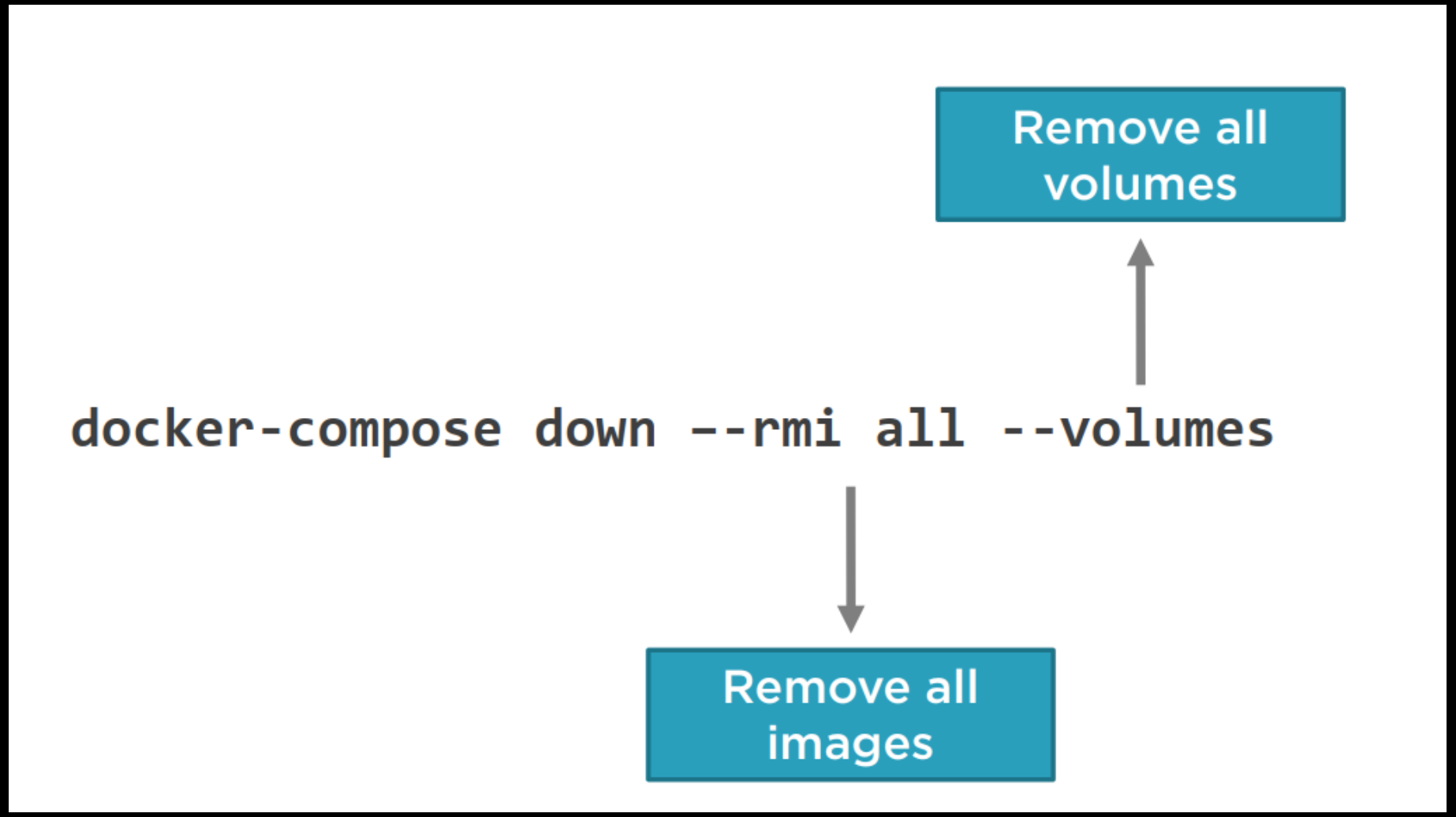


STOP AND REMOVE CONTAINERS

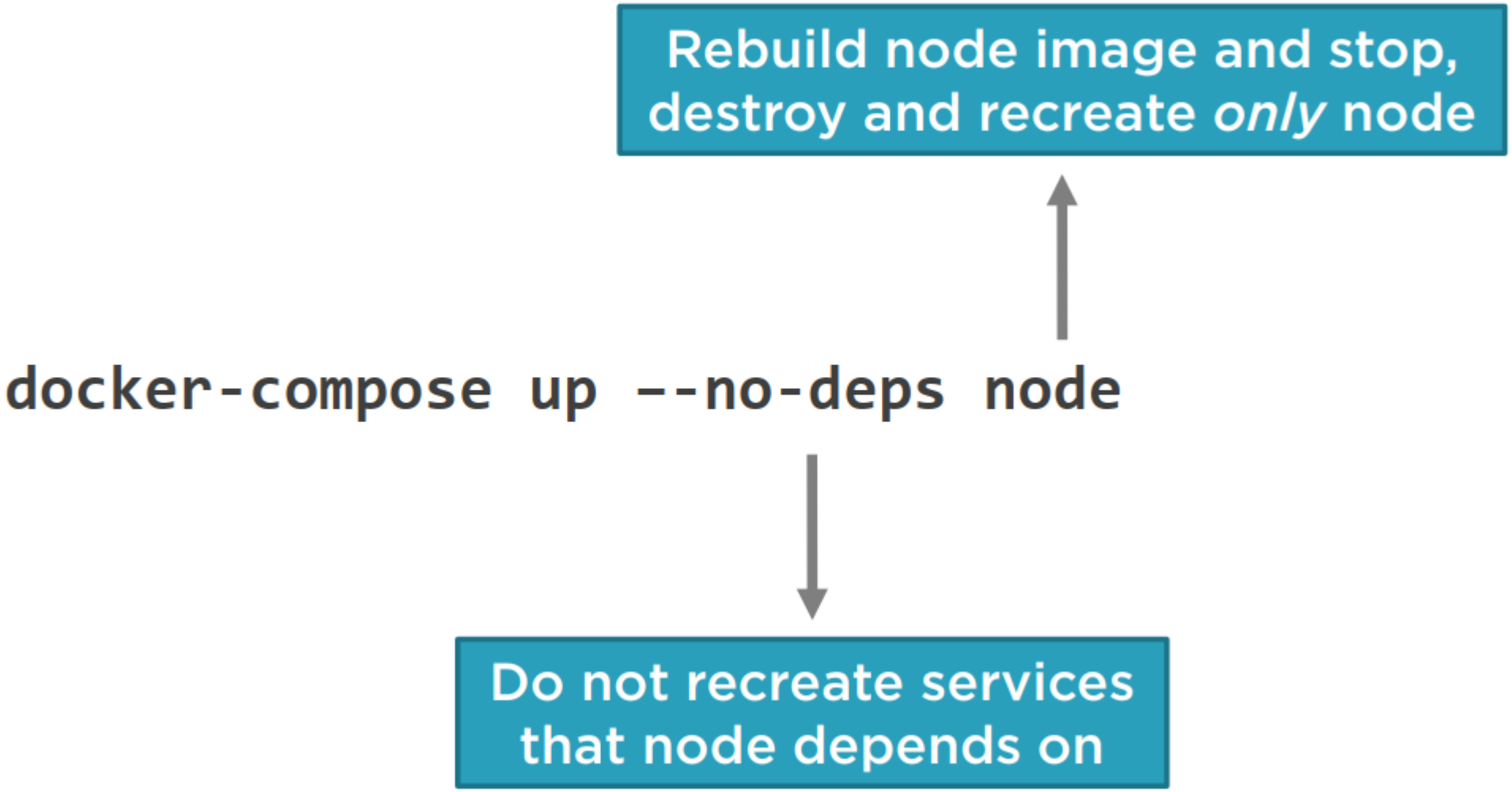
```
docker-compose down
```

Take all of the containers down (stop and remove)

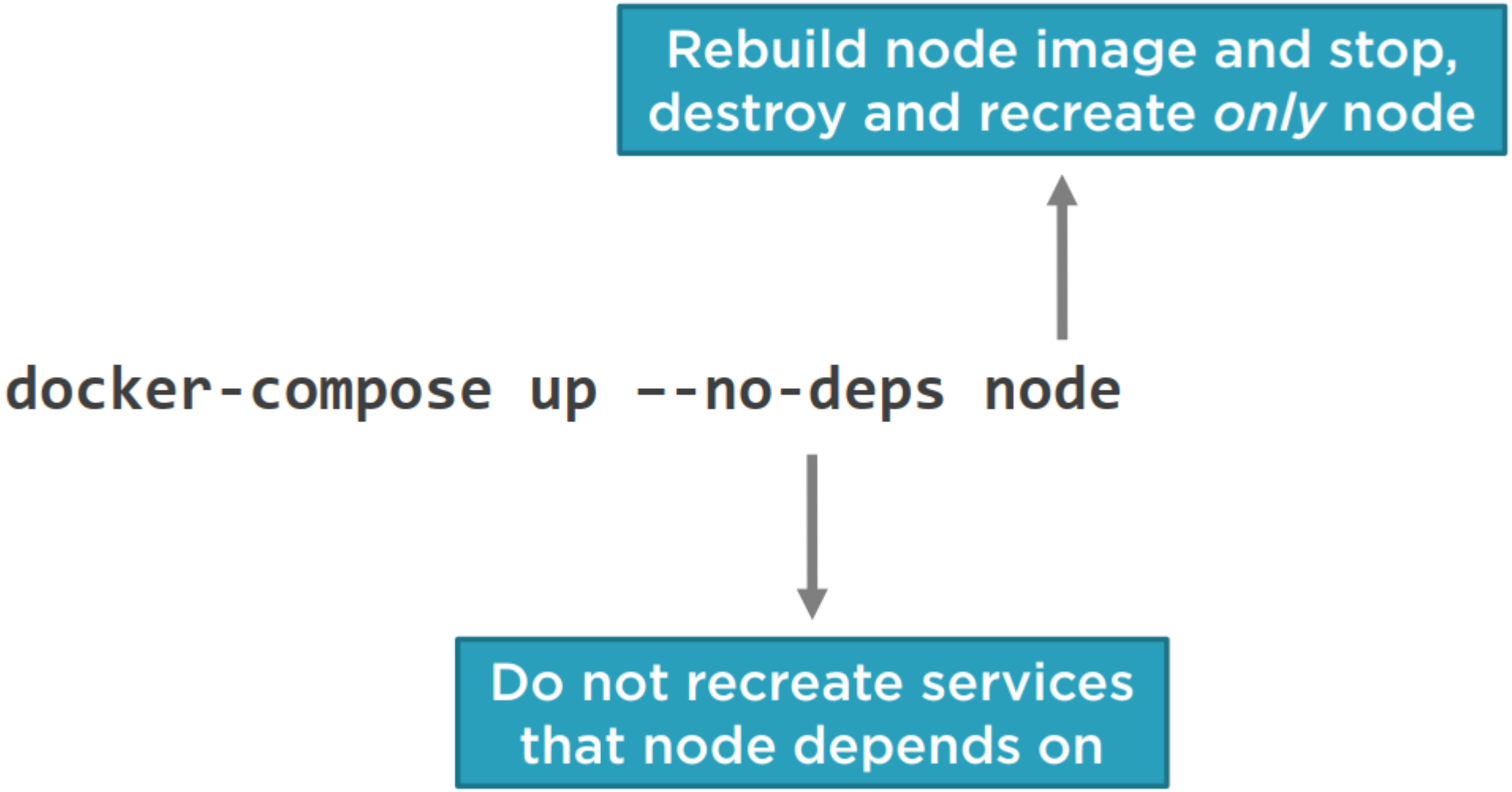
STOP AND REMOVE CONTAINERS, IMAGES, VOLUMES



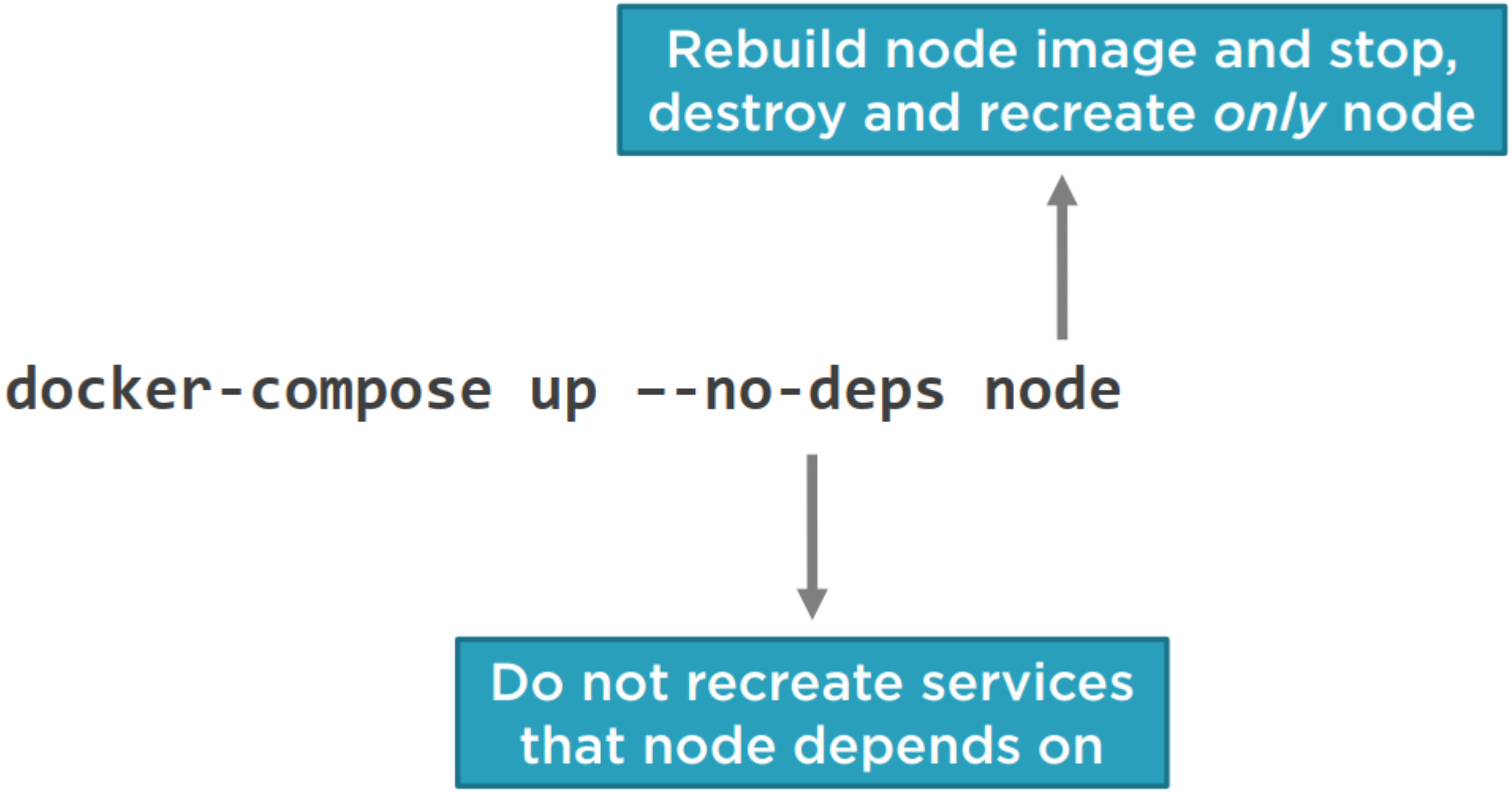
CREATING AND STARTING CONTAINERS



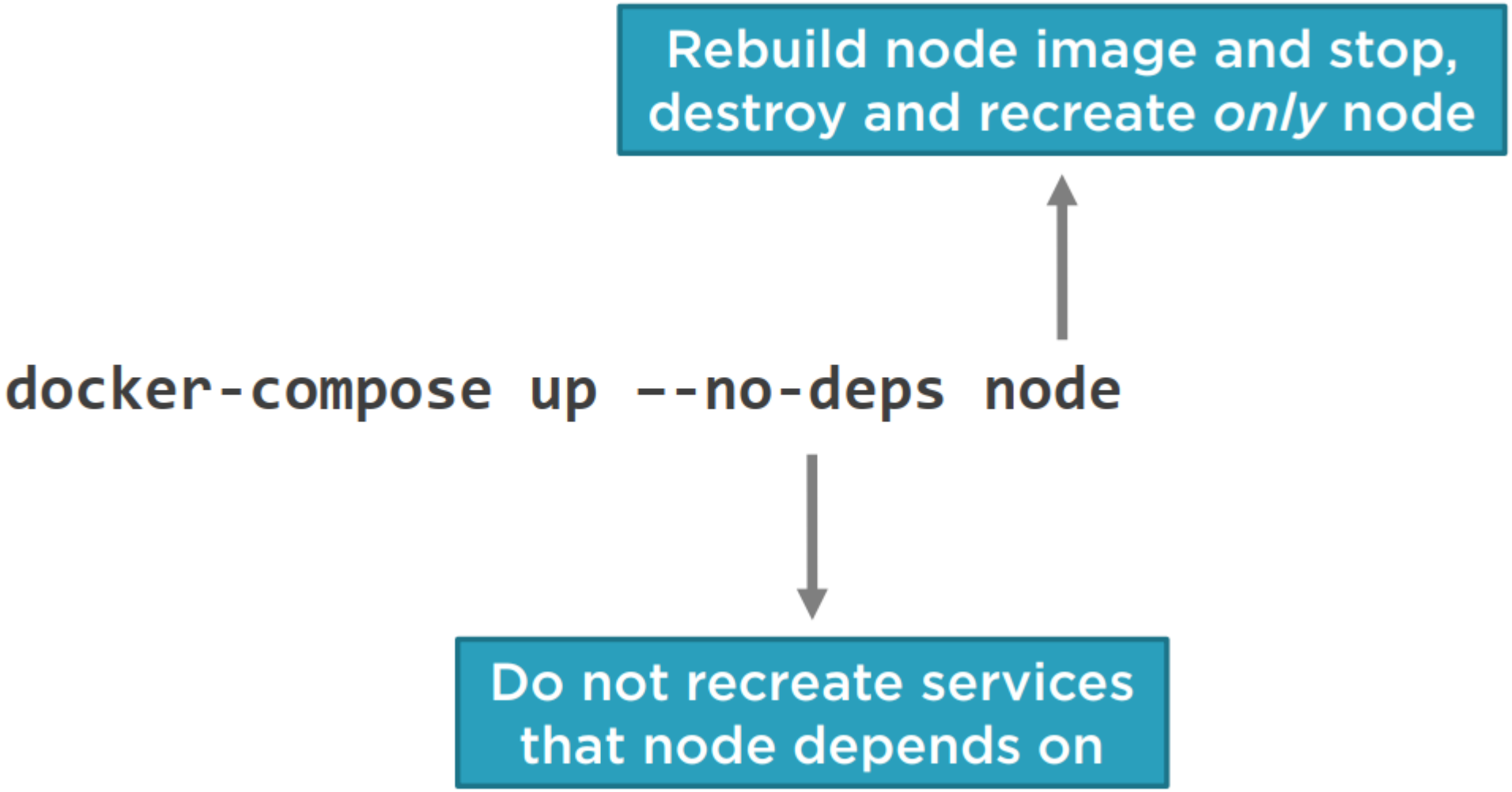
CREATING AND STARTING CONTAINERS



CREATING AND STARTING CONTAINERS



CREATING AND STARTING CONTAINERS



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

- **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
```

-

תרגיל DOCKER-COMPOSE

תרגיל 5


Thanks