Management and Operations of Networks, Services, and Systems

Provision a web service

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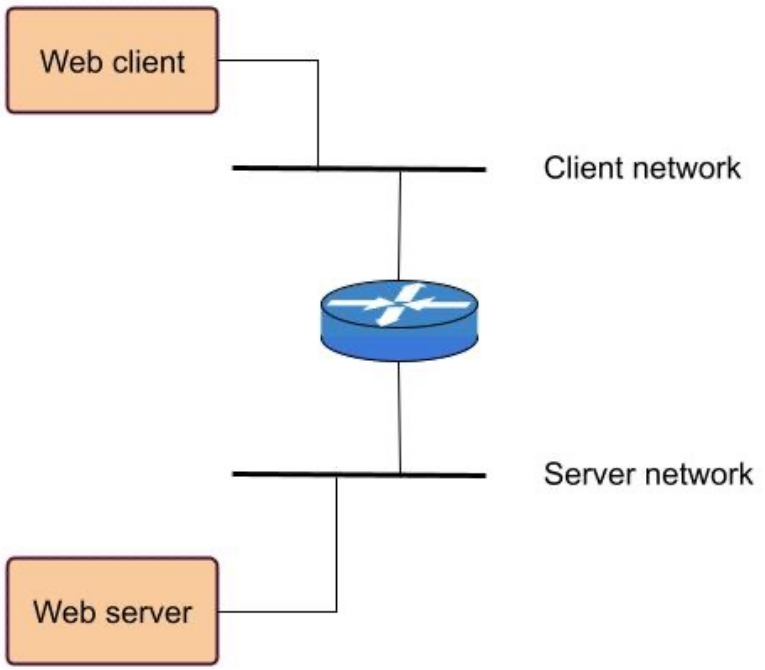
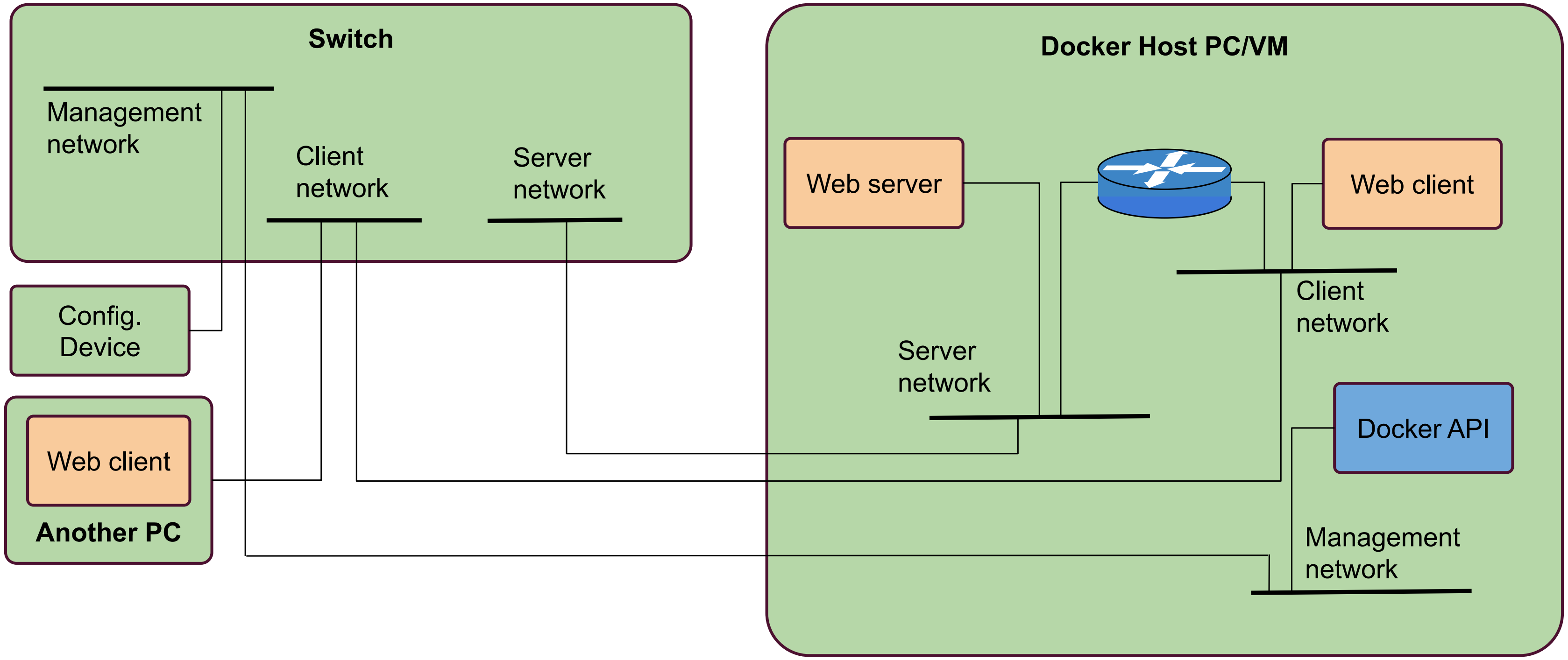
Target network and service topology

- Need IP addresses for all interfaces on both networks – please use private network ranges
- Use nginx as the web server
  - and later as load balancer
- Use browsertime to automate traffic generation
- Use a linux router

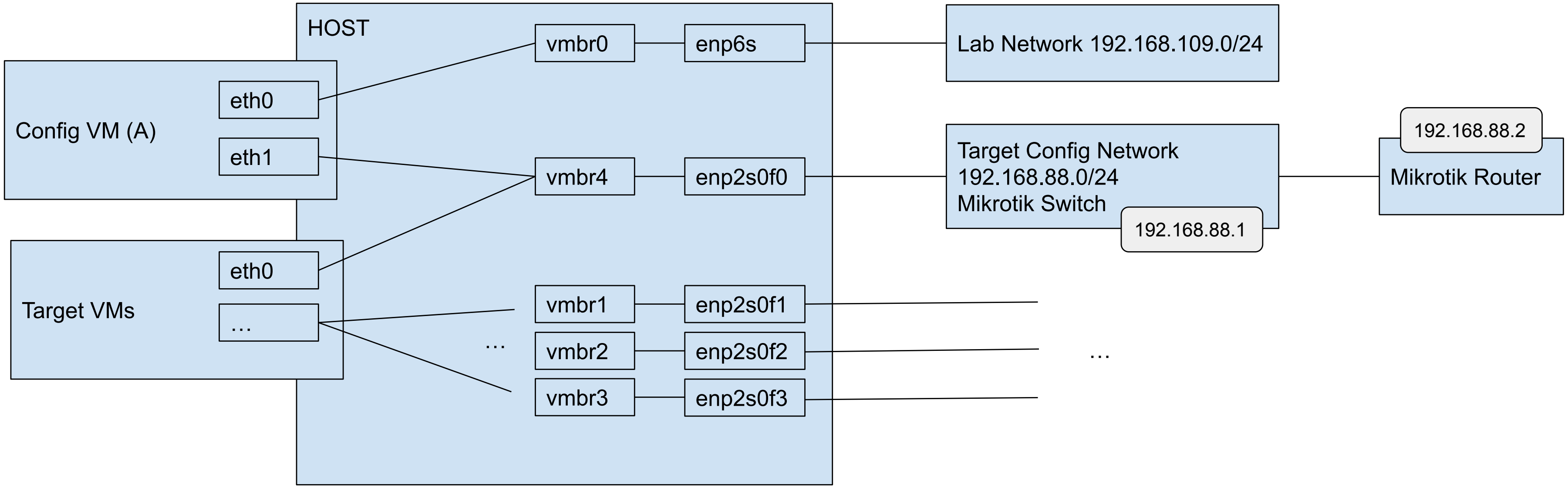


Devices to provision

- Do you need 3 PCs for the apps and router?
- Can you do it with just one PC/VM using docker?



Virtual machine provider and network setup



https://github.com/rmorla/gors

Docker – network isolation

- Docker creates isolated networks – as overlay (virtual) networks on top of the underlay (physical) network
- What can you do to provide external visibility to your service?
- Configure port forwarding on the docker host, exposing the nginx service on a docker host port
  - Quite ok for this case (why?)
- Use macvlan interfaces to connect the container interface with your underlay interface at the Ethernet level
  - Works for this case and when containers need Ethernet connection with the underlay network – so let’s use it

https://github.com/rmorla/gors/tree/main/hardware

Bootstrapping – switch

- Connect to console
  - USB/RJ45 console cable
- Backup configurations, erase configurations
  - https://gist.github.com/rmorla/dbad561ced1810b1208b7e291537b3e3
  - https://wiki.mikrotik.com/wiki/Manual:System/Backup
- Secure your device
  - https://wiki.mikrotik.com/wiki/Manual:Securing_Your_Router
- Setup management VLAN, enable ssh access
  - https://wiki.mikrotik.com/wiki/Manual:Basic_VLAN_switching
  - https://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst2960/software/release/12-2_40_se/configuration/guide/scg/swvlan.pdf
- Create your management configuration backup
  - That you can reload for a clean-slate setup

Bootstrapping – docker host

- Get a fresh installation of linux / ubuntu / debian
- Install docker on linux
  - https://gist.github.com/rmorla/61098bf2fc333a8c090db3e5bc77394b
- You can also try K8s
  - https://kubernetes.io/docs/tasks/tools/install-kubectl-linux/
- Configure a network interface on the management network
- Take a snapshot of the docker host VM (if you're using a VM)

Bootstrapped

- At this point both the switch and the docker host should be ssh-accessible by the control device via the management network
- This is an expensive step that requires manual configurations and should be avoided as much as possible
- So how do I get a a clean-slate for predictable deployments?
  - On the switch, do a backup right after bootstrapping; when you want to erase the switch, reload the bootstrapping backup and hopefully you will have a cleaned up switch with ssh access
  - If you're using a VM for the docker host, take a snapshot right after bootstrapping
  - If you're using a bare metal host OS, it's harder. Try to do as little as possible in the host OS and as much as possible with docker
- Now you can start provisioning

Provision the switch

- Setup Client/Server bridges
- Configure access ports on the switch in the case you want to connect to the server or client network

Provision the docker host

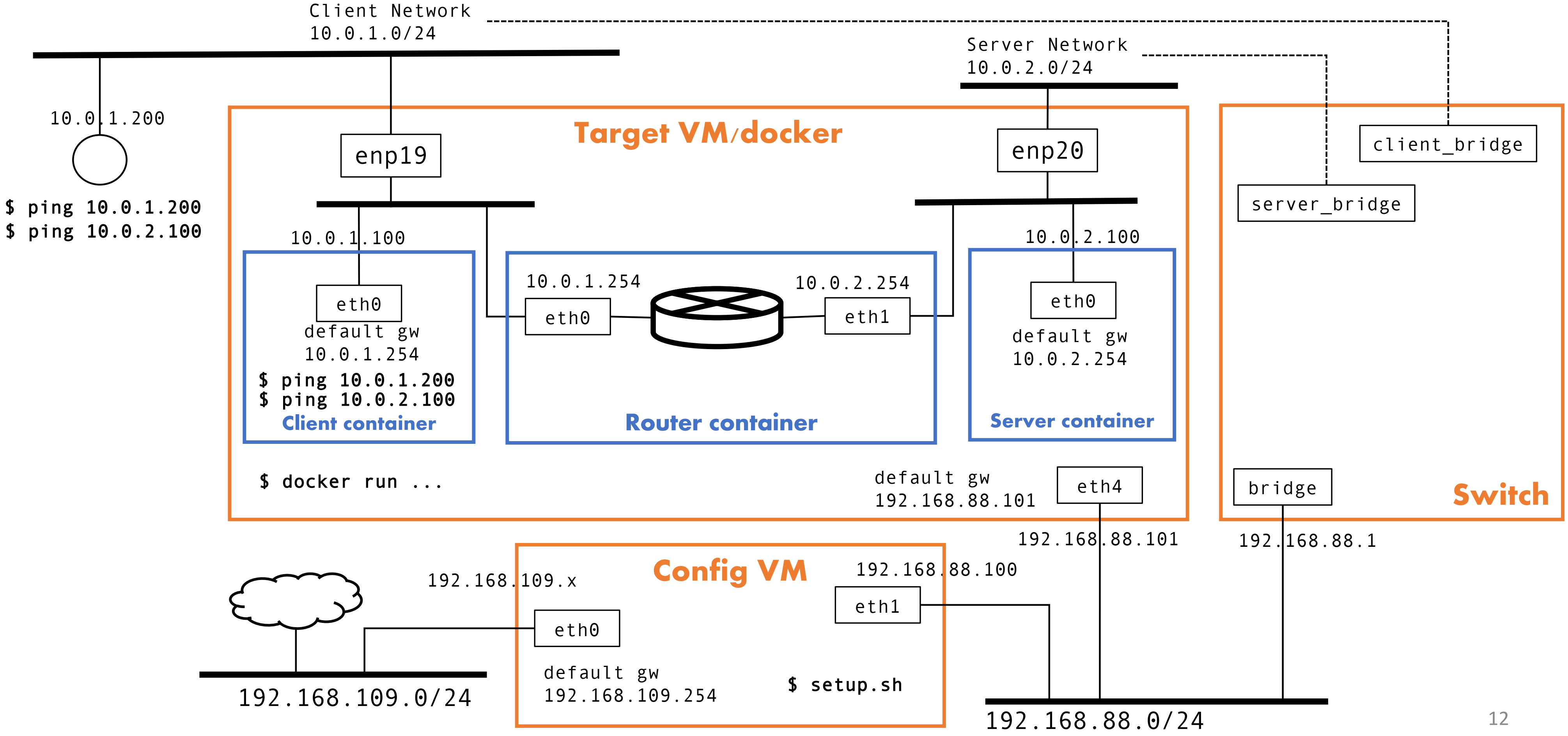
- Connect the trunk port on the switch to another Ethernet interface on the docker host
- Create macvlan networks on the host
  - `docker network create -d macvlan --subnet=10.10.10.0/24  -o parent=eth0 pub_net`
- Now run the docker containers with the macvlan interfaces
  - `docker run --net pub_net --ip 10.10.10.3 ...`

Provision linux router, nginx, browsertime

- Deploy a bare linux container image
    - alpine ubuntu debian ...
    - Activate forwarding
- Find out how to deploy nginx with docker
    - `https://hub.docker.com/_/nginx`
- Find out how to deploy browsertime web client automation
    - `https://hub.docker.com/r/sitespeedio/browsertime/`

Two networks with a router

For config VM setup and other code see:
https://github.com/rmorla/gors



Setup

```
sudo docker rm -f client server router
sudo docker network rm client_net server_net
sudo ip l set ens19 up
sudo ip l set ens20 up
```

Networks

```
sudo docker network create -d macvlan --subnet=10.0.1.0/24 --gateway=10.0.1.1 -o parent=ens19 client_net
sudo docker network create -d macvlan --subnet=10.0.2.0/24 --gateway=10.0.2.1 -o parent=ens20 server_net
```

Client and server

```
sudo docker run -d --net client_net --ip 10.0.1.100 --cap-add=NET_ADMIN --name client netubuntu
sudo docker run -d --net server_net --ip 10.0.2.100 --cap-add=NET_ADMIN --name server netubuntu
```

Router

```
sudo docker run -d --net client_net --ip 10.0.1.254 --cap-add=NET_ADMIN --name router netubuntu
sudo docker network connect server_net router --ip 10.0.2.254
```

Routing on client and server

```
sudo docker exec client /bin/bash -c 'ip r del default via 10.0.1.1'
sudo docker exec client /bin/bash -c 'ip r a 10.0.2.0/24 via 10.0.1.254'
sudo docker exec server /bin/bash -c 'ip r del default via 10.0.2.1'
sudo docker exec server /bin/bash -c 'ip r a 10.0.1.0/24 via 10.0.2.254’
```

Test

```
docker exec -it client ping 10.0.2.100
```

Build ‘netubuntu’ image with network tools

Create these files, copy to target host

>> **baseimage/Dockerfile**

```
FROM ubuntu:20.04
RUN apt update && apt install -y vim
iproute2 iputils-ping tcpdump
iptables dnsutils curl
COPY sleep.sh /root/sleep.sh
CMD /root/sleep.sh
```

>> **baseimage/sleep.sh**

```
#!/bin/bash
while true ; do /bin/sleep 5m; done
```

Build netubuntu image

>> **run on docker host**

```
sudo docker build --tag
netubuntu:latest ~/baseimage
```

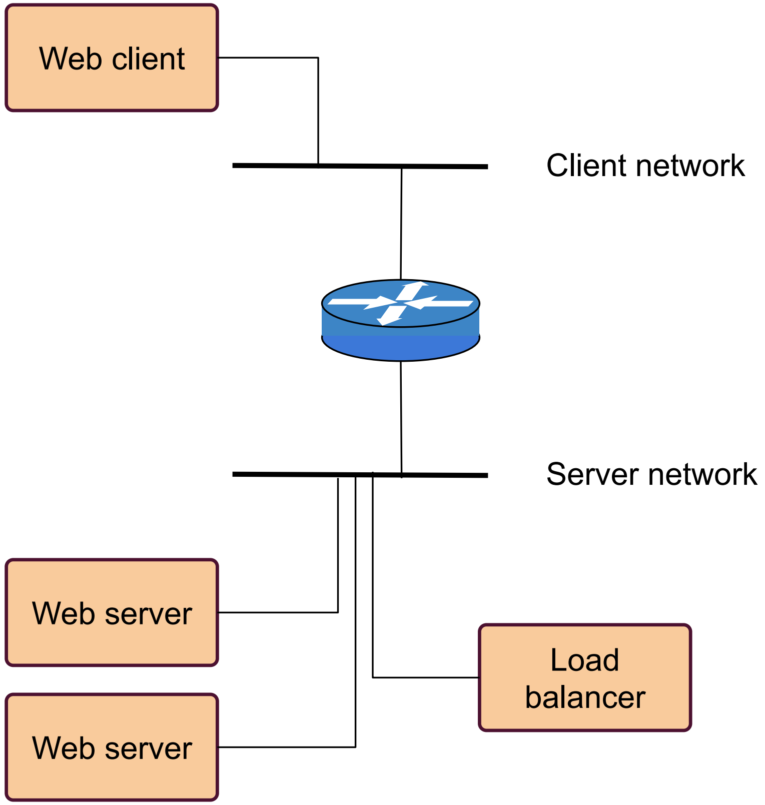
Test, monitoring, reconfiguration

- Test and monitoring
    - Are the services running? How can you test if they are?
    - Can you get a metric for how good they are performing?
- Automatically copy browsertime's logs to the control device
- Automatically copy the server's logs to the control device
- Capture the traffic to/from the servers
    - tcpdump, tshark
    - On which interface will you be doing the capture?
    - Can you use port mirroring in this setup?
- Assume the current version of nginx has a vulnerability; reconfigure the deployment to use a prior version of ngnix

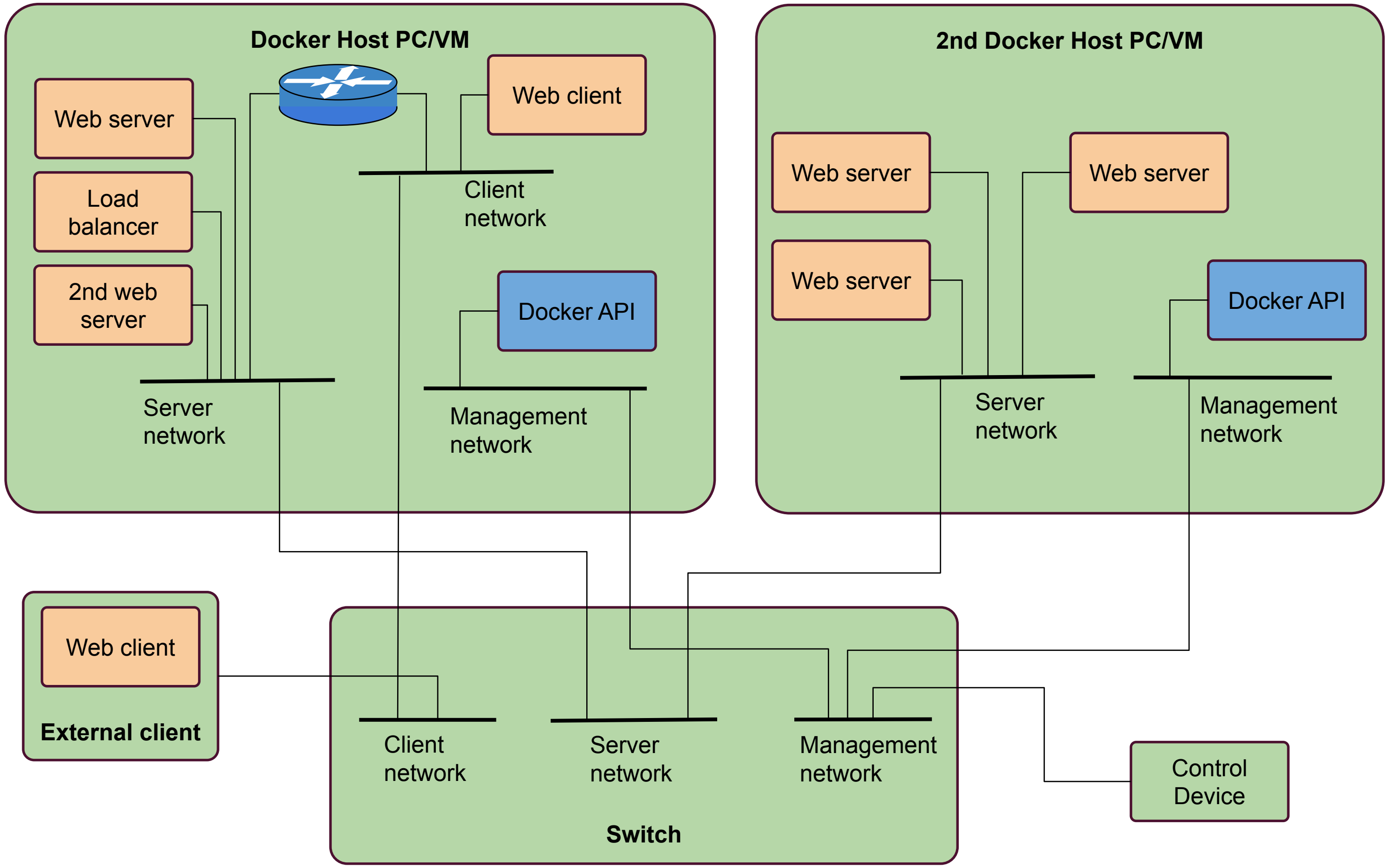
Load balancing

- Now provision the following load balancing scenario
- You can use this reference for configuring app and lb nginx

  `https://towardsdatascience.com/sample-load-balancing-solution-with-docker-and-nginx-cf1ffc60e644`



Load balancing – provisioning



Load balancing

- Can you get more page views/s with two LB’ed web servers instead of one – on the same VM?
- What about if the LB’ed web servers are on another VM?

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