

DATA2410-1 22V Datanettverk og Skytjenester
GROUP Portfolio Assignment 2 - Docker and Zabbix Real Use-Case

Ulrik Bakken Singsaas | s351917

Adrian Bakstad | s341507

Thea Emilie Haugen | s351879

Andrea Bjørge | s344175

May 13, 2022

Contents

1. Introduction	3
1.1. Our project directory	3
1.2. Virtual Machines with VirtualBox	3
2. VM1: Docker containers setup	5
2.1. Docker Compose Setup	5
3. VM2 and VM3: Install Zabbix agent and Zabbix proxy	9
3.1. VM2: Zabbix proxy and MariaDB	9
3.1.1. Installing Zabbix proxy	9
3.1.2. Configuring MariaDB database for the proxy to use	9
3.1.3. Configuring Zabbix proxy	10
3.1.4. Starting and enabling the Zabbix proxy	11
3.1.5. Registering Zabbix proxy in the Zabbix frontend	11
3.2. VM3: Zabbix Agent installation and setup	11
4. VM2: Nginx Proxy	13
4.1. Installing Nginx Proxy and preparing configuration files	13
4.2. Applying configurations to the proxy	13
4.3. Comment on Zabbix Server Web Frontend Nginx configuration	15
5. VM1: Zabbix Frontend	16
5.1. Items	16
5.2. Triggers	16
6. Conclusion and summary	18
7. References	19

1. Introduction

This report will cover our solution to the Group Portfolio 2 Assignment, given to us in the subject DATA2410. The report is divided into six separate chapters. The first chapter is an introduction to our project. It gives a short description of our project structure, to improve the readability of this report. It also goes into detail about how we set up the VMs we used to implement our solution. The main part of this report consists of the four chapters following immediately after the introduction, and will cover the steps we took to implement the different requirements in the assignment description. These requirements are mainly linked to understanding Docker containers, Zabbix monitoring tools, network communication, installation and configuration of a web server. Lastly, the sixth and final chapter of the report will be a brief summary and conclusion of our work.

1.1. Our project directory

At the beginning of the project we set up a group project directory called `portfolio2`. In this directory we decided to sort our files into different sub-folders for structure, backup and easy access purposes. The files were sorted based on their functionality and contents. Below is a list of the different sub-folders that were of significance to our project. Many of these sub-folders will be referenced in the report.

- `docker`: files pertaining to Docker functionality
- `docs`: files pertaining to documentation and explanation of our project
- `configs`: files that aren't in use, but are kept as backup
 - `configs/intel11`: redundant Docker files for VMs on intel1
 - `configs/mysql`: old mysql configuration files
 - `configs/nginx`: old nginx configuration files
 - `configs/zabbix`: old Zabbix configuration files

1.2. Virtual Machines with VirtualBox

Originally, we attempted to use Docker containers on the intel1-server to implement our solution. However, the server ran out of storage space, so we created virtual machines through VirtualBox as a substitute.

The first thing we needed was a VM running Ubuntu Focal Fossa. We needed the VM to have 4GB of RAM and 10GB of disk space. As shown in Figure 1, we downloaded the image for Ubuntu Focal Fossa (20.04) from: <https://releases.ubuntu.com/20.04/ubuntu-20.04.4-desktop-amd64.iso> and created VM1 from this image.

The next step was to configure VM1. We started by setting up VM1 on a bridged network. The reason we started with VM1 was to make sure that it was working. We created VM2 by cloning VM1 and changing the mac address. By cloning VM1 one more time, we created VM3. By changing the MAC addresses, as shown in Figure 2, we ensured that each VM had their own local IP on the bridged network. By doing it this way, we made sure that all three VMs could communicate with each other, whilst also being able to communicate with the host machine.

The architecture diagram in the assignment description can be interpreted to mean that we should use an internal network for all of the VMs whilst giving VM2 a second bridged network adapter. This would ensure that only the nginx proxy could reach the outside of the internal VM network. Since the assignment didn't specify what network method to use for the VMs, we decided against this, because it would make our assignment more complicated than necessary.

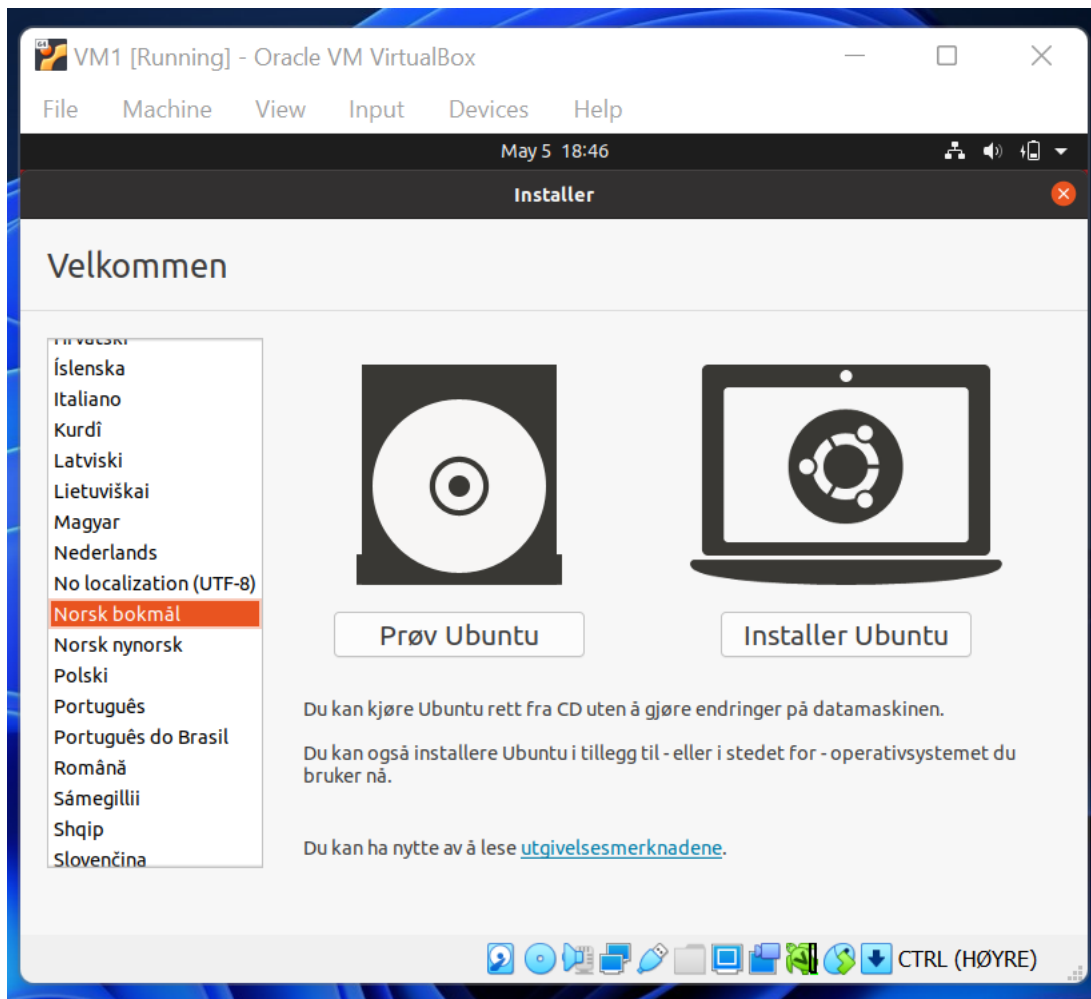


Figure 1: Showing Ubuntu installation screen

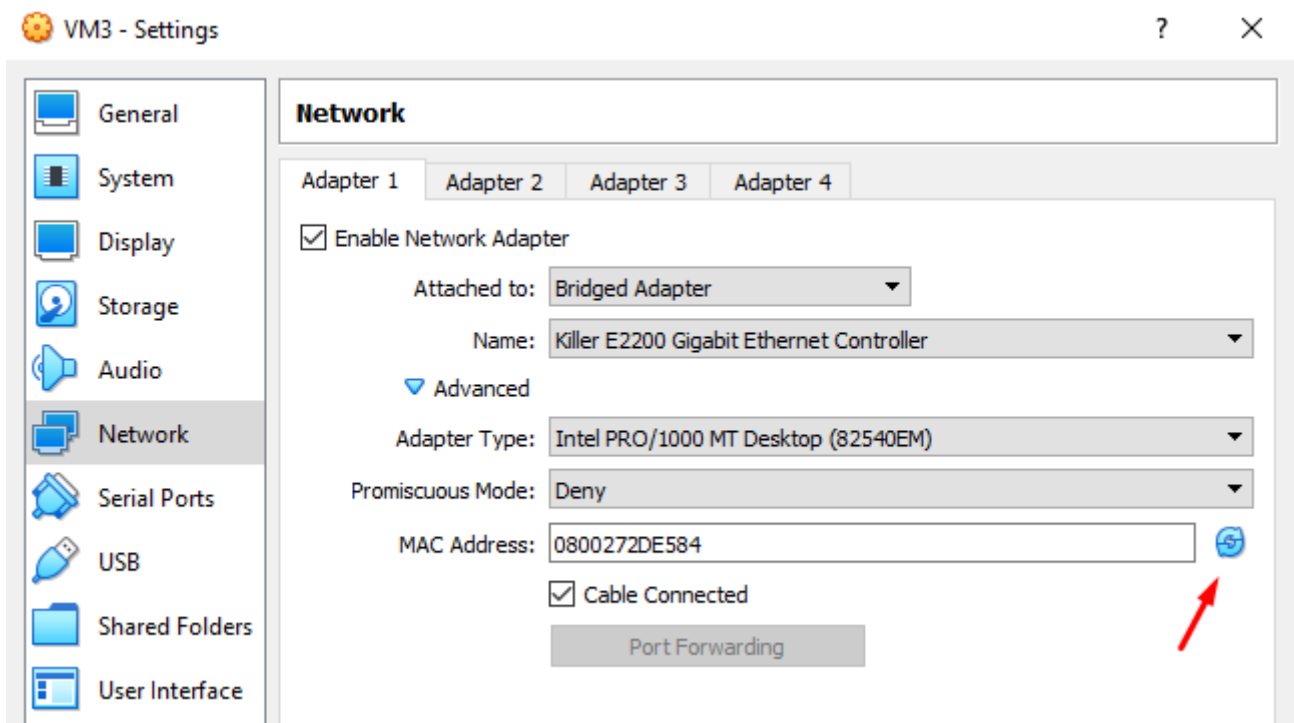


Figure 2: Showing Network panel in virtualbox for VM3

2. VM1: Docker containers setup

This chapter of the report explains how we completed section II of the assignment. It includes the installation and setup of Docker containers, how we configured our docker-compose stack and made the Docker bridge network inside of VM1. It also covers how we used the frontend to set up the host profiles. It displays our understanding of both conventional VMs and using the Docker software.

2.1. Docker Compose Setup

After setting up the three VMs, we used the file `docker-compose.yml`, from the `docker` folder in our project directory, to set up the four docker containers with the required config instructions for the assignment within VM1. The first step in setting up the Docker containers was to install Docker on VM1.

We used the following command to install docker and docker-compose.

```
sudo apt-get install -y docker-compose
```

We used the Docker images specified in the assignment description to serve as a base for the Docker containers in the Docker compose stack. By setting the environment variables in the compose file, we affected the generation of the respective config files for each container. We created created and linked up volumes to these generated files to make it possible to edit the internal volume files from outside the Docker containers via the Docker volume functionality. This was possible because the volume files outside the Docker containers are linked with the config files we mapped them to inside each of the Docker containers. Setting up volumes for outside access made debugging easier while working on the project. E.g. we utilized this setup to verify if the environment variables in the `docker-compose.yml` file were correctly written to config files like `zabbix_server.conf` inside the server container, while remaining outside the Docker container and checking directly from the host machine.

The following block of code describes how we set up the volumes according to the description above.

```
sudo docker volume create mysql-server-data
sudo docker volume create zabbix-server-config
sudo docker volume create zabbix-web-config
sudo docker volume create zabbix-agent-config
sudo docker volume create docs
```

```
# example commands for the zabbix-server-config volume for the server container
```

```
# finding volume
```

```
sudo docker volume ls
```

```
# finding system path to volume for editing
```

```
sudo docker volume inspect zabbix-server-config
```

```
# editing the file via volume link
```

```
sudo vim /var/lib/docker/volumes/zabbix-server-config/_data/zabbix_server.conf
```

In the block below, we display our docker compose file `docker-compose.yml` from the `docker` folder in our project directory. The comments in the file provide details about the functionality of the different sections of the file that are important for the implementation of the solution.

```
# Docker Container setup for VM1
```

```
version: "3.0"
```

```
services:
```

```
  # mysql container setup
```

```
  mysql-server:
```

```
    image: haakco/mysql80
```

```
    ports:
```

```
      - 3306
```

```
    hostname: mysql-server
```

```
    restart: unless-stopped
```

```
    volumes:
```

```
      - mysql-server-data:/var/lib/mysql
```

```
    environment:
```

```

- MYSQL_ROOT_PASSWORD=123
- MYSQL_DATABASE=zabbix
- MYSQL_USER=zabbix
- MYSQL_PASSWORD=123
cap_add:
- SYS_NICE
networks:
  zabbix-net:
    ipv4_address: 172.200.1.1
    # not supposed to have two commands put putting it on one line broke things and
    # this seems to work
    # tried this, but it did not work:
    # command: bash -c "--default-authentication-plugin=mysql_native_password \
    # && --datadir=/var/lib/mysql/data"
command: --default-authentication-plugin=mysql_native_password
command: --datadir=/var/lib/mysql/data

# zabbix server setup
zabbix-server:
  image: zabbix/zabbix-server-mysql
  ports:
    - 10051:10051
  hostname: zabbix-server
  restart: unless-stopped
  volumes:
    - zabbix-server-config:/etc/zabbix
    - docs:/usr/share/doc/
  environment:
    - DB_SERVER_HOST=mysql-server
    - MYSQL_DATABASE=zabbix
    - MYSQL_USER=zabbix
    - MYSQL_PASSWORD=123
  depends_on:
    - mysql-server
  networks:
    zabbix-net:
      ipv4_address: 172.200.1.2

# zabbix web container
zabbix-web:
  image: zabbix/zabbix-web-nginx-mysql
  ports:
    - 80:8080
  hostname: zabbix-web
  restart: unless-stopped
  volumes:
    - zabbix-web-config:/etc/zabbix
  environment:
    - DB_SERVER_HOST=mysql-server
    - MYSQL_DATABASE=zabbix
    - MYSQL_USER=zabbix
    - MYSQL_PASSWORD=123
    - ZBX_SERVER_HOST=zabbix-server
  depends_on:
    - mysql-server
    - zabbix-server
  networks:
    zabbix-net:
      ipv4_address: 172.200.1.3

```

```

# zabbix agent container
zabbix-agent:
  image: zabbix/zabbix-agent
  ports:
    - 10050:10050
  hostname: zabbix-agent
  restart: unless-stopped
  volumes:
    - zabbix-agent-config:/etc/zabbix
  environment:
    - ZBX_SERVER_HOST=zabbix-server
  depends_on:
    - zabbix-server
  networks:
    zabbix-net:
      ipv4_address: 172.200.1.4

# custom network for the containers
# This is the part that meets the bridged network for docker requirements part
# of the assignment
# not to be confused with the bridged network that the VirtualBox VMs and the
# host machine are sharing
networks:
  zabbix-net:
    driver: bridge
    ipam:
      config:
        - subnet: 172.200.1.0/16

# volumes for the containers
# This is how we link the generated config files to the host machine for easy
# debug, not required as the configs are regenerated on every run and must
# be set with environment variables, as shown above
volumes:
  mysql-server-data:
    external: true
  zabbix-server-config:
    external: true
  zabbix-web-config:
    external: true
  zabbix-agent-config:
    external: true
  docs:
    external: true

```

We used the following command on VM1 to start the docker containers with the `docker-compose.yml` file.

```
sudo docker-compose up
```

After the Docker containers were up and running, we decided to set up host profiles for active and passive checks between the zabbix agent and server in the docker stack, as shown in Figure 3. This was to ensure that everything was connected properly. The Zabbix frontend is hosted on VM1 port 80 as per the assignment description. At this point in the assignment we typed the address of VM1 without supplying port as it was mapped to port 80 into a web browser to access the web frontend.

zabbix-agent	Items 66	Triggers 34	Graphs 13	Discovery 3	Web	
zabbix_server	Items 67	Triggers 34	Graphs 13	Discovery 3	Web	172.200.1.4:10050

Linux by Zabbix agent active	Enabled	None
Linux by Zabbix agent	Enabled	ZBX

Figure 3: Showing that the zabbix-agent and zabbix-server is working

We decided to split the Figure 3 image into two parts to improve the readability. The figure shows that our Docker stack is functioning correctly with fully set up hosts for both active and passive checks

Figure 4 shows a screenshot of the Docker compose log. It shows that all the checks are working between the agent and server, except one. We assumed that this one check from the template probably wasn't suited for being run in a Docker environment, because some things can be different in a Docker environment. The error, however, did not reoccur so we attributed it to a minor fault in the startup process.

```

zabbix-web_1 | 192.168.50.247 - - [12/May/2022:11:10:04 +0000] "POST /zabbix.php?action=noti
fications.get&sid=b6bbe17608fd0db2&output=ajax HTTP/1.0" 200 424 "http://192.168.50.247:8080/zab
bix.php?action=host.list" "Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:100.0) Gecko/20100101 Fi
refox/100.0" "192.168.50.206"
zabbix-agent_1 | 78:20220512:111009.996 active check "system.sw.packages" is not supported
: Cannot obtain package information.
zabbix-web_1 | 192.168.50.247 - - [12/May/2022:11:10:11 +0000] "POST /jsrpc.php?output=json-
rpc HTTP/1.0" 200 63 "http://192.168.50.247:8080/zabbix.php?action=host.list" "Mozilla/5.0 (Wind
ows NT 10.0; Win64; x64; rv:100.0) Gecko/20100101 Firefox/100.0" "192.168.50.206"
zabbix-server_1 | 188:20220512:111014.632 item "zabbix-agent:system.sw.packages" became not
supported: Cannot obtain package information.
zabbix-web_1 | 192.168.50.247 - - [12/May/2022:11:10:21 +0000] "POST /jsrpc.php?output=json-
rpc HTTP/1.0" 200 63 "http://192.168.50.247:8080/zabbix.php?action=host.list" "Mozilla/5.0 (Wind
ows NT 10.0; Win64; x64; rv:100.0) Gecko/20100101 Firefox/100.0" "192.168.50.206"

```

Figure 4: Logs from docker compose after setting up hosts on frontend

3. VM2 and VM3: Install Zabbix agent and Zabbix proxy

This chapter explains how we completed section III of the assignment. That includes how we installed, configured and started a Zabbix proxy, connected to both MariaDB and our Zabbix server. It also covers how we installed and configured a Zabbix agent on VM3, and got it to communicate with the Zabbix server through the Zabbix proxy.

3.1. VM2: Zabbix proxy and MariaDB

We followed a guide called “Zabbix proxy: Install on ubuntu 20.04 in 10 minutes!”, hereby referred to as “the guide”, to complete task 1 in section III of the assignment description. There were a few differences between what we did and what the guide did while setting up Zabbix proxy. These differences will be described below.

3.1.1. Installing Zabbix proxy

We started by installing Zabbix proxy on VM2 with the following commands:

```
sudo apt-get install wget

wget https://repo.zabbix.com/zabbix/6.0/ubuntu/pool/main/z/zabbix-release/
zabbix-release_6.0-1%2Bubuntu20.04_all.deb

sudo dpkg -i zabbix-release_6.0-1+ubuntu20.04_all.deb

# We needed this as well since we got the wrong version (6.2 beta) of the proxy by just downloading
# the release package
wget https://repo.zabbix.com/zabbix/6.0/ubuntu/pool/main/z/zabbix/
zabbix-proxy-mysql_6.0.1-1%2Bubuntu20.04_amd64.deb

sudo dpkg -i zabbix-proxy-mysql_6.0.1-1+ubuntu20.04_amd64.deb

sudo apt-get install -f

sudo apt-get install zabbix-proxy-mysql

sudo apt-get install zabbix-sql-scripts
```

NB: The download links we used are not the ones that were given in the assignment description. We decided against using those, because we ran into issues with the `zabbix-release` packages giving us the wrong version on Zabbix proxy. E.g we would end up with version 4, 5, or 6.2 beta. None of those versions were compatible with our server, which ran version 6.0. We needed the Zabbix proxy version 6.0.x, because the major release version has to be same on both server and proxy to establish a connection (Zabbix, 2019). We got our downloads from the official Zabbix repo listed in our references.

3.1.2. Configuring MariaDB database for the proxy to use

After we finished installing the Zabbix proxy, we installed and configured the MariaDB database, in accordance with both the guide, and the assignment description.

The following block of code describes the installation of MariaDB on VM2:

```
# to use curl, we need to install it
sudo apt install software-properties-common -y

curl -LsS -O https://downloads.mariadb.com/MariaDB/mariadb_repo_setup

sudo bash mariadb_repo_setup --mariadb-server-version=10.6

sudo apt update

sudo apt -y install mariadb-common mariadb-server-10.6 mariadb-client-10.6
```

After installing MariaDB, we began configuring the database by running the following commands to start and enable MariaDB to start on boot:

```
# Makes the service start on startup
sudo systemctl enable mariadb

sudo systemctl start mariadb
```

The next step in the configuration of the database was to reset the root password. We did that using the commands in the following code block: The new password for root was set to '123'

```
sudo mysql_secure_installation

Enter current password for root (enter for none): Press Enter

Switch to unix_socket authentication [Y/n] y

Change the root password? [Y/n] y

New password: <Enter root DB password>

Re-enter new password: <Repeat root DB password>

Remove anonymous users? [Y/n] y

Disallow root login remotely? [Y/n] y

Remove test database and access to it? [Y/n] y

Reload privilege tables now? [Y/n] y
```

After the root password was set, it was time to create the database by running the commands in the following block of code:

```
sudo mysql -uroot -p'123' -e "create database zabbix_proxy character set utf8mb4 collate utf8mb4_bin;"

sudo mysql -uroot -p'123' -e "grant all privileges on *.* to zabbix@localhost identified by 'zabbixDBpass';"
```

The last step in the configuration of the database was to import the initial schema and data that Zabbix requires. This was done with the following command:

```
sudo cat /usr/share/doc/zabbix-sql-scripts/mysql/proxy.sql | mysql -uzabbix -p'zabbixDBpass' zabbix_proxy
```

In the installation and configuration of the database, we followed the guide quite exactly. Therefore, there are very few differences between what we did to install and configure the database, and what is suggested in the guide. The only notable difference between the guide and what we did was that we set the root password to '123', instead of 'rootDBpass'.

3.1.3. Configuring Zabbix proxy

Once the installation and configuration of the database was complete, it was time to configure the Zabbix proxy. The first step when configuring the Zabbix proxy was to open the config file with the following command:

```
sudo gedit /etc/zabbix/zabbix_proxy.conf
```

In the file we changed the following values:

```
ConfigFrequency=100
Server=192.168.50.95
Hostname=Zabbix Proxy

# Lastly we set the database user and pass to match the database we just created
DBPassword=zabbixDBpass
DBName=zabbix_proxy
DBUser=zabbix
```

After editing the necessary values, we saved and exited the file. We set the ConfigFrequency to be 100 seconds.

This parameter determines how often the proxy retrieves data from the configuration file, and is useful to cut down on the waiting time between status updates from the Zabbix proxy. We also noted the `Hostname`, because this was needed to connect the proxy to the server in the web frontend. We also ensured the the `DBPassword` was set to the correct value.

The notable differences between our config file, and the config file in the guide is that we have a different IP address for the zabbix server, and a different hostname for the proxy itself. The difference in IP address is to connect the Zabbix proxy to the right server.

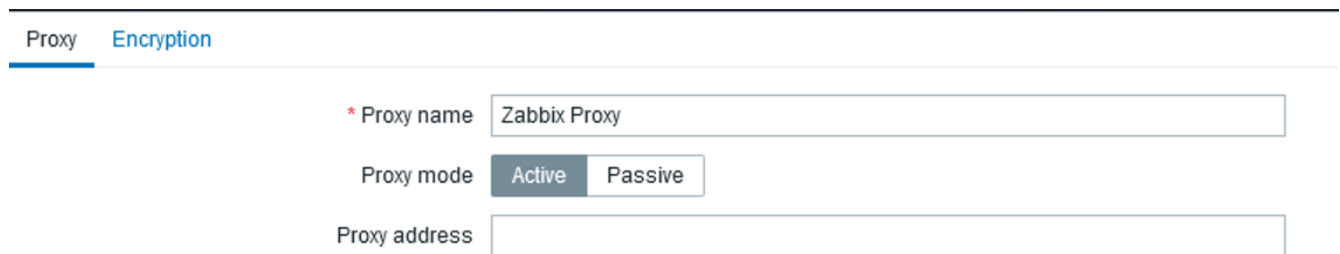
3.1.4. Starting and enabling the Zabbix proxy

Next, we started the Zabbix proxy and enabled it to boot on startup with the following commands:

```
sudo systemctl enable zabbix-proxy  
  
sudo systemctl start zabbix-proxy
```

3.1.5. Registering Zabbix proxy in the Zabbix frontend

Figure 5 shows how we set up the proxy in the Zabbix frontend after finishing the configuration on VM2. Figure 6 verifies that the proxy is properly connected to the server.



The screenshot shows the 'Proxy' tab in the Zabbix frontend. The 'Proxy name' field contains 'Zabbix Proxy'. The 'Proxy mode' is set to 'Active' (with 'Passive' as an alternative). The 'Proxy address' field is empty.

Figure 5: Showing proxy creation dialog window

It is important to note that Figure 6 shows that the `last seen (age)` is less than 6s. Now we know that the proxy is connected to the server.

Name ▲	Mode	Encryption	Compression	Last seen (age)	Host count	Item count
Zabbix Proxy	Active	None PSK	On	3s	1	73

Figure 6: Showing that the Zabbix proxy is connected

3.2. VM3: Zabbix Agent installation and setup

The following code block must be run on VM3 to install the Zabbix-agent.

```
wget https://repo.zabbix.com/zabbix/6.0/ubuntu/pool/main/z/zabbix-release/  
zabbix-release_6.0-1%2Bubuntu20.04_all.deb  
  
sudo dpkg -i zabbix-release_6.0-1+ubuntu20.04_all.deb  
  
# We had to use this one to get the right version  
wget https://repo.zabbix.com/zabbix/6.0/ubuntu/pool/main/z/zabbix/  
zabbix-agent_6.0.1-1%2Bubuntu20.04_amd64.deb  
  
sudo dpkg -i zabbix-agent_6.0-1+ubuntu20.04_amd64.deb  
  
sudo apt-get install -f  
  
sudo apt-get install zabbix-agent
```

The following code block creates the psk encryption key.

```
openssl rand -hex 32 > zabbix_agent.psk

cat zabbix_agent.psk
e8126679667a8594bc8d3d76121b6ba2a5fb4b6d41bea2cd62190c163fbc6c6b
```

The following code block moves the psk encryption key to /opt/zabbix folder.

```
sudo mkdir /opt/zabbix

sudo chmod 777 /opt/zabbix

sudo mv zabbix_agent.psk /opt/zabbix/
```

The following command was used to edit the zabbix-agentd.conf file

```
sudo vim /etc/zabbix/zabbix_agentd.conf
```

The following code block contains the lines we changed in the zabbix-agent.conf file; to enable psk encryption.

```
TLSConnect=psk
TLSAccept=psk
TLSPSKIdentity=cbt_psk_01
TLSPSKFile=/opt/zabbix_agent.psk

# The local ip of our bridged networked VM2
Server=192.168.50.247
```

Lastly we started and enabled the agent to start on boot with the following commands:

```
sudo systemctl enable zabbix-agent

sudo systemctl start zabbix-agent
```

In the Zabbix frontend we added psk encryption to the zabbix_server_vm3_agent host as shown in Figure 7.

Host

Host IPMI Tags Macros Inventory Encryption Value mapping

Connections to host: No encryption PSK Certificate

Connections from host: ☐ No encryption ☒ PSK ☐ Certificate

* PSK identity: cbt_psk_01

* PSK: e8126679667a8594bc8d3d76121b6ba2a5fb4b6d41bea2cd62190c163fbc6c6b

Update Clone Full clone Delete Cancel

Figure 7: VM3 Zabbix Agent encryption settings

It is evident that the Zabbix agent on VM3 is working and using psk encryption, as shown in Figure 8. We decided to split the Figure 8 image into two parts to improve the readability.

Name ▲	Items	Triggers	Graphs	Discovery	Web	Interface
zabbix-agent	Items 66	Triggers 34	Graphs 13	Discovery 3	Web	
zabbix_server	Items 67	Triggers 34	Graphs 13	Discovery 3	Web	172.200.1.4:10050
zabbix_server_agent_vm3	Items 73	Triggers 29	Graphs 14	Discovery 3	Web	192.168.50.151:10050

Proxy	Templates	Status	Availability	Agent encryption
	Linux by Zabbix agent active	Enabled		None
	Linux by Zabbix agent	Enabled	ZBX	None
Zabbix Proxy	Linux by Zabbix agent	Enabled	ZBX	PSK None PSK CERT

Figure 8: Showing our host setup with VM3 Zabbix Agent

4. VM2: Nginx Proxy

This chapter explains how we completed section IV of the assignment by installing, configuring and starting an nginx reverse proxy that listens on localhost, redirecting its traffic to the Zabbix server frontend. This is a good way to control outside access to only this site and not the rest of the network, e.g. if we do port forwarding on VM2's local IP address to make it accessible to the outside.

4.1. Installing Nginx Proxy and preparing configuration files

We started by installing nginx on the VM, using the following commands.

```
sudo apt-get update

sudo apt-get install nginx
```

Once nginx was installed, we disabled the default virtual host by unlinking it, using the following command.

```
sudo unlink /etc/nginx/sites-enabled/default
```

4.2. Applying configurations to the proxy

In order to add our new configurations to the proxy, we first moved to the `sites-available` directory. Once there, we created a new configuration file, called `reverse-proxy.conf`. We used the following command.

```
nano /etc/nginx/sites-available/reverse-proxy.conf
```

The newly created `reverse-proxy.conf` file and its configurations can be seen in the block below.

```
server {
    listen 8080;
    server_name localhost;

    location / {
        proxy_pass http://192.168.50.95:80; # Zabbix server IP address
        proxy_set_header Host $http_host;
        proxy_set_header X-Real-IP $remote_addr;
        proxy_set_header X-Forwarded-For $proxy_add_x_forwarded_for;
        proxy_set_header X-Forwarded-Proto $scheme;
    }
}
```

These configurations ensures that the nginx-proxy listens on port 8080 of VM2, and redirects all incoming traffic from that port to the Zabbix-server using `proxy_pass`. To clarify, VM1's local IP in the VirtualBox bridged network is 192.168.50.95 and the docker container holding the Zabbix frontend is mapped to this ip on port 80.

To complete the proxy, we activated the directives by linking to `/sites-enabled/` using the following command.

```
sudo ln -s /etc/nginx/sites-available/reverse-proxy.conf /etc/nginx/sites-enabled/reverse-proxy.conf
```

Lastly, to see if it worked, we ran an nginx configuration test and restarted the service.

```
# Making nginx run on boot to make our setup permanent
sudo systemctl enable nginx
```

```

sudo systemctl start nginx

sudo systemctl configtest nginx
* Testing nginx configuration [ OK ]

sudo systemctl restart nginx
* Restarting nginx nginx [ OK ]

```

This verifies that nginx works as intended.

Figure 9 shows the zabbix frontend being accessed from the host machine through the nginx proxy on VM2. The URL to reach the zabbix frontend isn't localhost:8080, as the architecture diagram suggested, but rather the IP address of VM2 which Figure 10 shows.

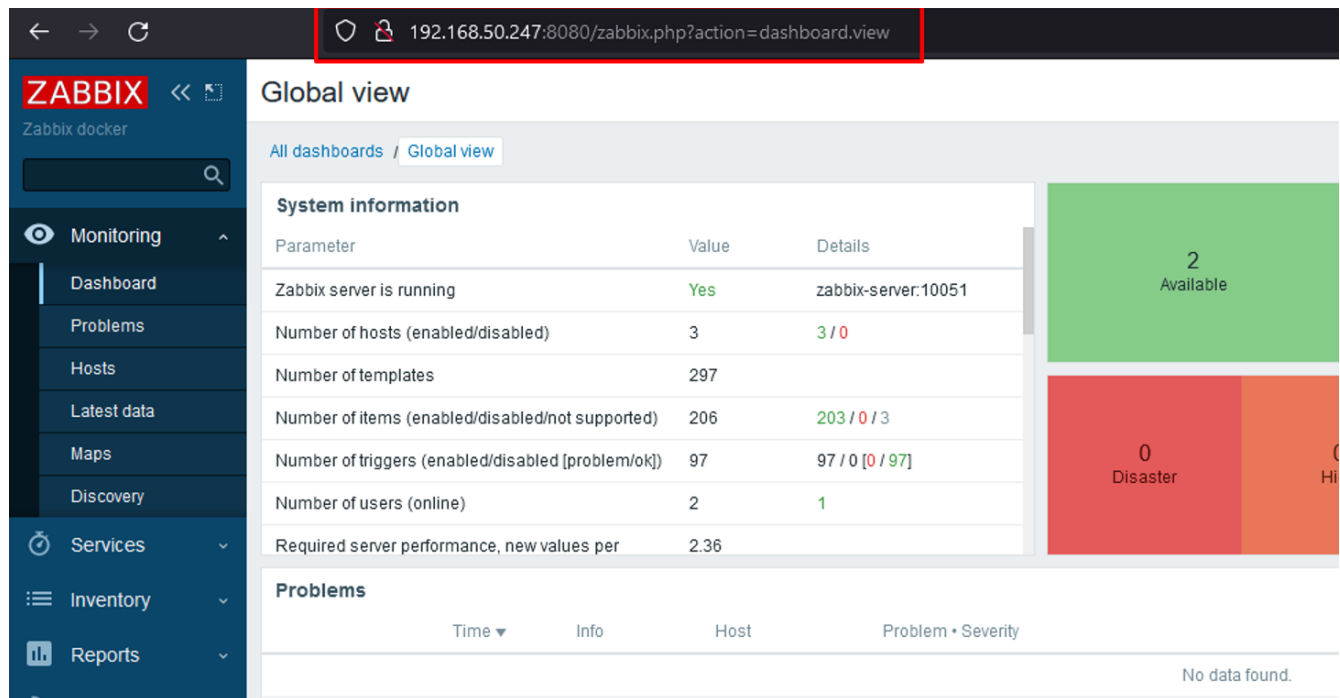


Figure 9: Showing zabbix frontend from nginx proxy

```

valid_lft forever preferred_lft forever
ubuntu1@ubuntu1-VirtualBox:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noque
    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
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 15
    link/ether 08:00:27:2a:01:1a brd ff:ff:ff:ff:ff:ff
    inet 192.168.50.247/24 brd 192.168.50.255 scope
        valid_lft 70486sec preferred_lft 70486sec

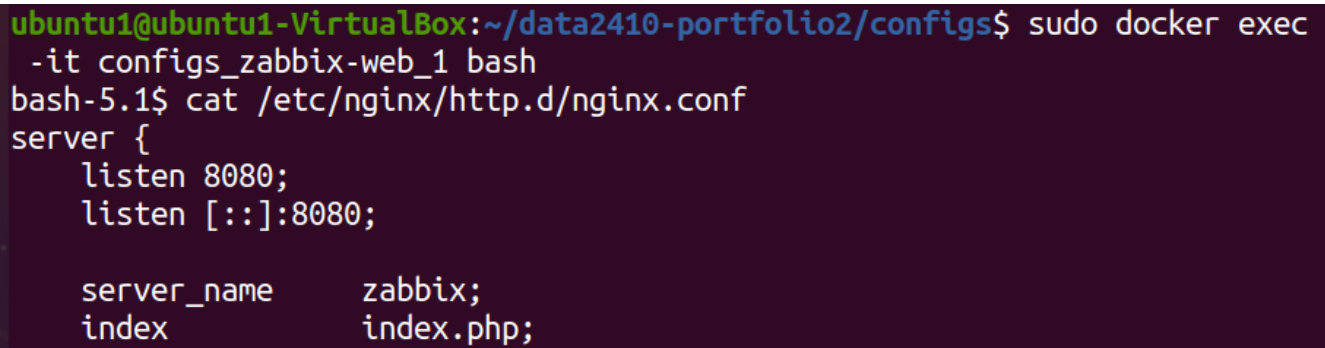
```

Figure 10: Showing local ip of VM2

The hostname on all VMs is ubuntu1 as a result of VM2 and VM3 being clones of VM1.

4.3. Comment on Zabbix Server Web Frontend Nginx configuration

Regarding task 3 section IV in the assignment, we have already configured the port forwarding of the zabbix-web via the `docker-compose.yml` file, mapping the host machine's port 80 to the container's 8080 port. The successful nginx configuration for the zabbix-web container is shown in Figure 11.

A terminal window with a dark purple background and light green text. The prompt is 'ubuntu1@ubuntu1-VirtualBox:~/data2410-portfolio2/configs\$'. The user enters 'sudo docker exec -it configs_zabbix-web_1 bash'. The prompt changes to 'bash-5.1\$'. The user enters 'cat /etc/nginx/http.d/nginx.conf'. The output shows the nginx configuration for the zabbix server, including listen directives and server settings.

```
ubuntu1@ubuntu1-VirtualBox:~/data2410-portfolio2/configs$ sudo docker exec
-it configs_zabbix-web_1 bash
bash-5.1$ cat /etc/nginx/http.d/nginx.conf
server {
    listen 8080;
    listen [::]:8080;

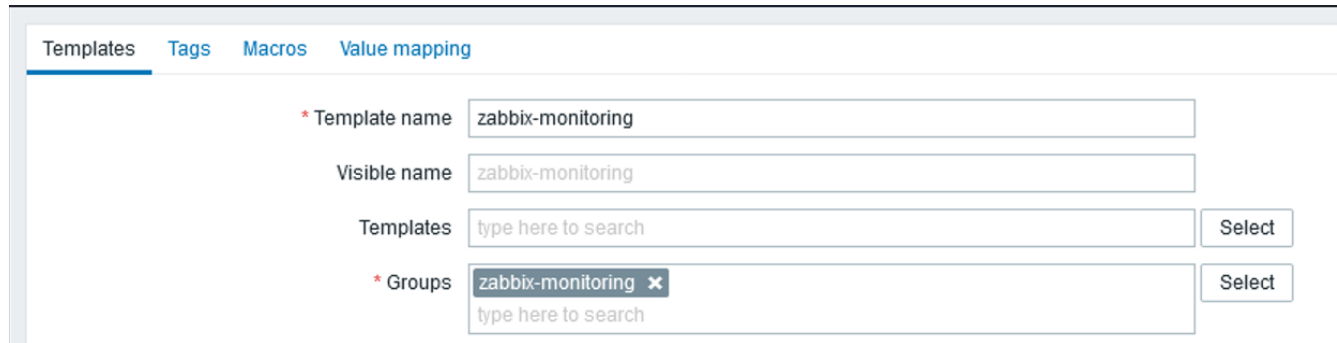
    server_name    zabbix;
    index          index.php;
```

Figure 11: Showing zabbix-web nginx config file

5. VM1: Zabbix Frontend

This chapter explains how completed section V of the assignment by using the Zabbix frontend to create a host group, a host and a template complete with items and triggers for the Zabbix agent running on VM3.

To access the Zabbix frontend, we connected to the nginx-proxy on VM2 via its local IP and port 8080 as specified. This redirected us to the VM1 zabbix-web Docker container and allowed us to interact with the server through this web interface. Once we had logged in to the Zabbix frontend, we added a host according to the assignment description, and made the items, as per task 2 a) and b) in section IV of the assignment description. Then we created a template, named `zabbix-monitoring` in the `zabbix-monitoring` hst group, as shown in Figure 12. Lastly, we added the triggers as per task 2 c) and d) in section IV of the assignment description.



The screenshot shows the Zabbix frontend 'Create template' dialog. It has tabs for 'Templates', 'Tags', 'Macros', and 'Value mapping'. The 'Template name' field contains 'zabbix-monitoring'. The 'Visible name' field also contains 'zabbix-monitoring'. The 'Templates' field is empty with a 'Select' button. The 'Groups' field contains 'zabbix-monitoring' with a dropdown arrow and a 'Select' button.

Figure 12: Showing template creation dialog

5.1. Items

We created the item for total disk space usage in the directory `/var` with an interval of one hour, and an item that monitors the Docker process usage with an interval of one minute, as shown in Figure 13:

```
#Total disk space usage in directory
fsv.fs.size[/var,used]

#Docker process usage
proc.cpu.util[dockerd]
```

	Name ▲	Triggers	Key	Interval	History
<input type="checkbox"/>	...		proc.cpu.util[dockerd]	1m	90d
<input type="checkbox"/>	...		fsv.fs.size[/var,used]	60m	90d

Figure 13: Showing that the items are created

5.2. Triggers

We created a trigger that triggers when the uptime is longer than 240 days, as shown in Figure 14:

```
last(/zabbix_server_agent_vm3/system.uptime)>240d
```

We created a trigger that triggers when disk I/O is higher than 20% average for five minutes, as shown in Figure 15:

```
avg(/zabbix_server_agent_vm3/system.cpu.util[,iowait],5m)>20
```

After creating the triggers, we checked to make sure that the triggers were created correctly, which is shown in Figure 16 and Figure 17.

After having done these steps, we and anyone using this as a guide should be able to set this host for the agent on VM3 with our custom items and triggers.

All hosts / zabbix_server_agent_vm3 Enabled ZBX Items 73 Triggers 28 Graphs 14 Discovery rules 3 Web scenarios

Trigger Tags Dependencies

* Name

Event name

Operational data

Severity ☒ Not classified ☐ Information ☐ Warning ☐ Average ☐ High ☐ Disaster

* Expression

[Expression constructor](#)

OK event generation ☒ Expression ☐ Recovery expression ☐ None

PROBLEM event generation mode ☒ Single ☐ Multiple

OK event closes ☒ All problems ☐ All problems if tag values match

Figure 14: Showing trigger uptime creation dialog

All hosts / zabbix_server_agent_vm3 Enabled ZBX Items 73 Triggers 29 Graphs 14 Discovery rules 3 Web scenarios

Trigger Tags Dependencies

* Name

Event name

Operational data

Severity ☒ Not classified ☐ Information ☐ Warning ☐ Average ☐ High ☐ Disaster

* Expression

[Expression constructor](#)

OK event generation ☒ Expression ☐ Recovery expression ☐ None

PROBLEM event generation mode ☒ Single ☐ Multiple

OK event closes ☒ All problems ☐ All problems if tag values match

Figure 15: Showing trigger disk I/O creation dialog

<input type="checkbox"/>	Information	OK	Linux by Zabbix agent: System name has changed	<code>last(/zabbix_server_agent_vm3/system.hostname,#1)<=>last(/zabbix_server_agent_vm3/system_server_agent_vm3/system.hostname))>0</code>
<input type="checkbox"/>	Warning	OK	Linux by Zabbix agent: System time is out of sync	<code>fuzzytime(/zabbix_server_agent_vm3/system.localtime,{\$SYSTEM.FUZZYTIME.MAX})=0</code>
<input type="checkbox"/>	Not classified	OK	uptime over 240 days	<code>last(/zabbix_server_agent_vm3/system.uptime)>240d</code>
<input type="checkbox"/>	Average	OK	Linux by Zabbix agent: Zabbix agent is not available	<code>max(/zabbix_server_agent_vm3/zabbix[host.agent.available],{\$AGENT.TIMEOUT})=0</code>

Figure 16: Showing the uptime trigger is created

<input type="checkbox"/>	Not classified	OK	Disk I/O is overloaded	<code>avg(/zabbix_server_agent_vm3/system.cpu.util[,iowait],5m)>20</code>
<input type="checkbox"/>	Warning	OK	Linux by Zabbix agent: Getting closer to process limit	<code>{ITEM.LASTVALUE1} active, {ITEM.LASTVALUE2} limit</code>
<input type="checkbox"/>	Warning	OK	Linux by Zabbix agent: has been restarted	<code>last(/zabbix_server_agent_vm3/system.uptime)<10m</code>
<input type="checkbox"/>	Warning	OK	Linux by Zabbix agent: High CPU utilization Depends on: zabbix_server_agent_vm3: Load average is too high	<code>min(/zabbix_server_agent_vm3/system.cpu.util,5m)>{\$CPU.UTIL.CRIT}</code>

Figure 17: Showing the disk I/O trigger is created

6. Conclusion and summary

In chapters two, three, four and five, we have detailed how we implemented the four main points of this assignment. Our main takeaways from this assignment has been working with traditional VMs networked together in a bridged network on the host machine as well as setting up a Zabbix monitoring environment on these machines. We have gained experience working with bridged Docker networking, Docker volume functionality and the setting of environment variables to help with the generation of config files, in addition to general configuration of a Docker compose stack through a .yaml Docker compose file.

We have also displayed how we worked with the zabbix environment and its services such as the server, the databases it depends on and its agents and proxies, as well as setting up the frontend and further using it to configure a custom setup similar to something a real industry client could want. We have installed this in two ways, both manually and using Docker compose stack. We have gone through the unique ways to configure this for each approach, whilst also connecting the two approaches and making them communicate with each other through various checks.

7. References

- Canonical. (n.d.). *Ubuntu 20.04.4 LTS (Focal Fossa)*. Ubuntu 20.04.4 lts (focal fossa). Retrieved May 12, 2022, from <https://www.releases.ubuntu.com/20.04/>
- Downloads.mariadb.com*. downloads.mariadb.com. (n.d.). Retrieved May 12, 2022, from https://downloads.mariadb.com/MariaDB/mariadb_repo_setup
- How to set up an nginx reverse proxy*. Hostinger Tutorials. (2022, April 28). Retrieved May 12, 2022, from <https://www.hostinger.com/tutorials/how-to-set-up-nginx-reverse-proxy/>
- Index of /zabbix/6.0/ubuntu/pool/main/z/*. Zabbix Official Repository. (n.d.). Retrieved May 12, 2022, from <https://repo.zabbix.com/zabbix/6.0/ubuntu/pool/main/z/>
- Lontons A. (2021, December 9). *Handy Tips #15: Deploying zabbix passive and active agents*. Zabbix Blog. Retrieved May 12, 2022, from <https://blog.zabbix.com/handy-tips-15-deploying-zabbix-passive-and-active-agents/17696/>
- Zabbix proxy: Install on ubuntu 20.04 in 10 minutes!*. Best Monitoring Tools. (n.d.). Retrieved May 12, 2022, from <https://bestmonitoringtools.com/install-zabbix-proxy-on-ubuntu/>
- Zabbix. (2019, March 25). *Zabbix proxy installation explained - youtube*. youtube.com/Zabbix. Retrieved May 12, 2022, from <https://www.youtube.com/watch?v=H1ny3o6xlTE>