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Inhoudsopgaven

Inleiding

Dit project, **Secure Management**, is uitgevoerd door **Devin Jaya** en **Youssef Yassin** als onderdeel van de opleiding **Infrabeheer** bij Groenewood Inc.

Het project is een uitbreiding op de infrastructuur en kennis die wij in de voorgaande periodes hebben opgebouwd. Tijdens dit project werken wij als medewerkers van het IT-consultancybedrijf *Groenewood Inc.* in opdracht van het bedrijf **Virtual Tron**. Onze opdracht is om de bestaande infrastructuur te vervangen, te beveiligen en te voorzien van de nodige beheertools voor een stabiele en veilige IT-omgeving.

Wij voeren dit project **met twee personen** uit. De taken zijn hierbij evenwichtig verdeeld:

- **Devin Jaya** richt zich voornamelijk op de configuratie van de **Fortigate-firewall**, het instellen van de **VDOM**, en het aanmaken van **firewall policies**.
- **Youssef Yassin** is verantwoordelijk voor de **configuratie van de switch**, het **cablemanagement**, en het opzetten van servers en beheertools zoals **LibreNMS** en de **TFTP-server**.

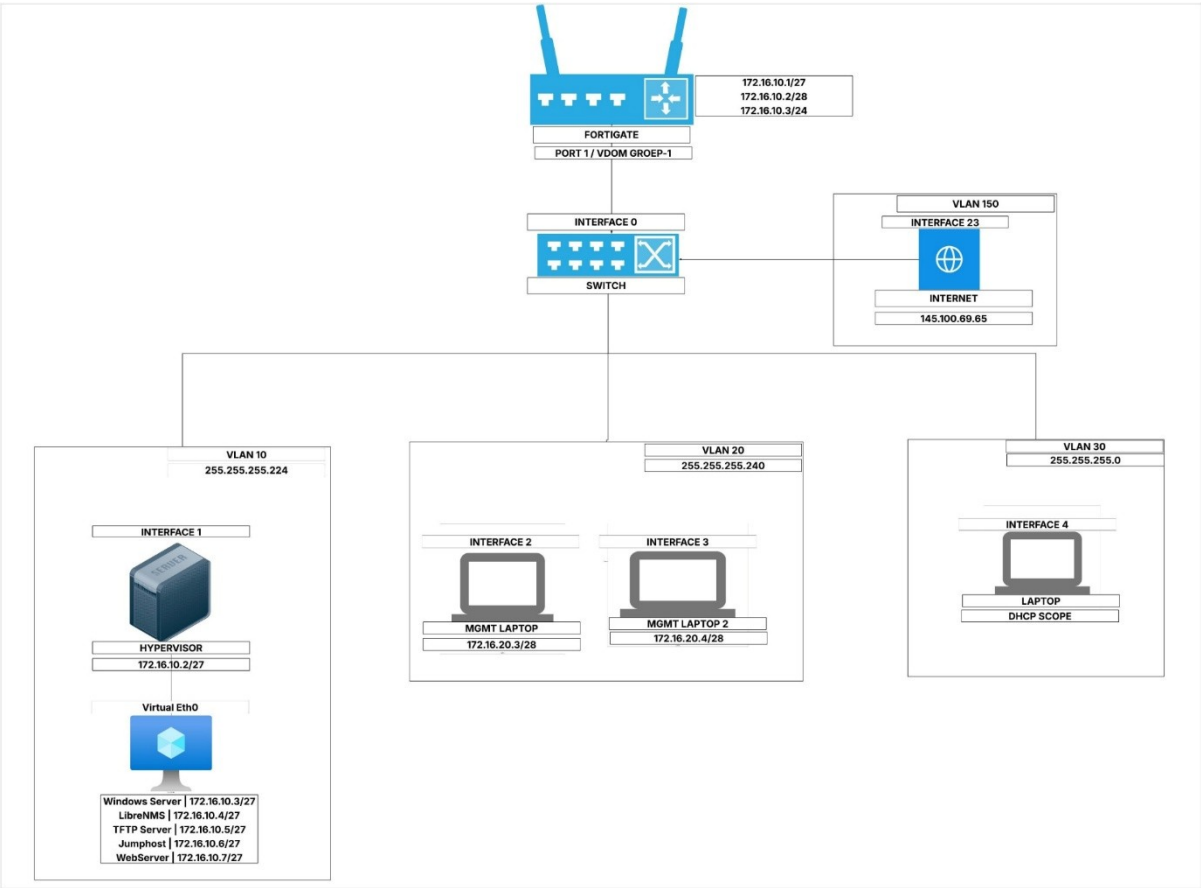
Samen zorgen wij voor een veilige, overzichtelijke en goed gedocumenteerde netwerkoplossing voor Virtual Tron. Alle configuraties, topologieën en resultaten zijn vastgelegd aan de hand van screenshots, foto’s en netwerkdiagrammen, zodat de voortgang en werking van het project duidelijk inzichtelijk blijven.

IP Plan

Netwerk	Subnet Masker	CIDR	Broadcast	VLAN ID	Doel
172.16.10.0	255.255.255.224	/27	172.16.10.31	10	Server network
172.16.20.0	255.255.255.240	/28	172.16.20.15	20	Mgmt netwerk
172.16.30.0	255.255.255.0	/24	172.16.30.255	30	Gebruikers network

Device	Interface	IP-adres	VLAN ID
Internet	Interface 23	145.100.69.65	150
Firewall VDOM	VLAN10	172.16.10.1/27	10
	VLAN20	172.16.20.1/28	20
	VLAN30	172.16.30.1/24	30
	VLAN150	145.100.69.65	150
Switch 1	VLAN20	172.16.20.2/28	20
Server1 (Hypervisor)	Interface 1	172.16.10.2/27	10
Windows Server (VM)	Virtual Eth0	172.16.10.3/27	10
LibreNMS (VM)	Virtual Eth0	172.16.10.4/27	10
TFTP Server (VM)	Virtual Eth0	172.16.10.5/27	10
Jumphost (VM)	Virtual Eth0	172.16.10.6/27	10
WebServer (VM)	Virtual Eth0	172.16.10.7/27	10
MGMT LAPTOP	Interface 2	172.16.20.3/28	20
MGMT LAPTOP 2	Interface 3	172.16.20.4/28	20
LAPTOP	Interface 4	DHCP	30

Netwerktekening



Fase 1:
Vervanging Huidige apparatuur

A. FortiGate Configureren

a. Interfaces controleren en activeren

```
config system interface                 # Open interfaceconfiguratie
edit "port1"                    # Selecteer poort 1 (trunkpoort)
set status up                   # Zorg dat poort actief is
set speed auto                  # Snelheid automatisch
next
end
```

b. VLAN’s aanmaken

```
config system interface                 # Open interface-instellingen
edit VLAN10                     # VLAN10 aanmaken
set vdom Groep-1
set ip 172.16.10.1/27           # IP-adres en subnetmasker
set allowaccess ping https ssh http # Toestaan van beheer en pings
set interface port1             # VLAN draait over fysieke poort 1
set vlanid 10                   # VLAN-ID 10 (Server VLAN)
next

edit VLAN20                     # VLAN20 aanmaken
set vdom Groep-1
set ip 172.16.20.1/28           # Management VLAN gateway
set allowaccess ping https ssh http
set interface port1
set vlanid 20                   # VLAN-ID 20 (Beheer VLAN)
next

edit VLAN30                     # VLAN30 aanmaken
set vdom Groep-1
set ip 172.16.30.1/24           # Gebruikers VLAN gateway
set allowaccess ping https ssh http
set interface port1
set vlanid 30                   # VLAN-ID 30 (Gebruikers VLAN)
next
end
```

c. Firewall Policies aanmaken (verkeer toestaan tussen VLAN’s)

```
config firewall policy                  # Firewall-regels configureren
edit 1
set name Mgmt-to-Servers        # Beheerders (VLAN20) → Servers (VLAN10)
set srcintf VLAN20
```

```
set dstintf VLAN10
set srcaddr all              # Alle bronnen toegestaan
set dstaddr all              # Alle bestemmingen toegestaan
set action accept              # Sta verkeer toe
set schedule always             # Altijd actief
set service ALL               # Alle protocollen toegestaan
set logtraffic all             # Log al het verkeer
next

edit 2
set name Mgmt-to-Users        # Beheerders (VLAN20) → Gebruikers (VLAN30)
set srcintf VLAN20
set dstintf VLAN30
set srcaddr all
set dstaddr all
set action accept
set schedule always
set service ALL
set logtraffic all
next

edit 3
set name Servers-to-Users       # Servers (VLAN10) → Gebruikers (VLAN30)
set srcintf VLAN10
set dstintf VLAN30
set srcaddr all
set dstaddr all
set action accept
set schedule always
set service ALL
set logtraffic all
next

Groep1
Devin123!
```

B. Switch Configureren

configure # Ga naar configuratiemodus

a. VLAN’s aanmaken

VLAN 10 – SERVER_VLAN

set vlans VLAN10 vlan-id 10 # Maak VLAN 10 aan
set vlans VLAN10 description "SERVER_VLAN" # Naam VLAN 10

VLAN 20 – MGMT_VLAN

set vlans VLAN20 vlan-id 20 # Maak VLAN 20 aan
set vlans VLAN20 description "MGMT_VLAN" # Naam VLAN 20
set vlans VLAN20 l3-interface vlan.20 # Koppel management IP aan VLAN 20
set interfaces vlan unit 20 family inet address 172.16.20.2/28

VLAN 30 – USERS_VLAN

set vlans VLAN30 vlan-id 30 # Maak VLAN 30 aan
set vlans VLAN30 description "USERS_VLAN"

b. Trunkpoort instellen (naar FortiGate)

set interfaces ge-0/0/0 unit 0 family ethernet-switching port-mode trunk
set interfaces ge-0/0/0 unit 0 family ethernet-switching vlan members [VLAN10 VLAN20 VLAN30 VLAN150]
set interfaces ge-0/0/0 description "Connection_to_FortiGate"

c. Access-poorten instellen

Servers (VLAN 10 → ge-0/0/1)

set interfaces ge-0/0/1 unit 0 family ethernet-switching port-mode access
set interfaces ge-0/0/1 unit 0 family ethernet-switching vlan members VLAN10
set interfaces ge-0/0/1 description "Servers"

Management PC’s (VLAN 20 → ge-0/0/2 t/m ge-0/0/3)

set interfaces ge-0/0/2 unit 0 family ethernet-switching port-mode access
set interfaces ge-0/0/2 unit 0 family ethernet-switching vlan members VLAN20
set interfaces ge-0/0/2 description "Management_PC1"
set interfaces ge-0/0/3 unit 0 family ethernet-switching port-mode access
set interfaces ge-0/0/3 unit 0 family ethernet-switching vlan members VLAN20
set interfaces ge-0/0/3 description "Management_PC2"

Gebruikers (VLAN 30 → ge-0/0/4)

set interfaces ge-0/0/4 unit 0 family ethernet-switching port-mode access
set interfaces ge-0/0/4 unit 0 family ethernet-switching vlan members VLAN30
set interfaces ge-0/0/4 description "User"

d. Standaard Gateway instellen (voor management traffic)

set routing-options static route 0.0.0.0/0 next-hop 172.16.20.1

e. SSH inschakelen

set system services ssh
set system root-authentication plain-text-password
(Voer jouw wachtwoord in) Admin123!

f. Hostname en Web-management

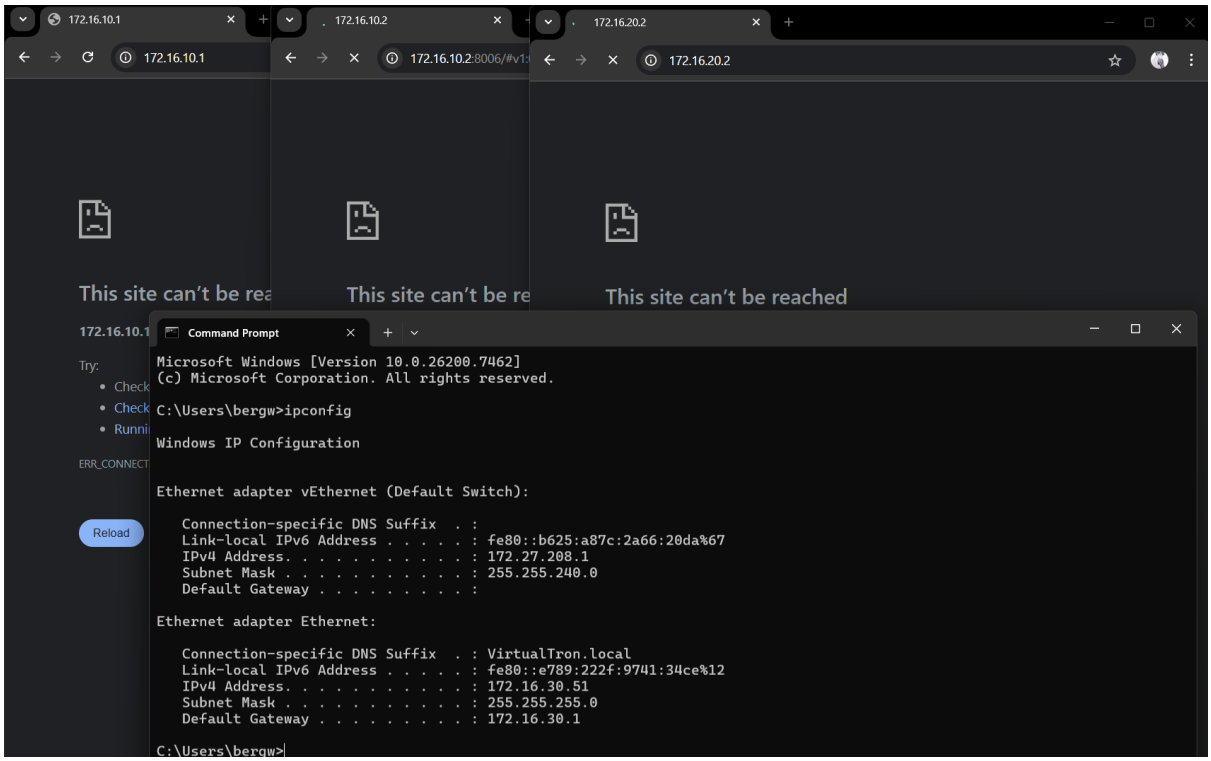
set system host-name EX2200-Groep1
set system services web-management http

g. Configuratie opslaan

Commit

root
Admin123!

C. Testen



Ik heb getest vanaf vlan 30 naar vlan 10 en ook vlan 20 proberen om die management en werk niet.

Fase 2:
Aansluiten WAN koppeling

A. Switch configuratie

a. Maak VLAN 150

VLAN 150 – INTERNET_VLAN

```
set vlans VLAN150 vlan-id 150            # Maak VLAN 150 aan (WAN VLAN)
set vlans VLAN150 description "INTERNET_VLAN"
```

b. Uplink naar Internet

(poort ge-0/0/23 → VLAN150)

```
set interfaces ge-0/0/23 unit 0 family ethernet-switching port-mode trunk
set interfaces ge-0/0/23 unit 0 family ethernet-switching vlan members VLAN150
set interfaces ge-0/0/23 description "Uplink_to_Internet"
```

B. Fortigate Configuratie

a. WAN VLAN150 configureren

```
config system interface
edit VLAN150
set vdom Groep-1                    # VDOM waarin de interface actief is
set ip 145.100.69.80 255.255.255.192    # Publiek IP-adres
set allowaccess ping https ssh          # Toegang toestaan voor beheer en testen
set role wan
set interface port1                 # Fysieke trunkpoort naar de switch
set vlanid 150                      # VLAN-ID voor WAN
set description WAN naar ICT netwerk     # Omschrijving van interface
next
end
```

b. Statische route naar gateway instellen

```
config router static
edit 1
set gateway 145.100.69.65           # Gateway van het publieke netwerk
set device VLAN150                  # WAN-interface als routepad
next
end
```

c. Toevoegen van de internet/SNAT-policy

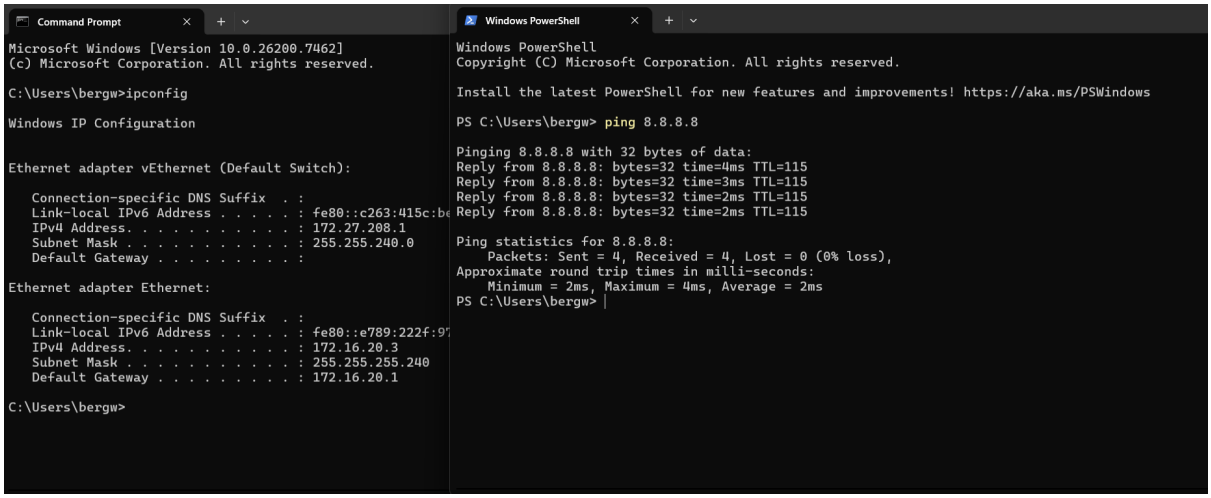
```
config firewall policy
edit 4
set name "WAN_SNAT_VLAN10"
set srcintf "VLAN10"
```

```
set dstintf "VLAN150"
set srcaddr "all"
set dstaddr "all"
set action accept
set schedule "always"
set service "ALL"
set nat enable
next
end

config firewall policy
edit 5
set name "WAN_SNAT_VLAN20"
set srcintf "VLAN20"
set dstintf "VLAN150"
set srcaddr "all"
set dstaddr "all"
set action accept
set schedule "always"
set service "ALL"
set nat enable
next
end

config firewall policy
edit 6
set name "WAN_SNAT_VLAN30"
set srcintf "VLAN30"
set dstintf "VLAN150"
set srcaddr "all"
set dstaddr "all"
set action accept
set schedule "always"
set service "ALL"
set nat enable
next
end
```

C. Testen



Deze is vanaf vlan 20 naar internet getest

Fase 3:
LibreNMS monitoring server

Overzicht

OS: Ubuntu 24.04 LTS

Server IP: 172.16.10.4

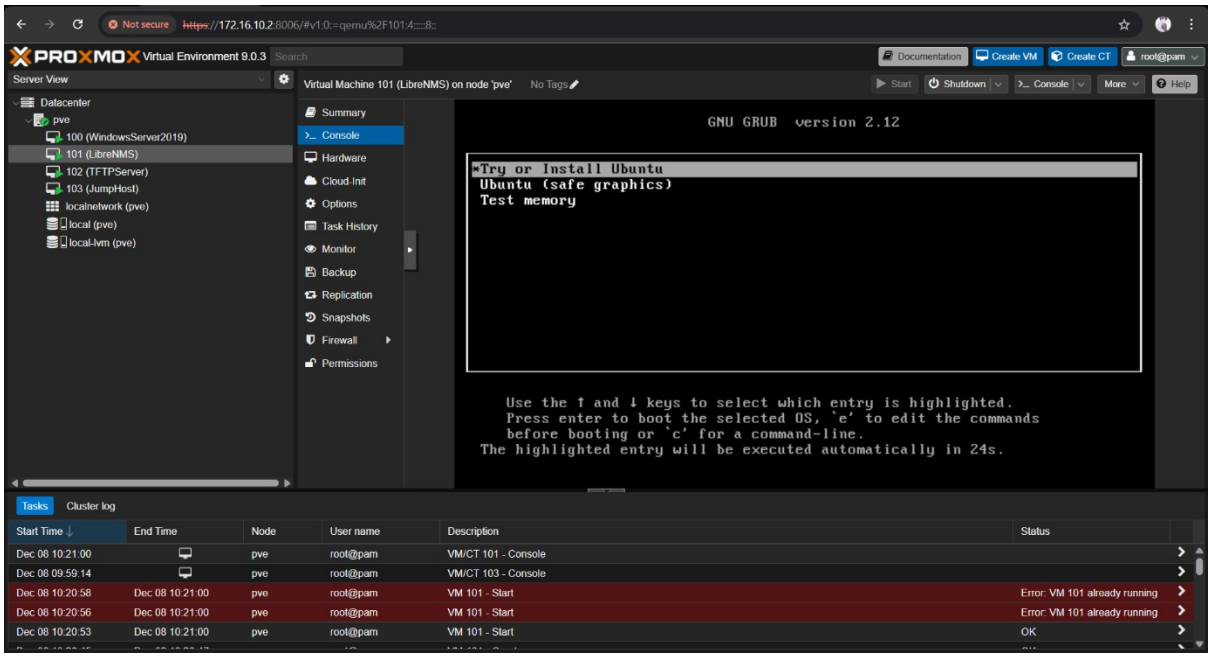
Project: Installatie en configuratie van LibreNMS inclusief Syslog-integratie

A. Installatie van Ubuntu in Proxmox

a. Opstarten van de installatie-media

1. Opstarten via GRUB-menu

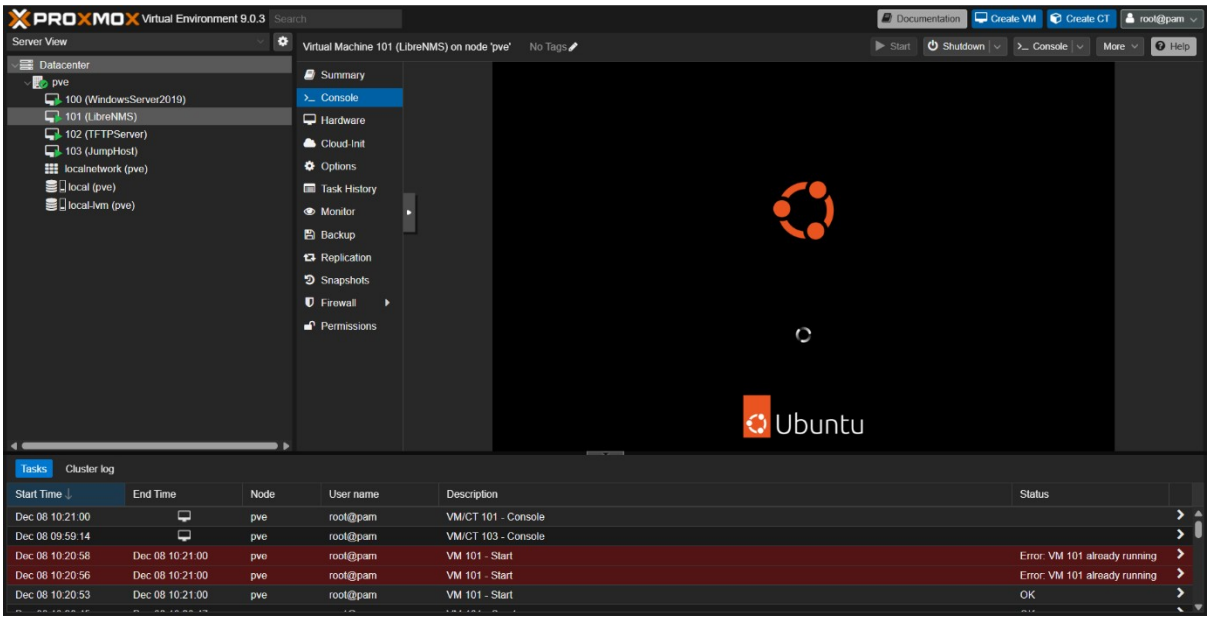
GNU GRUB



Selecteer de optie **Try or Install Ubuntu**.

Dit start het installatieprogramma van Ubuntu vanaf de gekoppelde ISO-installatiemedia.

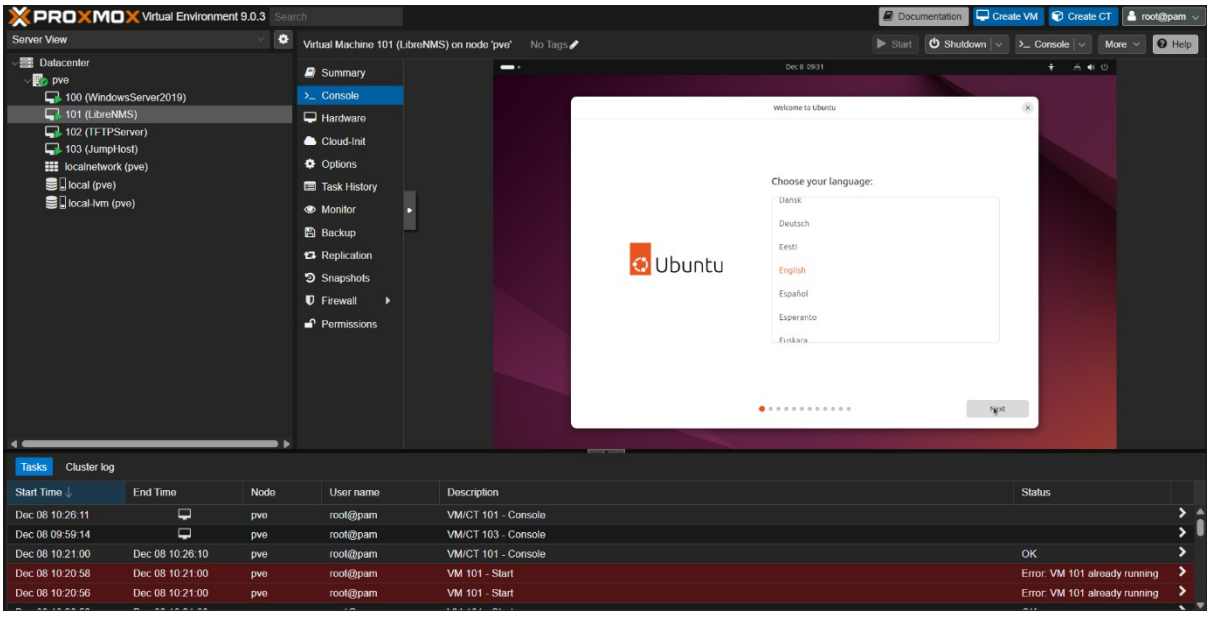
2. Ubuntu laadscherm



De installatieomgeving van Ubuntu wordt geladen. Wacht tot het volgende scherm verschijnt.

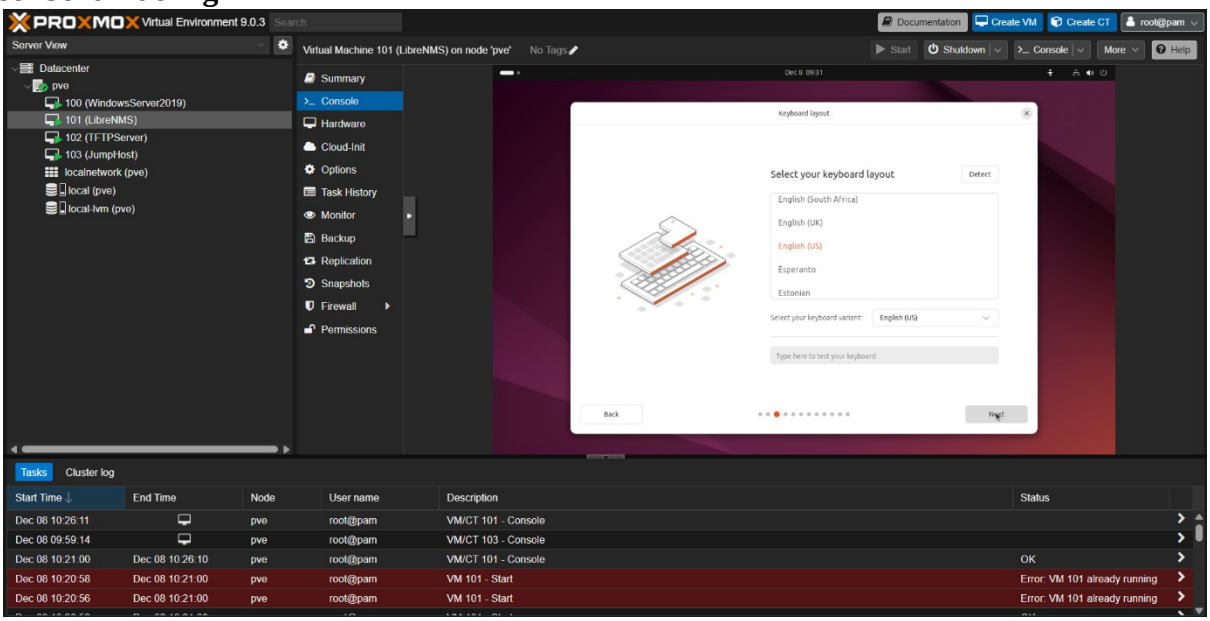
b. Installatievoorkeuren

3. Kies uw taal



Selecteer de gewenste taal voor de installatie. In dit voorbeeld is **English** geselecteerd.
Klik op **Next**.

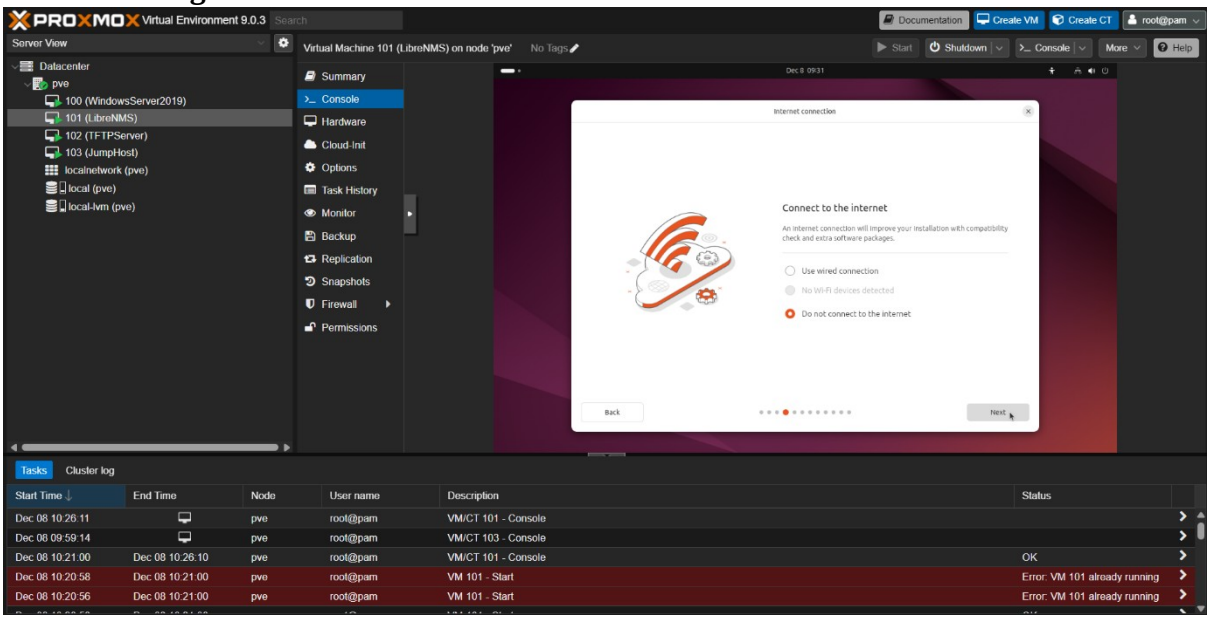
4. Toetsenbordindeling



Selecteer de toetsenbordindeling die u wilt gebruiken. In dit voorbeeld is **English** geselecteerd. U kunt het toetsenbord testen in het veld eronder.

Klik op **Next**.

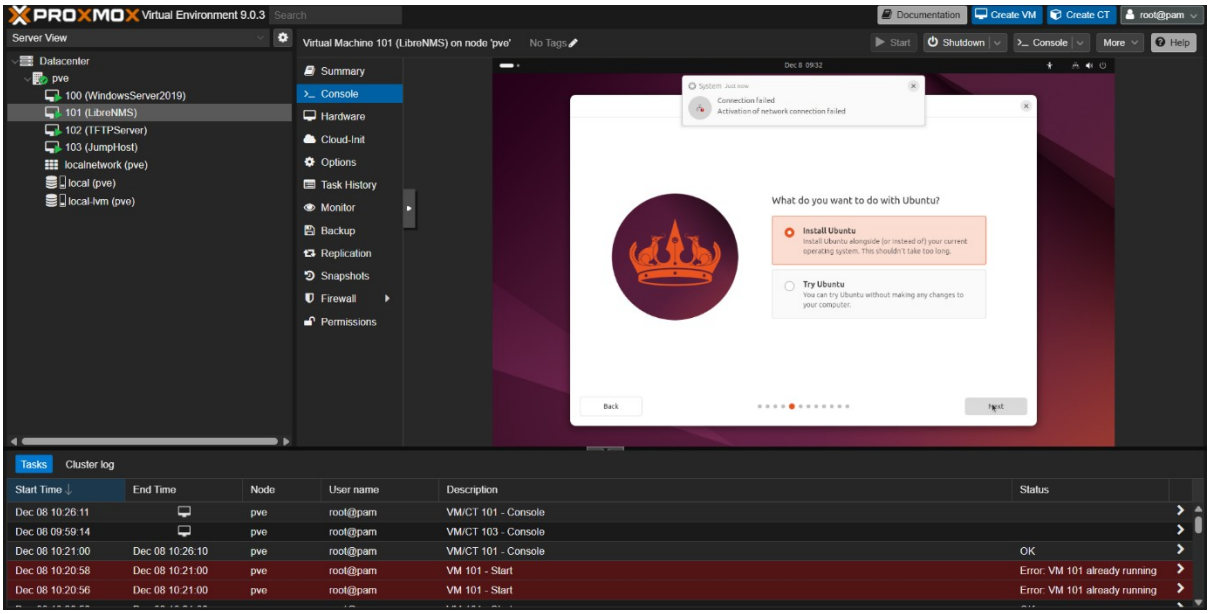
5. Netwerkverbinding



Ga door zonder verbinding als de installatie anders stopt. De netwerkinstellingen kunnen later worden geconfigureerd.

Klik op **Next**.

6.Installatie van Ubuntu

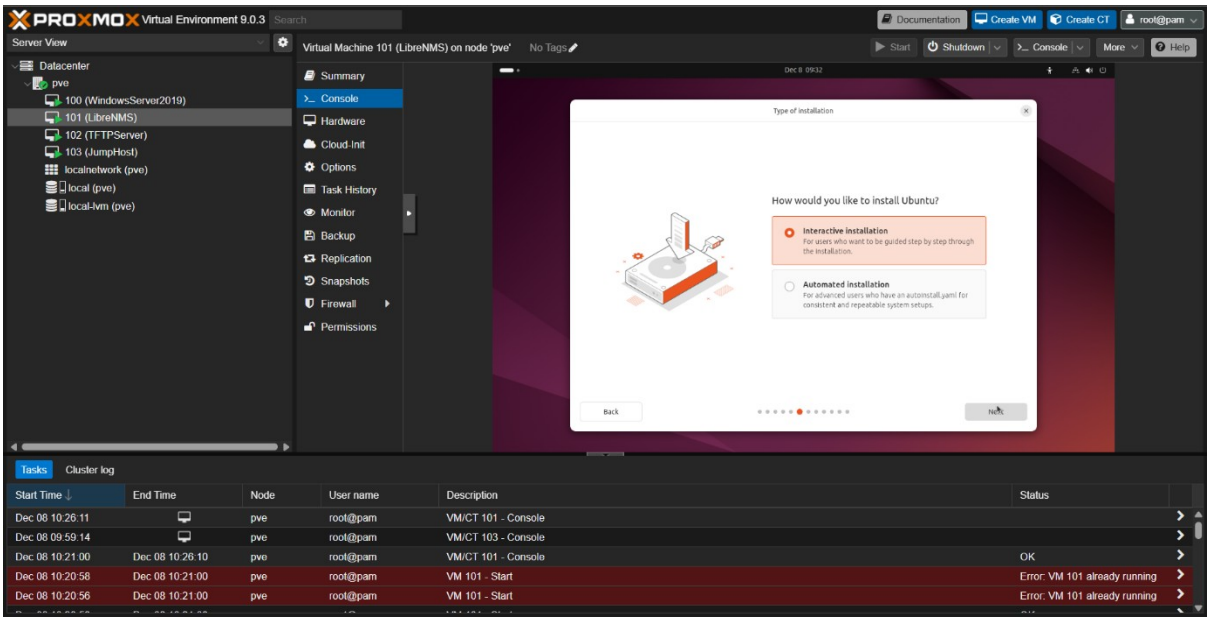


Er verschijnt een melding **Connection failed**, wat de netwerkstatus van de vorige stap bevestigt.

Selecteer **Install Ubuntu**.

Klik op **Next**.

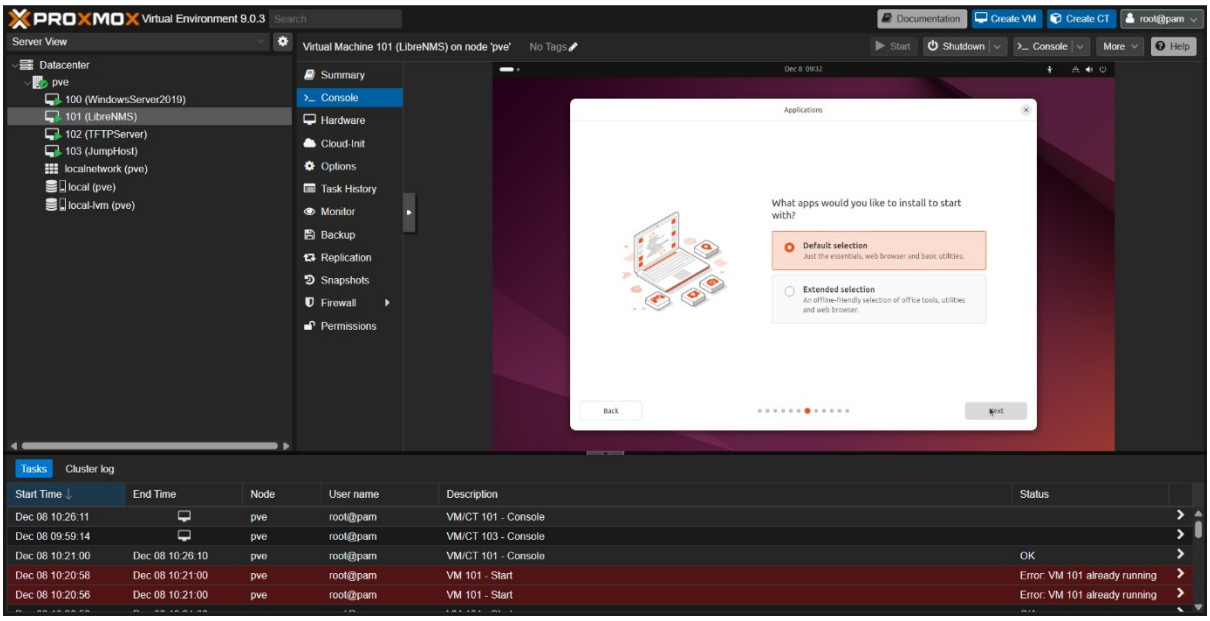
7. Type installatie



Selecteer **Interactive installation**. Dit is de standaard methode om het installatieproces handmatig te doorlopen.

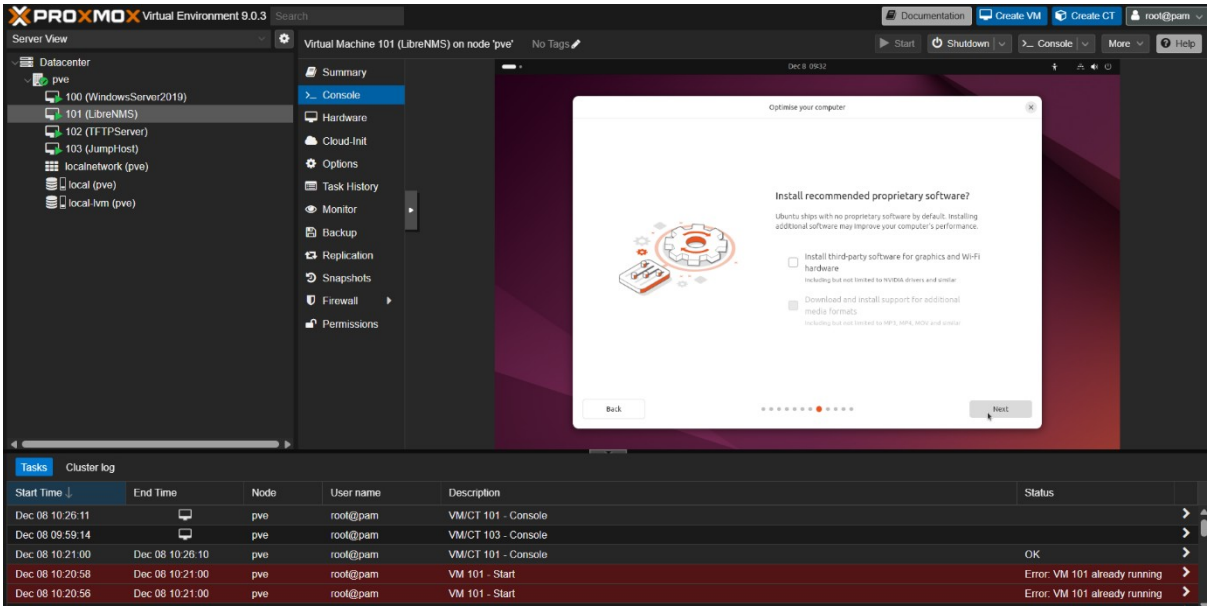
Klik op **Next**.

8. Applicaties



Selecteer **Default selection**. Dit installeert een webbrowser en basis utilities. Dit is meestal voldoende voor een server-VM, tenzij u een desktopomgeving wilt.
Klik op **Next**.

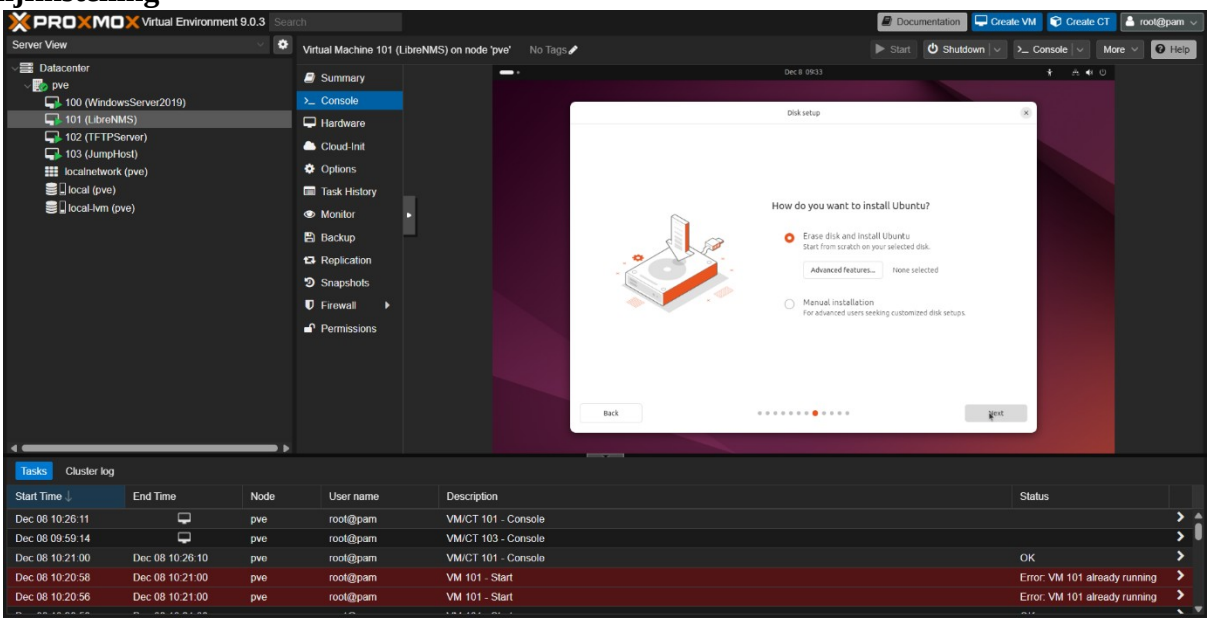
9. Aanbevolen software



U kunt ervoor kiezen om **geen** propriëtaire software voor grafische en Wi-Fi-hardware te installeren, tenzij u deze specifiek nodig heeft. Voor een server-VM is dit meestal niet nodig.
Klik op **Next**.

c. Schijfindeling en afronding

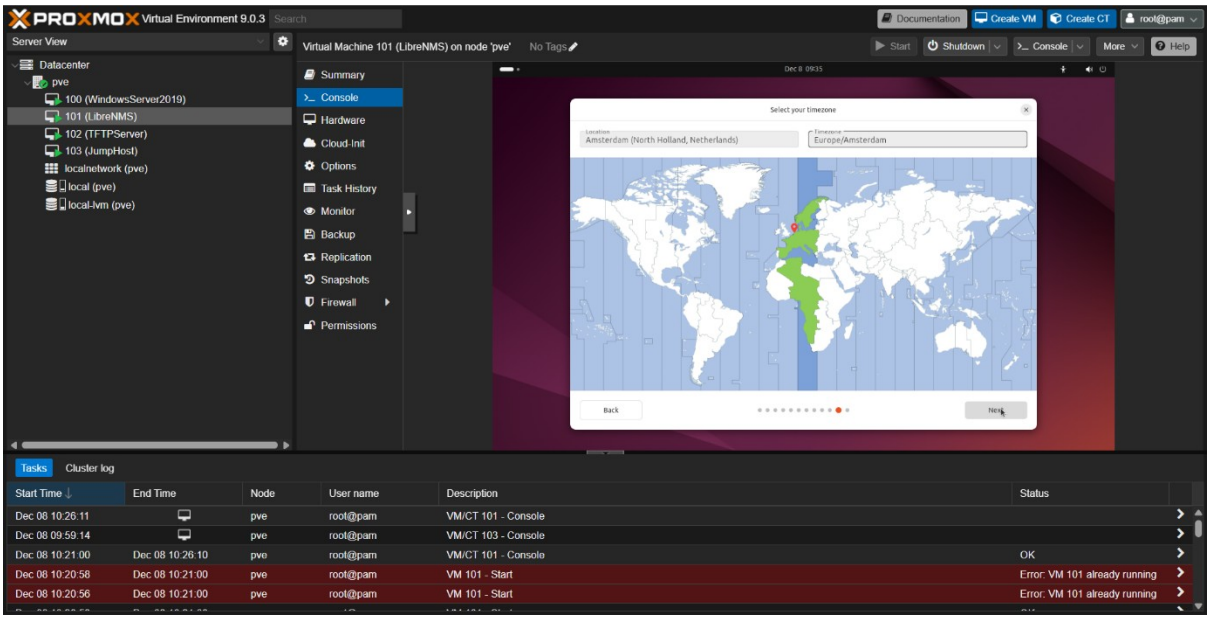
10. Schijfinstelling



Selecteer **Erase disk and install Ubuntu** Dit is de aanbevolen optie voor een schone installatie op een nieuwe virtuele harde schijf.
Klik op **Next**.

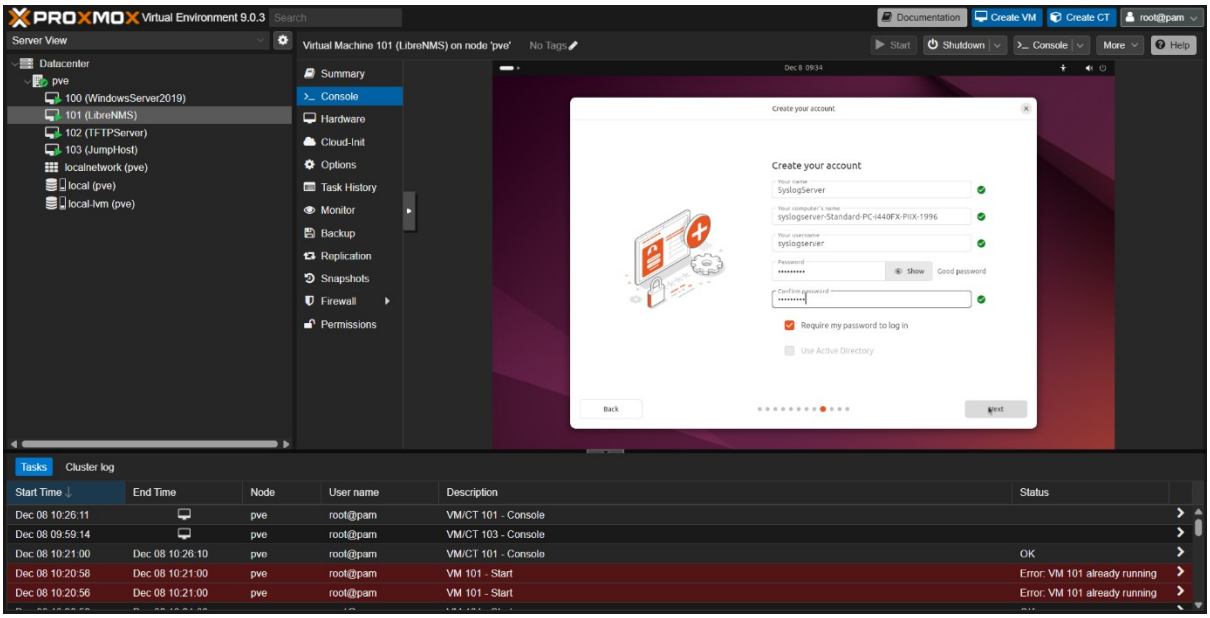
d. Tijdzone en Gebruikersaccount

11. Tijdzone selecteren



Selecteer uw tijdzone. In dit voorbeeld is **Europa/Amsterdam** geselecteerd.
Klik op **Next**.

12. Account aanmaken



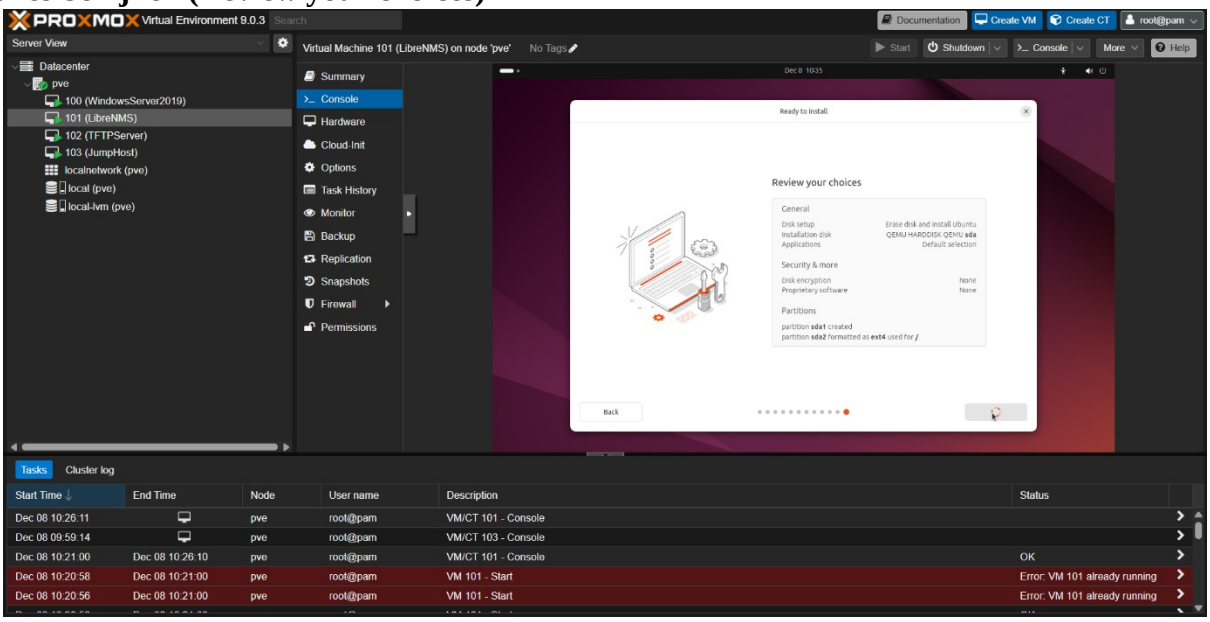
Voer de gegevens in voor het aan te maken gebruikersaccount.

- **Your name:** SyslogServer
- **Your computer's name:** syslogserver-Standard-PC...
- **Pick a username:** syslogserver
- **Password/Confirm password:** Stel een wachtwoord in.
- De optie **Require my password to log in** is standaard aangevinkt.

Klik op **Next**.

e. Overzicht en Installatie

13. Keuzes bekijken (Review your choices)



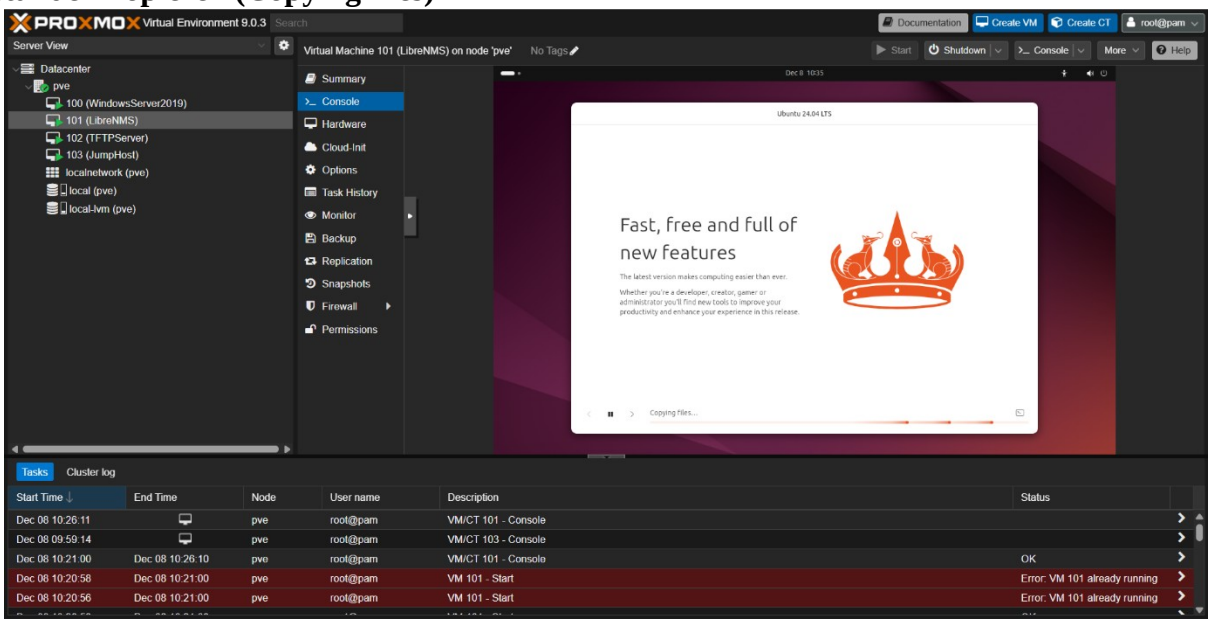
Controleer het overzicht van de geselecteerde installatie-opties, zoals:

- **Disk setup:** Erase disk and install Ubuntu
- **Applications:** Default selection
- **Proprietary software:** None

- **Partitions:** De indeling wordt getoond, bijvoorbeeld een ext4 partitie voor /.

Klik op **Install** (rechtsonder) om het proces te starten.

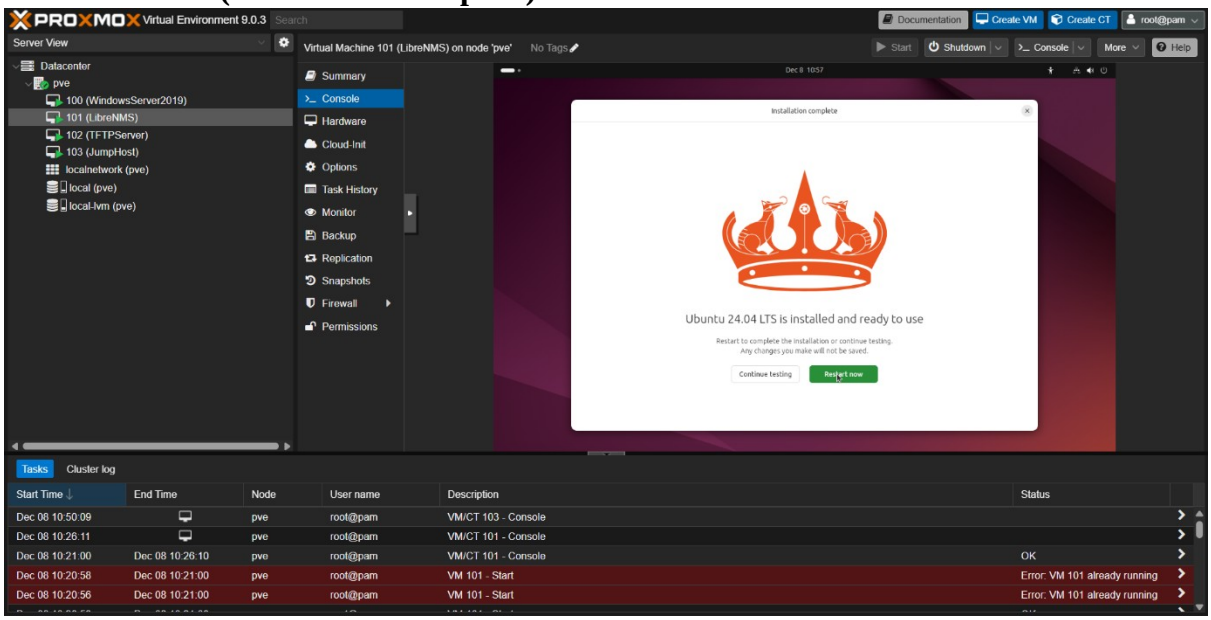
14. Bestanden kopiëren (Copying files)



De installatie is begonnen en het systeem kopieert nu de benodigde bestanden. Wacht tot dit proces is voltooid.

f. Afronding en Herstart

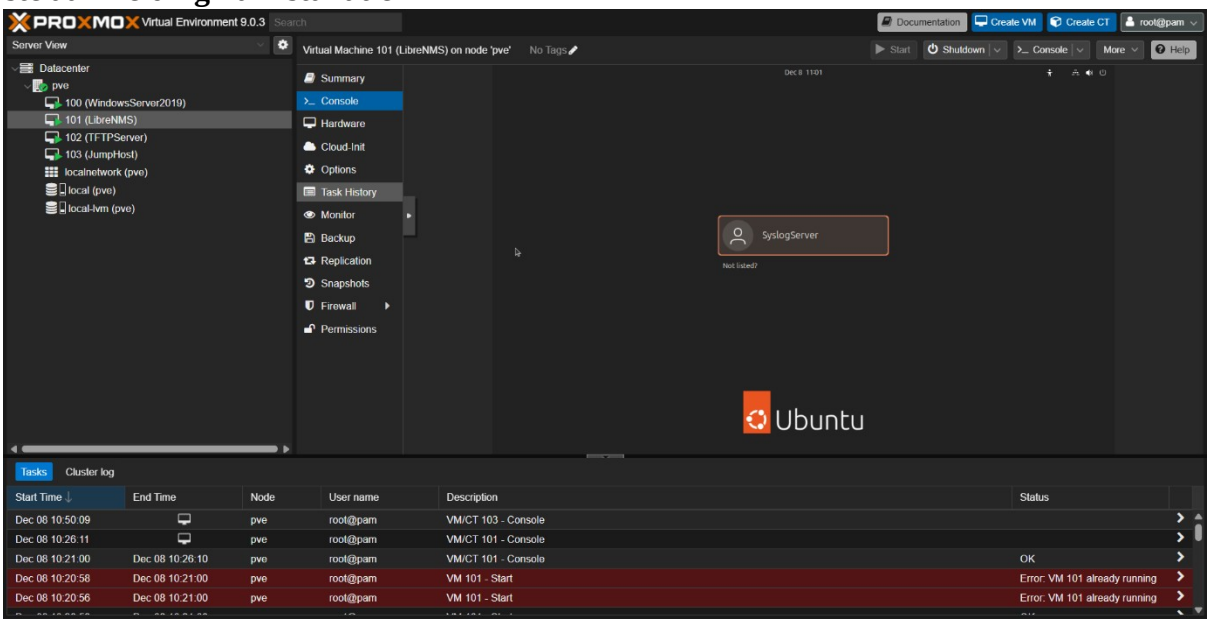
15. Installatie voltooid (Installation Complete)



De installatie van **Ubuntu 24.04 LTS** is voltooid.

Klik op **Restart Now** om de virtuele machine opnieuw op te starten en in het nieuwe besturingssysteem te booten.

16. Eerste aanmelding na installatie

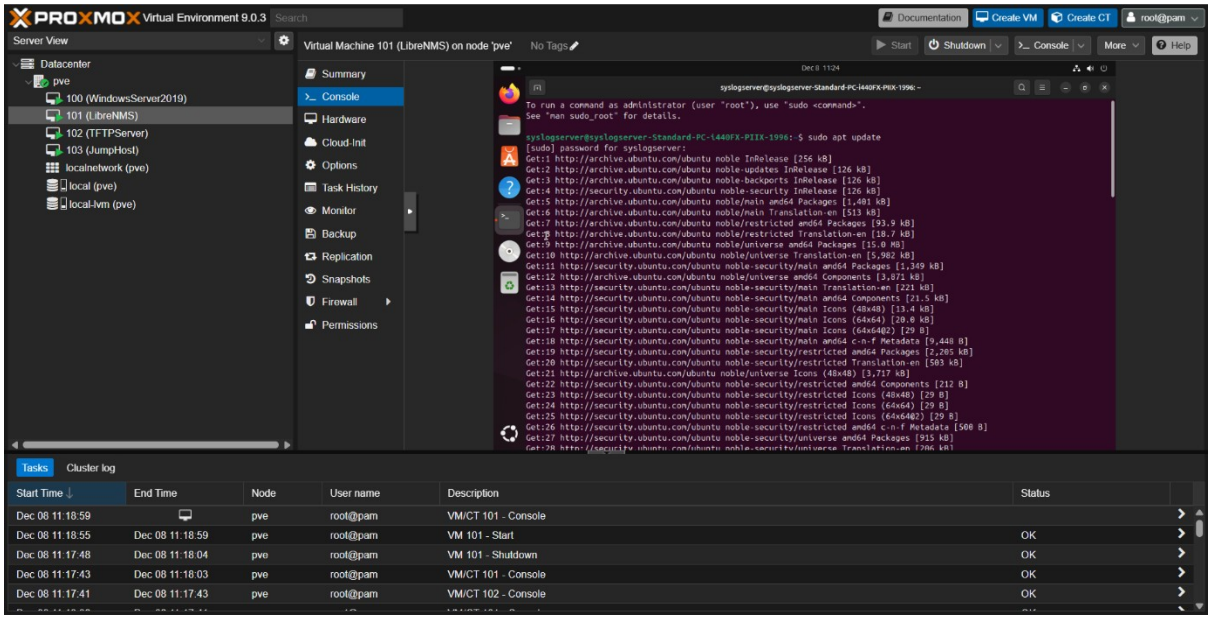


De VM is succesvol opgestart in het geïnstalleerde Ubuntu-systeem.
Klik op de aangemaakte gebruiker (syslogserver in dit voorbeeld) en voer het wachtwoord in om aan te melden.

B. SYSLOG Installatie & Configuratie + LibreNMS

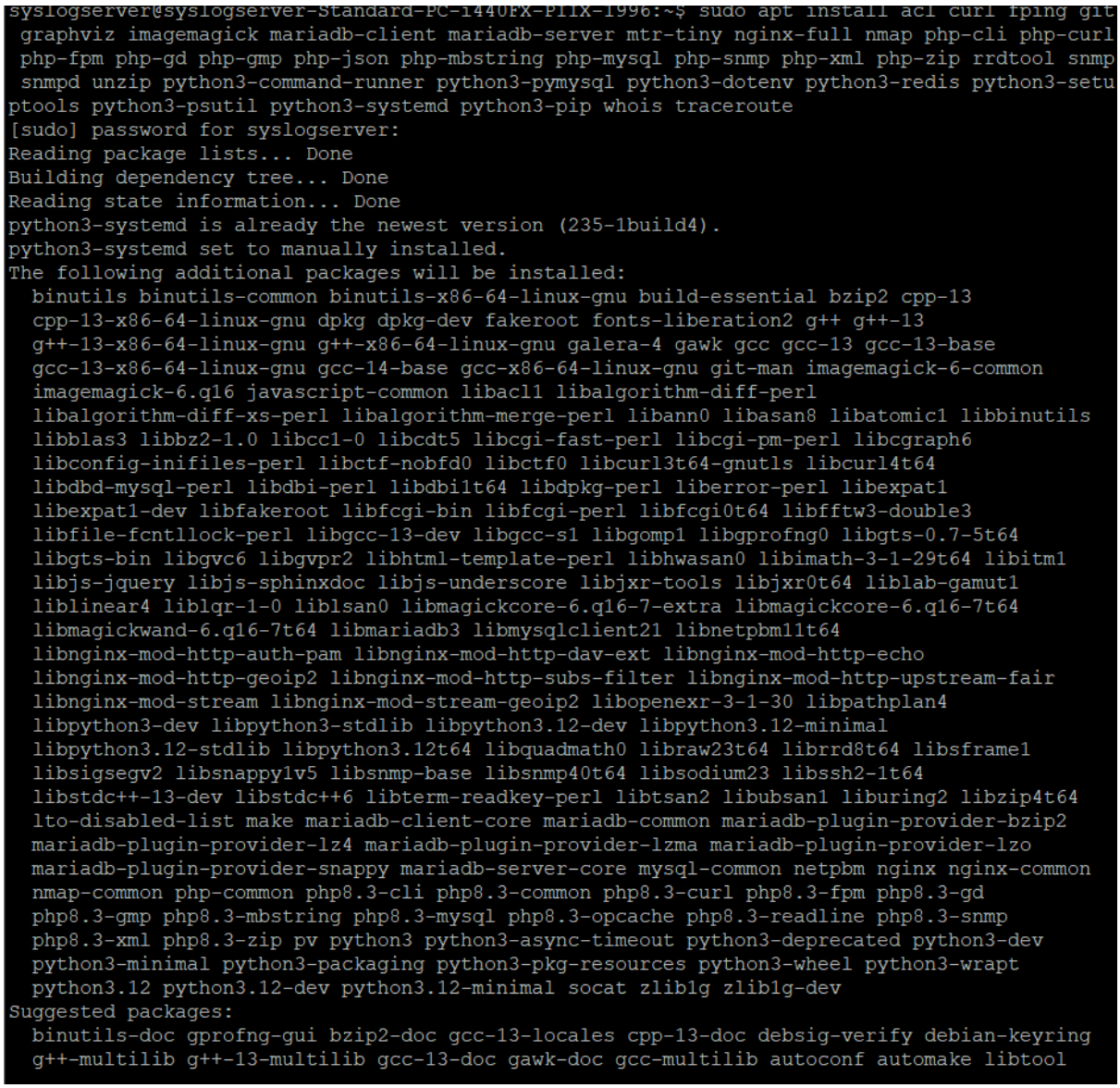
a. Vereiste pakketten installeren

Systeem up-to-date maken



sudo apt update

Haalt de nieuwste pakketlijsten op van Ubuntu.



Benodigde pakketten installeren

sudo apt install acl curl fping git graphviz imagemagick mariadb-client mariadb-server mtr-tiny nginx-full nmap php-cli php-curl php-fpm php-gd php-gmp php-json php-mbstring php-mysql php-snmp php-xml php-zip rrdtool snmp snmpd unzip python3-command-runner python3-pymysql python3-dotenv python3-redis python3-setuptools python3-psutil python3-systemd python3-pip whois traceroute

Installeert alle programma's die LibreNMS nodig heeft, zoals:

- webserver (nginx)
- database (MariaDB)
- PHP
- SNMP en netwerktools

b. LibreNMS systeemgebruiker

```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo useradd librenms -d /opt/libre
nms -M -r -s "$(which bash)"
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$
```

sudo useradd librenms -d /opt/librenms -M -r -s "$(which bash)"
Maakt een speciale gebruiker aan voor LibreNMS, voor veiligheid.

a. Download LibreNMS

```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ cd /opt
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:/opt$ Sudo git clone https://github.co
m/librenms/librenms.git
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:/opt$ sudo git clone https://github.co
m/librenms/librenms.git
Cloning into 'librenms'...
remote: Enumerating objects: 243841, done.
remote: Counting objects: 100% (941/941), done.
remote: Compressing objects: 100% (615/615), done.
Receiving objects:  13% (33081/243841), 33.41 MiB | 7.41 MiB/s
```

cd /opt

sudo git clone https://github.com/librenms/librenms.git

Downloadt LibreNMS naar de map /opt/librenms.

b. Machtigingen instellen

```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:/opt$ sudo chown -R librenms:librenms
/opt/librenms

sudo chmod 771 /opt/librenms

sudo setfacl -d -m g::rwx /opt/librenms/rrd /opt/librenms/logs /opt/librenms/bootstrap/cache/
 /opt/librenms/storage/

sudo setfacl -R -m g::rwx /opt/librenms/rrd /opt/librenms/logs /opt/librenms/bootstrap/cache/
 /opt/librenms/storage/
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:/opt$
```

sudo chown -R librenms:librenms /opt/librenms

Zorgt dat LibreNMS eigenaar is van zijn eigen bestanden.

sudo chmod 771 /opt/librenms

Geeft juiste maprechten.

sudo setfacl -d -m g::rwx /opt/librenms/rrd /opt/librenms/logs
/opt/librenms/bootstrap/cache/ /opt/librenms/storage/

sudo setfacl -R -m g::rwx /opt/librenms/rrd /opt/librenms/logs
/opt/librenms/bootstrap/cache/ /opt/librenms/storage/

Zorgt dat LibreNMS altijd kan schrijven naar deze mappen.

c. Installatie PHP-afhankelijkheden

```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:/opt$ su - librenms
Password:
librenms@syslogserver-Standard-PC-i440FX-PIIX-1996:~$
```

su – librenms

Wisselt naar de LibreNMS-gebruiker.

```
librenms@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ ./scripts/composer_wrapper.php install
--no-dev
Could not scan for classes inside "vendor/dapphp/radius" which does not appear to be a file n
or a folder
> LibreNMS\ComposerHelper::preInstall
Installing dependencies from lock file
Verifying lock file contents can be installed on current platform.
Package operations: 127 installs, 0 updates, 0 removals
  - Downloading php-http/discovery (1.20.0)
  - Downloading amenadiel/jpgraph (v4.1.1)
  - Downloading clue/socket-raw (v1.6.0)
  - Downloading dapphp/radius (v3.0.0)
  - Downloading doctrine/inflector (2.1.0)
  - Downloading doctrine/lexer (3.0.1)
  - Downloading dragonmantank/cron-expression (v3.6.0)
  - Downloading easybook/geshi (v1.0.8.19)
  - Downloading enshrined/svg-sanitize (0.22.0)
  - Downloading voku/portable-ascii (2.0.3)
  - Downloading symfony/polyfill-php80 (v1.33.0)
  - Downloading symfony/polyfill-mbstring (v1.33.0)
  - Downloading symfony/polyfill-ctype (v1.33.0)
  - Downloading phpoption/phpoption (1.9.4)
  - Downloading graham-campbell/result-type (v1.1.3)
  - Downloading vlucas/phpdotenv (v5.6.2)
  - Downloading symfony/css-selector (v7.3.6)
  - Downloading tijsverkoyen/css-to-inline-styles (v2.3.0)
  - Downloading symfony/deprecation-contracts (v3.6.0)
  - Downloading symfony/var-dumper (v7.3.5)
  - Downloading symfony/polyfill-uuid (v1.33.0)
  - Downloading symfony/uid (v7.3.1)
  - Downloading symfony/routing (v7.3.6)
  - Downloading symfony/process (v7.3.4)
  - Downloading symfony/polyfill-php85 (v1.33.0)
  - Downloading symfony/polyfill-php84 (v1.33.0)
  - Downloading symfony/polyfill-php83 (v1.33.0)
  - Downloading symfony/polyfill-intl-normalizer (v1.33.0)
  - Downloading symfony/polyfill-intl-idn (v1.33.0)
  - Downloading symfony/mime (v7.3.4)
  - Downloading psr/container (2.0.2)
  - Downloading symfony/service-contracts (v3.6.1)
  - Downloading psr/event-dispatcher (1.0.0)
```

./scripts/composer_wrapper.php install --no-dev

Installeert PHP-libraries die LibreNMS nodig heeft.

```
librenms@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ exit
logout
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:/opt$
```

exit

Terug naar normale gebruiker.

```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:/opt$ sudo wget https://getcomposer.or
g/composer-stable.phar

sudo mv composer-stable.phar /usr/bin/composer

sudo chmod +x /usr/bin/composer


--2025-12-08 11:43:51--  https://getcomposer.org/composer-stable.phar
Resolving getcomposer.org (getcomposer.org)... 57.128.19.244, 2001:41d0:304:300::18ef
Connecting to getcomposer.org (getcomposer.org)|57.128.19.244|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 3281618 (3.1M) [application/octet-stream]
Saving to: 'composer-stable.phar'

composer-stable.phar    100%[=========================>]   3.13M  8.64MB/s    in 0.4s

2025-12-08 11:43:51 (8.64 MB/s) - 'composer-stable.phar' saved [3281618/3281618]

syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:/opt$
```

sudo wget https://getcomposer.org/composer-stable.phar

sudo mv composer-stable.phar /usr/bin/composer

sudo chmod +x /usr/bin/composer

Installeert Composer (PHP pakketbeheer).

d. Tijdzone configureren

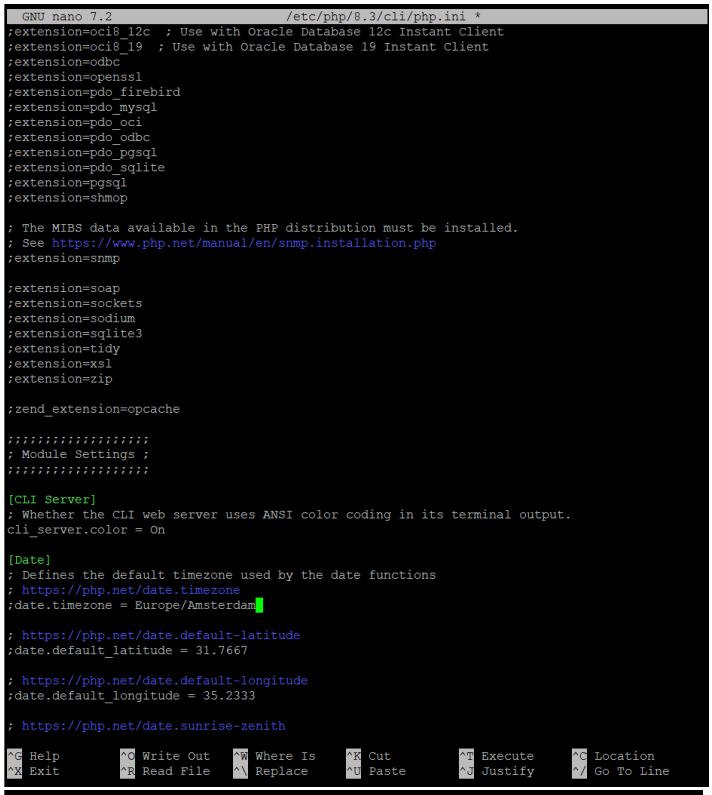
```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo nano /etc/php/8.3/fpm/php.ini
[sudo] password for syslogserver:
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$
```

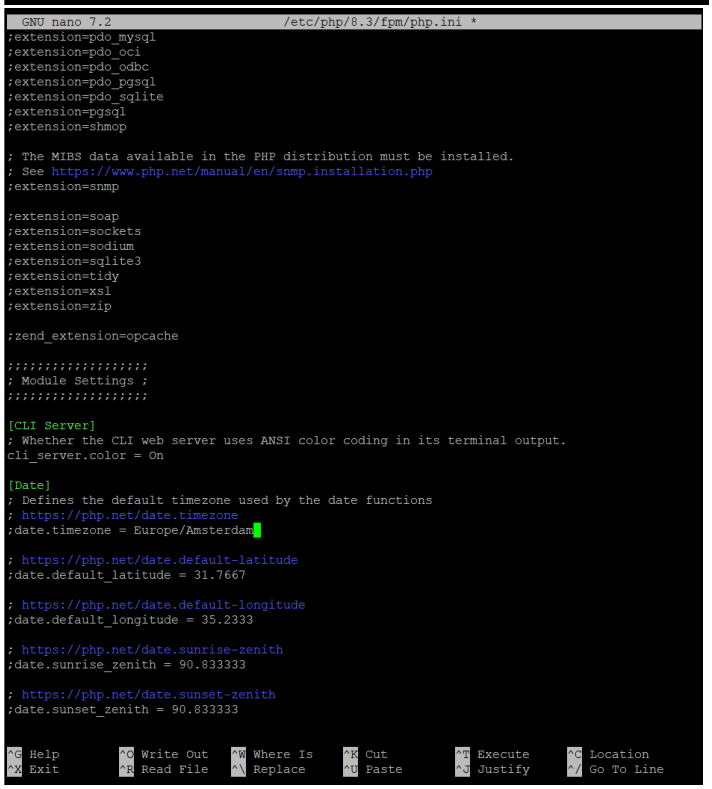
sudo nano /etc/php/8.3/fpm/php.ini

```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo nano /etc/php/8.3/cli/php.ini
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$
```

sudo nano /etc/php/8.3/cli/php.ini

Controleer of de juiste timezone is ingesteld in PHP.





timedatectl set-timezone Europe/Amsterdam

Zet de systeemtijd correct.

e. MariaDB configuratie

```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo nano /etc/mysql/mariadb.conf.d
/50-server.cnf
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$
```

sudo nano /etc/mysql/mariadb.conf.d/50-server.cnf

Database-instellingen aanpassen.

```
  GNU nano 7.2                 /etc/mysql/mariadb.conf.d/50-server.cnf *
#
# These groups are read by MariaDB server.
# Use it for options that only the server (but not clients) should see

# this is read by the standalone daemon and embedded servers
[server]

# this is only for the mysqld standalone daemon
[mysqld]

innodb_file_per_table=1
lower_case_table_names=0

#
# * Basic Settings
#

#user                   = mysql
pid-file                = /run/mysqld/mysqld.pid
basedir                 = /usr
#datadir                = /var/lib/mysql
#tmpdir                 = /tmp

# Broken reverse DNS slows down connections considerably and name resolve is
# safe to skip if there are no "host by domain name" access grants
#skip-name-resolve

# Instead of skip-networking the default is now to listen only on
# localhost which is more compatible and is not less secure.
bind-address            = 127.0.0.1

#
# * Fine Tuning
#

#key_buffer_size        = 128M
#max_allowed_packet     = 1G
#thread_stack           = 192K
#thread_cache_size      = 8
# This replaces the startup script and checks MyISAM tables if needed
# the first time they are touched
#myisam_recover_options = BACKUP
#max_connections        = 100
#table_cache            = 64

#
# * Logging and Replication

^G Help        ^O Write Out   ^W Where Is    ^K Cut         ^T Execute     ^C Location
^X Exit        ^R Read File   ^\ Replace     ^U Paste       ^J Justify     ^/ Go To Line
```

innodb_file_per_table=1

lower_case_table_names=0

```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo systemctl enable mariadb
Synchronizing state of mariadb.service with SysV service script with /usr/lib/systemd/systemd
-sysv-install.
Executing: /usr/lib/systemd/systemd-sysv-install enable mariadb
```

sudo systemctl enable mariadb

```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo systemctl restart mariadb
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$
```

sudo systemctl restart mariadb

Start MariaDB automatisch en herstart de service.

```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo mysql -u root
Welcome to the MariaDB monitor.  Commands end with ; or \g.
Your MariaDB connection id is 34
Server version: 10.11.13-MariaDB-0ubuntu0.24.04.1 Ubuntu 24.04

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

MariaDB [(none)]>
```

sudo mysql -u root

Logt in op de database.

```
MariaDB [(none)]> CREATE DATABASE librenms CHARACTER SET utf8mb4 COLLATE utf8mb4_unicode_ci;

Query OK, 1 row affected (0.024 sec)

MariaDB [(none)]>
MariaDB [(none)]> CREATE USER 'librenms'@'localhost' IDENTIFIED BY 'syslog-server';
Query OK, 0 rows affected (0.004 sec)

MariaDB [(none)]>
MariaDB [(none)]> GRANT ALL PRIVILEGES ON librenms.* TO 'librenms'@'localhost';
Query OK, 0 rows affected (0.016 sec)

MariaDB [(none)]>
MariaDB [(none)]> Exit
Bye
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$
```

CREATE DATABASE librenms CHARACTER SET utf8mb4 COLLATE utf8mb4_unicode_ci;

CREATE USER 'librenms'@'localhost' IDENTIFIED BY 'syslog-server';

GRANT ALL PRIVILEGES ON librenms.* TO 'librenms'@'localhost';

Exit

Maakt database en gebruiker aan voor LibreNMS.

f. Configureer PHP-FPM Pool

```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo cp /etc/php/8.3/fpm/pool.d/www
.conf /etc/php/8.3/fpm/pool.d/librenms.conf
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$
```

sudo cp /etc/php/8.3/fpm/pool.d/www.conf /etc/php/8.3/fpm/pool.d/librenms.conf

Maakt een aparte PHP-configuratie voor LibreNMS.

```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo nano /etc/php/8.3/fpm/pool.d/l
ibrenms.conf
[sudo] password for syslogserver:
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$
```

sudo nano /etc/php/8.3/fpm/pool.d/librenms.conf

```
  GNU nano 7.2                /etc/php/8.3/fpm/pool.d/librenms.conf *
; Start a new pool named 'www'.
; the variable $pool can be used in any directive and will be replaced by the
; pool name ('www' here)
[librenms]

; Per pool prefix
; It only applies on the following directives:
; - 'access.log'
; - 'slowlog'
; - 'listen' (unixsocket)
; - 'chroot'
; - 'chdir'
; - 'php_values'
; - 'php_admin_values'
; When not set, the global prefix (or /usr) applies instead.
; Note: This directive can also be relative to the global prefix.
; Default Value: none
;prefix = /path/to/pools/$pool

; Unix user/group of the child processes. This can be used only if the master
; process running user is root. It is set after the child process is created.
; The user and group can be specified either by their name or by their numeric
; IDs.
; Note: If the user is root, the executable needs to be started with
;       --allow-to-run-as-root option to work.
; Default Values: The user is set to master process running user by default.
;                 If the group is not set, the user's group is used.
user = librenms
group = librenms

; The address on which to accept FastCGI requests.
; Valid syntaxes are:
;   'ip.add.re.ss:port'    - to listen on a TCP socket to a specific IPv4 address on
;                            a specific port;
;   '[ip:6:addr:ess]:port' - to listen on a TCP socket to a specific IPv6 address on
;                            a specific port;
;   'port'                 - to listen on a TCP socket to all addresses
;                            (IPv6 and IPv4-mapped) on a specific port;
;   '/path/to/unix/socket' - to listen on a unix socket.
; Note: This value is mandatory.
listen = /run/php-fpm-librenms.sock

; Set listen(2) backlog.
; Default Value: 511 (-1 on Linux, FreeBSD and OpenBSD)
;listen.backlog = 511

; Set permissions for unix socket, if one is used. In Linux, read/write

^G Help        ^O Write Out   ^W Where Is    ^K Cut         ^T Execute     ^C Location
^X Exit        ^R Read File   ^\ Replace     ^U Paste       ^J Justify     ^/ Go To Line
```

Pas aan:

listen = /run/php-fpm-librenms.sock

g. NGINX configuratie

```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo nano /etc/nginx/conf.d/librenm
s.conf
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$
```

sudo nano /etc/nginx/conf.d/librenms.conf

Maakt een website-configuratie voor LibreNMS.

```
  GNU nano 7.2                    /etc/nginx/conf.d/librenms.conf
server {
    listen 80;
    server_name _;

    root /opt/librenms/html;
    index index.php;

    charset utf-8;
    gzip on;
    gzip_types text/css application/javascript text/javascript application/x-javascript imag>

    location / {
        try_files $uri $uri/ /index.php?$query_string;
    }

    location ~ \.php$ {
        include fastcgi.conf;
        fastcgi_param SCRIPT_FILENAME $document_root$fastcgi_script_name;
        fastcgi_pass unix:/run/php/php8.3-fpm-librenms.sock;
    }

    location ~ /\.(?!well-known).* {
        deny all;
    }
}
                                [ Read 25 lines ]
^G Help       ^O Write Out    ^W Where Is     ^K Cut        ^T Execute    ^C Location
^X Exit       ^R Read File    ^\ Replace      ^U Paste      ^J Justify    ^/ Go To Line
```

server {

listen 80;

server_name _;

```
    root /opt/librenms/html;
    index index.php;

    charset utf-8;
    gzip on;
    gzip_types text/css application/javascript text/javascript application/x-javascript
image/svg+xml text/plain text/xsd text/xsl text/xml image/x-icon;

    location / {
        try_files $uri $uri/ /index.php?$query_string;
    }

    location ~ [^/]\.php(/|$) {
        fastcgi_pass unix:/run/php/php8.3-fpm-librenms.sock;
        fastcgi_split_path_info ^(.+\.php)(/.+)$;
        include fastcgi.conf;
        fastcgi_param SCRIPT_FILENAME $document_root$fastcgi_script_name;
    }

    location ~ /\.(?!well-known).* {
        deny all;
    }
}
```

```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo rm /etc/nginx/sites-enabled/de
fault /etc/nginx/sites-available/default
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo systemctl restart nginx
Warning: The unit file, source configuration file or drop-ins of nginx.service changed on dis
k. Run 'systemctl daemon-reload' to reload units.
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo systemctl deamon-reload
Unknown command verb 'deamon-reload', did you mean 'daemon-reload'?
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo systemctl daemon-reload
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo rm /etc/nginx/sites-enabled/de
fault /etc/nginx/sites-available/default
rm: cannot remove '/etc/nginx/sites-enabled/default': No such file or directory
rm: cannot remove '/etc/nginx/sites-available/default': No such file or directory
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo systemctl restart nginx
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo systemctl restart php8.3-fpm
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$
```

sudo rm /etc/nginx/sites-enabled/default /etc/nginx/sites-available/default

Verwijdert de standaard website.

sudo systemctl daemon-reload

sudo systemctl restart nginx

sudo systemctl restart php8.3-fpm

Herstart webserver en PHP.

```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo ln -s /opt/librenms/lnms /usr/
bin/lnms
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo cp /opt/librenms/misc/lnms-com
pletion.bash /etc/bash_completion.d/
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$
```

sudo ln -s /opt/librenms/lnms /usr/bin/lnms

Maakt het lnms commando overal bruikbaar.

sudo cp /opt/librenms/misc/lnms-completion.bash /etc/bash_completion.d/

Automatische aanvulling in de terminal.

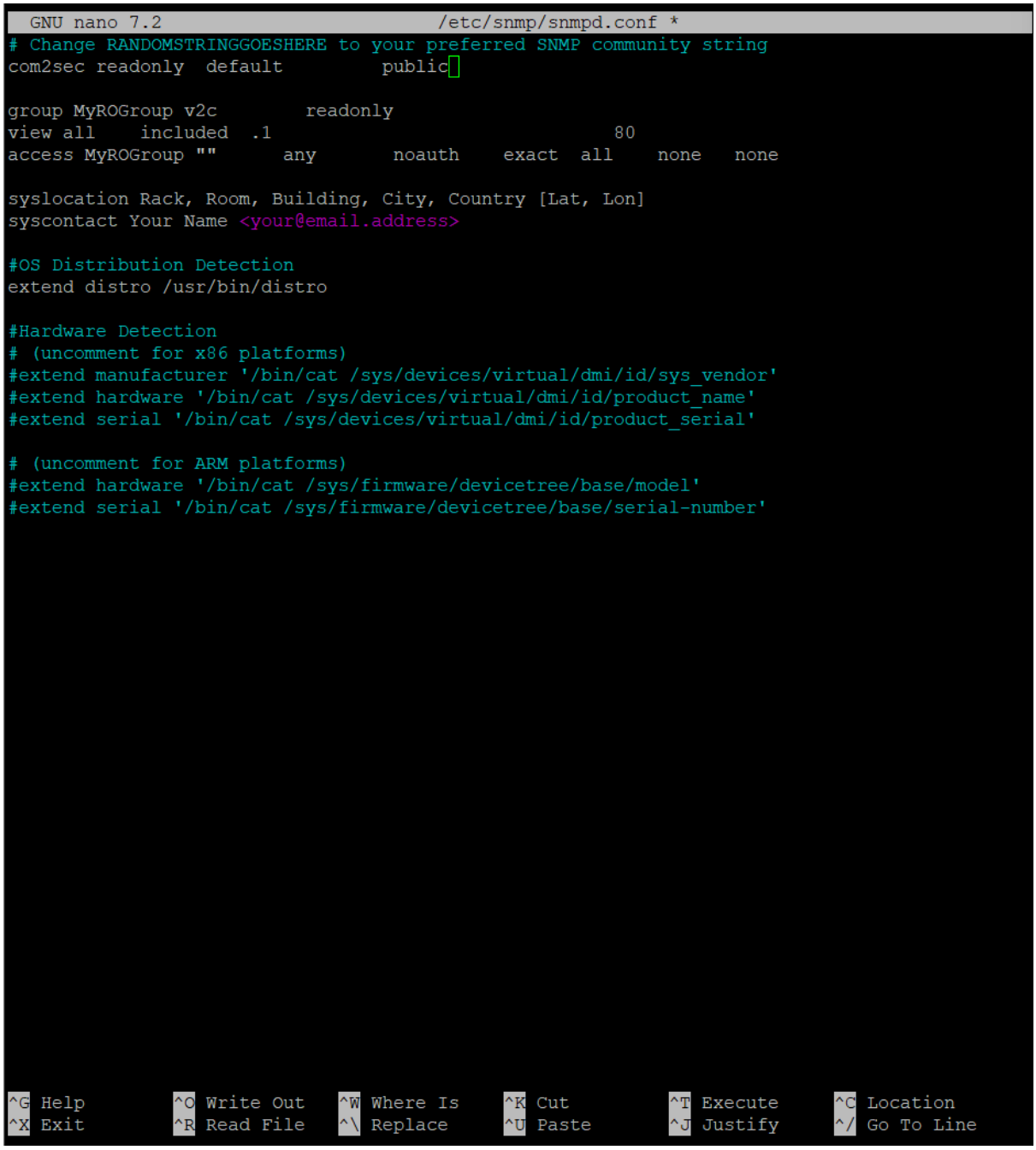
h. SNMP configuratie

```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo cp /opt/librenms/snmpd.conf.ex
ample /etc/snmp/snmpd.conf
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo nano /etc/snmp/snmpd.conf
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$
```

sudo cp /opt/librenms/snmpd.conf.example /etc/snmp/snmpd.conf

sudo nano /etc/snmp/snmpd.conf

Stelt SNMP in zodat LibreNMS apparaten kan uitlezen.



curl -o /usr/bin/distro https://raw.githubusercontent.com/librenms/librenms-agent/master/snmp/distro

sudo chmod +x /usr/bin/distro

Script voor OS-herkenning.

```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo curl -o /usr/bin/distro https:
//raw.githubusercontent.com/librenms/librenms-agent/master/snmp/distro
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100  5187  100  5187    0     0  22335      0 --:--:-- --:--:-- --:--:-- 22454
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo chmod +x /usr/bin/distro
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo systemctl enable snmpd
Synchronizing state of snmpd.service with SysV service script with /usr/lib/systemd/systemd-s
ysv-install.
Executing: /usr/lib/systemd/systemd-sysv-install enable snmpd
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo systemctl restart snmpd
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$
```

sudo systemctl enable snmpd

sudo systemctl restart snmpd

Start SNMP.

i. Cron & systemd jobs

```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo cp /opt/librenms/dist/librenms
.cron /etc/cron.d/librenms
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$
```

sudo cp /opt/librenms/dist/librenms.cron /etc/cron.d/librenms

Automatische taken voor LibreNMS.

```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo cp /opt/librenms/dist/librenms
-scheduler.service /opt/librenms/dist/librenms-scheduler.timer /etc/systemd/system/
sudo systemctl enable librenms-scheduler.timer
sudo systemctl start librenms-scheduler.timer
sudo cp /opt/librenms/misc/librenms.logrotate /etc/logrotate.d/librenms
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$
```

sudo cp /opt/librenms/dist/librenms-scheduler.service /opt/librenms/dist/librenms-scheduler.timer /etc/systemd/system/

sudo systemctl enable librenms-scheduler.timer

sudo systemctl start librenms-scheduler.timer

Scheduler activeren.

sudo cp /opt/librenms/misc/librenms.logrotate /etc/logrotate.d/librenms

Logbestanden automatisch opschonen.

j. Web Installer

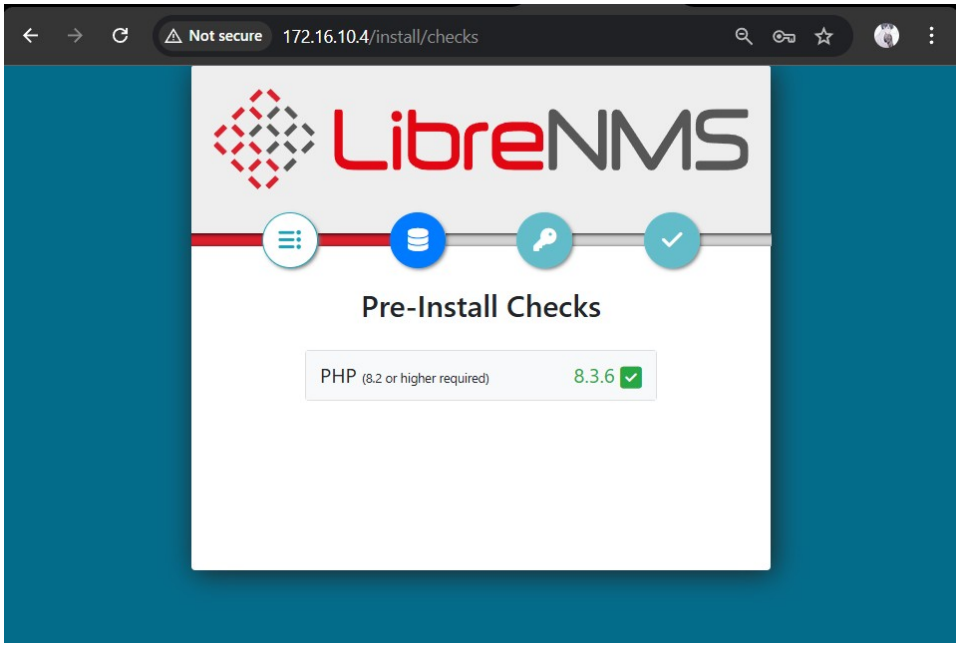
```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo chown librenms:librenms /opt/l
ibrenms/config.php
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$
```

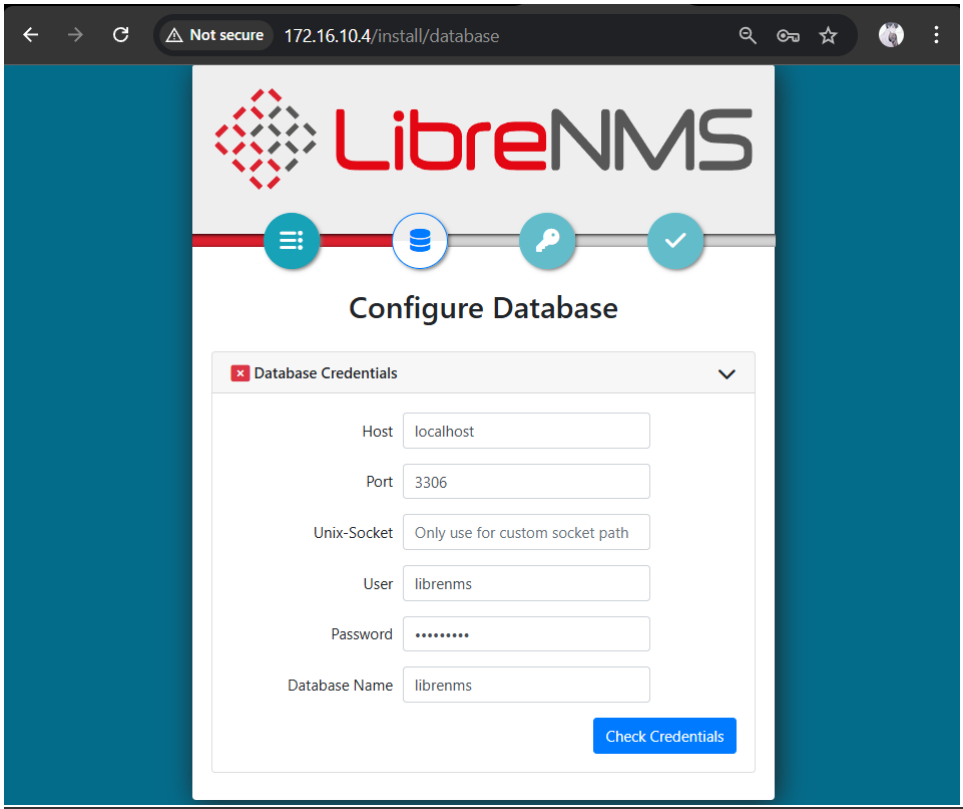
sudo chown librenms:librenms /opt/librenms/config.php

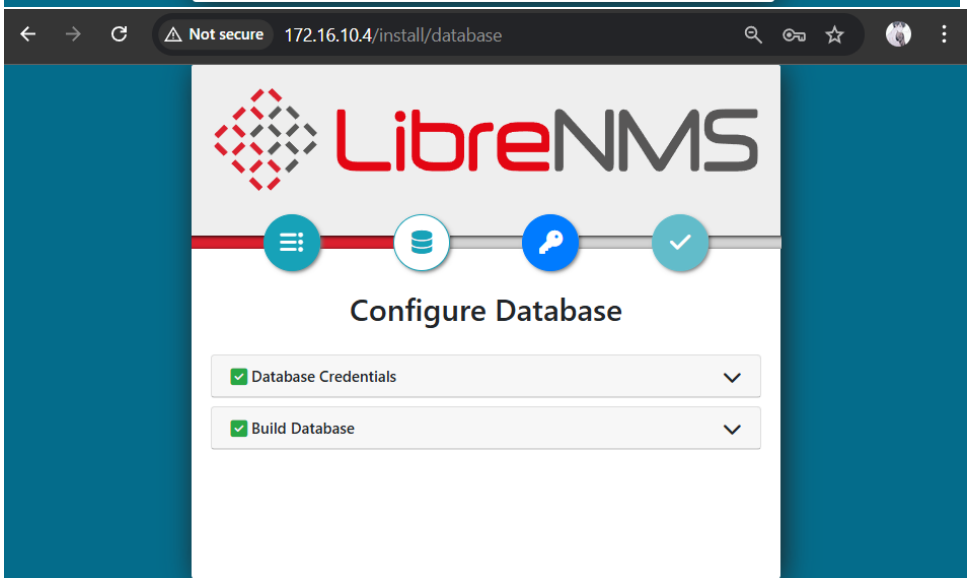
Zorgt dat LibreNMS het configuratiebestand kan aanpassen.

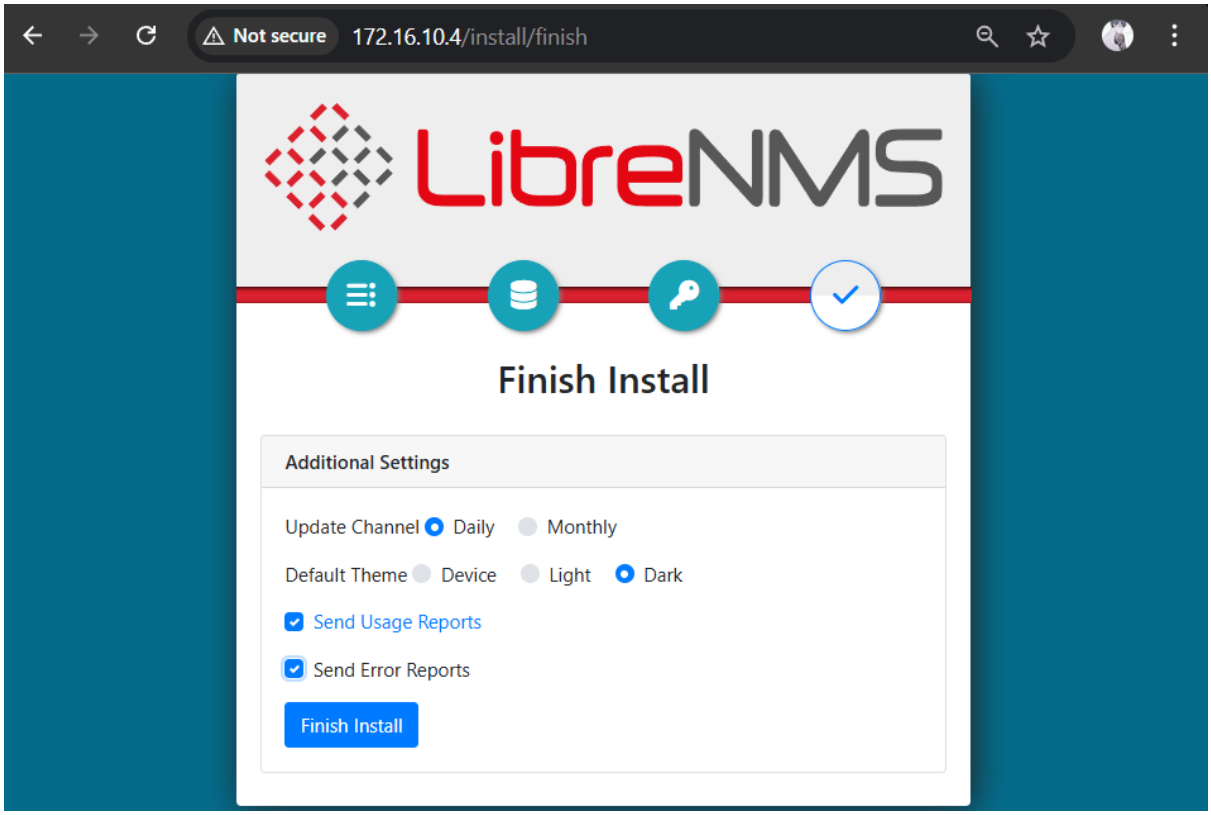
Web login:

- Gebruiker: librenmsadmin
- Wachtwoord: syslog-server




Not secure
172.16.10.4/install/database
LibreNMS
Configure Database
Database Credentials
Host
localhost
Port
3306
Unix-Socket
Only use for custom socket path
User
librenms
Password
Database Name
librenms
Check Credentials


Not secure
172.16.10.4/install/database
LibreNMS
Configure Database
Database Credentials
Build Database



k. Syslog integratie met LibreNMS

```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo apt install rsyslog
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Suggested packages:
  rsyslog-mysql | rsyslog-pgsql rsyslog-mongodb rsyslog-doc rsyslog-openssl
  | rsyslog-gnutls rsyslog-gssapi rsyslog-relp
The following packages will be upgraded:
  rsyslog
1 upgraded, 0 newly installed, 0 to remove and 318 not upgraded.
Need to get 511 kB of archives.
After this operation, 0 B of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 rsyslog amd64 8.2312.0-3ubunt
u9.1 [511 kB]
Fetched 511 kB in 1s (528 kB/s)
(Reading database ... 199485 files and directories currently installed.)
Preparing to unpack .../rsyslog_8.2312.0-3ubuntu9.1_amd64.deb ...
Unpacking rsyslog (8.2312.0-3ubuntu9.1) over (8.2312.0-3ubuntu9) ...
Setting up rsyslog (8.2312.0-3ubuntu9.1) ...
Installing new version of config file /etc/apparmor.d/usr.sbin.rsyslogd ...
info: The user `syslog' is already a member of `adm'.
Processing triggers for man-db (2.12.0-4build2) ...
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$
```

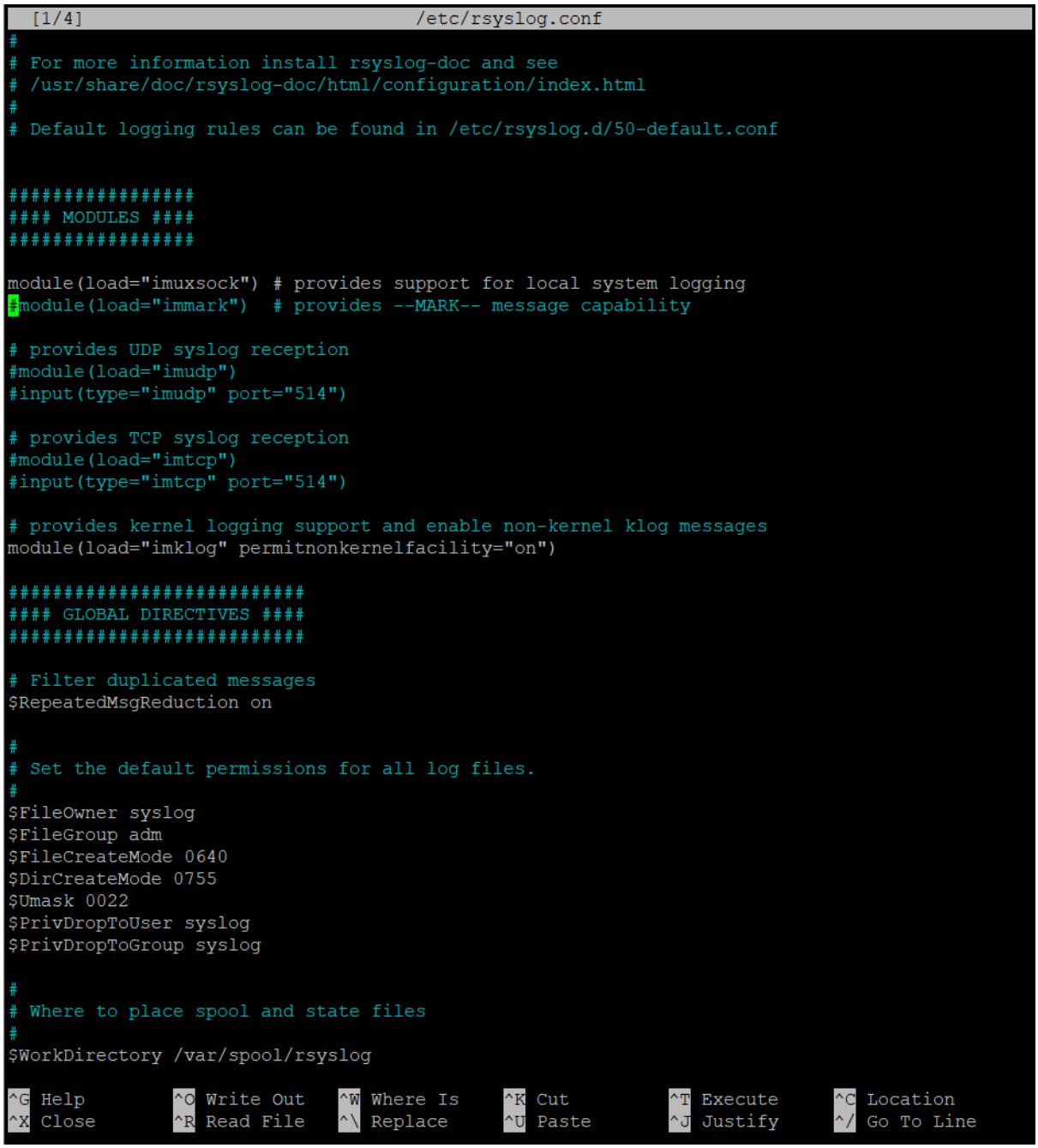
sudo apt install rsyslog

Installeert logserver.

```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo nano /etc/rsyslog.conf
[sudo] password for syslogserver:
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$
```

sudo nano /etc/rsyslog.conf

Activeer UDP/TCP:



- UDP/TCP activeren:

module(load="imudp")

input(type="imudp" port="514")

Voor TCP (optioneel):

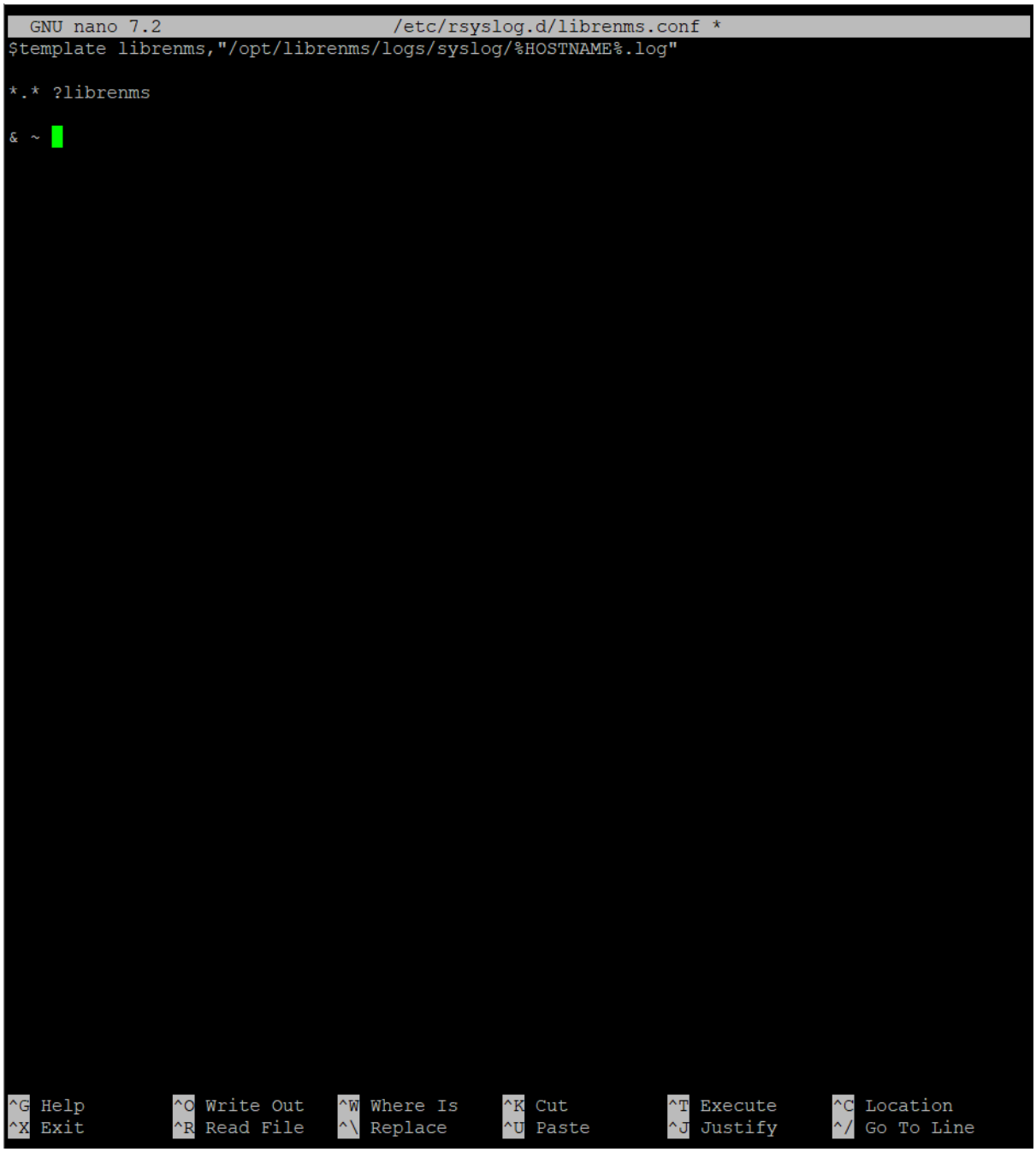
module(load="imtcp")

input(type="imtcp" port="514")

```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo nano /etc/rsyslog.d/librenms.c
onf
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$
```

sudo nano /etc/rsyslog.d/librenms.conf

Zorgt dat logs worden opgeslagen voor LibreNMS.



template librenms → opslaan naar /opt/librenms/logs/syslog/

```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo systemctl restart rsyslog
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$
```

sudo systemctl restart rsyslog

Herstart rsyslog.

```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo mkdir -p /opt/librenms/logs/sy
slog

sudo chown -R librenms:librenms /opt/librenms/logs
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$
```

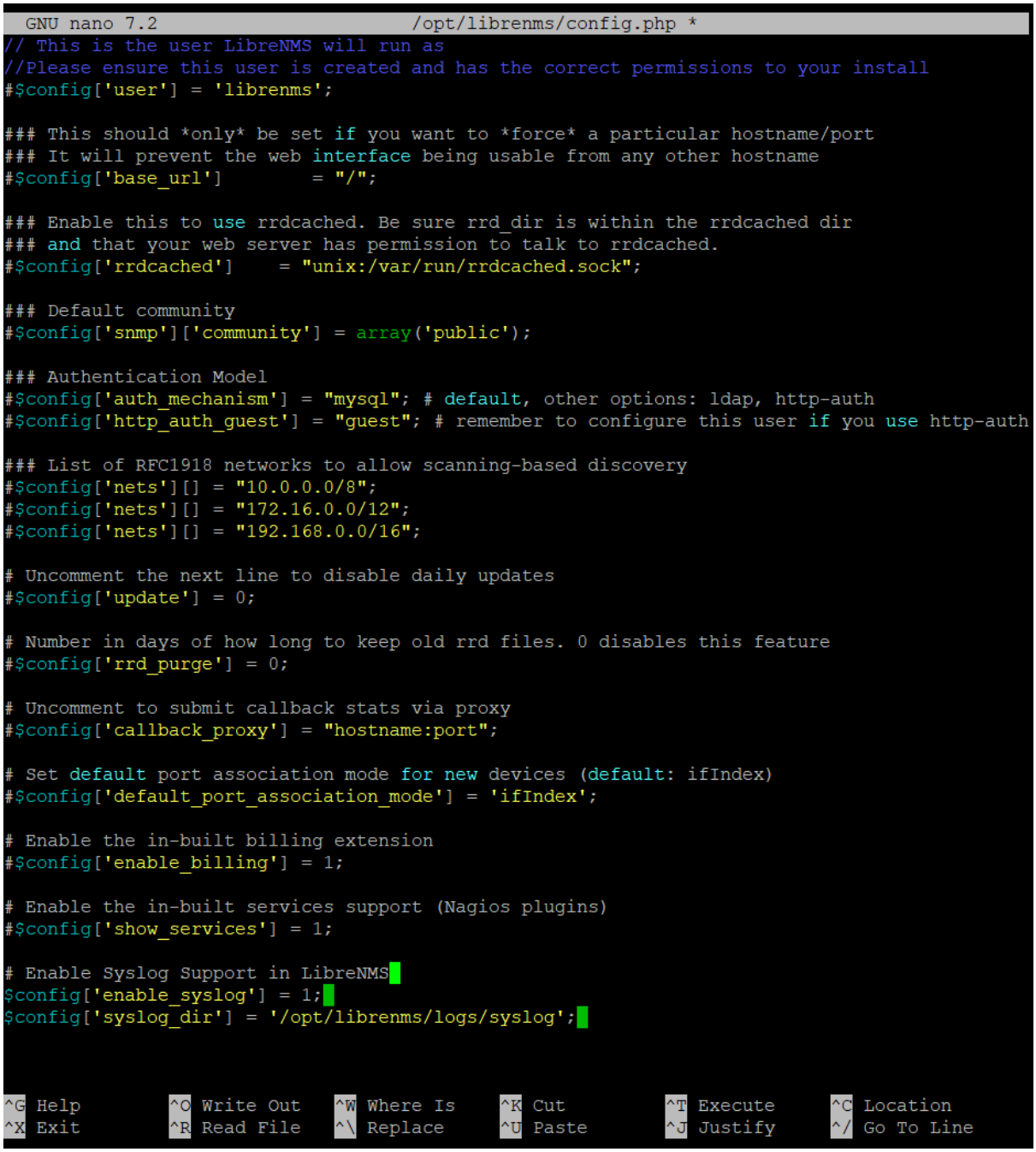
sudo mkdir -p /opt/librenms/logs/syslog

sudo chown -R librenms:librenms /opt/librenms/logs

Maakt logmap aan met juiste rechten.

sudo nano /opt/librenms/config.php

```
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$ sudo nano /opt/librenms/config.php
syslogserver@syslogserver-Standard-PC-i440FX-PIIX-1996:~$
```



Voeg toe:

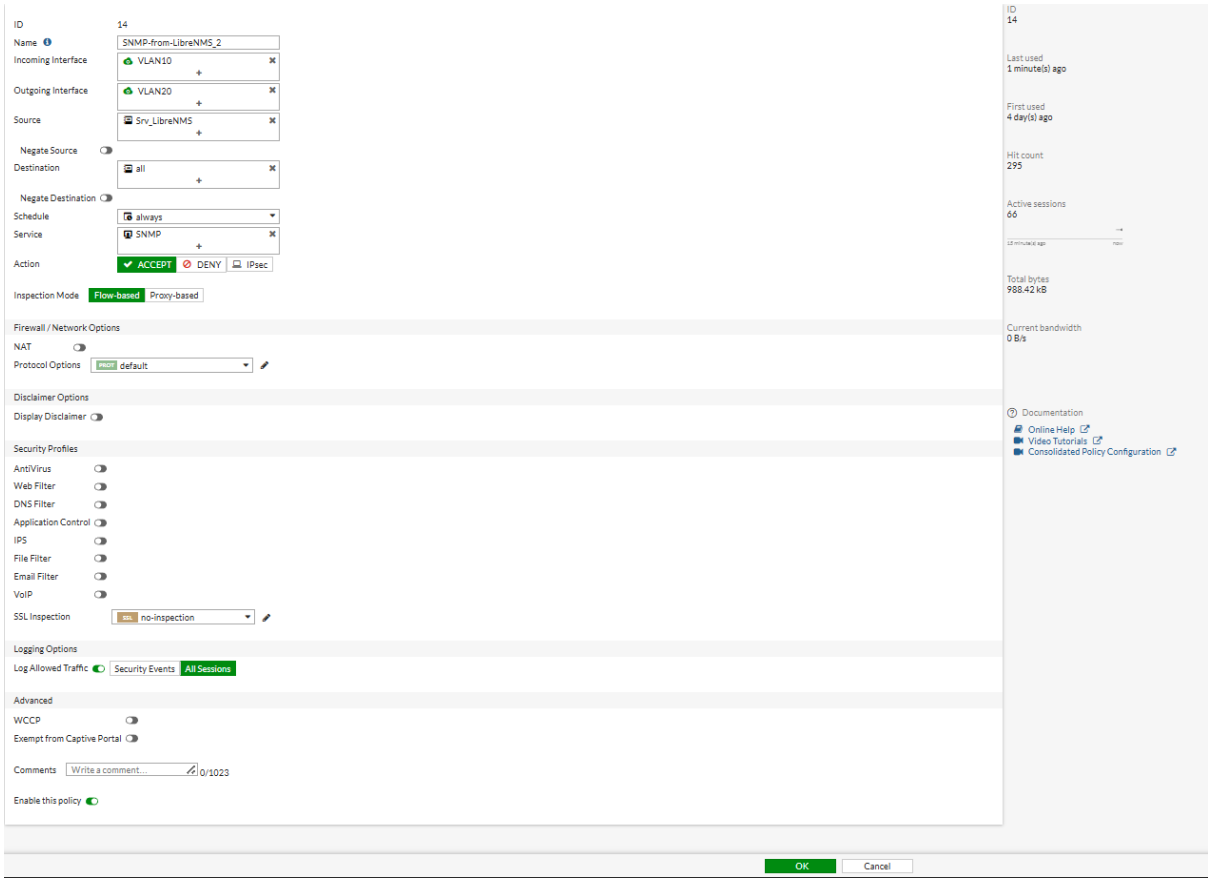
$config['enable_syslog'] = 1;

$config['syslog_dir'] = '/opt/librenms/logs/syslog';

C. SNMP Instellen op Fortigate

a. Firewall policy – SNMP van LibreNMS naar VLAN20

Scherm:



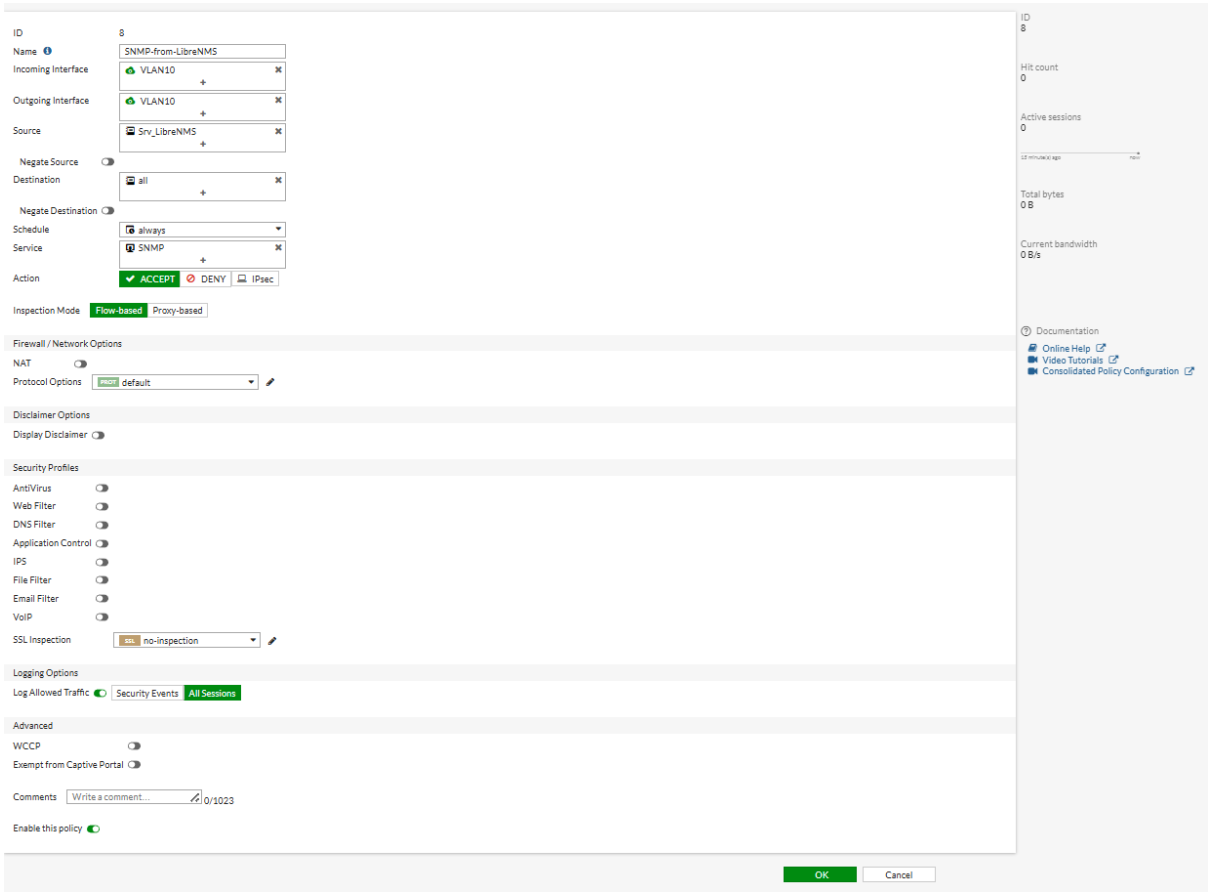
Configuratie:

- **Naam**: SNMP-from-LibreNMS_2
- **Incoming Interface**: VLAN10
- **Outgoing Interface**: VLAN20
- **Source**: Srv_LibreNMS
- **Destination**: all
- **Service**: SNMP
- **Schedule**: always
- **Actie**: ACCEPT
- **NAT**: Uitgeschakeld
- **Inspectiemodus**: Flow-based
- **Logging**: All Sessions

Resultaat: LibreNMS kan SNMP-verkeer sturen naar apparaten in VLAN20.

b. Firewall policy – SNMP binnen VLAN10

Scherm:



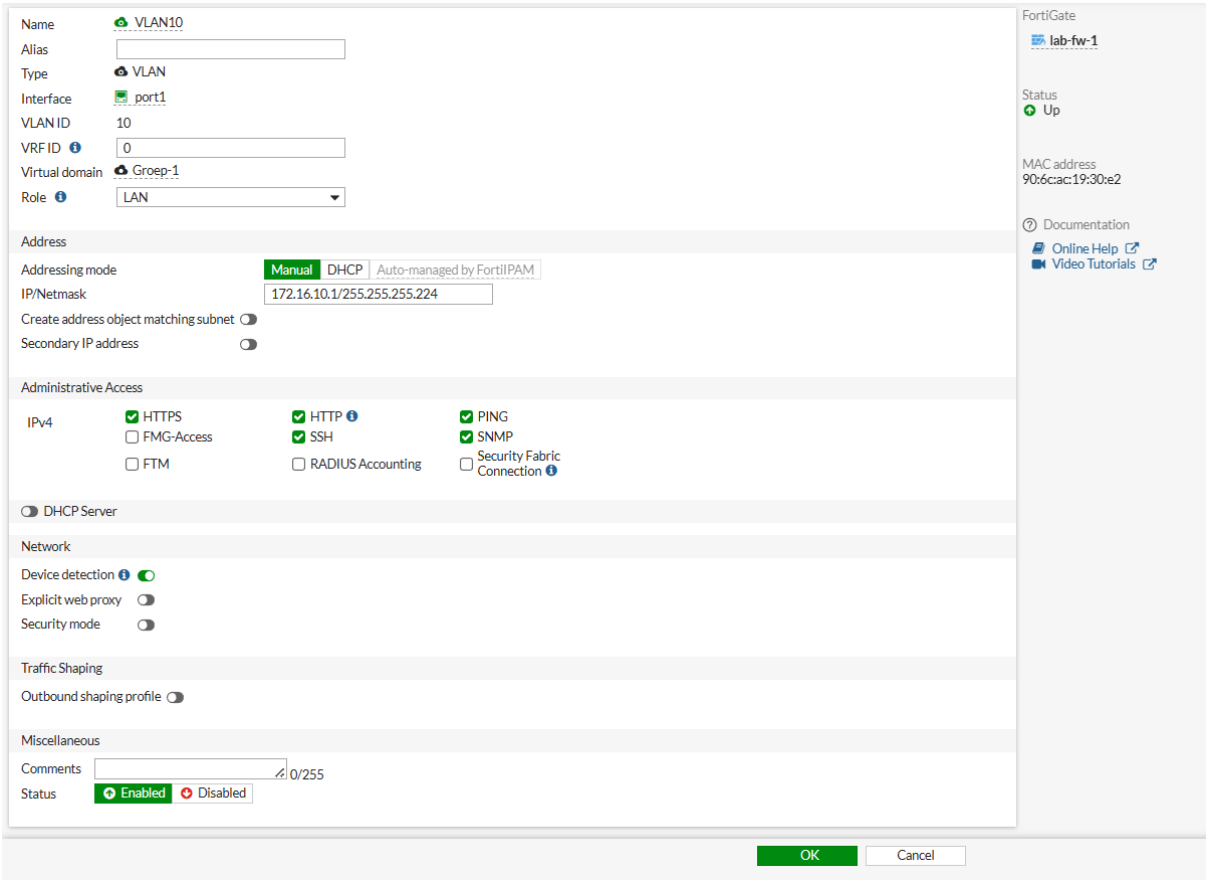
Configuratie:

- **Naam**: SNMP-from-LibreNMS
- **Incoming Interface**: VLAN10
- **Outgoing Interface**: VLAN10
- **Source**: Srv_LibreNMS
- **Destination**: all
- **Service**: SNMP
- **Schedule**: always
- **Actie**: ACCEPT
- **NAT**: Uitgeschakeld
- **Inspectiemodus**: Flow-based
- **Logging**: All Sessions

Resultaat: LibreNMS kan SNMP-verkeer sturen naar apparaten binnen VLAN10.

c. Interface configuratie – VLAN10

Scherm:



Configuratie:

- **Interface type**: VLAN
- **VLAN ID**: 10
- **Parent interface**: port1
- **IP-adres**: 172.16.10.1 /27
- **Rol**: LAN

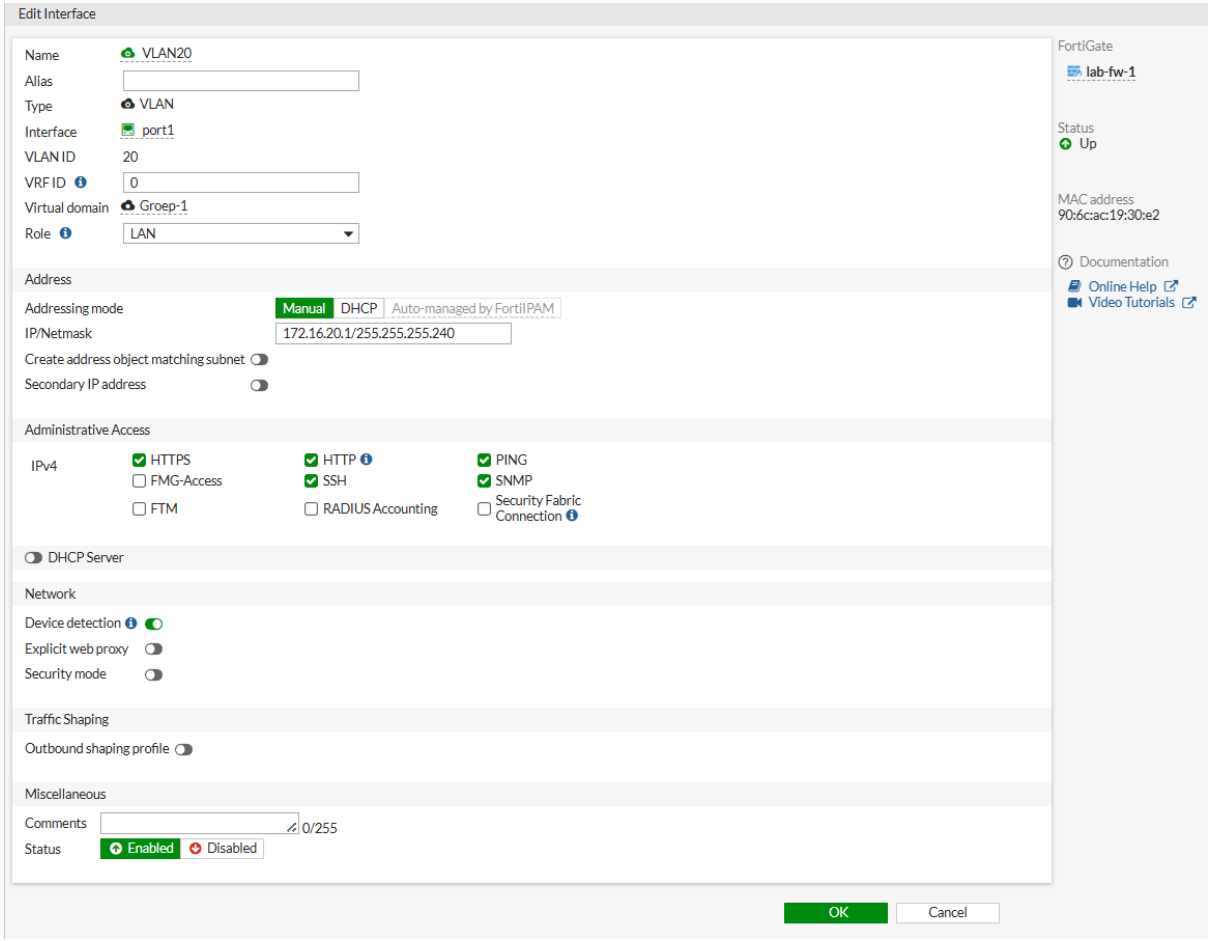
Administrative Access:

- HTTPS
- HTTP
- SSH
- PING
- **SNMP**

Resultaat: Apparaten in VLAN10 zijn bereikbaar voor beheer en SNMP-monitoring.

d. Interface configuratie – VLAN20

Scherm:



Configuratie:

- **Interface type**: VLAN
- **VLAN ID**: 20
- **Parent interface**: port1
- **IP-adres**: 172.16.20.1 /28
- **Rol**: LAN

Administrative Access:

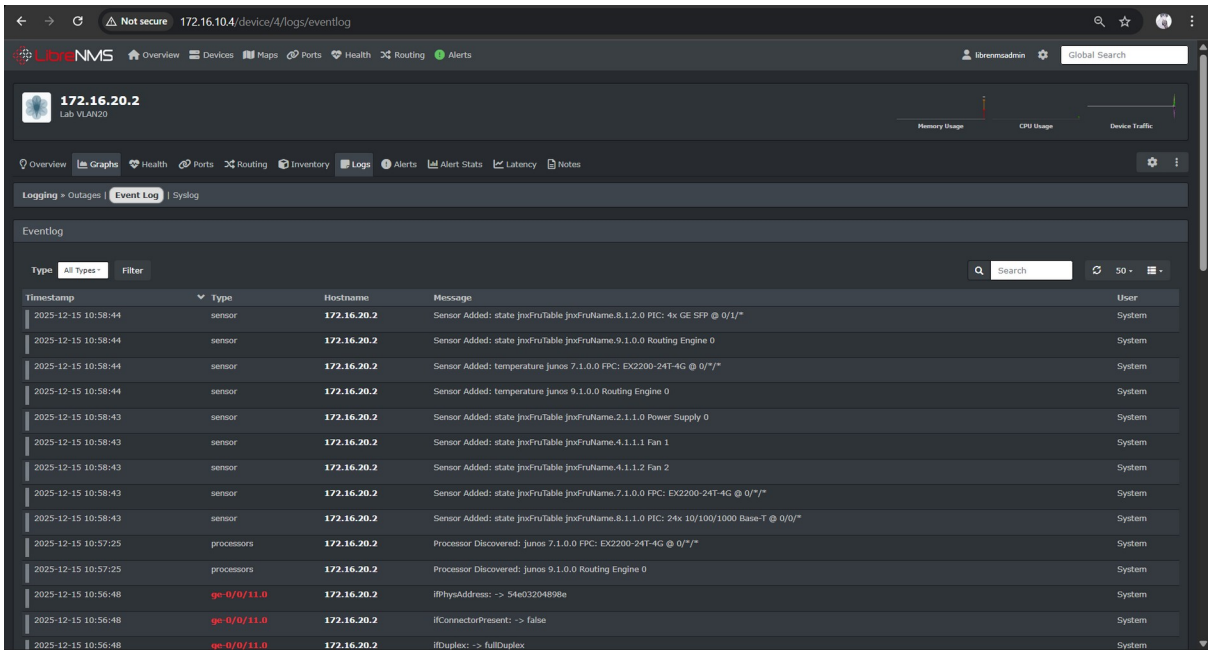
- HTTPS
- HTTP
- SSH
- PING
- **SNMP**

Resultaat: Apparaten in VLAN20 zijn bereikbaar voor beheer en SNMP-monitoring.

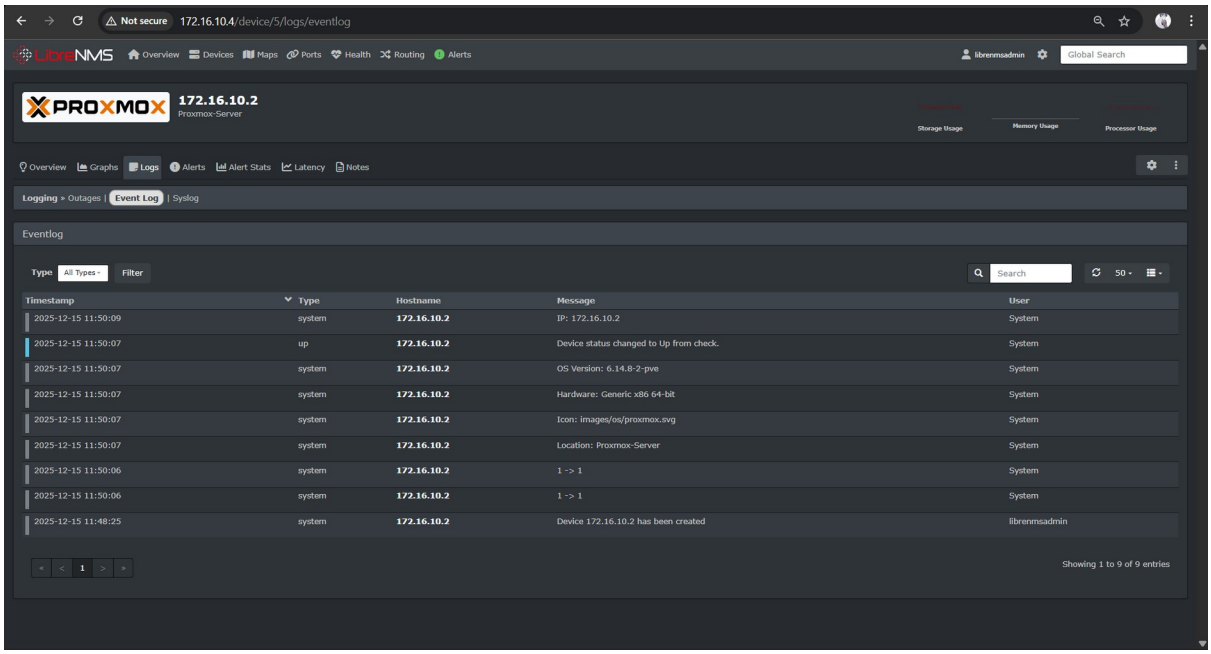
D. SNMP instellen op switch

configure
set snmp location "Lab VLAN20"
set snmp contact "admin@example.com"
set snmp interface vlan.20
set snmp community public authorization read-only clients 172.16.10.4/32
commit

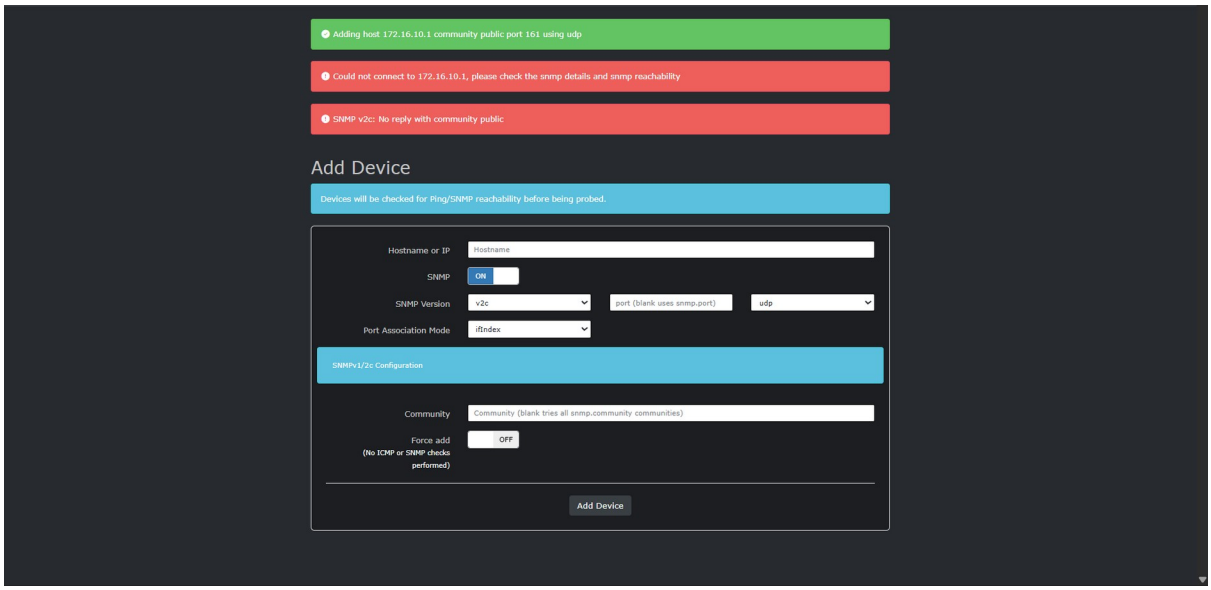
E. Testen



Switch 172.16.20.2 op pulled in LibreNMS via SNMP.



Proxmox 172.16.10.2 op pulled in LibreNMS via SNMP.

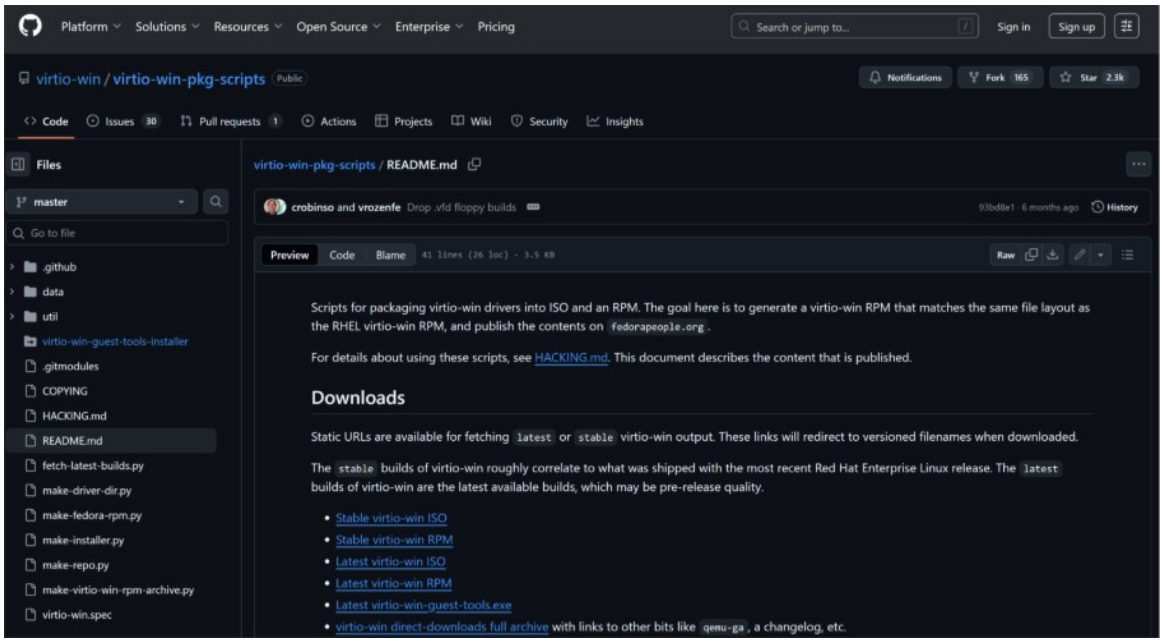


Fortigate 172.16.10.1 kunnen niet op pulle in LibreNMS via SNMP.

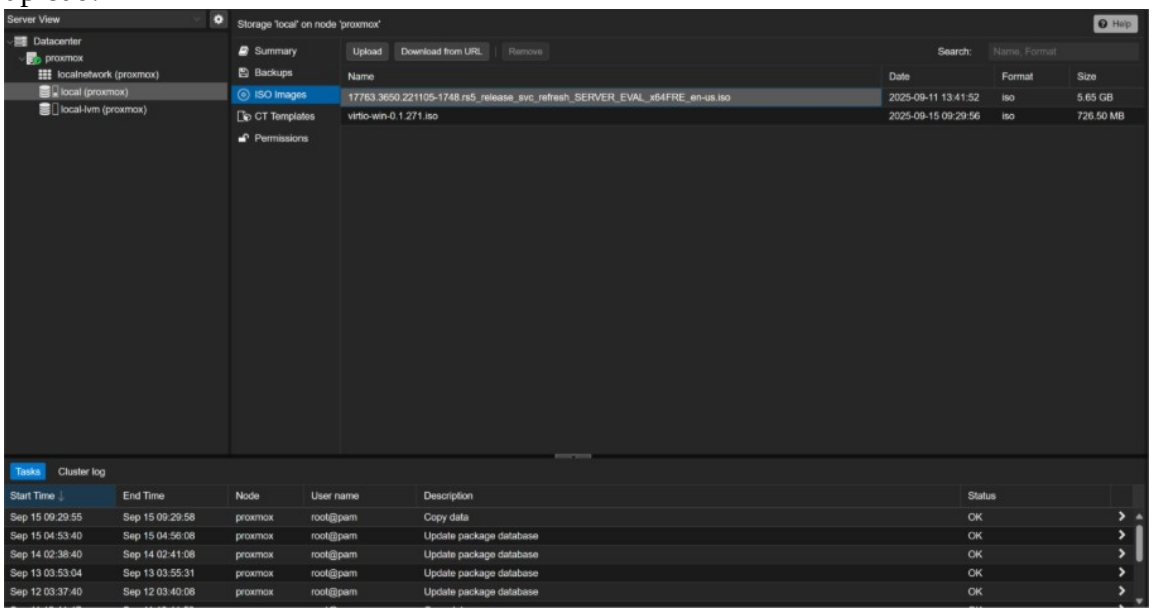
Fase 4:
Inrichten DHCP, DNS en AD en testen op gebruikers/management laptop Kopie

A. Windows server 2019 installatieproces

Installeer de benodigde drivers voor windows server 2019 die je gaat draaien op je proxmox server. Zonder deze gaat het niet lukken. Selecteer de bovenste: Stable virtio-win ISO.

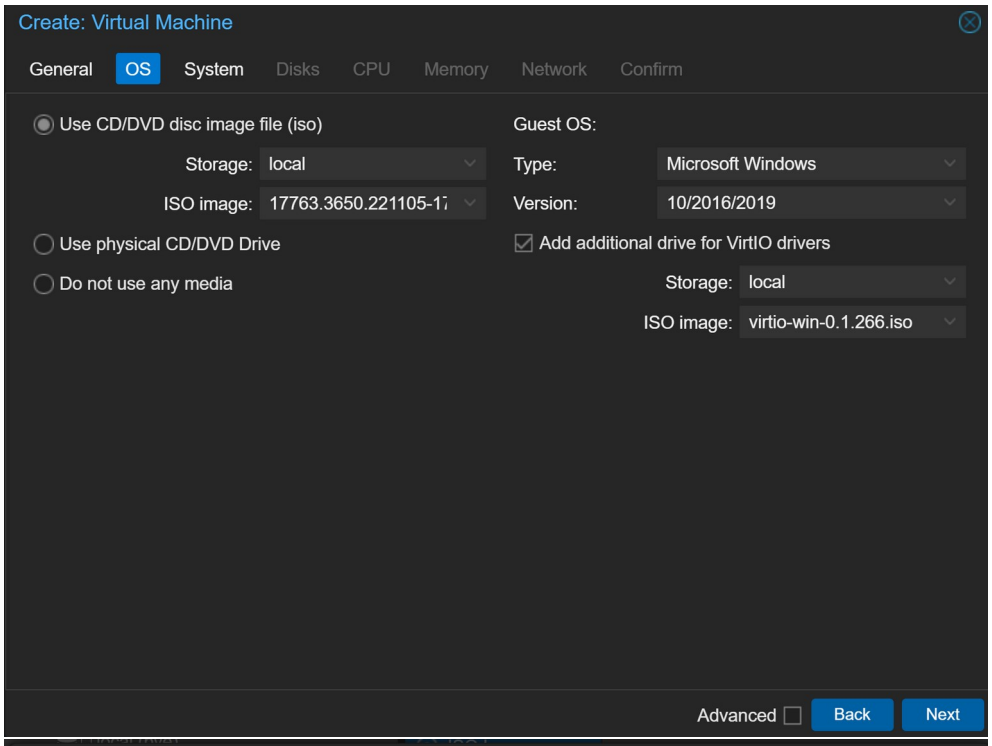


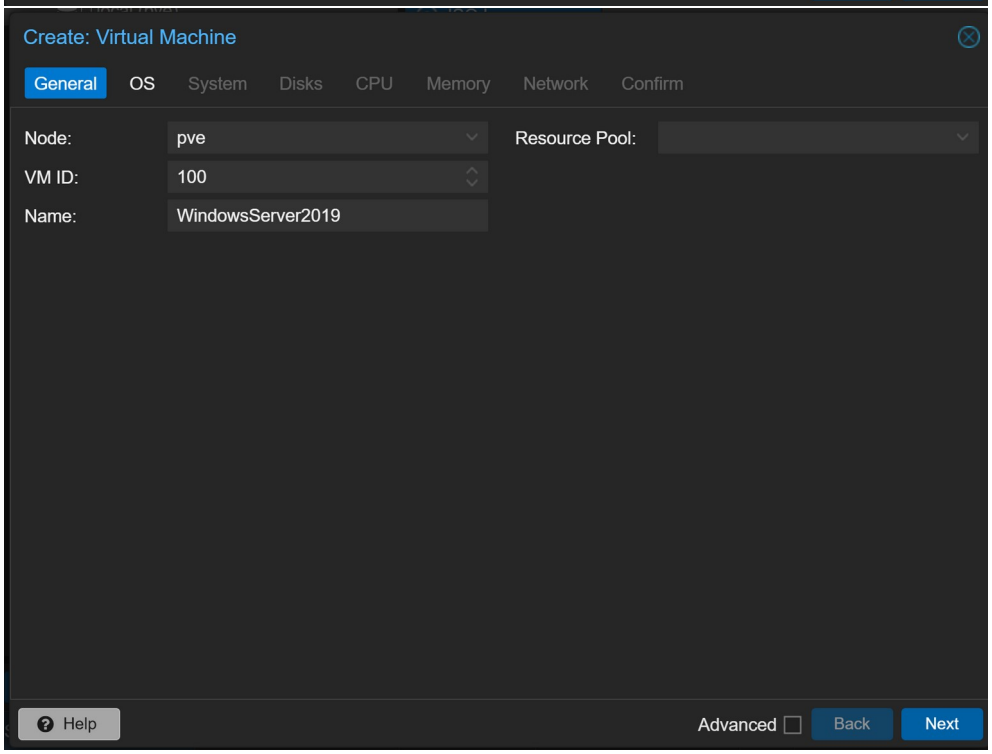
Upload de ISO's. Dus de windows server 2019 en de ISO met de vereiste drivers op de proxmox server. Om dat te doen ga je naar local (proxmox)->ISO images en linksboven op upload.

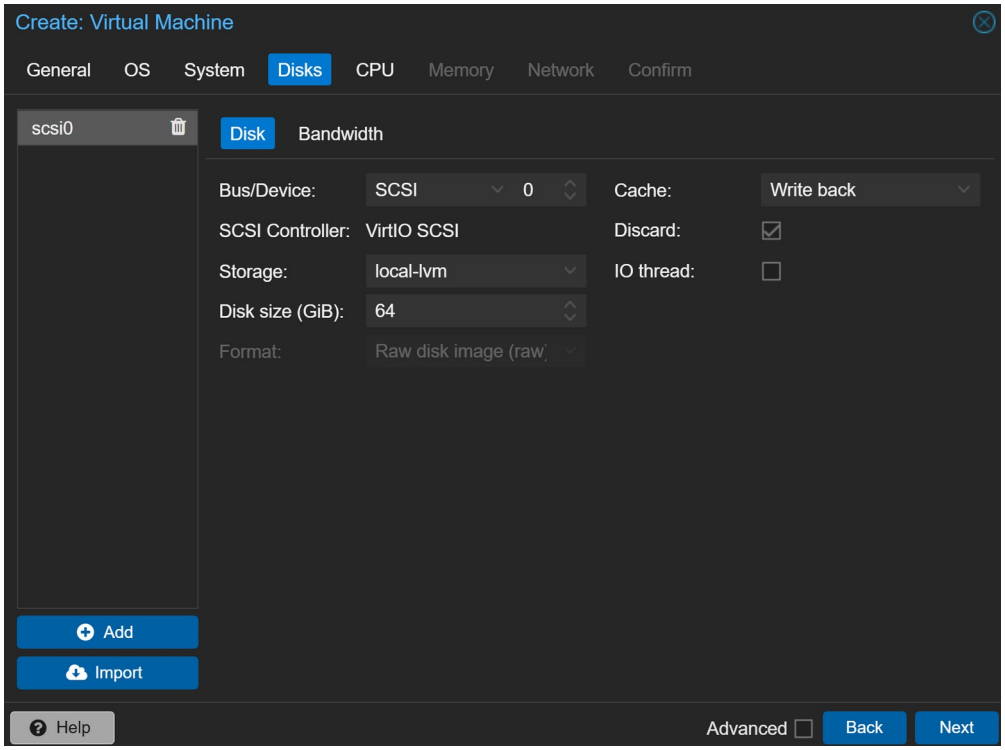


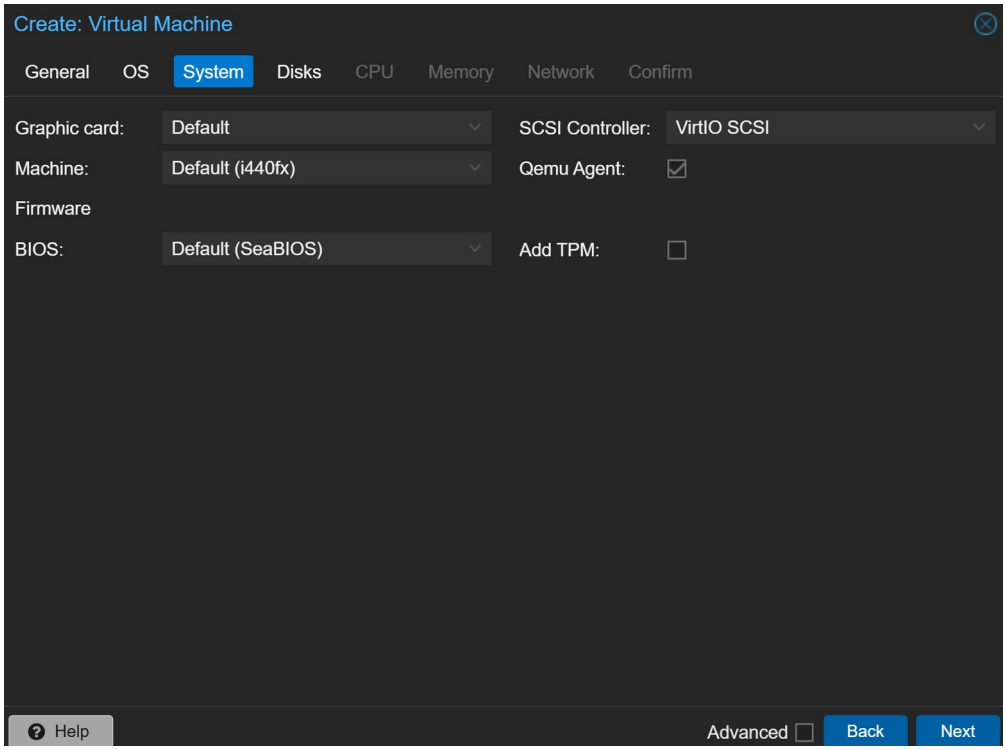
B. Instellingen van de windows server 2019

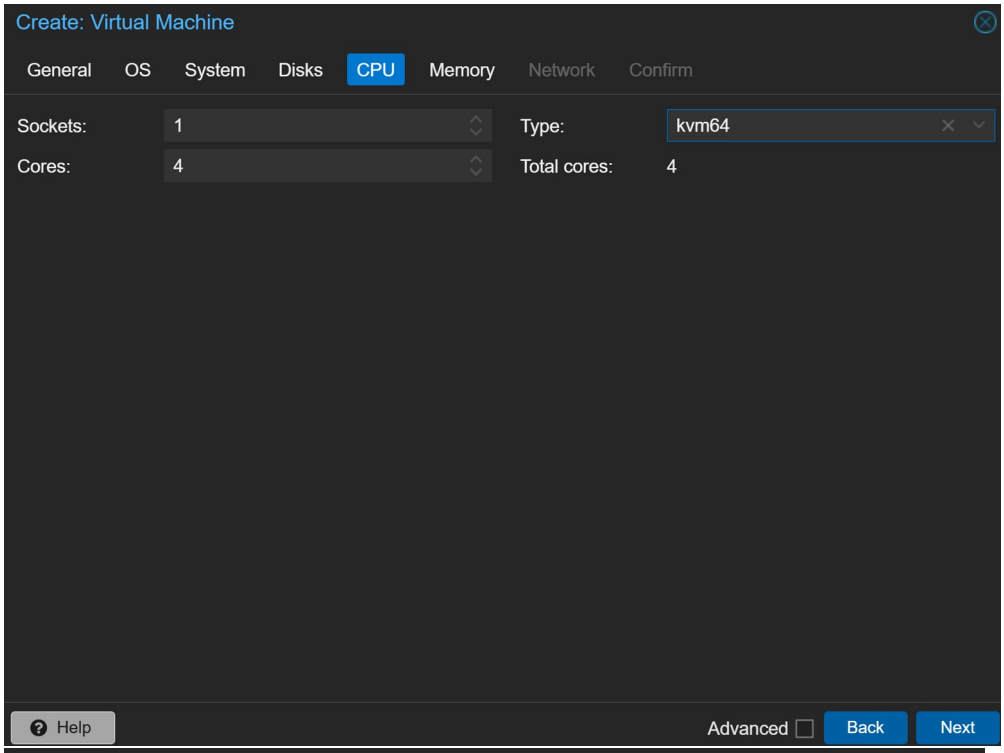
Hierbeneden staan de instellingen voor Windows Server 2019. Voeg dus de geüploade ISO van Server 2019 toe als besturingssysteem, en volg vervolgens de overige stappen.

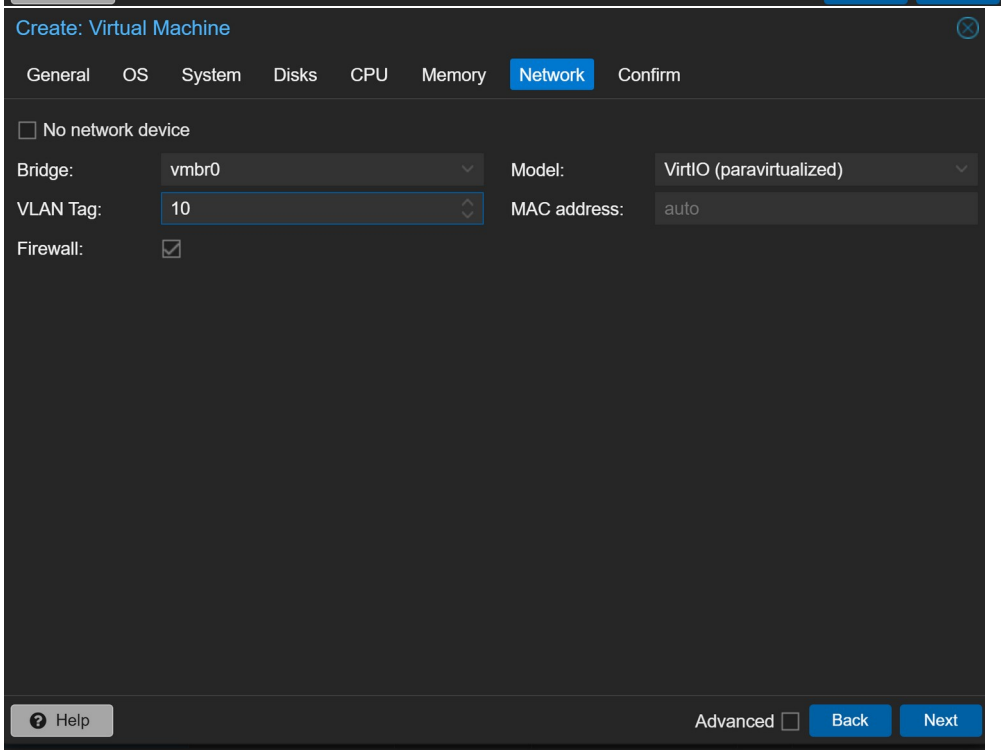




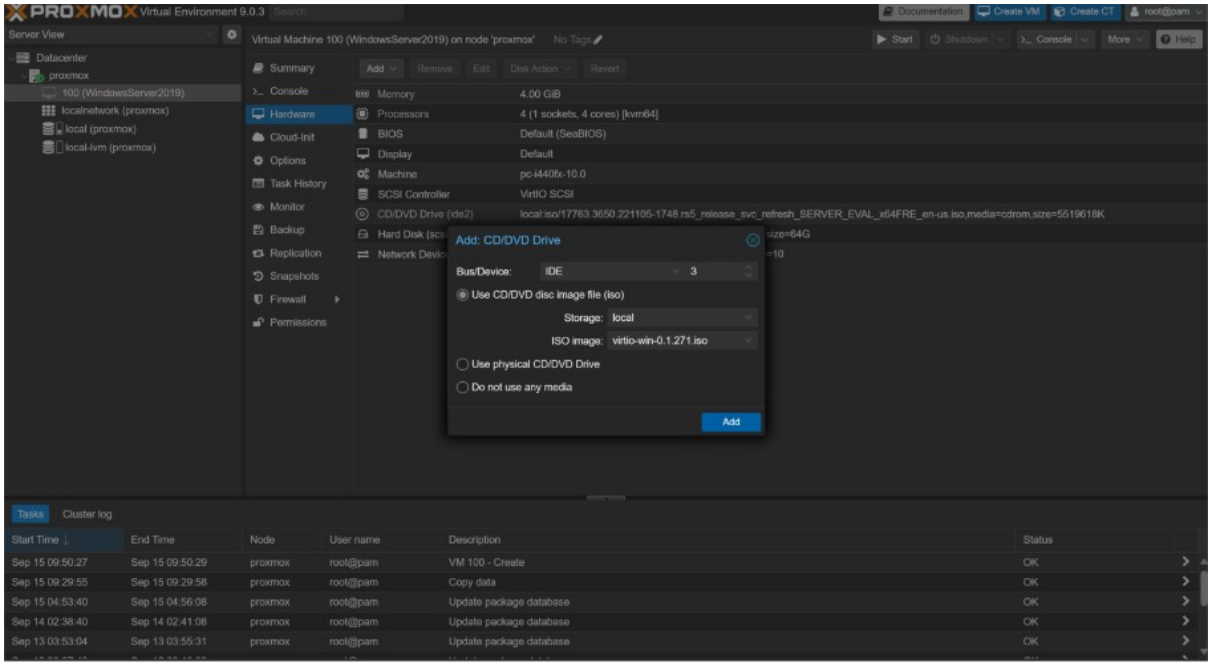

Create: Virtual Machine
General
OS
System
Disks
CPU
Memory
Network
Confirm
scsi0
Disk
Bandwidth
Bus/Device:
SCSI
0
Cache:
Write back
SCSI Controller:
VirtIO SCSI
Discard:
Storage:
local-lvm
IO thread:
Disk size (GiB):
64
Format:
Raw disk image (raw)
Add
Import
Help
Advanced
Back
Next


Create: Virtual Machine
General
OS
System
Disks
CPU
Memory
Network
Confirm
Graphic card:
Default
SCSI Controller:
VirtIO SCSI
Machine:
Default (i440fx)
Qemu Agent:
Firmware
BIOS:
Default (SeaBIOS)
Add TPM:
Help
Advanced
Back
Next

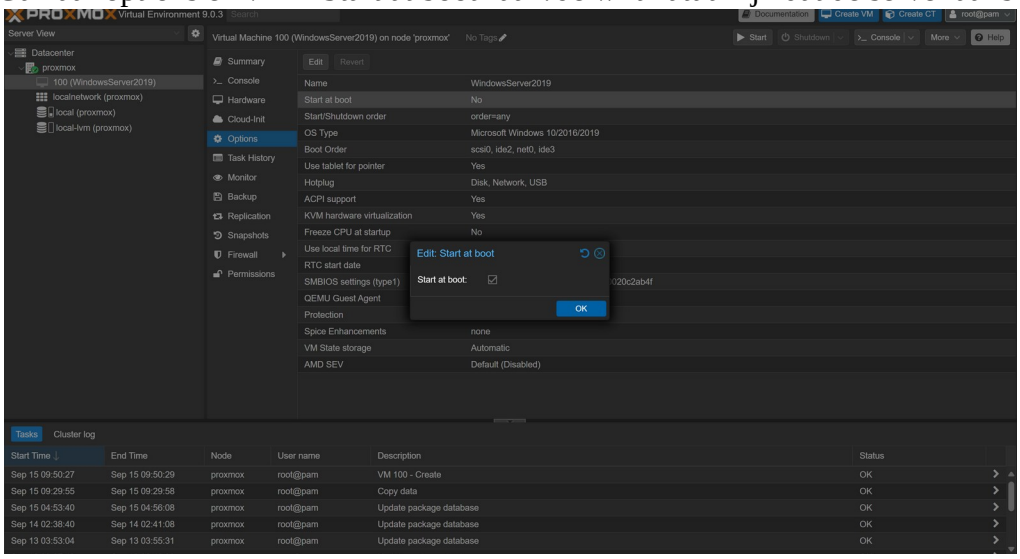

Create: Virtual Machine
General
OS
System
Disks
CPU
Memory
Network
Confirm
Sockets:
1
Type:
kvm64
Cores:
4
Total cores:
4
Help
Advanced
Back
Next


Create: Virtual Machine
General
OS
System
Disks
CPU
Memory
Network
Confirm
No network device
Bridge:
vmbr0
Model:
VirtIO (paravirtualized)
VLAN Tag:
10
MAC address:
auto
Firewall:
Help
Advanced
Back
Next

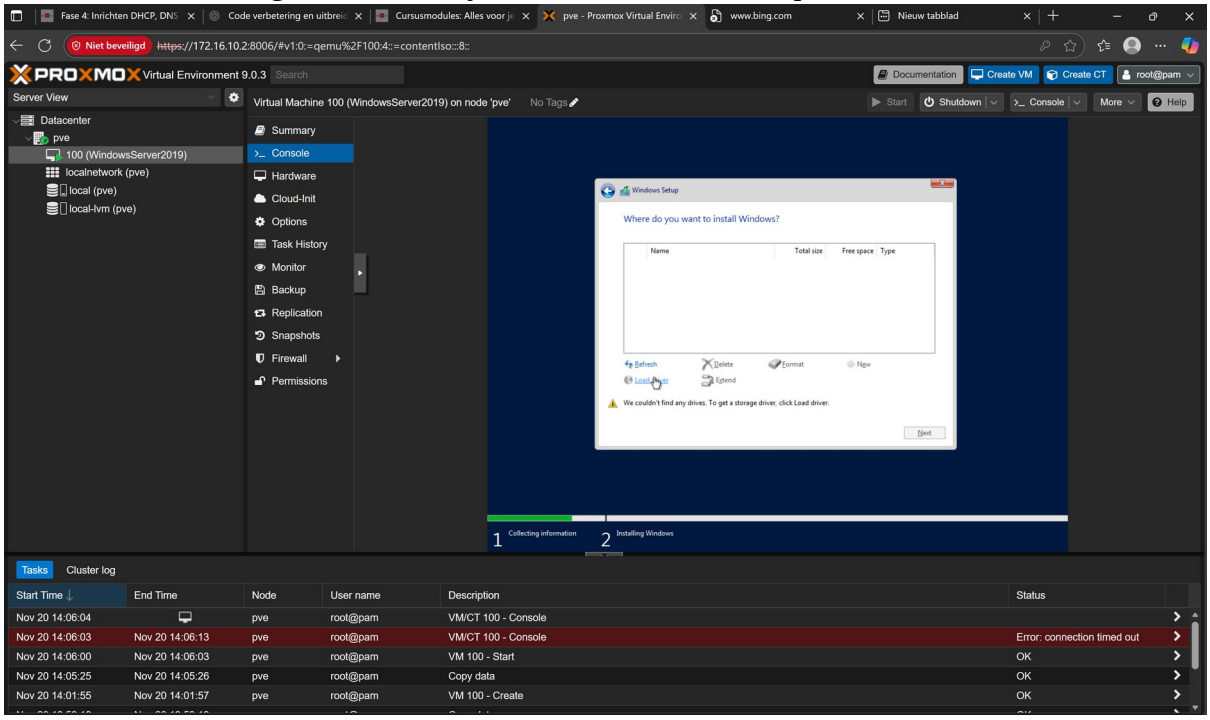
Druk op de windows server 2019 VM en navigeer naar Hardware->add->add CD/DVD Drive. Bij ISO Image voeg dan de ISO waar al die drivers in zitten. Druk dan op add.



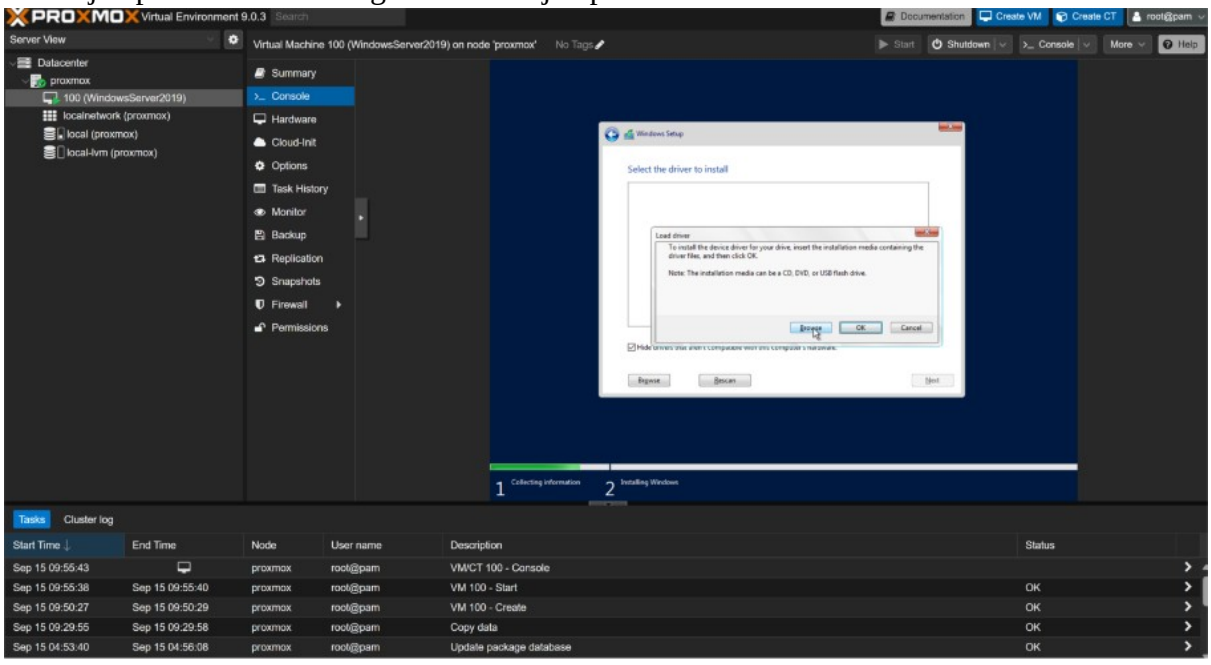
Ga naar options en vink "Start at boot" aan. Je wilt natuurlijk dat de server aanblijft.



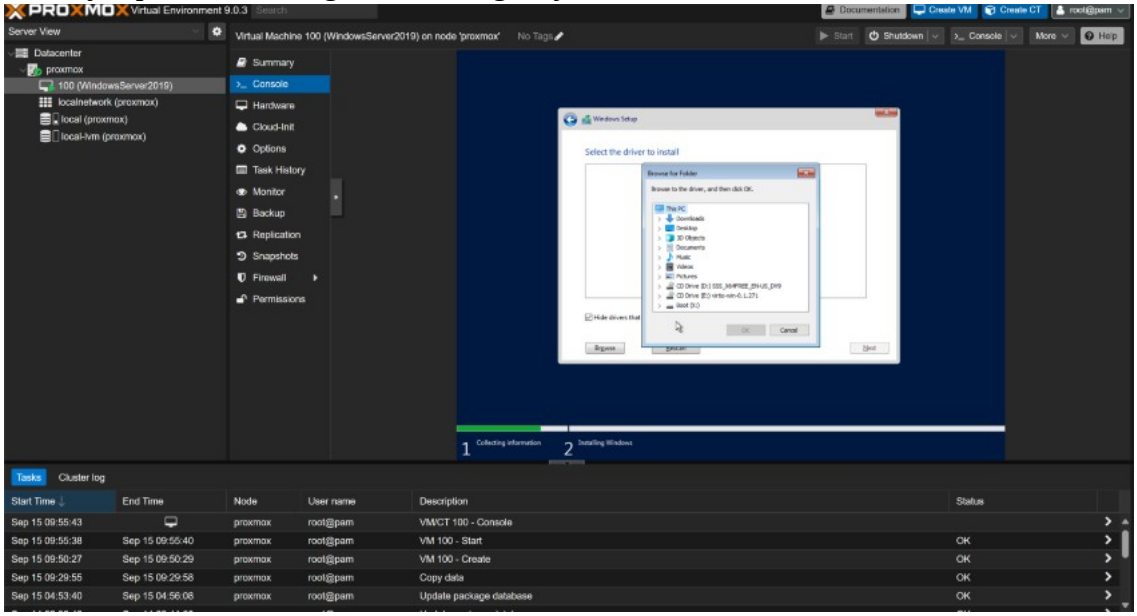
De machine herkent geen harde schijf. Je moet dan drukken op load driver.



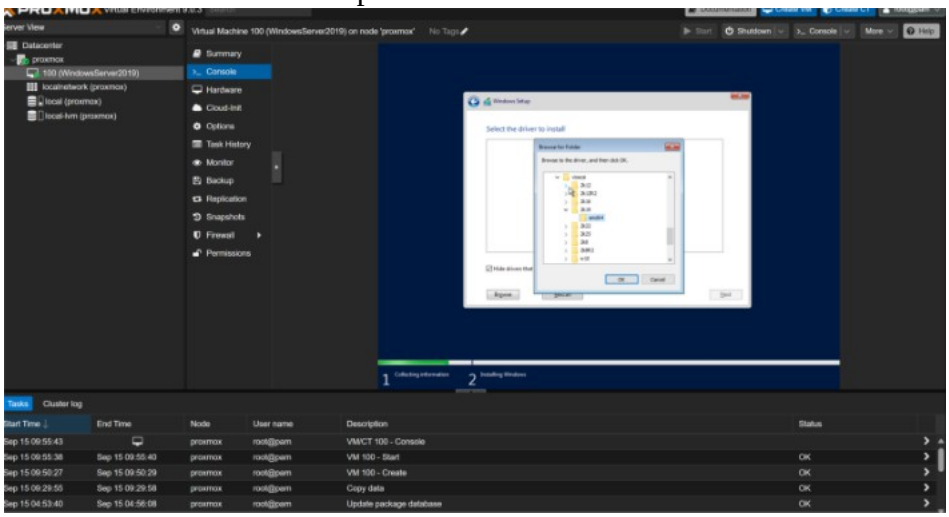
Nadat je op load driver hebt gedrukt druk je op browse.



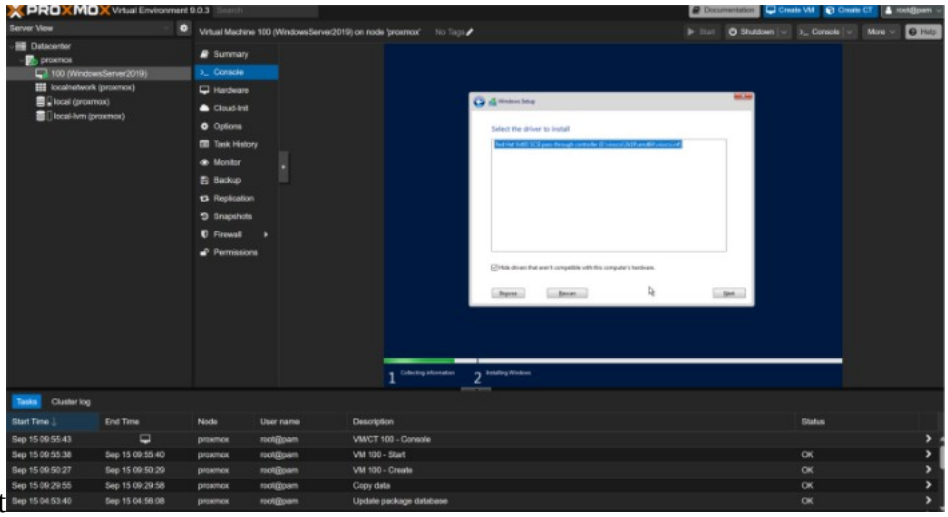
Nadat je op browse hebt gedrukt, navigeer je naar CD Drive E:->viosci->2k19->amd64.



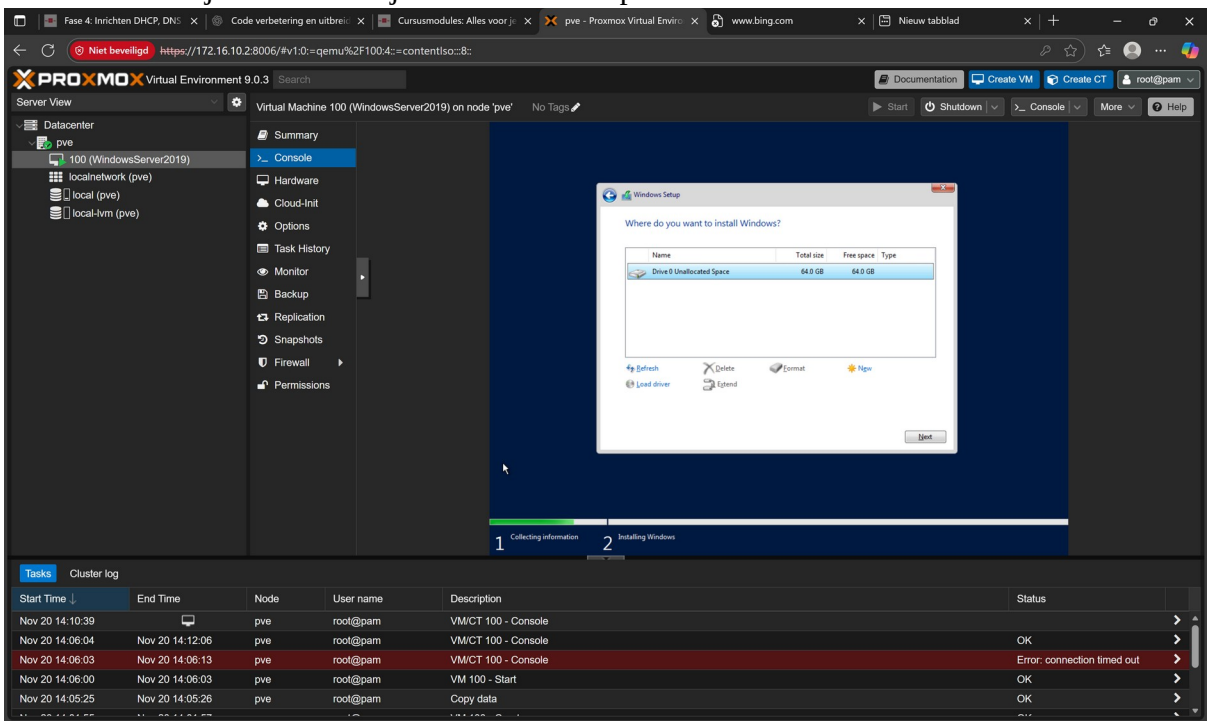
Hieronder de foto waar het precies is.



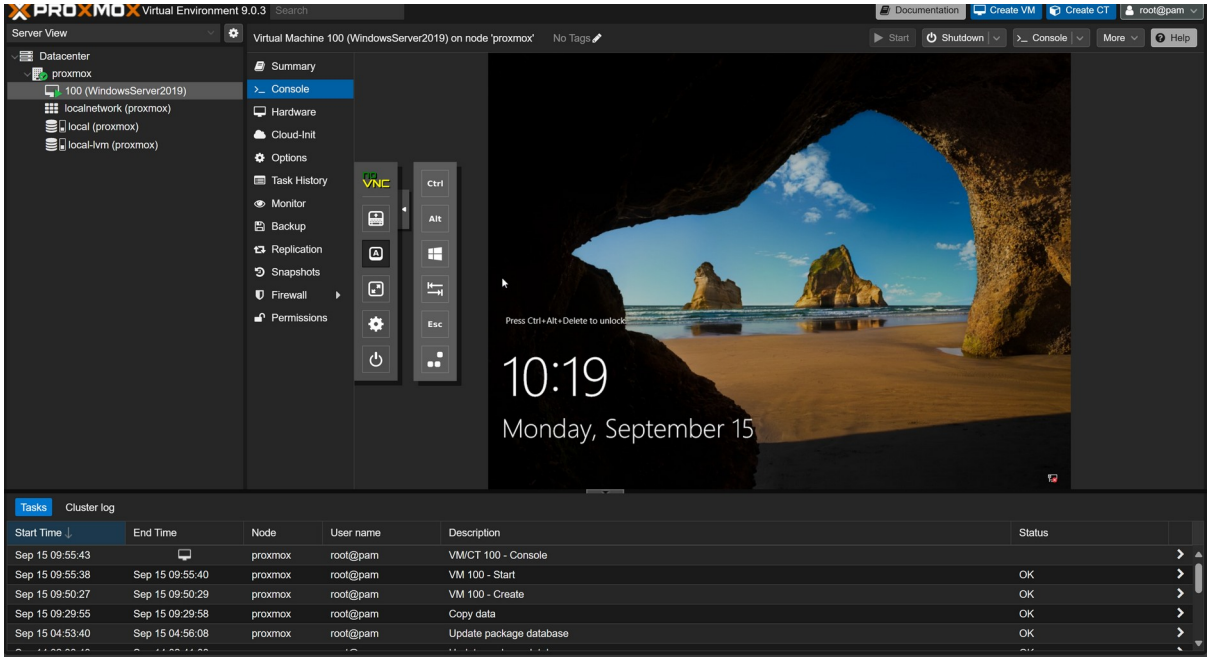
klik daarna op next



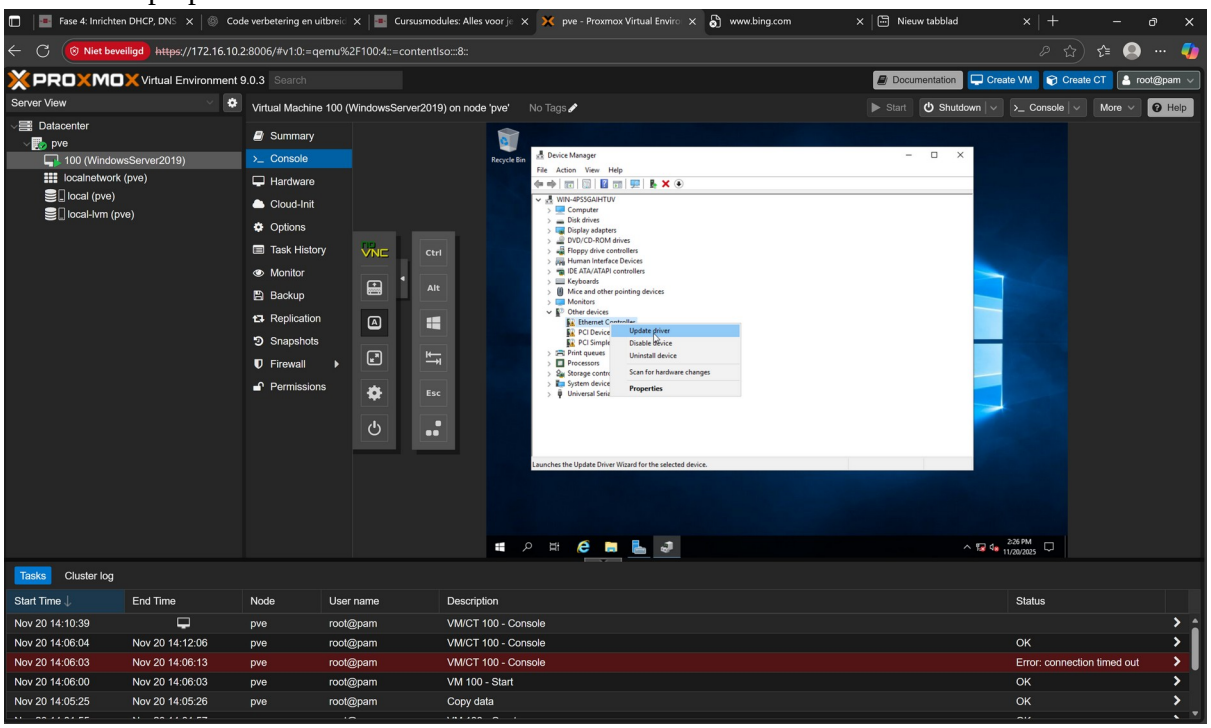
Je ziet nu dat hij de harde schijf herkent. Druk op next om de installatie te starten.



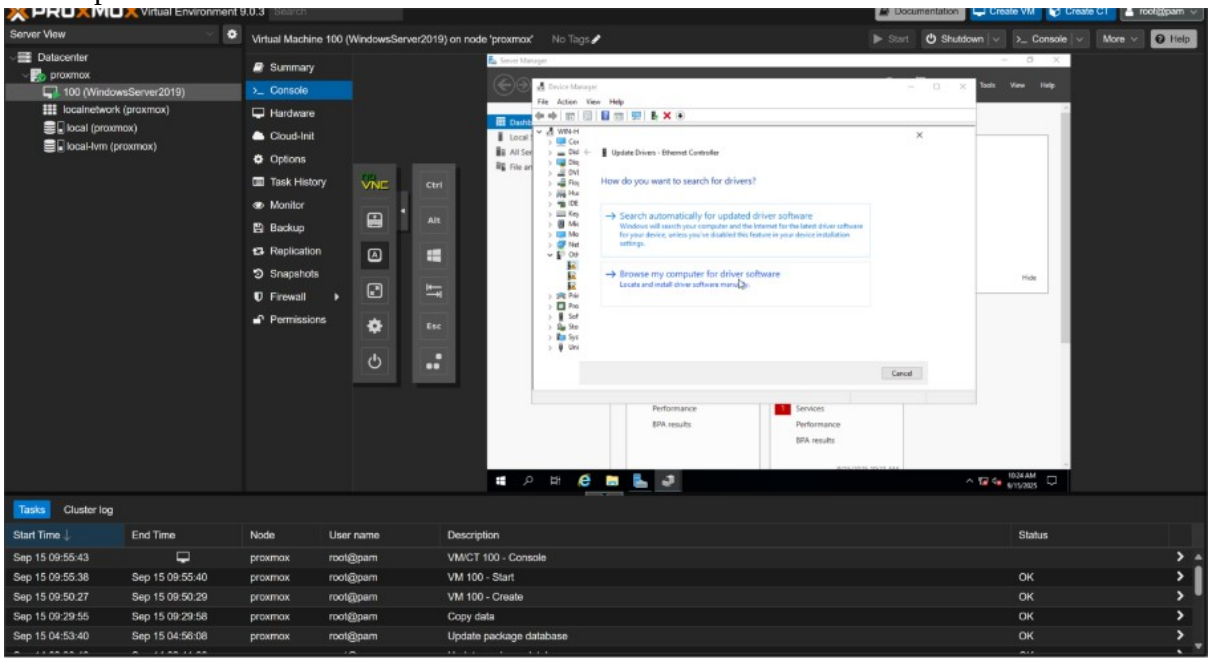
Nadat alles klaar is. Zie je nu dit voor uw scherm. Er staat ook "press ctrl+alt+delete to unlock". Klik op het pijltje links van het scherm en navigeer naar speciale toetsen->ctrl+alt+delete. Voer het wachtwoord is en klaar.



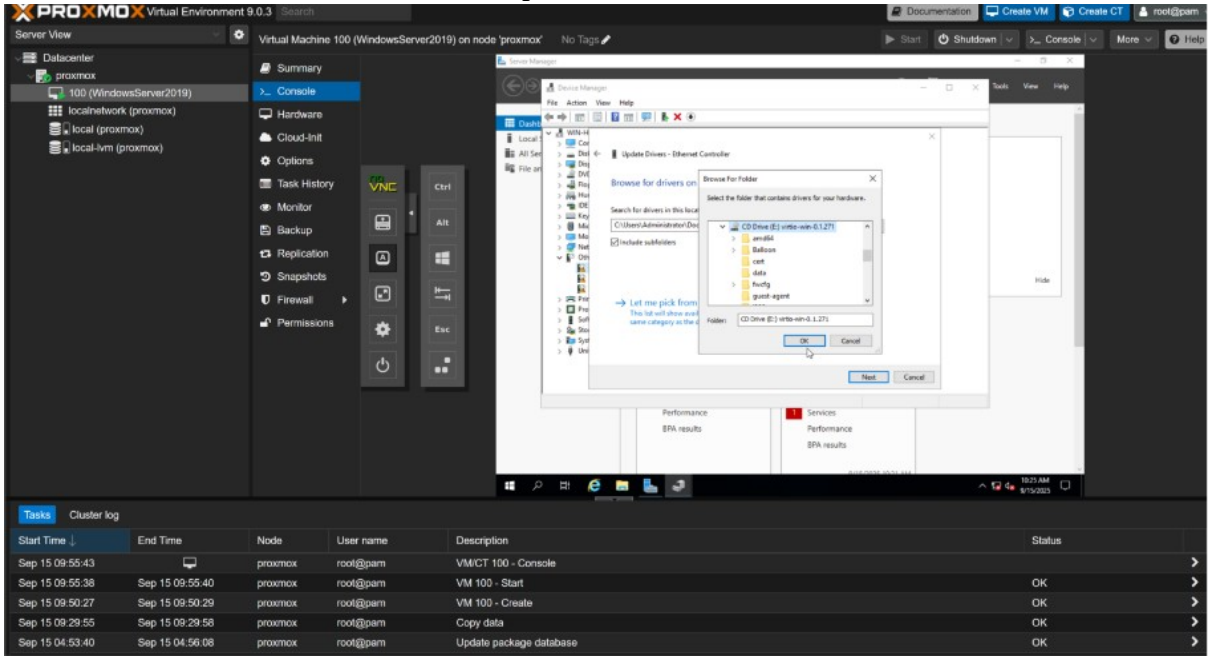
Wat je nu wilt doen is de drivers updaten. Dit is heel belangrijk voor de windows server. Klik op other drivers, druk op de rechtermuisknop bij de drivers met een gele driehoek ernaast. Druk dan op update driver.



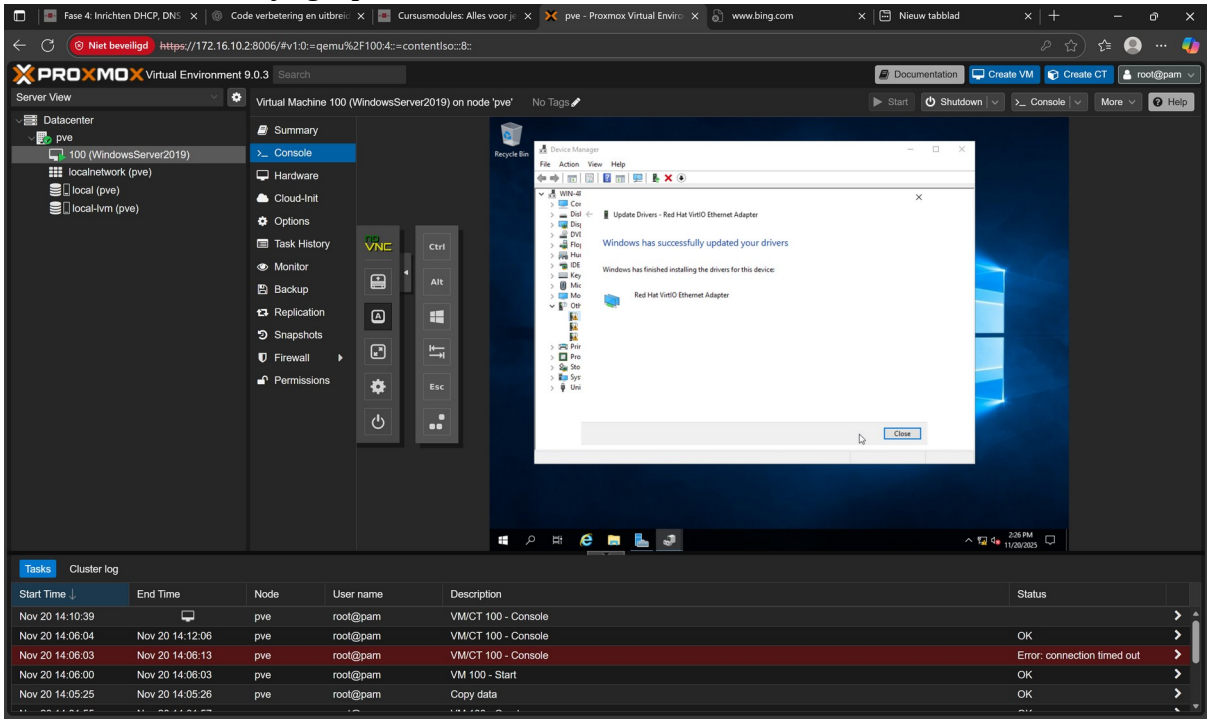
Druk op browse



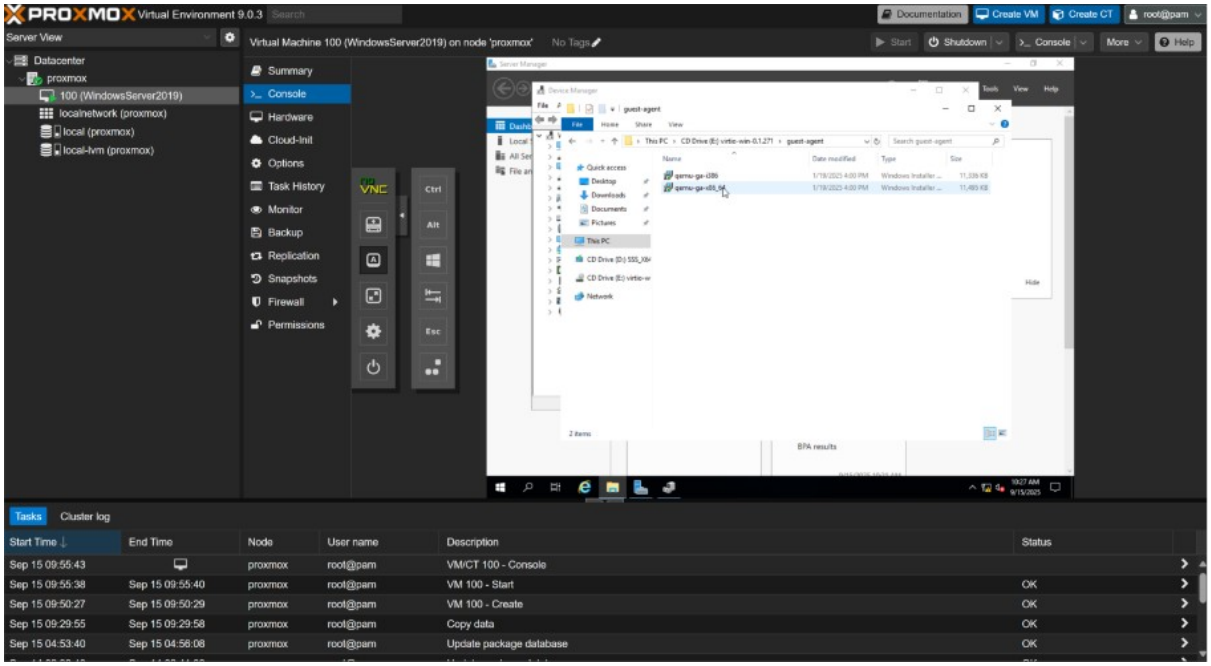
Selecteer dan de cd drive E:. Druk dan op ok en next.



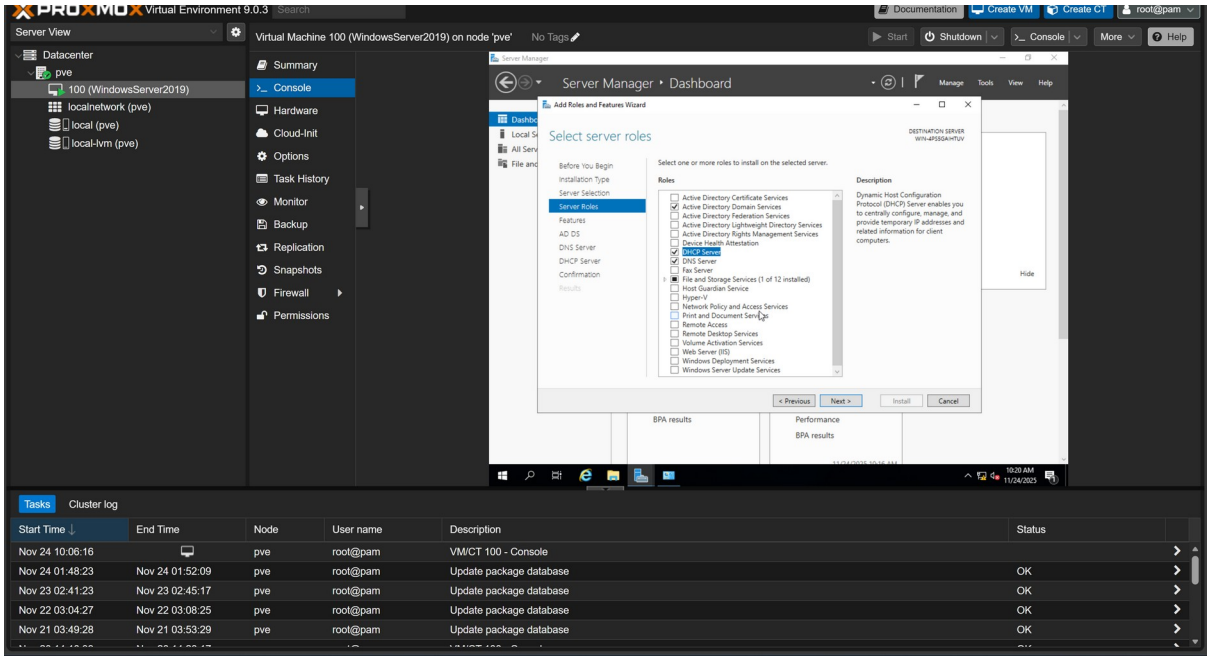
Gelukt. De drivers zijn geupdated. Doe dit ook voor de andere twee drivers.



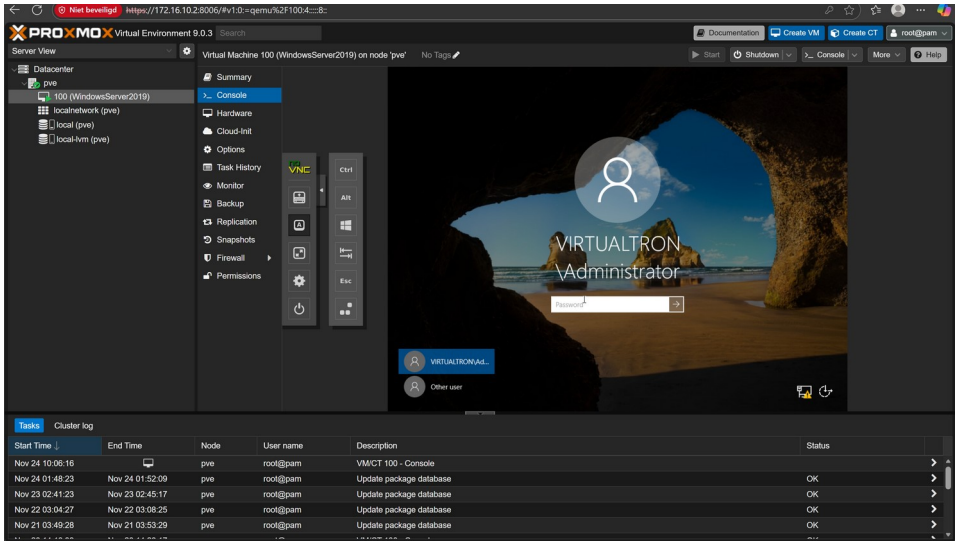
Nadat dat gelukt is ga je naar This PC->CD Drive E:->guest-agent en dubbelklik je op de onderste applicatie. Dit gaat dan de overige drivers updaten.



Ga naar server manager en dan naar add roles and features. Selecteer dan de volgende server roles: ADDS, DNS, DHCP



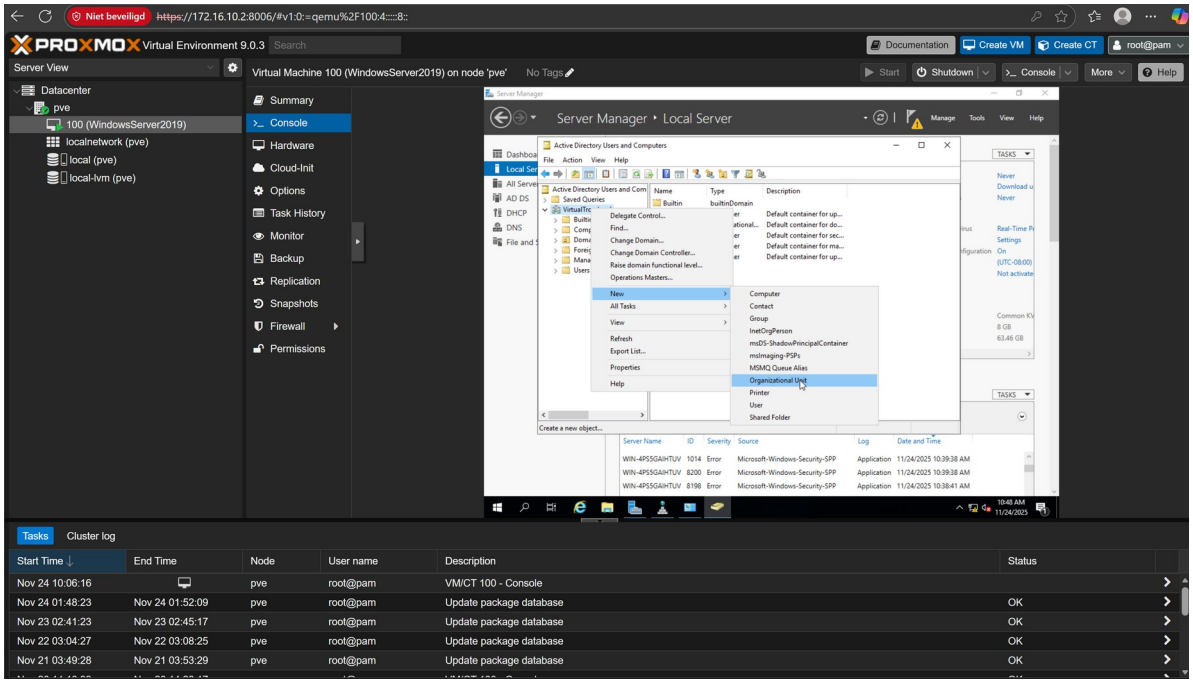
Nadat je je server promoveert als domain controller en het opnieuw opstart. Moet je dit scherm voor je zien.


Niet beveiligd
https://172.16.10.2:8006/#v1:0:=qemu%2F100:4::::8::
PROXMOX Virtual Environment 9.0.3
Search
Documentation
Create VM
Create CT
root@pam
Server View
Virtual Machine 100 (WindowsServer2019) on node 'pve'
No Tags
Start
Shutdown
Console
More
Help
Datacenter
pve
100 (WindowsServer2019)
localnetwork (pve)
local (pve)
local-lvm (pve)
Summary
Console
Hardware
Cloud-Init
Options
Task History
Monitor
Backup
Replication
Snapshots
Firewall
Permissions
noVNC
Ctrl
Alt
Esc
VIRTUALTRON
Administrator
Password
VIRTUALTRON\Ad...
Other user
Tasks
Cluster log
Start Time
End Time
Node
User name
Description
Status
Nov 24 10:06:16
pve
root@pam
VM/CT 100 - Console
Nov 24 01:48:23
Nov 24 01:52:09
pve
root@pam
Update package database
OK
Nov 23 02:41:23
Nov 23 02:45:17
pve
root@pam
Update package database
OK
Nov 22 03:04:27
Nov 22 03:08:25
pve
root@pam
Update package database
OK
Nov 21 03:49:28
Nov 21 03:53:29
pve
root@pam
Update package database
OK

C. OU’s, Gebruikers en Groepen

a. OU’s aanmaken

1. Open Active Directory Users and Computers (ADUC).
2. Rechtsklik op je domeinnaam (virtualtron.local) → New → Organizational Unit.
   a. Naam: Virtual-Tron
3. Rechtsklik op de nieuwe OU Virtual-Tron → New → Organizational Unit.
   a. Naam: Users
4. Rechtsklik opnieuw op Virtual-Tron → New → Organizational Unit.
   a. Naam: Admins



b. Groepen aanmaken

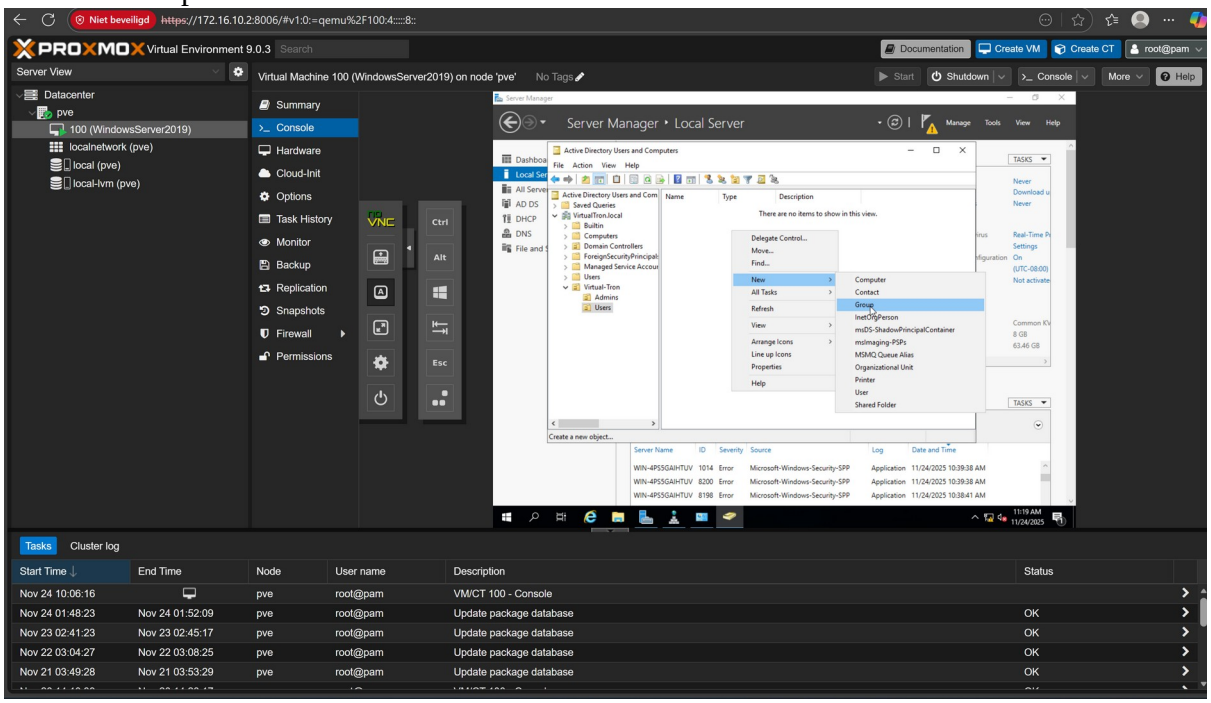
Groep in OU Users

1. Navigeer naar Virtual-Tron → Users.
2. Rechtsklik → New → Group.
3. Vul in:
   - **Group name:** Domain-Users
   - **Group scope:** Global
   - **Group type:** Security
4. Klik op OK.

Groep in OU Admins

1. Navigeer naar Virtual-Tron → Admins.
2. Rechtsklik → New → Group.

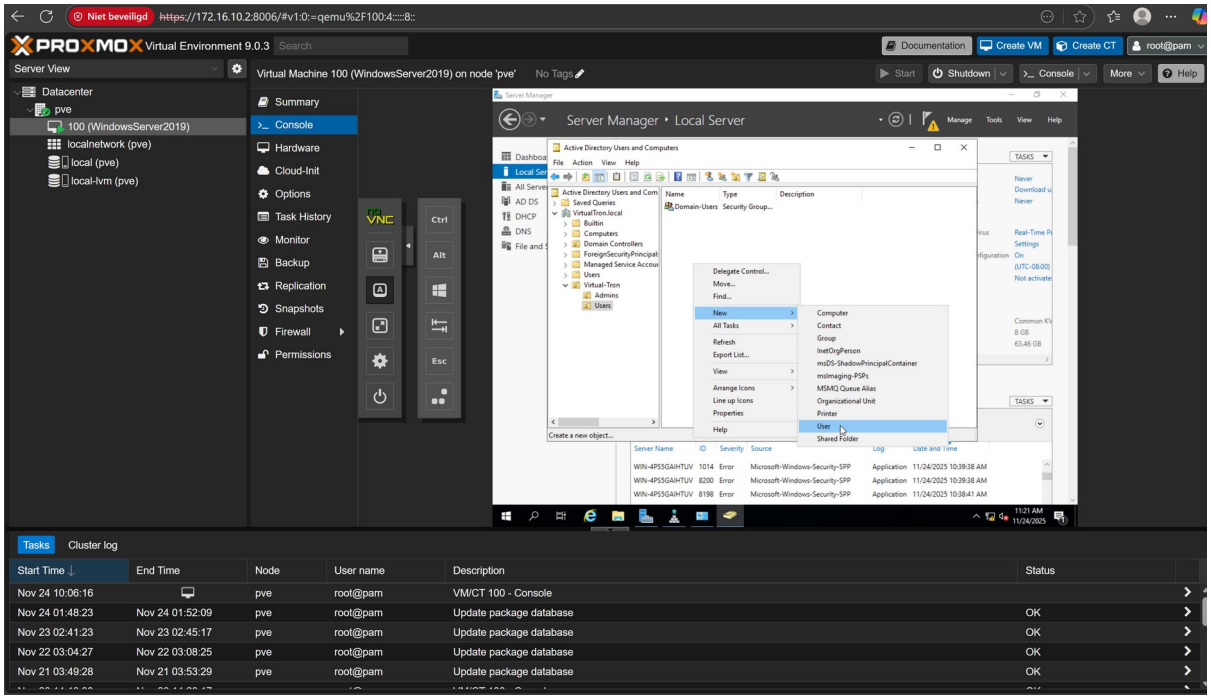
3. Vul in:
    - **Group name:** Domain-Admins
    - **Group scope:** Global
    - **Group type:** Security
4. Klik op OK.



c. Gebruikers aanmaken

User in OU Users

1. Navigeer naar Virtual-Tron → Users.
2. Rechtsklik → New → User.
3. Vul de gegevens in, bijvoorbeeld:
    - **Voornaam:** piet
    - **Achternaam:** piet
    - **User logon name:** pietpiet
4. Klik Next, stel een wachtwoord in en vink User must change password at next logon aan.
5. Klik Finish.
6. Dubbelklik op de gebruiker pietpiet → tabblad Member Of → Add… → voeg de gebruiker toe aan de groep Domain-Users.



User in OU Admins

1. Navigeer naar Virtual-Tron → Admins.
2. Rechtsklik → New → User.
3. Vul de gegevens in, bijvoorbeeld:
   - **Voornaam:** Piet
   - **Achternaam:** Admin
   - **User logon name:** padmin
4. Klik Next en stel een sterk wachtwoord in.
5. Dubbelklik op de gebruiker padmin → tabblad Member Of → Add… → voeg de gebruiker toe aan de groep Domain-Admins.

```
virtualtron.local
└── Virtual-Tron
    ├── Users
    │   ├── Group: Domain-Users (Global Security)
    │   └── User:  pietpiet(lid van Domain-Users)
    │
    └── Admins
        ├── Group: Domain-Admins (Global Security)
        └── User:  padmin (lid van Domain-Admins)
```

Testen

Ik test of de gebruiker is aangemaakt en of ik kan inloggen daarop:

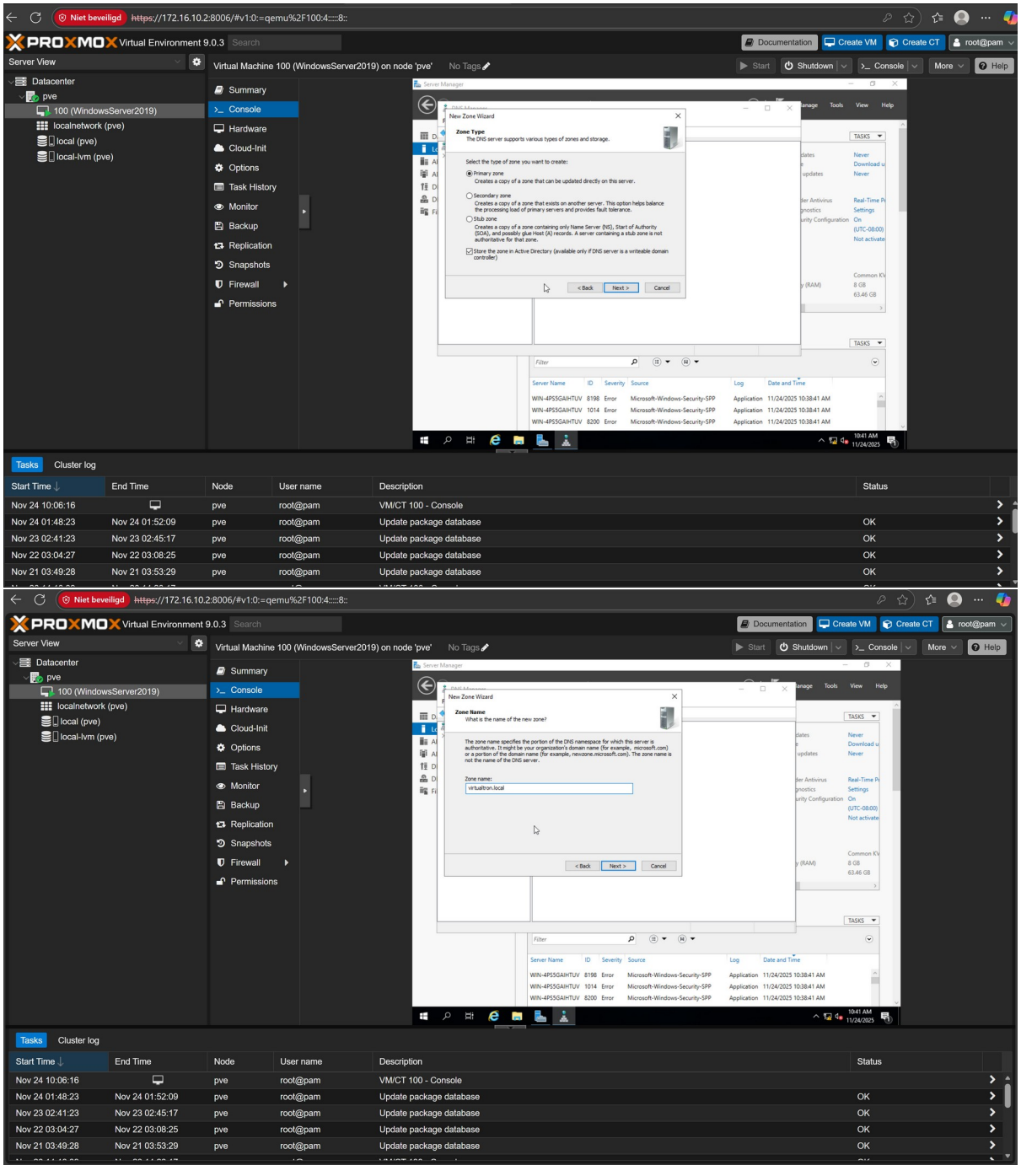
D. DNS Configuratie

a. Installatie van de DNS-rol

1. Open Server Manager → Add Roles and Features.
2. Kies Role-based installation.
3. Vink DNS Server aan en voltooi de installatie.
4. Na de installatie, open de DNS Manager (dnsmgmt.msc).

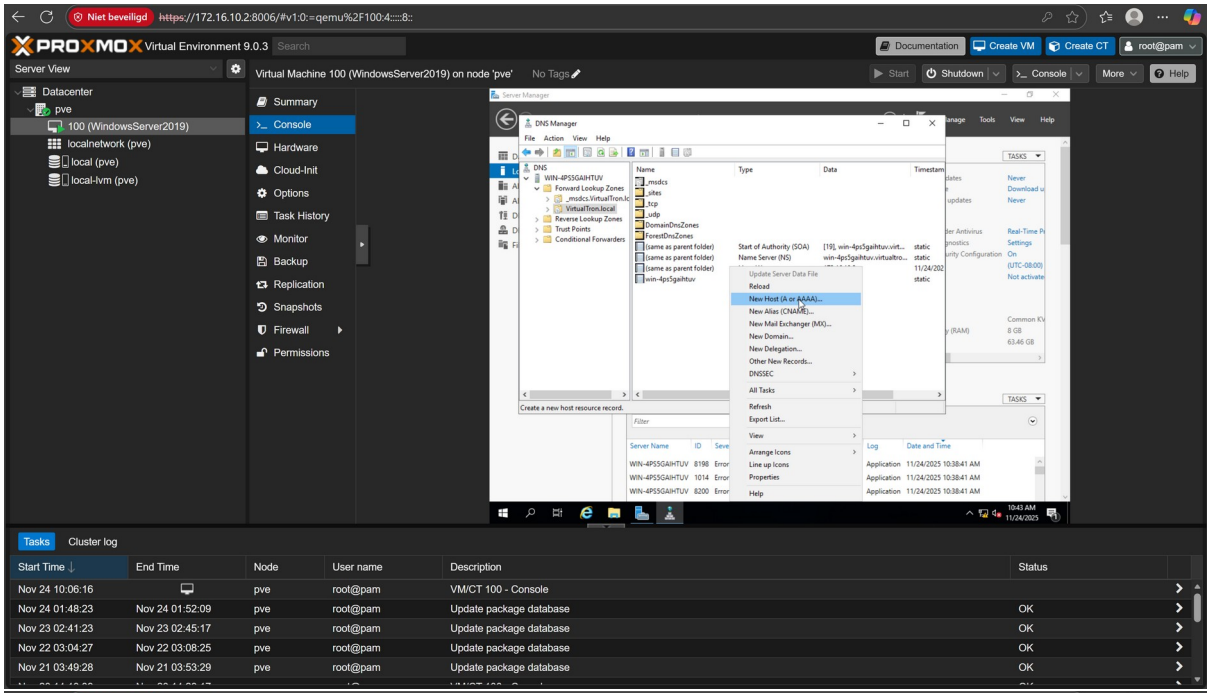
b. Nieuwe Forward Lookup Zone

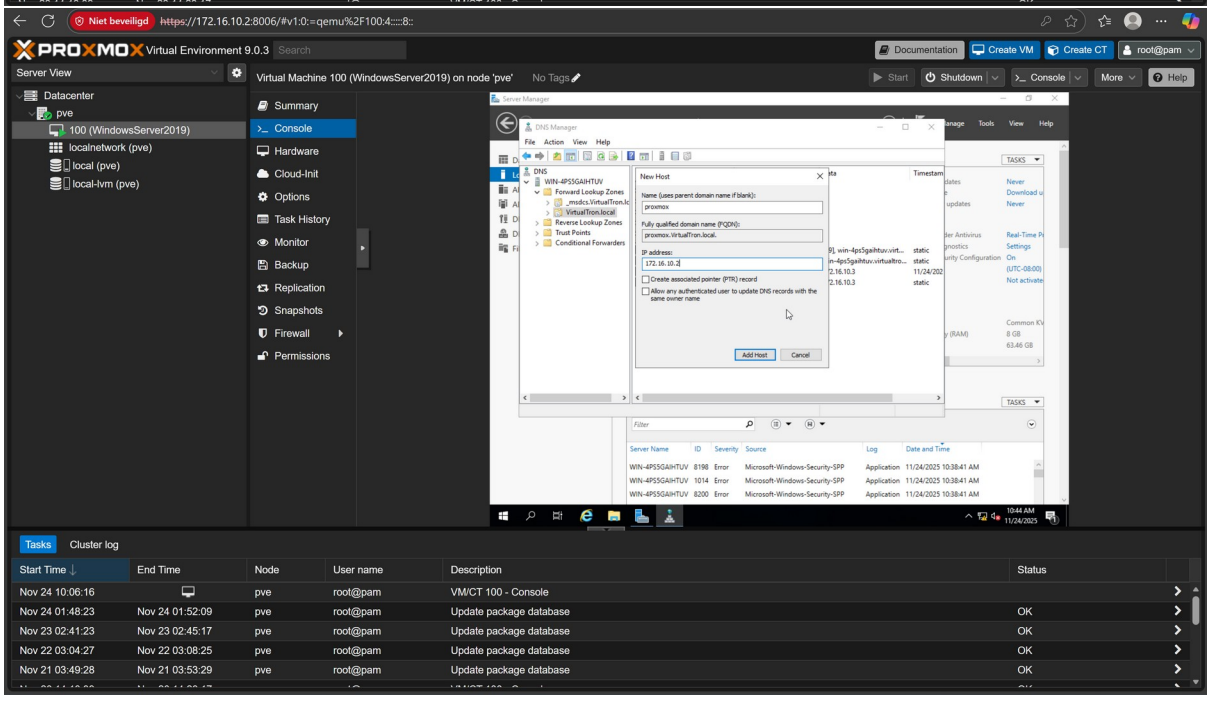
1. In DNS Manager → Rechtsklik op Forward Lookup Zones → New Zone.
2. Kies Primary Zone.
3. **Zone name:** virtualtron.local.
4. Accepteer de standaardinstellingen voor het zone file en klik op Finish.



c. A-record voor Proxmox

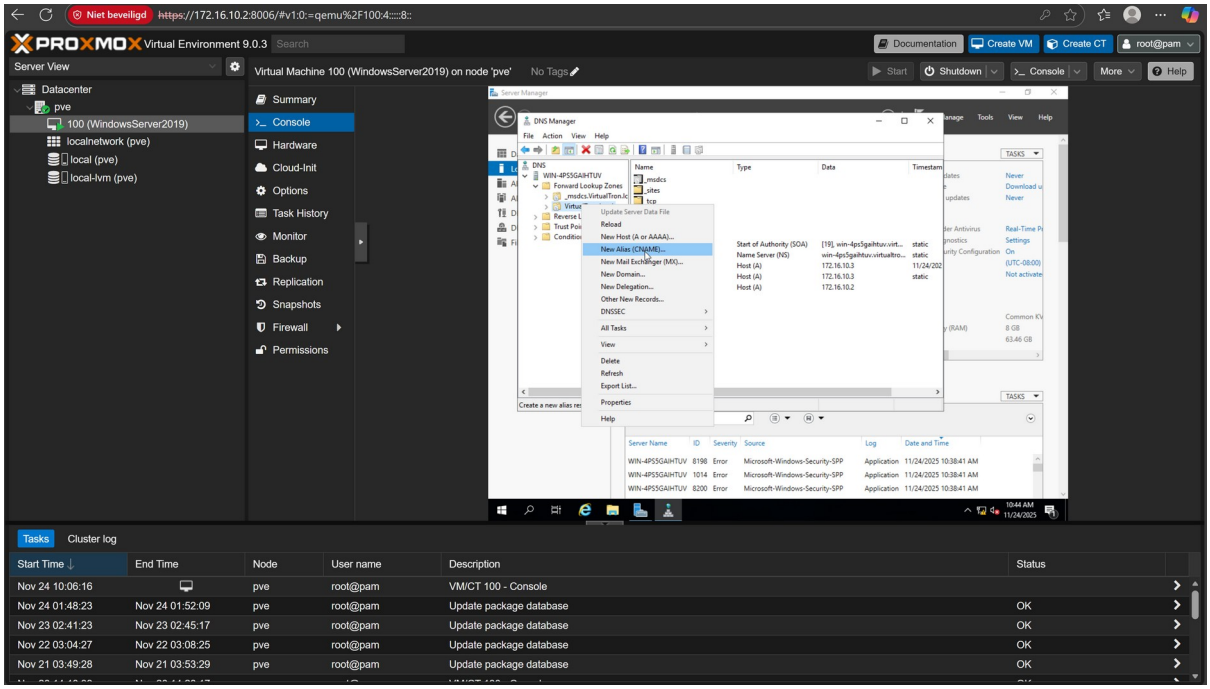
1. Navigeer naar de nieuwe zone virtualtron.local.
2. Rechtsklik → New Host (A or AAAA).
3. Vul in:
   - **Name:** proxmox
   - **IP address:** 172.16.10.2
4. Klik op Add Host.
   - Resultaat: proxmox.virtualtron.local verwijst nu naar 172.16.10.2.





d. CNAME-record (Alias)

1. Rechtsklik in de zone virtualtron.local → New Alias (CNAME).
2. Vul in:
   - **Alias name:** pve
   - **Fully Qualified Domain Name (FQDN):** proxmox.virtualtron.local
3. Klik op OK.
   - Resultaat: pve.virtualtron.local verwijst nu naar proxmox.virtualtron.local.



e. DNS instellen op clients

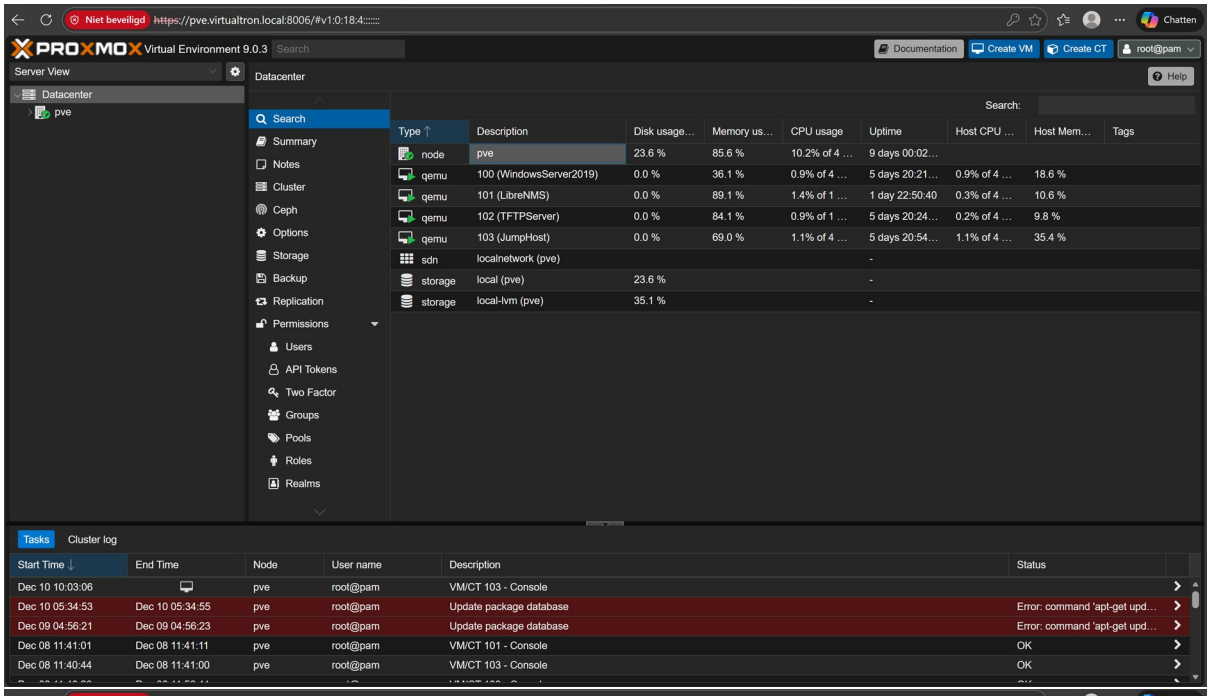
Configureer de netwerkadapter op clients (zoals de management laptop) met de volgende DNS-instellingen:

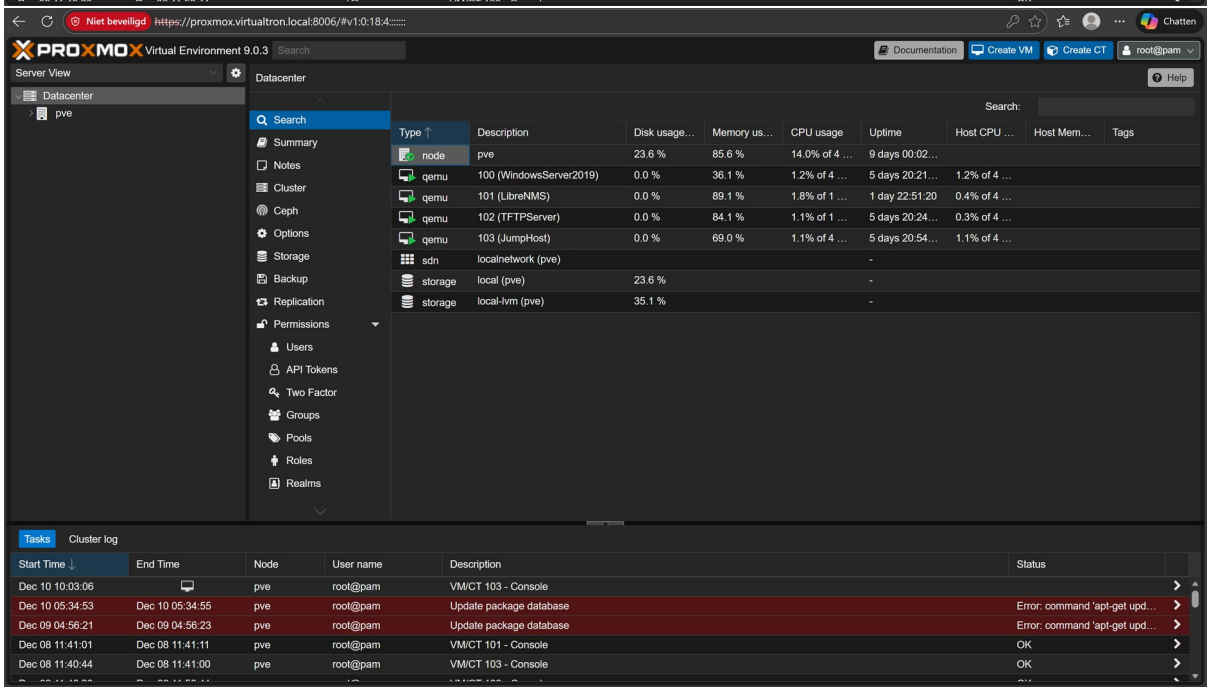
- **Preferred DNS server:** 172.16.10.3 (de Windows Server)
- **Alternate DNS server:** 8.8.8.8 (Google)

f. Testen

Open een webbrowser op een laptop en voer de volgende commando's uit om de configuratie te testen:

- Proxmox.virtualtron.local:8006
- Pve.virtualtron.local:8006





E. DHCP Configuratie

a. Installatie van de DHCP-rol

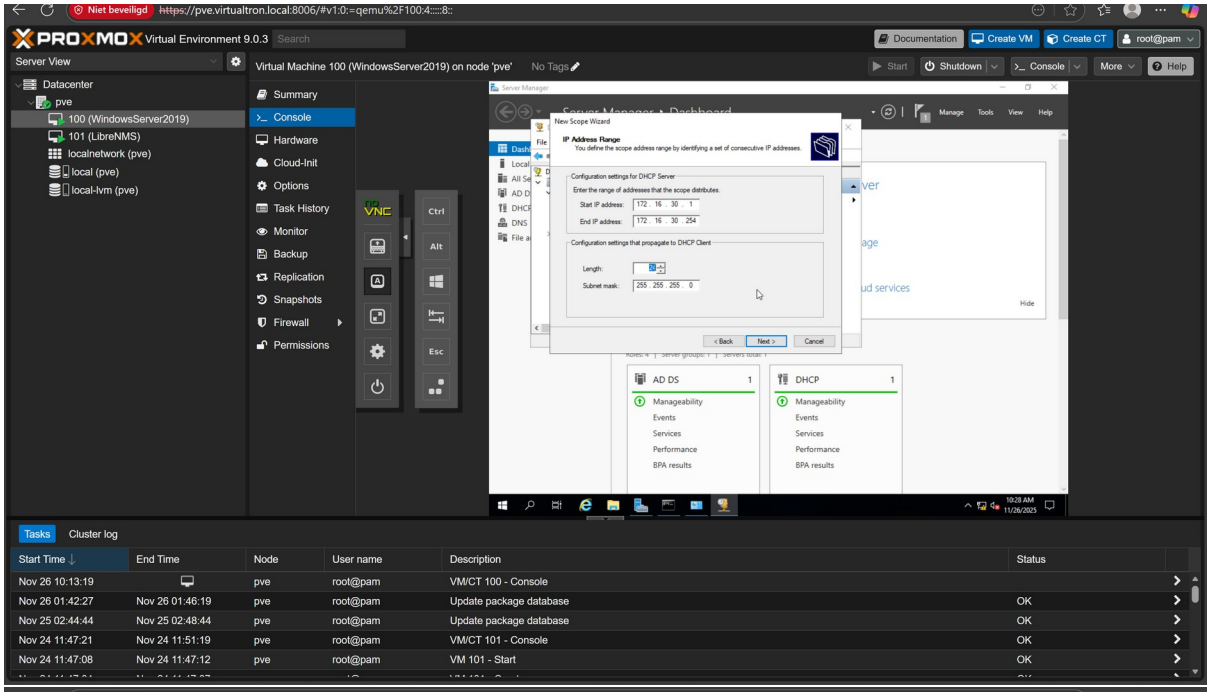
1. Open Server Manager → Add Roles and Features.
2. Kies DHCP Server en voltooi de installatie.
3. Start na de installatie de wizard Complete DHCP configuration via de notificaties in Server Manager.
4. Open de DHCP Manager (dhcpmgmt.msc).

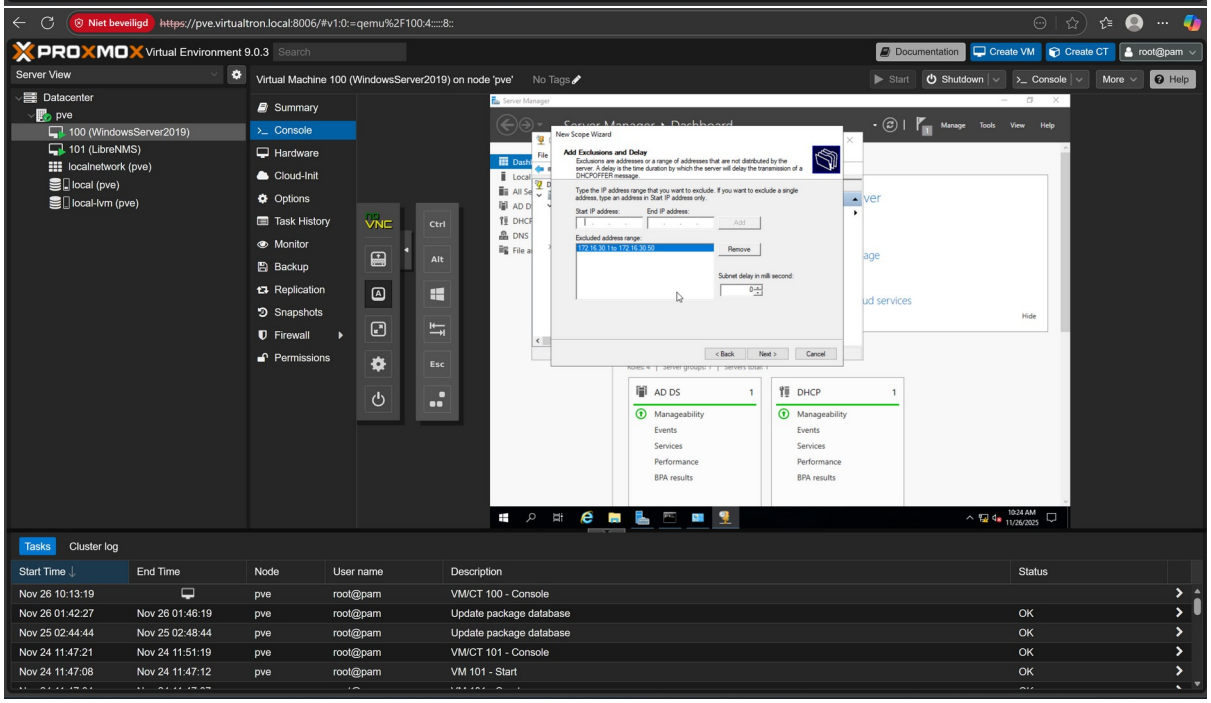
b. DHCP Server autoriseren

1. In DHCP Manager → Rechtsklik op de servernaam → Authorize.
2. Ververs de weergave (F5). Het icoon bij de servernaam moet nu groen zijn.

c. Nieuwe Scope voor VLAN30

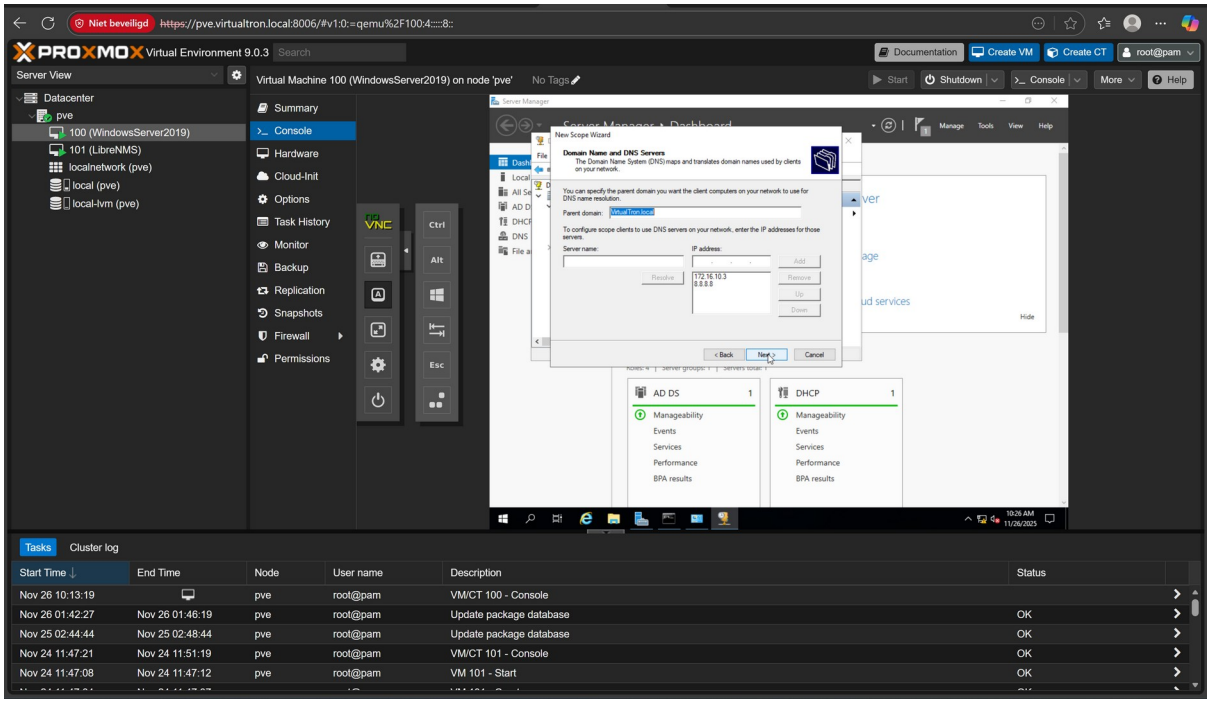
1. Rechtsklik op IPv4 → New Scope.
2. Start de wizard en vul de volgende gegevens in:
    - **Name:**
    - **Start IP address:** 172.16.30.1
    - **End IP address:** 172.16.30.254
    - **Subnet Mask:** 255.255.255.0
3. Voeg een exclusion range toe voor statische adressen:
    - **Start IP address:** 172.16.30.1
    - **End IP address:** 172.16.30.50
4. Behoud de standaard Lease Duration (8 dagen) en voltooi de wizard.

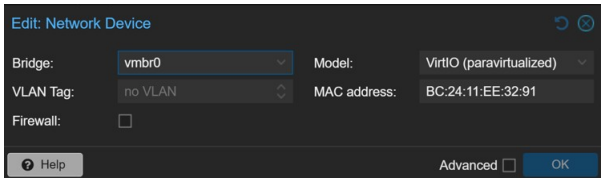




d. Scope Options instellen

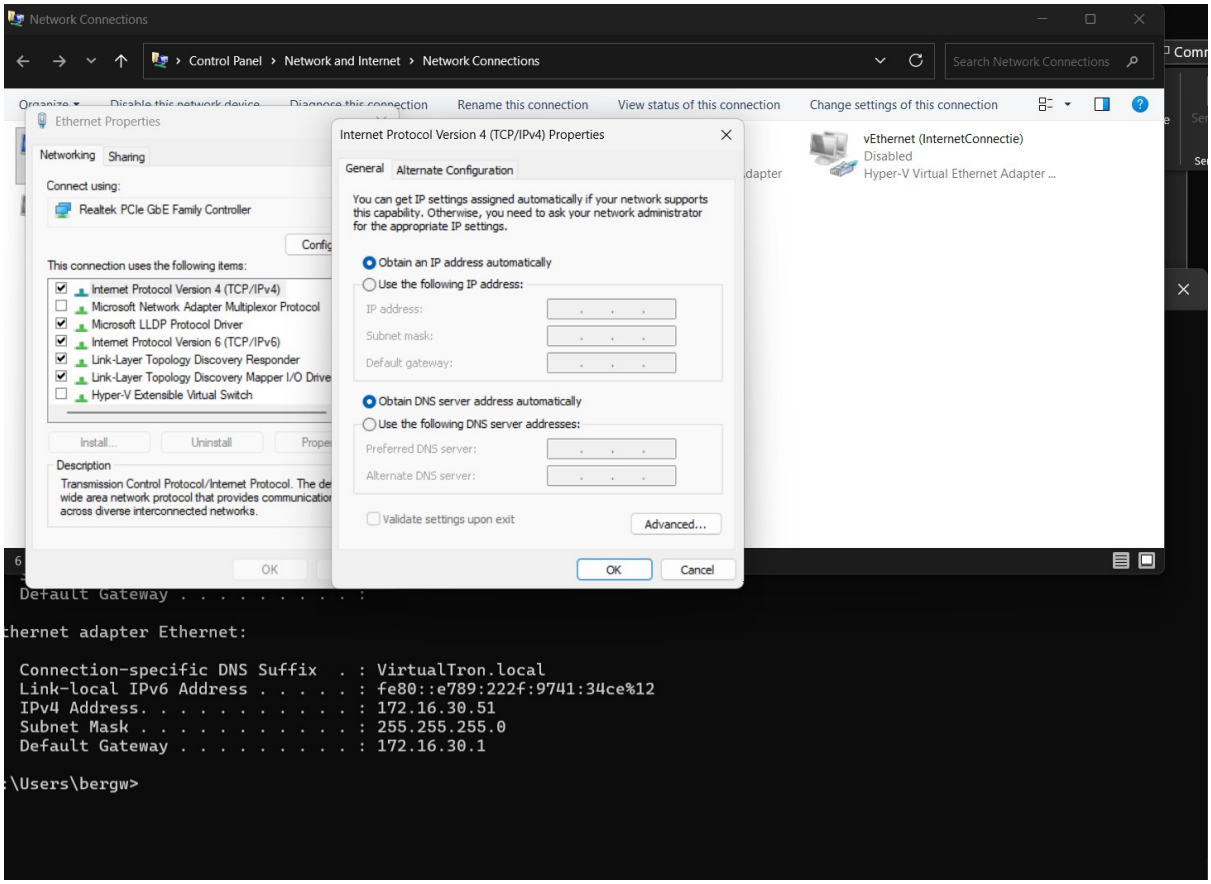
1. Navigeer naar de zojuist aangemaakte scope en rechtsklik op Scope Options → Configure Options.
2. Voeg de volgende opties toe en configureer ze:
    - **003 Router:** 172.16.30.1
    - **006 DNS Servers:** 172.16.10.3 en 8.8.8.8
    - **015 DNS Domain Name:** virtualtron.local
3. Activeer de scope door er met de rechtermuisknop op te klikken en Activate te kiezen.
4. Vlan tag weggehaald bij netwerkadapters in Proxmox, stond eerst op 10.





We hadden een probleem. De server herkende de netwerk niet. Wij hebben in de proxmox bij hardware van de windows server de vlan tag als 10 en firewall aangezet. We hebben het probleem opgelost door de vlan tag leeg te houden en firewall uit te zetten.

g. Testen



Ik heb mijn laptop in vlan 30 gezet en dhcp aangezet en ik kreeg deze keer wel een ip adres.

e. DHCP Relay inschakelen op FortiGate

```
config system interface                 # Open interfaceconfiguratie
edit "VLAN30"                          # Selecteer interface VLAN30
set dhcp-relay-service enable       # DHCP-relay inschakelen op deze interface
set dhcp-relay-ip 172.16.10.3       # DHCP-aanvragen doorsturen naar DHCP-server
172.16.10.3
next                                # Volgende interface
end                                    # Einde van de configuratiemodus
```

Fase 5:
Beheerders Jumphost

Fase 5

Fase 6:
Inrichten TFTP Backup Ubuntu server

A. Installeer TFTP-server op Ubuntu

Open het terminal.

a. Installeer TFTP + xinetd

sudo apt update

```
tftpserver@tftpserver-Standard-PC-i440FX-PIIX-1996:~$ sudo apt update
Warning: The unit file, source configuration file or drop-ins of apt-news.service changed on
disk. Run 'systemctl daemon-reload' to reload units.
Warning: The unit file, source configuration file or drop-ins of esm-cache.service changed on
 disk. Run 'systemctl daemon-reload' to reload units.
Hit:1 http://security.ubuntu.com/ubuntu noble-security InRelease
Hit:2 http://archive.ubuntu.com/ubuntu noble InRelease
Hit:3 http://archive.ubuntu.com/ubuntu noble-updates InRelease
Hit:4 http://archive.ubuntu.com/ubuntu noble-backports InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
572 packages can be upgraded. Run 'apt list --upgradable' to see them.
tftpserver@tftpserver-Standard-PC-i440FX-PIIX-1996:~$
```

sudo apt install tftp-hpa tftpd-hpa xinetd -y

```
tftpserver@tftpserver-Standard-PC-i440FX-PIIX-1996:~$ sudo apt install tftpd-hpa
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Suggested packages:
  pxelinux
The following NEW packages will be installed:
  tftpd-hpa
0 upgraded, 1 newly installed, 0 to remove and 572 not upgraded.
Need to get 39.5 kB of archives.
After this operation, 116 kB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu noble/main amd64 tftpd-hpa amd64 5.2+20150808-1.4build
1 [39.5 kB]
Fetched 39.5 kB in 0s (114 kB/s)
Preconfiguring packages ...
Selecting previously unselected package tftpd-hpa.
(Reading database ... 150742 files and directories currently installed.)
Preparing to unpack .../tftpd-hpa_5.2+20150808-1.4build1_amd64.deb ...
Unpacking tftpd-hpa (5.2+20150808-1.4build1) ...
Setting up tftpd-hpa (5.2+20150808-1.4build1) ...

tftpd-hpa directory (/srv/tftp) already exists, doing nothing.
Processing triggers for man-db (2.12.0-4build2) ...
tftpserver@tftpserver-Standard-PC-i440FX-PIIX-1996:~$
```

b. Configureer TFTP directory

sudo mkdir /srv/tftp
sudo chmod -R 777 /srv/tftp
sudo chown -R nobody:nogroup /srv/tftp

c. Open config file:

sudo nano /etc/default/tftpd-hpa

```
tftpserver@tftpserver-Standard-PC-i440FX-PIIX-1996:~$ sudo nano /etc/default/tftpd-hpa
tftpserver@tftpserver-Standard-PC-i440FX-PIIX-1996:~$
```

Zet dit erin:
TFTP_USERNAME="tftp"
TFTP_DIRECTORY="/srv/tftp"
TFTP_ADDRESS="0.0.0.0:69"
TFTP_OPTIONS="--secure"

Opslaan → CTRL+O
Afsluiten → CTRL+X

d. Restart service:

sudo systemctl restart tftpd-hpa
sudo systemctl enable tftpd-hpa

e. Controleer service:

sudo systemctl status tftpd-hpa

```
tftpserver@tftpserver-Standard-PC-i440FX-PIIX-1996:~$ sudo systemctl status tftpd-hpa.service
● tftpd-hpa.service - LSB: HPA's tftp server
     Loaded: loaded (/etc/init.d/tftpd-hpa; generated)
     Active: active (running) since Thu 2025-12-04 12:29:33 CET; 25s ago
       Docs: man:systemd-sysv-generator(8)
    Process: 6980 ExecStart=/etc/init.d/tftpd-hpa start (code=exited, status=0/SUCCESS)
      Tasks: 1 (limit: 2277)
     Memory: 696.0K (peak: 1.5M)
        CPU: 51ms
     CGroup: /system.slice/tftpd-hpa.service
             └─6988 /usr/sbin/in.tftpd --listen --user tftp --address :69 --secure /srv/tftp

Dec 04 12:29:33 tftpserver-Standard-PC-i440FX-PIIX-1996 systemd[1]: Starting tftpd-hpa.servi>
Dec 04 12:29:33 tftpserver-Standard-PC-i440FX-PIIX-1996 tftpd-hpa[6980]:  * Starting HPA's t>
Dec 04 12:29:33 tftpserver-Standard-PC-i440FX-PIIX-1996 tftpd-hpa[6980]:    ...done.
Dec 04 12:29:33 tftpserver-Standard-PC-i440FX-PIIX-1996 systemd[1]: Started tftpd-hpa.servic>
lines 1-15/15 (END)
```

Het moet **active (running)** zijn.

B. Firewall configureren voor TFTP

TFTP werkt op **UDP 69**

a. Op Ubuntu:

sudo ufw allow 69/udp
sudo ufw reload

```
tftpserver@tftpserver-Standard-PC-i440FX-PIIX-1996:~$ sudo ufw allow 69/udp
sudo ufw reload
Rules updated
Rules updated (v6)
Firewall not enabled (skipping reload)
tftpserver@tftpserver-Standard-PC-i440FX-PIIX-1996:~$
```

C. Fortigate toegang geven tot TFTP

Je moet een firewall-policy maken:

a. Fortigate CLI

config firewall policy
edit 9
set name "Forti-to-TFTP"
set srcintf "VLAN20"
set dstintf "VLAN10"
set srcaddr "all"
set dstaddr "all"
set service "TFTP"
set action accept
set schedule always
next
end
Als TFTP-server in VLAN10 zit, mag de FortiGate dat benaderen.

D. Backup Fortigate naar TFTP-server

Ga naar **CLI**:
execute backup config tftp fortigate_backup.conf 172.16.10.5

```
lab-fw-1 $ execute backup config tftp fortigate_backup.conf 172.16.10.5
Please wait...
Connect to tftp server 172.16.10.5 ...
#
Send config file to tftp server OK.

lab-fw-1 $
```

Test op TFTPServer
ls -l /srv/tftp

```
tftpserver@tftpserver-Standard-PC-i440FX-PIIX-1996:~$ ls -l /srv/tftp
total 80
-rw-rw-rw- 1 root root 78071 Dec  4 13:22 fortigate_backup.conf
tftpserver@tftpserver-Standard-PC-i440FX-PIIX-1996:~$
```

E. Test TFTP verbinding

Op Ubuntu:
tftp 172.16.10.5
tftp> status
tftp> quit

```
tftpserver@tftpserver-Standard-PC-i440FX-PIIX-1996:~$ tftp 172.16.10.5
tftp> status
Connected to 172.16.10.5.
Mode: netascii Verbose: off Tracing: off Literal: off
Rexmt-interval: 5 seconds, Max-timeout: 25 seconds
tftp>
```

Fase 7:
Web server voor documentatie

Fase 7

Reflectie

Tijdens dit project hebben wij veel geleerd over het ontwerpen en configureren van een complete en veilige IT-infrastructuur. Hoewel onze taken verdeeld waren – Devin richtte zich op de FortiGate-firewall en Youssef op de switchconfiguratie en servers – werkten we regelmatig samen om problemen op te lossen en de omgeving goed te laten functioneren.

We hebben beiden gemerkt dat kleine fouten in één onderdeel direct invloed kunnen hebben op het hele netwerk. Hierdoor leerden we nauwkeurig te werken, logisch te testen en effectief te communiceren. Devin ontwikkelde zich vooral in firewall policies, VLAN-configuratie en routing. Youssef kreeg meer ervaring met serverinstallaties, LibreNMS, TFTP en Windows Server-diensten zoals AD, DNS en DHCP.

Het project heeft ons niet alleen technisch sterker gemaakt, maar ook beter in samenwerken, plannen en documenteren. We kijken tevreden terug op een goed functionerende en stabiele infrastructuur en nemen de opgedane kennis mee naar toekomstige projecten.