

Systems Advanced Linux

Network Management



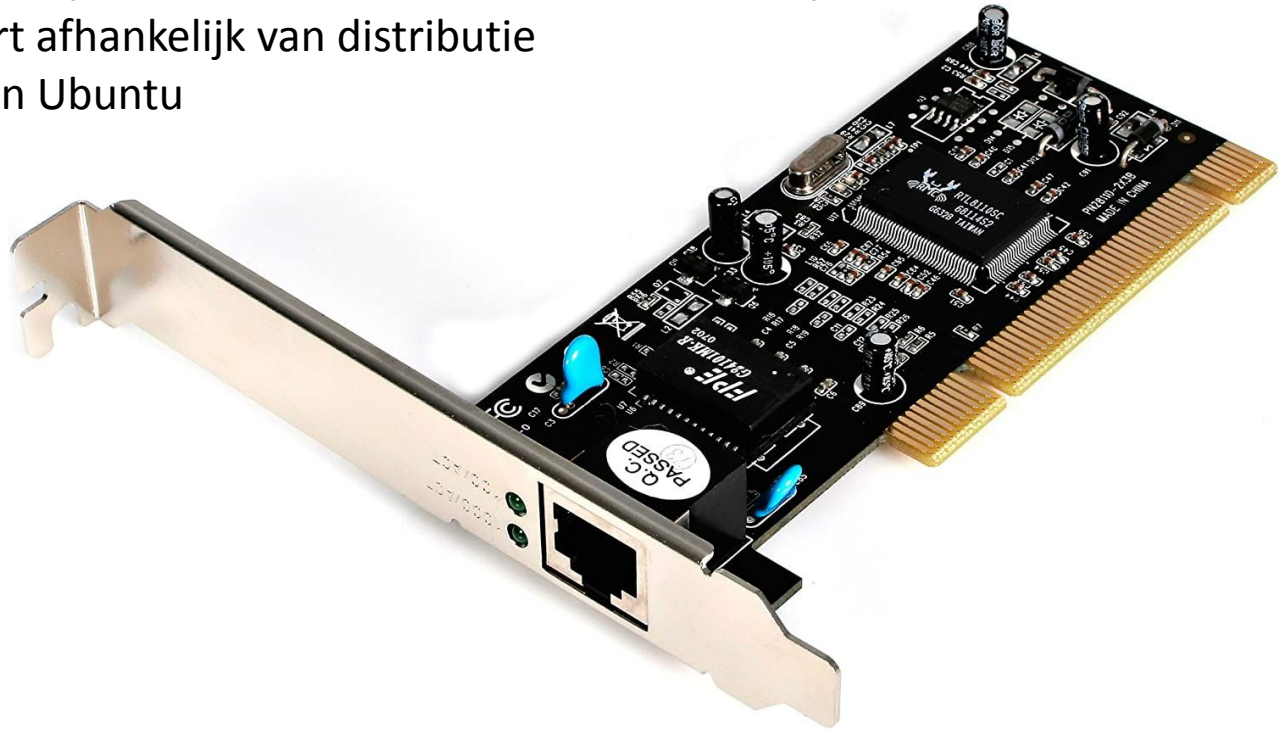
**DE HOGESCHOOL
MET HET NETWERK**

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Intro

- configuratie NIC (network interface controller)
 - via CLI: varieert afhankelijk van distributie
 - we bekijken Ubuntu



netplan

Netwerk configuratie is een yaml file met volgende algemene opmaak

```
network:
  version: 2
  renderer: networkd
  ethernets:
    DEVICE_NAME:
      dhcp4: yes/no                (of true/false)
      addresses:
        - FIXED_IP/PREFIX
      routes:
        - to: default
          via: GATEWAY_IP
      nameservers:
        addresses: [NAMESERVER, NAMESERVER]
        search: [LOCAL.DOMAIN, OTHERDOMAIN]
```

<https://netplan.io/reference>

netplan

netwerk configuratie in een yaml file, afhankelijk van de installatie:

1 netwerkkaart, dhcp

```
networks:  
  renderer: networkd  
  ethernets: (niet wifi of bridge)  
    ens33: (naam)  
      dhcp4: true
```

Als `renderer:` wordt weggelaten is dat automatisch `networkd`

ip address via DHCP

```
student@ubuntu-server:~$ cd /etc/netplan  
student@ubuntu-server:/etc/netplan$ ls  
00-installer-config.yaml  
student@ubuntu-server:/etc/netplan$ cat 00-installer-config.yaml  
# This is the network config written by 'subiquity'  
network:  
  ethernets:  
    ens33:  
      dhcp4: true  
  version: 2
```

FYI: 'subiquity' is de server installer voor Ubuntu ("ubiquity for servers")

netplan

beter voor een server: *fixed ip* (static)

gateway: alle trafic voor buiten het netwerk wordt naar de gateway (router) gestuurd

1 netwerkkaart, fixed (static) ip address

renderer: networkd

ethernets: (*niet wifi of bridge*)

ens33: (*naam*)

addresses:

- FIXED_IP/PREFIX

routes:

- to: default

Via: GATEWAY_IP

nameservers:

addresses: [NAMESERVER,NAMESERVER]

search: [LOCAL.DOMAIN]

static ip address

```
student@ubuntu-server:/etc/netplan$ cat 00-installer-config.yaml
# fixed ip address
network:
  version: 2
  ethernets:
    ens33:
      addresses:
        - 192.168.246.129/24
      routes:
        - to: default
          via: 192.168.246.2
      nameservers:
        search: [localdomain]
        addresses: [192.168.246.2]
student@ubuntu-server:/etc/netplan$
```

netplan

Wijzigingen in `/etc/netplan/*.yaml` worden doorgevoerd met:

sudo netplan try

je hebt 120s tijd om te bevestigen, daarna wordt de configuratie ongedaan gemaakt

sudo netplan apply

Dit maakt ook de volgende file aan:

`/run/systemd/network/<nr>-netplan-<nic>.network`

ip address via DHCP

```
student@ubuntu-server-2:~$ cd /run/systemd/network/
student@ubuntu-server-2:/run/systemd/network$ cat 10-netplan-ens33.network
[Match]
Name=ens33

[Network]
DHCP=ipv4
LinkLocalAddressing=ipv6

[DHCP]
RouteMetric=100
UseMTU=true
student@ubuntu-server-2:/run/systemd/network$
```

static ip address

```
student@ubuntu-server:~$ cd /run/systemd/network/
student@ubuntu-server:/run/systemd/network$ cat 10-netplan-ens33.network
[Match]
Name=ens33

[Network]
LinkLocalAddressing=ipv6
Address=192.168.246.129/24
DNS=192.168.246.2
Domains=local

[Route]
Destination=0.0.0.0/0
Gateway=192.168.246.2
student@ubuntu-server:/run/systemd/network$
```

netplan

Wijzigingen in `/etc/netplan/*.yaml` worden doorgevoerd met
`sudo netplan apply`

Dit schrijft ook de nodige DNS instellingen in volgende file, beheerd door systemd resolve: `/run/systemd/resolve/resolv.conf`

Je kan die opvragen met het commando **`resolvectl status NW_DEVICE`**

```
student@ubuntu-server:~$ resolvectl status ens33
Link 2 (ens33)
  Current Scopes: DNS
    Protocols: +DefaultRoute +LLMNR -mDNS -DNSOverTLS DNSSEC=no/unsupported
Current DNS Server: 192.168.246.2
  DNS Servers: 192.168.246.2
  DNS Domain: local
student@ubuntu-server:~$
```

network status bekijken

Je kan de huidige instellingen ook bekijken met **networkctl** en

networkctl status DEVICE

```
student@ubuntu-server:~$ networkctl
IDX LINK   TYPE      OPERATIONAL SETUP
  1 lo      loopback  carrier    unmanaged
  2 ens33   ether     routable   configured

2 links listed.
student@ubuntu-server:~$ networkctl status ens33
● 2: ens33
    Link File: /usr/lib/systemd/network/99-default.link
    Network File: /run/systemd/network/10-netplan-ens33.network
    Type: ether
    State: routable (configured)
    Online state: online
    Alternative Names: enp2s1
        Path: pci-0000:02:01.0
        Driver: e1000
        Vendor: Intel Corporation
        Model: 82545EM Gigabit Ethernet Controller (Copper) (PRO/1000 MT Single Port Adapter)
        HW Address: 00:0c:29:48:bf:7a (VMware, Inc.)
        MTU: 1500 (min: 46, max: 16110)
        QDisc: fq_codel
    IPv6 Address Generation Mode: eui64
    Queue Length (Tx/Rx): 1/1
    Auto negotiation: yes
        Speed: 1Gbps
        Duplex: full
        Port: tp
    Address: 192.168.246.129
             fe80::20c:29ff:fe48:bf7a
    Gateway: 192.168.246.2
             DNS: 192.168.246.2
    Search Domains: local
    Activation Policy: up
    Required For Online: yes
    DHCP6 Client DUID: DUID-EN/Vendor:0000ab11bc8bae4d072be9320000
    Connected To: n/a on port 00:50:56:c0:00:08

Sep 21 16:36:51 ubuntu-server systemd-networkd[824]: ens33: Link UP
Sep 21 16:36:51 ubuntu-server systemd-networkd[824]: ens33: Gained carrier
Sep 21 16:36:52 ubuntu-server systemd-networkd[824]: ens33: Gained IPv6LL
student@ubuntu-server:~$
```


ip address

- informatie opvragen en wijzigingen aanbrengen
 - informatie opvragen zonder arguments: **alle nic's**

```
student@ubuntu-server:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    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: ens33: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 00:0c:29:48:bf:7a brd ff:ff:ff:ff:ff:ff
    altname enp2s1
    inet 192.168.246.129/24 brd 192.168.246.255 scope global ens33
        valid_lft forever preferred_lft forever
    inet6 fe80::20c:29ff:fe48:bf7a/64 scope link
        valid_lft forever preferred_lft forever
student@ubuntu-server:~$
```

mac address

link state

broadcast address

IP address

prefix

ip addr of ip address show of ip a of ip a s

ip address show <nic>

- informatie opvragen en wijzigingen aanbrengen
 - informatie opvragen met arguments: 1 specifieke nic

```
student@ubuntu-server:~$ ip a s dev ens33
2: ens33: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 00:0c:29:48:bf:7a brd ff:ff:ff:ff:ff:ff
    altname enp2s1
    inet 192.168.246.129/24 brd 192.168.246.255 scope global ens33
        valid_lft forever preferred_lft forever
    inet6 fe80::20c:29ff:fe48:bf7a/64 scope link
        valid_lft forever preferred_lft forever
student@ubuntu-server:~$ _
```

ip a s ens33

of

ip a s dev ens33

ip addr show up

```
student@ubuntu-server:~$ sudo ip link set ens33 down  
[sudo] password for student:
```

(O-oh. ip link set down en heb mezelf uit mijn ssh sessie gesloten :^)

```
student@ubuntu-server:~$ ip a s ens33  
2: ens33: <BROADCAST,MULTICAST> mtu 1500 qdisc fq_codel state DOWN group default qlen 1000  
    link/ether 00:0c:29:48:bf:7a brd ff:ff:ff:ff:ff:ff  
    altname enp2s1  
student@ubuntu-server:~$ ip a s up  
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000  
    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  
student@ubuntu-server:~$ sudo ip link set ens33 up  
[sudo] password for student:  
student@ubuntu-server:~$ ip a s ens33  
2: ens33: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000  
    link/ether 00:0c:29:48:bf:7a brd ff:ff:ff:ff:ff:ff  
    altname enp2s1  
    inet 192.168.246.129/24 brd 192.168.246.255 scope global ens33  
        valid_lft forever preferred_lft forever  
    inet6 fe80::20c:29ff:fe48:bf7a/64 scope link  
        valid_lft forever preferred_lft forever  
student@ubuntu-server:~$
```

`ip a s up` toont enkel de actieve linken

(`down` bestaat niet als argument)

ip link up en ip link down

disablen van een nic

```
ip link set ens33 down
```

enablen van een nic

```
ip link set ens33 up
```

→ Dit leest de netplan-yaml file opnieuw uit!

herstarten van de networkservice

`sudo netplan apply`

OF

`sudo systemctl restart systemd-networkd` (op Server)

configuratie uit yaml-file in `/etc/netplan` wordt opnieuw toegepast

setting up IP address

Tijdelijke wijziging

```
student@ubuntu-server:~$ ip a s ens33 | grep 192
    inet 192.168.246.129/24 brd 192.168.246.255 scope global ens33
student@ubuntu-server:~$ sudo ip addr del 192.168.246.129/24 dev ens33
student@ubuntu-server:~$ ip a s ens33 | grep 192    ——— geen output=geen ip
student@ubuntu-server:~$ sudo ip addr add 192.168.246.129/24 dev ens33
student@ubuntu-server:~$ ip a s ens33 | grep 192
    inet 192.168.246.129/24 scope global ens33
student@ubuntu-server:~$
```

`ip addr del 192.168.246.129/24 dev ens33` om 1 IP van de nic te verwijderen

`ip addr flush dev ens33` om alle IPs van de nic te verwijderen

`ip addr add 192.168.246.129/24 dev ens33` om 1 IP van de nic toe te voegen

`ip link set ens33 up` → verwijdert huidige instellingen en leest de yaml-file opnieuw uit!

```
student@ubuntu-server:~$ sudo ip link set ens33 down && sudo ip link set ens33 up
student@ubuntu-server:~$ ip a s ens33 | grep 192
    inet 192.168.246.129/24 brd 192.168.246.255 scope global ens33
student@ubuntu-server:~$ _
```

hostname

Tijdelijke wijziging

```
student@ubuntu-server:~$ sudo hostname nieuwenaaam
[sudo] password for student:
student@ubuntu-server:~$ bash
student@nieuwenaaam:~$ cat /etc/hostname
ubuntu-server
student@nieuwenaaam:~$ exit
exit
student@ubuntu-server:~$ _
```

Nieuwe naam zichtbaar bij het starten van een nieuwe shell

/etc/hostname is niet aangepast, dus bij een reboot opnieuw oude naam

hostnames mogen bestaan uit 64 letters, cijfers, (punten en) koppeltekens, maar niet eindigen met een koppelteken.

hostnamectl

Permanente wijziging

```
student@ubuntu-server:~$ cat /etc/hostname
ubuntu-server
student@ubuntu-server:~$ sudo hostnamectl set-hostname nieuwenaam
student@ubuntu-server:~$ cat /etc/hostname
nieuwenaam
student@ubuntu-server:~$ bash
student@nieuwenaam:~$ exit
exit
student@ubuntu-server:~$ _
```

/etc/hostname is aangepast, dus bij het starten van een nieuwe shell en het herstarten van de PC in de toekomst blijft de nieuwe naam behouden.

/etc/hosts

Aanpassen van /etc/hosts voor name-resolving (voor sudo)

- **sudo** doet voor ieder commando een name-resolving voor de hostname
 - Daarom is het belangrijk dat je de file /etc/hosts ook aanpast
 - anders heb je, afhankelijk van distro en versie, een lange timeout voordat een **sudo** commando wordt uitgevoerd

```
student@ubuntu-server:~$ cat /etc/hostname
ubuntu-server
student@ubuntu-server:~$ cat /etc/hosts
127.0.0.1 localhost
127.0.1.1 ubuntu-server

# The following lines are desirable for IPv6 capable hosts
::1      ip6-localhost ip6-loopback
fe00::0  ip6-localnet
ff00::0  ip6-mcastprefix
ff02::1  ip6-allnodes
ff02::2  ip6-allrouters
student@ubuntu-server:~$ _
```

ip neighbor (arp table)

IP-NEIGHBOUR(8)

Linux

IP-NEIGHBOUR(8)

NAME

`ip-neighbour` - neighbour/arp tables management.

SYNOPSIS

`ip [OPTIONS] neigh { COMMAND | help }`

`ip neigh { add | del | change | replace } { ADDR [lladdr LLADDR] [nud STATE] | proxy ADDR } [dev DEV] [router] [extern_learn]`

`ip neigh { show | flush } [proxy] [to PREFIX] [dev DEV] [nud STATE] [vrf NAME]`

`ip neigh get ADDR dev DEV`

`STATE := { permanent | noarp | stale | reachable | none | incomplete | delay | probe | failed }`

DESCRIPTION

The `ip neigh` command manipulates neighbour objects that establish bindings between protocol addresses and link layer addresses for hosts sharing the same link. Neighbour entries are organized into tables. The IPv4 neighbour table is also known by another name - the ARP table.

ip neighbor of ip n

```
student@ubuntu-server:~$ ip n show
192.168.246.2 dev ens33 lladdr 00:50:56:e5:6d:29 STALE
192.168.246.50 dev ens33 FAILED
192.168.246.1 dev ens33 lladdr 00:50:56:c0:00:08 REACHABLE
```

```
student@ubuntu-server:~$
student@ubuntu-server:~$
student@ubuntu-server:~$
student@ubuntu-server:~$
student@ubuntu-server:~$
```

```
student@ubuntu-server:~$ ping -c 1 192.168.246.130
PING 192.168.246.130 (192.168.246.130) 56(84) bytes of data:
64 bytes from 192.168.246.130: icmp_seq=1 ttl=64 time=0.621 ms
```

```
--- 192.168.246.130 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.621/0.621/0.621/0.000 ms
```

```
student@ubuntu-server:~$ ip n show
192.168.246.130 dev ens33 lladdr 00:0c:29:08:39:3f REACHABLE
192.168.246.2 dev ens33 lladdr 00:50:56:e5:6d:29 REACHABLE
192.168.246.50 dev ens33 FAILED
192.168.246.1 dev ens33 lladdr 00:50:56:c0:00:08 REACHABLE
student@ubuntu-server:~$ sudo ip n del 192.168.246.130 dev ens33
student@ubuntu-server:~$ ip n show
192.168.246.2 dev ens33 lladdr 00:50:56:e5:6d:29 REACHABLE
192.168.246.50 dev ens33 FAILED
192.168.246.1 dev ens33 lladdr 00:50:56:c0:00:08 REACHABLE
student@ubuntu-server:~$
```

192.168.246.50 ping host unreachable

192.168.246.130 connectie via ssh

```
student@ubuntu-server-2:~$ ip a s ens33
2: ens33: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 00:0c:29:08:39:3f brd ff:ff:ff:ff:ff:ff
    altname enp2s1
    inet 192.168.246.130/24 metric 100 brd 192.168.246.255 scope global dynamic ens33
```

delete arp table entry

ip route of ip r

IP-ROUTE(8)

Linux

IP-ROUTE(8)

NAME

ip-route - routing table management

SYNOPSIS

ip [ip-OPTIONS] route { COMMAND | help }

ip route { show | flush } SELECTOR

ip route save SELECTOR

ip route restore

ip route get ROUTE_GET_FLAGS ADDRESS [from ADDRESS iif STRING] [oif STRING] [mark MARK] [tos TOS] [vrf NAME] [ipproto PROTOCOL] [sport NUMBER] [dport NUMBER]

ip route { add | del | change | append | replace } ROUTE

DESCRIPTION

ip route is used to manipulate entries in the kernel routing tables.

Route types:

ip route of ip r

```
student@ubuntu-server:~$ ip route
default via 192.168.246.2 dev ens33 proto static
192.168.246.0/24 dev ens33 proto kernel scope link src 192.168.246.129
student@ubuntu-server:~$
```

ip r show of **ip r list**

Tijdelijk wijzigingen routing:

vb. default gateway

eventueel eerst de foutieve verwijderen

sudo ip route del default

nadien nieuwe toevoegen

sudo ip route add default via 192.168.14.xx

ping

Met **ping** wordt vaak de TCP/IP configuratie getest.

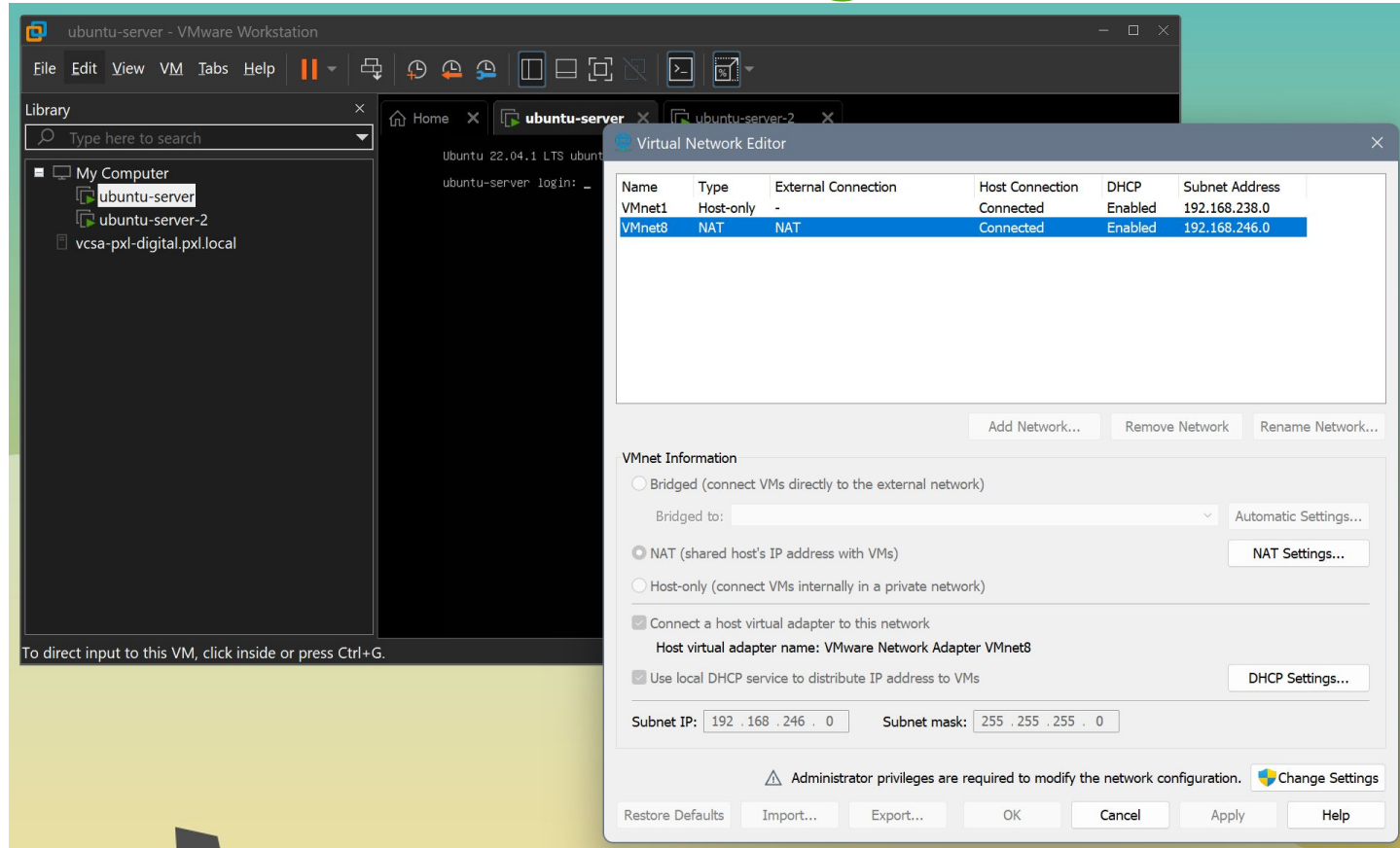
(ook **traceroute**, **dig**)



```
student@ubuntu-server:~$ ping 192.168.246.130
PING 192.168.246.130 (192.168.246.130) 56(84) bytes of data.
 64 bytes from 192.168.246.130: icmp_seq=1 ttl=64 time=0.536 ms
 64 bytes from 192.168.246.130: icmp_seq=2 ttl=64 time=0.326 ms
 64 bytes from 192.168.246.130: icmp_seq=3 ttl=64 time=0.310 ms
^C
--- 192.168.246.130 ping statistics ---
 3 packets transmitted, 3 received, 0% packet loss, time 2039ms
 rtt min/avg/max/mdev = 0.310/0.390/0.536/0.102 ms
student@ubuntu-server:~$
```

ping -c5 192.168.202.132

VMware: NAT-instelling in Workstation



VMware: NAT-instellingen op de host

interface VMnet8

NAT router en DNS Server

ip = 192.168.246.**2**


DHCP Server

ip = 192.168.246.**254**

```
# thraa @ DESKTOP-TOMC in ~ [20:45:41]
$ Get-NetIPConfiguration *VMnet8

InterfaceAlias      : VMware Network Adapter VMnet8
InterfaceIndex      : 33
InterfaceDescription : VMware Virtual Ethernet Adapter for VMnet8
NetProfile.Name      : Unidentified network
IPv4Address          : 192.168.246.1
IPv6DefaultGateway  :
IPv4DefaultGateway  :
DNSServer            : fec0:0:0:ffff::1
                    : fec0:0:0:ffff::2
                    : fec0:0:0:ffff::3

# thraa @ DESKTOP-TOMC in ~ [20:45:54]
$ _
```



VMware: NAT-instelling in de VM

Server: Een lease wordt aangevraagd door **networkd** bij het opstarten of herstarten van het netwerk van deze netwerkkaart.

```
student@ubuntu-server-2:~$ cat /var/run/systemd/netif/leases/2
```

```
# This is private data. Do not parse.
```

```
ADDRESS=192.168.246.130
```

```
NETMASK=255.255.255.0
```

```
ROUTER=192.168.246.2
```

```
SERVER_ADDRESS=192.168.246.254
```

```
NEXT_SERVER=192.168.246.254
```

```
T1=900
```

```
T2=1575
```

```
LIFETIME=1800
```

```
DNS=192.168.246.2
```

```
DOMAINNAME=localdomain
```

```
CLIENTID=ff2b9434c100020000ab11efc354e33aab64e2
```

```
student@ubuntu-server-2:~$ networkctl
```

IDX	LINK	TYPE	OPERATIONAL	SETUP
1	lo	loopback	carrier	unmanaged
2	ens33	ether	routable	configured

```
2 links listed.
```

```
student@ubuntu-server-2:~$
```

VMware: NAT-instelling in de VM

DNS en GATEWAY

```
student@ubuntu-server:~$ networkctl status
●          State: routable
  Online state: online
    Address: 192.168.246.129 on ens33
             fe80::20c:29ff:fe48:bf7a on ens33
    Gateway: 192.168.246.2 on ens33
       DNS: 192.168.246.2
Search Domains: local
```

