

Einleitung

Alle Arbeiten wurden im dafür eingerichteten BFH-Lab erledigt. Das Lab hat folgende Architektur:

Network Configuration - Lab Setup

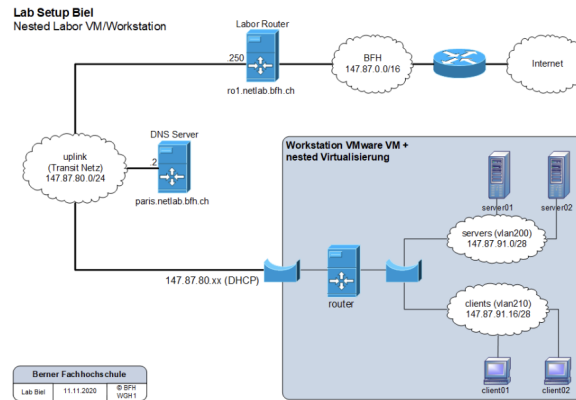


Figure 1: Architektur Lab

Zugangsdaten zum Lab:

username: netlab

password: hv\$mast3r

<https://147.87.85.239/>

Die Konfigurationen wurden wo möglich nicht via Webadmin sondern via Konfigurations-Datei erstellt.

Exercise 1 Static Routing

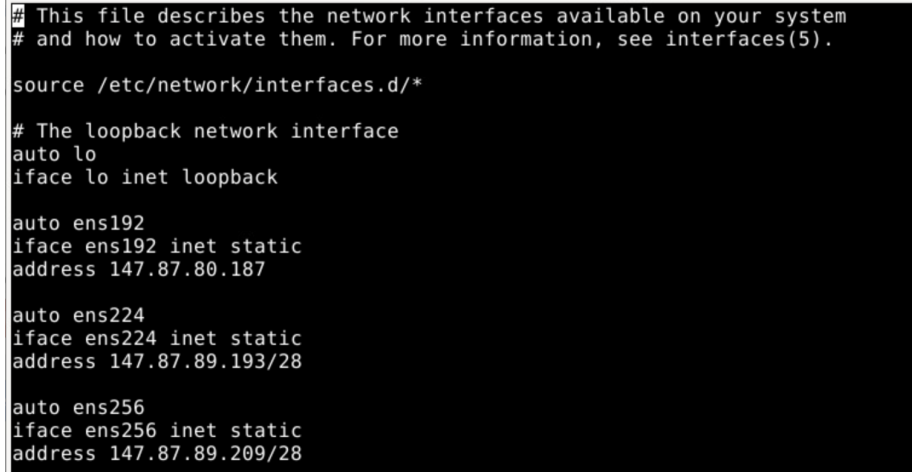
Task 2

Aufgabe

Now start the “router” VM and configure the router interfaces according to the guidelines1 for your group: “ens192” → uplink “ens224” → servers “ens256” → clients See “S22.L2 – Lab Networks and Names” → “Routing and DHCP information”. For the configuration you can use the administration tool “webmin”.

Erarbeitung

Die Interface-Konfiguration kann im File `/etc/network/interfaces` vorgenommen werden:

A screenshot of a terminal window showing the content of the file /etc/network/interfaces. The text is as follows:

```
# This file describes the network interfaces available on your system
# and how to activate them. For more information, see interfaces(5).

source /etc/network/interfaces.d/*

# The loopback network interface
auto lo
iface lo inet loopback

auto ens192
iface ens192 inet static
address 147.87.80.187

auto ens224
iface ens224 inet static
address 147.87.89.193/28

auto ens256
iface ens256 inet static
address 147.87.89.209/28
```

Figure 2: screenshot-interfaces-task2

`auto ens192` bedeutet, dass das Interface beim Befehl `ifup -a` automatisch aktiviert wird. (Task 3)

Task 4

Aufgabe

Now configure the “Default Route” of your router according to the guidelines.

Erarbeitung

Die “Default Route” kann mit folgendem Befehl zur Routing Tabelle hinzugefügt werden:

```
ip route add default via 147.87.80.250
```

Task 5

Aufgabe

In order for your router to resolve other machines by name, you must next configure its DNS resolver. (...)

Erarbeitung

Für diesen Task wurde die Datei `resolv.conf` editiert

```

root@router:/etc# cat resolv.conf
domain netlab.bfh.ch
search netlab.bfh.ch
nameserver 147.87.80.2
nameserver 147.87.89.194
search n087.nslab.ch

```

Figure 3: dns configuration

Die finale Konfiguration von `interfaces.d` sieht wir folgt aus:

```

source /etc/network/interfaces.d/*

# The loopback network interface
auto lo
iface lo inet loopback

auto ens192
iface ens192 inet static
    address 147.87.80.187
    gateway 147.87.80.250
    netmask 255.255.255.0
auto ens224
iface ens224 inet static
    address 147.87.89.193
    broadcast 147.87.89.207
    netmask 255.255.255.240
auto ens256
iface ens256 inet static
    address 147.87.89.209
    broadcast 147.87.89.223
    netmask 255.255.255.240
root@router:/etc/network#

```

Figure 4: screenshot file interfaces.d

Task 6

Aufgabe

Your DHCP server should start automatically after a reboot of the router.

Erarbeitung

Auch nach einem Reboot kann der Router die Webseite `based.cooking` erreichen.

```
-N <nodeinfo opt> use icmp6 node info query, try <help> as argument
For more details see ping(8).
root@router:~# ping -4 based.cooking
PING (205.185.115.79) 56(84) bytes of data:
64 bytes from lukesmith.xyz (205.185.115.79): icmp_seq=1 ttl=44 time=146 ms
64 bytes from lukesmith.xyz (205.185.115.79): icmp_seq=2 ttl=44 time=147 ms
64 bytes from lukesmith.xyz (205.185.115.79): icmp_seq=3 ttl=44 time=145 ms
64 bytes from lukesmith.xyz (205.185.115.79): icmp_seq=4 ttl=44 time=145 ms
64 bytes from lukesmith.xyz (205.185.115.79): icmp_seq=5 ttl=44 time=145 ms
64 bytes from lukesmith.xyz (205.185.115.79): icmp_seq=6 ttl=44 time=150 ms
^C
--- ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 5007ms
```

Figure 5: screenshot ping

Exercise 2 DHCP Server Configuration

In diesem Teil geht es darum, den DHCP-Server auf dem Router zu konfigurieren, so dass die Clients dynamische Adressen erhalten. ## Task 2

Aufgabe

Configure here the options “Domain name”, “DNS servers” with the domain and the DNS servers according to “S22.L2 – Lab Networks and Names” → “DNS information”) for your group. Set the “Default lease time” and the “Maximum lease time” to small values (e.g. 200 and 300 secs) so that later on DHCP traffic is generated on your networks and you can record and analyze it with “wireshark”.

Erarbeitung

Die Einstellungen konnten im File `/etc/dhcp/dhcpd.conf` vorgenommen werden:

Task 3

Aufgabe

Restrict the DHCP communication to the interface “ens256” under (Edit Network Interface). Select the interface and click (Save).

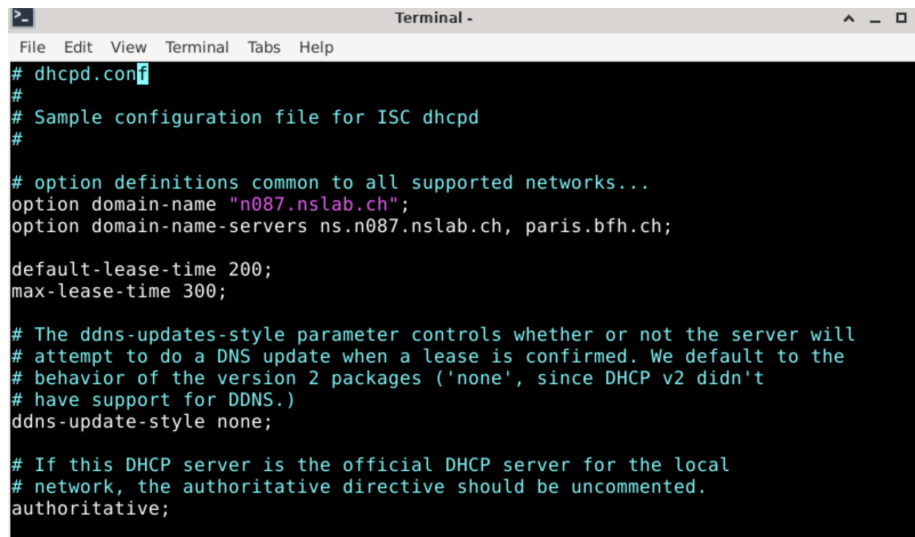
Erarbeitung

Die Restriktion, auf welchen Interfaces der Router DHCP-Adressen anbietet, kann in folgendem File getätigt werden: `> /etc/default/isc-dhcp-server`

task 4

Aufgabe

Now add your “clients” subnet using “Add a new subnet”: Enter as “Subnet description” e.g. “clients”. Enter the “Network address” according to the guidelines



```
Terminal -
File Edit View Terminal Tabs Help

# dhcpd.conf
#
# Sample configuration file for ISC dhcpd
#
# option definitions common to all supported networks...
option domain-name "n087.nslab.ch";
option domain-name-servers ns.n087.nslab.ch, paris.bfh.ch;

default-lease-time 200;
max-lease-time 300;

# The ddns-updates-style parameter controls whether or not the server will
# attempt to do a DNS update when a lease is confirmed. We default to the
# behavior of the version 2 packages ('none', since DHCP v2 didn't
# have support for DDNS.)
ddns-update-style none;

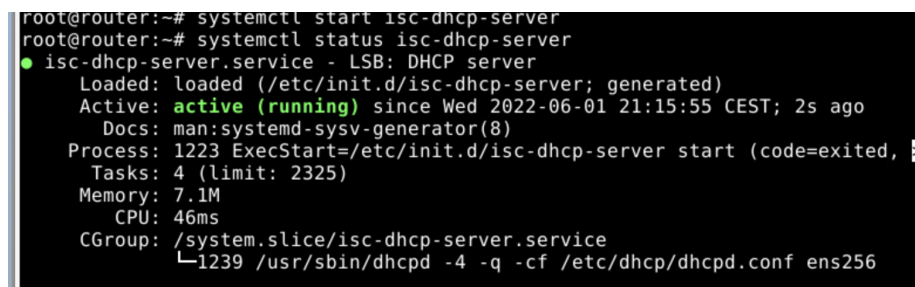
# If this DHCP server is the official DHCP server for the local
# network, the authoritative directive should be uncommented.
authoritative;
```

Figure 6: screenshot file dhcpd.conf

for your “clients” network. Calculate the “Netmask” for your “clients” network and enter it. Enter the address range (DHCP scope) for your “clients” network under “Address ranges”. Now create the subnet with (Create).

Erarbeitung

Hier hatten wir Probleme, dass der DHCP-Dienst nicht startete. Der Befehl `journalctl -xe` zeigt das Journal aller Systemd-Dienste. Dies hat uns aufgezeigt, dass unsere Konfiguration in `/etc/dhcp/dhcpd.conf` fehlerhaft war. Nach einer Korrektur, konnte der Dienst gestartet werden.



```
root@router:~# systemctl start isc-dhcp-server
root@router:~# systemctl status isc-dhcp-server
● isc-dhcp-server.service - LSB: DHCP server
   Loaded: loaded (/etc/init.d/isc-dhcp-server; generated)
   Active: active (running) since Wed 2022-06-01 21:15:55 CEST; 2s ago
     Docs: man:systemd-sysv-generator(8)
  Process: 1223 ExecStart=/etc/init.d/isc-dhcp-server start (code=exited,
    Tasks: 4 (limit: 2325)
   Memory: 7.1M
      CPU: 46ms
   CGroup: /system.slice/isc-dhcp-server.service
           └─1239 /usr/sbin/dhcpd -4 -q -cf /etc/dhcp/dhcpd.conf ens256
```

Figure 7: screenshot systemd dhcp

Ausschnitt aus `/etc/dhcp/dhcpd.conf`:

Nun können die Clients Adressen in der Range 147.87.89.210 - 222 / 28 beziehen.

```
# This is a very basic subnet declaration.

subnet 147.87.89.208 netmask 255.255.255.240 {
    range 147.87.89.210 147.87.89.222;
    option routers 147.87.89.209;
}
```

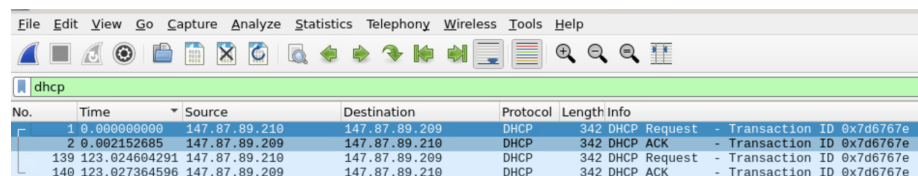
Figure 8: image dhcpd subnet

exercise 3

Im Exercise 3 geht es darum, die vorherigen Konfigurationen zu überprüfen. Der Router wie auch der DHCP-Server funktionierten wie erwartet.

task 1

Der folgende Screenshot zeigt ein Wireshark ausschnitt, welcher ein DHCP-Lease Ablauf zeigt zwischen dem Router(DHCP-Server) 147.87.89.209 und dem Client 147.87.89.209



No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	147.87.89.210	147.87.89.209	DHCP	342	DHCP Request - Transaction ID 0x7d6767e
2	0.002152685	147.87.89.209	147.87.89.210	DHCP	342	DHCP ACK - Transaction ID 0x7d6767e
139	123.024604291	147.87.89.210	147.87.89.209	DHCP	342	DHCP Request - Transaction ID 0x7d6767e
140	123.027364596	147.87.89.209	147.87.89.210	DHCP	342	DHCP ACK - Transaction ID 0x7d6767e

Figure 9: wireshark dhcp handshake

task 2/3

Der Client02 hat eine korrekte IP erhalten. ## task 4 Die Internet-Verbindung steht, diese kann normal genutzt werden.

```
this operation.  
  
C:\Users\user>ipconfig /renew  
  
Windows IP Configuration  
  
Ethernet adapter Ethernet0:  
  
    Connection-specific DNS Suffix  . : n087.nslab.ch  
    Link-local IPv6 Address . . . . . : fe80::2c69:e0b3:4ded:7c2a%6  
    IPv4 Address. . . . . : 147.87.89.211  
    Subnet Mask . . . . . : 255.255.255.240  
    Default Gateway . . . . . : 147.87.89.209  
  
C:\Users\user>
```

Figure 10: screenshot ipconfig windows

```
C:\Users\user>ping www.google.com  
  
Pinging www.google.com [172.217.168.36] with 32 bytes of data:  
Reply from 172.217.168.36: bytes=32 time=4ms TTL=111  
Reply from 172.217.168.36: bytes=32 time=4ms TTL=111  
Reply from 172.217.168.36: bytes=32 time=4ms TTL=111  
  
Ping statistics for 172.217.168.36:  
    Packets: Sent = 3, Received = 3, Lost = 0 (0% loss),  
    Approximate round trip times in milli-seconds:  
        Minimum = 4ms, Maximum = 4ms, Average = 4ms  
Control-C  
^C  
C:\Users\user>
```

Figure 11: screenshot ping google