

Linux Networking

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1 Ausgangslage

2 Kochbuch

It is expected of you to hand in a step-by-step cookbook for the whole final setup. Explain important commands and reason your decisions. We should be able to fully retrace what you did to be able to assess your work. One cookbook is expected per group.

2.1 General

Change the password ... Also, change the hostname to the name given in LTB.

Wir verbinden uns auf jeden Container und ändern den Inhalt der Datei `/etc/hostname` auf den Namen des Containers. Dafür benützen wir `sudo nano /etc/hostname`, ändern den Namen und speichern mit Ctrl-O und beenden nano mit Ctrl-X. Zusätzlich rufen wir `sudo hostname <newHostName>` auf.

Wir setzen das Passwort des jeweiligen Containers auf seinen Namen mit `sudo passwd ins`.

2.2 IP Address Assignment

Use Netplan to assign the ip addresses to the interfaces. ...

Name	IP
Client	ENS2: 172.16.0.2
R1	ENS2: 172.16.0.1 ENS3: 10.0.1.1
R2	ENS2: 10.0.1.2 ENS3: 10.0.4.1 ENS4: 10.0.2.1
R3	ENS2: 10.0.2.2 ENS3: 10.0.5.1 ENS4: 10.0.3.1
R4	ENS2: 10.0.4.2 ENS3: 10.0.5.2 ENS4: 10.0.100.1
R5	ENS2: 10.0.3.2 ENS3: 192.168.1.1
Server	?: 192.168.1.100
MITM	ENS2: 10.0.100.2

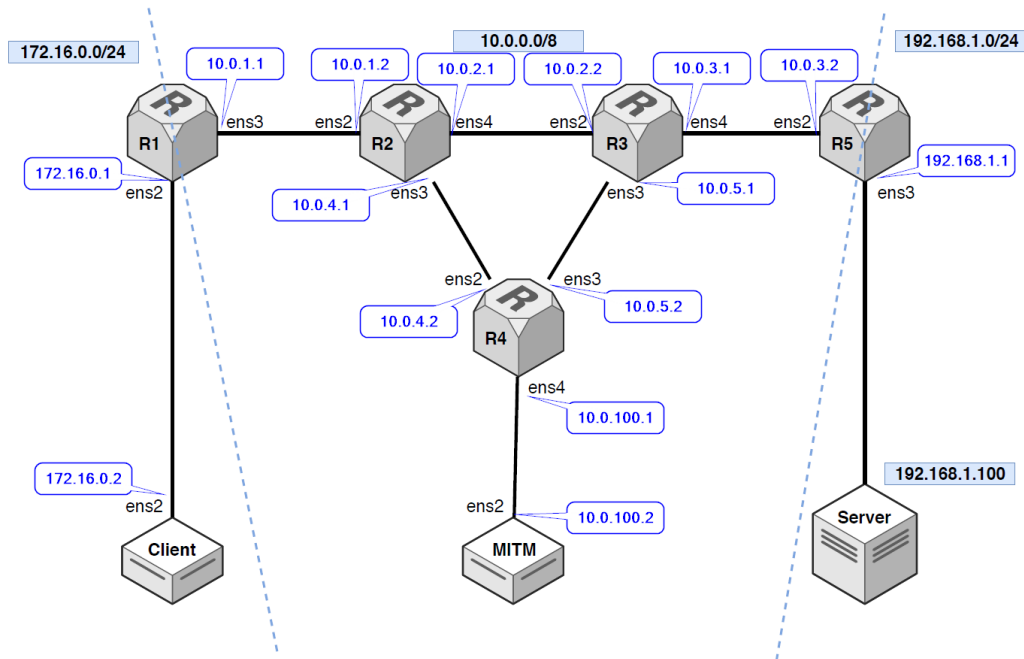


Abbildung 1: Netplan

Die Adressen sind so definiert, dass jede Verbindung ein eigenes Subnet hat. Bird sucht seine Nachbarn anhand des Broadcasts.

Wir ändern den netplan mit `sudo nano /etc/netplan/50-cloud-init.yaml`.

```

1 # This file is generated from information provided by
2 # the datasource. Changes to it will not persist across an instance.
3 # To disable cloud-init's network configuration capabilities, write a file
4 # /etc/cloud/cloud.cfg.d/99-disable-network-config.cfg with the following:
5 # network: {config: disabled}
6 network:
7   version: 2
8   ethernets:
9     ens2:
10       dhcp4: false
11       addresses: [172.16.0.1/24]
12     ens3:
13       dhcp4: false
14       addresses: [10.0.1.1/24]

```

Listing 1: /etc/netplan/50-cloud-init.yaml on R1

Mit `netplan apply` übernehmen wir die neu definierten IP-Adressen.

2.3 BIRD

Now, your routers must run OSPF. ...

- OSPFv2 must run on the routers.
- Find a way to protect the CPU from too much OSPF processing.
- A restart of BIRD should not result in lost routes.

Wir definieren die Configuration von Bird indem wir `/etc/bird/bird.conf` anpassen.

2.4 IP Forwarding

"IP-Forwarding" ist standartgemäs ausgeschaltet. Mit `sysctl net.ipv4.ip_forward=1` aktivieren wird das weiterleiten der Packete erlaubt.

2.5 Script

Da wir keine Ahnung von "Bird" hatten, wurde das Anpassen und Testen der Configuration aufwendig, weshalb wir kurzer Hand ein Script erzeugten, welche die zuvor definierten Einstellungen anwendet:

```
1  #!/bin/bash
2
3  setup_hostname()
4  {
5      echo "Set hostname to $1"
6      echo "$1" > '/etc/hostname'
7      hostname $1
8  }
9
10 setup_ip()
11 {
12     echo "Setup netplan"
13     cat <<EOF > '/etc/netplan/50-cloud-init.yaml'
14 # This file is generated from information provided by $0
15 # Changes to it will not persist across an instance.
16 # To disable cloud-init's network configuration capabilities, write a file
17 # /etc/cloud/cloud.cfg.d/99-disable-network-config.cfg with the following:
18 # network: {config: disabled}
19 network:
20     version: 2
21     ethernets:
22 EOF
23     if [ $# -ge "1" ]; then
24         echo " ens2 = $1"
25         cat <<EOF >> '/etc/netplan/50-cloud-init.yaml'
26         ens2:
27             dhcp4: false
28             addresses: [$1]
29 EOF
30     fi
31     if [ $# -ge "2" ]; then
32         echo " ens3 = $2"
33         cat <<EOF >> '/etc/netplan/50-cloud-init.yaml'
34         ens3:
35             dhcp4: false
36             addresses: [$2]
37 EOF
38     fi
39     if [ $# -ge "3" ]; then
40         echo " ens4 = $3"
41         cat <<EOF >> '/etc/netplan/50-cloud-init.yaml'
42         ens4:
43             dhcp4: false
44             addresses: [$3]
45 EOF
46     fi
47 }
48
49 setup_bird()
50 {
51     echo "Setup bird"
52     cat <<EOF > '/etc/bird/bird.conf'
53 # This file is generated from information provided by $0
54 # Please refer to the documentation in the bird-doc package or BIRD User's
55 # Guide on http://bird.network.cz/ for more information on configuring BIRD
56 # and
57 # adding routing protocols.
58 # log "/var/log/bird.log" all;
59 log syslog { info, remote, warning, error, auth, fatal, bug };
```

```

60
61 # Change this into your BIRD router ID.
62 router id $1;
63
64 # The Device protocol is not a real routing protocol. It doesn't generate
    any
65 # routes and it only serves as a module for getting information about
    network
66 # interfaces from the kernel.
67 protocol device {
68     scan time 1; # Scan interfaces every 10 seconds
69 }
70
71 # The Kernel protocol is not a real routing protocol. Instead of
    communicating
72 # with other routers in the network, it performs synchronization of BIRD's
73 # routing tables with the OS kernel.
74 protocol kernel {
75     metric 64;          # Use explicit kernel route metric to avoid collisions
76                        # with non-BIRD routes in the kernel routing table
77     persist;           # Don't remove routes on BIRD shutdown
78     scan time 20;      # Scan kernel routing table every 20 seconds
79     import none;
80     export all;        # Actually insert routes into the kernel routing table
81 }
82
83
84 protocol rip {
85     export all;
86     import all;
87     interface "*";
88 }
89
90 protocol static {
91     import all;
92 }
93 EOF
94
95     for var in "$@"
96     do
97         echo " $var"
98         if [ "$var" != "$1" ]; then
99             echo "         route $var;" >> '/etc/bird/bird.conf'
100         fi
101     done
102
103     cat <<EOF >> '/etc/bird/bird.conf'
104 }
105
106 protocol ospf {
107     tick 1;          # The routing table calculation and clean-up of areas'
                        # databases is not performed when a single link
108                        # state change arrives. To lower the CPU utilization,
                        # it's processed later at periodical intervals of num
109                        # seconds. The default value is 1.
110     import all;
111     #export filter {
112     #    ospf_metric1 = 1000;
113     #    if source = RTS_STATIC then accept; else reject;
114     #};
115
116     area 0 {
117         networks {
118             10.0.0.0/8;
119             172.16.0.0/24;
120             192.168.1.0/24;

```

```

121     };
122
123     interface "ens*" {
124         cost 5;
125         type broadcast;
126         hello 5;
127         retransmit 2;
128         wait 10;
129         dead 20;
130     };
131
132     interface "*" {
133         cost 1000;
134         stub;
135     };
136 };
137 }
138
139 EOF
140 sysctl net.ipv4.ip_forward=1
141 ip route flush table main
142 bird -p
143 birdc down
144 # bird -R
145 systemctl start bird
146 birdc show status
147 systemctl status bird
148 }
149
150 setup()
151 {
152     echo "Start setup for '$1'"
153     case $1 in
154         Client)
155         setup_hostname "Client"
156         setup_ip "172.16.0.2/24"
157         echo "          gateway4: 172.16.0.1" >> '/etc/netplan/50-
            cloud-init.yaml'
158         ;;
159         MITM)
160         setup_hostname "MITM"
161         setup_ip "10.0.100.2"
162         echo "          gateway4: 10.0.100.1" >> '/etc/netplan/50-
            cloud-init.yaml'
163         ;;
164         R1)
165         setup_hostname "R1"
166         setup_ip "172.16.0.1/24" "10.0.1.1/24"
167         setup_bird "1.1.1.1" "172.16.0.0/24 via \"ens2\""
168         # "10.0.0.0/8 via \"ens3\""
169         ;;
170         R2)
171         setup_hostname "R2"
172         setup_ip "10.0.1.2/24" "10.0.4.1/24" "10.0.2.1/24"
173         setup_bird "2.2.2.2"
174         # "10.0.1.0/24 via \"ens2\"" "10.0.4.0/24 via \"ens3\""
            "10.0.3.0/24 via \"ens4\""
175         ;;
176         R3)
177         setup_hostname "R3"
178         setup_ip "10.0.2.2/24" "10.0.5.1/24" "10.0.3.1/24"
179         setup_bird "3.3.3.3"
180         # "10.0.2.0/24 via \"ens2\"" "10.0.4.0/24 via \"ens3\""
            "10.0.5.0/24 via \"ens4\""
181         ;;
182         R4)

```

```

183         setup_hostname "R4"
184         setup_ip "10.0.4.2/24" "10.0.5.2/24" "10.0.100.1/24"
185         setup_bird "4.4.4.4"
186         ;;
187     R5)
188         setup_hostname "R5"
189         setup_ip "10.0.3.2/24" "192.168.1.1/24"
190         setup_bird "5.5.5.5" "192.168.1.0/24 via \"ens3\""
191         # "10.0.0.0/8 via \"ens2\""
192         ;;
193     *)
194         echo "name is unknown..."
195         exit 1
196         ;;
197     esac
198     netplan apply
199 }
200
201 echo "CldInf Networker"
202 if [ "$EUID" -ne 0 ]; then
203     echo "Please run as root"
204     exit 1
205 elif [ $# -lt "1" ]; then
206     hostname=$(hostname)
207     case $hostname in
208         Client|MITM|R1|R2|R3|R4|R5)
209             setup $hostname
210             ;;
211         *)
212             echo "Usage: $0 <name>"
213             echo " name = Client, MITM, [R1 .. R5]"
214             exit 1
215             ;;
216     esac
217 else
218     setup $1
219 fi

```

Listing 2: /doConfig.sh

3 Verifizierung

Verify your routing implementation. Explain which exact commands you used for each verification step and show how they provide prove that your setup works.

3.1 Route Failover

Verify that your setup works. Prove that a route failover takes place in case of a route outage. To do that, a well known tool can be used.

3.2 Passive Interfaces

Show that no OSPF packets are sent into the client and server networks, too. `tcpdump` and `tshark` are good tools for that, sniff on the suspicious interfaces and filter for OSPFv2 packets. To be sure that your filter works, sniff on an interface where you expect OSPF-messages, too.

3.3 Access Website

Finally, you must be able to access the webpage from the webserver. You can use `curl` or `wget` for that. The webserver listens on port 8080.

4 Performanz

Provide the measurement before and after the appliance of the `tc` commands.
Provide the exact used `tc` commands.

5 Referenzblatt

We also expect you to hand in a reference sheet for all the net-work commands used in this lab. Just list every command and its function. This reference must not be longer than one page.

Befehl	Funktion
<code>sudo nano <Pfad></code>	Öffnen eines Files im Texteditor
<code>sudo nano hostname <newHostName></code>	Zum ändern des Hostnames
<code>sudo nano passwd <user></code>	Editieren vom passwd file im Terminal
<code>sudo birdc</code>	Zum kommunizieren mit einem laufenden BIRD
<code>sudo birdc show status</code>	Anzeigen vom router status, BIRD version, Laufzeit und Zeitpunkt von der letzten Rekonfiguration.
<code>sudo birdc show interfaces</code>	Anzeigen der Liste von allen Interfaces. Zeigt für jedes Interface, Typ, Status, MTU und die zugewiesene Adresse an.
<code>sudo birdc show ospf interface</code>	Anzeigen von detaillierten Informationen über die OSPF Interfaces.
<code>birdc show ospf neighbors</code>	Anzeigen der Liste mit allen OSPF Nachbarn deren Zustand.
<code>birdc show ospf state</code>	Anzeigen von detaillierten Informationen über OSPF Bereiche basierend auf der link-state database. Es zeigt die Netzwerk Topologie, stub Netzwerke, zusammengeführte Netzwerke und Router von anderen Areas und externen Routen. Ausserdem zeigt es erreichbare Netzwerk Knoten an.
<code>ping -c <num> <ip></code>	sendet num mal einen Ping an die ip
<code>tcptraceroute <ip></code>	Zum Anzeigen vom Pfad im Netzwerk vom Host, auf dem die Traceroute ausgeführt wird, und der angegebenen IP, sowie dem Ort, an dem die Route, falls vorhanden, nicht abgeschlossen werden kann und allen Hops bis zum Ziel.
<code>blub</code>	blob
<code>blub</code>	blob
<code>blub</code>	blob

6 Anhänge

6.1 Routing

- Your delivered report must include the new usernames and pass-words of the hosts.
- Your delivery must contain the created netplan files and an address plan.
- Attach the BIRD config files to your cookbook and explain how you achieve the minimal requirements.
- Verify your routing implementation. Explain which exact commands you used for each verification step and show how they provide proof that your setup works.

Erarbeitung der BIRD-config ist im 2.3 erläutert. Verifikation der Routing unter 3.

6.2 Firewall

We're interested in the used `nmap` command, where the firewall runs and why you've chosen that location. Print the ruleset of the firewall and attach it to your report.