Lab 3 – DHCP, ARP, VRRP

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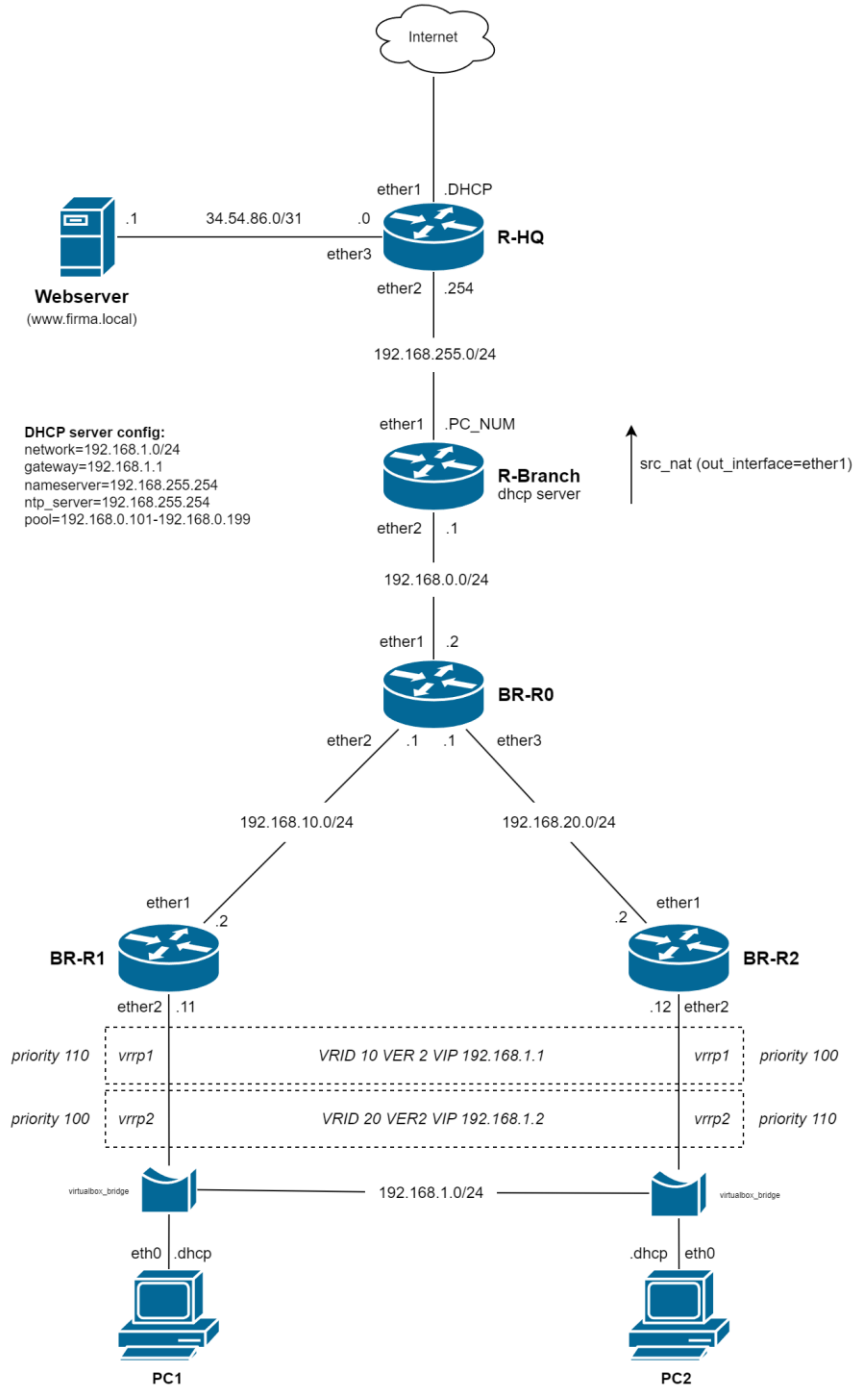
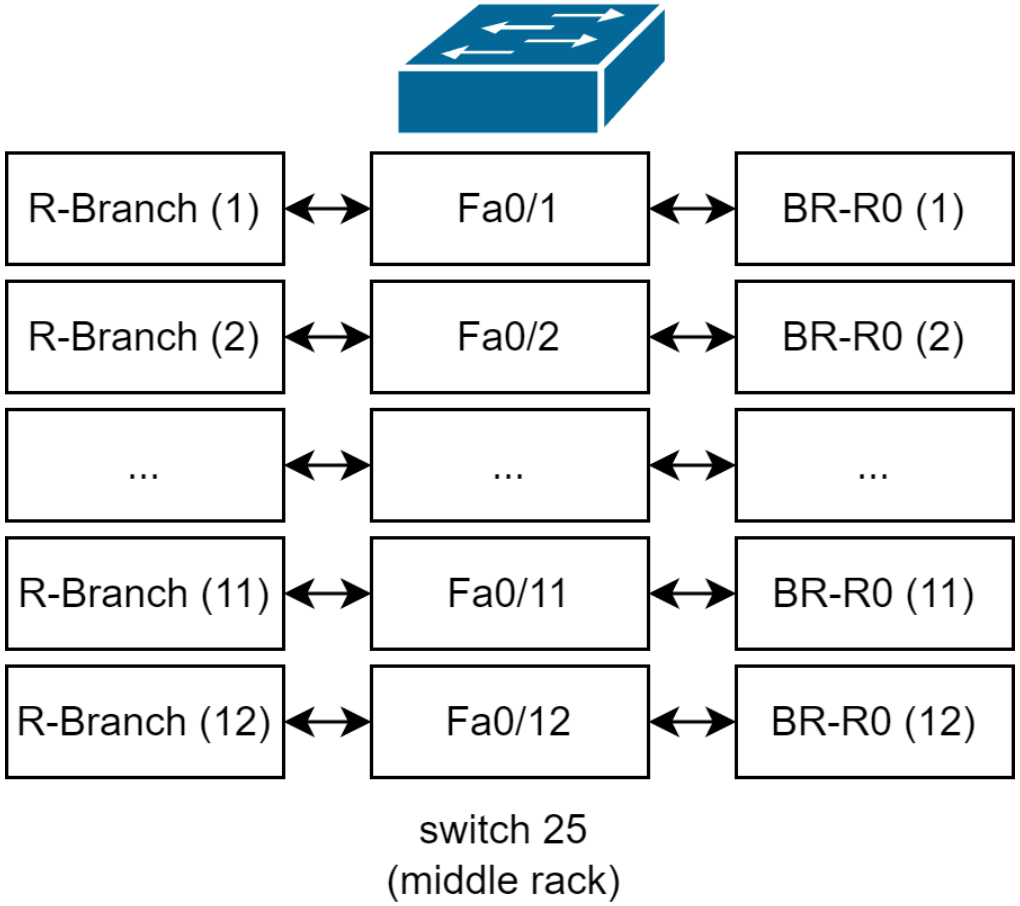
Agenda

- DHCP server/client/relay, DHCP snooping
- VRRP (+loadbalancing)
- ARP table, ARP modes
- static routing

Network Topology



Interconnection with virtual environment



Virtual site remote access

Group	Device	SW25 port	URL	Telnet port
1	R-Branch1	Fa0/1	mlab.pef.mendelu.cz	30001
2	R-Branch2	Fa0/2		30002
3	R-Branch3	Fa0/3		30003
4	R-Branch4	Fa0/4		30004
5	R-Branch5	Fa0/5		30005
6	R-Branch6	Fa0/6		30006
7	R-Branch7	Fa0/7		30007
8	R-Branch8	Fa0/8		30008
9	R-Branch9	Fa0/9		30009
10	R-Branch10	Fa0/10		30010
11	R-Branch11	Fa0/11		30011
12	R-Branch12	Fa0/12		30012

Remote telnet connection can be initiated only from host (physical) computer!

Configuration

commands reference

Basics – Hostname

Set device hostname:

```
/system/identity set name=<hostname>
```

Basics – IP addressing

Add new IP address:

```
/ip address/add address=X.X.X.X/X interface=X
```

Verification:

```
/ip address/print detail

Flags: X - disabled, I - invalid, D - dynamic
 0   address=192.168.10.2/24 network=192.168.10.0 interface=ether1
     actual-interface=ether1

 1   address=192.168.1.11/24 network=192.168.1.0 interface=ether2
     actual-interface=ether2
```

Basics – static routes

Add new static route:

```
/ip route/add disabled=no dst-address=X.X.X.X/X gateway=X.X.X.X
```

Verification:

```
/ip route/print {detail}

Flags: D - DYNAMIC; A - ACTIVE; c - CONNECT, s - STATIC
Columns: DST-ADDRESS, GATEWAY, DISTANCE
#      DST-ADDRESS       GATEWAY         DISTANCE
0  As  0.0.0.0/0         192.168.1.25           1
   DAc 192.168.1.0/24    ether2                 0
   DAc 172.16.1.1/30     eoip1                  0
   DAc 10.0.255.255/32   lo0                    0
```

Basics – IP pool

Add new pool:

```
/ip pool add name=<pool_name> ranges=<start_ip>-<end_ip>
```

Verification:

```
/ip pool/print {detail}

Columns: NAME, RANGES
#  NAME   RANGES
0  pool1  172.16.12.11-172.16.12.12
```

Basics – DHCP network

Create new DHCP network:

```
/ip dhcp-server/network/add address=<network_id>/<mask> dns-
server=<nameserver> domain=<fqdn> gateway=<gateway>
```

Verification:

```
/ip dhcp-server/network/print {detail}

Columns: ADDRESS, GATEWAY, DNS-SERVER, DOMAIN
# ADDRESS          GATEWAY      DNS-SERVER     DOMAIN
0 10.0.0.0/24      10.0.0.1     10.0.0.10      firma.cz
```

Basics – DHCP server

Create new DHCP server:

```
/ip dhcp-server/add add address-pool=<ip_pool> interface=<interface>
name=<server_name>
```

Verification:

```
/ip dhcp-server/print {detail}

Columns: NAME, INTERFACE, RELAY, ADDRESS-POOL, LEASE-TIME
# NAME     INTERFACE  RELAY            ADDRESS-POOL  LEASE-TIME
0 server1  ether1     255.255.255.255  pool1         30m
```

Basics – DHCP leases

Add new static lease:

```
/ip dhcp-server/lease add address=192.168.1.199 mac-
address=12:34:56:11:0B:02 server=server1
```

Display DHCP server leases (both dynamic and static):

```
/ip dhcp-server/lease print

Flags: D - DYNAMIC
Columns: ADDRESS, MAC-ADDRESS, HOST-NAME, SERVER, STATUS, LAST-SEEN
#   ADDRESS         MAC-ADDRESS         HOST-NAME  SERVER   STATUS  LAST-SEEN
0   192.168.1.199   12:34:56:11:0B:02   site       server1  bound   3m37s
1 D 192.168.1.198   12:34:56:11:0B:01   site       server1  bound   2m28s
```

Basics – DHCP client

Add new DHCP client:

```
/ip/dhcp-client/add interface=<interface> add-default-route=<yes|no>
use-peer-dns=<yes|no> use-peer-ntp=<yes|no>
```

Verification:

```
/ip address/print {detail}


/ip/dhcp-client print {detail}


0   interface=ether1 add-default-route=yes default-route-distance=1
use-peer-dns=yes use-peer-ntp=yes dhcp-options=hostname,clientid
status=bound address=10.43.128.1/24 gateway=10.43.128.2 dhcp-
server=10.43.128.5 primary-dns=195.178.72.150 secondary-dns=8.8.8.8
primary-ntp=195.178.72.110 expires-after=9m57s
```

Basics – DHCP relay

Add new DHCP relay:

```
/ip/dhcp-relay/add name=<relay_name> dhcp-server=<server_ip> disabled=no
interface=<client_interface> local-address=<local_ip>
```

Verification:

```
/ip/dhcp-relay/print {detail}

Columns: NAME, INTERFACE, DHCP-SERVER, LOCAL-ADDRESS
# NAME    INTERFACE  DHCP-SERVER    LOCAL-ADDRESS
0 relay1  ether1     5.5.5.5        1.2.3.4
```

DHCP snooping

Req. config on bridge:

```
/interface/bridge set <bridge> dhcp-snooping=yes
```

Req. config on port:

```
/interface/bridge set bridge=<bridge> port=<port> trusted=yes
```

Source NAT (masquerade)

Create new Firewall NAT rule:

```
/ip/firewall/nat/add action=masquerade chain=srcnat out-interface=<intf>
```

Verification:

```
/ip/firewall/nat/print {detail}

Flags: X - disabled, I - invalid; D - dynamic
 0    chain=srcnat action=masquerade out-interface=ether1 log=no log-
prefix="“

/ip/firewall/nat/print chain=srcnat stats

Columns: CHAIN, ACTION, BYTES, PACKETS
# CHAIN   ACTION        BYTES   PACKETS
0 srcnat  masquerade  691 083    13 026
```

ARP

View ARP cache:

```
/ip/arp print {detail}
#    ADDRESS          MAC-ADDRESS         INTERFACE
0 DC 192.168.1.2      00:00:5E:00:01:02   ether2
1 DC 192.168.1.12     12:34:56:88:0B:02   ether2
```

Configuration on ethernet interface (bridge):

```
/interface/ethernet set <ethernet> arp=<arp_mode>
/interface/bridge set <bridge> arp=<arp_mode>
```

Verification:

```
/interface/ethernet print detail
/interface/bridge print detail
```

VRRP (example config)

Master:

```
/interface/vrrp/add
authentication=ah
password=thisissupersecretkey
interface=ether1 name=vrrp1
preemtion-mode=yes version=2
vrid=10 priority=110
```

Backup:

```
/interface/vrrp/add
authentication=ah
password=thisissupersecretkey
interface=ether1 name=vrrp1
preemtion-mode=no version=2
vrid=10 priority=100
```

Verification (master,backup):

```
/interface/vrrp/print detail
```

VRRP load balancing

Add another VRRP instance on both routers. Don’t forget to assign correct IP to VRRP interface.

Backup:

```
/interface/vrrp/add
authentication=ah
password=thisissupersecretkey
interface=ether1 name=vrrp1
preemtion-mode=no version=2
vrid=20 priority=100
```

Master:

```
/interface/vrrp/add
authentication=ah
password=thisissupersecretkey
interface=ether1 name=vrrp1
preemtion-mode=yes version=2
vrid=20 priority=110
```

…and now test router outage ☺

Lab completion checklist

What should work

- ping between any device within .1, .10, .20, and .0 networks
- BR-R1 and BR-R2 failover
- traffic load balance between BR-R1 and BR-R2
- DNS resolver and NTP server on 192.168.255.1
- WEB server at www.firma.local accessible from both PC1 and PC2
- internet access

What should not work (why?)

- ping between webserver/R-HQ and any endpoint behind R-Branch