

Zad 1 Udostępnienie strony apache

Na SRV1 wydajemy polecenia:

```
# apt update  
# apt install apache2  
  
# mkdir -p /www/strona1  
# echo "strona testowa SRV1" > /www/strona1/index.html
```

Na SRV2 wydajemy polecenia:

```
# apt update  
# apt install apache2  
  
# mkdir -p /www/strona2  
# echo "strona testowa SRV2" > /www/strona2/index.html
```

[SRV1 i SRV2] Tworzymy i modyfikujemy plik:

```
/etc/apache2/sites-available/contoso.conf [-M--] 0  
  
<VirtualHost *:80>  
DocumentRoot /www/strona1  
ServerName srv1.contoso.com  
ServerAlias www.contoso.com  
ServerAdmin admin@contoso.com  
  
<Directory /www/strona1/>  
Options Indexes  
Require all granted  
</Directory>  
  
</VirtualHost>
```

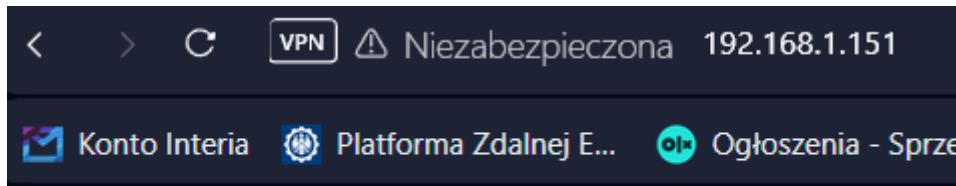
Następnie modyfikujemy:

```
/etc/apache2/apache2.conf [-M--] 11 L:[  
<Directory /www/>  
    Options Indexes FollowSymLinks  
    AllowOverride None  
    Require all granted  
</Directory>  
  
#<Directory /srv/>  
#    Options Indexes FollowSymLinks  
#    AllowOverride None  
#    Require all granted  
#</Directory>
```

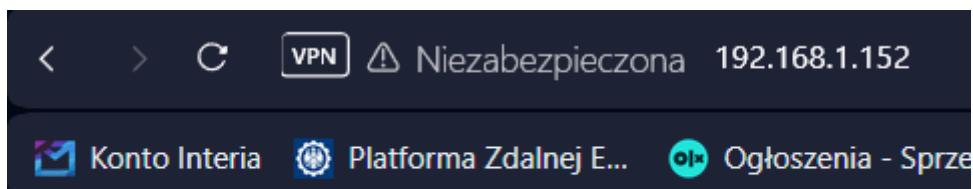
Wydajemy polecenie: `a2ensite contoso.conf && systemctl restart apache2`

Musiałem wydać jeszcze polecenia (wyłączenie domyślnej strony apache):

```
srv1@SRV1:~$ sudo a2dissite 000-default.conf
Site 000-default disabled.
To activate the new configuration, you need to run:
  systemctl reload apache2
srv1@SRV1:~$ sudo systemctl reload apache2
srv1@SRV1:~$
```

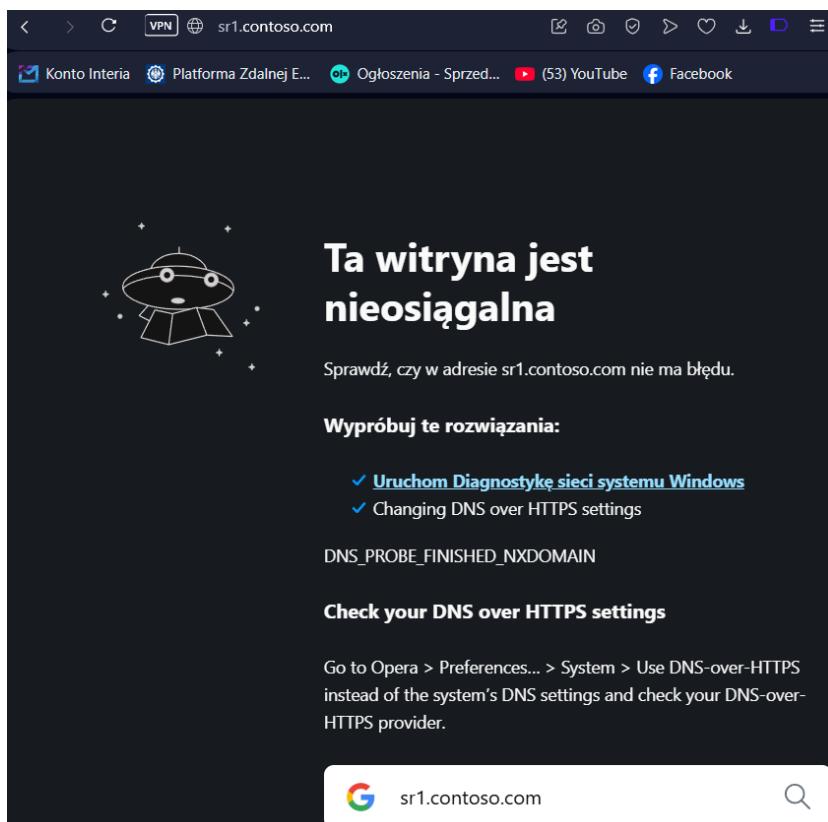


strona testowa SRV1



strona testowa SRV2

W razie wyłączenia serwera:



Zad 2 Konfiguracja DNS

```
apt update && apt install bind9 -y
```

[LB1] Edytujemy plik:

```
/etc/bind/named.conf.default-zones [-M--  
// broadcast zones as per RFC 1912  
  
zone "localhost" {  
<---->type master;  
<---->file "/etc/bind/db.local";  
};  
  
zone "127.in-addr.arpa" {  
<---->type master;  
<---->file "/etc/bind/db.127";  
};  
  
zone "0.in-addr.arpa" {  
<---->type master;  
<---->file "/etc/bind/db.0";  
};  
  
zone "255.in-addr.arpa" {  
<---->type master;  
<---->file "/etc/bind/db.255";  
};  
  
zone "contoso.com" {  
type master;  
file "/etc/bind/db.contoso.com";  
};
```

```
cp /etc/bind/db.local /etc/bind/db.contoso.com
```

Modyfikujemy plik:

```
/etc/bind/db.contoso.com [---] 0 L:[ 1+21 22/ 22] *(433 / 0  
;  
; BIND data file for local loopback interface  
;  
$TTL<-->604800  
@<---->IN<---->SOA<---->contoso.com. root.contoso.com. (  
<----><----><----> 2><---->; Serial  
<----><----><----> 604800><---->; Refresh  
<----><----><----> 86400><---->; Retry  
<----><----><---->2419200><---->; Expire  
<----><----><----> 604800 )<---->; Negative Cache TTL  
;  
@<---->IN<---->NS<---->ns1.contoso.com.  
ns1<---->IN<---->A<---->192.168.1.141  
lb1<---->IN<---->A<---->192.168.1.141  
lb2<---->IN<---->A<---->192.168.1.142  
srv1<-->IN<---->A<---->192.168.1.151  
srv2<-->IN<---->A<---->192.168.1.152  
  
www<---->10<---->IN<---->A<---->192.168.1.151  
www<---->10<---->IN<---->A<---->192.168.1.152  
@<---->IN<---->AAAA<-->::1
```

Sprawdzamy poprawność:

```
$ sudo named-checkzone contoso.com /etc/bind/db.contoso.com
zone contoso.com/IN: loaded serial 2
OK
```

`systemctl reload bind9`

Sprawdzamy połączenie:



```
C:\Users\lenovo>ping lb1.contoso.com
Pinging lb1.contoso.com [192.168.1.141] with 32 bytes of data:
Reply from 192.168.1.141: bytes=32 time<1ms TTL=64
Reply from 192.168.1.141: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.1.141:
    Packets: Sent = 2, Received = 2, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
Control-C
^C
C:\Users\lenovo>ping srv1.contoso.com

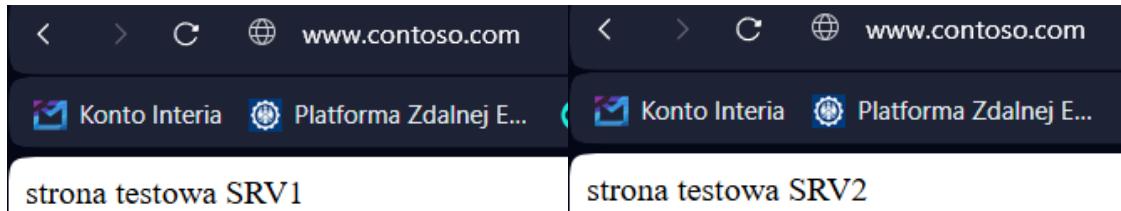
Pinging srv1.contoso.com [192.168.1.151] with 32 bytes of data:
Reply from 192.168.1.151: bytes=32 time<1ms TTL=64
Reply from 192.168.1.151: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.1.151:
    Packets: Sent = 2, Received = 2, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
Control-C
^C
```

```
C:\Users\lenovo>ping www.contoso.com  
Pinging www.contoso.com [192.168.1.151] with 32 bytes of data:  
Reply from 192.168.1.151: bytes=32 time<1ms TTL=64  
Reply from 192.168.1.151: bytes=32 time<1ms TTL=64  
  
Ping statistics for 192.168.1.151:  
    Packets: Sent = 2, Received = 2, Lost = 0 (0% loss),  
Approximate round trip times in milli-seconds:  
    Minimum = 0ms, Maximum = 0ms, Average = 0ms  
Control-C  
^C  
C:\Users\lenovo>ping www.contoso.com  
Pinging www.contoso.com [192.168.1.152] with 32 bytes of data:  
Reply from 192.168.1.152: bytes=32 time<1ms TTL=64  
Reply from 192.168.1.152: bytes=32 time<1ms TTL=64  
  
Ping statistics for 192.168.1.152:  
    Packets: Sent = 2, Received = 2, Lost = 0 (0% loss),  
Approximate round trip times in milli-seconds:  
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

```
www.contoso.com  
-----  
Record Name . . . . . : www.contoso.com  
Record Type . . . . . : 1  
Time To Live . . . . . : 281079  
Data Length . . . . . : 4  
Section . . . . . . . : Answer  
A (Host) Record . . . . : 192.168.1.151
```

```
www.contoso.com  
-----  
Record Name . . . . . : www.contoso.com  
Record Type . . . . . : 1  
Time To Live . . . . . : 281168  
Data Length . . . . . : 4  
Section . . . . . . . : Answer  
A (Host) Record . . . . : 192.168.1.152
```



Zad 3 Konfiguracja VRRP

```
apt update && apt install keepalived -y  
  
# echo "net.ipv4.ip_nonlocal_bind=1">>>/etc/sysctl.conf  
# sysctl -p  (włączamy obsługę nieprzypisanych adresów IP)
```

Tworzymy plik:

```
srv1@SRV1: ~          X  srv2@SRV2: ~  
  
/etc/keepalived/keepalived.conf  [-M--]  9 L  
  
global_defs {  
    notification_email {  
        admin@example.com  
    }  
    notification_email_from noreply@example.com  
    smtp_server 127.0.0.1  
    smtp_connect_timeout 60  
}  
  
  
vrrp_instance VRRP_1 {  
    interface enp0s3  
    state BACKUP  
    virtual_router_id 51  
    priority 100  
    advert_int 2  
    nopreempt  
  
    authentication {  
        auth_type AH  
        auth_pass password  
    }  
  
    virtual_ipaddress {  
        192.168.1.153  
    }  
}
```

```
/etc/keepalived/keepalived.conf [-M--] 17 L:[ 1+23 24/ 26] *(923 / 964b) 0c
global_defs {
    notification_email {
        admin@example.com          # Odbiorca powiadomień e-mail
    }
    notification_email_from noreply@example.com # Nadawca powiadomień
    smtp_server 127.0.0.1                  # Serwer SMTP
    smtp_connect_timeout 60                 # Timeout SMTP (sekundy)
}

vrrp_instance VRRP_1 {
    interface enp0s3                      # Interfejs VRRP
    state MASTER                           # Rola początkowa (MASTER lub BACKUP)
    virtual_router_id 51                  # Unikalny ID grupy VRRP
    priority 101                          # Priorytet (większy = bardziej preferowany)
    advert_int 2                          # Czas między ogłoszeniami (sekundy)
    nopreempt                            # Brak przejmowania roli MASTER po powrocie

    authentication {
        auth_type AH                      # Typ uwierzytelnienia
        auth_pass password               # Hasło do VRRP
    }

    virtual_ipaddress {
        192.168.1.153                   # Wirtualny adres IP
    }
}
```

Na obu maszynach:

```
# systemctl enable keepalived  
# systemctl start keepalived
```

Sprawdzamy działanie :

```
C:\Users\lenovo>ping 192.168.1.153
Pinging 192.168.1.153 with 32 bytes of data:
Reply from 192.168.1.153: bytes=32 time<1ms TTL=64
Reply from 192.168.1.153: bytes=32 time<1ms TTL=64
Reply from 192.168.1.153: bytes=32 time<1ms TTL=64

C:\Users\lenovo>arp -a

Interface: 192.168.1.107 --- 0xc
Internet Address          Physical Address      Type
192.168.1.1                c0-94-ad-3e-b3-24  dynamic
192.168.1.102              b0-19-21-ab-2d-68  dynamic
192.168.1.104              0c-89-10-87-81-b9  dynamic
192.168.1.141              08-00-27-1b-3d-4b  dynamic
192.168.1.151              08-00-27-f6-fe-93  dynamic
192.168.1.152              08-00-27-77-e5-d2  dynamic
192.168.1.153              08-00-27-f6-fe-93  dynamic
```

Modyfikujemy plik na LB1:

```
/etc/bind/db.contoso.com [-M--] 45 L:[ 1+18 19/ 22]
;
; BIND data file for local loopback interface
;
$TTL<-->604800
@<---->IN<---->SOA<---->contoso.com. root.contoso.com.
<----><----><---->        4><---->; Serial
<----><----><----> 604800><---->; Refresh
<----><----><----> 86400><---->; Retry
<----><----><---->2419200><---->; Expire
<----><----><----> 604800 )<---->; Negative Cache TTL
;
@<---->IN<---->NS<---->ns1.contoso.com.
ns1<--->IN<---->A<---->192.168.1.141
lb1<--->IN<---->A<---->192.168.1.141
lb2<--->IN<---->A<---->192.168.1.142
srv1<-->IN<---->A<---->192.168.1.151
srv2<-->IN<---->A<---->192.168.1.152

www<--->10<---->IN<---->A<---->192.168.1.153_
; www<-->4<---->IN<---->A<---->192.168.1.152
```

```
systemctl reload bind9
```

```
C:\Users\lenovo>ping srv2.contoso.com

Pinging srv2.contoso.com [192.168.1.152] with 32 bytes of data:
Reply from 192.168.1.152: bytes=32 time<1ms TTL=64
Reply from 192.168.1.152: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.1.152:
    Packets: Sent = 2, Received = 2, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
Control-C
^C
C:\Users\lenovo>ping www.contoso.com

Pinging www.contoso.com [192.168.1.153] with 32 bytes of data:
Reply from 192.168.1.153: bytes=32 time<1ms TTL=64
Reply from 192.168.1.153: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.1.153:
    Packets: Sent = 2, Received = 2, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
Control-C
```

Pod odłączeniu SRV1:

```
C:\Users\lenovo>ping srv1.contoso.com

Pinging srv1.contoso.com [192.168.1.151] with 32 bytes of data:
Control-C
^C
C:\Users\lenovo>ping srv2.contoso.com

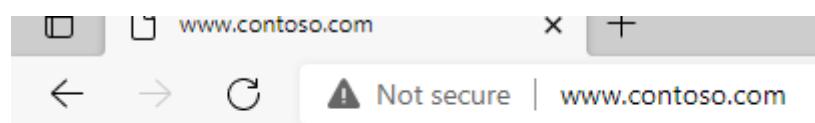
Pinging srv2.contoso.com [192.168.1.152] with 32 bytes of data:
Reply from 192.168.1.152: bytes=32 time<1ms TTL=64
Reply from 192.168.1.152: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.1.152:
    Packets: Sent = 2, Received = 2, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
Control-C
^C
C:\Users\lenovo>ping www.contoso.com

Pinging www.contoso.com [192.168.1.153] with 32 bytes of data:
Reply from 192.168.1.153: bytes=32 time<1ms TTL=64
Reply from 192.168.1.153: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.1.153:
    Packets: Sent = 2, Received = 2, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
Control-C
^C
C:\Users\lenovo>arp -a

Interface: 192.168.1.107 --- 0xc
  Internet Address      Physical Address          Type
  192.168.1.1           c0-94-ad-3e-b3-24        dynamic
  192.168.1.102         b0-19-21-ab-2d-68        dynamic
  192.168.1.104         0c-89-10-87-81-b9        dynamic
  192.168.1.141         08-00-27-1b-3d-4b        dynamic
  192.168.1.152         08-00-27-77-e5-d2        dynamic
  192.168.1.153         08-00-27-77-e5-d2        dynamic
```



strona testowa SRV2

Zad 4 VRRP z 2 interfejsami

[SV1] Modyfikujemy plik:

```
/etc/keepalived/keepalived.conf [-M-]

vrrp_instance VRRP_1 {
    interface enp0s3
    state MASTER
    virtual_router_id 51
    priority 99
    advert_int 2

    authentication {
        auth_type AH
        auth_pass password
    }

    virtual_ipaddress {
        192.168.1.153
    }

    track_interface {
        enp0s8 weight 3
    }
}
```

systemctl restart keepalived



Wyłączamy enp0s8: sudo ip link set enp0s8 down

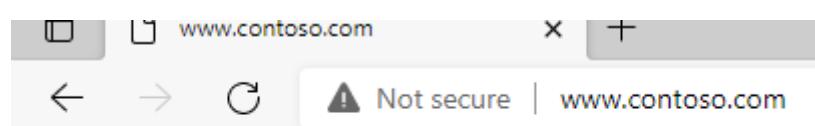
```
srv1@SRV1:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
        inet 127.0.0.1/8 scope host lo
            valid_lft forever preferred_lft forever
        inet6 ::1/128 scope host
            valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP
    link/ether 08:00:27:f6:fe:93 brd ff:ff:ff:ff:ff:ff
        inet 192.168.1.151/24 brd 192.168.1.255 scope global enp0s3
            valid_lft forever preferred_lft forever
        inet6 fe80::a00:27ff:fe93/64 scope link
            valid_lft forever preferred_lft forever
3: enp0s8: <BROADCAST,MULTICAST> mtu 1500 qdisc pfifo_fast state DOWN group default
    link/ether 08:00:27:99:9a:c8 brd ff:ff:ff:ff:ff:ff
        inet 172.30.0.10/24 brd 172.30.0.255 scope global enp0s8
            valid_lft forever preferred_lft forever
srv1@SRV1:~$
```

```
srv1@SRV1:~$ sudo systemctl status keepalived.service
● keepalived.service - Keepalive Daemon (LVS and VRRP)
   Loaded: loaded (/lib/systemd/system/keepalived.service; enabled; vendor preset: enabled)
   Active: active (running) since Thu 2025-05-08 10:10:04 CEST; 28min ago
     Main PID: 538 (keepalived)
       Tasks: 2 (limit: 1132)
      Memory: 1.6M
        CPU: 146ms
      CGroup: /system.slice/keepalived.service
              └─538 /usr/sbin/keepalived --dont-fork
                  ├─539 /usr/sbin/keepalived --dont-fork
                  ├─539 /usr/sbin/keepalived --dont-fork

maj 08 10:33:32 SRV1 Keepalived_vrrp[539]: (VRRP_1) Entering BACKUP STATE
maj 08 10:33:33 SRV1 Keepalived_vrrp[539]: (VRRP_1) received lower priority (100) advert from 192.168.1.152 -
maj 08 10:33:35 SRV1 Keepalived_vrrp[539]: (VRRP_1) received lower priority (100) advert from 192.168.1.152 -
maj 08 10:33:37 SRV1 Keepalived_vrrp[539]: (VRRP_1) received lower priority (100) advert from 192.168.1.152 -
maj 08 10:33:39 SRV1 Keepalived_vrrp[539]: (VRRP_1) received lower priority (100) advert from 192.168.1.152 -
maj 08 10:33:39 SRV1 Keepalived_vrrp[539]: (VRRP_1) Entering MASTER STATE
maj 08 10:34:21 SRV1 Keepalived_vrrp[539]: Netlink reports enp0s8 down
maj 08 10:34:21 SRV1 Keepalived_vrrp[539]: (VRRP_1) Changing effective priority from 102 to 99
maj 08 10:34:27 SRV1 Keepalived_vrrp[539]: (VRRP_1) Master received advert from 192.168.1.152 with higher priority
maj 08 10:34:27 SRV1 Keepalived_vrrp[539]: (VRRP_1) Entering BACKUP STATE
lines 1-21/21 (END)
```

Sprawdzamy działanie :

Interface: 192.168.1.116 --- 0x7	Internet Address	Physical Address	Type
	192.168.1.1	c0-94-ad-3e-b3-24	dynamic
	192.168.1.101	a8-31-62-9e-3c-a2	dynamic
	192.168.1.102	b0-19-21-ab-2d-68	dynamic
	192.168.1.103	a8-31-62-ab-c3-4c	dynamic
	192.168.1.105	a8-31-62-49-6d-51	dynamic
	192.168.1.106	a8-31-62-49-6d-6b	dynamic
	192.168.1.141	08-00-27-1b-3d-4b	dynamic
	192.168.1.151	08-00-27-f6-fe-93	dynamic
	192.168.1.152	08-00-27-77-e5-d2	dynamic
	192.168.1.153	08-00-27-77-e5-d2	dynamic



strona testowa SRV2

Zad 5 Konfiguracja aktywności serwera w zależności od skrypty

[SRV1] Nanosimy zmiany w pliku:

```
vrrp_script keepalived_check {
    script "/root/keepalived_check.sh"
    interval 2      # Uruchamiaj skrypt co 2 sekundy
    timeout 2       # Poczekaj do 2 sekund na skrypt przed przyjęciem niezerowego kodu wyjścia
    rise 3          # kod zero 3 razy z rzędu, wyjdź ze stanu FAULT
    fall 3          # kod niezerowy 3 razy z rzędu, wprowadź stan FAULT
    weight -50      # Zmniejsz priorytet o 50 przy wykrytej awarii
}

vrrp_instance VRRP_1 {
    interface enp0s3
    state MASTER
    virtual_router_id 51
    priority 101
    advert_int 2

    authentication {
        auth_type AH
        auth_pass password
    }

    virtual_ipaddress {
        192.168.1.153
    }

    track_script {
        keepalived_check
    }
}
```

Tworzymy plik:

```
//root/keepalived_check.sh [-M--] 37 L:[ 1+ 2 3/ 8] *(

#!/bin/bash

/usr/bin/ping -c 1 -W 1 192.168.1.142 &> /dev/null
if [ $? -eq 0 ];then
    exit 0
else
    exit 2
fi
```

Chmod 700 /root/keepalived_check.sh

systemctl restart keepalived

systemctl status keepalived

(przy wyłączonym LB2)

```
srv1@SRV1:~$ sudo systemctl status keepalived
● keepalived.service - Keepalive Daemon (LVS and VRRP)
   Loaded: loaded (/lib/systemd/system/keepalived.service; enabled; vendor preset: enabled)
     Active: active (running) since Thu 2025-05-08 11:36:04 CEST; 12s ago
       Main PID: 901 (keepalived)
          Tasks: 4 (limit: 1132)
         Memory: 2.3M
            CPU: 48ms
           CGroup: /system.slice/keepalived.service
             └─901 /usr/sbin/keepalived --dont-fork
               ├─902 /usr/sbin/keepalived --dont-fork
               ├─919 /bin/bash /root/keepalived_check.sh
               └─920 /usr/bin/ping -c 1 -W 1 192.168.1.142

maj 08 11:36:04 SRV1 Keepalived_vrrp[902]: Registering Kernel netlink command channel
maj 08 11:36:04 SRV1 Keepalived_vrrp[902]: Opening file '/etc/keepalived/keepalived.conf'.
maj 08 11:36:04 SRV1 Keepalived_vrrp[902]: WARNING - default user 'keepalived_script' for script execution does not exist - please
maj 08 11:36:04 SRV1 Keepalived_vrrp[902]: SECURITY VIOLATION - scripts are being executed but script_security not enabled.
maj 08 11:36:04 SRV1 Keepalived_vrrp[902]: (VRRP_1) Initial state master is incompatible with AH authentication - clearing
maj 08 11:36:04 SRV1 Keepalived_vrrp[902]: Registering gratuitous ARP shared channel
maj 08 11:36:04 SRV1 Keepalived_vrrp[902]: (VRRP_1) Entering BACKUP STATE (init)
maj 08 11:36:05 SRV1 Keepalived_vrrp[902]: Script 'keepalived_check' now returning 2
maj 08 11:36:05 SRV1 Keepalived_vrrp[902]: VRRP_Script(keepalived_check) failed (exited with status 2)
maj 08 11:36:05 SRV1 Keepalived_vrrp[902]: (VRRP_1) Changing effective priority from 101 to 51
srv1@SRV1:~$
```

Interface:	192.168.1.116 --- 0x7	
Internet Address	Physical Address	Type
192.168.1.1	c0-94-ad-3e-b3-24	dynamic
192.168.1.101	a8-31-62-9e-3c-a2	dynamic
192.168.1.102	b0-19-21-ab-2d-68	dynamic
192.168.1.103	a8-31-62-ab-c3-4c	dynamic
192.168.1.105	a8-31-62-49-6d-51	dynamic
192.168.1.106	a8-31-62-49-6d-6b	dynamic
192.168.1.141	08-00-27-1b-3d-4b	dynamic
192.168.1.151	08-00-27-f6-fe-93	dynamic
192.168.1.152	08-00-27-77-e5-d2	dynamic
192.168.1.153	08-00-27-77-e5-d2	dynamic

Po włączeniu LB2:

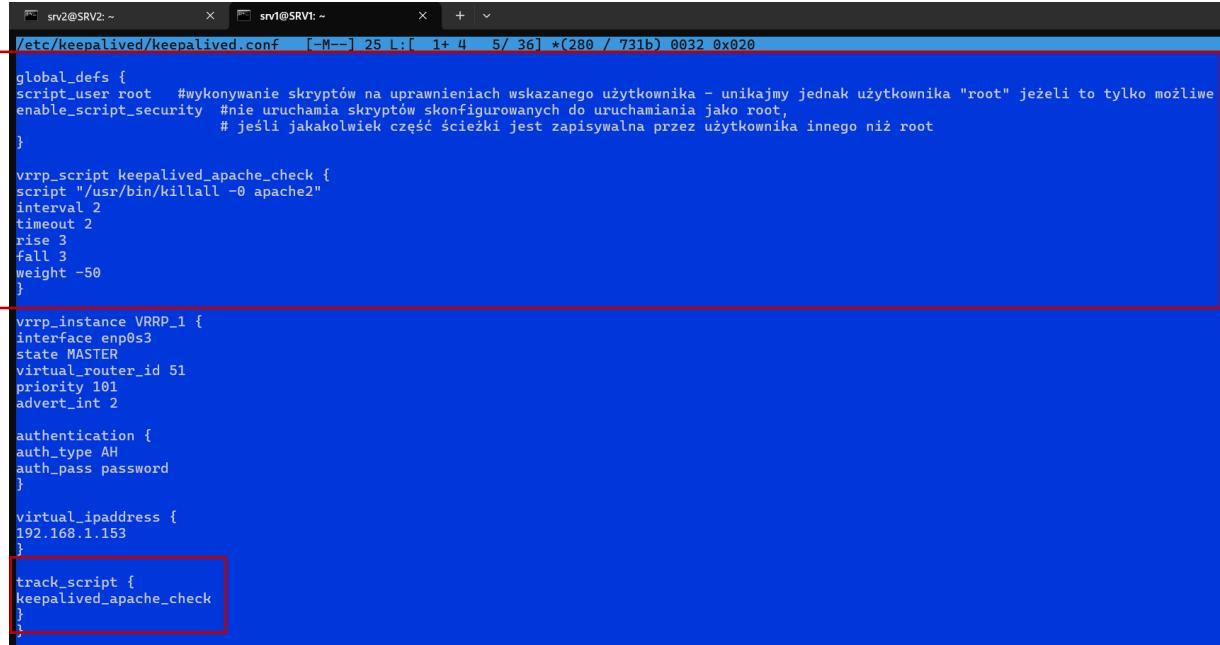
```
srv1@SRV1:~$ sudo systemctl status keepalived
● keepalived.service - Keepalive Daemon (LVS and VRRP)
   Loaded: loaded (/lib/systemd/system/keepalived.service; enabled; vendor preset: enabled)
     Active: active (running) since Thu 2025-05-08 11:36:04 CEST; 3min 46s ago
       Main PID: 901 (keepalived)
          Tasks: 2 (limit: 1132)
         Memory: 1.6M
            CPU: 603ms
           CGroup: /system.slice/keepalived.service
             └─901 /usr/sbin/keepalived --dont-fork
               ├─902 /usr/sbin/keepalived --dont-fork

maj 08 11:36:05 SRV1 Keepalived_vrrp[902]: Script 'keepalived_check' now returning 2
maj 08 11:36:05 SRV1 Keepalived_vrrp[902]: VRRP_Script(keepalived_check) failed (exited with status 2)
maj 08 11:36:05 SRV1 Keepalived_vrrp[902]: (VRRP_1) Changing effective priority from 101 to 51
maj 08 11:39:33 SRV1 Keepalived_vrrp[902]: Script 'keepalived_check' now returning 0
maj 08 11:39:36 SRV1 Keepalived_vrrp[902]: VRRP_Script(keepalived_check) succeeded
maj 08 11:39:36 SRV1 Keepalived_vrrp[902]: (VRRP_1) Changing effective priority from 51 to 101
maj 08 11:39:38 SRV1 Keepalived_vrrp[902]: (VRRP_1) received lower priority (100) advert from 192.168.1.152 - discarding
maj 08 11:39:40 SRV1 Keepalived_vrrp[902]: (VRRP_1) received lower priority (100) advert from 192.168.1.152 - discarding
maj 08 11:39:42 SRV1 Keepalived_vrrp[902]: (VRRP_1) received lower priority (100) advert from 192.168.1.152 - discarding
maj 08 11:39:43 SRV1 Keepalived_vrrp[902]: (VRRP_1) Entering MASTER STATE
srv1@SRV1:~$
```

Interface:	192.168.1.116 --- 0xf	
Internet Address	Physical Address	Type
192.168.1.1	c0-94-ad-3e-b3-24	dynamic
192.168.1.101	a8-31-62-9e-3c-a2	dynamic
192.168.1.102	b0-19-21-ab-2d-68	dynamic
192.168.1.103	a8-31-62-ab-c3-4c	dynamic
192.168.1.105	a8-31-62-49-6d-51	dynamic
192.168.1.106	a8-31-62-49-6d-6b	dynamic
192.168.1.141	08-00-27-1b-3d-4b	dynamic
192.168.1.151	08-00-27-f6-fe-93	dynamic
192.168.1.152	08-00-27-77-e5-d2	dynamic
192.168.1.153	08-00-27-f6-fe-93	dynamic

Zad 6

[SRV1] Modyfikujemy plik:



```
/etc/keepalived/keepalived.conf  [-M--] 25 L:[ 1+ 4  5/ 36] *(280 / 731b) 0032 0x020

global_defs {
script_user root    #wykonywanie skryptów na uprawnieniach wskazanego użytkownika - unikajmy jednak użytkownika "root" jeżeli to tylko możliwe
enable_script_security  #nie uruchamia skryptów skonfigurowanych do uruchamiania jako root,
                        #jeśli jakakolwiek część ścieżki jest zapisywana przez użytkownika innego niż root
}

vrrp_script keepalived_apache_check {
script "/usr/bin/killall -0 apache2"
interval 2
timeout 2
rise 3
fall 3
weight -50
}

vrrp_instance VRRP_1 {
interface enp0s3
state MASTER
virtual_router_id 51
priority 101
advert_int 2

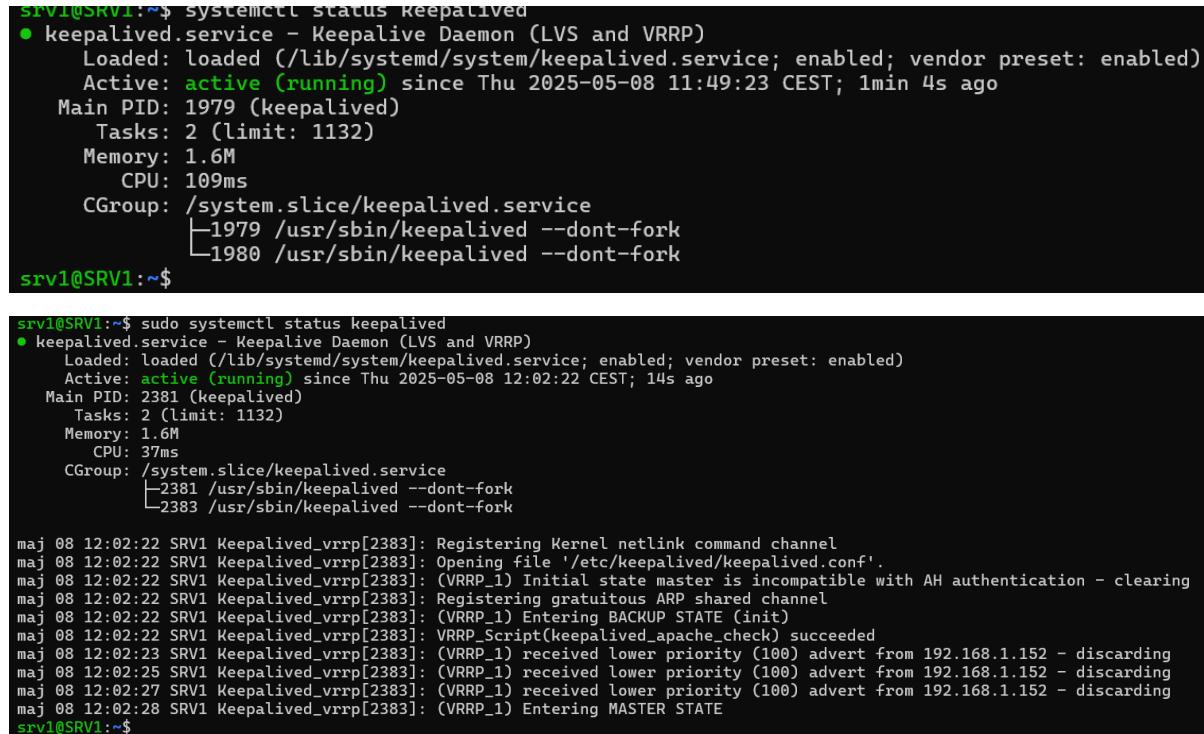
authentication {
auth_type AH
auth_pass password
}

virtual_ipaddress {
192.168.1.153
}

track_script {
keepalived_apache_check
}
}
```

apt install psmisc

systemctl restart keepalived



```
srv1@SRV1:~$ systemctl status keepalived
● keepalived.service - Keepalive Daemon (LVS and VRRP)
   Loaded: loaded (/lib/systemd/system/keepalived.service; enabled; vendor preset: enabled)
   Active: active (running) since Thu 2025-05-08 11:49:23 CEST; 1min 4s ago
     Main PID: 1979 (keepalived)
        Tasks: 2 (limit: 1132)
       Memory: 1.6M
          CPU: 109ms
        CGroup: /system.slice/keepalived.service
                └─1979 /usr/sbin/keepalived --dont-fork
                  ├─1980 /usr/sbin/keepalived --dont-fork
srv1@SRV1:~$
```



```
srv1@SRV1:~$ sudo systemctl status keepalived
● keepalived.service - Keepalive Daemon (LVS and VRRP)
   Loaded: loaded (/lib/systemd/system/keepalived.service; enabled; vendor preset: enabled)
   Active: active (running) since Thu 2025-05-08 12:02:22 CEST; 14s ago
     Main PID: 2381 (keepalived)
        Tasks: 2 (limit: 1132)
       Memory: 1.6M
          CPU: 37ms
        CGroup: /system.slice/keepalived.service
                ├─2381 /usr/sbin/keepalived --dont-fork
                └─2383 /usr/sbin/keepalived --dont-fork

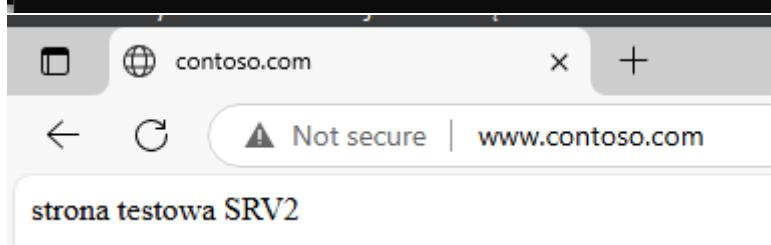
maj 08 12:02:22 SRV1 Keepalived_vrrp[2383]: Registering Kernel netlink command channel
maj 08 12:02:22 SRV1 Keepalived_vrrp[2383]: Opening file '/etc/keepalived/keepalived.conf'.
maj 08 12:02:22 SRV1 Keepalived_vrrp[2383]: (VRRP_1) Initial state master is incompatible with AH authentication - clearing
maj 08 12:02:22 SRV1 Keepalived_vrrp[2383]: Registering gratuitous ARP shared channel
maj 08 12:02:22 SRV1 Keepalived_vrrp[2383]: (VRRP_1) Entering BACKUP STATE (init)
maj 08 12:02:22 SRV1 Keepalived_vrrp[2383]: VRRP_Script(keepalived_apache_check) succeeded
maj 08 12:02:23 SRV1 Keepalived_vrrp[2383]: (VRRP_1) received lower priority (100) advert from 192.168.1.152 - discarding
maj 08 12:02:25 SRV1 Keepalived_vrrp[2383]: (VRRP_1) received lower priority (100) advert from 192.168.1.152 - discarding
maj 08 12:02:27 SRV1 Keepalived_vrrp[2383]: (VRRP_1) received lower priority (100) advert from 192.168.1.152 - discarding
maj 08 12:02:28 SRV1 Keepalived_vrrp[2383]: (VRRP_1) Entering MASTER STATE
srv1@SRV1:~$
```

```

srv1@SRV1:~$ sudo systemctl stop apache2.service
srv1@SRV1:~$ sudo systemctl status keepalived
● keepalived.service - Keepalive Daemon (LVS and VRRP)
   Loaded: Loaded (/lib/systemd/system/keepalived.service; enabled; vendor preset: enabled)
   Active: active (running) since Thu 2025-05-08 12:02:22 CEST; 2min 18s ago
     Main PID: 2381 (keepalived)
        Tasks: 2 (limit: 1132)
       Memory: 1.6M
          CPU: 226ms
         CGroup: /system.slice/keepalived.service
             └─2381 /usr/sbin/keepalived --dont-fork
                 ├─2383 /usr/sbin/keepalived --dont-fork

maj 08 12:02:22 SRV1 Keepalived_vrrp[2383]: VRRP_Script(keepalived_apache_check) succeeded
maj 08 12:02:23 SRV1 Keepalived_vrrp[2383]: (VRRP_1) received lower priority (100) advert from 192.168.1.152 - discards
maj 08 12:02:25 SRV1 Keepalived_vrrp[2383]: (VRRP_1) received lower priority (100) advert from 192.168.1.152 - discards
maj 08 12:02:27 SRV1 Keepalived_vrrp[2383]: (VRRP_1) received lower priority (100) advert from 192.168.1.152 - discards
maj 08 12:02:28 SRV1 Keepalived_vrrp[2383]: (VRRP_1) Entering MASTER STATE
maj 08 12:04:12 SRV1 Keepalived_vrrp[2383]: Script `keepalived_apache_check` now returning 1
maj 08 12:04:16 SRV1 Keepalived_vrrp[2383]: VRRP_Script(keepalived_apache_check) failed (exited with status 1)
maj 08 12:04:16 SRV1 Keepalived_vrrp[2383]: (VRRP_1) Changing effective priority from 101 to 51
maj 08 12:04:21 SRV1 Keepalived_vrrp[2383]: (VRRP_1) Master received advert from 192.168.1.152 with higher priority 100
maj 08 12:04:21 SRV1 Keepalived_vrrp[2383]: (VRRP_1) Entering BACKUP STATE
Lines 1-21/21 (END)

```



Zad 7

Modyfikujemy plik:

```

srv2@SRV2: ~          X  srv1@SRV1: ~          X
/etc/keepalived/keepalived.conf  [-M--]  1 L:[  9
enable_script_security...
}

vrrp_track_file trackfile {
file /var/run/vrrp_track_file
}

vrrp_instance VRRP_1 {
interface enp0s3
state MASTER
virtual_router_id 51
priority 101
advert_int 2

authentication {
auth_type AH
auth_pass password
}

virtual_ipaddress {
192.168.1.153
}
track_file {
trackfile weight 1
}
}

```

```
echo 5 > /var/run/vrrp_track_file
```

```
apt install tcpdump
```

```
systemctl restart keepalived
```

```
srv1@SRV1:~$ sudo systemctl status keepalived
● keepalived.service - Keepalive Daemon (LVS and VRRP)
   Loaded: loaded (/lib/systemd/system/keepalived.service; enabled; vendor preset: enabled)
     Active: active (running) since Thu 2025-05-08 12:19:51 CEST; 40s ago
       Main PID: 3130 (keepalived)
          Tasks: 2 (limit: 1132)
            Memory: 1.6M
              CPU: 16ms
            CGroup: /system.slice/keepalived.service
                └─3130 /usr/sbin/keepalived --dont-fork
                  ├─3131 /usr/sbin/keepalived --dont-fork

maj 08 12:19:51 SRV1 Keepalived_vrrp[3131]: Opening file '/etc/keepalived/keepalived.conf'.
maj 08 12:19:51 SRV1 Keepalived_vrrp[3131]: "vrrp_track_file" is deprecated, please use "track_file"
maj 08 12:19:51 SRV1 Keepalived_vrrp[3131]: (VRRP_1) Initial state master is incompatible with AH authentication - clearing
maj 08 12:19:51 SRV1 Keepalived_vrrp[3131]: (VRRP_1) Changing effective priority from 101 to 106
maj 08 12:19:51 SRV1 Keepalived_vrrp[3131]: Registering gratuitous ARP shared channel
maj 08 12:19:51 SRV1 Keepalived_vrrp[3131]: (VRRP_1) Entering BACKUP STATE (init)
maj 08 12:19:51 SRV1 Keepalived_vrrp[3131]: (VRRP_1) received lower priority (100) advert from 192.168.1.152 - discarding
maj 08 12:19:54 SRV1 Keepalived_vrrp[3131]: (VRRP_1) received lower priority (100) advert from 192.168.1.152 - discarding
maj 08 12:19:56 SRV1 Keepalived_vrrp[3131]: (VRRP_1) received lower priority (100) advert from 192.168.1.152 - discarding
maj 08 12:19:58 SRV1 Keepalived_vrrp[3131]: (VRRP_1) Entering MASTER STATE
srv1@SRV1:~$
```

```
echo 6 > /var/run/vrrp_track_file
```

```
Loaded: loaded (/lib/systemd/system/keepalived.service; enabled; vendor preset: enabled)
Active: active (running) since Thu 2025-05-08 12:19:51 CEST; 7min ago
Main PID: 3130 (keepalived)
   Tasks: 2 (limit: 1132)
     Memory: 1.6M
       CPU: 48ms
      CGroup: /system.slice/keepalived.service
          ├─3130 /usr/sbin/keepalived --dont-fork
          └─3131 /usr/sbin/keepalived --dont-fork

aj 08 12:19:51 SRV1 Keepalived_vrrp[3131]: "vrrp_track_file" is deprecated, please use "track_file"
aj 08 12:19:51 SRV1 Keepalived_vrrp[3131]: (VRRP_1) Initial state master is incompatible with AH authentication - clearing
aj 08 12:19:51 SRV1 Keepalived_vrrp[3131]: (VRRP_1) Changing effective priority from 101 to 106
aj 08 12:19:51 SRV1 Keepalived_vrrp[3131]: Registering gratuitous ARP shared channel
aj 08 12:19:51 SRV1 Keepalived_vrrp[3131]: (VRRP_1) Entering BACKUP STATE (init)
aj 08 12:19:52 SRV1 Keepalived_vrrp[3131]: (VRRP_1) received lower priority (100) advert from 192.168.1.152 - discarding
aj 08 12:19:54 SRV1 Keepalived_vrrp[3131]: (VRRP_1) received lower priority (100) advert from 192.168.1.152 - discarding
aj 08 12:19:56 SRV1 Keepalived_vrrp[3131]: (VRRP_1) received lower priority (100) advert from 192.168.1.152 - discarding
aj 08 12:19:58 SRV1 Keepalived_vrrp[3131]: (VRRP_1) Entering MASTER STATE
aj 08 12:26:59 SRV1 Keepalived_vrrp[3131]: (VRRP_1) Changing effective priority from 106 to 107
srv1@SRV1:~$ sudo tcpdump -v -i enp0s3 host 224.0.0.18
tcpdump: listening on enp0s3, link-type EN10MB (Ethernet), snapshot length 262144 bytes
12:28:10.582843 IP (tos 0xc0, ttl 255, id 247, offset 0, flags [none], proto AH (51), length 64)
  192.168.1.151 > vrrp.mcast.net: AH(length=4(24-bytes), spi=0x0a80197,seq=0x1c8,icv=0xb0d92cdac55bf6a3321c65): VRRPv2, Advertisement, vrid 51, prio 10
  7, authtype ah, intvl 2s, length 28, addrs: 192.168.1.153
12:28:12.583310 IP (tos 0xc0, ttl 255, id 248, offset 0, flags [none], proto AH (51), length 64)
  192.168.1.151 > vrrp.mcast.net: AH(length=4(24-bytes), spi=0xc0a80197,seq=0x0cc7d785d0b0f8f2c38218990): VRRPv2, Advertisement, vrid 51, prio 10
  7, authtype ah, intvl 2s, length 28, addrs: 192.168.1.153
```

```
srv1@SRV1:~$ sudo systemctl stop apache2
srv1@SRV1:~$ sudo systemctl status keepalived
● keepalived.service - Keepalive Daemon (LVS and VRRP)
   Loaded: loaded (/lib/systemd/system/keepalived.service; enabled; vendor preset: enabled)
     Active: active (running) since Thu 2025-05-08 12:19:51 CEST; 16min ago
       Main PID: 3130 (keepalived)
          Tasks: 2 (limit: 1132)
            Memory: 1.6M
              CPU: 89ms
            CGroup: /system.slice/keepalived.service
                ├─3130 /usr/sbin/keepalived --dont-fork
                └─3131 /usr/sbin/keepalived --dont-fork

maj 08 12:19:51 SRV1 Keepalived_vrrp[3131]: "vrrp_track_file" is deprecated, please use "track_file"
maj 08 12:19:51 SRV1 Keepalived_vrrp[3131]: (VRRP_1) Initial state master is incompatible with AH authentication - clearing
maj 08 12:19:51 SRV1 Keepalived_vrrp[3131]: (VRRP_1) Changing effective priority from 101 to 106
maj 08 12:19:51 SRV1 Keepalived_vrrp[3131]: Registering gratuitous ARP shared channel
maj 08 12:19:51 SRV1 Keepalived_vrrp[3131]: (VRRP_1) Entering BACKUP STATE (init)
maj 08 12:19:52 SRV1 Keepalived_vrrp[3131]: (VRRP_1) received lower priority (100) advert from 192.168.1.152 - discarding
maj 08 12:19:54 SRV1 Keepalived_vrrp[3131]: (VRRP_1) received lower priority (100) advert from 192.168.1.152 - discarding
maj 08 12:19:56 SRV1 Keepalived_vrrp[3131]: (VRRP_1) received lower priority (100) advert from 192.168.1.152 - discarding
maj 08 12:19:58 SRV1 Keepalived_vrrp[3131]: (VRRP_1) Entering MASTER STATE
maj 08 12:26:59 SRV1 Keepalived_vrrp[3131]: (VRRP_1) Changing effective priority from 106 to 107
srv1@SRV1:~$
```

```

virtual_ipaddress {
192.168.1.153
}
track_file {
trackfile weight 2
}

```

```

srv1@SRV1:~$ sudo systemctl restart keepalived
srv1@SRV1:~$ sudo systemctl status keepalived
● keepalived.service - Keepalive Daemon (LVS and VRRP)
    Loaded: loaded (/lib/systemd/system/keepalived.service; enabled; vendor preset: enabled)
      Active: active (running) since Thu 2025-05-08 12:41:40 CEST; 6s ago
        Main PID: 3250 (keepalived)
          Tasks: 2 (limit: 1132)
            Memory: 1.6M
              CPU: 16ms
            CGroup: /system.slice/keepalived.service
                └─3250 /usr/sbin/keepalived --dont-fork
                  ├─3251 /usr/sbin/keepalived --dont-fork

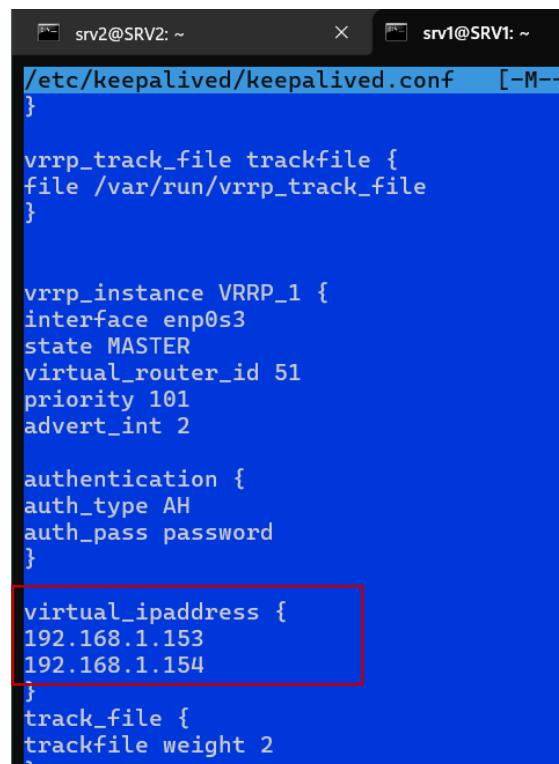
maj 08 12:41:40 SRV1 Keepalived_vrrp[3251]: Opening file '/etc/keepalived/keepalived.conf'
maj 08 12:41:40 SRV1 Keepalived_vrrp[3251]: "vrrp_track_file" is deprecated, please use "track_file"
maj 08 12:41:40 SRV1 Keepalived_vrrp[3251]: (VRRP_1) Initial state master is incompatible with AH authentication - clearing
maj 08 12:41:40 SRV1 Keepalived_vrrp[3251]: (VRRP_1) Changing effective priority from 101 to 113
maj 08 12:41:40 SRV1 Keepalived_vrrp[3251]: Registering gratuitous ARP shared channel
maj 08 12:41:40 SRV1 Keepalived_vrrp[3251]: (VRRP_1) Entering BACKUP STATE (init)
maj 08 12:41:41 SRV1 Keepalived_vrrp[3251]: (VRRP_1) received lower priority (100) advert from 192.168.1.152 - discarding
maj 08 12:41:43 SRV1 Keepalived_vrrp[3251]: (VRRP_1) received lower priority (100) advert from 192.168.1.152 - discarding
maj 08 12:41:45 SRV1 Keepalived_vrrp[3251]: (VRRP_1) received lower priority (100) advert from 192.168.1.152 - discarding
maj 08 12:41:46 SRV1 Keepalived_vrrp[3251]: (VRRP_1) Entering MASTER STATE
srv1@SRV1:~$ 

srv1@SRV1:~$ sudo tcpdump -v -i enp0s3 host 224.0.0.18
tcpdump: listening on enp0s3, link-type EN10MB (Ethernet), snapshot length 262144 bytes
12:42:28.737006 IP (tos 0xc0, ttl 255, id 22, offset 0, flags [none], proto AH [51], length 64)
  192.168.1.151 > 18.0.0.224.in-addr.arp: AH(length=4(24-bytes),spi=0xfc0a80197,seq=0x1377,icv=0xfb567c9d8ae4a76f46dbc80): VRRPv2, Advertisement, vrid 51
  , prio 113, authtype ah, intvl 2s, length 20, addrs: 192.168.1.153

```

Zad 8 Dodatkowy VIP

[SRV1] Modyfikujemy plik:



```

srv2@SRV2: ~          srv1@SRV1: ~
/etc/keepalived/keepalived.conf  [-M--]
}

vrrp_track_file trackfile {
file /var/run/vrrp_track_file
}

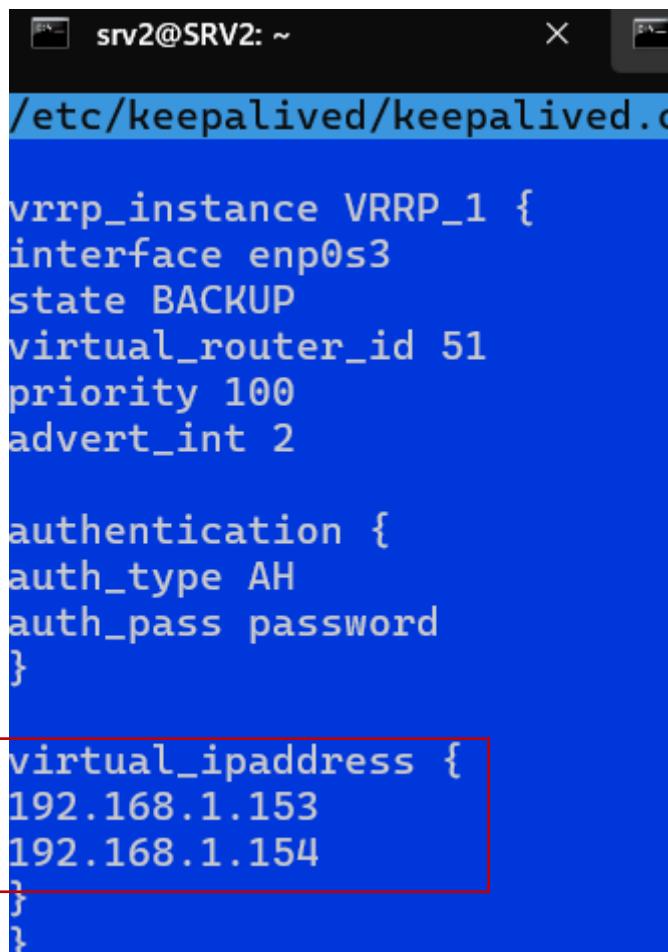
vrrp_instance VRRP_1 {
interface enp0s3
state MASTER
virtual_router_id 51
priority 101
advert_int 2

authentication {
auth_type AH
auth_pass password
}

virtual_ipaddress {
192.168.1.153
192.168.1.154
}
track_file {
trackfile weight 2
}

```

[SRV2] Modyfikujemy plik:



```
vrrp_instance VRRP_1 {
    interface enp0s3
    state BACKUP
    virtual_router_id 51
    priority 100
    advert_int 2

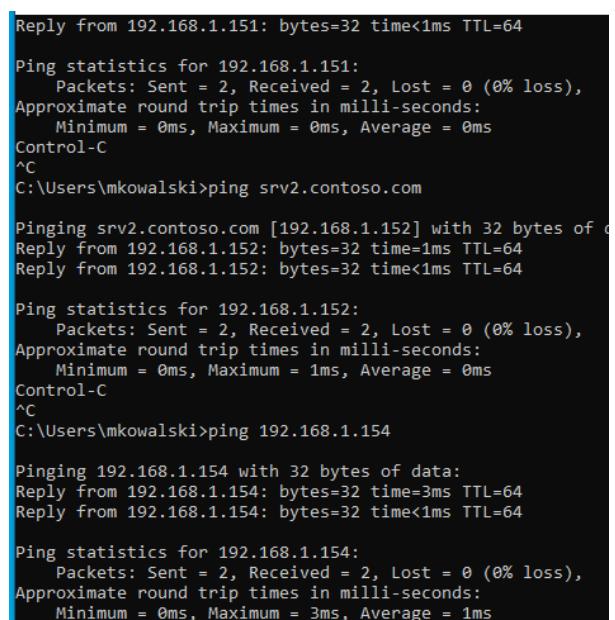
    authentication {
        auth_type AH
        auth_pass password
    }

    virtual_ipaddress {
        192.168.1.153
        192.168.1.154
    }
}
```

[SRV1 SRV2]

systemctl restart keepalived

Sprawdzamy działanie:



```
Reply from 192.168.1.151: bytes=32 time<1ms TTL=64
Ping statistics for 192.168.1.151:
  Packets: Sent = 2, Received = 2, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
  Minimum = 0ms, Maximum = 0ms, Average = 0ms
Control-C
^C
C:\Users\mkowalski>ping srv2.contoso.com

Pinging srv2.contoso.com [192.168.1.152] with 32 bytes of data:
Reply from 192.168.1.152: bytes=32 time=1ms TTL=64
Reply from 192.168.1.152: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.1.152:
  Packets: Sent = 2, Received = 2, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
  Minimum = 0ms, Maximum = 1ms, Average = 0ms
Control-C
^C
C:\Users\mkowalski>ping 192.168.1.154

Pinging 192.168.1.154 with 32 bytes of data:
Reply from 192.168.1.154: bytes=32 time=3ms TTL=64
Reply from 192.168.1.154: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.1.154:
  Packets: Sent = 2, Received = 2, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
  Minimum = 0ms, Maximum = 3ms, Average = 1ms
```

Interface:	192.168.1.116 --- 0xf	
Internet Address	Physical Address	Type
192.168.1.1	c0-94-ad-3e-b3-24	dynamic
192.168.1.101	a8-31-62-9e-3c-a2	dynamic
192.168.1.102	b0-19-21-ab-2d-68	dynamic
192.168.1.103	a8-31-62-ab-c3-4c	dynamic
192.168.1.104	0c-89-10-87-81-b9	dynamic
192.168.1.105	a8-31-62-49-6d-51	dynamic
192.168.1.106	a8-31-62-49-6d-6b	dynamic
192.168.1.141	08-00-27-1b-3d-4b	dynamic
192.168.1.151	08-00-27-f6-fe-93	dynamic
192.168.1.152	08-00-27-77-e5-d2	dynamic
192.168.1.153	08-00-27-f6-fe-93	dynamic
192.168.1.154	08-00-27-f6-fe-93	dynamic

Zad 9

[SRV1] Modyfikujemy plik:

```

srv2@SRV2: ~          X  srv1@SRV1: ~          X
/etc/keepalived.conf  [-M--] 35 L:[ 6+27  33/ 35] *
}

vrrp_track_file trackfile {
file /var/run/vrrp_track_file
}

vrrp_instance VRRP_1 {
interface enp0s3
state MASTER
virtual_router_id 51
priority 101
advert_int 2

authentication {
auth_type AH
auth_pass password
}

virtual_ipaddress {
192.168.1.153
192.168.1.154
}
track_file {
trackfile weight 2
}

notify "/root/keepalived_notify.sh"
}


```

Tworzymy plik:

```
srv2@SRV2: ~      x  srv1@SRV1: ~      x  +  ~
/root/keepalived_notify.sh  [-M--]  91 L:[ 1+ 2   3/  3] *(105 / 105b) <EOF>
#!/bin/bash

echo "$1 $2 został przeniesiony do stanu $3 z priorytetem $4" >> /var/log/keepalived_status
```

systemctl restart keepalived

Rozłączmy kartę enp0s3 na SRV1:

```
root@SRV1:~# cat /var/log/keepalived_status
INSTANCE VRRP_1 został przeniesiony do stanu BACKUP z priorytetem 101
INSTANCE VRRP_1 został przeniesiony do stanu MASTER z priorytetem 101
INSTANCE VRRP_1 został przeniesiony do stanu STOP z priorytetem 101
INSTANCE VRRP_1 został przeniesiony do stanu BACKUP z priorytetem 101
INSTANCE VRRP_1 został przeniesiony do stanu MASTER z priorytetem 101
INSTANCE VRRP_1 został przeniesiony do stanu FAULT z priorytetem 101
root@SRV1:~# _
```

Podłączmy ens0s3:

```
root@SRV1:~# cat /var/log/keepalived_status
INSTANCE VRRP_1 został przeniesiony do stanu BACKUP z priorytetem 101
INSTANCE VRRP_1 został przeniesiony do stanu MASTER z priorytetem 101
INSTANCE VRRP_1 został przeniesiony do stanu STOP z priorytetem 101
INSTANCE VRRP_1 został przeniesiony do stanu BACKUP z priorytetem 101
INSTANCE VRRP_1 został przeniesiony do stanu MASTER z priorytetem 101
INSTANCE VRRP_1 został przeniesiony do stanu FAULT z priorytetem 101
INSTANCE VRRP_1 został przeniesiony do stanu BACKUP z priorytetem 101
INSTANCE VRRP_1 został przeniesiony do stanu MASTER z priorytetem 101
root@SRV1:~#
```

Zmieniamy plik:

```
/root/keepalived_notify.sh  [-M--]  0 L:[ 1+ 7   8/ 32] *(132 /1086b) 0010 0x00A
#!/bin/bash

echo "$1 $2 został przeniesiony do stanu $3 z priorytetem $4" >> /var/log/keepalived_status

STAN=$3
NAZWA=$2
TYP=$1

case $STAN in
    "BACKUP") # Wykonaj ponizsza akcje przy przejściu w stan BACKUP
        date >> /var/log/keepalived_status_backup
        echo "$1 $2 został przeniesiony do stanu $3 z priorytetem $4" >> /var/log/keepalived_status_backup
        exit 0
    ;;
    "FAULT") # Wykonaj ponizsza akcje przy przejściu w stan FAULT
        date >> /var/log/keepalived_status_fault
        echo "$1 $2 został przeniesiony do stanu $3 z priorytetem $4" >> /var/log/keepalived_status_fault
        exit 0
    ;;
    "MASTER") # Wykonaj ponizsza akcje przy przejściu w stan MASTER
        date >> /var/log/keepalived_status_master
        echo "$1 $2 został przeniesiony do stanu $3 z priorytetem $4" >> /var/log/keepalived_status_master
        exit 0
    ;;
    *)         # Nieznany stan ${STAN} dla VRRP ${TYP} ${NAZWA}
        echo "Nieznany stan ${STAN} dla VRRP ${TYP} ${NAZWA}"
        exit 1
    ;;
esac
```

systemctl restart keepalived

Sprawdźmy działanie (wyłączony interfejs):

```
root@SRV1:~# cat /var/log/keepalived_status
keepalived_status      keepalived_status_fault
Keepalived_status_backup  keepalived_status_master
root@SRV1:~# cat /var/log/keepalived_status_master
czw, 8 maj 2025, 20:52:57 CEST
INSTANCE VRRP_1 został przeniesiony do stanu MASTER z priorytetem 101
root@SRV1:~# cat /var/log/keepalived_status_fault
czw, 8 maj 2025, 20:53:16 CEST
INSTANCE VRRP_1 został przeniesiony do stanu FAULT z priorytetem 101
root@SRV1:~# cat /var/log/keepalived_status_backup
czw, 8 maj 2025, 20:52:50 CEST
INSTANCE VRRP_1 został przeniesiony do stanu BACKUP z priorytetem 101
root@SRV1:~# _
```

(włączony interfejs)

```
root@SRV1:~# cat /var/log/keepalived_status_backup
czw, 8 maj 2025, 20:52:50 CEST
INSTANCE VRRP_1 został przeniesiony do stanu BACKUP z priorytetem 101
czw, 8 maj 2025, 20:54:51 CEST
INSTANCE VRRP_1 został przeniesiony do stanu BACKUP z priorytetem 101
root@SRV1:~# cat /var/log/keepalived_status_fault
czw, 8 maj 2025, 20:53:16 CEST
INSTANCE VRRP_1 został przeniesiony do stanu FAULT z priorytetem 101
root@SRV1:~# cat /var/log/keepalived_status_master
czw, 8 maj 2025, 20:52:57 CEST
INSTANCE VRRP_1 został przeniesiony do stanu MASTER z priorytetem 101
czw, 8 maj 2025, 20:54:57 CEST
INSTANCE VRRP_1 został przeniesiony do stanu MASTER z priorytetem 101
root@SRV1:~# _
```

ciekawostka

zamiast wynikowego skryptu `/root/keepalived_notify_backup`, można by też wykorzystać poniższe parametry w ramach pliku konfiguracyjnego `/etc/keepalived/keepalived.conf`:

- `notify_backup /root/keepalived_notify_backup.sh`
- `notify_fault /root/keepalived_notify_fault.sh`
- `notify_master /root/keepalived_notify_master.sh`

Zad 10 Serwer LVS- NAT

[SRV1 SRV2]

```
# systemctl disable keepalived
# systemctl stop keepalived
```

[LB1]

```
apt install ipvsadm
```

Modyfikujemy pliki:

```
/etc/sysctl.conf [-M--] 0 L
# for what other values do
#kernel.sysrq=438
net.ipv4.ip_forward=1
net.ipv4.ip_nonlocal_bind=1
```

```
root@LB1:~# sysctl -p
net.ipv4.ip_forward = 1
net.ipv4.ip_nonlocal_bind = 1
root@LB1:~# _
```

```
/etc/default/ipvsadm [-M--] 13 L:[ 1+ 9 10/ 16] *(178 / 277b)
# ipvsadm

# if you want to start ipvsadm on boot set this to true
AUTO="true"

# daemon method (none|master|backup)
DAEMON="master"

# use interface (eth0,eth1...)
IFACE="enp0s3" <>

# syncid to use.
# (0 means no filtering of syncids happen, that is the default)
# SYNCID="0"
```

```
root@LB1:~# systemctl restart ipvsadm.service
root@LB1:~# systemctl status ipvsadm.service
● ipvsadm.service - LSB: ipvsadm daemon
  Loaded: loaded (/etc/init.d/ipvsadm; generated)
  Active: active (exited) since Thu 2025-05-08 22:48:16 CEST; 9s ago
    Docs: man:systemd-sysv-generator(8)
  Process: 729 ExecStart=/etc/init.d/ipvsadm start (code=exited, status=0/SUCCESS)
    CPU: 14ms
```

```
maj 08 22:48:15 LB1 systemd[1]: Starting LSB: ipvsadm daemon...
maj 08 22:48:16 LB1 ipvsadm[729]: Clearing the current IPVS table...done.
maj 08 22:48:16 LB1 ipvsadm[729]: Loading IPVS configuration...done.
maj 08 22:48:16 LB1 ipvsadm[729]: Starting IPVS Connection Synchronization Daemon: master.
maj 08 22:48:16 LB1 systemd[1]: Started LSB: ipvsadm daemon.
root@LB1:~#
```

```
apt install curl
```

```
apt install ufw
```

```
root@LB1:~# curl http://172.30.0.10
strona testowa SRV1
root@LB1:~# curl http://172.30.0.20
strona testowa SRV2
root@LB1:~# _
```

[LB1] Modyfikujemy pliki:

```
/etc/default/ufw [-M--] 30 L:[ 1+18 19/ 48] *(743 /1901b) 0034 0x022
# /etc/default/ufw
#
# Set to yes to apply rules to support IPv6 (no means only IPv6 on loopback
# accepted). You will need to 'disable' and then 'enable' the firewall for
# the changes to take affect.
IPv6=yes

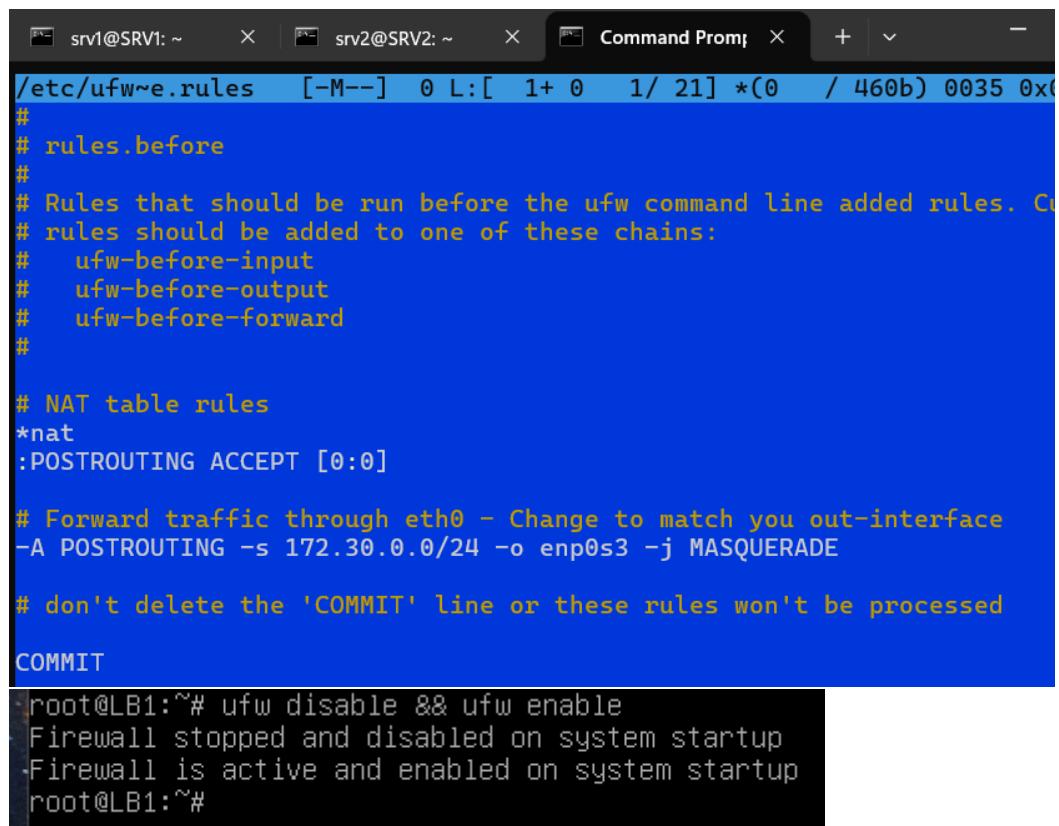
# Set the default input policy to ACCEPT, DROP, or REJECT. Please note that
# you change this you will most likely want to adjust your rules.
DEFAULT_INPUT_POLICY="ACCEPT"

# Set the default output policy to ACCEPT, DROP, or REJECT. Please note that
# you change this you will most likely want to adjust your rules.
DEFAULT_OUTPUT_POLICY="ACCEPT"

# Set the default forward policy to ACCEPT, DROP or REJECT. Please note that
# if you change this you will most likely want to adjust your rules
DEFAULT_FORWARD_POLICY="ACCEPT"

# Set the default application policy to ACCEPT, DROP, REJECT or SKIP. Please
# note that setting this to ACCEPT may be a security risk. See 'man ufw' for
# details
DEFAULT_APPLICATION_POLICY="SKIP"

# By default ufw only touches its own chains. Set this to 'yes' to have ufw
```



The screenshot shows a terminal window with three tabs: 'srv1@SRV1: ~', 'srv2@SRV2: ~', and 'Command Prompt'. The 'Command Prompt' tab is active and displays the contents of the file '/etc/ufw~e.rules'. The file contains several sections of ufw rules, including 'rules.before', 'nat', and a 'POSTROUTING' chain. At the bottom of the file, there is a 'COMMIT' command. Below the file content, the terminal shows the command 'root@LB1:~# ufw disable && ufw enable' being run, followed by the output indicating the firewall has been stopped, disabled, and then started and enabled again.

```
/etc/ufw~e.rules [-M--] 0 L:[ 1+ 0 1/ 21] *(0 / 460b) 0035 0x020
#
# rules.before
#
# Rules that should be run before the ufw command line added rules. Current
# rules should be added to one of these chains:
#   ufw-before-input
#   ufw-before-output
#   ufw-before-forward
#
# NAT table rules
*nat
:POSTROUTING ACCEPT [0:0]

# Forward traffic through eth0 - Change to match your out-interface
-A POSTROUTING -s 172.30.0.0/24 -o enp0s3 -j MASQUERADE

# don't delete the 'COMMIT' line or these rules won't be processed

COMMIT
root@LB1:~# ufw disable && ufw enable
Firewall stopped and disabled on system startup
Firewall is active and enabled on system startup
root@LB1:~#
```

Modyfikujemy ustawienia interfejsów na serwerach:

```
auto enp0s8          auto enp0s8
iface enp0s8 inet static      iface enp0s8 inet static
    address 172.30.0.20/24      address 172.30.0.10/24
    gateway 172.30.0.1        gateway 172.30.0.1
```

(w razie potrzeby: ip addr flush dev enp0s{8/3}) restartujemy ustawienia sieciowe

Wyłączamy pierwszy interfejs (brifge) i testujemy:

```
root@SRV2:~# 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: enp0s3: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc pfifo_fast state DOWN group default qlen 1000
    link/ether 08:00:27:77:e5:d2 brd ff:ff:ff:ff:ff:ff
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether 08:00:27:ca:94:bf brd ff:ff:ff:ff:ff:ff
        inet 172.30.0.20/24 brd 172.30.0.255 scope global enp0s8
            valid_lft forever preferred_lft forever
root@SRV2:~# ping wp.pl
PING wp.pl (212.77.98.9) 56(84) bytes of data.
64 bytes from www.wp.pl (212.77.98.9): icmp_seq=1 ttl=58 time=17.5 ms
64 bytes from www.wp.pl (212.77.98.9): icmp_seq=2 ttl=58 time=17.5 ms
^C
--- wp.pl ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms
rtt min/avg/max/mdev = 17.507/17.514/17.522/0.007 ms
root@SRV2:~#
```

```
root@SRV1:~# ip route
default via 172.30.0.1 dev enp0s8 onlink
172.30.0.0/24 dev enp0s8 proto kernel scope link src 172.30.0.10
root@SRV1:~# ping wp.pl
PING wp.pl (212.77.98.9) 56(84) bytes of data.
64 bytes from www.wp.pl (212.77.98.9): icmp_seq=1 ttl=58 time=17.4 ms
64 bytes from 9.98.77.212.in-addr.arpa (212.77.98.9): icmp_seq=2 ttl=58 time=17.3 ms
^C
--- wp.pl ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1002ms
rtt min/avg/max/mdev = 17.256/17.335/17.414/0.079 ms
root@SRV1:~#
```

Modyfikujemy plik:

```
/etc/bind/db.contoso.com [-M--] 45 L:[ 1+18 19/ 22] *(392 /
;
; BIND data file for local loopback interface
;
$TTL<-->604800
@<---->IN<---->SOA<--->contoso.com. root.contoso.com. (
<----><----><----> 4<---->; Serial
<----><----><----> 604800<---->; Refresh
<----><----><----> 86400<---->; Retry
<----><----><----> 2419200<---->; Expire
<----><----><----> 604800 )<---->; Negative Cache TTL
;
@<---->IN<---->NS<---->ns1.contoso.com.
ns1<--->IN<---->A<---->192.168.1.141
lb1<--->IN<---->A<---->192.168.1.141
lb2<--->IN<---->A<---->192.168.1.142
srv1<--->IN<---->A<---->192.168.1.151
srv2<--->IN<---->A<---->192.168.1.152   IP LB1
www<--->10<---->IN<---->A<---->192.168.1.141
; www<--->4<---->IN<---->A<---->192.168.1.152
@<---->TN<---->AAAA<--->;1
```

Systemctl restart bind9

Zmieniamy adresy domyślnych adresów serwerów DNS:

```
LB1 [Uruchomiona] - Oracle VM Virtu SRV1 [Uruchomiona] - Oracle VM Virtu
Plik Maszyna Widok Wejście Urządzenia Plik Maszyna Widok Wejście
/etc/resolv.conf [-M--] 0 L:/ 1/etc/resolv.conf [-M--]
nameserver 127.0.0.1 nameserver 172.30.0.1

SRV2 [Uruchomiona] - Oracle VM Virtu LB2 [Uruchomiona] - Oracle VM Virtu
Plik Maszyna Widok Wejście Plik Maszyna Widok Wejście
/etc/resolv.conf [-M--] /etc/resolv.conf [-M--] 2
nameserver 172.30.0.1 nameserver 172.30.0.1
```

zabezpieczamy w/w plik przed nadpisaniem:

```
# chattr +i /etc/resolv.conf
```

```
root@SRV2:~# ping www.contoso.com
PING www.contoso.com (192.168.1.141) 56(84) bytes of data.
64 bytes from 192.168.1.141 (192.168.1.141): icmp_seq=1 ttl=64 time=0.572 ms
64 bytes from 192.168.1.141 (192.168.1.141): icmp_seq=2 ttl=64 time=0.540 ms
^C
--- www.contoso.com ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1002ms
rtt min/avg/max/mdev = 0.540/0.556/0.572/0.016 ms
root@SRV2:~# _

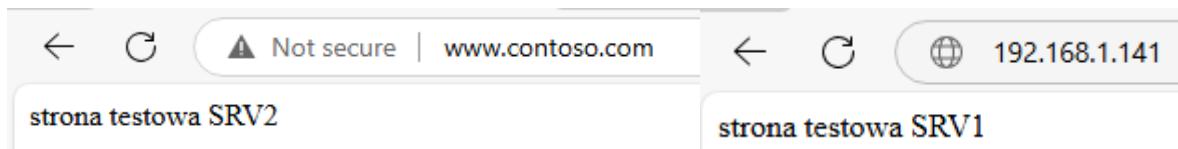
root@SRV1:~# echo "To jest server SRV1" > /var/www/html/index.html
root@SRV1:~# _

root@SRV2:~# echo "To jest serwer SRV2" > /var/www/html/index.html
root@SRV2:~# _
```

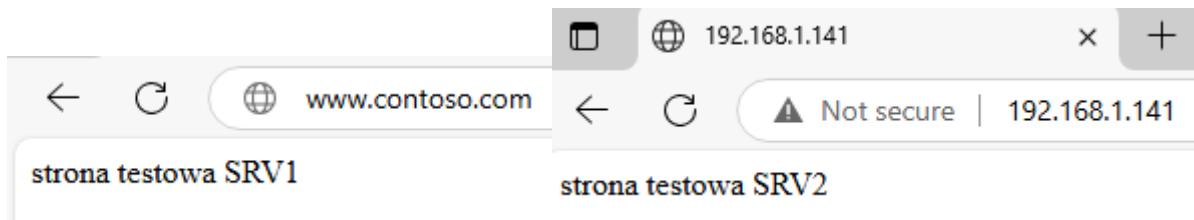
```
root@LB1:~# ipvsadm -l
IP Virtual Server version 1.2.1 (size=4096)
Prot LocalAddress:Port Scheduler Flags
#   -> RemoteAddress:Port           Forward Weight ActiveConn InActConn
root@LB1:~# ipvsadm -At 192.168.1.141:80 -s rr
root@LB1:~# ipvsadm -at 192.168.1.141:80 -r 172.30.0.10:80 -m
root@LB1:~# ipvsadm -at 192.168.1.141:80 -r 172.30.0.20:80 -m
root@LB1:~# ipvsadm -l
IP Virtual Server version 1.2.1 (size=4096)
Prot LocalAddress:Port Scheduler Flags
  -> RemoteAddress:Port           Forward Weight ActiveConn InActConn
  TCP  192.168.1.141:http rr
    -> 172.30.0.10:http            Masq    1      0      0
    -> 172.30.0.20:http            Masq    1      0      0
root@LB1:~# ipvsadm -S > /etc/ipvsadm.rules
root@LB1:~# _
```

```
root@LB1:~# curl 192.168.1.141
strona testowa SRV2
root@LB1:~# curl 192.168.1.141
strona testowa SRV1
root@LB1:~# _
```

←Test dzielenia równoważenia obciążenia



Po chwili:



Zad 11 LVS- DR

[SRV1 SRV2] chattr -i /etc/resolv.conf

```
/etc/resolv.conf [---  
#nameserver 172.30.0.1  
nameserver 192.168.1.1
```

```
root@SRV1:~# ping wp.pl  
PING wp.pl (212.77.98.9) 56(84) bytes of data.  
64 bytes from 9.98.77.212.in-addr.arpa (212.77.98.9): icmp_seq=1 ttl=59 time=36.8 ms  
64 bytes from 9.98.77.212.in-addr.arpa (212.77.98.9): icmp_seq=2 ttl=59 time=17.4 ms  
^C  
--- wp.pl ping statistics ---  
2 packets transmitted, 2 received, 0% packet loss, time 1001ms  
rtt min/avg/max/mdev = 17.417/27.100/36.784/9.683 ms  
root@SRV1:~#  
root@SRV2:~# ping wp.pl  
PING wp.pl (212.77.98.9) 56(84) bytes of data.  
64 bytes from www.wp.pl (212.77.98.9): icmp_seq=1 ttl=59 time=16.4 ms  
64 bytes from 9.98.77.212.in-addr.arpa (212.77.98.9): icmp_seq=2 ttl=59 time=17.2 ms  
^C64 bytes from 9.98.77.212.in-addr.arpa (212.77.98.9): icmp_seq=3 ttl=59 time=17.6 ms  
64 bytes from 9.98.77.212.in-addr.arpa (212.77.98.9): icmp_seq=4 ttl=59 time=17.1 ms  
64 bytes from 9.98.77.212.in-addr.arpa (212.77.98.9): icmp_seq=5 ttl=59 time=16.9 ms
```

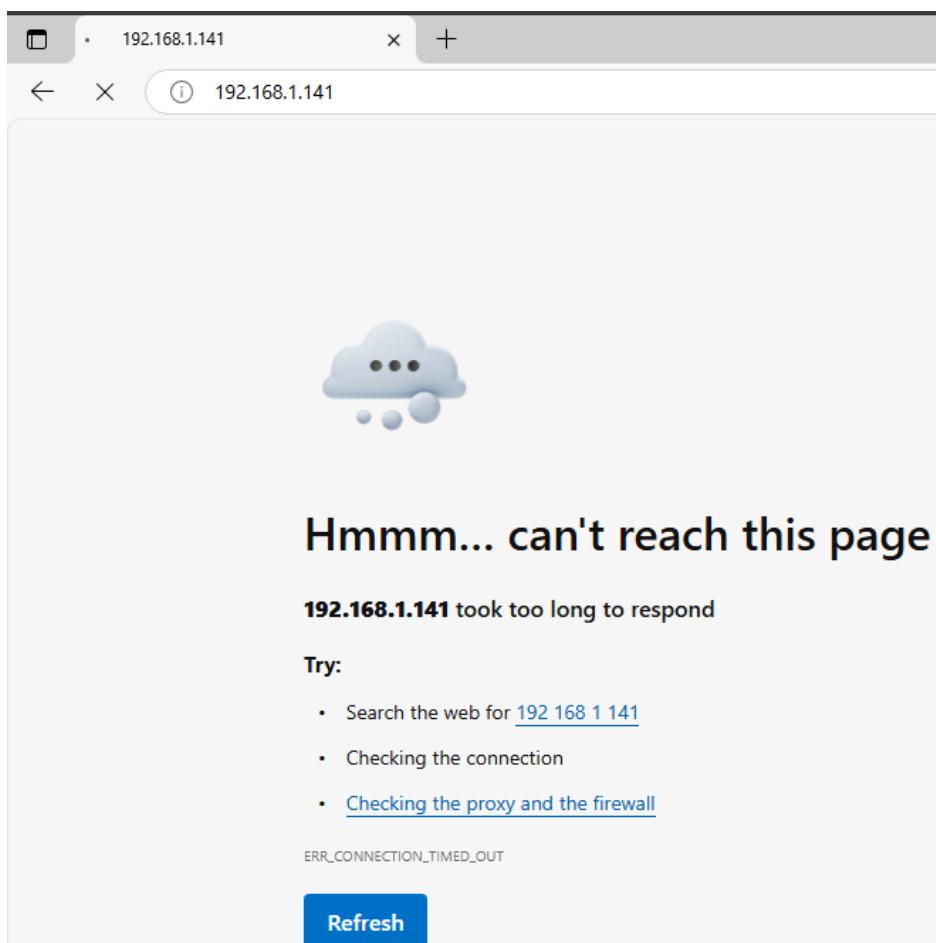
```
root@LB1:~# ipvsadm -l  
IP Virtual Server version 1.2.1 (size=4096)  
Prot LocalAddress:Port Scheduler Flags  
  -> RemoteAddress:Port      Forward Weight ActiveConn InActConn  
TCP  192.168.1.141:http  rr  
    -> 172.30.0.10:http        Masq    1      0  
    -> 172.30.0.20:http        Masq    1      0  
root@LB1:~#
```

```

root@LB1:~# ipvsadm -C
root@LB1:~# ipvsadm -At 192.168.1.141:80 -s rr
root@LB1:~# ipvsadm -at 192.168.1.141:80 -r 192.168.1.151:80 -g
root@LB1:~# ipvsadm -at 192.168.1.141:80 -r 192.168.1.152:80 -g
root@LB1:~# ipvsadm -l
IP Virtual Server version 1.2.1 (size=4096)
Prot LocalAddress:Port Scheduler Flags
    -> RemoteAddress:Port           Forward Weight ActiveConn InActConn
TCP   192.168.1.141:http  rr
    -> 192.168.1.151:http          Route    1      0      0
    -> 192.168.1.152:http          Route    1      0      0
root@LB1:~#
root@LB1:~# ipvsadm -S > /etc/ipvsadm.rules
root@LB1:~#

```

Sprawdzamy dzielenie:



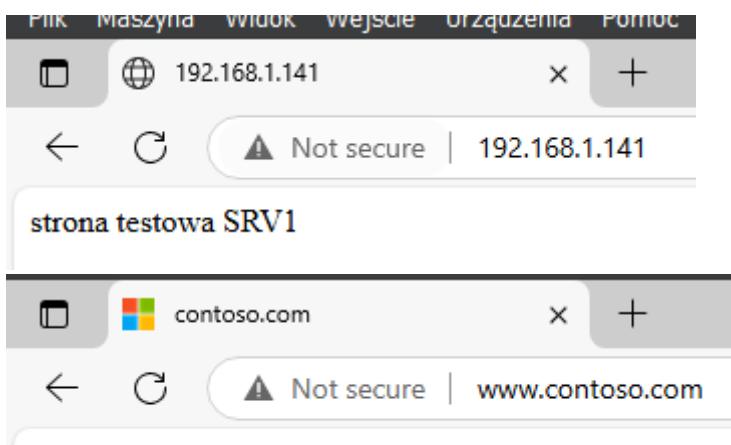
[SRV1] # `tcpdump -i enp0s3 port 80 -en`

```

16:09:44.173729 08:00:27:1b:3d:4b > 08:00:27:f6:fe:93, ethertype IPv4 (0x0800), length 66: 192.168.1.116.49759 > 192.168.1.141.80: Flags [S], seq 218510418, win 64240, options [mss 1460,nop,wscale 8,nop,nop,sackOK], length 0
16:09:45.929292 08:00:27:1b:3d:4b > 08:00:27:f6:fe:93, ethertype IPv4 (0x0800), length 66: 192.168.1.116.49757 > 192.168.1.141.80: Flags [S], seq 2361904277, win 64240, options [mss 1460,nop,wscale 8,nop,nop,sackOK], length 0
16:09:46.174944 08:00:27:1b:3d:4b > 08:00:27:f6:fe:93, ethertype IPv4 (0x0800), length 66: 192.168.1.116.49759 > 192.168.1.141.80: Flags [S], seq 218510418, win 64240, options [mss 1460,nop,wscale 8,nop,nop,sackOK], length 0
16:09:49.941039 08:00:27:1b:3d:4b > 08:00:27:f6:fe:93, ethertype IPv4 (0x0800), length 66: 192.168.1.116.49757 > 192.168.1.141.80: Flags [S], seq 2361904277, win 64240, options [mss 1460,nop,wscale 8,nop,nop,sackOK], length 0

```

```
root@SRV1:~# iptables -t nat -A PREROUTING -d 192.168.1.141 -j REDIRECT  
root@SRV1:~#
```



The screenshot shows a web browser window with two tabs open. The top tab is titled '192.168.1.141' and the bottom tab is titled 'contoso.com'. Both tabs have a yellow warning icon indicating they are 'Not secure'. The content of both tabs is 'strona testowa SRV1'.

```
root@SRV1:~# tcpdump -i enp0s3 port 80 -en
tcpdump: verbose output suppressed, use -v[v]... for full protocol decode
listening on enp0s3, link-type EN10MB (Ethernet), snapshot length 262144 bytes
(16:13:34.295539 08:00:27:1b:3d:4b > 08:00:27:f6:fe:93, ethertype IPv4 (0x0800), length 66: 192.168.1.116.49947 > 192.168.1.141.80: Flags [S], seq 1174180795, win 64240, options [mss 1460,nop,wscale 8,nop,nop,sackOK], length 0
16:13:34.296287 08:00:27:f6:fe:93 > 08:00:27:e2:68:7e, ethertype IPv4 (0x0800), length 66: 192.168.1.141.80 > 192.168.1.116.49947: Flags [S.], seq 278817308, ack 1174180796, win 64240, options [mss 1460,nop,nop,sackOK,nop,wscale 7], length 0
16:13:34.297866 08:00:27:1b:3d:4b > 08:00:27:f6:fe:93, ethertype IPv4 (0x0800), length 60: 192.168.1.116.49947 > 192.168.1.141.80: Flags [.], ack 1, win 1026, length 0
16:13:34.325823 08:00:27:1b:3d:4b > 08:00:27:f6:fe:93, ethertype IPv4 (0x0800), length 496: 192.168.1.116.49947 > 192.168.1.141.80: Flags [P.], seq 1:443, ack 1, win 1026, length 442: HTTP: GET / HTTP/1.1
16:13:34.325885 08:00:27:f6:fe:93 > 08:00:27:e2:68:7e, ethertype IPv4 (0x0800), length 54: 192.168.1.141.80 > 192.168.1.116.49947: Flags [.], ack 443, win 501, length 0
16:13:34.335940 08:00:27:f6:fe:93 > 08:00:27:e2:68:7e, ethertype IPv4 (0x0800), length 357: 192.168.1.141.80 > 192.168.1.116.49947: Flags [P.], seq 1:304, ack 443, win 501, length 303: HTTP: HTTP/1.1 200 OK
16:13:34.390102 08:00:27:1b:3d:4b > 08:00:27:f6:fe:93, ethertype IPv4 (0x0800), length 60: 192.168.1.116.49947 > 192.168.1.141.80: Flags [.], ack 304, win 1025, length 0
16:13:34.452949 08:00:27:1b:3d:4b > 08:00:27:f6:fe:93, ethertype IPv4 (0x0800), length 438: 192.168.1.116.49947 > 192.168.1.141.80: Flags [P.], seq 443:827, ack 304, win 1025, length 384: HTTP: GET / favicon.ico HTTP/1.1
16:13:34.452994 08:00:27:f6:fe:93 > 08:00:27:e2:68:7e, ethertype IPv4 (0x0800), length 54: 192.168.1.141.80 > 192.168.1.116.49947: Flags [.], ack 827, win 501, length 0
16:13:34.453557 08:00:27:f6:fe:93 > 08:00:27:e2:68:7e, ethertype IPv4 (0x0800), length 545: 192.168.1.141.80 > 192.168.1.116.49947: Flags [P.], seq 304:795, ack 827, win 501, length 491: HTTP: HTTP/1.1 404 Not Found
16:13:34.513737 08:00:27:1b:3d:4b > 08:00:27:f6:fe:93, ethertype IPv4 (0x0800), length 60: 192.168.1.116.49947 > 192.168.1.141.80: Flags [.], ack 795, win 1023, length 0
16:13:39.454860 08:00:27:f6:fe:93 > 08:00:27:e2:68:7e, ethertype IPv4 (0x0800), length 54: 192.168.1.141.80 > 192.168.1.116.49947: Flags [F.], seq 795, ack 827, win 501, length 0
16:13:39.455613 08:00:27:1b:3d:4b > 08:00:27:f6:fe:93, ethertype IPv4 (0x0800), length 60: 192.168.1.116.49947 > 192.168.1.141.80: Flags [.], ack 796, win 1023, length 0
```

Zad 12 dodanie wag

```
root@LB1:~# ipvsadm -l
IP Virtual Server version 1.2.1 (size=4096)
Prot LocalAddress:Port Scheduler Flags
  -> RemoteAddress:Port           Forward Weight ActiveConn InActConn
TCP  192.168.1.141:http rr
  -> 192.168.1.151:http          Route   1      0      0
  -> 192.168.1.152:http          Route   1      1      0
root@LB1:~# ipvsadm -C
root@LB1:~# ipvsadm -At 192.168.1.141:80 -s wrr
root@LB1:~# ipvsadm -at 192.168.1.141:80 -r 192.168.1.151:80 -g -w 1
root@LB1:~# ipvsadm -at 192.168.1.141:80 -r 192.168.1.152:80 -g -w 2
root@LB1:~# ipvsadm -l
IP Virtual Server version 1.2.1 (size=4096)
Prot LocalAddress:Port Scheduler Flags
  -> RemoteAddress:Port           Forward Weight ActiveConn InActConn
TCP  192.168.1.141:http wrr
  -> 192.168.1.151:http          Route   1      0      0
  -> 192.168.1.152:http          Route   2      1      0
root@LB1:~# ipvsadm -S > /etc/ipvsadm.rules
root@LB1:~#
```

Testujemy:



Zad 13 dodanie VIP

```
LB1 [Uruchomiona] - Oracle VM VirtualBox
Plik Maszyna Widok Wejście Urządzenia Pomoc
/etc/network/interfaces [BM--] 25 L:[ 1+18
# This file describes the network interfaces a
# and how to activate them. For more informati
source /etc/network/interfaces.d/*
# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface

auto enp0s3
iface enp0s3 inet static
  address 192.168.1.141/24
  gateway 192.168.1.1

auto enp0s3:1
iface enp0s3:1 inet static
  address 192.168.1.145/24

auto enp0s8
iface enp0s8 inet static
  address 172.30.0.1/24

auto enp0s9
iface enp0s9 inet static
  address 172.16.0.1/24
```

Modyfikujemy plik, poprzez dopisanie aliasu dla interfejsu.

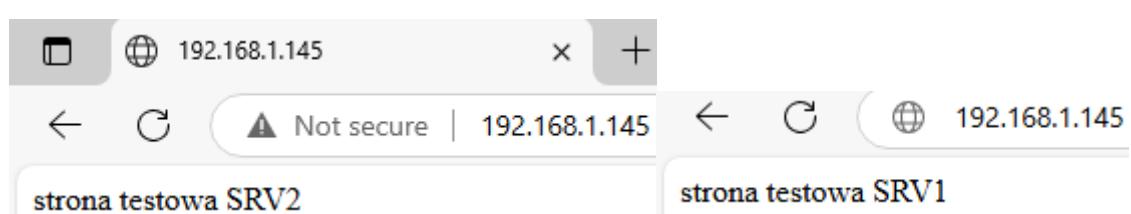
Restartujemy ustawienia sieciowe

Modyfikujemy plik:

```
/etc/bind/db.contoso.com [-M--] 45 L:[ 1+18 19/ 22] *(392 / 4
;
; BIND data file for local loopback interface
;
$TTL<-->604800
@<---->IN<---->SOA<---->contoso.com. root.contoso.com. (
<----><----><----> 4><---->; Serial
<----><----><----> 604800><---->; Refresh
<----><----><----> 86400><---->; Retry
<----><----><---->2419200><---->; Expire
<----><----><----> 604800 )<---->; Negative Cache TTL
;
@<---->IN<---->NS<---->ns1.contoso.com.
ns1<--->IN<---->A<---->192.168.1.141
lb1<--->IN<---->A<---->192.168.1.141
lb2<--->IN<---->A<---->192.168.1.142
srv1<--->IN<---->A<---->192.168.1.151
srv2<--->IN<---->A<---->192.168.1.152
;
www<--->10<---->IN<---->A<---->192.168.1.145
;www<-->4<---->IN<---->A<---->192.168.1.152
@<---->IN<---->AAAA<-->::1
```

```
root@LB1:~# ipvsadm -l
IP Virtual Server version 1.2.1 (size=4096)
Prot LocalAddress:Port Scheduler Flags
    -> RemoteAddress:Port           Forward Weight ActiveConn InActConn
TCP  192.168.1.141:http  wrr
    -> 192.168.1.151:http          Route   1      0      0
    -> 192.168.1.152:http          Route   2      3      0
root@LB1:~# ipvsadm -C
root@LB1:~# ipvsadm -At 192.168.1.145 -s wrr
Zero port specified for non-persistent service
root@LB1:~# ipvsadm -At 192.168.1.145:80 -s wrr
root@LB1:~# ipvsadm -at 192.168.1.145:80 -r 192.168.1.151:80 -gw 1
root@LB1:~# ipvsadm -at 192.168.1.145:80 -r 192.168.1.152:80 -gw 2
root@LB1:~# ipvsadm -l
IP Virtual Server version 1.2.1 (size=4096)
Prot LocalAddress:Port Scheduler Flags
    -> RemoteAddress:Port           Forward Weight ActiveConn InActConn
TCP  192.168.1.145:http  wrr
    -> 192.168.1.151:http          Route   1      0      0
    -> 192.168.1.152:http          Route   2      0      0
root@LB1:~# ipvsadm -S > /etc/ipvsadm.rules
root@LB1:~#
```

```
root@SRV1:~# iptables -t nat -A PREROUTING -d 192.168.1.145 -j REDIRECT
root@SRV1:~#
```



Zad 14 Utworzenie HA dla LVS

Rozłączamy interfejs na SRV1 i sprawdzamy:

The screenshot shows a browser window with the address bar containing 'www.contoso.com'. A warning icon indicates 'Not secure'. The main content area displays the text 'strona testowa SRV2'. To the right of the content, the text 'Dziela „normalnie”' is displayed.

Po ponownym włączniu interfejsu na SRV1:

The screenshot shows a browser window with the address bar containing 'www.contoso.com'. A warning icon indicates 'Not secure'. The main content area displays the text 'strona testowa SRV1'. Below the content, a terminal window shows the command 'root@SRV1:~# systemctl stop apache2' followed by 'root@SRV1:~#'. To the right of the content, the text 'Sprawdzamy:' is displayed.

The screenshot shows a browser window with the address bar containing 'www.contoso.com'. A warning icon indicates 'Not secure'. The main content area displays the text 'strona testowa SRV2'. To the right of the content, the text '(wyłącznie SRV2)' is displayed.

Odlaczamy interfejs na LB1, test:

The screenshot shows a browser window with the address bar containing 'www.contoso.com'. A warning icon indicates 'Not secure'. The main content area displays the text 'Hmmm... can't reach this pag' and 'www.contoso.com's server IP address could not be found'. Below this, a 'Try:' section lists 'Checking the connection' and 'Checking the proxy, firewall, and DNS settings'. At the bottom, the error code 'ERR_NAME_NOT_RESOLVED' is shown. A blue 'Refresh' button is visible at the bottom left.

```
[LB2] apt install ipvsadm
```

```
# echo "net.ipv4.ip_nonlocal_bind=1">>>/etc/sysctl.conf  
# echo "net.ipv4.ip_forward=1">>>/etc/sysctl.conf  
  
# sysctl -p
```

Modyfikujemy plik:

```
/etc/default/ipvsadm [-M--] 13 L:[ 1+ 9 10/ 1  
# ipvsadm  
  
# if you want to start ipvsadm on boot set this to  
AUTO="true"  
  
# daemon method (none|master|backup)  
DAEMON="backup"  
  
# use interface (eth0,eth1...)  
IFACE="enp0s3" <  
  
# syncid to use.  
# (0 means no filtering of syncids happen, that is  
# SYNCID="0"
```

```
root@LB2:~# systemctl restart ipvsadm.service  
root@LB2:~# systemctl status ipvsadm.service  
● ipvsadm.service - LSB: ipvsadm daemon  
   Loaded: loaded (/etc/init.d/ipvsadm; generated)  
   Active: active (exited) since Sat 2025-05-10 22:38:34 CEST; 5s ago  
     Docs: man:systemd-sysv-generator(8)  
 Process: 599 ExecStart=/etc/init.d/ipvsadm start (code=exited, status=0/SUCCESS)  
   CPU: 14ms  
  
maj 10 22:38:34 LB2 systemd[1]: ipvsadm.service: Succeeded.  
maj 10 22:38:34 LB2 systemd[1]: Stopped LSB: ipvsadm daemon.  
maj 10 22:38:34 LB2 systemd[1]: Starting LSB: ipvsadm daemon...  
maj 10 22:38:34 LB2 ipvsadm[599]: Clearing the current IPVS table...done.  
maj 10 22:38:34 LB2 ipvsadm[599]: Loading IPVS configuration...done.  
maj 10 22:38:34 LB2 ipvsadm[599]: Starting IPVS Connection Synchronization Daemon: backup.  
maj 10 22:38:34 LB2 systemd[1]: Started LSB: ipvsadm daemon.  
root@LB2:~# -
```

```
[LB1 LB2]# apt update -y && apt install keepalived -y
```

Modyfikujemy pliki:

```
/etc/keepalived/keepalived.conf [-M--] 9 L:[ 1+28 29/ 38] *(723 / 855b) 0010 0x00A
vrrp_instance VRRP_EXT {
interface enp0s3
state MASTER
virtual_router_id 52
priority 101
advert_int 1

authentication {
auth_type AH
auth_pass password
}

virtual_ipaddress {
192.168.1.146
}
}

virtual_server 192.168.1.146 80 {
    delay_loop 1      //interwał sprawdzania prawidłowego działania prawdziwych serwerów
    lb_algo wrr      //algorytm równoważenia obciążenia dla lvs
    lb_kind DR        // metoda równoważenia obciążenia dla LVS
    protocol TCP      //protokół przekierowanych połączeń

    real_server 192.168.1.151 80 {
        weight 2
        TCP_CHECK {
            connect_timeout 10    //limit czasu oczekiwania na połączenie po którym zostanie uznane iż jest awaria
        }
    }

    real_server 192.168.1.152 80 {
        weight 1
        TCP_CHECK {
            connect_timeout 10
        }
    }
}
```

```
/etc/keepalived.conf [-M--] 1 L:[ 1+37 38/ 38] *
vrrp_instance VRRP_EXT {
interface enp0s3
state BACKUP
virtual_router_id 52
priority 100
advert_int 1

authentication {
auth_type AH
auth_pass password
}

virtual_ipaddress {
192.168.1.146
}
}

virtual_server 192.168.1.146 80 {
    delay_loop 1
    lb_algo wrr
    lb_kind DR
    protocol TCP

    real_server 192.168.1.151 80 {
        weight 2
        TCP_CHECK {
            connect_timeout 10
        }
    }

    real_server 192.168.1.152 80 {
        weight 1
        TCP_CHECK {
            connect_timeout 10
        }
    }
}
```

[LB1 LB2]

```
root@LB1:~# systemctl enable keepalived
Synchronizing state of keepalived.service with SysV service script with /lib/systemd/systemd-sysv-install.
Executing: /lib/systemd/systemd-sysv-install enable keepalived
root@LB1:~# systemctl start keepalived
root@LB1:~# _
```

[SRV1 SRV2]

```
# iptables -t nat -A PREROUTING -d 192.168.1.146 -j REDIRECT
```

Sprawdzamy aktywność nowego adresu:

```
C:\Windows\system32\cmd.exe
Microsoft Windows [Version 10.0.19043.2364]
(c) Microsoft Corporation. All rights reserved.

C:\Users\mkowalski>ping 192.168.1.146

Pinging 192.168.1.146 with 32 bytes of data:
Reply from 192.168.1.146: bytes=32 time=1ms TTL=64
Reply from 192.168.1.146: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.1.146:
    Packets: Sent = 2, Received = 2, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
Control-C
^C
C:\Users\mkowalski>
```

[LB1]

```
/etc/bind/db.contoso.com      [-M--] 45 L:[ 1+18 19/ 22] *(392 .
;
; BIND data file for local loopback interface
;
$TTL<-->604800
@<---->IN<---->SOA<--->contoso.com. root.contoso.com. (
<----><----><---->      9><---->; Serial
<----><----><----> 604800><---->; Refresh
<----><----><----> 86400><---->; Retry
<----><----><---->2419200><---->; Expire
<----><----><----> 604800 )<---->; Negative Cache TTL
;
@<---->IN<---->NS<---->ns1.contoso.com.
ns1<--->IN<---->A<---->192.168.1.141
lb1<--->IN<---->A<---->192.168.1.141
lb2<--->IN<---->A<---->192.168.1.142
srv1<-->IN<---->A<---->192.168.1.151
srv2<-->IN<---->A<---->192.168.1.152

www<--->10<---->IN<---->A<---->192.168.1.146
;www<-->4<---->IN<---->A<---->192.168.1.152
@<---->IN<---->AAAA<-->::1
```

Systemctl restart bind9

Sprawdzamy:

```
C:\Users\mkowalski>ping lb1.contoso.com

Pinging lb1.contoso.com [192.168.1.141] with 32 bytes of data:
Reply from 192.168.1.141: bytes=32 time<1ms TTL=64
Reply from 192.168.1.141: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.1.141:
  Packets: Sent = 2, Received = 2, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
  Minimum = 0ms, Maximum = 0ms, Average = 0ms
Control-C
^C
C:\Users\mkowalski>ping lb2.contoso.com

Pinging lb2.contoso.com [192.168.1.142] with 32 bytes of data:
Reply from 192.168.1.142: bytes=32 time=1ms TTL=64
Reply from 192.168.1.142: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.1.142:
  Packets: Sent = 2, Received = 2, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
  Minimum = 0ms, Maximum = 1ms, Average = 0ms
Control-C
^C
C:\Users\mkowalski>ping www.contoso.com

C:\Users\mkowalski>ping www.contoso.com

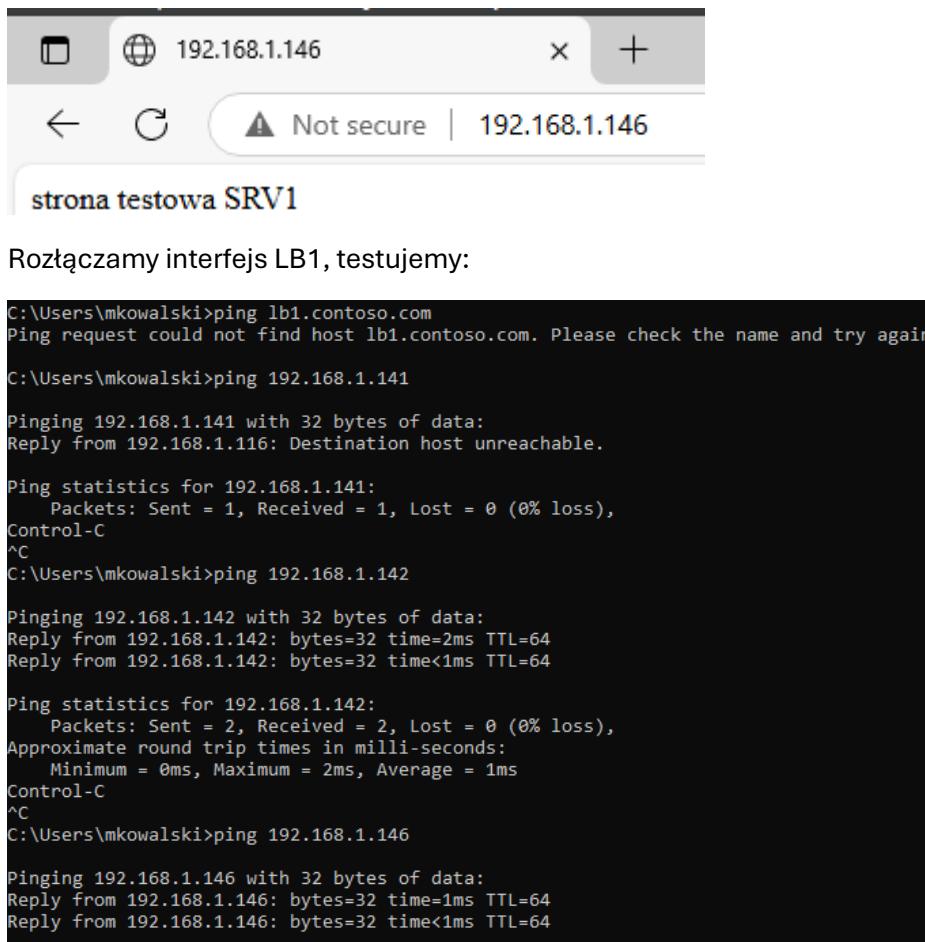
Pinging www.contoso.com [192.168.1.146] with 32 bytes of data:
Reply from 192.168.1.146: bytes=32 time<1ms TTL=64
Reply from 192.168.1.146: bytes=32 time<1ms TTL=64
```

```
C:\Users\mkowalski>arp -a

Interface: 169.254.85.188 --- 0x6
  Internet Address      Physical Address      Type
  169.254.255.255        ff-ff-ff-ff-ff-ff    static
  224.0.0.22              01-00-5e-00-00-16    static
  224.0.0.251             01-00-5e-00-00-fb    static
  224.0.0.252             01-00-5e-00-00-fc    static
  239.255.255.250         01-00-5e-7f-ff-fa    static
  255.255.255.255         ff-ff-ff-ff-ff-ff    static

Interface: 192.168.1.116 --- 0xf
  Internet Address      Physical Address      Type
  192.168.1.1            c0-94-ad-3e-b3-24    dynamic
  192.168.1.101           a8-31-62-9e-3c-a2    dynamic
  192.168.1.102           b0-19-21-ab-2d-68    dynamic
  192.168.1.103           a8-31-62-ab-c3-4c    dynamic
  192.168.1.105           a8-31-62-49-6d-51    dynamic
  192.168.1.106           a8-31-62-49-6d-6b    dynamic
  192.168.1.115           d8-a3-5c-8e-71-b2    dynamic
  192.168.1.117           44-5c-e9-a1-8f-3b    dynamic
  192.168.1.141           08-00-27-1b-3d-4b    dynamic
  192.168.1.142           08-00-27-04-d9-91    dynamic
  192.168.1.145           08-00-27-1b-3d-4b    dynamic
  192.168.1.146           08-00-27-1b-3d-4b    dynamic
  192.168.1.151           08-00-27-f6-fe-93    dynamic
  192.168.1.152           08-00-27-77-e5-d2    dynamic
  192.168.1.255             ff-ff-ff-ff-ff-ff    static
  224.0.0.22              01-00-5e-00-00-16    static
  224.0.0.251             01-00-5e-00-00-fb    static
  224.0.0.252             01-00-5e-00-00-fc    static
  239.255.255.250         01-00-5e-7f-ff-fa    static
  255.255.255.255         ff-ff-ff-ff-ff-ff    static

C:\Users\mkowalski>
```



```
C:\Users\mkowalski>arp -a

Interface: 169.254.85.188 --- 0x6
  Internet Address        Physical Address      Type
  169.254.255.255        ff-ff-ff-ff-ff-ff    static
  224.0.0.22              01-00-5e-00-00-16    static
  224.0.0.251             01-00-5e-00-00-fb    static
  224.0.0.252             01-00-5e-00-00-fc    static
  239.255.255.250         01-00-5e-7f-ff-fa    static
  255.255.255.255         ff-ff-ff-ff-ff-ff    static

Interface: 192.168.1.116 --- 0xf
  Internet Address        Physical Address      Type
  192.168.1.1              c0-94-ad-3e-b3-24  dynamic
  192.168.1.101            a8-31-62-9e-3c-a2  dynamic
  192.168.1.102            b0-19-21-ab-2d-68  dynamic
  192.168.1.103            a8-31-62-ab-c3-4c  dynamic
  192.168.1.105            a8-31-62-49-6d-51  dynamic
  192.168.1.106            a8-31-62-49-6d-6b  dynamic
  192.168.1.142            08-00-27-04-d9-91  dynamic
  192.168.1.146            08-00-27-04-d9-91  dynamic
  192.168.1.255            ff-ff-ff-ff-ff-ff    static
  224.0.0.22              01-00-5e-00-00-16    static
  224.0.0.251             01-00-5e-00-00-fb    static
  224.0.0.252             01-00-5e-00-00-fc    static
  239.255.255.250         01-00-5e-7f-ff-fa    static
  255.255.255.255         ff-ff-ff-ff-ff-ff    static
```

strona testowa SRV1

```
root@SRV1:~# iptables -A INPUT -s 192.168.1.141 -j DROP  
root@SRV1:~#
```

```
root@LB1:~# systemctl status keepalived.service
● keepalived.service - Keepalive Daemon (LVS and VRRP)
   Loaded: loaded (/lib/systemd/system/keepalived.service; enabled; vendor preset: enabled)
   Active: active (running) since Sat 2025-05-10 22:53:16 CEST; 31min ago
     Main PID: 3464 (keepalived)
        Tasks: 3 (limit: 1132)
       Memory: 3.5M
          CPU: 1.350s
        CGroup: /system.slice/keepalived.service
                  └─3464 /usr/sbin/keepalived --dont-fork
                    ├─3465 /usr/sbin/keepalived --dont-fork
                    ├─3466 /usr/sbin/keepalived --dont-fork

maj 10 22:53:17 LB1 Keepalived_healthcheckers[3465]: TCP connection to [192.168.1.151]:tcp:80 succeeded
maj 10 22:53:20 LB1 Keepalived_vrrp[3466]: (VRRP_EXT) Entering MASTER STATE
maj 10 23:06:55 LB1 Keepalived_vrrp[3466]: Netlink reports enp0s3 down
maj 10 23:06:55 LB1 Keepalived_vrrp[3466]: (VRRP_EXT) Entering FAULT STATE
maj 10 23:06:55 LB1 Keepalived_vrrp[3466]: (VRRP_EXT) sent 0 priority
maj 10 23:07:01 LB1 Keepalived_healthcheckers[3465]: TCP_CHECK on service [192.168.1.151]:tcp:80 failed
maj 10 23:07:01 LB1 Keepalived_healthcheckers[3465]: Removing service [192.168.1.151]:tcp:80 to VS
maj 10 23:07:02 LB1 Keepalived_healthcheckers[3465]: TCP_CHECK on service [192.168.1.152]:tcp:80 failed
maj 10 23:07:02 LB1 Keepalived_healthcheckers[3465]: Removing service [192.168.1.152]:tcp:80 to VS
maj 10 23:07:02 LB1 Keepalived_healthcheckers[3465]: Last quorum 1-0=1 > 0 for VS [192.168.1.146]:tcp:80
lines 1-22/22 (END)
```

```
root@LB2:~# systemctl status keepalived
● keepalived.service - Keepalive Daemon (LVS and VRRP)
   Loaded: loaded (/lib/systemd/system/keepalived.service; enabled; vendor preset: enabled)
   Active: active (running) since Sat 2025-05-10 22:54:09 CEST; 30min ago
     Main PID: 1427 (keepalived)
        Tasks: 3 (limit: 1132)
       Memory: 3.7M
          CPU: 2.539s
        CGroup: /system.slice/keepalived.service
                  ├─1427 /usr/sbin/keepalived --dont-fork
                  ├─1428 /usr/sbin/keepalived --dont-fork
                  └─1429 /usr/sbin/keepalived --dont-fork

maj 10 22:54:09 LB2 Keepalived_healthcheckers[1428]: Opening file '/etc/keepalived/keepalived.conf'.
maj 10 22:54:09 LB2 Keepalived_healthcheckers[1428]: Initializing ipvs
maj 10 22:54:09 LB2 Keepalived_vrrp[1429]: (VRRP_EXT) Entering BACKUP STATE (init)
maj 10 22:54:09 LB2 Keepalived_healthcheckers[1428]: Gained quorum 1+0=1 <= 3 for VS [192.168.1.146]
maj 10 22:54:09 LB2 Keepalived_healthcheckers[1428]: Activating healthchecker for service [192.168.1.151]
maj 10 22:54:09 LB2 Keepalived_healthcheckers[1428]: Activating healthchecker for service [192.168.1.152]
maj 10 22:54:09 LB2 Keepalived_healthcheckers[1428]: Activating BFD healthchecker
maj 10 22:54:10 LB2 Keepalived_healthcheckers[1428]: TCP connection to [192.168.1.152]:tcp:80 succeeded
maj 10 22:54:11 LB2 Keepalived_healthcheckers[1428]: TCP connection to [192.168.1.151]:tcp:80 succeeded
maj 10 23:06:58 LB2 Keepalived_vrrp[1429]: (VRRP_EXT) Entering MASTER STATE
lines 1-22/22 (END)
```

```
root@LB1:~# ipvsadm -l
IP Virtual Server version 1.2.1 (size=4096)
Prot LocalAddress:Port Scheduler Flags
    -> RemoteAddress:Port           Forward Weight ActiveConn InActConn
TCP  192.168.1.145:http wrr
    -> 192.168.1.151:http          Route   1      0      0
    -> 192.168.1.152:http          Route   2      0      0
TCP  192.168.1.146:http wrr
root@LB1:~#
```

```
root@LB2:~# ipvsadm -l
IP Virtual Server version 1.2.1 (size=4096)
Prot LocalAddress:Port Scheduler Flags
    -> RemoteAddress:Port           Forward Weight ActiveConn InActConn
TCP  192.168.1.146:http wrr
    -> 192.168.1.151:http          Route   2      0      0
    -> 192.168.1.152:http          Route   1      0      0
root@LB2:~#
```

```
root@SRV1:~# iptables -D INPUT -s 192.168.1.141 -j DROP
root@SRV1:~#
```

```
root@LB2:~# ipvsadm -l
IP Virtual Server version 1.2.1 (size=4096)
Prot LocalAddress:Port Scheduler Flags
    -> RemoteAddress:Port           Forward Weight ActiveConn InActConn
TCP  192.168.1.146:http wrr
    -> 192.168.1.151:http          Route   2      0      0
    -> 192.168.1.152:http          Route   1      0      0
root@LB2:~#
```

```
root@LB2:~# systemctl status keepalived
● keepalived.service - Keepalive Daemon (LVS and VRRP)
   Loaded: loaded (/lib/systemd/system/keepalived.service; enabled; vendor preset: enabled)
   Active: active (running) since Sat 2025-05-10 22:54:09 CEST; 35min ago
     Main PID: 1427 (keepalived)
        Tasks: 3 (limit: 1132)
       Memory: 3.7M
      CPU: 2.854s
     CGroup: /system.slice/keepalived.service
             └─1427 /usr/sbin/keepalived --dont-fork
                  ├─1428 /usr/sbin/keepalived --dont-fork
                  └─1429 /usr/sbin/keepalived --dont-fork

maj 10 22:54:09 LB2 Keepalived_healthcheckers[1428]: Opening file '/etc/keepalived/keepalived.conf'.
maj 10 22:54:09 LB2 Keepalived_healthcheckers[1428]: Initializing ipvs
maj 10 22:54:09 LB2 Keepalived_vrrp[1429]: (VRRP_EXT) Entering BACKUP STATE (init)
maj 10 22:54:09 LB2 Keepalived_healthcheckers[1428]: Gained quorum 1+0=1 <= 3 for VS [192.168.1.146]
maj 10 22:54:09 LB2 Keepalived_healthcheckers[1428]: Activating healthchecker for service [192.168.1.146]
maj 10 22:54:09 LB2 Keepalived_healthcheckers[1428]: Activating healthchecker for service [192.168.1.151]
maj 10 22:54:09 LB2 Keepalived_healthcheckers[1428]: Activating BFD healthchecker
maj 10 22:54:10 LB2 Keepalived_healthcheckers[1428]: TCP connection to [192.168.1.152]:tcp:80 successful
maj 10 22:54:11 LB2 Keepalived_healthcheckers[1428]: TCP connection to [192.168.1.151]:tcp:80 successful
maj 10 23:06:58 LB2 Keepalived_vrrp[1429]: (VRRP_EXT) Entering MASTER STATE
1 lines 1-22/22 (END)
```

```
root@LB1:~# ipvsadm -l
IP Virtual Server version 1.2.1 (size=4096)
Prot LocalAddress:Port Scheduler Flags
    -> RemoteAddress:Port           Forward Weight ActiveConn InActConn
TCP  192.168.1.145:http wrr
    -> 192.168.1.151:http          Route   1      0      0
    -> 192.168.1.152:http          Route   2      0      0
TCP  192.168.1.146:http wrr
root@LB1:~#
```

```
root@LB1:~# systemctl status keepalived.service
● keepalived.service - Keepalive Daemon (LVS and VRRP)
   Loaded: loaded (/lib/systemd/system/keepalived.service; enabled; vendor preset: enabled)
     Active: active (running) since Sat 2025-05-10 22:53:16 CEST; 36min ago
       Main PID: 3464 (keepalived)
         Tasks: 3 (limit: 1132)
        Memory: 3.5M
          CPU: 1.399s
        CGroup: /system.slice/keepalived.service
                  └─3464 /usr/sbin/keepalived --dont-fork
                     ├─3465 /usr/sbin/keepalived --dont-fork
                     ├─3466 /usr/sbin/keepalived --dont-fork

maj 10 22:53:17 LB1 Keepalived_healthcheckers[3465]: TCP connection to [192.168.1.151]:tcp:80 succeeded
maj 10 22:53:20 LB1 Keepalived_vrrp[3466]: (VRRP_EXT) Entering MASTER STATE
maj 10 23:06:55 LB1 Keepalived_vrrp[3466]: Netlink reports enp0s3 down
maj 10 23:06:55 LB1 Keepalived_vrrp[3466]: (VRRP_EXT) Entering FAULT STATE
maj 10 23:06:55 LB1 Keepalived_vrrp[3466]: (VRRP_EXT) sent 0 priority
maj 10 23:07:01 LB1 Keepalived_healthcheckers[3465]: TCP_CHECK on service [192.168.1.151]:tcp:80 failed
maj 10 23:07:01 LB1 Keepalived_healthcheckers[3465]: Removing service [192.168.1.151]:tcp:80 to VS
maj 10 23:07:02 LB1 Keepalived_healthcheckers[3465]: TCP_CHECK on service [192.168.1.152]:tcp:80 failed
maj 10 23:07:02 LB1 Keepalived_healthcheckers[3465]: Removing service [192.168.1.152]:tcp:80 to VS
maj 10 23:07:02 LB1 Keepalived_healthcheckers[3465]: Lost quorum 1-0=1 > 0 for VS [192.168.1.146]:tcp:80
lines 1-22/22 (END)
```

Zad 15 Dodanie zapory i użycie dodatkowych interfejsów

[LB1 LB2]

Apt install ufw -y

Zmieniamy pliki:

```
/etc/default/ufw  [-M--] 30 L:[ 1+18 19/ 48] *(743 /1901b) 0034 0x022
# /etc/default/ufw
#
# Set to yes to apply rules to support IPv6 (no means only IPv6 on loopback
# accepted). You will need to 'disable' and then 'enable' the firewall for
# the changes to take affect.
IPv6=yes

# Set the default input policy to ACCEPT, DROP, or REJECT. Please note that
# you change this you will most likely want to adjust your rules.
DEFAULT_INPUT_POLICY='ACCEPT'

# Set the default output policy to ACCEPT, DROP, or REJECT. Please note that
# you change this you will most likely want to adjust your rules.
DEFAULT_OUTPUT_POLICY='ACCEPT'

# Set the default forward policy to ACCEPT, DROP or REJECT. Please note that
# if you change this you will most likely want to adjust your rules
DEFAULT_FORWARD_POLICY='ACCEPT'
```

```

File: /etc/ufw/before.rules  [-M--] 75 L:[ 1+15 16/ 21] *(403 / 480b) 0010 0x00
#
# rules.before
#
# Rules that should be run before the ufw command line added rules. Custom
# rules should be added to one of these chains:
#   ufw-before-input
#   ufw-before-output
#   ufw-before-forward
#
#
# NAT table rules
*nat
:POSTROUTING ACCEPT [0:0]

# Forward traffic through eth0 - Change to match your out-interface
-A POSTROUTING -s 172.30.0.0/24 -o enp0s3 -j SNAT --to-source 192.168.1.146

# don't delete the 'COMMIT' line or these rules won't be processed

COMMIT

```

ufw disable && ufw enable

Modyfikujemy pliki:

```

Ib2@LB2: ~          X  LB1          X + 
/etc/keepalived/keepalived.conf  [-M--]  0 L:[ 1+ 8  9/
vrrp_instance VRRP_EXT {
interface enp0s3
state BACKUP
vrrp_instance VRRP_EXT {
interface enp0s3
state BACKUP
virtual_router_id 52
priority 100
advert_int 1

authentication {
auth_type AH
auth_pass password
}

virtual_ipaddress {
192.168.1.146
}
}

virtual_server 192.168.1.146 80 {
delay_loop 1
lb_algo wrr
lb_kind NAT
protocol TCP

real_server 172.30.0.10 80 {
weight 2
TCP_CHECK {
connect_timeout 10
}
}

real_server 172.30.0.20 80 {
weight 1
TCP_CHECK {
connect_timeout 10
}
}
```

```

lb2@LB2: ~          X  LB1          X  +
/etc/keepalived/keepalived.conf  [-M--]  2 L:[  1+37
vrrp_instance VRRP_EXT {
interface enp0s3
state MASTER
virtual_router_id 52
priority 101
advert_int 1

authentication {
auth_type AH
auth_pass password
}

virtual_ipaddress {
192.168.1.146
}
}

virtual_server 192.168.1.146 80 {
    delay_loop 1
    lb_algo wrr
    lb_kind NAT
    protocol TCP

    real_server 172.30.0.10 80 {
        weight 2
        TCP_CHECK {
            connect_timeout 10
        }
    }

    real_server 172.30.0.20 80 {
        weight 1
        TCP_CHECK {
            connect_timeout 10
        }
    }
}
}

```

systemctl restart keepalived

```

root@LB1: # systemctl restart keepalived.service
root@LB1:~# systemctl status keepalived.service
● keepalived.service - Keepalive Daemon (LVS and VRRP)
   Loaded: loaded (/lib/systemd/system/keepalived.service; enabled; vendor preset: enabled)
   Active: active (running) since Mon 2025-05-12 16:47:09 CEST; 2s ago
     Main PID: 1038 (keepalived)
       Tasks: 3 (limit: 1132)
      Memory: 1.9M
         CPU: 9ms
      CGroup: /system.slice/keepalived.service
              └─1038 /usr/sbin/keepalived --dont-fork
                  ├─1039 /usr/sbin/keepalived --dont-fork
                  └─1040 /usr/sbin/keepalived --dont-fork

maj 12 16:47:09 LB1 Keepalived_healthcheckers[1039]: Initializing ipvs
maj 12 16:47:09 LB1 Keepalived_healthcheckers[1039]: Gained quorum 1+0=1 <= 3 for VS [192.168.1.146]
maj 12 16:47:09 LB1 Keepalived_healthcheckers[1039]: Activating healthchecker for service [172.30.0]
maj 12 16:47:09 LB1 Keepalived_healthcheckers[1039]: Activating healthchecker for service [172.30.0]
maj 12 16:47:09 LB1 Keepalived_healthcheckers[1039]: Activating BFD healthchecker
maj 12 16:47:10 LB1 Keepalived_vrrp[1040]: (VRRP_EXT) received lower priority (110) advert from 192
maj 12 16:47:11 LB1 Keepalived_vrrp[1040]: (VRRP_EXT) received lower priority (110) advert from 192
maj 12 16:47:11 LB1 Keepalived_healthcheckers[1039]: TCP connection to [172.30.0.10]:tcp:80 success.
maj 12 16:47:11 LB1 Keepalived_healthcheckers[1039]: TCP connection to [172.30.0.20]:tcp:80 success.
maj 12 16:47:12 LB1 Keepalived_vrrp[1040]: (VRRP_EXT) received lower priority (110) advert from 192
lines 1-22/22 (END)
^C
root@LB1:~# ipvsadm -l
IP Virtual Server version 1.2.1 (size=4096)
Prot LocalAddress:Port Scheduler Flags
  -> RemoteAddress:Port           Forward Weight ActiveConn InActConn
TCP  192.168.1.146:http  wrr
  -> 172.30.0.10:http            Masq    2      0      0
  -> 172.30.0.20:http            Masq    1      0      0
root@LB1:~#

```

```

lb2@LB2:~$ sudo systemctl restart keepalived.service
lb2@LB2:~$ sudo systemctl status keepalived.service
● keepalived.service - Keepalive Daemon (LVS and VRRP)
  Loaded: loaded (/lib/systemd/system/keepalived.service; enabled; vendor>
  Active: active (running) since Mon 2025-05-12 16:45:38 CEST; 5s ago
    Main PID: 692 (keepalived)
      Tasks: 3 (limit: 1132)
     Memory: 1.9M
        CPU: 13ms
       CGroup: /system.slice/keepalived.service
           └─692 /usr/sbin/keepalived --dont-fork
             ├─693 /usr/sbin/keepalived --dont-fork
             └─694 /usr/sbin/keepalived --dont-fork

maj 12 16:45:38 LB2 Keepalived_vrrp[694]: Registering gratuitous ARP shared>
maj 12 16:45:38 LB2 Keepalived_vrrp[694]: (VRRP_EXT) Entering BACKUP STATE >
maj 12 16:45:38 LB2 Keepalived_healthcheckers[693]: Opening file '/etc/keep>
maj 12 16:45:38 LB2 Keepalived_healthcheckers[693]: Initializing ipvs
maj 12 16:45:38 LB2 Keepalived_healthcheckers[693]: Gained quorum 1+0=1 <= >
maj 12 16:45:38 LB2 Keepalived_healthcheckers[693]: Activating healthchecke>
maj 12 16:45:38 LB2 Keepalived_healthcheckers[693]: Activating healthchecke>
maj 12 16:45:38 LB2 Keepalived_healthcheckers[693]: Activating BFD healthch>
maj 12 16:45:40 LB2 Keepalived_healthcheckers[693]: TCP connection to [172.>
maj 12 16:45:40 LB2 Keepalived_healthcheckers[693]: TCP connection to [172.>

lb2@LB2:~$ sudo ipvsadm -l
IP Virtual Server version 1.2.1 (size=4096)
Prot LocalAddress:Port Scheduler Flags
  -> RemoteAddress:Port          Forward Weight ActiveConn InActConn
TCP  192.168.1.146:http wrr
  -> 172.30.0.10:http            Masq    2      0      0
  -> 172.30.0.20:http            Masq    1      0      0
lb2@LB2:~$
```

[SRV1 SRV2]

```

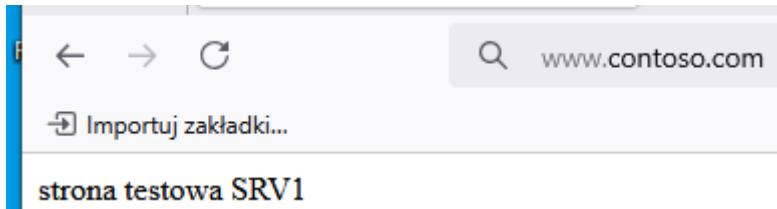
auto enp0s8
iface enp0s8 inet static
  address 172.30.0.10/24
  gateway 172.30.0.1
```

```

root@SRV2:~# ping wp.pl
PING wp.pl (212.77.98.9) 56(84) bytes of data.
64 bytes from 212.77.98.9: icmp_seq=1 ttl=59 time=16.0 ms
64 bytes from 212.77.98.9: icmp_seq=2 ttl=59 time=17.1 ms
^C
```

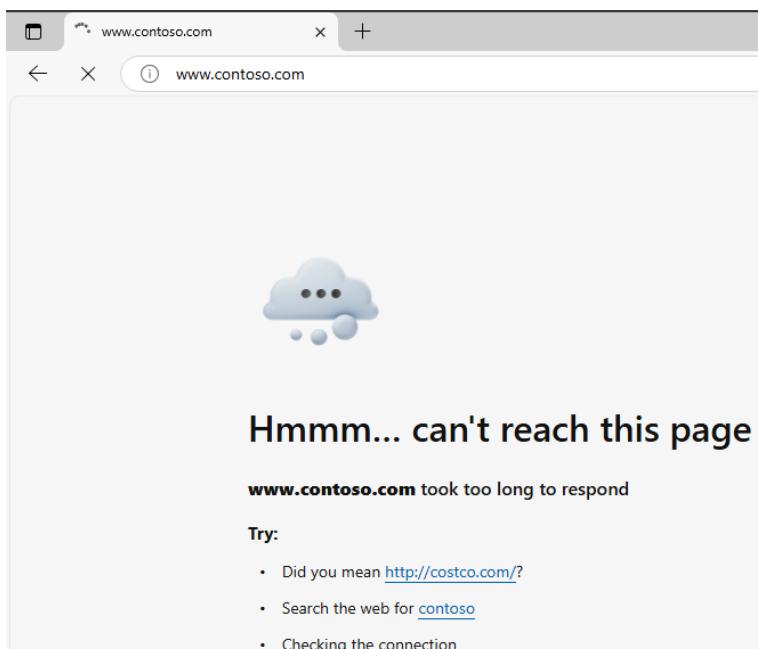
```

root@SRV1:~# ping wp.pl
PING wp.pl (212.77.98.9) 56(84) bytes of data.
64 bytes from www.wp.pl (212.77.98.9): icmp_seq=1 ttl=59 time=16.7 ms
64 bytes from www.wp.pl (212.77.98.9): icmp_seq=2 ttl=59 time=16.3 ms
^C
--- wp.pl ping statistics ---
```



Zad 16

Rozłączmy interfejs na LB1, testujemy:



Test usługi NAT:

```
root@SRV2:~# ip route get 1.1.1.1
1.1.1.1 via 172.30.0.1 dev enp0s8 src 172.30.0.20 uid 0
    cache
root@SRV2:~# ping 1.1.1.1
PING 1.1.1.1 (1.1.1.1) 56(84) bytes of data.
From 192.168.1.141 icmp_seq=1 Destination Host Unreachable
From 192.168.1.141 icmp_seq=2 Destination Host Unreachable
[...]
root@SRV1:~# ip route get 1.1.1.1
1.1.1.1 via 172.30.0.1 dev enp0s8 src 172.30.0.10 uid 0
    cache
root@SRV1:~# ping wp.pl
ping: wp.pl: Odwzorowanie nazwy jest chwilowo niemożliwe
root@SRV1:~# -
```

Podłączamy interfejs:

```
root@SRV1:~# ip route get 1.1.1.1
1.1.1.1 via 172.30.0.1 dev enp0s8 src 172.30.0.10 uid 0
    cache
root@SRV1:~#
```

```

root@SRV2:~# ip route
default via 172.30.0.1 dev enp0s8 onlink
172.30.0.0/24 dev enp0s8 proto kernel scope link src 172.30.0.20
192.168.1.0/24 dev enp0s3 proto kernel scope link src 192.168.1.152
root@SRV2:~# ping wp.pl
PING wp.pl (212.77.98.9) 56(84) bytes of data.
64 bytes from www.wp.pl (212.77.98.9): icmp_seq=1 ttl=58 time=16.7 ms
64 bytes from www.wp.pl (212.77.98.9): icmp_seq=2 ttl=58 time=28.3 ms
^C

```

[LB1] Modyfikujemy plik:

```

/etc/keepalived/keepalived.conf
vrrp_sync_group LB {
group {
VRRP_EXT
VRRP_INT}}

vrrp_instance VRRP_EXT {
interface enp0s3
state MASTER
virtual_router_id 52
priority 101
advert_int 1

authentication {
auth_type AH
auth_pass password}

virtual_ipaddress {
192.168.1.146)}

vrrp_instance VRRP_INT {
interface enp0s8
state MASTER
virtual_router_id 53
priority 101
advert_int 1

authentication {
auth_type AH
auth_pass password}

virtual_ipaddress {
172.30.0.3}}

```

```

virtual_server 192.168.1.146 80 {
delay_loop 1
lb_algo wrr
lb_kind NAT
protocol TCP

real_server 172.30.0.10 80 {
weight 2
TCP_CHECK {connect_timeout 10} }

real_server 172.30.0.20 80 {
weight 1
TCP_CHECK {connect_timeout 10}}}

```

[LB2]

```
Command Prompt - ssh lb1@1 X lb2@LB2: ~
/etc/keeed.conf [-M--] 10 L:[ 1+
vrrp_sync_group LB {
group {
VRRP_EXT
VRRP_INT
} }

vrrp_instance VRRP_EXT {
interface enp0s3
state BACKUP
virtual_router_id 52
priority 100
advert_int 1

authentication {
auth_type AH
auth_pass password
}

virtual_ipaddress {
192.168.1.146}

vrrp_instance VRRP_INT {
interface enp0s8
state BACKUP
virtual_router_id 53
priority 100
advert_int 1

authentication {
auth_type AH
auth_pass password
}

virtual_ipaddress {
172.30.0.3}}
}

virtual_server 192.168.1.146 80 {
delay_loop 1
lb_algo wrr
lb_kind NAT
protocol TCP

real_server 172.30.0.10 80 {
weight 2
TCP_CHECK {
connect_timeout 10
}
}

real_server 172.30.0.20 80 {
weight 1
TCP_CHECK {
connect_timeout 10
}
}
```

```

$ sudo systemctl restart keepalived
$ sudo systemctl status keepalived.service
● keepalived.service - Keepalive Daemon (LVS and VRRP)
   Loaded: loaded (/lib/systemd/system/keepalived.service; enabled; vendor
   Active: active (running) since Sun 2025-05-11 20:04:12 CEST; 17s ago
     Main PID: 646 (keepalived)
       Tasks: 3 (limit: 1132)
         Memory: 1.9M
            CPU: 35ms
          CGroup: /system.slice/keepalived.service
                  └─646 /usr/sbin/keepalived --dont-fork
                    ├─647 /usr/sbin/keepalived --dont-fork
                    ├─648 /usr/sbin/keepalived --dont-fork

maj 11 20:04:14 LB1 Keepalived_vrrp[648]: (VRRP_INT) received lower priorit
maj 11 20:04:14 LB1 Keepalived_vrrp[648]: (VRRP_EXT) received lower priorit
maj 11 20:04:14 LB1 Keepalived_healthcheckers[647]: TCP connection to [172.
maj 11 20:04:15 LB1 Keepalived_vrrp[648]: (VRRP_INT) received lower priorit
maj 11 20:04:15 LB1 Keepalived_vrrp[648]: (VRRP_EXT) received lower priorit
maj 11 20:04:16 LB1 Keepalived_vrrp[648]: (VRRP_INT) received lower priorit
maj 11 20:04:16 LB1 Keepalived_vrrp[648]: (VRRP_EXT) received lower priorit
maj 11 20:04:16 LB1 Keepalived_vrrp[648]: (VRRP_INT) Entering MASTER STATE
maj 11 20:04:16 LB1 Keepalived_vrrp[648]: VRRP_Group(LB) Syncing instances
maj 11 20:04:16 LB1 Keepalived_vrrp[648]: (VRRP_EXT) Entering MASTER STATE

$ sudo ipvsadm -l
IP Virtual Server version 1.2.1 (size=4096)
Prot LocalAddress:Port Scheduler Flags
-> RemoteAddress:Port           Forward Weight ActiveConn InActConn
TCP  192.168.1.145:http wrr
-> 192.168.1.151:http           Route    1      0      0
-> 192.168.1.152:http           Route    2      0      0
TCP  192.168.1.146:http wrr
-> 172.30.0.10:http             Masq    2      0      0
-> 172.30.0.20:http             Masq    1      0      0

```

```

lb2@LB2:~$ sudo systemctl restart keepalived
lb2@LB2:~$ sudo systemctl status keepalived
● keepalived.service - Keepalive Daemon (LVS and VRRP)
   Loaded: loaded (/lib/systemd/system/keepalived.service; enabled; vendor
   Active: active (running) since Sun 2025-05-11 20:04:03 CEST; 37s ago
     Main PID: 632 (keepalived)
       Tasks: 3 (limit: 1132)
         Memory: 1.9M
            CPU: 54ms
          CGroup: /system.slice/keepalived.service
                  ├─632 /usr/sbin/keepalived --dont-fork
                  ├─633 /usr/sbin/keepalived --dont-fork
                  └─634 /usr/sbin/keepalived --dont-fork

maj 11 20:04:04 LB2 Keepalived_healthcheckers[633]: TCP connection to [172.
maj 11 20:04:04 LB2 Keepalived_healthcheckers[633]: TCP connection to [172.
maj 11 20:04:11 LB2 Keepalived_vrrp[634]: (VRRP_EXT) Backup received priori
maj 11 20:04:12 LB2 Keepalived_vrrp[634]: (VRRP_EXT) Entering MASTER STATE
maj 11 20:04:12 LB2 Keepalived_vrrp[634]: VRRP_Group(LB) Syncing instances
maj 11 20:04:12 LB2 Keepalived_vrrp[634]: (VRRP_INT) Entering MASTER STATE
maj 11 20:04:16 LB2 Keepalived_vrrp[634]: (VRRP_INT) Master received advert
maj 11 20:04:16 LB2 Keepalived_vrrp[634]: (VRRP_INT) Entering BACKUP STATE
maj 11 20:04:16 LB2 Keepalived_vrrp[634]: VRRP_Group(LB) Syncing instances
maj 11 20:04:16 LB2 Keepalived_vrrp[634]: (VRRP_EXT) Entering BACKUP STATE

lb2@LB2:~$ sudo ipvsadm -l
IP Virtual Server version 1.2.1 (size=4096)
Prot LocalAddress:Port Scheduler Flags
-> RemoteAddress:Port           Forward Weight ActiveConn InActConn
TCP  192.168.1.146:http wrr
-> 172.30.0.10:http              Masq    2      0      0
-> 172.30.0.20:http              Masq    1      0      0
lb2@LB2:~$ |

```

Zmieniamy dane adresowe [SRV1 SRV2]:

auto enp0s8 iface enp0s8 inet static address 172.30.0.10/24 gateway 172.30.0.3	auto enp0s8 iface enp0s8 inet static address 172.30.0.20/24 gateway 172.30.0.3
---	---

```

# The primary network interface
auto enp0s3
iface enp0s3 inet static
    address 192.168.12.152/24
#    gateway 192.168.1.1

```

Modyfikujemy interfejsy, które mają bezpośredni dostęp do sieci zewnętrznych.

Na nieprawidłowe

```
root@SRV1:~# ip route
default via 172.30.0.3 dev enp0s8 onlink
172.30.0.0/24 dev enp0s8 proto kernel scope link src 172.30.0.10
192.168.1.0/24 dev enp0s3 proto kernel scope link src 192.168.1.15
root@SRV1:~# ping 1.1.1.1
PING 1.1.1.1 (1.1.1.1) 56(84) bytes of data.
64 bytes from 1.1.1.1: icmp_seq=1 ttl=58 time=12.2 ms
64 bytes from 1.1.1.1: icmp_seq=1 ttl=57 time=12.4 ms (DUP!)
64 bytes from 1.1.1.1: icmp_seq=2 ttl=58 time=10.6 ms
64 bytes from 1.1.1.1: icmp_seq=2 ttl=57 time=10.7 ms (DUP!)
root@SRV2:~# ip route get 1.1.1.1
1.1.1.1 via 172.30.0.3 dev enp0s8 src 172.30.0.20 uid 0
    cache
root@SRV2:~#
```

Rozłączamy interfejs LB1:



Podłączamy interfejs LB1:



Zad 17 Dodanie pliku kontrolnego

[SRV1 SRV2]

```
echo test > /var/www/html/test.txt
```

```
root@LB1:~# genhash -s 172.30.0.20 -p 80 -u /test.txt
MD5SUM = d8e8fcda2dc0f896fd7cb4cb0031ba249

root@LB1:~# genhash -s 172.30.0.10 -p 80 -u /test.txt
MD5SUM = d8e8fcda2dc0f896fd7cb4cb0031ba249

root@LB1:~#
```

[LB1 LB2]

Nanosimy zmiany w plikach:

```
/etc/keepalived/keepalived.conf [-M--] 4 L:[ 33+36 69/ 71] *(1495/1508b) 0032 0x020

authentication {
auth_type AH
auth_pass password
}

virtual_ipaddress {
172.30.0.3
}

real_server 172.30.0.10 80 {
    weight 2
    HTTP_GET {
        url {
            path /test.txt //definiujemy sciezke w ramach adresu URL do testowanego pliku
            digest d8e8fca2dc0f896fd7cb4cb0031ba249 //odcisk palca wygenerowany z wykorzystaniem narzecza genhash
        }
        connect_timeout 3 //limit czasu oczekiwania na połaczenie
        nb_get_retry 3 //liczba ponownych prob
        delay_before_retry 3 //opoznienie przed ponowna proba
    }
}

real_server 172.30.0.20 80 {
    weight 1
    HTTP_GET {
        url {
            path /test.txt //definiujemy sciezke w ramach adresu URL do testowanego pliku
            digest d8e8fca2dc0f896fd7cb4cb0031ba249 //odcisk palca wygenerowany z wykorzystaniem narzecza genhash
        }
        connect_timeout 3 //limit czasu oczekiwania na połaczenie
        nb_get_retry 3 //liczba ponownych prob
        delay_before_retry 3 //opoznienie przed ponowna proba
}
```

Systemctl restart keepalived

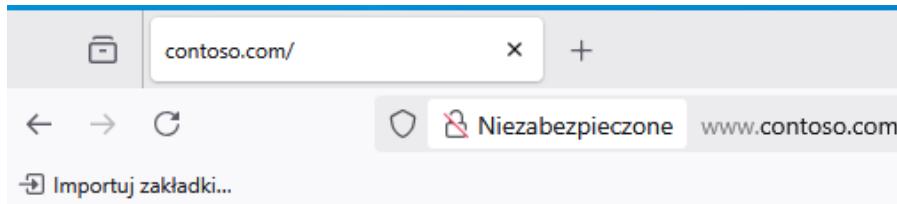
[SRV1] systemctl stop apache2

```
lb2@LB2:~$ sudo systemctl status keepalived.service
● keepalived.service - Keepalive Daemon (LVS and VRRP)
   Loaded: loaded (/lib/systemd/system/keepalived.service; enabled; vendor preset: enabled)
   Active: active (running) since Mon 2025-05-12 22:10:52 CEST; 42min ago
     Main PID: 704 (keepalived)
       Tasks: 3 (limit: 1132)
         Memory: 1.9M
            CPU: 2.523s
      CGroup: /system.slice/keepalived.service
              ├─704 /usr/sbin/keepalived --dont-fork
              ├─705 /usr/sbin/keepalived --dont-fork
              └─706 /usr/sbin/keepalived --dont-fork

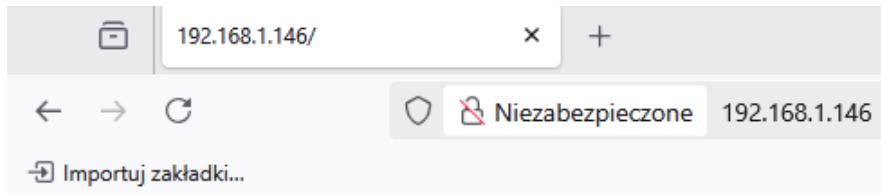
maj 12 22:14:50 LB2 Keepalived_healthcheckers[705]: HTTP_CHECK on service [172.30.0.10]:tcp:80 failed after 3 retry.
maj 12 22:14:50 LB2 Keepalived_healthcheckers[705]: Removing service [172.30.0.10]:tcp:80 to VS [192.168.1.146]:tcp:80
maj 12 22:22:37 LB2 Keepalived_vrrp[706]: (VRRP_EXT) Backup received priority 0 advertisement
maj 12 22:22:37 LB2 Keepalived_vrrp[706]: (VRRP_EXT) Entering MASTER STATE
maj 12 22:22:37 LB2 Keepalived_vrrp[706]: VRRP_Group(LB) Syncing instances to MASTER state
maj 12 22:22:37 LB2 Keepalived_vrrp[706]: (VRRP_INT) Entering MASTER STATE
maj 12 22:22:41 LB2 Keepalived_vrrp[706]: (VRRP_EXT) Master received advert from 192.168.1.141 with higher priority 111, ours 110
maj 12 22:22:41 LB2 Keepalived_vrrp[706]: (VRRP_EXT) Entering BACKUP STATE
maj 12 22:22:41 LB2 Keepalived_vrrp[706]: VRRP_Group(LB) Syncing instances to BACKUP state
maj 12 22:22:41 LB2 Keepalived_vrrp[706]: (VRRP_INT) Entering BACKUP STATE
lb2@LB2:~$
```

```
lb1@LB1:~$ sudo systemctl status keepalived.service
[sudo] hasło użytkownika lb1:
● keepalived.service - Keepalive Daemon (LVS and VRRP)
   Loaded: loaded (/lib/systemd/system/keepalived.service; enabled; vendor preset: enabled)
   Active: active (running) since Mon 2025-05-12 22:22:38 CEST; 31min ago
     Main PID: 719 (keepalived)
       Tasks: 3 (limit: 1132)
         Memory: 1.9M
            CPU: 1.953s
      CGroup: /system.slice/keepalived.service
              ├─719 /usr/sbin/keepalived --dont-fork
              ├─720 /usr/sbin/keepalived --dont-fork
              └─721 /usr/sbin/keepalived --dont-fork

maj 12 22:22:38 LB1 Keepalived_vrrp[721]: (VRRP_EXT) received lower priority (110) advert from 192.168.1.142 - discarding
maj 12 22:22:39 LB1 Keepalived_healthcheckers[720]: HTTP_CHECK on service [172.30.0.10]:tcp:80 failed after 3 retry.
maj 12 22:22:39 LB1 Keepalived_healthcheckers[720]: Removing service [172.30.0.10]:tcp:80 to VS [192.168.1.146]:tcp:80
maj 12 22:22:39 LB1 Keepalived_healthcheckers[720]: Remote Web server [172.30.0.20]:tcp:80 succeed on service.
maj 12 22:22:39 LB1 Keepalived_vrrp[721]: (VRRP_EXT) received lower priority (110) advert from 192.168.1.142 - discarding
maj 12 22:22:40 LB1 Keepalived_vrrp[721]: (VRRP_EXT) received lower priority (110) advert from 192.168.1.142 - discarding
maj 12 22:22:41 LB1 Keepalived_vrrp[721]: (VRRP_EXT) received lower priority (110) advert from 192.168.1.142 - discarding
maj 12 22:22:41 LB1 Keepalived_vrrp[721]: (VRRP_INT) Entering MASTER STATE
maj 12 22:22:41 LB1 Keepalived_vrrp[721]: VRRP_Group(LB) Syncing instances to MASTER state
maj 12 22:22:41 LB1 Keepalived_vrrp[721]: (VRRP_EXT) Entering MASTER STATE
lb1@LB1:~$
```



strona testowa SRV1



strona testowa SRV2

[SRV1]

Przywracamy apache2 na SRV1

`echo test2 > /var/www/html/test.txt`

```
lb1@LB1:~$ sudo systemctl restart keepalived.service
lb1@LB1:~$ sudo systemctl status keepalived.service
● keepalived.service - Keepalive Daemon (LVS and VRRP)
   Loaded: loaded (/lib/systemd/system/keepalived.service; enabled; vendor preset: enabled)
     Active: active (running) since Mon 2025-05-12 22:59:00 CEST; 1s ago
       Main PID: 752 (Keepalived)
          Tasks: 3 (limit: 1132)
         Memory: 1.9M
            CPU: 17ms
           CGroup: /system.slice/keepalived.service
               ├─752 /usr/sbin/keepalived --dont-fork
               ├─753 /usr/sbin/keepalived --dont-fork
               └─754 /usr/sbin/keepalived --dont-fork

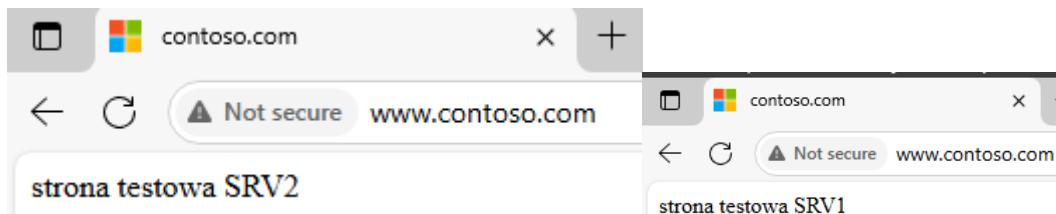
maj 12 22:59:00 LB1 Keepalived_healthcheckers[753]: Gained quorum 1+0=1 <= 3 for VS [192.168.1.146]:tcp:80
maj 12 22:59:00 LB1 Keepalived_healthcheckers[753]: Activating healthchecker for service [172.30.0.10]:tcp:80 for VS [192.168.1.146]:tcp:80
maj 12 22:59:00 LB1 Keepalived_healthcheckers[753]: Activating healthchecker for service [172.30.0.20]:tcp:80 for VS [192.168.1.146]:tcp:80
maj 12 22:59:00 LB1 Keepalived_healthcheckers[753]: Activating BFD healthchecker
maj 12 22:59:00 LB1 Keepalived_vrrp[754]: (VRRP_EXT) Entering BACKUP STATE (init)
maj 12 22:59:00 LB1 Keepalived_vrrp[754]: (VRRP_INT) Entering BACKUP STATE (init)
maj 12 22:59:01 LB1 Keepalived_vrrp[754]: (VRRP_EXT) received lower priority (110) advert from 192.168.1.142 - discarding
maj 12 22:59:01 LB1 Keepalived_healthcheckers[753]: Remote Web server [172.30.0.20]:tcp:80 succeed on service.
maj 12 22:59:01 LB1 Keepalived_healthcheckers[753]: HTTP_CHECK on service [172.30.0.10]:tcp:80 failed after 3 retry.
maj 12 22:59:01 LB1 Keepalived_healthcheckers[753]: Removing service [172.30.0.10]:tcp:80 to VS [192.168.1.146]:tcp:80
lb1@LB1:~$
```



`echo test > /var/www/html/test.txt`

```
lb1@LB1:~$ sudo systemctl status keepalived.service
● keepalived.service - Keepalive Daemon (LVS and VRRP)
   Loaded: loaded (/lib/systemd/system/keepalived.service; enabled; vendor preset: enabled)
     Active: active (running) since Mon 2025-05-12 22:59:00 CEST; 2min 45s ago
       Main PID: 752 (Keepalived)
          Tasks: 3 (limit: 1132)
         Memory: 1.9M
            CPU: 209ms
           CGroup: /system.slice/keepalived.service
               ├─752 /usr/sbin/keepalived --dont-fork
               ├─753 /usr/sbin/keepalived --dont-fork
               └─754 /usr/sbin/keepalived --dont-fork

maj 12 22:59:02 LB1 Keepalived_vrrp[754]: (VRRP_EXT) received lower priority (110) advert from 192.168.1.142 - discarding
maj 12 22:59:03 LB1 Keepalived_vrrp[754]: (VRRP_EXT) received lower priority (110) advert from 192.168.1.142 - discarding
maj 12 22:59:04 LB1 Keepalived_vrrp[754]: (VRRP_EXT) received lower priority (110) advert from 192.168.1.142 - discarding
maj 12 22:59:04 LB1 Keepalived_vrrp[754]: (VRRP_INT) Entering MASTER STATE
maj 12 22:59:04 LB1 Keepalived_vrrp[754]: VRRP_Group(LB) Syncing instances to MASTER state
maj 12 22:59:04 LB1 Keepalived_vrrp[754]: (VRRP_EXT) Entering MASTER STATE
maj 12 23:01:41 LB1 Keepalived_healthcheckers[753]: MDS digest success to [172.30.0.10]:tcp:80 url(/test.txt)
maj 12 23:01:42 LB1 Keepalived_healthcheckers[753]: MDS digest success to [172.30.0.10]:tcp:80 url(/test.txt)
maj 12 23:01:42 LB1 Keepalived_healthcheckers[753]: Remote Web server [172.30.0.10]:tcp:80 succeed on service.
maj 12 23:01:42 LB1 Keepalived_healthcheckers[753]: Adding service [172.30.0.10]:tcp:80 to VS [192.168.1.146]:tcp:80
lb1@LB1:~$
```



Ciekawostka
1) Można dla strony udostępnionej z wykorzystaniem transmisji szyfrowanej HTTPS wykorzystać zamiast parametru "HTTP_GET" parametr "SSL_GET" (konfiguracja jest taka sama, umieszcza się tylko zamiast parametru "HTTP_GET" parametr "SSL_GET").
2) Można także do sprawdzania "prawdziwych serwerów" wykorzystać mechanizm "MISC_CHECK" bazujący na wyniku otrzymanym z uruchomionego skryptu:

```
real_server @IP PORT {  
    weight num  
    MISC_CHECK {  
        misc_path /path_to_script/script.sh  
        (or misc_path "/path_to_script/script.sh <arg_list>")  
    }}}
```

Zad 19 (nie było 18) Sorry server

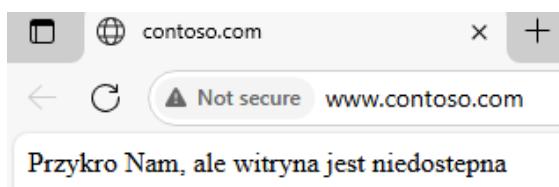
[LB1 LB2]

```
# apt update && apt install apache2 -y  
  
# echo "Przykro Nam, ale Nasza witryna jest obecnie niedostepna" > /var/www/html/index.html  
  
# systemctl restart apache2
```

Modyfikujemy pliki:

```
/etc/keepalived/keepalived.conf [-M--]  
  
virtual_server 192.168.1.146 80 {  
    delay_loop 1  
    lb_algo wrr  
    lb_kind NAT  
    protocol TCP  
    sorry_server 192.168.1.141 80_
```

Wyłączamy SRV1 SRV2:



Zad 20 LVS- TUN

[LB1 LB2]

```
# ipvsadm -C
```

Modyfikujemy pliki:

```
/etc/keepalived/keepalived.conf [-M--] 16 L:[ 1+ 1 2
vrrp_instance VRRP_EXT {
interface enp0s3
state BACKUP
virtual_router_id 52
priority 100
advert_int 1

authentication {
auth_type AH
auth_pass password
}

virtual_ipaddress {
192.168.1.146
}
}

virtual_server 192.168.1.146 80 {
delay_loop 1
lb_algo wrr
lb_kind TUN
protocol TCP
sorry_server 192.168.1.142 80

real_server 192.168.1.151 80 {
weight 2

HTTP_GET {
url {
path /test.txt
digest d8e8fcda2dc0f896fd7cb4cb0031ba249
}
connect_timeout 3
nb_get_retry 3
delay_before_retry 3
}
}

real_server 192.168.1.152 80 {
weight 1

HTTP_GET {
url {
path /test.txt
digest d8e8fcda2dc0f896fd7cb4cb0031ba249
}
connect_timeout 3
nb_get_retry 3
delay_before_retry 3
}
}
```

```
lb1@LB1: ~          lb2@LB2: ~ [-M--] 0 L:[ 1+ 2
/etc/keepalived/keepalived.conf
vrrp_instance VRRP_EXT {
    interface enp0s3
    state MASTER
    virtual_router_id 52
    priority 101
    advert_int 1

    authentication {
        auth_type AH
        auth_pass password
    }

    virtual_ipaddress {
        192.168.1.146
    }
}

virtual_server 192.168.1.146 80 {
    delay_loop 1
    lb_algo wrr
    lb_kind TUN
    protocol TCP
    sorry_server 192.168.1.141 80
    real_server 192.168.1.151 80 {
        weight 2
        HTTP_GET {
            url {
                path /test.txt
                digest d8e8fcda2dc0f896fd7cb4cb0031ba249
            }
            connect_timeout 3
            nb_get_retry 3
            delay_before_retry 3
        }
    }
}

real_server 192.168.1.152 80 {
    weight 1
    HTTP_GET {
        url {
            path /test.txt
            digest d8e8fcda2dc0f896fd7cb4cb0031ba249
        }
        connect_timeout 3
        nb_get_retry 3
        delay_before_retry 3
    }
}
```

systemctl restart keepalived.service

```

lb2@LB2:~$ sudo systemctl status keepalived.service
● keepalived.service - Keepalive Daemon (LVS and VRRP)
   Loaded: loaded (/lib/systemd/system/keepalived.service; enabled; vendor
   Active: active (running) since Tue 2025-05-13 12:15:05 CEST; 7min ago
     Main PID: 721 (keepalived)
        Tasks: 3 (limit: 1132)
       Memory: 1.9M
          CPU: 138ms
        CGroup: /system.slice/keepalived.service
                  └─721 /usr/sbin/keepalived --dont-fork
                      ├─722 /usr/sbin/keepalived --dont-fork
                      └─723 /usr/sbin/keepalived --dont-fork

maj 13 12:20:58 LB2 Keepalived_healthcheckers[722]: Removing sorry server [192.168.1.151]
maj 13 12:20:58 LB2 Keepalived_healthcheckers[722]: Adding alive servers to [192.168.1.151]
maj 13 12:21:24 LB2 Keepalived_healthcheckers[722]: MD5 digest success to [192.168.1.151]
maj 13 12:21:25 LB2 Keepalived_healthcheckers[722]: MD5 digest success to [192.168.1.152]
maj 13 12:21:25 LB2 Keepalived_healthcheckers[722]: Remote Web server [192.168.1.151]
maj 13 12:21:25 LB2 Keepalived_healthcheckers[722]: Adding service [192.168.1.151]
maj 13 12:21:46 LB2 Keepalived_vrrp[723]: (VRRP_EXT) Backup received priority 0
maj 13 12:21:46 LB2 Keepalived_vrrp[723]: (VRRP_EXT) Entering MASTER STATE
maj 13 12:21:50 LB2 Keepalived_vrrp[723]: (VRRP_EXT) Master received advertisement
maj 13 12:21:50 LB2 Keepalived_vrrp[723]: (VRRP_EXT) Entering BACKUP STATE

lb2@LB2:~$ sudo ipvsadm -l
IP Virtual Server version 1.2.1 (size=4096)
Prot LocalAddress:Port Scheduler Flags
  -> RemoteAddress:Port           Forward Weight ActiveConn InActConn
TCP  192.168.1.146:http wrr
    -> 192.168.1.151:http         Tunnel  2      0      0
    -> 192.168.1.152:http         Tunnel  1      0      0
lb2@LB2:~$
```

[SRV1 SRV2]

```
# echo ipip >>/etc/modules
# modprobe ipip
```

Nanosimy zmiany w plikach:

```

/etc/network/interfaces [-M--] 2
# 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

# The primary network interface
auto enp0s3
iface enp0s3 inet static
    address 192.168.1.151/24
    gateway 192.168.1.1

auto tun10
iface tun10 inet static
    up ip link set tun10 up
    address 192.168.1.146/32
```

```
# systemctl restart networking.service
```

Nanosimy zmiany w plikach:

```
/etc/sysctl.conf [-M--] 0 L:[ 66+3
# for what other values do
#kernel.sysrq=438

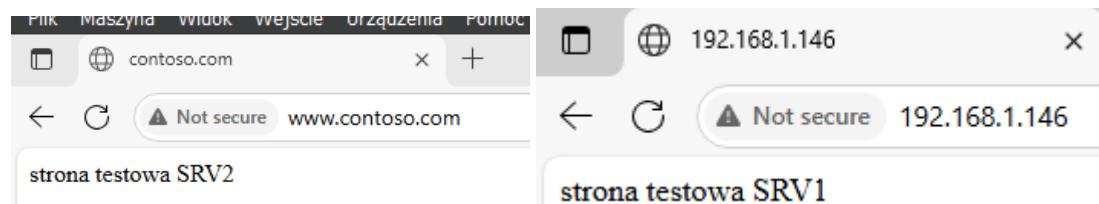
net.ipv4.conf.all.rp_filter=0
net.ipv4.conf.tunl0.rp_filter=0
net.ipv4.conf.enp0s3.arp_ignore=1
net.ipv4.conf.enp0s3.arp_announce=2
```

Notatka

W ramach pierwszych dwóch ustawień jest wyłączany filtr, który sprawdza, czy pakiet pochodzi z kierunku, w którym poszedłby pakiet wychodzący (tzw. filtrowanie odwróconej ścieżki), co nie jest prawdą w tymże przypadku (jeżeli `rp_filter` będzie ustawione na 1, to linux sprawdzi tablicę tras, aby zobaczyć, czy pakiet wejściowy „należy” do tej sieci, i porzuci go, jeśli nie). Tak więc, musimy wyłączyć ten filtr dla interfejsu tunl0. Jeśli "prawdziwe serwery" znajdują się w tej samej sieci, co system/klaster równoważenia obciążenia, to konieczne jest także dostosowanie ustawień ARP na tych "prawdziwych serwerach", czyli wyłączenie odpowiadania na zapytania dot. adresu VIP.

`sysctl -p`

Testujemy:



[SRV1]

`Systemctl stop apache2`

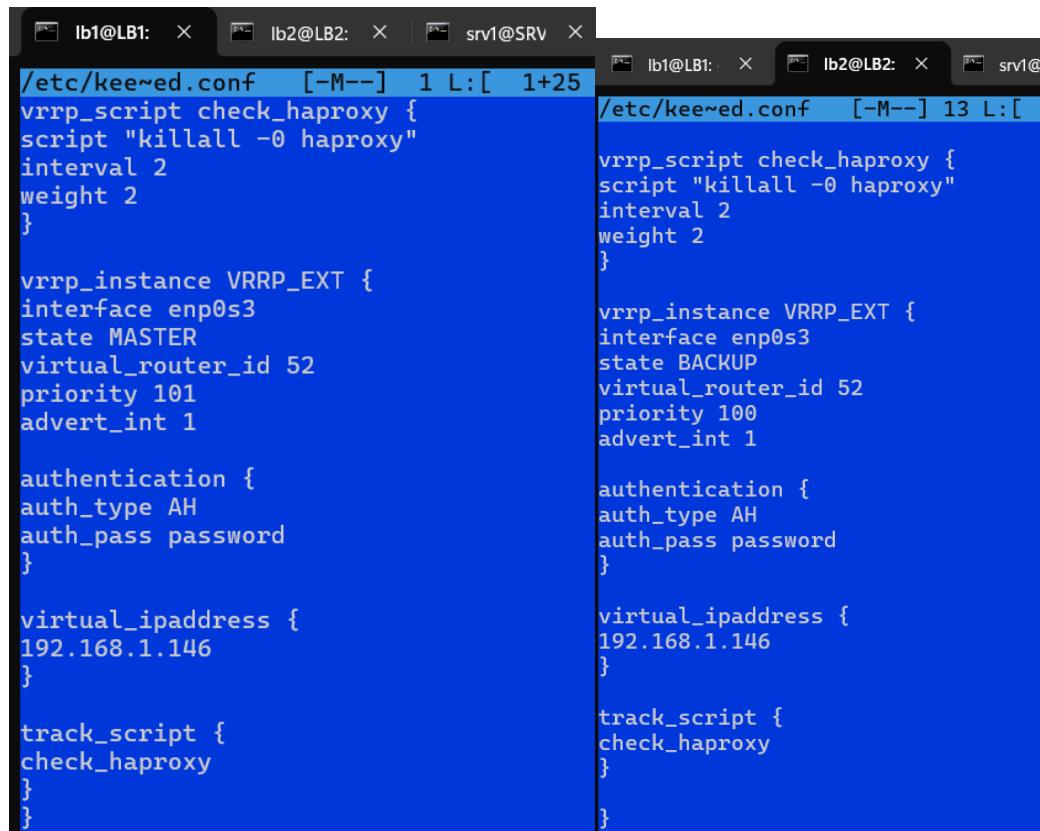


Zad 21 HAProxy

[LB1 LB2]

```
# apt update && apt install haproxy -y
```

Nanosimy zmiany w plikach:



```
/etc/keepalived.conf [-M--] 1 L:[ 1+25
vrrp_script check_haproxy {
script "killall -0 haproxy"
interval 2
weight 2
}

vrrp_instance VRRP_EXT {
interface enp0s3
state MASTER
virtual_router_id 52
priority 101
advert_int 1

authentication {
auth_type AH
auth_pass password
}

virtual_ipaddress {
192.168.1.146
}

track_script {
check_haproxy
}
}

/vetc/keepalived.conf [-M--] 13 L:[

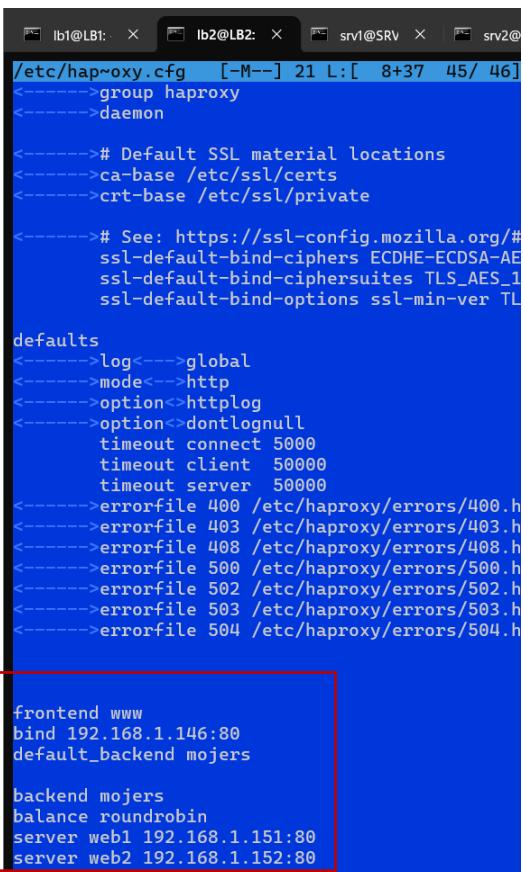
vrrp_script check_haproxy {
script "killall -0 haproxy"
interval 2
weight 2
}

vrrp_instance VRRP_EXT {
interface enp0s3
state BACKUP
virtual_router_id 52
priority 100
advert_int 1

authentication {
auth_type AH
auth_pass password
}

virtual_ipaddress {
192.168.1.146
}

track_script {
check_haproxy
}
}
```



```
/etc/haproxy.cfg [-M--] 21 L:[ 8+37 45/ 46]
<----->group haproxy
<----->daemon

<-----># Default SSL material locations
<----->ca-base /etc/ssl/certs
<----->crt-base /etc/ssl/private

<-----># See: https://ssl-config.mozilla.org/
ssl-default-bind-ciphers ECDHE-ECDSA-AE
ssl-default-bind-ciphersuites TLS_AES_1
ssl-default-bind-options ssl-min-ver TL

defaults
<----->log<---->global
<----->mode<-->http
<----->option<>httplog
<----->option<>dontlognull
    timeout connect 5000
    timeout client  50000
    timeout server  50000
<----->errorfile 400 /etc/haproxy/errors/400.h
<----->errorfile 403 /etc/haproxy/errors/403.h
<----->errorfile 408 /etc/haproxy/errors/408.h
<----->errorfile 500 /etc/haproxy/errors/500.h
<----->errorfile 502 /etc/haproxy/errors/502.h
<----->errorfile 503 /etc/haproxy/errors/503.h
<----->errorfile 504 /etc/haproxy/errors/504.h

frontend www
bind 192.168.1.146:80
default_backend mojers

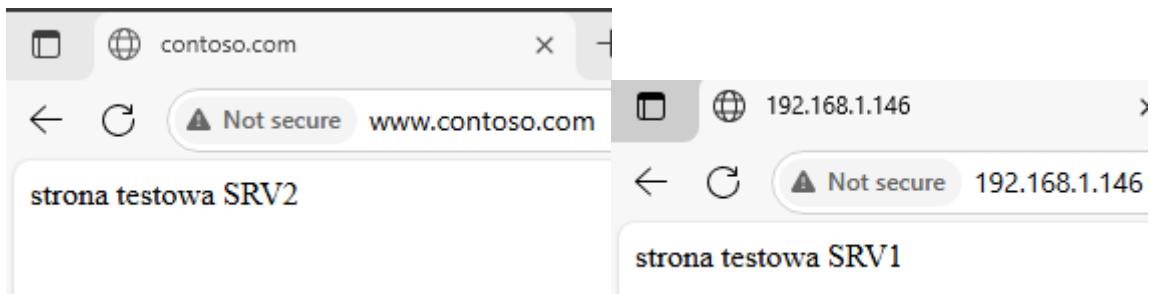
backend mojers
balance roundrobin
server web1 192.168.1.151:80
server web2 192.168.1.152:80
```

← na obu maszynach

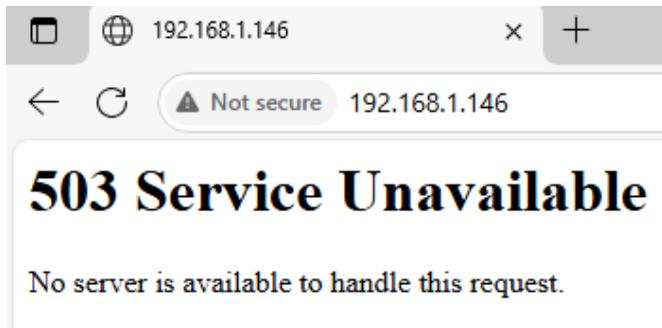
```

lb2@LB2:~$ sudo ipvsadm -C
lb2@LB2:~$ sudo systemctl restart keepalived.service
lb2@LB2:~$ sudo systemctl restart haproxy.service
Job for haproxy.service failed because the control process exited with error
code.
See "systemctl status haproxy.service" and "journalctl -xe" for details.
lb2@LB2:~$ sudo haproxy -f /etc/haproxy/haproxy.cfg
[NOTICE] 132/143808 (1445) : haproxy version is 2.2.9-2+deb11u7
[NOTICE] 132/143808 (1445) : path to executable is /usr/sbin/haproxy
[ALERT] 132/143808 (1445) : Starting frontend www: cannot bind socket [192.1
68.1.146:80]
lb2@LB2:~$ sudo systemctl stop apache2.service
lb2@LB2:~$ sudo haproxy -f /etc/haproxy/haproxy.cfg
lb2@LB2:~$ sudo systemctl restart haproxy.service
lb2@LB2:~$
```

Sprawdzamy działanie:



Zatrzymujemy apache na SRV1:



Zad 22 HA

[LB1 Lb2] Nanosimy zmiany w plikach:

```

lb1@LB1:~$ ls
lb2@LB2:~$ ls
srv1@SRV1:~$ ls
srv2@SRV1:~$ ls
/etc/haproxy.cfg  [-M--]  0 L:[ 37+38  75/ 76] *(1524/1525

frontend www
bind 192.168.1.146:80
default_backend mojers

backend mojers
balance roundrobin
server web1 192.168.1.151:80 check
server web2 192.168.1.152:80 check inter 10s fall 2 rise 5
```

```
systemctl restart haproxy
```

```
[SRV1] systemctl stop apache2
```

Sprawdzamy działanie:



Zad 23 wagi

[LB1 LB2]

Nanosimy zmiany w plikach:

```
/etc/haproxy.cfg [-M--] 38 L:[ 37+ 7 44/ 1000 ]
```

```
frontend www
bind 192.168.1.146:80
default_backend mojers

backend mojers
balance roundrobin
server web1 192.168.1.151:80 weight 2 check
server web2 192.168.1.152:80 weight 1 check.
```

The terminal window shows the configuration file /etc/haproxy.cfg. A red box highlights the section under the 'backend' directive where two servers are defined with their weights and check intervals.

```
systemctl restart haproxy
```

Sprawdzamy działanie:



Zad 24 SSH

[LB1 LB2] Modyfikujemy pliki:

```
lb1@LB1: ~ [-M--] 0 L:[ 16+38 54/ 54] *(160L
/etc/haproxy.cfg      [ -M-- ] 0 L:[ 16+38 54/ 54] *(160L
    ssl-default-bind-ciphers ECDHE-ECDSA-AES128-GCM-SHA256
    ssl-default-bind-ciphersuites TLS_AES_128_GCM_SHA256
    ssl-default-bind-options ssl-min-ver TLSv1.2 r

defaults
<---->log<--->global
#<---->mode<-->http
#<---->option<-->httplog
    -option donolognul
    timeout connect 5000
    timeout client 50000
    timeout server 50000
<---->errorfile 400 /etc/haproxy/errors/400.http
<---->errorfile 403 /etc/haproxy/errors/403.http
<---->errorfile 408 /etc/haproxy/errors/408.http
<---->errorfile 500 /etc/haproxy/errors/500.http
<---->errorfile 502 /etc/haproxy/errors/502.http
<---->errorfile 503 /etc/haproxy/errors/503.http
<---->errorfile 504 /etc/haproxy/errors/504.http

frontend www
bind 192.168.1.146:80
default_backend mojers

backend mojers
mode http
balance roundrobin
server web1 192.168.1.151:80 weight 2 check
server web2 192.168.1.152:80 weight 1 check

frontend sshd
bind *:1999
default_backend sshsrv2

backend sshsrv2
mode tcp
server srv2 172.30.0.20:22
```

systemctl restart haproxy

Sprawdzamy działanie:

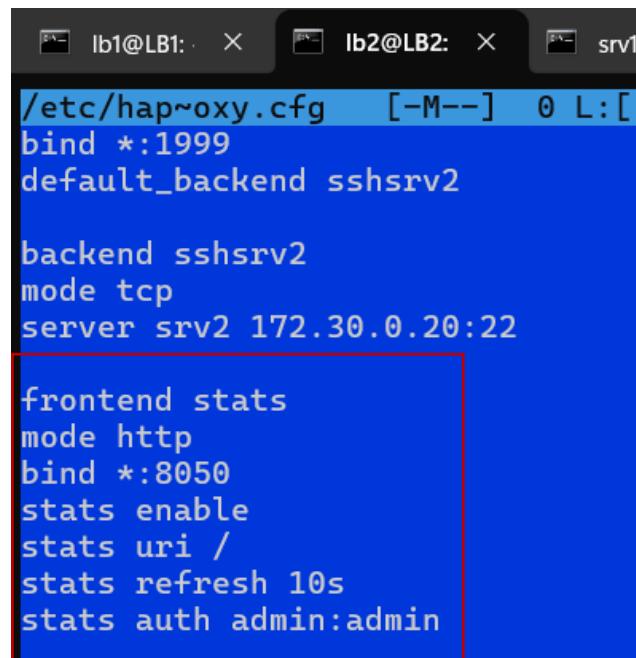
```
C:\Users\lenovo>ssh user@192.168.1.146 -p 1999
The authenticity of host '[192.168.1.146]:1999 ([192.168.1.146]:1999)' can't
be established.
ED25519 key fingerprint is SHA256:ygL1brJFIDwN+lcoNRjAtbta1MuVznubb2nr8qW38F
W.
This host key is known by the following other names/addresses:
C:\Users\lenovo/.ssh/known_hosts:19: 192.168.1.119
C:\Users\lenovo/.ssh/known_hosts:20: 192.168.1.123
C:\Users\lenovo/.ssh/known_hosts:21: 192.168.1.152
C:\Users\lenovo/.ssh/known_hosts:22: 192.168.1.151
C:\Users\lenovo/.ssh/known_hosts:23: 192.168.1.141
C:\Users\lenovo/.ssh/known_hosts:24: 192.168.1.142
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '[192.168.1.146]:1999' (ED25519) to the list of k
nown hosts.
user@192.168.1.146's password:
Linux SRV2 5.10.0-8-amd64 #1 SMP Debian 5.10.46-4 (2021-08-03) x86_64

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/*copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
user@SRV2:~$
```

Zad 25 Statystyki

Nanosiemy zmiany w plikach:



```
lb1@LB1: ~ X lb2@LB2: ~ X srv1

/etc/haproxy.cfg [-M--] 0 L:[

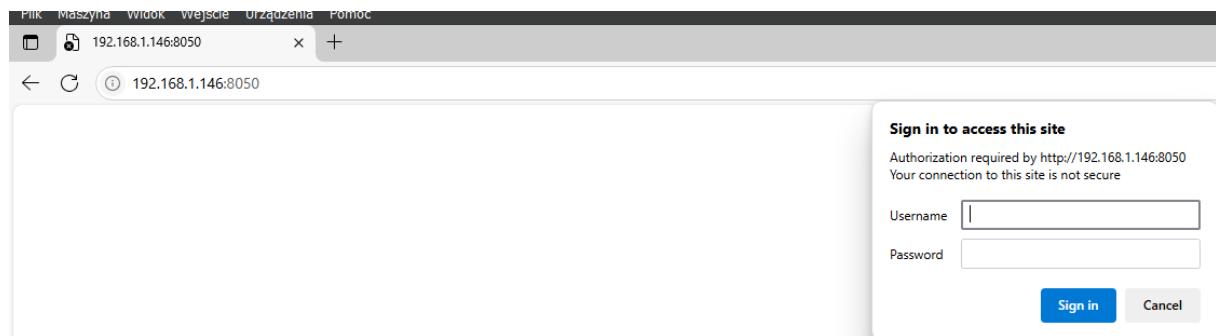
bind *:1999
default_backend sshsrv2

backend sshsrv2
mode tcp
server srv2 172.30.0.20:22

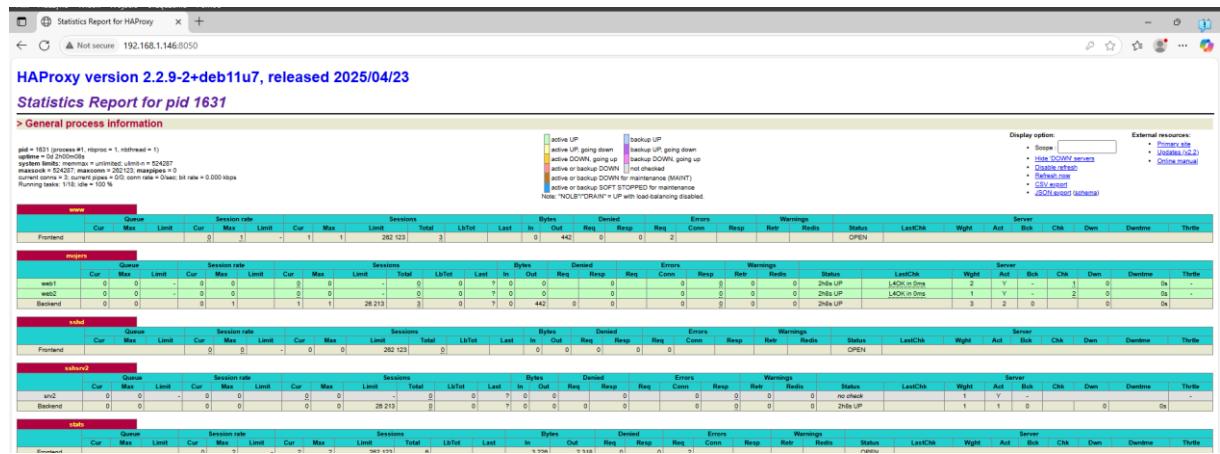
frontend stats
mode http
bind *:8050
stats enable
stats uri /
stats refresh 10s
stats auth admin:admin
```

```
# systemctl restart haproxy
```

Sprawdzamy działanie



(l: admin, h: admin)



Zad 26 Blokada połączeń

Modyfikujemy pliki:

```
lb1@LB1: ~ X lb2@LB2: ~ X srv1@SRV ~ X srv2@SRV ~ X
/etc/haproxy.cfg [-M--] 9 L:[ 27+13 40/ 73 ] *(137
    timeout server 50000
<----->errorfile 400 /etc/haproxy/errors/400.http
<----->errorfile 403 /etc/haproxy/errors/403.http
<----->errorfile 408 /etc/haproxy/errors/408.http
<----->errorfile 500 /etc/haproxy/errors/500.http
<----->errorfile 502 /etc/haproxy/errors/502.http
<----->errorfile 503 /etc/haproxy/errors/503.http
<----->errorfile 504 /etc/haproxy/errors/504.http

frontend www
bind 192.168.1.146:80
default_backend mojers
mode http
acl bad_comps src -f /etc/haproxy/badcomps.txt
http-request deny if bad_comps
```

```

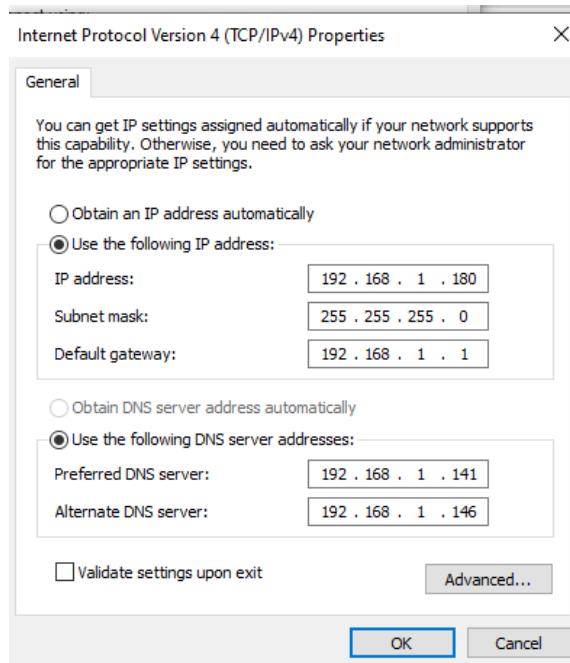
lb1@LB1:~$ sudo systemctl restart haproxy
Job for haproxy.service failed because the control process exited with error
code.
See "systemctl status haproxy.service" and "journalctl -xe" for details.
lb1@LB1:~$ sudo haproxy -f /etc/haproxy/haproxy.cfg
[NOTICE] 132/173656 (1784) : haproxy version is 2.2.9-2+deb11u7
[NOTICE] 132/173656 (1784) : path to executable is /usr/sbin/haproxy
[ALERT] 132/173656 (1784) : parsing [/etc/haproxy/haproxy.cfg:41] : error de
tected while parsing ACL 'bad_comps' : failed to open pattern file </etc/hap
roxy/badcomps.txt>.
[ALERT] 132/173656 (1784) : parsing [/etc/haproxy/haproxy.cfg:42] : error de
tected while parsing an 'http-request deny' condition : no such ACL : 'bad_c
omps'.
[ALERT] 132/173656 (1784) : Error(s) found in configuration file : /etc/hap
roxy/haproxy.cfg
lb1@LB1:~$
```

[LB1 LB2] Tworzymy plik z adresem IP, który ma być ignorowany:

```
echo 192.168.1.180 >> /etc/haproxy/badcomps.txt
```

systemctl restart haproxy

Sprawdzamy działanie:



Zad 27 ACL i warunki

[LB1 LB2] Nanosimy zmiany w plikach:

```
lb1@LB1: ~ X lb2@LB2: ~ X srv1@SRV ~ X srv2@SRV ~ X

/etc/haproxy.cfg [-M--] 0 L:[ 25+19 44/ 74] *(150:
    timeout connect 5000
    timeout client 50000
    timeout server 50000
<----->errorfile 400 /etc/haproxy/errors/400.http
<----->errorfile 403 /etc/haproxy/errors/403.http
<----->errorfile 408 /etc/haproxy/errors/408.http
<----->errorfile 500 /etc/haproxy/errors/500.http
<----->errorfile 502 /etc/haproxy/errors/502.http
<----->errorfile 503 /etc/haproxy/errors/503.http
<----->errorfile 504 /etc/haproxy/errors/504.http

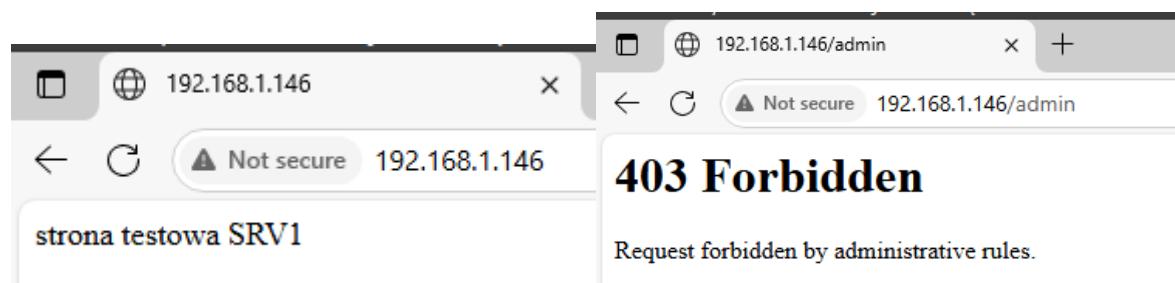
frontend www
bind 192.168.1.146:80
default_backend mojers
mode http
acl bad_comps src -f /etc/haproxy/badcomps.txt
acl url_admin path -i -m beg /admin
http-request deny if url_admin bad_comps
```

systemctl restart haproxy

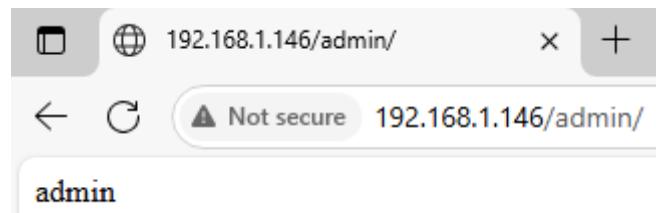
[SRV1 SRV2]

```
root@SRV2:~# mkdir /www/strona1/admin
root@SRV2:~# echo admin > /www/strona1/admin/index.html
root@SRV2:~# _
```

Sprawdzamy działanie:

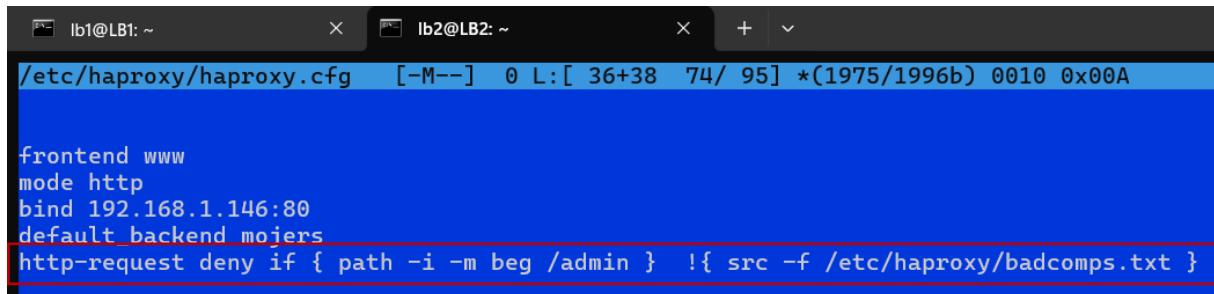


Z adresem innym niż 192.168.1.180:



Zad 28

[LB1 LB2] Modyfikujemy pliki:

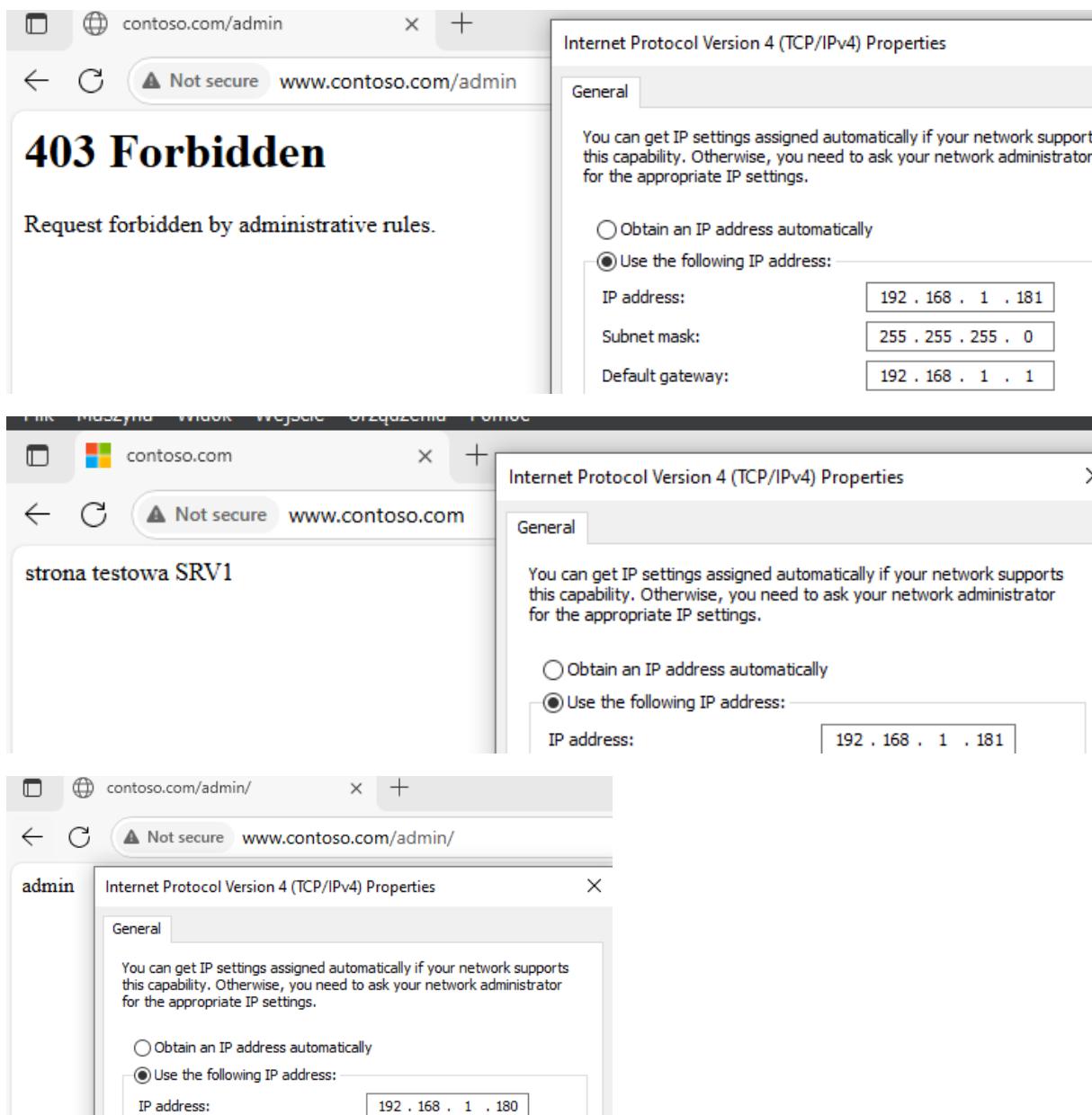


```
lb1@LB1: ~          lb2@LB2: ~
/etc/haproxy/haproxy.cfg  [-M--]  0 L:[ 36+38  74/ 95] *(1975/1996b) 0010 0x00A

frontend www
mode http
bind 192.168.1.146:80
default backend mojers
http-request deny if { path -i -m beg /admin } !{ src -f /etc/haproxy/badcomps.txt }
```

Systemctl restart haproxy

Sprawdzamy działanie:



contoso.com/admin

Not secure www.contoso.com/admin

403 Forbidden

Request forbidden by administrative rules.

Internet Protocol Version 4 (TCP/IPv4) Properties

General

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

Obtain an IP address automatically

Use the following IP address:

IP address: 192 . 168 . 1 . 181

Subnet mask: 255 . 255 . 255 . 0

Default gateway: 192 . 168 . 1 . 1

contoso.com

Not secure www.contoso.com

strona testowa SRV1

Internet Protocol Version 4 (TCP/IPv4) Properties

General

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

Obtain an IP address automatically

Use the following IP address:

IP address: 192 . 168 . 1 . 181

contoso.com/admin/

Not secure www.contoso.com/admin/

admin Internet Protocol Version 4 (TCP/IPv4) Properties

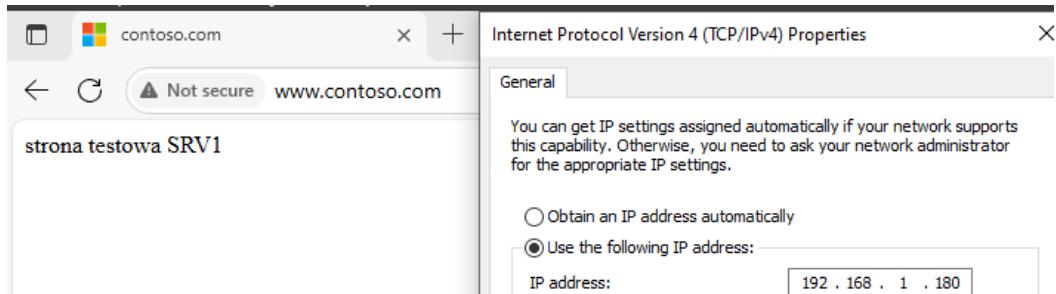
General

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

Obtain an IP address automatically

Use the following IP address:

IP address: 192 . 168 . 1 . 180



Zad 29

[LB1 LB2] Modyfikujemy pliki:

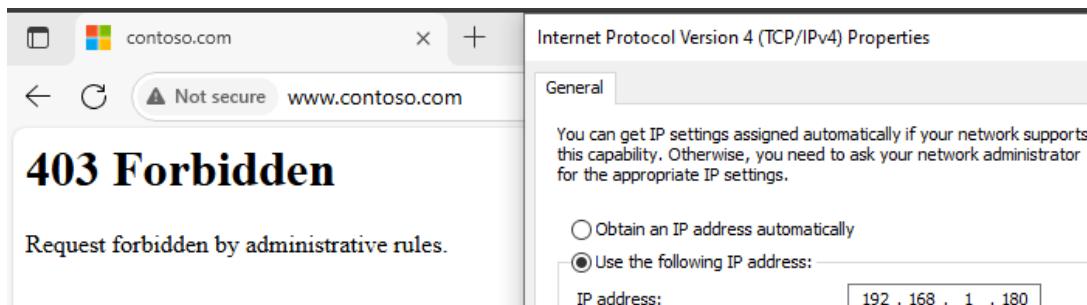
```
/etc/haproxy.cfg [-M--] 49 L:[ 25+19 44/ 83] *(1499/20'
    timeout connect 5000
    timeout client 50000
    timeout server 50000
<----->errorfile 400 /etc/haproxy/errors/400.http
<----->errorfile 403 /etc/haproxy/errors/403.http
<----->errorfile 408 /etc/haproxy/errors/408.http
<----->errorfile 500 /etc/haproxy/errors/500.http
<----->errorfile 502 /etc/haproxy/errors/502.http
<----->errorfile 503 /etc/haproxy/errors/503.http
<----->errorfile 504 /etc/haproxy/errors/504.http

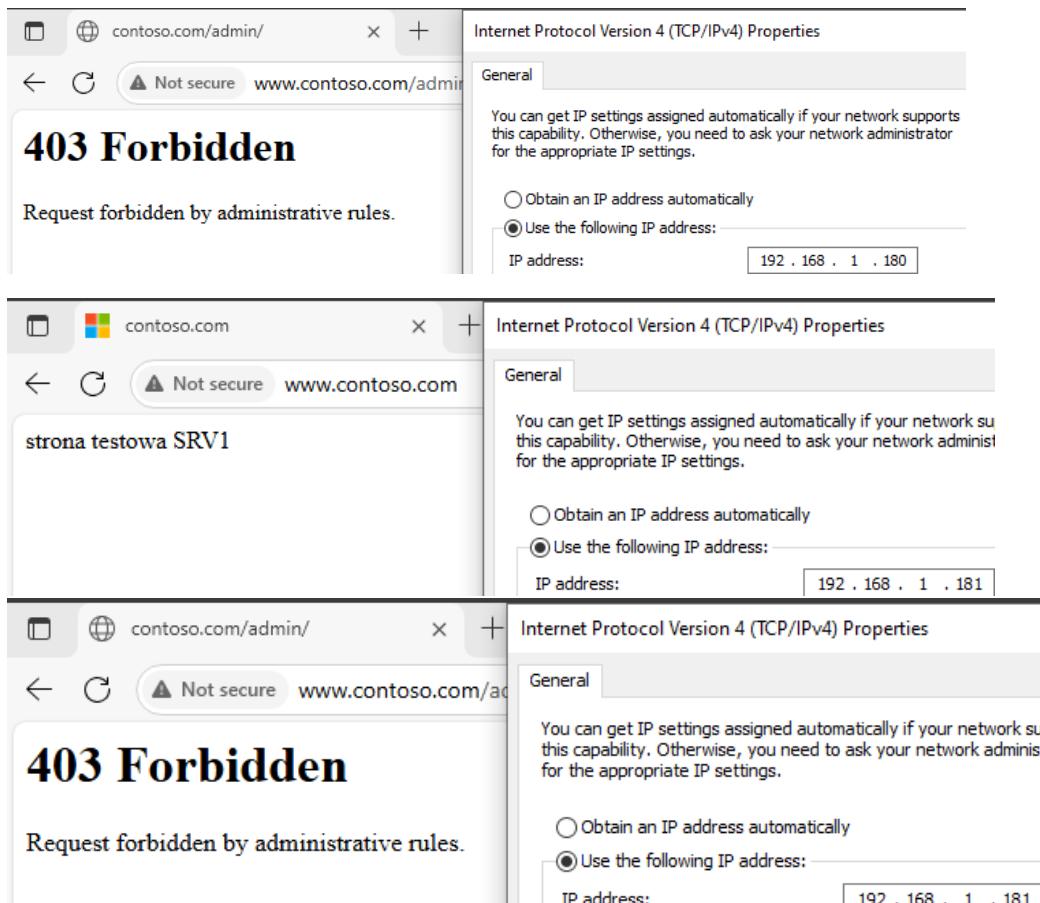
frontend www
bind 192.168.1.146:80
default_backend mojers
mode http
acl url_admin path -i -m beg /admin
acl url_admin path -i -m beg /index

http-request deny if url_admin || { src 192.168.1.180 }
```

Systemctl restart haproxy

Sprawdzamy działanie:





Zad 30 Przekierowanie na inny serwer

[LB1 LB2] Modyfikujemy pliki:

```

lb1@LB1: ~          lb2@LB2: ~
/etc/haproxy.cfg      [-M--]  0 L:[ 37+20  57/109] *

frontend www
mode http
bind 192.168.1.146:80
default_backend mojers
acl bad_comps src -f /etc/haproxy/badcomps.txt
use_backend zabronione if bad_comps

backend zabronione
mode http
server cloudflare 1.1.1.1:80

```

`systemctl restart haproxy`

Sprawdzamy:

The screenshot displays three browser windows side-by-side, each showing a different IP configuration state.

- Top Tab:** Shows a test page at www.contoso.com with the message "strona testowa SRV1". To its right is the "Internet Protocol Version 4 (TCP/IPv4) Properties" window for the "General" tab, which includes the note: "You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings." It shows the radio button for "Use the following IP address" is selected, with the IP address set to 192.168.1.181.
- Middle Tab:** Shows the same test page at www.contoso.com/admin/ with the message "admin". To its right is the same "Internet Protocol Version 4 (TCP/IPv4) Properties" window, showing the same configuration details.
- Bottom Tab:** Shows the test page at www.contoso.com with the message "Please enable cookies." Below it is an "Error 1034" message from Cloudflare: "Edge IP Restricted | www.contoso.com". To its right is the "Internet Protocol Version 4 (TCP/IPv4) Properties" window for the "General" tab, which includes the note: "You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings." It shows the radio button for "Use the following IP address" is selected, with the IP address set to 192.168.1.181.

Error 1034 Details:

Ray ID: 93f3cee30a1a7dc4 • 2025-05-13 17:17:14 UTC

Edge IP Restricted

What happened?

You've requested a page on a website that is part of the [Cloudflare](#) network. The host (www.contoso.com) resolved to an IP address that the owner of the website does not have access to.

What can I do?

If you are a visitor of this website:
Please try again in a few minutes.

If you are the owner of this website:
Check your DNS records to ensure they are pointed to the IP address(es) you were assigned at registration.

Was this page helpful?
Thank you for your feedback!

Cloudflare Ray ID: 93f3cee30a1a7dc4 • Your IP: 46.151.20.169 • Performance & security by [Cloudflare](#)

Zad 31 SSL

[LB1 LB2]

```
lb1@LB1:~$ sudo openssl req -new -x509 -newkey rsa:2048 -days 1024 -nodes -out /etc/ssl/lb.pem -keyout /etc/ssl/lb.key
Generating a RSA private key
.....+++++
.....+++++
writing new private key to '/etc/ssl/lb.key'
-----
You are about to be asked to enter information that will be incorporated
into your certificate request.
What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.
-----
Country Name (2 letter code) [AU]:PL
State or Province Name (full name) [Some-State]:
Locality Name (eg, city) []:
Organization Name (eg, company) [Internet Widgits Pty Ltd]:
Organizational Unit Name (eg, section) []:
Common Name (e.g. server FQDN or YOUR name) []:
Email Address []:
```

cat /etc/ssl/lb.key >> /etc/ssl/lb.pem

Nanosimy zmiany w plikach:

```
/etc/haproxy.cfg  [-M--] 14 L:[ 11+15 26/ 96] *(956 /230
<-----># Default SSL material locations
<----->ca-base /etc/ssl/certs
<----->crt-base /etc/ssl/private

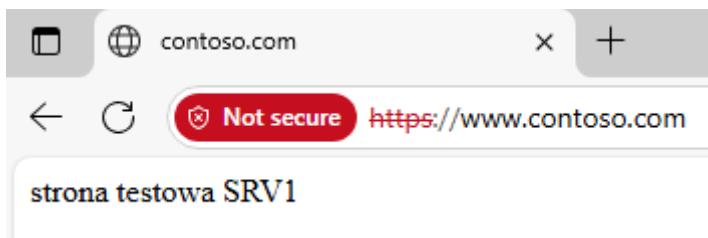
<-----># See: https://ssl-config.mozilla.org/#server=haproxy
      ssl-default-bind-ciphers ECDHE-ECDSA-AES128-GCM-SHA256
      ssl-default-bind-ciphersuites TLS_AES_128_GCM_SHA256
      ssl-default-bind-options ssl-min-ver TLSv1.2 no-tlsv1
<----->tune.ssl.default-dh-param 2048

defaults
<----->log<--->global
#<----->mode<--->http
#<----->option<--->httplog
<----->option<--->dontlognull
      timeout connect 5000
      timeout client 50000
      timeout server 50000
<----->errorfile 400 /etc/haproxy/errors/400.http
<----->errorfile 403 /etc/haproxy/errors/403.http
<----->errorfile 408 /etc/haproxy/errors/408.http
<----->errorfile 500 /etc/haproxy/errors/500.http
<----->errorfile 502 /etc/haproxy/errors/502.http
<----->errorfile 503 /etc/haproxy/errors/503.http
<----->errorfile 504 /etc/haproxy/errors/504.http

frontend www
bind 192.168.1.146:80
bind 192.168.1.146:443 ssl crt /etc/ssl/lb.pem
default_backend mojers
mode http
http-request redirect scheme https unless { ssl_fc }
```

systemctl restart haproxy

Testujemy:



Zad 32

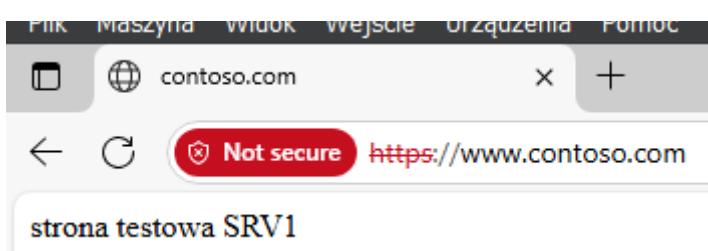
[SRV1 SRV2] Wydajemy polecenia:

```
# a2enmod ssl  
# a2ensite default-ssl  
# systemctl restart apache2
```

[LB1 LB2] Nanosimy zmiany w plikach:

```
/etc/haproxy.cfg [-M--] 0 L:[ 63+38 101/101] *(2535/2535b) <EOF> [*][X]  
#acl bad_comps src -f /etc/haproxy/badcomps.txt  
#acl url_admin path -i -m beg /admin  
#http-request deny if url_admin bad_comps  
  
backend mojers  
mode http  
balance roundrobin  
server web1 192.168.1.152:443 ssl verify none weight 2 check inter 10s fall  
server web2 192.168.1.151:443 ssl verify none weight 1 check inter 10s fall
```

```
# systemctl restart haproxy
```

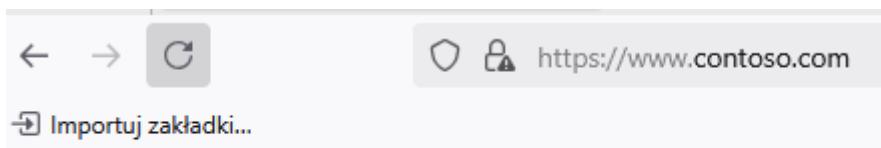


Zad 33

[LB1 LB2] Nanosimy zmiany w plikach:

```
/etc/haproxy.cfg [---] 0 L:[ 37+18 55/ 88] *(1694/1823b) 0010 0x0  
frontend www  
bind 192.168.1.146:443  
default_backend mojers  
mode tcp  
  
backend mojers  
mode tcp  
balance roundrobin  
server web1 192.168.1.151:443 weight 2 check inter 10s fall 2 rise 5  
server web2 192.168.1.152:443 weight 1 check inter 10s fall 2 rise 5
```

Testujemy:



Zad 34

[LB1 LB2] Modyfikujemy pliki:

```
/etc/haproxy.cfg [-M--] 0 L:[ 37+30 67/100] *(1854/1

frontend www
mode http
bind 192.168.1.146:80
bind 192.168.1.146:443 ssl crt /etc/ssl/lb.pem

http-request redirect scheme https unless { ssl_fc }

acl domena1 hdr(host) -i one.contoso.com
acl domena2 hdr(host) -i two.contoso.com
use_backend backend1 if domena1
use_backend backend2 if domena2

backend backend1
mode http
server srv1 192.168.1.151:80

backend backend2
mode http
server srv2 192.168.1.152:80
```

systemctl restart haproxy

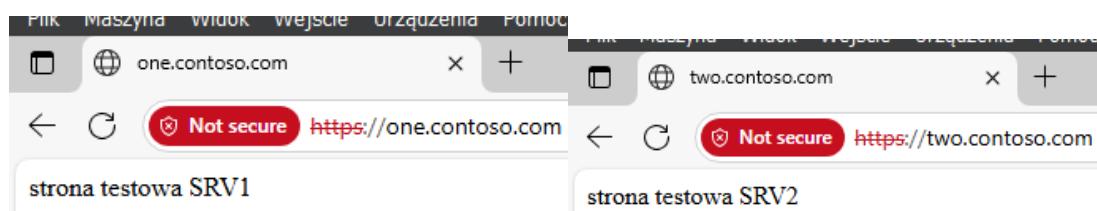
Notatka

Powyższa konfiguracja zakłada, że w pliku z certyfikatem i kluczem prywatnym (/etc/ssl/lb.pem) na potrzeby różnych nazw DNS używamy jednego i tego samego certyfikatu z kluczem prywatnym bądź typu *wildcard* (wystawiony na jakąkolwiek poddomenę w ramach zadanej domeny), bądź typu *multi-domain* (wystawiony na wiele różnych nazw DNS). Ażkolwiek gdyby istniała potrzeba wykorzystania różnych certyfikatów z powiązanym kluczem prywatnym, to wtedy wystarczy wszystkie te certyfikaty i powiązane z nimi klucze prywatne umieścić w tym jednym pliku, a HAProxy już sobie z tego pliku wybierze ten właściwy.

Modyfikujemy plik hosts:

```
*hosts - Notepad
File Edit Format View Help
# Copyright (c) 1993-2009 Microsoft Corp.
#
# This is a sample HOSTS file used by Microsoft TCP/IP for Windows.
#
# This file contains the mappings of IP addresses to host names. Each
# entry should be kept on an individual line. The IP address should
# be placed in the first column followed by the corresponding host name
# The IP address and the host name should be separated by at least one
# space.
#
# Additionally, comments (such as these) may be inserted on individual
# lines or following the machine name denoted by a '#' symbol.
#
# For example:
#
#      102.54.94.97    rhino.acme.com        # source server
#      38.25.63.10      x.acme.com           # x client host

# localhost name resolution is handled within DNS itself.
#      127.0.0.1          localhost
#      ::1               localhost
192.168.1.146 one.contoso.com
192.168.1.146 two.contoso.com
```



Zad 35 Przekierowanie

[LB1 LB2] Zmieniamy konfiguracje:

```
/etc/haproxy/haproxy.cfg [-M--] 0 L:[ 36+38 74/ 81] *(1646/1653b) 0010 0x00

frontend www
mode http
bind 192.168.1.146:80
redirect location http://one.contoso.com/page1 code 302 if { path_beg /page2 }
default_backend mojers

backend mojers
mode http
balance roundrobin
server srv1 192.168.1.151:80 weight 2 check
server srv2 192.168.1.152:80 weight 1 check
```

systemctl restart haproxy

[SRV1 SRV2]

```
root@SRV1:~# mkdir -p /var/www/html/page1 && echo page1Test > /var/www/html/page1/intex.html
root@SRV1:~# mkdir -p /var/www/html/page2 && echo page2Test > /var/www/html/page2/intex.html
root@SRV1:~# ls /var/www/html/
admin index.html page1 page2 test1.txt
root@SRV1:~# _
```

Index of /page1

Name	Last modified	Size	Description
Parent Directory	-		
intex.html	2025-05-13 21:29	10	

Apache/2.4.62 (Debian) Server at one.contoso.com Port 80

Po wpisaniu page2 (na końcu adresu) (raz tak, raz tak)

one.contoso.com/page1/

← ⏪ Not secure one.contoso.com/page1/

page1Test

Zad 36 LVS, ldirectord i heartbeat

[LB1 LB2] wydajemy polecenia:

```
# apt remove haproxy keepalived ipvsadm  
# apt update && apt install heartbeat ldirectord ipvsadm -y
```

Nanosimy zmiany w plikach:

```
/etc/sysctl.conf  [----]  0 L:[ 59+34  9  
#net.ipv4.conf.all.log_martians = 1  
#  
#####  
# Magic system request Key  
# 0=disable, 1=enable all, >1 bitmask of  
# See https://www.kernel.org/doc/html/lat  
# for what other values do  
#kernel.sysrq=438  
net.ipv4.ip_forward=1  
net.ipv4.ip_nonlocal_bind=1  
# sysctl -p
```

```
/etc/ha.d/ha.cf      [-M--]  8 L:[ 1+24  25/ 25] *(454 / 454b) <EOF>  [*][X]

logfacility local0
logfile /var/log/ha.log
debug 0

bcast enp0s3
mcast enp0s3 225.0.0.1 694 1 0

# Port na którym nasluchuje heartbeat
udpport 694

# Odstęp między "pulsami serca"
keepalive 2
# Jak szybko Heartbeat powinien zdecydować, że węzeł w klastrze jest martwy?
deadtime 10

# Wylacz menedzera klastra Pacemaker
crm off

# Automatycznie powraca do węzła "podstawowego".
auto_fallback on

# Jakie maszyny znajdują się w klastrze
node lb1
node lb2
```

```
lb1@LB1: ~          X  lb2@LB2: ~          X  +  ▾
/etc/ha.d/haresources  [-M--]  0 L:[ 1+ 0  1/  1] *(0   /  76b) 0108 0x06C
lb2 ldirectord::ldirectord.cf IPAddr2::192.168.1.146/24/enp0s3/192.168.1.255

lb1@LB1: ~          X  lb2@LB2: ~          X  +  ▾
/etc/ha.d/haresources  [-M--] 52 L:[ 1+ 0  1/  1] *(52   /  76b) 0047 0x02F
lb1 ldirectord::ldirectord.cf IPAddr2::192.168.1.146/24/enp0s3/192.168.1.255
```

```
/etc/ha.d/authkeys  [-M

auth 1
1 sha1 somepassword
```

chmod 600 /etc/ha.d/authkeys

```
/etc/hosts      [-M--] 12
127.0.0.1<---->localhost
127.0.1.1<---->LB1
192.168.1.141 lb1
192.168.1.142 lb2
```

```
/etc/ha.d/ldirectord.cf [-M--] 4 L:[ 1+33 34/ 62] *(770 /1341b) 0115 0x073
# Dummy configuration file.
#
# See /usr/share/doc/ldirectord/examples/ldirectord.cf.gz for
# configuration examples.

checktimeout=5
checkinterval=2
autoreload=yes
logfile="/var/log/ldirectord.log"
quiescent=no

#
# virtual = x.y.z.w:p
# protocol = tcp|udp
# scheduler = rr|wrr|lc|wlc
# real = x.y.z.w:p gate|masq|ipip [waga]
# fallback - serwer do ktorego zostanie przekazane gdy prawdziwe serwery nie dzialaja
#
virtual=192.168.1.146:80
    real=192.168.1.151:80 gate
    real=192.168.1.152:80 gate 2
    fallback=127.0.0.1:80 gate
    service=http
    request="ldirector.html"
    receive="Test Page"
    scheduler=wrr
    protocol=tcp
    checktype=negotiate

#DLA SMTP
virtual=192.168.1.146:25
    real=192.168.1.152:25 gate
    fallback=192.168.1.151:25 gate
    service=none
    scheduler=wlc
    protocol=tcp
    checktype=connect

virtual=192.168.1.146:25
    real=192.168.1.152:25 gate
    fallback=192.168.1.151:25 gate
    service=none
    scheduler=wlc
    protocol=tcp
    checktype=connect

#DLA DNS
virtual=192.168.1.146:53
    real=192.168.1.152:53 gate..
    fallback=192.168.1.151:53 gate
    service=none
    scheduler=wlc
    checktype=ping
    protocol=udp

virtual=192.168.1.146:53
    real=192.168.1.152:53 gate
    fallback=192.168.1.151:53 gate
    service=dns
    scheduler=wlc
    checktype=ping
    protocol=tcp
```

```
[SRV1 SRV2]# echo "Test Page" > /var/www/html/ldirector.html
```

```
[LB1 LB2]
```

The screenshot shows two terminal windows side-by-side. The left window, titled 'lb1@LB1: ~', displays the contents of the configuration file '/etc/ha.d.ldirectord.cf'. The right window, titled 'lb2@LB2: ~', shows the output of several system commands related to ldirectord.

```
/etc/ha.d.ldirectord.cf [----] 0 L:[ 1+ 5   6/ 62] *(119 /1341b) 0010 0x00A
# Dummy configuration file.
#
# See /usr/share/doc/ldirectord/examples/ldirectord.cf.gz for
# configuration examples.

checktimeout=5
checkinterval=2
autoreload=yes
logfile="/var/log/ldirectord.log"
quiescent=no

#
# virtual = x.y.z.w:p
# protocol = tcp|udp
# scheduler = rr|wrr|lc|wlc
# real = x.y.z.w:p gate|masq|ipip [waga]
# fallback - serwer do ktorego zostanie przekazane gdy prawdziwe serwery nie dzialaja
#
virtual=192.168.1.146:80
    real=192.168.1.152:80 gate
    real=192.168.1.151:80 gate 2
    fallback=127.0.0.1:80 gate
    service=http
    request="ldirector.html"
    receive="Test Page"
    scheduler=wrr
    protocol=tcp
    checktype=negotiate

#DLA SMTP
virtual=192.168.1.146:25
    real=192.168.1.152:25 gate
    fallback=192.168.1.151:25 gate
    service=none
    scheduler=wlc
    protocol=tcp
    checktype=connect
virtual=192.168.1.146:25

# systemctl enable heartbeat
# systemctl restart heartbeat
# systemctl enable ldirectord
# systemctl restart ldirectord
```

```
lb2@LB2:~$ sudo systemctl restart ldirectord
lb2@LB2:~$ sudo ipvsadm -l
IP Virtual Server version 1.2.1 (size=4096)
Prot LocalAddress:Port Scheduler Flags
  -> RemoteAddress:Port           Forward Weight ActiveConn InActConn
TCP  192.168.1.146:http wrr
  -> 192.168.1.151:http          Route    1      0      0
  -> 192.168.1.152:http          Route    2      0      0
lb2@LB2:~$
```

Testujemy:

