Juniper JunOS

Katedra informačných sietí

Fakulta riadenia a informatiky, ŽU

Agenda

- Predstavenie JunOS
- Navigácia v CLI
- Základná konfigurácia smerovača
- OSPFv2 a OSPFv3
- Porovnanie konfigurácie s Cisco IOS

JunOS

Fyzická topológia

- Cisco 2691
  - 12.4(25c) Advanced IP services
- Juniper vMX
  - Model: olive
  - Junos: 15.1F6.9

Fa0/0   em0

Logická topológia

192.168.1.0/24
2001:DEAD:BEEF::/64

JunipervMX-15.1F6.9-1

R1

.1

.2

Loop1: 10.1.1.1/24
        2001:ACAD:1:1::1/64
Loop2: 10.1.2.1/24
        2001:ACAD:1:2::1/64
Loop3: 10.1.3.1/24
        2001:ACAD:1:3::1/64

Loop1: 10.2.1.1/24
        2001:ACAD:2:1::1/64
Loop2: 10.2.2.1/24
        2001:ACAD:2:2::1/64
Loop3: 10.2.3.1/24
        2001:ACAD:2:3::1/64

Po nabootovaní

- Po boote vyžaduje JunOS login
  - Default je root, žiadne heslo

```
...
prefetching /usr/libexec64/rpd
Starting jlaunchhelperd.
/etc/rc: WARNING: run_rc_command: cannot run
Starting cron.

Wed Mar 14 15:15:07 UTC 2018

FreeBSD/amd64 (Amnesiac) (ttyu0)

login: root

--- JUNOS 15.1F6.9 Kernel 64-bit  JNPR-10.1-20160616.329709_builder_stable_10
root@:~ #
```

Po nabootovaní

- Používateľ sa nachádza v klasickom BSD systéme
- Do konfigurácie sa dostane pomocou príkazu **cli**

```
root@:~ # pwd
/root
root@:~ # ls -lha
total 2
drwxr-xr-x   2 root  wheel   512B Mar 15 06:34 .
drwxrwxr-x  22 root  wheel   512B Mar 15 06:34 ..
lrwxr-xr-x   1 root  wheel    36B Mar 15 06:34 .cshrc -> /packages/mnt/os-
runtime/root/.cshrc
lrwxr-xr-x   1 root  wheel    36B Mar 15 06:34 .login -> /packages/mnt/os-
runtime/root/.login
lrwxr-xr-x   1 root  wheel    38B Mar 15 06:34 .profile ->
/packages/mnt/os-runtime/root/.profile
root@:~ # cli
root>

root> ?
Possible completions:
  configure            Manipulate software configuration information
  ping                 Ping remote target
  quit                 Exit the management session
  request              Make system-level requests
  set                  Set CLI properties, date/time, craft interface
message
  show                 Show system information
  ssh                  Start secure shell on another host
  telnet               Telnet to another host
  traceroute           Trace route to remote host
...
```

Pohybovanie sa v režimoch JunOS

- Rovnako ako na Cisco boxoch, funguje otáznik

```
root> ?
Possible completions:
  clear               Clear information in the system
  configure           Manipulate software configuration information
  file                Perform file operations
  help                Provide help information
  monitor             Show real-time debugging information
  mtrace              Trace multicast path from source to receiver
  op                  Invoke an operation script
  ping                Ping remote target
  quit                Exit the management session
  request             Make system-level requests
...
```

KIS FRI UNIZA

Konfiguračný režim

- Príkaz **configure**
- Pre „vystúpenie" príkaz **exit**

```
root> configure
Entering configuration mode

[edit]
root#

[edit]
root# exit
Exiting configuration mode

root>
```

Pohyb v podrežimoch

- Príkaz **edit**
- Pre „vystúpenie" príkaz **exit**

```
[edit]
root# edit interfaces lo0

[edit interfaces lo0]
root# edit unit 0 family inet

[edit interfaces lo0 unit 0 family inet]
root# exit

[edit interfaces lo0]
root# exit

[edit]
root#
```

Aplikovanie zmien

- Pre aplikovanie (a uloženie) konfigurácie je potrebné zadať príkaz **commit**
  - Rôzne možnosti
    - Commit
    - Commit and-quit
    - Commit check
    - Commit confirmed
- Najskôr je ale potrebné nastaviť heslo pre root-a

```
[edit]
root# commit
[edit]
  'system'
    Missing mandatory statement: 'root-authentication'
error: commit failed: (missing mandatory statements)

[edit]
root#
```

11

KIS FRI UNIZA

Commit

- Commit
  - Skontroluje logiku príkazov a aplikuje zmeny
- Commit and-quit
  - Skontroluje logiku príkazov a aplikuje zmeny
  - „Vystúpi" z konfiguračného režimu
- Commit check
  - Skontroluje logiku príkazov
- Commit confirmed
  - Skontroluje logiku príkazov a aplikuje zmeny
  - Čaká definovaný čas na príkaz commit
  - Ak nie je zadaný, vráti zmeny

Nastavenie root hesla

- Možnosť zadania plain-text hesla

```
[edit]
root# set system root-authentication plain-text-password
New password:
error: minimum password length is 6
error: require change of case, digits or punctuation

[edit]
root# set system root-authentication plain-text-password
New password:
Retype new password:

[edit]
root#
```

Nastavenie root hesla

- Overenie hesla

```
[edit]
root# show | compare
[edit system]
+   root-authentication {
+       encrypted-password "$5$uh4PWIjf$4Z.8NZnq/KjHVU9ZpU4o1yzkKTO5gGig4jDqbZwGt45";
## SECRET-DATA
+   }

[edit]
root# commit
commit complete

[edit]
root#
```

Zobrazenie konfigurácie

- Príkaz **show**

```
root# show
## Last changed: 2018-04-23 15:11:31 UTC
version 15.1F6.9;
system {
    root-authentication {
        encrypted-password "$5$aL4hORZ5$gP7Ygnvf4aJvD449m.RESuBMLgBbXe3jL0gVy/Z12jB"; ##
SECRET-DATA
    }
    syslog {
        user * {
            any emergency;
        }
        file messages {
            any notice;
            authorization info;
        }
        file interactive-commands {
            interactive-commands any;
        }
    }
}

[edit]
root#
```

15

KIS FRI UNIZA

IPv4 adresácia

Zobrazenie IPv4 adries na rozhraniach

- Príkaz **show interfaces terse**

```
root> show interfaces terse
Interface               Admin Link Proto    Local                   Remote
cbp0                    up    up
em0                     up    up
em1                     up    up
em2                     up    up
em3                     up    up
esi                     up    up
gre                     up    up
ipip                    up    up
irb                     up    up
lo0                     up    up
lo0.16384               up    up   inet     127.0.0.1               --> 0/0
lo0.16385               up    up   inet     128.0.0.1               --> 0/0
                                            128.0.0.4               --> 0/0
                             inet6     fe80::200:f:fc00:0
lsi                     up    up
...
```

KIS FRI UNIZA

Nastavenie IPv4 adries na rozhraniach

```
[edit]
root# set interfaces em0 unit 0 family inet address 192.168.1.1/24

[edit]
root# show | compare
[edit]
+   interfaces {
+       em0 {
+           unit 0 {
+               family inet {
+                   address 192.168.1.1/24;
+               }
+           }
+       }
+   }

[edit]
root# commit
commit complete
```

Overenie IPv4 adries na rozhraniach

```
root> show interfaces terse
Interface                   Admin Link Proto     Local                          Remote
cbp0                        up    up
demux0                      up    up
dsc                         up    up
em0                         up    up
em0.0                       up    up   inet      192.168.1.1/24
em1                         up    up
em2                         up    up
em3                         up    up
esi                         up    up
gre                         up    up
ipip                        up    up
...
```

Cisco na druhej strane

- Zobuď rozhranie a zadaj IPv4 adresu

```
R1(config)#interface FastEthernet0/0
R1(config-if)#no shutdown
R1(config-if)#ip address 192.168.1.2 255.255.255.0
```

Overenie

```
root> ping 192.168.1.2
PING 192.168.1.2 (192.168.1.2): 56 data bytes
64 bytes from 192.168.1.2: icmp_seq=0 ttl=255 time=5.220 ms
64 bytes from 192.168.1.2: icmp_seq=1 ttl=255 time=8.164 ms
64 bytes from 192.168.1.2: icmp_seq=2 ttl=255 time=8.955 ms
64 bytes from 192.168.1.2: icmp_seq=3 ttl=255 time=3.899 ms
^C
--- 192.168.1.2 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
round-trip min/avg/max/stddev = 3.899/6.559/8.955/2.073 ms

root>
```

```
R1#ping 192.168.1.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 60/63/68 ms
R1#
```

KIS FRI UNIZA

Smerovacia tabuľka na JunOS

```
root> show route

inet.0: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

192.168.1.0/24     *[Direct/0] 00:08:25
                    > via em0.0
192.168.1.1/32     *[Local/0] 00:08:25
                       Local via em0.0
```

Smerovacia tabuľka na Cisco

```
R1#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

C    192.168.1.0/24 is directly connected, FastEthernet0/0
R1#
```

IPv6 adresácia

Nastavenie IPv6 adries na rozhraniach

```
[edit]
root# set interfaces em0 unit 0 family inet6 address FE80::1/64
root# set interfaces em0 unit 0 family inet6 address 2001:DEAD:BEEF::1/64

[edit]
root# show | compare
[edit interfaces em0 unit 0]
+       family inet6 {
+               address 2001:dead:beef::1/64;
+       }

[edit]
root# commit
commit complete
```

Overenie IPv6 adries na rozhraniach

```
root> show interfaces terse
Interface                   Admin Link Proto    Local                     Remote
cbp0                        up    up
demux0                      up    up
dsc                         up    up
em0                         up    up
em0.0                       up    up   inet     192.168.1.1/24
                                       inet6    2001:dead:beef::1/64
                                                fe80::52c9:4aff:fed3:ed00/64
em1                         up    up
em2                         up    up
em3                         up    up
…
```

Cisco na druhej strane

- Zapni IPv6
- Zobuď rozhranie a zadaj IPv4 adresu

```
R1(config)#ipv6 unicast-routing
R1(config)#ipv6 cef

R1(config-if)#no shutdown
R1(config-if)#ipv6 address fe80::2 link-local
R1(config-if)#ipv6 address 2001:DEAD:BEEF::2/64
```

Overenie

```
root> ping 2001:DEAD:BEEF::2
PING6(56=40+8+8 bytes) 2001:dead:beef::1 --> 2001:dead:beef::2
16 bytes from 2001:dead:beef::2, icmp_seq=0 hlim=64 time=14.228 ms
16 bytes from 2001:dead:beef::2, icmp_seq=1 hlim=64 time=9.163 ms
16 bytes from 2001:dead:beef::2, icmp_seq=2 hlim=64 time=12.788 ms
16 bytes from 2001:dead:beef::2, icmp_seq=3 hlim=64 time=8.585 ms
^C
--- 2001:DEAD:BEEF::2 ping6 statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
round-trip min/avg/max/std-dev = 8.585/11.191/14.228/2.381 ms

root>
```

```
R1#ping 2001:DEAD:BEEF::1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DEAD:BEEF::1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 324/603/1048 ms
R1#
```

Overenie Link-local adries

```
root> ping 2001:DEAD:BEEF::2
PING6(56=40+8+8 bytes) 2001:dead:beef::1 --> 2001:dead:beef::2
16 bytes from 2001:dead:beef::2, icmp_seq=0 hlim=64 time=14.228 ms
16 bytes from 2001:dead:beef::2, icmp_seq=1 hlim=64 time=9.163 ms
16 bytes from 2001:dead:beef::2, icmp_seq=2 hlim=64 time=12.788 ms
16 bytes from 2001:dead:beef::2, icmp_seq=3 hlim=64 time=8.585 ms
^C
--- 2001:DEAD:BEEF::2 ping6 statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
round-trip min/avg/max/std-dev = 8.585/11.191/14.228/2.381 ms

root>
```

```
R1#ping fe80::1
Output Interface: fastethernet0/0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to FE80::1, timeout is 2 seconds:
Packet sent with a source address of FE80::2
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 392/516/640 ms
R1#
```

Smerovacia tabuľka na JunOS

```
root> show route

inet.0: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

192.168.1.0/24     *[Direct/0] 00:08:25
                    > via em0.0
192.168.1.1/32     *[Local/0] 00:08:25
                       Local via em0.0


inet6.0: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

2001:dead:beef::/64*[Direct/0] 00:08:25
                       > via em0.0
2001:dead:beef::1/128
                    *[Local/0] 00:08:25
                       Local via em0.0
fe80::1/128        *[Local/0] 00:08:14
                       Local via em0.0
```

Smerovacia tabuľka na Cisco

```
R1#show ipv6 route
IPv6 Routing Table - 4 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
       U - Per-user Static route
       I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
       O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
C   2001:DEAD:BEEF::/64 [0/0]
     via ::, FastEthernet0/0
L   2001:DEAD:BEEF::2/128 [0/0]
     via ::, FastEthernet0/0
L   FE80::/10 [0/0]
     via ::, Null0
L   FF00::/8 [0/0]
     via ::, Null0
R1#
```

Pridanie Loopback rozhraní

Pridanie Loopback rozhraní

- Na každom smerovači vytvoríme 3 Loopback rozhrania

- Loopback 0.1:
  - 10.1.1.1/24
  - 2001:ACAD:1:1::1/64
  - FE80::1
- Loopback 0.1 :
  - 10.1.2.1/24
  - 2001:ACAD:1:2::1/64
  - FE80::1
- Loopback 0.1 :
  - 10.1.3.1/24
  - 2001:ACAD:1:3::1/64
  - FE80::1

- Loopback 1:
  - 10.2.1.1/24
  - 2001:ACAD:2:1::1/64
  - FE80::2
- Loopback 2:
  - 10.2.2.1/24
  - 2001:ACAD:2:2::1/64
  - FE80::2
- Loopback 3:
  - 10.2.3.1/24
  - 2001:ACAD:2:3::1/64
  - FE80::2

JunOS a Loopback rozhrania

- JunOS nepodporuje viac Loopback rozhraní na jednom boxe
  - Iba jedno jediné – lo0
- Adresa musí mať masku /32, resp. /128 (to tvrdí dokumentácia)

- Finta: dať adresy na rozhranie lo0.1

```
[edit interfaces lo0 unit 1]
root# set family inet address 10.1.1.1/24
root# set family inet6 address 2001:ACAD:1:1::1/64
root# set family inet6 address FE80::1/64

root# set family inet address 10.1.2.1/24
root# set family inet6 address 2001:ACAD:1:2::1/64
root# set family inet6 address FE80::1/64

root# set family inet address 10.1.3.1/24
root# set family inet6 address 2001:ACAD:1:3::1/64
root# set family inet6 address FE80::1/64
```

Overenie

```
root# show interfaces terse
Interface               Admin Link Proto  Local                   Remote
cbp0                    up    up
em0                     up    up
em0.0                   up    up   inet   192.168.1.1/24
                                   inet6  2001:dead:beef::1/64
                                          fe80::1/64
em1                     up    up
...
irb                     up    up
lo0                     up    up
lo0.1                   up    up   inet   10.1.1.1/24
                                          10.1.2.1/24
                                          10.1.3.1/24
                                   inet6  2001:acad:1:1::1/64
                                          2001:acad:1:2::1/64
                                          2001:acad:1:3::1/64
                                          fe80::1/64
lo0.16384               up    up   inet   127.0.0.1               --> 0/0
lo0.16385               up    up   inet   128.0.0.1               --> 0/0
                                          128.0.0.4               --> 0/0
                                   inet6  fe80::200:f:fc00:0
lsi                     up    up
...
```

Overenie na Cisco

```
R1#show ip int br
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            192.168.1.2     YES manual up                     up
Serial0/0                  unassigned      YES unset  administratively down down
FastEthernet0/1            unassigned      YES manual administratively down down
Serial0/1                  unassigned      YES unset  administratively down down
Loopback1                  10.2.1.1        YES manual up                     up
Loopback2                  10.2.2.1        YES manual up                     up
Loopback3                  10.2.3.1        YES manual up                     up
```

```
R1#show ipv6 interface brief
FastEthernet0/0            [up/up]
    FE80::2
    2001:DEAD:BEEF::2
Loopback1                  [up/up]
    FE80::2
    2001:ACAD:2:1::1
Loopback2                  [up/up]
    FE80::2
    2001:ACAD:2:2::1
Loopback3                  [up/up]
    FE80::2
    2001:ACAD:2:3::1
```

Smerovacia tabuľka JunOS (prvá časť)

```
root> show route

inet.0: 8 destinations, 8 routes (8 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.1.1.0/24          *[Direct/0] 00:06:26
                      > via lo0.1
10.1.1.1/32          *[Local/0] 00:06:26
                        Local via lo0.1
10.1.2.0/24          *[Direct/0] 00:06:26
                      > via lo0.1
10.1.2.1/32          *[Local/0] 00:06:26
                        Local via lo0.1
10.1.3.0/24          *[Direct/0] 00:06:26
                      > via lo0.1
10.1.3.1/32          *[Local/0] 00:06:26
                        Local via lo0.1
192.168.1.0/24       *[Direct/0] 00:06:26
                      > via em0.0
192.168.1.1/32       *[Local/0] 00:06:26
                        Local via em0.0
```

Smerovacia tabuľka JunOS (druhá časť)

```
inet6.0: 9 destinations, 9 routes (9 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

2001:acad:1:1::/64 *[Direct/0] 00:06:26
                     > via lo0.1
2001:acad:1:1::1/128
                   *[Local/0] 00:06:26
                     Local via lo0.1
2001:acad:1:2::/64 *[Direct/0] 00:06:26
                     > via lo0.1
2001:acad:1:2::1/128
                   *[Local/0] 00:06:26
                     Local via lo0.1
2001:acad:1:3::/64 *[Direct/0] 00:06:26
                     > via lo0.1
2001:acad:1:3::1/128
                   *[Local/0] 00:06:26
                     Local via lo0.1
2001:dead:beef::/64*[Direct/0] 00:06:26
                     > via em0.0
2001:dead:beef::1/128
                   *[Local/0] 00:06:26
                     Local via em0.0
fe80::1/128        *[Local/0] 00:06:26
                     Local

root>
```

KIS FRI UNIZA

Smerovacia tabuľka Cisco IOS

```
R1#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/24 is subnetted, 3 subnets
C       10.2.1.0 is directly connected, Loopback1
C       10.2.2.0 is directly connected, Loopback2
C       10.2.3.0 is directly connected, Loopback3
C    192.168.1.0/24 is directly connected, FastEthernet0/0
R1#
```

Smerovacia tabuľka Cisco IOS

```
R1#show ipv6 route
IPv6 Routing Table - 10 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
       U - Per-user Static route
       I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
       O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
C   2001:ACAD:2:1::/64 [0/0]
     via ::, Loopback1
L   2001:ACAD:2:1::1/128 [0/0]
     via ::, Loopback1
C   2001:ACAD:2:2::/64 [0/0]
     via ::, Loopback2
L   2001:ACAD:2:2::1/128 [0/0]
     via ::, Loopback2
C   2001:ACAD:2:3::/64 [0/0]
     via ::, Loopback3
L   2001:ACAD:2:3::1/128 [0/0]
     via ::, Loopback3
C   2001:DEAD:BEEF::/64 [0/0]
     via ::, FastEthernet0/0
L   2001:DEAD:BEEF::2/128 [0/0]
     via ::, FastEthernet0/0
L   FE80::/10 [0/0]
     via ::, Null0
L   FF00::/8 [0/0]
     via ::, Null0
```

OSPFv2 – single area

Router ID

- Nenastavuje sa v jednotlivých procesoch, ale pre smerovač ako celok
- Pre všetky procesy rovnaké
    - Pre OSPF je možný len jeden proces
    - Konfiguruje sa bez čísla

```
[edit]
root# set routing-options router-id 1.1.1.1
```

Pridanie rozhrania

- Príkaz „network" neexistuje
  - Jediná možnosť je pridať celé rozhranie
- Oblasť sa zapisuje ako 4-miestne číslo

```
[edit]
root# set protocols ospf area 0.0.0.0 interface em0
```

Konfigurácia Cisco IOS

```
R1(config)#router ospf 1
R1(config-router)#router-id 2.2.2.2
R1(config-router)#exit

R1(config)#interface FastEthernet0/0
R1(config-if)#ip ospf 1 area 0
R1(config-if)#
```

Overenie rozhraní

```
root# show ospf interface
Interface              State    Area            DR ID           BDR ID          Nbrs
em0.0                  DR       0.0.0.0         1.1.1.1         2.2.2.2             1

root#
```

```
R1#show ip ospf interface brief
Interface      PID    Area            IP Address/Mask    Cost  State Nbrs F/C
Fa0/0          1      0               192.168.1.2/24     10    BDR   1/1
R1#
```

Overenie susedov

```
root# show ospf neighbor
Address            Interface              State      ID            Pri  Dead
192.168.1.2        em0.0                  Full       2.2.2.2         1    30

root#
```

```
R1#show ip ospf neighbor

Neighbor ID      Pri    State          Dead Time    Address          Interface
1.1.1.1          128    FULL/DR        00:00:34     192.168.1.1      FastEthernet0/0
R1#
```

OSPFv2 – multi area

Pridanie rozhrania

- Do oblasti 1 pridáme loopback rozhrania

```
[edit]
root# set protocols ospf area 1 interface lo0.1 passive
```

Konfigurácia Cisco IOS

```
R1(config)#interface range loopback 1 - 3
R1(config-if-range)#ip ospf 1 area 1
R1(config-if-range)#exit

R1(config)#router ospf 1
R1(config-router)#passive-interface loopback 1
R1(config-router)#passive-interface loopback 2
R1(config-router)#passive-interface loopback 3
```

Overerenie rozhraní

```
root# show ospf interface
Interface          State    Area            DR ID           BDR ID          Nbrs
em0.0              DR       0.0.0.0         1.1.1.1         2.2.2.2             1


root#
```

```
R1#show ip ospf interface brief
Interface    PID    Area            IP Address/Mask    Cost  State Nbrs F/C
Fa0/0        1      0               192.168.1.2/24     10    BDR   1/1
Lo1          1      1               10.2.1.1/24        1     LOOP  0/0
Lo2          1      1               10.2.2.1/24        1     LOOP  0/0
Lo3          1      1               10.2.3.1/24        1     LOOP  0/0
R1#
```

Overenie smerovacej tabuľky

```
root> show route protocol ospf

inet.0: 12 destinations, 12 routes (12 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
10.2.1.1/32         *[OSPF/10] 00:01:38, metric 2
                     > to 192.168.1.2 via em0.0
10.2.2.1/32         *[OSPF/10] 00:01:38, metric 2
                     > to 192.168.1.2 via em0.0
10.2.3.1/32         *[OSPF/10] 00:01:38, metric 2
                     > to 192.168.1.2 via em0.0
224.0.0.5/32        *[OSPF/10] 00:42:08, metric 1
                        MultiRecv
```

```
R1#show ip route ospf
     10.0.0.0/8 is variably subnetted, 9 subnets, 2 masks
O IA    10.1.3.0/24 [110/10] via 192.168.1.1, 00:00:39, FastEthernet0/0
O IA    10.1.2.1/32 [110/10] via 192.168.1.1, 00:00:39, FastEthernet0/0
O IA    10.1.3.1/32 [110/10] via 192.168.1.1, 00:00:39, FastEthernet0/0
O IA    10.1.2.0/24 [110/10] via 192.168.1.1, 00:00:39, FastEthernet0/0
O IA    10.1.1.0/24 [110/10] via 192.168.1.1, 00:00:39, FastEthernet0/0
O IA    10.1.1.1/32 [110/10] via 192.168.1.1, 00:00:39, FastEthernet0/0
R1#
```

KIS FRI UNIZA

Nastavenie typu rozhrania

```
[edit]
root# set protocols ospf area 1 interface lo0.1 interface-type p2p
```

```
R1(config)#interface range loopback 1 - 3
R1(config-if-range)#ip ospf network point-to-point
```

Overenie smerovacej tabuľky

```
root> show route protocol ospf
inet.0: 12 destinations, 15 routes (12 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.2.1.0/24          *[OSPF/10] 00:01:33, metric 2
                      > to 192.168.1.2 via em0.0
10.2.2.0/24          *[OSPF/10] 00:01:33, metric 2
                      > to 192.168.1.2 via em0.0
10.2.3.0/24          *[OSPF/10] 00:01:33, metric 2
                      > to 192.168.1.2 via em0.0
224.0.0.5/32         *[OSPF/10] 00:46:12, metric 1
                         MultiRecv
```

```
R1#show ip route ospf
     10.0.0.0/8 is variably subnetted, 9 subnets, 2 masks
O IA    10.1.3.0/24 [110/10] via 192.168.1.1, 00:00:39, FastEthernet0/0
O IA    10.1.2.0/24 [110/10] via 192.168.1.1, 00:00:39, FastEthernet0/0
O IA    10.1.1.0/24 [110/10] via 192.168.1.1, 00:00:39, FastEthernet0/0
R1#
```

OSPFv2 – databázy

OSPF databáza na JunOS

```
root> show ospf database

    OSPF database, Area 0.0.0.0
 Type        ID                 Adv Rtr            Seq          Age  Opt  Cksum  Len
Router  *1.1.1.1            1.1.1.1            0x80000007   472  0x22 0x89c2  36
Router   2.2.2.2            2.2.2.2            0x80000004   206  0x22 0xf349  36
Network  192.168.1.2        2.2.2.2            0x80000001   473  0x22 0x9b0   32
Summary *10.1.1.0           1.1.1.1            0x80000003   572  0x22 0xcd5d  28
Summary *10.1.2.0           1.1.1.1            0x80000003   122  0x22 0xc267  28
Summary *10.1.3.0           1.1.1.1            0x80000002   472  0x22 0xb970  28
Summary  10.2.1.0           2.2.2.2            0x80000001   219  0x22 0xb175  28
Summary  10.2.2.0           2.2.2.2            0x80000001   219  0x22 0xa67f  28
Summary  10.2.3.0           2.2.2.2            0x80000001   219  0x22 0x9b89  28

    OSPF database, Area 0.0.0.1
 Type        ID                 Adv Rtr            Seq          Age  Opt  Cksum  Len
Router  *1.1.1.1            1.1.1.1            0x80000006   233  0x22 0x7766  60
Summary *10.2.1.0           1.1.1.1            0x80000001   218  0x22 0xd950  28
Summary *10.2.2.0           1.1.1.1            0x80000001   218  0x22 0xce5a  28
Summary *10.2.3.0           1.1.1.1            0x80000001   218  0x22 0xc364  28
Summary *192.168.1.0        1.1.1.1            0x80000003   467  0x22 0xb417  28
```

OSPF databáza na Cisco IOS

```
R1#show ip ospf database

            OSPF Router with ID (2.2.2.2) (Process ID 1)

                Router Link States (Area 0)

Link ID         ADV Router      Age         Seq#        Checksum Link count
1.1.1.1         1.1.1.1         363         0x80000007 0x0089C2 1
2.2.2.2         2.2.2.2         177         0x80000004 0x00F349 1

                Net Link States (Area 0)

Link ID         ADV Router      Age         Seq#        Checksum
192.168.1.2     2.2.2.2         362         0x80000001 0x0009B0

                Summary Net Link States (Area 0)

Link ID         ADV Router      Age         Seq#        Checksum
10.1.1.0        1.1.1.1         431         0x80000003 0x00CD5D
10.1.2.0        1.1.1.1         122         0x80000003 0x00C267
10.1.3.0        1.1.1.1         363         0x80000002 0x00B970
10.2.1.0        2.2.2.2         186         0x80000001 0x00B175
10.2.2.0        2.2.2.2         186         0x80000001 0x00A67F
10.2.3.0        2.2.2.2         186         0x80000001 0x009B89

                Router Link States (Area 1)

Link ID         ADV Router      Age         Seq#        Checksum Link count
2.2.2.2         2.2.2.2         191         0x80000005 0x00F3DC 3

                Summary Net Link States (Area 1)

Link ID         ADV Router      Age         Seq#        Checksum
10.1.1.0        2.2.2.2         849         0x80000001 0x001807
10.1.2.0        2.2.2.2         849         0x80000001 0x000D11
10.1.3.0        2.2.2.2         359         0x80000001 0x00021B
192.168.1.0     2.2.2.2         849         0x80000001 0x00F4CB
```

OSPFv3 – single area

Pridanie rozhrania

- Na JunOS Router-ID už máme

```
[edit]
root# set protocols ospf3 area 0.0.0.0 interface em0
```

```
R1(config)#ipv6 router ospf 1
R1(config-rtr)#router-id 2.2.2.2
R1(config-rtr)#exit

R1(config)#interface fastEthernet 0/0
R1(config-if)#ipv6 ospf 1 area 0
```

Overerenie rozhraní

```
root> show ospf3 interface
Interface              State    Area            DR ID           BDR ID              Nbrs
em0.0                  DR       0.0.0.0         1.1.1.1         2.2.2.2                1


root>
```

```
R1#show ipv6 ospf interface brief
Interface      PID    Area               Intf ID    Cost  State Nbrs F/C
Fa0/0          1      0                  4          10    BDR   1/1
R1#
```

Overenie susedov

```
root> show ospf3 neighbor
ID                 Interface              State     Pri   Dead
2.2.2.2            em0.0                  Full       1     37
   Neighbor-address fe80::2


root>
```

```
R1#show ipv6 ospf neighbor

Neighbor ID      Pri    State          Dead Time    Interface ID    Interface
1.1.1.1          128    FULL/DR        00:00:35     1               FastEthernet0/0
R1#
```

OSPFv2 – multi area

Pridanie rozhrania

- Do oblasti 1 pridáme loopback rozhrania

```
[edit]
root# set protocols ospf3 area 1 interface lo0.1 passive
```

Konfigurácia Cisco IOS

```
R1(config)#interface range loopback 1 - 3
R1(config-if-range)#ipv6 ospf 1 area 1
R1(config-if-range)#exit

R1(config)#ipv6 router ospf 1
R1(config-router)#passive-interface loopback 1
R1(config-router)#passive-interface loopback 2
R1(config-router)#passive-interface loopback 3
```

Overenie rozhraní

```
root> show ospf3 interface
Interface           State   Area            DR ID           BDR ID          Nbrs
em0.0               DR      0.0.0.0         1.1.1.1         2.2.2.2            1
lo0.1               DRother 0.0.0.1         0.0.0.0         0.0.0.0            0

root>
```

```
R1#show ipv6 ospf interface brief
Interface   PID   Area            Intf ID   Cost   State Nbrs F/C
Fa0/0       1     0               4         10     BDR   1/1
Lo1         1     1               13        1      LOOP  0/0
Lo2         1     1               14        1      LOOP  0/0
Lo3         1     1               15        1      LOOP  0/0
R1#
```

Overenie smerovacej tabuľky - JunOS

```
root> show route protocol ospf3

inet.0: 12 destinations, 15 routes (12 active, 0 holddown, 0 hidden)

inet6.0: 13 destinations, 13 routes (13 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

2001:acad:2:1::1/128
                *[OSPF3/10] 00:03:46, metric 1
                 > to fe80::2 via em0.0
2001:acad:2:2::1/128
                *[OSPF3/10] 00:03:46, metric 1
                 > to fe80::2 via em0.0
2001:acad:2:3::1/128
                *[OSPF3/10] 00:03:46, metric 1
                 > to fe80::2 via em0.0
ff02::5/128     *[OSPF3/10] 00:11:27, metric 1
                   MultiRecv

root>
```

KIS FRI UNIZA

Overenie smerovacej tabuľky – Cisco IOS

```
R1#show ipv6 route ospf
IPv6 Routing Table - 16 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
       U - Per-user Static route
       I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
       O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
OI  2001:ACAD:1:1::/64 [110/10]
     via FE80::1, FastEthernet0/0
OI  2001:ACAD:1:1::1/128 [110/10]
     via FE80::1, FastEthernet0/0
OI  2001:ACAD:1:2::/64 [110/10]
     via FE80::1, FastEthernet0/0
OI  2001:ACAD:1:2::1/128 [110/10]
     via FE80::1, FastEthernet0/0
OI  2001:ACAD:1:3::/64 [110/10]
     via FE80::1, FastEthernet0/0
OI  2001:ACAD:1:3::1/128 [110/10]
     via FE80::1, FastEthernet0/0
R1#
```

Nastavenie typu rozhrania

```
[edit]
root# set protocols ospf3 area 1 interface lo0.1 interface-type p2p
```

```
R1(config)#interface range loopback 1 - 3
R1(config-if-range)#ipv6 ospf network point-to-point
```

Overenie smerovacej tabuľky - JunOS

```
root> show route protocol ospf3

inet.0: 12 destinations, 15 routes (12 active, 0 holddown, 0 hidden)

inet6.0: 13 destinations, 16 routes (13 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

2001:acad:1:1::/64  [OSPF3/10] 00:02:00, metric 0
                    > via lo0.1
2001:acad:1:2::/64  [OSPF3/10] 00:02:00, metric 0
                    > via lo0.1
2001:acad:1:3::/64  [OSPF3/10] 00:02:00, metric 0
                    > via lo0.1
2001:acad:2:1::/64 *[OSPF3/10] 00:01:44, metric 2
                    > to fe80::2 via em0.0
2001:acad:2:2::/64 *[OSPF3/10] 00:01:44, metric 2
                    > to fe80::2 via em0.0
2001:acad:2:3::/64 *[OSPF3/10] 00:01:44, metric 2
                    > to fe80::2 via em0.0
ff02::5/128        *[OSPF3/10] 00:14:49, metric 1
                      MultiRecv

root>
```

Overenie smerovacej tabuľky – Cisco IOS

```
R1#show ipv6 route ospf
IPv6 Routing Table - 13 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
       U - Per-user Static route
       I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
       O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
OI  2001:ACAD:1:1::/64 [110/10]
     via FE80::1, FastEthernet0/0
OI  2001:ACAD:1:2::/64 [110/10]
     via FE80::1, FastEthernet0/0
OI  2001:ACAD:1:3::/64 [110/10]
     via FE80::1, FastEthernet0/0
R1#
```

Ďakujem za pozornosť!

- Ohodnoť našu CNA na google:
  - https://goo.gl/maps/BAnFvQKYCBpffcEX7