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Sprawozdanie z realizacji laboratorium KRI nr 2
ISIS 1

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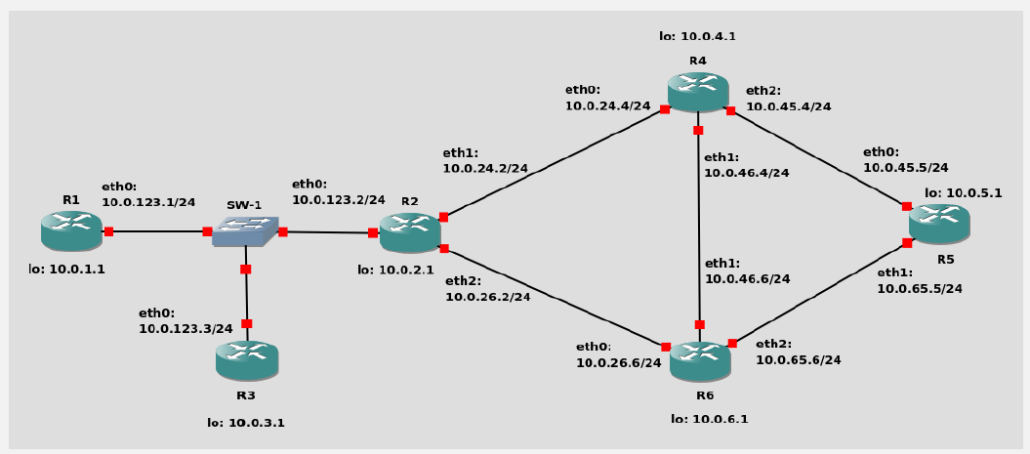
Spis treści

Wstęp

Niniejszy dokument to sprawozdanie z realizacji laboratorium w ramach przedmiotu KRI. Oświadczamy, że ta praca, stanowiąca podstawę do uznania osiągnięcia efektów uczenia się z przedmiotu KRI, została wykonana przez nas samodzielnie.

1. Zadanie A: Jedno-obszarowa konfiguracja IS-IS

Początkiem realizacji laboratorium było skonfigurowanie routingu protokołu IS-IS w sieci zgodnie z instrukcją laboratoryjną.



Rys. 1: Topologia emulowanej sieci

Następnie przy użyciu komend: *show isis neighbor detail*, *show isis topology* oraz *show isis interface* sprawdziliśmy konfigurację naszej sieci.

```
R1# show isis neighbor detail
Area 1:
 R2
    Interface: eth0, Level: 1, State: Up, Expires in 28s
    Adjacency flaps: 1, Last: 54m56s ago
    Circuit type: L1, Speaks: IPv4
    SNPA: 0242.0a0a.0003, LAN id: R3.12
    LAN Priority: 64, is not DIS, DIS flaps: 2, Last: 53m6s ago
    Area Address(es):
      49
    IPv4 Address(es):
      10.0.123.2

 R3
    Interface: eth0, Level: 1, State: Up, Expires in 27s
    Adjacency flaps: 1, Last: 53m6s ago
    Circuit type: L1, Speaks: IPv4
    SNPA: 0242.0a0a.0004, LAN id: R3.12
    LAN Priority: 127, is DIS, DIS flaps: 1, Last: 53m6s ago
    Area Address(es):
      49
    IPv4 Address(es):
      10.0.123.3
```

(a) *show isis neighbor detail*

```
R1# show isis topology
Area 1:
IS-IS paths to level-1 routers that speak IP
Vertex              Type         Metric Next-Hop             Interface Parent
R1
10.0.1.1/32         IP internal  0                                     R1(4)
10.0.123.0/24       IP internal  0                                     R1(4)
R3                  TE-IS        10     R3                  eth0      R1(4)
R2                  TE-IS        10     R2                  eth0      R1(4)
R3                  pseudo_TE-IS 20     R3                  eth0      R3(4)
                                        R2                  eth0      R2(4)
R4                  TE-IS        20     R2                  eth0      R2(4)
R6                  TE-IS        20     R2                  eth0      R2(4)
10.0.123.0/24       IP TE        20     R3                  eth0      R3(4)
                                        R2                  eth0      R2(4)
10.0.3.1/32         IP TE        20     R3                  eth0      R3(4)
10.0.2.1/32         IP TE        20     R2                  eth0      R2(4)
10.0.24.0/24        IP TE        20     R2                  eth0      R2(4)
10.0.26.0/24        IP TE        20     R2                  eth0      R2(4)
R6                  pseudo_TE-IS 30     R2                  eth0      R4(4)
                                                                      R6(4)
R5                  TE-IS        30     R2                  eth0      R4(4)
                                                                      R6(4)
10.0.4.1/32         IP TE        30     R2                  eth0      R4(4)
10.0.45.0/24        IP TE        30     R2                  eth0      R4(4)
10.0.46.0/24        IP TE        30     R2                  eth0      R4(4)
                                                                      R6(4)
10.0.56.0/24        IP TE        30     R2                  eth0      R6(4)
10.0.6.1/32         IP TE        30     R2                  eth0      R6(4)
10.0.5.1/32         IP TE        40     R2                  eth0      R5(4)
```

(b) *show isis topology*

Rys. 2: Wynik komend dla **R1**

```
R1# show isis interface
Area 1:
  Interface   CircId   State    Type     Level
  lo          0x0      Up       loopback L1
  eth0        0xa      Up       lan      L1
```

Rys. 3: Wynik komendy *show isis interface* dla **R1**

Polecenie"show isis neighbors detail" udostępnia szczegółowe informacje dotyczące sąsiadów danego routera. Wśród nich znajduje się informacja o interfejsie, z którego nawiązano połączenie z sąsiadem, poziomie routera, aktualnym stanie sąsiada, ilości wystąpień flaps (czyli zrywania i nawiązywania połączenia), obszarach osiągalnych z routera. Dodatkowo, można uzyskać informację o czasie ostatniego otrzymanego pakietu Hello oraz przepustowości łączy.

Polecenie "show isis topology" pozwala na wyświetlenie informacji o topologii sieci ISIS. Informacja ta jest generowana na podstawie danych przesyłanych między routerami w sieci ISIS. Można z niej odczytać o routerach w sieci, statusy połączeń między nimi, metryki i koszty połączeń, a także informacje o następnym routerze, który musi być osiągnięty, aby dotrzeć do konkretnego routera. Jest także widoczne, na którym interfejsie router został wykryty oraz jego SNPA.

Polecenie "show isis interface" wyświetla informacje o interfejsach, które są skonfigurowane i biorą udział w protokole IS-IS. W wyniku tego polecenia pokazywane są szczegóły dotyczące nazwy interfejsu, identyfikatora obwodu oraz jego statusu. Wyświetlane są również informacje o typie interfejsu oraz poziomie IS-IS, z którym interfejs jest skojarzony.

```
R1# show ip route
Codes: K - kernel route, C - connected, S - static, R - RIP,
       O - OSPF, I - IS-IS, B - BGP, E - EIGRP, N - NHRP,
       T - Table, v - VNC, V - VNC-Direct, A - Babel, F - PBR,
       f - OpenFabric,
       > - selected route, * - FIB route, q - queued, r - rejected, b - backup
       t - trapped, o - offload failure

C>* 10.0.1.1/32 is directly connected, lo, 01:42:07
I>* 10.0.2.1/32 [115/20] via 10.0.123.2, eth0, weight 1, 01:06:22
I>* 10.0.3.1/32 [115/20] via 10.0.123.3, eth0, weight 1, 01:06:22
I>* 10.0.4.1/32 [115/30] via 10.0.123.2, eth0, weight 1, 01:04:54
I>* 10.0.5.1/32 [115/40] via 10.0.123.2, eth0, weight 1, 01:03:44
I>* 10.0.6.1/32 [115/30] via 10.0.123.2, eth0, weight 1, 01:01:05
I>* 10.0.24.0/24 [115/20] via 10.0.123.2, eth0, weight 1, 01:06:22
I>* 10.0.26.0/24 [115/20] via 10.0.123.2, eth0, weight 1, 01:06:22
I>* 10.0.45.0/24 [115/30] via 10.0.123.2, eth0, weight 1, 01:05:24
I>* 10.0.46.0/24 [115/30] via 10.0.123.2, eth0, weight 1, 01:05:54
I>* 10.0.56.0/24 [115/30] via 10.0.123.2, eth0, weight 1, 01:01:05
I   10.0.123.0/24 [115/20] via 10.0.123.2, eth0 inactive, weight 1, 01:06:22
                           via 10.0.123.3, eth0 inactive, weight 1, 01:06:22
C>* 10.0.123.0/24 is directly connected, eth0, 01:42:07
C>* 20.0.1.0/24 is directly connected, lo1, 01:42:02
C>* 20.0.2.0/24 is directly connected, lo2, 01:42:02
C>* 20.0.3.0/24 is directly connected, lo3, 01:42:02
C>* 20.0.4.0/24 is directly connected, lo4, 01:42:02
```

Rys. 4: Wynik komendy *show ip route* dla **R2**

```
R2# show isis neighbor detail
Area 1:
 R1
    Interface: eth0, Level: 1, State: Up, Expires in 29s
    Adjacency flaps: 1, Last: 56m57s ago
    Circuit type: L1, Speaks: IPv4
    SNPA: 0242.0a0a.0002, LAN id: R3.12
    LAN Priority: 64, is not DIS, DIS flaps: 1, Last: 56m57s ago
    Area Address(es):
      49
    IPv4 Address(es):
      10.0.123.1

 R3
    Interface: eth0, Level: 1, State: Up, Expires in 29s
    Adjacency flaps: 1, Last: 55m7s ago
    Circuit type: L1, Speaks: IPv4
    SNPA: 0242.0a0a.0004, LAN id: R3.12
    LAN Priority: 127, is DIS, DIS flaps: 1, Last: 55m7s ago
    Area Address(es):
      49
    IPv4 Address(es):
      10.0.123.3

 R4
    Interface: eth1, Level: 1, State: Up, Expires in 29s
    Adjacency flaps: 1, Last: 54m29s ago
    Circuit type: L1, Speaks: IPv4
    SNPA: 2020.2020.2020
    Area Address(es):
      49
    IPv4 Address(es):
      10.0.24.4

 R6
    Interface: eth2, Level: 1, State: Up, Expires in 29s
    Adjacency flaps: 1, Last: 50m6s ago
    Circuit type: L1, Speaks: IPv4
    SNPA: 2020.2020.2020
    Area Address(es):
      49
    IPv4 Address(es):
      10.0.26.6
```

(a) *show isis neighbor detail*

```
R2# show isis topology
Area 1:
IS-IS paths to level-1 routers that speak IP
Vertex               Type         Metric Next-Hop             Interface Parent
R2
10.0.123.0/24        IP internal  0                                     R2(4)
10.0.2.1/32          IP internal  0                                     R2(4)
10.0.24.0/24         IP internal  0                                     R2(4)
10.0.26.0/24         IP internal  0                                     R2(4)
R3                   TE-IS        10     R3                  eth0      R2(4)
R1                   TE-IS        10     R1                  eth0      R2(4)
R4                   TE-IS        10     R4                  eth1      R2(4)
R6                   TE-IS        10     R6                  eth2      R2(4)
R3                   pseudo_TE-IS 20     R3                  eth0      R3(4)
                                         R1                  eth0      R1(4)
R6                   pseudo_TE-IS 20     R4                  eth1      R4(4)
                                         R6                  eth2      R6(4)
R5                   TE-IS        20     R4                  eth1      R4(4)
                                         R6                  eth2      R6(4)
10.0.123.0/24        IP TE        20     R3                  eth0      R3(4)
                                         R1                  eth0      R1(4)
10.0.3.1/32          IP TE        20     R3                  eth0      R3(4)
10.0.1.1/32          IP TE        20     R1                  eth0      R1(4)
10.0.24.0/24         IP TE        20     R4                  eth1      R4(4)
10.0.4.1/32          IP TE        20     R4                  eth1      R4(4)
10.0.45.0/24         IP TE        20     R4                  eth1      R4(4)
10.0.46.0/24         IP TE        20     R4                  eth1      R4(4)
                                         R6                  eth2      R6(4)
10.0.26.0/24         IP TE        20     R6                  eth2      R6(4)
10.0.56.0/24         IP TE        20     R6                  eth2      R6(4)
10.0.6.1/32          IP TE        20     R6                  eth2      R6(4)
10.0.5.1/32          IP TE        30     R4                  eth1      R5(4)
                                         R6                  eth2
```

(b) *show isis topology*

Rys. 5: Wynik komend dla **R2**

```
R2# show isis interface
Area 1:
  Interface   CircId   State    Type     Level
  eth0        0xc      Up       lan      L1
  lo          0x0      Up       loopback L1
  eth1        0x0      Up       p2p      L1
  eth2        0x0      Up       p2p      L1
```

Rys. 6: Wynik komendy *show isis interface* dla **R2**

```
R2# show ip route
Codes: K - kernel route, C - connected, S - static, R - RIP,
       O - OSPF, I - IS-IS, B - BGP, E - EIGRP, N - NHRP,
       T - Table, v - VNC, V - VNC-Direct, A - Babel, F - PBR,
       f - OpenFabric,
       > - selected route, * - FIB route, q - queued, r - rejected, b - backup
       t - trapped, o - offload failure

I>* 10.0.1.1/32 [115/20] via 10.0.123.1, eth0, weight 1, 01:06:42
C>* 10.0.2.1/32 is directly connected, lo, 01:42:10
I>* 10.0.3.1/32 [115/20] via 10.0.123.3, eth0, weight 1, 01:06:29
I>* 10.0.4.1/32 [115/20] via 10.0.24.4, eth1, weight 1, 01:05:00
I>* 10.0.5.1/32 [115/30] via 10.0.24.4, eth1, weight 1, 00:30:47
  *                      via 10.0.26.6, eth2, weight 1, 00:30:47
I>* 10.0.6.1/32 [115/20] via 10.0.26.6, eth2, weight 1, 01:01:11
I   10.0.24.0/24 [115/20] via 10.0.24.4, eth1 inactive, weight 1, 01:06:12
C>* 10.0.24.0/24 is directly connected, eth1, 01:42:10
I   10.0.26.0/24 [115/20] via 10.0.26.6, eth2 inactive, weight 1, 01:01:34
C>* 10.0.26.0/24 is directly connected, eth2, 01:42:10
I>* 10.0.45.0/24 [115/20] via 10.0.24.4, eth1, weight 1, 01:05:30
I>* 10.0.46.0/24 [115/20] via 10.0.24.4, eth1, weight 1, 01:01:34
  *                       via 10.0.26.6, eth2, weight 1, 01:01:34
I>* 10.0.56.0/24 [115/20] via 10.0.26.6, eth2, weight 1, 01:01:11
I   10.0.123.0/24 [115/20] via 10.0.123.1, eth0 inactive, weight 1, 01:06:42
                           via 10.0.123.3, eth0 inactive, weight 1, 01:06:42
C>* 10.0.123.0/24 is directly connected, eth0, 01:42:10
```

Rys. 7: Wynik komendy *show ip route* dla **R2**

```
R3# show isis neighbor detail
Area 1:
 R2
    Interface: eth0, Level: 1, State: Up, Expires in 27s
    Adjacency flaps: 1, Last: 55m47s ago
    Circuit type: L1, Speaks: IPv4
    SNPA: 0242.0a0a.0003, LAN id: 0000.0000.0003.12
    LAN Priority: 64, is not DIS, DIS flaps: 1, Last: 55m38s ago
    Area Address(es):
      49
    IPv4 Address(es):
      10.0.123.2

 R1
    Interface: eth0, Level: 1, State: Up, Expires in 27s
    Adjacency flaps: 1, Last: 55m47s ago
    Circuit type: L1, Speaks: IPv4
    SNPA: 0242.0a0a.0002, LAN id: 0000.0000.0003.12
    LAN Priority: 64, is not DIS, DIS flaps: 1, Last: 55m38s ago
    Area Address(es):
      49
    IPv4 Address(es):
      10.0.123.1
```

(a) *show isis neighbor detail*

```
R3# show isis topology
Area 1:
IS-IS paths to level-1 routers that speak IP
Vertex               Type         Metric Next-Hop             Interface Parent
R3
10.0.123.0/24        IP internal  0                                     R3(4)
10.0.3.1/32          IP internal  0                                     R3(4)
R2                   TE-IS        10     R2                  eth0      R3(4)
R1                   TE-IS        10     R1                  eth0      R3(4)
R3
R4                   TE-IS        20     R2                  eth0      R2(4)
R6                   TE-IS        20     R2                  eth0      R2(4)
10.0.123.0/24        IP TE        20     R2                  eth0      R2(4)
                                         R1                  eth0      R1(4)
10.0.2.1/32          IP TE        20     R2                  eth0      R2(4)
10.0.24.0/24         IP TE        20     R2                  eth0      R2(4)
10.0.26.0/24         IP TE        20     R2                  eth0      R2(4)
10.0.1.1/32          IP TE        20     R1                  eth0      R1(4)
R6                   pseudo_TE-IS 30     R2                  eth0      R4(4)
                                                                       R6(4)
R5                   TE-IS        30     R2                  eth0      R4(4)
                                                                       R6(4)
10.0.4.1/32          IP TE        30     R2                  eth0      R4(4)
10.0.45.0/24         IP TE        30     R2                  eth0      R4(4)
10.0.46.0/24         IP TE        30     R2                  eth0      R4(4)
                                                                       R6(4)
10.0.56.0/24         IP TE        30     R2                  eth0      R6(4)
10.0.6.1/32          IP TE        30     R2                  eth0      R6(4)
10.0.5.1/32          IP TE        40     R2                  eth0      R5(4)
```

(b) *show isis topology*

Rys. 8: Wynik komend dla **R3**

```
R3# show isis interface
Area 1:
  Interface   CircId   State    Type     Level
  eth0        0x12     Up       lan      L1
  lo          0x0      Up       loopback L1
```

Rys. 9: Wynik komendy *show isis interface* dla **R3**

```
R3# show ip route
Codes: K - kernel route, C - connected, S - static, R - RIP,
       O - OSPF, I - IS-IS, B - BGP, E - EIGRP, N - NHRP,
       T - Table, v - VNC, V - VNC-Direct, A - Babel, F - PBR,
       f - OpenFabric,
       > - selected route, * - FIB route, q - queued, r - rejected, b - backup
       t - trapped, o - offload failure

I>* 10.0.1.1/32 [115/20] via 10.0.123.1, eth0, weight 1, 01:06:32
I>* 10.0.2.1/32 [115/20] via 10.0.123.2, eth0, weight 1, 01:06:32
C>* 10.0.3.1/32 is directly connected, lo, 01:42:11
I>* 10.0.4.1/32 [115/30] via 10.0.123.2, eth0, weight 1, 01:05:03
I>* 10.0.5.1/32 [115/40] via 10.0.123.2, eth0, weight 1, 01:03:53
I>* 10.0.6.1/32 [115/30] via 10.0.123.2, eth0, weight 1, 01:01:14
I>* 10.0.24.0/24 [115/20] via 10.0.123.2, eth0, weight 1, 01:06:32
I>* 10.0.26.0/24 [115/20] via 10.0.123.2, eth0, weight 1, 01:06:32
I>* 10.0.45.0/24 [115/30] via 10.0.123.2, eth0, weight 1, 01:05:33
I>* 10.0.46.0/24 [115/30] via 10.0.123.2, eth0, weight 1, 01:06:03
I>* 10.0.56.0/24 [115/30] via 10.0.123.2, eth0, weight 1, 01:01:14
I   10.0.123.0/24 [115/20] via 10.0.123.1, eth0 inactive, weight 1, 01:06:32
                           via 10.0.123.2, eth0 inactive, weight 1, 01:06:32
C>* 10.0.123.0/24 is directly connected, eth0, 01:42:11
```

Rys. 10: Wynik komendy *show ip route* dla **R3**

```
R4# show isis neighbor detail
Area 1:
 R2
    Interface: eth0, Level: 1, State: Up, Expires in 27s
    Adjacency flaps: 1, Last: 55m46s ago
    Circuit type: L1, Speaks: IPv4
    SNPA: 2020.2020.2020
    Area Address(es):
      49
    IPv4 Address(es):
      10.0.24.2

 R5
    Interface: eth2, Level: 1, State: Up, Expires in 29s
    Adjacency flaps: 1, Last: 53m30s ago
    Circuit type: L1, Speaks: IPv4
    SNPA: 2020.2020.2020
    Area Address(es):
      49
    IPv4 Address(es):
      10.0.45.5

 R6
    Interface: eth1, Level: 1, State: Up, Expires in 29s
    Adjacency flaps: 1, Last: 51m12s ago
    Circuit type: L1, Speaks: IPv4
    SNPA: 0242.0a0a.0303, LAN id: R6.20
    LAN Priority: 64, is DIS, DIS flaps: 1, Last: 51m11s ago
    Area Address(es):
      49
    IPv4 Address(es):
      10.0.46.6
```

(a) *show isis neighbor detail*

```
R4# show isis topology
Area 1:
IS-IS paths to level-1 routers that speak IP
Vertex               Type         Metric Next-Hop             Interface Parent
R4
10.0.24.0/24         IP internal  0                                     R4(4)
10.0.4.1/32          IP internal  0                                     R4(4)
10.0.45.0/24         IP internal  0                                     R4(4)
10.0.46.0/24         IP internal  0                                     R4(4)
R2                   TE-IS        10     R2                  eth0      R4(4)
R5                   TE-IS        10     R5                  eth2      R4(4)
R6                   TE-IS        10     R6                  eth1      R4(4)
R3                   pseudo_TE-IS 20     R2                  eth0      R2(4)
R6                   pseudo_TE-IS 20     R6                  eth1      R6(4)
R3                   TE-IS        20     R2                  eth0      R3(2)
R1                   TE-IS        20     R2                  eth0      R3(2)
10.0.123.0/24        IP TE        20     R2                  eth0      R2(4)
10.0.2.1/32          IP TE        20     R2                  eth0      R2(4)
10.0.24.0/24         IP TE        20     R2                  eth0      R2(4)
10.0.26.0/24         IP TE        20     R2                  eth0      R2(4)
                                         R6                  eth1      R6(4)
10.0.45.0/24         IP TE        20     R5                  eth2      R5(4)
10.0.5.1/32          IP TE        20     R5                  eth2      R5(4)
10.0.56.0/24         IP TE        20     R5                  eth2      R5(4)
                                         R6                  eth1      R6(4)
10.0.46.0/24         IP TE        20     R6                  eth1      R6(4)
10.0.6.1/32          IP TE        20     R6                  eth1      R6(4)
10.0.3.1/32          IP TE        30     R2                  eth0      R3(4)
10.0.1.1/32          IP TE        30     R2                  eth0      R1(4)
```

(b) *show isis topology*

Rys. 11: Wynik komend dla **R4**

```
R4# show isis interface
Area 1:
  Interface   CircId   State    Type     Level
  eth0        0x0      Up       p2p      L1
  lo          0x0      Up       loopback L1
  eth2        0x0      Up       p2p      L1
  eth1        0x16     Up       lan      L1
```

Rys. 12: Wynik komendy *show isis interface* dla **R4**

```
R4# show ip route
Codes: K - kernel route, C - connected, S - static, R - RIP,
       O - OSPF, I - IS-IS, B - BGP, E - EIGRP, N - NHRP,
       T - Table, v - VNC, V - VNC-Direct, A - Babel, F - PBR,
       f - OpenFabric,
       > - selected route, * - FIB route, q - queued, r - rejected, b - backup
       t - trapped, o - offload failure

I>* 10.0.1.1/32 [115/30] via 10.0.24.2, eth0, weight 1, 01:06:07
I>* 10.0.2.1/32 [115/20] via 10.0.24.2, eth0, weight 1, 01:06:07
I>* 10.0.3.1/32 [115/30] via 10.0.24.2, eth0, weight 1, 01:06:07
C>* 10.0.4.1/32 is directly connected, lo, 01:42:12
I>* 10.0.5.1/32 [115/20] via 10.0.45.5, eth2, weight 1, 01:03:57
I>* 10.0.6.1/32 [115/20] via 10.0.46.6, eth1, weight 1, 01:01:18
I   10.0.24.0/24 [115/20] via 10.0.24.2, eth0 inactive, weight 1, 01:06:07
C>* 10.0.24.0/24 is directly connected, eth0, 01:42:12
I>* 10.0.26.0/24 [115/20] via 10.0.24.2, eth0, weight 1, 01:01:42
  *                       via 10.0.46.6, eth1, weight 1, 01:01:42
I   10.0.45.0/24 [115/20] via 10.0.45.5, eth2 inactive, weight 1, 01:04:07
C>* 10.0.45.0/24 is directly connected, eth2, 01:42:12
I   10.0.46.0/24 [115/20] via 10.0.46.6, eth1 inactive, weight 1, 01:01:42
C>* 10.0.46.0/24 is directly connected, eth1, 01:42:12
I>* 10.0.56.0/24 [115/20] via 10.0.45.5, eth2, weight 1, 00:31:14
  *                       via 10.0.46.6, eth1, weight 1, 00:31:14
I>* 10.0.123.0/24 [115/20] via 10.0.24.2, eth0, weight 1, 01:06:07
```

Rys. 13: Wynik komendy *show ip route* dla **R4**

```
R5# show isis neighbor detail
Area 1:
 R4
    Interface: eth0, Level: 1, State: Up, Expires in 29s
    Adjacency flaps: 1, Last: 54m21s ago
    Circuit type: L1, Speaks: IPv4
    SNPA: 2020.2020.2020
    Area Address(es):
      49
    IPv4 Address(es):
      10.0.45.4

 R6
    Interface: eth1, Level: 1, State: Up, Expires in 30s
    Adjacency flaps: 1, Last: 21m19s ago
    Circuit type: L1, Speaks: IPv4
    SNPA: 2020.2020.2020
    Area Address(es):
      49
    IPv4 Address(es):
      10.0.56.6
```

(a) *show isis neighbor detail*

```
R5# show isis topology
Area 1:
IS-IS paths to level-1 routers that speak IP
Vertex               Type         Metric Next-Hop             Interface Parent
R5
10.0.45.0/24         IP internal  0                                     R5(4)
10.0.5.1/32          IP internal  0                                     R5(4)
10.0.56.0/24         IP internal  0                                     R5(4)
R4                   TE-IS        10     R4                  eth0      R5(4)
R6                   TE-IS        10     R6                  eth1      R5(4)
R6                   pseudo_TE-IS 20     R4                  eth0      R4(4)
                                         R6                  eth1      R6(4)
R2                   TE-IS        20     R4                  eth0      R4(4)
                                         R6                  eth1      R6(4)
10.0.24.0/24         IP TE        20     R4                  eth0      R4(4)
10.0.4.1/32          IP TE        20     R4                  eth0      R4(4)
10.0.45.0/24         IP TE        20     R4                  eth0      R4(4)
10.0.46.0/24         IP TE        20     R4                  eth0      R4(4)
                                         R6                  eth1      R6(4)
10.0.26.0/24         IP TE        20     R6                  eth1      R6(4)
10.0.56.0/24         IP TE        20     R6                  eth1      R6(4)
10.0.6.1/32          IP TE        20     R6                  eth1      R6(4)
R3                   pseudo_TE-IS 30     R4                  eth0      R2(4)
                                         R6                  eth1
R3                   TE-IS        30     R4                  eth0      R3(2)
                                         R6                  eth1
R1                   TE-IS        30     R4                  eth0      R3(2)
                                         R6                  eth1
10.0.123.0/24        IP TE        30     R4                  eth0      R2(4)
                                         R6                  eth1
10.0.2.1/32          IP TE        30     R4                  eth0      R2(4)
                                         R6                  eth1
10.0.3.1/32          IP TE        40     R4                  eth0      R3(4)
                                         R6                  eth1
10.0.1.1/32          IP TE        40     R4                  eth0      R1(4)
                                         R6                  eth1
```

(b) *show isis topology*

Rys. 14: Wynik komend dla **R5**

```
R5# show isis interface
Area 1:
  Interface   CircId   State    Type     Level
  eth0        0x0      Up       p2p      L1
  lo          0x0      Up       loopback L1
  eth1        0x0      Up       p2p      L1
```

Rys. 15: Wynik komendy *show isis interface* dla **R5**

```
R5# show ip route
Codes: K - kernel route, C - connected, S - static, R - RIP,
       O - OSPF, I - IS-IS, B - BGP, E - EIGRP, N - NHRP,
       T - Table, v - VNC, V - VNC-Direct, A - Babel, F - PBR,
       f - OpenFabric,
       > - selected route, * - FIB route, q - queued, r - rejected, b - backup
       t - trapped, o - offload failure

I>* 10.0.1.1/32 [115/40] via 10.0.45.4, eth0, weight 1, 00:30:48
  *                      via 10.0.56.6, eth1, weight 1, 00:30:48
I>* 10.0.2.1/32 [115/30] via 10.0.45.4, eth0, weight 1, 00:30:48
  *                      via 10.0.56.6, eth1, weight 1, 00:30:48
I>* 10.0.3.1/32 [115/40] via 10.0.45.4, eth0, weight 1, 00:30:48
  *                      via 10.0.56.6, eth1, weight 1, 00:30:48
I>* 10.0.4.1/32 [115/20] via 10.0.45.4, eth0, weight 1, 01:04:01
C>* 10.0.5.1/32 is directly connected, lo, 01:42:13
I>* 10.0.6.1/32 [115/20] via 10.0.56.6, eth1, weight 1, 00:30:48
I>* 10.0.24.0/24 [115/20] via 10.0.45.4, eth0, weight 1, 01:04:01
I>* 10.0.26.0/24 [115/20] via 10.0.56.6, eth1, weight 1, 00:30:48
I   10.0.45.0/24 [115/20] via 10.0.45.4, eth0 inactive, weight 1, 01:04:01
C>* 10.0.45.0/24 is directly connected, eth0, 01:42:13
I>* 10.0.46.0/24 [115/20] via 10.0.45.4, eth0, weight 1, 00:30:48
  *                      via 10.0.56.6, eth1, weight 1, 00:30:48
I   10.0.56.0/24 [115/20] via 10.0.56.6, eth1 inactive, weight 1, 00:30:48
C>* 10.0.56.0/24 is directly connected, eth1, 01:42:13
I>* 10.0.123.0/24 [115/30] via 10.0.45.4, eth0, weight 1, 00:30:48
  *                        via 10.0.56.6, eth1, weight 1, 00:30:48
```

Rys. 16: Wynik komendy *show ip route* dla **R5**

```
R6# show isis neighbor detail
Area 1:
 R2
    Interface: eth0, Level: 1, State: Up, Expires in 27s
    Adjacency flaps: 1, Last: 52m40s ago
    Circuit type: L1, Speaks: IPv4
    SNPA: 2020.2020.2020
    Area Address(es):
      49
    IPv4 Address(es):
      10.0.26.2

 R4
    Interface: eth1, Level: 1, State: Up, Expires in 28s
    Adjacency flaps: 1, Last: 52m29s ago
    Circuit type: L1, Speaks: IPv4
    SNPA: 0242.0a0a.0302, LAN id: 0000.0000.0006.20
    LAN Priority: 64, is not DIS, DIS flaps: 1, Last: 52m20s ago
    Area Address(es):
      49
    IPv4 Address(es):
      10.0.46.4

 R5
    Interface: eth2, Level: 1, State: Up, Expires in 27s
    Adjacency flaps: 1, Last: 21m45s ago
    Circuit type: L1, Speaks: IPv4
    SNPA: 2020.2020.2020
    Area Address(es):
      49
    IPv4 Address(es):
      10.0.56.5
```

(a) *show isis neighbor detail*

```
R6# show isis topology
Area 1:
IS-IS paths to level-1 routers that speak IP
Vertex               Type         Metric Next-Hop             Interface Parent
R6
10.0.26.0/24         IP internal  0                                     R6(4)
10.0.46.0/24         IP internal  0                                     R6(4)
10.0.56.0/24         IP internal  0                                     R6(4)
10.0.6.1/32          IP internal  0                                     R6(4)
R2                   TE-IS        10     R2              eth0          R6(4)
R4                   TE-IS        10     R4              eth1          R6(4)
R5                   TE-IS        10     R5              eth2          R6(4)
R3                   pseudo_TE-IS 20     R2              eth0          R2(4)
R6
R3                   TE-IS        20     R2              eth0          R3(2)
R1                   TE-IS        20     R2              eth0          R3(2)
10.0.123.0/24        IP TE        20     R2              eth0          R2(4)
10.0.2.1/32          IP TE        20     R2              eth0          R2(4)
10.0.24.0/24         IP TE        20     R2              eth0          R2(4)
                                         R4              eth1          R4(4)
10.0.26.0/24         IP TE        20     R2              eth0          R2(4)
10.0.4.1/32          IP TE        20     R4              eth1          R4(4)
10.0.45.0/24         IP TE        20     R4              eth1          R4(4)
                                         R5              eth2          R5(4)
10.0.46.0/24         IP TE        20     R4              eth1          R4(4)
10.0.5.1/32          IP TE        20     R5              eth2          R5(4)
10.0.56.0/24         IP TE        20     R5              eth2          R5(4)
10.0.3.1/32          IP TE        30     R2              eth0          R3(4)
10.0.1.1/32          IP TE        30     R2              eth0          R1(4)
```

(b) *show isis topology*

Rys. 17: Wynik komend dla **R6**

```
R6# show isis interface
Area 1:
  Interface   CircId   State    Type     Level
  eth0        0x0      Up       p2p      L1
  eth1        0x20     Up       lan      L1
  eth2        0x0      Up       p2p      L1
  lo          0x0      Up       loopback L1
```

Rys. 18: Wynik komendy *show isis interface* dla **R6**

```
R1# show ip route
Codes: K - kernel route, C - connected, S - static, R - RIP,
       O - OSPF, I - IS-IS, B - BGP, E - EIGRP, N - NHRP,
       T - Table, v - VNC, V - VNC-Direct, A - Babel, F - PBR,
       f - OpenFabric,
       > - selected route, * - FIB route, q - queued, r - rejected, b - backup
       t - trapped, o - offload failure

C>* 10.0.1.1/32 is directly connected, lo, 01:42:07
I>* 10.0.2.1/32 [115/20] via 10.0.123.2, eth0, weight 1, 01:06:22
I>* 10.0.3.1/32 [115/20] via 10.0.123.3, eth0, weight 1, 01:06:22
I>* 10.0.4.1/32 [115/30] via 10.0.123.2, eth0, weight 1, 01:04:54
I>* 10.0.5.1/32 [115/40] via 10.0.123.2, eth0, weight 1, 01:03:44
I>* 10.0.6.1/32 [115/30] via 10.0.123.2, eth0, weight 1, 01:01:05
I>* 10.0.24.0/24 [115/20] via 10.0.123.2, eth0, weight 1, 01:06:22
I>* 10.0.26.0/24 [115/20] via 10.0.123.2, eth0, weight 1, 01:06:22
I>* 10.0.45.0/24 [115/30] via 10.0.123.2, eth0, weight 1, 01:05:24
I>* 10.0.46.0/24 [115/30] via 10.0.123.2, eth0, weight 1, 01:05:54
I>* 10.0.56.0/24 [115/30] via 10.0.123.2, eth0, weight 1, 01:01:05
I   10.0.123.0/24 [115/20] via 10.0.123.2, eth0 inactive, weight 1, 01:06:22
                           via 10.0.123.3, eth0 inactive, weight 1, 01:06:22
C>* 10.0.123.0/24 is directly connected, eth0, 01:42:07
C>* 20.0.1.0/24 is directly connected, lo1, 01:42:02
C>* 20.0.2.0/24 is directly connected, lo2, 01:42:02
C>* 20.0.3.0/24 is directly connected, lo3, 01:42:02
C>* 20.0.4.0/24 is directly connected, lo4, 01:42:02
```

Rys. 19: Wynik komendy *show ip route* dla **R6**

Następnie, uruchomione zostały polecenia ping i traceroute między adresami loopback R1-R5

```
R1# ping 10.0.5.1
PING 10.0.5.1 (10.0.5.1): 56 data bytes
64 bytes from 10.0.5.1: seq=0 ttl=62 time=0.431 ms
64 bytes from 10.0.5.1: seq=1 ttl=62 time=0.230 ms
64 bytes from 10.0.5.1: seq=2 ttl=62 time=0.130 ms
^C
--- 10.0.5.1 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max = 0.130/0.263/0.431 ms
R1# traceroute 10.0.5.1
traceroute to 10.0.5.1 (10.0.5.1), 30 hops max, 46 byte packets
 1  10.0.123.2 (10.0.123.2)  0.068 ms  0.017 ms  0.014 ms
 2  10.0.26.6 (10.0.26.6)  0.013 ms  0.008 ms  0.006 ms
 3  10.0.5.1 (10.0.5.1)  0.006 ms  0.016 ms  0.013 ms
R1# 2023/04/14 00:02:43 [PHJDC-499N2][EC 100663314] STARVATION: task vtysh_rl_read (55ff8b690a83) ran for 15
027ms (cpu time 0ms)
```

Rys. 20: Wynik komend *ping* i *traceroute* na adres loopback routera **R5** z **R1**

```
R5# ping 10.0.1.1
PING 10.0.1.1 (10.0.1.1): 56 data bytes
64 bytes from 10.0.1.1: seq=0 ttl=62 time=0.276 ms
64 bytes from 10.0.1.1: seq=1 ttl=62 time=0.389 ms
64 bytes from 10.0.1.1: seq=2 ttl=62 time=0.415 ms
^C
--- 10.0.1.1 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max = 0.276/0.360/0.415 ms
R5# traceroute 10.0.1.1
traceroute to 10.0.1.1 (10.0.1.1), 30 hops max, 46 byte packets
 1  10.0.45.4 (10.0.45.4)  0.007 ms  0.008 ms  0.006 ms
 2  10.0.26.2 (10.0.26.2)  0.006 ms  0.016 ms  0.013 ms
 3  10.0.1.1 (10.0.1.1)  0.013 ms  0.016 ms  0.013 ms
R5# 2023/04/14 00:04:15 [PHJDC-499N2][EC 100663314] STARVATION: task vtysh_rl_read (55f1f1e50a83) ran for 150
28ms (cpu time 0ms)
```

Rys. 21: Wynik komend *ping* i *traceroute* na adres loopback routera **R1** z **R5**

Jak widać transfer pakietów przebiega w sposób prawidłowy wzdłuż drogi R1-R2-R4-R5

2. Zadanie B: Baza danych IS-IS

Skonfigurowaliśmy interfejsy loopback, które będą potem używane jako ID routerów. Ich przypisanie wygląda następująco:

```
R1# show isis database
Area 1:
IS-IS Level-1 link-state database:
LSP ID                 PduLen  SeqNumber   Chksum  Holdtime  ATT/P/OL
R1.00-00             *     89   0x00000076  0x8372     334    0/0/0
R2.00-00                  127   0x00000073  0x50d3     327    0/0/0
R3.00-00                   89   0x0000006d  0x8f63     318    0/0/0
R3.12-00                   62   0x0000005a  0xa7aa     349    0/0/0
R4.00-00                  127   0x00000072  0x96ae     345    0/0/0
R5.00-00                  108   0x0000006f  0xe5d6     310    0/0/0
R6.00-00                  127   0x0000006e  0xa28d     313    0/0/0
R6.20-00                   51   0x00000054  0x3c12     316    0/0/0
    8 LSPs
```

Rys. 22: Wynik komendy *show isis database* na **R1**

```
R1# show isis database detail
Area 1:
IS-IS Level-1 link-state database:
LSP ID                 PduLen  SeqNumber   Chksum  Holdtime  ATT/P/OL
R1.00-00             *     89   0x00000075  0x8571     311    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  Hostname: R1
  TE Router ID: 10.0.1.1
  Router Capability: 10.0.1.1 , D:0, S:0
  Extended Reachability: 0000.0000.0003.12 (Metric: 10)
  IPv4 Interface Address: 10.0.1.1
  Extended IP Reachability: 10.0.1.1/32 (Metric: 10)
  Extended IP Reachability: 10.0.123.0/24 (Metric: 10)

R2.00-00                  127   0x00000072  0x52d2     318    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  Hostname: R2
  TE Router ID: 10.0.2.1
  Router Capability: 10.0.2.1 , D:0, S:0
  Extended Reachability: 0000.0000.0003.12 (Metric: 10)
  Extended Reachability: 0000.0000.0004.00 (Metric: 10)
  Extended Reachability: 0000.0000.0006.00 (Metric: 10)
  IPv4 Interface Address: 10.0.2.1
  Extended IP Reachability: 10.0.123.0/24 (Metric: 10)
  Extended IP Reachability: 10.0.2.1/32 (Metric: 10)
  Extended IP Reachability: 10.0.24.0/24 (Metric: 10)
  Extended IP Reachability: 10.0.26.0/24 (Metric: 10)

R3.00-00                   89   0x0000006c  0x9162     309    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  Hostname: R3
  TE Router ID: 10.0.3.1
  Router Capability: 10.0.3.1 , D:0, S:0
  Extended Reachability: 0000.0000.0003.12 (Metric: 10)
  IPv4 Interface Address: 10.0.3.1
  Extended IP Reachability: 10.0.123.0/24 (Metric: 10)
  Extended IP Reachability: 10.0.3.1/32 (Metric: 10)

R3.12-00                   62   0x00000059  0xa9a9     328    0/0/0
  Extended Reachability: 0000.0000.0003.00 (Metric: 0)
  Extended Reachability: 0000.0000.0002.00 (Metric: 0)
  Extended Reachability: 0000.0000.0001.00 (Metric: 0)
```

Rys. 23: Wynik komendy *show isis database detail* na **R1** cz.1

```
R4.00-00                 127   0x00000071  0x98ad     333    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  Hostname: R4
  TE Router ID: 10.0.4.1
  Router Capability: 10.0.4.1 , D:0, S:0
  Extended Reachability: 0000.0000.0002.00 (Metric: 10)
  Extended Reachability: 0000.0000.0005.00 (Metric: 10)
  Extended Reachability: 0000.0000.0006.20 (Metric: 10)
  IPv4 Interface Address: 10.0.4.1
  Extended IP Reachability: 10.0.24.0/24 (Metric: 10)
  Extended IP Reachability: 10.0.4.1/32 (Metric: 10)
  Extended IP Reachability: 10.0.45.0/24 (Metric: 10)
  Extended IP Reachability: 10.0.46.0/24 (Metric: 10)

R5.00-00                 108   0x0000006f  0xe5d6     346    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  Hostname: R5
  TE Router ID: 10.0.5.1
  Router Capability: 10.0.5.1 , D:0, S:0
  Extended Reachability: 0000.0000.0004.00 (Metric: 10)
  Extended Reachability: 0000.0000.0006.00 (Metric: 10)
  IPv4 Interface Address: 10.0.5.1
  Extended IP Reachability: 10.0.45.0/24 (Metric: 10)
  Extended IP Reachability: 10.0.5.1/32 (Metric: 10)
  Extended IP Reachability: 10.0.56.0/24 (Metric: 10)

R6.00-00                 127   0x0000006e  0xa28d     349    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  Hostname: R6
  TE Router ID: 10.0.6.1
  Router Capability: 10.0.6.1 , D:0, S:0
  Extended Reachability: 0000.0000.0002.00 (Metric: 10)
  Extended Reachability: 0000.0000.0006.20 (Metric: 10)
  Extended Reachability: 0000.0000.0005.00 (Metric: 10)
  IPv4 Interface Address: 10.0.6.1
  Extended IP Reachability: 10.0.26.0/24 (Metric: 10)
  Extended IP Reachability: 10.0.46.0/24 (Metric: 10)
  Extended IP Reachability: 10.0.56.0/24 (Metric: 10)
  Extended IP Reachability: 10.0.6.1/32 (Metric: 10)

R6.20-00                  51   0x00000054  0x3c12     352    0/0/0
  Extended Reachability: 0000.0000.0006.00 (Metric: 0)
  Extended Reachability: 0000.0000.0004.00 (Metric: 0)

    8 LSPs
```

Rys. 24: Wynik komendy *show isis database detail* na **R1** cz.2

Analizując bazę danych LSP, można uzyskać informacje na temat sieci i routerów widocznych przez każdy router w sieci IS-IS. Przykładowo, po przeanalizowaniu szczegółowych danych jednego z routerów, takiego jak R6, można zidentyfikować sieci rozgłaszane przez ten router wraz z ich metrykami. W przypadku R6, rozgłaszane są sieci: 10.0.26.0/24 (metryka 10), 10.0.46.0/24 (metryka 10), 10.0.56.0/24 (metryka 10) oraz 10.0.6.1/32 (metryka 10, adres loopback dla R6). Dodatkowo, uzyskujemy informacje o o obszarze routera, w którym się znajduje.

3. Zadanie C: Koszt łączy IS-IS

Zgodnie z poleceniem, na obu końcach łączy R2-R6 oraz R4-R5 koszty zostały zmienione na poziom 100. Następnie, celem weryfikacji uruchomiono polecenie traceroute mające zbadać ścieżkę między R1 a R5.

```
R1# traceroute 10.0.5.1
traceroute to 10.0.5.1 (10.0.5.1), 30 hops max, 46 byte packets
 1  10.0.123.2 (10.0.123.2)  0.008 ms  0.008 ms  0.005 ms
 2  10.0.24.4 (10.0.24.4)  0.006 ms  0.008 ms  0.006 ms
 3  10.0.46.6 (10.0.46.6)  0.005 ms  0.008 ms  0.006 ms
 4  10.0.5.1 (10.0.5.1)  0.006 ms  0.017 ms  0.013 ms
R1# 2023/04/14 00:19:50 [PHJDC-499N2][EC 100663314] STARVATION: task vtysh_rl_read (55ff8b690a83) ran for 20
023ms (cpu time 0ms)
```

Rys. 25: Wynik komendy *traceroute* na adres loopback routera **R5** z **R1** po zmianie kosztów na łączach

Zgodnie z oczekiwaniami, trasa uległa zmianie i teraz wygląda ona następująco R1-R2-R4-R6-R5. Trasa ta przechodzi przez większą ilość routerów ale, w związku ze zmianami kosztów na łączach jest ona najkorzystniejszą.

Następnie sprawdziliśmy isis interface detail na R2 i R4

```
R2# show isis interface detail
Area 1:
  Interface: eth0, State: Up, Active, Circuit Id: 0xc
    Type: lan, Level: L1, SNPA: 0242.0a0a.0003
    Level-1 Information:
      Metric: 10, Active neighbors: 2
      Hello interval: 3, Holddown count: 10 (pad)
      CNSP interval: 10, PSNP interval: 2
      LAN Priority: 64, is not DIS
    IP Prefix(es):
      10.0.123.2/24

  Interface: lo, State: Up, Passive, Circuit Id: 0x0
    Type: loopback, Level: L1
    Level-1 Information:
      Metric: 10
    IP Prefix(es):
      10.0.2.1/32

  Interface: eth1, State: Up, Active, Circuit Id: 0x0
    Type: p2p, Level: L1
    Level-1 Information:
      Metric: 10, Active neighbors: 1
      Hello interval: 3, Holddown count: 10 (pad)
      CNSP interval: 10, PSNP interval: 2
    IP Prefix(es):
      10.0.24.2/24

  Interface: eth2, State: Up, Active, Circuit Id: 0x0
    Type: p2p, Level: L1
    Level-1 Information:
      Metric: 100, Active neighbors: 1
      Hello interval: 3, Holddown count: 10 (pad)
      CNSP interval: 10, PSNP interval: 2
    IP Prefix(es):
      10.0.26.2/24
```

Rys. 26: Wynik *show isis interface detail* dla **R2**

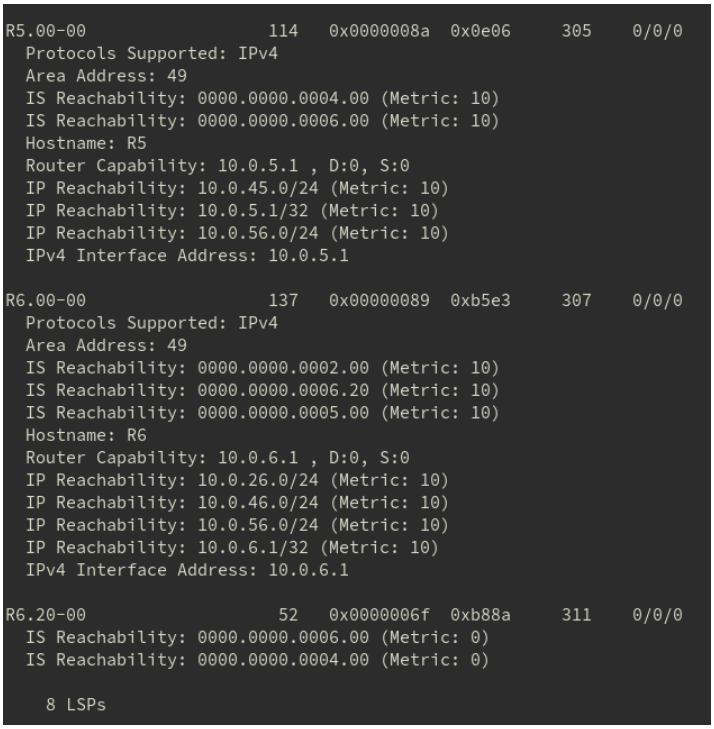
```
R4# show isis interface detail
Area 1:
  Interface: eth0, State: Up, Active, Circuit Id: 0x0
    Type: p2p, Level: L1
    Level-1 Information:
      Metric: 10, Active neighbors: 1
      Hello interval: 3, Holddown count: 10 (pad)
      CNSP interval: 10, PSNP interval: 2
    IP Prefix(es):
      10.0.24.4/24

  Interface: lo, State: Up, Passive, Circuit Id: 0x0
    Type: loopback, Level: L1
    Level-1 Information:
      Metric: 10
    IP Prefix(es):
      10.0.4.1/32

  Interface: eth2, State: Up, Active, Circuit Id: 0x0
    Type: p2p, Level: L1
    Level-1 Information:
      Metric: 100, Active neighbors: 1
      Hello interval: 3, Holddown count: 10 (pad)
      CNSP interval: 10, PSNP interval: 2
    IP Prefix(es):
      10.0.45.4/24

  Interface: eth1, State: Up, Active, Circuit Id: 0x16
    Type: lan, Level: L1, SNPA: 0242.0a0a.0302
    Level-1 Information:
      Metric: 10, Active neighbors: 1
      Hello interval: 3, Holddown count: 10 (pad)
      CNSP interval: 10, PSNP interval: 2
      LAN Priority: 64, is not DIS
    IP Prefix(es):
      10.0.46.4/24
```

Rys. 27: Wynik *show isis interface detail* dla **R4**

Zgodnie z poleceniem cofnęliśmy zmiany wartości metryk i dokonaliśmy nowych zmian teraz na wszystkich routerach metrykę na wąską. Później sprawdziliśmy poleceniem show isis database detail.

```
R1# show isis database detail
Area 1:
IS-IS Level-1 link-state database:
LSP ID                  PduLen  SeqNumber   Chksum  Holdtime  ATT/P/OL
R1.00-00            *     91   0x00000090  0x0f2a     333    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  IS Reachability: 0000.0000.0003.12 (Metric: 10)
  Hostname: R1
  Router Capability: 10.0.1.1 , D:0, S:0
  IP Reachability: 10.0.1.1/32 (Metric: 10)
  IP Reachability: 10.0.123.0/24 (Metric: 10)
  IPv4 Interface Address: 10.0.1.1

R2.00-00                137   0x00000090  0x582f     325    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  IS Reachability: 0000.0000.0003.12 (Metric: 10)
  IS Reachability: 0000.0000.0004.00 (Metric: 10)
  IS Reachability: 0000.0000.0006.00 (Metric: 10)
  Hostname: R2
  Router Capability: 10.0.2.1 , D:0, S:0
  IP Reachability: 10.0.123.0/24 (Metric: 10)
  IP Reachability: 10.0.2.1/32 (Metric: 10)
  IP Reachability: 10.0.24.0/24 (Metric: 10)
  IP Reachability: 10.0.26.0/24 (Metric: 10)
  IPv4 Interface Address: 10.0.2.1

R3.00-00                 91   0x00000088  0x84b2     336    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  IS Reachability: 0000.0000.0003.12 (Metric: 10)
  Hostname: R3
  Router Capability: 10.0.3.1 , D:0, S:0
  IP Reachability: 10.0.123.0/24 (Metric: 10)
  IP Reachability: 10.0.3.1/32 (Metric: 10)
  IPv4 Interface Address: 10.0.3.1

R3.12-00                 63   0x00000075  0xbb0a     318    0/0/0
  IS Reachability: 0000.0000.0003.00 (Metric: 0)
  IS Reachability: 0000.0000.0002.00 (Metric: 0)
  IS Reachability: 0000.0000.0001.00 (Metric: 0)

R4.00-00                137   0x0000008c  0xdbd1     326    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  IS Reachability: 0000.0000.0002.00 (Metric: 10)
  IS Reachability: 0000.0000.0005.00 (Metric: 10)
  IS Reachability: 0000.0000.0006.20 (Metric: 10)
  Hostname: R4
  Router Capability: 10.0.4.1 , D:0, S:0
  IP Reachability: 10.0.24.0/24 (Metric: 10)
  IP Reachability: 10.0.4.1/32 (Metric: 10)
  IP Reachability: 10.0.45.0/24 (Metric: 10)
  IP Reachability: 10.0.46.0/24 (Metric: 10)
  IPv4 Interface Address: 10.0.4.1
```

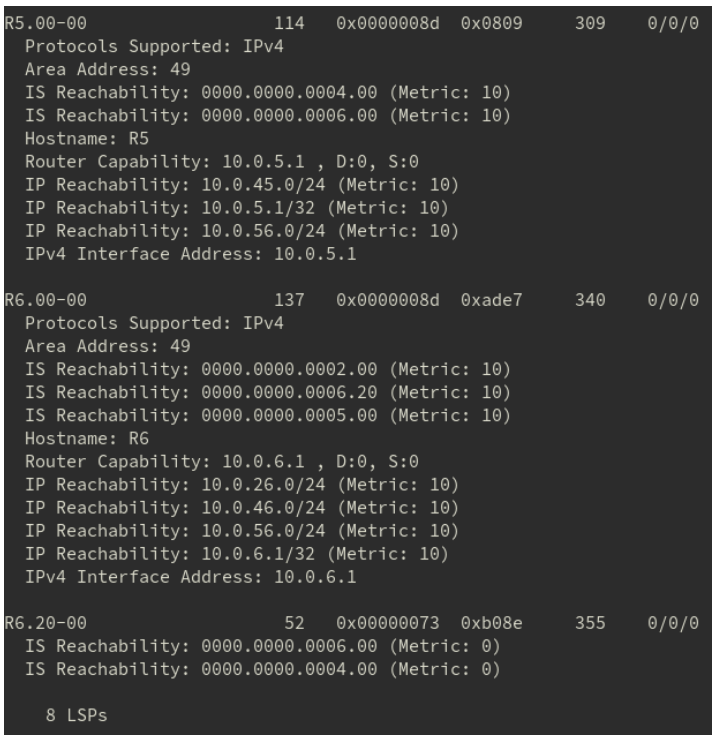
Rys. 28: Wynik *show isis database detail* dla **R1** (cz. 1)



Rys. 29: Wynik *show isis database detail* dla **R1** (cz. 2)

```
R2# show isis database detail
Area 1:
IS-IS Level-1 link-state database:
LSP ID                  PduLen  SeqNumber   Chksum  Holdtime  ATT/P/OL
R1.00-00                  91   0x00000093  0x092d     323    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  IS Reachability: 0000.0000.0003.12 (Metric: 10)
  Hostname: R1
  Router Capability: 10.0.1.1 , D:0, S:0
  IP Reachability: 10.0.1.1/32 (Metric: 10)
  IP Reachability: 10.0.123.0/24 (Metric: 10)
  IPv4 Interface Address: 10.0.1.1

R2.00-00            *    137   0x00000093  0x5232     300    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  IS Reachability: 0000.0000.0003.12 (Metric: 10)
  IS Reachability: 0000.0000.0004.00 (Metric: 10)
  IS Reachability: 0000.0000.0006.00 (Metric: 10)
  Hostname: R2
  Router Capability: 10.0.2.1 , D:0, S:0
  IP Reachability: 10.0.123.0/24 (Metric: 10)
  IP Reachability: 10.0.2.1/32 (Metric: 10)
  IP Reachability: 10.0.24.0/24 (Metric: 10)
  IP Reachability: 10.0.26.0/24 (Metric: 10)
  IPv4 Interface Address: 10.0.2.1

R3.00-00                  91   0x0000008b  0x7eb5     307    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  IS Reachability: 0000.0000.0003.12 (Metric: 10)
  Hostname: R3
  Router Capability: 10.0.3.1 , D:0, S:0
  IP Reachability: 10.0.123.0/24 (Metric: 10)
  IP Reachability: 10.0.3.1/32 (Metric: 10)
  IPv4 Interface Address: 10.0.3.1

R3.12-00                  63   0x00000078  0xb50d     309    0/0/0
  IS Reachability: 0000.0000.0003.00 (Metric: 0)
  IS Reachability: 0000.0000.0002.00 (Metric: 0)
  IS Reachability: 0000.0000.0001.00 (Metric: 0)

R4.00-00                 137   0x0000008f  0xd5d4     329    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  IS Reachability: 0000.0000.0002.00 (Metric: 10)
  IS Reachability: 0000.0000.0005.00 (Metric: 10)
  IS Reachability: 0000.0000.0006.20 (Metric: 10)
  Hostname: R4
  Router Capability: 10.0.4.1 , D:0, S:0
  IP Reachability: 10.0.24.0/24 (Metric: 10)
  IP Reachability: 10.0.4.1/32 (Metric: 10)
  IP Reachability: 10.0.45.0/24 (Metric: 10)
  IP Reachability: 10.0.46.0/24 (Metric: 10)
  IPv4 Interface Address: 10.0.4.1
```

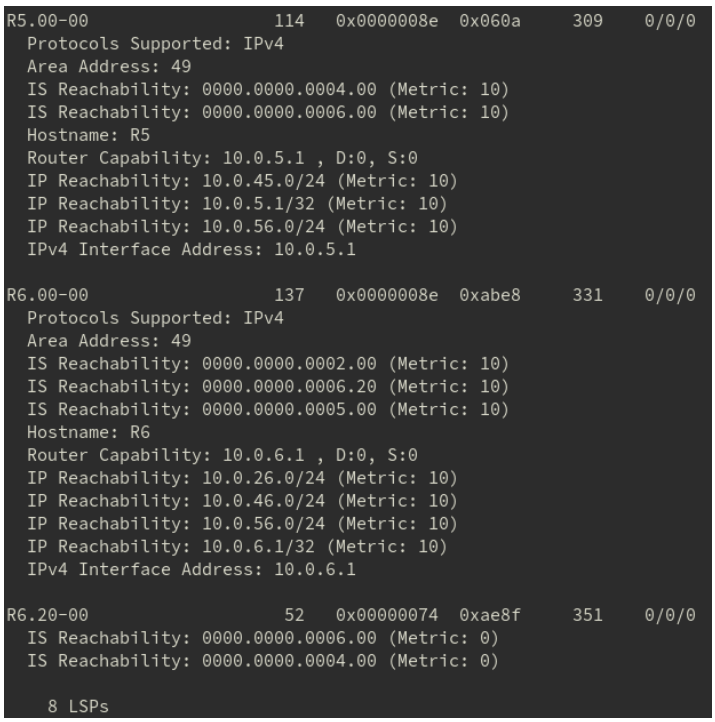
Rys. 30: Wynik *show isis database detail* dla **R2** (cz. 1)



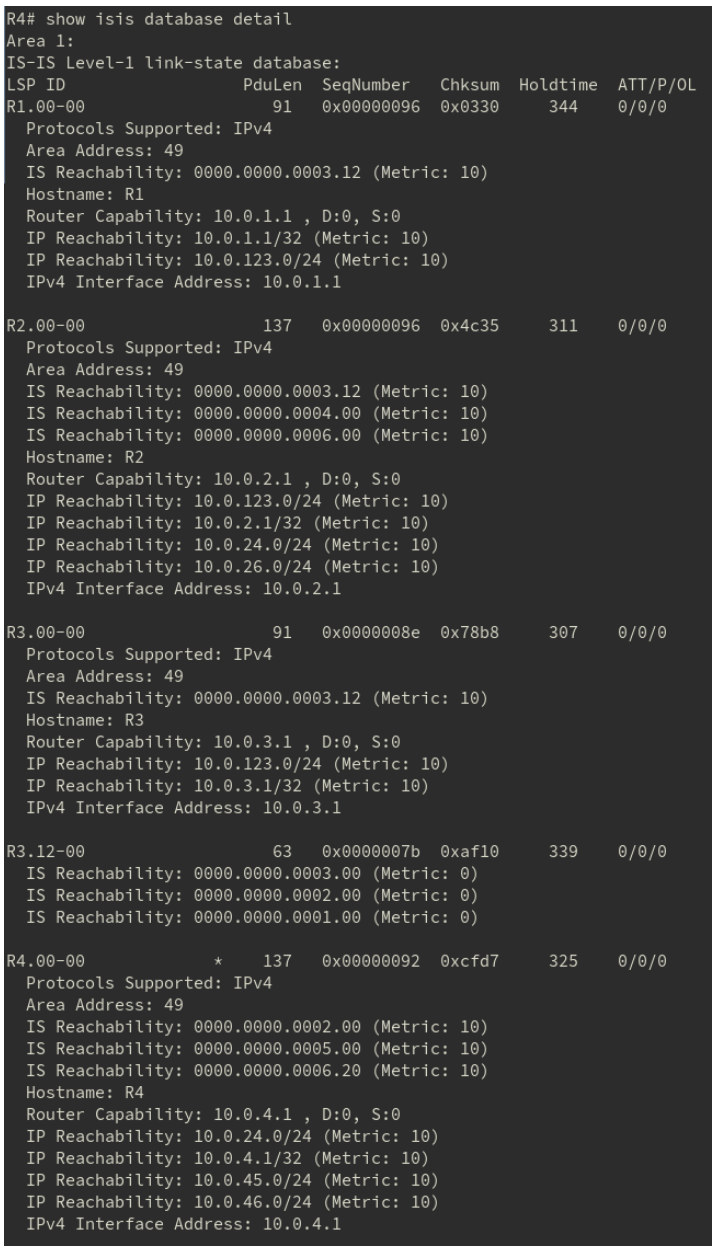
Rys. 31: Wynik *show isis database detail* dla **R2** (cz. 2)

```
R3# show isis database detail
Area 1:
IS-IS Level-1 link-state database:
LSP ID                  PduLen  SeqNumber   Chksum  Holdtime  ATT/P/OL
R1.00-00                  91   0x00000094  0x072e     321    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  IS Reachability: 0000.0000.0003.12 (Metric: 10)
  Hostname: R1
  Router Capability: 10.0.1.1 , D:0, S:0
  IP Reachability: 10.0.1.1/32 (Metric: 10)
  IP Reachability: 10.0.123.0/24 (Metric: 10)
  IPv4 Interface Address: 10.0.1.1

R2.00-00                 137   0x00000095  0x4e34     347    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  IS Reachability: 0000.0000.0003.12 (Metric: 10)
  IS Reachability: 0000.0000.0004.00 (Metric: 10)
  IS Reachability: 0000.0000.0006.00 (Metric: 10)
  Hostname: R2
  Router Capability: 10.0.2.1 , D:0, S:0
  IP Reachability: 10.0.123.0/24 (Metric: 10)
  IP Reachability: 10.0.2.1/32 (Metric: 10)
  IP Reachability: 10.0.24.0/24 (Metric: 10)
  IP Reachability: 10.0.26.0/24 (Metric: 10)
  IPv4 Interface Address: 10.0.2.1

R3.00-00             *    91   0x0000008d  0x7ab7     341    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  IS Reachability: 0000.0000.0003.12 (Metric: 10)
  Hostname: R3
  Router Capability: 10.0.3.1 , D:0, S:0
  IP Reachability: 10.0.123.0/24 (Metric: 10)
  IP Reachability: 10.0.3.1/32 (Metric: 10)
  IPv4 Interface Address: 10.0.3.1

R3.12-00             *    63   0x00000079  0xb30e     306    0/0/0
  IS Reachability: 0000.0000.0003.00 (Metric: 0)
  IS Reachability: 0000.0000.0002.00 (Metric: 0)
  IS Reachability: 0000.0000.0001.00 (Metric: 0)

R4.00-00                 137   0x00000090  0xd3d5     314    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  IS Reachability: 0000.0000.0002.00 (Metric: 10)
  IS Reachability: 0000.0000.0005.00 (Metric: 10)
  IS Reachability: 0000.0000.0006.20 (Metric: 10)
  Hostname: R4
  Router Capability: 10.0.4.1 , D:0, S:0
  IP Reachability: 10.0.24.0/24 (Metric: 10)
  IP Reachability: 10.0.4.1/32 (Metric: 10)
  IP Reachability: 10.0.45.0/24 (Metric: 10)
  IP Reachability: 10.0.46.0/24 (Metric: 10)
  IPv4 Interface Address: 10.0.4.1
```

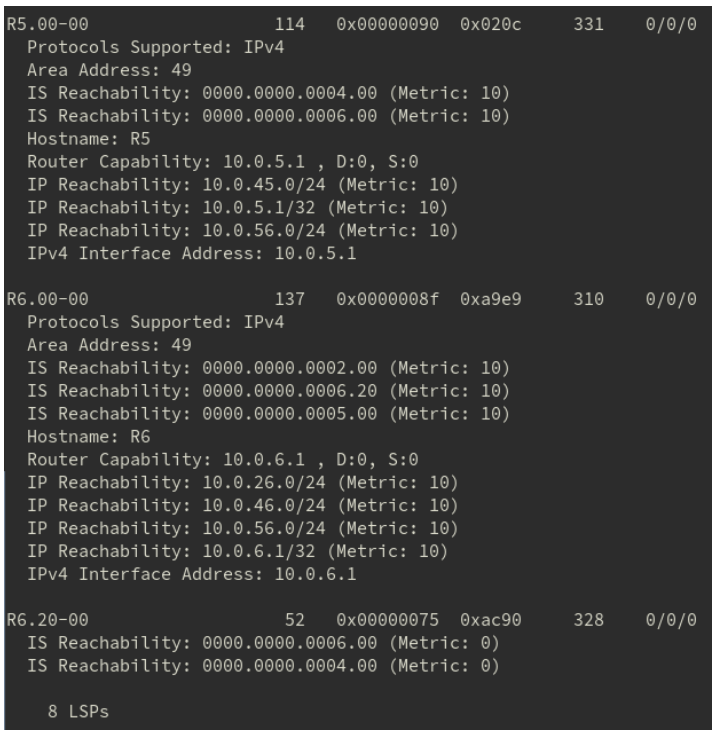
Rys. 32: Wynik *show isis database detail* dla **R3** (cz. 1)



Rys. 33: Wynik *show isis database detail* dla **R3** (cz. 2)



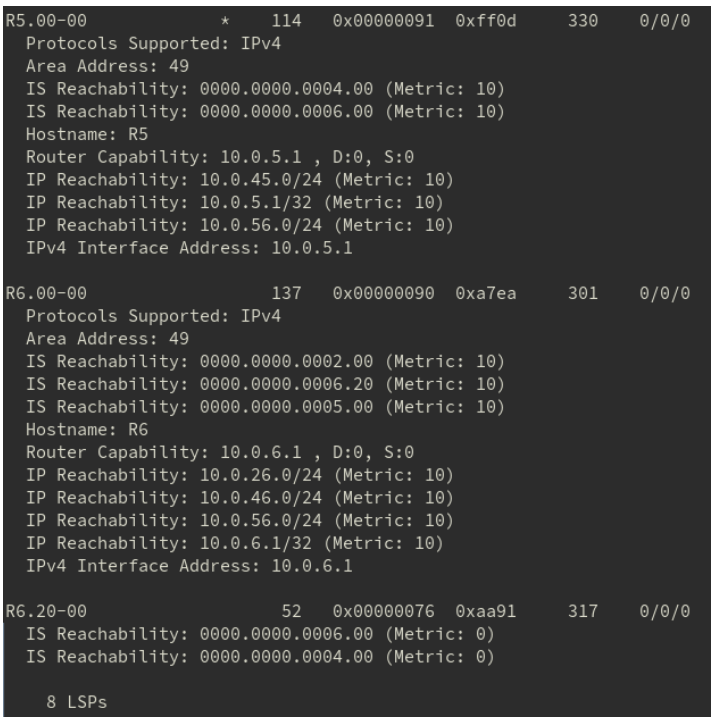
Rys. 34: Wynik *show isis database detail* dla **R4** (cz. 1)



Rys. 35: Wynik *show isis database detail* dla **R4** (cz. 2)

```
R5# show isis database detail
Area 1:
IS-IS Level-1 link-state database:
LSP ID                 PduLen  SeqNumber   Chksum  Holdtime  ATT/P/OL
R1.00-00                 91   0x00000097  0x0131     327    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  IS Reachability: 0000.0000.0003.12 (Metric: 10)
  Hostname: R1
  Router Capability: 10.0.1.1 , D:0, S:0
  IP Reachability: 10.0.1.1/32 (Metric: 10)
  IP Reachability: 10.0.123.0/24 (Metric: 10)
  IPv4 Interface Address: 10.0.1.1

R2.00-00                137   0x00000097  0x4a36     301    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  IS Reachability: 0000.0000.0003.12 (Metric: 10)
  IS Reachability: 0000.0000.0004.00 (Metric: 10)
  IS Reachability: 0000.0000.0006.00 (Metric: 10)
  Hostname: R2
  Router Capability: 10.0.2.1 , D:0, S:0
  IP Reachability: 10.0.123.0/24 (Metric: 10)
  IP Reachability: 10.0.2.1/32 (Metric: 10)
  IP Reachability: 10.0.24.0/24 (Metric: 10)
  IP Reachability: 10.0.26.0/24 (Metric: 10)
  IPv4 Interface Address: 10.0.2.1

R3.00-00                 91   0x00000090  0x74ba     338    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  IS Reachability: 0000.0000.0003.12 (Metric: 10)
  Hostname: R3
  Router Capability: 10.0.3.1 , D:0, S:0
  IP Reachability: 10.0.123.0/24 (Metric: 10)
  IP Reachability: 10.0.3.1/32 (Metric: 10)
  IPv4 Interface Address: 10.0.3.1

R3.12-00                 63   0x0000007c  0xad11     335    0/0/0
  IS Reachability: 0000.0000.0003.00 (Metric: 0)
  IS Reachability: 0000.0000.0002.00 (Metric: 0)
  IS Reachability: 0000.0000.0001.00 (Metric: 0)

R4.00-00                137   0x00000093  0xcdd8     319    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  IS Reachability: 0000.0000.0002.00 (Metric: 10)
  IS Reachability: 0000.0000.0005.00 (Metric: 10)
  IS Reachability: 0000.0000.0006.20 (Metric: 10)
  Hostname: R4
  Router Capability: 10.0.4.1 , D:0, S:0
  IP Reachability: 10.0.24.0/24 (Metric: 10)
  IP Reachability: 10.0.4.1/32 (Metric: 10)
  IP Reachability: 10.0.45.0/24 (Metric: 10)
  IP Reachability: 10.0.46.0/24 (Metric: 10)
  IPv4 Interface Address: 10.0.4.1
```

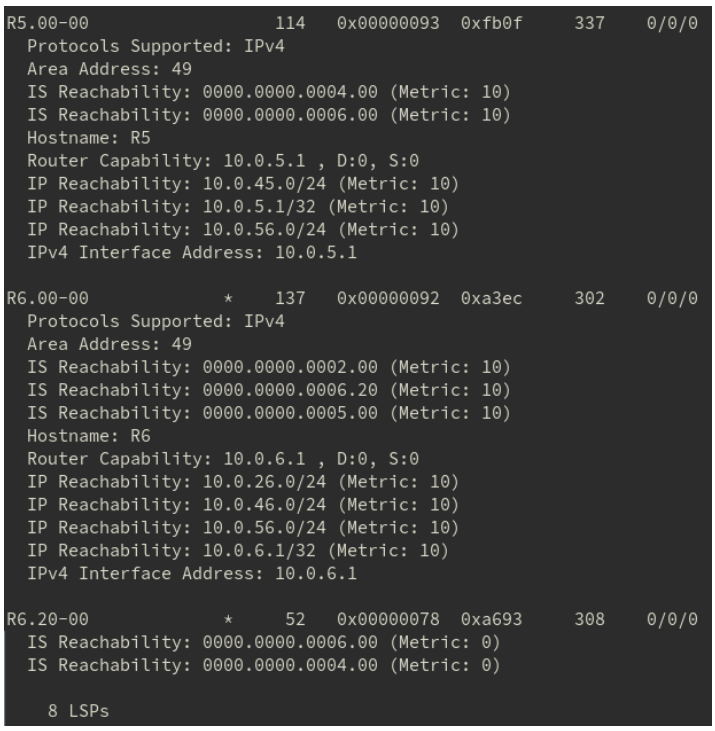
Rys. 36: Wynik *show isis database detail* dla **R5** (cz. 1)



Rys. 37: Wynik *show isis database detail* dla **R5** (cz. 2)

```
R6# show isis database detail
Area 1:
IS-IS Level-1 link-state database:
LSP ID                  PduLen  SeqNumber   Chksum  Holdtime  ATT/P/OL
R1.00-00                  91   0x00000099  0xfc33     344    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  IS Reachability: 0000.0000.0003.12 (Metric: 10)
  Hostname: R1
  Router Capability: 10.0.1.1 , D:0, S:0
  IP Reachability: 10.0.1.1/32 (Metric: 10)
  IP Reachability: 10.0.123.0/24 (Metric: 10)
  IPv4 Interface Address: 10.0.1.1

R2.00-00                 137   0x00000099  0x4638     320    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  IS Reachability: 0000.0000.0003.12 (Metric: 10)
  IS Reachability: 0000.0000.0004.00 (Metric: 10)
  IS Reachability: 0000.0000.0006.00 (Metric: 10)
  Hostname: R2
  Router Capability: 10.0.2.1 , D:0, S:0
  IP Reachability: 10.0.123.0/24 (Metric: 10)
  IP Reachability: 10.0.2.1/32 (Metric: 10)
  IP Reachability: 10.0.24.0/24 (Metric: 10)
  IP Reachability: 10.0.26.0/24 (Metric: 10)
  IPv4 Interface Address: 10.0.2.1

R3.00-00                  91   0x00000092  0x70bc     359    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  IS Reachability: 0000.0000.0003.12 (Metric: 10)
  Hostname: R3
  Router Capability: 10.0.3.1 , D:0, S:0
  IP Reachability: 10.0.123.0/24 (Metric: 10)
  IP Reachability: 10.0.3.1/32 (Metric: 10)
  IPv4 Interface Address: 10.0.3.1

R3.12-00                  63   0x0000007e  0xa913     347    0/0/0
  IS Reachability: 0000.0000.0003.00 (Metric: 0)
  IS Reachability: 0000.0000.0002.00 (Metric: 0)
  IS Reachability: 0000.0000.0001.00 (Metric: 0)

R4.00-00                 137   0x00000095  0xc9da     335    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  IS Reachability: 0000.0000.0002.00 (Metric: 10)
  IS Reachability: 0000.0000.0005.00 (Metric: 10)
  IS Reachability: 0000.0000.0006.20 (Metric: 10)
  Hostname: R4
  Router Capability: 10.0.4.1 , D:0, S:0
  IP Reachability: 10.0.24.0/24 (Metric: 10)
  IP Reachability: 10.0.4.1/32 (Metric: 10)
  IP Reachability: 10.0.45.0/24 (Metric: 10)
  IP Reachability: 10.0.46.0/24 (Metric: 10)
  IPv4 Interface Address: 10.0.4.1
```

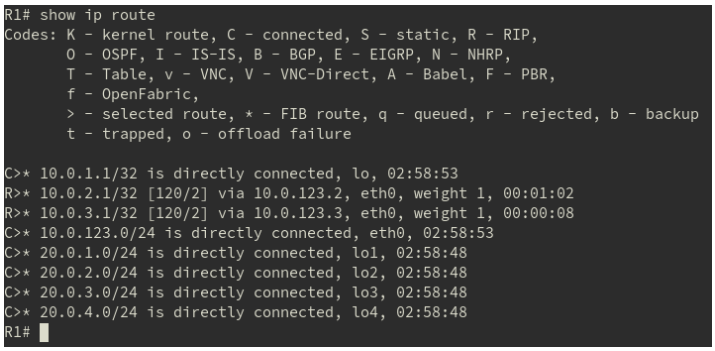
Rys. 38: Wynik *show isis database detail* dla **R6** (cz. 1)



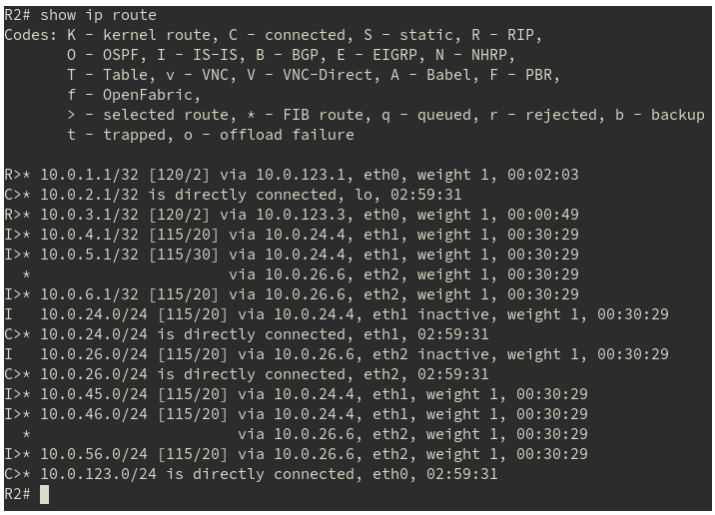
Rys. 39: Wynik *show isis database detail* dla **R6** (cz. 2)

4. Zadanie D: Redystrybucja routingu

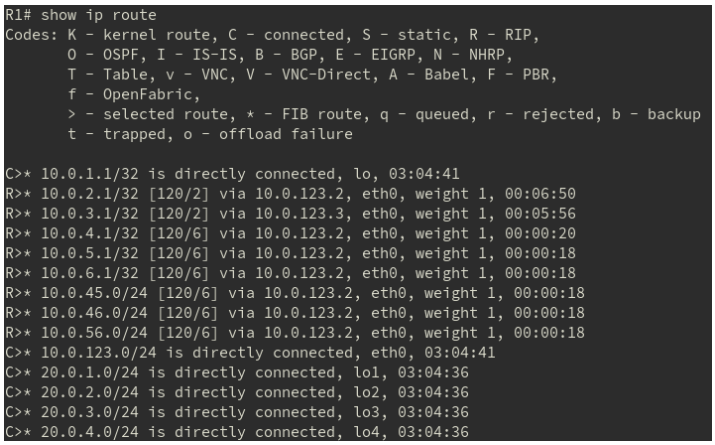
Instrukcje wymagały skonfigurowania routerów R1, R2 i R3 z wykorzystaniem protokołu RIP. W przypadku R1 i R3, protokół RIP był jedynym obsługiwanym protokołem, podczas gdy dla R2 protokół IS-IS pozostał włączony, jednak nie na interfejsie, który połączył R1, R2 i R3. W celu potwierdzenia poprawności wykonania poleceń, sprawdzono tablice routingu dla R1 i R2.



Rys. 40: Wynik *show ip route* dla **R1**

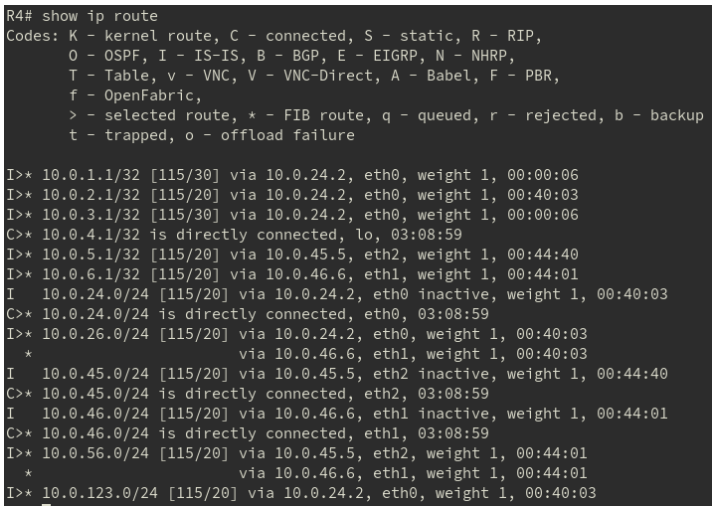


Rys. 41: Wynik *show ip route* dla **R2**



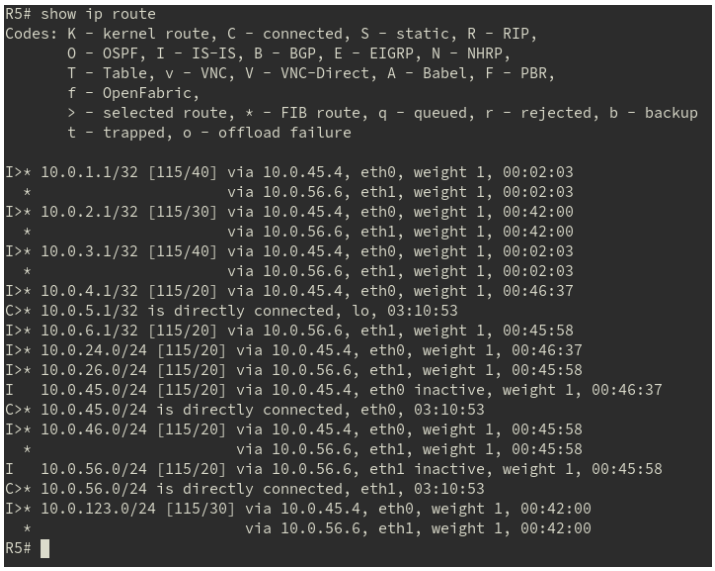
Rys. 42: Wynik *show ip route* dla **R1** po wykonaniu komendy *redistribute isis metric 5*

W tablicach routingu dla R1 widoczne są tylko adresy R2 i R3. Natomiast w przypadku R2, dzięki protokołowi RIP, widoczne są adresy R1 i R3, a pozostała część sieci jest dostępna dzięki protokołowi IS-IS. Następnie, wdrożono redystrybucję przy użyciu polecenia "redistribute isis metric 5", a następnie ponownie sprawdzono tablice routingu dla R1, aby upewnić się, czy trasy IS-IS są już tam widoczne.



Rys. 43: Wynik *show ip route* dla **R4** po wykonaniu komendy *redistribute ipv4 rip level-1metric 20*

Obecnie tabela routingu jest większa niż poprzednio, ponieważ pojawiły się wpisy odnośnie innych routerów, które są dostępne dzięki redystrybucji z protokołu IS-IS z R2. Następnie, użyto polecenia "redistribute ipv4 rip level-1 metric 20", które miało na celu przeprowadzenie redystrybucji w drugą stronę, czyli z routerów RIP do routerów IS-IS przez R2. W celu sprawdzenia poprawności wykonania poleceń, zweryfikowano tablicę routingu R4.



Rys. 44: Wynik *show ip route* dla **R5**

Można zauważyć, że wpisy o R1 i R2 widoczne są w tablicy routingowej, co świadczy o poprawnym procesie redystrybucji. Dla R5:

Następnie sprawdzona została bazą LSDB na R2, za pomocą polecenia show isis database detail.

```
R2# show isis database detail
Area 1:
IS-IS Level-1 link-state database:
LSP ID                 PduLen  SeqNumber   Chksum  Holdtime  ATT/P/OL
R2.00-00             *    134   0x000000d4  0x0454     341    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  Hostname: R2
  TE Router ID: 10.0.2.1
  Router Capability: 10.0.2.1 , D:0, S:0
  Extended Reachability: 0000.0000.0004.00 (Metric: 10)
  Extended Reachability: 0000.0000.0006.00 (Metric: 10)
  IPv4 Interface Address: 10.0.2.1
  Extended IP Reachability: 10.0.123.0/24 (Metric: 10)
  Extended IP Reachability: 10.0.24.0/24 (Metric: 10)
  Extended IP Reachability: 10.0.26.0/24 (Metric: 10)
  Extended IP Reachability: 10.0.2.1/32 (Metric: 10)
  Extended IP Reachability: 10.0.1.1/32 (Metric: 20)
  Extended IP Reachability: 10.0.3.1/32 (Metric: 20)

R4.00-00               127   0x000000d5  0xcf12     354    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  Hostname: R4
  TE Router ID: 10.0.4.1
  Router Capability: 10.0.4.1 , D:0, S:0
  Extended Reachability: 0000.0000.0002.00 (Metric: 10)
  Extended Reachability: 0000.0000.0005.00 (Metric: 10)
  Extended Reachability: 0000.0000.0006.20 (Metric: 10)
  IPv4 Interface Address: 10.0.4.1
  Extended IP Reachability: 10.0.24.0/24 (Metric: 10)
  Extended IP Reachability: 10.0.4.1/32 (Metric: 10)
  Extended IP Reachability: 10.0.45.0/24 (Metric: 10)
  Extended IP Reachability: 10.0.46.0/24 (Metric: 10)

R5.00-00               108   0x000000d1  0x2139     318    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  Hostname: R5
  TE Router ID: 10.0.5.1
  Router Capability: 10.0.5.1 , D:0, S:0
  Extended Reachability: 0000.0000.0004.00 (Metric: 10)
  Extended Reachability: 0000.0000.0006.00 (Metric: 10)
  IPv4 Interface Address: 10.0.5.1
  Extended IP Reachability: 10.0.45.0/24 (Metric: 10)
  Extended IP Reachability: 10.0.5.1/32 (Metric: 10)
  Extended IP Reachability: 10.0.56.0/24 (Metric: 10)

R6.00-00               127   0x000000d2  0xd9f1     327    0/0/0
  Protocols Supported: IPv4
  Area Address: 49
  Hostname: R6
  TE Router ID: 10.0.6.1
  Router Capability: 10.0.6.1 , D:0, S:0
  Extended Reachability: 0000.0000.0002.00 (Metric: 10)
  Extended Reachability: 0000.0000.0006.20 (Metric: 10)
  Extended Reachability: 0000.0000.0005.00 (Metric: 10)
  IPv4 Interface Address: 10.0.6.1
  Extended IP Reachability: 10.0.26.0/24 (Metric: 10)
  Extended IP Reachability: 10.0.46.0/24 (Metric: 10)
  Extended IP Reachability: 10.0.56.0/24 (Metric: 10)
  Extended IP Reachability: 10.0.6.1/32 (Metric: 10)

R6.20-00                51   0x000000b7  0x7575     330    0/0/0
  Extended Reachability: 0000.0000.0006.00 (Metric: 0)
  Extended Reachability: 0000.0000.0004.00 (Metric: 0)

    5 LSPs
```

Rys. 45: Wynik *show isis database detail* dla **R2**

W tabeli widoczne są tylko wpisy LSP dotyczące routerów IS-IS, natomiast informacje o routerach R1 i R3 można znaleźć w LSP R2 jako Extended IP Reachability. W tym przypadku metryka tych połączeń wynosi 20, w przeciwieństwie do innych przypadków, gdzie metryka wynosi 10. Jest to spowodowane definicją wartości metryki podczas redystrybucji.