МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ
Федеральное государственное автономное образовательное учреждение
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ФИЗИКО-ТЕХНИЧЕСКИЙ ИНСТИТУТ
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Configuring Multiarea OSPFv3

Отчет по лабораторной работе № 7
по дисциплине «Компьютерные сети»
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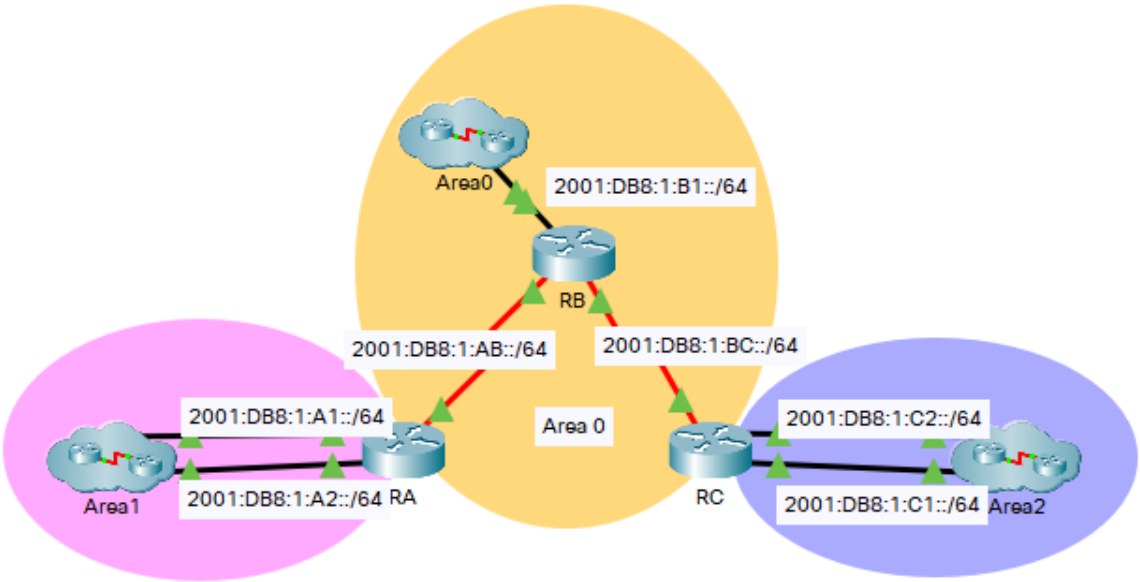
Симферополь, 2022

Device	Interface	IPv6 Address	OSPF Area
RA	G0/0	2001:DB8:1:A1::1/64	1
	G0/1	2001:DB8:1:A2::1/64	1
	S0/0/0	2001:DB8:1:AB::2/64	0
	Link-Local	FE80::A	N/A
RB	G0/0	2001:DB8:1:B1::1/64	0
	S0/0/0	2001:DB8:1:AB::1/64	0
	S0/0/1	2001:DB8:1:BC::1/64	0
	Link-Local	FE80::B	N/A
RC	G0/0	2001:DB8:1:C1::1/64	2
	G0/1	2001:DB8:1:C2::1/64	2
	S0/0/1	2001:DB8:1:BC::2/64	0
	Link-Local	FE80::C	N/A



Part 1: Configure OSPFv3

Step 1: Enable IPv6 routing and configure OSPFv3 on RA.

a. Enable IPv6 routing.

b. Configure OSPFv3 on RA with a process ID of 1 and a router ID of 1.1.1.1.

```
RA(config)#ipv6 unicast-routing
RA(config)#ipv6 router ospf 1
RA(config-rtr)#router-id 1.1.1.1
```

Step 2: Advertise each directly connected network in OSPFv3 on RA.

Configure each active IPv6 interface with OSPFv3 assigning each to the area listed in the **Addressing Table**.

```
RA#show ipv6 inte
RA#show ipv6 interface br
RA#show ipv6 interface brief
GigabitEthernet0/0         [up/up]
    FE80::A
    2001:DB8:1:A1::1
GigabitEthernet0/1         [up/up]
    FE80::A
    2001:DB8:1:A2::1
GigabitEthernet0/2         [administratively down/down]
    unassigned
Serial0/0/0                [up/up]
    FE80::A
    2001:DB8:1:AB::2
Serial0/0/1                [administratively down/down]
    unassigned
Vlan1                      [administratively down/down]
    unassigned
RA#con
RA#conf
RA#configure term
RA#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
RA(config)#interface gig
RA(config)#interface gigabitEthernet 0/0
RA(config-if)#ipv6 ospf 1 area 1
RA(config-if)#exit
RA(config)#int
01:45:30: %OSPFv3-5-ADJCHG: Process 1, Nbr 11.11.11.11 on GigabitEthernet0/0 from LOADING to FULL, Loading Done
% Incomplete command.
RA(config)#inter
RA(config)#interface gig
RA(config)#interface gigabitEthernet 0/1
RA(config-if)#ipv6 ospf 1 area 1
RA(config-if)#
01:46:20: %OSPFv3-5-ADJCHG: Process 1, Nbr 12.12.12.12 on GigabitEthernet0/1 from LOADING to FULL, Loading Done

RA(config-if)#interface ser
RA(config-if)#interface se
RA(config-if)#exit
RA(config)#interface ser
RA(config)#interface ser
RA(config)#interface serial 0/0/0
RA(config-if)#ipv6 ospf 1 area 0
RA(config-if)#
```

Step 3: Configure OSPFv3 on RB and RC

Repeat the Steps 1 and 2 for RB and RC, changing the router ID to 2.2.2.2 and 3.3.3.3 respectively.

```
RB#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
RB(config)#ipv6 uni
RB(config)#ipv6 unicast-routing
RB(config)#ipv6 router ospf 1
%OSPFv3-4-NORTRID: OSPFv3 process 1 could not pick a router-id,please configure manually
RB(config-rtr)#router-id 2.2.2.2
RB(config-rtr)#do sh ipv6 interface br
GigabitEthernet0/0         [up/up]
    FE80::B
    2001:DB8:1:B1::1
GigabitEthernet0/1         [administratively down/down]
    unassigned
GigabitEthernet0/2         [administratively down/down]
    unassigned
Serial0/0/0                [up/up]
    FE80::B
    2001:DB8:1:AB::1
Serial0/0/1                [up/up]
    FE80::B
    2001:DB8:1:BC::1
Vlan1                      [administratively down/down]
    unassigned
RB(config-rtr)#interface gig
RB(config-rtr)#exit
RB(config)#inter
RB(config)#interface gig
RB(config)#interface gigabitEthernet 0//
                                       ^
% Invalid input detected at '^' marker.

RB(config)#interface gigabitEthernet 0/0
RB(config-if)#ipv6 ospf 1 area 0
RB(config-if)#
02:09:21: %OSPFv3-5-ADJCHG: Process 1, Nbr 21.21.21.21 on GigabitEthernet0/0 from LOADING to FULL, Loading Done

RB(config-if)#exit
RB(config)#intera
RB(config)#inter
RB(config)#interface gig
RB(config)#interface se
% Incomplete command.
RB(config)#interface se
RB(config)#interface serial 0/0
%Invalid interface type and number
RB(config)#interface serial 0/0/0
RB(config-if)#ipv6 ospf 1 area 0
RB(config-if)#
02:10:40: %OSPFv3-5-ADJCHG: Process 1, Nbr 1.1.1.1 on Serial0/0/0 from LOADING to FULL, Loading Done

RB(config-if)#exit
RB(config)#inter
RB(config)#interface ser
RB(config)#interface serial 0/0/1
RB(config-if)#ipv6 ospf 1 area 0
RB(config-if)#
```

```
RC>ena
RC#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
RC(config)#ipv6 uni
RC(config)#ipv6 unicast-routing
RC(config)#ipv6 router ospf 1
%OSPFv3-4-NORTRID: OSPFv3 process 1 could not pick a router-id,please configure manually
RC(config-rtr)#router-id 3.3.3.3
RC(config-rtr)#do sh ipv6 inter br
GigabitEthernet0/0         [up/up]
    FE80::C
    2001:DB8:1:C1::1
GigabitEthernet0/1         [up/up]
    FE80::C
    2001:DB8:1:C2::1
GigabitEthernet0/2         [administratively down/down]
    unassigned
Serial0/0/0                [administratively down/down]
    unassigned
Serial0/0/1                [up/up]
    FE80::C
    2001:DB8:1:BC::2
Vlan1                      [administratively down/down]
    unassigned
RC(config-rtr)#exit
RC(config)#inerf
RC(config)#iner
RC(config)#inte
RC(config)#interface gig
RC(config)#interface gigabitEthernet 0/0
RC(config-if)#ipv6 ospf 1 area 2
RC(config-if)#
02:15:31: %OSPFv3-5-ADJCHG: Process 1, Nbr 31.31.31.31 on GigabitEthernet0/0 from LOADING to FULL, Loading Done

RC(config-if)#exit
RC(config)#inter
RC(config)#interface gig
RC(config)#interface gigabitEthernet 0/1
RC(config-if)#ipv6 ospf 1 area 2
RC(config-if)#exit
RC(config)#ine
02:16:41: %OSPFv3-5-ADJCHG: Process 1, Nbr 32.32.32.32 on GigabitEthernet0/1 from LOADING to FULL, Loading Do
RC(config)#iner
RC(config)#inte
RC(config)#interface se
RC(config)#interface serial 0/0/1
RC(config-if)#ipv6 ospf 1 area 2
RC(config-if)#
02:17:08: %OSPFv3-4-AREA_MISMATCH: Received packet with incorrect area from FE80::B, Serial0/0/1, area 0.0.0.2, packet area 0.0.0.0

02:17:18: %OSPFv3-4-AREA_MISMATCH: Received packet with incorrect area from FE80::B, Serial0/0/1, area 0.0.0.2, packet area 0.0.0.0

RC(config-if)#
02:17:28: %OSPFv3-4-AREA_MISMATCH: Received packet with incorrect area from FE80::B, Serial0/0/1, area 0.0.0.2, packet area 0.0.0.0
```

```
RC#int
RC#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
RC(config)#int
RC(config)#interface
00:01:50: %OSPFv3-4-AREA_MISMATCH: Received packet with incorrect area from FE80::B,
Serial0/0/1, area 0.0.0.2, packet area 0.0.0.0
se
RC(config)#interface serial 0/0/1
RC(config-if)#ipv
00:02:00: %OSPFv3-4-AREA_MISMATCH: Received packet with incorrect area from FE80::B,
Serial0/0/1, area 0.0.0.2, packet area 0.0.0.0
6 ospf 1
00:02:10: %OSPFv3-4-AREA_MISMATCH: Received packet with incorrect area from FE80::B,
Serial0/0/1, area 0.0.0.2, packet area 0.0.0.0
area 0
RC(config-if)#
00:02:20: %OSPFv3-5-ADJCHG: Process 1, Nbr 2.2.2.2 on Serial0/0/1 from LOADING to FULL,
Loading Done
```

Part 2: Verify Multiarea OSPFv3 Operations

Step 1: Verify connectivity to each of the OSPFv3 areas.

From RA, ping each of the following remote devices in area 0 and area 2: 2001:DB8:1:B1::2, 2001:DB8:1:A1::2, 2001:DB8:1:A2::2, 2001:DB8:1:C1::2, and 2001:DB8:1:C2::2.

```
RA#ping 2001:DB8:1:B1::2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:1:B1::2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/7/17 ms

RA#ping 2001:DB8:1:A1::2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:1:A1::2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/0 ms

RA#ping 2001:DB8:1:A2::2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:1:A2::2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/1 ms

RA#ping 2001:DB8:1:C1::2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:1:C1::2, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

RA#ping 2001:DB8:1:C2::2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:1:C2::2, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

RA#
```

Step 2: Use show commands to examine the current OSPFv3 operations.

Use the following commands to gather information about your OSPFv3 multiarea implementation.

```
show ipv6 ospf
show ipv6 route
show ipv6 ospf database
show ipv6 ospf interface
show ipv6 ospf neighbor
```

Note: Packet Tracer output for **show ipv6 protocols** is currently not aligned with IOS 15 output. Refer to the real equipment labs for correct **show** command output.

OSPF

```
RA#show ipv6 ospf
 Routing Process "ospfv3 1" with ID 1.1.1.1
 SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
 Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs
 LSA group pacing timer 240 secs
 Interface flood pacing timer 33 msecs
 Retransmission pacing timer 66 msecs
 Number of external LSA 0. Checksum Sum 0x000000
 Number of areas in this router is 2. 2 normal 0 stub 0 nssa
 Reference bandwidth unit is 100 mbps
    Area 1
        Number of interfaces in this area is 2
        SPF algorithm executed 6 times
        Number of LSA 14. Checksum Sum 0x086860
        Number of DCbitless LSA 0
        Number of indication LSA 0
        Number of DoNotAge LSA 0
        Flood list length 0
    Area BACKBONE(0)
        Number of interfaces in this area is 1
        SPF algorithm executed 6 times
        Number of LSA 14. Checksum Sum 0x06208a
        Number of DCbitless LSA 0
        Number of indication LSA 0
        Number of DoNotAge LSA 0
        Flood list length 0
```

Route

```
RA#sh ipv6 route
IPv6 Routing Table - 12 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
       U - Per-user Static route, M - MIPv6
       I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
       ND - ND Default, NDp - ND Prefix, DCE - Destination, NDr - Redirect
       O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
       D - EIGRP, EX - EIGRP external
C   2001:DB8:1:A1::/64 [0/0]
     via GigabitEthernet0/0, directly connected
L   2001:DB8:1:A1::1/128 [0/0]
     via GigabitEthernet0/0, receive
C   2001:DB8:1:A2::/64 [0/0]
     via GigabitEthernet0/1, directly connected
L   2001:DB8:1:A2::1/128 [0/0]
     via GigabitEthernet0/1, receive
C   2001:DB8:1:AB::/64 [0/0]
     via Serial0/0/0, directly connected
L   2001:DB8:1:AB::2/128 [0/0]
     via Serial0/0/0, receive
O   2001:DB8:1:B1::/64 [110/65]
     via FE80::B, Serial0/0/0
O   2001:DB8:1:BC::/64 [110/128]
     via FE80::B, Serial0/0/0
OI  2001:DB8:1:C1::/64 [110/129]
     via FE80::B, Serial0/0/0
OI  2001:DB8:1:C2::/64 [110/129]
     via FE80::B, Serial0/0/0
O   2001:DB8:A0::/64 [110/65]
     via FE80::B, Serial0/0/0
L   FF00::/8 [0/0]
     via Null0, receive
```

Database

```
RA#sh ipv6 ospf database
            OSPF Router with ID (1.1.1.1) (Process ID 1)

                Router Link States (Area 1)

ADV Router      Age         Seq#       Fragment ID  Link count Bits
1.1.1.1         728         0x80000003 0            2          B
12.12.12.12     729         0x80000002 0            1
11.11.11.11     728         0x80000002 0            1

                Net Link States (Area 1)
ADV Router      Age         Seq#       Link ID (DR)   Rtr count
11.11.11.11     728         0x80000001 1              2
12.12.12.12     728         0x80000001 1              2

                Inter Area Prefix Link States (Area 1)
ADV Router      Age         Seq#       Metric Prefix
1.1.1.1         754         0x80000001 64     2001:DB8:1:AB::/64
1.1.1.1         744         0x80000002 65     2001:DB8:1:B1::/64
1.1.1.1         744         0x80000003 128    2001:DB8:1:BC::/64
1.1.1.1         709         0x80000004 65     2001:DB8:A0::/64
1.1.1.1         611         0x80000005 129    2001:DB8:1:C2::/64
1.1.1.1         611         0x80000006 129    2001:DB8:1:C1::/64

                Link (Type-8) Link States (Area 1)
ADV Router      Age         Seq#       Link ID    Interface
1.1.1.1         729         0x80000003 1          Gi0/0
1.1.1.1         729         0x80000004 2          Gi0/1
11.11.11.11     739         0x80000002 1          Gi0/0
12.12.12.12     738         0x80000002 1          Gi0/1

                Intra Area Prefix Link States (Area 1)
ADV Router      Age         Seq#       Link ID    Ref-lstype  Ref-LSID
1.1.1.1         768         0x80000003 2          0x2001      0
11.11.11.11     729         0x80000003 1          0x2002      1
12.12.12.12     728         0x80000003 1          0x2002      1
            OSPF Router with ID (1.1.1.1) (Process ID 1)

                Router Link States (Area 0)

ADV Router      Age         Seq#       Fragment ID  Link count Bits
1.1.1.1         758         0x80000002 0            1          B
21.21.21.21     727         0x80000002 0            1
2.2.2.2         628         0x80000004 0            3
3.3.3.3         625         0x80000002 0            1          B

                Net Link States (Area 0)
ADV Router      Age         Seq#       Link ID (DR)   Rtr count
21.21.21.21     727         0x80000001 1              2

                Inter Area Prefix Link States (Area 0)
ADV Router      Age         Seq#       Metric Prefix
1.1.1.1         753         0x80000001 1      2001:DB8:1:A1::/64
1.1.1.1         753         0x80000002 1      2001:DB8:1:A2::/64
3.3.3.3         631         0x80000001 1      2001:DB8:1:C2::/64
3.3.3.3         631         0x80000003 1      2001:DB8:1:C1::/64

                Link (Type-8) Link States (Area 0)
ADV Router      Age         Seq#       Link ID    Interface
1.1.1.1         758         0x80000002 4          Se0/0/0
2.2.2.2         762         0x80000004 4          Se0/0/0
```

```
                Router Link States (Area 0)

ADV Router      Age         Seq#       Fragment ID  Link count Bits
1.1.1.1         758         0x80000002 0            1          B
21.21.21.21     727         0x80000002 0            1
2.2.2.2         628         0x80000004 0            3
3.3.3.3         625         0x80000002 0            1          B

                Net Link States (Area 0)
ADV Router      Age         Seq#       Link ID (DR)   Rtr count
21.21.21.21     727         0x80000001 1              2

                Inter Area Prefix Link States (Area 0)
ADV Router      Age         Seq#       Metric Prefix
1.1.1.1         753         0x80000001 1      2001:DB8:1:A1::/64
1.1.1.1         753         0x80000002 1      2001:DB8:1:A2::/64
3.3.3.3         631         0x80000001 1      2001:DB8:1:C2::/64
3.3.3.3         631         0x80000003 1      2001:DB8:1:C1::/64

                Link (Type-8) Link States (Area 0)
ADV Router      Age         Seq#       Link ID    Interface
1.1.1.1         758         0x80000002 4          Se0/0/0
2.2.2.2         762         0x80000004 4          Se0/0/0

                Intra Area Prefix Link States (Area 0)
ADV Router      Age         Seq#       Link ID    Ref-lstype  Ref-LSID
1.1.1.1         761         0x80000002 2          0x2001      0
2.2.2.2         728         0x80000005 1          0x2002      1
2.2.2.2         728         0x80000006 2          0x2001      0
21.21.21.21     728         0x80000003 1          0x2002      1
3.3.3.3         635         0x80000001 2          0x2001      0
RA#
```

interface

```
RA#sh ipv6 ospf interface
GigabitEthernet0/0 is up, line protocol is up
  Link Local Address FE80::A, Interface ID 1
  Area 1, Process ID 1, Instance ID 0, Router ID 1.1.1.1
  Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State BDR, Priority 1
  Designated Router (ID) 11.11.11.11, local address FE80::A
  Backup Designated Router (ID) 1.1.1.1, local address FE80::A
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:01
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 11.11.11.11  (Designated Router)
  Suppress hello for 0 neighbor(s)
GigabitEthernet0/1 is up, line protocol is up
  Link Local Address FE80::A, Interface ID 2
  Area 1, Process ID 1, Instance ID 0, Router ID 1.1.1.1
  Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State BDR, Priority 1
  Designated Router (ID) 12.12.12.12, local address FE80::A
  Backup Designated Router (ID) 1.1.1.1, local address FE80::A
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:01
  Index 2/2, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 12.12.12.12  (Designated Router)
  Suppress hello for 0 neighbor(s)
Serial0/0/0 is up, line protocol is up
  Link Local Address FE80::A, Interface ID 4
  Area 0, Process ID 1, Instance ID 0, Router ID 1.1.1.1
  Network Type POINT-TO-POINT, Cost: 64
  Transmit Delay is 1 sec, State POINT-TO-POINT,
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:06
  Index 3/3, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1 , Adjacent neighbor count is 1
    Adjacent with neighbor 2.2.2.2
  Suppress hello for 0 neighbor(s)
```

Neighbor

```
RA#sh ipv6 ospf neighbor

Neighbor ID     Pri   State           Dead Time   Interface ID    Interface
11.11.11.11       1   FULL/DR         00:00:36    1               GigabitEthernet0/0
12.12.12.12       1   FULL/DR         00:00:36    1               GigabitEthernet0/1
2.2.2.2           0   FULL/  -        00:00:36    4               Serial0/0/0
RA#
```