# Answers to the questions

1.What issues do OSPF areas solve?

1. Reducing the load on the processor of the router, as the number of devices in the topology is reduced within its area.
2. The routing table is reduced, since it is possible to summarize routes at the border of the zone.

Summarize routes: we can combine a network with a larger mask in a network with a smaller mask. For example, 192.168.1.0/24, 192.168.2.0/24, 192.168.3.0/24 and so on up to 192.168.255.0/24 can be combined into a network 192.168.0.0/16 (with a 16-bit mask). Thus, we reduced the routing table.

1. Reducing an amount of update packages

2.Which LSAs are used to advertise routing information inside area? What information do these LSAs contain? How are these messages propagated?

Inside an area LSA-1 and LSA-2 are used.LSA-1 is sent by each router. The package contains information about all interfaces: interface status (up/ down) and ip addresses, interface cost (metric). LSA-2 sends information about communication channels and routers on this channel. For example, in area there can be a designated router and this router also sends LSA-2. But in our 9.2.2.8, there were only P2P routers. All routers listening to OSPF send and receive messages on multicast 224.0.0.5. And designated router also listens to 224.0.0.6.

3. Which LSAs are used to advertise routing information between areas? What information do these LSAs contain? How are these messages propagated?

To send information between area, we have ABR and ASBR routers. The first sends out LSA-3 (the third type). It contains routing information to networks from another area. The second is LSA-5. It contains routing information to networks outside of OSPF. These messages will be distributed via multicast.

4.Give an example of each LSA type (with content examples) originated by each router in lab 9.2.2.8.

We use “show ip ospf database” on routers:

R1:

LSA-1

Router Link States (Area 0)

Link ID ADV Router Age Seq# Checksum Link count

1.1.1.1 1.1.1.1 1463 0x80000004 0x004681 2

2.2.2.2 2.2.2.2 1464 0x80000003 0x00e1e3 2

We see two routers: 1.1.1.1 and 2.2.2.2 both LSA-1 in area 0

Router Link States (Area 1)

Link ID ADV Router Age Seq# Checksum Link count

1.1.1.1 1.1.1.1 1637 0x80000005 0x0096c5 2

In area 1 there is only 1.1.1.1 router telling about its interfaces(if there was any other router). In this case – itself.

LSA-2

Designated router is absent (since P2P) and there is no LSA-2.

LSA-3

Summary Net Link States (Area 0)

Link ID ADV Router Age Seq# Checksum

192.168.1.1 1.1.1.1 13 0x80000005 0x00a644

192.168.2.1 1.1.1.1 13 0x80000006 0x00994f

192.168.6.1 2.2.2.2 1460 0x80000005 0x005190

192.168.23.0 2.2.2.2 1435 0x80000006 0x000490

192.168.4.1 2.2.2.2 1227 0x80000007 0x00e5bb

192.168.5.1 2.2.2.2 1227 0x80000008 0x00d8c6

In area 0 – LSA-3. There are ip addresses came from another areas. For example, 192.168.1.1 and 192.168.2.1 are an ip addresses from area 1 and they are seen in area 0. Another example is that ip addresses 192.168.6.1 and 192.168.23.0 are from area 3.

We can see in output below LSA-3 but came in area 1

Summary Net Link States (Area 1)

Link ID ADV Router Age Seq# Checksum

192.168.12.0 1.1.1.1 12 0x8000000b 0x00910d

192.168.6.1 1.1.1.1 1453 0x80000007 0x00edb5

192.168.23.0 1.1.1.1 1428 0x80000008 0x00a0b5

192.168.4.1 1.1.1.1 1220 0x80000009 0x0082e0

192.168.5.1 1.1.1.1 1220 0x8000000a 0x0075eb

For example, the output consists of ip address 192.168.4.1. It is Lo4 of the router R3. So the data about it came this route: area3->R2->area0->R1->area1. And this ip (192.168.4.1) is told about as router 1.1.1.1 is connected to the both area 1 and area 0.

LSA-5

Type-5 AS External Link States

Link ID ADV Router Age Seq# Checksum Tag

0.0.0.0 1.1.1.1 235 0x80000003 0x00fad1 1

For example, 0.0.0.0 shows an access to the Internet, and router 1.1.1.1 tells about this to itself

R2:

LSA-1

Router Link States (Area 0)

Link ID ADV Router Age Seq# Checksum Link count

2.2.2.2 2.2.2.2 1097 0x80000004 0x00dfe4 2

1.1.1.1 1.1.1.1 1097 0x80000005 0x004482 2

We see here 2 routers: 2.2.2.2 и 1.1.1.1. This is LSA-1.

Summary Net Link States (Area 0)

Link ID ADV Router Age Seq# Checksum

192.168.6.1 2.2.2.2 1093 0x80000009 0x004994

192.168.23.0 2.2.2.2 1068 0x8000000a 0x00fb94

192.168.4.1 2.2.2.2 860 0x8000000b 0x00ddbf

192.168.5.1 2.2.2.2 860 0x8000000c 0x00d0ca

192.168.1.1 1.1.1.1 1448 0x80000005 0x00a644

192.168.2.1 1.1.1.1 1448 0x80000006 0x00994f

LSA-3. For example, Lo6 with 192.168.6.1 is located in area 3 and it is reported in area 0. Similarly, with 192.168.23.0.

Router Link States (Area 3)

Link ID ADV Router Age Seq# Checksum Link count

2.2.2.2 2.2.2.2 865 0x80000006 0x006cb7 3

3.3.3.3 3.3.3.3 865 0x80000006 0x00f1af 4

LSA-1. We see here R2(2.2.2.2) and R3(3.3.3.3) routers. They are in area 3.

Summary Net Link States (Area 3)

Link ID ADV Router Age Seq# Checksum

192.168.12.0 2.2.2.2 1088 0x8000000a 0x007526

192.168.1.1 2.2.2.2 1088 0x8000000b 0x00fea1

192.168.2.1 2.2.2.2 1088 0x8000000c 0x00f1ac

LSA-3. In area 3 it is reported about 192.168.12.0 from area 0 and 192.168.1.1 from area 1.

Summary ASB Link States (Area 3)

Link ID ADV Router Age Seq# Checksum

1.1.1.1 2.2.2.2 1088 0x80000009 0x008386

LSA-4. It tells in area 3 how to get to the router with Internet access. Router 2.2.2.2 reports that there is such a router 1.1.1.1 with Internet access

Type-5 AS External Link States

Link ID ADV Router Age Seq# Checksum Tag

0.0.0.0 1.1.1.1 1272 0x80000003 0x00fad1 1

LSA-5. This is the route to the Internet.

R3:

R3#show ip ospf data

OSPF Router with ID (3.3.3.3) (Process ID 1)

Router Link States (Area 3)

Link ID ADV Router Age Seq# Checksum Link count

3.3.3.3 3.3.3.3 1459 0x80000006 0x00f1af 4

2.2.2.2 2.2.2.2 1460 0x80000006 0x006cb7 3

LSA-1. Routers 3.3.3.3 and 2.2.2.2 tell about the state of the interfaces (up / down), about ip addresses and the cost of the interfaces.

Summary Net Link States (Area 3)

Link ID ADV Router Age Seq# Checksum

192.168.12.0 2.2.2.2 1682 0x8000000a 0x007526

192.168.1.1 2.2.2.2 1682 0x8000000b 0x00fea1

192.168.2.1 2.2.2.2 1682 0x8000000c 0x00f1ac

LSA-3. It is reported that routes received from area 0 and area 1 (via area 0)

Summary ASB Link States (Area 3)

Link ID ADV Router Age Seq# Checksum

1.1.1.1 2.2.2.2 1682 0x80000009 0x008386

LSA-4. route to the router with Internet access

Type-5 AS External Link States

Link ID ADV Router Age Seq# Checksum Tag

0.0.0.0 1.1.1.1 65 0x80000004 0x00f8d2 1

LSA-5. Information about the routes, (from the router, with access to the Internet), outside OSPF.