

OSPF – базовая настройка мультizonной структуры

```
Router(config)#router ospf 1
Router(config-router)#network 192.168.1.0 0.0.0.255 area 0
Router(config-router)#network 10.0.1.0 0.0.0.255 area 0
```

```
Router(config)#router ospf 1
Router(config-router)#network 192.168.3.0 0.0.0.255 area 0
Router(config-router)#network 10.0.1.0 0.0.0.255 area 0
```

```
Router(config)#router ospf 1
Router(config-router)#network 192.168.2.0 0.0.0.255 area 0
Router(config-router)#network 10.0.1.0 0.0.0.255 area 0
```

Настройка ABR (пограничного) роутера

```
ABR(config)#router ospf 1
ABR(config-router)#netw
ABR(config-router)#network 10.0.1.0 0.0.0.255 area 0
ABR(config-router)#
00:31:26: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.2.1 on
GigabitEthernet0/0 from LOADING to FULL, Loading Done
00:31:26: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.3.1 on
GigabitEthernet0/0 from LOADING to FULL, Loading Done
```

```
ABR(config-router)#network 10.0.2.0 0.0.0.255 area 1
```

Посмотреть DR роутер

```
Router#sh ip ospf nei
```

```
Neighbor ID Pri State Dead Time Address Interface
192.168.1.1 1 FULL/DR OTHER 00:00:32 10.0.1.1
GigabitEthernet0/0
```

```
192.168.3.1 1 FULL/DR 00:00:31 10.0.1.3 GigabitEthernet0/0
10.0.2.1 1 FULL/DROTHER 00:00:38 10.0.1.4 GigabitEthernet0/0
Router#
```

Назначить приоритет

```
ABR(config-if)#ip ospf priority 100
ABR(config-if)#int g1/0
ABR(config-if)#ip ospf priority 100
```

Перезагрузить OSPF

```
ABR#clear ip ospf process
Reset ALL OSPF processes? [no]: y
```

Это нужно сделать на всех роутерах.

Смотрим что получилось

```
Router#sh ip ospf nei
Neighbor ID Pri State Dead Time Address Interface
192.168.1.1 1 FULL/DROTHER 00:00:33 10.0.1.1
GigabitEthernet0/0
192.168.3.1 1 FULL/DROTHER 00:00:32 10.0.1.3
GigabitEthernet0/0
10.0.2.1 100 FULL/DR 00:00:39 10.0.1.4 GigabitEthernet0/0
```

```
Router#sh ip rou
Codes: C - connected, S - static, I - IGRP, 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, E - EGP
i - IS-IS, 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, 2 subnets

```
C 10.0.1.0 is directly connected, GigabitEthernet0/0
0 IA 10.0.2.0 [110/2] via 10.0.1.4, 00:04:24,
GigabitEthernet0/0
172.20.0.0/24 is subnetted, 3 subnets
0 IA 172.20.1.0 [110/3] via 10.0.1.4, 00:04:24,
GigabitEthernet0/0
0 IA 172.20.2.0 [110/3] via 10.0.1.4, 00:04:24,
GigabitEthernet0/0
0 IA 172.20.3.0 [110/3] via 10.0.1.4, 00:04:24,
GigabitEthernet0/0
0 192.168.1.0/24 [110/2] via 10.0.1.1, 00:04:14,
GigabitEthernet0/0
C 192.168.2.0/24 is directly connected, GigabitEthernet2/0
0 192.168.3.0/24 [110/2] via 10.0.1.3, 00:56:34,
GigabitEthernet0/0
```

* IA означает, что маршруты OSPF зародились в другом регионе

```
Router#sh ip ospf nei
```

```
Neighbor ID Pri State Dead Time Address Interface
10.0.2.1 100 FULL/DR 00:00:31 10.0.1.4 GigabitEthernet0/0
192.168.3.1 1 FULL/DROTHER 00:00:34 10.0.1.3
GigabitEthernet0/0
192.168.1.1 1 FULL/DROTHER 00:00:34 10.0.1.1
GigabitEthernet0/0
Router#
```

Neighbor ID – 32-х битное число, которое, роутер назначает сам, выбирая *наибольший IP-адрес из своих интерфейсов*.

Это поведение можно изменить. Хорошим тоном считается *DR* назначить *наибольший ID*

```
ABR(config)#router ospf 1
ABR(config-router)#router-id 20.20.20.20
ABR(config-router)#Reload or use "clear ip ospf process"
command, for this to take effect
```

После этого нужно опять *перезгрузить OSPF*

```
ABR#clear ip ospf process
Reset ALL OSPF processes? [no]: y
```

```
Router#sh ip ospf ne
Neighbor ID Pri State Dead Time Address Interface
5.5.5.5 1 2WAY/DR OTHER 00:00:39 10.0.2.3 GigabitEthernet0/0
20.20.20.20 100 FULL/DR 00:00:34 10.0.2.1 GigabitEthernet0/0
6.6.6.6 1 FULL/BDR 00:00:31 10.0.2.2 GigabitEthernet0/0
```

* BDR - запасной DR

** DROTHER - эти ни DR ни BDR, если упадут DR & BDR, то произойдут выборы

*** FULL - полное взаимодействие

*** 2WAY - просто соседские отношения, без обмена LSA, эти роутеры обмениваются LSA только с DR и BDR

Если роутеру установить приоритет 0 то он не будет выбираться ни DR ни BDR.

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

Router Link States (Area 0)

```
Link ID ADV Router Age Seq# Checksum Link count |
20.20.20.20 20.20.20.20 1139 0x80000003 0x002073 1 |
3.3.3.3 3.3.3.3 1139 0x80000004 0x006639 2 | -- LSA первого
типа
1.1.1.1 1.1.1.1 1134 0x80000004 0x00b8fa 2 |
2.2.2.2 2.2.2.2 1134 0x80000004 0x008f1a 2 |
```

Net Link States (Area 0)

```
Link ID ADV Router Age Seq# Checksum |
10.0.1.4 20.20.20.20 1134 0x80000003 0x00328d | -- LSA второго
типа
```

Summary Net Link States (Area 0)

```
Link ID ADV Router Age Seq# Checksum
10.0.2.0 20.20.20.20 1175 0x80000001 0x00a061 |
10.0.3.0 20.20.20.20 1170 0x80000002 0x00946b |
172.20.1.0 20.20.20.20 1124 0x80000003 0x007eca |
172.20.3.0 20.20.20.20 1124 0x80000004 0x0066df |
172.20.2.0 20.20.20.20 1124 0x80000005 0x006fd6 | -- LSA
третьего типа
```

```
172.16.1.0 20.20.20.20 1119 0x80000006 0x00a8a1 |
172.16.3.0 20.20.20.20 1119 0x80000007 0x0090b6 |
172.16.2.0 20.20.20.20 1119 0x80000008 0x0099ad |
Router#
```

```
Router#sh ip rout ospf 1
```

```
10.0.0.0/24 is subnetted, 3 subnets
```

```
0 IA 10.0.2.0 [110/2] via 10.0.1.4, 00:22:58,
GigabitEthernet0/0
```

```
0 IA 10.0.3.0 [110/2] via 10.0.1.4, 00:22:58,
GigabitEthernet0/0
```

```
172.16.0.0/24 is subnetted, 3 subnets
```

```
0 IA 172.16.1.0 [110/3] via 10.0.1.4, 00:22:48,
GigabitEthernet0/0
```

```
0 IA 172.16.2.0 [110/3] via 10.0.1.4, 00:22:48,
GigabitEthernet0/0
```

```
0 IA 172.16.3.0 [110/3] via 10.0.1.4, 00:22:48,
GigabitEthernet0/0
```

```
172.20.0.0/24 is subnetted, 3 subnets
```

```
0 IA 172.20.1.0 [110/3] via 10.0.1.4, 00:22:58,
GigabitEthernet0/0 |
```

```
0 IA 172.20.2.0 [110/3] via 10.0.1.4, 00:22:58,
GigabitEthernet0/0 | -- маршруты полученные по LSA 3 типа
```

```
0 IA 172.20.3.0 [110/3] via 10.0.1.4, 00:22:58,
GigabitEthernet0/0 |
```

```
0 192.168.2.0 [110/2] via 10.0.1.2, 00:22:58,
GigabitEthernet0/0 |
```

```
0 192.168.3.0 [110/2] via 10.0.1.3, 00:22:58,
GigabitEthernet0/0 | -- информация о маршрутах в нашем регионе
по LSA первого типа
```

Посмотреть информацию о LSA

```
Router#sh ip ospf database router
```

OSPF Router with ID (1.1.1.1) (Process ID 1)

Router Link States (Area 0)

LS age: 181

Options: (No TOS-capability, DC)

LS Type: Router Links
Link State ID: 1.1.1.1
Advertising Router: 1.1.1.1
LS Seq Number: 80000005
Checksum: 0xb6fb
Length: 48
Number of Links: 2

Link connected to: a Transit Network
(Link ID) Designated Router address: 10.0.1.4
(Link Data) Router Interface address: 10.0.1.1
Number of TOS metrics: 0
TOS 0 Metrics: 1

Link connected to: a Stub Network
(Link ID) Network/subnet number: 192.168.1.0
(Link Data) Network Mask: 255.255.255.0
Number of TOS metrics: 0
TOS 0 Metrics: 1

LS age: 187
--More--

Router#sh ip ospf
Routing Process "ospf 1" with ID 1.1.1.1
Supports only single TOS(TOS0) routes
Supports opaque LSA
SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs
Number of external LSA 0. Checksum Sum 0x000000
Number of opaque AS LSA 0. Checksum Sum 0x000000
Number of DCbitless external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
External flood list length 0
Area BACKBONE(0)
Number of interfaces in this area is 2
Area has no authentication
SPF algorithm executed 17 times | -- сколько раз делался перерасчет
Area ranges are
Number of LSA 13. Checksum Sum 0x05c771

```
Number of opaque link LSA 0. Checksum Sum 0x000000
Number of DCbitless LSA 0
Number of indication LSA 0
Number of DoNotAge LSA 0
Flood list length 0
--More--
```

Изменим схему сети, что бы посмотреть балансировку

Посмотреть *стоимость маршрута*

```
ABR#sh ip ospf int f4/0
FastEthernet4/0 is up, line protocol is up
Internet address is 20.0.1.2/24, Area 0
Process ID 1, Router ID 20.20.20.20, Network Type BROADCAST,
Cost: 1 | -- стоимость
Transmit Delay is 1 sec, State DR, Priority 100
Designated Router (ID) 20.20.20.20, Interface address 20.0.1.2
Backup Designated Router (ID) 10.10.10.10, Interface address
20.0.1.1
Timer intervals configured, Hello 10, Dead 40, Wait 40,
Retransmit 5
    Hello due in 00:00:04
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 10.10.10.10 (Backup Designated
Router)
Suppress hello for 0 neighbor(s)
```

Посмотреть скорость интерфейса

```
ABR#sh int f4/0
FastEthernet4/0 is up, line protocol is up (connected)
Hardware is Lance, address is 0060.2f0a.8bed (bia
0060.2f0a.8bed)
Internet address is 20.0.1.2/24
```

MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec, | -- *скорость интерфейса*.

reliability 255/255, txload 1/255, rxload 1/255

Encapsulation ARPA, loopback not set

ARP type: ARPA, ARP Timeout 04:00:00,

Last input 00:00:08, output 00:00:05, output hang never

Last clearing of "show interface" counters never

Input queue: 0/75/0 (size/max/drops); Total output drops: 0

Queueing strategy: fifo

Output queue :0/40 (size/max)

5 minute input rate 54 bits/sec, 0 packets/sec

5 minute output rate 54 bits/sec, 0 packets/sec

760 packets input, 62204 bytes, 0 no buffer

Received 0 broadcasts, 0 runts, 0 giants, 0 throttles

0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort

0 input packets with dribble condition detected

574 packets output, 46216 bytes, 0 underruns

0 output errors, 0 collisions, 1 interface resets

0 babbles, 0 late collision, 0 deferred

0 lost carrier, 0 no carrier

--More--

Можно поменять *стоимость интерфейса* вручную, при этом он уже не будет просчитываться роутером автоматически по формуле

```
Router(config)#int f0/0
```

```
Router(config-if)#ip ospf cost 10
```

Посмотреть *метрику*

```
Router#sh ip rout
```

Codes: C - connected, S - static, I - IGRP, 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, E - EGP

i - IS-IS, 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 10.0.1.0 is directly connected, FastEthernet0/0
0 IA 10.0.2.0 [110/2] via 20.0.1.2, 00:43:46, FastEthernet1/0
0 IA 10.0.3.0 [110/2] via 20.0.1.2, 00:43:46, FastEthernet1/0
20.0.0.0/24 is subnetted, 2 subnets
C 20.0.1.0 is directly connected, FastEthernet1/0
0 20.0.2.0 [110/2] via 20.0.1.2, 00:27:01, FastEthernet1/0
[110/2] via 10.0.1.5, 00:27:01, FastEthernet0/0
172.16.0.0/24 is subnetted, 3 subnets
0 IA 172.16.1.0 [110/3] via 20.0.1.2, 00:43:46,
FastEthernet1/0 | -- метрика
0 IA 172.16.2.0 [110/3] via 20.0.1.2, 00:43:46,
FastEthernet1/0
0 IA 172.16.3.0 [110/3] via 20.0.1.2, 00:43:46,
FastEthernet1/0
172.20.0.0/24 is subnetted, 3 subnets
0 IA 172.20.1.0 [110/3] via 20.0.1.2, 00:43:46,
FastEthernet1/0
0 IA 172.20.2.0 [110/3] via 20.0.1.2, 00:43:46,
FastEthernet1/0
0 IA 172.20.3.0 [110/3] via 20.0.1.2, 00:43:46,
FastEthernet1/0
0 192.168.1.0/24 [110/2] via 10.0.1.1, 00:26:46,
FastEthernet0/0
0 192.168.2.0/24 [110/2] via 10.0.1.2, 00:26:46,
FastEthernet0/0
0 192.168.3.0/24 [110/2] via 10.0.1.3, 00:26:46,
FastEthernet0/0
```