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Федеральное государственное автономное образовательное учреждение высшего образования
«Российский университет транспорта (МИИТ)»
Кафедра: «Вычислительные системы, сети и информационная безопасность»

Пояснительная записка к курсовому проекту
по дисциплине:
«Компьютерные сети»
На тему:
«Разработка сети передачи данных с помощью протоколов HSRP, RIP, OSPF.»

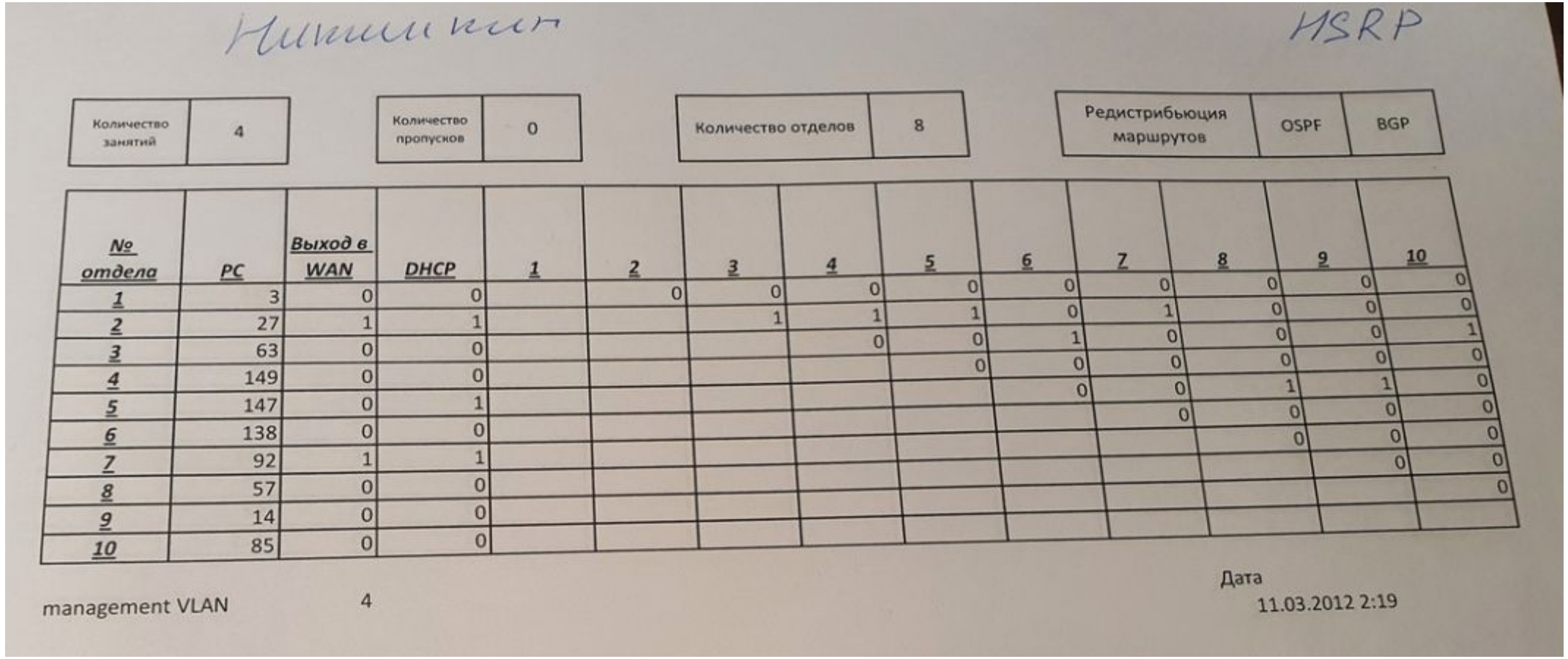
Выполнил:

Студент группы

Проверил:

Желенков Б.В.

Задание курсового проекта



Никишкин

HSRP

Количество занятий	4

Количество пропусков	0

Количество отделов	8

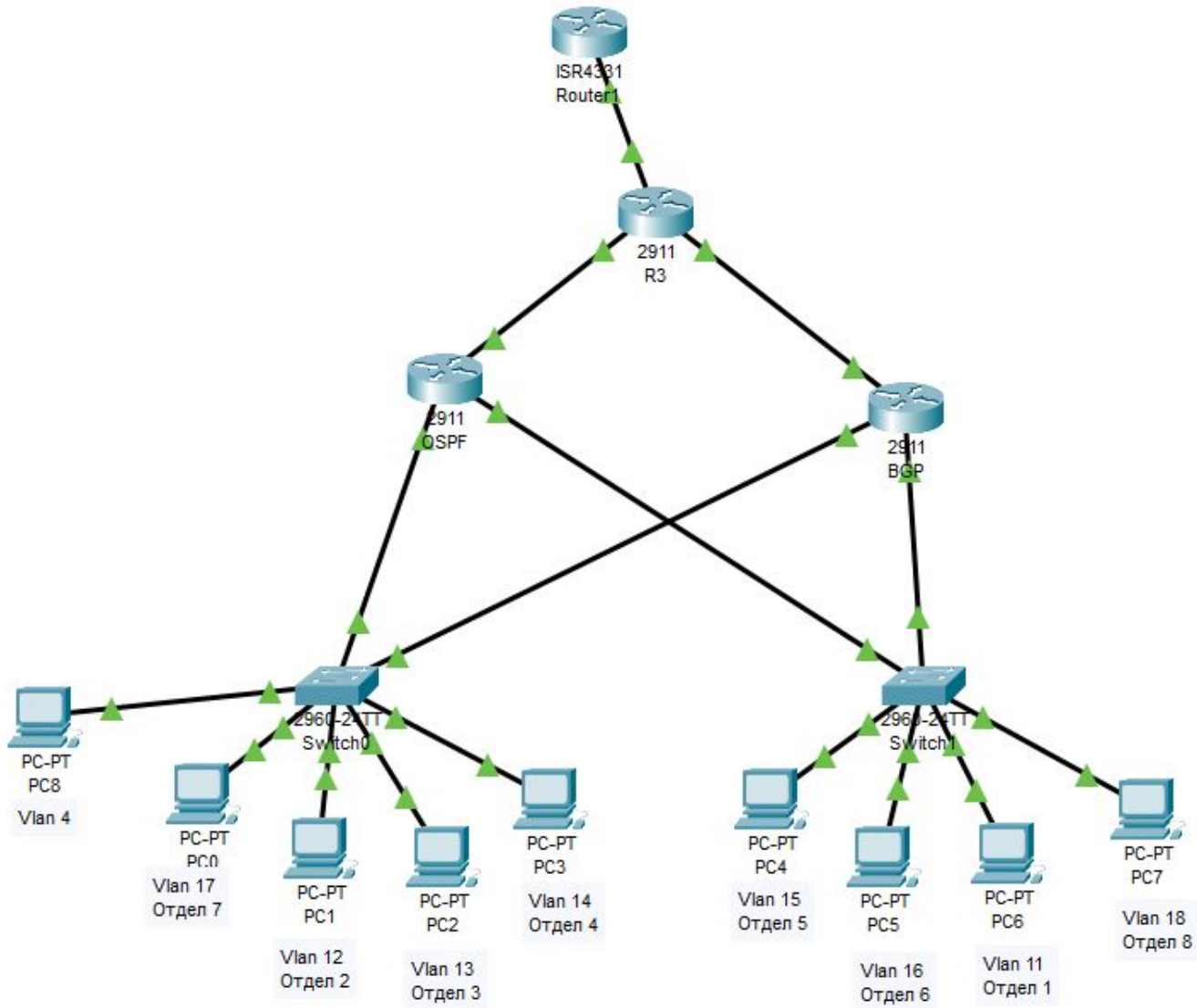
Редистрибьюция маршрутов	OSPF	BGP

№ отдела	PC	Выход в WAN	DHCP	1	2	3	4	5	6	7	8	9	10
1	3	0	0		0	0	0	0	0	0	0	0	0
2	27	1	1			1	1	1	0	1	0	0	0
3	63	0	0				0	0	1	0	0	0	1
4	149	0	0					0	0	0	0	0	0
5	147	0	1						0	0	1	1	0
6	138	0	0							0	0	0	0
7	92	1	1								0	0	0
8	57	0	0									0	0
9	14	0	0										
10	85	0	0										

management VLAN 4

Дата
11.03.2012 2:19

Схема сети для сборки



Адресный план

№ отдела	PC	Выход в WAN	DHCP	Сеть	Нач. адрес	Кон. Адрес	Broadcast	Маска
1	3	0	0	10.0.1.0	10.0.1.1	10.0.1.6	10.0.1.7	255.255.255.248
2	27	1	1	10.0.2.0	10.0.2.1	10.0.2.62	10.0.2.63	255.255.255.192
3	63	0	0	10.0.3.0	10.0.3.1	10.0.3.126	10.0.3.127	255.255.255.128
4	149	0	0	10.0.4.0	10.0.4.1	10.0.4.254	10.0.4.255	255.255.255.0
5	147	0	1	10.0.5.0	10.0.5.1	10.0.5.254	10.0.5.255	255.255.255.0
6	138	0	0	10.0.6.0	10.0.6.1	10.0.6.254	10.0.6.255	255.255.255.0
7	92	1	1	10.0.7.0	10.0.7.1	10.0.7.126	10.0.7.127	255.255.255.128
8	57	0	0	10.0.8.0	10.0.8.1	10.0.8.62	10.0.8.63	255.255.255.192

№ отдела	№ vlan	Адрес gateway	Адрес первого ПК
1	11	10.0.1.2	10.0.1.3
2	12	10.0.2.3	10.0.2.5
3	13	10.0.3.4	10.0.3.2
4	14	10.0.4.4	10.0.4.2
5	15	10.0.5.2	10.0.5.3
6	16	10.0.6.2	10.0.6.3
7	17	10.0.7.3	10.0.7.5
8	18	10.0.8.2	10.0.8.3

Адресный план

Маршрутизатор	Порт	Адрес	Маска
OSPF	Gi0/0	192.168.1.1	255.255.255.0
	Gi0/2.7	10.0.7.4	255.255.255.128
	Gi0/2.2	10.0.2.4	255.255.255.192
	Gi0/2.3	10.0.3.4	255.255.255.128
	Gi0/2.4	10.0.4.4	255.255.255.0
BGP	Gi0/0	192.168.2.1	255.255.255.0
	Gi0/1.5	10.0.5.2	255.255.255.0
	Gi0/1.6	10.0.6.2	255.255.255.0
	Gi0/1.8	10.0.8.2	255.255.255.192
	Gi0/1.1	10.0.1.2	255.255.255.248
	Gi0/2.7	10.0.7.2	255.255.255.128
	Gi0/2.2	10.0.2.2	255.255.255.192
R3	Gi0/0	192.168.1.2	255.255.255.0
	Gi0/1	192.168.2.2	255.255.255.0
	Gi0/2	192.168.3.1	255.255.255.0

Настройка списков доступов для отделов

```
OSPF#sh access-list
Standard IP access list 20
    10 permit 10.0.3.0 0.0.0.127
    20 permit 10.0.4.0 0.0.0.255
    30 permit 10.0.5.0 0.0.0.255
    40 permit 10.0.7.0 0.0.0.127
Standard IP access list 30
    10 permit 10.0.6.0 0.0.0.255
    20 permit 10.0.2.0 0.0.0.63
Standard IP access list 40
    10 permit 10.0.2.0 0.0.0.63
Standard IP access list 70
    10 permit 10.0.2.0 0.0.0.63
```

```
BGP#sh access-list
Standard IP access list 50
    10 permit 10.0.2.0 0.0.0.63
    20 permit 10.0.8.0 0.0.0.63
Standard IP access list 60
    10 permit 10.0.3.0 0.0.0.127
Standard IP access list 10
    10 deny any
Standard IP access list 80
    10 permit 10.0.5.0 0.0.0.255
Standard IP access list 20
    10 permit 10.0.3.0 0.0.0.127
    20 permit 10.0.4.0 0.0.0.255
    30 permit 10.0.5.0 0.0.0.255
    40 permit 10.0.7.0 0.0.0.127
Standard IP access list 70
    10 permit 10.0.2.0 0.0.0.63
```

```
Standard IP access list 10
    10 permit 10.0.2.0 0.0.0.63
    20 permit 10.0.7.0 0.0.0.127
```

Конфигурация оборудования: OSPF

```
interface GigabitEthernet0/0
 ip address 192.168.1.1 255.255.255.0
 duplex auto
 speed auto
!
interface GigabitEthernet0/1
 no ip address
 duplex auto
 speed auto
!
interface GigabitEthernet0/2
 no ip address
 duplex auto
 speed auto
!
interface GigabitEthernet0/2.2
 encapsulation dot1Q 12
 ip address 10.0.2.4 255.255.255.192
 ip helper-address 192.168.1.2
 ip access-group 20 out
 standby 12 ip 10.0.2.3
 standby 12 priority 105
 standby 12 preempt
 standby 12 track GigabitEthernet0/0
!
interface GigabitEthernet0/2.3
 encapsulation dot1Q 13
 ip address 10.0.3.4 255.255.255.128
 ip access-group 30 out
!
interface GigabitEthernet0/2.4
 encapsulation dot1Q 14
 ip address 10.0.4.4 255.255.255.0
 ip access-group 40 out
!
```

```
interface GigabitEthernet0/2.7
 encapsulation dot1Q 17
 ip address 10.0.7.4 255.255.255.128
 ip helper-address 192.168.1.2
 ip access-group 70 out
 standby 17 ip 10.0.7.3
 standby 17 priority 105
 standby 17 preempt
 standby 17 track GigabitEthernet0/0
!
interface Vlan1
 no ip address
 shutdown
!
router ospf 1
 log-adjacency-changes
 network 10.0.7.0 0.0.0.127 area 0
 network 10.0.2.0 0.0.0.63 area 0
 network 10.0.3.0 0.0.0.127 area 0
 network 10.0.4.0 0.0.0.255 area 0
 network 192.168.1.0 0.0.0.255 area 0
!
ip classless
!
ip flow-export version 9
!
!
access-list 20 permit 10.0.3.0 0.0.0.127
access-list 20 permit 10.0.4.0 0.0.0.255
access-list 20 permit 10.0.5.0 0.0.0.255
access-list 20 permit 10.0.7.0 0.0.0.127
access-list 30 permit 10.0.6.0 0.0.0.255
access-list 30 permit 10.0.2.0 0.0.0.63
access-list 40 permit 10.0.2.0 0.0.0.63
access-list 70 permit 10.0.2.0 0.0.0.63
```

Конфигурация оборудования: BGP

```
interface GigabitEthernet0/0
 ip address 192.168.2.1 255.255.255.0
 duplex auto
 speed auto
!
interface GigabitEthernet0/1
 no ip address
 duplex auto
 speed auto
!
interface GigabitEthernet0/1.1
 encapsulation dot1Q 11
 ip address 10.0.1.2 255.255.255.248
 ip access-group 10 out
!
interface GigabitEthernet0/1.5
 encapsulation dot1Q 15
 ip address 10.0.5.2 255.255.255.0
 ip helper-address 192.168.2.2
 ip access-group 50 out
!
interface GigabitEthernet0/1.6
 encapsulation dot1Q 16
 ip address 10.0.6.2 255.255.255.0
 ip access-group 60 out
!
interface GigabitEthernet0/1.8
 encapsulation dot1Q 18
 ip address 10.0.8.2 255.255.255.192
 ip access-group 80 out
!
```

```
interface GigabitEthernet0/2
 no ip address
 duplex auto
 speed auto
!
interface GigabitEthernet0/2.2
 encapsulation dot1Q 12
 ip address 10.0.2.2 255.255.255.192
 ip helper-address 192.168.1.2
 ip access-group 20 out
 standby 12 ip 10.0.2.3
 standby 12 preempt
 standby 12 track GigabitEthernet0/0
!
interface GigabitEthernet0/2.7
 encapsulation dot1Q 17
 ip address 10.0.7.2 255.255.255.128
 ip helper-address 192.168.1.2
 ip access-group 70 out
 standby 17 ip 10.0.7.3
 standby 17 preempt
 standby 17 track GigabitEthernet0/0
!
```

```
router bgp 2
 bgp log-neighbor-changes
 no synchronization
 neighbor 192.168.2.2 remote-as 1
 network 10.0.5.0 mask 255.255.255.0
 network 10.0.6.0 mask 255.255.255.0
 network 10.0.8.0 mask 255.255.255.192
 network 10.0.1.0 mask 255.255.255.248
 network 192.168.2.0
!
ip classless
!
ip flow-export version 9
!
!
access-list 50 permit 10.0.2.0 0.0.0.63
access-list 50 permit 10.0.8.0 0.0.0.63
access-list 60 permit 10.0.3.0 0.0.0.127
access-list 10 deny any
access-list 80 permit 10.0.5.0 0.0.0.255
access-list 20 permit 10.0.3.0 0.0.0.127
access-list 20 permit 10.0.4.0 0.0.0.255
access-list 20 permit 10.0.5.0 0.0.0.255
access-list 20 permit 10.0.7.0 0.0.0.127
access-list 70 permit 10.0.2.0 0.0.0.63
!
```

Конфигурация оборудования: R3

```
ip dhcp excluded-address 10.0.2.1
ip dhcp excluded-address 10.0.2.2
ip dhcp excluded-address 10.0.2.3
ip dhcp excluded-address 10.0.2.4
ip dhcp excluded-address 10.0.5.1
ip dhcp excluded-address 10.0.5.2
ip dhcp excluded-address 10.0.7.1
ip dhcp excluded-address 10.0.7.2
ip dhcp excluded-address 10.0.7.3
ip dhcp excluded-address 10.0.7.4
!
ip dhcp pool 2
 network 10.0.2.0 255.255.255.192
 default-router 10.0.2.3
ip dhcp pool 5
 network 10.0.5.0 255.255.255.0
 default-router 10.0.5.2
ip dhcp pool 7
 network 10.0.7.0 255.255.255.128
 default-router 10.0.7.3
!
```

```
interface GigabitEthernet0/0
 ip address 192.168.1.2 255.255.255.0
 ip nat inside
 duplex auto
 speed auto
!
interface GigabitEthernet0/1
 ip address 192.168.2.2 255.255.255.0
 ip nat inside
 duplex auto
 speed auto
!
interface GigabitEthernet0/2
 ip address 192.168.3.1 255.255.255.0
 ip nat outside
 duplex auto
 speed auto
!
interface Vlan1
 no ip address
 shutdown
!
router ospf 1
 log-adjacency-changes
 redistribute bgp 1 metric 2 subnets
 network 192.168.1.0 0.0.0.255 area 0
 default-information originate
!
```

```
router bgp 1
 bgp router-id 192.168.2.2
 bgp log-neighbor-changes
 no synchronization
 neighbor 192.168.2.1 remote-as 2
 network 192.168.2.0
 redistribute ospf 1
 redistribute static
!
ip nat pool test 192.168.3.2 192.168.3.3 netmask 255.255.255.0
ip nat inside source list 10 pool test
ip classless
ip route 0.0.0.0 0.0.0.0 GigabitEthernet0/2
!
ip flow-export version 9
!
!
access-list 10 permit 10.0.2.0 0.0.0.63
access-list 10 permit 10.0.7.0 0.0.0.127
!
```

Конфигурация оборудования: Switch 0

```
interface FastEthernet0/1
 switchport access vlan 17
 switchport mode access
 spanning-tree portfast
!
interface FastEthernet0/2
 switchport access vlan 12
 switchport mode access
 spanning-tree portfast
!
interface FastEthernet0/3
 switchport access vlan 13
 switchport mode access
 spanning-tree portfast
!
interface FastEthernet0/4
 switchport access vlan 14
 switchport mode access
 spanning-tree portfast
!
interface FastEthernet0/5
 switchport access vlan 4
 switchport mode access
 spanning-tree portfast
!
interface FastEthernet0/6
```

```
interface GigabitEthernet0/1
 switchport trunk native vlan 4
 switchport mode trunk
 spanning-tree portfast
!
interface GigabitEthernet0/2
 switchport trunk native vlan 4
 switchport mode trunk
 spanning-tree portfast
!
interface Vlan1
 no ip address
 shutdown
!
interface Vlan4
 ip address 192.168.5.1 255.255.255.0
!
interface Vlan12
 ip address 10.0.2.1 255.255.255.192
!
interface Vlan13
 ip address 10.0.3.1 255.255.255.128
!
interface Vlan14
 ip address 10.0.4.1 255.255.255.0
!
interface Vlan17
 ip address 10.0.7.1 255.255.255.128
!
line vty 0 4
 password 123
 login
line vty 5 15
 password 123
 login
!
```

Конфигурация оборудования: Switch 1

```
interface FastEthernet0/1
 switchport access vlan 15
 switchport mode access
 spanning-tree portfast
!
interface FastEthernet0/2
 switchport access vlan 16
 switchport mode access
 spanning-tree portfast
!
interface FastEthernet0/3
 switchport access vlan 11
 switchport mode access
 spanning-tree portfast
!
interface FastEthernet0/4
 switchport access vlan 18
 switchport mode access
 spanning-tree portfast
!
```

```
interface GigabitEthernet0/1
 switchport trunk native vlan 4
 switchport mode trunk
 spanning-tree portfast
!
interface GigabitEthernet0/2
 switchport trunk native vlan 4
 switchport mode trunk
 spanning-tree portfast
!
interface Vlan1
 no ip address
 shutdown
!
interface Vlan11
 ip address 10.0.1.1 255.255.255.248
!
interface Vlan15
 ip address 10.0.5.1 255.255.255.0
!
interface Vlan16
 ip address 10.0.6.1 255.255.255.0
!
interface Vlan18
 ip address 10.0.8.1 255.255.255.192
!

line vty 0 4
 password 123
 login
line vty 5 15
 password 123
 login
!
```

Таблица маршрутизации: OSPF

```
OSPF#sh ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, 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 192.168.1.2 to network 0.0.0.0

     10.0.0.0/8 is variably subnetted, 12 subnets, 5 masks
O E2    10.0.1.0/29 [110/2] via 192.168.1.2, 00:41:56, GigabitEthernet0/0
C       10.0.2.0/26 is directly connected, GigabitEthernet0/2.2
L       10.0.2.4/32 is directly connected, GigabitEthernet0/2.2
C       10.0.3.0/25 is directly connected, GigabitEthernet0/2.3
L       10.0.3.4/32 is directly connected, GigabitEthernet0/2.3
C       10.0.4.0/24 is directly connected, GigabitEthernet0/2.4
L       10.0.4.4/32 is directly connected, GigabitEthernet0/2.4
O E2    10.0.5.0/24 [110/2] via 192.168.1.2, 00:41:56, GigabitEthernet0/0
O E2    10.0.6.0/24 [110/2] via 192.168.1.2, 00:41:56, GigabitEthernet0/0
C       10.0.7.0/25 is directly connected, GigabitEthernet0/2.7
L       10.0.7.4/32 is directly connected, GigabitEthernet0/2.7
O E2    10.0.8.0/26 [110/2] via 192.168.1.2, 00:41:56, GigabitEthernet0/0
     192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, GigabitEthernet0/0
L       192.168.1.1/32 is directly connected, GigabitEthernet0/0
O E2 192.168.2.0/24 [110/2] via 192.168.1.2, 00:41:56, GigabitEthernet0/0
O*E2 0.0.0.0/0 [110/1] via 192.168.1.2, 00:41:56, GigabitEthernet0/0
```

Таблица маршрутизации: BGP

```
BGP#sh ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, 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 192.168.2.2 to network 0.0.0.0

     10.0.0.0/8 is variably subnetted, 14 subnets, 5 masks
C       10.0.1.0/29 is directly connected, GigabitEthernet0/1.1
L       10.0.1.2/32 is directly connected, GigabitEthernet0/1.1
C       10.0.2.0/26 is directly connected, GigabitEthernet0/2.2
L       10.0.2.2/32 is directly connected, GigabitEthernet0/2.2
B       10.0.3.0/25 [20/2] via 192.168.2.2, 00:00:00
B       10.0.4.0/24 [20/2] via 192.168.2.2, 00:00:00
C       10.0.5.0/24 is directly connected, GigabitEthernet0/1.5
L       10.0.5.2/32 is directly connected, GigabitEthernet0/1.5
C       10.0.6.0/24 is directly connected, GigabitEthernet0/1.6
L       10.0.6.2/32 is directly connected, GigabitEthernet0/1.6
C       10.0.7.0/25 is directly connected, GigabitEthernet0/2.7
L       10.0.7.2/32 is directly connected, GigabitEthernet0/2.7
C       10.0.8.0/26 is directly connected, GigabitEthernet0/1.8
L       10.0.8.2/32 is directly connected, GigabitEthernet0/1.8
B    192.168.1.0/24 [20/20] via 192.168.2.2, 00:00:00
     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/24 is directly connected, GigabitEthernet0/0
L       192.168.2.1/32 is directly connected, GigabitEthernet0/0
B*   0.0.0.0/0 [20/0] via 192.168.2.2, 00:00:00
```

Таблица маршрутизации: R3

```
Router#sh ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, 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 0.0.0.0 to network 0.0.0.0

     10.0.0.0/8 is variably subnetted, 8 subnets, 4 masks
B       10.0.1.0/29 [20/0] via 192.168.2.1, 00:00:00
O       10.0.2.0/26 [110/2] via 192.168.1.1, 00:42:36, GigabitEthernet0/0
O       10.0.3.0/25 [110/2] via 192.168.1.1, 00:42:36, GigabitEthernet0/0
O       10.0.4.0/24 [110/2] via 192.168.1.1, 00:42:36, GigabitEthernet0/0
B       10.0.5.0/24 [20/0] via 192.168.2.1, 00:00:00
B       10.0.6.0/24 [20/0] via 192.168.2.1, 00:00:00
O       10.0.7.0/25 [110/2] via 192.168.1.1, 00:42:36, GigabitEthernet0/0
B       10.0.8.0/26 [20/0] via 192.168.2.1, 00:00:00
     192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, GigabitEthernet0/0
L       192.168.1.2/32 is directly connected, GigabitEthernet0/0
     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/24 is directly connected, GigabitEthernet0/1
L       192.168.2.2/32 is directly connected, GigabitEthernet0/1
     192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.3.0/24 is directly connected, GigabitEthernet0/2
L       192.168.3.1/32 is directly connected, GigabitEthernet0/2
S*   0.0.0.0/0 is directly connected, GigabitEthernet0/2
```

Проверка работы NAT и HSRP

- **Трек на хост в WAN из отделов 2 и 7**

```
C:\>tracert 3.3.3.3

Tracing route to 3.3.3.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      10.0.2.4

NAT: s=10.0.2.5->192.168.3.2, d=3.3.3.3 [17]

NAT: s=10.0.2.5->192.168.3.2, d=3.3.3.3 [18]
```

```
C:\>tracert 3.3.3.3

Tracing route to 3.3.3.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      10.0.7.4

NAT: s=10.0.7.6->192.168.3.3, d=3.3.3.3 [10]

NAT: s=10.0.7.6->192.168.3.3, d=3.3.3.3 [11]
```

Проверка работы протокола HSRP

Трек на хост в WAN

```
C:\>tracert 3.3.3.3

Tracing route to 3.3.3.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      10.0.2.4
```

Трек на хост в WAN после отключение одного из интерфейсов

```
C:\>tracert 3.3.3.3

Tracing route to 3.3.3.3 over a maximum of 30 hops:

  1    *         0 ms      0 ms      10.0.2.2
```

Состояние интерфейсов в hsrp

```
Interface   Grp  Pri P State    Active          Standby         Virtual IP
Gig         12   105 P Active   local           10.0.2.2        10.0.2.3
Gig         17   105 P Active   local           10.0.7.2        10.0.7.3
```

Состояние после отключение одного из интерфейсов в hsrp

```
Interface   Grp  Pri P State    Active          Standby         Virtual IP
Gig         12   95  P Standby  10.0.2.2        local           10.0.2.3
Gig         17   95  P Standby  10.0.7.2        local           10.0.7.3
```