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Факультет Математики и Информатики
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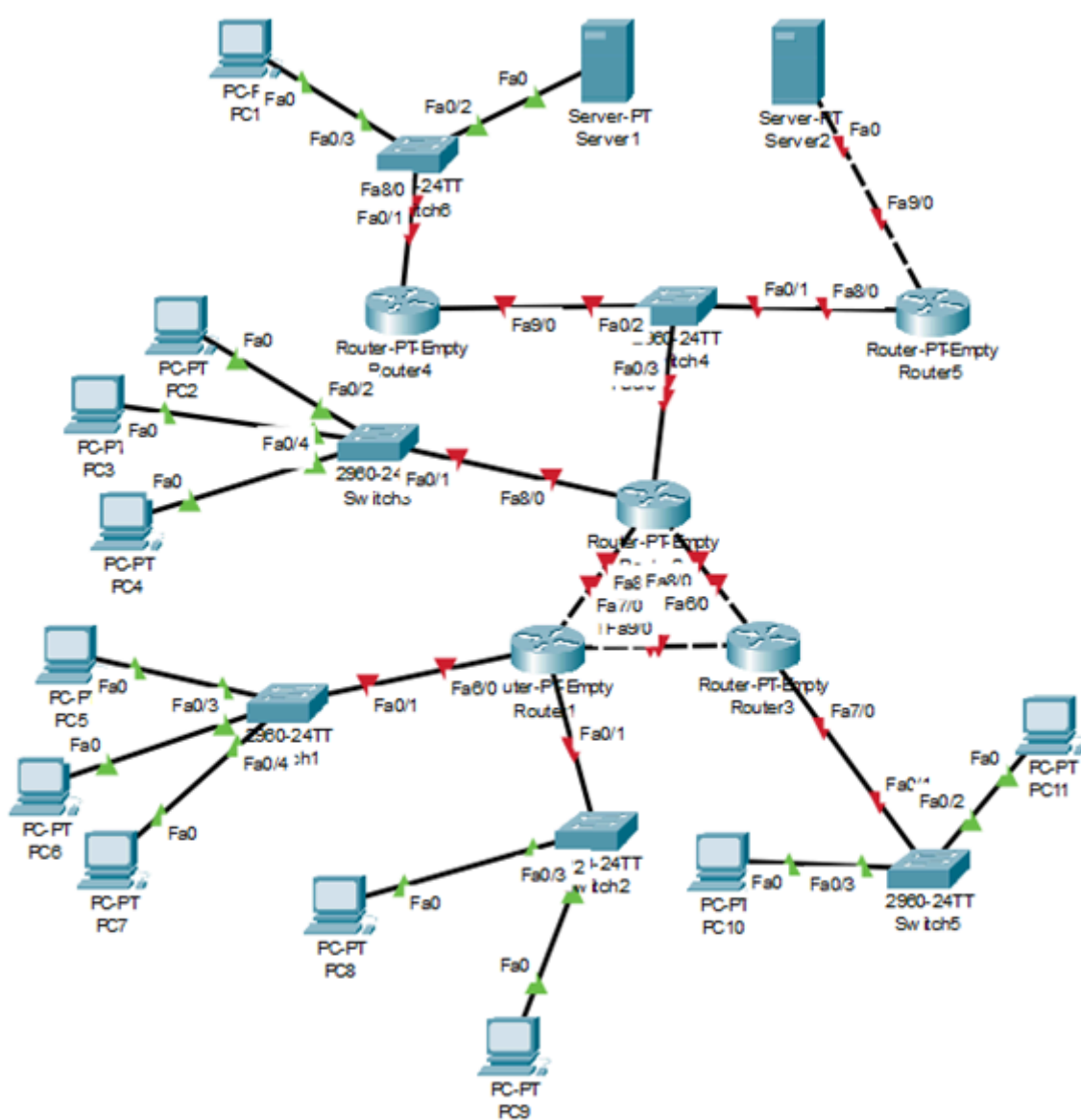
Лабораторная работа №5
по предмету "Компьютерные сети"
тема: "Статическая маршрутизация
и протоколы динамической маршрутизации"

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Кишинев, 2024

Введение.

Основной целью данной работы является развитие в Cisco Packet Tracer-е практических навыков статической и динамической настройки таблиц маршрутизации на маршрутизаторах в сетях.



схема

Задание 1. Исходя из следующих адресов сети :

а) 192.168.21.30/24

б) 172.16.20.238/20

с) 10.10.32.0/18

разработать схему IPv4 адресов для подсетей сети, если известно, что в каждой подсети не более 14 хостов. Создать 3 автономных системы AS1, AS2 и AS3, каждая из которых повторяет конфигурацию из схемы, но так чтобы :

- устройствам в AS1 были назначены IP-адреса, по схеме, разработанной в пункте а).
- устройствам в AS2 были назначены IP-адреса, по схеме, разработанной в пункте б).
- устройствам в AS3 были назначены IP-адреса, по схеме, разработанной в пункте с).

У хоста необходимо позаимствовать 4 бита, образуя таким образом 16 подсетей ($2^4=16$) с 14 используемыми адресами, так как по условию не более 14 хостов. Для каждого IP адреса маска сети увеличивается на 4. Из 16 подсетей будут использоваться только 10. В итоге получаются следующие таблицы :

а) 192.168.21.30/24 + 4/28

Первый байт	Второй байт	Третий байт	Биты расширенной маски							
11111111	11111111	11111111	1	1	1	1	0	0	0	0
Первый байт в десятичном формате	Второй байт в десятичном формате	Третий байт в десятичном формате	Четвертый байт в десятичном формате							
255	255	255	240							

Шаг подсети : $256 - 240 = 16$

№	адрес подсети	4 байт (биты расширенной маски)	Диапазон используемых адресов	адреса широковещательный адрес
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1	192.168.21.0/28	0	0	0	0	0	0	0	0	192.168.21.1-192.168.21.14	192.168.21.15
2	192.168.21.16/28	0	0	0	1	0	0	0	0	192.168.21.17-192.168.21.30	192.168.21.31
3	192.168.21.32/28	0	0	1	0	0	0	0	0	192.168.21.33-192.168.21.46	192.168.21.47
4	192.168.21.48/28	0	0	1	1	0	0	0	0	192.168.21.49-192.168.21.62	192.168.21.63
5	192.168.21.64/28	0	1	0	0	0	0	0	0	192.168.21.65-192.168.21.78	192.168.21.79
6	192.168.21.80/28	0	1	0	1	0	0	0	0	192.168.21.81-192.168.21.94	192.168.21.95
7	192.168.21.96/28	0	1	1	0	0	0	0	0	192.168.21.97-192.168.21.110	192.168.21.111
8	192.168.21.112/28	0	1	1	1	0	0	0	0	192.168.21.113-192.168.21.126	192.168.21.127
9	192.168.21.128/28	1	0	0	0	0	0	0	0	192.168.21.129-192.168.21.142	192.168.21.143
10	192.168.21.144/28	1	0	0	1	0	0	0	0	192.168.21.145-192.168.21.158	192.168.21.159
11	192.168.21.160/28	1	0	1	0	0	0	0	0	192.168.21.161-192.168.21.174	192.168.21.175
12	192.168.21.176/28	1	0	1	1	0	0	0	0	192.168.21.177-192.168.21.190	192.168.21.191
13	192.168.21.192/28	1	1	0	0	0	0	0	0	192.168.21.193-192.168.21.206	192.168.21.207
14	192.168.21.208/28	1	1	0	1	0	0	0	0	192.168.21.209-192.168.21.222	192.168.21.223
15	192.168.21.224/28	1	1	1	0	0	0	0	0	192.168.21.225-192.168.21.238	192.168.21.239
16	192.168.21.240/28	1	1	1	1	0	0	0	0	192.168.21.241-192.168.21.254	192.168.21.255

6) 172.16.20.238/20 + 4/24

Первый байт	Второй байт	Третий байт	Биты расширенной маски							
11111111	11111111	11111111	0	0	0	0	0	0	0	0
Первый байт в десятичном формате	Второй байт в десятичном формате	Третий байт в десятичном формате	Четвертый байт в десятичном формате							
255	255	255	0							

Шаг подсети : 256 – 255 = 1

№	адрес подсети	3 байт (биты расширенной маски)								Диапазон используемых адресов	адрес широковещательный адрес
1	172.16.16.0/24	0	0	0	1	0	0	0	0	172.16.16.1-172.16.16.254	172.16.16.255
2	172.16.17.0/24	0	0	0	1	0	0	0	1	172.16.17.1-172.16.17.254	172.16.17.255

3	172.16.18.0/24	0	0	0	1	0	0	1	0	172.16.18.1-172.16.18.254	172.16.18.255
4	172.16.19.0/24	0	0	0	1	0	0	1	1	172.16.19.1-172.16.19.254	172.16.19.255
5	172.16.20.0/24	0	0	0	1	0	1	0	0	172.16.20.1-172.16.20.254	172.16.20.255
6	172.16.21.0/24	0	0	0	1	0	1	0	1	172.16.21.1-172.16.21.254	172.16.21.255
7	172.16.22.0/24	0	0	0	1	0	1	1	0	172.16.22.1-172.16.22.254	172.16.22.255
8	172.16.23.0/24	0	0	0	1	0	1	1	1	172.16.23.1-172.16.23.254	172.16.23.255
9	172.16.24.0/24	0	0	0	1	1	0	0	0	172.16.24.1-172.16.24.254	172.16.24.255
10	172.16.25.0/24	0	0	0	1	1	0	0	1	172.16.25.1-172.16.25.254	172.16.25.255
11	172.16.26.0/24	0	0	0	1	1	0	1	0	172.16.26.1-172.16.26.254	172.16.26.255
12	172.16.27.0/24	0	0	0	1	1	0	1	0	172.16.27.1-172.16.27.254	172.16.27.255
13	172.16.28.0/24	0	0	0	1	0	1	0	1	172.16.28.1-172.16.28.254	172.16.28.255
14	172.16.29.0/24	0	0	0	1	1	1	0	1	172.16.29.1-172.16.29.254	172.16.29.255
15	172.16.30.0/24	0	0	0	1	1	0	1	0	172.16.30.1-172.16.30.254	172.16.30.255
16	172.16.31.0/24	0	0	0	1	1	1	1	1	172.16.31.1-172.16.31.254	172.16.31.255

с) 10.10.32.0/18 + 4/22

Первый байт	Второй байт	Биты расширенной маски								Четвертый байт
11111111	11111111	1	1	1	1	1	1	0	0	00000000
Первый байт в десятичном формате	Второй байт в десятичном формате	Третий байт в десятичном формате								Четвертый байт в десятичном формате
255	255	252								0

Шаг подсети : 256 – 252 = 4

№	адрес подсети	3 байт (биты расширенной маски)								Диапазон используемых адресов	адрес широковещательный адрес
1	10.10.16.0/22	0	0	0	1	0	0	0	0	10.10.16.1-10.10.19.254	10.10.19.255
2	10.10.20.0/22	0	0	0	1	0	1	0	0	10.10.20.1-10.10.23.254	10.10.23.255

3	10.10.24.0/22	0	0	0	1	1	0	0	0	10.10.24.1-10.10.27.254	10.10.27.255
4	10.10.28.0/22	0	0	0	1	1	1	0	0	10.10.28.1-10.10.31.254	10.10.31.255
5	10.10.32.0/22	0	0	1	0	0	0	0	0	10.10.32.1-10.10.35.254	10.10.35.255
6	10.10.36.0/22	0	0	1	0	0	1	0	0	10.10.36.1-10.10.39.254	10.10.39.255
7	10.10.40.0/22	0	0	1	0	1	0	0	0	10.10.40.1-10.10.43.254	10.10.43.255
8	10.10.44.0/22	0	0	1	0	1	1	0	0	10.10.44.1-10.10.47.254	10.10.47.255
9	10.10.48.0/22	0	0	0	1	1	0	0	0	10.10.48.1-10.10.51.254	10.10.51.255
10	10.10.52.0/22	0	0	1	1	0	1	0	0	10.10.52.1-10.10.55.254	10.10.55.255
11	10.10.56.0/22	0	0	1	1	1	0	0	0	10.10.56.1-10.10.59.254	10.10.59.255
12	10.10.60.0/22	0	0	1	1	1	1	0	0	10.10.60.1-10.10.63.254	10.10.63.255
13	10.10.64.0/22	0	1	0	0	0	0	0	0	10.10.64.1-10.10.67.254	10.10.67.255
14	10.10.68.0/22	0	1	0	0	0	1	0	0	10.10.68.1-10.10.71.254	10.10.71.255
15	10.10.72.0/22	0	1	0	0	1	0	0	0	10.10.72.1-10.10.75.254	10.10.75.255
16	10.10.76.0/22	0	1	0	0	1	1	0	0	10.10.76.1-10.10.79.254	10.10.79.255

Исходя из полученной информации из таблиц, можно составить схему адресации для каждого IP адреса :


а) 192.168.21.30/28

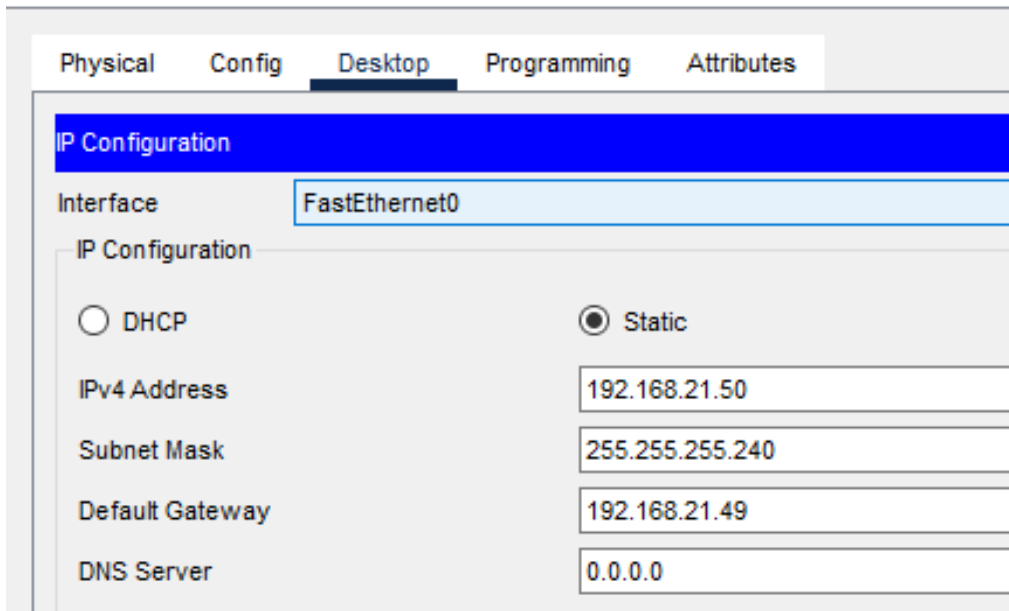
Устройство	Интерфейс	IP адрес	Маска подсети	Адрес маршрутизатора по умолчанию
Router1	Fa6/0	192.168.21.1	255.255.255.240	N/A
	Fa7/0	192.168.21.17	255.255.255.240	N/A
	Fa8/0	192.168.21.113	255.255.255.240	N/A
	Fa9/0	192.168.21.129	255.255.255.240	N/A
Router2	Fa6/0	192.168.21.145	255.255.255.240	N/A

	Fa7/0	192.168.21.114	255.255.255.240	N/A
	Fa8/0	192.168.21.49	255.255.255.240	N/A
	Fa9/0	192.168.21.65	255.255.255.240	N/A
Router3	Fa7/0	192.168.21.33	255.255.255.240	N/A
	Fa8/0	192.168.21.146	255.255.255.240	N/A
	Fa9/0	192.168.21.130	255.255.255.240	N/A
Router4	Fa8/0	192.168.21.81	255.255.255.240	N/A
	Fa9/0	192.168.21.66	255.255.255.240	N/A
Router5	Fa8/0	192.168.21.67	255.255.255.240	N/A
	Fa9/0	192.168.21.97	255.255.255.240	N/A
PC1	NIC	192.168.21.82	255.255.255.240	192.168.21.81
PC2	NIC	192.168.21.50	255.255.255.240	192.168.21.49
PC3	NIC	192.168.21.51	255.255.255.240	192.168.21.49
PC4	NIC	192.168.21.52	255.255.255.240	192.168.21.1
PC5	NIC	192.168.21.2	255.255.255.240	192.168.21.1
PC6	NIC	192.168.21.3	255.255.255.240	192.168.21.1
PC7	NIC	192.168.21.4	255.255.255.240	192.168.21.1
PC8	NIC	192.168.21.18	255.255.255.240	192.168.21.17
PC9	NIC	192.168.21.19	255.255.255.240	192.168.21.17

PC10	NIC	192.168.21.34	255.255.255.240	192.168.21.33
PC11	NIC	192.168.21.35	255.255.255.240	192.168.21.33
Server1	NIC	192.168.21.83	255.255.255.240	192.168.21.81
Server2	NIC	192.168.21.98	255.255.255.240	192.168.21.97


Устанавливаю соответствующие IP адреса всем устройствам сетью :

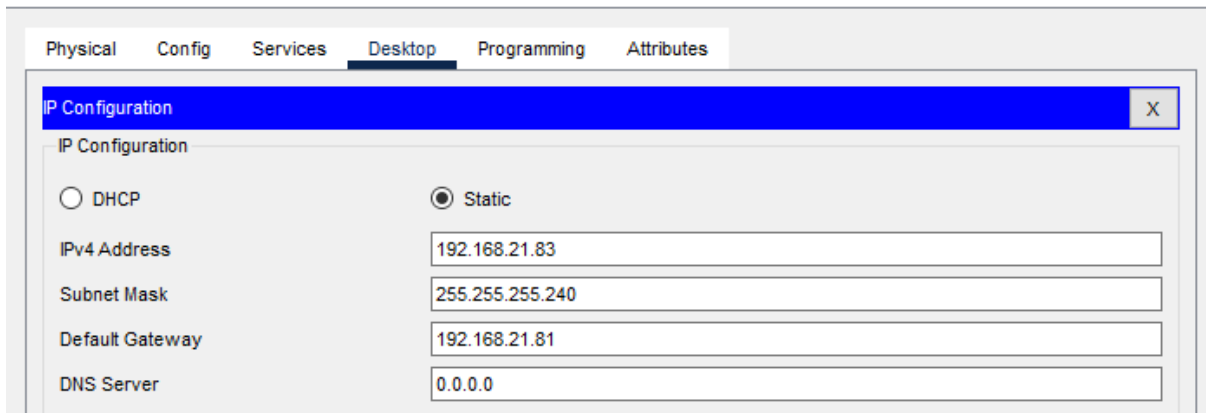
 PC2



The screenshot shows the configuration window for PC2. The 'Desktop' tab is selected. Under 'IP Configuration', the 'FastEthernet0' interface is chosen. The 'Static' radio button is selected for the IP configuration type. The fields are filled with: IPv4 Address: 192.168.21.50, Subnet Mask: 255.255.255.240, Default Gateway: 192.168.21.49, and DNS Server: 0.0.0.0.

Interface	FastEthernet0
IP Configuration	Static
IPv4 Address	192.168.21.50
Subnet Mask	255.255.255.240
Default Gateway	192.168.21.49
DNS Server	0.0.0.0

 Server1



The screenshot shows the configuration window for Server1. The 'Desktop' tab is selected. Under 'IP Configuration', the configuration is set to 'Static'. The fields are filled with: IPv4 Address: 192.168.21.83, Subnet Mask: 255.255.255.240, Default Gateway: 192.168.21.81, and DNS Server: 0.0.0.0.

IP Configuration	Static
IPv4 Address	192.168.21.83
Subnet Mask	255.255.255.240
Default Gateway	192.168.21.81
DNS Server	0.0.0.0


```

Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface FastEthernet6/0
Router(config-if)#ip address 192.168.21.145 255.255.255.240
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet7/0
Router(config-if)#ip address 192.168.21.114 255.255.255.240
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet8/0
Router(config-if)#ip address 192.168.21.49 255.255.255.240
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet9/0
Router(config-if)#ip address 192.168.21.65 255.255.255.240
Router(config-if)#exit

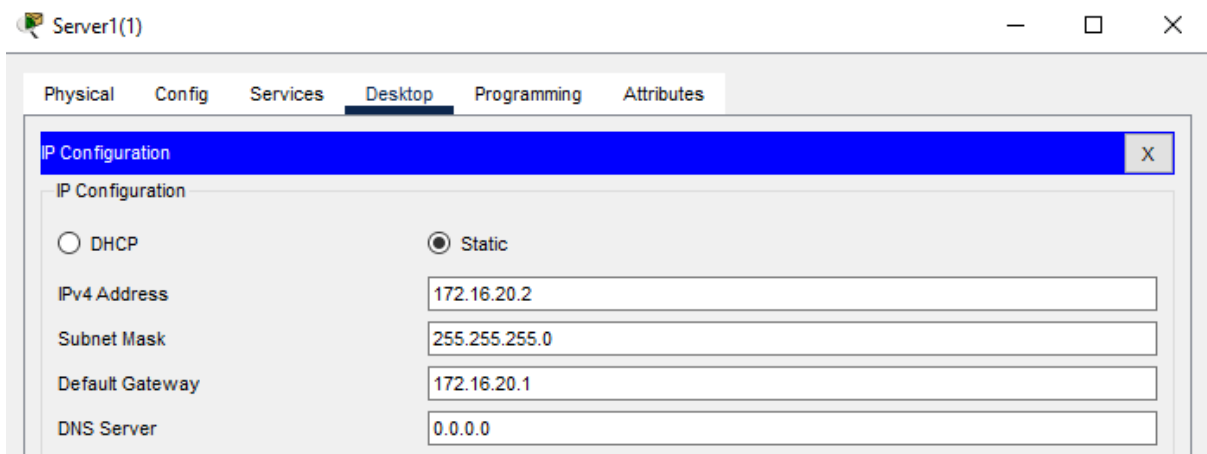
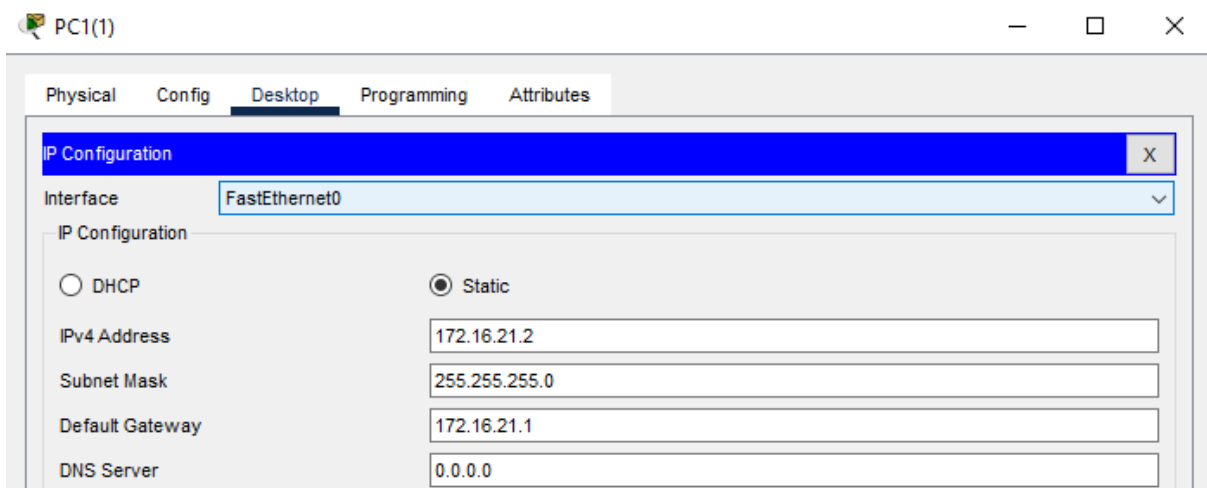
```

6) 172.16.20.238/24

Устройство	Интерфейс	IP адрес	Маска подсети	Адрес маршрутизатора по умолчанию
Router1	Fa6/0	172.16.16.1	255.255.255.0	N/A
	Fa7/0	172.16.17.1	255.255.255.0	N/A
	Fa8/0	172.16.23.1	255.255.255.0	N/A
	Fa9/0	172.16.24.1	255.255.255.0	N/A
Router2	Fa6/0	172.16.25.1	255.255.255.0	N/A
	Fa7/0	172.16.23.2	255.255.255.0	N/A
	Fa8/0	172.16.19.1	255.255.255.0	N/A
	Fa9/0	172.16.20.1	255.255.255.0	N/A
Router3	Fa7/0	172.16.18.1	255.255.255.0	N/A
	Fa8/0	172.16.25.2	255.255.255.0	N/A
	Fa9/0	172.16.24.2	255.255.255.0	N/A
Router4	Fa8/0	172.16.21.1	255.255.255.0	N/A
	Fa9/0	172.16.20.2	255.255.255.0	N/A
Router5	Fa8/0	172.16.20.3	255.255.255.0	N/A
	Fa9/0	172.16.22.1	255.255.255.0	N/A
PC1	NIC	172.16.21.2	255.255.255.0	172.16.21.1

PC2	NIC	172.16.19.2	255.255.255.0	172.16.19.1
PC3	NIC	172.16.19.3	255.255.255.0	172.16.19.1
PC4	NIC	172.16.19.4	255.255.255.0	172.16.19.1
PC5	NIC	172.16.16.2	255.255.255.0	172.16.16.1
PC6	NIC	172.16.16.3	255.255.255.0	172.16.16.1
PC7	NIC	172.16.16.4	255.255.255.0	172.16.16.1
PC8	NIC	172.16.17.2	255.255.255.0	172.16.17.1
PC9	NIC	172.16.17.3	255.255.255.0	172.16.17.1
PC10	NIC	172.16.18.2	255.255.255.0	172.16.18.1
PC11	NIC	172.16.18.3	255.255.255.0	172.16.18.1
Server1	NIC	172.16.20.2	255.255.255.0	172.16.20.1
Server2	NIC	172.16.22.2	255.255.255.0	172.16.22.1

Устанавливаю, полученные IP адреса всем устройствам сети :



```

Router2(1)
Physical Config CLI Attributes
IOS Command Line Interface

Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface FastEthernet6/0
Router(config-if)#ip address 172.16.25.1 255.255.255.0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet7/0
Router(config-if)#ip address 172.16.23.2 255.255.255.0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet8/0
Router(config-if)#ip address 172.16.19.1 255.255.255.0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet9/0
Router(config-if)#ip address 172.16.20.1 255.255.255.0
Router(config-if)#exit

```

c) 10.10.32.0/22

Устройство	Интерфейс	IP адрес	Маска подсети	Адрес маршрутизатора по умолчанию
Router1	Fa6/0	0.10.16.1	255.255.252.0	N/A
	Fa7/0	0.10.20.1	255.255.252.0	N/A
	Fa8/0	0.10.44.1	255.255.252.0	N/A
	Fa9/0	0.10.48.1	255.255.252.0	N/A
Router2	Fa6/0	0.10.52.1	255.255.252.0	N/A
	Fa7/0	0.10.44.2	255.255.252.0	N/A
	Fa8/0	0.10.28.1	255.255.252.0	N/A
	Fa9/0	0.10.32.1	255.255.252.0	N/A
Router3	Fa7/0	0.10.24.1	255.255.252.0	N/A
	Fa8/0	0.10.52.2	255.255.252.0	N/A
	Fa9/0	0.10.48.2	255.255.252.0	N/A
Router4	Fa8/0	0.10.36.1	255.255.252.0	N/A
	Fa9/0	0.10.32.2	255.255.252.0	N/A
Router5	Fa8/0	0.10.32.3	255.255.252.0	N/A
	Fa9/0	0.10.40.1	255.255.252.0	N/A

PC1	NIC	0.10.36.2	255.255.252.0	0.10.36.1
PC2	NIC	0.10.28.2	255.255.252.0	0.10.28.1
PC3	NIC	0.10.28.3	255.255.252.0	0.10.28.1
PC4	NIC	0.10.28.4	255.255.252.0	0.10.28.1
PC5	NIC	0.10.16.2	255.255.252.0	0.10.16.1
PC6	NIC	0.10.16.3	255.255.252.0	0.10.16.1
PC7	NIC	0.10.16.4	255.255.252.0	0.10.16.1
PC8	NIC	0.10.20.2	255.255.252.0	0.10.20.1
PC9	NIC	0.10.20.3	255.255.252.0	0.10.20.1
PC10	NIC	0.10.24.2	255.255.252.0	0.10.24.1
PC11	NIC	0.10.24.3	255.255.252.0	0.10.24.1
Server1	NIC	0.10.32.2	255.255.252.0	0.10.32.1
Server2	NIC	0.10.40.2	255.255.252.0	0.10.40.1

Устанавливаю IP адреса устройствам сети :

PC1(2)

Physical Config **Desktop** Programming Attributes

IP Configuration X

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 10.10.36.2

Subnet Mask 255.255.252.0

Default Gateway 10.10.36.1

DNS Server 0.0.0.0

Server1(2)

Physical Config Services **Desktop** Programming Attributes

IP Configuration X

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 10.10.32.2

Subnet Mask 255.255.252.0

Default Gateway 10.10.32.1

DNS Server 0.0.0.0

```
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface FastEthernet6/0
Router(config-if)#ip address 10.10.52.1 255.255.252.0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet7/0
Router(config-if)#ip address 10.10.44.2 255.255.252.0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet8/0
Router(config-if)#ip address 10.10.28.1 255.255.252.0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet9/0
Router(config-if)#ip address 10.10.32.1 255.255.252.0
Router(config-if)#exit
```

Задание 2. Применить статическую маршрутизацию для настройки маршрутизаторов R1, R2, R3, R4 и R5 в автономной системе AS1.

Для организации статической маршрутизации я захожу в командную строку каждого роутера и прописываю команду `ip route {ip адрес сети, к которой провожу маршрутизацию} {расширенная маска сети} {ip адрес, через который провожу маршрутизацию}`. Выполнив команду `do show ip route`, проверяю статически правильно ли настроен каждый путь.

Physical Config CLI Attributes

IOS Command Line Interface

```
Router>
Router>en
Router#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 192.168.21.48 255.255.255.240 192.168.21.114
Router(config)#ip route 192.168.21.80 255.255.255.240 192.168.21.114
Router(config)#ip route 192.168.21.96 255.255.255.240 192.168.21.114
Router(config)#ip route 192.168.21.32 255.255.255.240 192.168.21.130
Router(config)#do show ip route
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

    192.168.21.0/28 is subnetted, 8 subnets
C       192.168.21.0 is directly connected, FastEthernet6/0
C       192.168.21.16 is directly connected, FastEthernet7/0
S       192.168.21.32 [1/0] via 192.168.21.130
S       192.168.21.48 [1/0] via 192.168.21.114
S       192.168.21.80 [1/0] via 192.168.21.114
S       192.168.21.96 [1/0] via 192.168.21.114
C       192.168.21.112 is directly connected, FastEthernet8/0
C       192.168.21.128 is directly connected, FastEthernet9/0
```

Physical Config CLI Attributes

IOS Command Line Interface

```
Router#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 192.168.21.0 255.255.255.240 192.168.21.113
Router(config)#ip route 192.168.21.16 255.255.255.240 192.168.21.113
Router(config)#ip route 192.168.21.32 255.255.255.240 192.168.21.146
Router(config)#ip route 192.168.21.80 255.255.255.240 192.168.21.66
%Invalid next hop address (it's this router)
Router(config)#ip route 192.168.21.80 255.255.255.240 192.168.21.66
Router(config)#ip route 192.168.21.96 255.255.255.240 192.168.21.67
Router(config)#do show ip route
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

192.168.21.0/28 is subnetted, 9 subnets
S       192.168.21.0 [1/0] via 192.168.21.146
        [1/0] via 192.168.21.113
S       192.168.21.16 [1/0] via 192.168.21.113
S       192.168.21.32 [1/0] via 192.168.21.146
C       192.168.21.48 is directly connected, FastEthernet8/0
C       192.168.21.64 is directly connected, FastEthernet9/0
S       192.168.21.80 [1/0] via 192.168.21.66
S       192.168.21.96 [1/0] via 192.168.21.67
C       192.168.21.112 is directly connected, FastEthernet7/0
C       192.168.21.144 is directly connected, FastEthernet6/0
```

IOS Command Line Interface

```

Router>en
Router#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 192.168.21.0 255.255.255.240 192.168.21.129
Router(config)#ip route 192.168.21.48 255.255.255.240 192.168.21.145
Router(config)#ip route 192.168.21.80 255.255.255.240 192.168.21.145
Router(config)#ip route 192.168.21.96 255.255.255.240 192.168.21.145
Router(config)#ip route 192.168.21.16 255.255.255.240 192.168.21.129
Router(config)#do show ip route
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

    192.168.21.0/28 is subnetted, 8 subnets
S       192.168.21.0 [1/0] via 192.168.21.129
S       192.168.21.16 [1/0] via 192.168.21.129
C       192.168.21.32 is directly connected, FastEthernet7/0
S       192.168.21.48 [1/0] via 192.168.21.145
S       192.168.21.80 [1/0] via 192.168.21.145
S       192.168.21.96 [1/0] via 192.168.21.145
C       192.168.21.128 is directly connected, FastEthernet9/0
C       192.168.21.144 is directly connected, FastEthernet8/0

```

IOS Command Line Interface

```

Router>en
Router#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 192.168.21.96 255.255.255.240 192.168.21.67
Router(config)#ip route 192.168.21.48 255.255.255.240 192.168.21.65
Router(config)#ip route 192.168.21.0 255.255.255.240 192.168.21.65
Router(config)#ip route 192.168.21.16 255.255.255.240 192.168.21.65
Router(config)#ip route 192.168.21.32 255.255.255.240 192.168.21.65
Router(config)#do show ip route
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

    192.168.21.0/28 is subnetted, 7 subnets
S       192.168.21.0 [1/0] via 192.168.21.65
S       192.168.21.16 [1/0] via 192.168.21.65
S       192.168.21.32 [1/0] via 192.168.21.65
S       192.168.21.48 [1/0] via 192.168.21.65
C       192.168.21.64 is directly connected, FastEthernet9/0
C       192.168.21.80 is directly connected, FastEthernet8/0
S       192.168.21.96 [1/0] via 192.168.21.67

```



```
Router5
Physical Config CLI Attributes
IOS Command Line Interface

Router>en
Router#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 192.168.21.80 255.255.255.240 192.168.21.66
Router(config)#ip route 192.168.21.48 255.255.255.240 192.168.21.65
Router(config)#ip route 192.168.21.0 255.255.255.240 192.168.21.65
Router(config)#ip route 192.168.21.16 255.255.255.240 192.168.21.65
Router(config)#ip route 192.168.21.32 255.255.255.240 192.168.21.65
Router(config)#do show ip route
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

      192.168.21.0/28 is subnetted, 7 subnets
S       192.168.21.0 [1/0] via 192.168.21.65
S       192.168.21.16 [1/0] via 192.168.21.65
S       192.168.21.32 [1/0] via 192.168.21.65
S       192.168.21.48 [1/0] via 192.168.21.65
C       192.168.21.64 is directly connected, FastEthernet8/0
S       192.168.21.80 [1/0] via 192.168.21.66
C       192.168.21.96 is directly connected, FastEthernet9/0
```

Задание 3. Применить протокол динамической маршрутизации EIGRP для настройки маршрутизаторов R1, R2, R3, R4 и R5 в автономной системе AS2.

Применяю протокол EIGRP для организации динамической маршрутизации, поэтому в командной строке каждого роутера использую следующие команды : “router eigrp 1”, затем после нее “network {ip адрес сети, к которой проводится маршрутизация, т.е окружающие роутер} {обратная расширенная маска}”.

Router1(1)

Physical Config CLI Attributes

IOS Command Line Interface

```
Router>en
Router#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router eigrp 1
Router(config-router)#network 172.16.16.0 0.0.0.255
Router(config-router)#network 172.16.17.0 0.0.0.255
Router(config-router)#network 172.16.23.0 0.0.0.255
Router(config-router)#
%DUAL-5-NBRCHANGE: IP-EIGRP 1: Neighbor 172.16.23.2 (FastEthernet8/0) is up: new adjacency

Router(config-router)#network 172.16.24.0 0.0.0.255
Router(config-router)#no auto-summary
```

Router2(1)

Physical Config CLI Attributes

IOS Command Line Interface

```
Router>en
Router#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router eigrp 1
Router(config-router)#network 172.16.19.0 0.0.0.255
Router(config-router)#network 172.16.20.0 0.0.0.255
Router(config-router)#network 172.16.23.0 0.0.0.255
Router(config-router)#network 172.16.25.0 0.0.0.255
Router(config-router)#no auto-summary
```

Router3(1)

Physical Config CLI Attributes

IOS Command Line Interface

```
Router>en
Router#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router eigrp 1
Router(config-router)#network 172.16.18.0 0.0.0.255
Router(config-router)#network 172.16.24.0 0.0.0.255
Router(config-router)#
%DUAL-5-NBRCHANGE: IP-EIGRP 1: Neighbor 172.16.24.1 (FastEthernet9/0) is up: new adjacency

Router(config-router)#network 172.16.25.0 0.0.0.255
Router(config-router)#
%DUAL-5-NBRCHANGE: IP-EIGRP 1: Neighbor 172.16.25.1 (FastEthernet8/0) is up: new adjacency

Router(config-router)#no auto-summary
Router(config-router)#
%DUAL-5-NBRCHANGE: IP-EIGRP 1: Neighbor 172.16.24.1 (FastEthernet9/0) resync: summary configured

%DUAL-5-NBRCHANGE: IP-EIGRP 1: Neighbor 172.16.25.1 (FastEthernet8/0) resync: summary configured
```

Router4(1)

Physical Config CLI Attributes

IOS Command Line Interface

```
Router>en
Router#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#route eigrp 1
Router(config-router)#network 172.16.20.0 0.0.0.255
Router(config-router)#
%DUAL-5-NBRCHANGE: IP-EIGRP 1: Neighbor 172.16.20.1 (FastEthernet9/0) is up: new adjacency

Router(config-router)#network 172.16.21.0 0.0.0.255
Router(config-router)#no auto-summary
Router(config-router)#
%DUAL-5-NBRCHANGE: IP-EIGRP 1: Neighbor 172.16.20.1 (FastEthernet9/0) resync: summary configured
```

Router5(1)

Physical Config CLI Attributes

IOS Command Line Interface

```
Router>en
Router#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#route eigrp 1
Router(config-router)#network 172.16.20.0 0.0.0.255
Router(config-router)#
%DUAL-5-NBRCHANGE: IP-EIGRP 1: Neighbor 172.16.20.2 (FastEthernet8/0) is up: new adjacency

%DUAL-5-NBRCHANGE: IP-EIGRP 1: Neighbor 172.16.20.1 (FastEthernet8/0) is up: new adjacency

Router(config-router)#network 172.16.22.0 0.0.0.255
Router(config-router)#no auto-summary
Router(config-router)#
%DUAL-5-NBRCHANGE: IP-EIGRP 1: Neighbor 172.16.20.2 (FastEthernet8/0) resync: summary configured

%DUAL-5-NBRCHANGE: IP-EIGRP 1: Neighbor 172.16.20.1 (FastEthernet8/0) resync: summary configured
```

```
Router1(1)

Physical Config CLI Attributes

IOS Command Line Interface

Router(config-router)#do show ip route
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

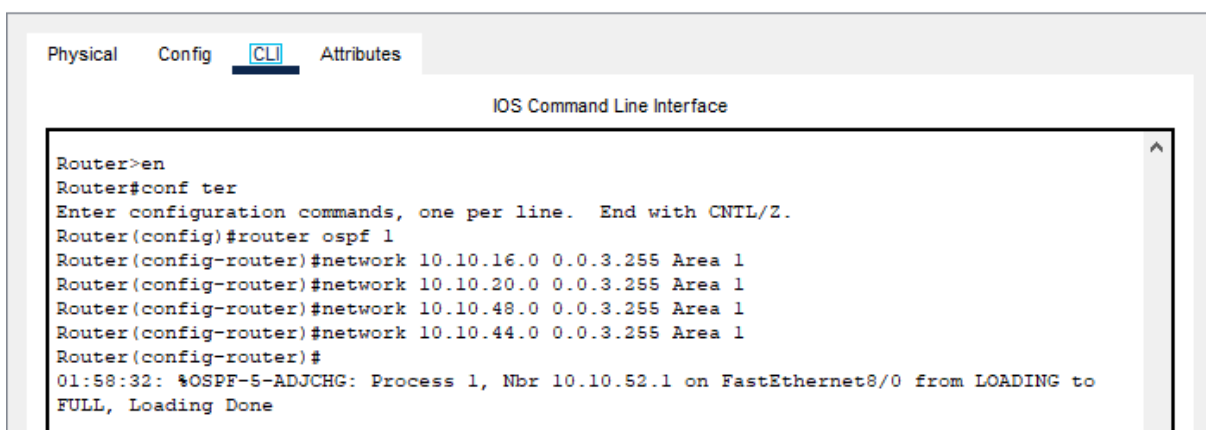
Gateway of last resort is not set

172.16.0.0/24 is subnetted, 10 subnets
C       172.16.16.0 is directly connected, FastEthernet6/0
C       172.16.17.0 is directly connected, FastEthernet7/0
D       172.16.18.0 [90/30720] via 172.16.24.2, 00:03:21, FastEthernet9/0
D       172.16.19.0 [90/30720] via 172.16.23.2, 00:06:21, FastEthernet8/0
D       172.16.20.0 [90/30720] via 172.16.23.2, 00:06:21, FastEthernet8/0
D       172.16.21.0 [90/33280] via 172.16.23.2, 00:02:24, FastEthernet8/0
D       172.16.22.0 [90/33280] via 172.16.23.2, 00:01:18, FastEthernet8/0
C       172.16.23.0 is directly connected, FastEthernet8/0
C       172.16.24.0 is directly connected, FastEthernet9/0
D       172.16.25.0 [90/30720] via 172.16.23.2, 00:06:21, FastEthernet8/0
        [90/30720] via 172.16.24.2, 00:03:21, FastEthernet9/0
```

Задание 4. Маршрутизаторы автономной системы AS3 разделены на два региона: Area 0 и Area 1. Применить протокол динамической маршрутизации OSPF с двумя регионами, Area 0 и Area 1, для настройки маршрутизаторов R1, R2, R3, R4 и R5 в автономной системе 22 AS3, так чтобы обеспечить соединение между любыми двумя устройствами исходной сети.

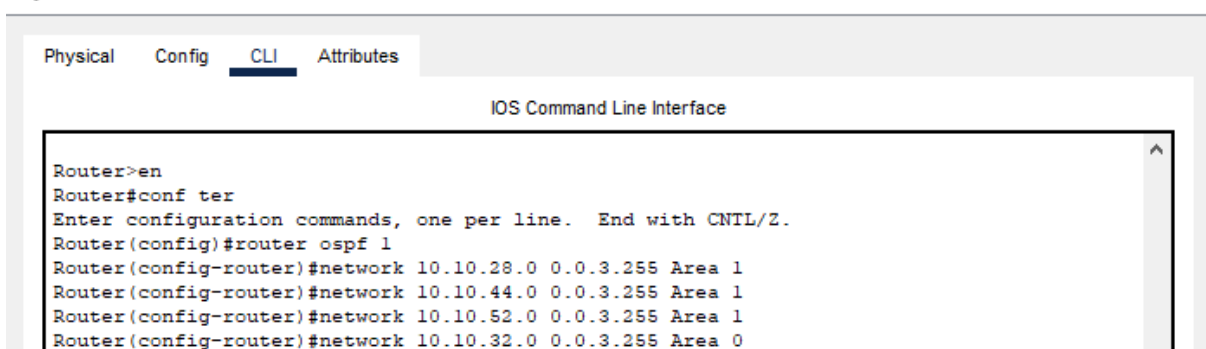
Для настройки динамической маршрутизации OSPF с двумя регионами Area 0 и Area 1 я использую следующие команды в командной строке каждого роутера : “router ospf 1” и “network {ip адрес сети сети, к которой проводится маршрутизация} {обратная маска подсети} {регион}.

Router1(2)

A screenshot of a network simulator window titled "Router1(2)". It has tabs for "Physical", "Config", "CLI", and "Attributes", with "CLI" selected. The main area is titled "IOS Command Line Interface" and shows a terminal session. The user enters 'en' to enter enable mode, then 'conf ter' to enter configuration mode. They configure OSPF process 1 and add four networks: 10.10.16.0, 10.10.20.0, 10.10.48.0, and 10.10.44.0, all in Area 1. A system message at the bottom indicates OSPF is loading on FastEthernet8/0.

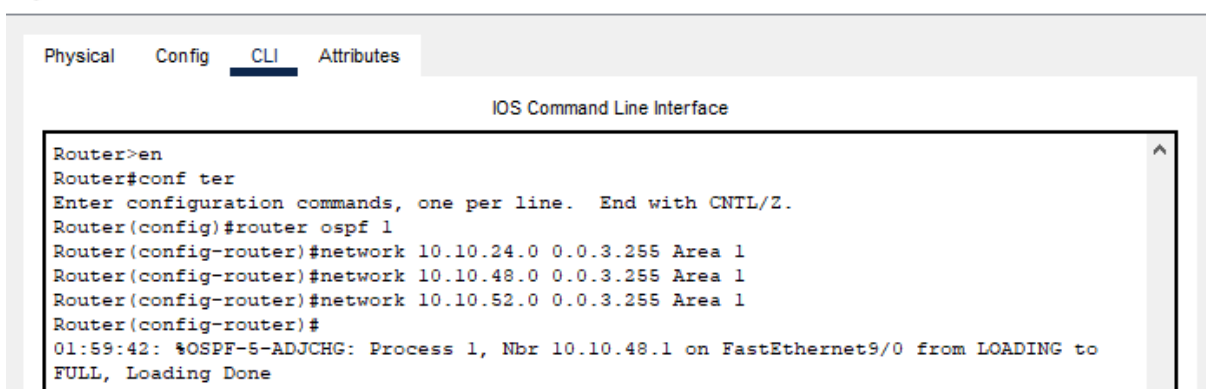
```
Router>en
Router#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#network 10.10.16.0 0.0.3.255 Area 1
Router(config-router)#network 10.10.20.0 0.0.3.255 Area 1
Router(config-router)#network 10.10.48.0 0.0.3.255 Area 1
Router(config-router)#network 10.10.44.0 0.0.3.255 Area 1
Router(config-router)#
01:58:32: %OSPF-5-ADJCHG: Process 1, Nbr 10.10.52.1 on FastEthernet8/0 from LOADING to
FULL, Loading Done
```

Router2(2)

A screenshot of a network simulator window titled "Router2(2)". It has tabs for "Physical", "Config", "CLI", and "Attributes", with "CLI" selected. The main area is titled "IOS Command Line Interface" and shows a terminal session. The user enters 'en' to enter enable mode, then 'conf ter' to enter configuration mode. They configure OSPF process 1 and add four networks: 10.10.28.0, 10.10.44.0, 10.10.52.0, and 10.10.32.0, all in Area 1.

```
Router>en
Router#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#network 10.10.28.0 0.0.3.255 Area 1
Router(config-router)#network 10.10.44.0 0.0.3.255 Area 1
Router(config-router)#network 10.10.52.0 0.0.3.255 Area 1
Router(config-router)#network 10.10.32.0 0.0.3.255 Area 0
```

Router3(2)

A screenshot of a network simulator window titled "Router3(2)". It has tabs for "Physical", "Config", "CLI", and "Attributes", with "CLI" selected. The main area is titled "IOS Command Line Interface" and shows a terminal session. The user enters 'en' to enter enable mode, then 'conf ter' to enter configuration mode. They configure OSPF process 1 and add three networks: 10.10.24.0, 10.10.48.0, and 10.10.52.0, all in Area 1. A system message at the bottom indicates OSPF is loading on FastEthernet9/0.

```
Router>en
Router#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#network 10.10.24.0 0.0.3.255 Area 1
Router(config-router)#network 10.10.48.0 0.0.3.255 Area 1
Router(config-router)#network 10.10.52.0 0.0.3.255 Area 1
Router(config-router)#
01:59:42: %OSPF-5-ADJCHG: Process 1, Nbr 10.10.48.1 on FastEthernet9/0 from LOADING to
FULL, Loading Done
```

Router4(2)

Physical Config CLI Attributes

IOS Command Line Interface

```
Router>en
Router#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#network 10.10.36.0 0.0.3.255 Area 0
Router(config-router)#network 10.10.32.0 0.0.3.255 Area 0
Router(config-router)#do show ip route
```

Router5(2)

Physical Config CLI Attributes

IOS Command Line Interface

```
Router>en
Router#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#network 10.10.32.0 0.0.3.255 Area 0
Router(config-router)#network 10.10.40.0 0.0.3.255 Area 0
02:03:31: %OSPF-5-ADJCHG: Process 1, Nbr 10.10.36.1 on FastEthernet8/0 from LOADING to FULL, Loading Done

02:03:31: %OSPF-5-ADJCHG: Process 1, Nbr 10.10.52.1 on FastEthernet8/0 from LOADING to FULL, Loading Done
```