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"Київський політехнічний інститут імені Ігоря Сікорського"
Фізико-технічний інститут

«Безпека комп'ютерних мереж»

Лабораторна робота №2
Варіант 5.2

«Маршрутизація в мережах»

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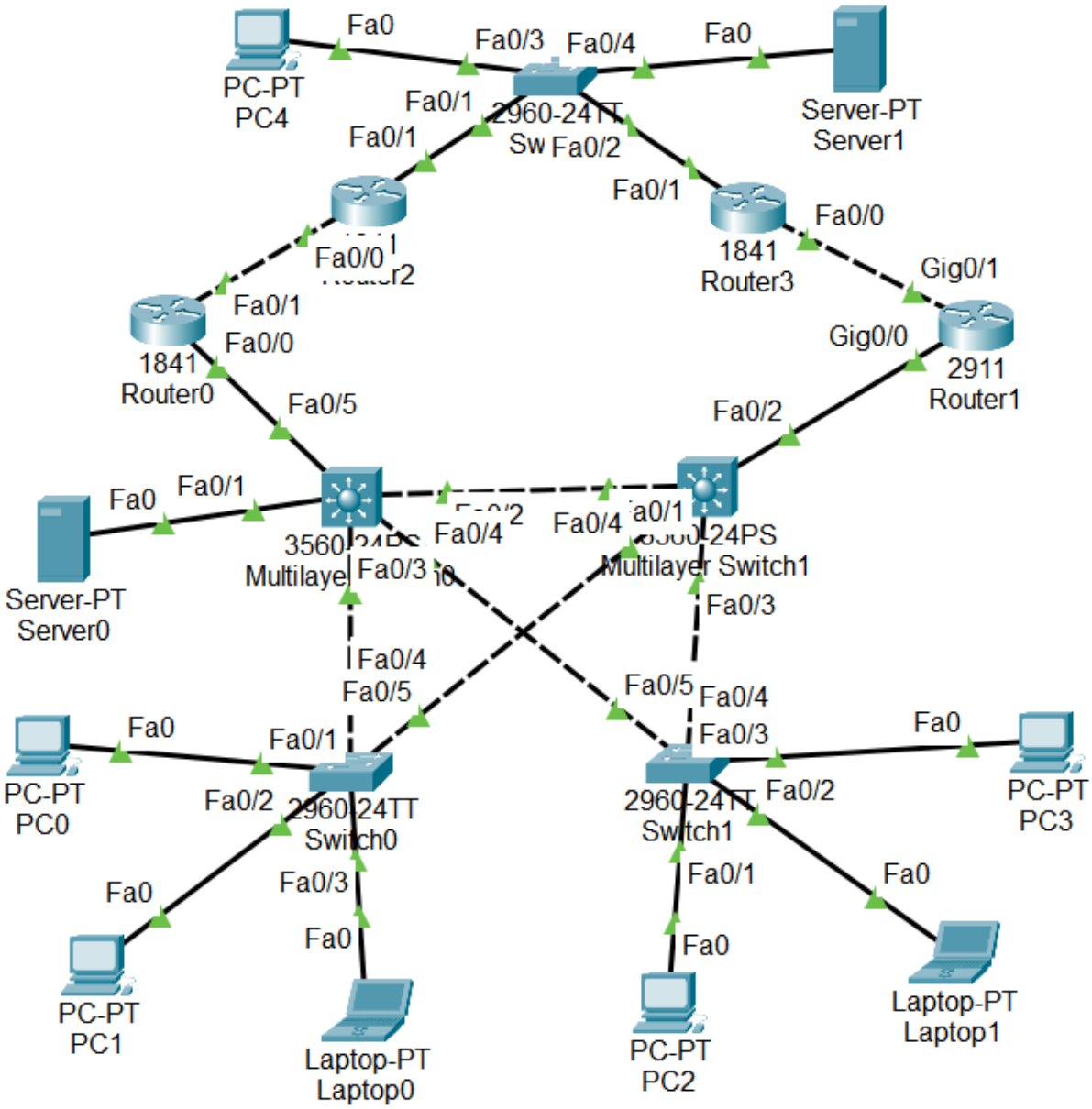
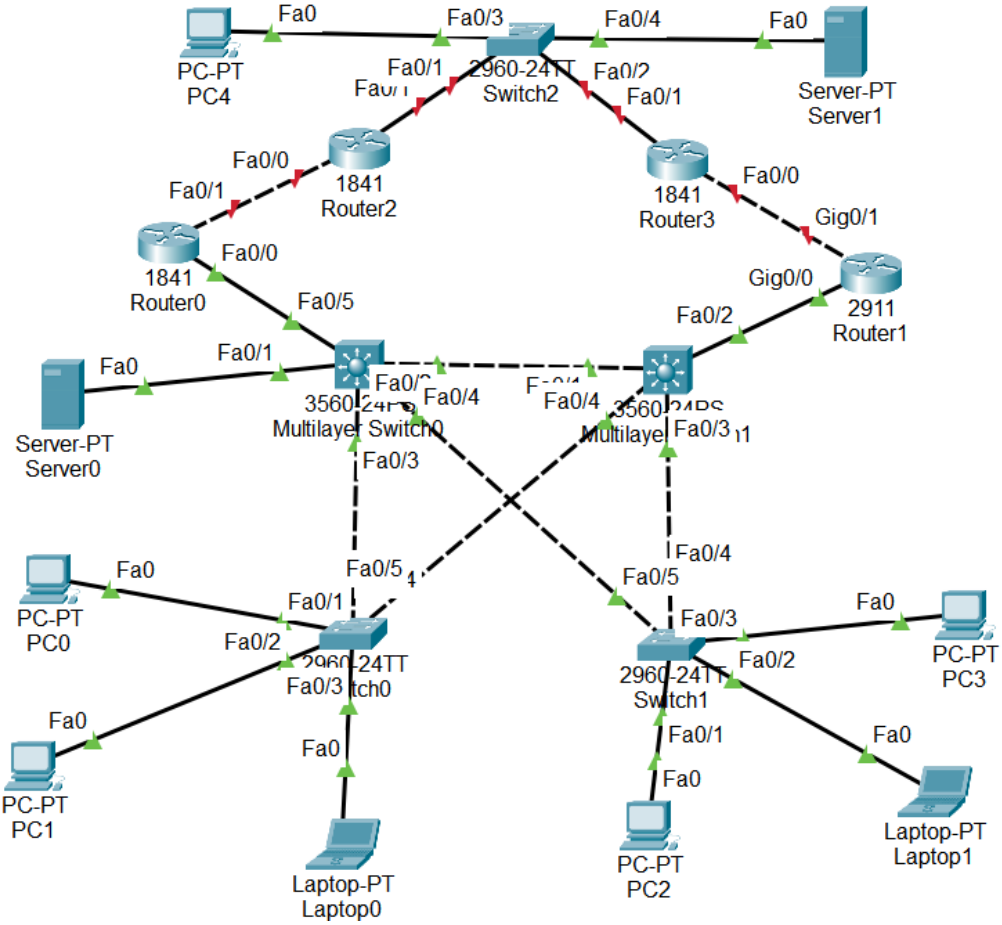
Київ-2022

Топологія


PC-PT
PC4
Fa0
Fa0/3
Fa0/4
Fa0
Server-PT
Server1
Fa0/1
Fa0/1
Fa0/2
Fa0/1
Fa0/0
1841
Router3
Fa0/0
Gig0/1
Fa0/1
Fa0/0
1841
Router0
Gig0/0
2911
Router1
Fa0/5
Fa0/2
Fa0
Fa0/1
Server-PT
Server0
Fa0/4
Fa0/4
Multilayer Switch1
Fa0/3
Fa0/3
Fa0/4
Fa0/5
Fa0/5
Fa0/4
Fa0/3
Fa0
Fa0/1
PC-PT
PC0
Fa0/2
Switch0
Fa0/2
Fa0
PC-PT
PC3
Switch1
Fa0/3
Fa0/1
Fa0
Fa0
Fa0
PC-PT
PC1
Laptop-PT
Laptop0
PC-PT
PC2
Laptop-PT
Laptop1

1. Динамічна маршрутизація.

Додали 2 маршрутизатора моделі 1841, комутатор, сервер та хост



Для «зовнішніх» адрес візьмемо діапазон 192.5.2.0/24

1.1 Налаштуємо маршрутизатори Router2 і Router3 і інтерфейси Fa0/1 та Fa0/0 на маршрутизаторах Router0 і Router1.

Router0

```
R0(config)#interface FastEthernet0/1
R0(config-if)#ip address 192.5.2.5 255.255.255.252
R0(config-if)#no shut

R0(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to
up

%LINEPROTO-5-UPDOWN: Line protocol on Interface
FastEthernet0/1, changed state to up
```

Router2

```
R2(config)#interface FastEthernet0/0
R2(config-if)#ip address 192.5.2.6 255.255.255.252
R2(config-if)#no shut

R2(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to
up

%LINEPROTO-5-UPDOWN: Line protocol on Interface
FastEthernet0/0, changed state to up

R2(config-if)#interface FastEthernet0/1
R2(config-if)#ip address 192.5.2.129 255.255.255.128
R2(config-if)#no shut

R2(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to
up

%LINEPROTO-5-UPDOWN: Line protocol on Interface
FastEthernet0/1, changed state to up
```

Аналогічно налаштовуємо маршрутизатори Router1 і Router3. Інтерфейс Fa0/1 буде мати адресу 192.5.2.130/25.

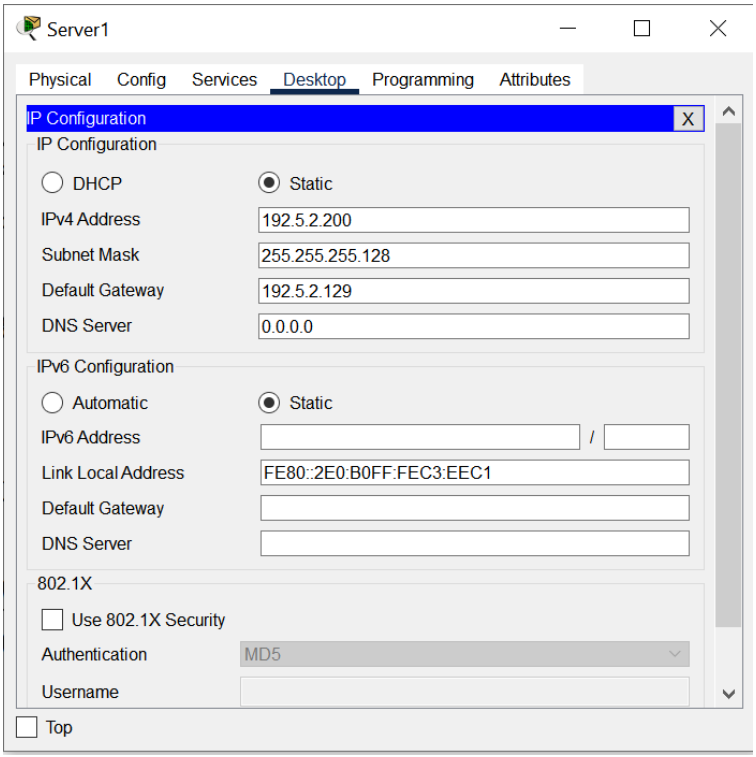
Router1

```
R1(config)#interface Gig0/1
R1(config-if)#ip address 192.5.2.9 255.255.255.252
R1(config-if)#no shut

R1(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state
to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface
GigabitEthernet0/1, changed state to up
```

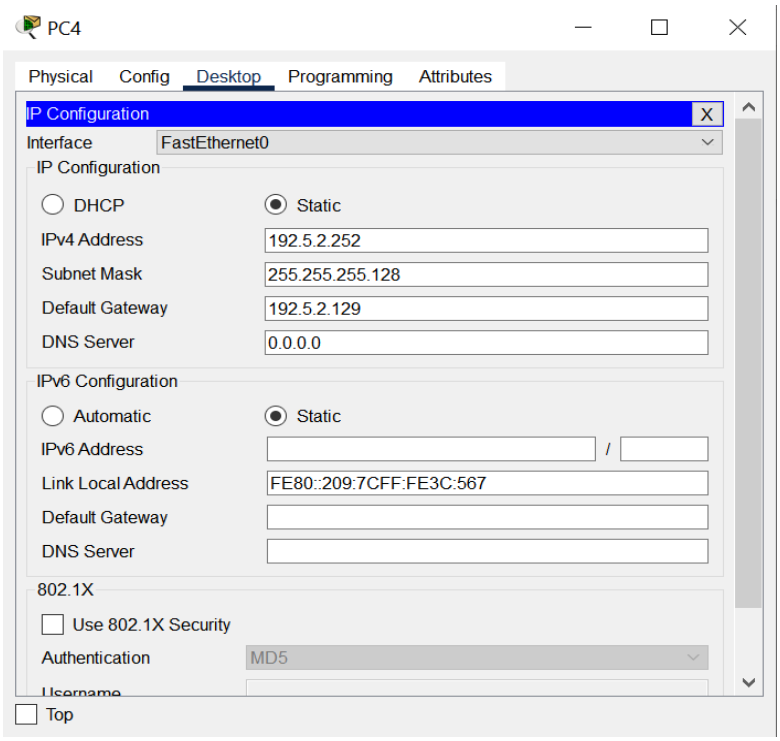
Router3

```
R3(config)#interface FastEthernet0/0
R3(config-if)#ip address 192.5.2.10 255.255.255.252
R3(config-if)#no shut

R3(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to
up

%LINEPROTO-5-UPDOWN: Line protocol on Interface
FastEthernet0/0, changed state to up

R3(config-if)#interface FastEthernet0/1
R3(config-if)#ip address 192.5.2.130 255.255.255.128
R3(config-if)#no shut

R3(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to
up

%LINEPROTO-5-UPDOWN: Line protocol on Interface
FastEthernet0/1, changed state to up
```

На Server1 встановили ip-адресу 192.5.2.200/25 і default-gateway 192.5.2.129.



Хосту PC0 призначили вільну адресу з діапазону підмережі.



1.2 Тепер приступимо до налаштування динамічної маршрутизації:

```
R0(config)#router ospf 100
R0(config-router)#network 10.50.2.0 0.0.0.255 area 0
R0(config-router)#
19:46:56: %OSPF-5-ADJCHG: Process 100, Nbr 192.5.2.9 on
FastEthernet0/0.1 from LOADING to FULL, Loading Done

19:46:56: %OSPF-5-ADJCHG: Process 100, Nbr 192.5.2.9 on
FastEthernet0/0.2 from LOADING to FULL, Loading Done

R0(config-router)#network 192.5.2.0 0.0.0.255 area 0
R0(config-router)#
19:47:09: %OSPF-5-ADJCHG: Process 100, Nbr 192.5.2.129 on
FastEthernet0/1 from LOADING to FULL, Loading Done
```

```
R2(config)#router ospf 100
R2(config-router)#network 192.5.2.0 0.0.0.255 area 0
R2(config-router)#exit
R2(config)#e
19:36:10: %OSPF-5-ADJCHG: Process 100, Nbr 192.5.2.5 on
FastEthernet0/0 from LOADING to FULL, Loading Done
```

```
R1(config)#router ospf 100
R1(config-router)#network 10.50.2.0 0.0.0.255 area 0
R1(config-router)#network 192.5.2.0 0.0.0.255 area 0
19:41:25: %OSPF-5-ADJCHG: Process 100, Nbr 192.5.2.5 on
GigabitEthernet0/0.1 from LOADING to FULL, Loading Done

19:41:25: %OSPF-5-ADJCHG: Process 100, Nbr 192.5.2.5 on
GigabitEthernet0/0.2 from LOADING to FULL, Loading Done
```

```
R3(config)#router ospf 100
R3(config-router)#network 192.5.2.0 0.0.0.255 area 0
R3(config-router)#
19:43:14: %OSPF-5-ADJCHG: Process 100, Nbr 192.5.2.129 on
FastEthernet0/1 from LOADING to FULL, Loading Done

19:43:16: %OSPF-5-ADJCHG: Process 100, Nbr 192.5.2.9 on
FastEthernet0/0 from LOADING to FULL, Loading Done
```

1.3 Перевірка таблиць маршрутизації.

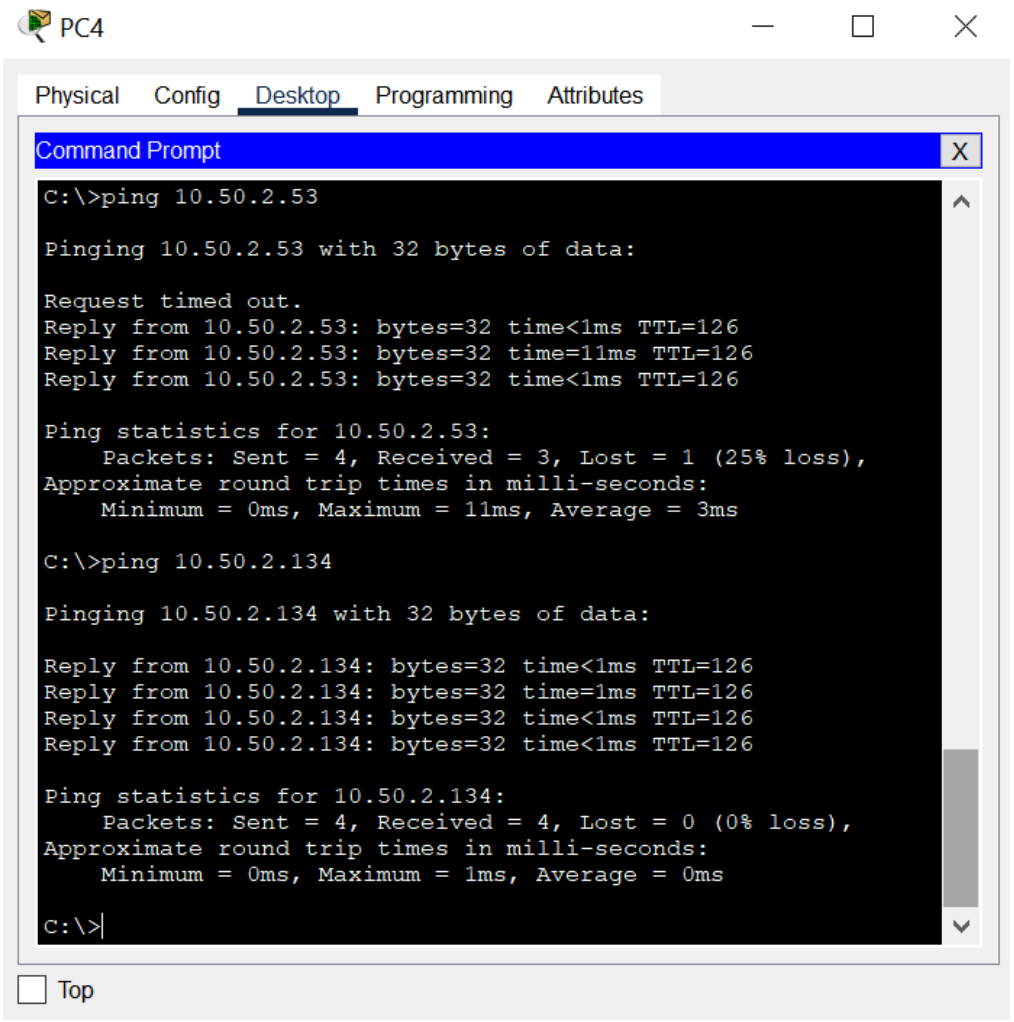
```
R0#sh ip ro
Codes: C - connected, S - static, I - IGRP, R - RIP, M -
mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF
inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA
external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2,
E - EGP
       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

     10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       10.50.2.48/28 is directly connected,
FastEthernet0/0.2
C       10.50.2.128/25 is directly connected,
FastEthernet0/0.1
     192.5.2.0/24 is variably subnetted, 3 subnets, 2 masks
C       192.5.2.4/30 is directly connected, FastEthernet0/1
O       192.5.2.8/30 [110/2] via 10.50.2.131, 00:16:04,
FastEthernet0/0.1
                     [110/2] via 10.50.2.51, 00:16:04,
FastEthernet0/0.2
O       192.5.2.128/25 [110/3] via 10.50.2.131, 00:16:04,
FastEthernet0/0.1
                       [110/3] via 10.50.2.51, 00:16:04,
FastEthernet0/0.2
```

```
R3#sh ip ro
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

     10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
O       10.50.2.48/28 [110/2] via 192.5.2.9, 00:03:59,
FastEthernet0/0
O       10.50.2.128/25 [110/2] via 192.5.2.9, 00:07:54,
FastEthernet0/0
     192.5.2.0/24 is variably subnetted, 3 subnets, 2 masks
O       192.5.2.4/30 [110/2] via 192.5.2.129, 00:07:54,
FastEthernet0/1
C       192.5.2.8/30 is directly connected, FastEthernet0/0
C       192.5.2.128/25 is directly connected, FastEthernet0/1
```

```
R2#sh ip ro
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

     10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
O       10.50.2.48/28 [110/3] via 192.5.2.130, 00:19:35,
FastEthernet0/1
O       10.50.2.128/25 [110/3] via 192.5.2.130, 00:19:45,
FastEthernet0/1
     192.5.2.0/24 is variably subnetted, 3 subnets, 2 masks
C       192.5.2.4/30 is directly connected, FastEthernet0/0
O       192.5.2.8/30 [110/2] via 192.5.2.130, 00:40:09,
FastEthernet0/1
C       192.5.2.128/25 is directly connected, FastEthernet0/1
```

```
R1#sh ip ro
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 not set

     10.0.0.0/8 is variably subnetted, 4 subnets, 3 masks
C       10.50.2.48/28 is directly connected,
GigabitEthernet0/0.2
L       10.50.2.51/32 is directly connected,
GigabitEthernet0/0.2
C       10.50.2.128/25 is directly connected,
GigabitEthernet0/0.1
L       10.50.2.131/32 is directly connected,
GigabitEthernet0/0.1
     192.5.2.0/24 is variably subnetted, 4 subnets, 3 masks
O       192.5.2.4/30 [110/2] via 10.50.2.130, 00:02:37,
GigabitEthernet0/0.1
                     [110/2] via 10.50.2.50, 00:02:37,
GigabitEthernet0/0.2
C       192.5.2.8/30 is directly connected,
GigabitEthernet0/1
L       192.5.2.9/32 is directly connected,
GigabitEthernet0/1
O       192.5.2.128/25 [110/2] via 192.5.2.10, 00:06:32,
GigabitEthernet0/1
```

Перевірка досяжності між різними підмережами топології

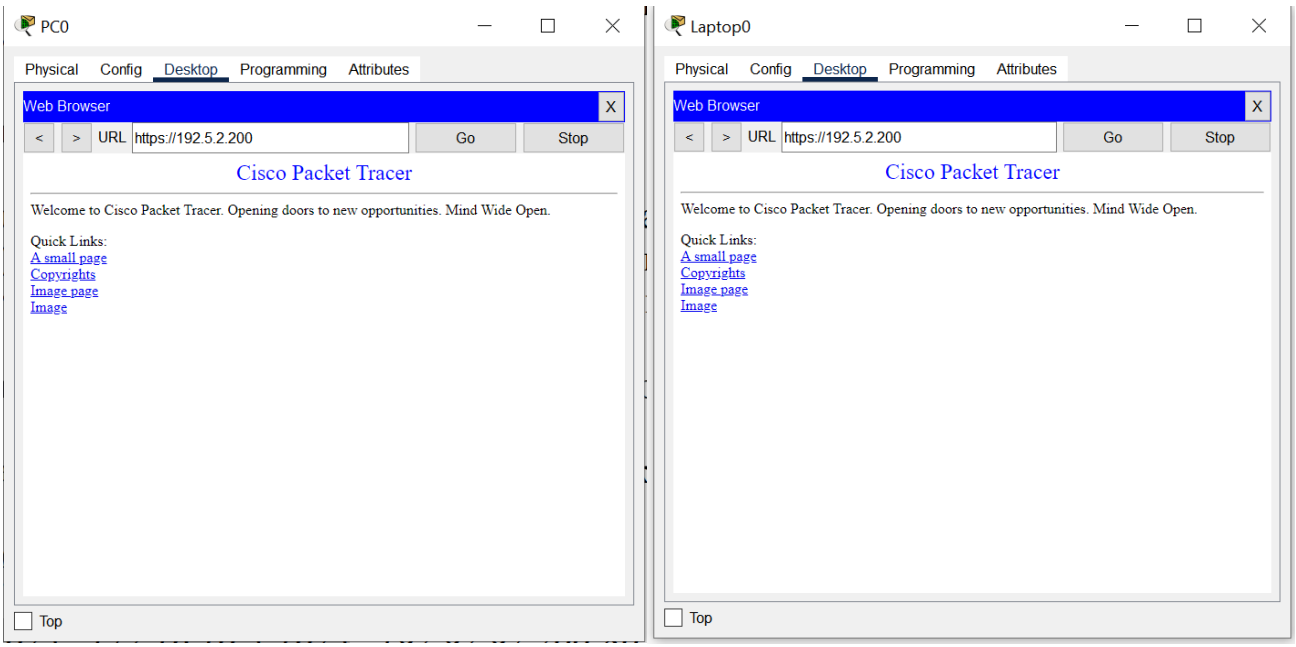


2. Трансляція мережних адрес.

```
R0(config)#int fa0/0.1
R0(config-subif)#ip nat inside
R0(config-subif)#int fa0/0.2
R0(config-subif)#ip nat inside
R0(config-subif)#int fa0/1
R0(config-if)#ip nat outside
R0(config-if)#exit
R0(config)#access-list 1 permit 10.50.2.0 0.0.0.255
R0(config)#ip nat inside source list 1 interface Fa0/1 overload
R0(config)#exit
```

```
R1(config)#int gi0/0.1
R1(config-subif)#ip nat inside
R1(config-subif)#int gi0/0.2
R1(config-subif)#ip nat inside
R1(config-subif)#int gi0/1
R1(config-if)#ip nat outside
R1(config-if)#exit
R1(config)#access-list 1 permit 10.50.2.0 0.0.0.255
R1(config)#ip nat inside source list 1 interface Gi0/1
R1(config)#ip nat inside source list 1 interface Gi0/1 overload
R1(config)#exit
```

2.1 Перевірка трансляції адрес



```
R0#show ip nat translation
Pro  Inside global     Inside local       Outside local      Outside global
tcp 192.5.2.5:1025     10.50.2.134:1025   192.5.2.200:80     192.5.2.200:80
```

```
R1#show ip nat translation
Pro  Inside global     Inside local       Outside local      Outside global
tcp 192.5.2.9:1025     10.50.2.54:1025    192.5.2.200:80     192.5.2.200:80
```

Після збереження налаштування у всіх маршрутизаторах і комутаторах зробили перевірку

R0#show running-config

interface FastEthernet0/0.1
encapsulation dot1Q 10
ip address 10.50.2.130 255.255.255.128
ip nat inside
standby 110 ip 10.50.2.129
standby 110 priority 150
standby 110 preempt

interface FastEthernet0/0.2
encapsulation dot1Q 1 native
ip address 10.50.2.50 255.255.255.240
ip nat inside
standby 101 ip 10.50.2.49
standby 101 preempt

interface FastEthernet0/1
ip address 192.5.2.5 255.255.255.252
ip nat outside

router ospf 100
log-adjacency-changes
network 10.50.2.0 0.0.0.255 area 0
network 192.5.2.0 0.0.0.255 area 0

ip nat inside source list 1 interface FastEthernet0/1 overload
access-list 1 permit 10.50.2.0 0.0.0.255

R1#show running-config

interface GigabitEthernet0/0.1
encapsulation dot1Q 10

```
ip address 10.50.2.131 255.255.255.128
ip nat inside
standby 110 ip 10.50.2.129
standby 110 preempt

interface GigabitEthernet0/0.2
encapsulation dot1Q 1 native
ip address 10.50.2.51 255.255.255.240
ip nat inside
standby 101 ip 10.50.2.49
standby 101 priority 150
standby 110 preempt

interface GigabitEthernet0/1
ip address 192.5.2.9 255.255.255.252
ip nat outside

router ospf 100
log-adjacency-changes
network 10.50.2.0 0.0.0.255 area 0
network 192.5.2.0 0.0.0.255 area 0

ip nat inside source list 1 interface GigabitEthernet0/1 overload
access-list 1 permit 10.50.2.0 0.0.0.255
```

R2#show running-config

```
hostname R2
!
interface FastEthernet0/0
ip address 192.5.2.6 255.255.255.252

interface FastEthernet0/1
ip address 192.5.2.129 255.255.255.128

router ospf 100
network 192.5.2.0 0.0.0.255 area 0
```

R3#show running-config

```
hostname R3
!
interface FastEthernet0/0
ip address 192.5.2.10 255.255.255.252
```

```
interface FastEthernet0/1
ip address 192.5.2.130 255.255.255.128

router ospf 100
network 192.5.2.0 0.0.0.255 area 0
```