

## Лабораторная работа VII.

Изучение статической маршрутизации для сетей  
с поддержкой IPv4 и IPv6 в сетевом симуляторе

Лучина Е.Д. ИУ7-71Б

### Задачи

- 1) Разделить сеть на подсети в соответствии с системой адресации IPv4. Выделить достаточно адресов для размещения  $x+20$  хостов в подсетях 1 и 2,  $x+10$  в подсети 3, по 2 адреса интерфейса на соединения “точка-точка” между маршрутизаторами, где  $x$  - Ваш номер по списку в ЭУ
- 2) Настроить статическую маршрутизацию так, чтобы пинг любым хостом или маршрутизатором любого другого хоста или маршрутизатора был успешным.
- 3) Выделить маршрутизаторам IPv6 адреса формата  $2001:x+y::z/64$ , где  $x$  - Ваш номер по списку в ЭУ,  $y$  - порядковый номер подсети,  $z$  - порядковый номер интерфейса
- 4) Установить автоконфигурирование IPv6 без отслеживания состояния (SLAAC) для интерфейсов хостов в подсетях 1 и 2. В подсети 3 использовать SLAAC +DHCPv6.
- 5) Настроить статическую маршрутизацию так, чтобы пинг любым хостом или маршрутизатором любого другого хоста или маршрутизатора с использованием IPv6 адреса был успешным

### Разделить сеть на подсети

Подсети 1 и 2 -  $16 + 20 = 36$  хостов,  $16 + 10 = 26$  хостов в третьей подсети

192.168.16.0/24 эту сеть будем делить на подсети

$36 + 2 = 38 < 2^6 = 64$  -> шесть бит с конца уходит под хостовую часть

- I. 192.168.16.0/26 - адрес подсети, маска - 255.255.255.192
- II. 192.168.16.64/26 - адрес подсети, маска - 255.255.255.192

192.168.16.128/26 разделим на оставшиеся подсети

$26 + 2 = 28 < 32 = 2^5$  - последние пять бит на хостовую часть

- III. 192.168.16.128/27 - адрес подсети, маска - 255.255.255.224
- IV. 192.168.16.160/30 - - адрес подсети, маска - 255.255.255.252
- V. 192.168.16.164/30 - - адрес подсети, маска - 255.255.255.252
- VI. 192.168.16.168/30 - - адрес подсети, маска - 255.255.255.252

### Настроить статическую маршрутизацию

Router1

Physical

Config

CLI

Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

GigabitEthernet0/0/0

GigabitEthernet0/0/1

GigabitEthernet0/1/0

GigabitEthernet0/1/1

GigabitEthernet0/1/2

GigabitEthernet0/1/3

Serial0/2/0

Serial0/2/1

Static Routes

Network

Mask

Next Hop

Network Address

192.168.16.164/30 via 192.168.16.162

192.168.16.168/30 via 192.168.16.162

192.168.16.128/27 via 192.168.16.162

Equivalent IOS Commands

Router(config)#ip route 192.168.16.164 255.255.255.252 192.168.16.162  
Router(config)#ip route 192.168.16.168 255.255.255.252 192.168.16.162  
Router(config)#ip route 192.168.16.128 255.255.255.224 192.168.16.162  
Router(config)#

Router2

Physical

Config

CLI

Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

GigabitEthernet0/0/0

GigabitEthernet0/0/1

Serial0/1/0

Serial0/1/1

Serial0/2/0

Serial0/2/1

Static Routes

Network

Mask

Next Hop

Network Address

192.168.16.0/26 via 192.168.16.161

192.168.16.64/26 via 192.168.16.161

192.168.16.168/30 via 192.168.16.166

Equivalent IOS Commands

Router(config)#  
Router(config)#ip route 192.168.16.0 255.255.255.192 192.168.16.161  
Router(config)#ip route 192.168.16.64 255.255.255.192 192.168.16.161  
Router(config)#ip route 192.168.16.160 255.255.255.252 192.168.16.162  
Router(config)#ip route 192.168.16.168 255.255.255.252 192.168.16.166  
Router(config)#ip route 192.168.16.128 255.255.255.224 192.168.16.166  
Router(config)#  
Router(config)#

Router3

Physical

Config

CLI

Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

GigabitEthernet0/0/0

GigabitEthernet0/0/1

Serial0/1/0

Serial0/1/1

Static Routes

Network

Mask

Next Hop

Network Address

192.168.16.0/26 via 192.168.16.165

192.168.16.64/26 via 192.168.16.165

192.168.16.160/30 via 192.168.16.165

Equivalent IOS Commands

Router(config)#  
Router(config)#ip route 192.168.16.0 255.255.255.192 192.168.16.165  
Router(config)#ip route 192.168.16.64 255.255.255.192 192.168.16.165  
Router(config)#ip route 192.168.16.160 255.255.255.252 192.168.16.165  
Router(config)#ip route 192.168.16.128 255.255.255.224 192.168.16.170  
Router(config)#

Router4

Physical

Config

CLI

Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

GigabitEthernet0/0/0

GigabitEthernet0/0/1

GigabitEthernet0/1/0

GigabitEthernet0/1/1

GigabitEthernet0/1/2

GigabitEthernet0/1/3

Static Routes

Network

Mask

Next Hop

Network Address

192.168.16.64/26 via 192.168.16.169

192.168.16.160/30 via 192.168.16.169

192.168.16.164/30 via 192.168.16.169

Equivalent IOS Commands

Router(config)#  
Router(config)#ip route 192.168.16.0 255.255.255.192 192.168.16.169  
Router(config)#ip route 192.168.16.64 255.255.255.192 192.168.16.169  
Router(config)#ip route 192.168.16.160 255.255.255.252 192.168.16.169  
Router(config)#ip route 192.168.16.164 255.255.255.252 192.168.16.169  
Router(config)#

PC1.1

Physical Config Desktop Programming Attributes

Command Prompt

```
C:\> ping 192.168.16.67

Pinging 192.168.16.67 with 32 bytes of data:

Reply from 192.168.16.67: bytes=32 time=1ms TTL=127
Reply from 192.168.16.67: bytes=32 time=3ms TTL=127
Reply from 192.168.16.67: bytes=32 time<1ms TTL=127
Reply from 192.168.16.67: bytes=32 time=3ms TTL=127

Ping statistics for 192.168.16.67:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 3ms, Average = 1ms

C:\> ping 192.168.16.165

Pinging 192.168.16.165 with 32 bytes of data:

Reply from 192.168.16.165: bytes=32 time=1ms TTL=254
Reply from 192.168.16.165: bytes=32 time=1ms TTL=254
Reply from 192.168.16.165: bytes=32 time=1ms TTL=254
Reply from 192.168.16.165: bytes=32 time=1ms TTL=254

Ping statistics for 192.168.16.165:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\> ping 192.168.16.132

Pinging 192.168.16.132 with 32 bytes of data:
```

```
Reply from 192.168.16.132: bytes=32 time=3ms TTL=124
Reply from 192.168.16.132: bytes=32 time=12ms TTL=124
Reply from 192.168.16.132: bytes=32 time=2ms TTL=124
Reply from 192.168.16.132: bytes=32 time=3ms TTL=124

Ping statistics for 192.168.16.132:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 12ms, Average = 5ms

C:\> ping 192.168.16.166

Pinging 192.168.16.166 with 32 bytes of data:

Reply from 192.168.16.166: bytes=32 time=2ms TTL=253
Reply from 192.168.16.166: bytes=32 time=12ms TTL=253
Reply from 192.168.16.166: bytes=32 time=12ms TTL=253
Reply from 192.168.16.166: bytes=32 time=2ms TTL=253

Ping statistics for 192.168.16.166:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 12ms, Average = 7ms

C:\> ping 192.168.16.170

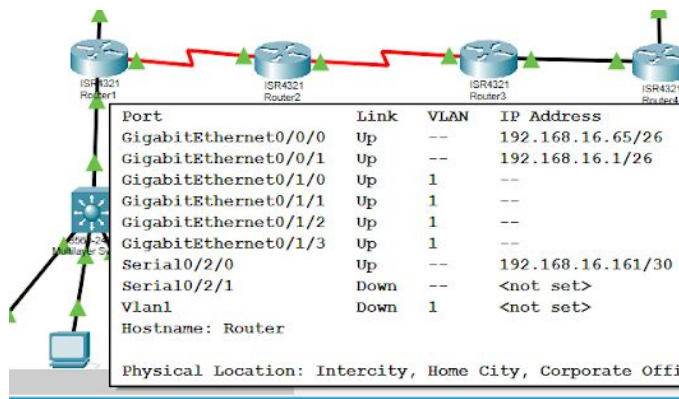
Pinging 192.168.16.170 with 32 bytes of data:

Reply from 192.168.16.170: bytes=32 time=2ms TTL=252
Reply from 192.168.16.170: bytes=32 time=12ms TTL=252
Reply from 192.168.16.170: bytes=32 time=2ms TTL=252
Reply from 192.168.16.170: bytes=32 time=2ms TTL=252

Ping statistics for 192.168.16.170:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 12ms, Average = 4ms
```

router1	Gig0/0/0	2001:18::1/64
	Gig0/0/1	2001:17::1/64

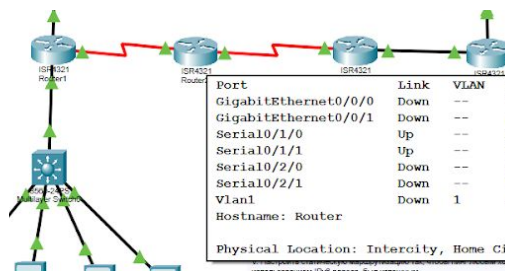
	Se0/2/0	2001:20::1/64
router2	Se0/1/0	2001:21::1/64
	Se0/1/1	2001:20::2/64
router3	Gig0/0/0	2001:22::1/64
	Se0/1/0	2001:21::2/64
router4	Gig0/0/0	2001:22::2/64
	Gig0/0/1	2001:19::1/64



Port	Link	VLAN	IP Address	IPv6 Address	MAC Address
GigabitEthernet0/0/0	Up	--	192.168.16.65/26	2001:18::1/64	0060.5C0A.2701
GigabitEthernet0/0/1	Up	--	192.168.16.1/26	2001:17::1/64	0060.5C0A.2702
GigabitEthernet0/1/0	Up	1	--	<not set>	00D0.97AA.6901
GigabitEthernet0/1/1	Up	1	--	<not set>	00D0.97AA.6902
GigabitEthernet0/1/2	Up	1	--	<not set>	00D0.97AA.6903
GigabitEthernet0/1/3	Up	1	--	<not set>	00D0.97AA.6904
Serial0/2/0	Up	--	192.168.16.161/30	2001:20::1/64	<not set>
Serial0/2/1	Down	--	<not set>	<not set>	<not set>
Vlan1	Down	1	<not set>	<not set>	00D0.D38B.9109

Hostname: Router

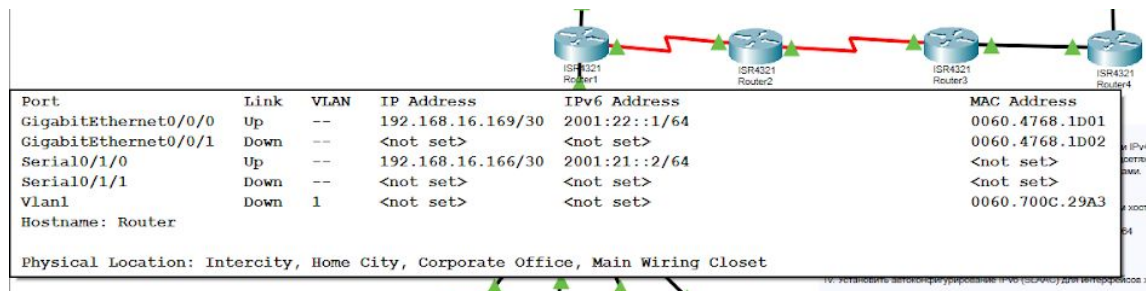
Physical Location: Intercity, Home City, Corporate Office, Main Wiring Closet



Port	Link	VLAN	IP Address	IPv6 Address	MAC Address
GigabitEthernet0/0/0	Down	--	<not set>	<not set>	0060.7047.BC01
GigabitEthernet0/0/1	Down	--	<not set>	<not set>	0060.7047.BC02
Serial0/1/0	Up	--	192.168.16.165/30	2001:21::1/64	<not set>
Serial0/1/1	Up	--	192.168.16.162/30	2001:20::2/64	<not set>
Serial0/2/0	Down	--	<not set>	<not set>	<not set>
Serial0/2/1	Down	--	<not set>	<not set>	<not set>
Vlan1	Down	1	<not set>	<not set>	0009.7CC9.E8DB

Hostname: Router

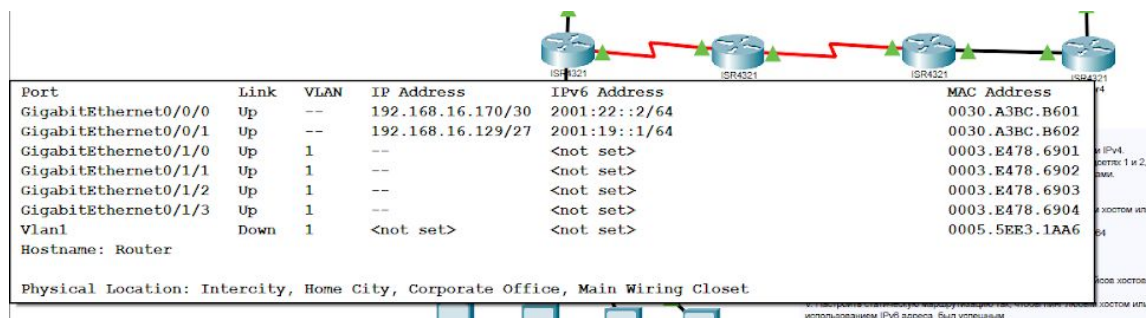
Physical Location: Intercity, Home City, Corporate Office, Main Wiring Closet



Port	Link	VLAN	IP Address	IPv6 Address	MAC Address
GigabitEthernet0/0/0	Up	--	192.168.16.169/30	2001:22::1/64	0060.4768.1D01
GigabitEthernet0/0/1	Down	--	<not set>	<not set>	0060.4768.1D02
Serial0/1/0	Up	--	192.168.16.166/30	2001:21::2/64	<not set>
Serial0/1/1	Down	--	<not set>	<not set>	<not set>
Vlan1	Down	1	<not set>	<not set>	0060.700C.29A3

Hostname: Router

Physical Location: Intercity, Home City, Corporate Office, Main Wiring Closet



Port	Link	VLAN	IP Address	IPv6 Address	MAC Address
GigabitEthernet0/0/0	Up	--	192.168.16.170/30	2001:22::2/64	0030.A3BC.B601
GigabitEthernet0/0/1	Up	--	192.168.16.129/27	2001:19::1/64	0030.A3BC.B602
GigabitEthernet0/1/0	Up	1	--	<not set>	0003.E478.6901
GigabitEthernet0/1/1	Up	1	--	<not set>	0003.E478.6902
GigabitEthernet0/1/2	Up	1	--	<not set>	0003.E478.6903
GigabitEthernet0/1/3	Up	1	--	<not set>	0003.E478.6904
Vlan1	Down	1	<not set>	<not set>	0005.5EE3.1AA6

Hostname: Router

Physical Location: Intercity, Home City, Corporate Office, Main Wiring Closet



```

Router(config)#ipvs unicast routing
Router(config)#int Gig0/0/0
Router(config-if)#ipv6 enable
Router(config-if)#ipv6 address 2001:22::2/64
Router(config-if)#exit
Router(config)#int Gig0/0/1
Router(config-if)#ipv6 enable
Router(config-if)#ipv6 address 2001:19::1/64

```

## Установить автоконфигурирование IPv6

Physical Config **Services** Desktop Programming Attributes

**SERVICES**

- HTTP
- DHCP
- DHCPv6**
- TFTP
- DNS
- SYSLOG
- AAA
- NTP
- EMAIL
- FTP
- IoT
- VM Management
- Radius EAP

**DHCPv6**

Interface: FastEthernet0 Service: ☒ On ☐ Off

DHCPv6 Pool: subnet3

DHCPv6 Pool List: subnet3 Create Pool Remove Pool

DNS Server: 2001:19::3 Domain Name: luchina.com

IPv6 Address Prefix

Prefix	Prefix Length	Valid Lifetime
<span>Create Edit Remove</span>		

IPv6 Prefix-Delegation

Prefix	DUID	Local Pool	Valid Lifetime	Preferred Lifetime
<span>Create Edit Remove</span>				

IPv6 Local Pool

Pool Name	Prefix	Prefix Length
<span>Create Edit Remove</span>		

Physical **Config** Desktop Programming Attributes

**GLOBAL**

- Settings
- Algorithm Settings
- INTERFACE**
- FastEthernet0
- Bluetooth

**FastEthernet0**

Port Status: ☒ On

Bandwidth: ☒ 100 Mbps ☐ 10 Mbps ☒ Auto

Duplex: ☐ Half Duplex ☒ Full Duplex ☒ Auto

MAC Address: 0002.4A84.2ED5

IP Configuration

☒ DHCP ☐ Static

IPv4 Address: 192.168.16.4

Subnet Mask: 255.255.255.192

IPv6 Configuration

☒ Automatic ☐ Static

IPv6 Address: 2001:17::202:4AFF:FE84:2ED5 / 64

Link Local Address: FE80::202:4AFF:FE84:2ED5

## Настроить статическую маршрутизацию с использованием ipv6

Router3

Physical Config **CLI** Attributes

IOS Command Line Interface

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ipv6 route 2001:17::1/64 2001:21::1
Router(config)#ipv6 route 2001:18::1/64 2001:21::1
Router(config)#ipv6 route 2001:20::1/64 2001:21::1
Router(config)#ipv6 route 2001:19::1/64 2001:22::2
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

Router3

Physical Config **CLI** Attributes

IOS Command Line Interface

```
Router#
Router#show ipv6 route
IPv6 Routing Table - 9 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
        U - Per-user Static route, M - MIPv6
        I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
        ND - ND Default, NDP - ND Prefix, DCE - Destination, NDR - Redirect
        O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
        ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
        D - EIGRP, EX - EIGRP external
S   2001:17::/64 [1/0]
    via 2001:21::1
S   2001:18::/64 [1/0]
    via 2001:21::1
S   2001:19::/64 [1/0]
    via 2001:22::2
S   2001:20::/64 [1/0]
    via 2001:21::1
C   2001:21::/64 [0/0]
    via Serial0/1/0, directly connected
L   2001:21::2/128 [0/0]
    via Serial0/1/0, receive
C   2001:22::/64 [0/0]
    via GigabitEthernet0/0/0, directly connected
L   2001:22::1/128 [0/0]
    via GigabitEthernet0/0/0, receive
L   FF00::/8 [0/0]
    via Null0, receive
Router#
```

## Command Prompt

```
C:\>
C:\>ping 2001:17::200:CFF:FED0:17CA
Ping request could not find host 2001:17::200:CFF:FED0:17CA. Please check the name and try again.
C:\>ping 2001:17::200:CFF:FED0:17CA

Pinging 2001:17::200:CFF:FED0:17CA with 32 bytes of data:

Reply from 2001:17::200:CFF:FED0:17CA: bytes=32 time=1ms TTL=127
Reply from 2001:17::200:CFF:FED0:17CA: bytes=32 time<1ms TTL=127
Reply from 2001:17::200:CFF:FED0:17CA: bytes=32 time=3ms TTL=127
Reply from 2001:17::200:CFF:FED0:17CA: bytes=32 time=11ms TTL=127

Ping statistics for 2001:17::200:CFF:FED0:17CA:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 11ms, Average = 3ms

C:\>ping 2001:19::1

Pinging 2001:19::1 with 32 bytes of data:

Reply from 2001:19::1: bytes=32 time=4ms TTL=252
Reply from 2001:19::1: bytes=32 time=7ms TTL=252
Reply from 2001:19::1: bytes=32 time=12ms TTL=252
Reply from 2001:19::1: bytes=32 time=29ms TTL=252

Ping statistics for 2001:19::1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 4ms, Maximum = 29ms, Average = 13ms
```