

Элтекс Модуль 4 Лаба 4

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Тема: Настройка протокола DHCP

1) Для заданной на схеме schema-lab4 сети, состоящей из управляемых коммутаторов, маршрутизаторов и персональных компьютеров выполнить планирование и документирование адресного пространства в подсетях LAN1, LAN2, LAN3 и назначить статические адреса маршрутизаторам и динамическое конфигурирование адресов для VPC.

R1:

```
configure terminal
interface FastEthernet0/0
    ip address 192.168.1.1 255.255.255.0
    no shutdown
exit
interface FastEthernet2/0
    ip address 192.168.2.1 255.255.255.0
    no shutdown
exit
interface FastEthernet1/0
    ip address 10.0.0.1 255.255.255.252
    no shutdown
exit
```

```
R1(config)#interface FastEthernet0/0
R1(config-if)#ip address 192.168.1.1 255.255.255.0
R1(config-if)#no shutdown
R1(config-if)#ip address 192.168.1.1 255.255.255.0
*Mar 1 00:01:05.079: %LINK-3-UPDOWN: Interface Fa
o up
*Mar 1 00:01:06.079: %LINEPROTO-5-UPDOWN: Line p
reto/0, changed state to up
R1(config-if)#exit
R1(config)#interface FastEthernet2/0
R1(config-if)#ip address 192.168.2.1 255.255.255.0
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#
*Mar 1 00:02:03.003: %LINK-3-UPDOWN: Interface Fa
o up
*Mar 1 00:02:04.003: %LINEPROTO-5-UPDOWN: Line p
reto/0, changed state to up
R1(config)#interface FastEthernet1/0
R1(config-if)#ip address 10.0.0.1 255.255.255.252
R1(config-if)#no shutdown
R1(config-if)#exit
*Mar 1 00:02:35.175: %LINK-3-UPDOWN: Interface Fa
o up
*Mar 1 00:02:36.175: %LINEPROTO-5-UPDOWN: Line p
reto/0, changed state to up
R1(config-if)#exit
R1(config)#[
```

Рисунок 1.1 - Настройка R1

R2:

```
Configure terminal
interface FastEthernet0/0
 ip address 10.0.0.2 255.255.255.252
 no shutdown
exit
```

```
R2(config)#interface FastEthernet0/0
R2(config-if)#ip address 10.0.0.2 255.255.255.252
R2(config-if)#no shutdown
R2(config-if)#exit
```

Рисунок 1.2 - Настройка R2

Коммутаторы :

```
enable
configure terminal
interface range GigabitEthernet0/0 – 2
 switchport mode access
 no shutdown
Exit
```

2) Настроить сервер DHCP на маршрутизаторе R2 для обслуживания адресных пулов адресного пространства подсетей LAN1 и LAN2.

R2:

```
configure terminal
ip dhcp pool POOL1
network 192.168.1.0 255.255.255.0
default-router 192.168.1.1
dns-server 8.8.8.8
exit
ip dhcp pool POOL2
network 192.168.2.0 255.255.255.0
default-router 192.168.2.1
dns-server 8.8.8.8
Exit
```

```
R2(dhcp-config)#network 192.168.1.0 255.255.255.0
R2(dhcp-config)#default-router 192.168.1.1
R2(dhcp-config)#dns-server 8.8.8.8
R2(dhcp-config)#exit
R2(config)#
R2(config)#
R2(config)#ip dhcp pool POOL2
R2(dhcp-config)#network 192.168.2.0 255.255.255.0
R2(dhcp-config)#default-router 192.168.2.1
R2(dhcp-config)#dns-server 8.8.8.8
R2(dhcp-config)#exit
```

Рисунок 2.1 - Настройка DHCP на R2

R1:

```
interface FastEthernet0/0
  ip helper-address 10.0.0.2
exit
interface FastEthernet2/0
  ip helper-address 10.0.0.2
exit
```

```
R1(config)#interface FastEthernet0/0
R1(config-if)#ip helper-address 10.0.0.2
R1(config-if)#exit
R1(config)#interface FastEthernet2/0
R1(config-if)#ip helper-address 10.0.0.2
R1(config-if)#exit
```

Рисунок 2.2 - Настройка DHCP Relay на R1

3) Настроить статическую (nb!) маршрутизацию между подсетями.

R1:

```
ip route 172.16.0.0 255.255.255.0 10.0.0.2
```

R2:

```
ip route 192.168.1.0 255.255.255.0 10.0.0.1
```

```
ip route 192.168.2.0 255.255.255.0 10.0.0.1
```

4) Проверить работоспособность протокола DHCP и маршрутизации, выполнив ping между всеми VPC.

Сначала выполним команду **ip dhcp** на всех компьютерах.

```
PC1> ip dhcp
DORA IP 192.168.1.2/24 GW 192.168.1.1

PC1> show ip

NAME      : PC1[1]
IP/MASK   : 192.168.1.2/24
GATEWAY   : 192.168.1.1
DNS       : 8.8.8.8
DHCP SERVER : 10.0.0.2
DHCP LEASE  : 86384, 86400/43200/75600
MAC        : 00:50:79:66:68:00
LPORT      : 24959
RHOST:PORT : 127.0.0.1:24960
MTU        : 1500

PC1>
```

Рисунок 4.1 - Получение адреса на PC1

```
PC2> ip dhcp
DDORA IP 192.168.1.3/24 GW 192.168.1.1

PC2> show ip

NAME      : PC2[1]
IP/MASK   : 192.168.1.3/24
GATEWAY   : 192.168.1.1
DNS       : 8.8.8.8
DHCP SERVER : 10.0.0.2
DHCP LEASE  : 86392, 86400/43200/75600
MAC        : 00:50:79:66:68:01
LPORT      : 24961
RHOST:PORT : 127.0.0.1:24962
MTU        : 1500
```

Рисунок 4.2 - Получение адреса на PC2

```
PC3> ip dhcp
DDORA IP 192.168.2.2/24 GW 192.168.2.1

PC3> show ip

NAME      : PC3[1]
IP/MASK   : 192.168.2.2/24
GATEWAY   : 192.168.2.1
DNS       : 8.8.8.8
DHCP SERVER : 10.0.0.2
DHCP LEASE  : 86396, 86400/43200/75600
MAC        : 00:50:79:66:68:02
LPORT      : 24969
RHOST:PORT : 127.0.0.1:24970
MTU        : 1500
```

Рисунок 4.3 - Получение адреса на PC3

```
PC4> ip dhcp
DORA IP 192.168.2.3/24 GW 192.168.2.1

PC4> show ip

NAME      : PC4[1]
IP/MASK   : 192.168.2.3/24
GATEWAY   : 192.168.2.1
DNS       : 8.8.8.8
DHCP SERVER : 10.0.0.2
DHCP LEASE  : 86396, 86400/43200/75600
MAC        : 00:50:79:66:68:03
LPORT      : 24971
RHOST:PORT : 127.0.0.1:24972
MTU        : 1500
```

Рисунок 4.4 - Получение адреса на PC4

Проверим связность со шлюзом, между компьютерами.

```
PC1> ping 192.168.1.1

84 bytes from 192.168.1.1 icmp_seq=1 ttl=255 time=3.677 ms
84 bytes from 192.168.1.1 icmp_seq=2 ttl=255 time=6.235 ms
84 bytes from 192.168.1.1 icmp_seq=3 ttl=255 time=7.136 ms
84 bytes from 192.168.1.1 icmp_seq=4 ttl=255 time=5.769 ms
84 bytes from 192.168.1.1 icmp_seq=5 ttl=255 time=5.040 ms
```

Рисунок 4.5 - Проверка связности PC1 со шлюзом

```

PC1> ping 192.168.1.3

84 bytes from 192.168.1.3 icmp_seq=1 ttl=64 time=5.596 ms
84 bytes from 192.168.1.3 icmp_seq=2 ttl=64 time=2.879 ms
84 bytes from 192.168.1.3 icmp_seq=3 ttl=64 time=0.810 ms
84 bytes from 192.168.1.3 icmp_seq=4 ttl=64 time=0.539 ms
84 bytes from 192.168.1.3 icmp_seq=5 ttl=64 time=7.847 ms

PC1> ping 192.168.2.2

84 bytes from 192.168.2.2 icmp_seq=1 ttl=63 time=23.053 ms
84 bytes from 192.168.2.2 icmp_seq=2 ttl=63 time=18.080 ms
84 bytes from 192.168.2.2 icmp_seq=3 ttl=63 time=16.465 ms
84 bytes from 192.168.2.2 icmp_seq=4 ttl=63 time=16.163 ms
84 bytes from 192.168.2.2 icmp_seq=5 ttl=63 time=15.605 ms

PC1> ping 192.168.2.3

84 bytes from 192.168.2.3 icmp_seq=1 ttl=63 time=24.128 ms
84 bytes from 192.168.2.3 icmp_seq=2 ttl=63 time=22.591 ms
84 bytes from 192.168.2.3 icmp_seq=3 ttl=63 time=11.504 ms
84 bytes from 192.168.2.3 icmp_seq=4 ttl=63 time=15.668 ms
84 bytes from 192.168.2.3 icmp_seq=5 ttl=63 time=16.049 ms

```

Рисунок 4.6 - Проверка связности PC1 с остальными компьютерами

```

PC1> ping 172.16.0.1

84 bytes from 172.16.0.1 icmp_seq=1 ttl=254 time=25.646 ms
84 bytes from 172.16.0.1 icmp_seq=2 ttl=254 time=14.733 ms
84 bytes from 172.16.0.1 icmp_seq=3 ttl=254 time=15.501 ms
84 bytes from 172.16.0.1 icmp_seq=4 ttl=254 time=16.274 ms
84 bytes from 172.16.0.1 icmp_seq=5 ttl=254 time=15.930 ms

```

Рисунок 4.7 - Проверка статической маршрутизации через оба маршрутизатора

5) Перехватить в wireshark диалог одного из VPC с сервером DHCP, разобрать с комментариями

Файл находится в репозитории под названием 5.pcapng

No.	Time	Source	Destination	Protocol	Length	Info
592	838.861556	0.0.0.0	255.255.255.255	DHCP	406	DHCP Discover - Transaction ID 0xa89dc520
593	839.861635	0.0.0.0	255.255.255.255	DHCP	406	DHCP Discover - Transaction ID 0xa89dc520
596	841.555745	192.168.1.1	192.168.1.2	DHCP	342	DHCP Offer - Transaction ID 0xa89dc520
597	841.555763	192.168.1.1	192.168.1.2	DHCP	342	DHCP Offer - Transaction ID 0xa89dc520
600	842.861657	0.0.0.0	255.255.255.255	DHCP	406	DHCP Request - Transaction ID 0xa89dc520
601	842.883966	192.168.1.1	192.168.1.2	DHCP	342	DHCP ACK - Transaction ID 0xa89dc520
690	940.985805	0.0.0.0	255.255.255.255	DHCP	406	DHCP Discover - Transaction ID 0x9fb6f367
692	941.986078	0.0.0.0	255.255.255.255	DHCP	406	DHCP Discover - Transaction ID 0x9fb6f367

DISCOVER

PC1 отправляет DHCP Discover. Transaction ID: 0xa89dc520. Client IP: 0.0.0.0, так как адрес еще не назначен.

```
Message type: Boot Request (1)
Hardware type: Ethernet (0x01)
Hardware address length: 6
Hops: 0
Transaction ID: 0xa89dc520
Seconds elapsed: 0
> Bootp flags: 0x0000 (Unicast)
Client IP address: 0.0.0.0
Your (client) IP address: 0.0.0.0
Next server IP address: 0.0.0.0
Relay agent IP address: 0.0.0.0
Client MAC address: Private_66:68:00 (00:50:79:66:68:00)
Client hardware address padding: 00000000000000000000000000000000
Server host name not given
Boot file name not given
Magic cookie: DHCP
▼ Option: (53) DHCP Message Type (Discover)
    Length: 1
        DHCP: Discover (1)
    > Option: (12) Host Name
    > Option: (61) Client identifier
    > Option: (255) End
    Padding: 0000000000000000000000000000000000000000000000000000000000000000
```

Рисунок 5.1- Пакет Discover

OFFER

DHCP-сервер R2 (10.0.0.2) через relay-agent R1 (192.168.1.1) предлагает адрес 192.168.1.2. В параметрах указаны DNS 8.8.8.8, маска 255.255.255.0. Transaction ID совпадает с Discover.

```
> Internet Protocol Version 4, Src: 192.168.1.1, Dst: 192.168.1.2
> User Datagram Protocol, Src Port: 67, Dst Port: 68
▼ Dynamic Host Configuration Protocol (Offer)
    Message type: Boot Reply (2)
    Hardware type: Ethernet (0x01)
    Hardware address length: 6
    Hops: 0
    Transaction ID: 0xa89dc520
    Seconds elapsed: 0
    > Bootp flags: 0x0000 (Unicast)
    Client IP address: 0.0.0.0
    Your (client) IP address: 192.168.1.2
    Next server IP address: 0.0.0.0
    Relay agent IP address: 192.168.1.1
    Client MAC address: Private_66:68:00 (00:50:79:66:68:00)
    Client hardware address padding: 00000000000000000000000000000000
    Server host name not given
    Boot file name not given
    Magic cookie: DHCP
    ▼ Option: (53) DHCP Message Type (Offer)
        Length: 1
            DHCP: Offer (2)
    > Option: (54) DHCP Server Identifier (10.0.0.2)
    > Option: (51) IP Address Lease Time
    > Option: (58) Default Router
```

Рисунок 5.2- Пакет Offer

```
Magic cookie: DHCP
└ Option: (53) DHCP Message Type (Offer)
    Length: 1
    DHCP: Offer (2)
└ Option: (54) DHCP Server Identifier (10.0.0.2)
    Length: 4
    DHCP Server Identifier: 10.0.0.2
└ Option: (51) IP Address Lease Time
    Length: 4
    IP Address Lease Time: 1 day (86400)
└ Option: (58) Renewal Time Value
    Length: 4
    Renewal Time Value: 12 hours (43200)
└ Option: (59) Rebinding Time Value
    Length: 4
    Rebinding Time Value: 21 hours (75600)
└ Option: (1) Subnet Mask (255.255.255.0)
    Length: 4
    Subnet Mask: 255.255.255.0
└ Option: (3) Router
    Length: 4
    Router: 192.168.1.1
└ Option: (6) Domain Name Server
    Length: 4
    Domain Name Server: 8.8.8.8
└ Option: (255) End
    Option End: 255
Padding: 00000000000000000000000000000000
```

Рисунок 5.3- Пакет Offer

REQUEST

Клиент принимает предложение и отправляет DHCP Request, указывая запрошенный адрес 192.168.1.2 и идентификатор сервера 10.0.0.2.

```
Message type: Boot Request (1)
Hardware type: Ethernet (0x01)
Hardware address length: 6
Hops: 0
Transaction ID: 0xa89dc520
Seconds elapsed: 0
> Bootp flags: 0x0000 (Unicast)
Client IP address: 192.168.1.2
Your (client) IP address: 0.0.0.0
Next server IP address: 0.0.0.0
Relay agent IP address: 0.0.0.0
Client MAC address: Private_66:68:00 (00:50:79:66:68:00)
Client hardware address padding: 000000000000000000000000
Server host name not given
Boot file name not given
Magic cookie: DHCP
▼ Option: (53) DHCP Message Type (Request)
    Length: 1
    DHCP: Request (3)
▼ Option: (54) DHCP Server Identifier (10.0.0.2)
    Length: 4
    DHCP Server Identifier: 10.0.0.2
▼ Option: (50) Requested IP Address (192.168.1.2)
    Length: 4
    Requested IP Address: 192.168.1.2
    ▼ Option: (61) Client identifier
```

Рисунок 5.4- Пакет Request

ACK

Сервер подтверждает аренду адреса 192.168.1.2 для клиента PC1 на 24 часа (Lease time).

```
> User Datagram Protocol, Src Port: 67, Dst Port: 68
▼ Dynamic Host Configuration Protocol (ACK)
    Message type: Boot Reply (2)
    Hardware type: Ethernet (0x01)
    Hardware address length: 6
    Hops: 0
    Transaction ID: 0xa89dc520
    Seconds elapsed: 0
    > Bootp flags: 0x0000 (Unicast)
        Client IP address: 192.168.1.2
        Your (client) IP address: 192.168.1.2
        Next server IP address: 0.0.0.0
        Relay agent IP address: 192.168.1.1
        Client MAC address: Private_66:68:00 (00:50:79:66:68:00)
        Client hardware address padding: 000000000000000000000000
        Server host name not given
        Boot file name not given
        Magic cookie: DHCP
    ▼ Option: (53) DHCP Message Type (ACK)
        Length: 1
        DHCP: ACK (5)
    ▼ Option: (54) DHCP Server Identifier (10.0.0.2)
        Length: 4
        DHCP Server Identifier: 10.0.0.2
    ▼ Option: (51) IP Address Lease Time
        Length: 4
        IP Address Lease Time: 1 day (86400)
    ▼ Option: (58) Renewal Time Value
        Length: 4
        Renewal Time Value: 12 hours (43200)
    ▼ Option: (59) Rebinding Time Value
        Length: 4
        Rebinding Time Value: 21 hours (75600)
    ... Options (1) Subnet Mask (255.255.255.0)
```

Рисунок 5.5- Пакет Ack

6) Сохранить файлы конфигураций устройств в виде набора файлов с именами, соответствующими именам устройств.

Все конфигурации сохранены в папку configs.