

Практика 4

1. Планирование и документирование адресного пространства.

R1 — основной маршрутизатор

R2 - DHCP-сервер

LAN1 — PC1, PC2 через switch1

LAN2 — PC3, PC4 через switch2

LAN3 — R1 и R2

Сеть	Диапазон	Шлюз	Назначение
LAN1	192.168.1.0/24	192.168.1.1	PC1, PC2
LAN2	192.168.2.0/24	192.168.2.1	PC3, PC4
LAN3	192.168.3.0/30		R1, R2

2. Настройка DHCP-сервера (R2) и DHCP-Relay (R1)

Настройка R2:

Интерфейс Fa0/0 (к R1)

```
en
conf t
interface Fa0/0
description Link to R1
ip address 192.168.3.2 255.255.255.252
exit
```

Создание DHCP для LAN1

```
ip dhcp pool LAN1_POOL
network 192.168.1.0 255.255.255.0
domain-name lan1.local
default-router 192.168.1.1
exit
```

Создание DHCP для LAN2

```
ip dhcp pool LAN2_POOL
network 192.168.2.0 255.255.255.0
domain-name lan2.local
default-router 192.168.2.1
exit
```

Исключение из пула адресов шлюза,

```
ip dhcp excluded-address 192.168.1.1
ip dhcp excluded-address 192.168.2.1
```

Настройка статической маршрутизации:

```
ip route 192.168.1.0 255.255.255.0 192.168.3.1
ip route 192.168.2.0 255.255.255.0 192.168.3.1
ip routing
end
write memory
DHCP-pool
```

```
R2#show ip dhcp pool

Pool LAN1_POOL :
  Utilization mark (high/low)      : 100 / 0
  Subnet size (first/next)         : 0 / 0
  Total addresses                   : 254
  Leased addresses                  : 0
  Pending event                    : none
  1 subnet is currently in the pool :
  Current index      IP address range      Leased addresses
  192.168.1.1        192.168.1.1 - 192.168.1.254    0

Pool LAN2_POOL :
  Utilization mark (high/low)      : 100 / 0
  Subnet size (first/next)         : 0 / 0
  Total addresses                   : 254
  Leased addresses                  : 0
  Pending event                    : none
  1 subnet is currently in the pool :
  Current index      IP address range      Leased addresses
  192.168.2.1        192.168.2.1 - 192.168.2.254    0
```

Таблица маршрутизации:

```
R2#show ip route
Codes: 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
       i - IS-IS, su - IS-IS summary, 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

S    192.168.1.0/24 [1/0] via 192.168.3.1
S    192.168.2.0/24 [1/0] via 192.168.3.1
     192.168.3.0/30 is subnetted, 1 subnets
C      192.168.3.0 is directly connected, FastEthernet0/0
```

Настройка R1 (как DHCP-Relay):

```
en
conf t
interface Fa1/0
```

```

description Link to R2
ip address 192.168.3.1 255.255.255.252
no shutdown
exit
interface Fa0/0
description LAN1 to Switch1
ip address 192.168.1.1 255.255.255.0
ip helper-address 192.168.3.2
no shutdown
exit
interface Fa2/0
description LAN2 to Switch2
ip address 192.168.2.1 255.255.255.0
ip helper-address 192.168.3.2
no shutdown
exit
ip routing
end
write memory

```

```

R1#show ip interface brief

```

Interface	IP-Address	OK?	Method	Status	Protocol
FastEthernet0/0	192.168.1.1	YES	manual	up	up
FastEthernet1/0	192.168.3.1	YES	manual	up	up
FastEthernet2/0	192.168.2.1	YES	manual	up	up

3)Проверка DHCP:

Выдача ip адреса ПК1

dhcp

```

PC1> dhcp
DDORA IP 192.168.1.2/24 GW 192.168.1.1
PC1> show ip

```

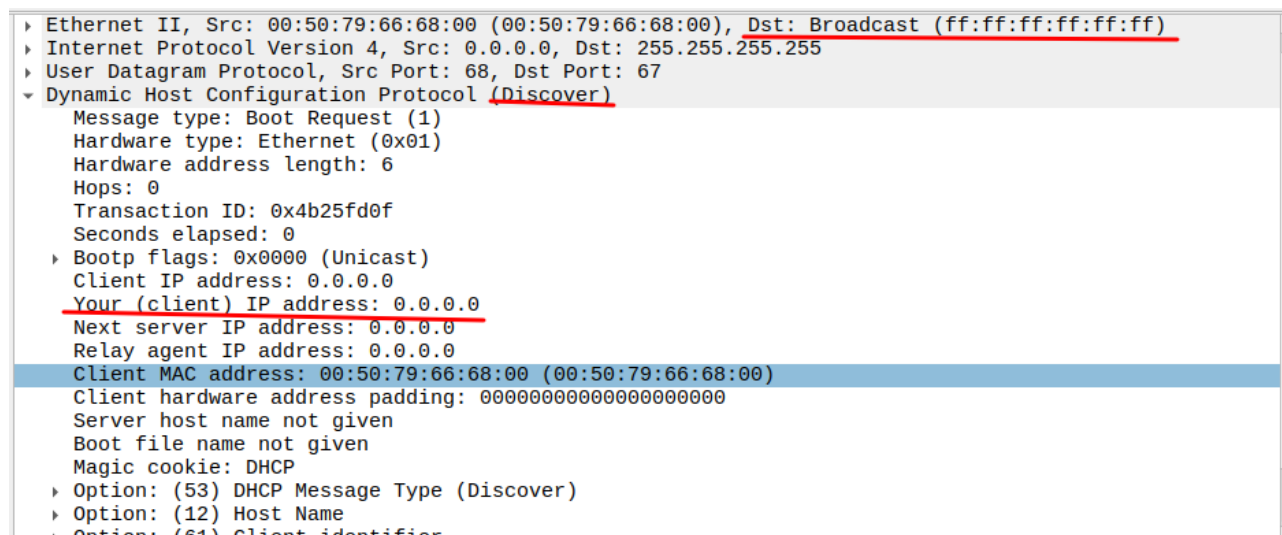
NAME	: PC1[1]
IP/MASK	: 192.168.1.2/24
GATEWAY	: 192.168.1.1
DNS	:
DHCP SERVER	: 192.168.3.2
DHCP LEASE	: 86390, 86400/43200/75600
DOMAIN NAME	: lan1.local
MAC	: 00:50:79:66:68:00
LPORT	: 22126
RHOST:PORT	: 127.0.0.1:22127
MTU	: 1500

DHCP-сервер выдал правильный ip адрес из пула LAN1

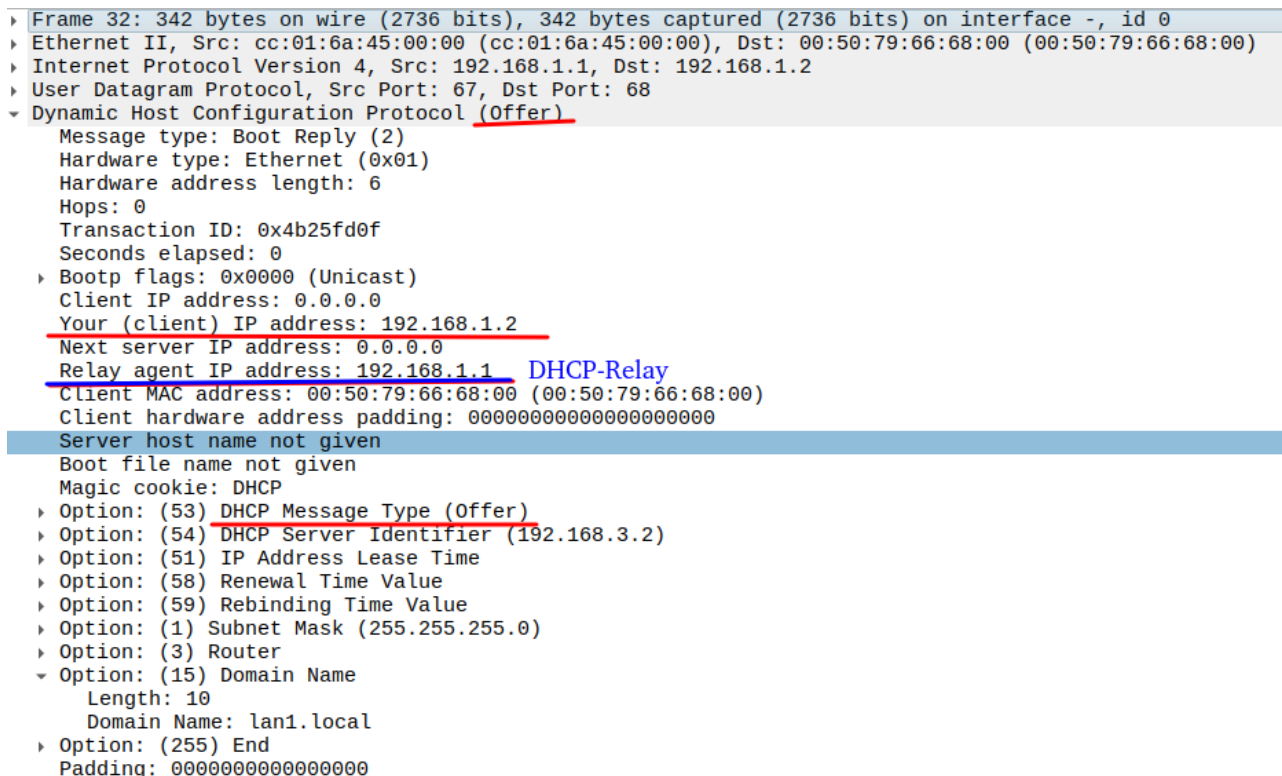
Проверим передачу пакетов в wireshark

29	38.596531	0.0.0.0	255.255.255.255	DHCP	406 DHCP Discover - Transaction ID 0x4b25fd0f
30	38.626947	cc:01:6a:45:00:00	Broadcast	ARP	60 Who has 192.168.1.2? Tell 192.168.1.1
31	40.329025	0c:03:68:8e:00:00	Spanning-tree-(for-...	STP	60 Conf. Root = 32768/1/0c:03:68:8e:00:00 Cost = 0 Port = 0x80...
32	40.339559	192.168.1.1	192.168.1.2	DHCP	342 DHCP Offer - Transaction ID 0x4b25fd0f
33	41.596637	0.0.0.0	255.255.255.255	DHCP	406 DHCP Request - Transaction ID 0x4b25fd0f
34	41.610174	192.168.1.1	192.168.1.2	DHCP	342 DHCP ACK - Transaction ID 0x4b25fd0f

Сначала ПК1 отправляет широковещательный запрос DISCOVER (ищет DHCP-сервер). IP адрес 0.0.0.0, т. к. ПК1 еще не получил адрес от DHCP-сервера.



Затем DHCP-сервер высылает OFFER. выбирает доступный IP-адрес из пула (192.168.1.2) и отправляет его клиенту. R1 служит как DHCP-Relay.



ПК1 посылает REQUEST, он принимает предложение и отправляет серверу запрос на использование предложенных параметров. Ip-адрес все еще 0.0.0.0, т. к. сервер еще не подтвердил запрос.

```

> Frame 33: 406 bytes on wire (3248 bits), 406 bytes captured (3248 bits) on interface -, id 0
> Ethernet II, Src: 00:50:79:66:68:00 (00:50:79:66:68:00), Dst: cc:01:6a:45:00:00 (cc:01:6a:45:00:00)
> Internet Protocol Version 4, Src: 0.0.0.0, Dst: 255.255.255.255
> User Datagram Protocol, Src Port: 68, Dst Port: 67
< Dynamic Host Configuration Protocol (Request)
  Message type: Boot Request (1)
  Hardware type: Ethernet (0x01)
  Hardware address length: 6
  Hops: 0
  Transaction ID: 0x4b25fd0f
  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: 00:50:79:66:68:00 (00:50:79:66:68:00)
  Client hardware address padding: 00000000000000000000
  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 (192.168.3.2)
    Length: 4
    DHCP Server Identifier: 192.168.3.2
  < Option: (50) Requested IP Address (192.168.1.2)
    Length: 4
    Requested IP Address: 192.168.1.2
  < Option: (61) Client identifier
    Length: 7
```

DHCP-сервер посылает ACK, подтверждает запрос и закрепляет у ПК1 выданный ip-адрес.

```

> Frame 34: 342 bytes on wire (2736 bits), 342 bytes captured (2736 bits) on interface -, id 0
> Ethernet II, Src: cc:01:6a:45:00:00 (cc:01:6a:45:00:00), Dst: 00:50:79:66:68:00 (00:50:79:66:68:00)
> 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 (ACK)
  Message type: Boot Reply (2)
  Hardware type: Ethernet (0x01)
  Hardware address length: 6
  Hops: 0
  Transaction ID: 0x4b25fd0f
  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: 00:50:79:66:68:00 (00:50:79:66:68:00)
  Client hardware address padding: 00000000000000000000
  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 (192.168.3.2)
    Length: 4
    DHCP Server Identifier: 192.168.3.2
  < 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)
```

Проверим выдачу ip-адресов на других ПК

ПК2:

dhcp

```
PC2> 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            :
DHCP SERVER    : 192.168.3.2
DHCP LEASE     : 86389, 86400/43200/75600
DOMAIN NAME    : lan1.local
MAC            : 00:50:79:66:68:01
LPORT         : 22128
RHOST:PORT     : 127.0.0.1:22129
MTU            : 1500
```

ПК3:

dhcp

```
PC3> 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            :
DHCP SERVER    : 192.168.3.2
DHCP LEASE     : 86393, 86400/43200/75600
DOMAIN NAME    : lan2.local
MAC            : 00:50:79:66:68:02
LPORT         : 22130
RHOST:PORT     : 127.0.0.1:22131
MTU            : 1500
```

ПК4:

dhcp

```
PC4> dhcp
DDORA 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            :
DHCP SERVER    : 192.168.3.2
DHCP LEASE     : 86393, 86400/43200/75600
DOMAIN NAME    : lan2.local
MAC            : 00:50:79:66:68:03
LPORT          : 22138
RHOST:PORT     : 127.0.0.1:22139
MTU            : 1500
```

DHCP-сервер выдает правильный IP-адреса, можно сделать вывод, что он работает правильно.

4) Проверка ping

Проверка доступности ПК2, ПК3, ПК4 с ПК1

ping 192.168.1.3

ping 192.168.2.2

ping 192.168.2.3

```
PC1> ping 192.168.1.3

84 bytes from 192.168.1.3 icmp_seq=1 ttl=64 time=1.767 ms
84 bytes from 192.168.1.3 icmp_seq=2 ttl=64 time=2.544 ms
84 bytes from 192.168.1.3 icmp_seq=3 ttl=64 time=9.185 ms
84 bytes from 192.168.1.3 icmp_seq=4 ttl=64 time=0.859 ms
84 bytes from 192.168.1.3 icmp_seq=5 ttl=64 time=0.735 ms

PC1> ping 192.168.2.2

84 bytes from 192.168.2.2 icmp_seq=1 ttl=63 time=30.172 ms
84 bytes from 192.168.2.2 icmp_seq=2 ttl=63 time=20.414 ms
84 bytes from 192.168.2.2 icmp_seq=3 ttl=63 time=14.934 ms
84 bytes from 192.168.2.2 icmp_seq=4 ttl=63 time=17.887 ms
84 bytes from 192.168.2.2 icmp_seq=5 ttl=63 time=17.173 ms

PC1> ping 192.168.2.3

84 bytes from 192.168.2.3 icmp_seq=1 ttl=63 time=30.591 ms
84 bytes from 192.168.2.3 icmp_seq=2 ttl=63 time=16.441 ms
84 bytes from 192.168.2.3 icmp_seq=3 ttl=63 time=18.151 ms
84 bytes from 192.168.2.3 icmp_seq=4 ttl=63 time=28.323 ms
84 bytes from 192.168.2.3 icmp_seq=5 ttl=63 time=17.839 ms
```


Проверка доступности ПК1, ПК2, ПК3 с ПК4

ping 192.168.1.2

ping 192.168.1.3

ping 192.168.2.2

```
PC4> ping 192.168.1.2

84 bytes from 192.168.1.2 icmp_seq=1 ttl=63 time=33.212 ms
84 bytes from 192.168.1.2 icmp_seq=2 ttl=63 time=15.696 ms
84 bytes from 192.168.1.2 icmp_seq=3 ttl=63 time=17.001 ms
84 bytes from 192.168.1.2 icmp_seq=4 ttl=63 time=17.880 ms
84 bytes from 192.168.1.2 icmp_seq=5 ttl=63 time=17.992 ms

PC4> ping 192.168.1.3

84 bytes from 192.168.1.3 icmp_seq=1 ttl=63 time=37.644 ms
84 bytes from 192.168.1.3 icmp_seq=2 ttl=63 time=16.655 ms
84 bytes from 192.168.1.3 icmp_seq=3 ttl=63 time=26.587 ms
84 bytes from 192.168.1.3 icmp_seq=4 ttl=63 time=17.765 ms
84 bytes from 192.168.1.3 icmp_seq=5 ttl=63 time=17.280 ms

PC4> ping 192.168.2.2

84 bytes from 192.168.2.2 icmp_seq=1 ttl=64 time=0.444 ms
84 bytes from 192.168.2.2 icmp_seq=2 ttl=64 time=0.696 ms
84 bytes from 192.168.2.2 icmp_seq=3 ttl=64 time=3.567 ms
84 bytes from 192.168.2.2 icmp_seq=4 ttl=64 time=2.798 ms
84 bytes from 192.168.2.2 icmp_seq=5 ttl=64 time=2.237 ms
```

Все ПК успешно пингуются.