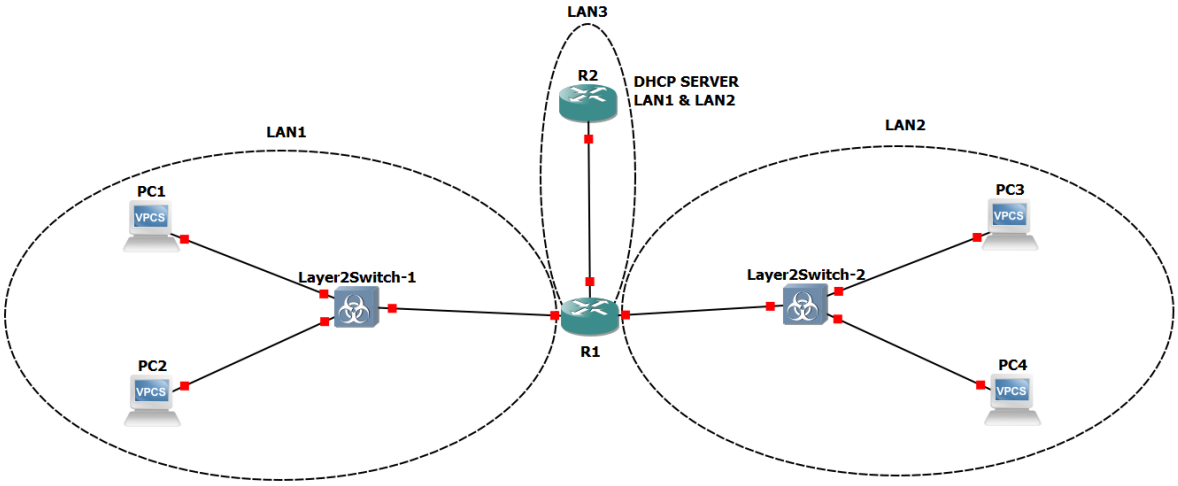
Лабораторная работа №4

«Настройка протокола DHCP»

Перед началом работы была построена следующая сеть:



На следующем этапе были настроены маршрутизаторы R1 и R2. R2 использовался в качестве DHCP сервера, а R1 выступал в качестве связующего звена между подсетями.

R1
configure terminal interface FastEthernet 0/0 ip address 192.168.1.1 255.255.255.0 ip helper-address 192.168.3.1 no shutdown exit interface FastEthernet 1/0 ip address 192.168.2.1 255.255.255.0 ip helper-address 192.168.3.1 no shutdown exit interface Ethernet 2/0 ip address 192.168.3.2 255.255.255.0 no shutdown exit ip routing

ip route 0.0.0.0 0.0.0.0 192.168.3.1

exit
write memory

R2

configure terminal

interface Ethernet 2/0
ip address 192.168.3.1 255.255.255.0
no shutdown
exit

ip dhcp pool LAN1
network 192.168.1.0 255.255.255.0
default-router 192.168.1.1
exit

ip dhcp pool LAN2
network 192.168.2.0 255.255.255.0
default-router 192.168.2.1
exit

ip dhcp excluded-address 192.168.1.1 192.168.1.10
ip dhcp excluded-address 192.168.2.1 192.168.2.10

ip route 192.168.1.0 255.255.255.0 192.168.3.2
ip route 192.168.2.0 255.255.255.0 192.168.3.2

exit
write memory

После настройки на всех PC был получен новый ip.

PC1:

```
PC1> ip dhcp
DDORA IP 192.168.1.13/24 GW 192.168.1.1

PC1> show ip

NAME        : PC1[1]
IP/MASK     : 192.168.1.13/24
GATEWAY     : 192.168.1.1
DNS         :
DHCP SERVER : 192.168.3.1
DHCP LEASE  : 86160, 86400/43200/75600
MAC         : 00:50:79:66:68:00
LPORT       : 22488
RHOST:PORT  : 127.0.0.1:22489
MTU         : 1500
```

PC2:

```
PC2> ip dhcp
DORA IP 192.168.1.12/24 GW 192.168.1.1

PC2> show ip

NAME        : PC2[1]
IP/MASK     : 192.168.1.12/24
GATEWAY     : 192.168.1.1
DNS         :
DHCP SERVER : 192.168.3.1
DHCP LEASE  : 86392, 86400/43200/75600
MAC         : 00:50:79:66:68:02
LPORT       : 22490
RHOST:PORT  : 127.0.0.1:22491
MTU         : 1500
```

PC3:

```
PC3> ip dhcp
DDORA IP 192.168.2.12/24 GW 192.168.2.1

PC3> show ip

NAME        : PC3[1]
IP/MASK     : 192.168.2.12/24
GATEWAY     : 192.168.2.1
DNS         :
DHCP SERVER : 192.168.3.1
DHCP LEASE  : 86067, 86400/43200/75600
MAC         : 00:50:79:66:68:01
LPORT       : 22492
RHOST:PORT  : 127.0.0.1:22493
MTU         : 1500
```

PC4:

```
PC4> ip dhcp
DDORA IP 192.168.2.11/24 GW 192.168.2.1

PC4> show ip

NAME        : PC4[1]
IP/MASK     : 192.168.2.11/24
GATEWAY     : 192.168.2.1
DNS         :
DHCP SERVER : 192.168.3.1
DHCP LEASE  : 86034, 86400/43200/75600
MAC         : 00:50:79:66:68:03
LPORT       : 22494
RHOST:PORT  : 127.0.0.1:22495
MTU         : 1500
```

После этого этапа была проведена проверка связности узлов с помощью команды «ping».

PC1:

```
PC1> ping 192.168.1.12

84 bytes from 192.168.1.12 icmp_seq=1 ttl=64 time=4.727 ms
84 bytes from 192.168.1.12 icmp_seq=2 ttl=64 time=0.740 ms
84 bytes from 192.168.1.12 icmp_seq=3 ttl=64 time=0.618 ms
84 bytes from 192.168.1.12 icmp_seq=4 ttl=64 time=3.528 ms
84 bytes from 192.168.1.12 icmp_seq=5 ttl=64 time=0.617 ms

PC1> ping 192.168.2.11

84 bytes from 192.168.2.11 icmp_seq=1 ttl=63 time=29.838 ms
84 bytes from 192.168.2.11 icmp_seq=2 ttl=63 time=15.097 ms
84 bytes from 192.168.2.11 icmp_seq=3 ttl=63 time=15.098 ms
84 bytes from 192.168.2.11 icmp_seq=4 ttl=63 time=14.653 ms
84 bytes from 192.168.2.11 icmp_seq=5 ttl=63 time=15.682 ms

PC1> ping 192.168.2.12

84 bytes from 192.168.2.12 icmp_seq=1 ttl=63 time=23.267 ms
84 bytes from 192.168.2.12 icmp_seq=2 ttl=63 time=14.785 ms
84 bytes from 192.168.2.12 icmp_seq=3 ttl=63 time=14.930 ms
84 bytes from 192.168.2.12 icmp_seq=4 ttl=63 time=14.584 ms
84 bytes from 192.168.2.12 icmp_seq=5 ttl=63 time=15.119 ms
```

PC2:

```
PC2> ping 192.168.1.13

84 bytes from 192.168.1.13 icmp_seq=1 ttl=64 time=8.787 ms
84 bytes from 192.168.1.13 icmp_seq=2 ttl=64 time=6.202 ms
84 bytes from 192.168.1.13 icmp_seq=3 ttl=64 time=0.603 ms
84 bytes from 192.168.1.13 icmp_seq=4 ttl=64 time=0.573 ms
84 bytes from 192.168.1.13 icmp_seq=5 ttl=64 time=5.002 ms

PC2> ping 192.168.2.11

84 bytes from 192.168.2.11 icmp_seq=1 ttl=63 time=29.554 ms
84 bytes from 192.168.2.11 icmp_seq=2 ttl=63 time=14.276 ms
84 bytes from 192.168.2.11 icmp_seq=3 ttl=63 time=15.046 ms
84 bytes from 192.168.2.11 icmp_seq=4 ttl=63 time=14.581 ms
84 bytes from 192.168.2.11 icmp_seq=5 ttl=63 time=15.249 ms

PC2> ping 192.168.2.12

84 bytes from 192.168.2.12 icmp_seq=1 ttl=63 time=24.399 ms
84 bytes from 192.168.2.12 icmp_seq=2 ttl=63 time=14.612 ms
84 bytes from 192.168.2.12 icmp_seq=3 ttl=63 time=15.455 ms
84 bytes from 192.168.2.12 icmp_seq=4 ttl=63 time=15.040 ms
84 bytes from 192.168.2.12 icmp_seq=5 ttl=63 time=14.693 ms
```

PC3:

```
PC3> ping 192.168.1.12

84 bytes from 192.168.1.12 icmp_seq=1 ttl=63 time=13.062 ms
84 bytes from 192.168.1.12 icmp_seq=2 ttl=63 time=18.765 ms
84 bytes from 192.168.1.12 icmp_seq=3 ttl=63 time=11.490 ms
84 bytes from 192.168.1.12 icmp_seq=4 ttl=63 time=15.071 ms
84 bytes from 192.168.1.12 icmp_seq=5 ttl=63 time=14.872 ms

PC3> ping 192.168.1.13

84 bytes from 192.168.1.13 icmp_seq=1 ttl=63 time=23.801 ms
84 bytes from 192.168.1.13 icmp_seq=2 ttl=63 time=15.210 ms
84 bytes from 192.168.1.13 icmp_seq=3 ttl=63 time=14.905 ms
84 bytes from 192.168.1.13 icmp_seq=4 ttl=63 time=14.332 ms
84 bytes from 192.168.1.13 icmp_seq=5 ttl=63 time=15.222 ms

PC3> ping 192.168.2.11

84 bytes from 192.168.2.11 icmp_seq=1 ttl=64 time=7.506 ms
84 bytes from 192.168.2.11 icmp_seq=2 ttl=64 time=0.632 ms
84 bytes from 192.168.2.11 icmp_seq=3 ttl=64 time=13.274 ms
84 bytes from 192.168.2.11 icmp_seq=4 ttl=64 time=0.675 ms
84 bytes from 192.168.2.11 icmp_seq=5 ttl=64 time=0.623 ms
```

PC4:

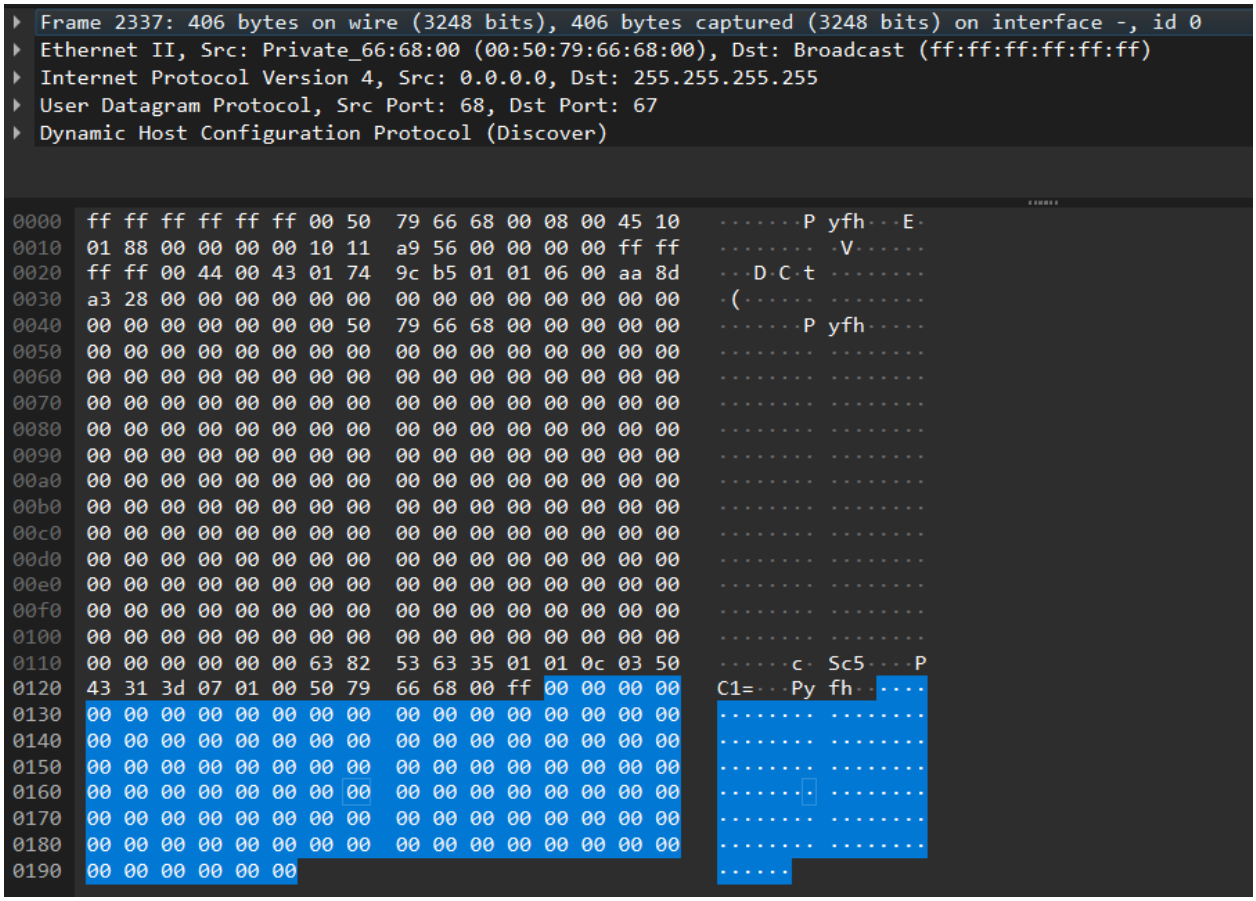
```
PC4> ping 192.168.1.12

84 bytes from 192.168.1.12 icmp_seq=1 ttl=63 time=28.965 ms
84 bytes from 192.168.1.12 icmp_seq=2 ttl=63 time=15.001 ms
84 bytes from 192.168.1.12 icmp_seq=3 ttl=63 time=14.849 ms
84 bytes from 192.168.1.12 icmp_seq=4 ttl=63 time=17.841 ms
84 bytes from 192.168.1.12 icmp_seq=5 ttl=63 time=12.550 ms

PC4> ping 192.168.1.13

84 bytes from 192.168.1.13 icmp_seq=1 ttl=63 time=15.110 ms
84 bytes from 192.168.1.13 icmp_seq=2 ttl=63 time=11.610 ms
84 bytes from 192.168.1.13 icmp_seq=3 ttl=63 time=15.552 ms
84 bytes from 192.168.1.13 icmp_seq=4 ttl=63 time=15.172 ms
84 bytes from 192.168.1.13 icmp_seq=5 ttl=63 time=14.822 ms

PC4> ping 192.168.2.12

84 bytes from 192.168.2.12 icmp_seq=1 ttl=64 time=5.345 ms
84 bytes from 192.168.2.12 icmp_seq=2 ttl=64 time=6.922 ms
84 bytes from 192.168.2.12 icmp_seq=3 ttl=64 time=7.110 ms
84 bytes from 192.168.2.12 icmp_seq=4 ttl=64 time=0.735 ms
84 bytes from 192.168.2.12 icmp_seq=5 ttl=64 time=6.331 ms
```

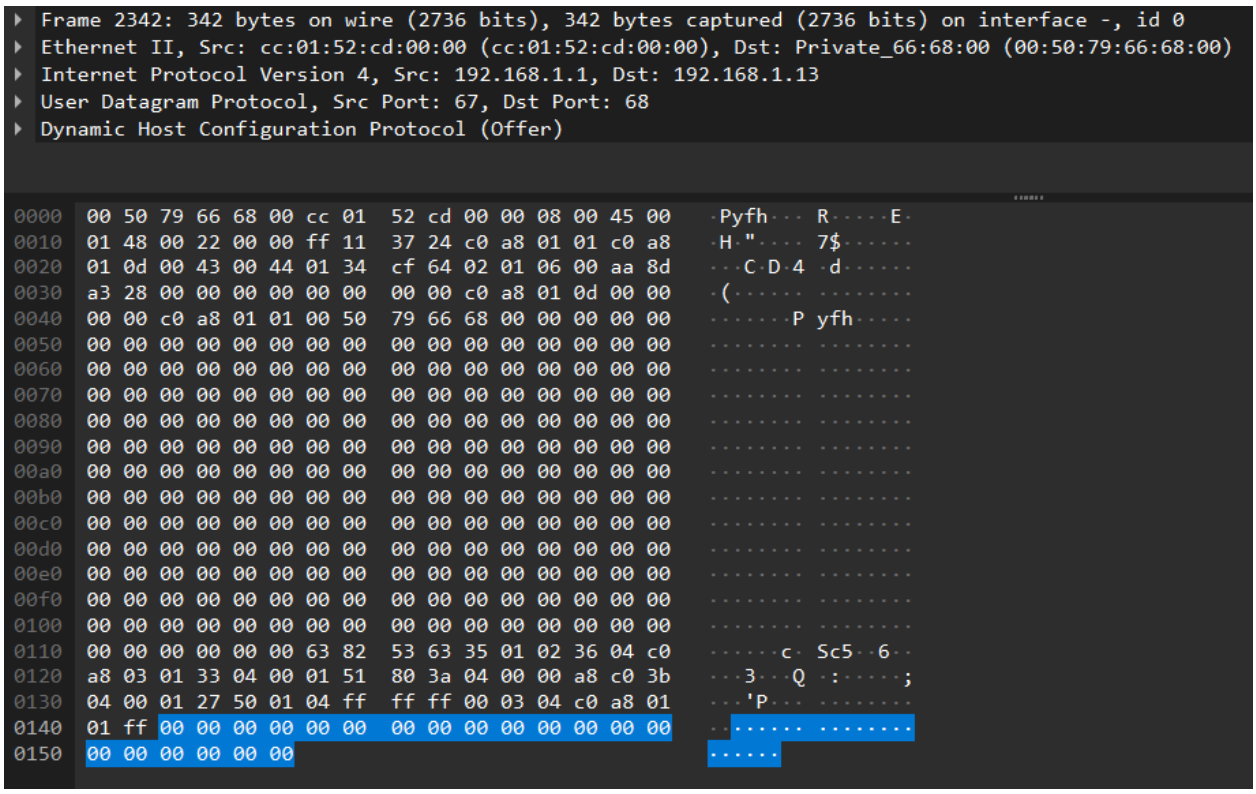
Ниже представлен скриншот диалога PC1 с DHCP сервером в момент запроса нового ip адреса первым.

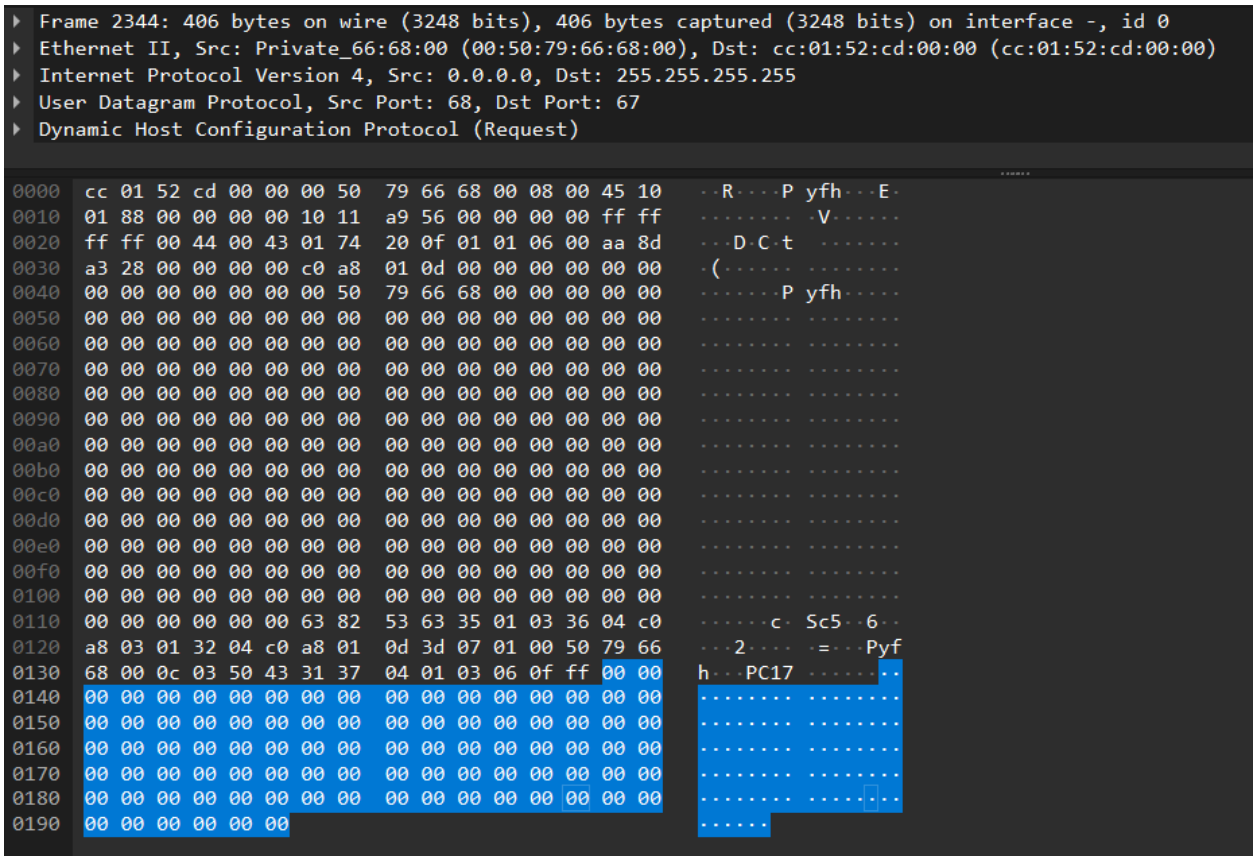
```
2337 3358.881296   0.0.0.0          255.255.255.255      DHCP     406 DHCP Discover - Transaction ID 0xaa8da328
2340 3359.881332   0.0.0.0          255.255.255.255      DHCP     406 DHCP Discover - Transaction ID 0xaa8da328
2341 3360.576779   192.168.1.1      192.168.1.13         DHCP     342 DHCP Offer    - Transaction ID 0xaa8da328
2342 3360.576802   192.168.1.1      192.168.1.13         DHCP     342 DHCP Offer    - Transaction ID 0xaa8da328
2344 3362.881411   0.0.0.0          255.255.255.255      DHCP     406 DHCP Request  - Transaction ID 0xaa8da328
2345 3362.900493   192.168.1.1      192.168.1.13         DHCP     342 DHCP ACK      - Transaction ID 0xaa8da328
```

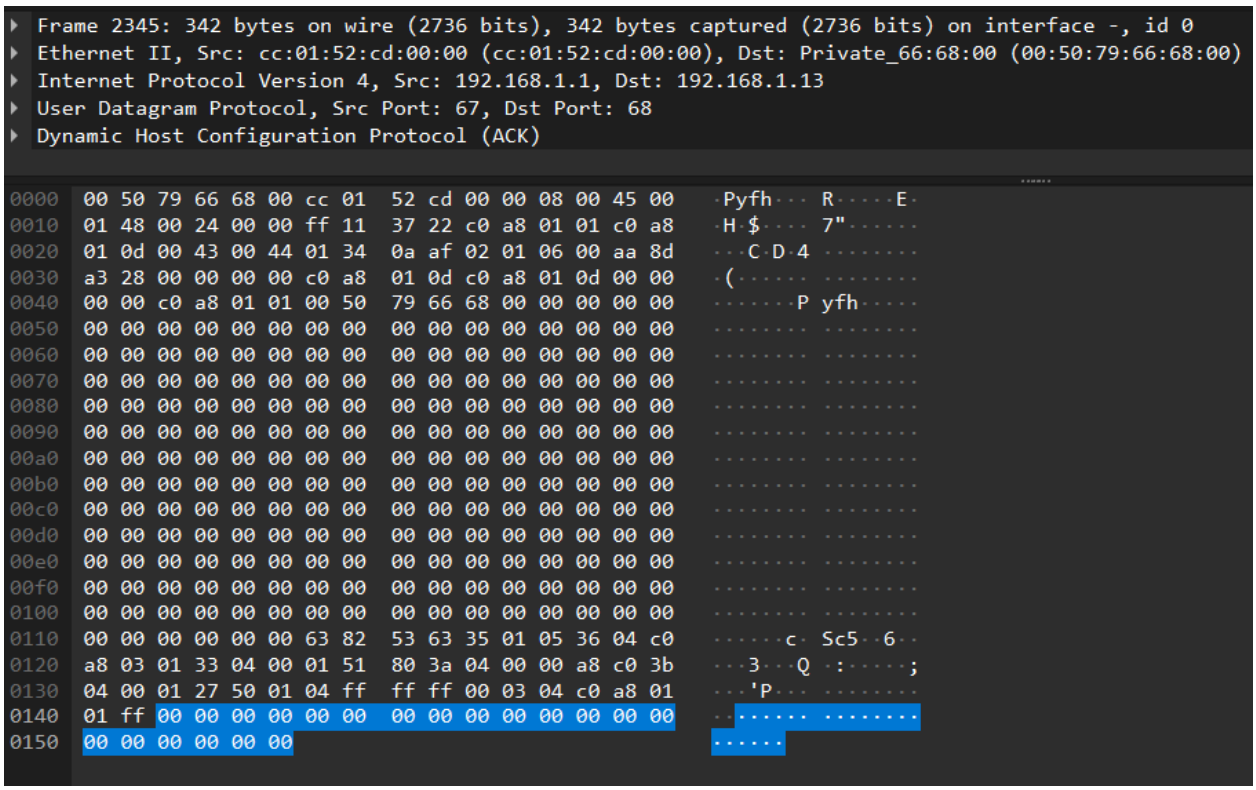
Диалог состоит из 5 пакетов с одинаковым Transaction ID (0xaa8da328). Первые два пакета имеют тип DHCP Discover, с помощью которых клиент ищет сервер. Так как за первую секунду сервер не удалось найти (возможно, из-за задержки), был повторно отправлен DHCP Discover. После этого сервер отправил два пакета, в которых предлагает клиенту ip (DHCP Offer), R1 переслал пакет дважды, так как до этого получил два DHCP Discover. После получения DHCP Offer клиент единожды подтвердил его с помощью DHCP Request. В конце данного диалога клиент получает подтверждение на использование нового ip от сервера (DHCP ACK).

Ниже представлены скриншоты данных пакетов.




Frame 2342: 342 bytes on wire (2736 bits), 342 bytes captured (2736 bits) on interface -, id 0
Ethernet II, Src: cc:01:52:cd:00:00 (cc:01:52:cd:00:00), Dst: Private_66:68:00 (00:50:79:66:68:00)
Internet Protocol Version 4, Src: 192.168.1.1, Dst: 192.168.1.13
User Datagram Protocol, Src Port: 67, Dst Port: 68
Dynamic Host Configuration Protocol (Offer)
0000 00 50 79 66 68 00 cc 01 52 cd 00 00 08 00 45 00
0010 01 48 00 22 00 00 ff 11 37 24 c0 a8 01 01 c0 a8
0020 01 0d 00 43 00 44 01 34 cf 64 02 01 06 00 aa 8d
0030 a3 28 00 00 00 00 00 00 00 00 c0 a8 01 0d 00 00
0040 00 00 c0 a8 01 01 00 50 79 66 68 00 00 00 00 00
0050 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0060 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0070 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0080 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0090 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00c0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00d0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00e0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00f0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0100 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0110 00 00 00 00 00 00 63 82 53 63 35 01 02 36 04 c0
0120 a8 03 01 33 04 00 01 51 80 3a 04 00 00 a8 c0 3b
0130 04 00 01 27 50 01 04 ff ff ff 00 03 04 c0 a8 01
0140 01 ff 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0150 00 00 00 00 00 00


Frame 2344: 406 bytes on wire (3248 bits), 406 bytes captured (3248 bits) on interface -, id 0
Ethernet II, Src: Private_66:68:00 (00:50:79:66:68:00), Dst: cc:01:52:cd:00:00 (cc:01:52:cd: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)
0000 cc 01 52 cd 00 00 00 50 79 66 68 00 08 00 45 10
0010 01 88 00 00 00 00 10 11 a9 56 00 00 00 00 ff ff
0020 ff ff 00 44 00 43 01 74 20 0f 01 01 06 00 aa 8d
0030 a3 28 00 00 00 00 c0 a8 01 0d 00 00 00 00 00 00
0040 00 00 00 00 00 00 00 50 79 66 68 00 00 00 00 00
0050 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0060 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0070 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0080 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0090 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00c0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00d0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00e0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00f0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0100 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0110 00 00 00 00 00 00 63 82 53 63 35 01 03 36 04 c0
0120 a8 03 01 32 04 c0 a8 01 0d 3d 07 01 00 50 79 66
0130 68 00 0c 03 50 43 31 37 04 01 03 06 0f ff 00 00
0140 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0150 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0160 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0170 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0180 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0190 00 00 00 00 00 00


Frame 2345: 342 bytes on wire (2736 bits), 342 bytes captured (2736 bits) on interface -, id 0
Ethernet II, Src: cc:01:52:cd:00:00 (cc:01:52:cd:00:00), Dst: Private_66:68:00 (00:50:79:66:68:00)
Internet Protocol Version 4, Src: 192.168.1.1, Dst: 192.168.1.13
User Datagram Protocol, Src Port: 67, Dst Port: 68
Dynamic Host Configuration Protocol (ACK)
0000 00 50 79 66 68 00 cc 01 52 cd 00 00 08 00 45 00
0010 01 48 00 24 00 00 ff 11 37 22 c0 a8 01 01 c0 a8
0020 01 0d 00 43 00 44 01 34 0a af 02 01 06 00 aa 8d
0030 a3 28 00 00 00 00 c0 a8 01 0d c0 a8 01 0d 00 00
0040 00 00 c0 a8 01 01 00 50 79 66 68 00 00 00 00 00
0050 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0060 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0070 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0080 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0090 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00c0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00d0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00e0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00f0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0100 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0110 00 00 00 00 00 00 63 82 53 63 35 01 05 36 04 c0
0120 a8 03 01 33 04 00 01 51 80 3a 04 00 00 a8 c0 3b
0130 04 00 01 27 50 01 04 ff ff ff 00 03 04 c0 a8 01
0140 01 ff 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0150 00 00 00 00 00 00