

Назначение ip-адресов для ПК, связанных с коммутатором:

```
PC1> ip 192.168.1.1
Checking for duplicate address...
PC1 : 192.168.1.1 255.255.255.0

PC1> show ip

NAME      : PC1[1]
IP/MASK   : 192.168.1.1/24
GATEWAY   : 0.0.0.0
DNS       :
MAC       : 00:50:79:66:68:02
LPORT     : 20138
RHOST:PORT: 127.0.0.1:20139
MTU       : 1500
```

```
PC2> ip 192.168.1.2
Checking for duplicate address...
PC2 : 192.168.1.2 255.255.255.0

PC2> show ip

NAME      : PC2[1]
IP/MASK   : 192.168.1.2/24
GATEWAY   : 0.0.0.0
DNS       :
MAC       : 00:50:79:66:68:03
LPORT     : 20140
RHOST:PORT: 127.0.0.1:20141
MTU       : 1500
```

ping PC1:

```
PC1> ping 192.168.1.2

84 bytes from 192.168.1.2 icmp_seq=1 ttl=64 time=15.234 ms
84 bytes from 192.168.1.2 icmp_seq=2 ttl=64 time=7.077 ms
84 bytes from 192.168.1.2 icmp_seq=3 ttl=64 time=7.407 ms
84 bytes from 192.168.1.2 icmp_seq=4 ttl=64 time=0.582 ms
84 bytes from 192.168.1.2 icmp_seq=5 ttl=64 time=6.489 ms
```

ping PC2:

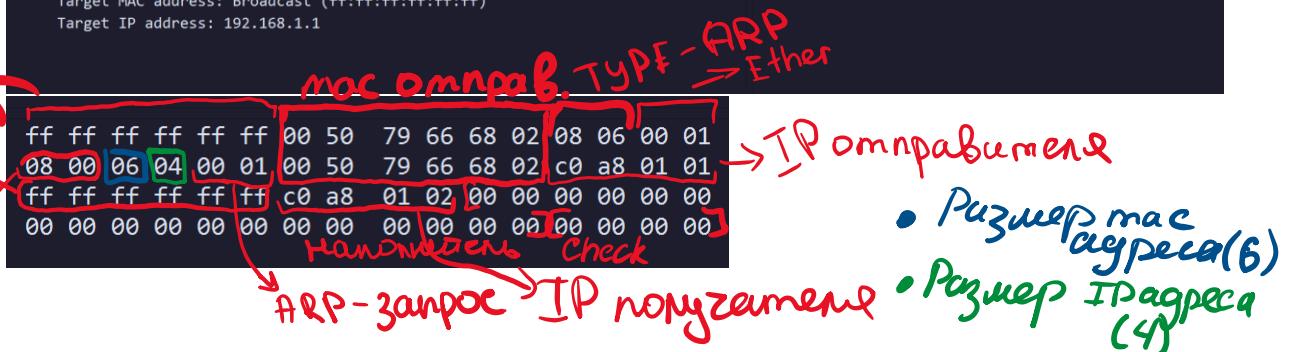
```
PC2> ping 192.168.1.1

84 bytes from 192.168.1.1 icmp_seq=1 ttl=64 time=6.273 ms
84 bytes from 192.168.1.1 icmp_seq=2 ttl=64 time=6.727 ms
84 bytes from 192.168.1.1 icmp_seq=3 ttl=64 time=5.130 ms
84 bytes from 192.168.1.1 icmp_seq=4 ttl=64 time=0.558 ms
84 bytes from 192.168.1.1 icmp_seq=5 ttl=64 time=0.562 ms
```

ARP запрос PC2:

Time	Source	Destination	Type	Length	Info
19 23.161912	Private_66:68:03	Broadcast	ARP	64	Who has 192.168.1.1? Tell 192.168.1.2
20 23.161985	Private_66:68:02	Private_66:68:03	ARP	64	192.168.1.1 is at 00:50:79:66:68:02

> Frame 19: 64 bytes on wire (512 bits), 64 bytes captured (512 bits)
 ✓ Ethernet II, Src: Private_66:68:03 (00:50:79:66:68:03), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
 > Destination: Broadcast (ff:ff:ff:ff:ff:ff)
 > Source: Private_66:68:03 (00:50:79:66:68:03)
 Type: ARP (0x0806)
 Padding: 00000000000000000000000000000000
 Frame check sequence: 0x00000000 [unverified]
 [FCS Status: Unverified]
 ✓ Address Resolution Protocol (request)
 Hardware type: Ethernet (1)
 Protocol type: IPv4 (0x0800)
 Hardware size: 6
 Protocol size: 4
 Opcode: request (1)
 Sender MAC address: Private_66:68:03 (00:50:79:66:68:03)
 Sender IP address: 192.168.1.2
 Target MAC address: Broadcast (ff:ff:ff:ff:ff:ff)
 Target IP address: 192.168.1.1



ARP ответ PC2:

```
20 23.161985      Private_66:68:02  [Private_66:68:03] ARP      64 192.168.1.1 is at 00:50:79:66:68:02

> Frame 20: 64 bytes on wire (512 bits), 64 bytes captured (512 bits)
└ Ethernet II, Src: Private_66:68:02 (00:50:79:66:68:02), Dst: Private_66:68:03 (00
  > Destination: Private_66:68:03 (00:50:79:66:68:03)
  > Source: Private_66:68:02 (00:50:79:66:68:02)
  Type: ARP (0x0806)
  Padding: 0000000000000000000000000000000000000000000000000000000000000000
  Frame check sequence: 0x00000000 [unverified]
  [FCS Status: Unverified]

└ Address Resolution Protocol (reply)
  Hardware type: Ethernet (1)
  Protocol type: IPv4 (0x0800)
  Hardware size: 6
  Protocol size: 4
  Opcode: reply (2)
  Sender MAC address: Private_66:68:02 (00:50:79:66:68:02)
  Sender IP address: 192.168.1.1
  Target MAC address: Private_66:68:03 (00:50:79:66:68:03)
  Target IP address: 192.168.1.2

mac noyz MAC Omnpab. Type - ARP EtherNet
ARP Omnpab. IP Omnpabut. IP noyzcamena Check

|    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 00 | 50 | 79 | 66 | 68 | 02 | 00 | 50 | 79 | 66 | 68 | 03 | 08 | 06 | 00 | 01 |
| 08 | 00 | 06 | 04 | 00 | 02 | 00 | 50 | 79 | 66 | 68 | 03 | c0 | a8 | 01 | 02 |
| 00 | 50 | 79 | 66 | 68 | 02 | c0 | a8 | 01 | 01 | 00 | 00 | 00 | 00 | 00 | 00 |
| 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |



- Размер mac адреса
- Размер IP адреса (4)

```

Назначение ip-адресов для ПК, связанных с маршрутизатором:

```
PC3> ip 192.168.1.3 192.168.1.1
Checking for duplicate address...
PC3 : 192.168.1.3 255.255.255.0 gateway 192.168.1.1

PC3> show ip

NAME      : PC3[1]
IP/MASK   : 192.168.1.3/24
GATEWAY   : 192.168.1.1
DNS       :
MAC       : 00:50:79:66:68:01
LPORT     : 20146
RHOST:PORT : 127.0.0.1:20147
MTU       : 1500
```

```
PC4> ip 192.168.2.4 192.168.2.1  
Checking for duplicate address...  
PC4 : 192.168.2.4 255.255.255.0 gateway 192.168.2.1
```

```
PC4> show ip
```

NAME	:	PC4[1]
IP/MASK	:	192.168.2.4/24
GATEWAY	:	192.168.2.1
DNS	:	
MAC	:	00:50:79:66:68:00
LPORT	:	20148
RHOST:PORT	:	127.0.0.1:20149
MTU	:	1500

ARP на линке между PC4 и маршрутизатором.

```

33 216.514466  Private_66:68:00      Broadcast      ARP      64 Who has 192.168.2.1? Tell 192.168.2.4
34 216.520251  cc:01:28:f6:00:10    Private_66:68:00  ARP      60 192.168.2.1 is at cc:01:28:f6:00:10

> Frame 33: 64 bytes on wire (512 bits), 64 bytes captured (512 bits)
  Ethernet II, Src: Private_66:68:00 (00:50:79:66:68:00), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
    > Destination: Broadcast (ff:ff:ff:ff:ff:ff)
    > Source: Private_66:68:00 (00:50:79:66:68:00)
    Type: ARP (0x0806)
    Padding: 00000000000000000000000000000000
    Frame check sequence: 0x00000000 [unverified]
    [FCS Status: Unverified]

  Address Resolution Protocol (request)
    Hardware type: Ethernet (1)
    Protocol type: IPv4 (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: request (1)
    Sender MAC address: Private_66:68:00 (00:50:79:66:68:00)
    Sender IP address: 192.168.2.4
    Target MAC address: Broadcast (ff:ff:ff:ff:ff:ff)
    Target IP address: 192.168.2.1

mac назыв. mac Омправ. Type - ARP EtherNet
IPV4 mac назыв. IP Омправит.

ARP запрос IP назначения
ARP запрос IP назначения
  
```

- Размер mac адресса(6)
- Размер IP адресса (4)

```

34 216.520251  cc:01:28:f6:00:10    Private_66:68:00  ARP      60 192.168.2.1 is at cc:01:28:f6:00:10

> Frame 34: 60 bytes on wire (480 bits), 60 bytes captured (480 bits)
  Ethernet II, Src: cc:01:28:f6:00:10 (cc:01:28:f6:00:10), Dst: Private_66:68:00 (00:50:79:66:68:00)
    > Destination: Private_66:68:00 (00:50:79:66:68:00)
    > Source: cc:01:28:f6:00:10 (cc:01:28:f6:00:10)
    Type: ARP (0x0806)
    Padding: 00000000000000000000000000000000

  Address Resolution Protocol (reply)
    Hardware type: Ethernet (1)
    Protocol type: IPv4 (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: reply (2)
    Sender MAC address: cc:01:28:f6:00:10 (cc:01:28:f6:00:10)
    Sender IP address: 192.168.2.1
    Target MAC address: Private_66:68:00 (00:50:79:66:68:00)
    Target IP address: 192.168.2.4

mac назыв. mac Омправ. Type - ARP EtherNet
IPV4 mac назыв. IP Омправит.

ARP ответ IP назначения
ARP ответ IP назначения
  
```

- Размер mac адресса(6)
- Размер IP адресса (4)

ICMP request и reply:

```

Frame 89: 98 bytes on wire (784 bits), 98 bytes captured (784 bits)
Ethernet II, Src: Private_66:68:00 (00:50:79:66:68:00), Dst: cc:01:28:f6:00:10 (cc:01:28:f6:00:10)
  Destination: cc:01:28:f6:00:10 (cc:01:28:f6:00:10)
  Source: Private_66:68:00 (00:50:79:66:68:00)
  Type: IPv4 (0x0800)
Internet Protocol Version 4, Src: 192.168.2.4, Dst: 192.168.1.3
  0100 .... = Version: 4
  .... 0101 = Header Length: 20 bytes (5)
  Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
  Total Length: 84
  Identification: 0x86d5 (34517)
  000.... = Flags: 0x0
  ...0 0000 0000 0000 = Fragment Offset: 0
  Time to Live: 64
  Protocol: ICMP (1)
  Header Checksum: 0x6f7c [validation disabled]
  [Header checksum status: Unverified]
  Source Address: 192.168.2.4
  Destination Address: 192.168.1.3
Internet Control Message Protocol
  Type: 8 (Echo (ping) request)
  Code: 0
  Checksum: 0x4980 [correct]
  [Checksum Status: Good]
  Identifier (BE): 54918 (0xd686)
  Identifier (LE): 34518 (0x86d6)
  Sequence Number (BE): 5 (0x0005)
  Sequence Number (LE): 1280 (0x0500)
  [Response frame: 99]
Data (56 bytes)
  Data: 08090a0b0c0d0e0f10112131415161718191a1b1c1d1e1f202122232425262728292e
  [Length: 56]

```

mac-
 адрес
 получателя
 ID
 пакета
 ICMP
 запрос

TTL
 mac отправ. IP
 IP траф.
 DSF
 Check
 номер
 последов.

```

cc 01 28 f6 00 10 00 50 79 66 68 00 08 00 45 00
00 54 86 d5 00 00 40 01 6f 7c c0 a8 02 04 c0 a8
01 03 08 00 49 80 d6 86 00 05 08 09 0a 0b 0c 0d
0e 0f 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d
1e 1f 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d
2e 2f 30 31 32 33 34 35 36 37 38 39 3a 3b 3c 3d
3e 3f  DATA

```

- Версия IP(4)
- Длина заголовка 4·5=20 байтров
- Сигн.
- ICMP протокол

```

> Frame 90: 98 bytes on wire (784 bits), 98 bytes captured (784 bits)
  Ethernet II, Src: cc:01:28:f6:00:10 (cc:01:28:f6:00:10), Dst: Private_66:68:00 (0
    > Destination: Private_66:68:00 (00:50:79:66:68:00)
    > Source: cc:01:28:f6:00:10 (cc:01:28:f6:00:10)
      Type: IPv4 (0x0800)
  Internet Protocol Version 4, Src: 192.168.1.3, Dst: 192.168.2.4
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
  Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
    Total Length: 84
    Identification: 0x86d5 (34517)
    000. .... = Flags: 0x0
    ...0 0000 0000 0000 = Fragment Offset: 0
    Time to Live: 63
    Protocol: ICMP (1)
    Header Checksum: 0x707c [validation disabled]
    [Header checksum status: Unverified]
    Source Address: 192.168.1.3
    Destination Address: 192.168.2.4
  Internet Control Message Protocol
    Type: 0 (Echo (ping) reply)
    Code: 0
    Checksum: 0x5180 [correct]
    [Checksum Status: Good]
    Identifier (BE): 54918 (0xd686)
    Identifier (LE): 34518 (0x86d6)
    Sequence Number (BE): 5 (0x0005)
    Sequence Number (LE): 1280 (0x0500)
    [Request frame: 89]
    [Response time: 15.267 ms]
  Data (56 bytes)
    Data: 08090a0b0c0d0e0f101112131415161718191a1b1c1d1e1f202122232425262728292e
    [Length: 56]

```

TTL

mac omanab.IPV4 DSF

- Версия IP(4)
 - Длина заголовка
 - $4 \cdot 5 = 20$ байтов
 - Символ
 - ICMP
протокол

00 50 79 66 68 00 cc 01 28 f6 00 10 08 00 45 00
00 54 86 d5 00 00 3f e1 70 7c c0 a8 01 03 c0 a8
02 04 00 00 51 80 d6 86 00 05 08 09 0a 0b 0c 0d
0e 0f 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d
1e 1f 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d
2e 2f 30 31 32 33 34 35 36 37 38 39 3a 3b 3c 3d
3e 3f 2 D A M M B L E