

Настройки ПК:

Ip-адреса:

PC1 – 192.168.1.1

PC2 – 192.168.1.2

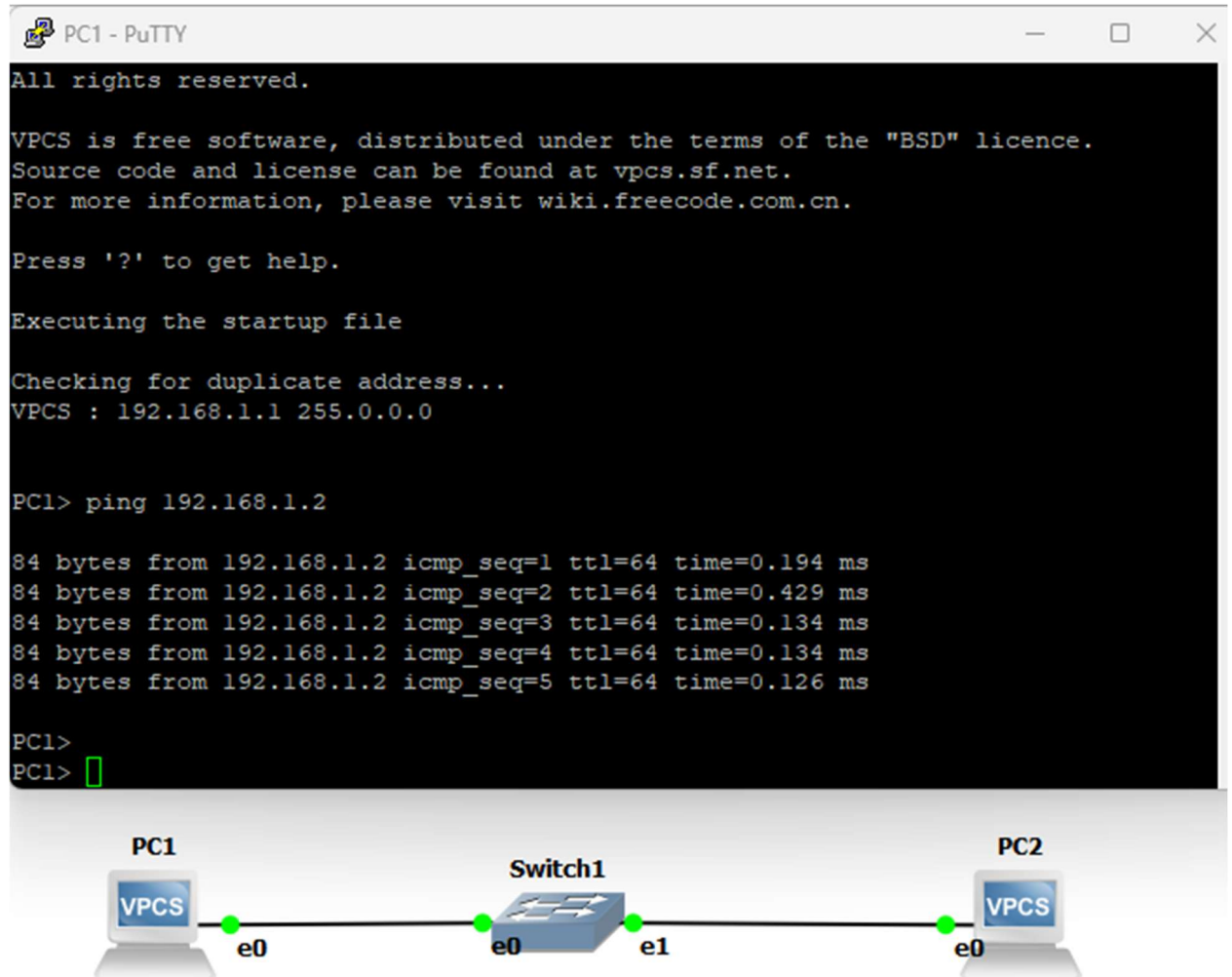


Рисунок 1 – проверка достижимости PC2 через SW1

Настройки интерфейсов:

PC1 – 192.168.1.1

PC2 – 192.168.2.1

R1 – 192.168.1.2; 192.168.2.2

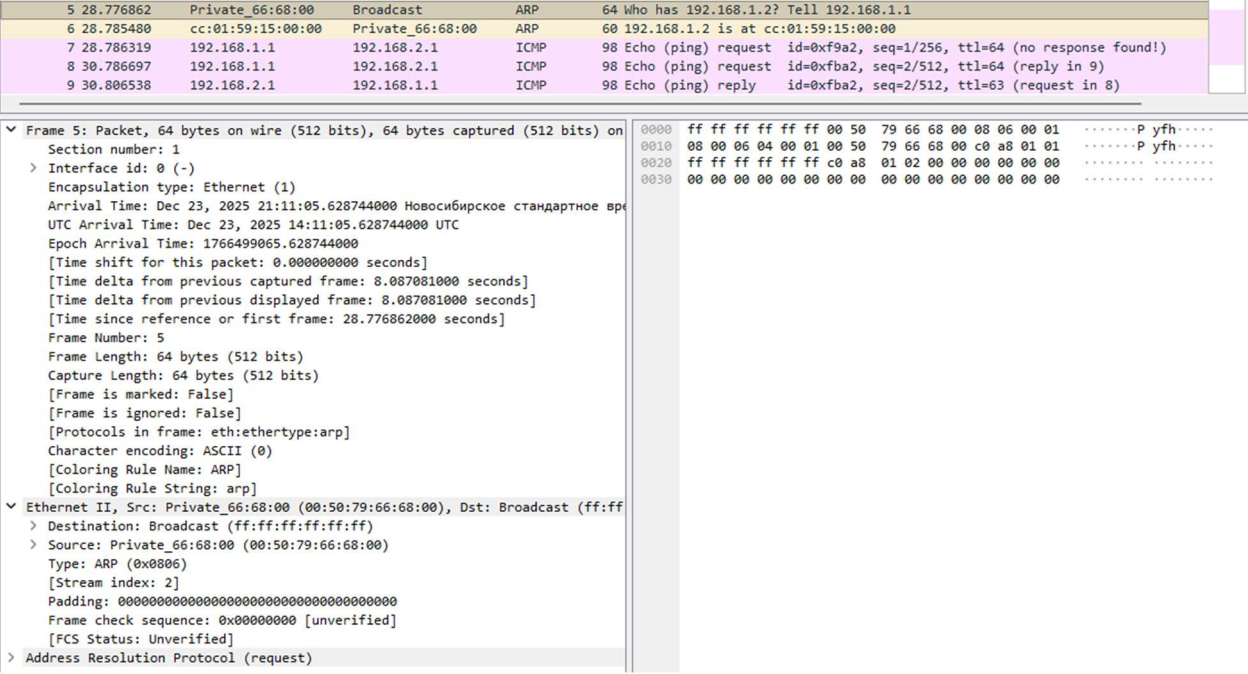


Рисунок 5 – ARP-кадр для поиска PC2 между PC1 и R1

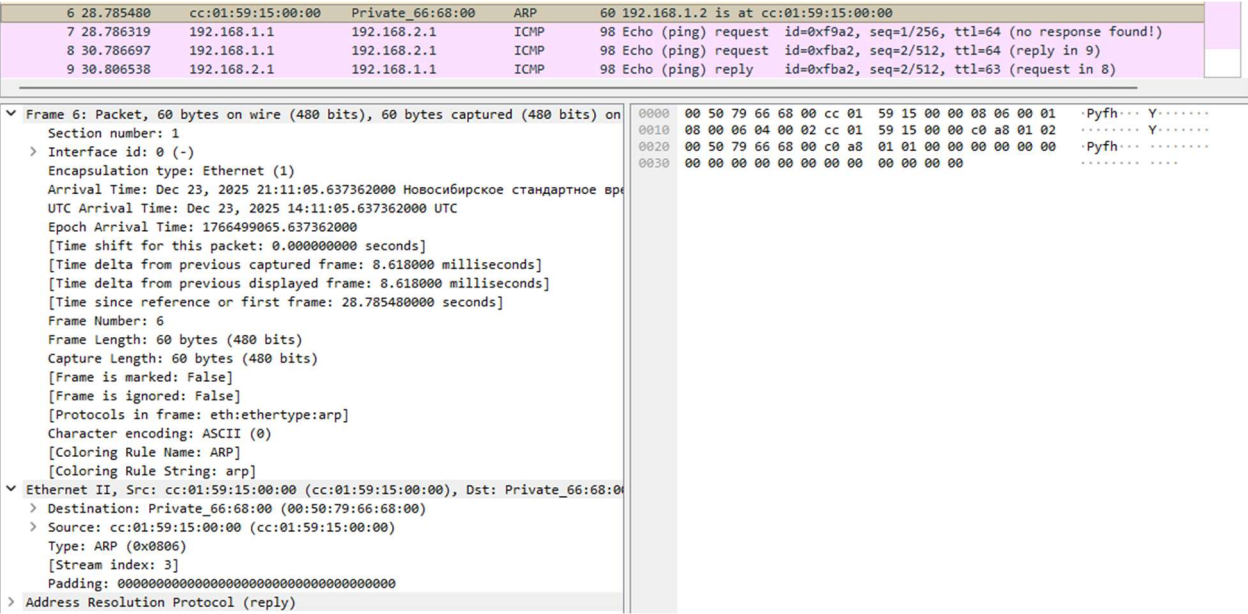


Рисунок 6 – Ответный ARP-кадр между PC1 и R1

	8	30.786697	192.168.1.1	192.168.2.1	ICMP	98 Echo (ping) request	id=0xfba2, seq=2/512, ttl=64 (reply in 8)
<--	9	30.806538	192.168.2.1	192.168.1.1	ICMP	98 Echo (ping) reply	id=0xfba2, seq=2/512, ttl=63 (request in 8)

No.	Time	Source	Destination	Protocol	Length	Info
>	Frame 8:	Packet, 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on Ethernet II, Src: Private_66:68:00 (00:50:79:66:68:00), Dst: cc:01:59:15:00:00				
>	Destination: cc:01:59:15:00:00 (cc:01:59:15:00:00)					
>	Source: Private_66:68:00 (00:50:79:66:68:00)					
	Type: IPv4 (0x0800)					
	[Stream index: 3]					
>	Internet Protocol Version 4, Src: 192.168.1.1, Dst: 192.168.2.1					
	0100 = Version: 4					
	.... 0101 = Header Length: 20 bytes (5)					
>	Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)					
	Total Length: 84					
	Identification: 0xa2fa (41722)					
>	000. = Flags: 0x0					
	...0 0000 0000 0000 = Fragment Offset: 0					
	Time to Live: 64					
	Protocol: ICMP (1)					
	Header Checksum: 0x535c [validation disabled]					
	[Header checksum status: Unverified]					
	Source Address: 192.168.1.1					
	Destination Address: 192.168.2.1					
	[Stream index: 0]					
>	Internet Control Message Protocol					
	Type: Echo (ping) request (8)					
	Code: 0					
	Checksum: 0x2467 [correct]					
	[Checksum Status: Good]					
	Identifier (BE): 64418 (0xfba2)					
	Identifier (LE): 41723 (0xa2fb)					
	Sequence Number (BE): 2 (0x0002)					
	Sequence Number (LE): 512 (0x0200)					
	[Response frame: 9]					
>	Data (56 bytes)					

Рисунок 7 – Исходящий ICMP-пакет между PC1 и R1

	9 30.806538	192.168.2.1	192.168.1.1	ICMP	98 Echo (ping) reply	id=0xfb2, seq=2/512, ttl=63 (request in 8)	
	10 30.937290	cc:01:59:15:00:00	cc:01:59:15:00:00	LOOP	60 Reply		
> Frame 9: Packet, 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on	0000	00 50 79 66 68 00 cc 01 59 15 00 00 08 00 45 00	Pyfh...Y.....E.				
✓ Ethernet II, Src: cc:01:59:15:00:00 (cc:01:59:15:00:00), Dst: Private_66:68:00:66:68:00 (00:50:79:66:68:00)	0010	00 54 a2 fa 00 00 3f 01 54 5c c0 a8 02 01 c0 a8	T.....?: T\.....				
Destination: Private_66:68:00 (00:50:79:66:68:00)	0020	01 01 00 00 2c 67 fb a2 00 02 08 09 0a 0b 0c 0d	.....g.....			
... .. = LG bit: Globally unique address (factory default)	0030	0e 0f 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d	.....			
... .. = IG bit: Individual address (unicast)	0040	1e 1f 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d	..!""\$%&'()*+,-./012345 6789:<=>				
Source: cc:01:59:15:00:00 (cc:01:59:15:00:00)	0050	2e 2f 30 31 32 33 34 35 36 37 38 39 3a 3b 3c 3d	>?				
... .. = LG bit: Globally unique address (factory default)	0060	3e 3f					
... .. = IG bit: Individual address (unicast)							
Type: IPv4 (0x0800)							
[Stream index: 3]							
✓ Internet Protocol Version 4, Src: 192.168.2.1, Dst: 192.168.1.1							
0100 = Version: 4							
.... 0101 = Header Length: 20 bytes (5)							
> Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)							
Total Length: 84							
Identification: 0xa2fa (41722)							
> 000. = Flags: 0x0							
...0 0000 0000 0000 = Fragment Offset: 0							
Time to Live: 63							
Protocol: ICMP (1)							
Header Checksum: 0x545c [validation disabled]							
[Header checksum status: Unverified]							
Source Address: 192.168.2.1							
Destination Address: 192.168.1.1							
[Stream index: 0]							
✓ Internet Control Message Protocol							
Type: Echo (ping) reply (0)							
Code: 0							
Checksum: 0x2c67 [correct]							
[Checksum Status: Good]							
Identifier (BE): 64418 (0xfb2)							
Identifier (LE): 41723 (0xa2fb)							
Sequence Number (BE): 2 (0x0002)							
Sequence Number (LE): 512 (0x0200)							
[Request frame: 8]							
[Response time: 19,841 ms]							
> Data (56 bytes)							

Рисунок 8 – Ответный ICMP-пакет между PC1 и R1

4	18.375193	cc:01:59:15:00:10	Broadcast	ARP	60	Who has 192.168.2.1? Tell 192.168.2.2
5	18.375246	Private_66:68:01	cc:01:59:15:00:10	ARP	60	192.168.2.1 is at 00:50:79:66:68:01
6	20.376104	192.168.1.1	192.168.2.1	ICMP	98	Echo (ping) request id=0xfba2, seq=2/512, ttl=63 (reply in 7)
7	20.376171	192.168.2.1	192.168.1.1	ICMP	98	Echo (ping) reply id=0xfba2, seq=2/512, ttl=64 (request in 6)
8	20.516940	cc:01:59:15:00:10	cc:01:59:15:00:10	LOOP	60	Reply

▼ Frame 4: Packet, 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on	0000	ff ff ff ff ff ff cc 01	59 15 00 10 08 06 00 01	.....Y.....
Section number: 1	0010	08 00 06 04 00 01 cc 01	59 15 00 10 c0 a8 02 02	.....Y.....
> Interface id: 0 (-)	0020	00 00 00 00 00 00 c0 a8	02 01 00 00 00 00 00 00	.....P yfh.....
Encapsulation type: Ethernet (1)	0030	00 00 00 00 00 00 00 00	00 00 00 00	.....
Arrival Time: Dec 23, 2025 21:11:05.647451000 Новосибирское стандартное вре				
UTC Arrival Time: Dec 23, 2025 14:11:05.647451000 UTC				
Epoch Arrival Time: 1766499065.647451000				
[Time shift for this packet: 0.000000000 seconds]				
[Time delta from previous captured frame: 8.105795000 seconds]				
[Time delta from previous displayed frame: 8.105795000 seconds]				
[Time since reference or first frame: 18.375193000 seconds]				
Frame Number: 4				
Frame Length: 60 bytes (480 bits)				
Capture Length: 60 bytes (480 bits)				
[Frame is marked: False]				
[Frame is ignored: False]				
[Protocols in frame: eth:ethertype:arp]				
Character encoding: ASCII (0)				
[Coloring Rule Name: ARP]				
[Coloring Rule String: arp]				
▼ Ethernet II, Src: cc:01:59:15:00:10 (cc:01:59:15:00:10), Dst: Broadcast (ff:f				
> Destination: Broadcast (ff:ff:ff:ff:ff:ff)				
> Source: cc:01:59:15:00:10 (cc:01:59:15:00:10)				
Type: ARP (0x0806)				
[Stream index: 2]				
Padding: 00				
> Address Resolution Protocol (request)				

Рисунок 9 – ARP-кадр для поиска PC2 между PC2 и R1

5	18.375246	Private_66:68:01	cc:01:59:15:00:10	ARP	60	192.168.2.1 is at 00:50:79:66:68:01
6	20.376104	192.168.1.1	192.168.2.1	ICMP	98	Echo (ping) request id=0xfba2, seq=2/512, ttl=63 (reply in 7)
7	20.376171	192.168.2.1	192.168.1.1	ICMP	98	Echo (ping) reply id=0xfba2, seq=2/512, ttl=64 (request in 6)
8	20.516940	cc:01:59:15:00:10	cc:01:59:15:00:10	LOOP	60	Reply

▼ Frame 5: Packet, 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on	0000	cc 01 59 15 00 10 00 50	79 66 68 01 08 06 00 01	..Y....P yfh.....
Section number: 1	0010	08 00 06 04 00 02 00 50	79 66 68 01 c0 a8 02 01	.....P yfh.....
> Interface id: 0 (-)	0020	cc 01 59 15 00 10 c0 a8	02 02 00 00 00 00 00 00	..Y.....
Encapsulation type: Ethernet (1)	0030	00 00 00 00 00 00 00 00	00 00 00 00	.....
Arrival Time: Dec 23, 2025 21:11:05.647504000 Новосибирское стандартное вре				
UTC Arrival Time: Dec 23, 2025 14:11:05.647504000 UTC				
Epoch Arrival Time: 1766499065.647504000				
[Time shift for this packet: 0.000000000 seconds]				
[Time delta from previous captured frame: 53.000 microseconds]				
[Time delta from previous displayed frame: 53.000 microseconds]				
[Time since reference or first frame: 18.375246000 seconds]				
Frame Number: 5				
Frame Length: 60 bytes (480 bits)				
Capture Length: 60 bytes (480 bits)				
[Frame is marked: False]				
[Frame is ignored: False]				
[Protocols in frame: eth:ethertype:arp]				
Character encoding: ASCII (0)				
[Coloring Rule Name: ARP]				
[Coloring Rule String: arp]				
▼ Ethernet II, Src: Private_66:68:01 (00:50:79:66:68:01), Dst: cc:01:59:15:00:1				
> Destination: cc:01:59:15:00:10 (cc:01:59:15:00:10)				
> Source: Private_66:68:01 (00:50:79:66:68:01)				
Type: ARP (0x0806)				
[Stream index: 3]				
Padding: 00				
> Address Resolution Protocol (reply)				

Рисунок 10 – Ответный ARP-кадр между PC2 и R1

6	20.376104	192.168.1.1	192.168.2.1	ICMP	98 Echo (ping) request	id=0xfba2, seq=2/512, ttl=63 (reply in 7)
7	20.376171	192.168.2.1	192.168.1.1	ICMP	98 Echo (ping) reply	id=0xfba2, seq=2/512, ttl=64 (request in 6)
8	20.516940	cc:01:59:15:00:10	cc:01:59:15:00:10	LOOP	60 Reply	
>	Frame 6: Packet, 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on Ethernet II, Src: cc:01:59:15:00:10 (cc:01:59:15:00:10), Dst: Private_66:68:01:66:68:01					
>	Destination: Private_66:68:01 (00:50:79:66:68:01)					
>	Source: cc:01:59:15:00:10 (cc:01:59:15:00:10)					
	Type: IPv4 (0x0800)					
	[Stream index: 3]					
>	Internet Protocol Version 4, Src: 192.168.1.1, Dst: 192.168.2.1					
	0100 = Version: 4					
	.... 0101 = Header Length: 20 bytes (5)					
>	Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)					
	Total Length: 84					
	Identification: 0xa2fa (41722)					
>	000. = Flags: 0x0					
	...0 0000 0000 0000 = Fragment Offset: 0					
	Time to Live: 63					
	Protocol: ICMP (1)					
	Header Checksum: 0x545c [validation disabled]					
	[Header checksum status: Unverified]					
	Source Address: 192.168.1.1					
	Destination Address: 192.168.2.1					
	[Stream index: 0]					
>	Internet Control Message Protocol					
	Type: Echo (ping) request (8)					
	Code: 0					
	Checksum: 0x2467 [correct]					
	[Checksum Status: Good]					
	Identifier (BE): 64418 (0xfba2)					
	Identifier (LE): 41723 (0xa2fb)					
	Sequence Number (BE): 2 (0x0002)					
	Sequence Number (LE): 512 (0x0200)					
	[Response frame: 7]					
>	Data (56 bytes)					

```

7 20.376171 192.168.2.1 192.168.1.1 ICMP 98 Echo (ping) reply id=0xfba2, seq=2/512, ttl=64 (request in 6)
8 20.516940 cc:01:59:15:00:10 cc:01:59:15:00:10 LOOP 60 Reply
> Frame 7: Packet, 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on
Ethernet II, Src: Private_66:68:01 (00:50:79:66:68:01), Dst: cc:01:59:15:00:10
  > Destination: cc:01:59:15:00:10 (cc:01:59:15:00:10)
  > Source: Private_66:68:01 (00:50:79:66:68:01)
    Type: IPv4 (0x0800)
    [Stream index: 3]
  > Internet Protocol Version 4, Src: 192.168.2.1, Dst: 192.168.1.1
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
      Total Length: 84
      Identification: 0xa2fa (41722)
    > 000. .... = Flags: 0x0
      ...0 0000 0000 0000 = Fragment Offset: 0
      Time to Live: 64
      Protocol: ICMP (1)
      Header Checksum: 0x535c [validation disabled]
      [Header checksum status: Unverified]
      Source Address: 192.168.2.1
      Destination Address: 192.168.1.1
      [Stream index: 0]
  > Internet Control Message Protocol
    Type: Echo (ping) reply (0)
    Code: 0
    Checksum: 0x2c67 [correct]
    [Checksum Status: Good]
    Identifier (BE): 64418 (0xfba2)
    Identifier (LE): 41723 (0xa2fb)
    Sequence Number (BE): 2 (0x0002)
    Sequence Number (LE): 512 (0x0200)
    [Request frame: 6]
    [Response time: 0,067 ms]
  > Data (56 bytes)

```

В заголовках исходящего ARP-кадра находится MAC-адрес источника, а вместо адреса получателя – широковещательный адрес, так как ещё не известен MAC-адрес устройства с указанным ip. В ответном же кадре уже явно

указаны MAC-адреса как источника, так и получателя. Также в обоих заголовках есть указание типа кадра, а именно ARP.

ICMP-пакет содержит информацию о ip-адресах источника и получателя, тип ICMP и контрольную сумму. Исходящий ICMP имеет тип request, а ответный – reply.