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Федеральное государственное бюджетное образовательное
учреждение высшего образования
НИЖЕГОРОДСКИЙ ГОСУДАРСТВЕННЫЙ ТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ
ИМ. Р.Е. АЛЕКСЕЕВА
ИНСТИТУТ РАДИОЭЛЕКТРОНИКИ И ИНФОРМАЦИОННЫХ
ТЕХНОЛОГИЙ

Курс “Сети и телекоммуникации”
Отчет по лабораторной работе №3

Выполнил: студент группы 18 В-1

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Нижний Новгород 2020

Задание:

Для экспериментов использовать схему из первой лабораторной работы. Все ip-адреса (или маски) необходимо поменять так, чтобы адрес сети у всех компьютеров был один. Все действия должны быть выполнены в симуляторе сетей CORE.

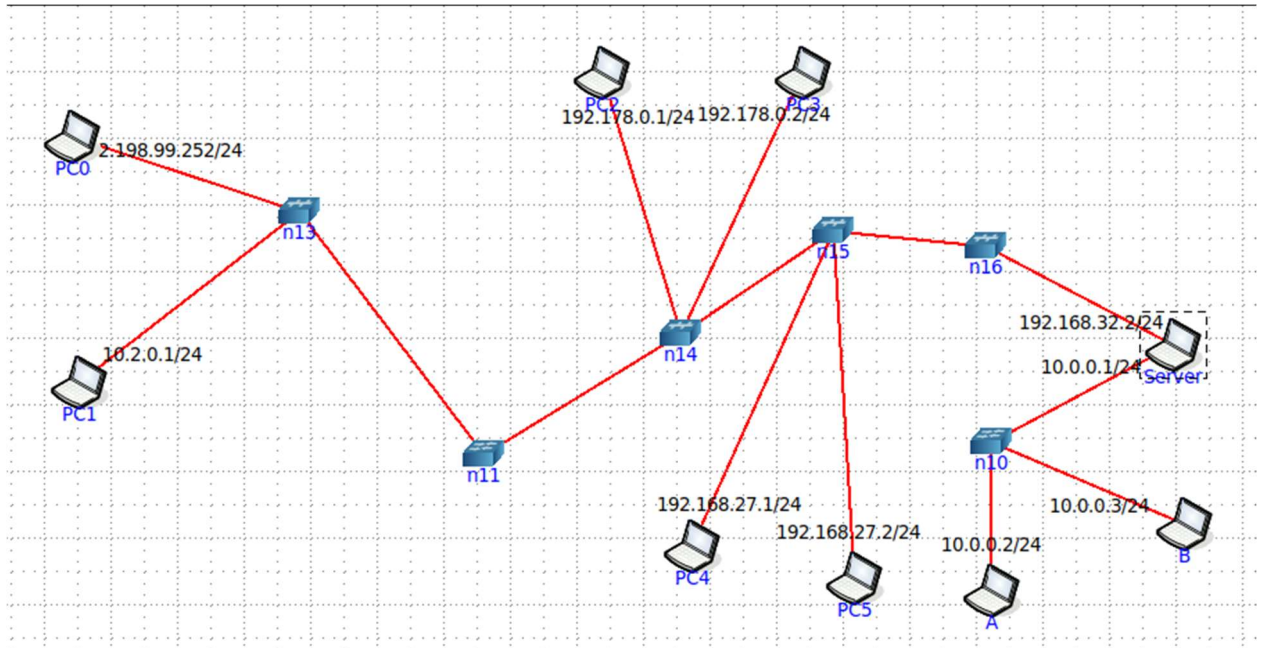
Часть 1. Формирование запроса и получение ответа

1. Начать захват пакетов при помощи Wireshark.
2. Сформировать кадр ARP-запроса с помощью утилиты PackETH и отправить его в сеть (компьютеры выбрать самостоятельно).
3. Убедиться, что был получен кадр ARP-ответа, соответствующий посланному запросу. Захваченные пакеты сохранить для отчета. Вывести arp таблицу (команда «arp»).
4. Прекратить захват пакетов.

Часть 2. ARP-спуфинг

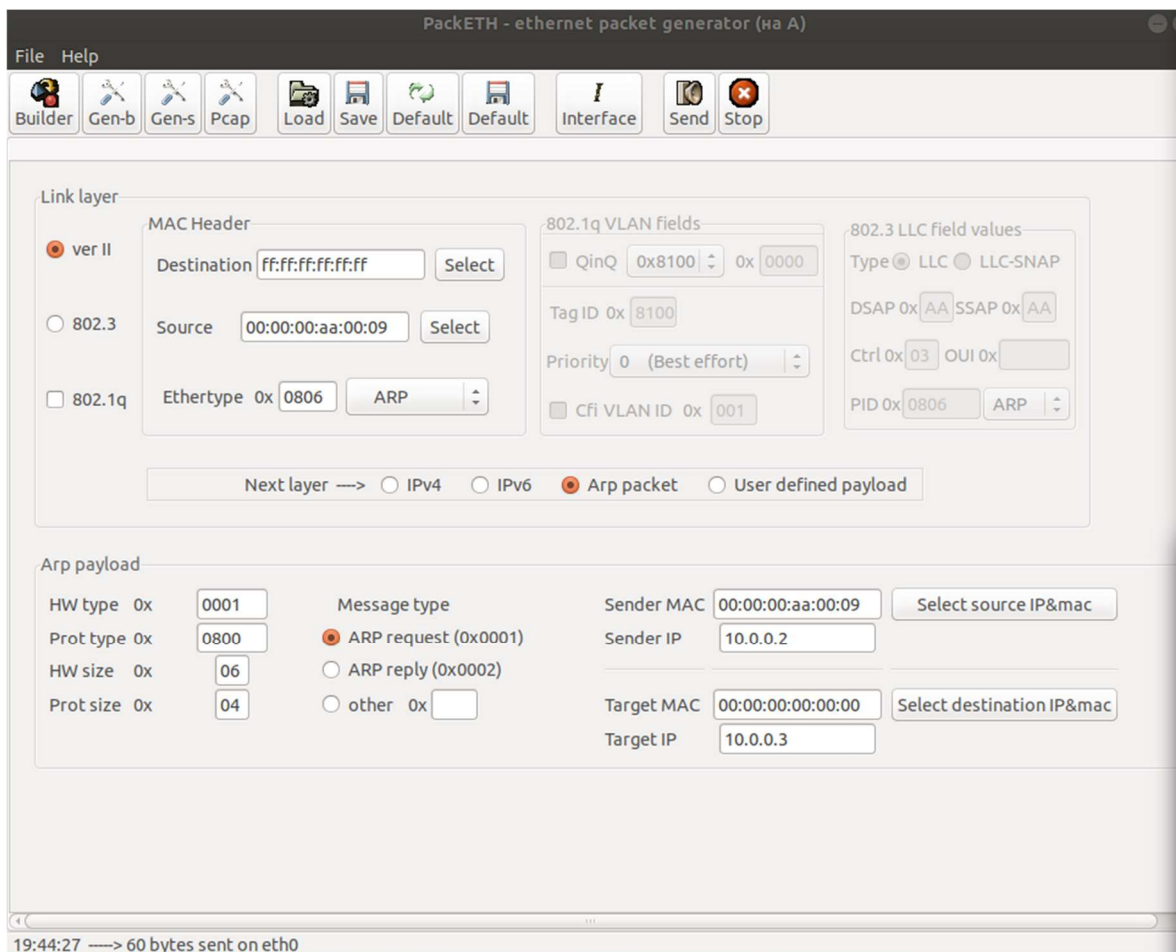
1. Выделить на схеме и обозначить три компьютера: А, В, Сервер.
2. Подготовить кадр ARP-ответа, направляемый Сервером хосту А с помощью программы PackETH. Кадр должен быть составлен так, чтобы MAC-адресу Сервера соответствовал IP-адрес хоста В. Вывести arp таблицу на хосте А. Отправить сформированный пакет от Сервера хосту А.
3. Организация чата между узлами с помощью netcat.
4. Начать захват пакетов при помощи Wireshark на Сервере.
5. Попытаться установить соединение между хостом А и хостом В с помощью программы netcat (А отправляет сообщения В). Убедиться, что запросы от хоста А, направленные хосту В поступают на Сервер.
6. Прекратить захват пакетов.
7. Сохранить для отчета отправленный кадр ARP-ответа и несколько перехваченных пакетов, переданных на Сервер, arp таблицу хоста А.

Схема сети:



Рассматриваем участок сети между компьютерами А, В и Server.

ARP-запрос от хоста А:



Пакеты:

The image displays two Wireshark packet capture windows. The top window, titled 'Capturing from veth6.0.fe', shows a list of 16 packets. The bottom window, titled 'Capturing from veth5.1.fe', shows a list of 11 packets. Both windows include a packet list, packet details, and packet bytes pane.

Top Window: Capturing from veth6.0.fe

No.	Time	Source	Destination	Protocol	Length	Info
5	10.239973177	fe80::200:ff:feaa:8	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:08
6	10.240029077	fe80::200:ff:feaa:9	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:09
7	12.743334792	fe80::54f9:3fff:fe0...	ff02::fb	MDNS	107	Standard query 0x0000 PTR _ipps._tcp.local, "QM" que
8	118.784026854	fe80::a896:23ff:fea...	ff02::2	ICMPv6	70	Router Solicitation from 56:f9:3f:0a:71:66
9	122.880246234	fe80::54f9:3fff:fe0...	ff02::2	ICMPv6	70	Router Solicitation from 56:f9:3f:0a:71:66
10	131.072472226	fe80::200:ff:feaa:7	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:07
11	135.168615380	fe80::200:ff:feaa:8	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:08
12	137.216347541	fe80::200:ff:feaa:9	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:09
13	137.219748950	fe80::a896:23ff:fea...	ff02::fb	MDNS	107	Standard query 0x0000 PTR _ipps._tcp.local, "QM" que
14	140.743924509	fe80::54f9:3fff:fe0...	ff02::fb	MDNS	107	Standard query 0x0000 PTR _ipps._tcp.local, "QM" que
15	225.704530865	00:00:00_aa:00:09	Broadcast	ARP	60	Who has 10.0.0.3? Tell 10.0.0.2
16	225.704552398	00:00:00_aa:00:08	00:00:00_aa:00:09	ARP	42	10.0.0.3 is at 00:00:00:aa:00:08

Bottom Window: Capturing from veth5.1.fe

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	fe80::200:ff:feaa:8	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:08
2	0.000021014	fe80::200:ff:feaa:9	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:09
3	2.503298947	fe80::d0ce:d2ff:fe2...	ff02::fb	MDNS	107	Standard query 0x0000 PTR _ipps._tcp.local, "QM" quest
4	108.544022745	fe80::a896:23ff:fea...	ff02::2	ICMPv6	70	Router Solicitation from 56:f9:3f:0a:71:66
5	114.688275338	fe80::d0ce:d2ff:fe2...	ff02::2	ICMPv6	70	Router Solicitation from d2:ce:d2:29:00:44
6	120.832381893	fe80::200:ff:feaa:7	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:07
7	124.928636382	fe80::200:ff:feaa:8	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:08
8	126.976342230	fe80::200:ff:feaa:9	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:09
9	126.979743380	fe80::a896:23ff:fea...	ff02::fb	MDNS	107	Standard query 0x0000 PTR _ipps._tcp.local, "QM" quest
10	130.503886804	fe80::d0ce:d2ff:fe2...	ff02::fb	MDNS	107	Standard query 0x0000 PTR _ipps._tcp.local, "QM" quest
11	215.464525776	00:00:00_aa:00:09	Broadcast	ARP	60	Who has 10.0.0.3? Tell 10.0.0.2

ARP-таблица:

The image shows a terminal window titled 'Терминал' with the following output:

```
root@A:/tmp/pycore.36721/A.conf# arp
Адрес HW-тип HW-адрес Флаги Маска Интерфейс
10.0.0.3 ether 00:00:00:aa:00:08 C eth0
root@A:/tmp/pycore.36721/A.conf#
```

Netcut (отправка сообщения с правильным соединением):

```
Терминал
Файл Правка Вид Поиск Терминал Справка
root@B:/tmp/pycore.36721/B.conf# nc 10.0.0.2 9000
123
RX packets 59 bytes 5985 (5.9 KB)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 11 bytes 866 (866.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
inet 127.0.0.1 netmask 255.0.0.0
inet6 ::1 prefixlen 128 scopeid 0x10<host>
loop txqueuelen 1000 (Локальная петля (Loopback))
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@A:/tmp/pycore.36721/A.conf# arp
root@A:/tmp/pycore.36721/A.conf# nc -lp 9000
123
```

Пакеты:

The image displays two Wireshark packet capture windows. The top window, titled 'Capturing from veth6.0.fe', shows a list of captured packets. The bottom window, titled 'Capturing from veth5.1.fe', shows another set of captured packets. Both windows include a packet list, packet details, and packet bytes panes.

Top Window: Capturing from veth6.0.fe

No.	Time	Source	Destination	Protocol	Length	Info
25	366.501978727	fe80::54f9:3fff:fe0...	ff02::2	ICMPv6	70	Router Solicitation from 56:f9:3f:0a:71:66
26	382.976019309	fe80::200:ff:feaa:7	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:07
27	393.263153928	fe80::a896:23ff:fea...	ff02::fb	MDNS	107	Standard query 0x0000 PTR _ipps._tcp.local, "QM" que
28	396.744606190	fe80::54f9:3fff:fe0...	ff02::fb	MDNS	107	Standard query 0x0000 PTR _ipps._tcp.local, "QM" que
29	399.360101511	fe80::200:ff:feaa:9	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:09
30	399.36066572	fe80::200:ff:feaa:8	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:08
31	420.713924355	10.0.0.2	10.0.0.3	TCP	70	9000 -> 46634 [PSH, ACK] Seq=1 Ack=1 Win=65280 Len=4
32	420.713953670	10.0.0.3	10.0.0.2	TCP	66	46634 -> 9000 [ACK] Seq=1 Ack=5 Win=64256 Len=0 TSval
33	425.727974502	00:00:00_aa:00:08	00:00:00_aa:00:09	ARP	42	Who has 10.0.0.2? Tell 10.0.0.3
34	425.728010062	00:00:00_aa:00:09	00:00:00_aa:00:08	ARP	42	Who has 10.0.0.3? Tell 10.0.0.2
35	425.728018629	00:00:00_aa:00:09	00:00:00_aa:00:08	ARP	42	10.0.0.2 is at 00:00:00:aa:00:09
36	425.728017972	00:00:00_aa:00:08	00:00:00_aa:00:09	ARP	42	10.0.0.3 is at 00:00:00:aa:00:08

Bottom Window: Capturing from veth5.1.fe

No.	Time	Source	Destination	Protocol	Length	Info
8	126.976342230	fe80::200:ff:feaa:9	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:09
9	126.979743380	fe80::a896:23ff:fea...	ff02::fb	MDNS	107	Standard query 0x0000 PTR _ipps._tcp.local, "QM" que
10	130.503886804	fe80::d0ce:d2ff:fe2...	ff02::fb	MDNS	107	Standard query 0x0000 PTR _ipps._tcp.local, "QM" que
11	215.464525776	00:00:00_aa:00:09	Broadcast	ARP	60	Who has 10.0.0.3? Tell 10.0.0.2
12	313.407714698	00:00:00_aa:00:09	Broadcast	ARP	42	Who has 10.0.0.3? Tell 10.0.0.2
13	339.968320680	fe80::a896:23ff:fea...	ff02::2	ICMPv6	70	Router Solicitation from 56:f9:3f:0a:71:66
14	372.735985531	fe80::d0ce:d2ff:fe2...	ff02::2	ICMPv6	70	Router Solicitation from d2:ce:d2:29:00:44
15	372.735967006	fe80::200:ff:feaa:7	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:07
16	383.023150653	fe80::a896:23ff:fea...	ff02::fb	MDNS	107	Standard query 0x0000 PTR _ipps._tcp.local, "QM" que
17	386.504571347	fe80::d0ce:d2ff:fe2...	ff02::fb	MDNS	107	Standard query 0x0000 PTR _ipps._tcp.local, "QM" que
18	389.120095338	fe80::200:ff:feaa:9	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:09
19	389.120124414	fe80::200:ff:feaa:8	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:08

ARP-ответ от Server (почти спуфинг):

PacketETH - ethernet packet generator (на Server)

File Help

Builder Gen-b Gen-s Pcap Load Save Default Default Interface Send Stop

Link layer

☒ ver II

MAC Header

Destination: 00:00:00:aa:00:09 Select

Source: 00:00:00:aa:00:07 Select

Ethertype: 0x 0806 ARP

802.1q VLAN Fields

QinQ: 0x8100 0x 0000

Tag ID: 0x 8100

Priority: 0 (Best effort)

Cfi VLAN ID: 0x 001

802.3 LLC Field values

Type: ☒ LLC ☐ LLC-SNAP

DSAP: 0x AA SSAP: 0x AA

Ctrl: 0x 03 OUI: 0x

PID: 0x 0806 ARP

Next layer: ☐ IPv4 ☐ IPv6 ☒ Arp packet ☐ User defined payload

Arp payload

HW type: 0x 0001 Message type: ☐ ARP request (0x0001) ☒ ARP reply (0x0002) ☐ other 0x

Prot type: 0x 0800

HW size: 0x 06

Prot size: 0x 04

Sender MAC: 00:00:00:aa:00:07 Select source IP&mac

Sender IP: 10.0.0.3

Target MAC: 00:00:00:aa:00:09 Select destination IP&mac

Target IP: 10.0.0.2

19:52:53 → 60 bytes sent on eth1

Пакеты:

Capturing from veth6.0.fe

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter ... <Ctrl-/> Expression...

No.	Time	Source	Destination	Protocol	Length	Info
26	382.976019309	fe80::200:ff:feaa:7	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:07
27	393.263153928	fe80::a896:23ff:fea...	ff02::fb	MDNS	107	Standard query 0x0000 PTR _ipps._tcp.local, "QM" que
28	396.744606190	fe80::54f9:3fff:fe0...	ff02::fb	MDNS	107	Standard query 0x0000 PTR _ipps._tcp.local, "QM" que
29	399.360101511	fe80::200:ff:feaa:9	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:09
30	399.360066572	fe80::200:ff:feaa:8	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:08
31	420.713924355	10.0.0.2	10.0.0.3	TCP	70	9000 → 46634 [PSH, ACK] Seq=1 Ack=1 Win=65280 Len=4
32	420.713953670	10.0.0.3	10.0.0.2	TCP	66	46634 → 9000 [ACK] Seq=1 Ack=5 Win=64256 Len=0 TSval
33	425.727974502	00:00:00:aa:00:08	00:00:00:aa:00:09	ARP	42	Who has 10.0.0.2? Tell 10.0.0.3
34	425.728010062	00:00:00:aa:00:09	00:00:00:aa:00:08	ARP	42	Who has 10.0.0.3? Tell 10.0.0.2
35	425.728018629	00:00:00:aa:00:09	00:00:00:aa:00:08	ARP	42	10.0.0.2 is at 00:00:00:aa:00:09
36	425.728017972	00:00:00:aa:00:08	00:00:00:aa:00:09	ARP	42	10.0.0.3 is at 00:00:00:aa:00:08
37	731.730565474	00:00:00:aa:00:07	00:00:00:aa:00:09	ARP	60	10.0.0.3 is at 00:00:00:aa:00:07

Sequence number: 1 (relative sequence number)
[Next sequence number: 5 (relative sequence number)]
Acknowledgment number: 1 (relative ack number)
1000 ... = Header Length: 32 bytes (8)
Flags: 0x018 (PSH, ACK)
Window size value: 510
[Calculated window size: 65280]
[Window size scaling factor: 128]

Capturing from veth5.1.fe

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter ... <Ctrl-/> Expression...

No.	Time	Source	Destination	Protocol	Length	Info
9	126.979743380	fe80::a896:23ff:fea...	ff02::fb	MDNS	107	Standard query 0x0000 PTR _ipps._tcp.local, "QM" que
10	130.503808094	fe80::d0ce:d2ff:fe2...	ff02::fb	MDNS	107	Standard query 0x0000 PTR _ipps._tcp.local, "QM" que
11	215.464525776	00:00:00:aa:00:09	Broadcast	ARP	60	Who has 10.0.0.3? Tell 10.0.0.2
12	313.407714698	00:00:00:aa:00:09	Broadcast	ARP	42	Who has 10.0.0.3? Tell 10.0.0.2
13	339.968320680	fe80::a896:23ff:fea...	ff02::2	ICMPv6	70	Router Solicitation from 56:f9:3f:0a:71:66
14	372.735985531	fe80::d0ce:d2ff:fe2...	ff02::2	ICMPv6	70	Router Solicitation from d2:ce:d2:29:00:44
15	372.735967006	fe80::200:ff:feaa:7	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:07
16	383.023150653	fe80::a896:23ff:fea...	ff02::fb	MDNS	107	Standard query 0x0000 PTR _ipps._tcp.local, "QM" que
17	386.504571347	fe80::d0ce:d2ff:fe2...	ff02::fb	MDNS	107	Standard query 0x0000 PTR _ipps._tcp.local, "QM" que
18	389.120095338	fe80::200:ff:feaa:9	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:09
19	389.120124414	fe80::200:ff:feaa:8	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:08
20	721.490540516	00:00:00:aa:00:07	00:00:00:aa:00:09	ARP	60	10.0.0.3 is at 00:00:00:aa:00:07

Frame 1: 70 bytes on wire (560 bits), 70 bytes captured (560 bits) on interface 0
Ethernet II, Src: 00:00:00:aa:00:08 (00:00:00:aa:00:08), Dst: IPv6mcast_02 (33:33:00:00:00:02)
Internet Protocol Version 6, Src: fe80::200:ff:feaa:8, Dst: ff02::2
Internet Control Message Protocol v6

Netcut (отправка сообщения после спуфинга):

```
Терминал
Файл Правка Вид Поиск Терминал Справка
root@B:/tmp/pycore.36721/B.conf# nc 10.0.0.2 9000
123
[]

Терминал
Файл Правка Вид Поиск Терминал Справка
root@A:/tmp/pycore.36721/A.conf# ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.0.0.2 netmask 255.255.255.0 broadcast 0.0.0.0
    inet6 fe80::200:ff:feaa:9 prefixlen 64 scopeid 0x20<link>
    ether 00:00:00:aa:00:09 txqueuelen 1000 (Ethernet)
    RX packets 59 bytes 5985 (5.9 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 11 bytes 866 (866.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Локальная петля (Loopback))
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@A:/tmp/pycore.36721/A.conf# arp
root@A:/tmp/pycore.36721/A.conf# nc -lp 9000
123
456
```

Пакеты:

Capturing from veth6.0.fe

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter ... <Ctrl-/> Expression... +

No.	Time	Source	Destination	Protocol	Length	Info
26	382.976019309	fe80::200:ff:feaa:7	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:07
27	393.263153928	fe80::a896:23ff:fea...	ff02::fb	MDNS	107	Standard query 0x0000 PTR _ipps._tcp.local, "QM" que
28	396.744606190	fe80::54f9:3fff:fe0...	ff02::fb	MDNS	107	Standard query 0x0000 PTR _ipps._tcp.local, "QM" que
29	399.360101511	fe80::200:ff:feaa:9	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:09
30	399.36066572	fe80::200:ff:feaa:8	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:08
31	420.713924355	10.0.0.2	10.0.0.3	TCP	70	9000 → 46634 [PSH, ACK] Seq=1 Ack=1 Win=65280 Len=4
32	420.713953670	10.0.0.3	10.0.0.2	TCP	66	46634 → 9000 [ACK] Seq=1 Ack=5 Win=64256 Len=0 TSval
33	425.727974502	00:00:00_aa:00:08	00:00:00_aa:00:09	ARP	42	Who has 10.0.0.2? Tell 10.0.0.3
34	425.728010662	00:00:00_aa:00:09	00:00:00_aa:00:08	ARP	42	Who has 10.0.0.3? Tell 10.0.0.2
35	425.728018629	00:00:00_aa:00:09	00:00:00_aa:00:08	ARP	42	10.0.0.2 is at 00:00:00:aa:00:09
36	425.728017972	00:00:00_aa:00:08	00:00:00_aa:00:09	ARP	42	10.0.0.3 is at 00:00:00:aa:00:08
37	731.730565474	00:00:00_aa:00:07	00:00:00_aa:00:09	ARP	60	10.0.0.3 is at 00:00:00:aa:00:07

Sequence number: 1 (relative sequence number)
[Next sequence number: 5 (relative sequence number)]
Acknowledgment number: 1 (relative ack number)
1000 = Header Length: 32 bytes (8)
▶ Flags: 0x018 (PSH, ACK)
Window size value: 510
[Calculated window size: 65280]
[Window size scaling factor: 128]

Capturing from veth5.1.fe

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter ... <Ctrl-/> Expression... +

No.	Time	Source	Destination	Protocol	Length	Info
18	389.120095338	fe80::200:ff:feaa:9	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:09
19	389.120124414	fe80::200:ff:feaa:8	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:08
20	721.490540516	00:00:00_aa:00:07	00:00:00_aa:00:09	ARP	60	10.0.0.3 is at 00:00:00:aa:00:07
21	802.979461700	10.0.0.2	10.0.0.3	TCP	70	9000 → 46634 [PSH, ACK] Seq=1 Ack=1 Win=510 Len=4 TS
22	803.184098084	10.0.0.2	10.0.0.3	TCP	70	[TCP Retransmission] 9000 → 46634 [PSH, ACK] Seq=1 A
23	803.392135087	10.0.0.2	10.0.0.3	TCP	70	[TCP Retransmission] 9000 → 46634 [PSH, ACK] Seq=1 A
24	803.808357552	10.0.0.2	10.0.0.3	TCP	70	[TCP Retransmission] 9000 → 46634 [PSH, ACK] Seq=1 A
25	804.640061630	10.0.0.2	10.0.0.3	TCP	70	[TCP Retransmission] 9000 → 46634 [PSH, ACK] Seq=1 A
26	806.304022202	10.0.0.2	10.0.0.3	TCP	70	[TCP Retransmission] 9000 → 46634 [PSH, ACK] Seq=1 A
27	808.192494874	00:00:00_aa:00:09	00:00:00_aa:00:07	ARP	42	Who has 10.0.0.3? Tell 10.0.0.2
28	809.216802548	00:00:00_aa:00:09	00:00:00_aa:00:07	ARP	42	Who has 10.0.0.3? Tell 10.0.0.2
29	809.728171679	10.0.0.2	10.0.0.3	TCP	70	[TCP Retransmission] 9000 → 46634 [PSH, ACK] Seq=1 A

▶ Frame 1: 70 bytes on wire (560 bits), 70 bytes captured (560 bits) on interface 0
▶ Ethernet II, Src: 00:00:00:aa:00:08 (00:00:00:aa:00:08), Dst: IPv6mcast_02 (33:33:00:00:00:02)
▶ Internet Protocol Version 6, Src: fe80::200:ff:feaa:8, Dst: ff02::2
▶ Internet Control Message Protocol v6

Netcut (после восстановления соединения):

```
Терминал
Файл Правка Вид Поиск Терминал Справка
root@B:/tmp/pycore.36721/B.conf# nc 10.0.0.2 9000
123
456
[ ]

Терминал
Файл Правка Вид Поиск Терминал Справка
root@A:/tmp/pycore.36721/A.conf# ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
inet 10.0.0.2 netmask 255.255.255.0 broadcast 0.0.0.0
inet6 fe80::200:ff:feaa:9 prefixlen 64 scopeid 0x20<link>
ether 00:00:00:aa:00:09 txqueuelen 1000 (Ethernet)
RX packets 59 bytes 5985 (5.9 KB)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 11 bytes 866 (866.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
inet 127.0.0.1 netmask 255.0.0.0
inet6 ::1 prefixlen 128 scopeid 0x10<host>
loop txqueuelen 1000 (Локальная петля (Loopback))
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@A:/tmp/pycore.36721/A.conf# arp
root@A:/tmp/pycore.36721/A.conf# nc -lp 9000
123
456
[ ]
```

Пакеты:

Capturing from veth6.0.fe

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter ... <Ctrl-/> Expression... +

No.	Time	Source	Destination	Protocol	Length	Info
31	420.713924355	10.0.0.2	10.0.0.3	TCP	70	9000 → 46634 [PSH, ACK] Seq=1 Ack=1 Win=65280 Len=4
32	420.713953670	10.0.0.3	10.0.0.2	TCP	66	46634 → 9000 [ACK] Seq=1 Ack=5 Win=64256 Len=0 TSval
33	425.727974502	00:00:00:aa:00:08	00:00:00:aa:00:09	ARP	42	Who has 10.0.0.2? Tell 10.0.0.3
34	425.728010062	00:00:00:aa:00:09	00:00:00:aa:00:08	ARP	42	Who has 10.0.0.3? Tell 10.0.0.2
35	425.728018629	00:00:00:aa:00:09	00:00:00:aa:00:08	ARP	42	10.0.0.2 is at 00:00:00:aa:00:08
36	425.728017972	00:00:00:aa:00:08	00:00:00:aa:00:09	ARP	42	10.0.0.3 is at 00:00:00:aa:00:08
37	731.730565474	00:00:00:aa:00:07	00:00:00:aa:00:09	ARP	60	10.0.0.3 is at 00:00:00:aa:00:07
38	825.344659097	fe80::a896:23ff:fea...	ff02::2	ICMPv6	70	Router Solicitation from 56:f9:3f:0a:71:66
39	826.624308127	00:00:00:aa:00:09	Broadcast	ARP	42	Who has 10.0.0.3? Tell 10.0.0.2
40	826.624320366	00:00:00:aa:00:08	00:00:00:aa:00:09	ARP	42	10.0.0.3 is at 00:00:00:aa:00:08
41	826.624333599	10.0.0.2	10.0.0.3	TCP	70	9000 → 46634 [PSH, ACK] Seq=5 Ack=1 Win=65280 Len=4
42	826.624339718	10.0.0.3	10.0.0.2	TCP	66	46634 → 9000 [ACK] Seq=1 Ack=9 Win=64256 Len=0 TSval

Sequence number: 1 (relative sequence number)
[Next sequence number: 5 (relative sequence number)]
Acknowledgment number: 1 (relative ack number)
1000 = Header Length: 32 bytes (8)
Flags: 0x018 (PSH, ACK)
Window size value: 510
[Calculated window size: 65280]
[Window size scaling factor: 128]

Capturing from veth5.1.fe

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter ... <Ctrl-/> Expression... +

No.	Time	Source	Destination	Protocol	Length	Info
21	802.979461700	10.0.0.2	10.0.0.3	TCP	70	9000 → 46634 [PSH, ACK] Seq=1 Ack=1 Win=510 Len=4 TS
22	803.184090804	10.0.0.2	10.0.0.3	TCP	70	[TCP Retransmission] 9000 → 46634 [PSH, ACK] Seq=1 A
23	803.392135087	10.0.0.2	10.0.0.3	TCP	70	[TCP Retransmission] 9000 → 46634 [PSH, ACK] Seq=1 A
24	803.808357552	10.0.0.2	10.0.0.3	TCP	70	[TCP Retransmission] 9000 → 46634 [PSH, ACK] Seq=1 A
25	804.64001630	10.0.0.2	10.0.0.3	TCP	70	[TCP Retransmission] 9000 → 46634 [PSH, ACK] Seq=1 A
26	806.304022202	10.0.0.2	10.0.0.3	TCP	70	[TCP Retransmission] 9000 → 46634 [PSH, ACK] Seq=1 A
27	808.192494874	00:00:00:aa:00:09	00:00:00:aa:00:07	ARP	42	Who has 10.0.0.3? Tell 10.0.0.2
28	809.216802548	00:00:00:aa:00:09	00:00:00:aa:00:07	ARP	42	Who has 10.0.0.3? Tell 10.0.0.2
29	809.728171679	10.0.0.2	10.0.0.3	TCP	70	[TCP Retransmission] 9000 → 46634 [PSH, ACK] Seq=1 A
30	810.240614299	00:00:00:aa:00:09	00:00:00:aa:00:07	ARP	42	Who has 10.0.0.3? Tell 10.0.0.2
31	815.104655187	fe80::a896:23ff:fea...	ff02::2	ICMPv6	70	Router Solicitation from 56:f9:3f:0a:71:66
32	816.384302723	00:00:00:aa:00:09	Broadcast	ARP	42	Who has 10.0.0.3? Tell 10.0.0.2

Frame 1: 70 bytes on wire (560 bits), 70 bytes captured (560 bits) on interface 0
Ethernet II, Src: 00:00:00:aa:00:08 (00:00:00:aa:00:08), Dst: IPv6mcast_02 (33:33:00:00:00:02)
Internet Protocol Version 6, Src: fe80::200:ff:feaa:8, Dst: ff02::2
Internet Control Message Protocol v6