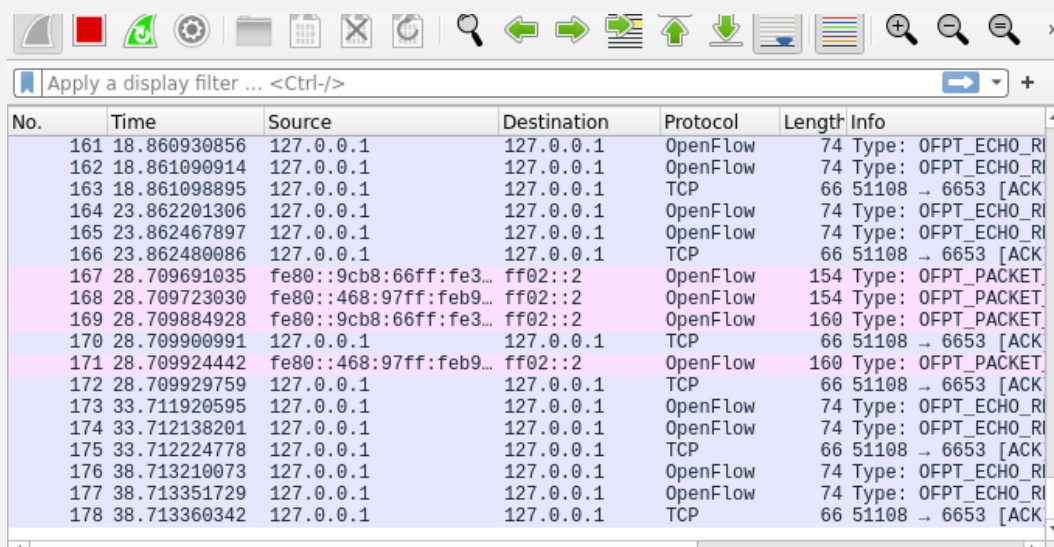


رسول کامکار ۹۸۲۶۶۵۳

پروژه دوم درس شبکه ۲

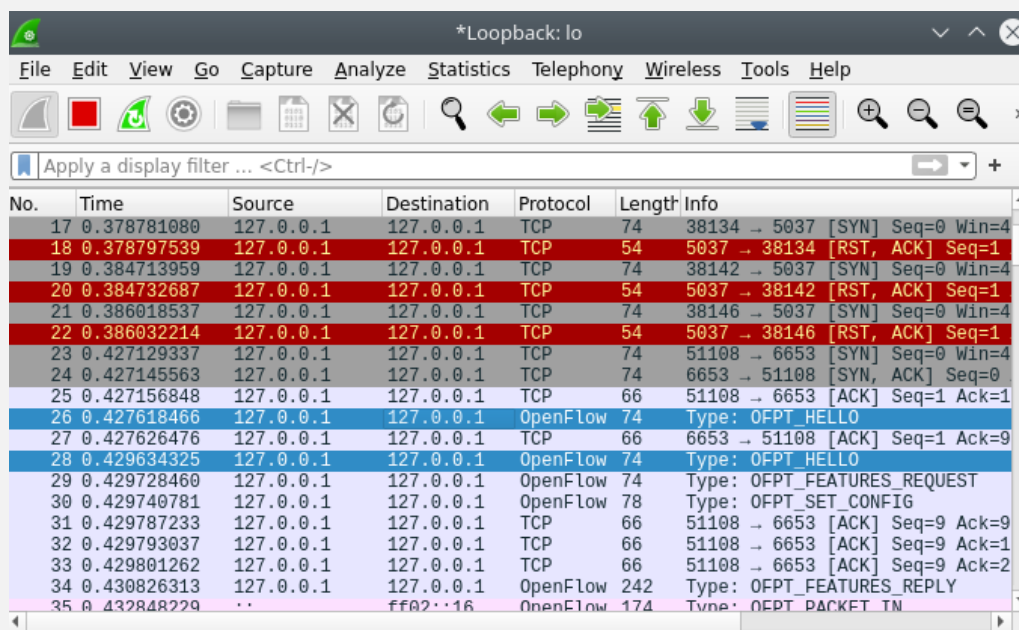
بخش ۱

۱- بسته ها از نوع OpenFlow و TCP هستند



No.	Time	Source	Destination	Protocol	Length	Info
161	18.860930856	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_ECHO_RI
162	18.861090914	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_ECHO_RI
163	18.861098895	127.0.0.1	127.0.0.1	TCP	66	51108 → 6653 [ACK
164	23.862201306	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_ECHO_RI
165	23.862467897	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_ECHO_RI
166	23.862480086	127.0.0.1	127.0.0.1	TCP	66	51108 → 6653 [ACK
167	28.709691035	fe80::9cb8:66ff:fe3...	ff02::2	OpenFlow	154	Type: OFPT_PACKET
168	28.709723030	fe80::468:97ff:feb9...	ff02::2	OpenFlow	154	Type: OFPT_PACKET
169	28.709884928	fe80::9cb8:66ff:fe3...	ff02::2	OpenFlow	160	Type: OFPT_PACKET
170	28.709900991	127.0.0.1	127.0.0.1	TCP	66	51108 → 6653 [ACK
171	28.709924442	fe80::468:97ff:feb9...	ff02::2	OpenFlow	160	Type: OFPT_PACKET
172	28.709929759	127.0.0.1	127.0.0.1	TCP	66	51108 → 6653 [ACK
173	33.711920595	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_ECHO_RI
174	33.712138201	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_ECHO_RI
175	33.712224778	127.0.0.1	127.0.0.1	TCP	66	51108 → 6653 [ACK
176	38.713210073	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_ECHO_RI
177	38.713351729	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_ECHO_RI
178	38.713360342	127.0.0.1	127.0.0.1	TCP	66	51108 → 6653 [ACK

۲-



No.	Time	Source	Destination	Protocol	Length	Info
17	0.378781080	127.0.0.1	127.0.0.1	TCP	74	38134 → 5037 [SYN] Seq=0 Win=4
18	0.378797539	127.0.0.1	127.0.0.1	TCP	54	5037 → 38134 [RST, ACK] Seq=1
19	0.384713959	127.0.0.1	127.0.0.1	TCP	74	38142 → 5037 [SYN] Seq=0 Win=4
20	0.384732687	127.0.0.1	127.0.0.1	TCP	54	5037 → 38142 [RST, ACK] Seq=1
21	0.386018537	127.0.0.1	127.0.0.1	TCP	74	38146 → 5037 [SYN] Seq=0 Win=4
22	0.386032214	127.0.0.1	127.0.0.1	TCP	54	5037 → 38146 [RST, ACK] Seq=1
23	0.427129337	127.0.0.1	127.0.0.1	TCP	74	51108 → 6653 [SYN] Seq=0 Win=4
24	0.427145563	127.0.0.1	127.0.0.1	TCP	74	6653 → 51108 [SYN, ACK] Seq=0
25	0.427156848	127.0.0.1	127.0.0.1	TCP	66	51108 → 6653 [ACK] Seq=1 Ack=1
26	0.427618466	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_HELLO
27	0.427626476	127.0.0.1	127.0.0.1	TCP	66	6653 → 51108 [ACK] Seq=1 Ack=9
28	0.429634325	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_HELLO
29	0.429728460	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_FEATURES_REQUEST
30	0.429740781	127.0.0.1	127.0.0.1	OpenFlow	78	Type: OFPT_SET_CONFIG
31	0.429787233	127.0.0.1	127.0.0.1	TCP	66	51108 → 6653 [ACK] Seq=9 Ack=9
32	0.429793037	127.0.0.1	127.0.0.1	TCP	66	51108 → 6653 [ACK] Seq=9 Ack=1
33	0.429801262	127.0.0.1	127.0.0.1	TCP	66	51108 → 6653 [ACK] Seq=9 Ack=2
34	0.430826313	127.0.0.1	127.0.0.1	OpenFlow	242	Type: OFPT_FEATURES_REPLY
35	0.432848229	...	ff02::16	OpenFlow	174	Type: OFPT_PACKET_IN

*Loopback: lo

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openflow_1_0.type

No.	Time	Source	Destination	Protocol	Length	Info
39	0.676275293	::	ff02::16	OpenFlow	174	Type: OFPT_PACKET_IN
35	0.432848229	::	ff02::16	OpenFlow	174	Type: OFPT_PACKET_IN
28	0.429634325	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_HELLO
29	0.429728460	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_FEATURES_REQUEST
34	0.430826313	127.0.0.1	127.0.0.1	OpenFlow	242	Type: OFPT_FEATURES_REPLY
5...	617.464544523	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_ECHO_REQUEST
5...	612.462848783	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_ECHO_REQUEST
5...	607.461835531	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_ECHO_REQUEST
5...	602.459458306	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_ECHO_REQUEST
5...	597.458328314	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_ECHO_REQUEST
5...	592.457787073	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_ECHO_REQUEST
5...	587.456862342	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_ECHO_REQUEST
5...	582.456439906	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_ECHO_REQUEST
5...	577.455670066	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_ECHO_REQUEST

▶ Frame 29: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface lo, id 0
 ▶ Ethernet II, Src: 00:00:00_00:00:00 (00:00:00:00:00:00), Dst: 00:00:00_00:00:00 (00:00:00:00:00:00)
 ▶ Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1
 ▶ Transmission Control Protocol, Src Port: 6653, Dst Port: 51108, Seq: 9, Ack: 9, Len: 8
 ▶ OpenFlow 1.0
 .000 0001 = Version: 1.0 (0x01)
 Type: OFPT_FEATURES_REQUEST (5)
 Length: 8
 Transaction ID: 4030503877

```

0000  00 00 00 00 00 00 00 00 00 00 00 00 08 00 45 00  .....E.
0010  00 3c fb 17 40 00 40 06 41 a2 7f 00 00 01 7f 00  <...@.@. A.....
0020  00 01 19 fd c7 a4 90 76 72 25 4f 76 29 db 80 18  .....v r%0v)....
0030  00 56 fe 30 00 00 01 01 08 0a 6a 2a 45 ce 6a 2a  ·V·0....·j*E·j*
0040  45 cc 01 05 00 08 f0 3c 9b c5  E.....< ..
  
```

Type: Unsigned integer, 1 byte

*Loopback: lo

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openflow_1_0.type

No.	Time	Source	Destination	Protocol	Length	Info
39	0.676275293	::	ff02::16	OpenFlow	174	Type: OFPT_PACKET_IN
35	0.432848229	::	ff02::16	OpenFlow	174	Type: OFPT_PACKET_IN
28	0.429634325	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_HELLO
29	0.429728460	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_FEATURES_REQUEST
34	0.430826313	127.0.0.1	127.0.0.1	OpenFlow	242	Type: OFPT_FEATURES_REPLY
5...	617.464544523	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_ECHO_REQUEST
5...	612.462848783	127.0.0.1	127.0.0.1	OpenFlow	74	Type: OFPT_ECHO_REQUEST

▶ Frame 34: 242 bytes on wire (1936 bits), 242 bytes captured (1936 bits) on interface lo, id 0

▶ Ethernet II, Src: 00:00:00_00:00:00 (00:00:00:00:00:00), Dst: 00:00:00_00:00:00 (00:00:00:00:00:00)

▶ Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1

▶ Transmission Control Protocol, Src Port: 51108, Dst Port: 6653, Seq: 9, Ack: 29, Len: 176

▼ OpenFlow 1.0

- .000 0001 = Version: 1.0 (0x01)
- Type: OFPT_FEATURES_REPLY (6)
- Length: 176
- Transaction ID: 4030503877
- ▶ Datapath unique ID: 0x0000000000000001
- n_buffers: 0
- n_tables: 254
- Pad: 000000
- ▶ capabilities: 0x000000c7
- ▶ actions: 0x00000fff
- ▶ Port data 1
- ▶ Port data 2
- ▶ Port data 3

```

0000  00 00 00 00 00 00 00 00 00 00 00 08 00 45 c0  .....E.
0010  00 e4 5a 8d 40 00 40 06 e0 c4 7f 00 00 01 7f 00  ..Z.@. ....
0020  00 01 c7 a4 19 fd 4f 76 29 db 90 76 72 39 80 18  .....0v )..vr9..
0030  00 56 fe d8 00 00 01 01 08 0a 6a 2a 45 cf 6a 2a  ..V.....j*E.j*
0040  45 ce 01 06 00 b0 f0 3c 9b c5 00 00 00 00 00 00  E.....< .....
  
```

Type: Unsigned integer, 1 byte

پیام feature request از سمت کنترلر به سویچ است و به سویچ درخواست میدهد که گزارشی از قابلیت های خود ارسال کند

پیام Feature reply پاسخ درخواست کنترلر از سمت سویچ است که قابلیت های سویچ، مانند وضعیت و سرعت پورت ها و اکشن هایی که پشتیبانی میکند را به کنترلر گزارش میکند

Wireshark interface showing network traffic analysis. The packet list displays several OpenFlow 1.0 packets (Type: OFPT_PACKET_IN) with source IP fe80::468:97ff:feb9:22b5 and destination ff02::2. The packet details pane shows the selected packet's structure, including Transaction ID, Buffer ID, Total length, In port, and Reason: No matching flow (table-miss flow entry) (0).

No.	Time	Source	Destination	Protocol	Length	Info
37	0.434264241	::	ff02::16	OpenFlow	180	Type: OFPT_PACKET_OUT
4...	497.444737057	fe80::468:97...	ff02::2	OpenFlow	154	Type: OFPT_PACKET_IN
4...	481.061636262	fe80::9cb8:6...	ff02::2	OpenFlow	154	Type: OFPT_PACKET_IN
3...	241.445146314	fe80::468:97...	ff02::2	OpenFlow	154	Type: OFPT_PACKET_IN
3...	239.397272628	fe80::9cb8:6...	ff02::2	OpenFlow	154	Type: OFPT_PACKET_IN
2...	120.612526752	fe80::468:97...	ff02::2	OpenFlow	154	Type: OFPT_PACKET_IN
2...	118.564592315	fe80::9cb8:6...	ff02::2	OpenFlow	154	Type: OFPT_PACKET_IN
1...	59.173952196	fe80::9cb8:6...	ff02::2	OpenFlow	154	Type: OFPT_PACKET_IN
1...	59.173928158	fe80::468:97...	ff02::2	OpenFlow	154	Type: OFPT_PACKET_IN
1...	28.709723030	fe80::468:97...	ff02::2	OpenFlow	154	Type: OFPT_PACKET_IN
1...	28.709691035	fe80::9cb8:6...	ff02::2	OpenFlow	154	Type: OFPT_PACKET_IN
1...	13.860736079	fe80::9cb8:6...	ff02::2	OpenFlow	154	Type: OFPT_PACKET_IN
1...	13.604930198	fe80::468:97...	ff02::2	OpenFlow	154	Type: OFPT_PACKET_IN
1...	5.924171078	fe80::9cb8:6...	ff02::2	OpenFlow	154	Type: OFPT_PACKET_IN
1...	5.924142674	fe80::468:97...	ff02::2	OpenFlow	154	Type: OFPT_PACKET_IN
1...	2.505207151	fe80::468:97...	ff02::16	OpenFlow	174	Type: OFPT_PACKET_IN
1...	2.268579630	fe80::9cb8:6...	ff02::16	OpenFlow	174	Type: OFPT_PACKET_IN
1...	2.024874432	fe80::468:97...	ff02::2	OpenFlow	154	Type: OFPT_PACKET_IN
1...	2.024847939	fe80::9cb8:6...	ff02::2	OpenFlow	154	Type: OFPT_PACKET_IN

OpenFlow 1.0
 .000 0001 = Version: 1.0 (0x01)
 Type: OFPT_PACKET_IN (10)
 Length: 88
 Transaction ID: 0
 Buffer Id: 0xffffffff
 Total length: 70
 In port: 2
 Reason: No matching flow (table-miss flow entry) (0)
 Pad: 00
 ▶ Ethernet II, Src: 06:68:97:b9:22:b5 (06:68:97:b9:22:b5), Dst: IPv6mcast_02 (33:33:00:00:00:02)
 ▶ Internet Protocol Version 6, Src: fe80::468:97ff:feb9:22b5, Dst: ff02::2
 ▶ Internet Control Message Protocol v6

0000 00 00 00 00 00 00 00 00 00 00 00 00 08 00 45 c0E.

Type: Unsigned integer, 1 byte

۵- بسته های packet_in زمانی به کنترلر ارسال میشوند که یا اکشن مربوط به آن بسته، ارسال به کنترلر تنظیم شده باشد، و یا سوییچ نتواند هیچ اکشنی را به آن بسته تطبیق دهد

۶- پروتکل OpenFlow استفاده شده است

هر کدام از این بسته ها نشان دهنده یک پیام echo از نوع reply یا request در پروتکل ICMP است که به دلیل عدم تطبیق در جدول سوییچ، به صورت packet_in و packet_out در آمده اند تا خود کنترلر آنها را هندل کند

The image shows a Wireshark packet capture window titled '*Loopback: lo'. The filter is set to 'icmp'. The packet list shows several OpenFlow packets (OFPT_PACKET_IN and OFPT_PACKET_OUT) with lengths of 182 bytes. The selected packet (No. 18) is an ICMP Echo (ping) request from 10.0.0.1 to 10.0.0.2. The packet details pane shows the following information:

- Length: 116
- Transaction ID: 0
- Buffer Id: 0xffffffff
- Total length: 98
- In port: 1
- Reason: No matching flow (table-miss flow entry) (0)
- Pad: 00
- Ethernet II, Src: 9e:b8:66:3a:69:7e (9e:b8:66:3a:69:7e), Dst: 06:68:97:b9:22:b5 (06:68:97:b9:22:b5)
- Internet Protocol Version 4, Src: 10.0.0.1, Dst: 10.0.0.2
- Internet Control Message Protocol**
 - Type: 8 (Echo (ping) request)
 - Code: 0
 - Checksum: 0xc436 [correct] [Checksum Status: Good]
 - Identifier (BE): 24891 (0x613b)
 - Identifier (LE): 15201 (0x3b61)
 - Sequence Number (BE): 1 (0x0001)
 - Sequence Number (LE): 256 (0x0100)
 - [No response seen]**
 - Timestamp from icmp data: Dec 4, 2022 12:56:46.000000000 EST
 - [Timestamp from icmp data (relative): 0.555236375 seconds]
 - Data (48 bytes)

The packet bytes pane shows the raw data: 0000 00 00 00 00 00 00 00 00 00 00 00 08 00 45 c0E..

The status bar at the bottom indicates 'Internet Control Message Protocol: Protocol'.

بخش دو

```
"Node: h1"
root@zero:/home/zero# iperf -s -p 5566 -i 1

Server listening on TCP port 5566
TCP window size: 85.3 KByte (default)

[ 6] local 10.0.0.1 port 5566 connected with 10.0.0.2 port 53804
[ ID] Interval      Transfer    Bandwidth
[ 6] 0.0000-1.0000 sec  2.86 GBytes 24.6 Gbits/sec
[ 6] 1.0000-2.0000 sec  2.85 GBytes 24.5 Gbits/sec
[ 6] 2.0000-3.0000 sec  2.77 GBytes 23.8 Gbits/sec
[ 6] 3.0000-4.0000 sec  2.75 GBytes 23.6 Gbits/sec
[ 6] 4.0000-5.0000 sec  3.09 GBytes 26.6 Gbits/sec
[ 6] 5.0000-6.0000 sec  2.97 GBytes 25.5 Gbits/sec
[ 6] 6.0000-7.0000 sec  3.07 GBytes 26.3 Gbits/sec
[ 6] 7.0000-8.0000 sec  2.75 GBytes 23.6 Gbits/sec
[ 6] 8.0000-9.0000 sec  3.06 GBytes 26.3 Gbits/sec
[ 6] 9.0000-10.0000 sec 3.26 GBytes 28.0 Gbits/sec
[ 6] 10.0000-11.0000 sec 3.14 GBytes 27.0 Gbits/sec
[ 6] 11.0000-12.0000 sec 3.21 GBytes 27.5 Gbits/sec
[ 6] 12.0000-13.0000 sec 3.36 GBytes 28.8 Gbits/sec
[ 6] 13.0000-14.0000 sec 3.27 GBytes 28.1 Gbits/sec
[ 6] 14.0000-14.9999 sec 3.45 GBytes 29.7 Gbits/sec
[ 6] 0.0000-14.9999 sec 45.9 GBytes 26.3 Gbits/sec
```

```
"Node: h2"
root@zero:/home/zero# iperf -c 10.0.0.1 -p 5566 -t 15

Client connecting to 10.0.0.1, TCP port 5566
TCP window size: 85.3 KByte (default)

[ 5] local 10.0.0.2 port 53804 connected with 10.0.0.1 port 5566
[ ID] Interval      Transfer    Bandwidth
[ 5] 0.0000-15.0001 sec 45.9 GBytes 26.3 Gbits/sec
root@zero:/home/zero#
```