

به نام خدا

پروژه ۲ شبکه

حدیث غفوری (9825413)

نصب وایرشارک

```
hadis@ubuntu: ~  
Hit:4 http://us.archive.ubuntu.com/ubuntu xenial-updates InRelease  
Hit:5 http://us.archive.ubuntu.com/ubuntu xenial-backports InRelease  
Get:6 http://ppa.launchpad.net/wireshark-dev/stable/ubuntu xenial/main i386 Pack  
ages [3,696 B]  
Get:7 http://ppa.launchpad.net/wireshark-dev/stable/ubuntu xenial/main Translati  
on-en [1,840 B]  
Fetched 29.9 kB in 3s (9,177 B/s)  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
82 packages can be upgraded. Run 'apt list --upgradable' to see them.  
hadis@ubuntu:~$ sudo apt install wireshark  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
The following packages were automatically installed and are no longer required:  
  libwireshark11 libwiretap8 libwscodecs2 libwsutil9 snapd-login-service  
  wireshark-gtk  
Use 'sudo apt autoremove' to remove them.  
The following additional packages will be installed:  
  libbrotli1 libminizip1 libwireshark-data libwireshark14 libwiretap11  
  libwsutil12 tshark wireshark-common wireshark-gtk wireshark-qt  
Suggested packages:  
  geoipupdate geoip-database-extra libjs-leaflet libjs-leaflet.markercluster
```

1.1

پروتوکول openflow,tcp

The image shows a Wireshark capture of network traffic and a terminal window. The Wireshark interface displays a list of packets, with the first packet being a TCP Reset (RST) from 127.0.0.1 to 127.0.0.1. The terminal window shows the output of a script that sets up a network topology, including creating a network, adding a controller, adding hosts, adding switches, adding links, configuring hosts, starting the controller, starting switches, waiting for switches to connect, testing ping reachability, and stopping the controller and switches.

1.2 پیغام های hello

سوئیچ باید بلافاصله پس از برقراری ارتباط TCP/TLS با کنترلر کند، یک پیام سلام به کنترلر کند ارسال کند.

Time	Source	Destination	Protocol	Length	Info
66.23.646189...	127.0.0.1	127.0.0.1	Open...	74	Type: OFPT_HELLO
71.23.651991...	127.0.0.1	127.0.0.1	Open...	74	Type: OFPT_HELLO
76.23.683776...	127.0.0.1	127.0.0.1	Open...	74	Type: OFPT_HELLO
83.23.713640...	127.0.0.1	127.0.0.1	Open...	74	Type: OFPT_HELLO
87.23.741508...	127.0.0.1	127.0.0.1	Open...	74	Type: OFPT_FEATURES_REQUEST
88.23.741521...	127.0.0.1	127.0.0.1	Open...	78	Type: OFPT_SET_CONFIG
93.23.747238...	127.0.0.1	127.0.0.1	Open...	242	Type: OFPT_FEATURES_REPLY
96.23.758767...	127.0.0.1	127.0.0.1	Open...	74	Type: OFPT_FEATURES_REQUEST
97.23.758789...	127.0.0.1	127.0.0.1	Open...	78	Type: OFPT_SET_CONFIG
100.23.760096...	127.0.0.1	127.0.0.1	Open...	242	Type: OFPT_FEATURES_REPLY
103.23.764214...	127.0.0.1	127.0.0.1	Open...	74	Type: OFPT_FEATURES_REQUEST
104.23.764229...	127.0.0.1	127.0.0.1	Open...	78	Type: OFPT_SET_CONFIG
107.23.775775...	127.0.0.1	127.0.0.1	Open...	290	Type: OFPT_FEATURES_REPLY
110.23.779916...	127.0.0.1	127.0.0.1	Open...	74	Type: OFPT_FEATURES_REQUEST
111.23.779932...	127.0.0.1	127.0.0.1	Open...	78	Type: OFPT_SET_CONFIG
114.23.783702...	127.0.0.1	127.0.0.1	Open...	290	Type: OFPT_FEATURES_REPLY
131.24.179491...	fe80::acb8:fd...	ff02::16	Open...	174	Type: OFPT_PACKET_IN
133.24.179603...	127.0.0.1	127.0.0.1	Open...	90	Type: OFPT_PACKET_OUT
134.24.186399...	fe80::acb8:fd...	ff02::2	Open...	154	Type: OFPT_PACKET_IN
135.24.186469...	127.0.0.1	127.0.0.1	Open...	90	Type: OFPT_PACKET_OUT
136.24.186532...	fe80::acb8:fd...	ff02::16	Open...	174	Type: OFPT_PACKET_IN
137.24.186573...	127.0.0.1	127.0.0.1	Open...	90	Type: OFPT_PACKET_OUT
138.24.186623...	fe80::acb8:fd...	ff02::fb	Open...	212	Type: OFPT_PACKET_IN
139.24.186661...	127.0.0.1	127.0.0.1	Open...	90	Type: OFPT_PACKET_OUT
140.24.186710...	fe80::acb8:fd...	ff02::fb	Open...	212	Type: OFPT_PACKET_IN
141.24.186745...	127.0.0.1	127.0.0.1	Open...	90	Type: OFPT_PACKET_OUT
142.24.187126...	127.0.0.1	127.0.0.1	Open...	130	Type: OFPT_PORT_STATUS
143.24.189920...	fe80::b899:22f...	ff02::fb	Open...	212	Type: OFPT_PACKET_IN
145.24.189990...	127.0.0.1	127.0.0.1	Open...	90	Type: OFPT_PACKET_OUT
146.24.196844...	fe80::b899:22f...	ff02::16	Open...	174	Type: OFPT_PACKET_IN
147.24.196926...	127.0.0.1	127.0.0.1	Open...	90	Type: OFPT_PACKET_OUT
148.24.196987...	fe80::b899:22f...	ff02::fb	Open...	212	Type: OFPT_PACKET_IN
149.24.197033...	127.0.0.1	127.0.0.1	Open...	90	Type: OFPT_PACKET_OUT

```

127.0.0.1 127.0.0.1 TCP 74 48536 → 6653 [SYN] Seq=0 Win=43690 Len=0 MSS=65495 SACK_PERM=1 TSval=3499562678 TSecr=
127.0.0.1 127.0.0.1 TCP 74 6653 → 48536 [SYN, ACK] Seq=0 Ack=1 Win=43690 Len=0 MSS=65495 SACK_PERM=1 TSval=349956
127.0.0.1 127.0.0.1 TCP 66 48536 → 6653 [ACK] Seq=1 Ack=1 Win=44032 Len=0 TSval=3499562678 TSecr=3499562678
127.0.0.1 127.0.0.1 Open... 74 Type: OFPT_HELLO
127.0.0.1 127.0.0.1 TCP 66 48536 → 6653 [ACK] Seq=1 Ack=9 Win=44032 Len=0 TSval=3499562678 TSecr=3499562678
127.0.0.1 127.0.0.1 TCP 74 48536 → 6653 [SYN] Seq=0 Win=43690 Len=0 MSS=65495 SACK_PERM=1 TSval=3499562684 TSecr=
127.0.0.1 127.0.0.1 TCP 74 6653 → 48536 [SYN, ACK] Seq=0 Ack=1 Win=43690 Len=0 MSS=65495 SACK_PERM=1 TSval=349956
127.0.0.1 127.0.0.1 TCP 66 48536 → 6653 [ACK] Seq=1 Ack=1 Win=44032 Len=0 TSval=3499562684 TSecr=3499562684
127.0.0.1 127.0.0.1 Open... 74 Type: OFPT_HELLO
127.0.0.1 127.0.0.1 TCP 66 48536 → 6653 [ACK] Seq=1 Ack=9 Win=44032 Len=0 TSval=3499562684 TSecr=3499562684
127.0.0.1 127.0.0.1 TCP 74 48540 → 6653 [SYN] Seq=0 Win=43690 Len=0 MSS=65495 SACK_PERM=1 TSval=3499562715 TSecr=
127.0.0.1 127.0.0.1 TCP 74 6653 → 48540 [SYN, ACK] Seq=0 Ack=1 Win=43690 Len=0 MSS=65495 SACK_PERM=1 TSval=349956
127.0.0.1 127.0.0.1 TCP 66 48540 → 6653 [ACK] Seq=1 Ack=1 Win=44032 Len=0 TSval=3499562715 TSecr=3499562715
127.0.0.1 127.0.0.1 Open... 74 Type: OFPT_HELLO
127.0.0.1 127.0.0.1 TCP 66 48540 → 6653 [ACK] Seq=1 Ack=9 Win=44032 Len=0 TSval=3499562722 TSecr=3499562716
127.0.0.1 127.0.0.1 DNS 76 Standard query 0xaa85 A daisy.ubuntu.com
127.0.0.1 127.0.0.1 DNS 76 Standard query 0x9c8b AAAA daisy.ubuntu.com
127.0.0.1 127.0.0.1 TCP 74 48542 → 6653 [SYN] Seq=0 Win=43690 Len=0 MSS=65495 SACK_PERM=1 TSval=3499562745 TSecr=
127.0.0.1 127.0.0.1 TCP 74 6653 → 48542 [SYN, ACK] Seq=0 Ack=1 Win=43690 Len=0 MSS=65495 SACK_PERM=1 TSval=349956
127.0.0.1 127.0.0.1 TCP 66 48542 → 6653 [ACK] Seq=1 Ack=1 Win=44032 Len=0 TSval=3499562745 TSecr=3499562745
127.0.0.1 127.0.0.1 Open... 74 Type: OFPT_HELLO
127.0.0.1 127.0.0.1 TCP 66 48542 → 6653 [ACK] Seq=1 Ack=9 Win=44032 Len=0 TSval=3499562750 TSecr=3499562745
127.0.0.1 127.0.0.1 Open... 74 Type: OFPT_HELLO
127.0.0.1 127.0.0.1 TCP 66 6653 → 48536 [ACK] Seq=9 Ack=9 Win=44032 Len=0 TSval=3499562773 TSecr=3499562773
127.0.0.1 127.0.0.1 Open... 74 Type: OFPT_FEATURES_REQUEST
127.0.0.1 127.0.0.1 Open... 78 Type: OFPT_SET_CONFIG
127.0.0.1 127.0.0.1 DNS 108 Standard query response 0xaa85 A daisy.ubuntu.com A 185.125.188.136 A 185.125.188.137
127.0.0.1 127.0.0.1 DNS 137 Standard query response 0x9c8b AAAA daisy.ubuntu.com SOA ns1.canonical.com
127.0.0.1 127.0.0.1 TCP 66 48536 → 6653 [ACK] Seq=9 Ack=17 Win=44032 Len=0 TSval=3499562778 TSecr=3499562773
127.0.0.1 127.0.0.1 TCP 66 48536 → 6653 [ACK] Seq=9 Ack=29 Win=44032 Len=0 TSval=3499562778 TSecr=3499562773
127.0.0.1 127.0.0.1 Open... 242 Type: OFPT_FEATURES_REPLY

```

1.3

```

133... 127.0.0.1 127.0.0.1 TCP 66 6653 → 48536 [ACK] Seq=9 Ack=9 Win=44032 Len=0 TSval=3499562773 TSecr=3499562773
508... 127.0.0.1 127.0.0.1 Open... 74 Type: OFPT_FEATURES_REQUEST
521... 127.0.0.1 127.0.0.1 Open... 78 Type: OFPT_SET_CONFIG
576... 127.0.0.1 127.0.0.1 DNS 108 Standard query response 0xaa85 A daisy.ubuntu.com A 185.125.188.136 A 185.125.188.137
756... 127.0.0.1 127.0.0.1 DNS 137 Standard query response 0x9c8b AAAA daisy.ubuntu.com SOA ns1.canonical.com
414... 127.0.0.1 127.0.0.1 TCP 66 48536 → 6653 [ACK] Seq=9 Ack=17 Win=44032 Len=0 TSval=3499562778 TSecr=3499562773
420... 127.0.0.1 127.0.0.1 TCP 66 48536 → 6653 [ACK] Seq=9 Ack=29 Win=44032 Len=0 TSval=3499562778 TSecr=3499562773
238... 127.0.0.1 127.0.0.1 Open... 242 Type: OFPT_FEATURES_REPLY

```

OFPT_FEATURES_REQUEST از کنترلر به سویچ

این پیام برای یافتن شناسه مسیر داده (DPID) سوئیچ استفاده می شود. DPID به طور منحصربه فرد یک مسیر داده را در توپولوژی OpenFlow شناسایی می کند و به صورت پویا با ترکیب آدرس MAC دستگاه در 48 بیت پایین تر، همراه با رشته های 16 بیتی که توسط پیاده کننده تعیین می شود، ایجاد می شود.

کنترلر به سویچ درخواست می دهد تا featureها و قابلیت هایی که دارد را اعلام کند و در پاسخ هم سویچ در قالب **OFPT_FEATURES_REPLY** آنها را برایش ارسال می کند.

```

[PDU Size: 176]
▼ OpenFlow 1.0
  .000 0001 = Version: 1.0 (0x01)
  Type: OFPT_FEATURES_REPLY (6)
  Length: 176
  Transaction ID: 1479766457
  ▼ Datapath unique ID: 0x0000000000000004
    MAC addr: 00:00:00_00:00:00 (00:00:00:00:00:00)
    Implementers part: 0x0004
    n_buffers: 256
    n_tables: 254
    Pad: 000000
    ▼ capabilities: 0x000000c7
0000 00 00 00 00 00 00 00 00 00 00 00 08 00 45 c0 .....E.
0010 00 e4 9f 54 40 00 40 06 9b fd 7f 00 00 01 7f 00 ...T@.@.
0020 00 01 bd 98 19 fd cd f3 89 65 69 3c 36 c8 80 18 .....ei<6.
0030 00 56 fe d8 00 00 01 01 08 0a d0 97 17 1b d0 97 .V.....
0040 17 15 01 06 00 b0 58 33 71 b9 00 00 00 00 00 00 .....X3 q.
0050 00 04 00 00 01 00 fe 00 00 00 00 00 00 c7 00 00 .....
0060 0f ff ff fe f2 46 39 99 20 27 73 34 00 00 00 00 .....F9. 's4.
0070 00 00 00 00 00 00 00 00 00 00 00 00 01 00 00 .....
0080 00 01 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0090 00 00 00 01 2e 49 d7 fd 2b fc 73 34 2d 65 74 68 .....I. +s4-eth
00a0 31 00 00 00 00 00 00 00 00 00 00 00 00 00 00 1.....
00b0 00 00 00 00 00 c0 00 00 00 00 00 00 00 00 00 .....
00c0 00 00 00 02 ee 3f 9b 83 2f eb 73 34 2d 65 74 68 .....?.. /s4-eth
00d0 32 00 00 00 00 00 00 00 00 00 00 00 00 00 00 2.....
00e0 00 00 00 00 00 c0 00 00 00 00 00 00 00 00 00 .....
00f0 00 00 .....

```

1.4

	Source	Destination	Protocol	Length	Info
2...	127.0.0.1	127.0.0.1	Open...	290	Type: OFPT_FEATURES_REPLY
1...	fe80::acb8:fd...	ff02::16	Open...	174	Type: OFPT_PACKET_IN
3...	127.0.0.1	127.0.0.1	Open...	90	Type: OFPT_PACKET_OUT
9...	fe80::acb8:fd...	ff02::2	Open...	154	Type: OFPT_PACKET_IN
9...	127.0.0.1	127.0.0.1	Open...	90	Type: OFPT_PACKET_OUT
2...	fe80::acb8:fd...	ff02::16	Open...	174	Type: OFPT_PACKET_IN
3...	127.0.0.1	127.0.0.1	Open...	90	Type: OFPT_PACKET_OUT
3...	fe80::acb8:fd...	ff02::fb	Open...	212	Type: OFPT_PACKET_IN
1...	127.0.0.1	127.0.0.1	Open...	90	Type: OFPT_PACKET_OUT
0...	fe80::acb8:fd...	ff02::fb	Open...	212	Type: OFPT_PACKET_IN
5...	127.0.0.1	127.0.0.1	Open...	90	Type: OFPT_PACKET_OUT
6...	127.0.0.1	127.0.0.1	Open...	130	Type: OFPT_PORT_STATUS
0...	fe80::b899:22f...	ff02::fb	Open...	212	Type: OFPT_PACKET_IN
0...	127.0.0.1	127.0.0.1	Open...	90	Type: OFPT_PACKET_OUT
4...	fe80::b899:22f...	ff02::16	Open...	174	Type: OFPT_PACKET_IN
6...	127.0.0.1	127.0.0.1	Open...	90	Type: OFPT_PACKET_OUT
7...	fe80::b899:22f...	ff02::fb	Open...	212	Type: OFPT_PACKET_IN
3...	127.0.0.1	127.0.0.1	Open...	90	Type: OFPT_PACKET_OUT
2...	fe80::b899:22f...	ff02::fb	Open...	212	Type: OFPT_PACKET_IN
4...	127.0.0.1	127.0.0.1	Open...	90	Type: OFPT_PACKET_OUT
3...	127.0.0.1	127.0.0.1	Open...	130	Type: OFPT_PORT_STATUS
5...	fe80::ec3f:9bf...	ff02::16	Open...	174	Type: OFPT_PACKET_IN
1...	127.0.0.1	127.0.0.1	Open...	90	Type: OFPT_PACKET_OUT
9...	fe80::ec3f:9bf...	ff02::2	Open...	154	Type: OFPT_PACKET_IN
6...	127.0.0.1	127.0.0.1	Open...	90	Type: OFPT_PACKET_OUT
4...	fe80::ec3f:9bf...	ff02::16	Open...	174	Type: OFPT_PACKET_IN
8...	127.0.0.1	127.0.0.1	Open...	90	Type: OFPT_PACKET_OUT
3...	fe80::ec3f:9bf...	ff02::16	Open...	194	Type: OFPT_PACKET_IN
6...	127.0.0.1	127.0.0.1	Open...	90	Type: OFPT_PACKET_OUT
1...	fe80::ec3f:9bf...	ff02::fb	Open...	212	Type: OFPT_PACKET_IN
3...	127.0.0.1	127.0.0.1	Open...	90	Type: OFPT_PACKET_OUT
7...	fe80::ec3f:9bf...	ff02::fb	Open...	212	Type: OFPT_PACKET_IN

1.5

Packet-In

پیام‌های بسته‌ای (OFP_PACKET_IN) از سوئیچ به کنترل‌کننده ارسال می‌شوند تا بسته دریافتی از یکی از پورتهای سوئیچ را برای پردازش بیشتر به کنترل‌کننده منتقل کنند.

به طور پیش‌فرض، یک پیام packet-in باید به همه کنترل‌کننده‌هایی که در نقش‌های مساوی (OFPCR_ROLE_EQUAL) و اصلی (OFPCR_ROLE_MASTER) هستند ارسال شود. این پیام نباید برای کنترلرهایی که در حالت Slave هستند ارسال شود.

سه روش وجود دارد که سوئیچ می‌تواند یک رویداد packet-in را به کنترل‌کننده ارسال کند:

- 1. Table-miss entry:** زمانی که هیچ flow entry منطقی برای بسته ورودی وجود ندارد، سوئیچ می‌تواند بسته را به کنترل‌کننده ارسال کند.
- 2. بررسی TTL:** هنگامی که مقدار TTL در یک بسته به صفر می‌رسد، سوئیچ می‌تواند بسته را به کنترل‌کننده ارسال کند.
- 3. عمل "ارسال به کنترل‌کننده" در matching entry (اعم از ورودی جدول جریان یا ورودی جدول گروه) بسته.**

رویدادهای packet-in می‌توانند شامل بسته کامل باشند یا می‌توانند برای بسته‌های بافر در سوئیچ پیکربندی شوند. اگر رویداد packet-in برای بسته‌های بافر پیکربندی شده باشد، رویدادهای packet-in فقط شامل بخشی از هدر بسته و یک شناسه بافر هستند.

کنترل‌کننده بسته کامل یا ترکیبی از هدر بسته و شناسه بافر را پردازش می‌کند. سپس، کنترل‌کننده یک پیام بسته خروجی ارسال می‌کند تا سوئیچ را برای پردازش بسته هدایت کند.

1.6

The image shows two side-by-side screenshots. The left screenshot is a Wireshark packet capture of ICMP traffic. It shows two packets: one from 10.0.0.1 to 10.0.0.2 (sequence 157) and another from 10.0.0.2 to 10.0.0.1 (sequence 160). Both are of type OFPT_PACKET_IN. The right screenshot is a terminal window showing the setup and execution of a Mininet network. It includes commands like 'sudo mn --topo single,3', 'mininet> h1 ping h2', and the resulting ping statistics showing 9 successful pings with 0% packet loss and an average time of 8165ms.

به کمک پروتکل open_flow پکت هایی از هاست h1 به هاست h2 و از هاست h2 به هاست h1 ارسال شده.

همان طور که از ایپی های مبدا و مقصد مشخص است ایپی هاست h1 برابر 10.0.0.1 و ایپی هاست h2 برابر 10.0.0.2 است.

سوال ۲

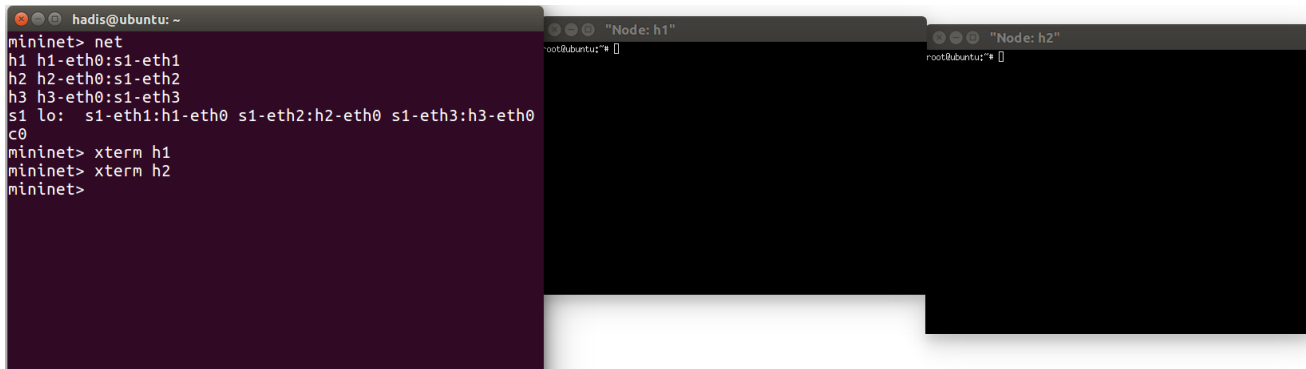
```
mininet> h1 ifconfig
h1 eth0 Link encap:Ethernet HWaddr 52:54:f8:b7:3e:bf
      inet addr:10.0.0.1 Bcast:10.255.255.255 Mask:255.0.0.0
      inet6 addr: fe80::5054:f8ff:feb7:3ebf/64 Scope:Link
      UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
      RX packets:153158 errors:0 dropped:0 overruns:0 frame:0
      TX packets:228082 errors:0 dropped:0 overruns:0 carrier:0
      collisions:0 txqueuelen:1000
      RX bytes:10111427 (10.1 MB) TX bytes:10657838136 (10.6 GB)

lo Link encap:Local Loopback
      inet addr:127.0.0.1 Mask:255.0.0.0
      inet6 addr: ::1/128 Scope:Host
      UP LOOPBACK RUNNING MTU:65536 Metric:1
      RX packets:0 errors:0 dropped:0 overruns:0 frame:0
      TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
      collisions:0 txqueuelen:1000
      RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
```

```
mininet> h2 ifconfig
h2-eth0  Link encap:Ethernet  HWaddr 6e:a9:63:3a:82:0b
        inet addr:10.0.0.2  Bcast:10.255.255.255  Mask:255.0.0.0
        inet6 addr: fe80::6ca9:63ff:fe3a:820b/64 Scope:Link
        UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
        RX packets:134924 errors:0 dropped:0 overruns:0 frame:0
        TX packets:89857 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:6300888279 (6.3 GB)  TX bytes:5930938 (5.9 MB)

lo       Link encap:Local Loopback
        inet addr:127.0.0.1  Mask:255.0.0.0
        inet6 addr: ::1/128 Scope:Host
        UP LOOPBACK RUNNING  MTU:65536  Metric:1
        RX packets:0 errors:0 dropped:0 overruns:0 frame:0
        TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

mininet>
```



Start the TCP server (-s) at h2 with port 5566 (-p). Also, monitor the results every one second (-i). the default setting is using TCP.

```
"Node: h2"
root@ubuntu:~# iperf -s -p 5566 -i 1
-----
Server listening on TCP port 5566
TCP window size: 85.3 KByte (default)
-----
```

Start the TCP client (-c) at h1. Also, set the transmission duration (-t) to 15 seconds. Note: after -c, you need to specify the server ip address.

```
"Node: h1"
root@ubuntu:~# iperf -c 10.0.0.2 -p 5566 -t 15
-----
Client connecting to 10.0.0.2, TCP port 5566
TCP window size: 85.3 KByte (default)
-----
[ 15] local 10.0.0.1 port 53568 connected with 10.0.0.2 port 5566
[ ID] Interval      Transfer    Bandwidth
[ 15] 0.0-15.0 sec  5.86 GBytes  3.36 Gbits/sec
root@ubuntu:~#

"Node: h2"
root@ubuntu:~# iperf -s -p 5566 -i 1
-----
Server listening on TCP port 5566
TCP window size: 85.3 KByte (default)
-----
[ 16] local 10.0.0.2 port 5566 connected with 10.0.0.1 port 53568
[ ID] Interval      Transfer    Bandwidth
[ 16] 0.0- 1.0 sec  402 MBytes  3.37 Gbits/sec
[ 16] 1.0- 2.0 sec  486 MBytes  4.08 Gbits/sec
[ 16] 2.0- 3.0 sec  444 MBytes  3.72 Gbits/sec
[ 16] 3.0- 4.0 sec  445 MBytes  3.73 Gbits/sec
[ 16] 4.0- 5.0 sec  336 MBytes  2.82 Gbits/sec
[ 16] 5.0- 6.0 sec  376 MBytes  3.15 Gbits/sec
[ 16] 6.0- 7.0 sec  298 MBytes  2.50 Gbits/sec
[ 16] 7.0- 8.0 sec  424 MBytes  3.56 Gbits/sec
[ 16] 8.0- 9.0 sec  328 MBytes  2.75 Gbits/sec
[ 16] 9.0-10.0 sec  402 MBytes  3.37 Gbits/sec
[ 16] 10.0-11.0 sec  337 MBytes  2.83 Gbits/sec
[ 16] 11.0-12.0 sec  505 MBytes  4.23 Gbits/sec
[ 16] 12.0-13.0 sec  430 MBytes  3.61 Gbits/sec
[ 16] 13.0-14.0 sec  447 MBytes  3.75 Gbits/sec
[ 16] 14.0-15.0 sec  341 MBytes  2.86 Gbits/sec
[ 16] 0.0-15.0 sec  5.86 GBytes  3.35 Gbits/sec
```

نتایج

در h1 (کلاينت):

از ثانیه ی صفر تا ۱۵ میانگین گذردهی 3.36 Gbps بوده است.

در h2 (سرور):

Throughput را در هرثانیه نشان میدهد.