

REPORT

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Instructions:

In the topology module, controller is by default the actual module itself. But for the case of Spanning tree, the inability of controller to eradicate the looping of packet is what makes the complete topology useless and inefficient. So, Controller is given the chance to analyze the traffic and channelize it in such a way, that there is no duplication of packets at a node more than once. And if we make the controller to set up the spanning tree in the given network and in someway or the other, make it allow packets via specific paths, disabling redundant and unnecessary links, We can avoid this packet looping condition.

In mininet, there already exists a remote controller namely pox controller, We shall provide the controller rights to this and let it create spanning tree

Capture the data in Wireshark and observe them separately.

Create topology h1-----s1-----s2-----h2 using stp.py topo file



1) For switches without spanning tree protocol:

```
>> run sudo "mn --custom stp.py --topo recttopo " on mininet
virtualmachine
>> xterm h1,h2,s1,s2,s3
>> For each xterm open a wireshark instance by typing "sudo wireshark &"
and start packet capture
>> run iperf server on h2 --> do "iperf -s" on h2
>> run iperf client on h1 --> do "iperf -c 10.0.0.2" on h1
```

2) Implementing switches using spanning tree protocol(stp):

```
>> run sudo "mn --custom stp.py --topo recttopo --controller remote
--switch ovsk --mac" on mininet virtual machine
```

```
>> h1's mac== 00:00:00:00:00:01
```

```
>> h2's mac== 00:00:00:00:00:02
```

```
>> we use a remote pox controller by running
```

```
"pox/pox.py --verbose openflow.spanning_tree --no-flood --hold-down
openflow.discovery forwarding.l2_multi"
```

```
>> xterm h1,h2,s1,s2,s3
```

```
>> For each xterm open a wireshark instance by typing "sudo wireshark &"
and start packet capture
```

```
>> run iperf server on h2 --> do "iperf -s" on h2
```

```
>> run iperf client on h1 --> do "iperf -c 10.0.0.2" on h1
```

The path from h1 to h2 here according to the results is
h1----s1----s2-----h2 using stp protocol

Hence we capture no packets from either h1 or h2 at either s3-eth1 or s3-eth2

The assignment deals with a network having a cycle and the various ways to control data traffic and data duplication. In the network without spanning tree protocol for this assignment:

- 1) H1 sends a packet to s1.
- 2) S1 sends it to s2 and s3
- 3) S2 duplicates it and sends it to s3
- 4) S3 duplicates it and sends it to s1
- 5) This leads to an unending loop of a packet and makes data transmission impossible

To avoid this, we build a spanning tree across the network, with new edges as those of the spanning tree edges. In this way, there would be only a single path from one node to another.

Let us extend our observation to the given network topology

Node H1:

Once a request is made for transmission from h1 to h2, it travels via clear path and receives acknowledgment. There isn't any packet loss, in the given network.

Once a request is made for transmission from h1 to h2 , it will ask its s1 for the location of h2, which in turn asks s2 and s3, they again ask among themselves, thus flooding the network creating multiple broadcast requests due to the loop in a never ending manner. So h1 could not get any response for location of h2 within the TTL of the broadcast request, thus assumes there is no host to route.

Node H2:

Since it is TCP network and the links are lossless links, same goes with the node H2, without spanning tree, it doesn't even receive any data transfer from h1, since h1 cannot get the location of h2 it doesn't send any packet data to the network and with spanning tree, it can receive data and send acknowledgments along the unique path to h1.

Switches:

For Switches S1, S2, S3, they are data transferring modules due to which, they receive and send unending cycles of packets in a case without spanning tree. And in spanning tree case, the data is received and sent by a switch without any problems.

Node H1 with Spanning Tree:

Wireshark 1.10.6 (v1.10.6 from master-1.10)

File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help

Filter: Expression... Clear Apply Save

No.	Time	Source	Destination	Protocol	Length	Info
12	57.78841900	e6:fa:3b:12:a0:68	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:1 Port Id = 1 TTL = 120
13	62.96779400	e6:fa:3b:12:a0:68	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:1 Port Id = 1 TTL = 120
14	65.21784200	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
15	65.29890200	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
16	65.29891100	10.0.0.1	10.0.0.2	TCP	74	56808 > complex-link [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=4
17	65.34412100	10.0.0.2	10.0.0.1	TCP	74	complex-link > 56808 [SYN, ACK] Seq=0 Ack=1 Win=28960 Len=0 MSS=1460 SACK_PER
18	65.34413900	10.0.0.1	10.0.0.2	TCP	66	56808 > complex-link [ACK] Seq=1 Ack=1 Win=29696 Len=0 TSval=486207 TSecr=486
19	65.34487500	10.0.0.1	10.0.0.2	TCP	90	56808 > complex-link [PSH, ACK] Seq=1 Ack=1 Win=29696 Len=24 TSval=486207 TSe
20	65.34490400	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=25 Win=29184 Len=0 TSval=486207 TSecr=48
21	65.34493600	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=25 Ack=1 Win=29696 Len=2896 TSval=486207 TSecr
22	65.34497900	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=2921 Win=34816 Len=0 TSval=486207 TSecr=
23	65.34498500	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=2921 Ack=1 Win=29696 Len=2896 TSval=486207 TSe
24	65.34500100	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=5817 Win=40960 Len=0 TSval=486207 TSecr=
25	65.34500500	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=5817 Ack=1 Win=29696 Len=2896 TSval=486207 TSe
26	65.34501900	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=8713 Win=46592 Len=0 TSval=486207 TSecr=
27	65.34502400	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=8713 Ack=1 Win=29696 Len=2896 TSval=486207 TSe
28	65.34503800	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=11609 Win=52224 Len=0 TSval=486207 TSecr
29	65.34504200	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=11609 Ack=1 Win=29696 Len=2896 TSval=486207 TS
30	65.34505700	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=14505 Win=58368 Len=0 TSval=486207 TSecr
31	65.34508800	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [PSH, ACK] Seq=14505 Ack=1 Win=29696 Len=2896 TSval=4862
32	65.34509100	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=17401 Ack=1 Win=29696 Len=2896 TSval=486207 TS
33	65.34509400	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=20297 Ack=1 Win=29696 Len=2896 TSval=486207 TS
34	65.34509700	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=23193 Ack=1 Win=29696 Len=2896 TSval=486207 TS
35	65.34510000	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=26089 Ack=1 Win=29696 Len=2896 TSval=486207 TS

0000 01 23 20 00 00 01 e6 fa 3b 12 a0 68 88 cc 02 07 .# :..h....

File: "/tmp/wireshark_pcap..." Packets: 7545 Profile: Default

Node H1 without Spanning Tree:

*h1-eth0 [Wireshark 1.10.6 (v1.10.6 from master-1.10)]

File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help

Filter: Expression... Clear Apply Save

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
2	0.004633000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
3	0.006528000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
4	0.011190000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
5	0.011291000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
6	0.014994000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
7	0.015335000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
8	0.018602000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
9	0.020257000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
10	0.021409000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
11	0.022527000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
12	0.025770000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
13	0.026663000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
14	0.028319000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
15	0.029146000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
16	0.030675000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
17	0.031483000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
18	0.033042000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
19	0.033859000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
20	0.035384000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
21	0.036176000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
22	0.038651000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
23	0.040010000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
24	0.041376000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
25	0.044534000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1

0000 ff ff ff ff ff ff 00 00 00 00 01 00 06 00 01

File: "/tmp/wireshark_pcap..." Packets: 8... Profile: Default

Node H2 without Spanning Tree:

*h2-eth0 [Wireshark 1.10.6 (v1.10.6 from master-1.10)]

File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help

Filter: Expression... Clear Apply Save

No.	Time	Source	Destination	Protocol	Length	Info
8916	8.659471000	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
8917	8.659564000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
8918	8.659570000	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
8919	8.659647000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
8920	8.659658000	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
8921	8.659721000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
8922	8.659728000	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
8923	8.659785000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
8924	8.659792000	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
8925	8.663673000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
8926	8.663695000	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
8927	8.665720000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
8928	8.665738000	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
8929	8.666977000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
8930	8.666996000	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
8931	8.667760000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
8932	8.667773000	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
8933	8.677674000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
8934	8.677688000	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
8935	8.677774000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
8936	8.677781000	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
8937	8.677846000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
8938	8.677852000	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
8939	8.677915000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1

0000 ff ff ff ff ff ff 00 00 00 00 01 00 06 00 01

File: "/tmp/wireshark_pcap..." Packets: 2... Profile: Default

Node H2 with Spanning Tree:

*h2-eth0 [Wireshark 1.10.6 (v1.10.6 from master-1.10)]

File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help

Filter: Expression... Clear Apply Save

No.	Time	Source	Destination	Protocol	Length	Info
12	57.694051000	2a:32:a8:13:3f:19	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:2 Port Id = 1 TTL = 120
13	57.980009000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
14	57.980025000	00:00:00 00:00:02	00:00:00 00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
15	58.096010000	10.0.0.1	10.0.0.2	TCP	74	56808 > complex-link [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=4
16	58.096030000	10.0.0.2	10.0.0.1	TCP	74	complex-link > 56808 [SYN, ACK] Seq=0 Ack=1 Win=28960 Len=0 MSS=1460 SACK_PER
17	58.096662000	10.0.0.1	10.0.0.2	TCP	66	56808 > complex-link [ACK] Seq=1 Ack=1 Win=29696 Len=0 TSval=486207 TSecr=486
18	58.097213000	10.0.0.1	10.0.0.2	TCP	90	56808 > complex-link [PSH, ACK] Seq=1 Ack=1 Win=29696 Len=24 TSval=486207 TSe
19	58.097220000	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=25 Win=29184 Len=0 TSval=486207 TSecr=48
20	58.097266000	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=25 Ack=1 Win=29696 Len=2896 TSval=486207 TSecr=
21	58.097271000	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=2921 Win=34816 Len=0 TSval=486207 TSecr=
22	58.097315000	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=2921 Ack=1 Win=29696 Len=2896 TSval=486207 TSe
23	58.097318000	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=5817 Win=40960 Len=0 TSval=486207 TSecr=
24	58.097334000	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=5817 Ack=1 Win=29696 Len=2896 TSval=486207 TSe
25	58.097337000	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=8713 Win=46592 Len=0 TSval=486207 TSecr=
26	58.097353000	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=8713 Ack=1 Win=29696 Len=2896 TSval=486207 TSe
27	58.097356000	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=11609 Win=52224 Len=0 TSval=486207 TSecr=
28	58.097371000	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=11609 Ack=1 Win=29696 Len=2896 TSval=486207 TS
29	58.097374000	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=14505 Win=58368 Len=0 TSval=486207 TSecr=
30	58.097465000	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [PSH, ACK] Seq=14505 Ack=1 Win=29696 Len=2896 TSval=4862
31	58.097493000	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=17401 Win=64000 Len=0 TSval=486207 TSecr=
32	58.097468000	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=17401 Ack=1 Win=29696 Len=2896 TSval=486207 TS
33	58.097496000	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=20297 Win=69632 Len=0 TSval=486207 TSecr=
34	58.097471000	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=20297 Ack=1 Win=29696 Len=2896 TSval=486207 TS
35	58.097499000	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=23193 Win=75776 Len=0 TSval=486207 TSecr=

0000 00 00 00 00 00 02 00 00 00 00 01 00 00 45 00E.

File: "/tmp/wireshark_pcap..." Packets: 8130 Profile: Default

Switch S1 without SPT:

*s1-eth1, s1-eth2, and s1-eth3 [Wireshark 1.10.6 (v1.10.6 from master-1.10)]

File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help

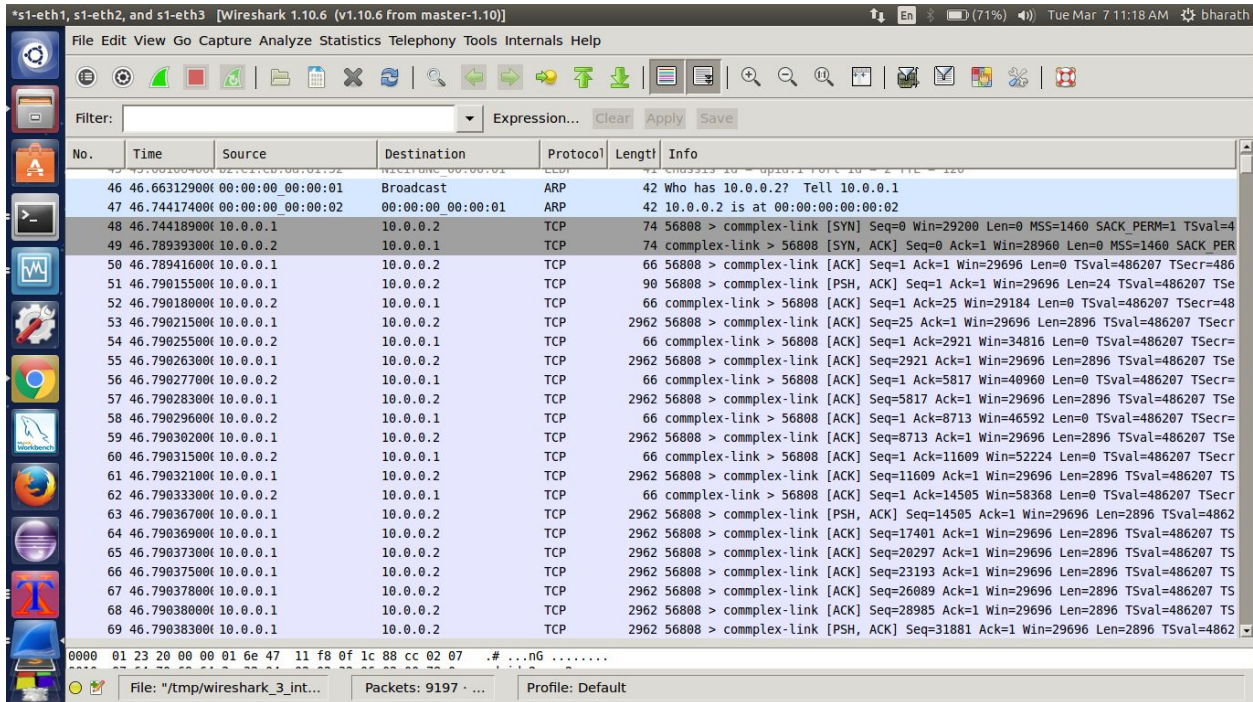
Filter: Expression... Clear Apply Save

No.	Time	Source	Destination	Protocol	Length	Info
10747	6.764224000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
10748	6.764325000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
10749	6.764413000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
10750	6.764587000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
10751	6.783327000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
10752	6.783423000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
10753	6.783491000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
10754	6.783671000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
10755	6.783781000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
10756	6.783882000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
10757	6.783973000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
10758	6.784055000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
10759	6.785412000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
10760	6.785734000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
10761	6.786008000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
10762	6.786926000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
10763	6.793949000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
10764	6.803826000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
10765	6.803943000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
10766	6.807318000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
10767	6.807711000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
10768	6.808622000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
10769	6.808695000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
10770	6.808753000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
10771	6.808800000	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1

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File: "/tmp/wireshark_3_int..." Packets: 4... Profile: Default

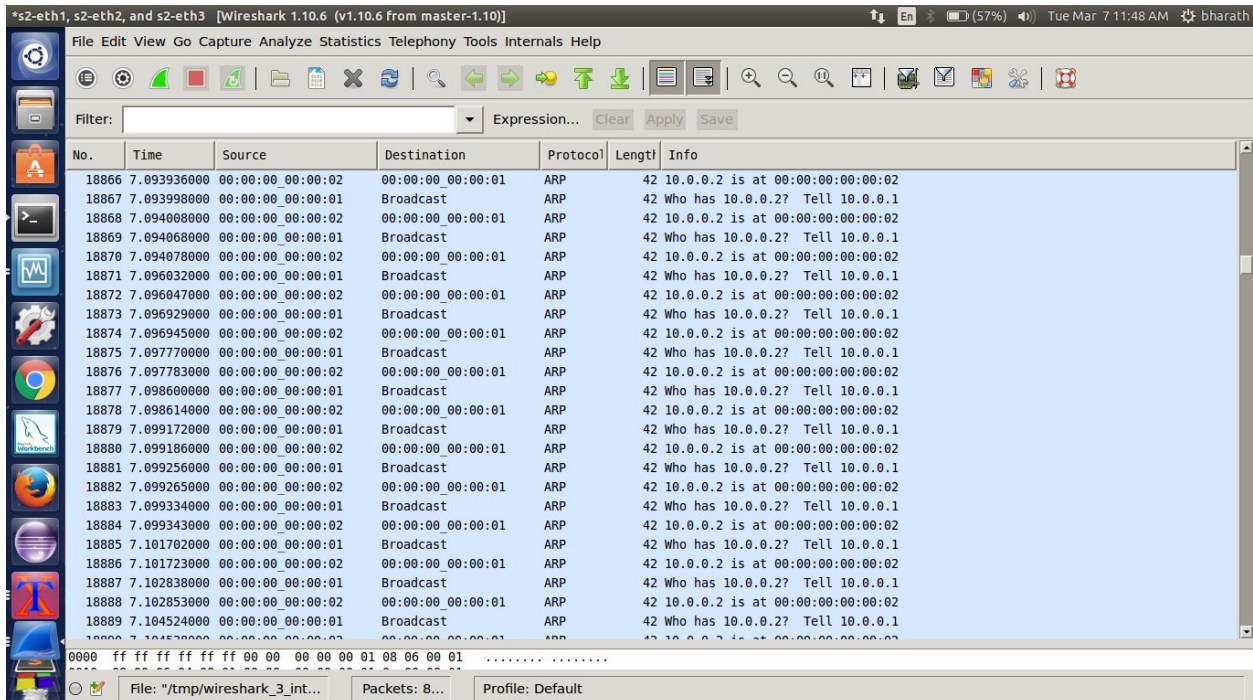
Switch S1 with SPT:



Wireshark 1.10.6 (v1.10.6 from master-1.10) capture showing traffic on interface s1-eth1. The filter is empty. The packet list shows the following packets:

No.	Time	Source	Destination	Protocol	Length	Info
46	46.66312900	00:00:00:00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
47	46.74417400	00:00:00:00:00:02	00:00:00:00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
48	46.74418900	10.0.0.1	10.0.0.2	TCP	74	56808 > complex-link [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=4
49	46.78939300	10.0.0.2	10.0.0.1	TCP	74	complex-link > 56808 [SYN, ACK] Seq=0 Ack=1 Win=28960 Len=0 MSS=1460 SACK_PER
50	46.78941600	10.0.0.1	10.0.0.2	TCP	66	56808 > complex-link [ACK] Seq=1 Ack=1 Win=29696 Len=0 TSval=486207 TSecr=486
51	46.79015500	10.0.0.1	10.0.0.2	TCP	90	56808 > complex-link [PSH, ACK] Seq=1 Ack=1 Win=29696 Len=24 TSval=486207 TSe
52	46.79018000	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=25 Win=29184 Len=0 TSval=486207 TSecr=48
53	46.79021500	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=25 Ack=1 Win=29696 Len=2896 TSval=486207 TSecr=
54	46.79025500	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=2921 Win=34816 Len=0 TSval=486207 TSecr=
55	46.79026300	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=2921 Ack=1 Win=29696 Len=2896 TSval=486207 TSe
56	46.79027700	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=5817 Win=40960 Len=0 TSval=486207 TSecr=
57	46.79028300	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=5817 Ack=1 Win=29696 Len=2896 TSval=486207 TSe
58	46.79029600	10.0.0.1	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=8713 Win=46592 Len=0 TSval=486207 TSecr=
59	46.79030200	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=8713 Ack=1 Win=29696 Len=2896 TSval=486207 TSe
60	46.79031500	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=11609 Win=52224 Len=0 TSval=486207 TSecr=
61	46.79032100	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=11609 Ack=1 Win=29696 Len=2896 TSval=486207 TS
62	46.79033300	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=14505 Win=58368 Len=0 TSval=486207 TSecr=
63	46.79036700	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [PSH, ACK] Seq=14505 Ack=1 Win=29696 Len=2896 TSval=4862
64	46.79036900	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=17401 Ack=1 Win=29696 Len=2896 TSval=486207 TS
65	46.79037300	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=20297 Ack=1 Win=29696 Len=2896 TSval=486207 TS
66	46.79037500	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=23193 Ack=1 Win=29696 Len=2896 TSval=486207 TS
67	46.79037800	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=26089 Ack=1 Win=29696 Len=2896 TSval=486207 TS
68	46.79038000	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=28985 Ack=1 Win=29696 Len=2896 TSval=486207 TS
69	46.79038300	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [PSH, ACK] Seq=31881 Ack=1 Win=29696 Len=2896 TSval=4862

Switch S2 without SPT:



Wireshark 1.10.6 (v1.10.6 from master-1.10) capture showing traffic on interface s2-eth1. The filter is empty. The packet list shows the following packets:

No.	Time	Source	Destination	Protocol	Length	Info
18866	7.09393600	00:00:00:00:00:02	00:00:00:00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
18867	7.09399800	00:00:00:00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
18868	7.09400800	00:00:00:00:00:02	00:00:00:00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
18869	7.09406800	00:00:00:00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
18870	7.09407800	00:00:00:00:00:02	00:00:00:00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
18871	7.09603200	00:00:00:00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
18872	7.09604700	00:00:00:00:00:02	00:00:00:00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
18873	7.09692900	00:00:00:00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
18874	7.09694500	00:00:00:00:00:02	00:00:00:00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
18875	7.09777000	00:00:00:00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
18876	7.09778300	00:00:00:00:00:02	00:00:00:00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
18877	7.09860000	00:00:00:00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
18878	7.09861400	00:00:00:00:00:02	00:00:00:00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
18879	7.09917200	00:00:00:00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
18880	7.09918600	00:00:00:00:00:02	00:00:00:00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
18881	7.09925600	00:00:00:00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
18882	7.09926500	00:00:00:00:00:02	00:00:00:00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
18883	7.09933400	00:00:00:00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
18884	7.09934300	00:00:00:00:00:02	00:00:00:00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
18885	7.10170200	00:00:00:00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
18886	7.10172300	00:00:00:00:00:02	00:00:00:00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
18887	7.10283800	00:00:00:00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
18888	7.10285300	00:00:00:00:00:02	00:00:00:00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
18889	7.10452400	00:00:00:00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1

Switch S2 with SPT:

*s2-eth1, s2-eth2, and s2-eth3 [Wireshark 1.10.6 (v1.10.6 from master-1.10)]

File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help

Filter: Expression... Clear Apply Save

No.	Time	Source	Destination	Protocol	Length	Info
37	37.11432000	2a:32:a8:13:3f:19	NIc1PaNe 00:00:00	LLDP	41	Chassis Id = dp1d:2 Port Id = 1 Ttl = 120
38	37.40027900	00:00:00 00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
39	37.40030200	00:00:00 00:00:02	00:00:00 00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
40	37.51628200	10.0.0.1	10.0.0.2	TCP	74	56808 > complex-link [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK PERM=1 TSval=4
41	37.51630700	10.0.0.2	10.0.0.1	TCP	74	complex-link > 56808 [SYN, ACK] Seq=0 Ack=1 Win=28960 Len=0 MSS=1460 SACK PER
42	37.51693700	10.0.0.1	10.0.0.2	TCP	66	56808 > complex-link [ACK] Seq=1 Ack=1 Win=29696 Len=0 TSval=486207 TSecr=486
43	37.51748700	10.0.0.1	10.0.0.2	TCP	90	56808 > complex-link [PSH, ACK] Seq=1 Ack=1 Win=29696 Len=24 TSval=486207 TSe
44	37.51749700	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=25 Win=29184 Len=0 TSval=486207 TSecr=48
45	37.51754100	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=25 Ack=1 Win=29696 Len=2896 TSval=486207 TSecr
46	37.51754700	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=2921 Win=34816 Len=0 TSval=486207 TSecr=
47	37.51758900	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=2921 Ack=1 Win=29696 Len=2896 TSval=486207 TSe
48	37.51759500	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=5817 Win=40960 Len=0 TSval=486207 TSecr=
49	37.51760900	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=5817 Ack=1 Win=29696 Len=2896 TSval=486207 TSe
50	37.51761300	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=8713 Win=46592 Len=0 TSval=486207 TSecr=
51	37.51762800	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=8713 Ack=1 Win=29696 Len=2896 TSval=486207 TSe
52	37.51763200	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=11609 Win=52224 Len=0 TSval=486207 TSecr
53	37.51764600	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=11609 Ack=1 Win=29696 Len=2896 TSval=486207 TS
54	37.51765100	10.0.0.2	10.0.0.1	TCP	66	complex-link > 56808 [ACK] Seq=1 Ack=14505 Win=58368 Len=0 TSval=486207 TSecr
55	37.51774000	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [PSH, ACK] Seq=14505 Ack=1 Win=29696 Len=2896 TSval=4862
56	37.51774300	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=17401 Ack=1 Win=29696 Len=2896 TSval=486207 TS
57	37.51774600	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=20297 Ack=1 Win=29696 Len=2896 TSval=486207 TS
58	37.51774900	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=23193 Ack=1 Win=29696 Len=2896 TSval=486207 TS
59	37.51775200	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=26089 Ack=1 Win=29696 Len=2896 TSval=486207 TS
60	37.51775400	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [ACK] Seq=28985 Ack=1 Win=29696 Len=2896 TSval=486207 TS
61	37.51775700	10.0.0.1	10.0.0.2	TCP	2962	56808 > complex-link [PSH, ACK] Seq=31881 Ack=1 Win=29696 Len=2896 TSval=4862

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File: "/tmp/wireshark_3_int... Packets: 8618 Profile: Default

Switch S3 without SPT:

*s3-eth1 and s3-eth2 [Wireshark 1.10.6 (v1.10.6 from master-1.10)]

File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help

Filter: Expression... Clear Apply Save

No.	Time	Source	Destination	Protocol	Length	Info
555	0.331870800	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
556	0.332790000	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
557	0.333696000	00:00:00_00:00:01	00:00:00_00:00:01	Broadcast	42	Who has 10.0.0.2? Tell 10.0.0.1
558	0.333715000	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
559	0.335668000	00:00:00_00:00:01	00:00:00_00:00:01	Broadcast	42	Who has 10.0.0.2? Tell 10.0.0.1
560	0.336059000	00:00:00_00:00:01	00:00:00_00:00:01	Broadcast	42	Who has 10.0.0.2? Tell 10.0.0.1
561	0.336080000	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
562	0.343899000	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
563	0.344899000	00:00:00_00:00:01	00:00:00_00:00:01	Broadcast	42	Who has 10.0.0.2? Tell 10.0.0.1
564	0.344919000	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
565	0.346818000	00:00:00_00:00:01	00:00:00_00:00:01	Broadcast	42	Who has 10.0.0.2? Tell 10.0.0.1
566	0.347323000	00:00:00_00:00:01	00:00:00_00:00:01	Broadcast	42	Who has 10.0.0.2? Tell 10.0.0.1
567	0.347345000	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
568	0.348291000	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
569	0.349250000	00:00:00_00:00:02	00:00:00_00:00:01	Broadcast	42	Who has 10.0.0.2? Tell 10.0.0.1
570	0.349269000	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
571	0.351163000	00:00:00_00:00:01	00:00:00_00:00:01	Broadcast	42	Who has 10.0.0.2? Tell 10.0.0.1
572	0.351645000	00:00:00_00:00:01	00:00:00_00:00:01	Broadcast	42	Who has 10.0.0.2? Tell 10.0.0.1
573	0.351667000	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
574	0.352650000	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
575	0.353597000	00:00:00_00:00:01	00:00:00_00:00:01	Broadcast	42	Who has 10.0.0.2? Tell 10.0.0.1
576	0.353616000	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02
577	0.363510000	00:00:00_00:00:01	00:00:00_00:00:01	Broadcast	42	Who has 10.0.0.2? Tell 10.0.0.1
578	0.364235000	00:00:00_00:00:01	00:00:00_00:00:01	Broadcast	42	Who has 10.0.0.2? Tell 10.0.0.1
579	0.364261000	00:00:00_00:00:02	00:00:00_00:00:01	ARP	42	10.0.0.2 is at 00:00:00:00:00:02

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File: "/tmp/wireshark_2_int... Packets: 5... Profile: Default

Switch S3 with SPT:

*s3-eth1 and s3-eth2 [Wireshark 1.10.6 (v1.10.6 from master-1.10)]

File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help

Filter: Expression... Clear Apply Save

No.	Time	Source	Destination	Protocol	Length	Info
4	3.191421000	4a:29:c3:e7:16:e6	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:2 Port Id = 3 TTL = 120
5	5.180041000	52:77:d1:6b:20:e3	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:3 Port Id = 1 TTL = 120
6	5.850846000	3e:02:6a:6b:f5:c2	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:3 Port Id = 2 TTL = 120
7	6.521202000	46:dd:1b:a0:3d:0d	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:1 Port Id = 3 TTL = 120
8	8.454739000	4a:29:c3:e7:16:e6	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:2 Port Id = 3 TTL = 120
9	10.427736000	52:77:d1:6b:20:e3	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:3 Port Id = 1 TTL = 120
10	11.053476000	3e:02:6a:6b:f5:c2	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:3 Port Id = 2 TTL = 120
11	11.723467000	46:dd:1b:a0:3d:0d	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:1 Port Id = 3 TTL = 120
12	13.645445000	4a:29:c3:e7:16:e6	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:2 Port Id = 3 TTL = 120
13	15.578390000	52:77:d1:6b:20:e3	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:3 Port Id = 1 TTL = 120
14	16.210980000	3e:02:6a:6b:f5:c2	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:3 Port Id = 2 TTL = 120
15	16.879463000	46:dd:1b:a0:3d:0d	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:1 Port Id = 3 TTL = 120
16	18.810708000	4a:29:c3:e7:16:e6	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:2 Port Id = 3 TTL = 120
17	20.791441000	52:77:d1:6b:20:e3	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:3 Port Id = 1 TTL = 120
18	21.418149000	3e:02:6a:6b:f5:c2	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:3 Port Id = 2 TTL = 120
19	22.091299000	46:dd:1b:a0:3d:0d	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:1 Port Id = 3 TTL = 120
20	24.070878000	4a:29:c3:e7:16:e6	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:2 Port Id = 3 TTL = 120
21	24.985759000	00:00:00_00:00:01	Broadcast	ARP	42	Who has 10.0.0.2? Tell 10.0.0.1
22	26.018896000	52:77:d1:6b:20:e3	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:3 Port Id = 1 TTL = 120
23	26.683564000	3e:02:6a:6b:f5:c2	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:3 Port Id = 2 TTL = 120
24	27.348574000	46:dd:1b:a0:3d:0d	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:1 Port Id = 3 TTL = 120
25	29.316365000	4a:29:c3:e7:16:e6	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:2 Port Id = 3 TTL = 120
26	31.260876000	52:77:d1:6b:20:e3	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:3 Port Id = 1 TTL = 120
27	31.894865000	3e:02:6a:6b:f5:c2	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:3 Port Id = 2 TTL = 120
28	32.541857000	46:dd:1b:a0:3d:0d	NiciraNe_00:00:01	LLDP	41	Chassis Id = dpid:1 Port Id = 3 TTL = 120

0000 01 23 20 00 00 01 4a 29 c3 e7 16 e6 88 cc 02 07 .#J)

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