COMP9331 Lab 6

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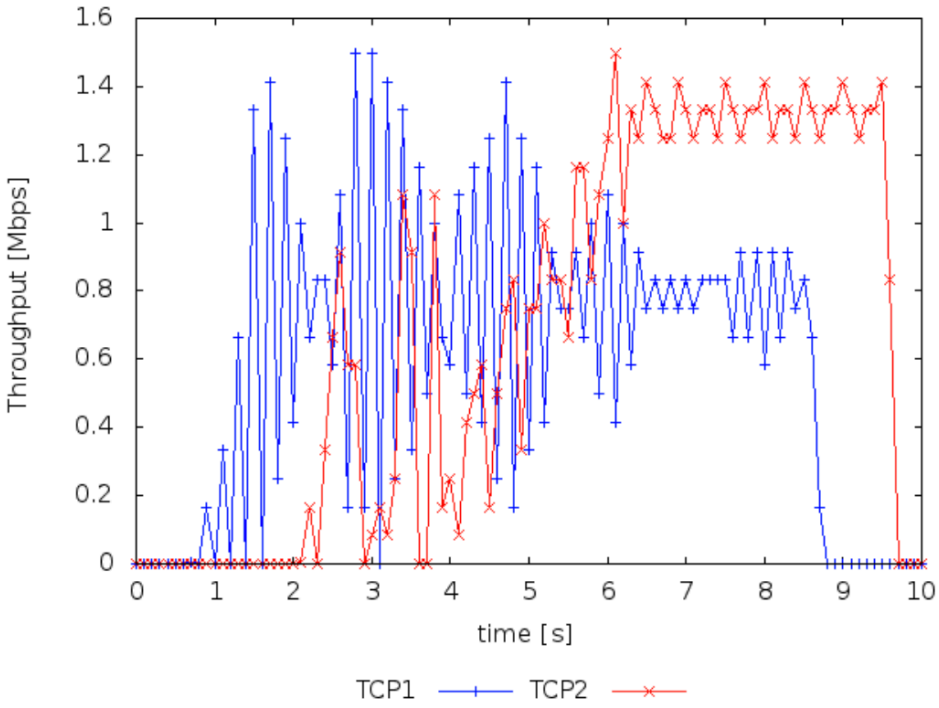
Exercise 1: Setting up NS2 simulation for measuring TCP throughput



Question 1

Why the throughput achieved by flow tcp2 is higher than tcp1 between time span 6 sec to 8 sec?

- Flow tcp 1 need to travel through n0-n1-n2-n4-n5. When it flow between n1-n2, it has to compete with tcp4 and when it go through n2-n4 it has to compete with tcp2. Compared to tcp1, tcp2 has more space to transfer between n2 and n4, and lower RTT. But tcp2 only travel through n3-n2-n4-n5. Thus, tcp2 with lower congestion and RTT, so tcp2 has higher throughput at last.

Question 2

Why the throughput for flow tcp1 is fluctuating between time span 0.5 sec to 2 sec?

- It is under the slow start phase to probing the available bandwidth.

Question 3

Why is the maximum throughput achieved by any one flow capped at around 1.5Mbps?

- At begining, tcp1 is still under its slow start phase and the throughput is restrained by other flow when they comes at 2.0 sec. They have to share the bandwidth and compete with each other before it find the maximum bandwidth.

Exercise 2: Understanding IP Fragmentation

Question 1

Which data size has caused fragmentation and why? Which host/router has fragmented the original datagram? How many fragments have been created when data size is specified as 2000?

- 2000 and 3500 bytes ICMP in this example which caused the fragmentation.Because the MTU is 1500 bytes.

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	192.168.1.1	255.255.255.255	UDP	215	Source port: 36861 Destination port: 7437
2	1.433512000	fe80::ec49:66ff:fef0:1	ff02::1	ICMPv6	78	Router Advertisement from e8:de:27:4d:a1:40
3	3.071798000	192.168.1.1	255.255.255.255	UDP	215	Source port: 36861 Destination port: 7437
4	3.262721000	192.168.1.103	8.8.8.8	ICMP	98	Echo (ping) request id=0xd805, seq=0/0, ttl=64 (reply in 5)
5	3.287081000	8.8.8.8	192.168.1.103	ICMP	98	Echo (ping) reply id=0xd805, seq=0/0, ttl=122 (request in 4)
6	3.993354000	192.168.1.106	224.0.0.251	MDNS	108	Standard query 0x0000 PTR _homekit._tcp.local, "QM" question
7	3.993713000	fe80::18fe:846:f78f:b9	ff02::fb	MDNS	128	Standard query 0x0000 PTR _homekit._tcp.local, "QM" question
8	4.264498000	192.168.1.103	8.8.8.8	ICMP	98	Echo (ping) request id=0xd805, seq=1/256, ttl=64 (reply in 9)
9	4.286191000	8.8.8.8	192.168.1.103	ICMP	98	Echo (ping) reply id=0xd805, seq=1/256, ttl=122 (request in 8)
10	5.269254000	192.168.1.103	8.8.8.8	ICMP	98	Echo (ping) request id=0xd805, seq=2/512, ttl=64 (reply in 11)
11	5.291311000	8.8.8.8	192.168.1.103	ICMP	98	Echo (ping) reply id=0xd805, seq=2/512, ttl=122 (request in 10)
12	6.045195000	192.168.1.1	255.255.255.255	UDP	215	Source port: 36861 Destination port: 7437
13	9.113418000	192.168.1.1	255.255.255.255	UDP	215	Source port: 36861 Destination port: 7437
14	9.169162000	192.168.1.103	255.255.255.255	DB-LSP-DI	268	Dropbox LAN sync Discovery Protocol
15	9.169892000	192.168.1.103	192.168.1.255	DB-LSP-DI	268	Dropbox LAN sync Discovery Protocol
16	10.55804300(	192.168.1.103	8.8.8.8	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=a13d) [Reassembled in #17]
17	10.55804500(	192.168.1.103	8.8.8.8	ICMP	562	Echo (ping) request id=0xd905, seq=0/0, ttl=64 (reply in 19)
18	10.61038600(	8.8.8.8	192.168.1.103	IPv4	1482	Fragmented IP protocol (proto=ICMP 1, off=0, ID=dfd0) [Reassembled in #19]

- 192.168.1.103 has fragmented the original datagram.
- 2 fragments has been created(#16,#17).

Question 2

Did the reply from the destination 8.8.8.8. for 3500-byte data size also get fragmented? Why and why not?

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▼ [3 IPv4 Fragments (3508 bytes): #55(1448), #56(1448), #57(612)]
    [Frame: 55, payload: 0-1447 (1448 bytes)]
    [Frame: 56, payload: 1448-2895 (1448 bytes)]
    [Frame: 57, payload: 2896-3507 (612 bytes)]
    [Fragment count: 3]
    [Reassembled IPv4 length: 3508]
    [Reassembled IPv4 data: 0000407edb0500025b51dd8b0007496808090a0b0c0d0e0f...]
```

- Yes, Because the reply is same size as the MTU which indicates the fragment.

Question 3

Give the ID, length, flag and offset values for all the fragments of the first packet sent by 192.168.1.103 with data size of 3500 bytes?

	ID	length	flag	offset
39	0x7a7b	1500	0x01	0
40	0x7a7b	1500	0x01	1480
41	0x7a7b	568	0x00	2960

Question 4

Has fragmentation of fragments occurred when data of size 3500 bytes has been used? Why and why not?

- It can't be sure. We only captured the packet at 192.168.0.103 but it can not be sure that whether there are further fragments after that. The fragmentation of fragments has not be done as we only received three fragments.

Question 5

What will happen if for our example one fragment of the original datagram from 192.168.1.103 is lost?

- All the fragments need to be retransmitted.

Exercise 3: Understanding the Impact of Network Dynamics on Routing

Question 1

Which nodes communicate with which other nodes? Which route do the packets follow? Does it change over time?

- Node 0 is connected with 1
- Node 1 is connected with 0, 2, 4
- Node 2 is connected with 1, 3
- Node 3 is connected with 2, 5
- Node 4 is connected with 1, 5
- Node 5 is connected with 3, 4
- Route is 0-1-4-5 and 2-3-5
- Route doesn't change over time.

Question 2

What happens at time 1.0 and at time 1.2? Does the route between the communicating nodes change as a result of that?

- Time 1.0: Link 1-4 go down and Route 0-1-4-5 doesn't change
- Time 1.2: Link 1-4 goes up, packets waiting at node 1 transferred follow the original route 1-4-5
- The route didn't change.

Question 3

Did you observe any additional traffic as compared to Step 3 above? How does the network react to the changes that take place at time 1.0 and time 1.2 now?

- Yes, by observing that the DV protocol is exchanging information for forwarding table.
- At time 1.0, link 1-4 goes down and the route changed to 0-1-2-3-5
- At time 1.2, link 1-4 go back to normal and the route changed back to 0-1-4-5

Question 4

How does this change affect the routing? Explain why.

- If apply this change on node 1-4 increased to 3, the route will change to 0-1-2-3-5(cost 4) and this is lower than the original route 0-1-4-5(cost 5).

Question 5

Describe what happens and deduce the effect of the line you just uncommented.

- By uncommented that line, we have two equal cost route which are 2-1-4-5 and 2-3-4 (both cost 4). Node 2 may have 2 ways to go and split the traffic.