

ITS 413 Internet Technologies and Applications

Assignment: Phase 3 Report

TCP and UDP sessions

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By submitting this report all members of the group listed above agree that each member has contributed approximately equal amounts to designing and performing experiments, as well as to preparing this report. All members agree that this report accurately reflects the experiments conducted by the group members, and is their own work (not works of other groups).

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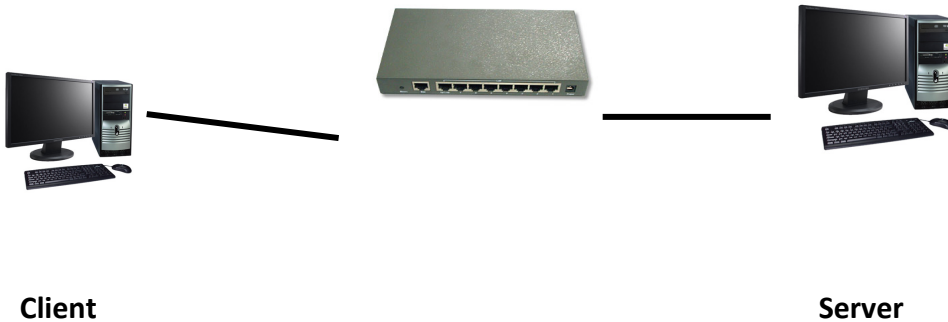
Thammasat University

Phase 2

Aim

1. Measure the speed of UDP transmission in different data rate.
2. Measure the speed of UDP wireless transmission in different data rate.

Network Topology



Equipment specification

Client

CPU: Core 2 1.83GHz

Memory: 3.2G

LAN: 100Mbps Ethernet

Wireless: 802.11 b/g

OS: Ubuntu 11.10 32 bit

Server

CPU: Celeron M 1.73GHz

Memory: 1Ghz

LAN: 100Mbps Ethernet

Wireless: 802.11 b/g

OS: Ubuntu 11.10 32bit

Router:

Model: Linksys Wireless G WRT54L

Parameters

Default Vales

- Server IP : 192.168.1.243
- Client IP(wire): 192.168.1.136
- Client IP(wireless): 192.168.1.205
- Port Number: 5001
- Time base: 60 s

“IPERF” Commands

Server:

- `iperf -s -u`

Client

- `iperf -c 192.168.1.243 -u -b(1~54Mbps)`

Experiment Results

1. UDP connection in wire

DataRate(Mb/s)	Throughput(Mb/s)
1	1
10	10
20	20
30	30
40	40
50	50
60	60
70	70
80	80
90	90
100	95.9

There is no failure of transmitting data up to 90 Mb/s of data rate, but the data rate reaches 100 Mb/s, the throughput becomes 95.9Mb/s. The throughput can not exceed 96Mb/s, because after 90Mb/s of data rate, the client already sending over 100Mb. Therefore, the client needs more time to send extra data after 100Mb, so the throughput will remain the same, unless the client, server, and the router supports speed more than 100Mb/s.

2. UDP wireless connection in different 802.11x mode.

1) 802.11b (average of 3 trials)

DataRate(Mb/s)	Throughput(Mb/s)
1	1
5	5
10	6.53
15	6.43
20	6.53
25	6.19
30	6.53
35	6.73
40	6.4
45	6.2
50	6.31
54	6.45

2) 802.11g (average of 3 trials)

DataRate(Mb/s)	Throughput(Mb/s)
1	1
5	5
10	10
15	15
20	20
25	23.03
30	23.97

35	23.26
40	24.43
45	24.57
50	23.3
54	24.67

3) 802.11bg (average of 3 trials)

DataRate(Mb/s)	Throughput(Mb/s)
1	1
5	5
10	10
15	15
20	20
25	23.03
30	23.97
35	23.26
40	24.43
45	24.57
50	23.3
54	24.67

In theory, 802.11 b has maximum 11Mb/s of data rate, and the maximum throughput obtained in this experiment is 6.73Mb/s. The efficiency is 61.2%.

The data rate of 802.11 g is 54 Mb/s, and the maximum throughput obtained is 24.67Mb/s. The efficiency is 45.6%.

The data rate of 802.11 b+g is also 54Mb/s, and the maximum throughput is 24.67Mb/s which is the same value as 802.11 g. And the efficiency is 45.6%.

Because this experiment was tested in range of 1 meter between the client and the server, it is not possible to check which one is better between 802.11 g and 802.11 b+g. However, as the term of efficiency 802.11 b is better than the other two modes.

Phase 3

1. UDP vs TCP
2. Multiple TCP Sessions
3. TCP and UDP Sessions
4. TCP sessions over vary duration

Aim of UDP vs TCP

1. Compare the maximum throughput of UDP and TCP in wired connection

Network Topology

- Same as the Phase 2.

Equipment Specification

- Same as the Phase 2

Parameter

Default Vales

- Server IP : 192.168.1.243
- Client IP(wire): 192.168.1.136
- Port Number: 5001
- Time base: 60 s

“IPERF” Commands

Server:

- `iperf -s -u`
- `iperf -s`

Client

- `iperf -c 192.168.1.243 -u -b(1~54Mbps)`
- `iperf -c 192.68.1.243`

Experiment Result

1. UDP

- Please check the result in Phase 2
- The maximum throughput of UDP is 95.9Mb/s

2. TCP

- The maximum throughput of TCP is 94.4Mb/s(measured 3 times)

There was nothing much thing to do for experiment, because the connection was in wire, so almost no interference affects the result. For both protocol, the buffer sizes were the same.

Summary

At the maximum data rate, 100Mb/s, there is the difference of throughput between TCP and UDP. The result showed up in the terminal for TCP connection did not show detailed information of each packet, so it is difficult to guess, but in theory the header size of TCP is bigger than UDP. So, in TCP extra header size is added to each packet, and that affect the client send bigger data size, which lead to longer time of transmission.

Aim of Multiple TCP Sessions

1. Measure the throughput when 3 clients send data to the server
 - send multiple data to different port number of the server at the same time.
2. Measure the throughput with different variable of each client
3. Do in wired connection.

“IPERF” Commands

Server:

- iperf -s -p 5001
- iperf -s -p 5002
- iperf -s -p 5003

Client

- iperf -c 192.168.1.243 -p 5001 & iperf -c 192.168.1.243 -p 5002 & iperf -c 192.168.1.243 -p 5003 &
- iperf -c 192.168.1.243 -i 3 -w 250KB -n 50M -t 40 -p 5001 &sleep 10;iperf -c 192.168.1.243 -i 3 -w 250KB -t 40 -n 50M -p 5002 &sleep 10;iperf -c 192.168.1.243 -i 3 -w 250KB -t 40 -n 50M -p 5003 &

Experiment Result

1. Send multiple data with default variables at the same time

	Port 5001	Port 5002	Port 5003
1 trial	29.4Mb/s	29.3Mb/s	39.6Mb/s
2 trial	30.4Mb/s	31.0Mb/s	36.8Mb/s

Even though, the throughput is not evenly divided, we can see that when multiple sessions are sent, the data rate is shared.

2. Send multiple data every 10 seconds with 40s of sending time.

	Port 5001	Port 5002	Port 5003
1 trial	94.7~94.4Mb/s	68.9~45.5Mb/s	63.6~73.2Mb/s
2 trial	94.7~94.0Mb/s	68.9~45.6Mb/s	64.0~73.2Mb/s

This experiment is port 5001 send data first with 40s of transmitting time, and 10 seconds later port 5002 starts sending do same as port 5001, and another 10 seconds later port 5003 sends, and do as other transmission, too.

In both of trials, we can see port 5001 maintain it's speed as maximum throughput, even though port 5002 starts transmitting to server. Port 5002 starts at 68.9 Mb/s, but gradually drops. We assume it is because port 5001 was transmitting, and later on, port 5003 starts transmit. At port 5003, 63.5Mb/s was the initial throughput, and finished with 73.2 Mb/s. It is increased after port 5002 finished transmitting.

Summary

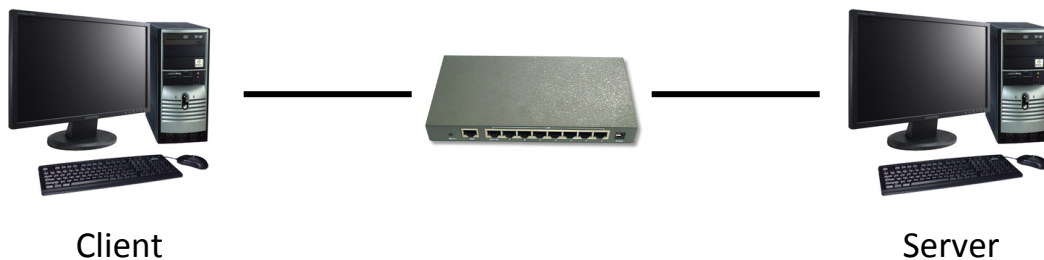
By comparing experiment 1 and 2, initiation of multiple TCP sessions at the same time will cause all clients to have similar throughput. However, when there is time difference of transmission start time, the first client will obtain full throughput, and the clients starts transmission between the first and the last will obtained low throughput. And the last client will starts at low throughput, but end with high throughput, because there is none of the other clients are transmitting.

Aims of TCP and UDP Sessions

1. To measure value that is transmitted between two computers by using TCP session.
2. To measure value that is transmitted between two computers by using UDP session.
3. To compare value of TCP session and value of UDP session with same time.

Network Diagram

Experiment: Wired Ethernet



Equipment Specifications

Server:

CPU: Intel Core i3

Memory: 2.00 GB

HDD: 500GB

LAN Interface: D-Link DGE-528T Gigabit

Ethernet Adapter

OS: Ubuntu Linux 10.04 32-bits

Client:

CPU: Intel Core i3

Memory: 2.00 GB

HDD: 500GB

LAN Interface: D-Link DGE-528T Gigabit

Ethernet Adapter

OS: Ubuntu Linux 10.04 32-bits

Parameters

List of default value

- Time = 60 second
- IP Server = 100.10.10.6
- IP Client = 100.10.10.7

List of different value

- TCP IP Port Server = 5001
- UDP IP Port Server = 5002
- UDP b = 10M
- Number of TCP per one UDP
- Number of UDP per one TCP

List of parameter experiment

- Transfer
- Bandwidth

“iperf” commands

Server:

- TCP: `iperf -s -p 5001`
- UDP: `iperf -s -p 5002 -u 10`

Client:

- TCP: `iperf -c 100.10.10.6 -p 5001 -t 60`
- UDP: `iperf -c 100.10.10.6 -p 5002 -t 60 -u -b 10m`

Experiments and Results

Number of UDP per one TCP

Form (TCP, UDP): (1, 0), (1, 1), (1, 2), (1, 3), (1, 4), (1, 5)

Number of TCP per one UDP

Form (TCP, UDP): (0, 1), (1, 1), (2, 1), (3, 1), (4, 1), (5, 1)

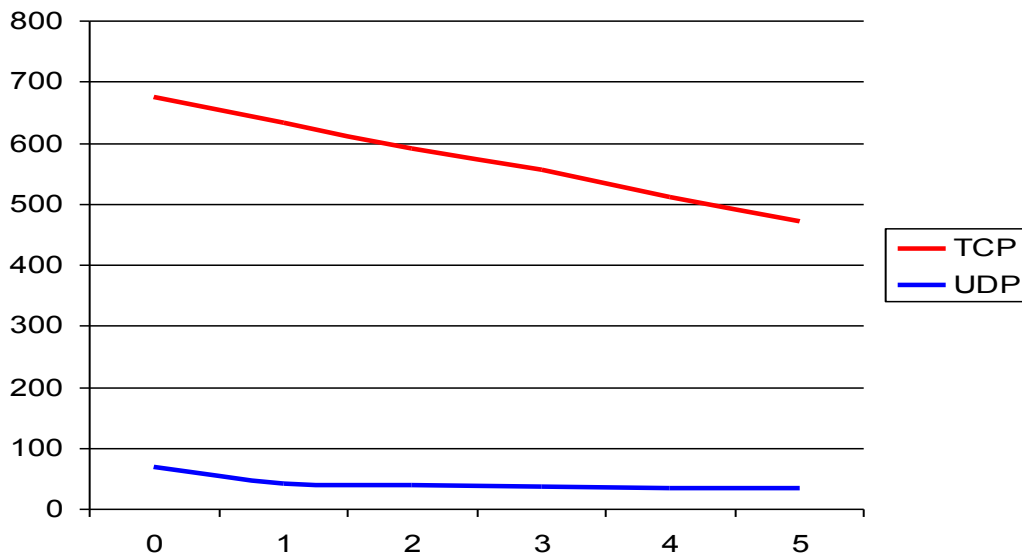
In the experiment, we have tested transfer and bandwidth of TCP and UDP by iperf that are shown in “iperf” commands. This test changes the number of UDP per one TCP and the number of TCP per one UDP and sends value at same time. Time that use in this test is 60 seconds.

Experiment 1 – Transfer

Number of UDP	Transfer of TCP (MBytes)
0	675
1	633
2	592
3	557
4	513
5	471

Number of TCP	Transfer of UDP (MBytes)
0	69.5
1	43
2	39.6
3	37.7
4	35.6
5	35.6

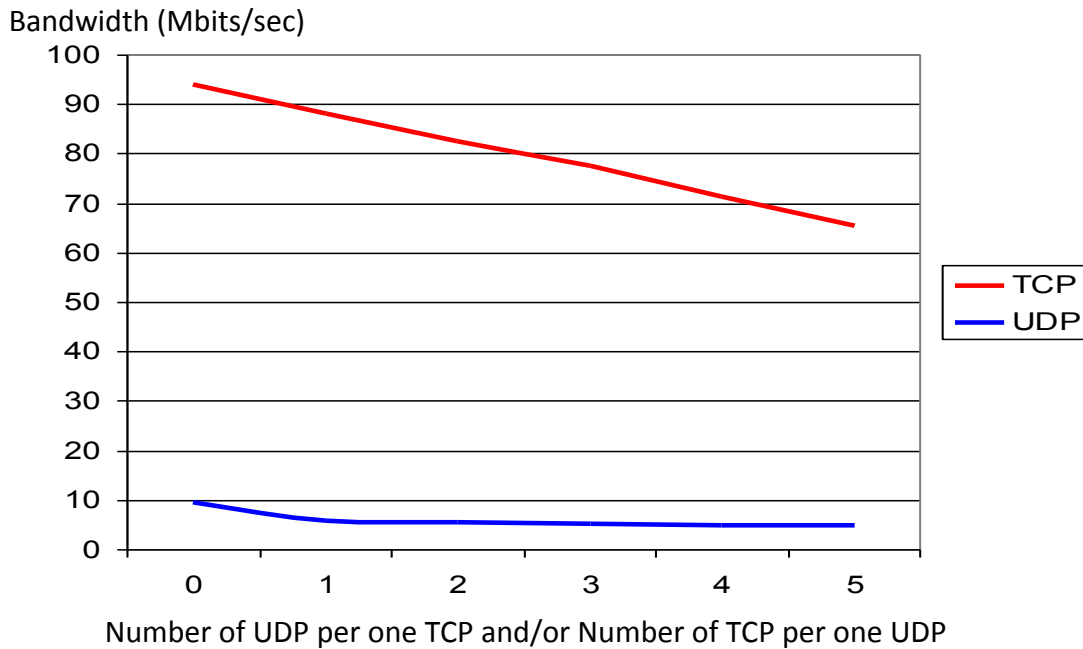
Data Transfer (MBytes)



Experiment 2 – Bandwidth

Number of UDP	B/W of TCP (Mbits/sec)
0	94.1
1	88.3
2	82.5
3	77.5
4	71.5
5	65.5

Number of TCP	B/W of UDP (Mbits/sec)
0	9.72
1	6.01
2	5.53
3	5.28
4	4.98
5	4.98



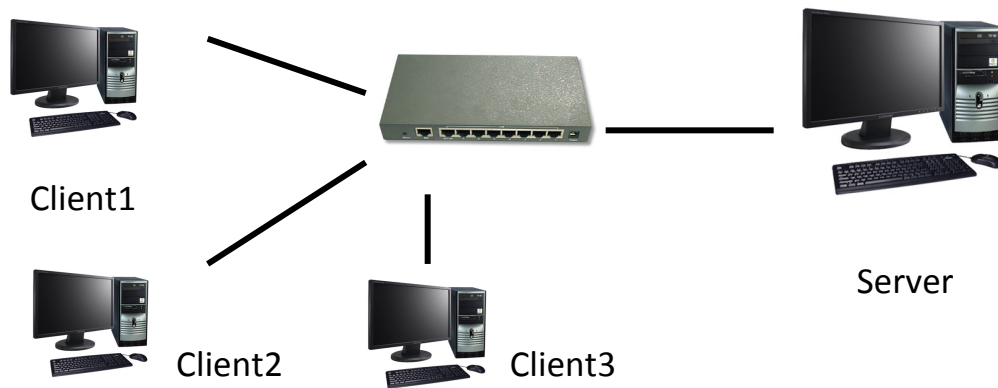
Conclusion

In summary, the value of both TCP and UDP are drop because of number of TCP and UDP increase and the time limits are 60 seconds that make transfer and bandwidth which send to server are decreased. TCP will have transfer and bandwidth more than UDP and order the value by port.

Aims of TCP Sessions over vary duration

4. To measure value that is transmitted between two computers by using time base of TCP.
5. To measure value that is transmitted between two computers by using many other times of TCP.
6. To compare time base of TCP session and many other times of TDP session with same parameter.

Network Diagram



Equipment Specifications

Same as the experiment 3 of phase 3

Parameters

List of default value

- IP Server = 100.10.10.6
- IP Client 1 = 100.10.10.7
- IP Client 2 = 100.10.10.12
- IP Client 3 = 100.10.10.13
- IP Port Server = 5001
- Time base = 60 second

List of different value

- Time except time base
- Number of time that start time is same
- Number of time use in 60 seconds

List of Parameter experiment

Transfer

“iperf” commands

Server:

- `iperf -s -p 5001`

Client:

- `iperf -c 100.10.10.6 -p 5001 -t 60`
- `iperf -c 100.10.10.6 -p 5001 -t 10`
- `iperf -c 100.10.10.6 -p 5001 -t 30`

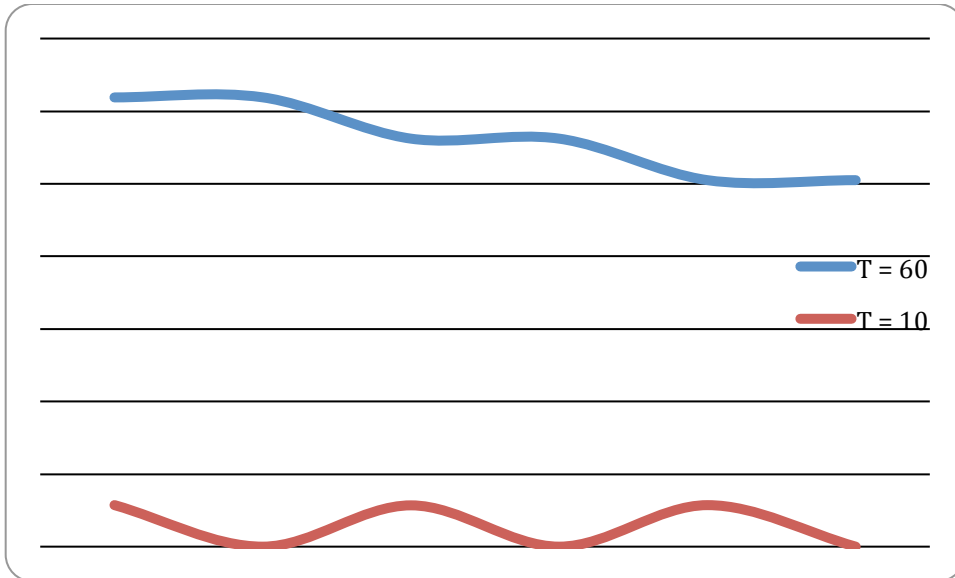
Experiments and Results

In this topic, we have tested transfer by use iperf that have in “iperf” commands. This test use only TCP session but the time limits that start same time are different durations by using 3 values are 60 seconds (base time which must usually use with other durations), 30 seconds and 10 seconds. This experiment test with 2 forms and the test that send with 60 seconds are 675 Mbytes and 94.1 Mbits/sec.

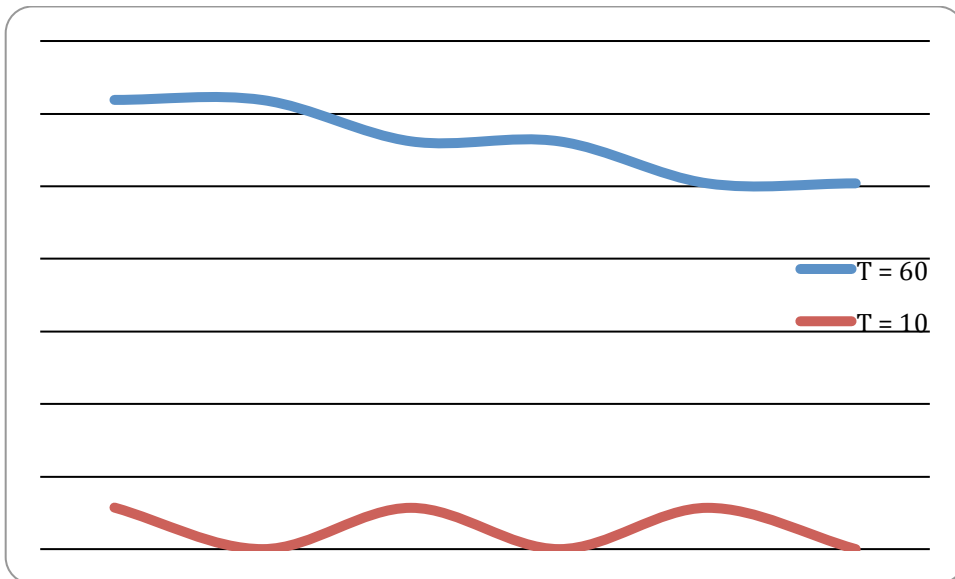
Experiment 1 – Time = 60 and 10 seconds

We use 60 and 10 seconds in this experiment but 10 seconds are used 3 times by spacing each 10 seconds and check the transfer data that send data from 2 clients which are client1 = 100.10.10.6 and 60 seconds and client2 = 100.10.10.12 and 10 seconds to server.

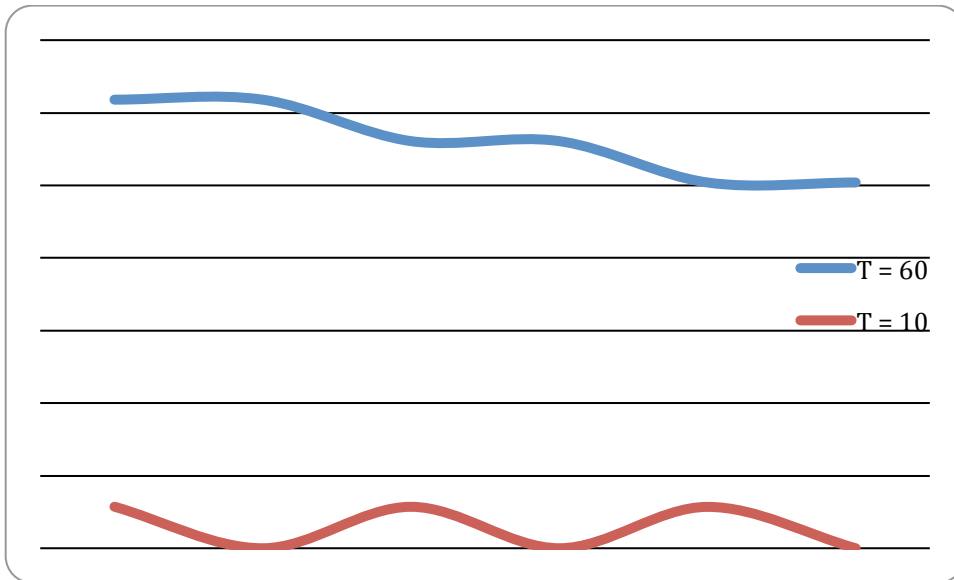
Test 1



Test 2



Test 3

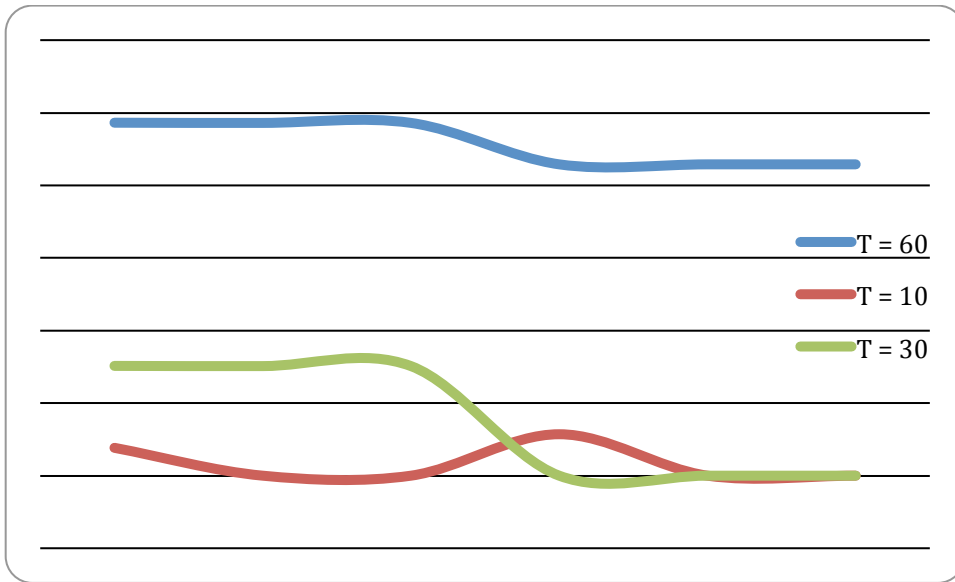


From 3 tests, those show the transfer data at all period in 60 seconds and the time in each have nearly transfer data and include bandwidth too. Transfer data and Bandwidth of T = 10 that pull from T = 60 are all equal.

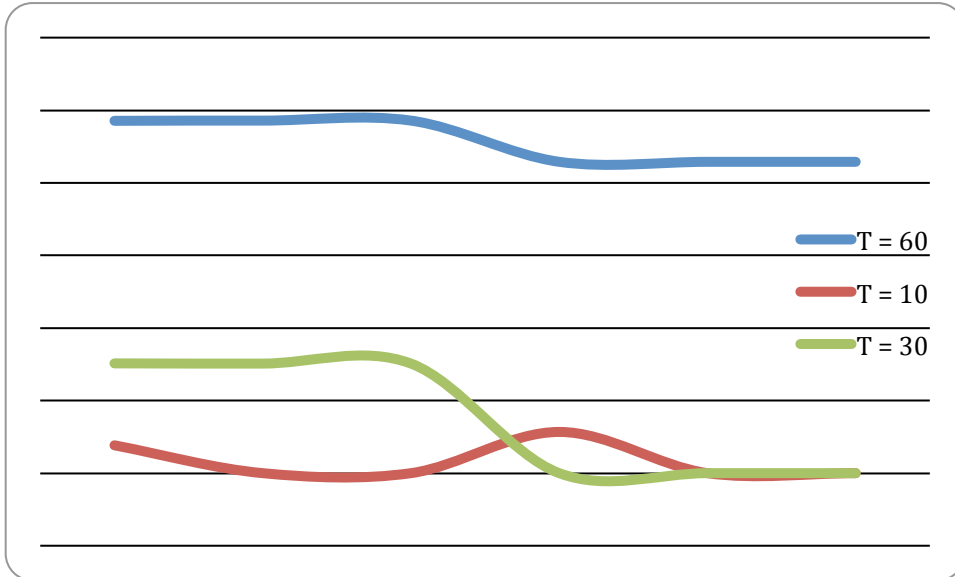
Experiment 2 – Time = 60, 30 and 10seconds

We use 60, 30 and 10 seconds in this experiment by spacing the period of 10 seconds as 20 seconds and check the transfer data that send data from 2 clients which are client1 = 100.10.10.6 and 60 seconds, client2 = 100.10.10.12 and 10 seconds and client3 = 100.10.10.13 and 30 seconds to server.

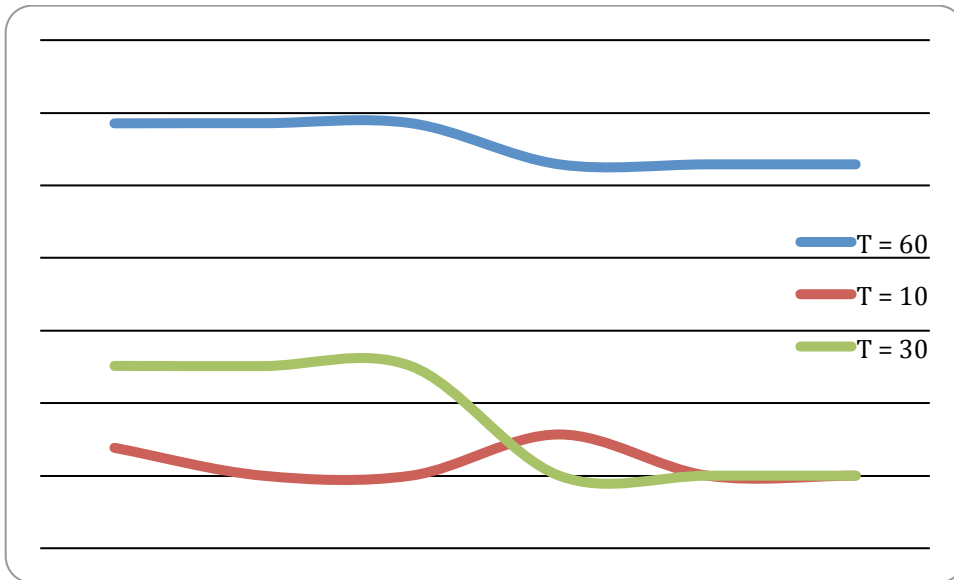
Test 1



Test 2



Test 3



In 3 tests, the graph line of T = 10s in 30 – 40 second period will pull the transfer data and bandwidth from T = 60s more than 0 – 10 seconds because at start time have more line to pull value from T = 60s