eStadium Project
Lab 2: Iperf Command

Objectives
- Being familiar with the command *iperf*.

In this Lab, we will set up two computers (PC1 and PC2) as an ad-hoc network and use the command *iperf* to measure network parameters of TCP (Transmission Control Protocol) connection and UDP (User Datagram Protocol) connection.

Mainly, we use *iperf* on TCP connection to measure the TCP throughput (Part B), which will lead to calculate the TCP window size. On the other hand, we use *iperf* on UDP connection to measure UDP throughput, jitter, and data loss (Part C). In addition, there are some *iperf*'s options that we will take a look (Part D – G).

Remark:
- One PC will act as a server (=receiver).
- Another PC will act as a client (=transmitter).
- The recorded measurement values are the values shown on the server, not the client.
- The setup with more than two PCs is possible.
- To install iperf, on Ubuntu, type

  >> *sudo apt-get install iperf*

  Note: This will install *iperf* online, then make sure that the internet must be connected during the installation.
- Please see the references for comprehensive explanation and examples.
- Please see the references or type *man iperf* to see the *iperf* command's options.
- If not specified, just put two PCs apart with a convenient distance (1-2m).

A: Setup the Ad-hoc Network

A.1) Set up the ad-hoc network between two PCs by following the steps in Lab 1. Note that let the IP address of PC1 is *PC1_IPaddress* (for example, 192.168.12.1).

B: TCP Connection – TCP Throughput Measurement

B.1) Set PC1 as a server (receiver) by typing

>> *iperf -s*

B.2) Set PC2 as a client (transmitter) by typing

>> *iperf -c PC1_IPaddress*

The screens are shown below

```
                        seksan@ubuntu: ~
File  Edit  View  Terminal  Tabs  Help

seksan@ubuntu:~$ iperf -s
------------------------------------------------------------
Server listening on TCP port 5001
TCP window size: 85.3 KByte (default)
------------------------------------------------------------
[  4] local 192.168.12.1 port 5001 connected with 192.168.12.12 port 50608
[ ID] Interval       Transfer     Bandwidth
[  4]  0.0-10.4 sec  6.08 MBytes  4.92 Mbits/sec
```

```
                        estadium@ubuntu: ~
File  Edit  View  Terminal  Tabs  Help

estadium@ubuntu:~$ iperf -c 192.168.12.1
------------------------------------------------------------
Client connecting to 192.168.12.1, TCP port 5001
TCP window size: 16.0 KByte (default)
------------------------------------------------------------
[  3] local 192.168.12.12 port 50608 connected with 192.168.12.1 port 5001
[ ID] Interval       Transfer     Bandwidth
[  3]  0.0-10.2 sec  6.08 MBytes  5.01 Mbits/sec
estadium@ubuntu:~$
```

Remark:

- The server must be set up first.
- The measured TCP throughput is 4.92 Mbit/s (the throughput shown on the server's screen).
- By default, *iperf* runs a 10 second test.
- By default, TCP window is 85.3 KByte at the server.
- By default, TCP window is 16.0 KByte at the client.
- When we know the TCP throughput, we can calculate an appropriate TCP window size (of the client) following this equation:

  TCP window size = (Throughput) X (Round Trip Time)

  where the round trip time (RTT) is measured by using *ping* command.

C: UDP Connection – UDP Throughput, Jitter, and Loss Measurement

C.1) Set PC1 as a server (receiver) by typing

>> *iperf -s -u*

C.2) Set PC2 as a client (transmitter) by typing

>> *iperf -c PC1_IPaddress -u*

The client will send the UDP packets with bandwidth 1 Mb/s (default). The screens are shown below

```
                        seksan@ubuntu: ~
File  Edit  View  Terminal  Tabs  Help
seksan@ubuntu:~$ iperf -s -u
------------------------------------------------------------
Server listening on UDP port 5001
Receiving 1470 byte datagrams
UDP buffer size:   110 KByte (default)
------------------------------------------------------------
[  3] local 192.168.12.1 port 5001 connected with 192.168.12.12 port 60475
[ ID] Interval       Transfer     Bandwidth        Jitter   Lost/Total Datagrams
[  3]  0.0-10.0 sec  1.25 MBytes  1.05 Mbits/sec  1.033 ms    0/  893 (0%)
```

Remark:
- The server must be set up first.
- The measured UDP throughput is the throughput shown on the server's screen. *By default the UDP throughput is around 1 Mbit/s.*
- The measured UDP jitter is shown on the server's screen, which is 1.033 ms.
- The measured data loss is shown on the server's screen, which is 0.
- By default, *iperf* runs a 10 second test.
- By default, UDP buffer is 110 KByte at the server.
- By default, UDP buffer is 110 KByte at the client.

D: Iperf's Option - TCP Connection with a Varying Observed Time Duration

D.1) Set PC1 as a server (receiver) by typing

>> *iperf -s*

D.2) Set PC2 as a client (transmitter) by typing

>> *iperf -c PC1_IPaddress -t 5*

The client will send TCP packets for 5 second. Note that this option is also available for UDP connection. The screens are shown below.

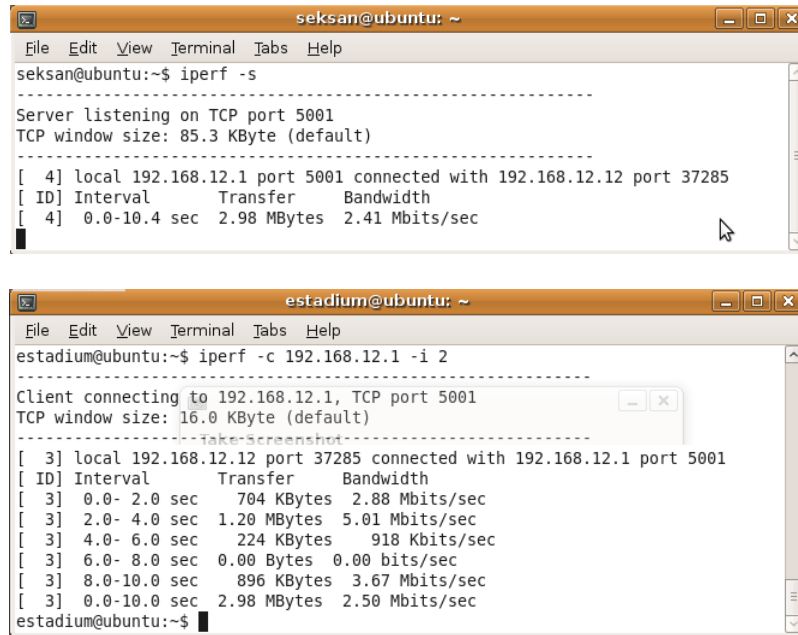**E: Iperf's Option - TCP Connection with a Varying Observed Time Interval**

E.1) Set PC1 as a server (receiver) by typing

>> *iperf -s*

E.2) Set PC2 as a client (transmitter) by typing

>> *iperf -c PC1_IPaddress -i 2*

The client will send TCP packets for 10 second (default) and show the details every 2 second. Note that this option is also available for UDP connection. The screens are shown below.

```
                        seksan@ubuntu: ~
 File  Edit  View  Terminal  Tabs  Help
 seksan@ubuntu:~$ iperf -s
 ------------------------------------------------------------
 Server listening on TCP port 5001
 TCP window size: 85.3 KByte (default)
 ------------------------------------------------------------
 [  4] local 192.168.12.1 port 5001 connected with 192.168.12.12 port 37285
 [ ID] Interval       Transfer     Bandwidth
 [  4]  0.0-10.4 sec  2.98 MBytes  2.41 Mbits/sec
```

```
                        estadium@ubuntu: ~
 File  Edit  View  Terminal  Tabs  Help
 estadium@ubuntu:~$ iperf -c 192.168.12.1 -i 2
 ------------------------------------------------------------
 Client connecting to 192.168.12.1, TCP port 5001
 TCP window size: 16.0 KByte (default)
 ------------------------------------------------------------
 [  3] local 192.168.12.12 port 37285 connected with 192.168.12.1 port 5001
 [ ID] Interval       Transfer     Bandwidth
 [  3]  0.0- 2.0 sec    704 KBytes  2.88 Mbits/sec
 [  3]  2.0- 4.0 sec  1.20 MBytes  5.01 Mbits/sec
 [  3]  4.0- 6.0 sec    224 KBytes   918 Kbits/sec
 [  3]  6.0- 8.0 sec  0.00 Bytes  0.00 bits/sec
 [  3]  8.0-10.0 sec    896 KBytes  3.67 Mbits/sec
 [  3]  0.0-10.0 sec  2.98 MBytes  2.50 Mbits/sec
 estadium@ubuntu:~$
```

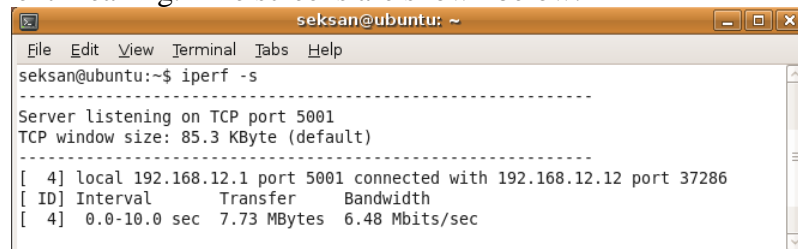**F: Iperf's Option - TCP Connection with a Varying TCP Window Size**

F.1) Set PC1 as a server (receiver) by typing

>> *iperf -s*
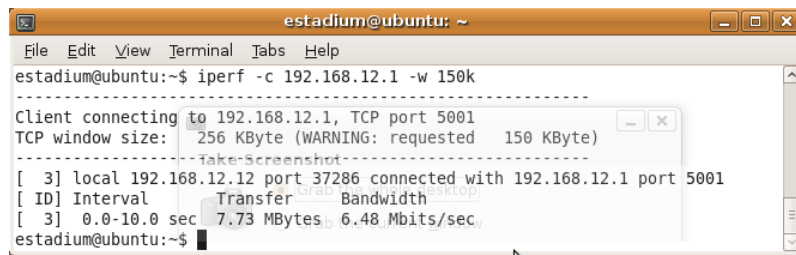
F.2) Set PC2 as a client (transmitter) by typing

>> *iperf -c PC1_IPaddress -w 150k*

The client will send TCP packets for 10 second (default) with requesting the TCP window size 150 KByte. Note that this option is also available for UDP connection but with a different meaning. The screens are shown below.

```
                        seksan@ubuntu: ~
 File  Edit  View  Terminal  Tabs  Help
 seksan@ubuntu:~$ iperf -s
 ------------------------------------------------------------
 Server listening on TCP port 5001
 TCP window size: 85.3 KByte (default)
 ------------------------------------------------------------
 [  4] local 192.168.12.1 port 5001 connected with 192.168.12.12 port 37286
 [ ID] Interval       Transfer     Bandwidth
 [  4]  0.0-10.0 sec  7.73 MBytes  6.48 Mbits/sec
```

```
                        estadium@ubuntu: ~
 File  Edit  View  Terminal  Tabs  Help
 estadium@ubuntu:~$ iperf -c 192.168.12.1 -w 150k
 ------------------------------------------------------------
 Client connecting to 192.168.12.1, TCP port 5001
 TCP window size:   256 KByte (WARNING: requested   150 KByte)
 ------------------------------------------------------------
 [  3] local 192.168.12.12 port 37286 connected with 192.168.12.1 port 5001
 [ ID] Interval       Transfer     Bandwidth
 [  3]  0.0-10.0 sec  7.73 MBytes  6.48 Mbits/sec
 estadium@ubuntu:~$
```

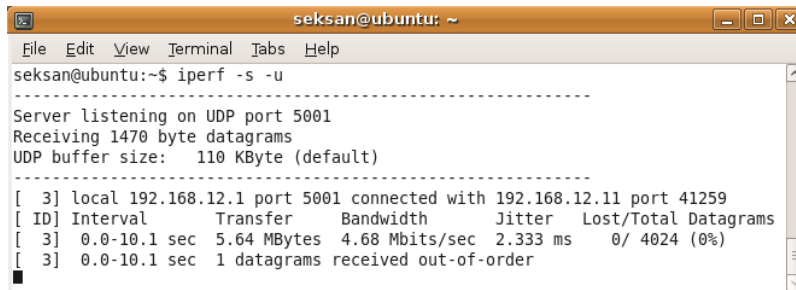## G: Iperf's Option - UDP Connection with a Varying Bandwidth

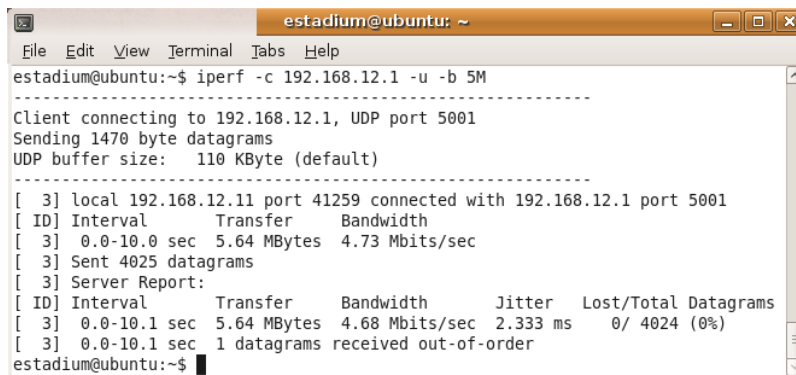G.1) Set PC1 as a server (receiver) by typing

>> *iperf -s -u*

G.2) Set PC2 as a client (transmitter) by typing

>> *iperf -c PC1_IPaddress -u -b 5M*

The client will send UDP packets for 10 second (default) with the bandwidth 5 Mbit/s. The screens are shown below.


```
                        seksan@ubuntu: ~
 File  Edit  View  Terminal  Tabs  Help
 seksan@ubuntu:~$ iperf -s -u
 ------------------------------------------------------------
 Server listening on UDP port 5001
 Receiving 1470 byte datagrams
 UDP buffer size:   110 KByte (default)
 ------------------------------------------------------------
 [  3] local 192.168.12.1 port 5001 connected with 192.168.12.11 port 41259
 [ ID] Interval       Transfer     Bandwidth      Jitter   Lost/Total Datagrams
 [  3]  0.0-10.1 sec  5.64 MBytes  4.68 Mbits/sec  2.333 ms    0/ 4024 (0%)
 [  3]  0.0-10.1 sec  1 datagrams received out-of-order
```



```
                        estadium@ubuntu: ~
 File  Edit  View  Terminal  Tabs  Help
 estadium@ubuntu:~$ iperf -c 192.168.12.1 -u -b 5M
 ------------------------------------------------------------
 Client connecting to 192.168.12.1, UDP port 5001
 Sending 1470 byte datagrams
 UDP buffer size:   110 KByte (default)
 ------------------------------------------------------------
 [  3] local 192.168.12.11 port 41259 connected with 192.168.12.1 port 5001
 [ ID] Interval       Transfer     Bandwidth
 [  3]  0.0-10.0 sec  5.64 MBytes  4.73 Mbits/sec
 [  3] Sent 4025 datagrams
 [  3] Server Report:
 [ ID] Interval       Transfer     Bandwidth      Jitter   Lost/Total Datagrams
 [  3]  0.0-10.1 sec  5.64 MBytes  4.68 Mbits/sec  2.333 ms    0/ 4024 (0%)
 [  3]  0.0-10.1 sec  1 datagrams received out-of-order
 estadium@ubuntu:~$
```

References:
[1] http://openmaniak.com/iperf.php
[2] http://pirlwww.lpl.arizona.edu/resources/guide/software/iperf/
[3] http://kb.pert.geant2.net/PERTKB/IperfTool