**Networks Lab Assignment 4**
**Group 37** -
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**Note -** Since size of the data files is too large, here is the google drive link for them -
https://drive.google.com/open?id=1cBdMjnMwJc5A7cB2XM3mU060gNQHyQEE

Application 1 - TCP Dumbbell topology - Yeah, Hybla, Westwood+

| Host1 | 172.16.111.1---172.16.115.1 | Host4 | - TCP-Yeah |
| Host2 | 172.16.112.1---172.16.116.1 | Host5 | - TCP-Hybla |
| Host3 | 172.16.113.1---172.16.117.1 | Host6 | - TCP-Westwood+ |

## Part 1

1. Create 8 nodes (6 hosts and 2 routers).
2. Assign router-router link with (10 Mbps, 50 ms) and router-host link with (100 Mbps, 20ms).
3. Both router use Drop-Tail queue and queue size according to bandwidth-delay product(given in question).
4. According to given topology all three sender send packets with different tcp protocols ( Hybla, Westwood+ , Yeah ).
5. In part 1, only one sender sends packets at a time.
6. Using NS3 3.28 flow monitor module collect and store performance data from the simulation.
7. Data of the analysis are present in text files.
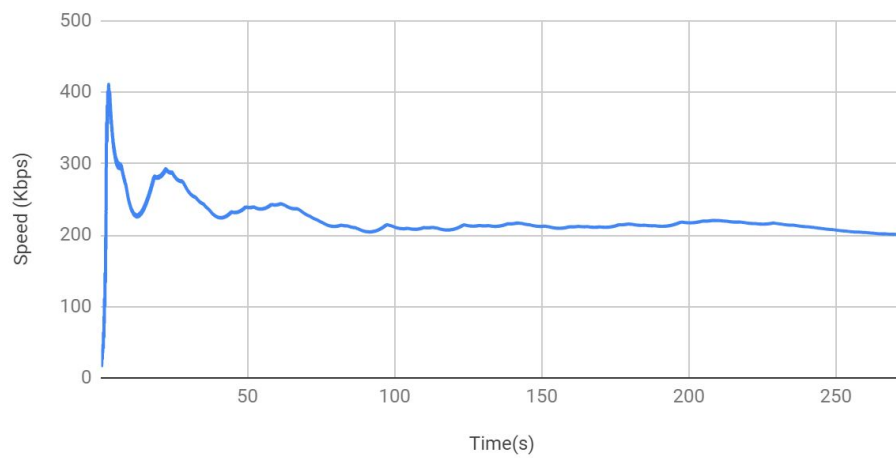
## 8. Graphs of the analysis are given below-

### 1 - TCP Hybla
Congestion Window
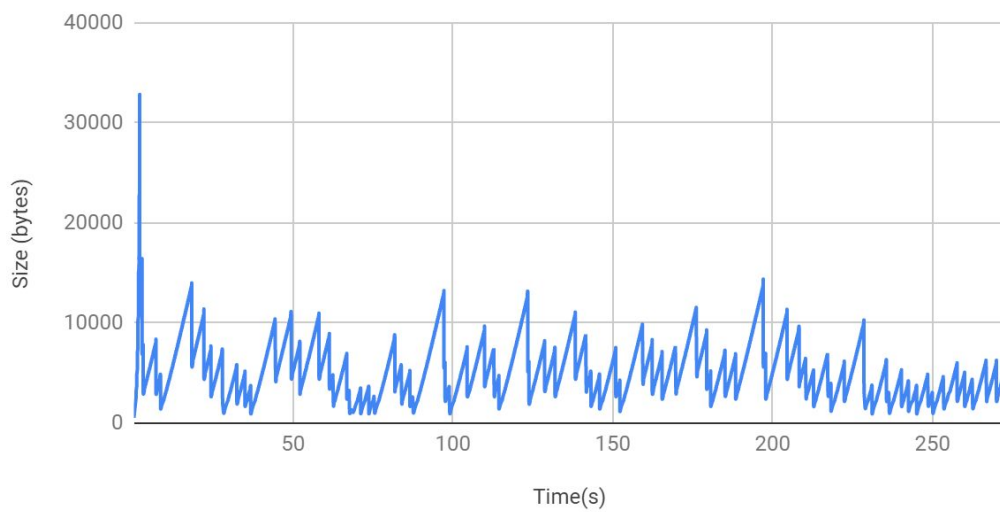


### 1 - TCP Hybla
Goodput

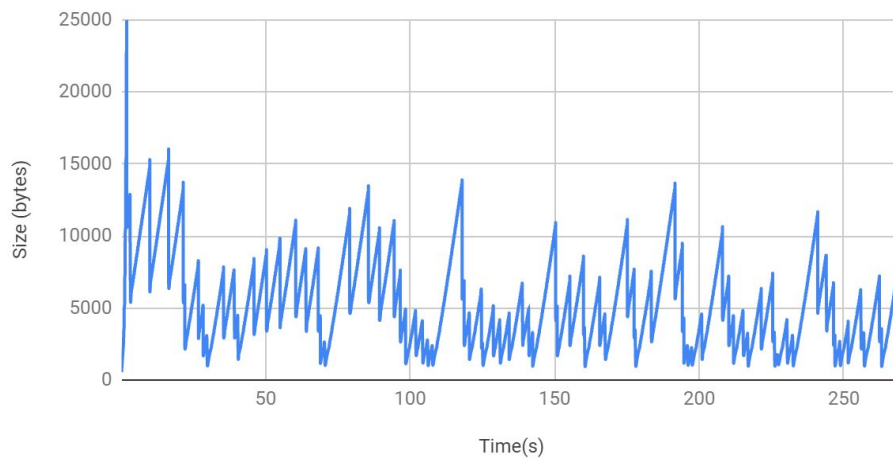Flow No. = 3

TCP hybla flow from 172.16.112.1 to 172.16.116.1

Total Packets Received = 999911 out of 1000000

Packet Lost -> Buffer Overflow = 0 Congestion = 89
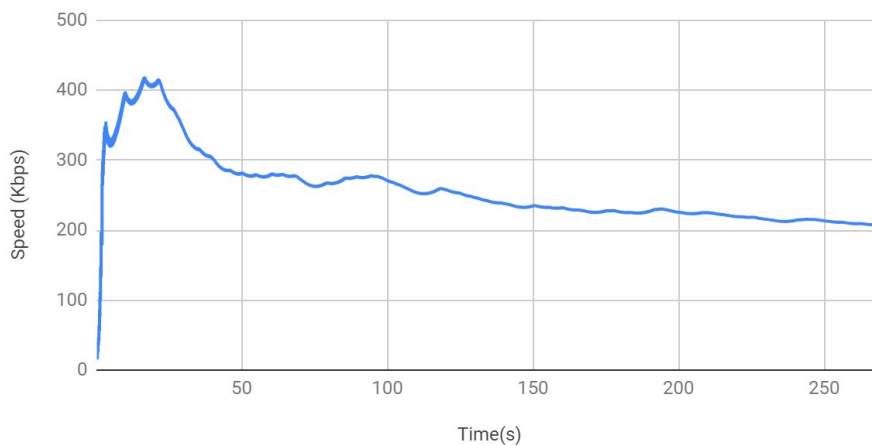
ThroughPut = 456.647 kbps

1 - TCP Westwood+

Congestion Window



1 - TCP Westwood+

Goodput

Flow No. = 5
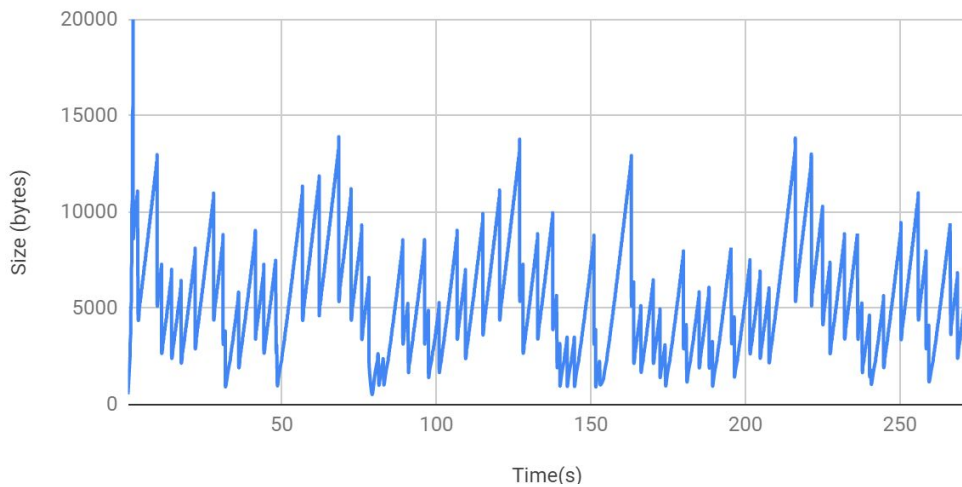TCP westwood flow 172.16.113.1 to 172.16.117.1
Total Packets Received = 999911 out of 1000000
Packet Lost -> Buffer Overflow = 0 Congestion = 89
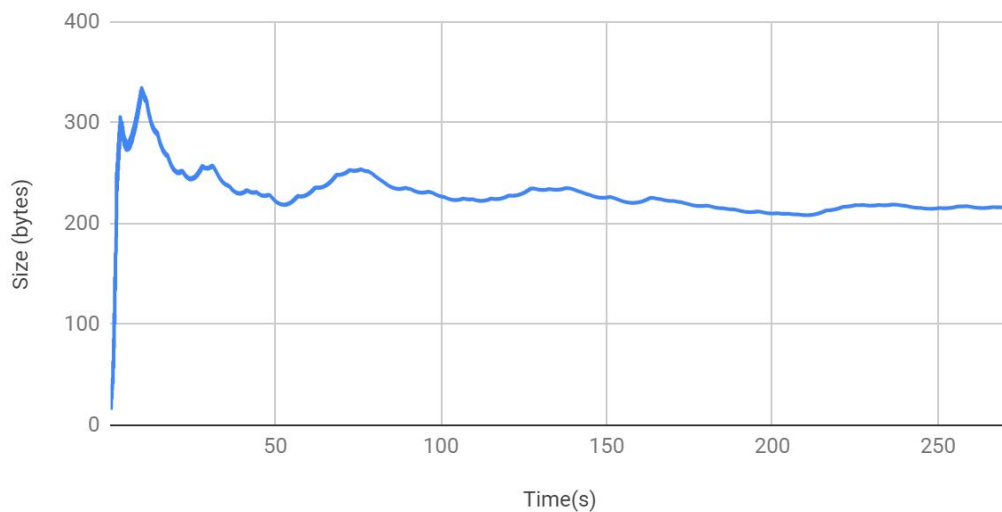ThroughPut = 459.841 kbps

1 - TCP Yeah

Congestion Window



Time(s)

1 - TCP Yeah

Goodput



Time(s)

Flow No. = 1
TCP Yeah flow 172.16.111.1 to 172.16.115.1
Total Packets Received = 999916 out of 1000000
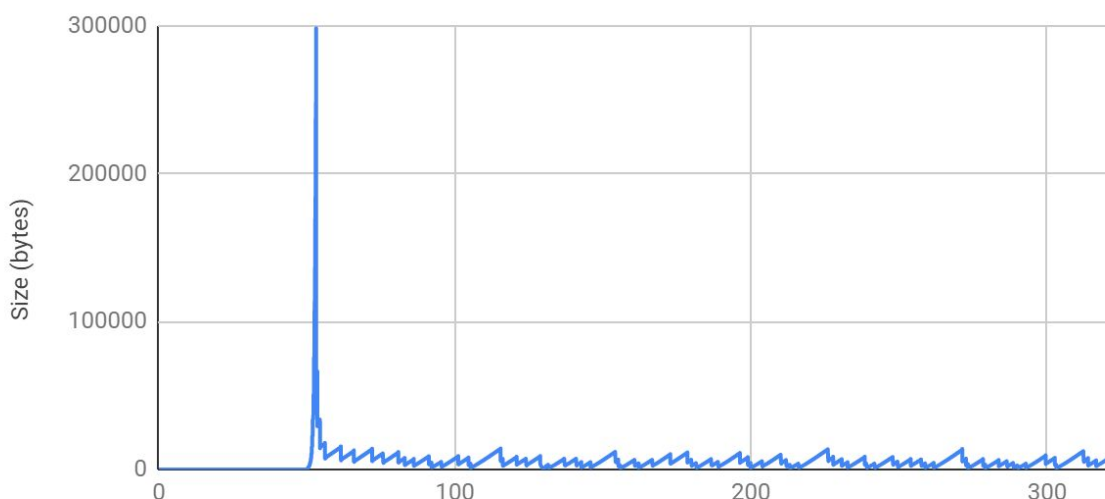Packet Lost -> Buffer Overflow = 0 Congestion = 84
ThroughPut = 367.975 kbps

## Part 2

1. Create 8 nodes (6 hosts and 2 routers).
2. Assign router-router link with  (10 Mbps, 50 ms) and router-host link with (100 Mbps, 20ms).
3. Both router use Drop-Tail queue and queue size according to bandwidth-delay product(given in question).
4. According to given topology all three sender send packets with different tcp protocols ( Hybla, Westwood+ , Yeah ).
5. In part 2, first 50 second only 1st host sends packet and then for next 1000 seconds all three hosts send simultaneously.
6. Using NS3 3.28 flow monitor module collect and store performance data from the simulation.
7. Data of the analysis are present in text files.
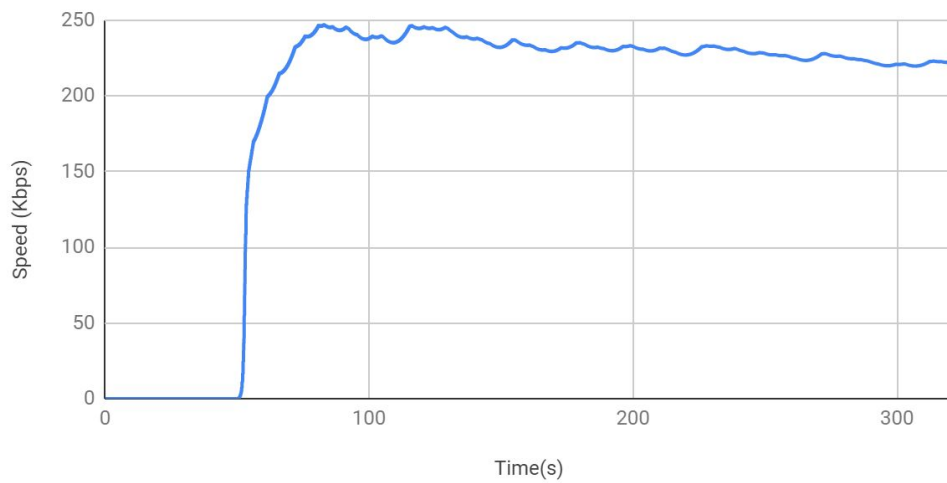8. Graphs of the analysis are given below -
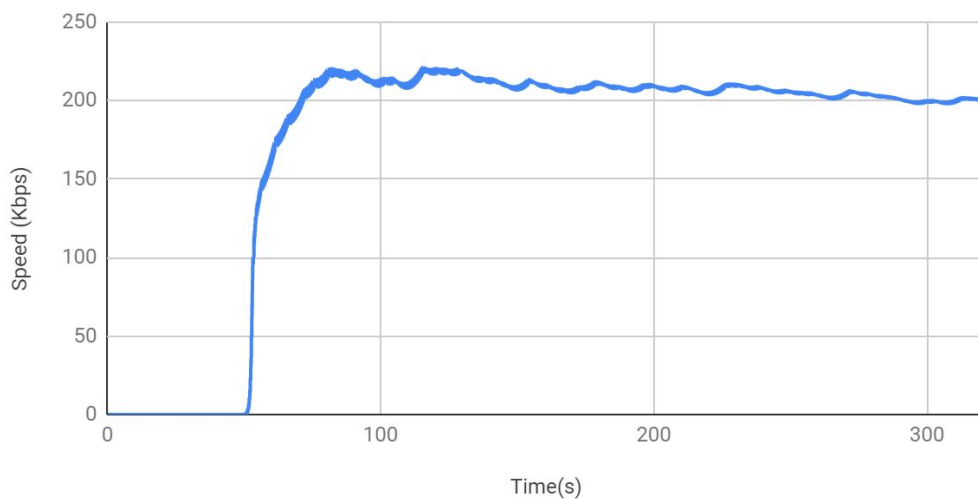
2 - TCP Hybla

Congestion Window

## 2 - TCP Hybla

Throughput



## 2 - TCP Hybla

Goodput



Flow No. = 3
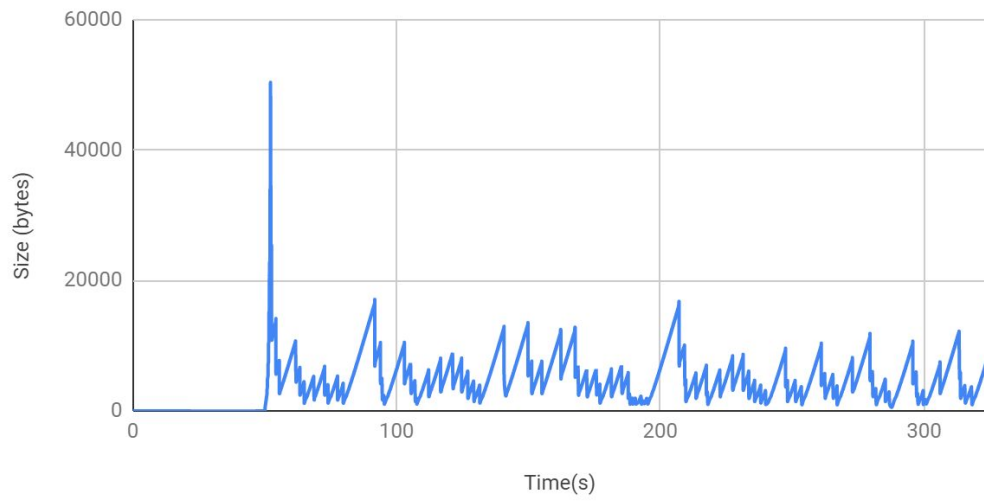TCP hybla flow 172.16.112.1 to 172.16.116.1
Total Packets Received = 999911 out of 1000000
Packet Lost -> Buffer Overflow = 0 Congestion = 89
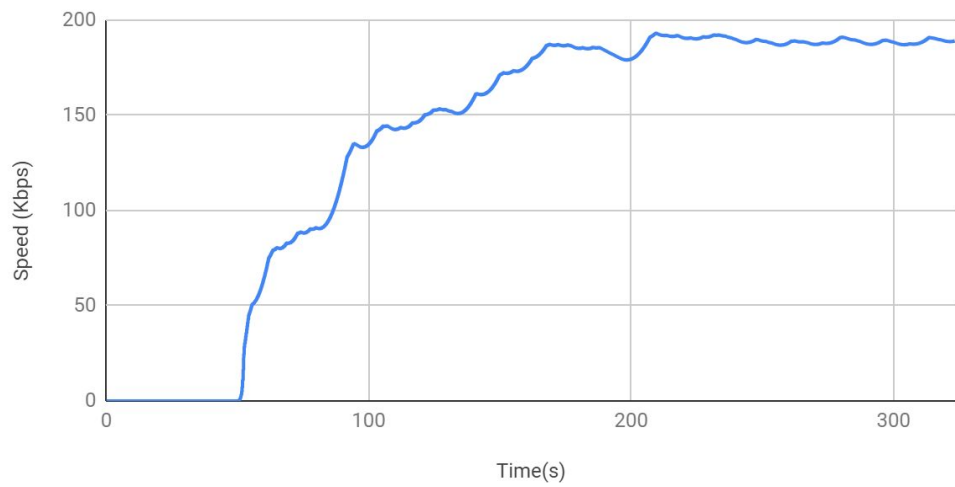Maximum ThroughPut = 247.067 kbps

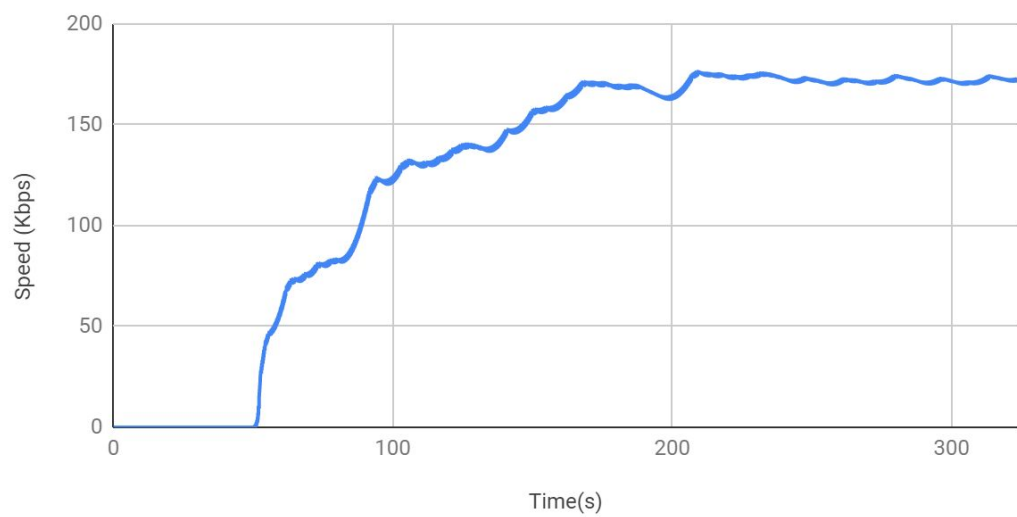## 2 - TCP Westwood+

Congestion Window



## 2 - TCP Westwood+

Throughput



## 2 - TCP Westwood+

Goodput

Flow No. = 4
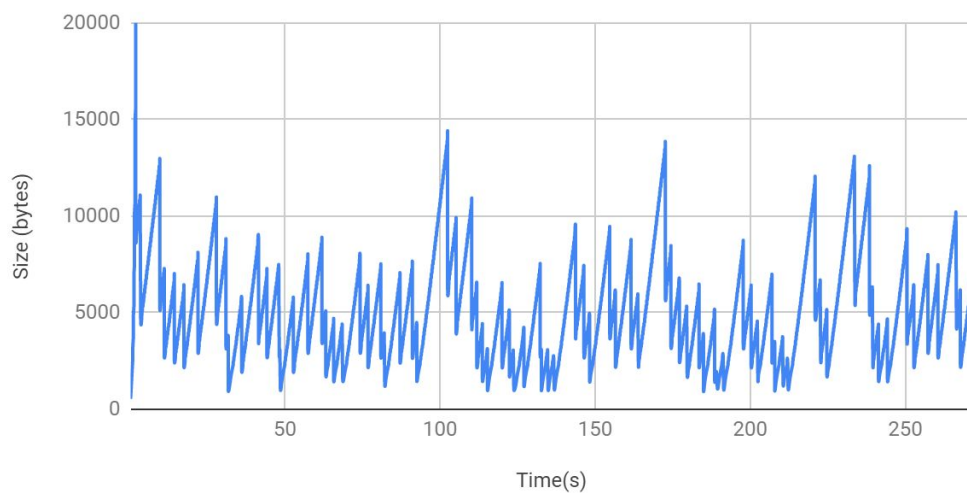TCP westwood flow 172.16.113.1 to 172.16.117.1
Total Packets Received = 999908 out of 1000000
Packet Lost -> Buffer Overflow = 0 Congestion = 92
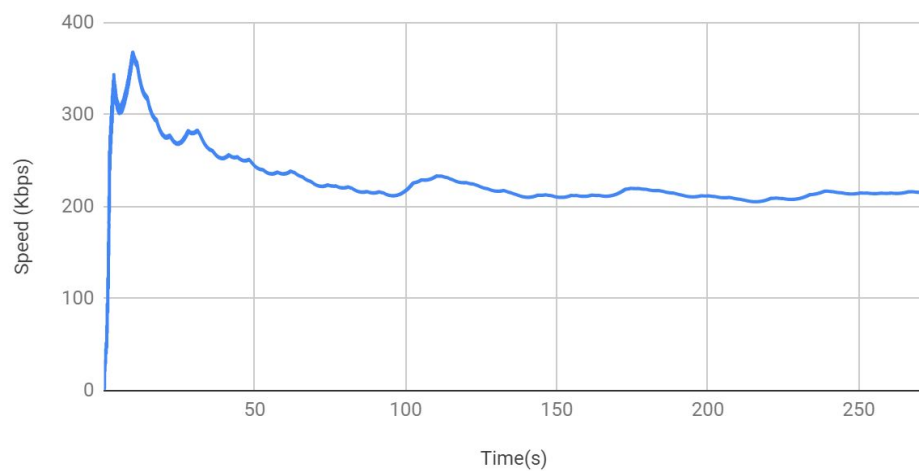Maximum ThroughPut = 193.087 kbps

## 2 - TCP Yeah
Congestion Window
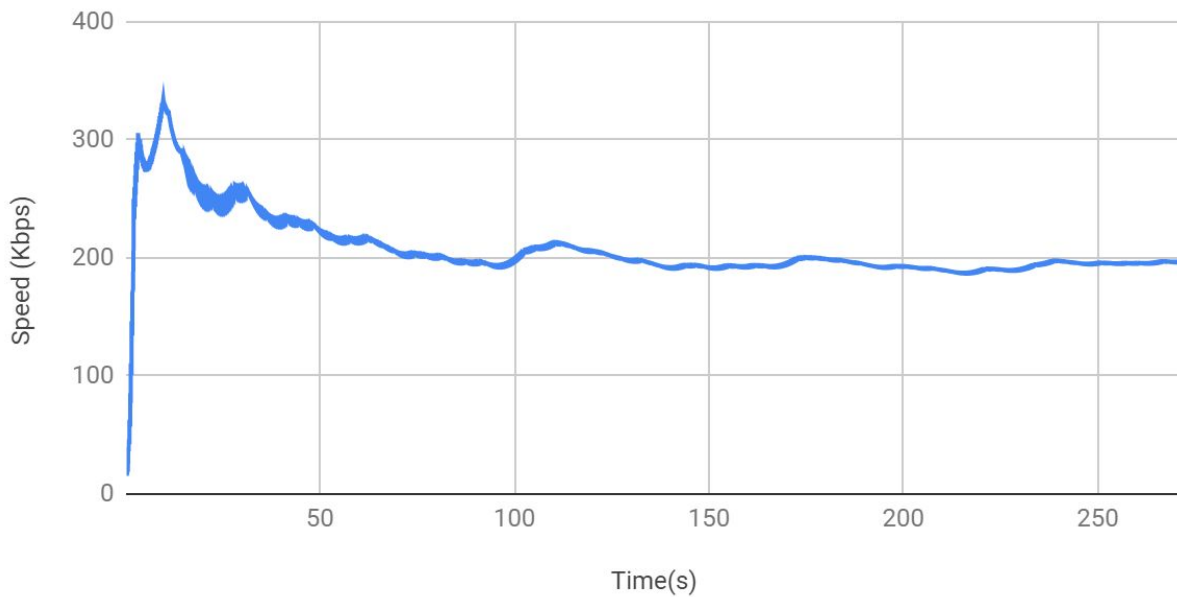


## 2 - TCP Yeah
Throughput

## 2 - TCP Yeah

Goodput



Flow No. = 1

TCP Yeah flow 172.16.111.1 to 172.16.115.1

Total Packets Received = 999909 out of 1000000

Packet Lost -> Buffer Overflow = 0 Congestion = 91

Maximum ThroughPut = 367.975 kbps

**Part 3**

Goodput data and Congestion Window data for each of the flows are submitted along with the document for each of the parts.