

# CS-349 NETWORKS ASSIGNMENT-4

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## APPLICATION #2

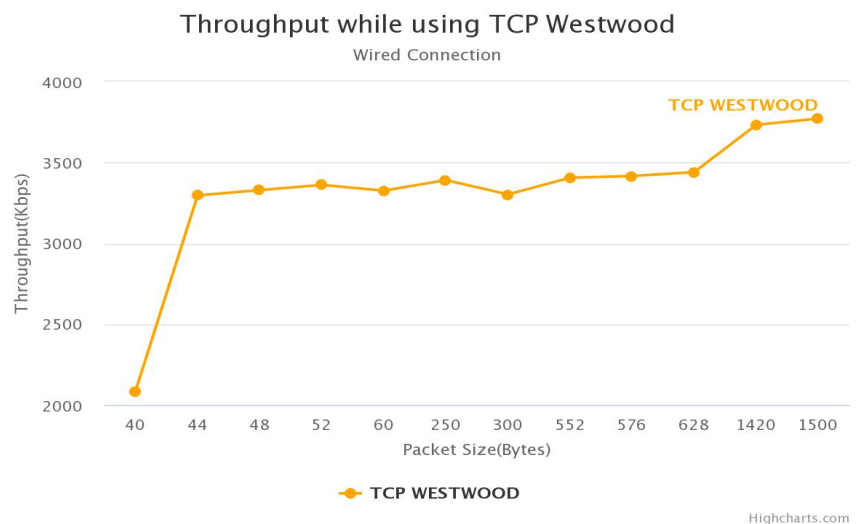
### WIRED CONNECTION

#### Conclusions from the graphs

- It was observed that on increase of packet size, there is an increase in throughput which becomes lower and lower as we continue to increase the size. So for instance the difference in throughput when the packet size is increased from 40 to 44 bytes is greater than the case when we increase the size from 1420 to 1500 bytes.
- TCP Westwood and TCP Veno show a greater throughput as compared to TCP Vegas.
- For all cases, we got the value of Fairness Index to be 1.

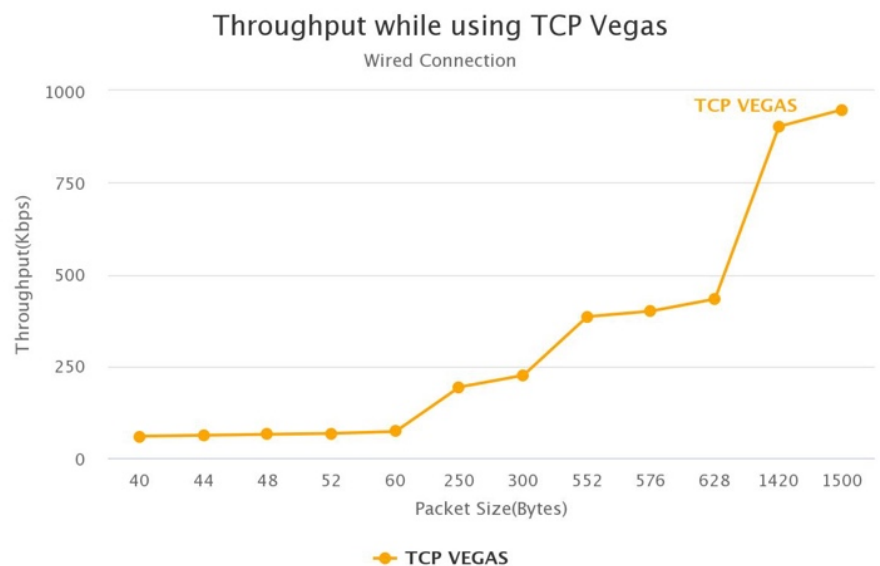
#### TCP WESTWOOD

Packet Size(Bytes)	Throughput (Kbps)	Fairness Index
40	2085.567260	1
44	3295.696687	1
48	3328.333043	1
52	3360.662126	1
60	3325.090131	1
250	3390.297151	1
300	3301.825896	1
552	3405.036632	1
576	3415.798894	1
628	3439.550993	1
1420	3732.406380	1
1500	3770.797060	1



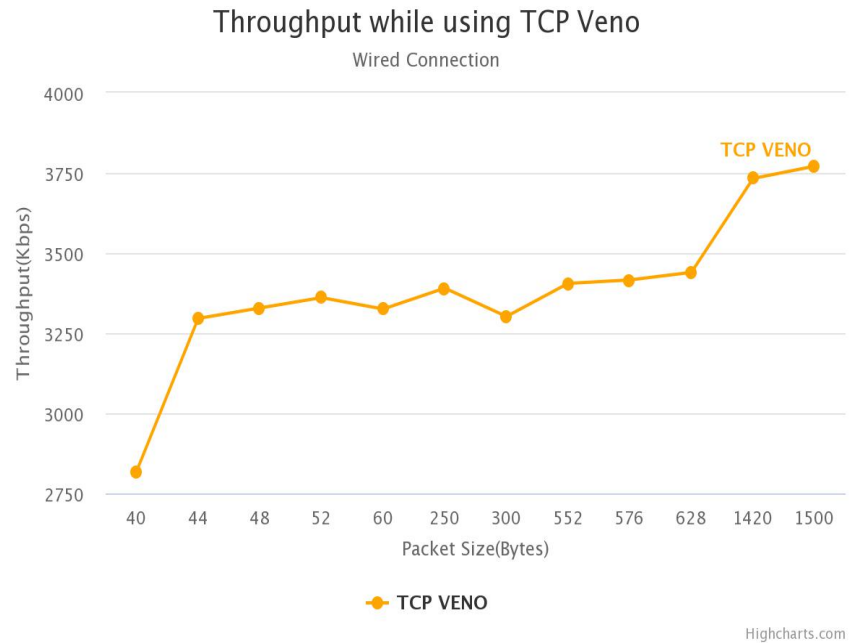
#### TCP VEGAS

Packet Size(Bytes)	Throughput (Kbps)	Fairness Index
40	58.988826	1
44	61.543859	1
48	64.098715	1
52	66.653397	1
60	71.762233	1
250	192.890714	1
300	224.700950	1
552	384.609348	1
576	399.802590	1
628	432.699810	1
1420	902.376271	1
1500	902.376271	1



## TCP VENO

Packet Size(Bytes)	Throughput (Kbps)	Fairness Index
40	2818.349558	1
44	3295.696687	1
48	3328.333043	1
52	3360.662126	1
60	3325.090131	1
250	3390.297151	1
300	3301.825896	1
552	3405.036632	1
576	3415.798894	1
628	3439.550993	1
1420	3732.406380	1
1500	3770.797060	1



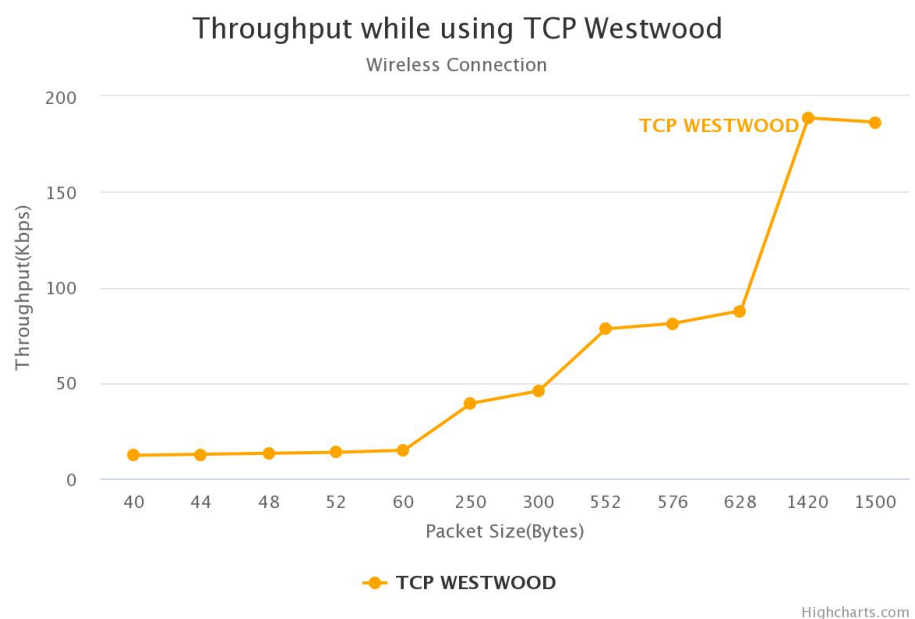
## WIRELESS CONNECTION

### Conclusions from the graphs

- Just like the case of wired connection, here also the throughput increases with increase in the packet size. And TCP Vegas shows a lower throughput as compared to the other TCP Agents (TCP Westwood and TCP Veno).
- We also observe that the throughput for all packet sizes is considerably lower than the wired components i.e. TCP Westwood Wireless has a lower throughput than TCP Westwood Wired.
- It was observed that the value of Fairness Index for all cases came out to be 1.

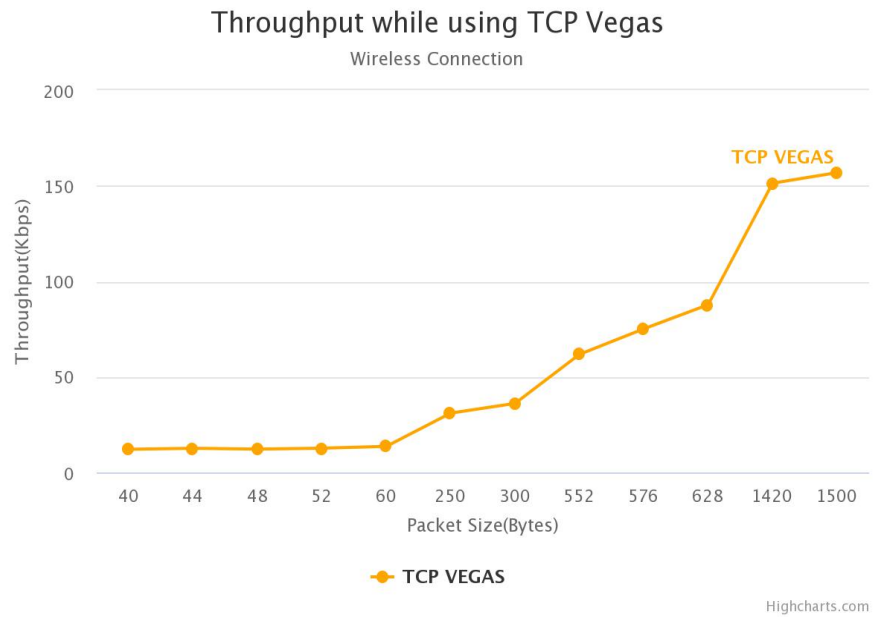
## TCP Westwood

Packet Size(Bytes)	Throughput (Kbps)	Fairness Index
40	12.069501	1
44	12.605346	1
48	13.132350	1
52	13.655610	1
60	14.681366	1
250	39.304154	1
300	45.744838	1
552	78.237620	1
576	81.134178	1
628	87.733800	1
1420	188.623222	1
1500	186.419813	1



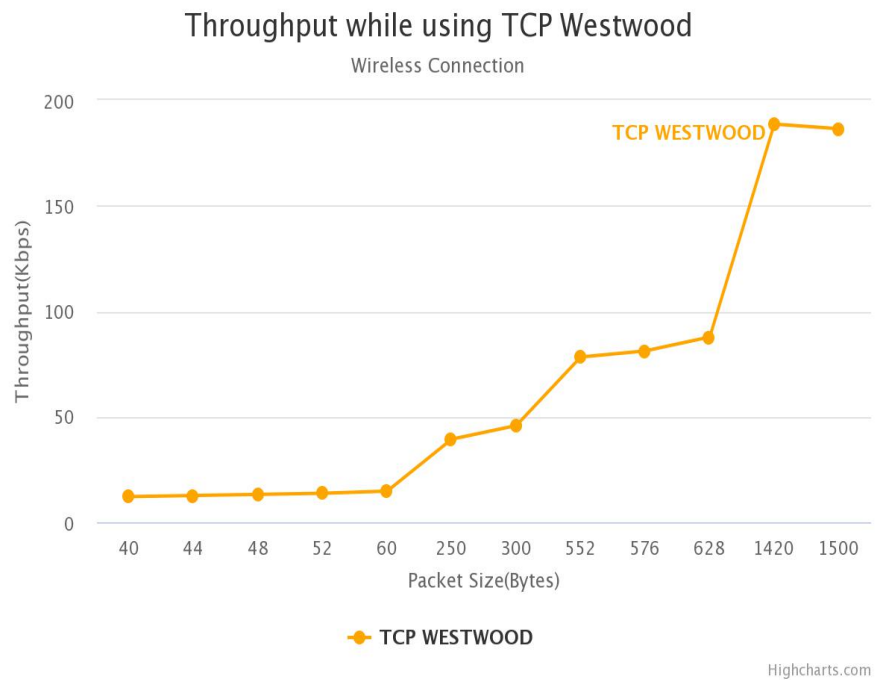
## TCP VEGAS

Packet Size(Bytes)	Throughput (Kbps)	Fairness Index
40	12.069501	1
44	12.605346	1
48	12.166187	1
52	12.650205	1
60	13.601185	1
250	31.009883	1
300	36.092578	1
552	61.744960	1
576	75.114307	1
628	87.733800	1
1420	151.321665	1
1500	156.830465	1



## TCP VENO

Packet Size(Bytes)	Throughput (Kbps)	Fairness Index
40	12.069501	1
44	12.605346	1
48	13.132350	1
52	13.655610	1
60	14.681366	1
250	39.304154	1
300	45.744838	1
552	78.237620	1
576	81.134178	1
628	87.733800	1
1420	188.623222	1
1500	186.419813	1



## JAINS FAIRNESS INDEX

We notice that in all the above cases (wired and wireless) for all agents, we have only on network connection.

Thus the value of Jain's Fairness Index is equal to 1.

# Jain's Fairness Index

$$f(x_1, x_2, x_3, \dots, x_n) = \frac{(\sum_{i=1}^n x_i)^2}{n \sum_{i=1}^n x_i^2}$$

In the above formula  $x_i$  represents the throughput of the  $i$ th connection.

Here is the plot of the same.

## Jain's Fairness Index for all cases

