Test Cases

Test environment:
Ubuntu 22.04, virtual machine on UTM.
Installed the ns2. (***sudo apt-get install ns2***)

Screenshot of the results:

```
don_kim@dongukserver:~/Desktop/ECEN602/ECEN602_Team07/MP5$ ns ns2.tcl SACK 1
case_no 1. delay1 = 5ms, delay2 = 12.5ms
(first 100s ignored)
Src1 Avg throughput: 0.52382720000000171 Mb/sec
Src2 Avg throughput: 0.47618133333333501 Mb/sec
src1/src2 ratio: 1.1000582411182294
don_kim@dongukserver:~/Desktop/ECEN602/ECEN602_Team07/MP5$ ns ns2.tcl SACK 2
case_no 2. delay1 = 5ms, delay2 = 20ms
(first 100s ignored)
Src1 Avg throughput: 0.54543146666666775 Mb/sec
Src2 Avg throughput: 0.4545770666666642 Mb/sec
src1/src2 ratio: 1.1998657800012291
don_kim@dongukserver:~/Desktop/ECEN602/ECEN602_Team07/MP5$ ns ns2.tcl SACK 3
case_no 3. delay1 = 5ms, delay2 = 27.5ms
(first 100s ignored)
Src1 Avg throughput: 0.56523306666667206 Mb/sec
Src2 Avg throughput: 0.43477546666666345 Mb/sec
src1/src2 ratio: 1.3000574089430597
don_kim@dongukserver:~/Desktop/ECEN602/ECEN602_Team07/MP5$ ns ns2.tcl VEGAS 1
case_no 1. delay1 = 5ms, delay2 = 12.5ms
(first 100s ignored)
Src1 Avg throughput: 0.58333333333333459 Mb/sec
Src2 Avg throughput: 0.41666666666666435 Mb/sec
src1/src2 ratio: 1.4000000000000108
don_kim@dongukserver:~/Desktop/ECEN602/ECEN602_Team07/MP5$ ns ns2.tcl VEGAS 2
case_no 2. delay1 = 5ms, delay2 = 20ms
(first 100s ignored)
Src1 Avg throughput: 0.68751999999999713 Mb/sec
Src2 Avg throughput: 0.3125066666666651 Mb/sec
src1/src2 ratio: 2.2000170663025878
don_kim@dongukserver:~/Desktop/ECEN602/ECEN602_Team07/MP5$ ns ns2.tcl VEGAS 3
case_no 3. delay1 = 5ms, delay2 = 27.5ms
(first 100s ignored)
Src1 Avg throughput: 0.75000000000000078 Mb/sec
Src2 Avg throughput: 0.24999999999999992 Mb/sec
src1/src2 ratio: 3.000000000000004
```

a. Simulation Results

(i) SACK

Case	Throughput src1 (Mbps)	Throughput src2 (Mbps)	Ratio of Throughputs (src1/src2)
1	0.523827	0.476181	1.100058
2	0.545431	0.454577	1.199865
3	0.565233	0.434775	1.300057

(ii) VEGAS

Case	Throughput src1 (Mbps)	Throughput src2 (Mbps)	Ratio of Throughputs (src1/src2)
1	0.583333	0.416666	1.400000
2	0.687519	0.312506	2.200170
3	0.750000	0.249999	3.0

b. Analysis

Relationship Between TCP Throughput and RTT

SACK:
1. As the end-to-end delay increases, the throughput ratio of src1 to src2 also increases.

2. SACK exhibits sensitivity to increased RTT, leading to a higher impact on throughput ratio.
3. After observing the behavior, we understand that the network experiences increased delays, SACK adjusts its performance, potentially favoring one source over another.

VEGAS:
1. VEGAS demonstrates a significant increase in throughput ratio with higher end-to-end delays.
2. The adaptive behavior of VEGAS to different RTT conditions results in a significant improvement in the throughput ratio.
3. This highlights the efficiency of VEGAS in adapting to dynamic network scenarios which ensures optimal utilization of resources.

Throughput Performance Comparison for Case 1

1. SACK: Throughput ratio is 1.100058

2. VEGAS: Throughput ratio is 1.400000

VEGAS outperforms SACK in Case 1, indicating better adaptability to the given network conditions. This suggests that VEGAS efficiently manages the end-to-end delays, resulting in a more balanced and optimized throughput for both scr1 & scr2.

The results highlight the impact of end-to-end delay on TCP throughput, with VEGAS demonstrating better performance in some cases. The adaptability of different TCP flavors to changing RTT scenarios is a key factor in determining their throughput ratio.