

Network Simulation

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Setup

In this network simulation, we implement the simulation file (ns2.tcl) for NS-2 simulator.

Procedure

Run ns2.tcl in command line with `ns ns2.tcl <TCP_flavor> <case_number>`, we can get the throughputs for different TCP flavors and RTT ratios, as well as the throughput ratios.

Results

TCP VEGAS

```
[main-10-230-41-4:Project Yinan$ ns ns2.tcl VEGAS 1
TCP Flavor = VEGAS
Case = 1
VEGAS
average throughput of link1 = 0.5833333333333347 Mbps
average throughput of link2 = 0.4166666666666652 Mbps
throughput ratio link1/link2 = 1.4000000000000072
running nam...
[main-10-230-41-4:Project Yinan$ ns ns2.tcl VEGAS 2
TCP Flavor = VEGAS
Case = 2
VEGAS
average throughput of link1 = 0.6874933333333304 Mbps
average throughput of link2 = 0.31250666666666521 Mbps
throughput ratio link1/link2 = 2.1999317347896583
running nam...
[main-10-230-41-4:Project Yinan$ ns ns2.tcl VEGAS 3
TCP Flavor = VEGAS
Case = 3
VEGAS
average throughput of link1 = 0.68418666666666716 Mbps
average throughput of link2 = 0.31578666666666494 Mbps
throughput ratio link1/link2 = 2.1666103698699679
running nam...
-
```

Case	RTT Ratio	Throughput 1	Throughput 2	Throughput Ratio
1	1:2	0.58333	0.41667	1.4000
2	1:3	0.68749	0.31251	2.1999
3	1:4	0.68419	0.31579	2.1666

TCP SACK

```
[main-10-230-41-4:Project Yinan$ ns ns2.tcl SACK 1
TCP Flavor = SACK
Case = 1
SACK
average throughput of link1 = 0.17569066666666683 Mbps
average throughput of link2 = 0.67067520000000036 Mbps
throughput ratio link1/link2 = 0.26196088161104919
running nam...
[main-10-230-41-4:Project Yinan$ ns ns2.tcl SACK 2
TCP Flavor = SACK
Case = 2
SACK
average throughput of link1 = 0.36535893333333302 Mbps
average throughput of link2 = 0.50103040000000021 Mbps
throughput ratio link1/link2 = 0.72921510018819791
running nam...
[main-10-230-41-4:Project Yinan$ ns ns2.tcl SACK 3
TCP Flavor = SACK
Case = 3
SACK
average throughput of link1 = 0.12854400000000027 Mbps
average throughput of link2 = 0.87146453333333607 Mbps
throughput ratio link1/link2 = 0.14750342106100611
running nam...
-
```

Case	RTT Ratio	Throughput 1	Throughput 2	Throughput Ratio
1	1:2	0.17569	0.67068	0.26196
2	1:3	0.36536	0.50103	0.72922
3	1:4	0.12854	0.87146	0.14750

Analysis

For VEGAS, as the RTT increases, the throughput decreases. However, for SACK, for higher RTT, the throughput is also higher. The cause is that the ACKs back to the source have to wait in the queue of the link in the middle and in the same time the source depletes the sending window.

For Case 1, considering the total throughput of each TCP flavors, VEGAS is $0.58333 + 0.41667 = 1$ Mbps, SACK is $0.17569 + 0.67068 = 0.84637$ Mbps. Therefore, VEGAS performs better than SACK. Because VEGAS can adjust to transmission loads, thus it can fully utilize the connection bandwidth. However, SACK focuses mainly on packet loss instead of fully utilizing the connection bandwidth, therefore, throughputs in SACK do not reach the limit of the connection bandwidth.