SUTD 2021 50.012 Networks Project Individual Report

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Main Contributions

For our project, our entire group separated into 3 sub-groups. I was in the same sub-group as Zhang Peiyuan for this project. We were responsible for the Misbehaving TCP Receiver portion of this project. I focused on investigating and implementing the 3 different types of attack: ACK Division, DupACK Spoofing, and Optimistic ACKing.

My main contributions were:

- Understood the 3 different types of TCP ACK abuse. This was done via reading through the original research paper that we referenced from.
- Implemented the 3 different types of attacks in code using Python, Scapy, and Mininet. Custom TCP protocols are relatively tricky to implement since debugging them can be quite time-consuming and tedious. Bugs can be quite subtle since it is within a distributed network environment. Certain quirky behaviors of Mininet and Scapy also needed to be considered. I also took inspiration from several online resources to successfully implement the scripts. I managed to implement the custom TCP protocols in Python 2, since I encountered some kind of weird behavior with Scapy in Python 3. All the custom TCP receivers were implemented by extending the TCP Reno congestion control algorithm.
- Extended the custom protocol scripts and bootstrapped them with specific interfaces so as to allow multiple experiments with multiple topologies. I developed the data processing and plotting scripts for the various different hosts. I also developed the scripts to convert the sequence numbers to obtain the instantaneous throughput graphs. For

the throughput against parameter value graphs, I utilized the average throughout through the entire duration of the data transfer.

- Implemented the defense mechanisms against the 3 different types of ACK abuse attacks. The defenses were implemented by further extending the server TCP Reno code and modifying it as necessary.

Activity Time Breakdown

Duration	Activity
18.5 hours	Group Meetings: - Ideation - Literature Review - Presentation Work - Meeting with TA - Share Experimental Setup & Results - Final Result Analysis - Finalize Report
4 hours	Understanding the original research paper.
20 hours	Implemented the custom TCP abusive receiver protocols.
10 hours	Implemented the custom Mininet topologies and plotting scripts.
7.5 hours	Implemented and tested the defense scripts.

Peer Review Feedback

Teammate Name	Rating (out of 5)	Comments/Remarks
Huang He	5	Really did a lot of work with aggressively sending packets, especially with the mixed protocols and tree topology.
Han Xing Yi	5	Very helpful in analysis of results and running very large-scale experiments of parallel TCP connections throughout the nights.
Qiao Yingjie	5	Was very proactive in doing the star topology portion of aggressively sending packets.
Zhang Peiyuan	5	Very helpful as he assisted me with implementing the custom TCP abusive receiver protocols.
Velusamy Sathiakumar Ragul Balaji	5	Great work in opening multiple parallel TCP connections and good project management.