WIRELESS NETWORKS

FINAL PROJECT REPORT

Submitted By-

ROLL NUMBER	NAME
MT17033 MT17042 MT17062	Ojasvi Aggarwal Prerna Kalla Urvashi Choudhary

1. Name of the team members and individual contributions of the team members. Also, provide a 2-3 sentence description of the specific work done by each member of the team.

Ojasvi Aggarwal -In pcap trace analysis, identifying the server ip, identifying the client, number of transactions, per client aggregate throughput and graphs was identified.

Prerna Kalla -In pcap trace analysis, identifying the the download time of all clients, fastest and the slowest clients , uplink and downlink traffic generated were identified.

Urvashi Choudhary -In pcap trace analysis, identifying the the average download throughput of all the clients , loss rates of all the clients were identified and throughput analysis was done.

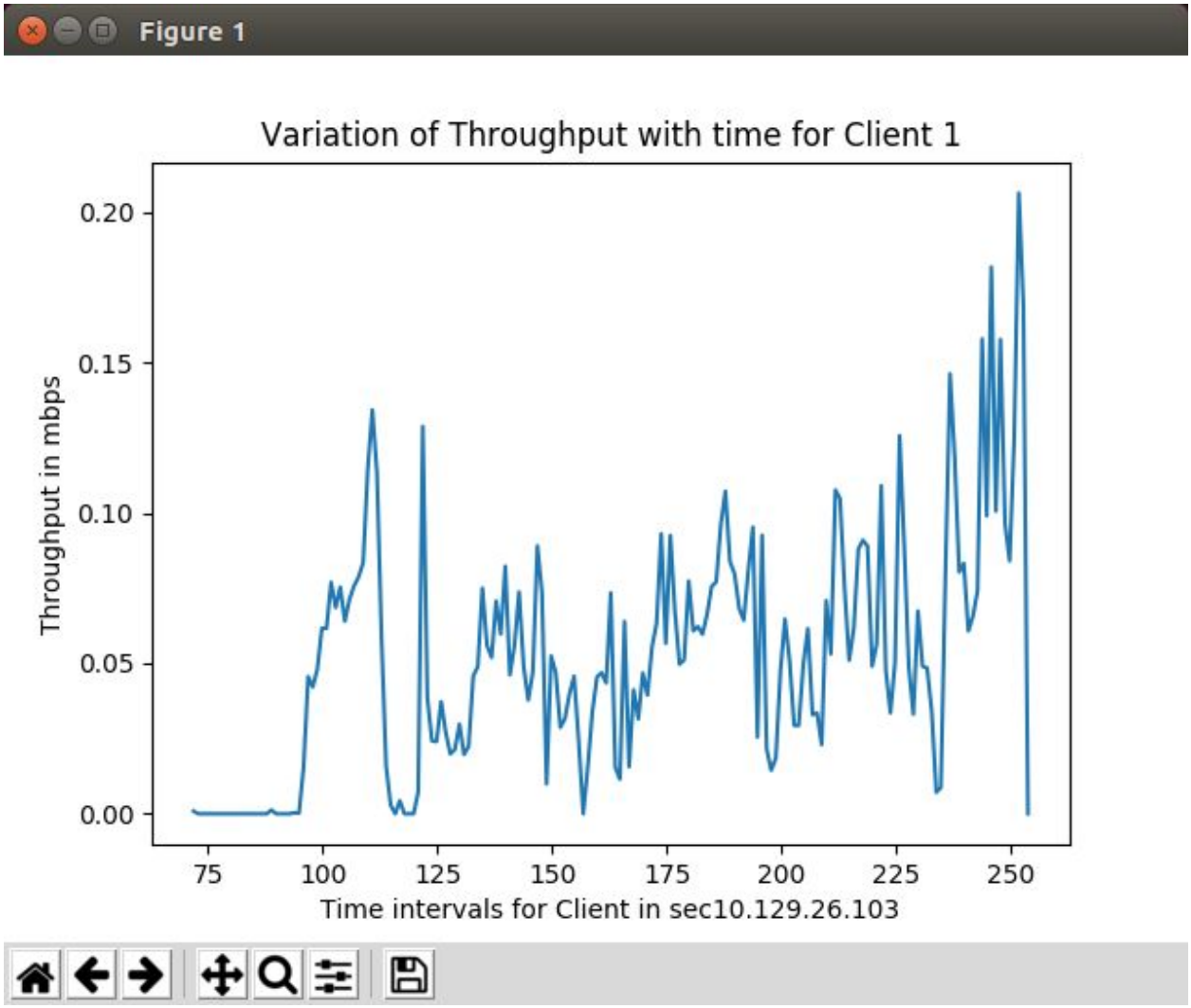
In the trace generation or simulation part, we needed to generate the program as a team. So, we couldn't bifurcate whether one should add mobility and other should deal with bulk sender. Hence, it was a joint team effort to reach the point where we all were satisfied by the simulation so generated.

2. A short description of the trace analysis, mentioning any interesting points you found.

Trace analysis- The initial step was conversion to a csv file and then applying logics to identify various thresholds from it like throughput of clients, uplink and downlink traffic, download time for clients etc.

Some interesting points extracted from the analysis are as follows:

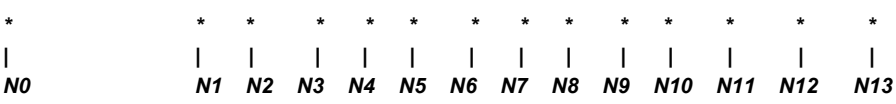
- Ideally, the per client average throughput in a system of 12 clients should be around 2 mbps but in the analysis, we observed only up to 0.4 mbps.
- Download time for clients ranged between 140-190 seconds
- Average loss rate was around 3%
- Average downlink throughout seen was around 59 kbps
- The graphs for throughput showed that throughput does not remain constant for any client in the trace. It keeps going up and down which can be seen in the graph given below.



3. A description of your simulation scenario and setup for the baseline case.

The simulation scenario is as follows:

Network topology :



- A server is connected to 12 clients via an AP.

- **Channel Conditions:**
    - The link between the server and AP is 100Mbps.
    - The channel operates at 54Mbps.
    - FriisPropagationLossModel has been used for loss attribute of the channel.
    - ConstantSpeedPropagationDelayModel has been used for propagation delay.
- **Data Transmitted:s**
    - A 10Mb file is transmitted by the server via AP. bulkSendHelper has been used for this purpose
    - Along with the data packets, ack packets are also present on the channel because it is a TCP connection.

- **Throughput: 22 mbps , per client approx 1.8mbps**
    - 54 mbps channel bandwidth.
    - Approx 24 mbps is used for data and it gets divided into 12 clients.
    - Therefore throughput should be roughly 2 mbps and this is inline with what we have achieved.

- **Time Duration:**
    - Transferring a 10Mb file with 1.8 mbps speed takes 44 sec.
    - The values achieved by us are in the range 33-57 sec.

4. A list of changes you have done to the simulation to go from the baseline to matching the download time seen in the real experiment. Please describe in detail the traffic models you have used (i.e., what is the download and upload traffic at each client). Please be clear on the exact parameters used.

Real time scenario:

- Channel conditions: server to AP 100mbps, wireless channel operating at 54mbps, **rate adaptation** has been done at the side of AP
- Data transmitted: 10MB file is being downloaded, and there is an uplink traffic of 4MB as the clients are getting authenticated before downloading the file and while downloading they also deviate from the task, therefore extra traffic is present.

- Throughput: Aggregate throughput is 6 mbps and per client throughput is 0.4 mbps because of extra traffic and losses.

Changes made to achieve above scenario:

- SIFS and DIFS have been kept according to 802.11g standard.
- Cwin is set the cmin=0 and cmax=1023
- Rate adaptation has been done using minstrel.
- Uplink traffic has been generated with the help of onOffHelper. Around 0.3Mb data is generated in the uplink traffic per client.
- RTS and CTS added according to 802.11g standard

5. The final download time you have obtained in simulation. You may or may not match the final number of the trace. If you did match, please explain why the match happened. If you could not match the download time in the trace, please explain why you did not match. There is no one right answer here, but clearly justify whichever answer you choose to provide.

- The download time in the original 12 clients pcap trace was around 140 to 190 sec.

- In the ideal baseline download time ranged between 33-50.

- We were able to increase the download time by adding uplink traffic, adding rate adaptation and properly specifying sifs, difs, contention window, rts and cts.

- The values do not exactly match with the ones in the pcap trace. Reasons for it as are as follows:
    - We have added noise models but varying the parameters have not shown a lot of difference, so from this we inferred that the noise model was not able to completely simulate the loss in real time.
    - Moreover, in the pcap trace along with the 12 clients there are ip address are also present who are using the wifi which can lead to congestion and extra delay, since our network simulation has only 12 clients we are not experiencing that amount of delay and loss..

6. If you have looked at, analyzed, and tried to match (between simulation and traces) any other parameters (e.g., TCP retransmission rates, time-sequence graphs, RTT, cwnd) please mention these in the report as well. If you have

instrumented your simulator to print out any interesting statistics (e.g., link layer collision rates), please mention them. Different teams will have different answers here, depending on how deep you have looked into the traces.

7. Optionally, once you describe the simulation for the case of 12 clients, re-run your simulation with varying number of clients (say, between 5 and 50), and observe how the average download time changes. That is, provide a graph of number of clients on x-axis vs. average download time on y-axis, while keeping the traffic model and everything else similar to the 12-client case that you analyzed. This graph should help you answer questions such as: what is the maximum number of WiFi clients per AP such that the download of a 10 MB file completes in under 5 minutes?