Department of Computer Science, Electrical and Space Engineering

Luleå University of Technology

D7030E Advanced wireless networks

LAB 4 Measuring performance of an Ad Hoc network

The objective of this assignment is to get familiar with selected behavior of Ad hoc WiFi networks. You will be conducting an experimental study of how the various packet size and number of stations affect wireless radio transmission and the application-level performance. You will work with both TCP and UDP types of traffic.

Scenario 1 – The effect of signal attenuation on communication ranges in WiFi networks

In this exercise you will explore multi-hop transmission in Ad Hoc network for different number of hops (Figure1). The IEEE 802.11 ad hoc mode (also known as independent basic service set, IBSS) should be used. During all experiments node(0) is a transmitter, the last node is a receiver. You have to measure the average throughput over time.

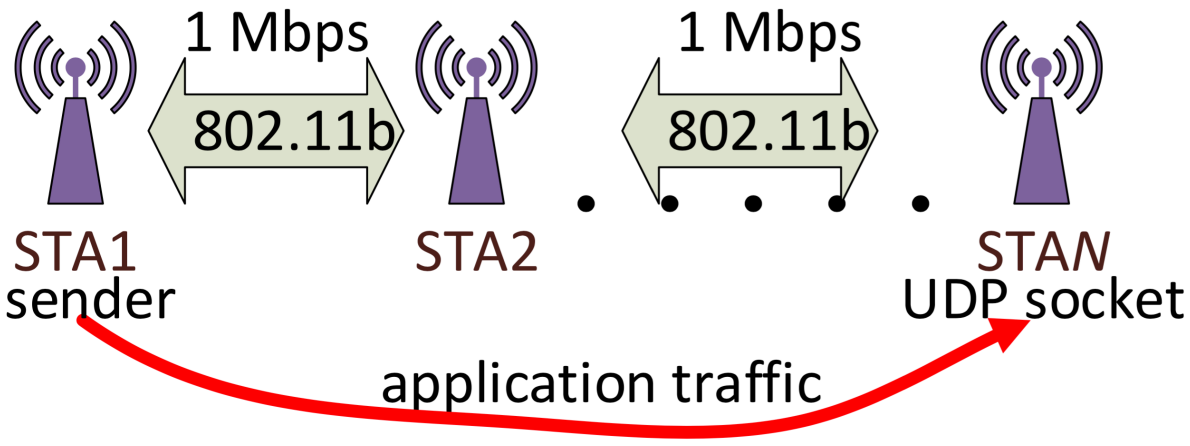

Figure 1. Topology for Scenario

Tasks:

1. Based on your experience from previous Labs fill in missed parts for Ad hoc scenario. Use the following settings.
    - Physical mode is "DsssRate1Mbps"
    - Use "ns3::ConstantRateWifiManager" for keeping bit rate constant
    - The MAC settings should be set to agree with the IEEE 802.11b specification.
    - Use Two-Ray Ground propagation model
    - Place nodes in a line in such a way that only adjacent stations can hear each other. Keep 200m distance between nodes
    - Always open socket on the last station
    - Always install onOff application on the first station
    - Enable routing between stations
2. Simulate scenario for different number of stations [3, 4, 5,6].
3. Also vary the UDP payload in the range {300B, 700B, 1200B}.
4. For EACH number of stations from the range run experiment with EVERY packet size. Calculate an application level throughput in bits per second.
5. Plot graphs showing the dependency of the throughput versus packet size for each number of stations.
6. Plot a graph showing the dependency of the throughput versus number of stations for packet size 1200B.
7. Compare nominative bitrate of physical layer and real throughputs on application layer. Be able to explain dependencies on your plots.
8. Reflect (speculate) on how one can theoretically predict the best packet size in order to minimize transmission time for 1GB of data in Ad Hoc multi-hop scenario.
9. Change type of traffic to TCP, i.e. uncomment corresponding part of code for the TCP socket and delete the UDP socket. Simulate scenario for 3 stations and two different lengths of packets 300B and 1200B. Calculate application level throughput for stations 3. Compare results with corresponding values for UDP traffic. Draw your conclusions.

NOTE1: Data rate of the application is intentionally much higher than the bit rate of phy layer. It will guarantee maximum throughput for the scenarios.
NOTE2: In Wireshark you can use ip.src==[first station IP] in filtering window and then Statistics -> Summary in order to see number of packets and time.
NOTE3: In order to change TCP segment size, use the following code:
int tcpSegmentSize = 1000;
Config::SetDefault ("ns3::TcpSocket::SegmentSize", UintegerValue (tcpSegmentSize));
in the upper part of your script.

The report

To pass this lab you need to submit a single (***concise*!**) report for **both** scenarios. The report must be well structured and well written. Remember: submit only ONE pdf file. All other forms of reports will be discarded.

Congrats, you have just accomplished the Ad Hoc lab!