SIMULATION EXERCISE 2: Exploring the Performance of 802.11ac

This exercise is designed to explore the influence of protocols on wireless network packet throughput, in particular at the MAC layer. The exercise is marked out of 100 marks, with marks for each part of the assignment as indicated below. The assignment contributes 17.5% of the overall EE452 module mark. Your report will be turned in via the link provide in Loop. This is an individual assignment. The university plagiarism policy applies in full.

Introduction

The advertised data rates for WiFi usually refers to the radio data rate of the packets. The actual throughput offered to the higher layers by IEEE802.11 will be significantly different.

Assignment

The goal of this assignment is for you to familiarise yourself with the MAC level operation of the 802.11ac Distributed Coordinator Function (DCF) and using NS-3 simulations to explore the impact of the number of communication nodes on the maximum throughput obtainable for TCP and UDP connections. You will be asked to explain why this difference exits for both cases (using trace files or timing diagrams to back up your explanations).

Part 1: Analysis of TCP and UDP:

Step 1: Analyse throughput for UDP as in assignment 1.

Step 2: Analyse the throughput for TCP.

Answer the following questions:

1) What is/are the advertised data rate/s for 802.11ac and what factors within the protocol influence these? **[10 marks]**
2) What throughput was obtained for the above scenario for UDP and TCP? **[10 marks]**
3) Explain in detail what factors could contribute to the throughput for the UDP connection not being equal to the advertised data rate? **[10 marks]**
4) Explain in detail why the throughput for the TCP connection is not equal to the advertised data rate? **[10 marks]**
5) Using a trace from the simulation develop a precise timing diagram to illustrate the transmission of a single 1024 byte UDP packet using the IEEE 802.11ac DCF with collision avoidance enable. **[15 marks]**

Part 2: Impact of load on performance

For both the TCP and UDP scenarios, modify the provided code to allow for more than one node using the access point. You will need to try different numbers of nodes to see different results.

For your results (for TCP and UDP) answer the following questions:

1) Measure the throughput. You should measure for different nodes, as it is possible not all nodes will experience the same throughput. Plot the throughput for different numbers of nodes. **[15 marks]**
2) Compare your results both in terms of the impact of number of nodes on the throughput and the comparison of TCP and UDP throughput. **[20 marks]**

Turn in:

Lab report detailing Steps 1-4. Answers to the questions above. Please use proper reporting including introduction, conclusion, and explanations of your work. **[10 marks]**