CS169 Project: Network coding in 802.11 wireless network

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INTRODUCTION

Network Coding (NC) is a technique that can achieve the multicast capacity of the networks. Unlike in traditional networks where packets are simply routed (store-and-forward paradigm), with NC, a router does not forward received packets directly to the next hop. Instead, it encodes the received packets from multiple prior hops and then, broadcasts the encoded packet (the result) to the destinations (next hops). The encoding process in the simplest form is essentially an XOR operation. Consider the following topology, where Alice (A) and Bob (B) are two senders and Calvin (C) and David (D) are the destinations respectively. With store and forward, since there is no direct link between Alice and Calvin, an intermediate node Emma (E) has to relay packets received from Alice the sender, to Calvin the destination. The same applies for packets sent by Bob, destined for David, as illustrated in the Figure below.

In the store and forward case, Alice and Bob require, at least, one transmission each to deliver a packet to Emma. Then, Emma has to perform at least two transmissions to deliver Alice’s and Bob’s packets to Calvin and David, respectively. Hence, if there are no retransmissions, the total number of transmissions to convey the two packets from Alice and Bob to Calvin and David, is 4. In the network coding case, If David is capable of overhearing Alice (i.e.
is in range of Alice’s broadcast and can overhear packets transmitted by her) and Calvin is capable of overhearing Bob, then Emma could XOR the received packets and broadcast the result to the destination nodes. Thereafter, Calvin or David simply XOR the overheard packet with his coded packet received to extract the original packet transmitted by the sender (and designated to him). Hence, if there are no retransmissions, the total number of transmissions to convey two packets is 3.

**REQUIREMENT**

- **Part 1:** In ns3, build the described store-and-forward topology using 802.11 (Yans-Wifi) wireless module.

- **Part 2:** Implement the XOR network coding scheme at Node E with the previous topology.

- After implementing these two schemes, you need to create your own test case (packets number, interval and start/finish time, etc) and calculate the throughput (the number of packets delivered end to end per unit time) with each scheme. Describe your test cases in your report. Compare and analyze the throughputs with store and forward versus network coding.

- **Hint:** you need implement two buffers at Node Emma in order to store packets from A and B.
SUBMISSION RULES

• You are to write and submit the code on your own.

• Deadline for submission is 13th March (12 midnight).

• The submission email should contain the code, a readme file for describing how to run your test case, a report that is at least two pages and at most (maximum) five pages.

• Code should be commented and is accompanied by at least one complete test example that shows how it works.

• Report should includes the description of your topology, the two schemes used and your analysis of throughput.

• Please don't forget to use the following subject "CS169: FINAL PROJECT"