CS M117

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Lab 3: Data Transmission over Bluetooth

Feb 14, 2013

**Abstract**

In this lab, we had four goals:

1. Check the effect of distance and Bit Error Rate on data transmission
2. Effect of one-to-many connection on Bluetooth data transmission
3. Interference among Bluetooth devices
4. Interference and fairness between Bluetooth and IEEE 802.11 devices

The goal of this report is to determine if there was a noticeable effect of the Bluetooth transmission, especially compared to the previous lab of the 802.11 devices.

**Results**

For part A, our goal was to check Bluetooth data throughput with respect to the distance between two devices. We did 3 different distances with 3 different packet types (DH1, DH3, DH5).

At 10 feet, our data rate throughputs were 60.24 kB/s, 195.65 kB/s, 263.69 kB/s for DH1, DH3, and DH5 packets, respectively.

At 15 feet, our data rate throughputs were 58.05 kB/s, 197.52 kB/s, 260.42 kB/s, for DH1, DH3, and DH5 packets, respectively.

At 30 feet, our data rate throughputs were 42.34 kB/s, 111.51 kB/s, 130.54 kB/s, for DH1, DH3, and DH5 packets, respectively.

From those numbers, we can see the data rates seem to drop as the distance increases, which is what we expected. There was a hiccup from 10 to 15 feet for DH3, but that weird number could be due to some interference we had with other items in the class, such as our phones.

The throughput doesn’t drop linearly with the distance, and this could be because of other interference in the class as we were further apart. (ie cellphones). With the DH5 packets, we were able to get a higher throughput at 30 feet than DH1 at 10 feet. It seems like the DH5 packet was able to send more data quicker than the rest.

For part B, our goal was to check Bluetooth data throughput with respect to the number of slaves. We did this experiment at a distance of 10ft (all slaves were about 10ft from the master).

With one slave, we had throughputs of 60.24 kB/s, 195.65 kB/s, 263.69 kB/s for DH1, DH3, and DH5 packets, respectively.

With 2 slaves, we had throughputs of 26.47 kB/s, 130.96 kB/s, 130.36 kB/s for DH1, DH3, and DH5 packets, respectively.

With 3 slaves, we had throughputs of 12.22 kB/s, 48.82 kB/s, 65.52 kB/s for DH1, DH3, and DH5 packets, respectively.

For the most part, with more slaves, we had a lower throughput per device. One observation we noticed was when there 2 slaves for DH5 packets. We noticed that it fluctuated a lot between 48 kB/s and 229 kB/s, and this may be caused from interference within the room.

The sum of the throughputs does not equal the numbers we got from Part A. This is probably because it takes more time to connect to multiple devices and send data to different connections, as opposed to throwing all the resources in one line.

For part C, we checked the fairness among Bluetooth transmissions by connecting 3 pairs that cross each other. We used DH5 packets for this section.

In this case, we got the following throughputs: 262.13 kB/s, 174.75 kB/s, and 195.20 kB/s.

From this, we can see that one of the pairs did not seem to exhibit much interference. I don’t know why it didn’t have interference, but it may have just been a little lucky.

On the other hand, the other two seemed to drop about 100kB/s throughput.

For part D, we checked the fairness between Bluetooth transmission and 802.11b TCP transmission.

For this, we recorded the Bluetooth throughput to be 174.45 kB/s, and the wi-fi throughput to be 733Mb/s ~ 91.625 MB/s. We can see that even the 802.11b connection can affect the Bluetooth connection that we had (it was lower about 100 kB/s than we had originally expected.)

**Discussion**

The Bluetooth throughput was not as quick as 802.11, but that is understandable. Wi-fi is supposed to be faster than Bluetooth for data transmission. We had a few interesting numbers in our experiment, such as the fluctuation in part B, and the no interference connection in part C.

**Conclusion**

Overall, the experiment went very well but with a few hiccups. Data transmission was generally about 260 kB/s with no interference (for DH5 packets), and it gradually decreased with more interference or further distance.

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| **#** | **Main goals** | **Results with error** |
| **1** | Check the effect of distance and Bit Error Rate on data transmission | From this experiment, we were able to notice that with greater distance, the data transmission rate decreased. |
| **2** | Effect of one-to-many connection on Bluetooth data transmission | With more connections, the data transmission decreased, because there was overhead sending to multiple devices. |
| **3** | Interference among Bluetooth devices | With more Bluetooth connections interwoven, the data transmission rate decreased, because there was more interference. |
| **4** | Interference and fairness between Bluetooth and IEEE 802.11 devices | The 802.11b transmission did affect the Bluetooth transmission rates. |