



Wireless LAB: 802.11b And Data Transmission Over Bluetooth

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ABSTRACT/GOALS

- ❑ Our main goal for this lab 1 was to investigate data transmission over 802.11b Wireless LAN using different transport protocols and in the presence of noise sources. We gained the knowledge of various factors affecting data throughput in a wireless channel and the effect of sporadic losses on TCP throughput. To accomplish this we measure the UDP and TCP data throughput using Iperf measurement tool at different locations in Boelter Hall.
- ❑ For the 2nd lab, In contrast to Lab 1 our main goal was to gain the basic knowledge of effect of distance and Bit Error Rate (BER) on data transmission. We got to know the effect of one-to-many connection on Bluetooth data transmission. We also get to experiment the Interference among Bluetooth devices. Interference and fairness between Bluetooth and IEEE 802.11 devices. For this purpose we measure the data throughput using 12test utility on one-to-one connection at different distances and for different packet types. We also measure the data throughput on one-to-three and one-to-five connections. In addition we perform the measurement of TCP data throughput using Iperf measurement tool in three crossed one-to-one connections. The measurement of TCP data throughput in one-to-one connection crossed by IEEE 802.11 data transfer.

THEORY – BACKGROUND OF WIFI

- ❑ The wireless LAN setup utilize the Infrastructure-mode of the 802.11b Wireless LAN adapters in the laptops in conjunction with a Linksys access point(as opposed to the Ad-hoc-mode where an access point is not needed).
- ❑ Using of DHCP (Dynamic Host Configuration Protocol) server provided by the access point, and the IP address will be dynamically allocated as done in home or public access wireless networks.
- ❑ The IEEE 802.11 wireless uses the two main Media Access Control. One is a base station like modem and other is Ad Hoc networking. If the is base station presence, then the first preference will go to wired network connection with the base station otherwise connect with the Ad Hoc networking.
- ❑ When there is a busy channel the transmission will be slow because of the protocol like Carrier Sense Multiple Access/Collision Avoidance
- ❑ Packages are sending in a small fragments over the networks and hence a checksum uses to track those fragments
- ❑ We use Datagram protocol and Transmission protocol with the Transport layer
- ❑ TCP protocol is considered reliable for the data transmission because of congestion control and collision avoidance.
- ❑ Unlike TCP protocol, UDP protocol results potential datagram overlap or loosing and thus is less reliable. However, it gets faster than TCP protocol

THEORY – BACKGROUND OF BLUETOOTH

- ❑ Bluetooth is considered as a secure short-range wireless network with the 1Mb/s symbol rate and range of 10+ meters
- ❑ Bluetooth profile can have Generic Access, Service Discovery, Cordless telephone, Intercom, Serial Port, Headset and Dial-up Networking and so on
- ❑ Bluetooth protocol stack has Application layer, Middleware layer, Data link layer and Physical layer
- ❑ For the physical link layer is Point-to-point link (Master slave relationship) with piconet. Each piconet has max capacity of 1Mbps and has fast frequency hopping of 1600 hops/sec
- ❑ All devices in a Piconet hop together. To form Piconet: master gives slaves its clock and device ID; Hopping pattern (48-bit); determined by device ID; Hopping pattern determined by Clock. A Piconet is centralized TDD system, with master controlling the clock and determined which device gets to communicate in which time slot
- ❑ For the medium Access Control, Bluetooth with 79 channels can support 79 Mb/s. When a Piconet is established, the slaves add offsets to their native clocks to synchronize to the master and each unit can become a master or slave.
- ❑ The access is completely contention free and the master implements centralized control
- ❑ Bluetooth's main goal is to Impact of distance and Bit Error Rate(BER) on throughput, Effect of one-to-many connection on throughput, Interference among Bluetooth devices, and Interference and fairness between Bluetooth and IEEE 802.11 devices.

LAB 1 RESULTS

- ❑ During this lab, we measured the observe the difference between the throughput of TCP and UDP vs signal strength using the central server laptop.
- ❑ From the Fig 1, it can be seen that increasing the distance will decrease the Signal Strength. It make sense that as distance Increases the strength of the signal should be lowered as we assumed. So, It confirm the reason behind why we start loosing data as distance increases since data transmission gets lost more easily.
- ❑ From the fig 2, it can also be seen that increasing the distance will decrease the Signal to Noise Ratio. It implies that with increases the distance the noise level also increases.

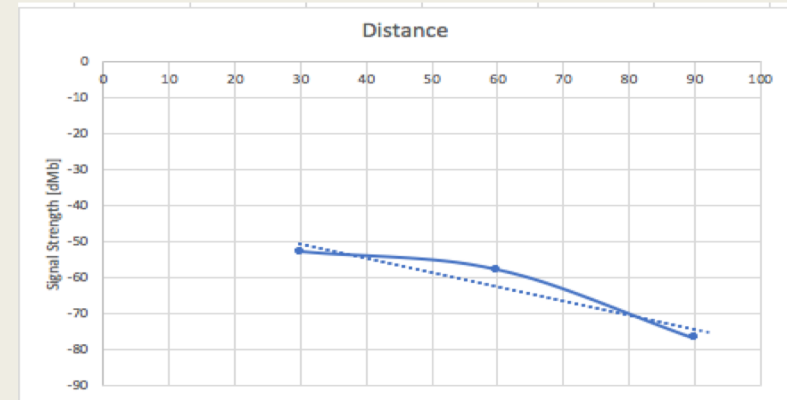


Fig: 1

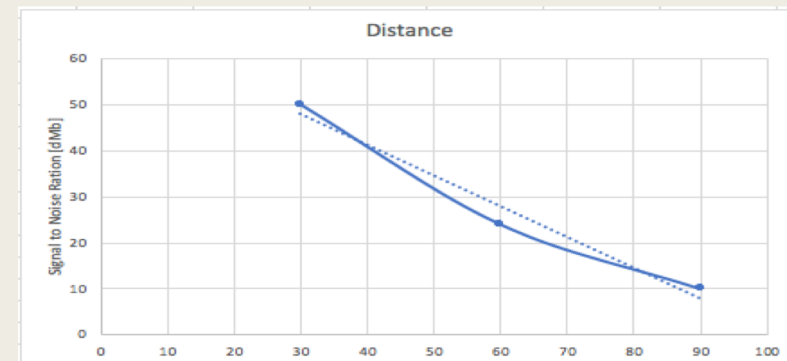


Fig: 2

LAB 1 RESULTS

- ❑ Both in fig 1 and fig 2 UDP and TCP Throughput increases with increases Signal to Noise Ratio.
- ❑ It means that the stronger it is, the faster data will be transferred using both protocols.
- ❑ In other words, it concludes that if we want to increase the rate of transmission, we also should care about the Signal to Noise Ratio. For better results we should increase the Signal to Noise Ratio.
- ❑ Since the data communication link has a linear relation with TCP and UDP protocols, data communication can be improved with this ratio.

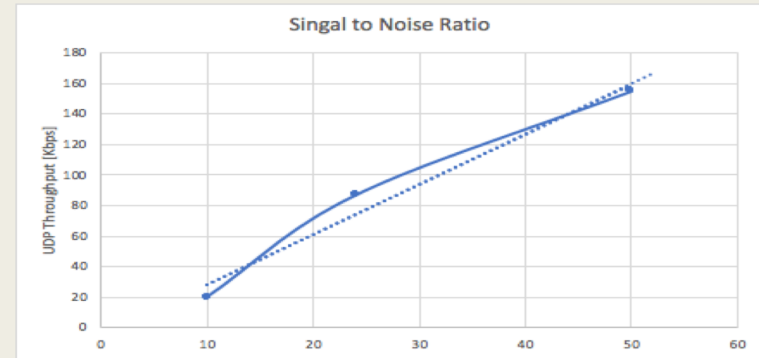


Fig: 1

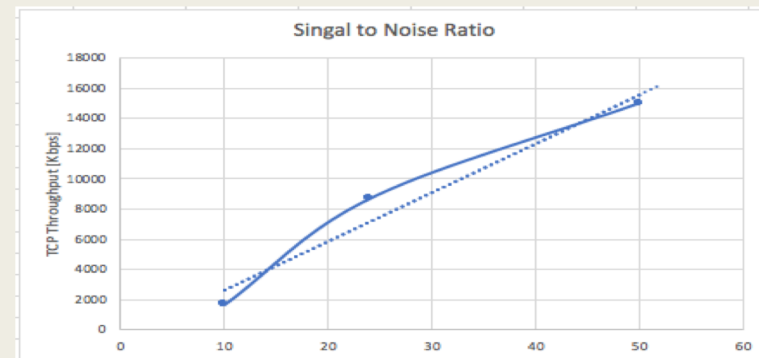
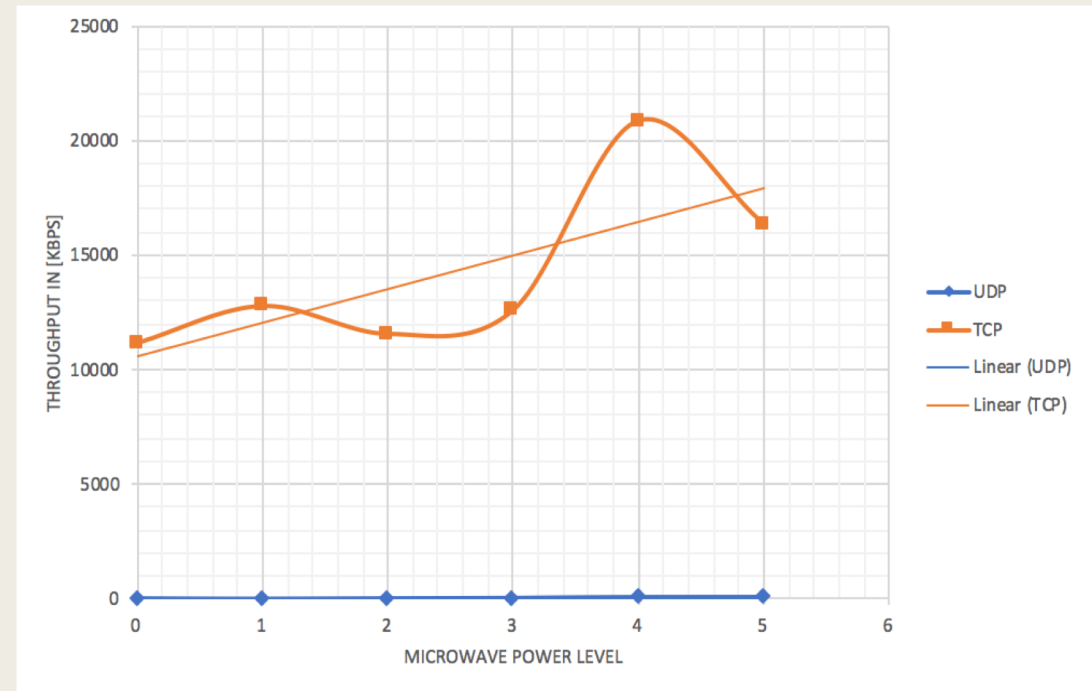


Fig: 2

LAB 1 RESULTS

- ❑ With the microwave power level (off, warm, deforest, medium, medium high, and high) TCP at the very first seems increasing in its rate but in the middle it decreases and then increases again. But the linear line shows that as microwave power goes from lower to higher TCP and UDP throughput increases.
- ❑ The reason could be because of the frequency of the microwave that is around 2.4GHz range, which is same as the frequency that modern computer uses for data communication.



Microwave power level:
0=off; 1=Warm; 2=Deforest; 3=Medium; 4=Medium high; 5=High.

Fig: 1

LAB 2 RESULTS

- ❑ Like in Wifi we noticed, in the Bluetooth also, as distance increases The data throughput also decreases.
- ❑ However, interesting things from the graph is that that with the same distance, DH1 has higher throughput than DH3 and DH5. In other word, DH5 has lower throughput comparatively for the same distance.
- ❑ Compare to Wifi, Bluetooth data throughput is much lower than both TCP and UDP in WLAN protocols.
- ❑ Hence it can be concluded that Bluetooth is built for short range distance communication.

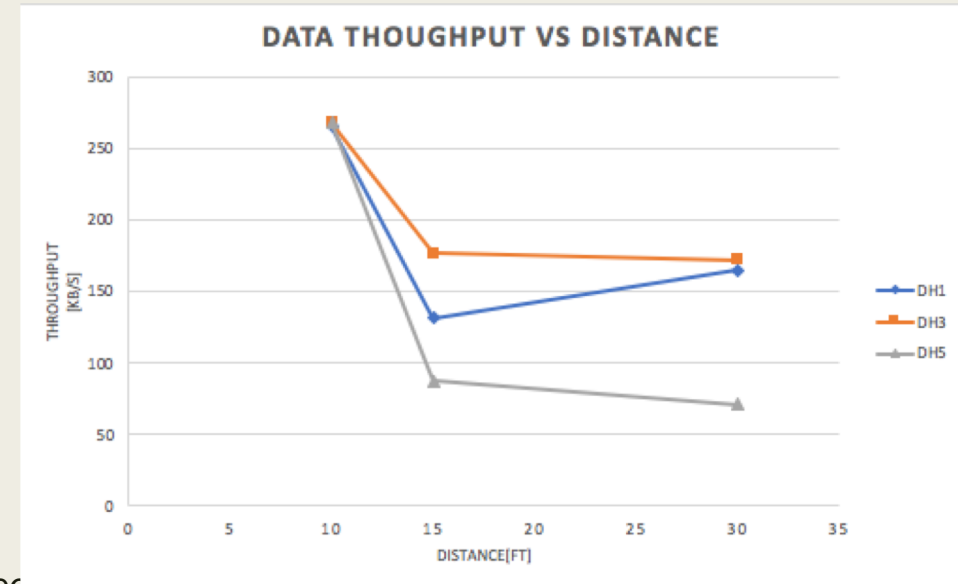


Fig: 1

LAB 2 RESULTS

- ❑ Like Wifi, in Bluetooth also as the distance from the master source increases the throughput decreases.
- ❑ Compare to previous graph, generally DH5 seems much faster Than DH1 and DH3 for the same Distance.
- ❑ Interesting fact about this graph is that WLAN TCP and UDP protocols Have higher throughput values than Bluetooth.
- ❑ Hence it can be concluded that Bluetooth is built for short range distance communication.



Fig: 1

DISCUSSION

- ❑ From experiment we have done in LAB1 and LAB2, it is found that both WIFI and Bluetooth has direct relationship with the distance over communication. As distances increases, the throughput decreases and vice-versa.
- ❑ It can also be concluded that WIFI has higher bandwidth around 9Mbps for TCP and 25Mbps for UDP than Bluetooth. While Bluetooth DH5 is fastest than DH1 and DH3.
- ❑ From the experiment, we have also concluded that WIFI is meant for higher bandwidth while Bluetooth is for short distance communication with slower data transfer.
- ❑ Bluetooth good when there is number of slaves up to max of 7 while WiFi is shared among the multiple computers.
- ❑ When doing LAB2, we had some errors and because of that we have seen increase and decrease of UDP and TCP throughput as distances increases.
- ❑ As expected Bluetooth has lot less bandwidth than WiFi.
- ❑ Because of the higher bandwidth wifi has, it transfer more data than Bluetooth does

CONCLUSION

- ❑ Both of the technology share the common ground is that both use of radio waves.
- ❑ From the experiment done in these two labs between WIFI and Bluetooth, it can be seen that both has benefits and downfalls when it comes to the data communication. Both methods has tradeoff when decide to use. From the experiment, comparatively Wifi has high bandwidth and transmission but at the same time it is expensive and susceptible to noise interference.
- ❑ Using TCP protocol considered more reliable and has less throughput within Wifi. But using UDP protocol fasten the speed of data transfer and is less reliable. In UDP protocol datagram gets overlap and get lost in transmission.
- ❑ Relatively Bluetooth on the other hand communicate on the same frequency but it has shorter range communication. Given the same conditions as Wifi, Bluetooth faces losses in the data throughput. However, Bluetooth is cheaper than WIFI.
- ❑ WIFI can be use for faster transfer as its bandwidth is High (11Mbps) vs WIFI (800Kbps)
- ❑ Latency for Bluetooth can be 200ms while with Wifi 150ms, hence Wifi is faster
- ❑ Wifi can act like Bluetooth and can connect two different device in short distance
- ❑ Wifi is generally more secure comparatively
- ❑ Wifi consume more power than Bluetooth
- ❑ Bluetooth supports low number of user while Wifi support high number of users
- ❑ GFSK modulation technologies is uses by Bluetooth but OFDM and QAM by Wifi
- ❑ Blueotth technology is scattered ad-hoc technology while Wifi provides asynchronous and time-bounded facility