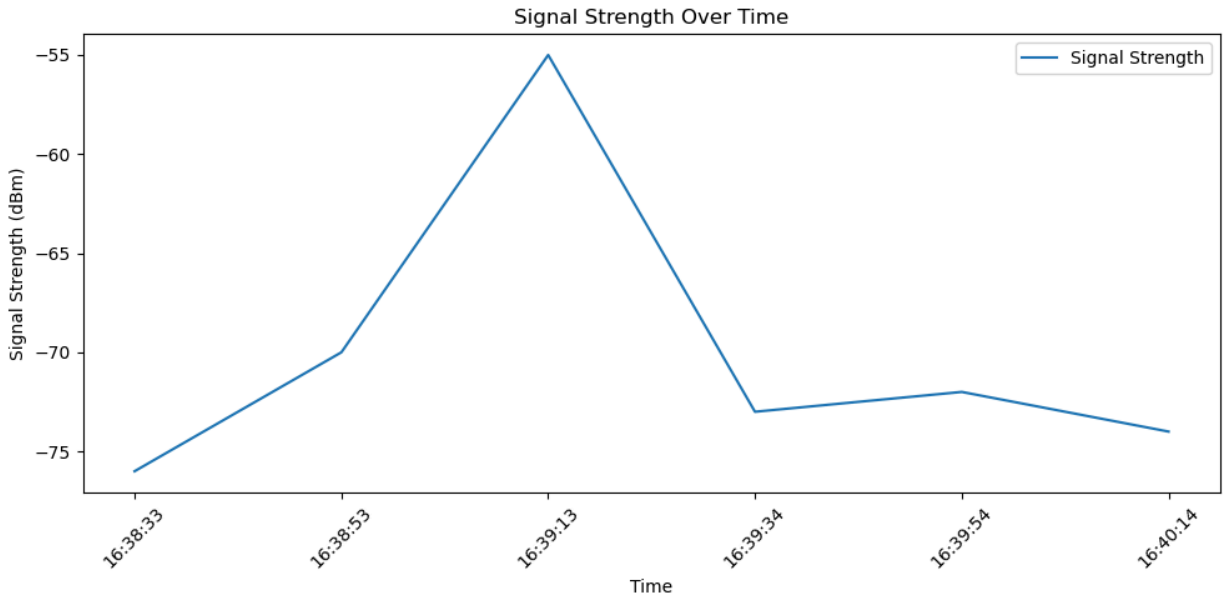
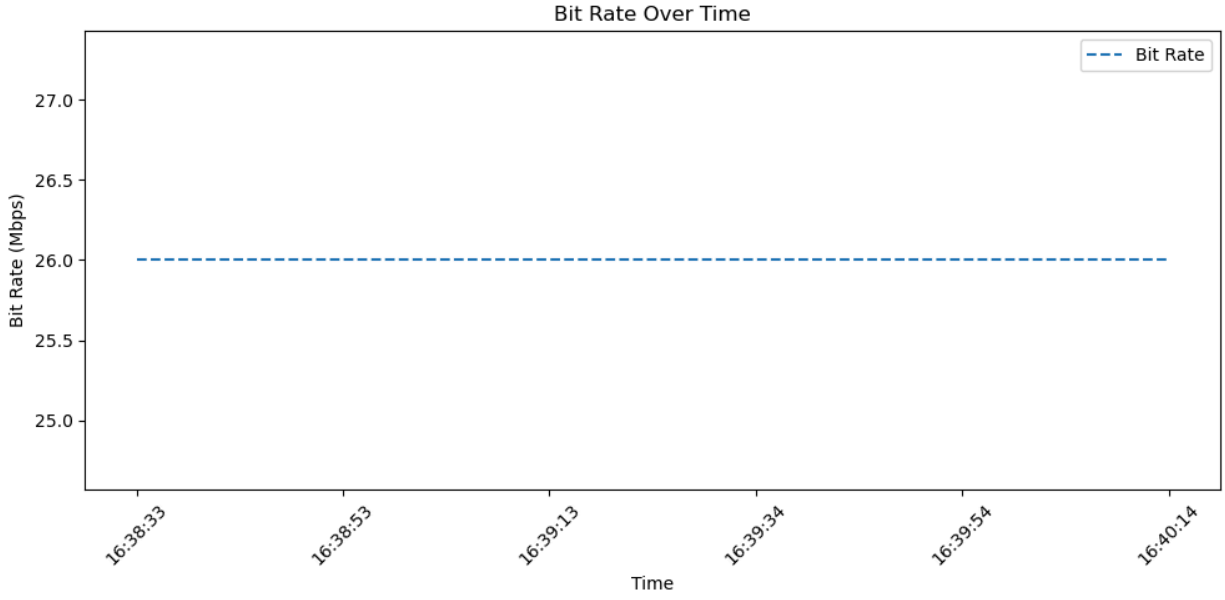
Q1

nikhil-suri@nikhil-suri-Lenovo-Legion-5-15IMH05:~/WN/A1/q1$ cat wireless_data.csv
Time,SSID,BSSID,Signal Level,Bit Rate,Transmission Power,Frequency Band
16:34:34,"Airtel_B,54:46:17:33:30:4C,-64,26,22.00,36 (5180
16:34:44,"Airtel_B,54:46:17:33:30:4C,-62,26,22.00,36 (5180
16:34:54,"Airtel_B,54:46:17:33:30:4C,-64,26,22.00,36 (5180
16:35:04,"Airtel_B,54:46:17:33:30:4C,-62,26,22.00,36 (5180
16:35:14,"Airtel_B,54:46:17:33:30:4C,-62,26,22.00,36 (5180
16:35:24,"Airtel_B,54:46:17:33:30:4C,-62,26,22.00,36 (5180
16:35:34,"Airtel_B,54:46:17:33:30:4C,-62,26,22.00,36 (5180
16:35:44,"Airtel_B,54:46:17:33:30:4C,-56,26,22.00,36 (5180
16:35:54,"Airtel_B,54:46:17:33:30:4C,-59,26,22.00,36 (5180
16:36:04,"Airtel_B,54:46:17:33:30:4C,-71,26,22.00,36 (5180
16:36:14,"Airtel_B,54:46:17:33:30:4C,-62,26,22.00,36 (5180
16:36:24,"Airtel_B,54:46:17:33:30:4C,-62,26,22.00,36 (5180

nikhil-suri@nikhil-suri-Lenovo-Legion-5-15IMH05:~/WN/A1/q1$ cat wireless_moving_data.csv
Time,SSID,BSSID,Signal Level,Bit Rate,Transmission Power,Frequency Band
16:38:33,"Airtel_B,54:46:17:33:30:4C,-63,26,22.00,36 (5180
16:38:43,"Airtel_B,54:46:17:33:30:4C,-76,26,22.00,36 (5180
16:38:53,"Airtel_B,54:46:17:33:30:4C,-74,26,22.00,36 (5180
16:39:03,"Airtel_B,54:46:17:33:30:4C,-70,26,22.00,36 (5180
16:39:13,"Airtel_B,54:46:17:33:30:4C,-62,26,22.00,36 (5180
16:39:23,"Airtel_B,54:46:17:33:30:4C,-55,26,22.00,36 (5180
16:39:34,"Airtel_B,54:46:17:33:30:4C,-51,26,22.00,36 (5180
16:39:44,"Airtel_B,54:46:17:33:30:4C,-73,26,22.00,36 (5180
16:39:54,"Airtel_B,54:46:17:33:30:4C,-72,26,22.00,36 (5180
16:40:04,"Airtel_B,54:46:17:33:30:4C,-72,26,22.00,36 (5180
16:40:14,"Airtel_B,54:46:17:33:30:4C,-72,26,22.00,36 (5180
16:40:24,"Airtel_B,54:46:17:33:30:4C,-74,26,22.00,36 (5180


Signal Strength Over Time
Signal Strength
Signal Strength (dBm)
−55
−60
−65
−70
−75
16:38:33
16:38:53
16:39:13
16:39:34
16:39:54
16:40:14
Time


Bit Rate Over Time
Bit Rate
Bit Rate (Mbps)
27.0
26.5
26.0
25.5
25.0
16:38:33
16:38:53
16:39:13
16:39:34
16:39:54
16:40:14
Time

Q2

a)

nikhil-suri@nikhil-suri-Lenovo-Legion-5-15IMH05:~/WN/A1/q2$ python3 a.py
SSIDs found in beacon frames:
Airtel_B 603
Akul_2.4G
B 603_EXT
Galaxy S20 FE 5G4332

b)

nikhil-suri@nikhil-suri-Lenovo-Legion-5-15IMH05:~/WN/A1/q2$ python3 b.py
Average Signal Strengths by BSSID:
aa:ba:69:94:d7:95: -43.32485156912638 dBm
b4:b0:24:6d:da:23: -77.77322404371584 dBm
54:46:17:33:30:4a: -75.53145336225596 dBm
84:90:0a:e0:44:c5: -83.6923076923077 dBm

c)

nikhil-suri@nikhil-suri-Lenovo-Legion-5-15IMH05:~/WN/A1/q2$ python3 c.py
Average Bitrates by BSSID

The following is essentially just the average of all possible Bitrates that are currently supported for the frames corresponding to a particular BSSID:

aa:ba:69:94:d7:95: 68.75 Mbps
b4:b0:24:6d:da:23: 49.0 Mbps
54:46:17:33:30:4a: 49.0 Mbps
84:90:0a:e0:44:c5: 50.875 Mbps

For the actual bitrates (in the form of data rates of the packets), we've the following:

Average data rates by BSSID:
aa:ba:69:94:d7:95: 1.0 Mbps
b4:b0:24:6d:da:23: 1.0 Mbps
54:46:17:33:30:4a: 1.0 Mbps

84:90:0a:e0:44:c5: 1.0 Mbps

d)

nikhil-suri@nikhil-suri-Lenovo-Legion-5-15IMH05:~/WN/A1/q2$ python3 d.py
Types of frames exchanged:
Type 0, Subtype 0: 365 times
Type 0, Subtype 1: 25 times
Type 2, Subtype 0: 66 times

e)

ACK Frame for (2, 8): RadioTap / 802.11 Control Ack 00:00:00:00:00:00 (TA) >
b4:b0:24:6d:da:23 (RA), Bitrate: 1.0 Mbps
ACK Frame for (2, 12): RadioTap / 802.11 Control Ack 00:00:00:00:00:00 (TA) >
bc:32:b2:8f:f9:75 (RA), Bitrate: 1.0 Mbps
ACK Frame for (2, 8): RadioTap / 802.11 Control Ack 00:00:00:00:00:00 (TA) >
aa:ba:69:94:d7:95 (RA), Bitrate: 1.0 Mbps
ACK Frame for (2, 8): RadioTap / 802.11 Control Ack 00:00:00:00:00:00 (TA) > bc:32:b2:8f:f9:75
(RA), Bitrate: 1.0 Mbps
ACK Frame for (2, 12): RadioTap / 802.11 Control Ack 00:00:00:00:00:00 (TA) >
b6:b0:24:0d:da:23 (RA), Bitrate: 1.0 Mbps
ACK Frame for (2, 12): RadioTap / 802.11 Control Ack 00:00:00:00:00:00 (TA) >
a8:ba:69:94:97:95 (RA), Bitrate: 1.0 Mbps
ACK Frame for (2, 12): RadioTap / 802.11 Control Ack 00:00:00:00:00:00 (TA) >
bc:32:b2:8f:f9:75 (RA), Bitrate: 1.0 Mbps
ACK Frame for (0, 8): RadioTap / 802.11 Control Ack 00:00:00:00:00:00 (TA) >
54:46:17:33:30:4a (RA), Bitrate: 5.5 Mbps
Acknowledged frame types:
Type (2, 12): 179 times
Type (1, 9): 4 times
Type (2, 8): 90 times
Type (0, 8): 19 times
Type (1, 12): 1 times
Type (0, 5): 1 times
Average Bitrate of ACK frames: 2.20578231292517 Mbps

f)

nikhil-suri@nikhil-suri-Lenovo-Legion-5-15IMH05:~/WN/A1/q2$ python3 f.py
Total packets in file: 6695

Filtered packets involving D1 and D2: 456
Average Signal Strength: -37.25657894736842 dBm
Average Bitrate: 14.871698113207547 Mbps

g)

nikhil-suri@nikhil-suri-Lenovo-Legion-5-15IMH05:~/WN/A1/q2$ python3 f.py
Total packets in file: 7936

Filtered packets involving D1 and D2: 382
Average Signal Strength: -46.18062827225131 dBm
Average Bitrate: 19.73821989528796 Mbps

Key Observations:

Signal Strength: The average signal strength reduced from -37 dBm to -46 dBm. Since dBm values are negative, a less negative value means stronger signal strength. This is expected since D3 was further away from the device D2 this time, since we were supposed to move D2 closer to D1. As a result, the signal strength of the packets received via wireshark at D3 reduced.

Bitrate: The average bitrate increased from 14 Mbps to 19 Mbps. A stronger signal usually results in higher bitrates because the wireless network can support higher data rates with less interference. In this case, we had moved D2 very close to D1 and as a result, bitrate increased slightly due to less distance between the devices, and correspondingly, less interference by objects in the surroundings.

Explanation:

This aligns with the theory that reduced distance enables higher throughput.

We observed a clear improvement in bitrate, confirming that proximity between the client and the access point positively impacts wireless performance.