Course Name:	MCAN Laboratory	Semester:	VI
Date of Performance:	26 / 01 / 2025	Batch No.:	B - 2
Faculty Name:	Dr. Rajashree Daryapurkar	Roll No.:	16014022050
Faculty Sign & Date:		Grade/Marks:	___ / 25

Experiment No.: 3
Title: Experiment on 802.11 WLAN

Aim and Objective of the Experiment:

Observe and understand the effect of changing bandwidth in WLAN Wi-Fi using using the IEEE 802.11 standard.

COs to be achieved:

CO2: Compare different types of wireless networks used in MANET.

Tools required:

NetSim software

Theory:

The **transmission power and distance** significantly impact the **throughput** of a communication system. Increasing transmission power strengthens the signal, improving the **signal-to-noise ratio (SNR)** and reducing errors, which leads to higher throughput. However, excessive power can cause **interference** in neighboring cells, affecting overall network performance. On the other hand, reducing power minimizes interference but may weaken the signal, increasing bit errors and retransmissions, ultimately lowering throughput.

Similarly, distance plays a crucial role in signal quality. As **distance increases**, the signal experiences **path loss**, leading to weaker reception, higher packet loss, and lower throughput. This often requires retransmissions, increasing latency and reducing network efficiency. Conversely, shorter distances improve signal strength, enhancing throughput with fewer transmission errors and lower power requirements. Therefore, optimizing both power and distance is essential for maintaining high throughput while balancing interference and energy efficiency.

Implementation details:

1. **Effect of Transmitter Power on Throughput:**
    1. Environment Grid length: 500m x 500m
    2. Distance between Access Point and the Wireless Node is set to 170m
    3. Set transmitter power to 100mW under Interface Wireless > Physical layer

properties of
4. Access point
5. Set DCF as the medium access layer protocol under datalink layer properties of access point and wireless node.
6. Channel Characteristics: Path Loss Only, Path Loss Model: Log Distance, Path Loss Exponent: 2.5.
7. Application Generation Rate: 10Mbps (Packet Size: 1460, Inter Arrival Time: 1168µs)
8. Click on the Application icon present in the top ribbon/toolbar and set Transport Protocol to UDP.
9. In NetSim GUI Plots are Enabled. Run simulation for 10s.
10. Go back to the scenario and decrease the Transmitter Power to 100, 80, 60, 40 and 20 respectively and run simulation for 10s. See that, there is a decrease in the Throughput gradually.

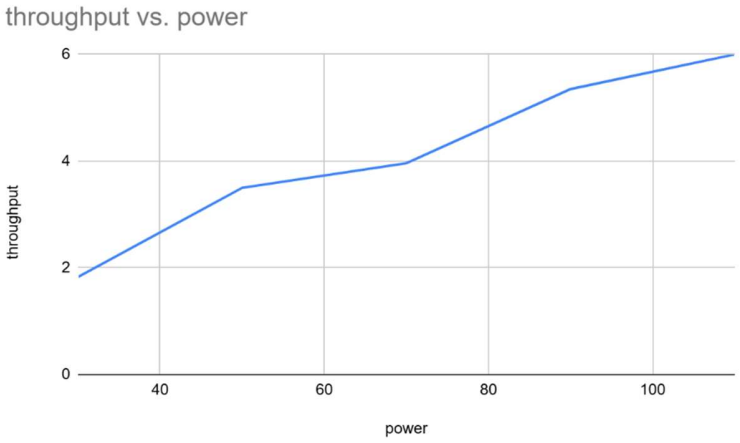
2. Effect of Distance on Throughput:

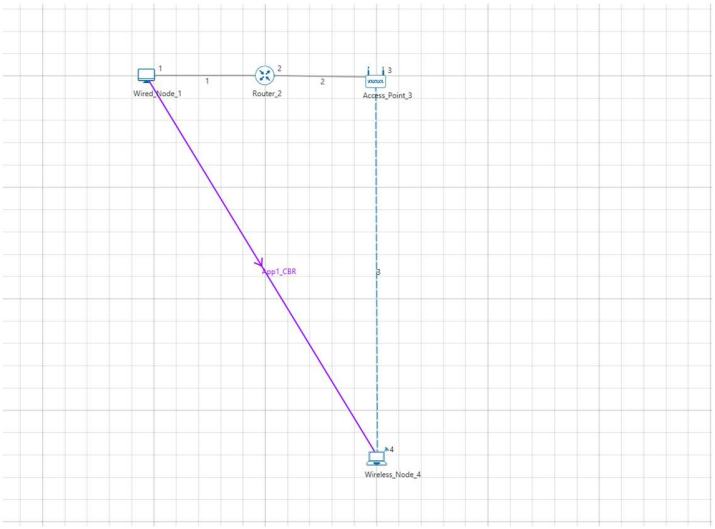
1. Environment Grid length: 500m x 500m.
2. Distance between Access Point and the Wireless Node is set to 10m.
3. Set DCF as the medium access layer protocol under datalink layer properties of access
4. point and wireless node.
5. WLAN Standard is set to 802.11ac and No. of Tx and Rx Antenna is set to 1 in access point and No. of Tx is 1 and Rx Antenna is set to 2 in wireless node (Right-Click Access Point or Wireless Node > Properties > Interface Wireless > Transmitting Antennas and Receiving Antennas) and Bandwidth is set to 20 MHz in both Access-point and wireless-node Transmitter Power set to 100mW in both Access-point and wireless-node.
6. Wired Link speed was set to 1Gbps and propagation delay to 10 µs in wired links.
7. Channel Characteristics: Path Loss Only, Path Loss Model: Log Distance, Path Loss Exponent: 3.5.
8. Application Generation Rate: 100 Mbps (Packet Size: 1460, Inter Arrival Time: 116 µs)
9. Click on the Application icon present in the top ribbon/toolbar and set Transport Protocol to UDP
10. In NetSim GUI Plots are Enabled and Run simulation for 10s.
11. Go back to the scenario and increase the Distance from 10m to 20m, 30m, 40m, 50m respectively and Run simulation for 10s.

Output/ results after execution:

1. Effect of Transmitter Power on Throughput:

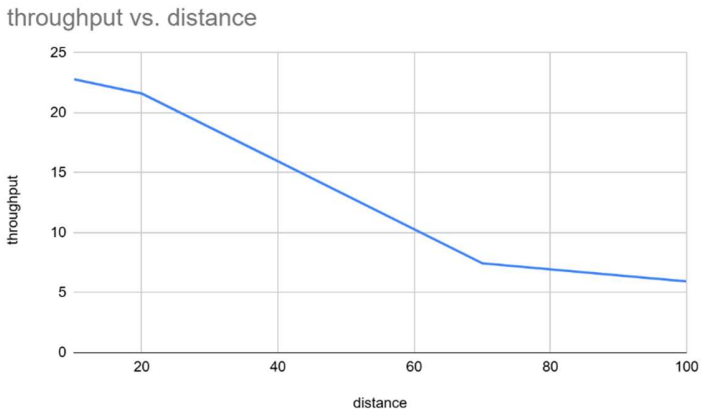
Transmitter Power (mW)	Throughput (Mbps)
30	1.83
50	3.50
70	3.96
90	5.35
110	6.00

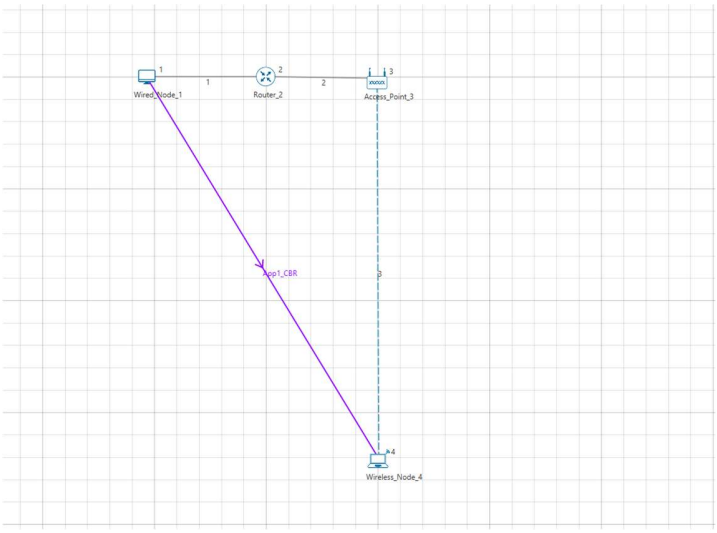




2. Effect of Distance on Throughput:

Distance (m)	Throughput (Mbps)
10	22.81
20	21.61
40	15.96
70	7.45
100	5.94



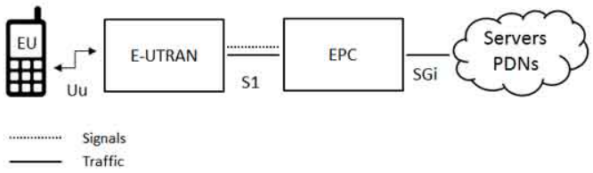


Post Lab Subjective/Objective type Questions:

1. Discuss five important features of LTE.

High data rates: Uplink is up to 50 Mbps and downlink is up to 100 Mbps.
Low Latency: Reduced control and user plane latency. The latency is around 5ms for the user plane.
Scalable Bandwidth: Supports bandwidths from 1.4 MHz to 20 MHz.
All-IP Network Architecture: Based on Evolved Packet System (EPS). No circuit switching; uses IP-based packet switching even for voice (VoLTE).
Improved Spectral Efficiency: Better usage of available spectrum compared to 3G.

2. Explain the working of LTE system with its functional block diagram.



Component Description EU (User Equipment): Mobile device (smartphone, tablet) with LTE radio. Communicates with the network using LTE air interface (Uu).

E-UTRAN (Evolved UMTS Terrestrial Radio Access Network): Contains eNodeBs (base stations). Manages radio resources, scheduling, encryption, and handovers. Connects UE to EPC through S1 interface.

EPC (Evolved Packet Core): Core network of LTE. Handles IP allocation, mobility, authentication, data routing. Key components: MME, SGW, PGW, HSS.

Servers / PDNs (Public Data Networks): External networks like Internet, corporate servers, IMS for VoLTE. Connected to EPC via SGi interface.

Conclusion:

The experiment provided hands-on experience with simulating a WLAN using the IEEE 802.11 standard in NetSim. It demonstrated how different factors like security protocols, interference, and network configurations affect WLAN performance.

Signature of faculty in-charge with Date: