

# Wi-Fi Technology Fundamentals



**WI-FI TECHNOLOGY**  
FUNDAMENTALS COURSE

Module-1

**Introduction and History of WiFi**

Session-1b

## Wi-Fi Network Topologies

# Last Session Recap.....



Module-1

**Introduction and History of WiFi**

Session-1a

## Wi-Fi Evolution

- ✓ WiFi Technology Evolution
- ✓ Generations of WiFi
- ✓ WiFi in Key Industries
- ✓ WiFi Technology Life Cycle / Industry Ecosystem
- ✓ Why WiFi has been so successful

# How to Stay Connected?

## Access Course Webpage



[Click here: Wi-Fi Technology Fundamentals Course \(candelatech.com\)](https://candelatech.com)

- ✓ Access course notes, slides, video recordings

## Register to Get Updates



[Click Here: Registration \(zoho.in\)](https://zoho.in)

- ✓ Provide basic contact info to get calendar invites, reminders and updates about the material and sessions.

## Join Whatsapp Group



[Click here: WhatsApp Group Invite](#)

- ✓ Provide basic contact info to get whatsapp messages about calendar invites, reminders and updates about the material and sessions.



Module-1  
Introduction and History of WiFi  
Session-1b

# Wi-Fi Network Topologies

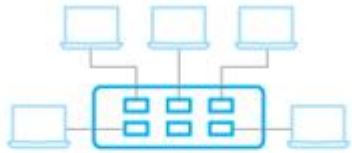


# What is a WiFi Access Point?



## Hub

A hub joins multiple devices on the same LAN, broadcasting messages to all ports without examining frames.



## Switch

A network switch forwards data to its proper destination, examining a packet's MAC address info to determine the intended device.

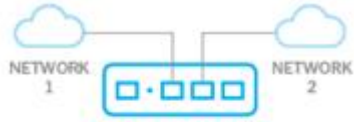


## WiFi Access Point



## Router

A router directs data requests from one network to another, using a packet's IP address to forward it to its destination.



## Gateway

A gateway connects discrete networks and translates packet data so it can travel between the systems.



## Bridge

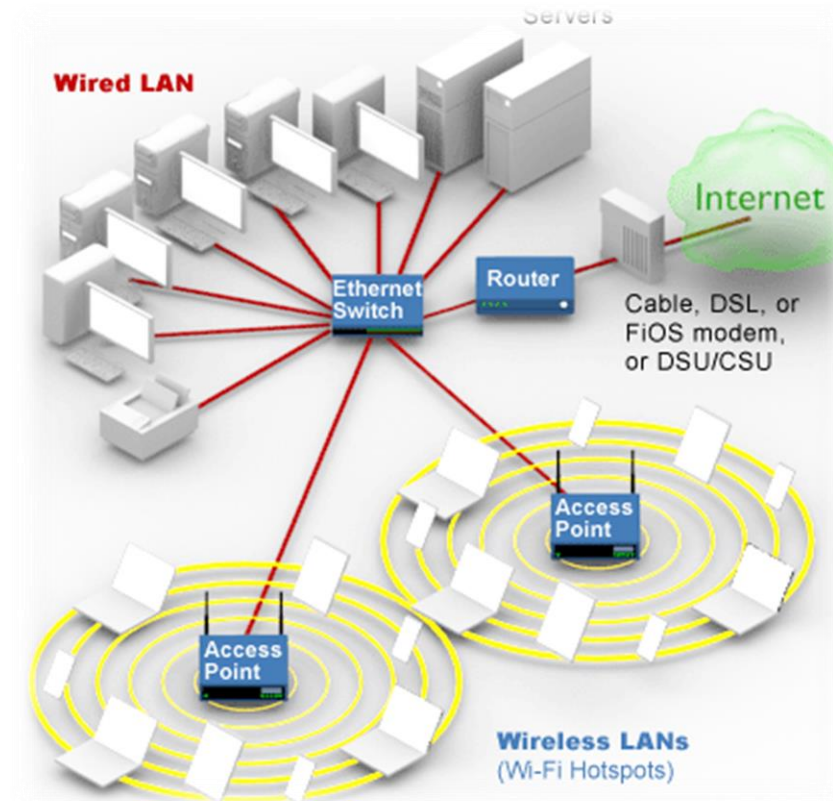
A network bridge acts as an interconnection between two LANs, creating a single network from separate LANs.



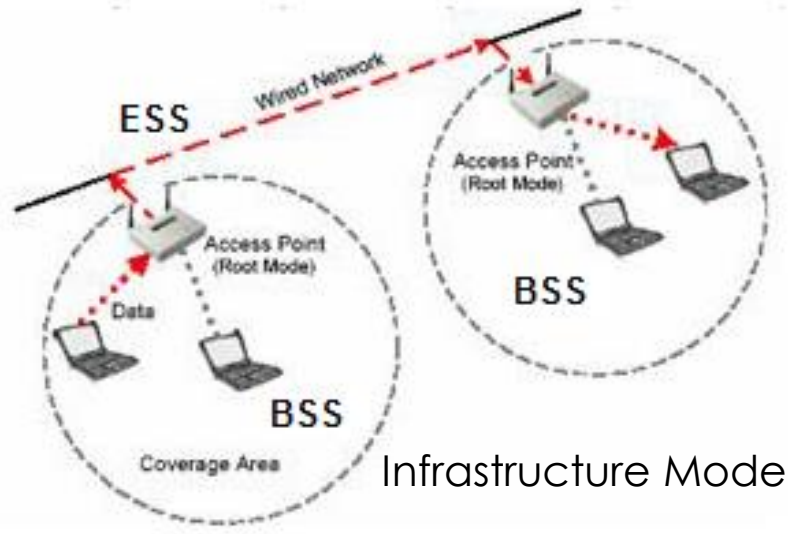
## Modem

A modem modulates and demodulates signals between devices, such as analog to digital.

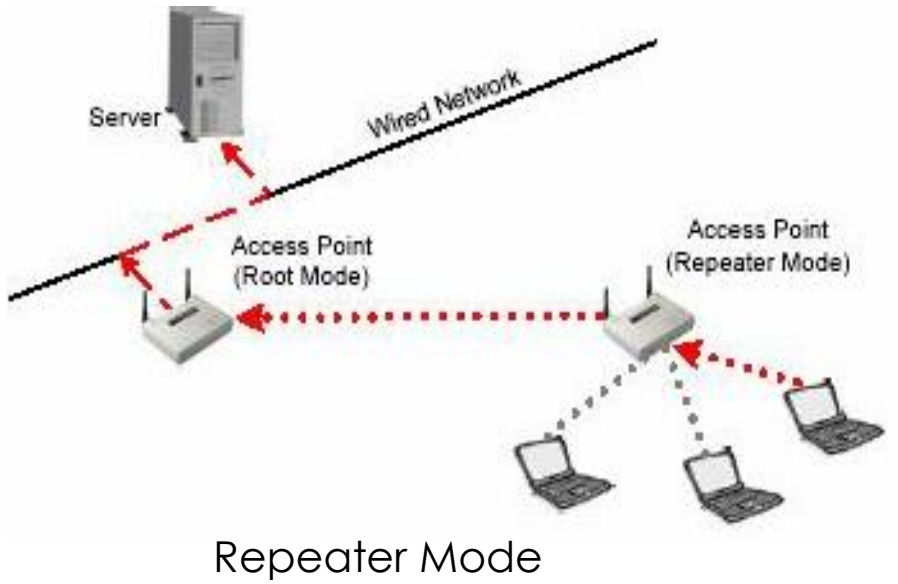
- ✓ Basis Functions
  - ✓ Wireless Portal
  - ✓ Connectivity
  - ✓ Coverage
  - ✓ Medium Access
  - ✓ Security
  - ✓ QoS
  - ✓ Mobility
  - ✓ Virtual Networks



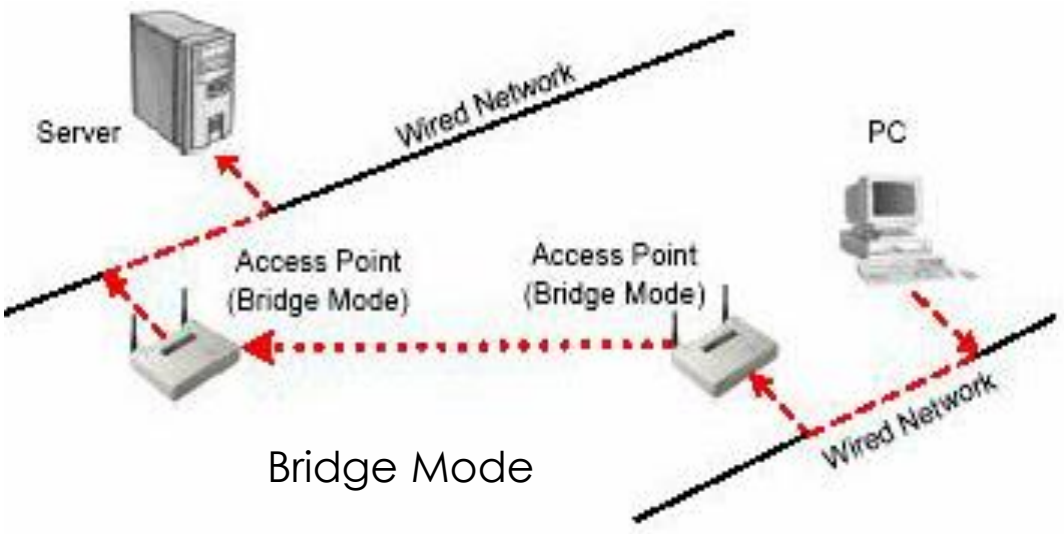
# Basic WiFi Topologies



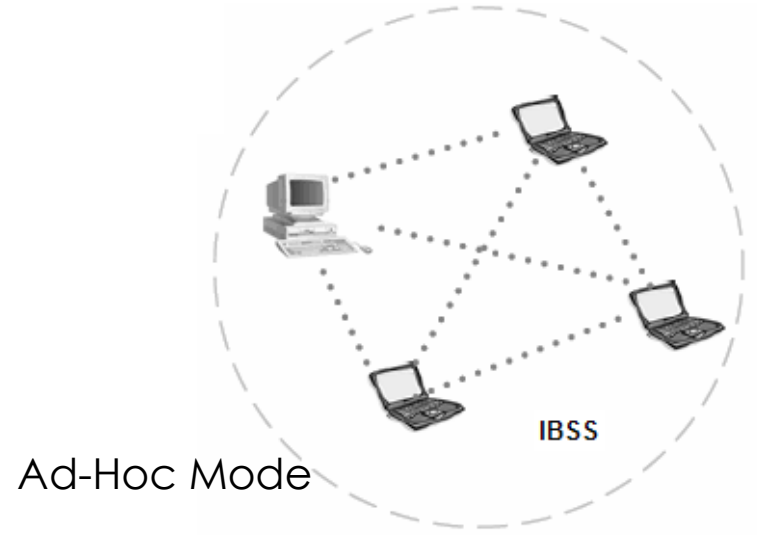
Infrastructure Mode



Repeater Mode



Bridge Mode

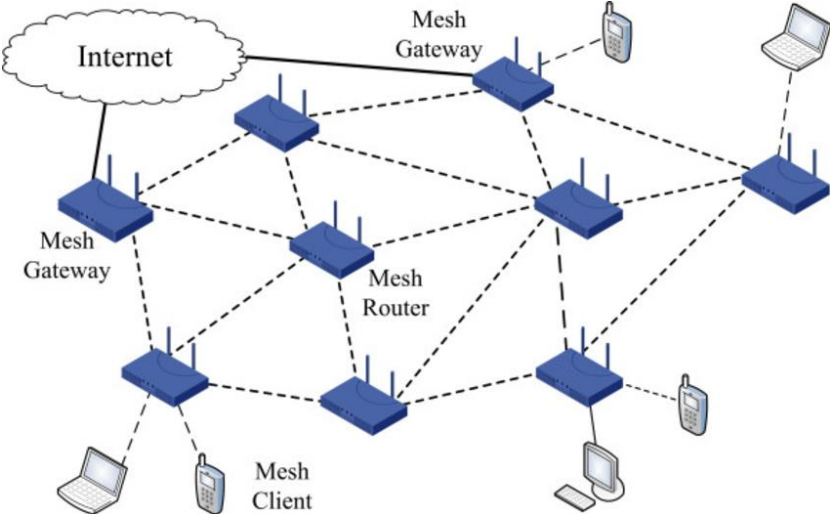


Ad-Hoc Mode

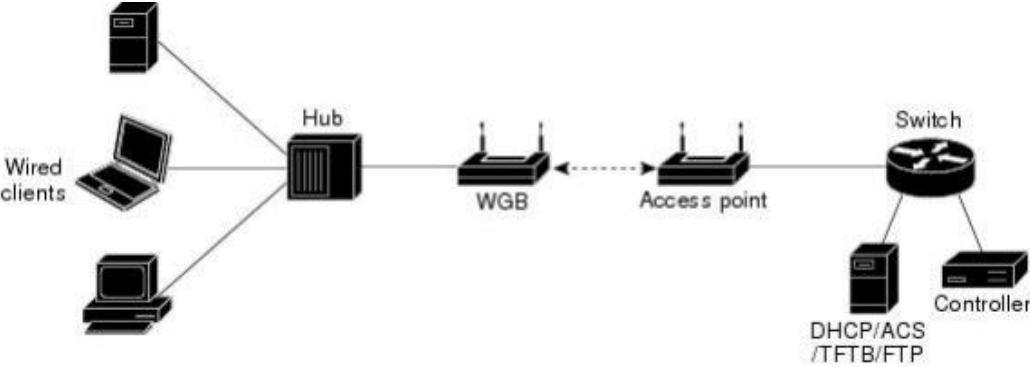
# Other Topologies



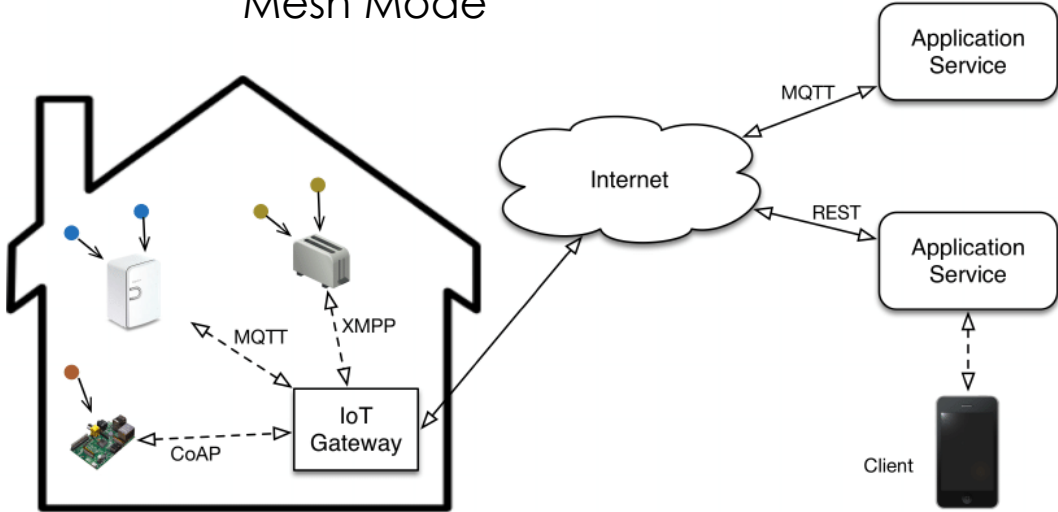
Mobile Hotspot Mode



Mesh Mode



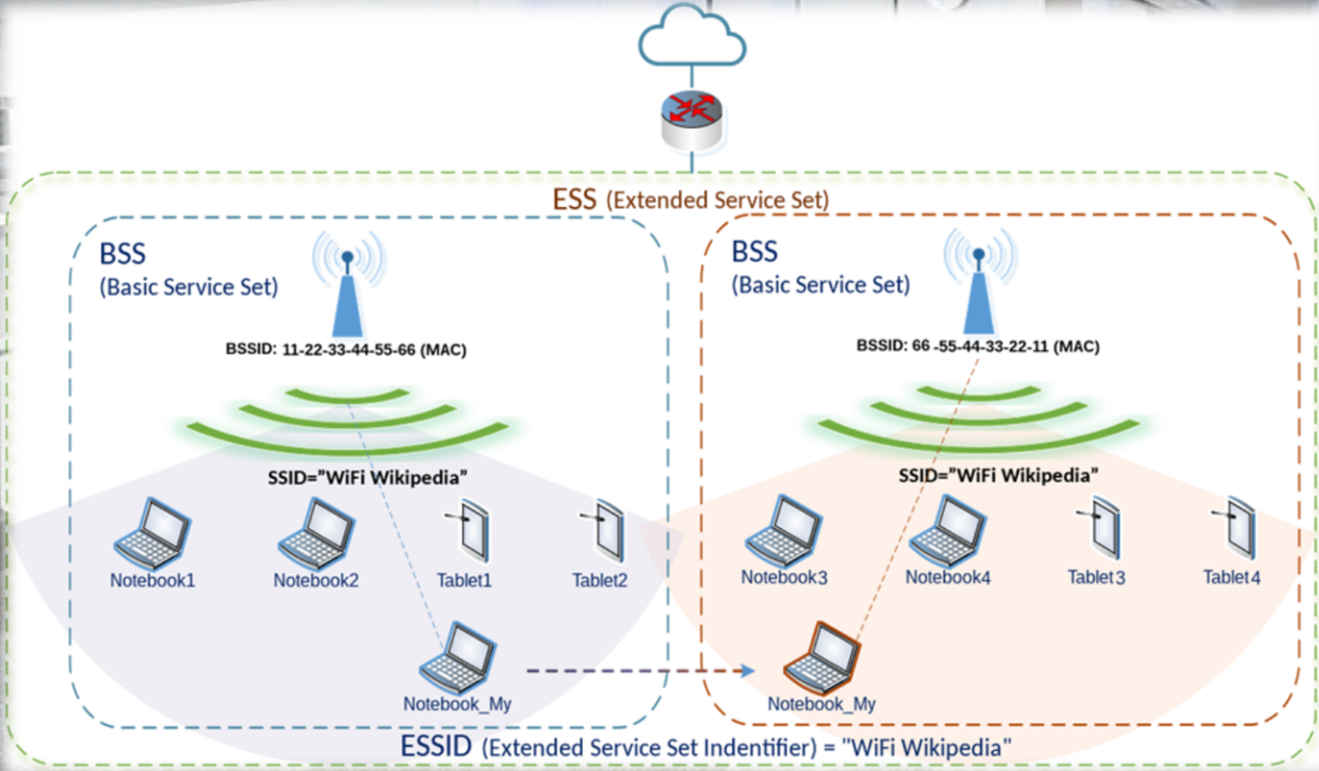
Work Group Bridge Mode



IoT Gateway Mode



# Infrastructure Mode





# Repeater Mode



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**EXTENDED WIFI**

**ROUTER**

# Bridge Mode





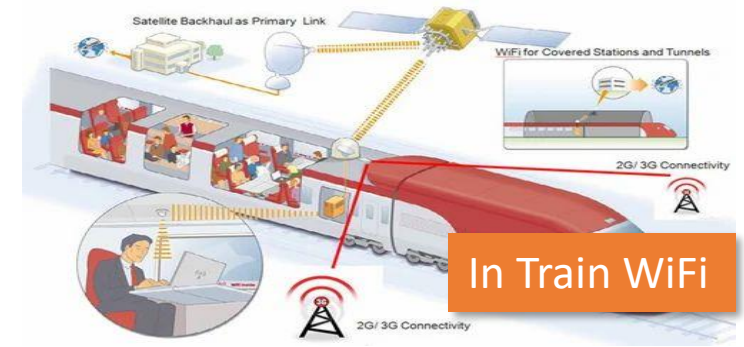
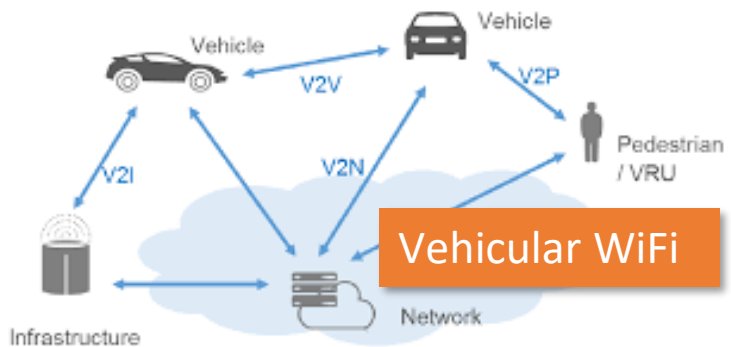
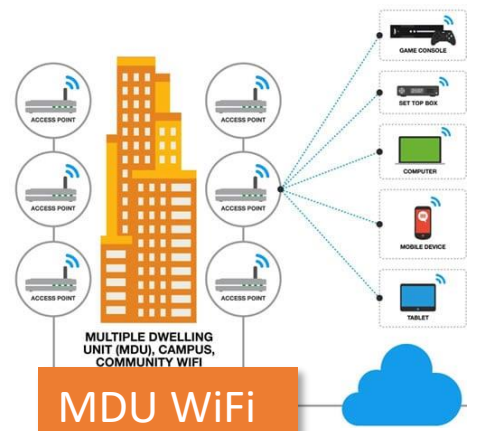
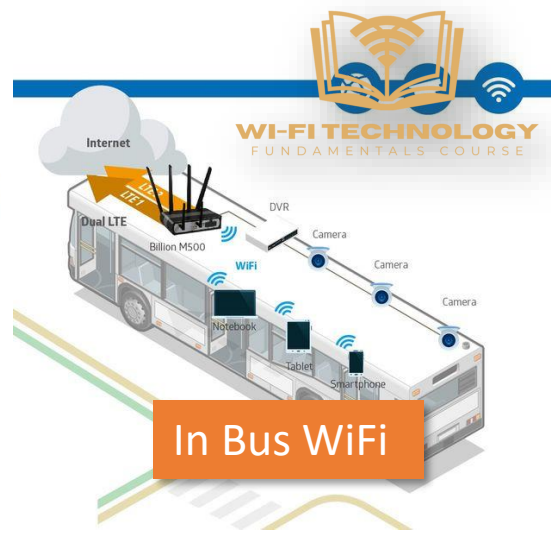
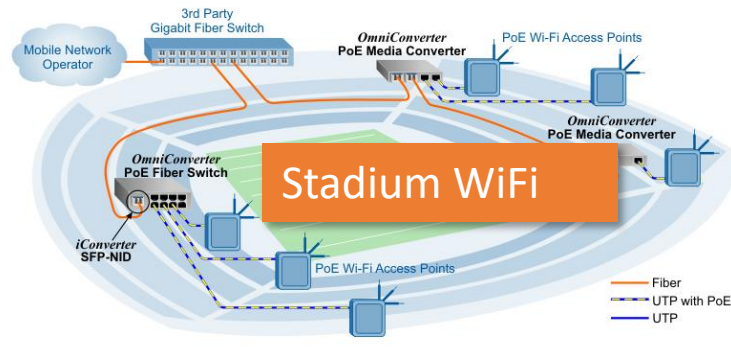
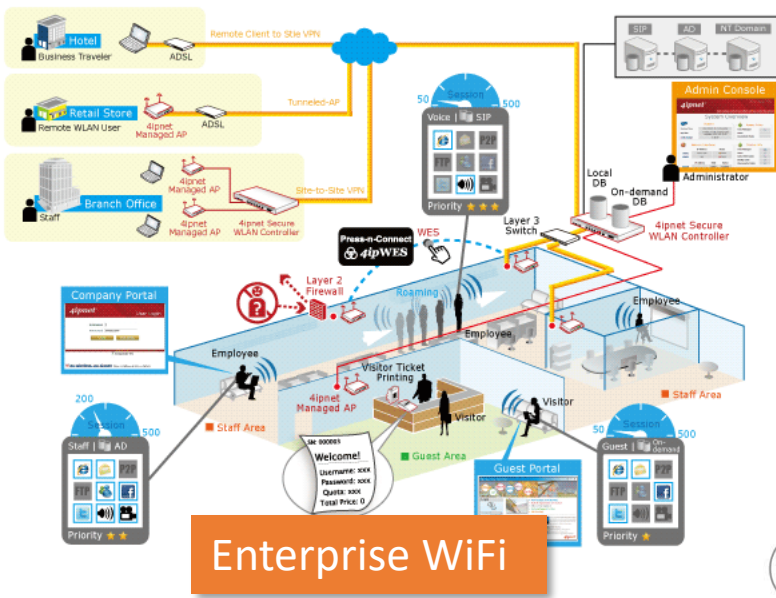
# Adhoc Mode



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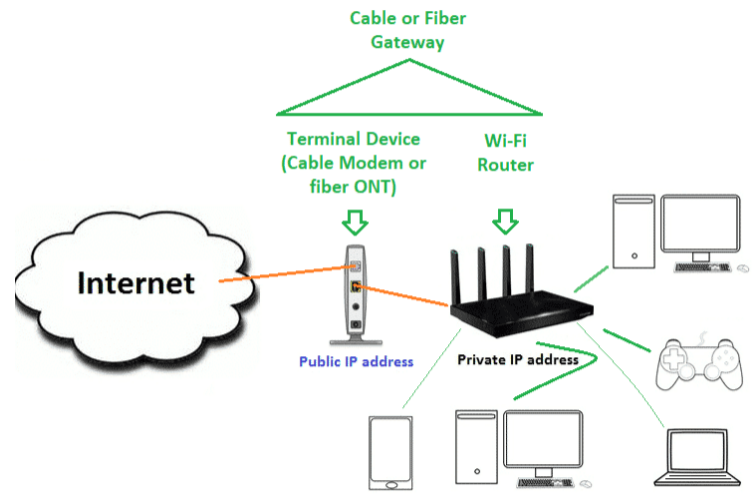
# WiFi Deployment Use Cases



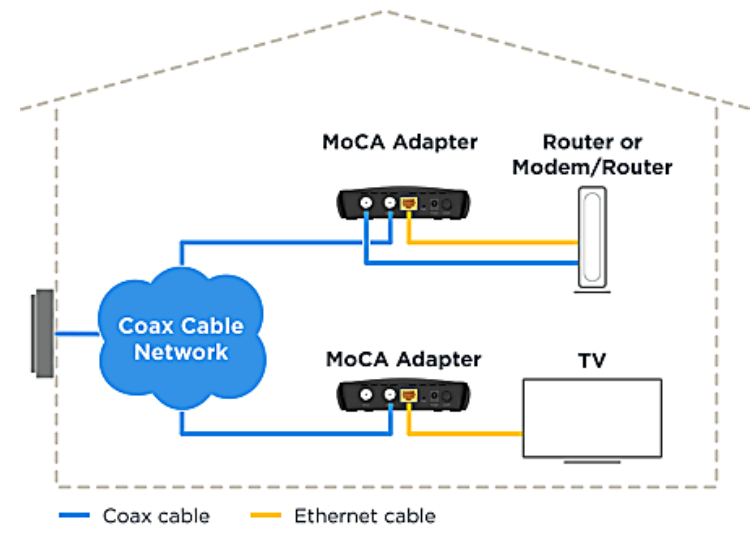




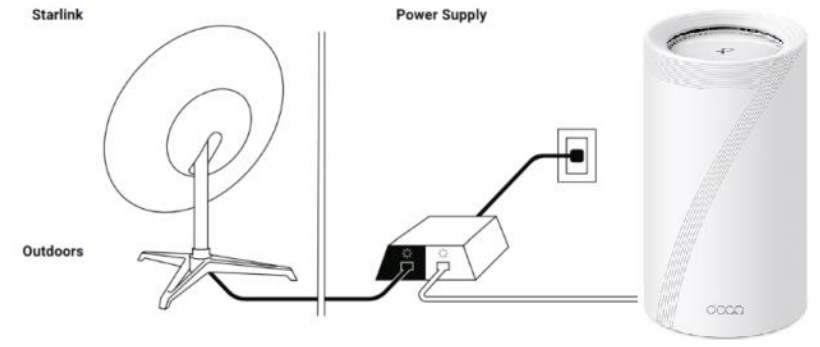
# Types of Wi-Fi Internet Connectivity Backhaul



Fiber Optics



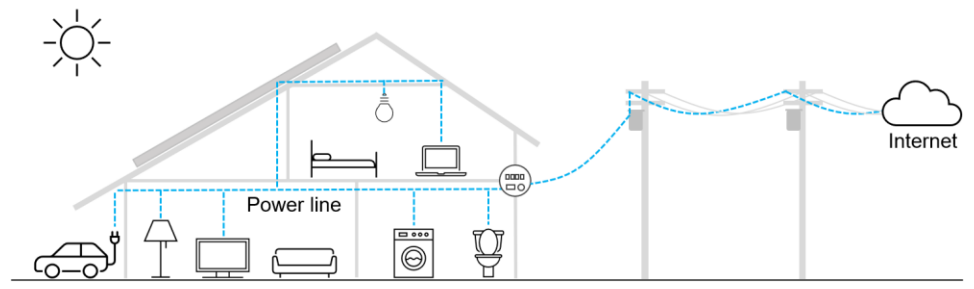
MoCA



Satellite

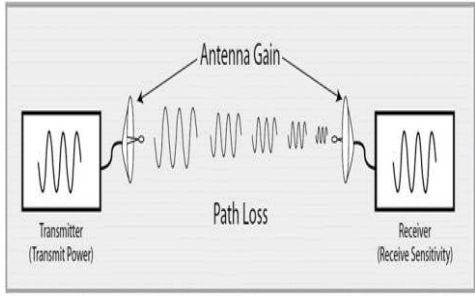


Cellular

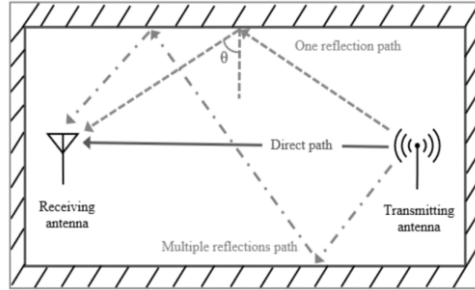


Powerline Backhaul

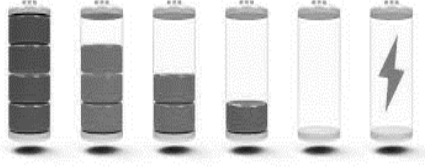
# WiFi Technology Challenges



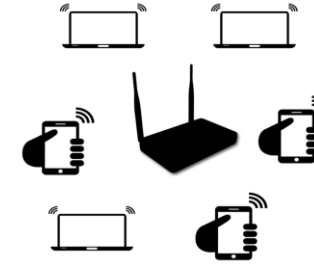
Path Loss



Multipath



Battery Life

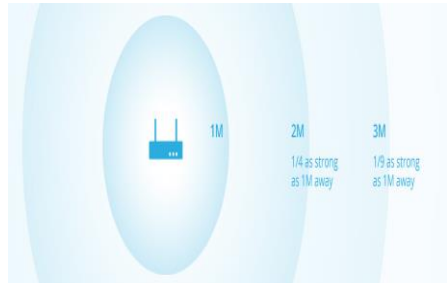


Medium Access

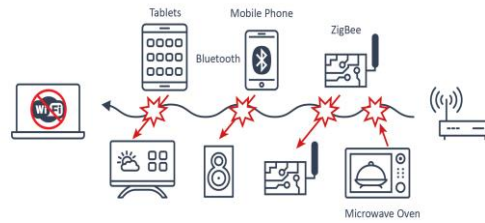
5 GHz Channel Allocations

| Frequency (GHz)    | 5.150             | 5.250 | 5.470            | 5.600 | 5.640             | 5.725 | 5.800            |
|--------------------|-------------------|-------|------------------|-------|-------------------|-------|------------------|
| IEEE T1 Allocation | UNH.1             |       | UNH.2a           |       | UNH.2b (Extended) |       | UNH.3            |
| Center Frequency   | 5180              | 5220  | 5480             | 5520  | 5600              | 5700  | 5800             |
| 20 MHz             | 36                | 40    | 54               | 58    | 62                | 100   | 104              |
| 40 MHz             | 48                | 52    | 100              | 104   | 116               | 120   | 132              |
| 80 MHz             | 56                | 60    | 124              | 132   | 140               | 144   | 156              |
| 160 MHz            | 64                | 68    | 136              | 144   | 152               | 156   | 168              |
| DFS Channels       | No DFS Required   |       | DFS Required     |       | DFS Required      |       | No DFS Required  |
| ETD                | 1,000 mW Tx Power |       | 250 mW eIRP      |       | 100, 124, 128     |       | 1,000 mW ERP     |
| DFS Channels       | Indoor & Outdoor  |       | Indoor & Outdoor |       | Devices Free      |       | Indoor & Outdoor |

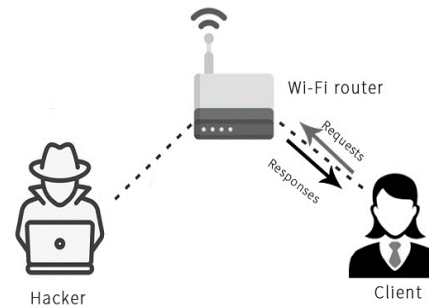
Limited Spectrum



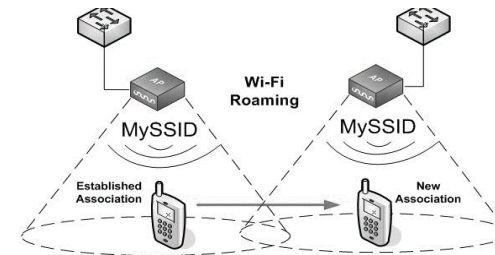
Limited Range



Interference



Security



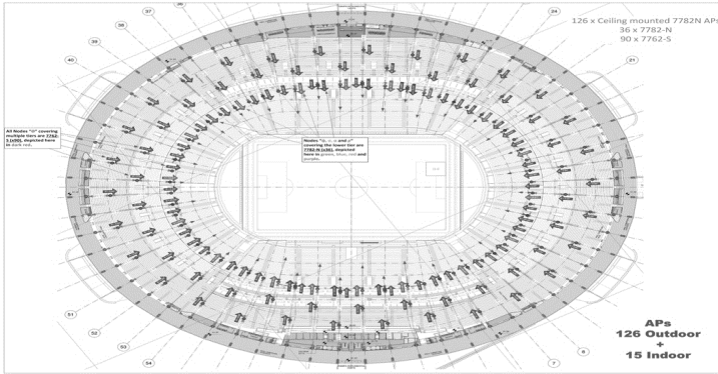
Mobility



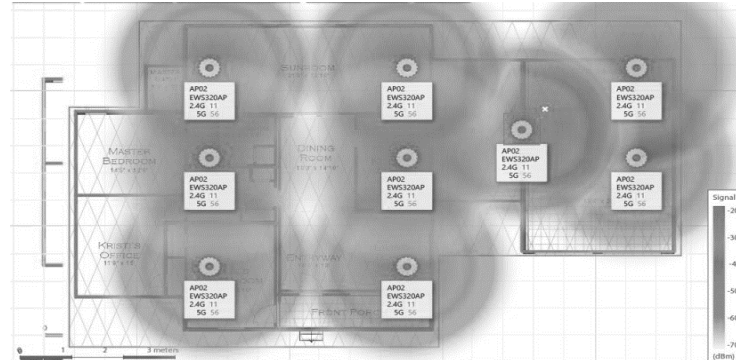
QoS



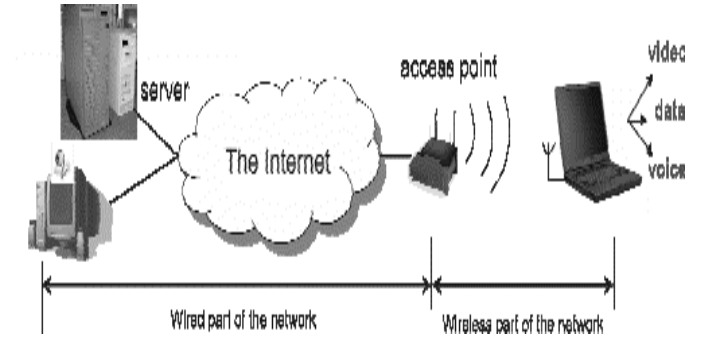
# WiFi Network Management/Business Challenges



Large Deployments



Network Planning



Need for Infrastructure



Network Troubleshooting



Seamless Roaming



Monetization



# Some References

V2v Communication using DSRC (Vehicular Wi-Fi)

<https://www.youtube.com/watch?v=3z09fCqmILU>

Ponco City Wi-Fi

<https://www.youtube.com/watch?v=ch69zvGABIY>

Stadium Wi-Fi

[https://www.cwnp.com/uploads/mike\\_leibovitz\\_stadium-wi-fi-deployment\\_new.pdf](https://www.cwnp.com/uploads/mike_leibovitz_stadium-wi-fi-deployment_new.pdf)

Passenger Wi-Fi in Trains

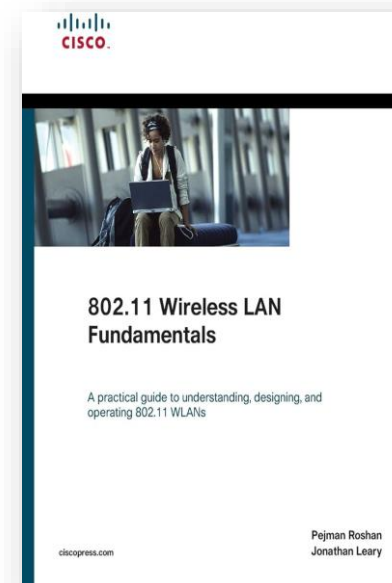
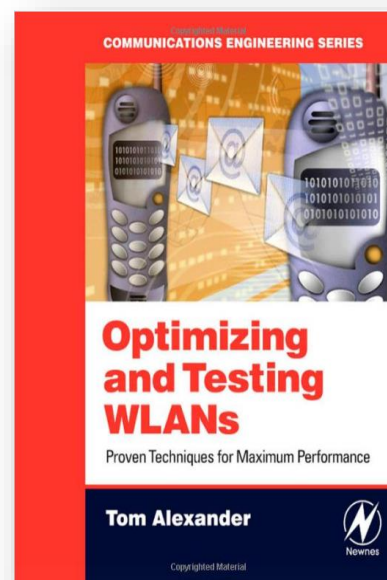
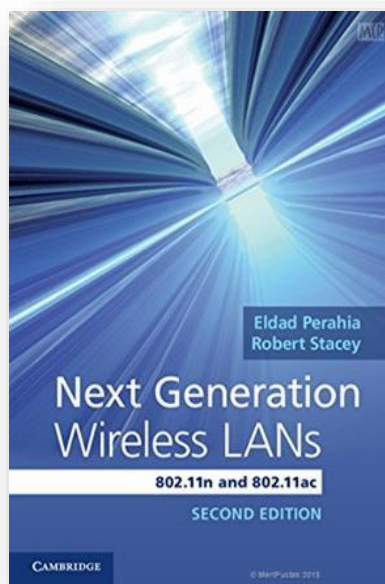
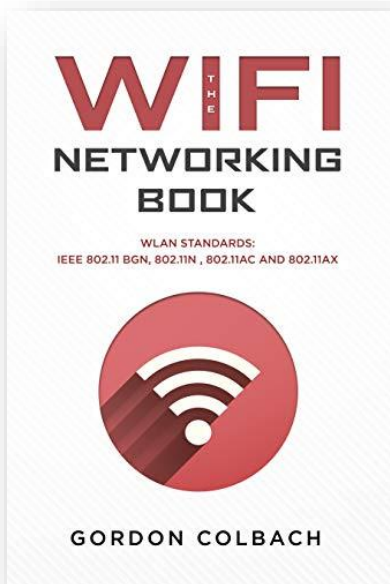
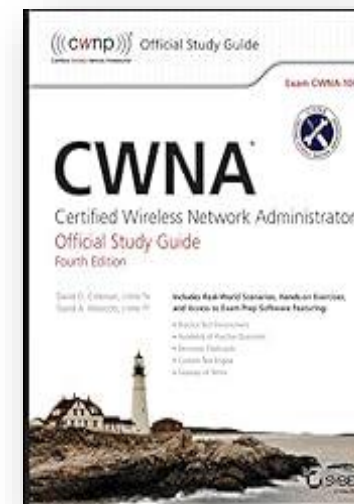
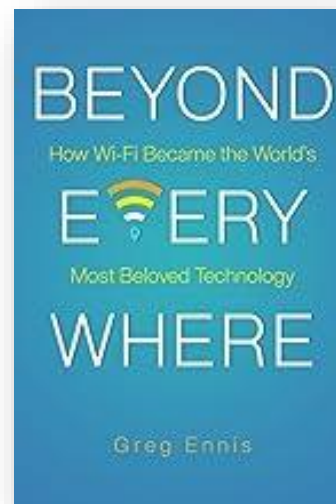
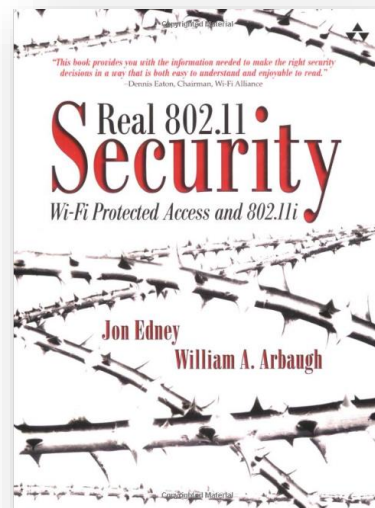
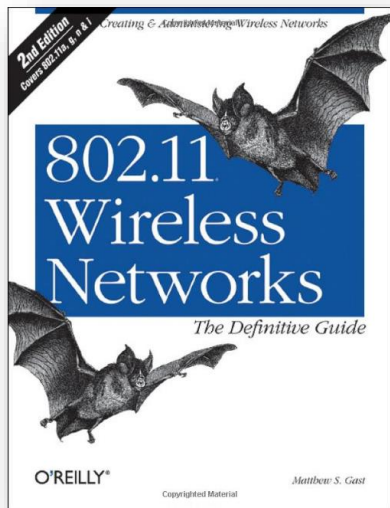
[https://www.pcvuesolutions.com/blog/iot/images/easyblog\\_shared/Moxa\\_White\\_Paper---Implementing\\_Passenger\\_Wi-Fi\\_Networks\\_Five\\_Key\\_Considerations.pdf](https://www.pcvuesolutions.com/blog/iot/images/easyblog_shared/Moxa_White_Paper---Implementing_Passenger_Wi-Fi_Networks_Five_Key_Considerations.pdf)

White Paper on Home Wi-Fi Networks

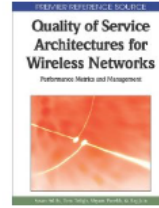
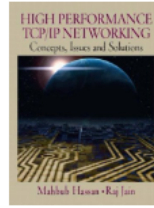
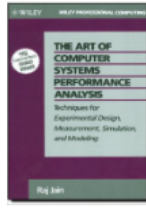
<https://carrier.huawei.com/~media/CNBG/Downloads/Technical%20Topics/Fixed%20Network/White%20Paper%20of%20Home%20Wi-Fi%20-en.pdf>

WiFi Mesh Networks

[https://www.cwnp.com/uploads/802-11s\\_mesh\\_networking\\_v1-0.pdf](https://www.cwnp.com/uploads/802-11s_mesh_networking_v1-0.pdf)



<https://www.cse.wustl.edu/~jain/>



April 2010

**Raj Jain,**  
**Barbara J. and Jerome R. Cox, Jr., Professor of**  
**Computer Science and Engineering,**  
**Washington University in St. Louis**

**Current Research:** [Quantum Communications](#), [Artificial Intelligence](#), [Blockchains](#), [Cybersecurity](#).

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Spring 2022: [CSE473S: Introduction to Computer Networks](#)  
Fall 2021: [CSE570S: Recent Advances in Networking \(Data Center Virtualization, SDN, Internet of Things, AI, Blockchains, Quantum Communications\)](#)  
Spring 2021: [CSE473S: Introduction to Computer Networks](#)  
Fall 2020: [CSE574S: Recent Advances in Wireless and Mobile Networking](#)  
Fall 2017: [CSE567M: Computer Systems Analysis](#)

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[The Catch-up Game: Quest for the Impact](#)  
[Blockchains: The Revolutionary Trust Protocol](#)

#### Datasets for AI/Cybersecurity Research

[WUSTL-IIOT-2021 Dataset for IIoT Cybersecurity Research](#)  
[WUSTL EHMS 2020 Dataset for Internet of Medical Things \(IoMT\) Cybersecurity Research](#)  
[WUSTL SCADA 2018 Dataset for Industrial Internet of Things \(IIoT\) Cybersecurity Research](#)  
[WUSTL High-Definition Video Trace Library for Multimedia Traffic Modeling Research](#)

#### Audio/Video Recordings of Lectures

[CSE570: Recent Advances in Networking](#) ( [2019](#), [2018](#), [2015](#), [2013](#) ) | [CSE567: Computer System Analysis](#) ( [2017](#), [2015](#), [2013](#), [2011](#), [2008](#), and [2006](#) ) | [CSE574: Wireless and Mobile Networks](#) ( [2018](#), [2016](#), [2014](#), [2010](#), [2008](#), [2006](#) ) | [CSE 571: Network Security](#): ( [2017](#), [2014](#), [2011](#), [2009](#), [2007](#) ) | [CSE473: Introduction to Computer Networks](#) ( [2016](#), [2011](#), [2010](#), [2009](#), and [2005](#) ) | [CSE 591: Introduction to Graduate Study in CS](#) ( [2018](#) )

#### Books:

[The Art of Computer Systems Performance Analysis: Techniques for Experimental Design, Measurement, Simulation, and Modeling](#) ( [Instruction Slides](#), [Errata](#) ) | [High Performance TCP/IP Networking](#) ( [Instruction Slides](#) ) | [Quality of Service Architectures for Wireless Networks: Performance Metrics and Management](#) | [FDDI Handbook: High-Speed Networking with Fiber and Other Media](#) | [Control-theoretic Formulation of Operating Systems Resource Management Policies](#)

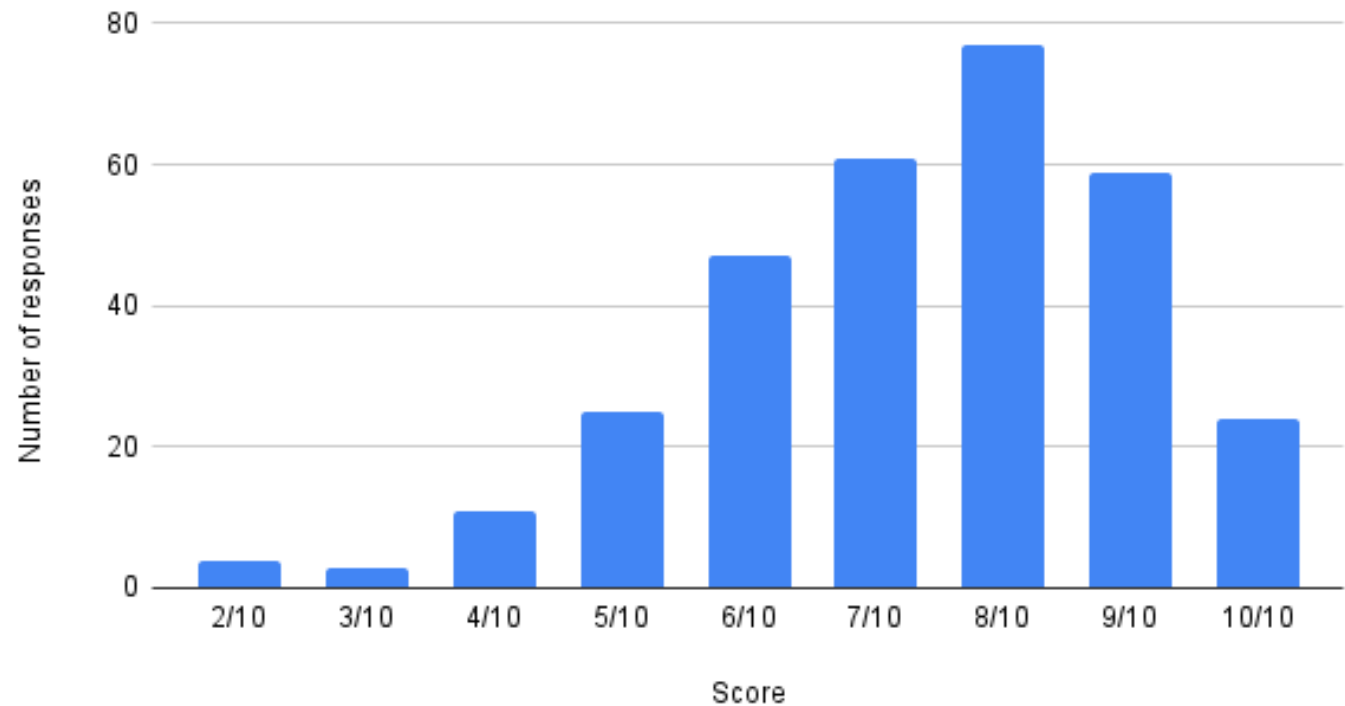
# Quiz 1a Results



Winner  
**Akhil Dev K P**

Number of participants - 311

Score distribution among participants - quiz 1a







**QUIZ!**

**TIME**