

Contents

2

- Introduction
- Need of Wi-Fi Technology
- Purpose
- History
- Wi-Fi Technology
- How a Wi-Fi Network Works
- Topologies & Configurations
- Applications
- Wi-Fi Security
- Advantages & Limitations
- Innovations

Introduction

3

Wireless Technology is an alternative to Wired Technology, which is commonly used, for connecting devices in wireless mode.

Wi-Fi is a generic term that refers to the IEEE 802.11 communications standard for Wireless Local Area Networks (WLANs).

Wi-Fi Network connect computers to each other, to the internet and to the wired network.

Wi-Fi works on physical and data link layer.

Naming secret

4

- The term Wi-Fi suggests Wireless Fidelity, resembling the long-established audio-equipment classification term high fidelity (in use since the 1930s) or Hi-Fi (used since 1950).
- Phil Belanger who is the founding member of the Wi-Fi Alliance states that term Wi-Fi was never supposed to mean anything at all.
- The “yin-yang” logo indicates the certification of a product for interoperability.

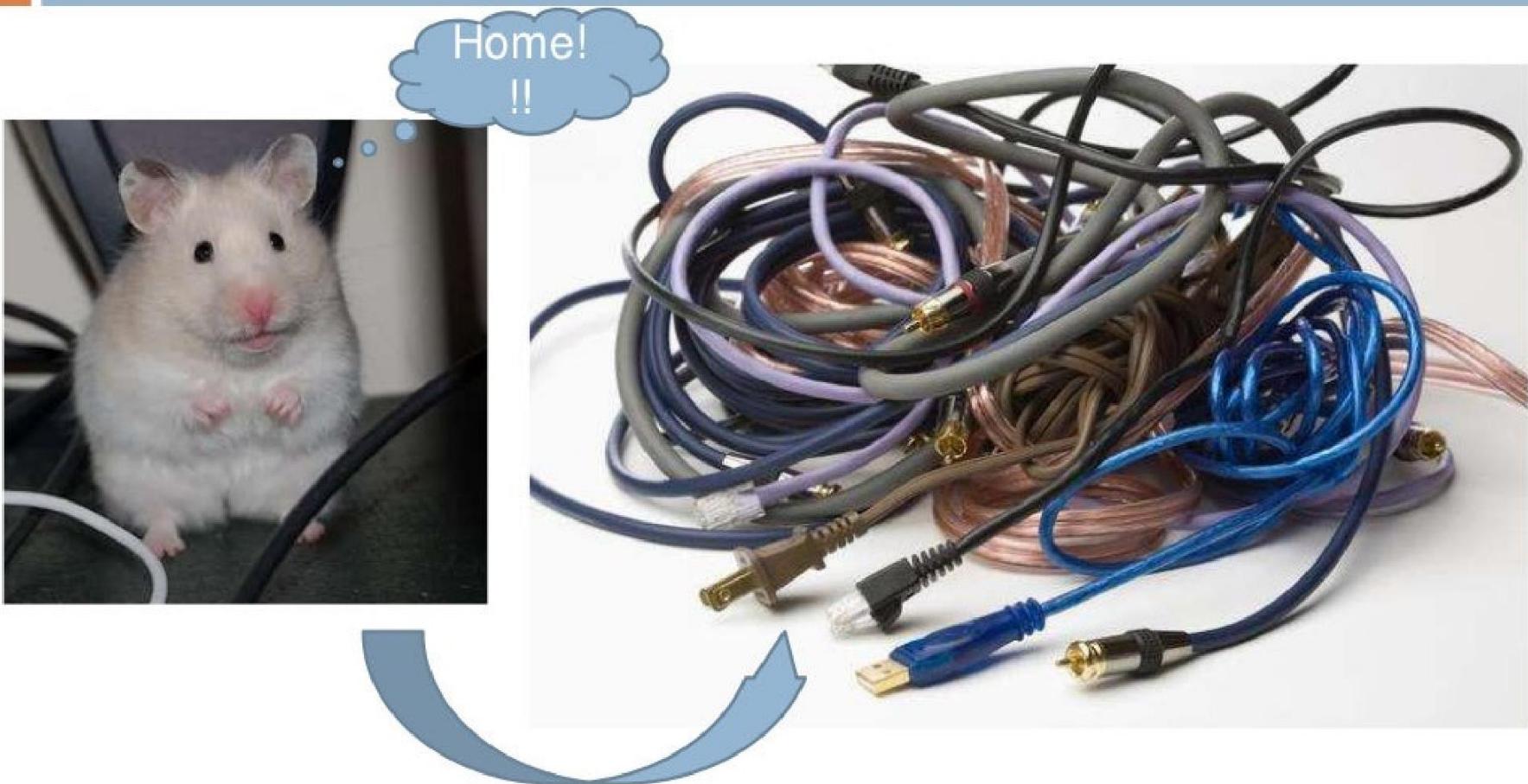


Wi-Fi Technology

Need of Wi-Fi Technology

Rat's Nest Of Wires

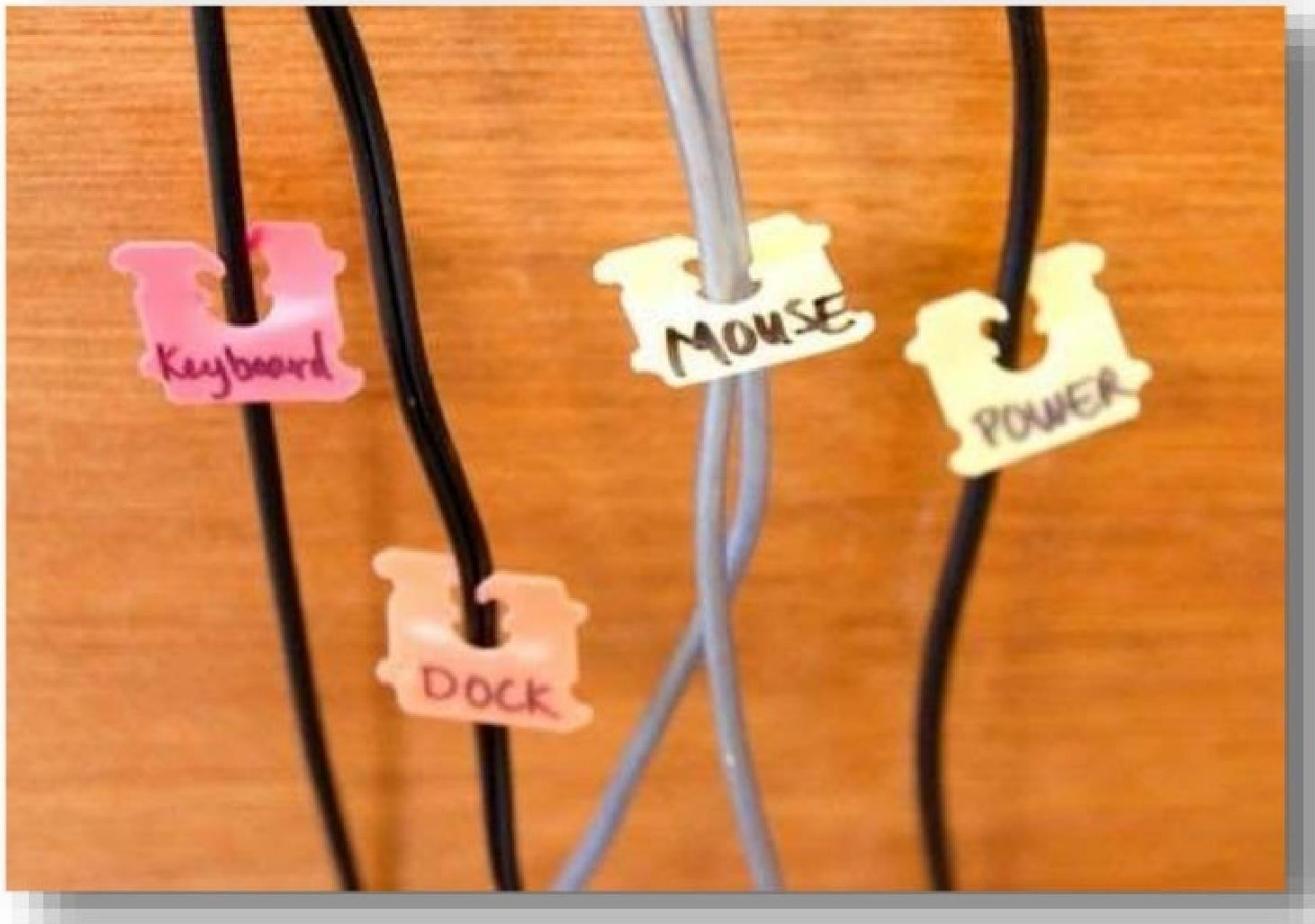
6



Wi-Fi Technology

Cables for Keyboard, Mouse, Power etc.

7



Freedom from wires!!

8



Wi-Fi Technology

Purpose

9

- The purpose of Wi-Fi is to hide complexity by enabling wireless access to applications and data, media and streams.
- The main aims of Wi-Fi are:
 - make access to information easier
 - ensure compatibility and co-existence of devices
 - eliminate complex cabling
 - eliminate switches, adapters, plugs, pins and connectors

History

Wi-Fi Alliance

11

- Wi-Fi technology builds on IEEE 802.11 standards. The IEEE develops and publishes these standards, but does not test equipment for compliance with them. The non-profit Wi-Fi Alliance formed in 1999 to fill this void.
- The Wi-Fi Alliance, a global association of companies.
- As of 2009 the Wi-Fi Alliance consisted of more than 300 companies from around the world.
- Manufacturers with membership in the Wi-Fi Alliance, whose products pass the certification process, gain the right to mark those products with the Wi-Fi logo.

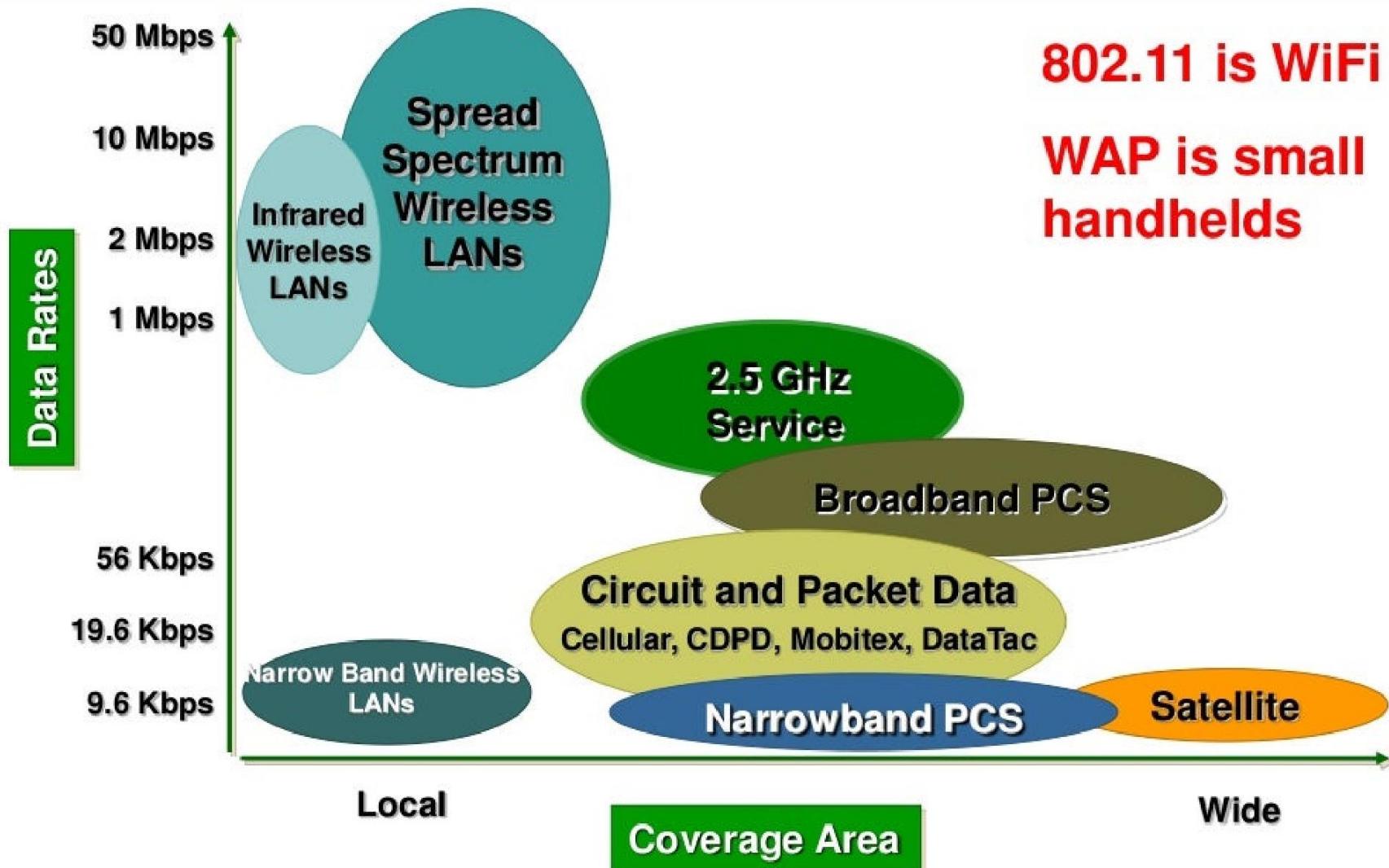
Wireless Landscape

12

Wireless Technology	Transmission Distance	Speed
Bluetooth	33 feet	1 Mbps
Satellite	Worldwide	290ms latency
1G Analog cellular	Nationwide	
2G digital cellular	Nationwide	14 Kbps
2.5G digital cellular	Nationwide	384 Kbps
3G digital cellular	Nationwide	2-10 Mbps
WLAN 802.11b	375 feet	11 Mbps
WLAN 802.11a, g	300 feet	54/128 Mbps
Fixed broadband Wireless (BWA)	35 miles	1 Gbps
WAP	Nationwide	384 Kbps
WiMAX 802.16, 4G	10 miles	75 Mbps

Wireless Data Networks

13



Wi-Fi Technology

The Wi-Fi Technology

15

- The technology used in Wi-Fi is easiest to understand in terms of radio. It is quite similar to walkie-talkies, the only difference being in the strength of signals.
- An ordinary walkie-talkie can handle only limited data in the range of 1000 bps, and operate at 49 MHz. In the case of Wi-Fi radios, the signal strength is much more, so they can handle much higher data rates.
- There are three versions of Wi-Fi radios currently available- the ones that work with,
 - 802.11b
 - 802.11a
 - 802.11g

IEEE 802.11b

16

- Appeared in late 1999
- Operates at 2.4GHz radio spectrum
- 11 Mbps (theoretical speed) - within 30 m Range
- 4-6 Mbps (actual speed)
- 100 -150 feet range
- Most popular, Least Expensive
- Interference from mobile phones and Bluetooth devices which can reduce the transmission speed.

IEEE 802.11a

17

- Introduced in 2001
- Operates at 5 GHz (less popular)
- 54 Mbps (theoretical speed)
- 15-20 Mbps (Actual speed)
- 50-75 feet range
- More expensive
- Not compatible with 802.11b

IEEE 802.11g

18

- Introduced in 2003
- Combine the feature of both standards (a,b)
- 100-150 feet range
- 54 Mbps Speed
- 2.4 GHz radio frequencies
- Compatible with ‘b’

Which Standard is right for me?

19

Benefits of A vs B vs G

802.11b

Wireless-B

- Lowest price
- Excellent signal range
- Coverage penetrates most walls
- Works with public hotspots

802.11a

Wireless-A

- Supports more users per room
- Unaffected by interference from 2.4GHz devices
- Can co-exist with B and G networks
- Coverage limited To one room

802.11g

Wireless-G

- Best value - only 10% premium for 5 times the speed of Wireless-B
- Compatible with Wireless-B networks and hotspots
- Excellent signal range
- Coverage penetrates most walls

Standards

20

- IEEE 802.11 - The original 1 Mbit/s and 2 Mbit/s, 2.4 GHz RF and IR standard
- IEEE 802.11a - 54 Mbit/s, 5 GHz standard (1999, shipping products in 2001)
- IEEE 802.11b - Enhancements to 802.11 to support 5.5 and 11 Mbit/s (1999)
- IEEE 802.11d - International (country-to-country) roaming extensions
- IEEE 802.11e - Enhancements: QoS, including packet bursting
- IEEE 802.11f - Inter-Access Point Protocol (IAPP)
- IEEE 802.11g - 54 Mbit/s, 2.4 GHz standard (backwards compatible with b) (2003)
- IEEE 802.11h - 5 GHz spectrum
- IEEE 802.11n - Higher throughput improvements
- IEEE 802.11p - Wireless Access for the Vehicular Environment
- IEEE 802.11r - Fast roaming
- IEEE 802.11s - Wireless mesh networking
- IEEE 802.11T - Wireless Performance Prediction (WPP) - test methods and metrics
- IEEE 802.11u - Interworking with non-802 networks (e.g., cellular)
- IEEE 802.11v - Wireless network management
- IEEE 802.11w - Protected Management Frames

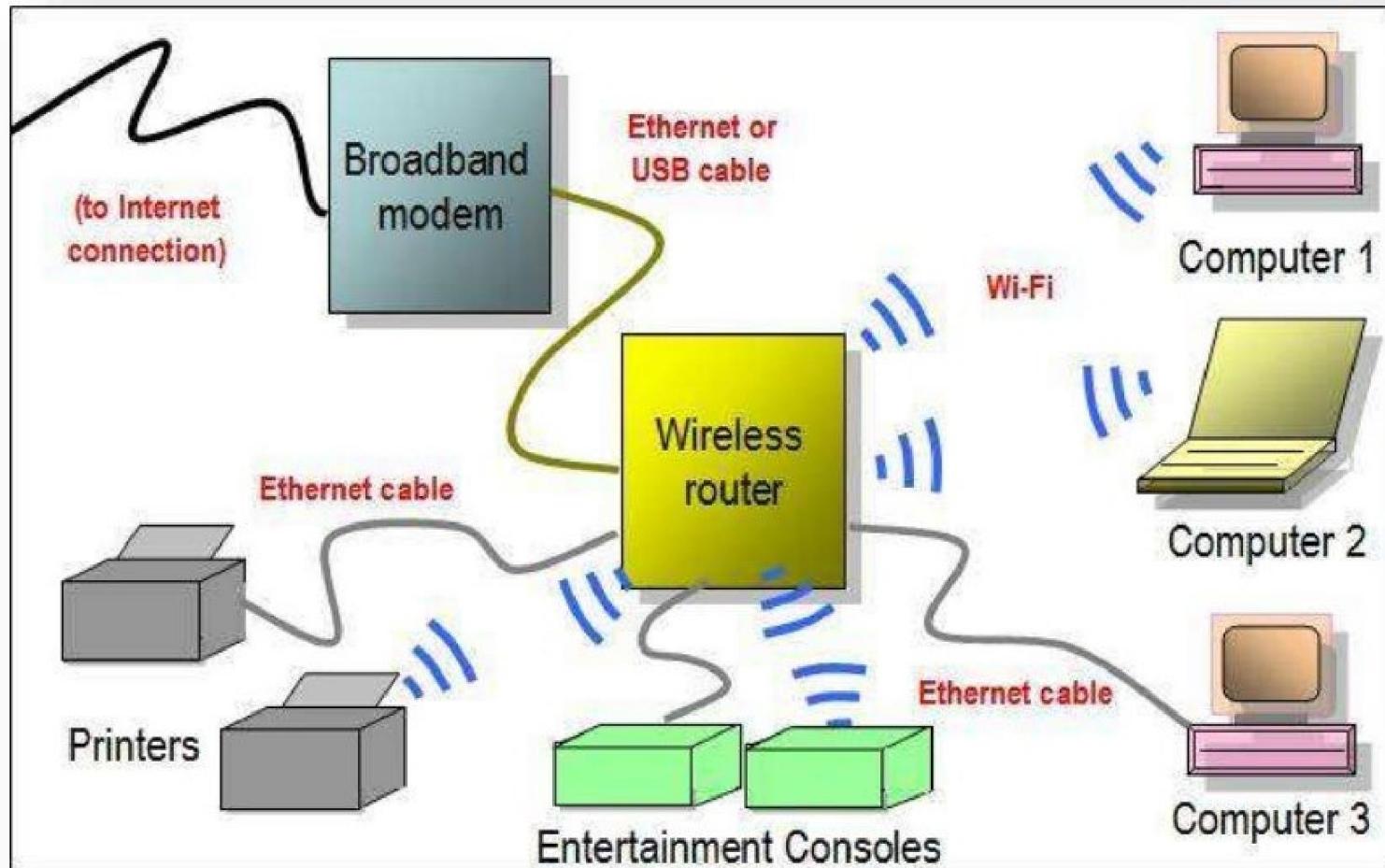
Elements of a WI-FI Network

21

- **Access Point (AP)** - The AP is a wireless LAN transceiver or “base station” that can connect one or many wireless devices simultaneously to the Internet.
- **Wi-Fi cards** - They accept the wireless signal and relay information. They can be internal and external.(e.g PCMCIA Card for Laptop and PCI Card for Desktop PC)
- **Safeguards** - Firewalls and anti-virus software protect networks from uninvited users and keep information secure.

How a Wi-Fi Network Works

22



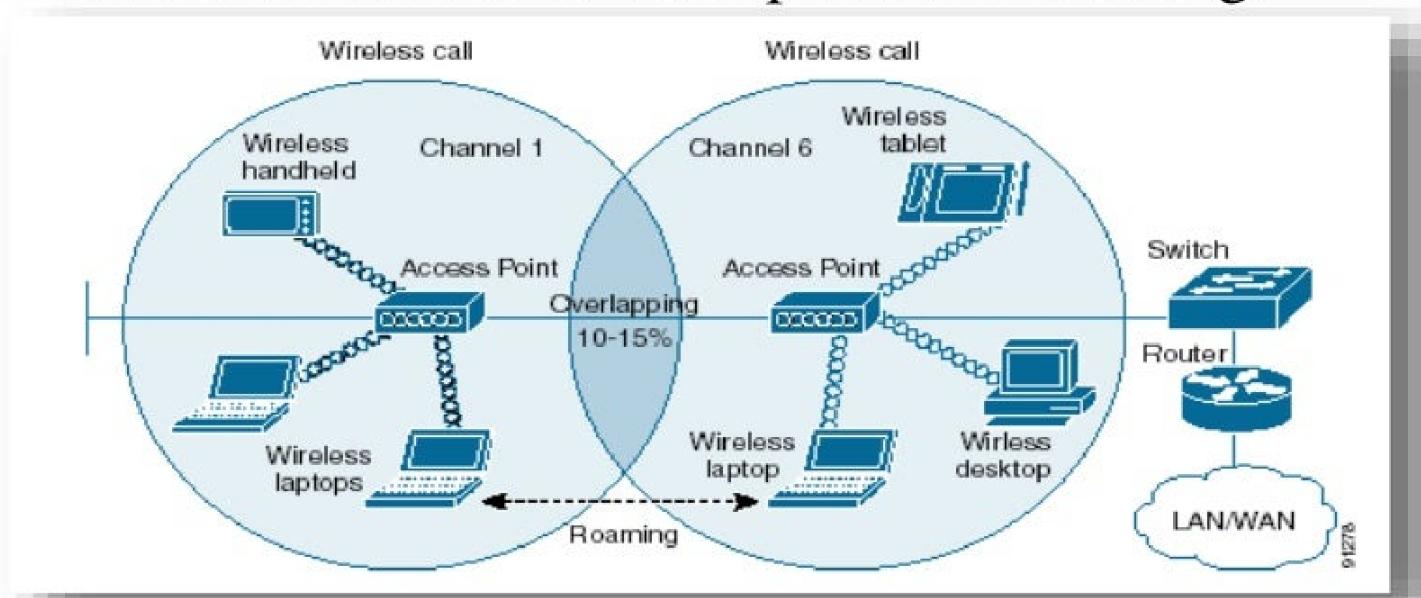
Wi-Fi Technology

Topologies & Configurations

AP-based topology

24

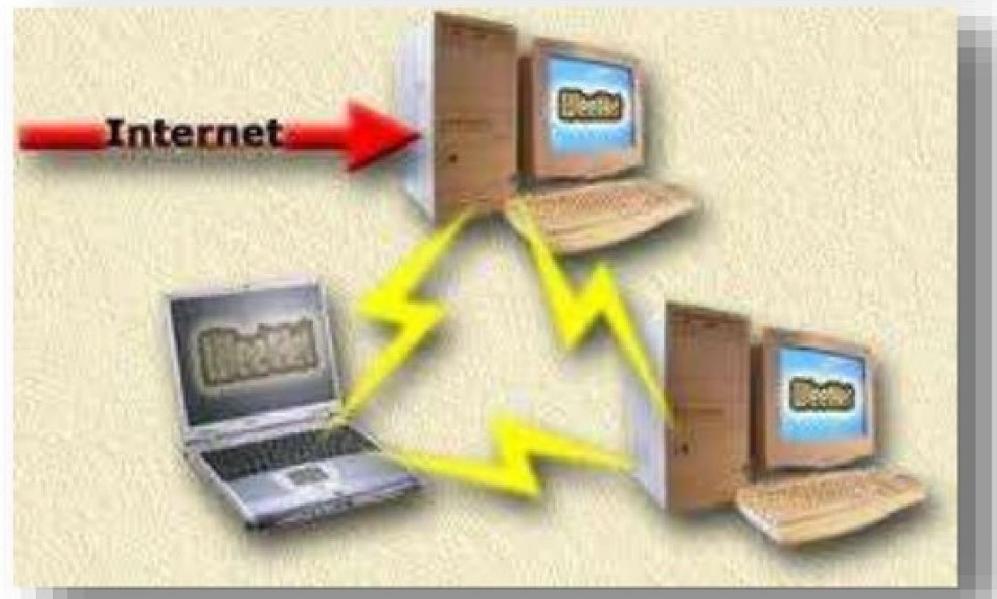
- The client communicate through Access Point.
- BSA-RF coverage provided by an AP.
- ESA-It consists of 2 or more BSA.
- ESA cell includes 10-15% overlap to allow roaming.



Peer-to-Peer topology

25

- AP is not required.
- Client devices within a cell can communicate directly with each other.
- It is useful for setting up of a wireless network quickly and easily.

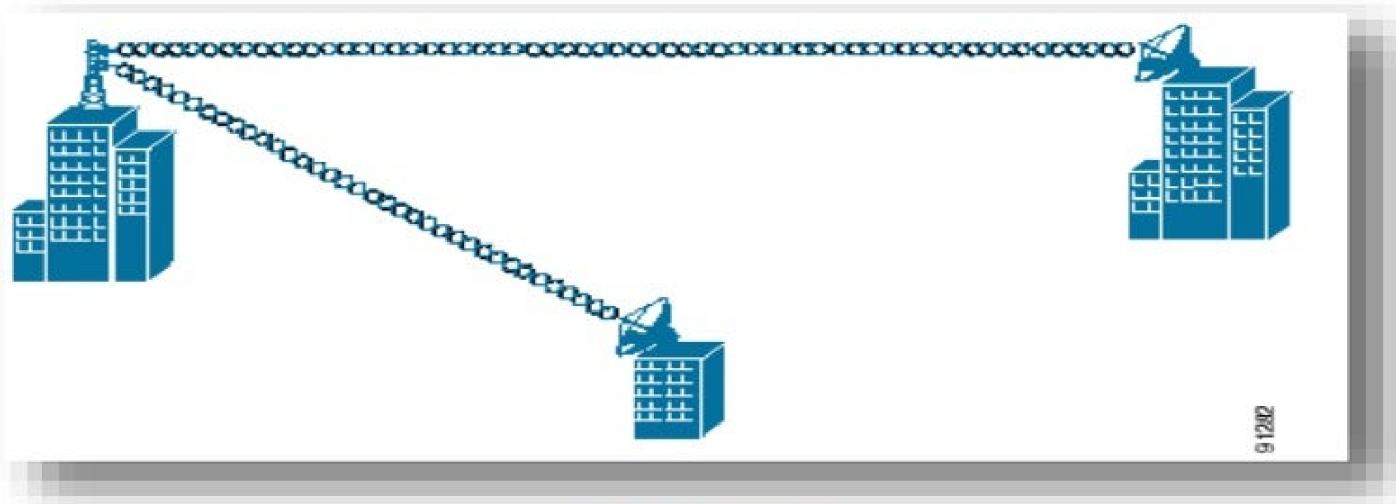


Wi-Fi Technology

Point-to-Multipoint bridge topology

26

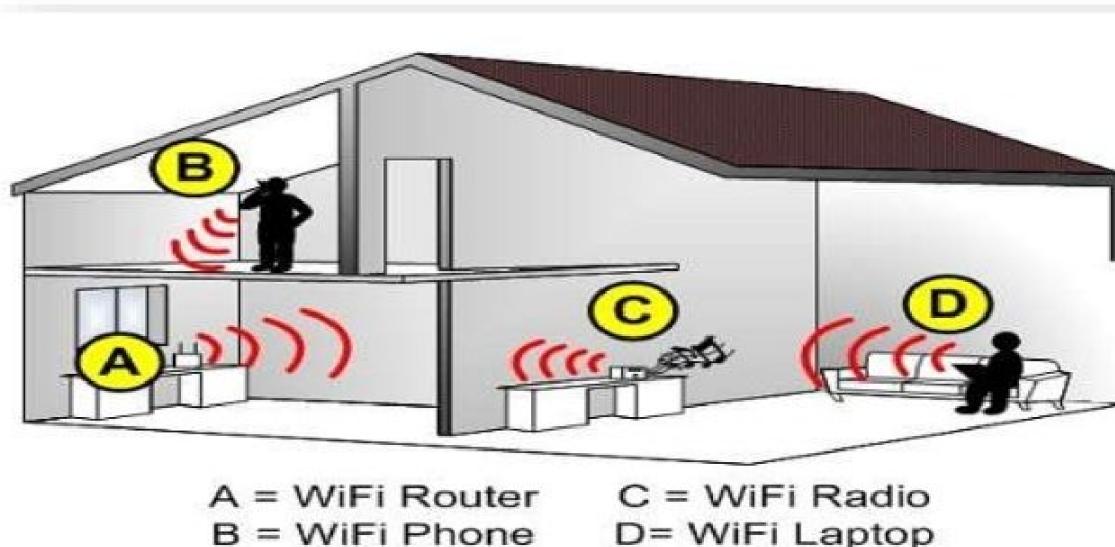
- This is used to connect a LAN in one building to LANs in other buildings even if the buildings are miles apart. These conditions receive a clear line of sight between buildings.
- The line-of-sight range varies based on the type of wireless bridge and antenna used as well as the environmental conditions.



Wi-Fi Configurations

27

- Wi-Fi is composed of three main sectors:
 - Home (individual residences and apartment buildings)
 - Public (Round about 70,000 “hotspots” through out the world)
 - Enterprise (corporations, universities, office parks)



Devices & Components

29



PCMCIA Card (Portables)



**PCI adapter
(inside)**



**USB adapter
(outside)**

Devices Contd.

30

Clients

- 2.4 GHz client adapter (802.11b)
- 5 GHz client adapter (802.11a)
- Workgroup bridge (802.11b)



Antenna

- 2.4GHz
- 5 GHz Antennas



Wi-Fi Direct: Wi-Fi P2P Connection



INTRODUCTION

- Wi-Fi direct is new technology
 - enhancing direct device to device communication without requiring a wireless access point.
- Wi-Fi direct builds upon the successful IEEE 802.11 infrastructure mode
 - lets devices negotiate who will take over the AP-like functionalities.

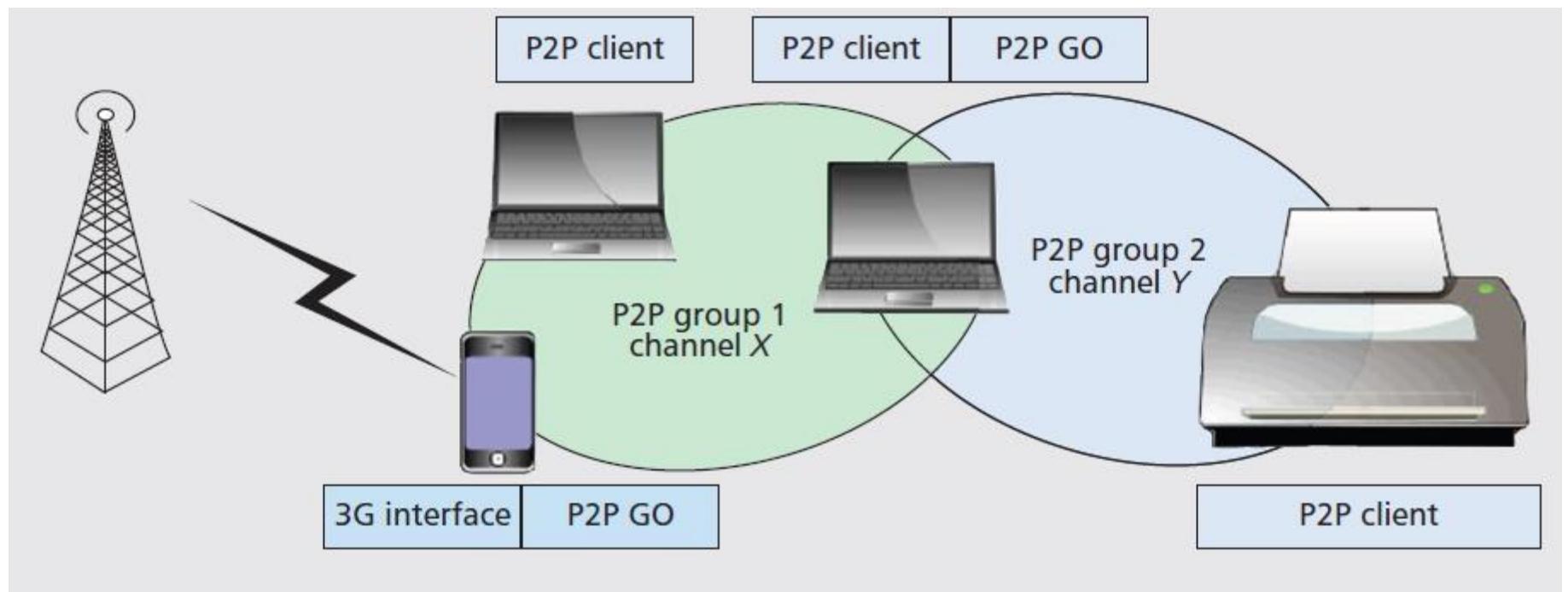
TECHNICAL OVERVIEW

- In a typical Wi-Fi network, client scans and associate to wireless networks available, which are created and announced by Access Points (AP).
- Wi-Fi Direct is that these roles are specified as dynamic,
 - hence a Wi-Fi Direct device has to implement both the role of a client and the role of an AP.
- These roles are therefore logical roles that could even be executed simultaneously by the same device, this type of operation is called Concurrent mode.

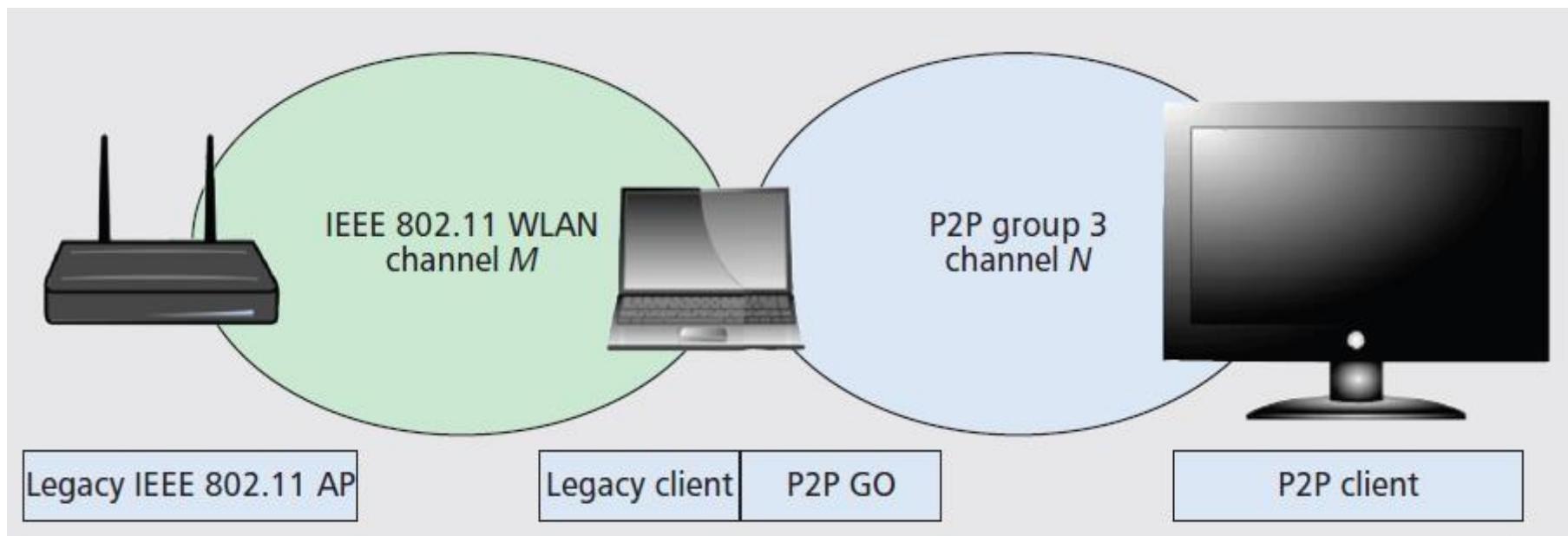
ARCHITECTURE

- Wi-Fi direct device communicate by establishing P2P group.
- The device implementing AP-like functionality in P2P group is referred to as the **P2P Group Owner(P2P GO)**, and device acting as client are known as **P2P clients**.
- Once P2P group is established, other P2P clients can join the group as in a traditional Wi-Fi network.
- When the device act as both as P2P client and as P2P GO
 - the device will typically alternate between the two roles by time-sharing the Wi-Fi interface
- Like a traditional AP, a P2P GO announces itself through beacons, and has to support power saving for its associated clients.

Wi-Fi Direct Setup: Scenario 1



Wi-Fi Direct Setup: Scenario 2



- Only the **P2P GO** is allowed to cross-connect the devices in its P2P group to an external network.
- Wi-Fi direct does not allow transferring the role of P2P GO within the group.
- If P2P GO leaves the P2P group then the group is break down, and has to re-established.