

# Home Wi-Fi

Bob Newcomb  
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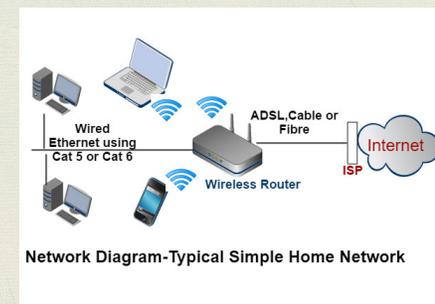
# Demystifying Wi-Fi



# What is Wi-Fi?

- ♦ Wireless networking protocol
  - ♦ Industry term for a type of LAN
    - ♦ Local Area Network
- ♦ In layman's terms
  - ♦ Internet access from a wireless-capable device
- ♦ Most devices support Wi-Fi so that the device can access a network to gain internet access and share network resources

# What does it look like?



## How does Wi-Fi work?

- ◆ Main Requirement
  - ◆ A device that receives and transmits a wireless signal
    - ◆ Router
    - ◆ sometimes a phone or computer

## Router



## Router

- ◆ Network hardware
- ◆ Wireless, uses Ethernet cable or both
- ◆ Allows communication between devices on your local network and the internet



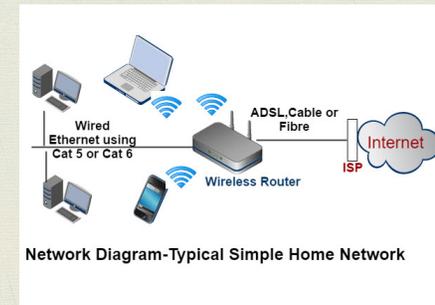
## Router - What it does

- ◆ “Runs” your network (LAN)
- ◆ Issues unique IP addresses for each device
  - ◆ i.e. 192.168.1.15
- ◆ Routes traffic to and from devices on your network
- ◆ Routes traffic to and from your ISP (internet service provider)

## Router - What it does

- ◆ Can allow multiple devices to connect to each other and to the internet
- ◆ There is a public IP address on the Internet side or Wide Area Network (WAN)
  - ◆ All traffic comes to the public IP address
  - ◆ The router sends and receives data to and from the private IP addresses of each device

## What does it look like?



## 802.11 - The icky details

- ◆ Set of technology standards for wireless networks
- ◆ Various updates have allowed manufactures to build network devices that have had increased
  - ◆ Speed
  - ◆ Range
  - ◆ LAN device capacity

## 802.11 variants

- ◆ 802.11a
- ◆ 802.11b
- ◆ 802.11g
- ◆ 802.11n Wi-Fi 4
- ◆ 802.11ac Wi-Fi 5 MIMO
- ◆ 802.11ax Wi-Fi 6 MIMO

With each step came increased performance, range and/or increased # of connected devices

## 802.11

- ◆ 802.11a/b/g are very slow by today's internet hungry world
- ◆ 802.11n or Wi-Fi 4 is capable of 1Gbps but.....
  - ◆ In practice it struggles to get 100 Mbps internet speed
- ◆ 802.11ac or Wi-Fi 5 is capable of 6.8 Gbps but.....
  - ◆ In practice I have received 200-400 Mbps internet speed
- ◆ 802.11ax or Wi-Fi 6 is capable of 9.6 Gbps but.....
  - ◆ In practice I have received 500 Mbps internet speed

## 802.11 - Frequency ranges

- ◆ 802.11b/g/n use the 2.4 GHz bands of frequency
- ◆ 802.11a/n/ac/ax use the 5 GHz bands
- ◆ The lower frequency has slower speeds and better range
- ◆ The higher frequency has higher speeds and reduced range

## 802.11 - Frequency ranges

- ◆ 2.4 GHz bands are subject to interference from:
  - ◆ Microwave ovens,
  - ◆ ISM (industrial, scientific and Medical) devices
  - ◆ Security cameras
  - ◆ cordless phones
  - ◆ baby monitors

## Latency

- ◆ This is the wait between request and response inside your network
- ◆ The more devices, the more chances of latency
- ◆ MIMO (Multi In, Multi Out)
  - ◆ Starting with Wi-Fi 5 it MIMO had 4X4 channels (think 4 4 lane freeways) for traffic to use
  - ◆ Wi-Fi 6 increased it to 8X8 channels which is 4 times as many

## Wi-Fi won't cover your house?

- ◆ Wi-Fi signals have trouble with
  - ◆ Walls (especially metal or metal frame walls)
  - ◆ Floors (especially concrete with rebar)
  - ◆ Large metal appliance (refrigerators)
  - ◆ Large multi-floor homes are problematic
- ◆ Test your Wi-Fi with speed test apps or websites such as speedtest.net

## Poor signal solutions

- ◆ Repeaters
  - ◆ Also called signal boosters and range extenders
  - ◆ Small devices - receive incoming signals and retransmit them
    - ◆ Tries to preserve signal intensity and distance data can travel
  - ◆ Connects to your LAN via wireless or Ethernet cable

## Poor signal solutions

- ◆ Repeaters
  - ◆ creates a separate network and passes data back forth from LAN to LAN
    - ◆ Sometimes transferring between networks as you walk around is problematic
  - ◆ Don't place the repeater too far from the router
    - ◆ Must have a good signal to repeat
    - ◆ Try half way to the dead spot(s)
    - ◆ This a less expensive option than Mesh routers

## Poor signal solutions

- ◆ Mesh Routers (using satellite hubs)
  - ◆ Separate hubs placed around the house to provide full coverage
  - ◆ Sold as packages and are designed to work with each other
  - ◆ Can have one to many satellite routers
  - ◆ Easily hands off between routers as you move about
  - ◆ Easily installed as they are built to work with each other
  - ◆ More expensive than repeaters

Eero Mesh Router & 2 Satellites



## Bridges

- ◆ Connects two networks
- ◆ Technically a repeater is a bridge however...
- ◆ Bridges are typically used to connect incompatible networks
  - ◆ Internet of Things bridges (often called hubs)
    - ◆ A Phillips Hue Hub is a Zigbee bridge so Phillips Hue lamps can be controlled by the Hub but can be accessed through your LAN

## But what does it mean for me?

- ◆ Internet usage has rapidly moved to video, streaming and meeting services
  - ◆ This trend will continue
  - ◆ 5G services by carriers will promote high band width services
  - ◆ The 5G competition will make ISPs improve their services
- ◆ Households are adding increased number of devices
  - ◆ phones
  - ◆ tablets
  - ◆ IOT (Internet of Things) devices
    - ◆ bulbs, switches, cameras, doorbells, thermostats etc.
- ◆ These can exceed your router's ability to handle it.

## Scenarios

- ◆ Light usage
  - ◆ Don't need really fast Internet
    - ◆ Not big on videos and don't see pauses for videos to buffer
    - ◆ Don't upload much
    - ◆ ISP is not providing fast speed (less than 50 Mbps) and you don't feel a need for more
  - ◆ Only a few devices use Wi-Fi and usually not at the same time
  - ◆ Speed tests in various of parts of the house don't show a steep drop off in Internet speed
- ◆ Shouldn't need to make any changes
  - ◆ Wi-Fi 4 should be good enough

## Scenarios

- ◆ Light usage but in a large house
  - ◆ Speed tests in various of parts of the house show steep drop offs in Internet speed
    - ◆ Large homes or homes with wall and floor interference
- ◆ Should look at Wi-Fi changes
  - ◆ Wi-Fi 5 or 802.11ac should be a help if your house about 1500 sq ft or less
  - ◆ You might be able to move the router to a more central location
  - ◆ For a larger home you may need repeaters or a mesh router

## Scenarios

- ◆ Heavier usage or you “feel the need for speed”
  - ◆ If speed tests show Internet speed is below what your ISP provides it is an indication you have a slower router (Wi-Fi 4 or earlier)
  - ◆ If the ISP is providing the router talk to them about an upgrade.
  - ◆ If you are using more and more devices upgrade to Wi-Fi 5 (or Wi-Fi 6 if you are using a lot of devices at the same time)
  - ◆ Wi-Fi 5 or 802.11ac should be a help if your house about 1500 sq ft or less
  - ◆ For a larger home you may need repeaters (budget approach) or a mesh router (best performance)
    - ◆ A Mesh router with one satellite is good for > 1500 sq ft < 2000 sq ft
    - ◆ Two satellites will for for 3000 sq ft.

## Wi-Fi 5 vs Wi-Fi 6

- ◆ Wi-Fi 6 is new and is not in all devices
  - ◆ Apple Devices
    - ◆ iPhone 11
    - ◆ 2019 iPad Pro and 2020 iPad Air
    - ◆ No Macs yet
  - ◆ Handles 4 times as many devices as Wi-Fi 5
  - ◆ Can handle more speed but ISPs aren't providing that speed yet
  - ◆ Will future proof you (for a while)

## Wi-Fi 5 vs Wi-Fi 6

- ◆ Wi-Fi 5
  - ◆ Cheaper
  - ◆ Moderate MIMO device handling
  - ◆ Most recent phones, tablets and computers use Wi-Fi 5
  - ◆ Handles 400 Mbps speed as provided by Spectrum

### Bob's "Found It" network



### Router

The Router interface for RBR750 shows two frequency bands: 2.4GHz and 5GHz. Under 2.4GHz, there is a printer (BRW008092D9124E) and a list of rooms: Family-Room Entertainment, Master-Bedroom Entertainment, and MasterBrdRmHomePod Entertainment. Under 5GHz, there is a list of devices: Joanne's iPad Pro Tablet, Bob's Newcombs iPad Tablet, Bob's iMac-27-5K Desktop, Bob's iMac-1 Desktop, and DLs-iMac-2.

### Satellite

The Satellite interface for Orbi Satellite-1 shows two frequency bands: 2.4GHz and 5GHz. Under 2.4GHz, there is a list of rooms: Family-Room Entertainment, Master-Bedroom Entertainment, and MasterBrdRmHomePod Entertainment. Under 5GHz, there is a list of devices: Bob's iMac-27-5K Desktop and Bob's iMac-1 Desktop.