

Computer Networking

7.3 WiFi: 802.11 Wireless LAN

7.3.1 802.11 Wireless LAN Architecture

GROUP MEMBERS:

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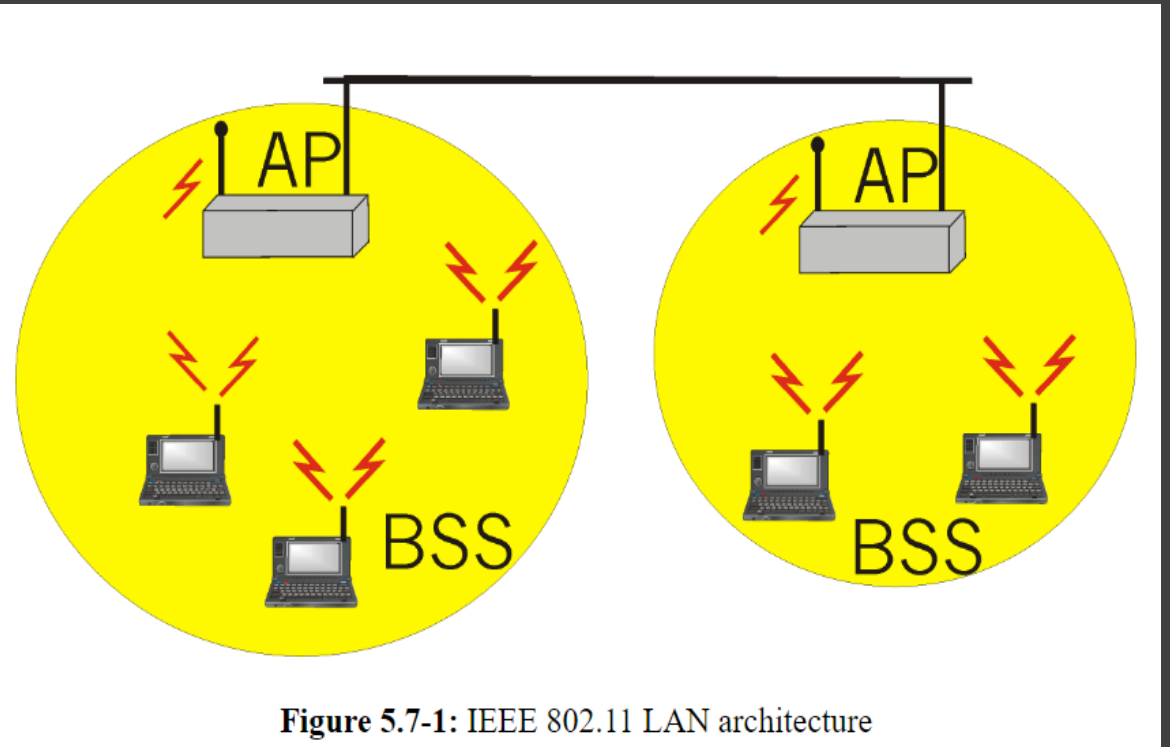
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What is Wireless LAN?

“A wireless LAN or **WLAN** is a wireless local area network that uses radio waves as its carrier.”



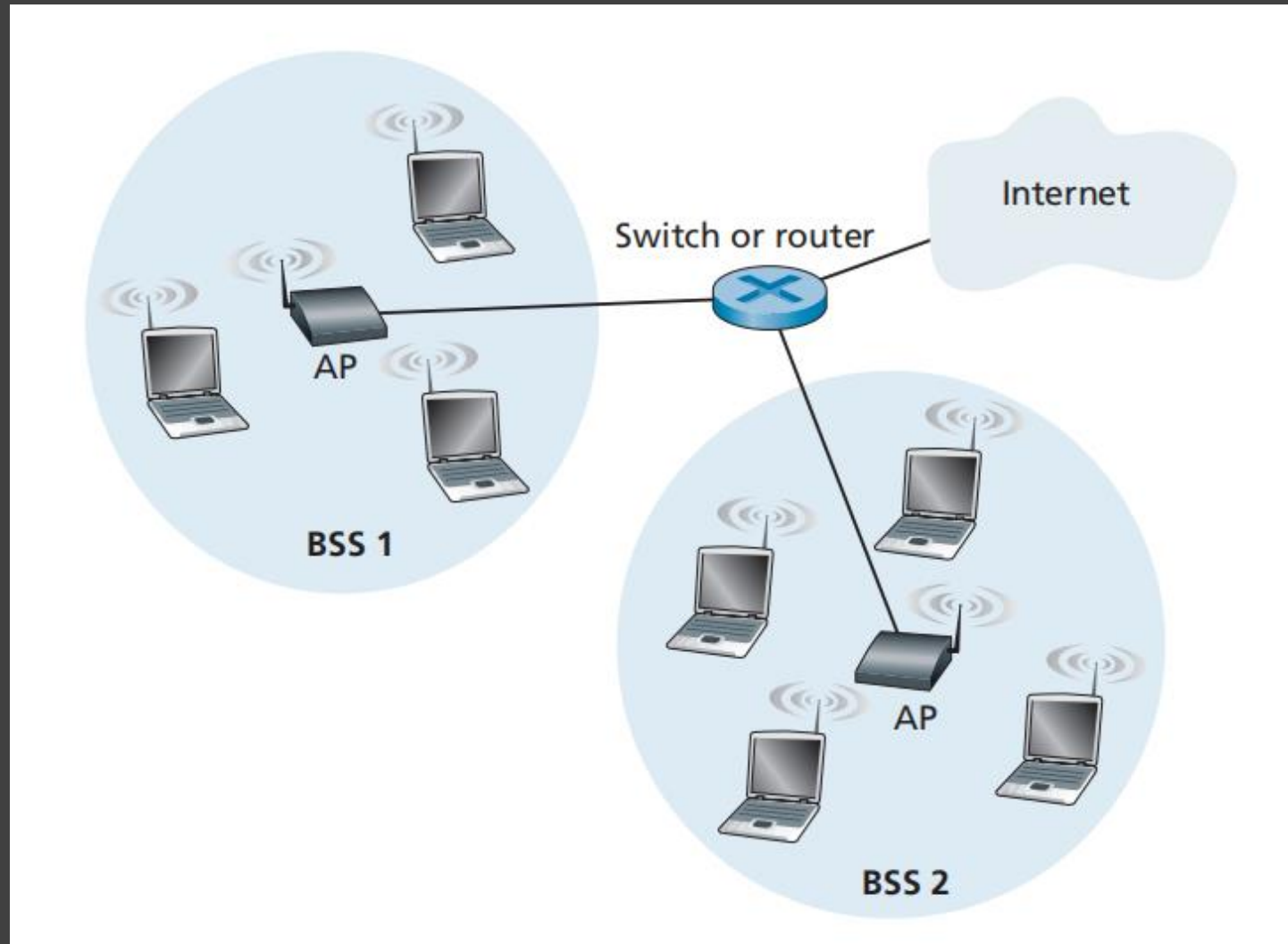
802.11 Wireless LAN

- 802.11 is a set of standards developed by **IEEE** for implementing wireless local area networking (WLAN) communication.
- Commonly referred to as **Wi-Fi**.
- **Radio waves** as medium.
- 70m range.
- 802.11 b, g, n, ac, ax are successive generations of 802.11.

IEEE STANDARDS FOR 802.11 WIRELESS LANs

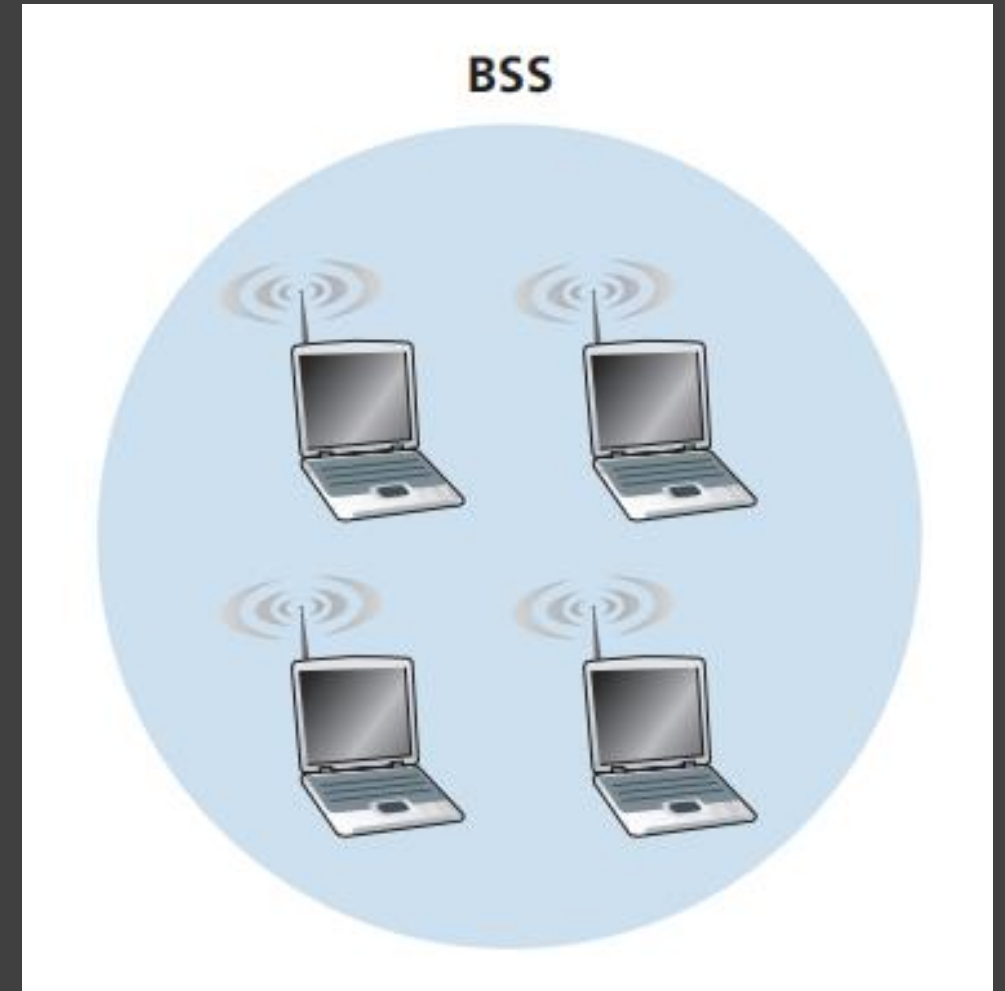
Standard	Year released	Speed	Range	Frequency
802.11 b	1999	11 Mbps	30 m	2.4 Ghz
802.11 g	2003	54 Mbps	30m	2.4 Ghz
802.11 n (WiFi:4)	2009	600 Mbps	70m	2.4, 5 Ghz
802.11 ac (WiFi:5)	2013	3.47 Gbps	70m	5 Ghz
802.11 ax (WiFi:6)	2020	14 Gbps	70m	2.4, 5Ghz
802.11 af	2014	35-560 Mbps	1km	54-790 Mhz
802.11 ah	2017	347 Mbps	1km	900 Mhz

802.11 Wireless LAN Architecture



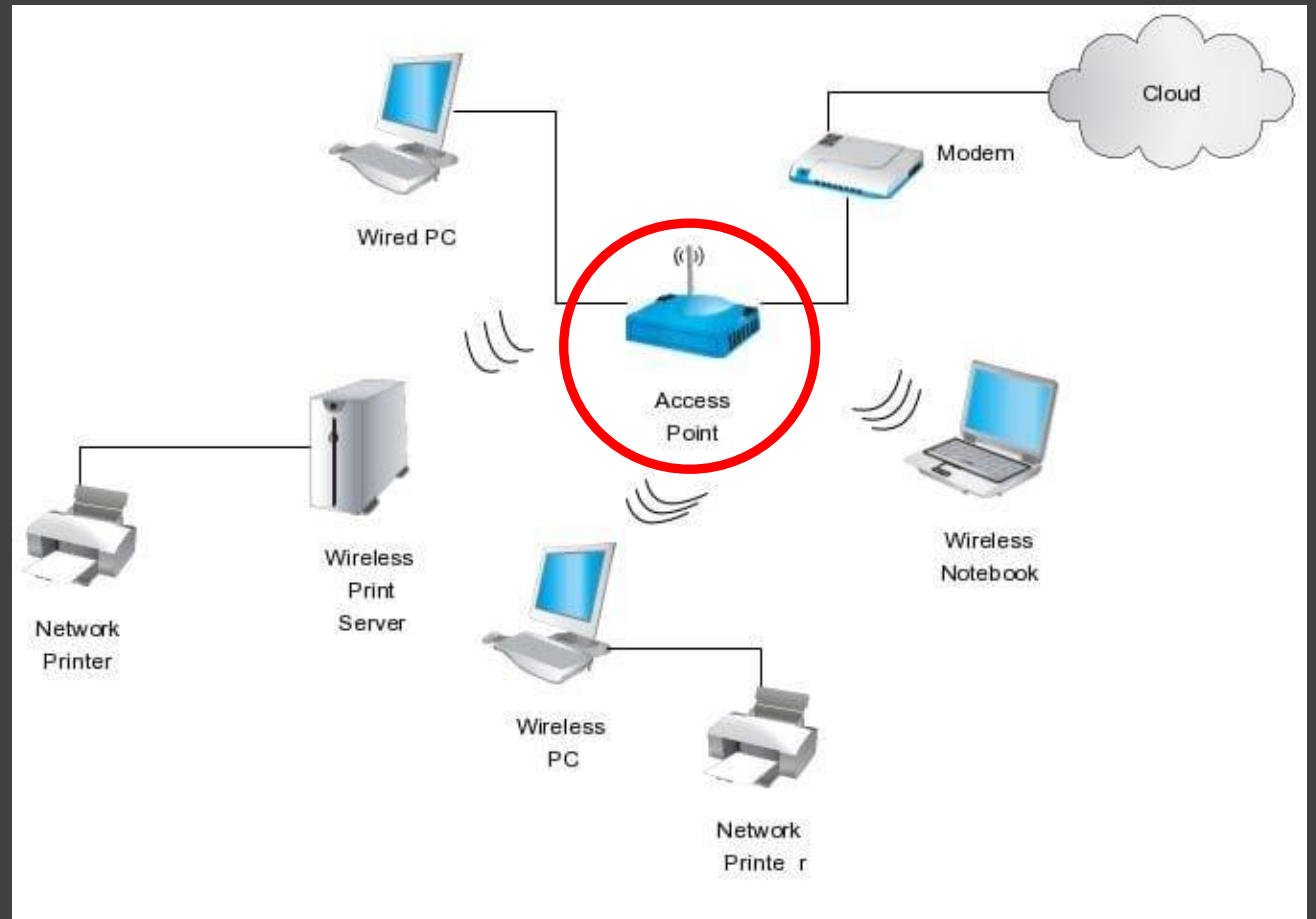
Basic Service Set (BSS)

- A fundamental building block of 802.11.
- Contains of one or more wireless stations and a central “base station” called **Access Point** (AP).



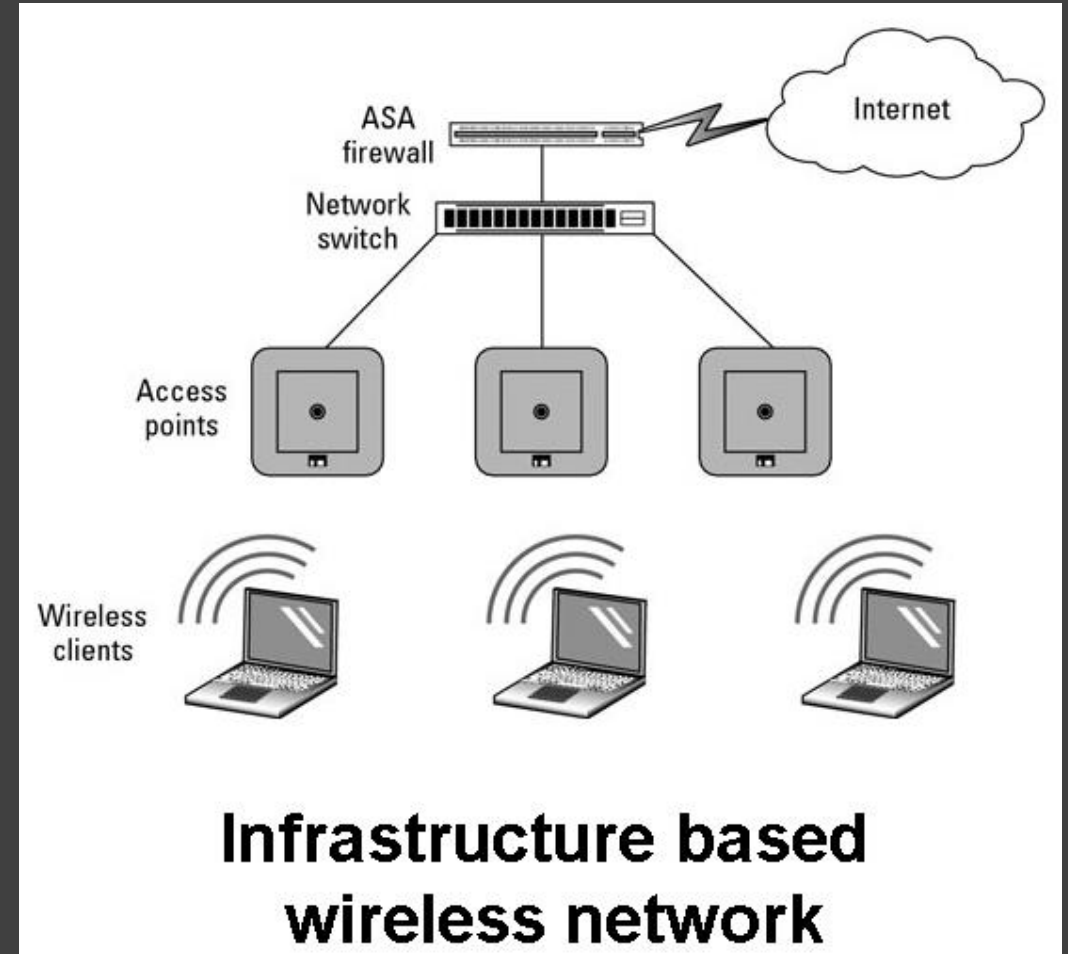
Access Point (AP)

- A networking hardware device that allows a Wi-Fi device to connect to a **wired network**.
- In infrastructure mode, it helps devices communicate with each other within a wireless network.



Infrastructure Wireless LANs

- **Wireless LANs** that deploy APs are often referred to as infrastructure wireless LANs.
- This "infrastructure" includes both the APs and the wired Ethernet framework that interconnects the APs and a router.



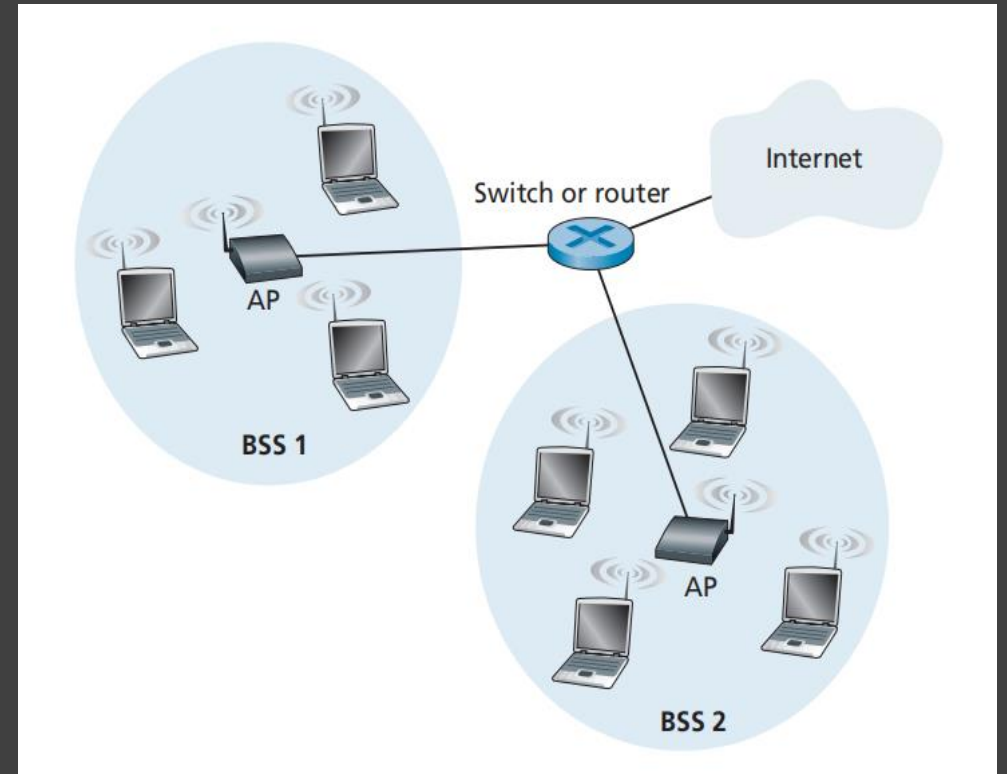
Ad Hoc Network

- IEEE 802.11 stations can also group themselves together to form an **ad hoc network**.
- A network with **no central control** and with no connection to the “outside world”.
- The network is formed spontaneously as devices come into proximity.
- No preexisting network infrastructure.



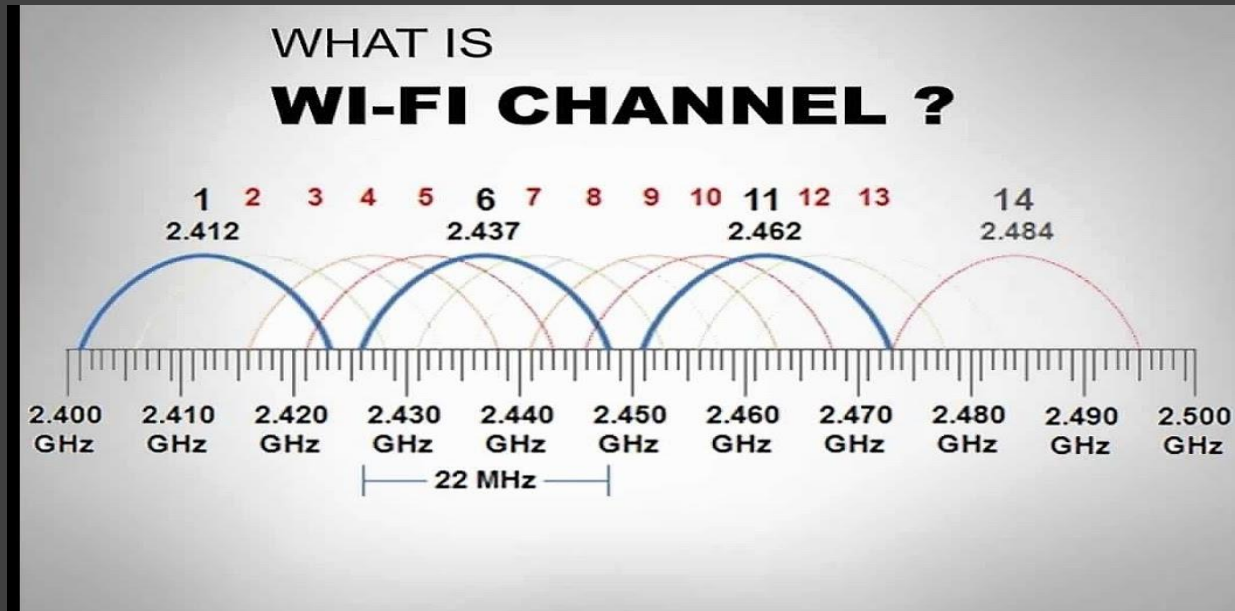
Channels and Association

- In 802.11, each wireless station needs to associate with an AP before it can send or receive network-layer data.
- When a network administrator installs an AP:
 - ❑ the administrator assigns a one or two-word Service Set Identifier (SSID - network name).
 - ❑ The administrator must also assign a channel number to the AP



Network Channels, or Wifi Channels:

- These are the medium through which your wireless network sends and receives data.
- 1, 6, and 11 is the set of three non-overlapping channels



2.4GHz Band	5GHz Band
1 - 2.412	36 - 5.180
2 - 2.417	40 - 5.20
3 - 2.422	44 - 5.220
4 - 2.427	48 - 5.240
5 - 2.432	52 - 5.260
6 - 2.437	56 - 5.280
7 - 2.442	60 - 5.300
8 - 2.447	64 - 5.320
9 - 2.452	149 - 5.745
10 - 2.457	153 - 5.765
11 - 2.462	157 - 5.785
	161 - 5.805
	165 - 5.825

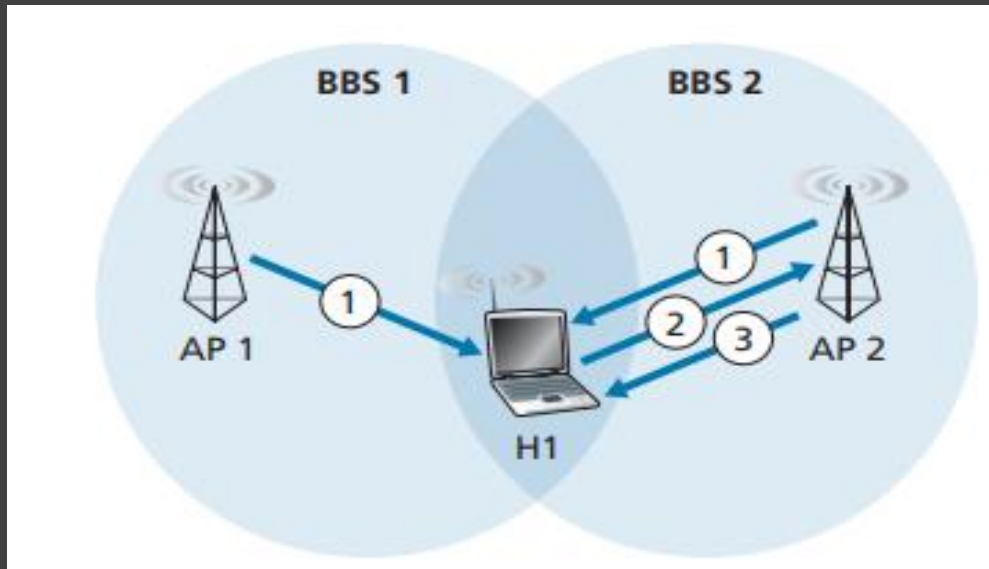
WiFi jungle

- A WiFi jungle is any physical location where a wireless station receives a sufficiently strong signal from two or more APs
- To gain Internet access, your wireless device needs to join exactly one of the subnets and hence needs to **associate** with exactly one of the APs.
- **Associating** means the wireless device creates a virtual wire between itself and the AP.
- But how does your wireless device associate with a particular AP?

Scanning (Active vs Passive)

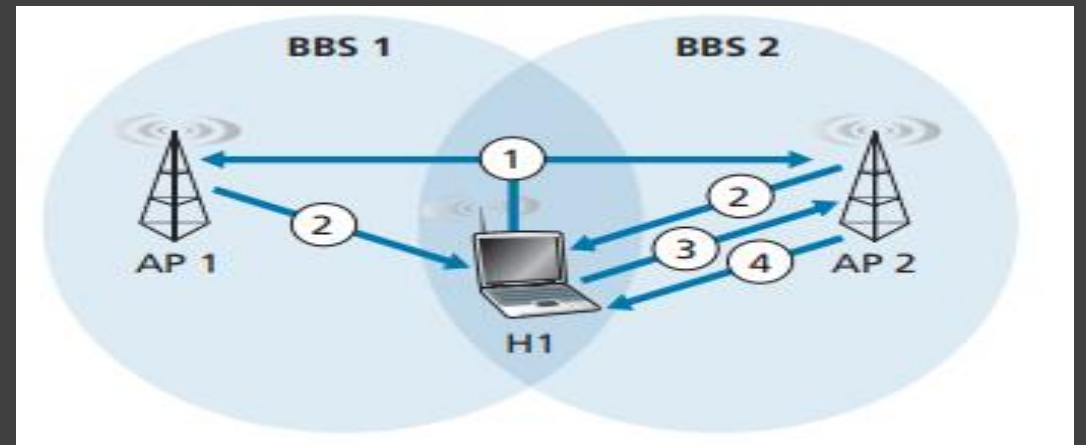
Passive Scanning

The process of scanning channels and listening for **beacon frames** is known as passive scanning.



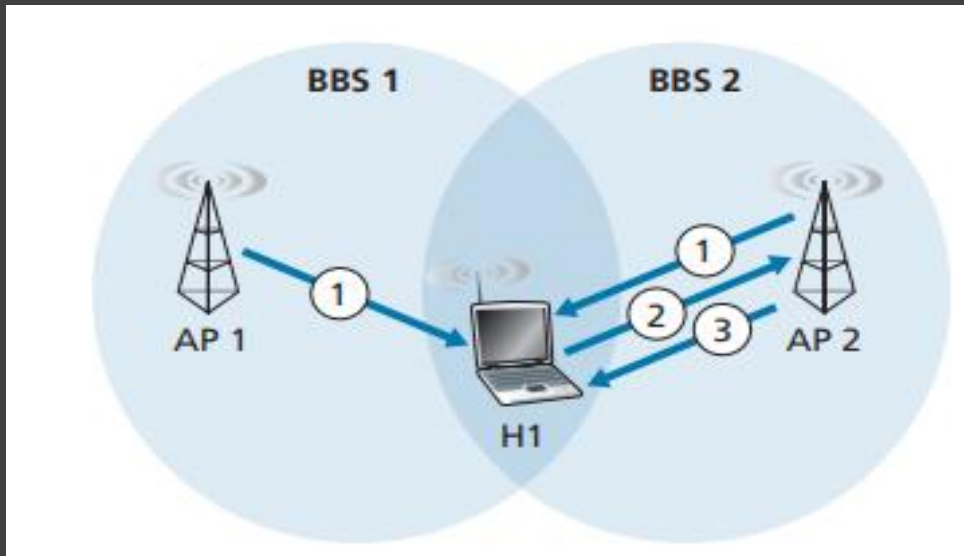
Active Scanning

A wireless device can also perform active scanning, by broadcasting a **probe frame** that will be received by all APs within the wireless device's range.



Passive Scanning

- Beacon frames sent from APs
- Association Request frame sent: H1 to selected AP
- Association Response frame sent: Selected AP to H1



Active Scanning

- Probe Request frame broadcast from H1
- Probes Response frame sent from APs
- Association Request frame sent: H1 to selected AP
- Association Response frame sent: Selected AP to H1

