# NETSIG 10/08/20

A few 802.11 Basics & Options for whole house networking

Basic terms

- **BSS** – An AP and all of the connected clients.

- **DS** – Distribution System connects multiple APs.

- **ESS** – One or more BSS combined into a single logical network.

- **MCS** – Modulation and Coding Scheme.

- **Physical Layer (PHY)** – The hardware & software that allows STA to communicate.

- **SSID** – Natural language ID of the ESS.

- **Station (STA)** – All devices connected to a WiFi network.
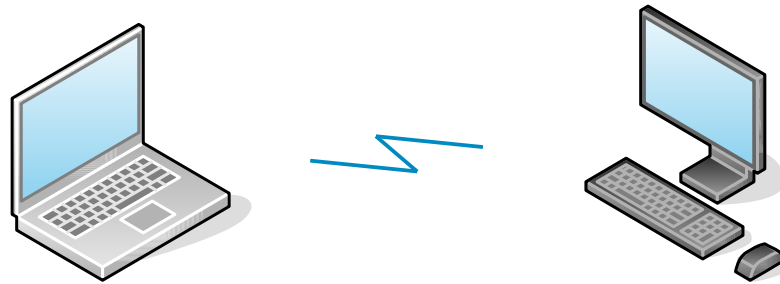
BSS - Basic Service Set

BSSID = MAC address of AP
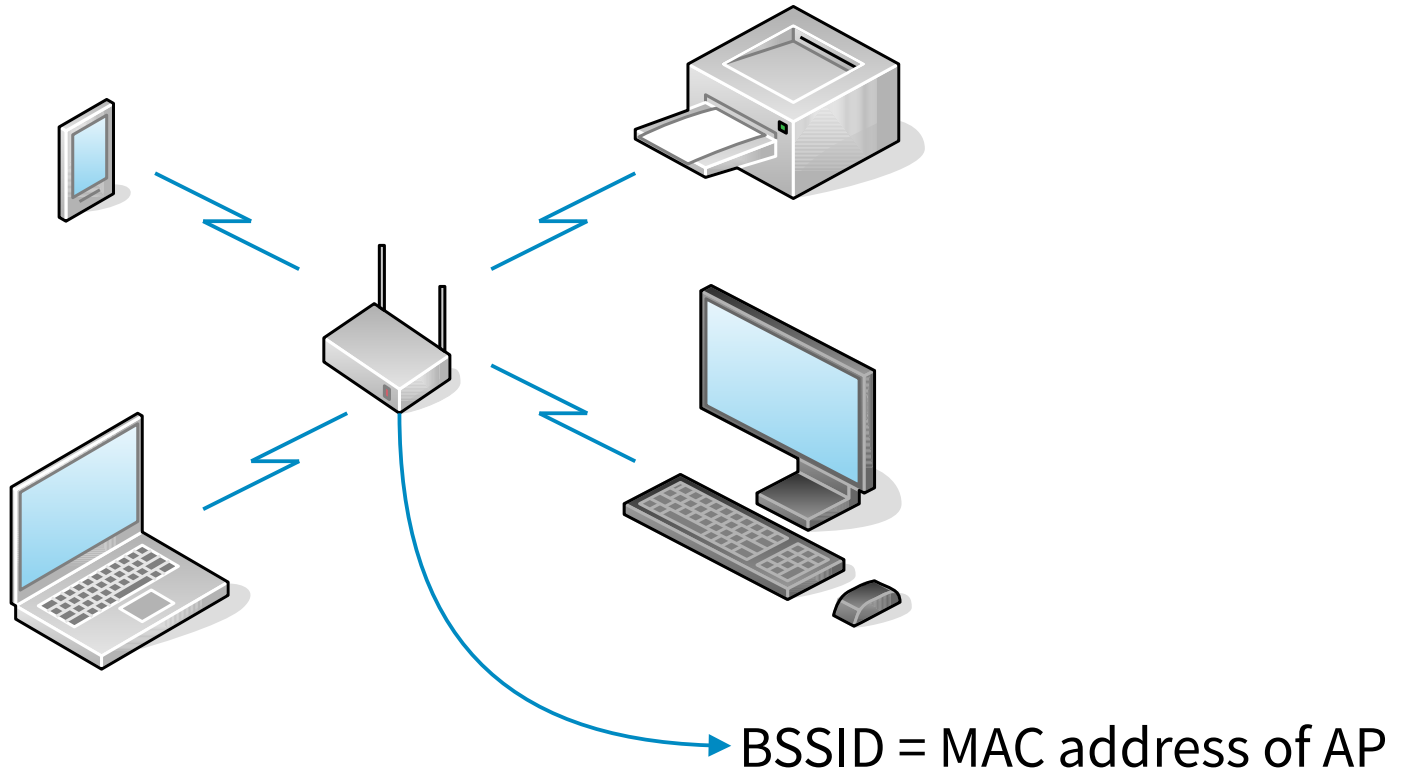
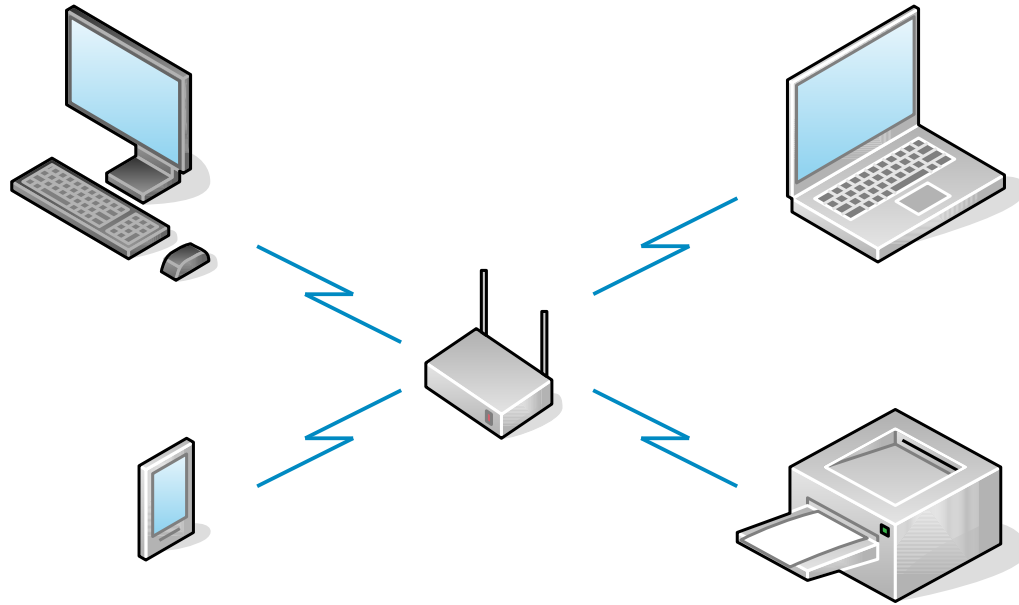# ESS - Extended Service Set

DS
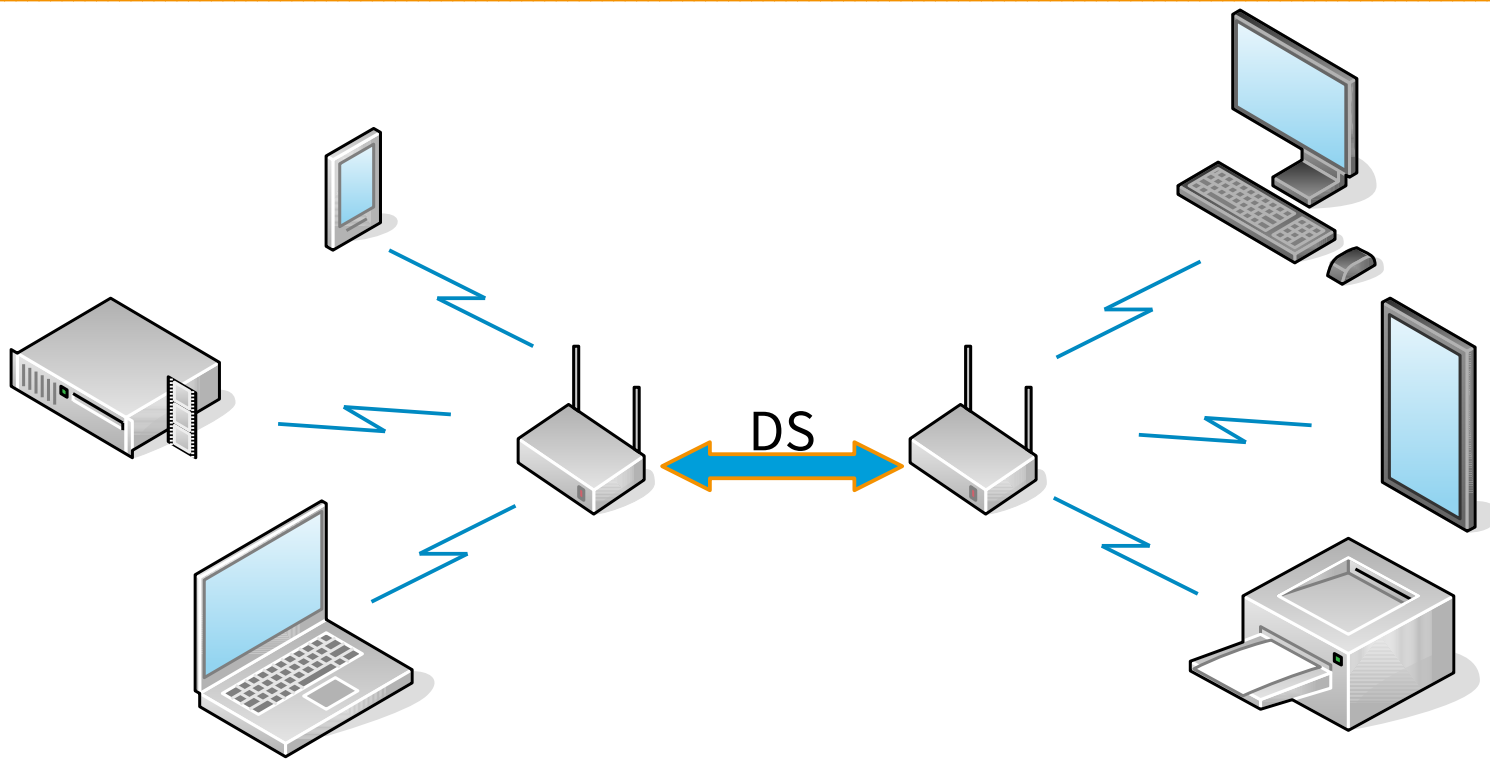
SSID = Natural language ID of ESS.

Two Modes of Operation

Ad Hoc – Peer to peer, no AP

Two Modes of Operation

Infrastructure – Uses an AP

WiFi radio frequency bands

The two most common radio rands for consumer WiFi are:

- 2.4GHz ISM band

- 5GHz ISM band

WiFi 2.4GHz band

- Longer range

  - Reaches further into your house but also allows more interference from your neighbor's WiFi overlapping yours

- Crowded – Microwave ovens, bluetooth, cordless phones, RC controllers, wireless microphones & speakers, lots more.

- Effectively only 3 channels available: 1, 6 and 11

- More older devices supported

WiFi 5GHz Band

- ~~More channels are available - less interference~~
  - Yes there are more non-overlapping channels available, but the 5GHz is also a shared service band with radar being the primary service.
  - Most WiFi will be limited to 36, 40, 44, 48 and 149, 153, 157, 161 and 165.
- Wider channels are available - more bandwidth.
- Shorter range
  - 5GHz radio signals are adsorbed at a higher rate by pretty much everything.
  - In some ways this is a useful attribute, neighbor's 5GHz signals aren't as strong.
  - More BSSs may be required cover your entire house/property.

Whole house WiFi Options
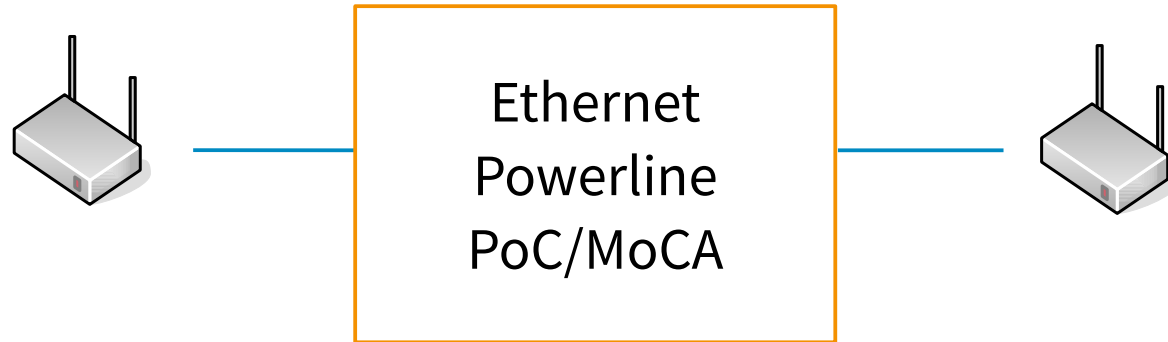
Distribution system

ESS
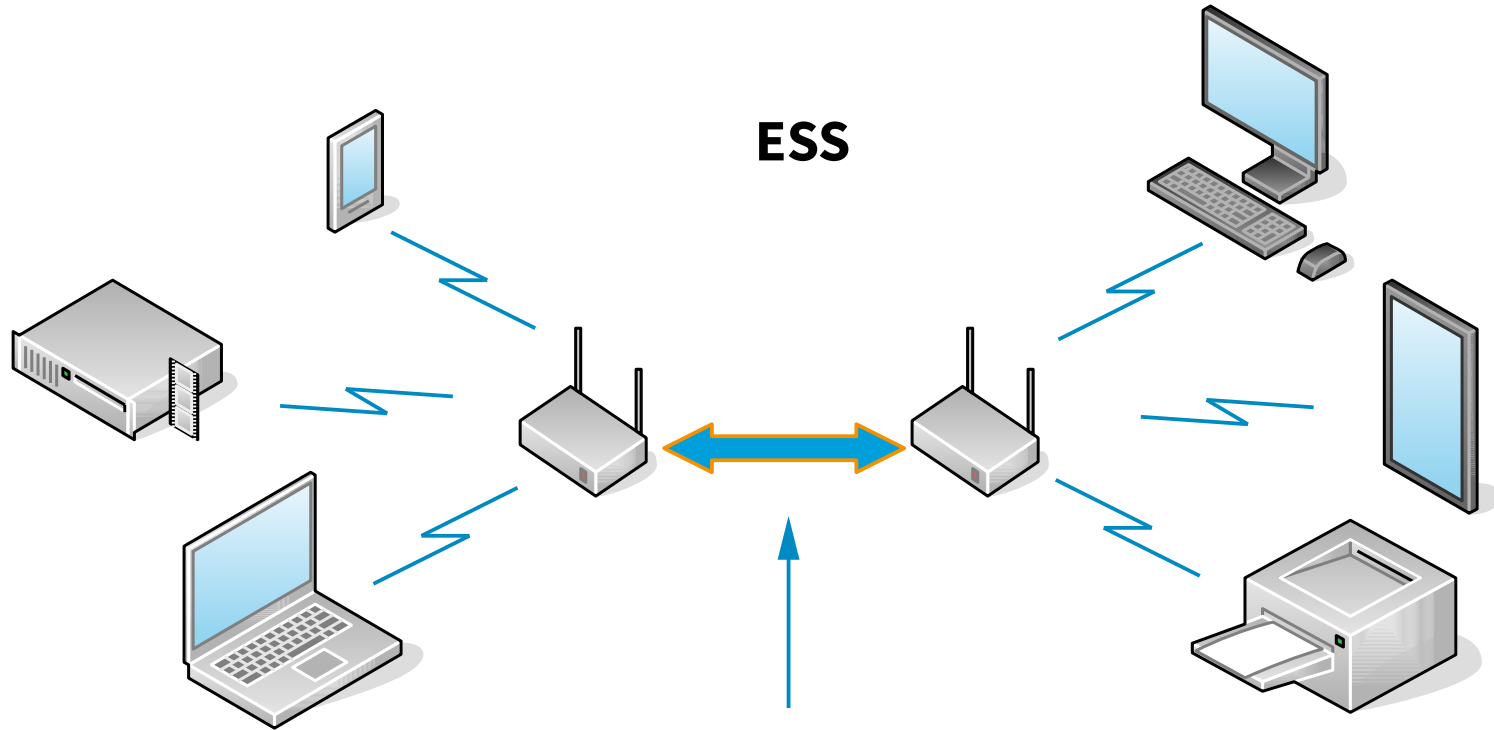
A distribution system is the link between two more more BSSs.

Distribution systems

- Wired

    - Ethernet – 802.3

    - Ethernet over Powerline

    - Ethernet over Coax – EoC or MoCA

- Wireless

    - WDS - Wireless Distribution System

    - 802.11s – Mesh (future presentation/hardware issues)

Distribution system - Wired

APs are connected through some form of wiring

Ethernet
Powerline
PoC/MoCA

Distribution system - Ethernet

Pro:

High speed

Con:

Need to run cable through walls or live with visible ethernet cables

Distribution system - Powerline

Pros:
- Simple to Install
- Power outlets are everywhere

Cons:
- May not work across different legs of house wiring or Powerline adaptors need to be on same circuit.
- Power strips which filter may cause them not to work.
- Radio frequency interference, turns wiring into antennas.

Distribution system - EoC/MoCA

Pro:
- Uses existing cable coax.
- Doesn't have RFI problems that Powerline has.

Con:
- Need to install POE filters on cable wire coming into the house and modem.
- Pricey.
- Limited to cable outlets.

Distribution system - Wireless

Pro:
- Doesn't have the disadvantages of Powerline or EoC/MoCA.
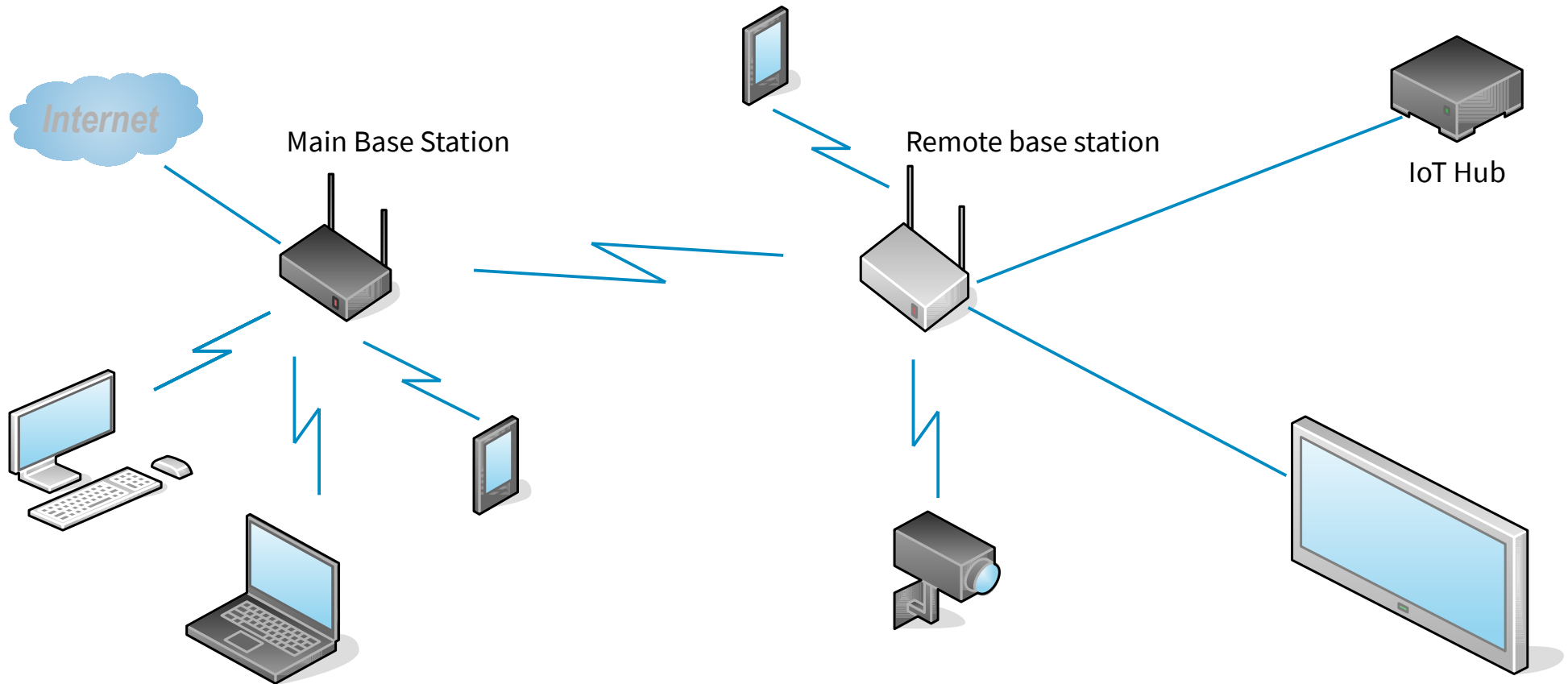- More options where AP can be placed.

Con:
- Data throughput could be cut in half
  - This may not be a real issue though.
    - Modern WiFi bandwidth is generally much higher than most Internet links.
    - Most WiFi usage doesn't need the highest throughput possible.
    - There is a scenario that can gain most of the advantage and mitigate most of the negative impact to bandwidth.

Wireless Distribution System

- Non standard extension to 802.11

  - There may be (and in my case are) compatibility issues between vendors.

- All stations must have the same

  - Radio channel

  - Method of encryption, e.g. WPA2-PSK

  - Encryption Key (PSK)

- May have different SSIDs

- All STAs are in the same IP subnet, i.e. same broadcast domain

A Typical Whole House Scenario

Internet

Main Base Station

Remote base station

IoT Hub

Remote AP bandwidth