Wireless & Mobile Computing

First Semester 3rd Class

Lecture Three

2025/2024

WLAN COMPONENTS

1. Wireless NICs, Network Interface Card

- Wireless deployments require a minimum of two devices that have a radio transmitter and a radio receiver tuned to the same radio frequencies:
- End devices with wireless network interface cards (NICs)
- A network device, such as a wireless router or wireless access point (AP)

- To communicate wirelessly, laptops, tablets, smart phones, and even the latest automobiles include integrated wireless NICs that incorporate a radio transmitter/receiver.
- However, if a device does not have an integrated wireless NIC, a *USB wireless adapter* can be used.

WLAN COMPONENTS

2. Wireless Home Router

- The type of infrastructure device that an end device associates and authenticates with varies based on the size and requirement of the WLAN. For example, a home user typically interconnects wireless devices using a small, wireless router.

- *The wireless router serves as the following*:
- Access point: This provides 802.11a/b/g/n/ac wireless access.
- Switch: This provides a four-port, full-duplex, 10/100/1000 Ethernet switch to interconnect wired devices.
- Router: This provides a default gateway for connecting to other network infrastructures, such as the Internet.

WLAN COMPONENTS

- A wireless router is commonly implemented as a small business wireless access device.
- The wireless router advertises its wireless services by sending beacons containing
- its shared *service set identifier (SSID)*.
- Devices wirelessly discover the SSID and attempt to associate and authenticate with it to access the local network and Internet.
- Most wireless routers also provide advanced features, such as
- high-speed access, support for video streaming,
- IPv6 addressing, quality of service (QoS), configuration utilities,
- and USB ports to connect printers or portable drives.

WLAN COMPONENTS

- Additionally, home users who want to extend their network services can implement *Wi-Fi range extenders*.
- A device can connect wirelessly to the extender, which boosts its communications to be repeated to the wireless router.
- **Wireless Access Points**
- Although range extenders are easy to set up and configure, the best solution would be to install another wireless access point to provide dedicated wireless access to the user devices.
- Wireless clients use their wireless NIC to discover nearby APs advertising their SSID.
- Clients then attempt to associate and authenticate with an AP.
- After being authenticated, wireless users have access to network resources.

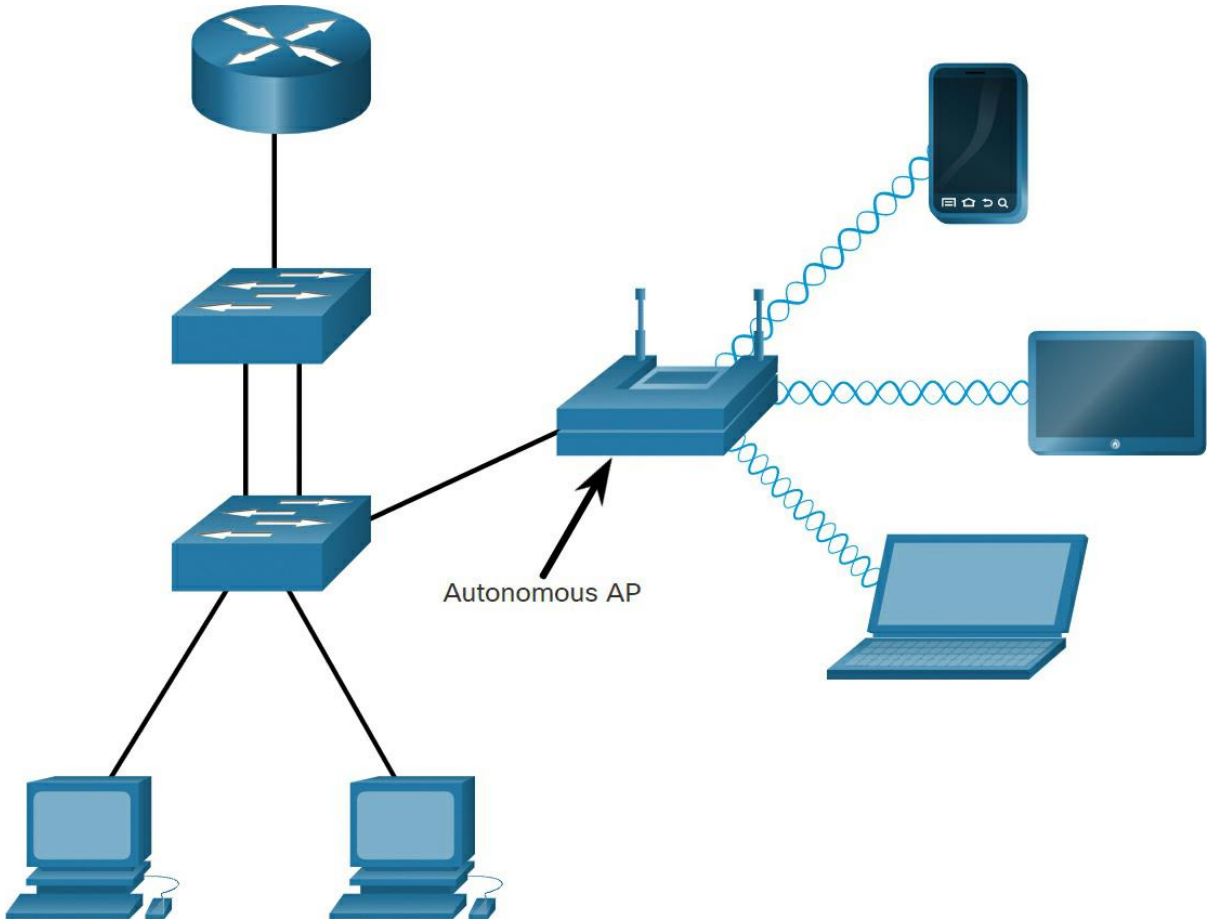
WLAN COMPONENTS

- AP Categories
- APs can be categorized as either autonomous APs or controller based APs.

1. Autonomous APs

- These are standalone devices configured using a command line interface (CLI) or a graphical user interface (GUI).
- Autonomous APs are useful in situations where only a couple of APs are required in the organization.
- A home router is an example of an autonomous AP,
- because the entire AP configuration resides on the device.
- If the wireless demands increase, more APs would be required.
- Each AP would operate independently of other APs, and each AP would require manual
- configuration and management.
- This would become overwhelming if many APs were needed.

Autonomous APs

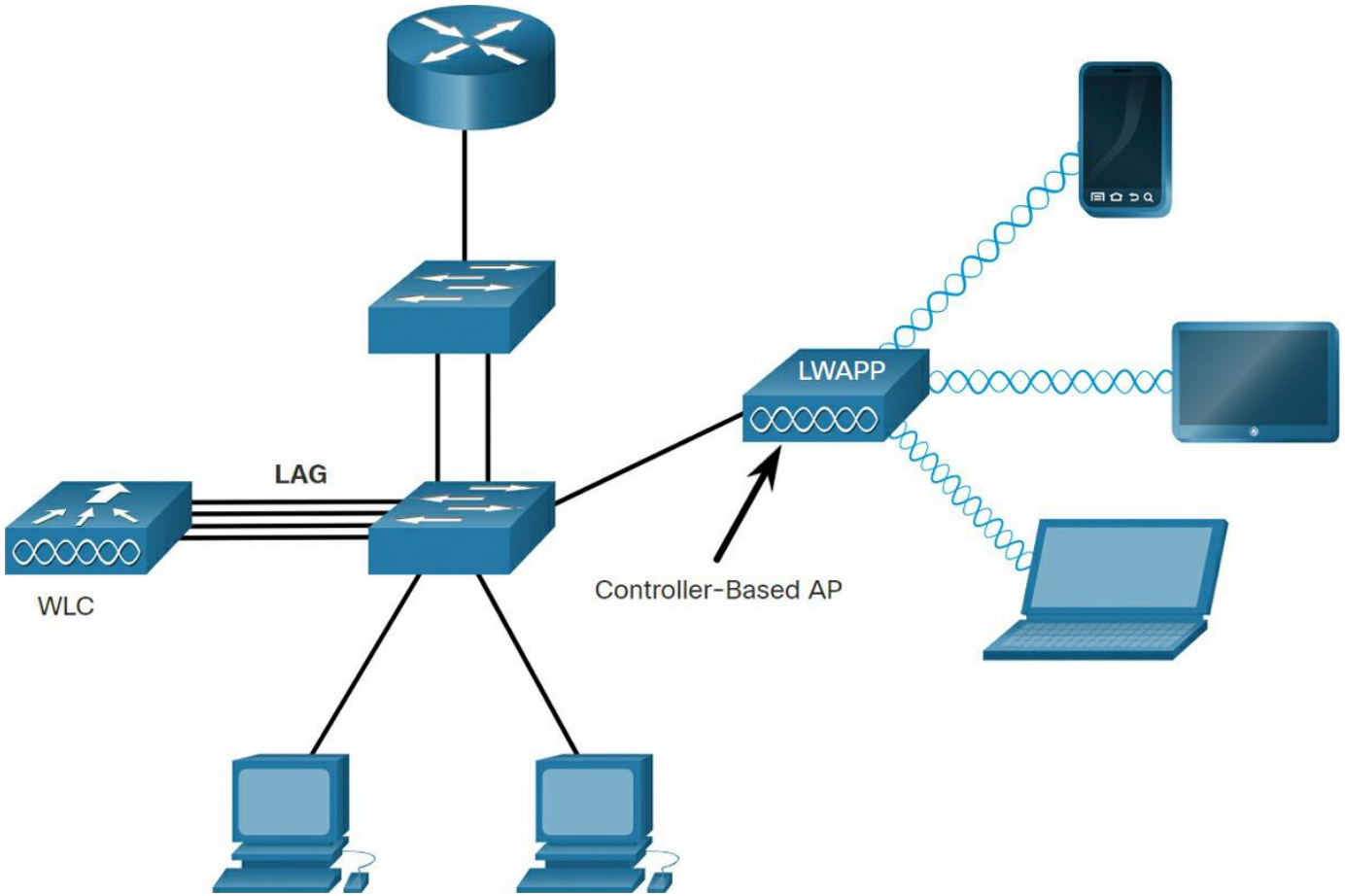


Controller-Based APs

2. Controller-Based APs

- These devices require no initial configuration and are often called lightweight APs (LAPs).
- LAPs use the Lightweight Access Point Protocol (LWAPP) to communicate with a WLAN
- controller (WLC).
- Controller-based APs are useful in situations where many APs are required in the network.
- As more APs are added, each AP is automatically configured and managed by the WLC.

Controller-Based APs



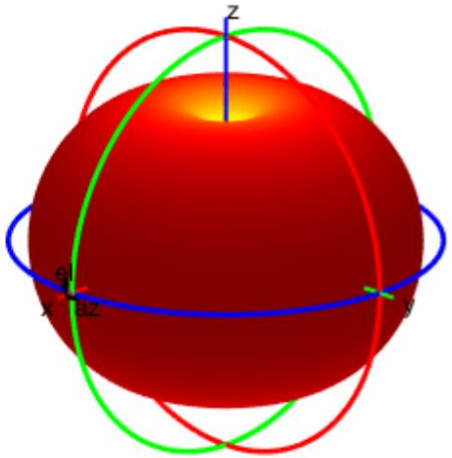
Controller-Based APs

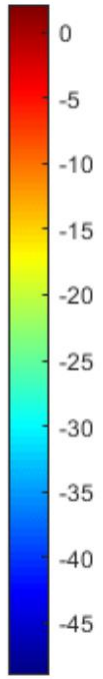
- Notice in the figure that the WLC has four ports connected to the switching infrastructure.
- These four ports are configured as a link aggregation group (LAG) to bundle them together.
- Much like how EtherChannel operates.
- LAG provides redundancy and load-balancing.
- All the ports on the switch that are connected to the WLC need to be trunking and configured with EtherChannel on.
- However, LAG does not operate exactly like EtherChannel.
- The WLC does not support Port Aggregation Protocol (PaGP) or Link Aggregation Control Protocol (LACP).

Wireless Antennas

- Most business class APs require external antennas to make them fully functioning units.

1. *Omnidirectional antennas*, provide 360-degree coverage and are ideal in houses, open office areas, conference rooms, and outside areas.





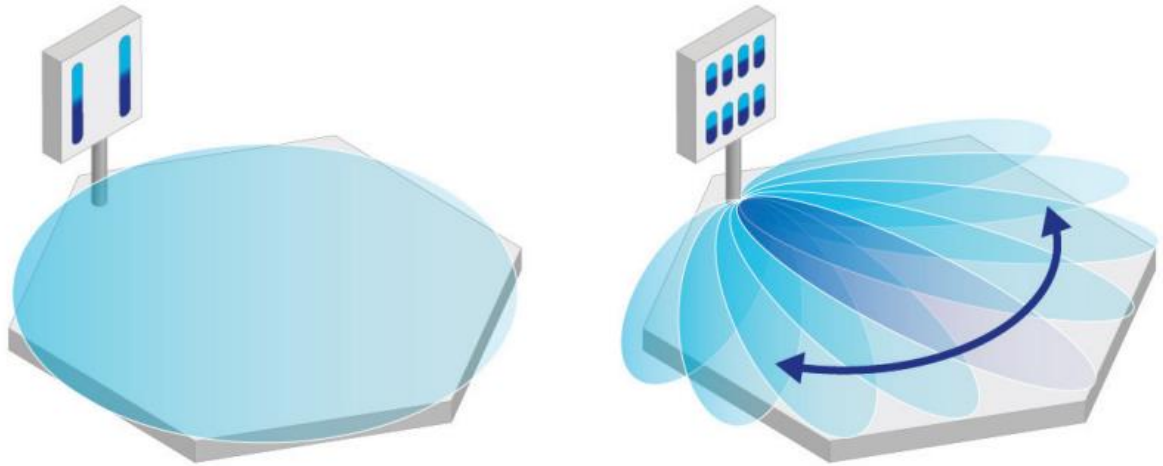
Wireless Antennas

2. *Directional antennas*

- focus the radio signal in a given direction.
- This enhances the signal to and from the AP in the direction the antenna is pointing.
- This provides a stronger signal strength in one direction and reduced signal strength in all other directions.
- Examples of directional Wi-Fi antennas include *Yagi antenna* and *parabolic dish antenna*.

Wireless Antennas

- *Multiple Input Multiple Output (MIMO)*
- uses multiple antennas to increase available bandwidth for IEEE 802.11n/ac/ax
- wireless networks.
- Up to eight transmit and receive antennas can be used to increase throughput.

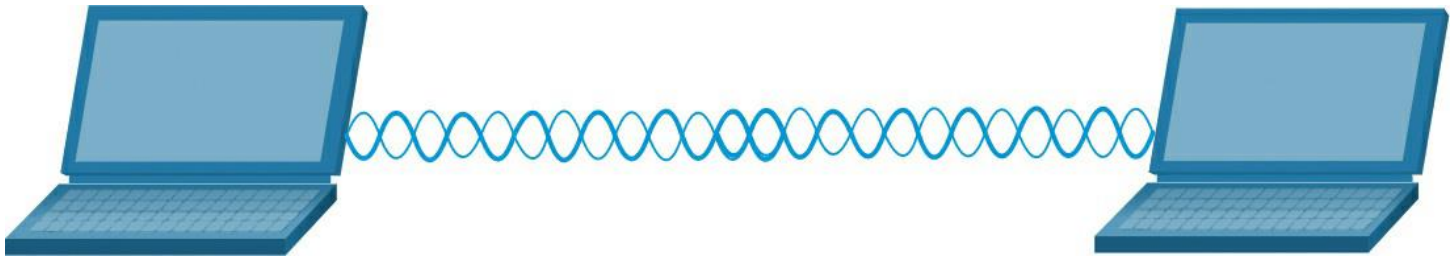


WLAN OPERATION

- *802.11 Wireless Topology Modes*
- Wireless LANs can accommodate various network topologies.
- The 802.11 standard identifies two main wireless topology modes:
- Ad hoc mode and Infrastructure mode

1. *Ad hoc mode*: This is when two devices connect wirelessly in a peer-to- peer (P2P) manner without using APs or wireless routers.

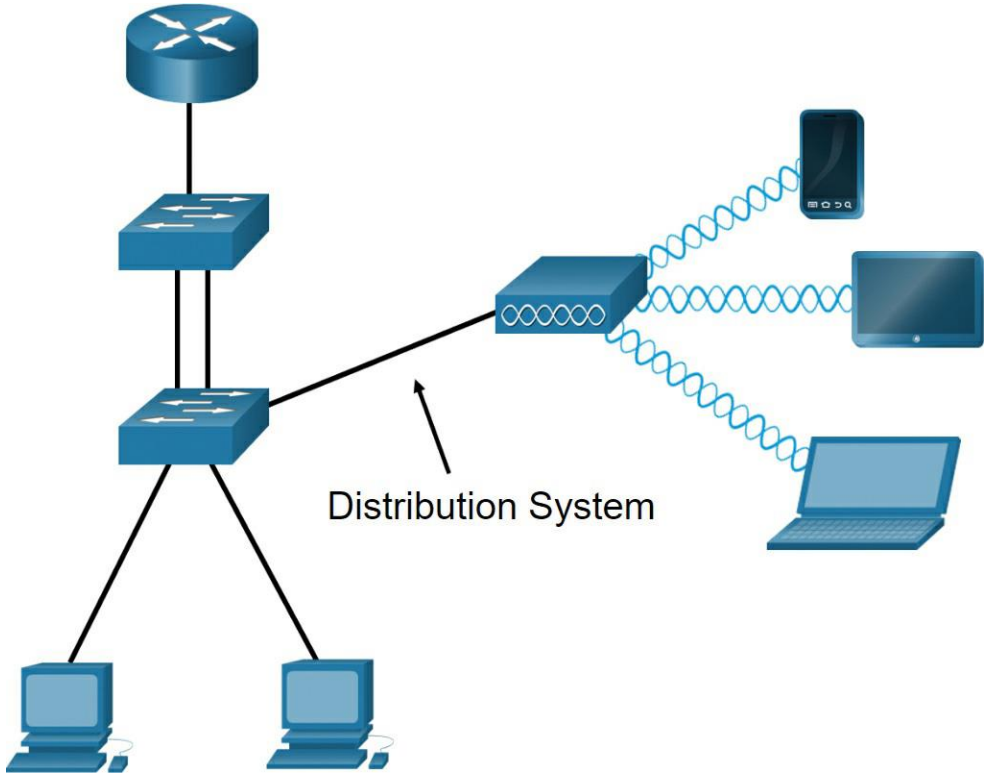
- Examples include wireless clients connecting directly to each other using Bluetooth or Wi-Fi Direct.
- The IEEE 802.11 standard refers to an ad hoc network as an *independent basic service set (IBSS)*.



WLAN OPERATION

2. *Infrastructure mode*:

- This is when wireless clients interconnect via a wireless router or AP, such as in WLANs.
- APs connect to the network infrastructure using the wired distribution system



WLAN OPERATION

3. *Tethering*:

- A variation of the ad hoc topology is when a smart phone or tablet with cellular data access is enabled to create a personal *hotspot*.

This feature is sometimes referred to as tethering.

- A hotspot is usually a temporary, quick solution that enables a smart phone to provide
- the wireless services of a Wi-Fi router.
- Other devices can associate and authenticate with the smart phone to use the Internet connection.