WiFi For Beginners Module 1

What is WiFi?

Introduction

Hello, my name's Nigel Bowden. Welcome to the WiFi for beginners podcast. This is a series of podcasts discussing the fundamentals of wireless LAN networking.

In each episode, we'll take a look at a different aspect of WiFi to build your understanding and knowledge of wireless LAN networks.

Each episode is be accompanied by a set of slides describing the topics covered in that episode. Although you don't need to review these slides whilst listening to the podcast, they will be useful for reviewing the material we discuss and may provide some visual aids to more fully understand some of the concepts and equipment described.

All recordings and supporting material can be found at WiFiForBeginners.com

Who Am I?

- Nigel Bowden
- UK Based
- IT & Telecoms Industry for 30+ years
- Specializing in Wireless LANs for 5+ years
- Industry certifications:
  - CWNP: Certified Wireless Network Expert (CWNE #135)
  - Cisco CCNP R&S
  - Cisco CCNP Wireless
  - Miscellaneous other vendor specific certs
- Roles: Design, Consultancy & Deployment of WLANs (mainly Cisco)
- Prolific social media participant:
  - @WiFiNigel (Twitter)
  - WiFiNigel.blogspot.com (Blog)

Aims of Podcast Series

- Present the fundamentals of WiFi in a series of audio presentations
  - Hopefully in an easy-to-understand format
  - Useful to those on a daily commute, driving, running etc.
- Who is it aimed at?
  - Most likely IT professionals, students, people interested in career move
- Assumed knowledge:
  - Fundamentals of the 7 layer OSI model
  - Ethernet
  - Switching and routing
  - IP addressing
  - Local Area Networks (LAN)
- WiFi in commercial/professional environment - not home

Series Topics

- 01 - What is WiFi?
- 02 - RF Basics
- 03 - Access Points
- 04 - More RF
- 05 - WiFi Clients
- 06 - Standards Bodies
- 07 - Wireless Control & Management
- 08 - Security
- 09 - WiFi Network Design
- 10 - Becoming a WiFI Guru

In This Episode

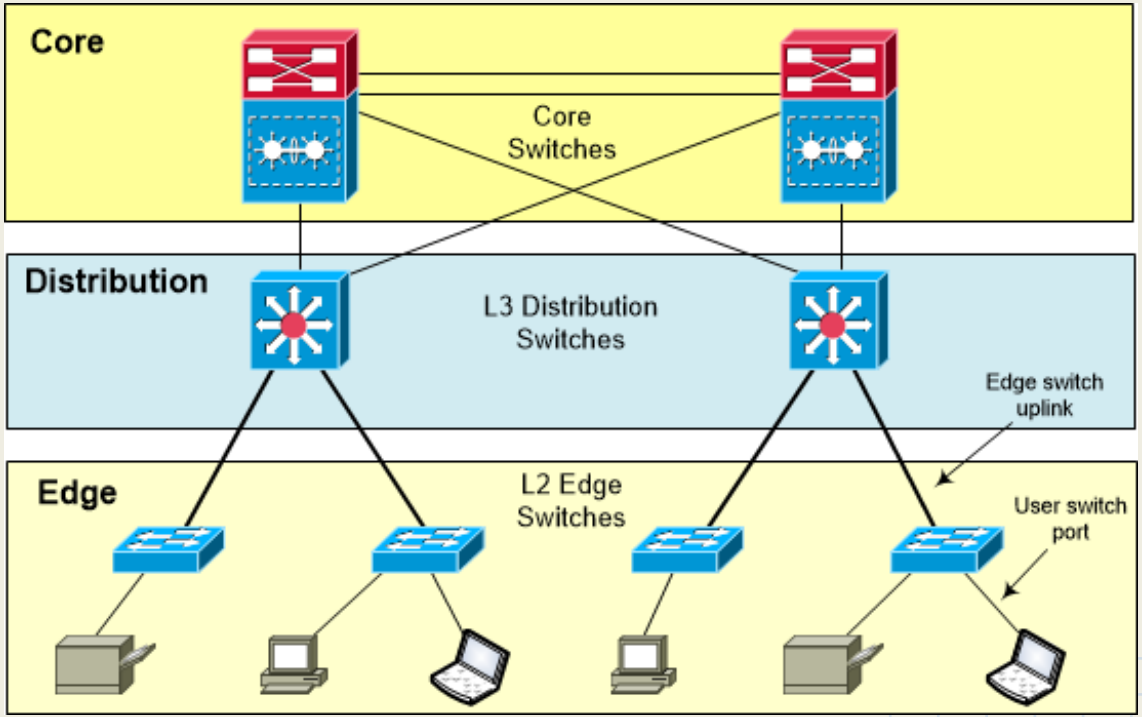
- What is a WiFi network?
- What is a wireless client?
- What is a wireless access point?
- What is a wireless controller?
- WiFi Security
- Wireless LAN Standards

What is a "WiFi?" Network?

- "WiFi" is brand name of the WiFi Alliance, used
  - Industry organisation responsible for interoperability testing of equipment
- A “WiFi” network is a wireless network which is more correctly: "Wireless LAN" (WLAN)
  - Wireless Local Area Network
- WiFi Network & Wireless LAN terms for the same type of wireless network
- Wireless LAN (WiFi network): a wireless network that uses equipment that conforms to the IEEE 802.11 standard
- Doesn’t include similar wireless technologies such as Bluetooth or Zigbee
- Like a “LAN”, a “WLAN” generally constrained to a floor/building/campus
  - Some “edge” cases e.g. point to point links between buildings

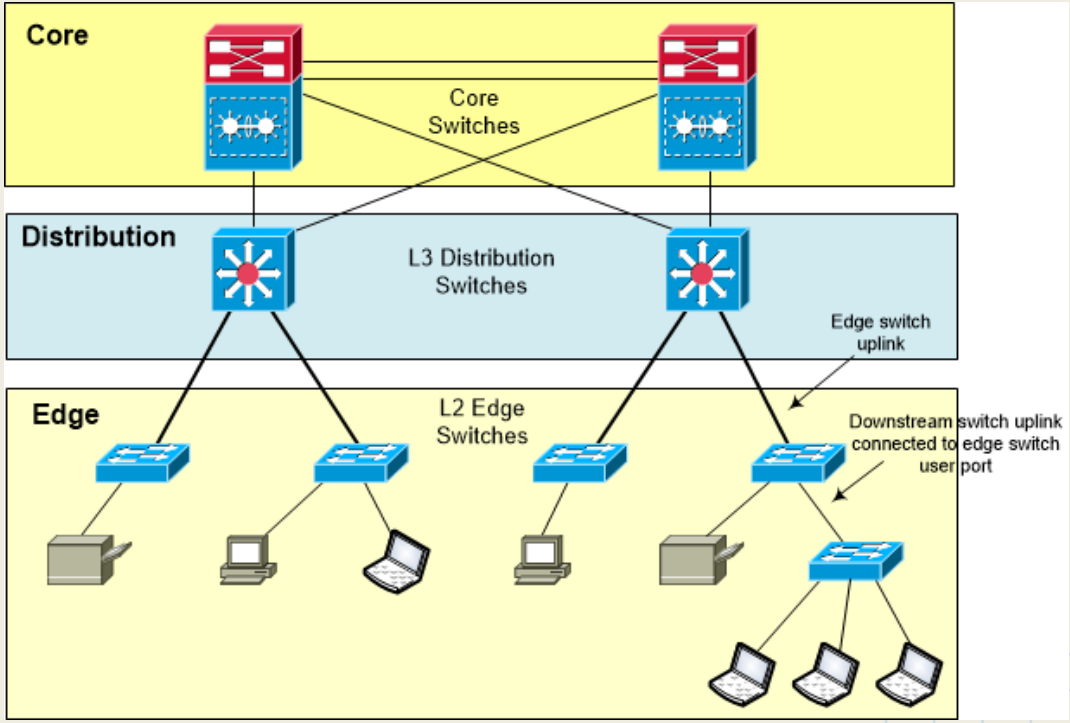
Reference Model

Standard Wired Network:



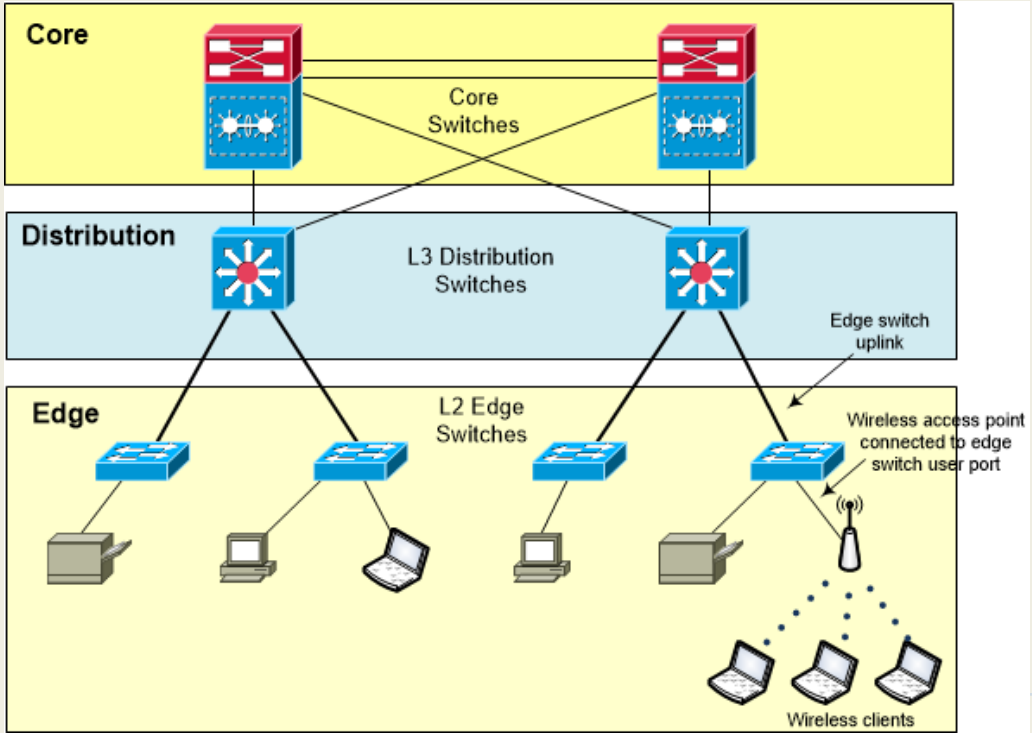
Reference Model

Extended edge (switch):



Reference Model

Extended edge (access point):



What is a "WiFi?" Network?

- WLANS deployed in many environments including:
  - Education (schools & universities)
  - Healthcare (hospitals)
  - Manufacturing
  - Logistics
  - Enterprise
  - Hospitality (hotel/conference)
  - Stadium
  - Home
  - Small/Medium business
- Each has own requirements & challenges

What is a "WiFi?" Network?

- Main wireless infrastructure components:
  - Wireless Access Points (AP)
  - Wireless Clients (e.g. laptops, tablets, smartphones)
  - Wireless LAN controller
  - (Data) Cable Infrastructure
- Although a WLAN is a “wireless” network, still requires a wired network to connect wireless infrastructure together and provide access to services
- A WLAN is generally overlaid on a (wired) LAN
- APs installed at the edge layer of network: extension of edge switches
- The job of the wireless network is to convert wireless client data into a format to be placed back on to wired network
  - instead of wired edge switch port, we have a wireless edge connection

What is a wireless client?

- Wireless “Client”
  - a user device that has WiFi capability
  - examples: tablets, smartphones, laptops, barcode scanners, medical equipment, security systems
  - may also be referred to as a “Station” in 802.11 standard & textbooks
- Wireless “clients” connect over a wireless connection to an “access point” using radio signals which carry user data
  - instead of connecting a device in to the edge of a network by plugging our client in to a switch, a wireless connection ‘plugs’ device in to network
  - For wired devices (clients), use an 802.3 layer 2 connection
  - For wireless device (clients), use an 802.11 layer 2 connection

What is a wireless client?

- Clients all have two major RF components:
  - radio - transmit & receive signals
  - antenna - may be multiple
- Capabilities of clients vary considerably:
  - How much power they have to transmit a signal
    - battery powered?
      - power levels, capacity
  - How well they can “hear” signals from the wireless network
    - size, type and number of antennas
  - Which IEEE 802.11 standard amendments they support
    - 802.11g, 802.11n, 802.11ac

What is an access point?

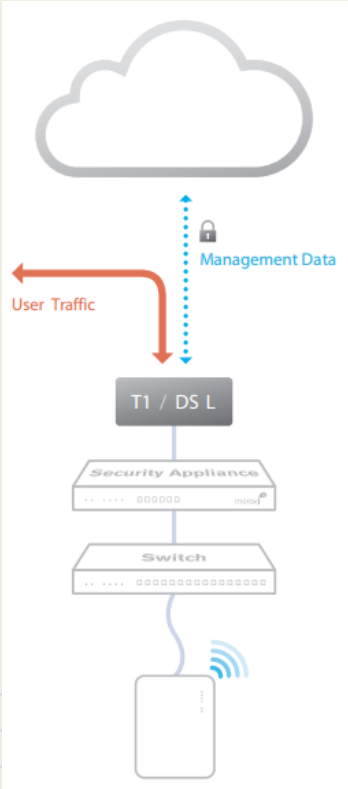
What is an access point?

- AP can be thought of in two halves:
  - wireless : radio & antenna
  - wired: Ethernet port
- Primary job is to convert radio frequency signals carrying data to/from clients on wireless side into data to flow through its Ethernet port on the wired side
- Acts as a “bridge” between clients data (over RF link) and the Ethernet network
  - converts between 802.11 & 802.3 frames
- Ethernet network is edge layer of wired network
  - access points typically share same area of the wired network

What is an access point?

- Often more than one radio as AP may support more than one band
  - 2.4GHz
  - 5GHz
- Multiple antennas - generally 2 to 4
  - internal
  - external
- Generally suspended from ceilings or walls throughout facility
- Coverage provided by each access point limited, so generally have them installed throughout a facility

What is a wireless controller?



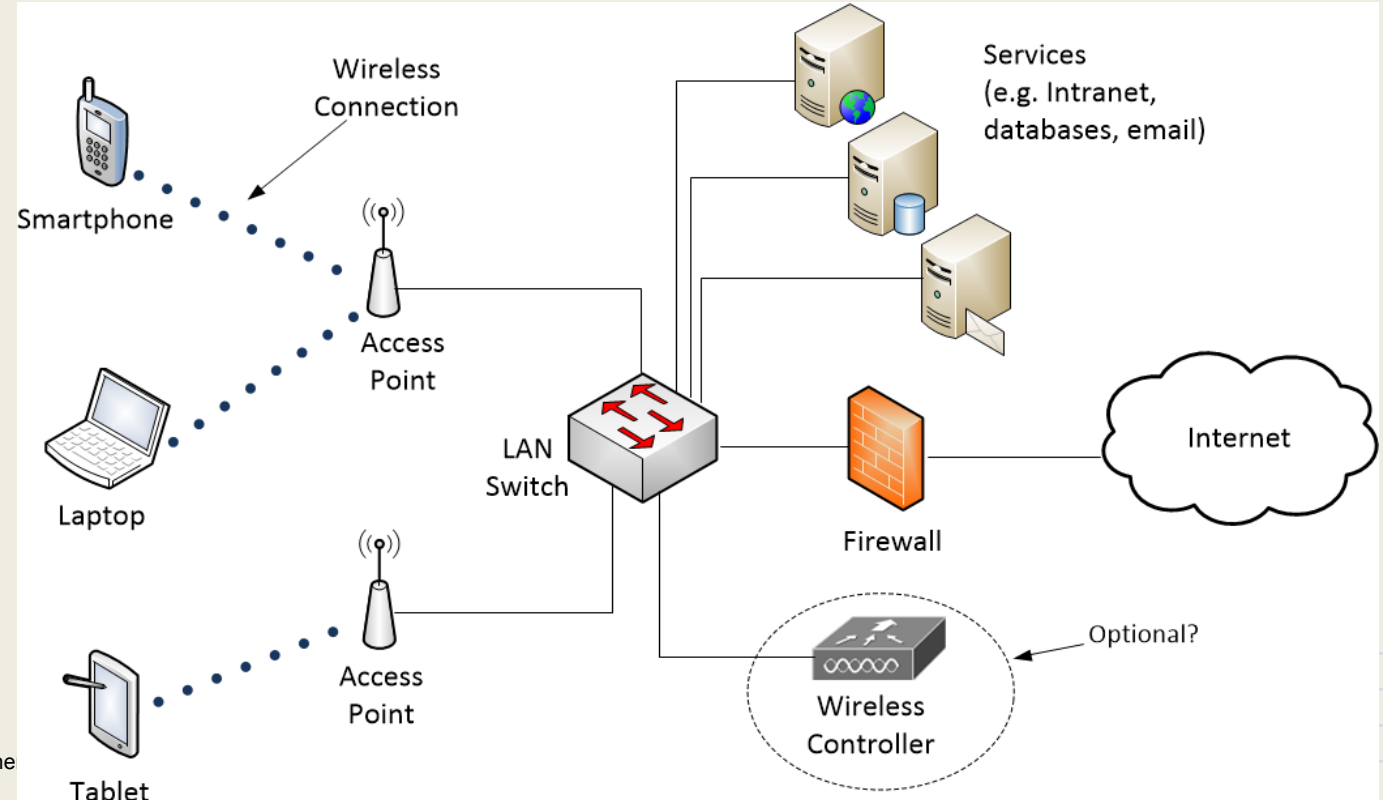
What is a wireless controller?

- Requirement for wireless controller (WLC) dependant upon
  - network size
  - vendor architecture
- Provides central management & coordination point for wireless network
  - Large number of APs difficult to configure and manage individually
  - Some functions of a WLAN require central coordination
    - AP channels being used
    - AP power settings
    - Roaming
    - Security
  - Monitoring of APs centralized

What is a wireless controller?

- Controller function may be:
  - a hardware or VM on-site
  - in the “cloud”
  - shared function across access points
    - cooperative control
- In all but the simplest networks, controller function is required in some form

What is a "WiFi?" Network?



WiFi Security

- Due to ubiquitous nature of the coverage of WiFi networks, security is a primary concern
  - Wireless LAN network often stretch beyond perimeter of a building or floor where a network is deployed
  - Provides opportunities for eavesdropping
    - equivalent of having span port on Ethernet switch to capture traffic
  - “Over the air” nature of WLANs also provides opportunities for interception of traffic
    - man in the middle attacks by setting up dummy APs using same SSID as your network

WiFi Security

- Need to provide two keys elements of security for WiFi networks:
  - encryption to prevent over the air eavesdropping
    - data scrambled with advanced ciphers to prevent decoding of captured data
      - encryption keys known only to WiFi stations on network
      - prevents offline attacks on captured data
  - authentication of all devices that join the network (and of the network itself)
    - users have to provide credentials (e.g. username/pwd, certificates)
    - network has to present valid credentials to devices joining
- Many security methods available for WiFi
  - WPA2 is current industry standard

WLAN Standards

- All WiFi networks must comply with the 802.11 standard
  - defined by the IEEE
    - (also responsible for 802.3, 802.1 etc.)
  - 802.11 standard is constantly evolving to keep pace with technology developments and demands of the marketplace
    - new amendments added over time to enhance the main 802.11 standard
      - recent example of an amendment is 802.11ac
        - “gigabit WiFi”
      - amendments created by working groups within IEEE who develop the standard

WLAN Standards

- In concert with the activities of the IEEE, we have the WiFi Alliance
  - alliance of WiFi equipment vendors who perform testing of equipment to certify if equipment is compatible with 802.11 and its various amendments
- In addition, WFA may also put out own standards in advance of completion of the IEEE working groups if WiFi industry has urgent requirements for standard
  - e.g. WPA & WPA2 security standards (pre-cursor to 802.11i security standard)

Summary

- What is a WiFi network?
  - Wireless LAN, IEEE 802.11, WFA (“WiFi”)
  - Generally part of network edge
- What is a wireless client?
  - tablets, laptops, smartphones
  - radio & antenna
  - varying capabilities
- What is a wireless access point?
  - bridge between wireless clients & wired network
  - radio and antennas
- What is a wireless controller?
  - central management & coordination function
  - hardware appliance, VM, cloud-based

Summary

- WiFi Security
  - Dangers of eavesdropping and interception
  - Encryption and authentication (WPA2)
- WLAN Standards
  - IEEE
  - WFA

More Information

- To find out more information about the topics covered in this module, visit http://WiFiForBeginners:
  - review the show notes
  - review accompanying slides
  - take the module quiz (just for fun)
- To enhance your WiFi knowledge check out the resources recommended at WiFiForBeginners.com
  - recommended books
  - recommended web sites
  - other useful resources to be added over time
  - CWTS: https://www.cwnp.com/certifications/cwts