Networking

Networking Implementation

2.4.1 - WiFi Standards

What are the different WiFi standards?

Overview
Given a scenario, the student will be able to install and configure the appropriate wireless standards and technologies

Grade Level(s)
10, 11, 12

Cyber Connections

- Threats & Vulnerabilities
- Networks & Internet
- Hardware & Software

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Teacher Notes:

CompTIA N10-008 Network+ Objectives

Objective 2.4

- Given a scenario, install and configure the appropriate wireless standards and technologies
    - 802.11 standards
        - a
        - b
        - g
        - n (WiFi 4)
        - ac (WiFi 5)
        - ax (WiFi 6)
    - Frequencies and range
        - 2.4GHz
        - 5GHz
    - Channels
        - Regulatory impacts
    - Channel bonding

WiFi Standards

Wireless Standards

Transmitting with a basic Ethernet hub and transmitting a signal using the basic ***802.11 standards*** are very similar. They are both two-way forms of communication and they both use the same frequency to transmit and receive. There are different wireless agencies and standards, for reference here's a list of agencies, their purpose, and websites.

Institute of Electrical and Electronics Engineers (IEEE)	Creates and maintains operational standards	www.ieee.org
Federal Communications Commission (FCC)	Regulates the use of wireless devices in the US	www.fcc.gov
European Telecommunications Standards Institute (ETSi)	Chartered to produce common standards in Europe	www.etsi.org

Teacher Notes:

Wi-Fi Alliance	Promotes and tests for WLAN interoperability	www.wi-fi.org
WLAN Association (WLANA)	Educates and raises consumer awareness regarding WLANs	www.wlana.org

There are numerous 802.11 committees and subcommittees. Here's a table covering those listed in the Network+ objectives and their respective purposes

802.11 Standard	Frequency	Max Data Rate	Range
802.11a	5 GHz	54 Mbps	100 ft
802.11b	2.4 GHz	11 Mbps	100 ft
802.11g	2.4 GHz	54 Mbps	125 ft
802.11n	2.4 and 5 GHz	600 Mbps	225 ft
802.11ac	5 GHz	6.8 Gbps	90 ft
802.11ax	2.4 and 5 GHz	10 Gbps	90 ft

Frequencies and Range

We used 2.4GHz and 5GHz to describe the ***frequency*** of wireless communication, however, the numeral provides both information about ***range*** (coverage) and bandwidth (speed). 2.4GHz provides the greatest coverage but at the lowest speeds. 5GHz provides better speeds but sacrifices coverage. 6GHz is even faster with an even shorter range. There are also stability issues that increase as the frequency increases. If you track the ping for 5GHz, you will see something like 6 ms, 6 ms, 6 ms, 6 ms, 400 ms, 6 ms, 6 ms, etc. In general, these short-term drops (increases) in ping are not noticeable when using applications like streaming television and video but could be noticeable when playing video games online.

Channels

Frequency bands are divided into several smaller bands called ***channels***. The 2.4GHz range is divided into 11 channels whereas the 5GHz range is divided into 45 channels. Channel 1 uses the lowest frequency, and each subsequent channel uses a slightly higher frequency. Only three channels in the 2.4GHz range can run simultaneously without overlapping and interfering with each other: channels 1, 6, and 11.

Teacher Notes:

The FCC regulates the channel ranges. There are a lot of little details that occur with these ranges, but you just need to understand that the FCC says how the channels can and cannot be used.

Our final term for this section is ***channel bonding***. Channel bonding is when a cable modem combines multiple channels to increase how much traffic can be "comfortably" supported. With DOCSIS 3.0 channel bonding you will see: 4x4, 8x4, 16x4, 24x8, and 32x8. The first number refers for downstream traffic and the second number refers to upstream traffic.