CompTIA A+ Core 1 Exam 220-1101

Lesson 4

Comparing Local Networking Hardware

Objectives

- Compare network types
- Compare networking hardware
- Explain network cable types
- Compare wireless networking types

Lesson 4

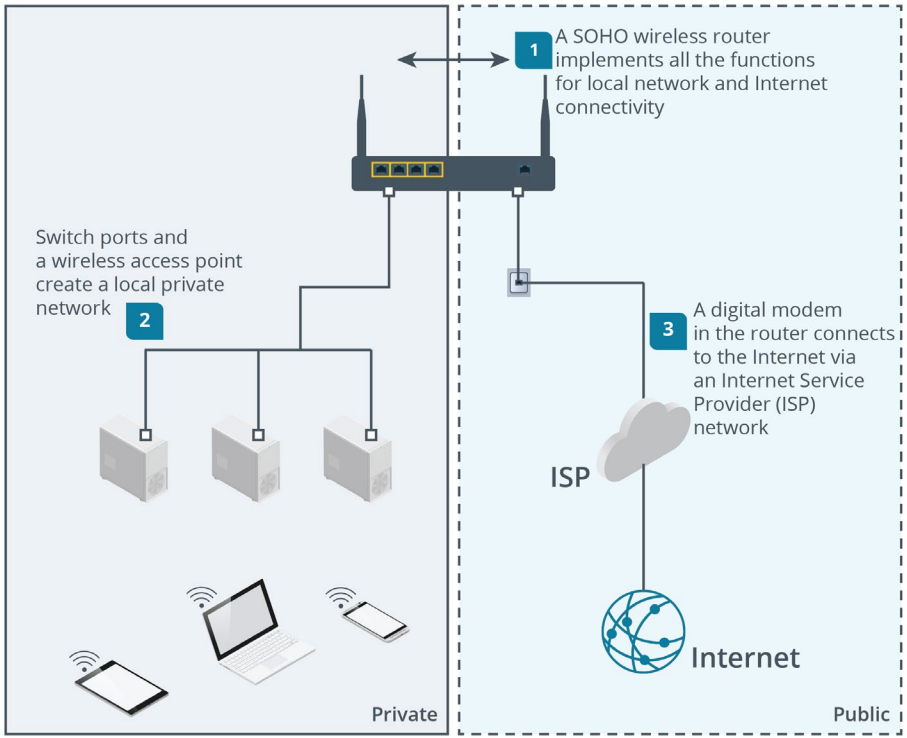
Topic 4A

Compare Network Types

LANs and WANs

- Local area network (LAN)
  - Ethernet (IEEE 802.3)
- Wireless local area network (WLAN)
  - Wi-Fi (IEEE 802.11)
- Wide area network (WAN)
  - Multiple geographic locations
  - Use of intermediate public or service provider networks
- Metropolitan area network (MAN)

SOHO and Enterprise Networks (Slide 1 of 2)



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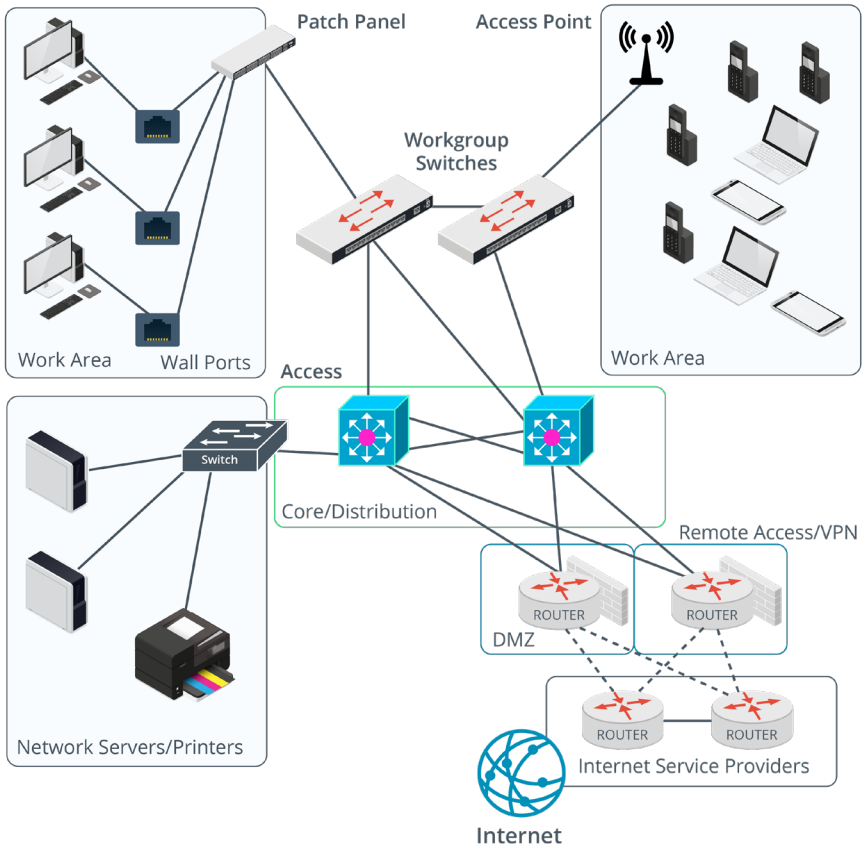
- Small Office Home Office (SOHO)
  - Single appliance provides Ethernet, Wi-Fi, and Internet connectivity

SOHO and Enterprise Networks (Slide 2 of 2)

- Enterprise networks
  - Reliability and scalability
  - Modular design



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Datacenters and Storage Area Networks

- Datacenter
  - Facility dedicated to hosting servers
  - Networking, power, climate control, and physical access control features
- Storage area network (SAN)
  - Network hosting configurable pool of storage devices
  - Clients of the network are application servers (not ordinary workstations)
  - Clients treat storage as logical disk
  - Fiber Channel and Internet SCSI (iSCSI)

Personal Area Networks

- Wireless and cellular connections over a few meters
  - PC and smartphone
  - PC/smartphone and peripheral devices
  - Internet of Things and wearable technology

Review Activity: Network Types

- LANs and WANs
- SOHO and Enterprise Networks
- Datacenters and Storage Area Networks
- Personal Area Networks

Lab Activity

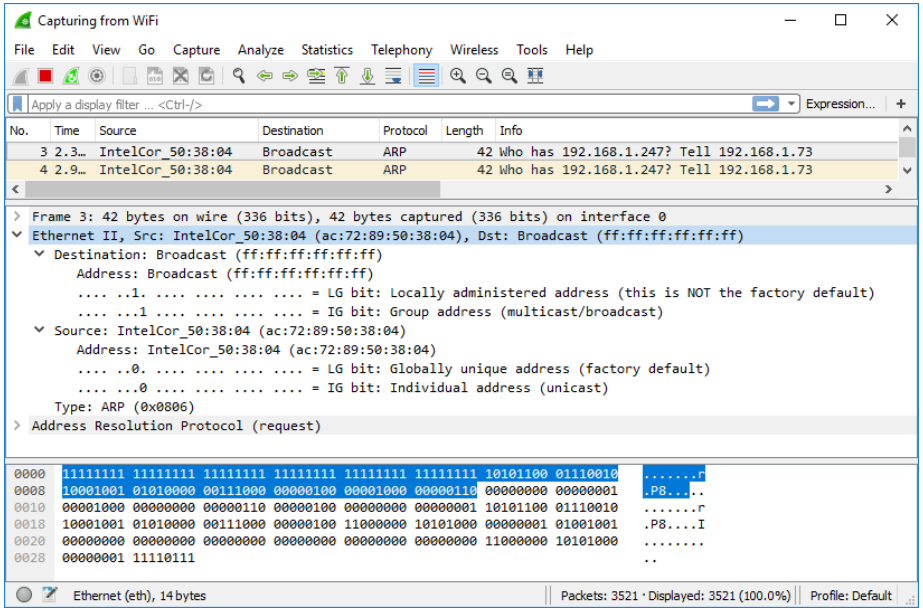
- Assisted Lab: Explore the VM Lab Environment
  - This orientation lab is designed to help you learn how to use the lab interface and operate the virtual machines (VMs) that you will use to complete each task
- Assisted labs guide you step-by-step through tasks
- Complete lab
  - Submit all items for grading and check each progress box
  - Select “Grade Lab” from final page
- Save lab
  - Select the hamburger menu and select “Save”
- Cancel lab without grading
  - Select the hamburger menu and select “End”

Lesson 4

Topic 4B

Compare Networking Hardware

Network Interface Cards

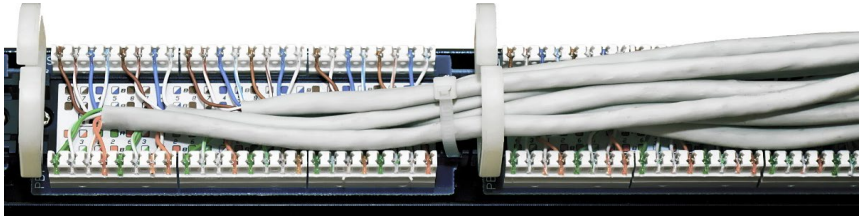


Screenshot courtesy of Wireshark

- Media type (transceiver)
  - Electrical versus optical
- Number of ports
- Framing and addressing
  - Media access control (MAC) address
  - Source and destination
  - Hex notation

Patch Panels

- Back
  - Terminate cabling from wall ports to insulation displacement connector (IDC) blocks
- Front
  - Modular RJ-45 connectors
  - Use patch cords to connect to switch ports



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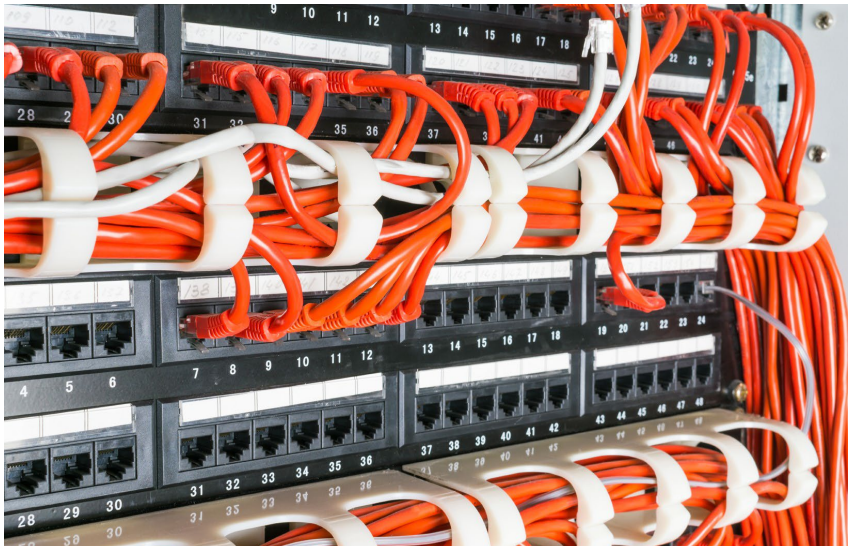

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Hubs

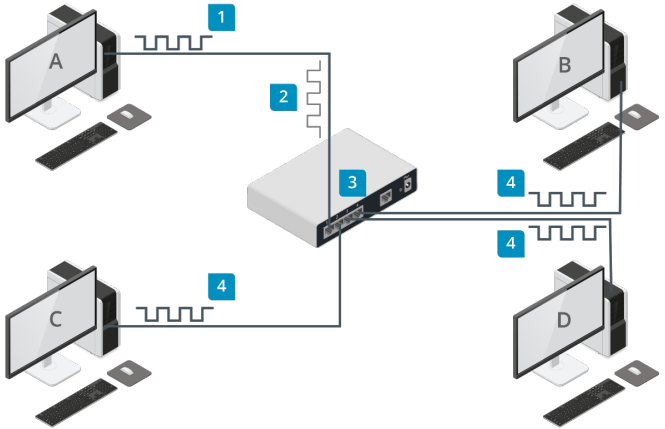
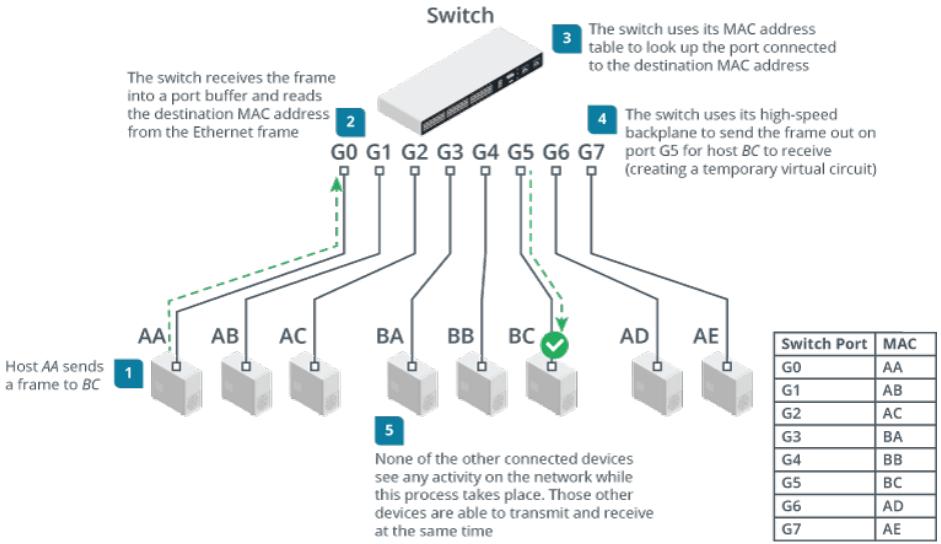


Image © 123RF.com

- Star topology wiring
  - Concentrator repeats signals over all cabled segments
- Hub
  - All ports are in same collision domain
  - Performance reduced by contention
  - Half-duplex 10/100 Mbps Ethernet only

Switches



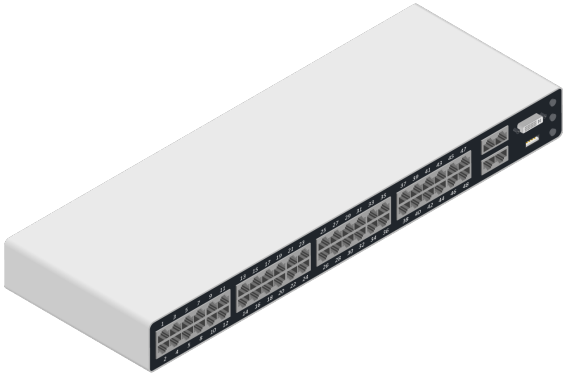
Switch Port	MAC
G0	AA
G1	AB
G2	AC
G3	BA
G4	BB
G5	BC
G6	AD
G7	AE

Image © 123RF.com

- Same star topology—each host cabled to a switch port
- Switch forwards traffic to specific destination port by learning MAC addresses
- Allows each port to operate at full-duplex and full speed
- Required for Gigabit Ethernet and better

Unmanaged and Managed Switches

- Unmanaged switch
  - Works without configuration
- Managed switch
  - Configuration interface
  - Additional functionality
  - Enterprise modular switches
  - Web or command-line interface



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Power over Ethernet

- PoE standards
  - 802.3af (~ 13 W)
  - 802.3at (PoE+) (~ 25 W)
  - 802.3bt (Ultra PoE) (~ 51 W (Type 3) or 73 W (Type 4)
- PoE-enabled switch
  - Endspan power sourcing equipment (PSE)
- Injector
  - Midspan

Review Activity: Network Hardware

- Network Interface Cards
- Patch Panels
- Hubs
- Switches
- Unmanaged and Managed Switches
- Power over Ethernet

Lab Activity

- Assisted Lab: Compare Networking Hardware
  - Use the GNS3 network simulator to configure an Ethernet network

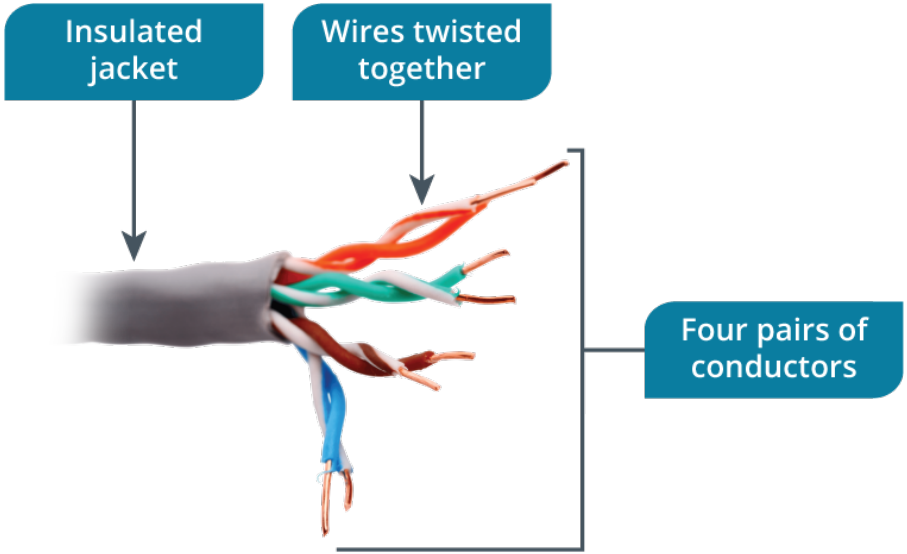
Lesson 4

Topic 4C

Explain Network Cable Types

Unshielded Twisted Pair

- Copper wire cabling carrying electrical signals
- Four balanced wire pairs
- Twisted at different rates and balanced to reduce interference
- Signal attenuation limits maximum distance to 100 m



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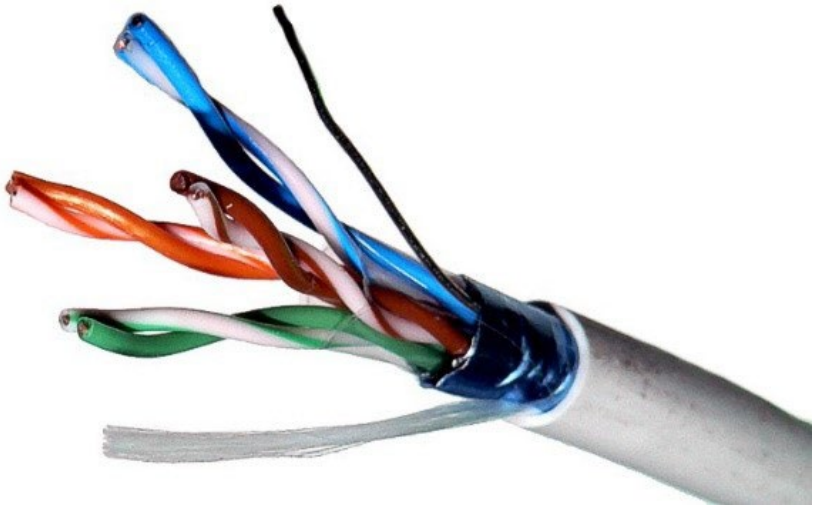
Shielded Twisted Pair



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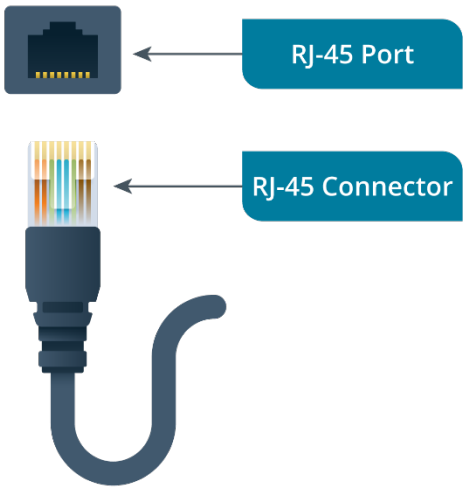
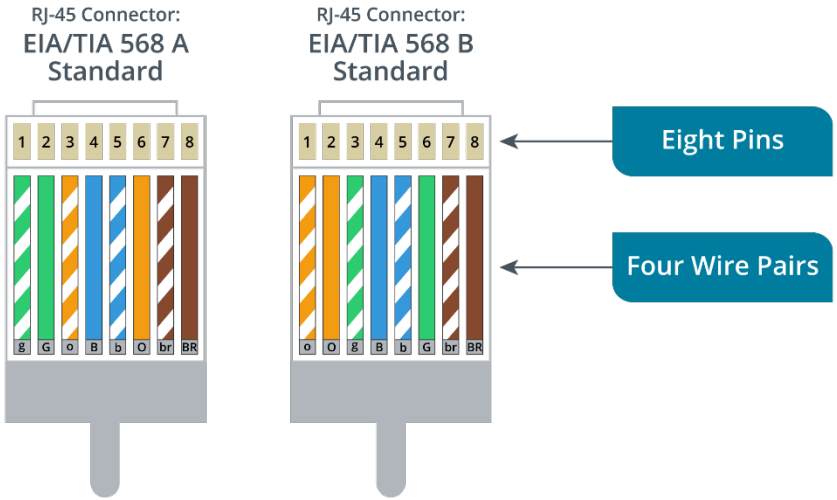
- Screening or shielding as extra protection against interference
  - Used for 10G Ethernet+ in datacenters for higher reliability
  - Used when cabling is near external interference sources (fluorescent lighting, power lines, motors, and generators)
- Screened cable has one thin outer foil shield around all pairs (ScTP, F/UTP, FTP)
- Fully shielded cabling has a braided outer screen and foil-shielded pairs (S/FTP and F/FTP)
- Shield elements in cable, connector, and patch panels must be bonded

Cat Standards

Cat	Max. Transfer Rate	Max. Distance	Network Application
5	100 Mbps	100 m (328 ft)	100BASE-TX (Fast Ethernet)
5e	1 Gbps	100 m (328 ft)	1000BASE-T (Gigabit Ethernet)
6	1 Gbps	100 m (328 ft)	1000BASE-T (Gigabit Ethernet)
	10 Gbps	55 m (180 ft)	10GBASE-T (10 Gigabit Ethernet)
6A	10 Gbps	100 m (328 ft)	10GBASE-T (10 Gigabit Ethernet)

Copper Cabling Connectors





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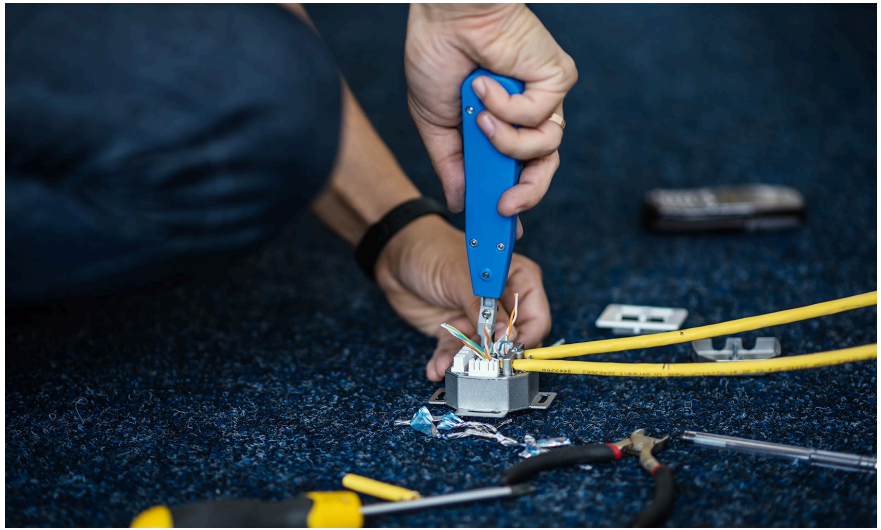
Copper Cabling Installation Tools



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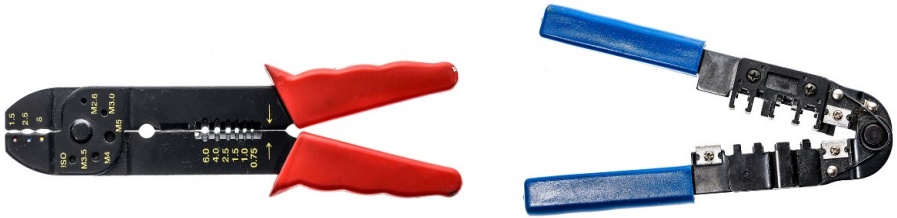

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- Patch cords are crimped to RJ-45 connectors
- Structured cable is terminated to insulation displacement connect (IDC) blocks in wall ports and patch panels
- Cable stripper
  - Remove insulation
- Punchdown tool
  - Terminate to IDCs
- Crimper
  - Add RJ-45 connector

Copper Cabling Test Tools

- Validate and test cable installation
- Cable tester
  - Verify termination
- Toner probe
  - Trace a cable
- Loopback plug
  - Test NIC or switch port

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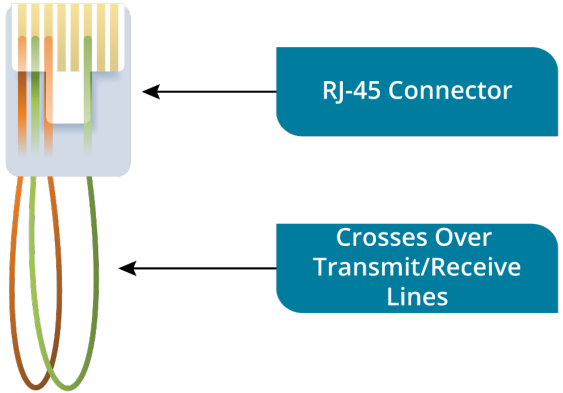

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Network Taps

- Capture network traffic
- Passive test access point (TAP)
- Active TAP
- Mirror port

Copper Cabling Installation Considerations

- Installation to plenum spaces
  - Building/fire safety regulations
  - Plenum rated cable
- Installation as outside plant (OSP)
  - Aerial, conduit, and direct burial
  - Protection against weathering

Optical Cabling

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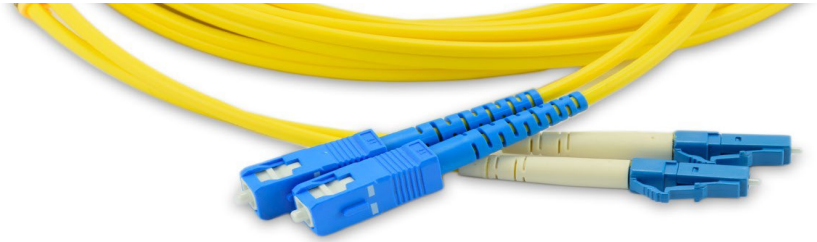

Image by YANAWUT SUNTORNKIJ © 123RF.com

- Fiber optic cable types
  - Single-mode fiber (SMF)
  - Multi-mode fiber (MMF)
- Connector types
  - Straight tip (ST)
  - Subscriber connector (SC)
  - Lucent connector (LC)

Coaxial Cabling

Image by destinacigdem © 123RF.com

Coaxial F-Connector

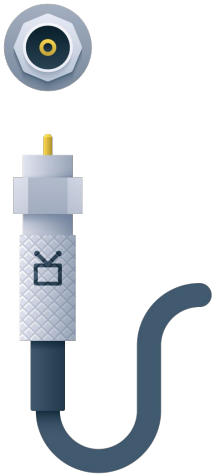

Image © 123RF.com

- Coaxial cable
  - Construction
  - Uses
- F-type connector

Review Activity: Network Cabling

- Unshielded Twisted Pair and Shielded Twisted Pair
- Cat Standards
- Copper Cabling Connectors
- Copper Cabling Installation and Test Tools
- Network Taps
- Copper Cabling Installation Considerations
- Optical Cabling
- Coaxial Cabling

Lesson 4

Topic 4D

Compare Wireless Networking Types

Access Points

- IEEE 802.11 / Wi-Fi
- Infrastructure mode WLAN
  - Access point interconnects wireless clients (stations)
  - Infrastructure Basic Service Set (BSS)
  - Basic Service Set Identifier (BSSID)
    - MAC address of AP radio
- Can bridge with wired network via a switch

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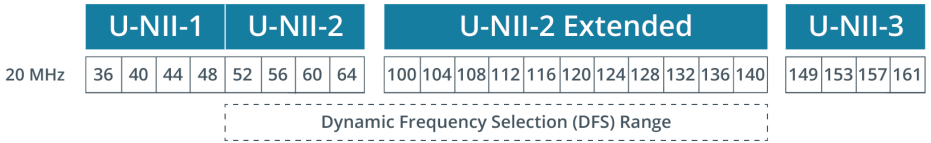
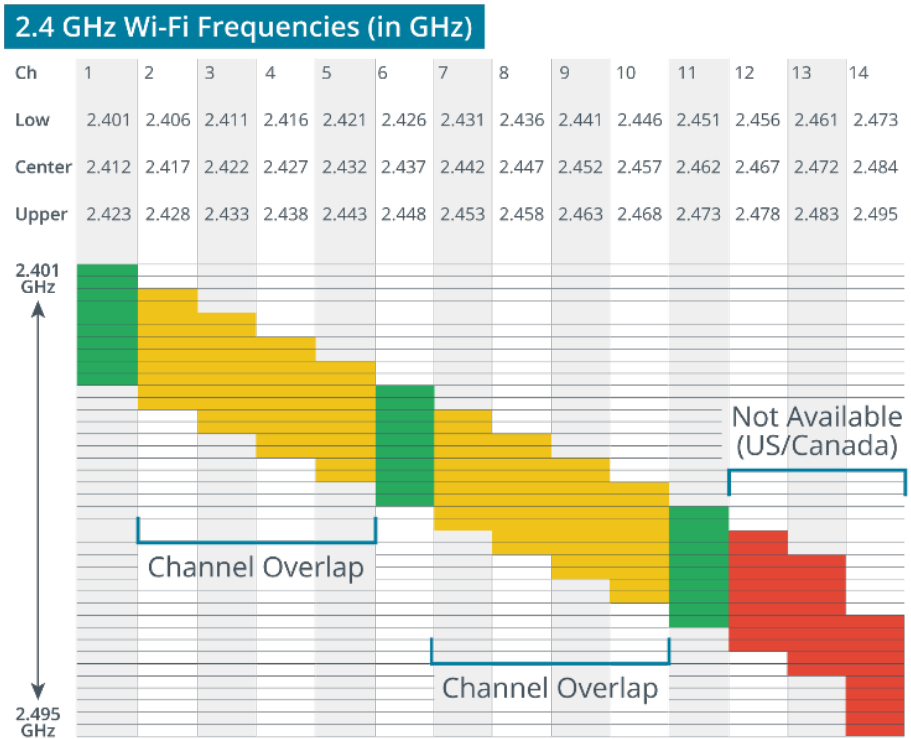
802.11a and the 5 GHz Frequency Band

- 2.4 GHz
  - Better propagation, but fewer channels and greater interference risk
- 5 GHz
  - Shorter range, but less congested
- IEEE 802.11a (54 Mbps)
  - 23 x non-overlapping 20 MHz channels
  - Dynamic Frequency Selection (DFS) and regulatory impacts



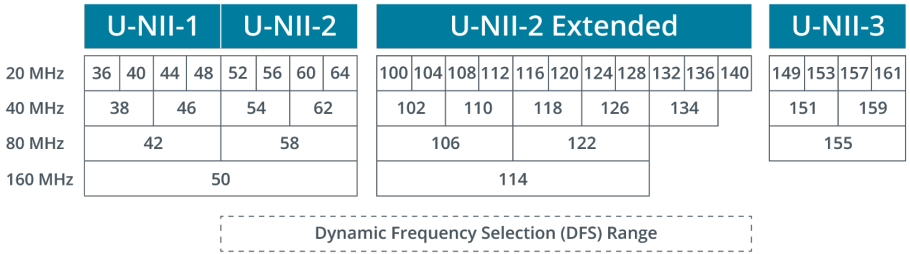
802.11b/g and the 2.4 GHz Frequency Band



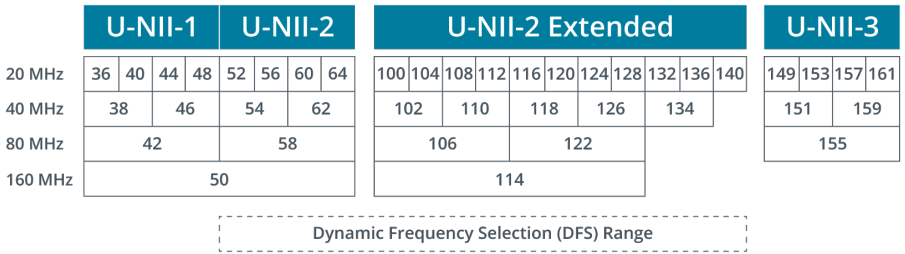
- IEEE 802.11b (11 Mbps)
  - 14 x 5 MHz channels
  - Wi-Fi still needs 20 MHz channel bandwidth
  - Channels require careful configuration to avoid overlap
- IEEE 802.11g (54 Mbps)
  - 802.11b compatibility mode

802.11n

- Dual band radios
  - 5 GHz or 2.4 GHz
- 40 MHz channel bonding
- Multiple input multiple output (MIMO)
  - Use of multiple antennas to improve reliability and bandwidth
  - 72 Mbps per stream
- Wi-Fi 4

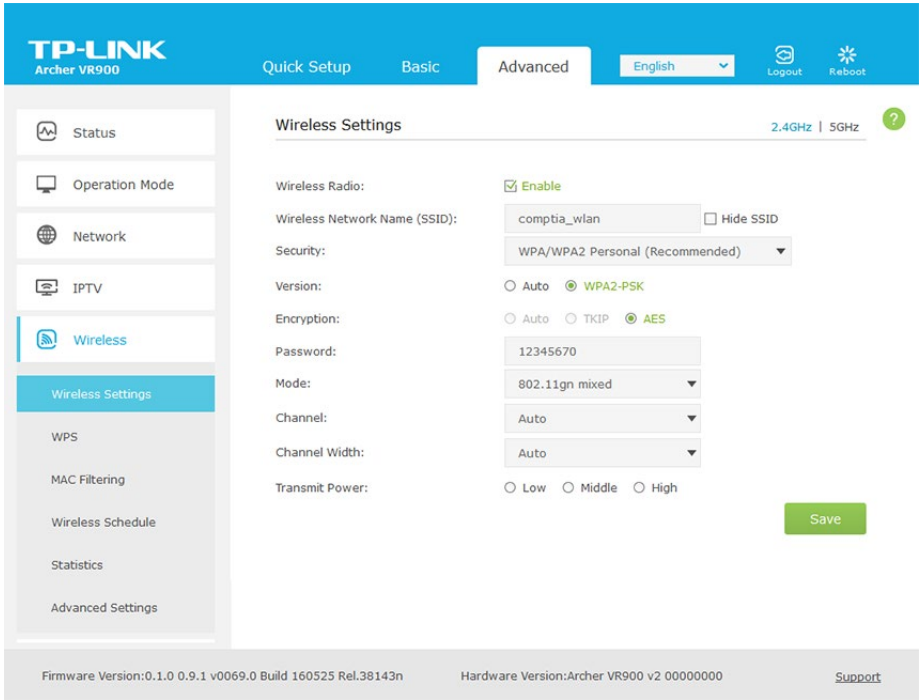


Wi-Fi 5 and Wi-Fi 6



- Wi-Fi 5 (802.11ac)
  - 5 GHz only
  - Tri-band radios
  - 80 and 160 MHz channel bonding
- Multiuser MIMO
  - Connect stations simultaneously
- Wi-Fi 6 (802.11ax)
  - 2.4 GHz or 5 GHz (plus new 6 GHz band)
  - Downlink and uplink MU-MIMO
  - Orthogonal frequency division multiple access (OFDMA)

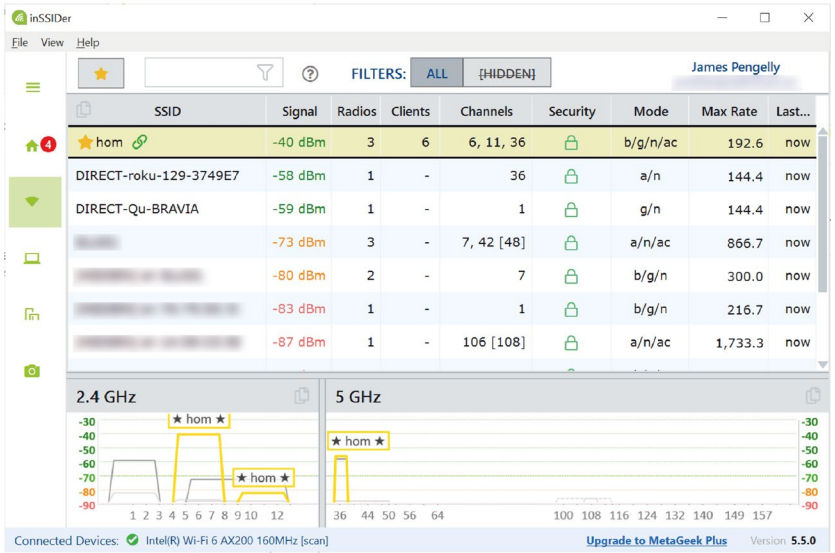
Wireless LAN Installation Considerations



Screenshot courtesy of TP-Link

- Network name or Service Set Identifier (SSID)
- Frequency band use
  - Same SSID or different SSID per band
  - Operation mode (legacy standards support)
- Channel usage
  - Non-overlapping
  - Channel width/bonding

Wi-Fi Analyzers



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- Software installed to mobile device
  - Reports configuration of nearby wireless networks
  - Signal strength on each channel
- Signal strength
  - Decibels-milliwatt (dBm)
  - Negative values with closer to zero better performance
  - Logarithmic scale
    - 3 dBm difference represents halving or doubling
- Signal-to-noise ratio (SNR)

Long Range Fixed Wireless

- Wireless bridges configured using microwave antennas
  - Line of sight
  - High gain
- Licensed spectrum use
  - Legal right to remove interference sources
- Unlicensed spectrum
  - Shared use of frequency band
  - Regulatory requirements on power
  - Transmit power, gain, and Effective Isotropic Radiated Power (EIRP)

Bluetooth, RFID, and NFC

- Bluetooth
  - Connectivity for wireless peripherals
- Radio Frequency ID (RFI)
  - Wireless asset tags
  - Inventory control
- Nearfield Communications (NFC)
  - Contactless payments

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Review Activity: Wireless Networking Types

- Access Points
- 802.11a and the 5 GHz Frequency Band
- 802.11b/g and the 2.4 GHz Frequency Band
- 802.11n
- Wi-Fi 5 and Wi-Fi 6
- Wireless LAN Installation Considerations
- Wi-Fi Analyzers
- Long-Range Fixed Wireless
- Bluetooth, RFID, and NFC

Lab Activity

- Assisted Lab: Compare Wireless Network Technologies
  - Use the GNS3 network simulator to configure Wi-Fi networks

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Lesson 4

Summary