INFOSECTRAIN
Educate. Excel. Empower.

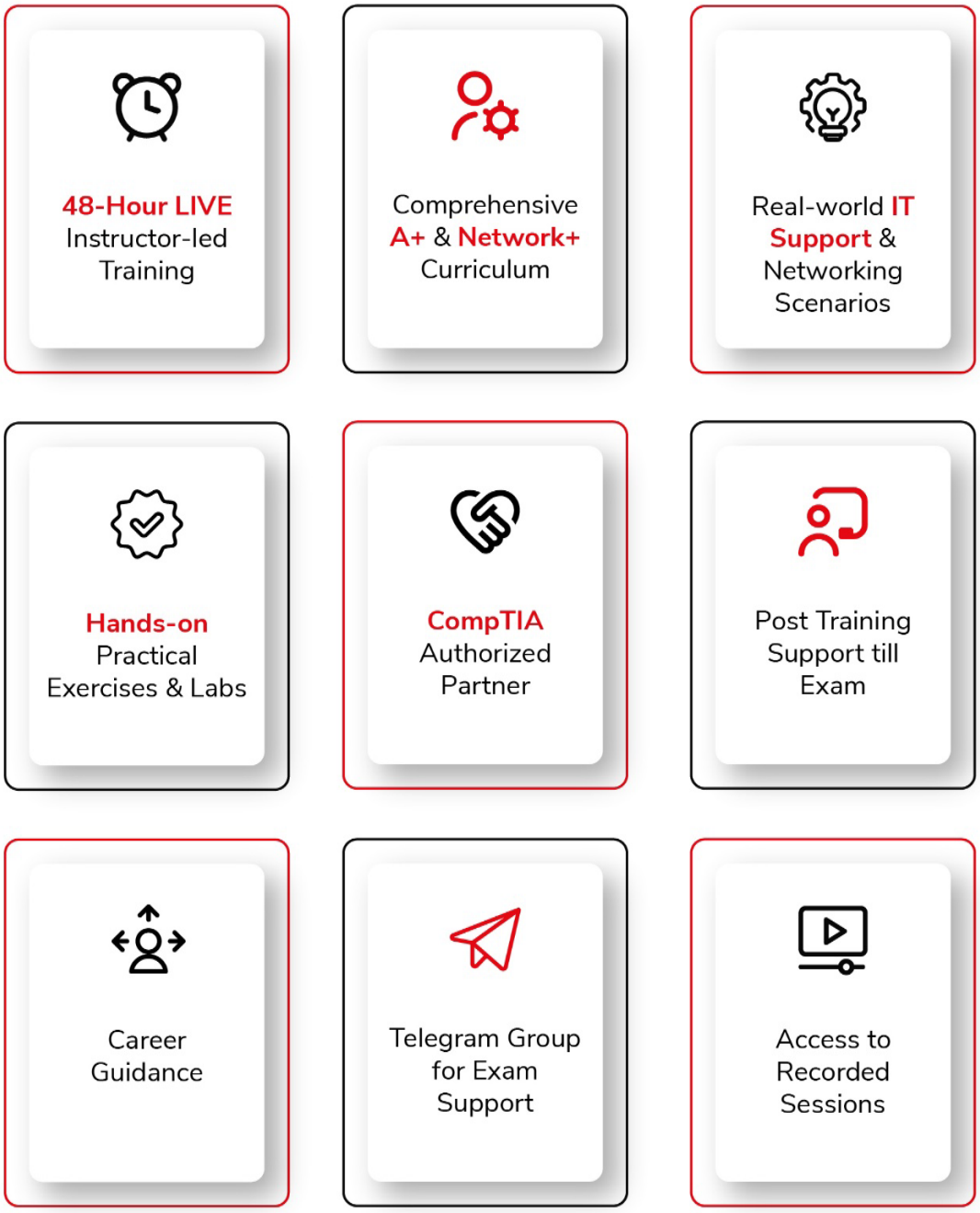
CompTIA AUTHORIZED PARTNER

CompTIA Combo Course

1. CompTIA A+
2. CompTIA Network+

Online Training

Course Highlights



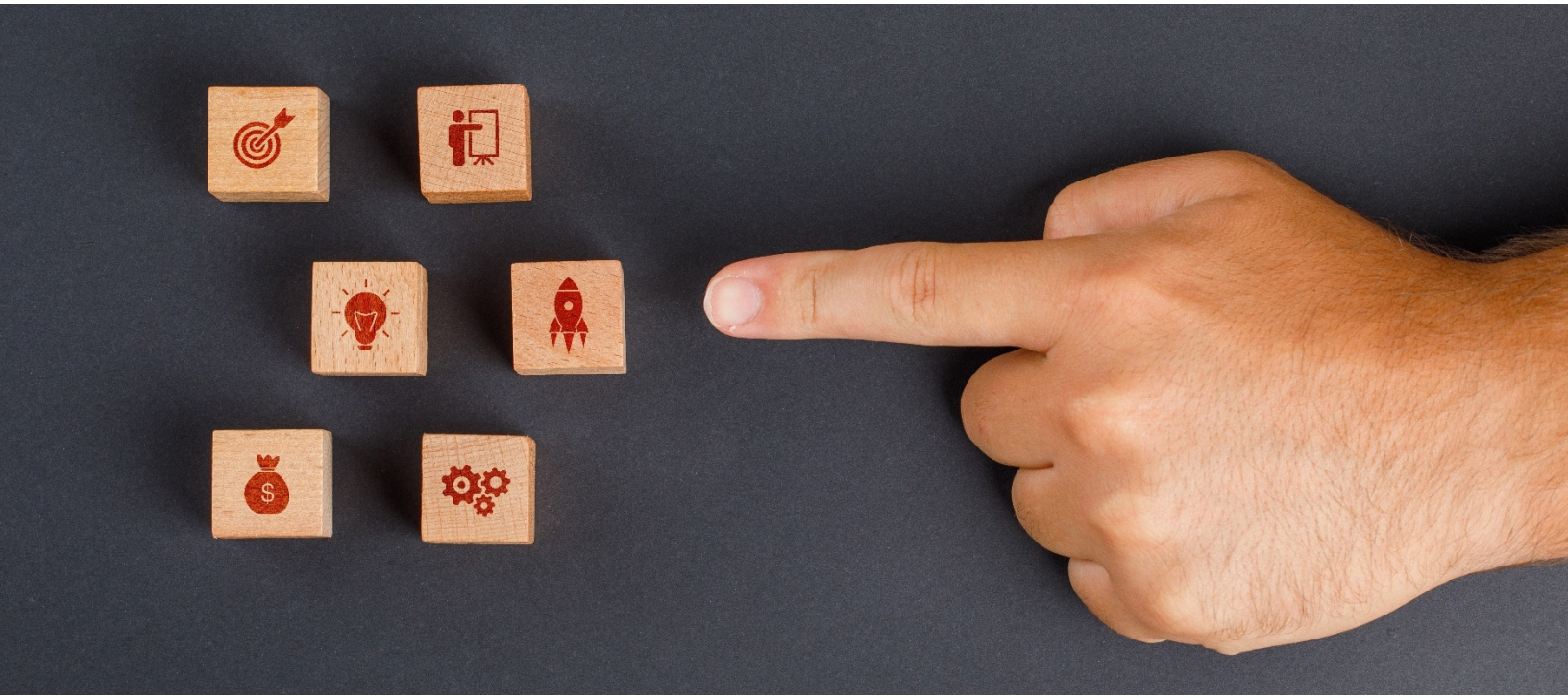
About Course

This combo course has been specifically designed to provide you with a solid foundation in both IT support and networking. It empowers you with the essential skills to troubleshoot, maintain, and secure computer systems (A+) while also equipping you with in-depth networking knowledge for managing and optimizing network infrastructures (N+). Starting from the basics of computer hardware and operating systems, the program progresses to cover networking concepts, protocols, and security fundamentals. By the end of this course, you'll be well-prepared to handle diverse IT challenges and pursue certifications that open doors to various career opportunities.

Course Objectives

By the end of this training program, participants will be able to:

- Understand and apply fundamental IT concepts, including hardware, operating systems, and security
- Troubleshoot and resolve hardware and software issues in computer systems
- Set up, maintain, and secure computer systems, ensuring proper configuration and performance
- Manage and optimize network infrastructures, including Local Area Networks (LANs) and Wide Area Networks (WANs)
- Implement and troubleshoot network devices, cables, and protocols
- Understand IP addressing, TCP/IP protocols, and network services
- Configure and secure wireless networks and VPNs
- Monitor, maintain, and optimize network performance for scalability and reliability
- Apply cybersecurity principles to protect network infrastructures and data
- Perform advanced troubleshooting of network issues and configurations



Target Audience

This course is ideal for:

- Aspiring IT Professionals
- Networking Enthusiasts
- Cybersecurity Beginners
- Current IT Technicians
- Network Engineers & Administrators

Pre-requisites

While there are no strict prerequisites to enroll in the course, the following recommendations will help you succeed in both certifications:

- Basic computer knowledge
- Stable internet connection for course participation.
- IT Support Experience (Recommended): 9-12 months in an IT support role

Exam Details

Certification Name	CompTIA A+ (V15)	CompTIA Network+ (V9)
Exam Code	CompTIA A+ 220-1201 (Core 1) and 220-1202 (Core 2)	N10-009
Exam Format	Multiple-choice, drag and drop, and performance-based	Multiple-choice and performance-based
No. of Questions	90 Questions	90 Questions
Exam Duration	90 Minutes	90 Minutes
Passing Score	220-1201: 675 (on a scale of 900) 220-1202: 700 (on a scale of 900)	720 (on a scale of 100-900)
Languages	English	English, German, Japanese, Portuguese, and Spanish

Course Content

CompTIA A+

CompTIA A+ Core 1 (220-1201) Domains

Domain 1: Mobile Devices (13%)

1.1 Given a scenario, monitor mobile device hardware and use appropriate replacement techniques.

- Battery
- Keyboard/keys
- Random-Access Memory (RAM)
- Hard Disk Drive (HDD)/Solid-State Drive (SSD)
- Wireless cards
- Physical privacy and security components
  - Biometrics
  - Near-field scanner features
- Wi-Fi antenna connector/placement
- Camera/webcam
- Microphone

1.2 Compare and contrast accessories and connectivity options for mobile devices.

- Connection methods
- Accessories
- Docking station
- Port replicator
- Trackpad/drawing pad/track points

1.3 Given a scenario, configure basic mobile device network connectivity and provide application support.

- Wireless/cellular data network (enable/disable)
  - 3G/4G/5G

- Hotspot
- Wi-Fi
- Subscriber Identity Module (SIM)/eSIM

- Bluetooth
  - Enable Bluetooth
  - Enable pairing
  - Find a device for pairing
  - Enter the appropriate Personal Identification Number (PIN) code
  - Test connectivity
- Location services
  - Global Positioning System (GPS) services
  - Cellular location services
- Mobile Device Management (MDM)
  - Device configurations
  - Policy enforcement
  - Corporate applications
- Mobile device synchronization
  - Recognizing data caps
  - Calendar
  - Contacts
  - Business applications

Domain 2: Networking (23%)

2.1 Compare and contrast Transmission Control Protocol (TCP) and User Datagram Protocol (UDP) ports, protocols, and their purposes.

- Ports and protocols
- TCP vs. UDP

2.2 Explain wireless networking technologies.

- Frequencies
- Channels
- NFC
- Radio-Frequency Identification (RFID)

2.3 Summarize services provided by networked hosts.

- Server roles
- Internet appliances

Domain 3: Hardware (25%)

3.1 Compare and contrast display components and attributes.

- Types
  - Liquid Crystal Display (LCD)
    - In-Plane Switching (IPS)
    - Twisted Nematic (TN)
    - Vertical Alignment (VA)
  - Organic Light-Emitting Diode (OLED)
  - Mini Light-Emitting Diode (Mini-LED)
- Touch screen/digitizer
- Inverter
- Attributes
  - Pixel density
  - Refresh rates
  - Screen resolution
  - Color gamut

3.2 Summarize basic cable types and their connectors, features, and purposes.

- Peripheral cables
  - USB 2.0
  - USB 3.0
  - Serial
  - Thunderbolt
- Video cables
  - High-definition Multimedia Interface (HDMI)
  - DisplayPort
  - Digital Visual Interface (DVI)
  - Video Graphics Array (VGA)
  - USB-C
- Hard drive cables
  - Serial Advanced Technology Attachment (SATA)
  - External SATA (eSATA)
- Adapters

- Connector types
  - Punchdown block
  - MicroUSB
  - MiniUSB
  - USB-C
  - Molex
  - Lightning
  - DB9 3.0 Hardware

3.3 Compare and contrast RAM characteristics.

- Form factors
  - Small Outline Dual In-line Memory Module (SODIMM)
  - Dual In-line Memory Module (DIMM)
- Double Data Rate (DDR) iterations
- Error-Correcting Code (ECC) vs. non-ECC RAM
- Channel configurations

3.4 Compare and contrast storage devices.

- Hard drives
  - Spindle speeds
  - Form factors
    - 2.5-inch
    - 3.5-inch
- Solid-state drives
  - Communications interfaces
    - Non-Volatile Memory express (NVMe)
    - SATA
    - Peripheral Component Interconnect express (PCIe)
    - Serial Attached SCSI [Small Computer System Interface] (SAS)
  - Form factors
    - M.2
    - mini-Serial Advanced Technology Attachment (mSATA)
- Drive configurations
  - Redundant Array of Independent Disks (RAID) 0, 1, 5, 6, 10

- Removable storage
  - Flash drives
  - Memory cards
- Optical drives

3.5 Given a scenario, install and configure motherboards, Central Processing Units (CPUs), and add-on cards.

- Motherboard form factors
  - Advanced Technology Extended (ATX)
  - microATX
  - Information Technology eXtended (ITX)
- Motherboard connector types
  - Peripheral Component Interconnect (PCI)
  - PCIe
  - Power connectors
  - SATA
  - eSATA
  - Headers
  - M.2
- Motherboard compatibility
  - CPU socket types
    - Advanced Micro Devices, Inc. (AMD)
    - Intel
  - Multisocket
- BIOS/Unified Extensible Firmware Interface (UEFI) settings
  - Boot options
  - USB permissions
  - Trusted Platform Module (TPM) security features
  - Fan considerations
  - Secure Boot
  - Boot password
  - BIOS password
  - Temperature monitoring
- Virtualization support

- Encryption
  - TPM
  - Hardware Security Module (HSM)
- CPU architecture
  - x86/x64
  - Advanced RISC [Reduced Instruction Set Computer] Machine (ARM)
  - Core configurations
- Expansion cards
  - Sound card
  - Video card
  - Capture card
- Cooling
  - Fans
  - Heat sink
  - Thermal paste/pads
  - Liquid

3.6 Given a scenario, install the appropriate power supply.

- Input 110–120 VAC vs. 220–240 VAC
- Output 3.3V vs. 5V vs. 12V
- 20+4 pin motherboard connector
- Redundant power supply
- Modular power supply
- Wattage rating
- Energy efficiency

3.7 Given a scenario, deploy and configure multifunction devices/printers and settings.

- Properly unbox device and consider set-up location
- Use appropriate drivers for a given operating system
  - Printer Control Language (PCL) vs. postscript
- Firmware
- Device connectivity
  - USB
  - Ethernet

- Wireless
- Public/shared devices
  - Printer share
  - Print server
- Configuration settings
  - Duplex
  - Orientation
  - Tray settings
  - Quality
- Security
  - User authentication
  - Badging
  - Audit logs
  - Secured prints
- Network scan services
  - Email
  - SMB
  - Cloud services
- Automatic Document Feeder (ADF)/flatbed scanner

3.8 Given a scenario, perform appropriate printer maintenance.

- Laser
  - Maintenance: Replace toner, apply maintenance kit, calibrate, and clean
- Inkjet
  - Ink cartridge, printhead, roller, and feeder
  - Maintenance: Clean printheads, replace cartridges, calibrate, and clear jams
- Thermal
  - Feed assembly
  - Special thermal paper
  - Maintenance: Replace paper, clean heating element, and remove debris
- Impact
  - Multipart paper
  - Maintenance: Replace ribbon, printhead, and paper

Domain 4: Virtualization and Cloud computing (11%)

4.1 Explain virtualization concepts

- Purpose of virtual machines
  - Sandbox
  - Test development
  - Application virtualization
    - Legacy software/OS
    - Cross-platform virtualization
- Requirements
  - Security
  - Network
  - Storage
- Desktop virtualization
  - Virtual Desktop Infrastructure (VDI)
- Containers
- Hypervisors
  - Type 1
  - Type 2

4.2 Summarize cloud computing concepts.

- Common cloud models
  - Private cloud
  - Public cloud
  - Hybrid cloud
  - Community cloud
  - Infrastructure as a Service (IaaS)
  - Software as a Service (SaaS)
  - Platform as a Service (PaaS)
- Cloud characteristics
  - Shared resources vs. dedicated resources
  - Metered utilization
    - Ingress/egress
  - Elasticity

- Availability
- File synchronization
- Multitenancy

Domain 5: Hardware and Network Troubleshooting (28%)

5.1 Given a scenario, troubleshoot motherboards, RAM, CPUs, and power.

- Common symptoms
  - Power-On Self-Test (POST) beeps
  - Proprietary crash screens
  - Blank screen
  - No power
  - Sluggish performance
  - Overheating
  - Burning smell
  - Random shutdown
  - Application crashes
  - Unusual noise
  - Capacitor swelling
  - Inaccurate system date/time

5.2 Given a scenario, troubleshoot drive and RAID issues.

- Common symptoms
  - Light-Emitting Diode (LED) status indicators
  - Grinding noises
  - Clicking sounds
  - Bootable device not found
  - Data loss/corruption
  - RAID failure
  - Self-Monitoring and Reporting Technology (S.M.A.R.T.) failure
  - Extended read/write times
  - Low performance Input/Output Operations Per Second (IOPS)
  - Missing drives in OS
  - Array missing
  - Audible alarms

5.3 Given a scenario, troubleshoot video, projector, and display issues.

- Common symptoms
  - Incorrect input source
  - Physical cabling issues
  - Burnt-out bulb
  - Fuzzy image
  - Display burn-in
  - Dead pixels
  - Flashing screen
  - Incorrect color display
  - Audio issues
  - Dim image
  - Intermittent projector shutdown
  - Sizing issues
  - Distorted image

5.4 Given a scenario, troubleshoot common mobile device issues.

- Common symptoms
  - Poor battery health
  - Swollen battery
  - Broken screen
  - Improper charging
  - Poor/no connectivity
  - Liquid damage
  - Overheating
  - Digitizer issues
  - Physically damaged ports
  - Malware
  - Cursor drift/touch calibration
  - Unable to install new applications
  - Stylus does not work
  - Degraded performance

5.5 Given a scenario, troubleshoot printer issues.

- Lines down the printed pages
- Garbled print
- Paper jams
- Faded prints
- Paper not feeding
- Multipage misfeed
- Multiple prints pending in queue
- Speckling on printed pages
- Double/echo images on the print
- Grinding noise
- Finishing issues
  - Staple jams
  - Hole punch
- Incorrect page orientation
- Tray not recognized
- Connectivity issues
- Frozen print queue

CompTIA A+ Core 2 (220-1202) Domains

Domain 1: Operating Systems (31%)

1.1 Identify basic features of Microsoft Windows editions

- Windows 10 editions
  - Home
  - Pro
  - Pro for Workstations
  - Enterprise
- Feature differences
  - Domain access vs. workgroup
  - Desktop styles/user interface
  - Availability of Remote Desktop Protocol (RDP)
  - Random-Access Memory (RAM) support limitations
  - BitLocker
  - gpedit.msc
- Upgrade paths
  - In-place upgrade

1.2 Given a scenario, use the appropriate Microsoft command-line tool

- Navigation
  - cd
  - dir
  - md
  - rmdir
  - Drive navigation inputs: M C: or D: or x:
- Command-line tools
  - chkdsk
  - format
  - xcopy
  - copy
  - robocopy

- gpupdate
- gpresult
- shutdown
- sfc
- [command name] /?
- diskpart
- pathping
- winver

1.3 Given a scenario, use features and tools of the Microsoft Windows 10 operating system (OS)

- Task Manager
  - Services
  - Startup
  - Performance
  - Processes
  - Users
- Microsoft Management Console (MMC) snap-in
  - Event Viewer (eventvwr.msc)
  - Disk Management (diskmgmt.msc)
  - Task Scheduler (taskschd.msc)
  - Device Manager (devmgmt.msc)
  - Certificate Manager (certmgr.msc)
  - Local Users and Groups (lusrmgr.msc)
  - Performance Monitor (perfmon.msc)
  - Group Policy Editor (gpedit.msc)
- Additional tools
  - System Information (msinfo32.exe)
  - Resource Monitor (resmon.exe)
  - System Configuration (msconfig.exe)
  - Disk Cleanup (cleanmgr.exe)
  - Disk Defragment (dfrgui.exe)
  - Registry Editor (regedit.exe)

1.4 Given a scenario, use the appropriate Microsoft Windows 10 Control Panel utility

- Internet options
- Devices and printers
- Programs and features
- Network and sharing center
- System
- Windows Defender Firewall
- Mail
- Sound
- User accounts
- Device manager
- Indexing options
- Administrative tools
- File Explorer Options
  - Show hidden files
  - Hide extensions
  - General options
  - View options
- Power Options
  - Hibernate
  - Power plans
  - Sleep/suspend
  - Standby
  - Choose what closing the lid does
  - Turn on fast startup
  - Universal Serial Bus (USB) selective suspend
- Ease of Access

1.5 Given a scenario, use the appropriate Windows settings

- Time and language
- Update and security
- Personalization
- Apps

- Privacy
- System
- Devices
- Network and Internet
- Gaming
- Accounts

1.6 Given a scenario, configure Microsoft Windows networking features on a client/desktop

- Workgroup vs. domain setup
  - Shared resources
  - Printers
  - File servers
  - Mapped drives
- Local OS firewall settings
  - Application restrictions and exceptions
  - Configuration
- File Explorer navigation – network paths
- Metered connections and limitations

1.7 Given a scenario, apply application installation and configuration concepts

- System requirements for applications
  - 32-bit vs. 64-bit dependent application requirements
  - Dedicated graphics card vs. integrated graphics card
  - Video Random-Access Memory (VRAM) requirements
  - RAM requirements
  - Central Processing Unit (CPU) requirements
  - External hardware tokens
  - Storage requirements
- OS requirements for applications
  - Application to OS compatibility
  - 32-bit vs. 64-bit OS
- Distribution methods
  - Physical media vs. downloadable
  - ISO mountable

- Other considerations for new applications
  - Impact to device
  - Impact to network
  - Impact to operation
  - Impact to business

1.8 Explain common OS types and their purposes

- Workstation OSs
  - Windows
  - Linux
  - macOS
  - Chrome OS
- Cell phone/tablet OSs
  - iPadOS
  - iOS
  - Android
- Various filesystem types
  - New Technology File System (NTFS)
  - File Allocation Table 32 (FAT32)
  - Third extended filesystem (ext3)
  - Fourth extended filesystem (ext4)
  - Apple File System (APFS)
  - Extensible File Allocation Table (exFAT)
- Vendor life-cycle limitations
  - End-of-Life (EOL)
  - Update limitations
- Compatibility concerns between OSs

1.9 Given a scenario, perform OS installations and upgrades in a diverse OS environment

- Boot methods
  - USB
  - Optical media
  - Network
  - Solid-state/flash drives

- Internet-based
- External/hot-swappable drive
- Internal hard drive (partition)

- Types of installations
  - Upgrade
  - Recovery partition
  - Clean install
  - Image deployment
  - Repair installation
  - Remote network installation
  - Other considerations M Third-party drivers
- Partitioning
  - GUID [globally unique identifier] Partition Table (GPT)
  - Master Boot Record (MBR)
- Drive format
- Upgrade considerations
  - Backup files and user preferences
  - Application and driver support/backward compatibility
  - Hardware compatibility
- Feature updates
  - Product life cycle

1.10 Identify common features and tools of the macOS/desktop OS

- Installation and uninstallation of applications
  - File types
    - .dmg
    - .pkg
    - .app
  - App Store
  - Uninstallation process
- Apple ID and corporate restrictions
- Best practices
  - Backups
  - Antivirus

- Updates/patches
- System Preferences
  - Displays
  - Networks
  - Printers
  - Scanners
  - Privacy
  - Accessibility
  - Time Machine
- Features
  - Multiple desktops
  - Mission Control
  - Keychain
  - Spotlight
  - iCloud
  - Gestures
  - Finder
  - Remote Disc
  - Dock
- Disk Utility
- FileVault
- Terminal
- Force Quit

1.11 Identify common features and tools of the Linux client/desktop OS

- Common commands
  - ls
  - pwd
  - mv
  - cp
  - rm
  - chmod
  - chown
  - su/sudo

- apt-get
- yum
- ip
- df
- grep
- ps
- man
- top
- find
- dig
- cat
- nano

- Best practices
  - Backups
  - Antivirus
  - Updates/patches
- Tools
  - Shell/terminal
  - Samba

Domain 2: Security (25%)

2.1 Summarize various security measures and their purposes

- Physical security
  - Access control vestibule
  - Badge reader
  - Video surveillance
  - Alarm systems
  - Motion sensors
  - Door locks
  - Equipment locks
  - Guards
  - Bollards
  - Fences
- Physical security for staff
  - Key fobs
  - Smart cards
  - Keys
  - Biometrics
    - Retina scanner
    - Fingerprint scanner
    - Palmprint scanner
  - Lighting
  - Magnetometers
- Logical security
  - Principle of least privilege
  - Access Control Lists (ACLs)
  - Email
  - Hard token
  - Soft token
  - Short Message Service (SMS)
  - Voice call
  - Authenticator application
- Mobile Device Management (MDM)

- Active Directory
  - Login script
  - Domain
  - Group Policy/updates
  - Organizational units
  - Home folder
  - Folder redirection
  - Security groups

2.3 Given a scenario, detect, remove, and prevent malware using the appropriate tools and methods

- Malware
  - Trojan
  - Rootkit
  - Virus
  - Spyware
  - Ransomware
  - Keylogger
  - Boot sector virus
  - Cryptominers
- Tools and methods
  - Recovery mode
  - Antivirus
  - Anti-malware
  - Software firewalls
  - Anti-phishing training
  - User education regarding common threats
  - OS reinstallation

2.4 Explain common social-engineering attacks, threats, and vulnerabilities

- Social engineering
  - Phishing
  - Vishing
  - Shoulder surfing
  - Whaling

- Tailgating
- Impersonation
- Dumpster diving
- Evil twin

- Threats
  - Distributed Denial of Service (DDoS)
  - Denial of Service (DoS)
  - Zero-day attack
  - Spoofing
  - On-path attack
  - Brute-force attack
  - Dictionary attack
  - Insider threat
  - Structured Query Language (SQL) injection
  - Cross-Site Scripting (XSS)
- Vulnerabilities
  - Non-compliant systems
  - Unpatched systems
  - Unprotected systems (missing antivirus/missing firewall)
  - EOL OSs

2.5 Given a scenario, manage and configure basic security settings in the Microsoft Windows OS

- Defender Antivirus
  - Activate/deactivate
  - Updated definitions
- Firewall
  - Activate/deactivate
  - Port security
  - Application security
- Users and groups
  - Local vs. Microsoft account
  - Standard account
  - Administrator

- Guest user
- Power user

- Login OS options
  - Username and password
  - Personal Identification Number (PIN)
  - Fingerprint
  - Facial recognition
- NTFS vs. share permissions
  - File and folder attributes
  - Inheritance
- Run as administrator vs. standard user
  - User Account Control (UAC)
- BitLocker
- BitLocker To Go
- Encrypting File System (EFS)

2.6 Given a scenario, configure a workstation to meet best practices for security

- Password best practices
  - Complexity requirements
    - Length
    - Character types
  - Expiration requirements
  - Basic Input/Output System (BIOS)/Unified Extensible Firmware Interface (UEFI) passwords
- End-user best practices
  - Use screensaver locks
  - Log off when not in use
  - Secure/protect critical hardware (e.g., laptops)
  - Secure Personally Identifiable Information (PII) and passwords
- Account management
  - Restrict user permissions
  - Restrict login times
  - Disable guest account
  - Use failed attempts lockout

- Use timeout/screen lock
- Change default administrator's user account/password
- Disable AutoRun
- Disable AutoPlay

2.7 Explain common methods for securing mobile and embedded devices

- Screen locks
  - Facial recognition
  - PIN codes
  - Fingerprint
  - Pattern
  - Swipe
- Remote wipes
- Locator applications
- OS updates
- Remote backup applications
- Failed login attempts restrictions
- Antivirus/anti-malware
- Firewalls
- Policies and procedures

2.8 Given a scenario, use common data destruction and disposal methods

- Physical destruction
  - Drilling
  - Shredding
  - Degaussing
  - Incinerating
- Recycling or repurposing best practices
  - Erasing/wiping
  - Low-level formatting
  - Standard formatting
- Outsourcing concepts
  - Third-party vendor
  - Certification of destruction/recycling

2.9 Given a scenario, install and configure browsers and relevant security settings

- Browser download/installation
  - Trusted sources
    - Hashing
  - Untrusted sources
- Extensions and plug-ins
  - Trusted sources
  - Untrusted sources
- Password managers
- Settings
  - Pop-up blocker
  - Clearing browsing data
  - Clearing cache
  - Private-browsing mode
  - Sign-in/browser data synchronization
  - Ad blockers

Domain 3: Software Troubleshooting (22%)

3.1 Given a scenario, troubleshoot common Windows OS problems

- Common symptoms
- Blue Screen Of Death (BSOD)
- Sluggish performance
- Boot problems
- Frequent shutdowns
- Services not starting
- Applications crashing
- Low memory warnings
- USB controller resource
- warnings
- System instability
- No OS found
- Slow profile load
- Time drift
- Common troubleshooting steps
- Reboot
- Restart services
- Uninstall/reinstall/update applications
- Add resources
- Verify requirements
- System file check
- Repair Windows
- Restore
- Reimage
- Roll back updates
- Rebuild Windows profiles

3.2 Given a scenario, troubleshoot common personal computer (PC) security issues

- Common symptoms
- Unable to access the network
- Desktop alerts

- False alerts regarding antivirus protection
- Altered system or personal files
- M Missing/renamed files
- Unwanted notifications within
- the OS
- OS update failures
- Browser-related symptoms
- Random/frequent pop-ups
- Certificate warnings
- Redirection

3.3 Given a scenario, use best practice procedures for malware removal

- Investigate and verify malware symptoms
- Quarantine infected systems
- Disable System Restore in Windows
- Remediate infected systems
  - Update anti-malware software
  - Scanning and removal techniques (e.g., safe mode, preinstallation environment)
- Schedule scans and run updates
- Enable System Restore and create a restore point in Windows
- Educate the end user

3.4 Given a scenario, troubleshoot common mobile OS and application issues

- Common symptoms
  - Application fails to launch
  - Application fails to close/crashes
  - Application fails to update
  - Slow to respond
  - OS fails to update
  - Battery life issues
  - Randomly reboots
  - Connectivity issues
  - Screen does not autorotate

3.5 Given a scenario, troubleshoot common mobile OS and application security issues

- Security concerns
  - Android Package (APK) source
  - Developer mode
  - Root access/jailbreak
  - Bootleg/malicious application
    - Application spoofing
- Common symptoms
  - High network traffic
  - Sluggish response time
  - Data-usage limit notification
  - Limited Internet connectivity
  - No Internet connectivity
  - High number of ads
  - Fake security warnings
  - Unexpected application behavior
  - Leaked personal files/data

Domain 4: Operational Procedures (22%)

4.1 Given a scenario, implement best practices associated with documentation and support systems information management

- Ticketing systems
  - User information
  - Device information
  - Description of problems
  - Categories
  - Severity
  - Escalation levels
  - Clear, concise written communication
    - Problem description
    - Progress notes
    - Problem resolution
- Asset management
  - Inventory lists
  - Database system
  - Asset tags and IDs
  - Procurement life cycle
  - Warranty and licensing
  - Assigned users
- Types of documents
  - Acceptable Use Policy (AUP)
  - Network topology diagram
  - Regulatory compliance requirements
    - Splash screens
  - Incident reports
  - Standard operating procedures
    - Procedures for custom installation of software package
  - New-user setup checklist
  - End-user termination checklist
- Knowledge base/articles

4.2 Explain basic change-management best practices

- Documented business processes
  - Rollback plan
  - Sandbox testing
  - Responsible staff member
- Change management
  - Request forms
  - Purpose of the change
  - Scope of the change
  - Date and time of the change
  - Affected systems/impact
  - Risk analysis
    - Risk level
  - Change board approvals
  - End-user acceptance

4.3 Given a scenario, implement workstation backup and recovery methods

- Backup and recovery
  - Full
  - Incremental
  - Differential
  - Synthetic
- Backup testing
  - Frequency
- Backup rotation schemes
  - On site vs. off site
  - Grandfather-Father-Son (GFS)
  - 3-2-1 backup rule

4.4 Given a scenario, use common safety procedures

- Electrostatic Discharge (ESD) straps
- ESD mats
- Equipment grounding
- Proper power handling
- Proper component handling and storage

- Antistatic bags
- Compliance with government regulations
- Personal safety
  - Disconnect power before repairing PC
  - Lifting techniques
  - Electrical fire safety
  - Safety goggles
  - Air filtration mask

4.5 Summarize environmental impacts and local environmental controls

- Material Safety Data Sheet (MSDS)/documentation for handling and disposal
  - Proper battery disposal
  - Proper toner disposal
  - Proper disposal of other devices and assets
- Temperature, humidity-level awareness, and proper ventilation
  - Location/equipment placement
  - Dust cleanup
  - Compressed air/vacuums
- Power surges, under-voltage events, and power failures
  - Battery backup
  - Surge suppressor

4.6 Explain the importance of prohibited content/activity and privacy, licensing, and policy concepts

- Incident response
  - Chain of custody
  - Inform management/law enforcement as necessary
  - Copy of drive (data integrity and preservation)
  - Documentation of incident
- Licensing/Digital Rights Management (DRM)/End-User License Agreement (EULA)
  - Valid licenses
  - Non-expired licenses
  - Personal use license vs. corporate use license
  - Open-source license
- Regulated data

- Credit card transactions
- Personal government-issued information
- PII
- Healthcare data
- Data retention requirements

4.7 Given a scenario, use proper communication techniques and professionalism

- Professional appearance and attire
  - Match the required attire of the given environment
    - Formal
    - Business casual
- Use proper language and avoid jargon, acronyms, and slang, when applicable
- Maintain a positive attitude/project confidence
- Actively listen, take notes, and avoid interrupting the customer
- Be culturally sensitive
  - Use appropriate professional titles, when applicable
- Be on time (if late, contact the customer)
- Avoid distractions
  - Personal calls
  - Texting/social media sites
  - Personal interruptions
- Dealing with difficult customers or situations
  - Do not argue with customers or be defensive
  - Avoid dismissing customer problems
  - Avoid being judgmental
  - Clarify customer statements
  - Do not disclose experience via social media outlets
- Set and meet expectations/time line and communicate status with the customer
  - Offer repair/replacement options, as needed
  - Provide proper documentation on the services provided
  - Follow up with customer/user at a later date to verify satisfaction
- Deal appropriately with customers' confidential and private materials
  - Located on a computer, desktop, printer, etc.

4.8 Identify the basics of scripting

- Script file types
  - .bat
  - .ps1
  - .vbs
  - .sh
  - .js
  - .py
- Use cases for scripting
  - Basic automation
  - Restarting machines
  - Remapping network drives
  - Installation of applications
  - Automated backups
  - Gathering of information/data
  - Initiating updates
- Other considerations when using scripts
  - Unintentionally introducing malware
  - Inadvertently changing system settings
  - Browser or system crashes due to mishandling of resources

CompTIA Network+

Domain 1: Networking Concepts (23%)

1.1 Explain concepts related to the Open Systems Interconnection (OSI) reference model

- Layer 1 - Physical
- Layer 2 - Data link
- Layer 3 - Network
- Layer 4 - Transport
- Layer 5 - Session
- Layer 6 - Presentation
- Layer 7 - Application

1.2 Compare and contrast networking appliances, applications, and functions

- Physical and virtual appliances
  - Router
  - Switch
  - Firewall
  - Intrusion Detection System (IDS)/ Intrusion Prevention System (IPS)
  - Load balancer
  - Proxy
  - Network-Attached Storage (NAS)
  - Storage Area Network (SAN)
  - Wireless
    - Access Point (AP)
    - Controller
- Applications
  - Content Delivery Network (CDN)
- Functions
  - Virtual Private Network (VPN)
  - Quality of Service (QoS)
  - Time to Live (TTL)

1.3 Summarize cloud concepts and connectivity options

- Network Functions Virtualization (NFV)
- Virtual Private Cloud (VPC)
- Network security groups
- Network security lists
- Cloud gateways
- Cloud connectivity options
- Scalability
- Elasticity
- Multitenancy

1.4 Explain common networking ports, protocols, services, and traffic types

- Protocols
  - File Transfer Protocol (FTP)
  - Secure File Transfer Protocol (SFTP)
  - Secure Shell (SSH)
  - Telnet
  - Simple Mail Transfer Protocol (SMTP)
  - Domain Name System (DNS)
  - Dynamic Host Configuration Protocol (DHCP)
  - Trivial File Transfer Protocol (TFTP)
  - Hypertext Transfer Protocol (HTTP)
  - Network Time Protocol (NTP)
  - Simple Network Management Protocol (SNMP)
  - Lightweight Directory Access Protocol (LDAP)
  - Hypertext Transfer Protocol Secure (HTTPS)
  - Server Message Block (SMB)
  - Syslog
  - Simple Mail Transfer Protocol Secure (SMTPS)
  - Lightweight Directory Access Protocol over SSL (LDAPS)
  - Structured Query Language (SQL) Server
  - Remote Desktop Protocol (RDP)
  - Session Initiation Protocol (SIP)
- Internet Protocol (IP) types

- Internet Control Message Protocol (ICMP)
- Transmission Control Protocol (TCP)
- User Datagram Protocol (UDP)
- Generic Routing Encapsulation (GRE)
- Internet Protocol Security (IPSec)
    - Authentication Header (AH)
    - Encapsulating Security Payload (ESP)
    - Internet Key Exchange (IKE)
- Traffic types
    - Unicast
    - Multicast
    - Anycast
    - Broadcast

1.5 Compare and contrast transmission media and transceivers

- Wireless
    - 802.11 standards
    - Cellular
    - Satellite
- Wired
    - 802.3 standards
    - Single-mode vs. multimode fiber
    - Direct Attach Copper (DAC) cable
        - Twinaxial cable
    - Coaxial cable
    - Cable speeds
    - Plenum vs. non-plenum cable
- Transceivers
    - Protocol
        - Ethernet
        - Fibre Channel (FC)
    - Form factors
        - Small Form-factor Pluggable (SFP)
        - Quad Small Form-factor Pluggable (QSFP)

- Connector types
  - Subscriber Connector (SC)
  - Local Connector (LC)
  - Straight Tip (ST)
  - Multi-fiber Push On (MPO)
  - Registered Jack (RJ)11
  - RJ45
  - F-type
  - Bayonet Neill Concelman (BNC)

1.6 Compare and contrast network topologies, architectures, and types

- Mesh
- Hybrid
- Star/hub and spoke
- Spine and leaf
- Point to point
- Three-tier hierarchical model
  - Core
  - Distribution
  - Access
- Collapsed core
- Traffic flows
  - North-south
  - East-west

1.7 Given a scenario, use appropriate IPv4 network addressing

- Public vs. private
  - Automatic Private IP Addressing (APIPA)
  - RFC1918
  - Loopback/localhost
- Subnetting
  - Variable Length Subnet Mask (VLSM)
  - Classless Inter-Domain Routing (CIDR)
- IPv4 address classes

- Class A, Class B, Class C, Class D, and Class E

1.8 Summarize evolving use cases for modern network environments

- Software-Defined Network (SDN) and Software-Defined Wide Area Network (SD-WAN)
  - Application aware
  - Zero-touch provisioning
  - Transport agnostic
  - Central policy management
- Virtual Extensible Local Area Network (VXLAN)
  - Data Center Interconnect (DCI)
  - Layer 2 encapsulation
- Zero Trust Architecture (ZTA)
  - Policy-based authentication
  - Least privilege access
- Secure Access Secure Edge (SASE)/ Security Service Edge (SSE)
- Infrastructure as Code (IaC)
  - Automation
    - Playbooks/templates/ reusable tasks
    - Configuration drift/compliance
    - Upgrades
    - Dynamic inventories
  - Source control
    - Version control
    - Central repository
    - Conflict identification
    - Branching
- IPv6 addressing
  - Mitigating address exhaustion
  - Compatibility requirements
    - Tunneling
    - Dual stack
    - NAT64

Domain 2: Network Implementation (20%)

2.1 Explain characteristics of routing technologies

- Static routing
- Dynamic routing
  - Border Gateway Protocol (BGP)
  - Enhanced Interior Gateway Routing Protocol (EIGRP)
  - Open Shortest Path First (OSPF)
- Route selection
  - Administrative distance
  - Prefix length
  - Metric
- Address translation
  - NAT
  - Port Address Translation (PAT)
- First Hop Redundancy Protocol (FHRP)
- Virtual IP (VIP)
- Subinterfaces

2.2 Given a scenario, configure switching technologies and features

- Virtual Local Area Network (VLAN)
  - VLAN database
  - Switch Virtual Interface (SVI)
- Interface configuration
  - Native VLAN
  - Voice VLAN
  - 802.1Q tagging
  - Link aggregation
  - Speed
  - Duplex
- Spanning tree
- Maximum Transmission Unit (MTU)
  - Jumbo frames

2.3 Given a scenario, select and configure wireless devices and technologies

- Channels
  - Channel width
  - Non-overlapping channels
  - Regulatory impacts (802.11h)
- Frequency options
  - 2.4GHz
  - 5GHz
  - 6GHz
  - Band steering
- Service set identifier (SSID)
  - Basic Service Set Identifier (BSSID)
  - Extended Service Set Identifier (ESSID)
- Network types
- Encryption
  - Wi-Fi Protected Access 2 (WPA2)
  - WPA3
- Guest networks
  - Captive portals
- Authentication
  - Pre-Shared Key (PSK) vs. Enterprise
- Antennas
  - Omnidirectional vs. directional
- Autonomous vs. lightweight access point

2.4 Explain important factors of physical installations

- Important installation implications
  - Locations
    - Intermediate Distribution Frame (IDF)
    - Main Distribution Frame (MDF)
  - Rack size
  - Port-side exhaust/intake
  - Cabling
    - Patch panel

- Fiber distribution panel
- Lockable
- Power
- Environmental factors

Domain 3: Network Operations (19%)

3.1 Explain the purpose of organizational processes and procedures

- Documentation
  - Physical vs. logical diagrams
  - Rack diagrams
  - Cable maps and diagrams
  - Network diagrams
  - IP Address Management (IPAM)
  - Service-Level Agreement (SLA)
  - Wireless survey/heat map
- Life-cycle management
  - End-of-Life (EOL)
  - End-of-Support (EOS)
  - Software management
  - Decommissioning
- Configuration management
  - Production configuration
  - Backup configuration
  - Baseline/golden configuration

3.2 Given a scenario, use network monitoring technologies.

- Methods
  - SNMP
    - Traps
      - Management Information Base (MIB)
      - Versions ‣ v2c ‣ v3
    - Community strings
    - Authentication
  - Flow data

- Packet capture
- Baseline metrics
  - Anomaly alerting/notification
- Log aggregation
  - Syslog collector
  - Security Information and Event Management (SIEM)
- Application Programming Interface (API) integration
- Port mirroring

- Solutions
  - Network discovery
    - Ad-hoc
    - Scheduled
  - Traffic analysis
  - Performance monitoring
  - Availability monitoring
  - Configuration monitoring

3.3 Explain Disaster Recovery (DR) concepts

- DR metrics
  - Recovery Point Objective (RPO)
  - Recovery Time Objective (RTO)
  - Mean Time to Repair (MTTR)
  - Mean Time Between Failures (MTBF)
- DR sites
  - Cold site Warm site Hot site
- High-availability approaches
  - Active-active and Active-passive
- Testing
  - Tabletop exercises
  - Validation tests

3.4 Given a scenario, implement IPv4 and IPv6 network services

- Dynamic addressing
  - DHCP

- Reservations
- Scope
- Lease time
- Options
- Relay/IP helper
- Exclusions

- Stateless Address Autoconfiguration (SLAAC)

- Name resolution
  - DNS
    - Domain Name Security Extensions (DNSSEC)
    - DNS over HTTPS (DoH) and DNS over TLS (DoT)
    - Record types
      - Address (A)
      - AAAA
      - Canonical name (CNAME)
      - Mail Exchange (MX)
      - Text (TXT)
      - Nameserver (NS)
      - Pointer (PTR)
    - Zone types
      - Forward
      - Reverse
    - Authoritative vs. non-authoritative
    - Primary vs. secondary
    - Recursive
  - Hosts file
- Time protocols
  - NTP
  - Precision Time Protocol (PTP)
  - Network Time Security (NTS)

3.5 Compare and contrast network access and management methods

- Site-to-site VPN
- Client-to-site VPN

- Clientless
- Split tunnel vs. full tunnel

- Connection methods
- Jump box/host
- In-band vs. out-of-band management

Domain 4: Network Security (14%)

4.1 Explain the importance of basic network security concepts

- Logical security
  - ✓ Encryption
    - → Data in transit and Data at rest
  - ✓ Certificates
    - → Public Key Infrastructure (PKI)
    - → Self-signed
  - ✓ Identity and Access Management (IAM)
    - → Authentication
      - Multi-Factor Authentication (MFA)
      - Single Sign-On (SSO)
      - Remote Authentication Dialin User Service (RADIUS)
      - Security Assertion Markup Language (SAML)
      - Terminal Access Controller Access Control System Plus (TACACS+)
      - Time-based authentication
    - → Authorization
      - Least privilege
      - Role-based access control
  - ✓ Geofencing
- Deception technologies
  - ✓ Honeypot and Honeynet
- Common security terminology
  - ✓ Risk
  - ✓ Vulnerability
  - ✓ Exploit
  - ✓ Threat
  - ✓ Confidentiality, Integrity, and Availability (CIA) triad
- Audits and regulatory compliance
  - ✓ Data locality
  - ✓ Payment Card Industry Data Security Standards (PCI DSS)
  - ✓ General Data Protection Regulation (GDPR)

- Network segmentation enforcement
  - Internet of Things (IoT) and Industrial Internet of Things (IIoT)
  - Supervisory Control and Data Acquisition (SCADA), industrial control System (ICS), Operational Technology (OT)
  - Guest
  - Bring Your Own Device (BYOD)

4.2 Summarize various types of attacks and their impact to the network

- VLAN hopping
- Media Access Control (MAC) flooding
- Address Resolution Protocol (ARP) poisoning
- ARP spoofing
- DNS poisoning
- DNS spoofing
- Rogue devices and services
  - DHCP
  - AP

4.3 Given a scenario, apply network security features, defense techniques, and solutions

- Device hardening
  - Disable unused ports and services
  - Change default passwords
- Network Access Control (NAC)
  - Port security
  - 802.1X
  - MAC filtering
- Key management
- Security rules
  - Access Control List (ACL)
  - Uniform Resource Locator (URL) filtering
  - Content filtering
- Zones
  - Trusted vs. untrusted
  - Screened subnet

Domain 5: Network troubleshooting (24%)

5.1 Explain the troubleshooting methodology

- Identify the problem
  - Gather information
  - Question users
  - Identify symptoms
  - Determine if anything has changed
  - Duplicate the problem, if possible
  - Approach multiple problems individually
- Establish a theory of probable cause
  - Question the obvious
  - Consider multiple approaches
    - Top-to-bottom/bottomto-top OSI model
    - Divide and conquer
- Test the theory to determine the cause
  - If theory is confirmed, determine next steps to resolve problem
  - If theory is not confirmed, establish a new theory or escalate
- Establish a plan of action to resolve the problem and identify potential effects
- Implement the solution or escalate as necessary
- Verify full system functionality and implement preventive measures if applicable
- Document findings, actions, outcomes, and lessons learned throughout the process

5.2 Given a scenario, troubleshoot common cabling and physical interface issues

- Cable issues
  - Incorrect cable
    - Single mode vs. multimode
    - Category 5/6/7/8
    - Shielded Twisted Pair (STP) vs. Unshielded Twisted Pair (UTP)
  - Signal degradation
    - Crosstalk
    - Interference
    - Attenuation
  - Improper termination

- Transmitter (TX)/Receiver (RX) transposed

- Interface issues
  - Increasing interface counters
    - Cyclic Redundancy Check (CRC)
    - Runts
    - Giants
    - Drops
  - Port status
    - Error disabled
    - Administratively down
    - Suspended
- Hardware issues
  - Power over Ethernet (PoE)
    - Power budget exceeded
    - Incorrect standard
  - Transceivers
    - Mismatch
    - Signal strength

5.3 Given a scenario, troubleshoot common issues with network services

- Switching issues
  - STP
    - Network loops
    - Root bridge selection
    - Port roles
    - Port states
  - Incorrect VLAN assignment
  - ACLs
- Route selection
  - Routing table
  - Default routes
- Address pool exhaustion
- Incorrect default gateway
- Incorrect IP address

- Duplicate IP address
- Incorrect subnet mask

5.4 Given a scenario, troubleshoot common performance issues

- Congestion/contention
- Bottlenecking
- Bandwidth
  - Throughput capacity
- Latency
- Packet loss
- Jitter
- Wireless
  - Interference
    - Channel overlap
  - Signal degradation or loss
  - Insufficient wireless coverage
  - Client disassociation issues
  - Roaming misconfiguration

5.5 Given a scenario, use the appropriate tool or protocol to solve networking issues

- Software tools
  - Protocol analyzer
  - Command line
    - ping
    - traceroute/tracert
    - nslookup
    - tcpdump
    - dig
    - netstat
    - ip/ifconfig/ipconfig
    - arp
  - Nmap
  - Link Layer Discovery Protocol (LLDP)/Cisco Discovery Protocol (CDP)
  - Speed tester

- Hardware tools
  - Toner
  - Cable tester
  - Taps
  - Wi-Fi analyzer
  - Visual fault locator
- Basic networking device commands
  - show mac-address-table
  - show route
  - show interface
  - show config
  - show arp
  - show vlan
  - show power

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