About the Exam

Candidates are encouraged to use this document to help prepare for the CompTIA Network+ (N10-008) certification exam. The CompTIA Network+ certification exam will verify the successful candidate has the knowledge and skills required to:

- Establish network connectivity by deploying wired and wireless devices
- Understand and maintain network documentation
- Understand the purpose of network services
- Understand basic datacenter, cloud, and virtual networking concepts
- Monitor network activity, identifying performance and availability issues
- Implement network hardening techniques
- Manage, configure, and troubleshoot network infrastructure

This is equivalent to 9–12 months of hands-on experience working in a junior network administrator/network support technician job role. These content examples are meant to clarify the test objectives and should not be construed as a comprehensive listing of all the content of this examination.

EXAM ACCREDITATION

The CompTIA Network+ (N10-008) exam is accredited by ANSI to show compliance with the ISO 17024 standard and, as such, undergoes regular reviews and updates to the exam objectives.

EXAM DEVELOPMENT

CompTIA exams result from subject matter expert workshops and industry-wide survey results regarding the skills and knowledge required of an entry-level IT professional.

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PLEASE NOTE

The lists of examples provided in bulleted format are not exhaustive lists. Other examples of technologies, processes, or tasks pertaining to each objective may also be included on the exam although not listed or covered in this objectives document. CompTIA is constantly reviewing the content of our exams and updating test questions to be sure our exams are current, and the security of the questions is protected. When necessary, we will publish updated exams based on existing exam objectives. Please know that all related exam preparation materials will still be valid.
TEST DETAILS

Required exam: N10-008
Number of questions: Maximum of 90
Types of questions: Multiple-choice and performance-based
Length of test: 90 minutes
Recommended experience:
- CompTIA A+ certified, or equivalent
- Minimum of 9–12 months of hands-on experience working in a junior network administrator/network support technician job role
Passing score: 720 (on a scale of 100-900)

EXAM OBJECTIVES (DOMAINS)

The table below lists the domains measured by this examination and the extent to which they are represented.

<table>
<thead>
<tr>
<th>DOMAIN</th>
<th>PERCENTAGE OF EXAMINATION</th>
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</thead>
<tbody>
<tr>
<td>1.0 Networking Fundamentals</td>
<td>24%</td>
</tr>
<tr>
<td>2.0 Network Implementations</td>
<td>19%</td>
</tr>
<tr>
<td>3.0 Network Operations</td>
<td>16%</td>
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<td>4.0 Network Security</td>
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<td>5.0 Network Troubleshooting</td>
<td>22%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
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1.0 Networking Fundamentals

1.1 Compare and contrast the Open Systems Interconnection (OSI) model layers and encapsulation concepts.

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

- Data encapsulation and decapsulation within the OSI model context
  - Ethernet header
  - Internet Protocol (IP) header
  - Transmission Control Protocol (TCP)/User Datagram Protocol (UDP) headers
  - TCP flags
  - Payload
  - Maximum transmission unit (MTU)

1.2 Explain the characteristics of network topologies and network types.

- Mesh
- Star/hub-and-spoke
- Bus
- Ring
- Hybrid

- Network types and characteristics
  - Peer-to-peer
  - Client-server
  - Local area network (LAN)
  - Metropolitan area network (MAN)
  - Wide area network (WAN)
  - Wireless local area network (WLAN)
  - Personal area network (PAN)

- Campus area network (CAN)
- Storage area network (SAN)
- Software-defined wide area network (SDWAN)
- Multiprotocol label switching (MPLS)
- Multipoint generic routing encapsulation (mGRE)

- Service-related entry point
  - Demarcation point
  - Smartjack

- Virtual network concepts
  - vSwitch
  - Virtual network interface card (vNIC)

- Network function virtualization (NFV)
- Hypervisor

- Provider links
  - Satellite
  - Digital subscriber line (DSL)
  - Cable
  - Leased line
  - Metro-optical
1.0 Networking Fundamentals

1.3 Summarize the types of cables and connectors and explain which is the appropriate type for a solution.

- **Copper**
  - Twisted pair
    - Cat 5
    - Cat 5e
    - Cat 6
    - Cat 6a
    - Cat 7
    - Cat 8
  - Coaxial/ RG-6
  - Twinaxial
  - Termination standards
    - TIA/EIA-568A
    - TIA/EIA-568B
- **Fiber**
  - Single-mode
  - Multimode
- **Connector types**
  - Local connector (LC), straight tip (ST), subscriber connector (SC), mechanical transfer (MT), registered jack (RJ)
  - Angled physical contact (APC)
  - Ultra-physical contact (UPC)
  - RJ11
- **Transceiver type**
  - RJ45
  - F-type connector
  - Transceivers/media converters
  - Transceiver type
    - Small form-factor pluggable (SFP)
    - Enhanced form-factor pluggable (SFP+)
    - Quad small form-factor pluggable (QSFP)
    - Enhanced quad small form-factor pluggable (QSFP+)
- **Cable management**
  - Patch panel/patch bay
  - Fiber distribution panel
  - Punchdown block
    - 66
    - 110
    - Krone
    - Bix
- **Ethernet standards**
  - Copper
    - 10BASE-T
    - 100BASE-TX
  - Fiber
    - 100BASE-FX
    - 100BASE-SX
    - 1000BASE-SX
    - 1000BASE-LX
    - 10GBASE-SR
    - 10GBASE-LR
    - Coarse wavelength division multiplexing (CWDM)
    - Dense wavelength division multiplexing (DWDM)
    - Bidirectional wavelength division multiplexing (WDDM)

1.4 Given a scenario, configure a subnet and use appropriate IP addressing schemes.

- **Public vs. private**
  - RFC1918
  - Network address translation (NAT)
  - Port address translation (PAT)
- **IPv4 vs. IPv6**
  - Automatic Private IP Addressing (APIPA)
  - Extended unique identifier (EUI-64)
  - Multicast
  - Unicast
  - Anycast
  - Broadcast
  - Link local
  - Loopback
  - Default gateway
- **IPv4 subnetting**
  - Classful
    - A
    - B
    - C
    - D
    - E
  - Classless Inter-Domain Routing (CIDR) notation
- **IPv6 concepts**
  - Tunneling
  - Dual stack
  - Shorthand notation
  - Router advertisement
  - Stateless address autoconfiguration (SLAAC)
- **Virtual IP (VIP)**
- **Subinterfaces**
Explain common ports and protocols, their application, and encrypted alternatives.

<table>
<thead>
<tr>
<th>Protocols</th>
<th>Ports</th>
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<tbody>
<tr>
<td>File Transfer Protocol (FTP)</td>
<td>20/21</td>
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<tr>
<td>Secure Shell (SSH)</td>
<td>22</td>
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<tr>
<td>Secure File Transfer Protocol (SFTP)</td>
<td>22</td>
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<tr>
<td>Telnet</td>
<td>23</td>
</tr>
<tr>
<td>Simple Mail Transfer Protocol (SMTP)</td>
<td>25</td>
</tr>
<tr>
<td>Domain Name System (DNS)</td>
<td>53</td>
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<tr>
<td>Dynamic Host Configuration Protocol (DHCP)</td>
<td>67/68</td>
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<tr>
<td>Trivial File Transfer Protocol (TFTP)</td>
<td>69</td>
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<tr>
<td>Hypertext Transfer Protocol (HTTP)</td>
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<tr>
<td>Post Office Protocol v3 (POP3)</td>
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<tr>
<td>Network Time Protocol (NTP)</td>
<td>123</td>
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<tr>
<td>Internet Message Access Protocol (IMAP)</td>
<td>143</td>
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<tr>
<td>Simple Network Management Protocol (SNMP)</td>
<td>161/162</td>
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<tr>
<td>Lightweight Directory Access Protocol (LDAP)</td>
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<tr>
<td>Hypertext Transfer Protocol Secure (HTTPS) [Secure Sockets Layer (SSL)]</td>
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<tr>
<td>HTTPS [Transport Layer Security (TLS)]</td>
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<tr>
<td>Server Message Block (SMB)</td>
<td>445</td>
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<tr>
<td>Syslog</td>
<td>514</td>
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<td>SMTP TLS</td>
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<td>Lightweight Directory Access Protocol (over SSL) (LDAPS)</td>
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<td>IMAP over SSL</td>
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<td>POP3 over SSL</td>
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<td>Structured Query Language (SQL) Server</td>
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<td>Remote Desktop Protocol (RDP)</td>
<td>3389</td>
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<td>Session Initiation Protocol (SIP)</td>
<td>5060/5061</td>
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<td>IP protocol types</td>
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<tr>
<td>· Internet Control Message Protocol (ICMP)</td>
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<tr>
<td>· TCP</td>
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<tr>
<td>· UDP</td>
<td></td>
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<tr>
<td>· Generic Routing Encapsulation (GRE)</td>
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<tr>
<td>· Internet Protocol Security (IPSec)</td>
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<tr>
<td>· Authentication Header (AH)/Encapsulating Security Payload (ESP)</td>
<td></td>
</tr>
<tr>
<td>· Connectionless vs. connection-oriented</td>
<td></td>
</tr>
</tbody>
</table>
1.6 Explain the use and purpose of network services.

- **DHCP**
  - Scope
  - Exclusion ranges
  - Reservation
  - Dynamic assignment
  - Static assignment
  - Lease time
  - Scope options
  - Available leases
  - DHCP relay
  - IP helper/UDP forwarding

- **DNS**
  - Record types
    - Address (A vs. AAAA)
    - Canonical name (CNAME)
    - Mail exchange (MX)
    - Start of authority (SOA)
    - Pointer (PTR)
    - Text (TXT)
    - Service (SRV)
    - Name server (NS)
  - Global hierarchy
    - Root DNS servers
    - Internal vs. external
    - Zone transfers

- **NTP**
  - Stratum
  - Clients
  - Servers

1.7 Explain basic corporate and datacenter network architecture.

- **Three-tiered**
  - Core
  - Distribution/aggregation layer
  - Access/edge

- **Software-defined networking**
  - Application layer
  - Control layer
  - Infrastructure layer
  - Management plane

- **Spine and leaf**
  - Software-defined network
  - Top-of-rack switching
  - Backbone

- **Traffic flows**
  - North-South
  - East-West

- **Branch office vs. on-premises**
  - Datacenter vs. colocation

- **Storage area networks**
  - Connection types
    - Fibre Channel over Ethernet (FCoE)
    - Fibre Channel
    - Internet Small Computer Systems Interface (iSCSI)

1.8 Summarize cloud concepts and connectivity options.

- **Deployment models**
  - Public
  - Private
  - Hybrid
  - Community

- **Service models**
  - Software as a service (SaaS)
  - Infrastructure as a service (IaaS)
  - Platform as a service (PaaS)
  - Desktop as a service (DaaS)

- **Infrastructure as code**
  - Automation/orchestration

- **Connectivity options**
  - Virtual private network (VPN)
  - Private-direct connection to cloud provider

- **Multitenancy**
- **Elasticity**
- **Scalability**
- **Security implications**
2.0 Network Implementations

2.1 Compare and contrast various devices, their features, and their appropriate placement on the network.

- **Networking devices**
  - Layer 2 switch
  - Layer 3 capable switch
  - Router
  - Hub
  - Access point
  - Bridge
  - Wireless LAN controller
  - Load balancer
  - Proxy server
  - Cable modem
  - DSL modem
  - Repeater

- **Voice gateway**
- **Media converter**
- **Intrusion prevention system (IPS)/intrusion detection system (IDS) device**
- **Firewall**
- **VPN headend**

- **Networked devices**
  - Voice over Internet Protocol (VoIP) phone
  - Printer
  - Physical access control devices
  - Cameras

- Heating, ventilation, and air conditioning (HVAC) sensors
- Internet of Things (IoT)
  - Refrigerator
  - Smart speakers
  - Smart thermostats
  - Smart doorbells
- Industrial control systems/supervisory control and data acquisition (SCADA)

2.2 Compare and contrast routing technologies and bandwidth management concepts.

- **Routing**
  - Dynamic routing
    - Protocols [Routing Internet Protocol (RIP), Open Shortest Path First (OSPF), Enhanced Interior Gateway Routing Protocol (EIGRP), Border Gateway Protocol (BGP)]
    - Link state vs. distance vector vs. hybrid
  - Static routing
  - Default route
  - Administrative distance
  - Exterior vs. interior
  - Time to live

- **Bandwidth management**
  - Traffic shaping
  - Quality of service (QoS)
2.3 Given a scenario, configure and deploy common Ethernet switching features.

- Data virtual local area network (VLAN)
- Voice VLAN
- Port configurations
  - Port tagging/802.1Q
  - Port aggregation
  - Link Aggregation Control Protocol (LACP)
- Duplex
- Speed
- Flow control
- Port mirroring
- Port security
- Jumbo frames
- Auto-medium-dependent interface crossover (MDI-X)
- Media access control (MAC) address tables
- Power over Ethernet (PoE)/Power over Ethernet plus (PoE+)
- Spanning Tree Protocol
- Carrier-sense multiple access with collision detection (CSMA/CD)
- Address Resolution Protocol (ARP)
- Neighbor Discovery Protocol

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**
- **Service set identifier (SSID)**
  - Basic service set
  - Extended service set
  - Independent basic service set (Ad-hoc)
  - Roaming
- **Antenna types**
  - Omni
  - Directional
- **Encryption standards**
  - WiFi Protected Access (WPA)/WPA2 Personal [Advanced Encryption Standard (AES)/Temporal Key Integrity Protocol (TKIP)]
  - WPA/WPA2 Enterprise (AES/TKIP)
- **Cellular technologies**
  - Code-division multiple access (CDMA)
  - Global System for Mobile Communications (GSM)
  - Long-Term Evolution (LTE)
  - 3G, 4G, 5G
- **Multiple input, multiple output (MIMO) and multi-user MIMO (MU-MIMO)**
3.0 Network Operations

3.1 Given a scenario, use the appropriate statistics and sensors to ensure network availability.

- **Performance metrics/sensors**
  - Device/chassis
  - Temperature
  - Central processing unit (CPU) usage
  - Memory
  - Network metrics
    - Bandwidth
    - Latency
    - Jitter
  - **SNMP**
    - Traps
    - Object identifiers (OIDs)
    - Management information bases (MIBs)
- **Network device logs**
  - Log reviews
  - Traffic logs
  - Audit logs
  - Syslog
  - Logging levels/severity levels
- **Interface statistics/status**
  - Link state (up/down)
  - Speed/duplex
  - Send/receive traffic
  - Cyclic redundancy checks (CRCs)
  - Protocol packet and byte counts
- **Interface errors or alerts**
  - CRC errors
  - Giants
  - Runts
  - Encapsulation errors
- **Environmental factors and sensors**
  - Temperature
  - Humidity
  - Electrical
  - Flooding
- **Baselines**
- **NetFlow data**
- **Uptime/downtime**

3.2 Explain the purpose of organizational documents and policies.

- **Plans and procedures**
  - Change management
  - Incident response plan
  - Disaster recovery plan
  - Business continuity plan
  - System life cycle
  - Standard operating procedures
- **Hardening and security policies**
  - Password policy
  - Acceptable use policy
  - Bring your own device (BYOD) policy
  - Remote access policy
- **Onboarding and offboarding policy**
- **Security policy**
- **Data loss prevention**
- **Common documentation**
  - Physical network diagram
  - Floor plan
  - Rack diagram
  - Intermediate distribution frame (IDF)/main distribution frame (MDF) documentation
  - Logical network diagram
  - Wiring diagram
- **Site survey report**
- **Audit and assessment report**
- **Baseline configurations**
- **Common agreements**
  - Non-disclosure agreement (NDA)
  - Service-level agreement (SLA)
  - Memorandum of understanding (MOU)
3.3 Explain high availability and disaster recovery concepts and summarize which is the best solution.

- Load balancing
- Multipathing
- Network interface card (NIC) teaming
- Redundant hardware/clusters
  - Switches
  - Routers
  - Firewalls
- Facilities and infrastructure support
  - Uninterruptible power supply (UPS)
  - Power distribution units (PDUs)
  - Generator
  - HVAC
  - Fire suppression

- Redundancy and high availability (HA) concepts
  - Cold site
  - Warm site
  - Hot site
  - Cloud site
  - Active-active vs. active-passive
    - Multiple Internet service providers (ISPs)/diverse paths
  - Virtual Router Redundancy Protocol (VRRP)/First Hop Redundancy Protocol (FHRP)
  - Mean time to repair (MTTR)
  - Mean time between failure (MTBF)
  - Recovery time objective (RTO)
  - Recovery point objective (RPO)

- Network device backup/restore
  - State
  - Configuration
4.0 Network Security

4.1 Explain common security concepts.
- Confidentiality, integrity, availability (CIA)
- Threats
  - Internal
  - External
- Vulnerabilities
  - Common vulnerabilities and exposures (CVE)
  - Zero-day
- Exploits
- Least privilege
- Role-based access
- Zero Trust
- Defense in depth
  - Network segmentation enforcement
- Screened subnet [previously known as demilitarized zone (DMZ)]
- Separation of duties
- Network access control
- Honeypot
- Authentication methods
  - Multifactor
  - Terminal Access Controller Access-Control System Plus (TACACS+)
  - Single sign-on (SSO)
  - Remote Authentication Dial-in User Service (RADIUS)
  - LDAP
  - Kerberos
  - Local authentication
- 802.1X
- Extensible Authentication Protocol (EAP)
- Risk Management
  - Security risk assessments
  - Threat assessment
  - Vulnerability assessment
  - Penetration testing
  - Posture assessment
  - Business risk assessments
  - Process assessment
  - Vendor assessment
- Security information and event management (SIEM)

4.2 Compare and contrast common types of attacks.
- Technology-based
  - Denial-of-service (DoS)/distributed denial-of-service (DDoS)
  - Botnet/command and control
  - On-path attack (previously known as man-in-the-middle attack)
  - DNS poisoning
  - VLAN hopping
  - ARP spoofing
  - Rogue DHCP
- Rogue access point (AP)
- Evil twin
- Ransomware
- Password attacks
  - Brute-force
  - Dictionary
  - MAC spoofing
  - IP spoofing
  - Deauthentication
  - Malware
- Human and environmental
  - Social engineering
  - Phishing
  - Tailgating
  - Piggybacking
  - Shoulder surfing
4.0 Network Security

4.3 Given a scenario, apply network hardening techniques.

- **Best practices**
  - Secure SNMP
  - Router Advertisement (RA) Guard
  - Port security
  - Dynamic ARP inspection
  - Control plane policing
  - Private VLANs
  - Disable unneeded switchports
  - Disable unneeded network services
  - Change default passwords
  - Password complexity/length

- Power levels
- Wireless client isolation
- Guest network isolation
- Preshared keys (PSKs)
- EAP
- Geofencing
- Captive portal

- **Wireless security**
  - MAC filtering
  - Antenna placement

- **IoT access considerations**

4.4 Compare and contrast remote access methods and security implications.

- **Site-to-site VPN**
- **Client-to-site VPN**
  - Clientless VPN
  - Split tunnel vs. full tunnel
- **Remote desktop connection**
- **Remote desktop gateway**
- **SSH**

- **Virtual network computing (VNC)**
- **Virtual desktop**
- **Authentication and authorization considerations**
- **In-band vs. out-of-band management**

4.5 Explain the importance of physical security.

- **Detection methods**
  - Camera
  - Motion detection
  - Asset tags
  - Tamper detection

- **Prevention methods**
  - Employee training
  - Access control hardware
    - Badge readers
    - Biometrics
    - Locking racks

- **Locking cabinets**
- **Access control vestibule**
  (previously known as a mantrap)
- **Smart lockers**

- **Asset disposal**
  - Factory reset/wipe configuration
  - Sanitize devices for disposal
5.0 Network Troubleshooting

5.1 Explain the network 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/bottom-to-top OSI model
  - Divide and conquer
- Test the theory to determine the cause
  - If the theory is confirmed, determine the next steps to resolve the problem
  - If the theory is not confirmed, reestablish 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, if applicable, implement preventive measures
- Document findings, actions, outcomes, and lessons learned

5.2 Given a scenario, troubleshoot common cable connectivity issues and select the appropriate tools.

- Specifications and limitations
  - Throughput
  - Speed
  - Distance
- Cable considerations
  - Shielded and unshielded
  - Plenum and riser-rated
- Cable application
  - Rollover cable/console cable
  - Crossover cable
  - Power over Ethernet
- Common issues
  - Attenuation
  - Interference
  - Decibel (dB) loss
- Incorrect pinout
- Bad ports
- Open/short
- Light-emitting diode (LED) status indicators
- Incorrect transceivers
- Duplexing issues
- Transmit and receive (TX/RX) reversed
- Dirty optical cables
- Common tools
  - Cable crimper
  - Punchdown tool
  - Tone generator
  - Loopback adapter
  - Optical time-domain reflectometer (OTDR)
  - Multimeter
  - Cable tester
  - Wire map
  - Tap
  - Fusion splicers
  - Spectrum analyzers
  - Snips/cutters
  - Cable stripper
  - Fiber light meter
5.0 Network Troubleshooting

5.3 Given a scenario, use the appropriate network software tools and commands.

- **Software tools**
  - WiFi analyzer
  - Protocol analyzer/packet capture
  - Bandwidth speed tester
  - Port scanner
  - iperf
  - NetFlow analyzers
  - Trivial File Transfer Protocol (TFTP) server

- **Command line tool**
  - Terminal emulator
  - IP scanner
  - **Command line tool**
    - ping
    - ipconfig/ifconfig/ip
    - nslookup/dig
    - traceroute/tracert
    - arp
    - netstat

- **Basic network platform commands**
  - hostname
  - route
  - telnet
  - tcpdump
  - nmap

5.4 Given a scenario, troubleshoot common wireless connectivity issues.

- **Specifications and limitations**
  - Throughput
  - Speed
  - Distance
  - Received signal strength indication (RSSI) signal strength
  - Effective isotropic radiated power (EIRP)/power settings

- **Considerations**
  - Antennas

- **Common issues**
  - Interference
  - Channel overlap
  - Antenna cable attenuation/signal loss

- **Considerations**
  - Placement
  - Type
  - Polarization
  - Channel utilization
  - AP association time
  - Site survey

5.5 Given a scenario, troubleshoot general networking issues.

- **Considerations**
  - Device configuration review
  - Routing tables
  - Interface status
  - VLAN assignment
  - Network performance baselines

- **Common issues**
  - Collisions
  - Broadcast storm
  - Duplicate MAC address
  - Duplicate IP address
  - Multicast flooding
  - Asymmetrical routing

- **Switching loops**
  - Routing loops
  - Rogue DHCP server
  - DHCP scope exhaustion
  - IP setting issues
  - Incorrect gateway
  - Incorrect subnet mask
  - Incorrect IP address
  - Incorrect DNS

- **Host-based/network-based firewall settings**
  - Blocked services, ports, or addresses
  - Incorrect VLAN
  - DNS issues
  - NTP issues
  - BYOD challenges
  - Licensed feature issues
  - Network performance issues

CompTIA Network+ Certification Exam Objectives 3.0 (Exam Number: N10-008)
# Network+ (N10-008) Acronym List

The following is a list of acronyms that appear on the CompTIA Network+ exam. Candidates are encouraged to review the complete list and attain a working knowledge of all listed acronyms as part of a comprehensive exam preparation program.

<table>
<thead>
<tr>
<th>ACRONYM</th>
<th>SPELLED OUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAAA</td>
<td>Authentication, Authorization, Accounting, Auditing</td>
</tr>
<tr>
<td>ACL</td>
<td>Access Control List</td>
</tr>
<tr>
<td>AES</td>
<td>Advanced Encryption Standard</td>
</tr>
<tr>
<td>AH</td>
<td>Authentication Header</td>
</tr>
<tr>
<td>AP</td>
<td>Access Point</td>
</tr>
<tr>
<td>APC</td>
<td>Angled Physical Contact</td>
</tr>
<tr>
<td>APIPA</td>
<td>Automatic Private Internet Protocol Addressing</td>
</tr>
<tr>
<td>ARP</td>
<td>Address Resolution Protocol</td>
</tr>
<tr>
<td>AUP</td>
<td>Acceptable Use Policy</td>
</tr>
<tr>
<td>BGP</td>
<td>Border Gateway Protocol</td>
</tr>
<tr>
<td>BNC</td>
<td>British Naval Connector/Bayonet Neill-Concelman</td>
</tr>
<tr>
<td>BYOD</td>
<td>Bring Your Own Device</td>
</tr>
<tr>
<td>CAM</td>
<td>Content Addressable Memory (table)</td>
</tr>
<tr>
<td>CAN</td>
<td>Campus Area Network</td>
</tr>
<tr>
<td>CDMA</td>
<td>Code Division Multiple Access</td>
</tr>
<tr>
<td>CIA</td>
<td>Confidentiality, Integrity, and Availability</td>
</tr>
<tr>
<td>CIDR</td>
<td>Classless Inter-Domain Routing</td>
</tr>
<tr>
<td>CLI</td>
<td>Command-Line Interface</td>
</tr>
<tr>
<td>CNAME</td>
<td>Canonical Name</td>
</tr>
<tr>
<td>CPU</td>
<td>Central Processing Unit</td>
</tr>
<tr>
<td>CRC</td>
<td>Cyclic Redundancy Check</td>
</tr>
<tr>
<td>CSMA/CA</td>
<td>Carrier-Sense Multiple Access with Collision Avoidance</td>
</tr>
<tr>
<td>CSMA/CD</td>
<td>Carrier-Sense Multiple Access with Collision Detection</td>
</tr>
<tr>
<td>CSU</td>
<td>Channel Service Unit</td>
</tr>
<tr>
<td>CVE</td>
<td>Common Vulnerabilities and Exposures</td>
</tr>
<tr>
<td>CWDM</td>
<td>Coarse Wavelength Division Multiplexing</td>
</tr>
<tr>
<td>Daas</td>
<td>Desktop as a Service</td>
</tr>
<tr>
<td>dB</td>
<td>Decibel</td>
</tr>
<tr>
<td>DoS</td>
<td>Distributed Denial-of-Service</td>
</tr>
<tr>
<td>DHCP</td>
<td>Dynamic Host Configuration Protocol</td>
</tr>
<tr>
<td>DLP</td>
<td>Data Loss Prevention</td>
</tr>
<tr>
<td>DNS</td>
<td>Domain Name System</td>
</tr>
<tr>
<td>DoS</td>
<td>Denial-of-Service</td>
</tr>
<tr>
<td>DSL</td>
<td>Digital Subscriber Line</td>
</tr>
<tr>
<td>DSU</td>
<td>Data Service Unit</td>
</tr>
<tr>
<td>DWDM</td>
<td>Dense Wavelength Division Multiplexing</td>
</tr>
<tr>
<td>EAP</td>
<td>Extensible Authentication Protocol</td>
</tr>
<tr>
<td>EIA</td>
<td>Electronic Industries Association</td>
</tr>
<tr>
<td>EIGRP</td>
<td>Enhanced Interior Gateway Routing Protocol</td>
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<thead>
<tr>
<th>ACRONYM</th>
<th>SPELLED OUT</th>
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<tbody>
<tr>
<td>EIRP</td>
<td>Effective Isotropic Radiated Power</td>
</tr>
<tr>
<td>ESP</td>
<td>Encapsulating Security Payload</td>
</tr>
<tr>
<td>EUI</td>
<td>Extended Unique Identifier</td>
</tr>
<tr>
<td>FCoE</td>
<td>Fibre Channel over Ethernet</td>
</tr>
<tr>
<td>FHRP</td>
<td>First Hop Redundancy Protocol</td>
</tr>
<tr>
<td>FTP</td>
<td>File Transfer Protocol</td>
</tr>
<tr>
<td>GBIC</td>
<td>Gigabit Interface Converter</td>
</tr>
<tr>
<td>GRE</td>
<td>Generic Routing Encapsulation</td>
</tr>
<tr>
<td>GSM</td>
<td>Global System for Mobile Communications</td>
</tr>
<tr>
<td>HA</td>
<td>High Availability</td>
</tr>
<tr>
<td>HDMI</td>
<td>High-Definition Multimedia Interface</td>
</tr>
<tr>
<td>HTTP</td>
<td>Hypertext Transfer Protocol</td>
</tr>
<tr>
<td>HTTPS</td>
<td>Hypertext Transfer Protocol Secure</td>
</tr>
<tr>
<td>HVAC</td>
<td>Heating, Ventilation, and Air Conditioning</td>
</tr>
<tr>
<td>IaaS</td>
<td>Infrastructure as a Service</td>
</tr>
<tr>
<td>ICMP</td>
<td>Internet Control Message Protocol</td>
</tr>
<tr>
<td>ICS</td>
<td>Industrial Control System</td>
</tr>
<tr>
<td>IDF</td>
<td>Intermediate Distribution Frame</td>
</tr>
<tr>
<td>IDS</td>
<td>Intrusion Detection System</td>
</tr>
<tr>
<td>IGMP</td>
<td>Internet Group Management Protocol</td>
</tr>
<tr>
<td>IMAP</td>
<td>Internet Message Access Protocol</td>
</tr>
<tr>
<td>IoT</td>
<td>Internet of Things</td>
</tr>
<tr>
<td>IP</td>
<td>Internet Protocol</td>
</tr>
<tr>
<td>IPS</td>
<td>Intrusion Prevention System</td>
</tr>
<tr>
<td>IPSec</td>
<td>Internet Protocol Security</td>
</tr>
<tr>
<td>IPv4</td>
<td>Internet Protocol version 4</td>
</tr>
<tr>
<td>IPv6</td>
<td>Internet Protocol version 6</td>
</tr>
<tr>
<td>iSCSI</td>
<td>Internet Small Computer Systems Interface</td>
</tr>
<tr>
<td>ISP</td>
<td>Internet Service Provider</td>
</tr>
<tr>
<td>LACP</td>
<td>Link Aggregation Control Protocol</td>
</tr>
<tr>
<td>LAN</td>
<td>Local Area Network</td>
</tr>
<tr>
<td>LC</td>
<td>Local Connector</td>
</tr>
<tr>
<td>LDAP</td>
<td>Lightweight Directory Access Protocol</td>
</tr>
<tr>
<td>LDAPS</td>
<td>Lightweight Directory Access Protocol (over SSL)</td>
</tr>
<tr>
<td>LED</td>
<td>Light-Emitting Diode</td>
</tr>
<tr>
<td>LTE</td>
<td>Long-Term Evolution</td>
</tr>
<tr>
<td>MAC</td>
<td>Media Access Control/Medium Access Control</td>
</tr>
<tr>
<td>MAN</td>
<td>Metropolitan Area Network</td>
</tr>
<tr>
<td>MDF</td>
<td>Main Distribution Frame</td>
</tr>
<tr>
<td>MDIX</td>
<td>Medium Dependent Interface Crossover</td>
</tr>
<tr>
<td>mGRE</td>
<td>Multipoint Generic Routing Encapsulation</td>
</tr>
<tr>
<td>MIB</td>
<td>Management Information Base</td>
</tr>
<tr>
<td>ACRONYM</td>
<td>SPELLED OUT</td>
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</tr>
<tr>
<td>MIMO</td>
<td>Multiple Input, Multiple Output</td>
</tr>
<tr>
<td>MU-MIMO</td>
<td>Multiuser - Multiple Input, Multiple Output</td>
</tr>
<tr>
<td>MOU</td>
<td>Memorandum of Understanding</td>
</tr>
<tr>
<td>MPLS</td>
<td>Multiprotocol Label Switching</td>
</tr>
<tr>
<td>MTBF</td>
<td>Mean Time Between Failure</td>
</tr>
<tr>
<td>MT-RJ</td>
<td>Mechanical Transfer - Registered Jack</td>
</tr>
<tr>
<td>MTTR</td>
<td>Mean Time to Repair</td>
</tr>
<tr>
<td>MU</td>
<td>Maximum Transmission Unit</td>
</tr>
<tr>
<td>MX</td>
<td>Mail Exchange</td>
</tr>
<tr>
<td>NAC</td>
<td>Network Access Control</td>
</tr>
<tr>
<td>NAS</td>
<td>Network Attached Storage</td>
</tr>
<tr>
<td>NAT</td>
<td>Network Address Translation</td>
</tr>
<tr>
<td>NDA</td>
<td>Non-Disclosure Agreement</td>
</tr>
<tr>
<td>NFV</td>
<td>Network Function Virtualization</td>
</tr>
<tr>
<td>NGFW</td>
<td>Next-Generation Firewall</td>
</tr>
<tr>
<td>NIC</td>
<td>Network Interface Card</td>
</tr>
<tr>
<td>NS</td>
<td>Name Server</td>
</tr>
<tr>
<td>NTP</td>
<td>Network Time Protocol</td>
</tr>
<tr>
<td>OID</td>
<td>Object Identifier</td>
</tr>
<tr>
<td>OSI</td>
<td>Open Systems Interconnection</td>
</tr>
<tr>
<td>OSPF</td>
<td>Open Shortest Path First</td>
</tr>
<tr>
<td>OTDR</td>
<td>Optical Time Domain Reflectometer</td>
</tr>
<tr>
<td>PaaS</td>
<td>Platform as a Service</td>
</tr>
<tr>
<td>PAN</td>
<td>Personal Area Network</td>
</tr>
<tr>
<td>PAT</td>
<td>Port Address Translation</td>
</tr>
<tr>
<td>PDU</td>
<td>Power Distribution Unit</td>
</tr>
<tr>
<td>PoE</td>
<td>Power over Ethernet</td>
</tr>
<tr>
<td>POP3</td>
<td>Post Office Protocol version 3</td>
</tr>
<tr>
<td>PSK</td>
<td>Pre-Shared Key</td>
</tr>
<tr>
<td>PTR</td>
<td>Pointer Record</td>
</tr>
<tr>
<td>QoS</td>
<td>Quality of Service</td>
</tr>
<tr>
<td>QSF</td>
<td>Quad Small Form-factor Pluggable</td>
</tr>
<tr>
<td>RA</td>
<td>Router Advertisements</td>
</tr>
<tr>
<td>RADIUS</td>
<td>Remote Authentication Dial-In User Service</td>
</tr>
<tr>
<td>RAID</td>
<td>Redundant Array of Inexpensive (or Independent) Disks</td>
</tr>
<tr>
<td>RDP</td>
<td>Remote Desktop Protocol</td>
</tr>
<tr>
<td>RF</td>
<td>Radio Frequency</td>
</tr>
<tr>
<td>RFC</td>
<td>Request for Comment</td>
</tr>
<tr>
<td>RG</td>
<td>Radio Guide</td>
</tr>
<tr>
<td>RIP</td>
<td>Routing Internet Protocol</td>
</tr>
<tr>
<td>RJ</td>
<td>Registered Jack</td>
</tr>
<tr>
<td>RPO</td>
<td>Recovery Point Objective</td>
</tr>
<tr>
<td>RSSI</td>
<td>Received Signal Strength Indication</td>
</tr>
<tr>
<td>RTO</td>
<td>Recovery Time Objective</td>
</tr>
<tr>
<td>RTSP</td>
<td>Real Time Streaming Protocol</td>
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<tr>
<td>SaaS</td>
<td>Software as a Service</td>
</tr>
<tr>
<td>SAN</td>
<td>Storage Area Network</td>
</tr>
<tr>
<td>SC</td>
<td>Standard Connector/Subscriber Connector</td>
</tr>
<tr>
<td>SCADA</td>
<td>Supervisory Control and Data Acquisition</td>
</tr>
<tr>
<td>SDN</td>
<td>Software-Defined Network</td>
</tr>
<tr>
<td>SDWAN</td>
<td>Software-Defined WAN</td>
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<thead>
<tr>
<th>ACRONYM</th>
<th>SPELLED OUT</th>
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<tbody>
<tr>
<td>SFP</td>
<td>Small Form-factor Pluggable</td>
</tr>
<tr>
<td>SFTP</td>
<td>Secure File Transfer Protocol</td>
</tr>
<tr>
<td>SIEM</td>
<td>Security Information and Event Management</td>
</tr>
<tr>
<td>SIP</td>
<td>Session Initiation Protocol</td>
</tr>
<tr>
<td>SLA</td>
<td>Service Level Agreement</td>
</tr>
<tr>
<td>SLAAC</td>
<td>Stateless Address Auto-Configuration</td>
</tr>
<tr>
<td>SMB</td>
<td>Server Message Block</td>
</tr>
<tr>
<td>SMTP</td>
<td>Simple Mail Transfer Protocol</td>
</tr>
<tr>
<td>SNMP</td>
<td>Simple Network Management Protocol</td>
</tr>
<tr>
<td>SOA</td>
<td>Start of Authority</td>
</tr>
<tr>
<td>SOHO</td>
<td>Small Office Home Office</td>
</tr>
<tr>
<td>SQL</td>
<td>Structured Query Language</td>
</tr>
<tr>
<td>SRV</td>
<td>Service Record</td>
</tr>
<tr>
<td>SSD</td>
<td>Solid-State Drive</td>
</tr>
<tr>
<td>SSH</td>
<td>Secure Shell</td>
</tr>
<tr>
<td>SSID</td>
<td>Service Set Identifier</td>
</tr>
<tr>
<td>SSL</td>
<td>Secure Sockets Layer</td>
</tr>
<tr>
<td>SSO</td>
<td>Single Sign-On</td>
</tr>
<tr>
<td>ST</td>
<td>Straight Tip or Snap Twist</td>
</tr>
<tr>
<td>STP</td>
<td>Spanning Tree Protocol</td>
</tr>
<tr>
<td>SYSLOG</td>
<td>System Log</td>
</tr>
<tr>
<td>TACACS+</td>
<td>Terminal Access Controller Access Control System Plus</td>
</tr>
<tr>
<td>TFTP</td>
<td>Trivial File Transfer Protocol</td>
</tr>
<tr>
<td>TIA/EIA</td>
<td>Telecommunications Industry Association/Electronic Industries Alliance</td>
</tr>
<tr>
<td>TKIP</td>
<td>Temporal Key Integrity Protocol</td>
</tr>
<tr>
<td>TLS</td>
<td>Transport Layer Security</td>
</tr>
<tr>
<td>TTL</td>
<td>Time to Live</td>
</tr>
<tr>
<td>TX/RX</td>
<td>Transmit and Receive</td>
</tr>
<tr>
<td>UDP</td>
<td>User Datagram Protocol</td>
</tr>
<tr>
<td>UPC</td>
<td>Ultra-Physical Contact</td>
</tr>
<tr>
<td>UPS</td>
<td>Uninterruptible Power Supply</td>
</tr>
<tr>
<td>URL</td>
<td>Uniform Resource Locator</td>
</tr>
<tr>
<td>USB</td>
<td>Universal Serial Bus</td>
</tr>
<tr>
<td>UTP</td>
<td>Unshielded Twister Bus</td>
</tr>
<tr>
<td>VIP</td>
<td>Virtual IP</td>
</tr>
<tr>
<td>VLAN</td>
<td>Virtual Local Area Network</td>
</tr>
<tr>
<td>VM</td>
<td>Virtual Machine</td>
</tr>
<tr>
<td>VNC</td>
<td>Virtual Network Computing</td>
</tr>
<tr>
<td>vNIC</td>
<td>virtual Network Interface Card</td>
</tr>
<tr>
<td>VoIP</td>
<td>Voice over Internet Protocol</td>
</tr>
<tr>
<td>VPN</td>
<td>Virtual Private Network</td>
</tr>
<tr>
<td>VRRP</td>
<td>Virtual Router Redundancy Protocol</td>
</tr>
<tr>
<td>WAN</td>
<td>Wide Area Network</td>
</tr>
<tr>
<td>WAP</td>
<td>Wireless Access Point</td>
</tr>
<tr>
<td>WDM</td>
<td>Wavelength Division Multiplexing</td>
</tr>
<tr>
<td>WLAN</td>
<td>Wireless Local Area Network</td>
</tr>
<tr>
<td>WPA</td>
<td>WiFi Protected Access</td>
</tr>
</tbody>
</table>
Network+ Proposed Hardware and Software List

CompTIA has included this sample list of hardware and software to assist candidates as they prepare for the Network+ exam. This list may also be helpful for training companies that wish to create a lab component for their training offering. The bulleted lists below each topic are sample lists and are not exhaustive.

**EQUIPMENT**
- Optical and copper patch panels
- Punchdown blocks
- Layer 2 switch
- Layer 3 switch
- PoE switch
- Router
- Firewall
- VPN headend
- Wireless access point
- Basic laptops that support virtualization
- Tablet/cell phone
- Media converters
- VoIP system (including a phone)

**SPARE HARDWARE**
- NICs
- Power supplies
- GBICs
- SFPs
- Managed switch
- Wireless access point
- UPS
- PoE injector

**SPARE PARTS**
- Patch cables
- RJ11 connectors
- RJ45 connectors, modular jacks
- Unshielded twisted pair cable spool
- Coaxial cable spool
- F connectors
- Fiber connectors
- Antennas
- Bluetooth/wireless adapters
- Consoles (RS-232 to USB serial adapter)

**TOOLS**
- Telco/network crimper
- Cable tester
- Punchdown tool
- Cable stripper
- Coaxial crimper
- Wire cutter
- Tone generator
- Fiber termination kit
- Optical power meter

**SOFTWARE**
- Protocol analyzer/packet capture
- Terminal emulation software
- Linux OS/Windows OS
- Software firewall
- Software IDS/IPS
- Network mapper
- Hypervisor software
- Virtual network environment
- WiFi analyzer
- Spectrum analyzer
- Network monitoring tools
- DHCP service
- DNS service
- NetFlow analyzer
- TFTP server
- Firmware backups for upgrades

**OTHER**
- Sample network documentation
- Sample logs
- Defective cables
- Cloud network diagrams

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