



Network Systems Technician (NST) Competency Requirements

This Competency listing serves to identify the major knowledge, skills, and standards areas which the Network Systems Technician needs in order to perform the professional networking concepts and practices required for modern wired and wireless information technology.

Network Systems Technicians must be knowledgeable in the following technical areas:

1.0 Network Terminology

- 1.1 Define the functions of a computer network
- 1.2 Identify network types and terminology associated with:
 - 1.2.1 Local Area Networks (LANs)
 - 1.2.2 Virtual Local Area Networks (VLANs) to include:
 - 1.2.2.1 Virtual Private Networks (VPN)
 - 1.2.3 Wide Area Networks (WANs) to include:
 - 1.2.3.1 Value Added Networks (VANs) and VPNs
 - 1.2.3.2 Metropolitan Area Networks (MANs)
- 1.3 Describe the fundamental terms and nomenclature for network topologies to include:
 - 1.3.1 Point-to-Point
 - 1.3.2 Bus
 - 1.3.3 Ring
 - 1.3.4 Star
 - 1.3.5 Hybrid
 - 1.3.6 Mesh
 - 1.3.7 Tree (Hierarchical)
- 1.4 Describe Network Services
 - 1.4.1 Explain the differences between peer-to-peer versus server-based networks
 - 1.4.2 Compare the different network infrastructures and services available:
 - 1.4.2.1 File sharing and file management
 - 1.4.2.2 Peripheral integration and sharing
 - 1.4.2.3 Email
 - 1.4.2.4 Remote Access Servers (RAS)
 - 1.4.2.5 Application servers
- 1.5 Define the Open Systems Interconnection (OSI) model
 - 1.5.1 List and describe the configuration of the seven OSI model layers to include:
 - 1.5.1.1 Application Layer – layer 7
 - 1.5.1.2 Presentation Layer – layer 6
 - 1.5.1.3 Session Layer – layer 5
 - 1.5.1.4 Transport Layer – layer 4
 - 1.5.1.5 Network Layer – layer 3
 - 1.5.1.6 Data-Link Layer – layer 2
 - 1.5.1.7 Physical Layer – layer 1
 - 1.5.2 Briefly explain the function of each layer within the OSI model
 - 1.5.3 Explain the importance and protocols of the OSI model layers in network design
 - 1.5.4 Explain how protocol data unit (PDU) are used in context with the OSI model

2.0 Network Architecture – Wired and Wireless

- 2.1 Identify the network architecture's primary components and performance criteria for:
 - 2.1.1 Servers
 - 2.1.2 Workstations
 - 2.1.3 Drives (HDD, SSD, Network)
 - 2.1.4 Buses
 - 2.1.5 Central Processing Units (CPUs)
 - 2.1.6 Memory
- 2.2 Compare Wired Local Area Networks (LANs) and Wide Area Networks (WANs):
 - 2.2.1 Describe wired connectors and cables in Ethernet networked systems to include:
 - 2.2.1.1 Coaxial Cable

Network Systems Technician Knowledge Competencies

- 2.2.1.2 Twisted Pair
 - 2.2.1.3 Optical Fiber
 - 2.2.2 Explain the function of Ethernet hubs, controllers, adapters, switches, routers and access points
 - 2.2.2.1 Identify the purpose of a Network interface controller (NIC)
 - 2.2.2.1.1 Ethernet Media Access Control (MAC) address
 - 2.2.2.2 Identify the uses of dual network interfaces
 - 2.2.2.3 Explain the use of a Peripheral Component Interconnect (PCI) and PCI express (PCIe)
- 2.3 Recognize Wireless Local Area Networks (WLAN)
 - 2.3.1 Explain the use of Orthogonal Frequency Division Multiplexing used in High Performance Radio Local Area Networks (HIPERLAN)
 - 2.3.2 Identify and compare differing characteristics between HIPERLAN and 802.11 wireless interfaces
 - 2.3.3 Explain and list the general characteristics for 802.11a/b/g/n/ac
 - 2.3.4 Describe the advantages of using network security protocols (WPA2, WPA, WEP)
 - 2.3.5 Describe the wireless transport architecture identified as Bluetooth technology
- 2.4 Define Internet connection sharing
 - 2.4.1 Explain the purpose of an Ad-hoc network
- 2.5 Define Broadband Network Communication
 - 2.5.1 Describe and define the term broadband network
 - 2.5.2 Explain the use of Fiber-optics in broadband technology
 - 2.5.3 Explain the operational and physical differences between Digital Subscriber Line (DSL) and cable
 - 2.5.4 Compare the functional difference between Integrated Services Digital Network (ISDN) and DSL
 - 2.5.5 Define Multichannel Multipoint Distribution Service (MMDS)
 - 2.5.5.1 Explain the operational characteristics of a Local Multipoint Distribution Service (LMDS)
 - 2.5.5.2 Explain how DOCSIS+ key-management protocol is used within MMDS and LMDS
 - 2.5.6 Explain the difference between a copper-wired local loop and a wireless local loop (WLL)
 - 2.5.6.1 List the advantages of a WLL over a copper-wired local loop
 - 2.5.6.2 Describe the services offered through a WLL
 - 2.5.7 Describe how a Broadband Free-space optical system (FSO) has evolved into Optical Wireless Broadband (OWB)
 - 2.5.7.1 Describe the advantages of an FSO or OWB system over a closed broadband system
 - 2.5.7.2 Explain the bandwidth options provided by optical networks

3.0 Network Configuration and Protocols - Wired and Wireless

- 3.1 Explain Internet addressing protocols, ports, standards and how network addressing works to include:
 - 3.1.1 Wide Area Network and TCP/IP assignments
 - 3.1.1.1 Describe the limitations of TCP/IP suite in a mobile network
 - 3.1.2 User Datagram Protocol (UDP)
 - 3.1.2.1 Layer 2 Tunneling Protocol (L2TP)
 - 3.1.3 Point-to-Point Tunneling Protocol (PPTP)
 - 3.1.4 ISP IP address assignment
 - 3.1.4.1 Simple Network Management Protocol (SNMP)
 - 3.1.4.2 Remote Monitor (RMON)
 - 3.1.4.3 IP Classes A thru E
 - 3.1.4.4 Subnet Masking
 - 3.1.4.5 Classless Inter-Domain Routing (CIDR)
 - 3.1.5 IPv4 using a 32-bit addressing
 - 3.1.6 IPv6 using a 128-bit addressing
 - 3.1.6.1 Explain the differences between IPv4 and IPv6
 - 3.1.7 Hyper Text Transfer Protocol (HTTP) web browsing, HTTPS (secure)
 - 3.1.8 Network Ping

Network Systems Technician Knowledge Competencies

- 3.1.9 Email Protocols
 - 3.1.9.1 Post Office Protocol 3 (POP3)
 - 3.1.9.2 Internet Message Access Protocol (IMAP)
 - 3.1.9.3 Simple Mail Transfer Protocol (SMTP)
- 3.1.10 Describe the Domain Naming Conventions (e.g.: .com, .org, .edu, etc.) managed by Internet Corporation for Assigned Names and Numbers (ICANN)
- 3.2 Identify additional Transport Layer Protocols and functions within a local area network (LAN):
 - 3.2.1 Sequenced Packet Exchange (SPX) or Internetwork Packet Exchange (IPX)
 - 3.2.1.1 LAN configurations with NetBEUI or IPX/SPX protocol
 - 3.2.2 File Transfer Protocol (FTP)
 - 3.2.3 Reverse Address Resolution Protocol (RARP)
 - 3.2.4 Describe the different types of wireless protocols:
 - 3.2.4.1 802.11 A, 802.11 B, 802.11G, 802.11 N, 802.11 AC
- 3.3 Explain network shared access configurations
 - 3.3.1 Explain how to configure and utilize an Ad-hoc network
 - 3.3.2 Explain network access and “access method” used by networks
 - 3.3.3 Explain the shared access technology involved with local area networking including:
 - 3.3.3.1 how to access Homegroup Computers, Shared Folders and Libraries
 - 3.3.4 Explain the basics as to how devices gain access to and share the network by differentiating between:
 - 3.3.4.1 Carrier Sense Multiple Access with Collision Detection (CSMA/CD)
 - 3.3.4.2 Carrier Sense Multiple Access/Collision Avoidance(CSMA/CA)
 - 3.3.4.3 Token Passing
 - 3.3.4.4 Define the terms backoff and wirespeed when used with CSMA/CD
- 3.4 Define the following terms:
 - 3.4.1 Multiplexing
 - 3.4.2 Demultiplexing
 - 3.4.3 Bandwidth
 - 3.4.4 Backbone links
- 3.5 Define data rate measurement of a network connection
- 3.6 Define data transmission protocols to include:
 - 3.6.1 synchronous
 - 3.6.2 asynchronous
- 3.7 Explain the characteristics and features of network connecting to include:
 - 3.7.1 client/server - domain
 - 3.7.2 peer-to-peer - home
- 3.8 Describe the structures, formats, fields and standards of:
 - 3.8.1 Packets – RTP/RTTP, VOIP, UDP
 - 3.8.2 Frames
 - 3.8.3 Messages
 - 3.8.4 Datagrams (User Datagram Protocol - UDP)
 - 3.8.5 Bits
 - 3.8.6 Segments
- 3.9 Describe the difference between switching:
 - 3.9.1 Circuit
 - 3.9.2 Packet
- 3.10 Identify how to configure the different types of wired networks
 - 3.10.1 Determine the proper use of wired cabling for different applications
 - 3.10.2 Identify how to connect:
 - 3.10.2.1 T1/T3/OC3 Data Multiplexers
 - 3.10.2.2 Matrix Switches
 - 3.10.2.3 Voice/Video Over IP
- 3.11 Explain how repeaters function and how they are used in networks
- 3.12 Describe the legacy networking connectivity of:
 - 3.12.1 Analog connectivity (dial-up) including modem access technology
 - 3.12.2 Dedicated circuits to include:
 - 3.12.2.1 Integrated Services Digital Network (ISDN)
 - 3.12.2.2 Asynchronous Digital Subscriber Line (ADSL)
 - 3.12.2.3 Digital telecommunication carrier T1/E1 (Transmission System)

- 3.12.2.4 Multiprotocol Label Switching (MPLS)
- 3.13 Define the basic theory of operation and deployment purposes of:
 - 3.13.1 Gateways
 - 3.13.2 Routers
 - 3.13.2.1 Explain routing/routed/non-routable protocols
 - 3.13.2.2 Explain the characteristics and functions of a mobile IP router
- 3.14 Explain the functions of:
 - 3.14.1 switch
 - 3.14.2 hub/repeater
 - 3.14.3 bridge
- 3.15 Describe the wireless connections in network systems to include:
 - 3.15.1 Bluetooth networks
 - 3.15.2 WPANs, MiWi and ZigBee wireless networks
- 3.16 Identify and establish criteria for using wireless and portable wireless devices in networks
- 3.17 Explain the benefits of using combination networks

4.0 Network Services and Operations

- 4.1 Describe using Windows server based platform utilities to include:
 - 4.1.1 User and group accounts
 - 4.1.1.1 access levels
 - 4.1.1.2 access protected shares
 - 4.1.1.3 access permissions
 - 4.1.2 Identify the similarities/differences between SAN, NAS and SMB3
- 4.2 Describe IaaS versus PaaS versus SaaS and where Cloud configurations fit into them
- 4.3 Describe security level access terminology
- 4.4 Utilize network administration tools contained in Windows server based platforms
- 4.5 Define the theory and classifications of signaling
- 4.6 Explain the use and function for network drivers:
 - 4.6.1 Open Data-link Interface (ODI)
 - 4.6.2 Network Driver Interface Specification (NDIS)
- 4.7 Describe the difference between transmission paths and protocols
- 4.8 Describe the Simple Network Management Protocol (SNMP) framework and its three parts: SNMP manager, SNMP agent and MIB
- 4.9 Define the distinction between analog and digital communications techniques
- 4.10 Explain the basics of broadband and baseband transmission protocols
- 4.11 Define the characteristics of signaling in digital communications
- 4.12 Describe the use and functions of Channel Service Unit / Data Service Unit (CSU/DSUs)
- 4.13 Explain how to setup software and hardware sharing utilities on a network
- 4.14 Describe the file systems used by network operating systems
- 4.15 Explain how file integrity is maintained when multiple users are accessing the same files
- 4.16 Describe the purposes of network services available with:
 - 4.16.1 Windows Internet Naming Service (WINS)
 - 4.16.2 Dynamic Host Configuration Protocol (DHCP)
 - 4.16.3 Domain Name System (DNS)
 - 4.16.4 Network Address Translation (NAT)
- 4.17 Recognize the proper parameters for network interface adapter cards
- 4.18 Explain basic network performance and monitoring tools contained within:
 - 4.18.1 Windows server based platforms
 - 4.18.2 Linux
 - 4.18.3 OS X (Apple)
- 4.19 Identify protocol stacks native to each network operating system
- 4.20 Describe the essential file structures used in booting
- 4.21 Explain the criteria and procedure for setting up separate hard disk partitions for different operating systems
- 4.22 Define the basic administration and security control features of network operating systems:
 - 4.22.1 Firewall
 - 4.22.2 Proxy Servers
 - 4.22.3 Demilitarized Zone (DMZ)

5.0 Diagnostics, Equipment, Tools and Troubleshooting

- 5.1 Describe the main tools available within network operating systems that can be used to measure network performance
- 5.2 Troubleshooting TCP/IP using utility commands and their switches
 - 5.2.1 Describe the three modes of Ping to Verify and test connectivity (ICMP, UDP, TCP)
 - 5.2.2 IPCONFIG - Displays the current TCP/IP configuration and information on 98/NT/2000
 - 5.2.3 TRACERT (Windows) or TRACEROUTE - Displays the path a packet takes to a destination host computer
 - 5.2.4 NETSTAT - Displays the TCP/IP protocol sessions, connections and open port connection information
 - 5.2.5 NBTSTAT - Displays a list of NetBIOS computer names that have been resolved to IP addresses
 - 5.2.6 ROUTE - Displays or modifies the local routing table
 - 5.2.7 ARP - Displays the cache of locally resolved IP addresses to Media Access Control (MAC) addresses
- 5.3 Describe the common causes and symptoms of network bottlenecks
- 5.4 Explain how the following test equipment works:
 - 5.4.1 Time Domain Reflectometers (TDRs)
 - 5.4.2 Oscilloscopes
 - 5.4.3 Network analyzers
 - 5.4.4 Software-based network monitors
 - 5.4.5 Simple network cable tester
 - 5.4.6 Network cable certifiers
- 5.5 Explain the criteria for selection of an Uninterrupted Power Supply (UPS) and/or Redundant Power Supply (RPS)

6.0 Network Security

- 6.1 Identify key points required for a typical network enterprise disaster plan
- 6.2 Identify network security tools and procedures to:
 - 6.2.1 safeguard against virus attacks
 - 6.2.2 monitor activities
- 6.3 Identify backup tools used in safeguarding critical resources to include:
 - 6.3.1 software
 - 6.3.2 hardware
- 6.4 Describe Domain Name System (DNS) attack mitigations to include:
 - 6.4.1 Denial of Service (DoS)
 - 6.4.2 Distributed Denial of Service (DDoS)
 - 6.4.3 Define a "botnet"
- 6.5 Explain the Secure Socket Layer (SSL) in network cybersecurity
- 6.6 Explain the purpose for wireless encryption keys
 - 6.6.1 Temporal Key Integrity Protocol (TKIP)
 - 6.6.2 Advanced Encryption Standard (AES)
 - 6.6.3 Counter Mode with Cipher Block Chaining Message Authentication Code Protocol (CCMP) (IEEE 802.11i)
- 6.7 Describe what Media Converters are and why they are needed
- 6.8 Define Remote Authentication Dial In User Service (RADIUS) protocol
- 6.9 Describe IEEE 802.1x and the Extensible Authentication Protocol (EAP)
- 6.10 Describe wireless network security protocols (WEP, WPA, WPA2)

7.0 Network and Industry Standards

- 7.1 Describe the configuration of the OSI (Open Systems Interconnection) model used in network architectures based upon ISO/IEC 7498-1 standard
 - 7.1.1 Explain the function standards and protocol standards at each level of the OSI model
 - 7.1.1.1 Layer 7: WWW browsers, NFS, SNMP, HTTP, HTTPS, FTP
 - 7.1.1.2 Layer 6: ASCII, EBCDIC, TIFF, GIF, PICT, JPEG, MPEG, MIDI
 - 7.1.1.3 Layer 5: NFS, NIS, RPC, SQL
 - 7.1.1.4 Layer 4: SPX, TCP, UDP
 - 7.1.1.5 Layer 3: Apple Talk DDP, IP, IPX
 - 7.1.1.6 Layer 2: ITU-T G.hn, PPP, ANSI FDDI

Network Systems Technician Knowledge Competencies

- 7.1.1.7 Layer 1: Parallel SCSI, Ethernet, Token Ring, FDDI, RJ45, ITU-T, V.35, V.24, IEEE 802.11, Bluetooth, IEEE 802.15.4
- 7.2 Interpret names and acronyms for network standards organizations:
 - 7.2.1 International Organization for Standardization (ISO)
 - 7.2.2 American National Standards Institute (ANSI)
 - 7.2.3 Information Technology Industry Council (ITIC)
 - 7.2.4 National Committee for Information Technology (NCITS)
 - 7.2.5 National Telecommunications and Information Administration (NTIA)
 - 7.2.6 Institute of Electrical and Electronics Engineers (IEEE)
 - 7.2.7 Telecommunications Industry Alliance/Electronics Industries Alliance (TIA/EIA)
 - 7.2.8 Cellular Telecommunications & Internet Association (CTIA)
 - 7.2.9 International Telecommunication Union- Telecommunication Standardization Sector (ITU-T)
 - 7.2.10 European Telecommunications Standards Institute (ETSI)
 - 7.2.11 Internet Engineering Task Force (IETF) - voluntary internet standards
- 7.3 Define Network Shared Access Standards
 - 7.3.1 Explain the standards for all LANs to include:
 - 7.3.1.1 Types of Ethernet media
 - 7.3.1.1.1 Ethernet
 - 7.3.1.1.2 Fast Ethernet
 - 7.3.1.1.3 Gigabit Ethernet
 - 7.3.1.2 Explain the utilization and define 10/100/1000 Base specifications
 - 7.3.1.3 IEEE 802.x standards
 - 7.3.2 Explain the content and identity of IEEE 802.3 Ethernet standards
 - 7.3.2.1 Describe cable termination standards for:
 - 7.3.2.1.1 Coaxial Cable
 - 7.3.2.1.2 Twisted Pair
 - 7.3.2.1.3 Optical Fiber
 - 7.3.2.2 Understand the differences in the collection of IEEE 802.3 standards defining the physical layer and the datalink layer of wired Ethernet
 - 7.3.3 Describe the features of WLAN standards 802.11(xx)
 - 7.3.4 Compare the differences between 802.3 and 802.11 standards
 - 7.3.5 Explain the basic features of the IEEE 802.15.x standard for WPANs to include:
 - 7.3.5.1 Bluetooth managed by Bluetooth Special Interest Group (BSIG) - 802.15.1
 - 7.3.5.2 MiWi, Zigbee managed by Zigbee Alliance – 802.15.4
 - 7.3.6 Explain the basic features of IEEE 802.16x standard for WiMAX
- 7.4 Explain the features of basic optical standards
- 7.5 Describe Fiber Distributed Data Interface (FDDI) procedure
- 7.6 Explain the Synchronous Optical Network (SONET) hierarchy in North America
 - 7.6.1 Explain Synchronous Digital Hierarchy (SDH) outside N.A.
 - 7.6.2 Describe Optical Transport Network (OTN) standards defined by ITU-T
- 7.7 Define the advanced Small Computer System Interface (SCSI) standards used in high-end server systems.
- 7.8 Explain the limitations of the hard disk drive standards:
 - 7.8.1 Advanced Technology Attachment (ATA)
 - 7.8.2 Serial Advanced Technology Attachment (SATA)
 - 7.8.3 Integrated Development Environment (IDE)
 - 7.8.4 SATA to Peripheral Component Interconnect express (PCIe)

End of Network Systems Technician Competencies

Find An ETA Test Site:

<http://www.eta-i.org/testing.html>

Suggested Additional Resource and Study Material:

As with most networking systems, you will find details and information on Websites: ieee.org; networkcomputing.com; cisco.com; pcworld.com; cnet.com; computerworld.com; pcmag.com; consumerreports.org; maximumpc.com; infoworld.com; microsoft.com; itunes.apple.com; rmroberts.com; darrilgibson.com; professormesser.com; youtube.com; and many, many other websites.

Guide to Designing and Implementing Local and Wide Area Networks, 3E; Michael J. Palmer, PhD and Bruce Sinclair; ISBN 978-0619216115; Course Technology; 2015; 250 pgs.

NST Research Document.pdf; Tcat Houser, RESIma, CST, NST; Self-published 2015; 90 pgs.; Available at www.eta-i.org or by calling 1-800-288-3824

Microsoft Windows Networking Essentials; Darril Gibson; ISBN 978-1118016855; Sybex; 2011; softcover; 368 pgs.

Cabling, part 1: LAN Networks and Cabling Systems, 5E; Andrew Oliviero; ISBN 978-1118848289; Sybex; 2014; softcover; 608 pgs.

CCNET Study Guide, 2E; Todd Lammle; ISBN 978-1118749685; Sybex; 2013; softcover; 744 pgs.

Upgrading and Repairing Networks, 5th Ed.; Scott Mueller, Terry Ogletree, Mark Soper; ISBN 978-0789735300; Que Publishing; 2006; softcover; 1200 pgs.

Designing and Building Enterprise DMZs; Hal Flynn; ISBN 978-1597491006; Syngress; 2006; softcover; 714 pgs.

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