

Student Study Guide

EXAM 98-366
Networking Fundamentals



Preparing for MTA Certification

**MICROSOFT TECHNOLOGY ASSOCIATE (MTA)
STUDENT STUDY GUIDE FOR IT PROS**

98-366 Networking Fundamentals



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Introduction



MTA validates building-block technology concepts and helps students explore, discover and pursue successful careers in Information Technology (IT) in an exciting and rewarding way! As the first step in the Microsoft Technology Certification Series, this new, entry-level certification provides students with confidence, credibility, and differentiation.

Explore IT career options without committing a lot of time and resources MTA exams validate the core technology knowledge that is in demand today by businesses around the world. Whether you want to explore becoming a network administrator, software engineer, web developer, or database analyst, MTA gets you started on the right path.

Prepare to compete A little investment in IT can go a long way in today's job market. Becoming MTA certified helps you build a solid foundation to prepare for intermediate technology studies and for Microsoft Certified Technology Specialist (MCTS) certifications. It can also help you compete on college admissions and jumpstart your IT career planning!

Empower yourself As the first step toward becoming an MCTS, MTA shows your commitment to technology while connecting you with a community of more than five million Microsoft Certified Professionals. Learn from them and show them what you know by becoming MTA certified!

This MTA Student Study Guide serves as a study tool to help students prepare for their MTA certification exam. Students are challenged with real-life situations for each of the major topics covered in the exam. Although successful completion of the study guide exercises does not guarantee that you will pass your MTA exam, it is an excellent way to gauge your readiness to take the exam and build confidence that you know your stuff on exam day.

I wish you all the best as you prepare for a successful career in technology!

Victoria Pohto

Victoria Pohto
MTA Product Marketing Manager

Career Planning

Most IT solutions or infrastructure built on Microsoft technologies require proficiency with one or all of the following products, often referred to as “The Microsoft Stack.”

- Microsoft Windows® Server® as the data center or development platform
- Microsoft SQL Server® as the data and business intelligence (BI) platform
- Microsoft Visual Studio® as the suite of application life-cycle management tools

MTA is the starting point of Microsoft technology certifications, providing aspiring technologists with the fundamental knowledge essential to succeed with continued studies and a successful career with technology.

Preparing for and becoming MTA certified helps you explore a variety of career paths in technology without investing a lot of time and money in a specialized career path. When you find a path that is right for you, Microsoft learning products and certification can help you prepare and guide your longer-term career planning.

If you already know that you want to start building a career in technology, MTA preparation and certification is the recommended entry point. Becoming MTA certified shows that you have a firm working

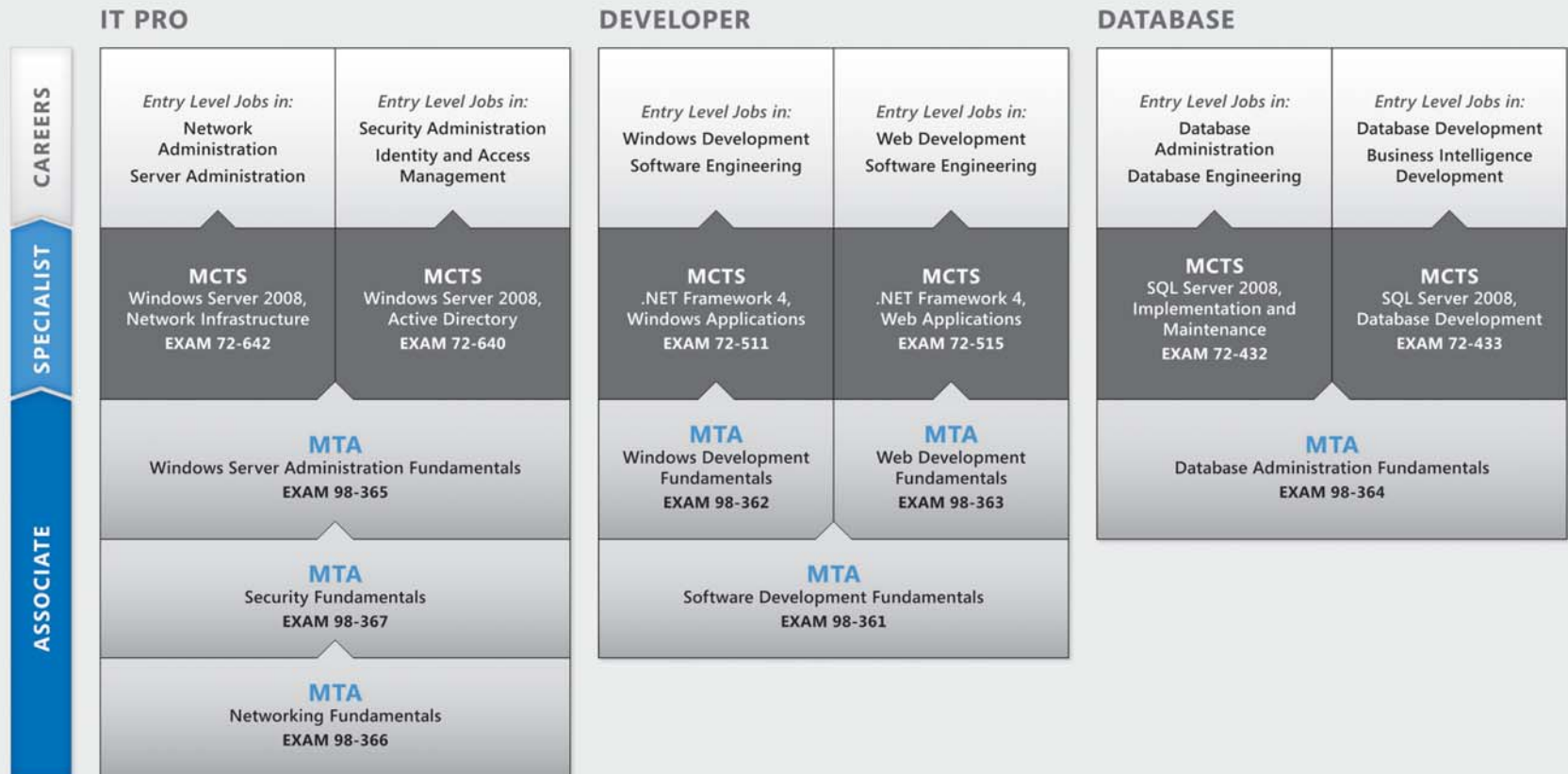
knowledge of the fundamental IT concepts critical for success with intermediate learning and certifications such as Microsoft Certified Technology Specialist (MCTS). Moreover, Microsoft certifications demonstrate an individual’s commitment of self-investment and confidence to take his or her knowledge and skills to the next level with an industry-recognized credential.

MTA is not a “career certification,” meaning that employers recognize you as “job ready,” but it is the first step toward that career goal and can help differentiate you for an internship or to college admissions committees. As you prepare for your first job focusing on technology, be sure that you are equipped with an MCTS credential—the intermediate level certification that validates Microsoft product and technology skills.

The MTA Certification path on the next page shows you the MTA exams that are recommended prior to taking on some of Microsoft’s intermediate technology certification, MCTS.

Microsoft Technology Associate Certification Paths

MTA is the recommended first step in the Microsoft IT Certification Program, and does not require pre-requisite exams. MTA certifications are not a pre-requisite for MCTS exams. *One MTA exam = One certification.*



For full Microsoft Certification roadmaps, visit <http://www.microsoft.com/learning/certification>

Exploring Job Roles

Choosing a career path is a big decision and it's not always easy, but you're not alone! Microsoft created a career site to help students understand the options and possibilities of pursuing a career in IT. The site also connects you with learning resources, student techie communities, and much more to help you prepare for a career in technology.

To chart your career with Microsoft technology, visit www.microsoft.com/learning/career/en/us/career-org-charts.aspx.

Database Administrator



As a database administrator, you are in charge of important databases that span multiple platforms and environments. You are a strong team player who thrives in a fast-paced environment. You build complex, highly scalable databases that meet business needs and security requirements. You are an expert in optimizing, maintaining, and troubleshooting databases, but also in designing archival, data distribution, and high-availability solutions.

Server Administrator



As a server administrator, you are in charge of implementing and managing some of the most important technology in your organization—the servers. You use extensive monitoring and profiling tools to manage the network and tune systems so they perform at optimal levels. You are an expert in Active Directory®, and you have an in-depth understanding of network protocols, and file and directory security.

Computer Support Technician



Consider starting your IT career by becoming a consumer support technician. You don't need any formal work experience, but a company might require that you know how to install, administer, and troubleshoot operating systems in a home network environment that has desktop computers, laptops, and printers. As a consumer support technician, you'll also handle network, virus, malicious software, and hardware support issues. You'll typically find this position in small to medium-sized organizations.

Exploring Job Roles

Web Developer



As a web developer, you are an expert in using the dynamic programming tools and languages that fuel the web. You might work independently or be part of a team that builds and integrates interactive web sites, applications, and services for both internal and public sites. Your role is to make it work, which means developing web applications and testing them on various browsers, enhancing and modifying them as necessary to ensure the best experience for the user. As a web developer, you might also architect websites, design data-driven applications, and find efficient client-server solutions. You must have an in-depth understanding of the software development life cycle and be able to communicate project status, issues, and resolutions.

Windows Developer



As a Windows® client developer, knowing how to optimize Windows code and track bugs is a given. But you also know how to use Microsoft Visual Studio® and the Microsoft .NET framework to design, develop, test, and deploy Windows-based applications that run on both corporate servers and desktop computers. Your key talents include understanding multiple Windows application models

and n-tier applications, and knowing how to work with object-oriented programming, algorithms, data structures, and multithreading. Windows developers have an in-depth understanding of software engineering principles, software life cycles, and security principles.

Additional Online Resources for New Developers:

<http://msdn.microsoft.com/beginner>

<http://msdn.microsoft.com/rampup>

Imagine Cup



The Imagine Cup is the world's premier student technology competition where students from around the world can learn new skills, make new friends, and change the world. Competitions include Software Design, Embedded Development, Game Design, Digital Media and Windows Phone 7®. The brightest young minds harness the power of technology to take on the world's toughest problems.

www.imaginecup.com

Value of Certification



Technology plays a role in virtually everything we do. In the 20-plus years since Microsoft has been certifying people on its products and technologies, millions of people have gained the knowledge, expertise, and credentials to enhance their careers, optimize business solutions, and create innovation within just about every business and social sector imaginable. Today's Information Technology (IT) hiring managers are more often using professional credentials, such as Microsoft certification, to identify properly skilled IT candidates. Certification becomes a way to easily differentiate qualified candidates in a sea of resumes.

The job outlook for IT professionals, as reported in a study prepared by the U.S. Department of Labor's Bureau of Labor Statistics (BLS), is positive! The BLS indicates an increase that will be "faster than the average for all occupations through 2014" for Computer Support Specialists, Systems Engineers, Database Administrators, and Computer Software Engineers. One significant message resulting from this study is that information and communications

technology (ICT) skills are the entry ticket to the job market, regardless of the country, industry, or job function. Information Technology is clearly an area worth investing time, resources, and education in – and technology certification is a key part of the education process, validating product and technology expertise as a result of their learning experiences.

Microsoft IT Certifications provide objective validation of the ability to perform critical IT functions successfully for worldwide IT professionals, developers, and information workers. Microsoft certifications represent a rich and varied spectrum of knowledge, job roles, and responsibilities. Further, earning a specific certification provides objective validation of the candidate's ability to perform critical IT functions successfully. Embraced by industry professionals worldwide, Microsoft certification remains one of the most effective ways to help reach long-term career goals.

MTA 98-366

NETWORKING FUNDAMENTALS



1

Understanding Networking Infrastructures

IN THIS CHAPTER

- 1.1 Understand the concepts of the internet, intranet, and extranet
- 1.2A Understand local area networks (LANs)
- 1.2B Understand local area networks (LANs)
- 1.3A Understand wide area networks (WANs)
- 1.3B Understand wide area networks (WANs)
- 1.4 Understand wireless networking
- 1.5 Understand network topologies and access methods



Understand the concepts of the internet, intranet, and extranet

SCENARIO: Before going to class, Sidney stops by Fourth Coffee for an iced coffee. The owner of Fourth Coffee, Josh, stops to talk with Sidney because he knows that she enjoys solving computer problems. Josh asks Sidney if she can help him manage Fourth Coffee's server and wireless network.

Josh has a few projects for Sidney to start working on immediately. He would like to be able to access Fourth Coffee's server from his home and mobile phones. In addition, he is concerned about keeping his customers' computers safe from viruses and hackers. Also, Josh would like to provide internal company information such as schedules and company policies to his employees.

Sidney thanks Josh and tells him that she'll start working on his projects today right after class.

- 1. What will Sidney need to install for Josh to be able to access Fourth Coffee's server from his home and mobile phones?**
 - a. a firewall
 - b. a VPN
 - c. an intranet
- 2. A firewall is to a network as:**
 - a. a door is to a classroom
 - b. an eraser is to a pencil
 - c. a movie is to a screen
- 3. The primary goal of an intranet is to:**
 - a. allow different businesses to share information
 - b. let users access different websites
 - c. provide company information to internal employees

hint

Even though a browser's security settings may be set high, a firewall still should be used.

Answers

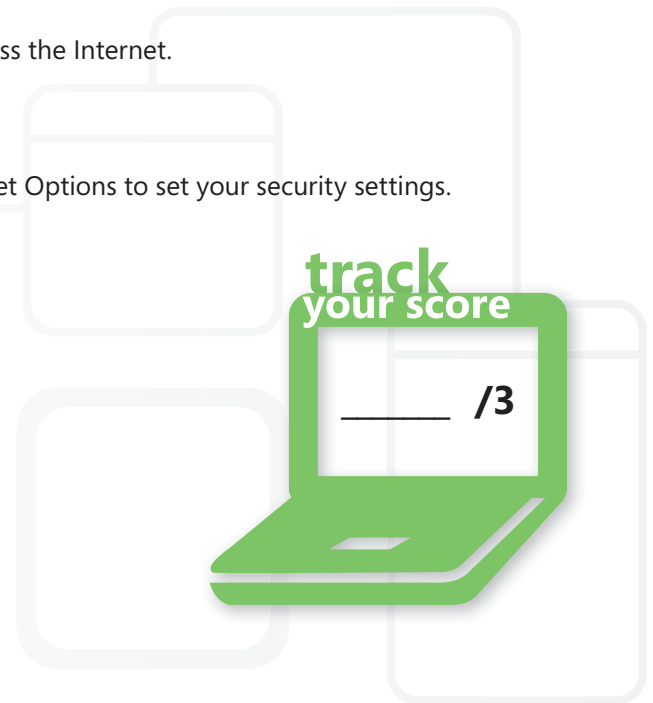
1. Josh wants to be able to access Fourth Coffee's server from his home and mobile phones, so Sidney will install a:
 - a. **VPN.** A VPN is a Virtual Private Network.
2. A firewall is to a network as:
 - a. **a door is to a classroom.** Firewalls keep computers safe and doors keep classrooms safe and quiet so that students may study.
3. An intranet's primary goal is to:
 - c. **provide company information to internal employees.** Extranets allow different business to share information and the Internet lets users access different websites.

Essential details

- **VPNs** create a private network and provide a secure tunnel across the Internet.
- **Firewalls** can be hardware devices.
- For security zones, keep the security level as high as possible.
- In Microsoft® Internet Explorer® click Tools and then click Internet Options to set your security settings.
- Mobile phones can be used to connect to a company's servers.

FAST TRACK HELP

- <http://msdn.microsoft.com/en-us/library/aa503420.aspx>
- <http://support.microsoft.com/kb/174360>
- <http://msdn.microsoft.com/en-us/library/ms953581.aspx>



Understand local area networks (LANs)

SCENARIO: Kim is studying to become an animator at the Graphic Design Institute. Michael, Kim's friend from class, asks Kim to study with him after class in the school's computer lab.

When Kim arrives in the lab she sees that Michael has already started his laptop and is connected to the school's network. Kim starts her laptop and attempts to connect to the school's network when she realizes that she forgot her wireless card. Kim tells Michael that she'll have to run home and get her wireless card. Michael tells her that she does not need to have her wireless card because she can connect directly to the network.

Kim asks Michael to show her how and he pulls out a cable and starts connecting it to her laptop's internal, wired NIC and explaining the steps.

1. **What type of network is Kim trying to connect to?**
 - a. WAN
 - b. LAN
 - c. PAN
2. **To verify that Kim's NIC (network interface card) works, Michael pings 127.0.0.1, which is known as the:**
 - a. loopback address
 - b. dynamic address
 - c. static address
3. **A NIC is to a LAN as:**
 - a. lyrics are to a song
 - b. a key is to a door
 - c. a movie is to a TV

hint

When troubleshooting network connections, use ping and ipconfig.

Answers

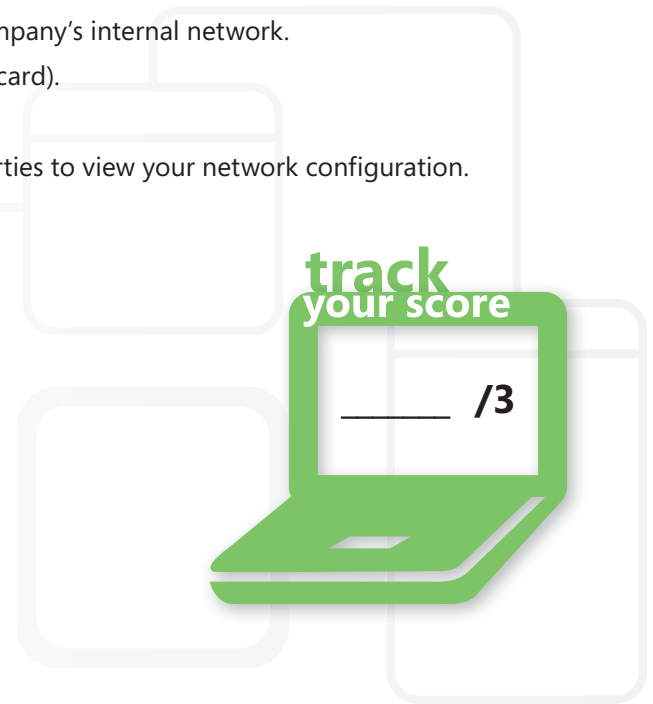
1. Kim is trying to connect to the school's:
 - a. **LAN.** A LAN is a Local Area Network.
2. To test Kim's NIC Michael pings the:
 - a. **loopback address.** The loopback address is 127.0.0.1 and a successful ping verifies that the NIC works.
3. A NIC is to a LAN as:
 - a. **a key is to a door.** A key provides access through a door just as a computer is required to have a NIC to access a LAN.

Essential details

- **LANs** connect local computers together in a small geographical area.
- **Perimeter networks** provide an extra layer of security for a company's internal network.
- Computers connect to a LAN through a **NIC** (network interface card).
- The **loopback** address is a reserved, static address of 127.0.0.1.
- In Microsoft® Windows 7®, right-click Network and select Properties to view your network configuration.

FAST TRACK HELP

- <http://windows.microsoft.com/en-US/windows7/Why-can-t-I-connect-to-a-network>
- <http://support.microsoft.com/kb/169790>
- <http://msdn.microsoft.com/en-us/library/ee494910.aspx>



Understand local area networks (LANs)

SCENARIO: Brian just graduated from his local community college in IT and started working for Adventure Works as an IT Technician. His new boss, Annie, decides to send him on a business trip to Seattle where he will help set up the computers in their new store.

When Brian arrives in Seattle he immediately checks into his hotel. He asks Erin, the hotel manager, if the hotel has Internet access. Erin tells Brian that the hotel has both wired and wireless LAN connections available, which he may use to access the Internet for free! Plus the hotel will be expanding Internet connectivity to the pool area soon.

Brian is thrilled that the hotel provides free Internet access so that he can work at night, if necessary, to succeed in his first IT job.

1. **When Brian connects a cable from his laptop's NIC into an RJ45 jack he is connecting to the:**
 - a. VLAN
 - b. wired LAN
 - c. wireless LAN
2. **A VLAN is also called a:**
 - a. logical network
 - b. internal network
 - c. external network
3. **What will be Erin's best solution for providing Internet connectivity to the pool area?**
 - a. expand the hotel's wired network
 - b. expand the hotel's wireless network
 - c. add a new WAN

hint

Access points are used to connect wireless devices to wired networks.

Answers

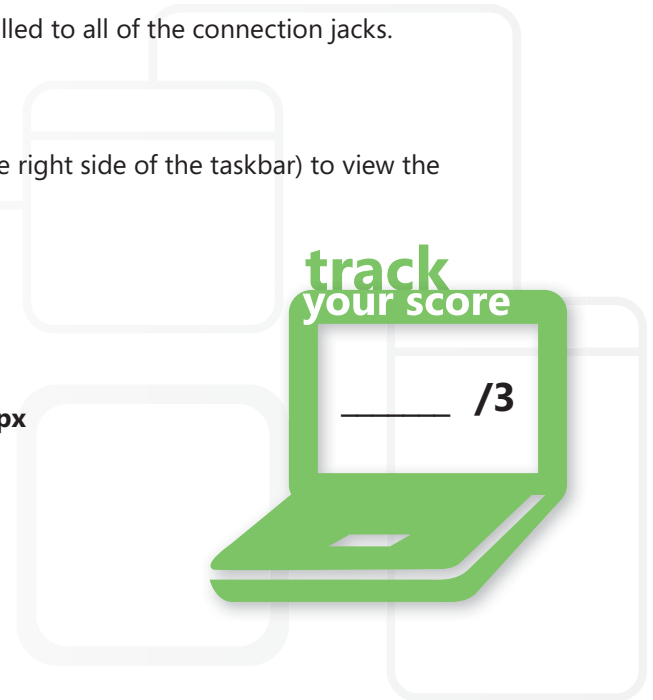
1. Connecting a cable from a laptop's NIC into a RJ45 jack allows Brian to use the hotel's:
b. wired LAN. Wired LANs use cables and wireless LANs use radio, microwave, or infrared light.
2. Another name for a VLAN is:
a. logical network. VLANs segment broadcast traffic, which in turn increases network performance.
3. The best solution Erin should implement to expand Internet connectivity to the pool area is:
b. expand the hotel's wireless network. A wireless LAN is easy to install in locations such as pool areas and hotel lobbies where it can be difficult to run cables.

Essential details

- **VLANs** are created on switches and help improve network performance.
- Wired networks take time to install because wires need to be pulled to all of the connection jacks.
- Wireless **LANs** are easy to expand to remote areas.
- Security can be implemented in both wired and wireless LANs.
- In Microsoft® Windows 7®, click the wireless network icon (on the right side of the taskbar) to view the available wireless networks.

FAST TRACK HELP

- <http://windows.microsoft.com/en-US/windows7/What-you-need-to-set-up-a-home-network>
- <http://www.microsoft.com/protect/data/home/wireless.aspx>
- <http://windows.microsoft.com/en-US/windows7/View-and-connect-to-available-wireless-networks>



Understand wide area networks (WANs)

SCENARIO: Fourth Coffee's business is booming! Josh, the owner, decides that now is the time to expand his business. In the next month he will open one new location 30 miles south. In three months he will open another location 30 miles north.

Josh wants to have a network between all three coffee shops. He is also concerned about security over the existing VPN that provides him with access to the coffee shop's network from his home and mobile phones.

When Josh shares his expansion plans and IT concerns with Sidney, his IT Consultant, she tells Josh that she has the solutions. Sidney can easily expand the network because she has been studying WANs in her college classes.

- 1. To link all three of Fourth Coffee's LANs together, Sidney will create a:**
 - a. LAN
 - b. PAN
 - c. WAN
- 2. Between the original coffee shop and the first expansion location, Sidney decides to order a private, dedicated line from the phone company known as:**
 - a. a leased line
 - b. dial-up
 - c. ISDN
- 3. Sidney reassures Josh that the existing VPN is secure because the data transferred across the public network is:**
 - a. defragmented
 - b. encrypted
 - c. zipped

hint

Always choose the most efficient IT solution to meet the goals of a given IT situation.

Answers

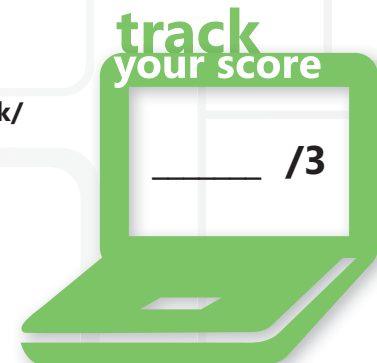
1. Sidney will link all three of Fourth Coffee's LANs together by creating a:
 - a. **WAN.** A WAN is a Wide Area Network which spans a large geographical area.
2. The private, dedicated line that Sidney orders from the phone company to connect the original coffee shop and the first expansion location is called a:
 - a. **leased line.** The cost for a leased line depends upon the speed.
3. Fourth Coffee's VPN is secure because the data transferred across the public network is:
 - b. **encrypted.** Encrypted data is scrambled, which protects it from unauthorized network clients.

Essential details

- WANs can span completely around the world—from the United States to Australia!
- A WAN link selection depends upon a company's goals for speed, availability, cost, and so on.
- The Plain Old Telephone Service (POTS) is the oldest communications network.
- For small companies, leased lines are a great WAN solution for connecting two locations.
- Always protect data by encrypting it prior to transferring it across the Internet.

FAST TRACK HELP

- <http://technet.microsoft.com/en-us/library/bb727043.aspx>
- <http://www.cisco.com/en/US/docs/internetworking/technology/handbook/Intro-to-WAN.html>
- <http://www.microsoft.com/windows/windows-7/features/bitlocker.aspx>



Understand wide area networks (WANs)

SCENARIO: While attending college, Allie accepts an IT internship at Tailspin Toys in Denver, Colorado. She realizes that this is an amazing opportunity for her to apply the skills that she has learned in her networking classes.

Richard, Tailspin Toys' CIO, informs her that she will be working with Cristian, another IT intern, who works for Tailspin Toys in Paris, France. Together they will determine the different types of WAN connections available in the United States and France. Both locations will use point-to-point, dedicated, digital circuits between their two local offices within their respective countries. Speed for the digital circuits needs to be a minimum bandwidth of 1 Mbps. In addition, Allie will need to research different home connection subscriptions available for Tailspin Toys' employees so that they can access the company's network via the Internet.

Allie and Cristian have fun challenges to solve!

- 1. Cristian determines that the point-to-point, dedicated, digital circuit that is available in Paris and meets the minimum bandwidth of 1 Mbps is the:**
 - a. E1
 - b. F1
 - c. T1
- 2. Allie determines that the United States' equivalent to Cristian's chosen digital circuit is the:**
 - a. E1
 - b. T1
 - c. U1
- 3. One home connection that Allie researches is a high-speed digital communication technology over standard copper telephone wire called:**
 - a. Cable TV
 - b. DSL
 - c. VPN

hint

Every country has its own unique IT standards and procedures.

Answers

1. In Paris, the point-to-point, dedicated, digital circuit that Cristian finds that meets the 1 Mbps minimum bandwidth is the:
 - a. **E1.** The E1 is available through Europe and has a bandwidth of 2.048 Mbps.
2. In the United States, Allie determines that the equivalent digital circuit to the E1 is the:
 - b. **T1.** The T1 is available through the United States and has a bandwidth of 1.544 Mbps.
3. For home connections, Allie finds a high-speed digital communication technology that operates over standard copper telephone wire, which is called:
 - b. **DSL.** DSL and Cable broadband Internet access technologies are popular choices for connecting home or small business systems to the Internet.

Essential details

- E1 and E3 are WAN connections available in Europe versus T1 and T3 for the United States.
- DSL and Cable broadband Internet access technologies each have a corresponding modem.
- Dial-up and ISDN have decreased in popularity while DSL and Cable have become more popular.
- Even more WAN technologies exist, such as Frame Relay and ATM (Asynchronous Transfer Mode).
- WAN links need to be optimized for efficient and fast performance.

FAST TRACK HELP

- <http://speedtest.emea.microsoftonline.com/>
- [http://technet.microsoft.com/en-us/library/cc753764\(WS.10\).aspx](http://technet.microsoft.com/en-us/library/cc753764(WS.10).aspx)
- <http://technet.microsoft.com/en-us/library/bb726928.aspx>



Understand wireless networking

SCENARIO: Scott wants to set up a wireless network in his family's house for Internet connectivity. If he is successful in creating a secure wireless network, his parents will pay for his first semester in IT at college! To ensure his success, Scott enlists his friend Susan, who has already set up a secure wireless network for her family.

Susan takes Scott on a shopping trip to their local electronics store to purchase the necessary equipment of a wireless router which supports the most current wireless networking standards. The family's desktop system will be wired and their new laptop will use wireless. The family uses DSL for their Internet connection.

After their shopping trip, Susan and Scott start setting up the wireless network. Will Scott succeed and earn a free semester at college?

- 1. The most current wireless networking standard is:**
 - a. 802.11n
 - b. 802.3
 - c. Bluetooth
- 2. To provide strong encryption protection without an enterprise authentication server, Scott uses:**
 - a. SSID
 - b. WEP
 - c. WPA-PSK
- 3. After the wireless network is completed, Scott's Dad sits on the deck and successfully connects the laptop to the Internet through their new, private, and secure:**
 - a. Gigahertz
 - b. VLAN
 - c. Wi-Fi hotspot

hint

Always secure a wireless network so that your data stays safe.

Answers

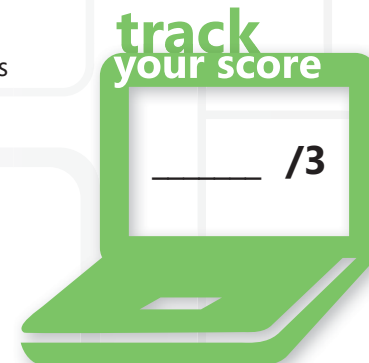
1. The wireless networking standard that is most current is:
 - a. **802.11n**. Two of the popular networking standards being used are 802.11g and 802.11n.
2. Strong encryption protection without an enterprise authentication server is provided through:
 - c. **WPA-PSK**. WPA-PSK is for personal/small business use; WPA-Enterprise, which uses authentication servers, is for an enterprise business.
3. On the deck, Scott's Dad connects his laptop to the Internet through their private and secure:
 - c. **Wi-Fi hotspot**. Public Wi-Fi hotspots are available in a variety of locations such as coffee shops, schools, airports, and restaurants.

Essential details

- Each of the wireless networking standards has different characteristics, such as speed, distance, frequency, and so on.
- Connect a WAP (wireless access point) to a wired router to provide connectivity between the wireless devices and wired network.
- WPA (Wi-Fi Protected Access) and WPA2 is more secure than WEP (Wired Equivalent Privacy).
- WP-Enterprise and WP2-Enterprise are used in business environments and work with an 802.1X authentication server.
- The 802.1X authentication method is used in business environments and requires a certificate or smart card for network access.

FAST TRACK HELP

- <http://standards.ieee.org/getieee802/802.11.html>
- <http://windows.microsoft.com/en-US/windows7/Set-up-a-security-key-for-a-wireless-network>
- <http://windows.microsoft.com/en-US/windows-vista/What-are-the-different-wireless-network-security-methods>



Understand network topologies and access methods

SCENARIO: During winter break from college, Jack decides to go skiing at Alpine Ski House, a small wilderness resort. He brings his laptop to the resort and finds out that wireless Internet connectivity is not available to the skiers. Alpine Ski House has only one desktop computer connected to the Internet.

Jack decides that this would be a great opportunity for him to apply the skills he is learning in class, so he asks to speak with the owner of Alpine Ski House, Molly. She willingly discusses her networking dilemmas with Jack. Should she implement a star or bus network topology? What is a mesh? Does she need a switch? Molly has too many IT questions and not enough answers, so she decides to hire Jack.

Jack starts to design a network solution for Alpine Ski House between his skiing sessions.

- 1. The topology concerned with how data gets transferred within the network is the:**
 - a. logical topology
 - b. mesh topology
 - c. physical topology
- 2. The topology considered more reliable because all of the nodes are connected to each other is the:**
 - a. bus topology
 - b. mesh topology
 - c. star topology
- 3. What topology should Jack choose for Molly's network?**
 - a. bus
 - b. ring
 - c. star

hint

It is important to know the advantages and disadvantages of various topologies.

Answers

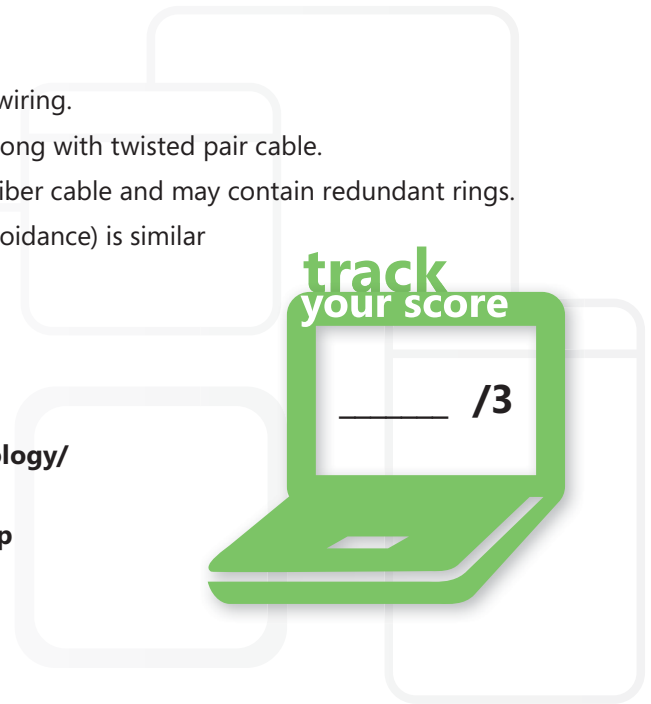
1. Within the network, the topology that deals with how data gets transferred is the:
 - a. **logical topology.** The logical topology works with the physical topology, which is concerned with how the devices are physically connected together.
2. The topology where all the nodes are connected to each other to form a reliable network is the:
 - a. **mesh topology.** Mesh topologies contain redundant wiring that provides multiple paths to the same destination.
3. For Molly's network at Alpine Ski House, the topology Jack should choose is the:
 - a. **star.** The star is the one of the most popular topologies implemented today because of its low cost and ease of installation.

Essential details

- Bus topologies were popular along with coaxial cable.
- Mesh topologies are more expensive because of the redundant wiring.
- In star topologies a switch is usually used as the central device along with twisted pair cable.
- Ring topologies are used as backbones for large networks with fiber cable and may contain redundant rings.
- CSMA/CD is similar to a chat room, while CSMA/CA (Collision Avoidance) is similar to a classroom.

FAST TRACK HELP

- <http://technet.microsoft.com/en-us/library/bb632621.aspx>
- <http://www.cisco.com/en/US/docs/internetworking/technology/handbook/Intro-to-LAN.html>
- <http://www.giac.org/resources/whitepaper/network/32.php>



2

Understanding Network Hardware

IN THIS CHAPTER

- 2.1A Understand switches
- 2.1B Understand switches
- 2.2 Understand routers
- 2.3A Understand media types
- 2.3B Understand media types





Understand switches

SCENARIO: Michelle is logged into one of her social networking sites when she receives an urgent text message from her friend Robert. Robert is trying to study for his IT networking class final and has some questions regarding the concepts and needs help. Michelle offers to meet Robert at Fourth Coffee.

While Michelle and Robert are studying at Fourth Coffee, Sidney, the IT Consultant at Fourth Coffee, stops by the table to say hi to Michelle, who is a friend of hers. Michelle tells Sidney that she is helping Robert study for a test. Sidney tells Robert that it is more fun to look at real equipment to learn the concepts and offers them a tour of Fourth Coffee's IT network.

While on the tour, Sidney starts to quiz Robert about the different networking components. Robert passes Sidney's test. What about you?

- 1. A computer's MAC address is:**
 - a. assigned by a Network Administrator
 - b. located on the NIC
 - c. acquired from an ISP (Internet Service Provider)
- 2. The OSI model is to networking as:**
 - a. music is to a Zune®
 - b. cookies are to milk
 - c. fashion rules are to fashion
- 3. A smart Layer 2 device that has an IP address, connects the office computers together, and provides full bandwidth to each port is called a:**
 - a. managed hub
 - b. managed switch
 - c. unmanaged switch

hint

A MAC address is also called a physical address and can be viewed with `ipconfig/all`.

Answers

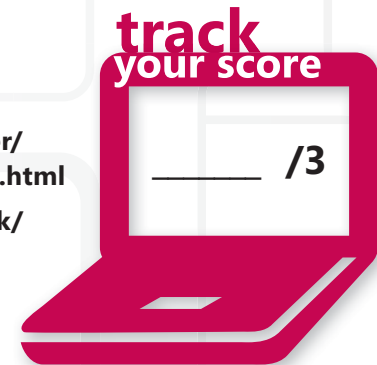
1. The MAC address for a computer is:
 - a. **located on the NIC.** The MAC address is determined by the vendor of the NIC.
2. The OSI model is to networking as:
 - a. **fashion rules are to fashion.** Just as stripes and solids do not usually match, networking devices perform certain functions and follow specific rules based on their OSI model layer.
3. A device that provides full bandwidth to each port, connects computers together, has an IP address, and operates at Layer 2 of the OSI model is a:
 - a. **managed switch.** Switches that are managed contain an IP address.

Essential details

- Know the layers of the ISO's (International Standards Organization) OSI model.
- Hubs and repeaters are Layer 1 devices, switches and NICs are Layer 2, and routers are Layer 3.
- Switches can create **VLANs** (Virtual Local Area Networks), which isolate network broadcast traffic.
- **Bandwidth** is the throughput or the data transfer rate.
- If you have a fast port but a slow cable, the network will operate at the slowest speed, which is the cable's speed.

FAST TRACK HELP

- http://www.cisco.com/cisco/web/solutions/small_business/resource_center/articles/connect_employees_and_offices/what_is_a_network_switch/index.html
- <http://www.cisco.com/en/US/docs/internetworking/technology/handbook/Intro-to-Internet.html>
- http://www.cisco.com/en/US/prod/switches/networking_solutions_products_genericcontent0900aec806c7afe.pdf



Understand switches

SCENARIO: Joel is working in his college dorm room on a term paper when he loses Internet connectivity. Because his laptop seems fine, Joel decides to enlist his friend Scott, who manages the dorm's network, to help him out.

Joel finds Scott and they go to the dorm's network room to determine what has happened. While in the network room, Joel learns more about how the dorm's LAN is configured. Joel remembers that switches operate at Layer 2 and shares that with Scott. However, Scott informs Joel that there are actually Layer 3 switches, too! Scott also tells Joel that a new switch module is expected next week and hardware redundancy is being added.

After the issue is resolved, Joel returns to his dorm room to work on the term paper. However, he keeps thinking about all he has learned and realizes that IT is both challenging and fun!

1. A Layer 3 switch performs:

- a. Layer 2 forwarding and Layer 3 switching in hardware
- b. Layer 2 segmenting and Layer 3 switching in hardware
- c. Layer 2 switching and Layer 3 forwarding in hardware

2. A switch is to a network as:

- a. a frame is to a picture
- b. a portal is to the web
- c. a case is to a computer

3. A motherboard is to a computer as:

- a. a backplane is to a switch
- b. a MAC address is to a switch
- c. a certificate is to a switch

hint

It is important to know the layers of the OSI model and how they operate.

Answers

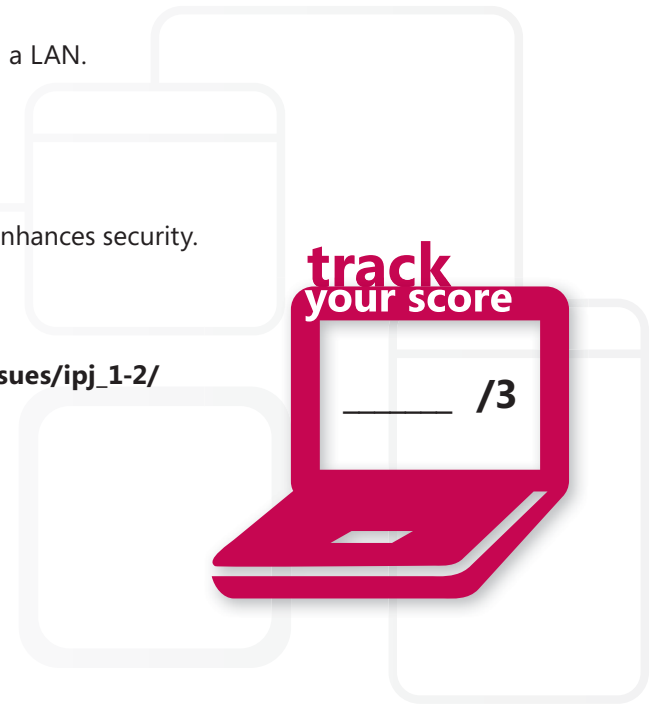
1. The sophisticated Layer 3 switch performs:
 - c. **Layer 2 switching and Layer 3 forwarding in hardware.** This is a very smart device operating at a higher layer!
2. A switch is to a network as:
 - b. **a portal is to the web.** A switch is a connection point for all local clients just like a portal is a collection point for different web resources.
3. A motherboard is to a computer as:
 - a. **a backplane is to a switch.** Modules may be inserted into a switch's backplane for expansion and upgrading purposes.

Essential details

- Switches are more than just a connection point for computers in a LAN.
- Choose the right networking device for the specific goal.
- Hardware redundancy provides highly available networks.
- Managed switches provide more options for network support.
- Use VLANs to segment systems from each other, which in turn enhances security.

FAST TRACK HELP

- http://www.cisco.com/web/about/ac123/ac147/archived_issues/ipj_1-2/switch_evolution.html
- <http://windows.microsoft.com/en-US/windows7/How-do-hubs-switches-routers-and-access-points-differ>
- <http://technet.microsoft.com/en-us/library/bb742373.aspx>



Understand routers

SCENARIO: After setting up his family's wireless network, Scott decides that he needs to acquire more hands-on experience using routers. Ty, his friend, recommends volunteering at the local Humane Society because he has heard that they have a lot of IT issues.

Scott approaches the Director of the Humane Society, Justin, about volunteering. Justin immediately welcomes Scott to his team! Justin would like Scott to install a network that will connect the five desktop systems that they currently have in the office to a server. Through the network the employees should have Internet access. Plus, he would like to establish a connection to a different Humane Society's server in a neighboring town so that they can share information. Justin anticipates expansion and would like to plan accordingly.

Scott is thrilled to receive this opportunity and knows he has a lot of studying to do!

1. The Humane Society cannot afford a router but they do have a switch and a Windows Server.

What should Scott do?

- tell Justin that they'll have to wait until they can afford a router
- use the switch because a Layer 2 device can perform the same functions as a router
- use the switch to connect the desktops and servers and then install routing software on the server

2. One week later a router is installed and Scott needs to figure out what routes the router knows, so he:

- accesses the router's NAT database and views the routes
- accesses the router's routing table and views the routes
- pings the router and it returns the routes

3. When Scott views the routes he sees that the router is learning new routes because of:

- dynamic routing
- NAT
- static routing

hint

Routers are very smart Layer 3 devices that are used to connect networks together.

Answers

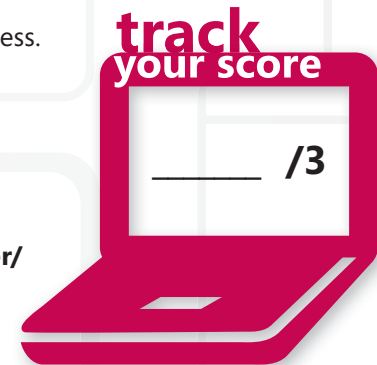
1. Because the Humane Society has a switch and a Windows Server, Scott should:
 - c. **use the switch to connect the desktops and servers and then install routing software on the server.** Through software, Windows Server® can act just like a router and perform the same functions.
2. To determine what routes the router knows, Scott:
 - b. **accesses the router's routing table and views the routes.** The routing table contains static and dynamic routes.
3. The router is learning new routes as a result of:
 - a. **dynamic routing.** The router continuously learns about new routes and routes that are no longer available.

Essential details

- Routing tables are shared between neighboring routers.
- The router always chooses the best path with the lowest cost from source to destination.
- NAT allows a private address to be translated to a public address for Internet access.
- Computers, routers, and other IP devices need a unique 32-bit IP address and a 32-bit IP subnet mask to communicate in an IP network.
- Computers also need a gateway address, which is the connected router's IP address.

FAST TRACK HELP

- http://www.cisco.com/en/US/tech/tk648/tk361/technologies_tech_note09186a0080094831.shtml
- http://www.cisco.com/cisco/web/solutions/small_business/resource_center/articles/connect_employees_and_offices/what_is_a_network_switch/index.html
- <http://technet.microsoft.com/en-us/network/bb545655.aspx>



Understand media types

SCENARIO: Ever since The School of Fine Art has been actively participating in different social networking sites, their enrollment has been exceeding their building's capacity! Jon, the CIO, and Brian, the IT Manager, are working through the different options available for wiring the new building they are planning to build in spring and possibly updating the existing building.

Jon is concerned about the planned long distance between the two buildings, interference from different electrical issues the School of Fine Art has been experiencing, and choosing the best media for their goals.

Brian and Jon discuss the best cabling options available for their new building and start planning the long-term goals for the School of Fine Art.

1. The best media choice for data to travel long distances without the risk of interference is:

- a. fiber
- b. thin coax
- c. unshielded twisted-pair

2. Fiber:

- a. can only be used for short distances
- b. is extremely inexpensive
- c. transmits data in the form of light

3. Any type of undesirable electromagnetic emission or electrical/electronic disturbance is known as:

- a. EIGRP
- b. EMI
- c. STP

hint

It is important to know the advantages and disadvantages of the different cable types!

Answers

1. The best media choice for data to travel long distances without the risk of interference is:
 - a. **fiber.** Fiber is an excellent choice for long distances and it keeps data secure.
2. Fiber:
 - c. **Transmits data in the form of light.** Data traveling via fiber cable is transferred extremely fast for long distances.
3. Interference in the form of electromagnetic emission or electrical/electronic disturbance is known as:
 - b. **EMI.** Interference can alter, modify, and drop data as it is transferred across media.

Essential details

- Fiber has a variety of different type of connectors that connect into switches, routers, and so on.
- Fiber is available in single-mode and multimode.
- Coax is commonly used for TV connections today rather than enterprise network installations.
- UTP is commonly used today in star and extended star topologies because it is inexpensive and easy to install.
- Wireless provides many advantages over traditional cabling choices and therefore continues to increase in popularity.

FAST TRACK HELP

- <http://www.ciscopress.com/articles/article.asp?p=31276&seqNum=4>
- <http://www.youtube.com/watch#!v=PqmFne1gel4&feature=related>
- http://www.cisco.com/en/US/netsol/ns340/ns394/ns348/ns337/networking_solutions_package.html



Understand media types

SCENARIO: The School of Fine Art created a project plan to design a network closet for their new building on campus. Jon, the CIO, would like to recruit students from a local community college to assist with this project.

Mary Kay, one of the recruited students, becomes the project leader. The first task assigned to the students will be to choose the appropriate cable type to use for wiring the required classrooms and the backbone of the LAN. The media goals for the cable running to the classrooms include ease of installation, keeping costs low, and being wired. The media goals for the backbone include being fast and being redundant. The backbone cabling will be more expensive and that is incorporated into the budget.

Mary Kay and her team of students are ready for the challenge! Are you ready to join the team?

- 1. Based on the media goals, the type of cable that should be run to the classrooms is:**
 - a. coaxial
 - b. fiber
 - c. UTP
- 2. Based on the media goals, the type of cable that should be used for the backbone is:**
 - a. fiber
 - b. STP
 - c. wireless
- 3. Jon asks Mary Kay what media she would recommend for the common areas. She replies:**
 - a. "Wireless, because of ease of installation and flexibility."
 - b. "Fiber, because of its low cost."
 - c. "Wireless because it is secure by default without any configuration."

hint

The speed and intended distance are critical factors in selecting transmission media.

Answers

1. Mary Kay and her team analyze the media goals for the classroom and choose:
 - c. **UTP.** UTP is the popular choice for a variety of wired installations because it is inexpensive and easy to install.
2. Mary Kay and her team analyze the media goals for the backbone and choose:
 - a. **fiber.** Fiber is the popular choice for enterprise backbones and may be implemented in dual rings to provide redundancy.
3. For the type of media to install in the common areas, Mary Kay quickly and easily answers:
 - a. **“Wireless, because of ease of installation and flexibility.”** Wireless is the preferred choice even though it will have to be configured to make it more secure.

Essential details

- UTP cables in LANs contain RJ45 connectors.
- Cat 5e and 6 are popular for new UTP installations.
- Because of safety concerns, it is relatively easy to create UTP cables and a lot more difficult to create fiber cables.
- Cables need to be organized efficiently and properly labeled.
- Know and follow the maximum distances for cable runs and even for wireless deployments.

FAST TRACK HELP

- <http://technet.microsoft.com/en-us/library/cc750550.aspx>
- http://www.belden.com/03Products/03_CableBasics.cfm
- <http://www.ciscopress.com/articles/article.asp?p=169686>



3

Understanding Protocols and Services

IN THIS CHAPTER

- 3.1A Understand the OSI model
- 3.1B Understand the OSI model
- 3.2 Understand IPv4
- 3.3A Understand IPv6
- 3.3B Understand IPv6
- 3.4 Understand names resolution
- 3.5 Understand networking services
- 3.6 Understand TCP/IP



Understand the OSI model

SCENARIO: Cassie and her friend Christian have just accepted new jobs at Lucerne Publishing. Cassie will be an IT Networking Technician supporting Microsoft® Windows Servers®. Christian will be an IT Web Developer working on Lucerne Publishing's website.

On their first day of work they attended Lucerne Publishing's new employee orientation to learn all about the company's policies. Various individuals provided lots of detailed information regarding policies and procedures related to their various departments.

After the orientation Cassie turned to Christian and began talking with him about what they had just learned during their orientation. Christian tells Cassie that the conversation reminds him of when they were in school and she would quiz him on what they had just learned in class. Can you pass Cassie's quiz on the OSI model?

1. **The OSI model contains:**
 - a. three layers
 - b. five layers
 - c. seven layers
2. **Data is placed onto the physical network medium at the:**
 - a. application layer
 - b. network layer
 - c. physical layer
3. **OSI is to networking as:**
 - a. a text message is to a mobile phone
 - b. a game rule is to football
 - c. a word is to a book

hint

Remember the OSI model's layers and their order via a mnemonic phrase – All People Seem To Need Daily Praise!

Answers

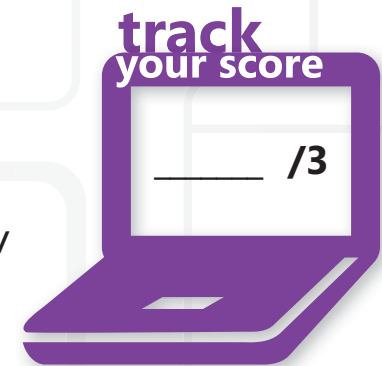
1. In the ISO's OSI model there are:
 - a. **seven layers**
2. The layer where data is placed onto the physical network medium is called the:
 - a. **physical layer.** The Physical layer (Layer 1) puts the data onto the wire at the source computer and then it is sent to the destination computer.
3. OSI is to networking as:
 - a. **a game rule is to football.** It is important to follow the standards when networking just like it is important to follow the game rules when playing football.

Essential details

- Know the OSI model's seven layers and the standards they represent.
- Standards are followed so that computers and devices can speak the same language in order to communicate with each other.
- Each layer communicates with the other layers directly above and below.
- Data is encapsulated or wrapped up at each layer within a different wrapper.
- Protocols are a set of rules that provide guidelines for computer communication.

FAST TRACK HELP

- <http://support.microsoft.com/kb/103884>
- <http://technet.microsoft.com/en-us/library/cc959881.aspx>
- <http://www.cisco.com/en/US/docs/internetworking/technology/handbook/Intro-to-Internet.html>



Understand the OSI model

SCENARIO: Cassie is excited as she arrives for her second day on the job at Lucerne Publishing as an IT Networking Technician. She will job shadow Holly for a couple of days to learn more about her job responsibilities.

Holly gives Cassie a tour of Lucerne Publishing's datacenter, which contains all of the Microsoft® Windows Servers® that Cassie will help support. As they are leaving the datacenter, Brian from the Accounting Department stops Holly to tell her that he has been having a problem connecting to the network. Holly tells Brian that she and Cassie will help solve the problem.

To solve Brian's problem, Holly and Cassie use tools to gather information about his IP address and then work through the layers of the TCP/IP model to determine why his computer is having networking problems. The problem will be solved quickly with knowledge of the OSI model!

- 1. The TCP/IP model contains:**
 - a. four layers and is not used today
 - b. four layers and follows the standards of the OSI reference model
 - c. seven layers and was created before the OSI model
- 2. All hosts participating in a TCP/IP network, including Brian's computer, are assigned:**
 - a. a MAC address
 - b. a port number
 - c. an IP address
- 3. A packet at Layer 3 becomes:**
 - a. a frame at Layer 2
 - b. a packet at Layer 2
 - c. a network address

hint

The ipconfig and ipconfig/all commands provide information that is useful for troubleshooting networks.

Answers

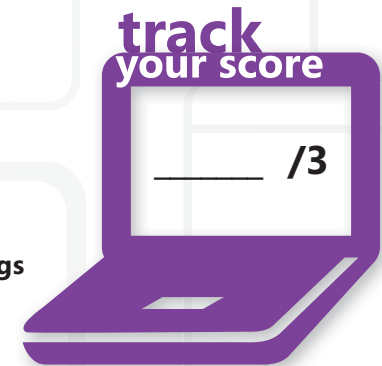
1. The TCP/IP model contains:
 - b. **four layers and follows the standards of the OSI reference model.** The TCP/IP model is an actual implementation of the OSI reference model even though it contains fewer layers.
2. All hosts participating in a TCP/IP network, including Brian's computer, are assigned:
 - c. **an IP address.** All computers and devices in a TCP/IP network need an IP address, subnet mask, and default gateway.
3. A Layer 3 packet becomes:
 - a. **a frame at Layer 2.** Data encapsulation at Layer 3 takes the form of a packet and at Layer 2 turns into a frame.

Essential details

- The TCP/IP model, or the TCP/IP protocol suit, contains four layers and protocols at each layer.
- Different encapsulation types exist at the different layers, such as packets at the Network layer.
- TCP operates at the Transport layer and IP operates at the Network layer.
- All computers and devices participating in a TCP/IP network require an IP address, subnet mask, and default gateway.
- There are a few ports that should be remembered including: 53 (DNS), 80 (HTTP), 25 (SMTP), 110 (POP3).

FAST TRACK HELP

- [http://technet.microsoft.com/en-us/library/cc786900\(WS.10\).aspx](http://technet.microsoft.com/en-us/library/cc786900(WS.10).aspx)
- <http://windows.microsoft.com/en-US/windows-vista/Change-TCP-IP-settings>
- <http://technet.microsoft.com/en-us/sysinternals/bb897557.aspx>



Understand IPv4

SCENARIO: Today is the first day of college classes for Paul and he is looking forward to learning more about networking mobile devices.

Paul has several items on his to-do list before going to his first class. First, he stops by the registration desk to make a quick change to his schedule. The Registrar asks him for his student identification number so that she can process the change. Next, he stops by the bookstore and the cashier asks him for his student identification number so that she can process his book order. Luckily, he finds his classroom just in time for the class to begin.

After class, Paul tells his friend Scott that the professor talked about IP version 4 addresses. Scott decides to quiz Paul because Scott has already taken the class and is sure he knows what Paul should have learned today!

- 1. An IP address is to a computer as:**
 - a. a student identification number is to a student
 - b. chocolate is to a chocolate chip cookie
 - c. fur is to a polar bear
- 2. Characteristics of IPv4 include:**
 - a. classes and 32-bit addresses
 - b. classes and 64-bit addresses
 - c. zones and 32-bit addresses
- 3. A default gateway is also known as:**
 - a. an access point
 - b. a switch
 - c. a router

hint

IPv4 is still used everywhere even though IPv6 is also available.

Answers

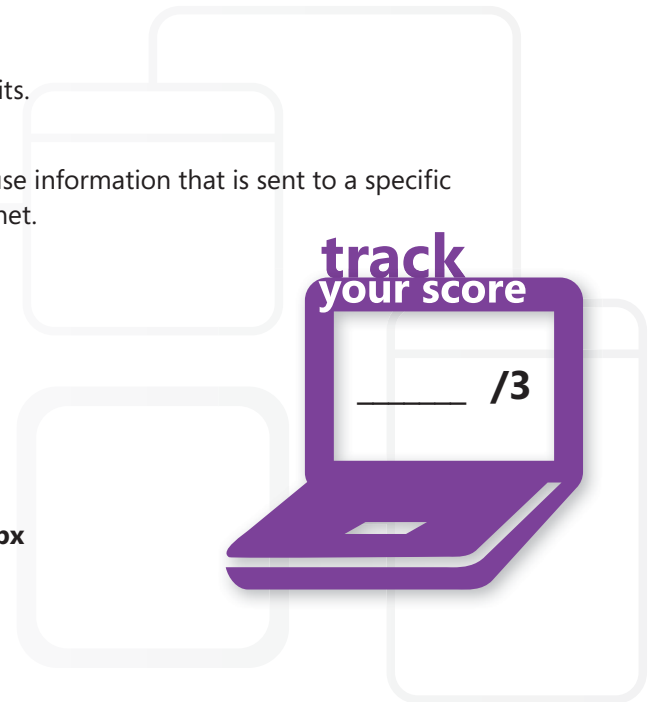
1. An IP address is to a computer as:
 - a. **a student identification number is to a student.** An IP address is unique to a computer just like each student has a unique identification number that is different from all of the other students' identification numbers.
2. IPv4 characteristics include:
 - a. **classes and 32-bit addresses.** IPv4 contains Class A through E classes and all IP addresses are 32-bit in length.
3. Another name for a default gateway is:
 - c. **a router.** The router provides a way for local subnet traffic to exit their subnet and travel to another network as their final destination.

Essential details

- IP addresses contain four octets and each octet contains eight bits.
- Ranges of IP addresses are reserved for private networks.
- A broadcast address is similar to an e-mail distribution list because information that is sent to a specific broadcast address will be sent to all devices on that specific subnet.
- Servers use static addresses; clients use dynamic IP addresses.
- DHCP servers provide IP addresses to clients for a set lease time.

FAST TRACK HELP

- <http://support.microsoft.com/kb/164015>
- <http://technet.microsoft.com/en-us/library/cc940018.aspx>
- <http://technet.microsoft.com/en-us/network/bb530961.aspx>



Understand IPv6

SCENARIO: Today is finally the day that Randy is going to upgrade his current mobile phone!

When Randy arrives at The Phone Company, which sells almost every phone available, he is approached by sales associate Laura. Laura is eager to help him choose a phone to meet his needs. Randy has some questions regarding the two models he has preselected. Laura does an excellent job in explaining the differences between the two phones. One economy model has a touch screen but does not offer scalability, or expansion, for future needs because it only supports IPv4 addresses. Another model has the best of everything, including a large touch screen and support for both IPv4 and IPv6.

Randy is torn between saving money and having a leading-edge phone. Laura tells him to consider his goals regarding how he will use his phone and how long he intends to keep his phone. If you were Randy, which phone would you choose?

1. **IPv4 is to IPv6 as:**
 - a. English is to Danish
 - b. Microsoft® Windows XP® is to Microsoft Windows 7®
 - c. Microsoft Word 2010® is to Microsoft Word 2007®
2. **If Randy buys the IPv6 phone and uninstalls IPv4 support, he can still communicate with an IPv4 device when he:**
 - a. is connected to a IPv4 default gateway
 - b. is connected to a Dual Stack Architecture network
 - c. converts his IPv6 address to an IPv4 address manually
3. **Randy's new IPv6 phone would have a:**
 - a. 32-bit IP address
 - b. 64-bit IP address
 - c. 128-bit IP address

hint

An IPv6 address contains eight groups of hexadecimal characters separated by colons. Example: `3ffe:ffff:0000:2f3b:02aa:00ff:fe28:9c5a!`

Answers

1. IPv4 is to IPv6 as:
 - b. Microsoft Windows XP is to Microsoft Windows 7.** Because businesses are moving to Windows 7, it is becoming the new standard, similar to the way businesses are migrating to IPv6.
2. IPv4 devices and Randy's IPv6 phone may still communicate with each other when Randy:
 - b. is connected to a Dual Stack Architecture network.** A network environment that is running both IPv4 and IPv6 simultaneously will provide communication between the two standards.
3. The new IPv6 phone that Randy may buy would have a:
 - c. 128-bit IP address.** IPv4 addresses are 32 bits and IPv6 addresses are 128 bits.

Essential details

- IPv4 addresses contain the numbers 0-255 and IPv6 addresses contain hexadecimal characters.
- Hexadecimal characters include the numbers 0-9 and letters A-F.
- IPv6 is becoming the new standard.
- Windows provides support for both IPv4 and IPv6 through the Dual Stack Architecture.
- Teredo, ISATAP, and 6to4 are tunneling technologies that provide transitional and backward compatibility between IPv6 and IPv4 networks.

FAST TRACK HELP

- <http://technet.microsoft.com/en-us/library/bb726995.aspx>
- <http://windows.microsoft.com/en-US/windows-vista/IPv6-frequently-asked-questions>
- <http://technet.microsoft.com/en-us/network/cc917486.aspx>



Understand IPv6

SCENARIO: Classes are finished for the semester and winter break has begun. Next semester all classes will use e-books, so Doug has decided to sell his current physical books to make a little extra money to buy great holiday gifts for his family and friends. Doug chooses to sell his books through Lucerne Publishing's new website. He registers on the website, lists his books, and is ecstatic that one of the books sells immediately.

After receiving the shipping details and packaging the book, it occurs to him that the process of addressing and packaging the book is similar to the way IP packets are structured and encapsulated. The book is encapsulated into an envelope and the envelope contains both his return address and the address for its final destination—just like an IP packet contains a source and destination address!

- 1. At the Networking Layer, in an IPv6 network, data is encapsulated into an IPv6:**
 - a. envelope
 - b. header
 - c. packet
- 2. An IPv6 subnet mask is written in:**
 - a. decimal
 - b. hexadecimal
 - c. octal
- 3. Subnet masks are to an IP address as a:**
 - a. keyboard is to a computer
 - b. website is to a link
 - c. zip code is to a postal address

hint

Ipconfig displays both IPv4 and IPv6 addresses.

Answers

1. In an IPv6 network, at the networking layer, data is encapsulated into an IPv6:
 - a. **packet**
2. A subnet mask for IPv6 is written in :
 - a. **hexadecimal.** IPv6 subnet masks are written in hexadecimal; IPv4 subnet masks are in decimal.
3. Subnet masks are to an IP address as a:
 - a. **zip code is to a postal address.** A zip code determines the city and state a package is to be delivered to, which is similar to performing a bitwise AND operation of the subnet mask and IP address to determine the subnet of the IP address.

Essential details

- IPv4 and IPv6 packets both contain the source and destination IP addresses that are used by the router to route the packet.
- IPv6 addresses contain a dedicated subnetting portion.
- Identify the subnet that an IP address belongs to in a network by performing a bitwise AND operation of the subnet mask and IP address.
- The loopback address for IPv4 is 127.0.0.1 and for IPv6 is 0:0:0:0:0:0:1 or ::1 (compressed format).

FAST TRACK HELP

- http://www.cisco.com/en/US/products/ps6553/products_ios_technology_home.html
- <http://msdn.microsoft.com/en-us/library/aa915659.aspx>
- http://www.juniper.net/techpubs/en_US/junos9.6/information-products/topic-collections/config-guide-routing/id-10122335.html



Understand names resolution

SCENARIO: Laura Steele is packing for her big trip to Australia. Her IT Internship class is travelling to Australia to study IT best practices in a different country. She is looking forward to the adventure and to expanding her knowledge. She knows that her career could take her any place in the world!

At the airport, Laura and her classmates check in at the Blue Yonder Airlines ticket counter. The ticket agent asks Laura her name and she tells the agent that her full name is Laura Steele Polly. Next, the ticket agent asks Laura for her driver's license number and Laura provides it to the ticket agent. The names and license number indicate that both refer to the same individual. Finally, after the ticket agent is fully satisfied that "Laura Steele" is really "Laura Steele Polly," Laura is given her boarding pass.

After receiving their boarding passes the students stand in the security line. While waiting for their turn, the students talk about the ticket check-in procedures. Laura Steele shares with her classmates that the check-in procedure reminds her of name resolution. Is it similar?

- 1. A domain name is to an IP address as:**
 - a. a kangaroo is to Australia
 - b. Laura Steele's name is to her driver's license number
 - c. Laura Steele's student identification number is to her name
- 2. When Laura Steele browses the Web on her mobile phone and types in `http://www.microsoft.com` and presses Enter:**
 - a. the domain name Microsoft.com is resolved to an IP address
 - b. the IP address is a calculated address based on the domain name
 - c. WINS checks the local LMHOSTS file and determines the MAC address of the domain name
- 3. The server that translates domain names to their corresponding IP addresses is called a:**
 - a. DHCP server
 - b. DNS server
 - c. WINS server

hint

It is usually easier to remember domain names and more difficult to remember IP addresses.

Answers

1. A domain name is to an IP address as:
 - a. **Laura Steele's name is to her driver's license number.** Both resolve a name to a number and identify the same location or person.
2. On her mobile phone, when Laura Steele types in **http://www.microsoft.com** and presses Enter:
 - a. **the domain name microsoft.com is resolved to an IP address.** The domain name microsoft.com will be translated by a DNS server to its respective IP address.
3. Domain names are resolved to their corresponding IP addresses by the:
 - b. **DNS server.** DHCP servers provide dynamic IP addresses to clients, DNS servers resolve domain names to IP addresses, and WINS servers map computer NetBIOS names to IP addresses.

Essential details

- WINS servers resolve NetBIOS names to IP addresses and assist in reducing NetBIOS traffic on subnets.
- DNS servers resolve domain names to IP addresses.
- DNS servers are part of the Internet's infrastructure.
- DNS servers are also used in both enterprise and small business networks.
- Different DNS record types exist on a DNS server.

FAST TRACK HELP

- <http://technet.microsoft.com/en-us/library/cc725802.aspx>
- <http://technet.microsoft.com/en-us/network/bb629410.aspx>
- <http://technet.microsoft.com/en-us/library/bb727005.aspx>



Understand networking services

SCENARIO: Fourth Coffee's business continues to grow. Josh, Fourth Coffee's owner, has decided to expand to California. Sidney, his IT consultant, will travel to Santa Clara, California and set up a remote wireless network that will be connected to Fourth Coffee headquarters in Seattle, Washington. Sidney will configure the wireless router to act as a DHCP server. There will be an onsite file server which will provide access to local resources, as well as provide DNS services. In addition, Josh would like to be able to access the network remotely so that he can keep up with business while on the road.

As Sidney leaves Fourth Coffee to catch her flight home, Josh stops her and asks how IPsec could be used in their network infrastructure. Sidney laughs and asks Josh if he has been busy reading his latest computer magazine online. He smiles and wishes her a safe trip.

1. **The DHCP server will provide a:**
 - a. dynamic IP addresses to the clients
 - b. static IP addresses to the clients
 - c. static IP addresses to the servers
2. **A Remote Access Server is to a client as a:**
 - a. lion is to Africa
 - b. locked car door is to a car
 - c. pixel is to a digital camera
3. **Regarding Josh's question, IPsec is:**
 - a. a protocol suite used for securing IP communications
 - b. used to assign static and dynamic IPv6 address to clients
 - c. used to provide security to IPv6 addresses

hint

When a system boots up it requests an IP address from a DHCP server through the DORA (Discover, Offer, Request, Acknowledge) process

Answers

1. Servers that offer DHCP services provide a:
 - a. **dynamic IP address to the clients.** Dynamic IP addresses are assigned to clients and can change when a lease is renewed. Static IP addresses are assigned to a server so they retain the same address and can be easily located.
2. A Remote Access Server is to a client as a:
 - b. **locked car door is to a car.** A Remote Access Server (RAS) is protected by a firewalls, and if a client is authenticated the client will be able to access the RAS's services just like a key will allow a driver to access a car.
3. To answer Josh's question, IPsec is :
 - a. **a protocol suite used for securing IP communications.** IPsec consists of open standards and uses cryptographic security services.

Essential details

- Clients are generally assigned dynamic address.
- Servers are assigned static address so that they may be easily located on a network.
- DHCP servers assign dynamic addresses to clients.
- Remote Access Servers, also known as Communication Servers, provide access to remote network resources.
- IPsec, created by IETF (Internet Engineering Task Force), secures IP communications through secure authentication and encryption.

FAST TRACK HELP

- <http://technet.microsoft.com/en-us/network/bb643151.aspx>
- [http://technet.microsoft.com/en-us/library/cc754634\(WS.10\).aspx](http://technet.microsoft.com/en-us/library/cc754634(WS.10).aspx)
- <http://technet.microsoft.com/en-us/network/bb531150.aspx>



Understand TCP/IP

SCENARIO: Sara just received an interesting e-mail from Andrew. Sara met Andrew a year ago in her first networking class at Maple College and ever since then they have been spending a lot of time together studying. However, now things have changed and Andrew has just asked her out on a real date!

She immediately replies to the e-mail and says, "Yes!" Immediately after hitting "send," Sara receives an e-mail indicating that her reply e-mail to Andrew was not delivered. Sara reaches for her mobile phone and begins texting Andrew when it dawns on her that she might possibly fix this computer problem—or at least determine what might have gone wrong.

Will she be able to resolve the problem so that she can go on a date with Andrew? Can you help her?

- 1. Sara first decides to use the pathping tool because it:**
 - a. acts as a terminal emulation program that will automatically troubleshoot the issue
 - b. determines the degree of packet loss along the path the data is traveling
 - c. shows the route that is taken by the packet as it moves across the IP network
- 2. Next Sara tries to see if she can reach the default gateway by using the...**
 - a. netstat tool
 - b. ping tool
 - c. loopback address
- 3. Based on the results, Sara decides that she needs to refresh her DHCP settings by using the:**
 - a. telnet tool
 - b. ipconfig tool
 - c. local loopback IP

hint

Using the analytical tools in the most efficient order will save time.

Answers

1. The pathping tool that Sara used:
 - b. **determines the degree of packet loss along the path the data is traveling.** This is a useful tool; however, Sara could have saved time by first checking her computer's connectivity to the default gateway.
2. To see whether her computer can reach the default gateway she used the:
 - b. **ping tool.** Depending upon the issue, the ping tool is usually one of the first tools used during troubleshooting.
3. To refresh her DHCP settings, Sara used the:
 - b. **ipconfig tool.** The ipconfig/release will release Sara's current IP address and the ipconfig/renew will give her computer a new IP address.

Essential details

- To check connectivity, first ping your loopback address (127.0.0.1), then ping your computer's IP address, then ping your default gateway, and finally ping the remote host.
- Ping contains different options for IPv4 and IPv6.
- Ipconfig/all displays lots of useful information, including DNS servers.
- Tracert traces the route a packet takes from the source to destination.
- Telnet logs into a router or computer.

FAST TRACK HELP

- <http://support.microsoft.com/kb/814155>
- <http://windows.microsoft.com/en-US/windows7/Using-command-line-tools-for-networking-information>
- http://www.cisco.com/en/US/tech/tk828/technologies_tech_note09186a00800a61c7.shtml

