

**Virginia Western Community College**  
**TEL 150**  
**Internetworking I**

**Prerequisites**

None

**Course Description**

Introduces the functions of each layer of the ISO/OSI reference model, data link and network addresses, data encapsulation, different classes of IP addresses and subnetting and the functions of the TCP/IP network-layer protocols.

**Semester Credits: 4 Lecture Hours: 3 Lab/Clinical/Internship Hours: #3**

**Required Materials****Textbook:**

CCNA routing and Switching Portable Command Guide, Authors: Scott Empson, 4th ed. ISBN: 9781587205880. All reading material is located on netacad.com

**Other Required Materials:**

Packet Tracer Software (available from the class website)

**Course Outcomes**

**At the completion of this course, the student should be able to:**

- Understand how host devices be used as clients, servers, or both. How are network devices used. Explain differences between LAN and WAN devices and topology. Define the four basic requirements of a converged network. Discuss trends such as BYOD, online collaboration, video, and cloud computing change the way we interact. List basic security threats and solutions for both small and large networks.
- List the features and functions of the Cisco IOS software. Describe how devices communicate across network media. Connect Cisco IOS devices with an IP address and verify connectivity between two end devices.
- Understand the rules that are necessary to successfully communicate. List protocols necessary in network communication. Review the role of standards organizations in establishing protocols for network interoperability. Discuss how the TCP/IP model and the OSI model are used to facilitate standardization in the communication process. Describe how data encapsulation allows data to be transported across the network. Know how local hosts access local resources on a network.

- Describe options for connecting devices to a data network and the purpose and functions of the physical layer in data networks. List how the functions of physical topologies compare with the functions of logical topologies. Describe Media Access Control relative to WAN and LAN.
- List the function of each of the Ethernet sublayers. Describe the characteristics and purpose of the Ethernet MAC address. Understand MAC address tables, forwarding and port settings on an ethernet switch. Describe the difference in MAP and IP Addresses. Understand the roll of ARP in an Ethernet network.
- Describe the purpose of the network layer in data communications. Understand IPv4 and IPv6 services, routing tables on hosts and routers. Perform steps required to set up a Cisco IOS router.
- Be able to convert between decimal and binary number systems. Define the structure of an IPv4 address. List the characteristics and uses of unicast, broadcast, and multicast IPv4 addresses. Describe the uses of public, private, and reserved addresses. Discuss the development, and characteristics of IPv6. Understand the purpose and use of multicast addresses. Use ICMP, ping and traceroute to test network connectivity.
- Explain the use and benefit of subnets. Calculate subnets for various typical scenarios.
- Describe the purpose of the transport layer in managing the transportation of data in end-to-end communications. Discuss ports. Define the characteristics and typical uses of TCP and UDP.
- Explain how the functions of the application layer, session layer, and presentation layer work together to provide network services to end-user applications. Explain how common application layer protocols interact with IP addressing services and end-user applications including WWW and email. Describe features and operations of well-known application layer protocols that allow file-sharing services, including FTP, File Sharing Services, and SMB protocol.
- Build a small, functional network. Insure that expected protocols and devices are taken into account. Insure basic security measures, including mitigating common vulnerabilities/threats and device hardening are included. Verify, debug and test performance using common methodologies and tools.

## Topical Description

Ch.	Introduction to Networks	Objectives
<b>1</b>	<b>Explore the Network</b>	
1.1	Globally Connected	Explain how multiple networks are used in everyday life.
1.2	LANs, WANs, and the Internet	Explain how topologies and devices are connected in a small to medium-sized business network.
1.3	The Network as a Platform	Explain the basic characteristics of a network that supports communication in a small to medium-sized business.

	1.4	The Changing Network Environment	Explain trends in networking that will affect the use of networks in small to medium-sized businesses.
<b>2</b>	Configure a Network Operating System		
	2.1	IOS Bootcamp	Explain the features and functions of the Cisco IOS Software.
	2.2	Basic Device Configuration	Configure initial settings on a network device using the Cisco IOS Software.
	2.3	Address Schemes	Given an IP addressing scheme, configure IP address parameters on devices to provide end-to-end connectivity in a small to medium-sized business network.
<b>3</b>	Network Protocols and Communications		
	3.1	Rules of Communication	Explain how rules facilitate communication.
	3.2	Network Protocols and Standards	Explain the role of protocols and standards organizations in facilitating interoperability in network communications.
	3.3	Data Transfer in the Network	Explain how devices on a LAN access resources in a small to medium-sized business network.
<b>4</b>	Network Access		
	4.1	Physical Layer Protocols	Explain how physical layer protocols and services support communications across data networks.
	4.2	Network Media	Build a simple network using the appropriate media.
	4.3	Data Link Layer Protocols	Explain the role of the data link layer in supporting communications across data networks.
	4.4	Media Access Control	Compare media access control techniques and logical topologies used in networks.
<b>5</b>	Ethernet		
	5.1	Ethernet Protocol	Explain the operation of Ethernet.
	5.2	LAN Switches	Explain how a switch operates.
	5.3	Address Resolution Protocol	Explain how the address resolution protocol enables communication on a network.
<b>6</b>	Network Layer		
	6.1	Network Layer Protocols	Explain how network layer protocols and services support communications across data networks.

	6.2	Routing	Explain how routers enable end-to-end connectivity in a small to medium-sized business network
	6.3	Routers	Explain how devices route traffic in a small to medium sized business network.
	6.4	Configuring a Cisco Router	Configure a router with basic configurations.
<b>7</b>	IP Addressing		
	7.1	IPv4 Network Addresses	Explain the use of IPv4 addresses to provide connectivity in small to medium-sized business networks.
	7.2	IPv6 Network Addresses	Configure IPv6 addresses to provide connectivity in small to medium-sized business networks.
	7.3	Connectivity Verification	Use common testing utilities to verify and test network connectivity.
<b>8</b>	Subnetting IP Networks		
	8.1	Subnetting an IPv4 Network	Implement an IPv4 addressing scheme to enable end-to-end connectivity in a small to medium-sized business network
	8.2	Addressing Schemes	Given a set of requirements, implement a VLSM addressing scheme to provide connectivity to end users in a small to medium-sized network.
	8.3	Design Considerations for IPv6	Explain design considerations for implementing IPv6 in a business network.
<b>9</b>	Transport Layer		
	9.1	Transport Layer Protocols	Explain how transport layer protocols and services support communications across data networks.
	9.2	TCP and UDP	Compare the operations of transport layer protocols in supporting end-to-end communication.
<b>10</b>	Application Layer		
	10.1	Application Layer Protocols	Explain the operation of the application layer in providing support to end-user applications.
	10.2	Well-Known Application Layer Protocols and Services	Explain how well-known TCP/IP application layer protocols operate.
<b>11</b>	Build a Small Network		

11.1	Network Design	Explain how a small network of directly connected segments is created, configured and verified.
11.2	Network Security	Configure switches and routers with device hardening features to enhance security.
11.3	Basic Network Performance	Use common show commands and utilities to establish a relative performance baseline for the network.
11.4	Network Troubleshooting	Troubleshoot a network.

### **Notes to Instructors**

- All instructors are to use a combination of Packet Tracer and hands on labs (via classroom equipment or the Netlab+ online lab server)
- Assignments consist of labs, quizzes, chapter tests, skills based exam, and a final exam