TEL 150
Internetworking I

COURSE OUTLINE

Prerequisites:

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/Recitation Hours: 3

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Course Outcomes

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

- Exploring the Network:
  - Explain how networks affect the way we interact, learn, work, and play.
  - Explain how host devices can be used as clients, servers, or both.
  - Explain the use of network devices.
  - Compare the devices and topologies of a LAN to the devices and topologies of a WAN.
  - Describe the basic structure of the Internet.
  - Explain the concept of a converged network.
  - Describe the four basic requirements of a reliable network.
  - Explain how trends such as BYOD, online collaboration, video, and cloud computing are changing the way we interact.
  - Explain how networking technologies are changing the home environment.
  - Identify basic security threats and solutions for both small and large networks.
  - Describe the importance of understanding the underlying switching and routing infrastructure of a network.
- Configure a Network Operating System:
  - Explain the purpose of the Cisco IOS.
  - Explain how to access a Cisco IOS device for configuration purposes.
  - Explain how to navigate Cisco IOS to configure network devices.
  - Describe the command structure of the Cisco IOS software.
  - Configure hostnames on a Cisco IOS device using the CLI.
  - Use Cisco IOS commands to limit access to device configurations.
  - Use Cisco IOS commands to save the running configuration.
  - Explain how devices communicate across network media.
  - Configure a host device with an IP address.
  - Verify connectivity between two end devices.
- Protocols and Communication:
  - Explain the purpose of the Cisco IOS.
  - Explain how to access a Cisco IOS device for configuration purposes.
  - Explain how to navigate Cisco IOS to configure network devices.
  - Describe the command structure of the Cisco IOS software.
  - Configure hostnames on a Cisco IOS device using the CLI.
  - Use Cisco IOS commands to limit access to device configurations.

- o Use Cisco IOS commands to save the running configuration.
- o Explain how devices communicate across network media.
- o Configure a host device with an IP address.
- o Verify connectivity between two end devices.
- Network Access:
  - o Identify device connectivity options.
  - o Describe the purpose and functions of the physical layer in the network.
  - o Describe basic principles of the physical layer standards.
  - o Identify the basic characteristics of copper cabling.
  - o Build a UTP cable used in Ethernet networks.
  - o Describe fiber-optic cabling and its main advantages over other media.
  - o Connect devices using wired and wireless media.
  - o Describe the purpose and function of the data link layer in preparing communication for transmission on specific media.
  - o Compare the functions of logical topologies and physical topologies.
  - o Describe the basic characteristics of media access control methods on WAN topologies.
  - o Describe the basic characteristics of media access control methods on LAN topologies.
- Ethernet:
  - o Explain how the Ethernet sublayers are related to the frame fields.
  - o Describe the Ethernet MAC address.
  - o Explain how a switch builds its MAC address table and forwards frames.
  - o Describe switch forwarding methods.
  - o Describe the types of port settings available for Layer 2 switches.
  - o Compare the roles of the MAC address and the IP address.
  - o Describe the purpose of ARP.
  - o Explain how ARP requests impact network and host performance.
- Network Layer:
  - o Describe the purpose of the network layer in data communication.
  - o Explain why the IPv4 protocol requires other layers to provide reliability.
  - o Explain the role of the major header fields in the IPv4 packet.
  - o Explain the role of the major header fields in the IPv6 packet.
  - o Explain how a host device using routing tables to direct packets to itself, a local destination, or a default gateway.
  - o Compare a host routing table to a routing table in a router.
  - o Describe the common components and interfaces of a router.
  - o Describe the boot-up process of a Cisco IOS router.
  - o Configure initial settings on a Cisco IOS router.
  - o Configure two active interfaces on a Cisco IOS router.

- o Configure devices to use the default gateway.
- IP Addressing:
  - o Convert between binary and decimal numbering systems.
  - o Describe the structure of an IPv4 address including the network portion, the host portion, and the subnet mask.
  - o Describe the purpose of the subnet mask.
  - o Compare the characteristics and uses of the unicast, broadcast, and multicast IPv4 addresses.
  - o Explain public, private, and reserved IPv4 addresses.
  - o Explain the need for IPv6 addressing.
  - o Describe the representation of an IPv6 address.
  - o Describe types of IPv6 network addresses.
  - o Configure global unicast addresses.
  - o Describe multicast addresses.
  - o Explain how ICMP is used to test network connectivity.
  - o Use ping and traceroute utilities to test network connectivity.
- Subnetting IP Networks:
  - o Explain how subnetting segments a network to enable better communication.
  - o Explain how to calculate IPv4 subnets for a /24 prefix.
  - o Explain how to calculate IPv4 subnets for a /16 and /8 prefix.
  - o Given a set of requirements for subnetting, implement an IPv4 addressing scheme.
  - o Explain how to create a flexible addressing scheme using variable length subnet masking (VLSM).
  - o Implement a VLSM addressing scheme.
  - o Explain how to implement IPv6 address assignments in a business network.
- Transport Layer:
  - o Describe the purpose of the transport layer in managing the transportation of data in end-to-end communication.
  - o Describe characteristics of the TCP and UDP protocols, including port numbers and their uses.
  - o Explain how TCP session establishment and termination processes facilitate reliable communication.
  - o Explain how TCP protocol data units are transmitted and acknowledged to guarantee delivery.
  - o Describe the UDP client processes to establish communication with a server.
  - o Compare features of UDP and TCP.
- Application Layer:
  - o Explain how the functions of the application layer, session layer, and presentation layer work together to provide network services to end user applications.

- o Explain how common application layer protocols interact with end user applications.
  - o Explain how web and email protocols operate.
  - o Explain how IP addressing protocols operate.
  - o Explain how file transfer protocols operate.
- Building a Small Network:
  - o Identify the devices used in a small network.
  - o Identify the protocols used in a small network.
  - o Explain how a small network serves as the basis of larger networks.
  - o Explain why basic security measures are needed on network devices.
  - o Identify security vulnerabilities and general mitigation techniques.
  - o Configure network devices with device hardening features to mitigate security threats.
  - o Apply the commands to back up and restore an IOS configuration file.
  - o Use the output of **ping** and **trace** commands to establish relative network performance.
  - o Use the output of the **tracert** command to establish relative network performance.
  - o Use show commands to verify the configuration and status of network devices.
  - o Use host and IOS commands to acquire information about network devices.

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Required Materials:

Packet Tracer Software (available from the class website)

Textbook:

All reading material is located on netacad.com

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Topical Description: (Outline chapters and sections to be covered in the book – may include timeline)

- Chapter 1: Exploring the Network
- Chapter 2: Configure a Network Operating System
- Chapter 3: Network Protocols and Communications
- Chapter 4: Network Access
- Chapter 5: Ethernet
- Chapter 6: Network Layer
- Chapter 7: IP Addressing
- Chapter 8: Subnetting IP Networks
- Chapter 9: Transport Layer
- Chapter 10: Application Layer
- Chapter 11: Build a Small Network

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Notes to Instructors
(List information about optional topics, departmental exams, etc.)

1. All instructors are to use a combination of Packet Tracer and hands on labs (via classroom equipment or the Netlab+ online lab server)

2. Assignments consist of labs, quizzes, chapter tests, skills based exam, and a final exam