#### **COURSE SYLLABUS**

LAST REVIEW	Fall 2022
COURSE TITLE	Applied Networking 2
COURSE NUMBER	CRTE 0117
DIVISION	Career and Technical Education
DEPARTMENT	CRTE
CIP CODE	11.1006
CREDIT HOURS	3
CONTACT HOURS/WEE	K Class: 3 Lab:
PREREQUISITES	None

#### **COURSE DESCRIPTION**

The focus of this course is on learning the architecture, components, and operations of routers and switches in a small network. In this course, you will learn how to configure a router and a switch for basic functionality. Students will be able to describe enhanced switching technologies such as VLANs, VLAN Trunking Protocol (VTP), Rapid Spanning Tree Protocol (RSTP), Per VLAN Spanning Tree Protocol (PVSTP), and 802.1q. Students will be able to configure and troubleshoot basic operations of a small-switched network. Students will be able to configure and verify static routing and default routing. Students will be able to configure and troubleshoot basic operations of routers in a small-routed network. Students will configure and troubleshoot VLANs and inter-VLAN routing. Students will configure, monitor, and troubleshoot ACLs for IPv4 and Ipv6. Students will be able to configure and troubleshoot this course, you will be able to configure and troubleshoot this course, you will be able to configure and troubleshoot Students will be able to configure, monitor, and troubleshoot ACLs for IPv4 and Ipv6. By the end of this course, you will be able to configure and troubleshoot routers and switches and resolve common issues with RIPv1, RIPv2, single-area and multi-area OSPF, virtual LANs, and inter-VLAN routing in both IPv4 and IPv6 networks.

#### **PROGRAM ALIGNMENT**

This course is part of a program aligned through the Kansas Board of Regents and Technical Education Authority. For more information, please visit: https://kansasregents.org/workforce\_development/program-alignment

### **PROGRAM LEARNING OUTCOMES**

- 1. Students will be able to configure a router and a switch for basic functionality
- 2. Students will be able to configure, monitor and troubleshoot access controls lists for various addressing methods
- 3. Students will be able to build, maintain and troubleshoot server hardware and software technologies
- 4. Students will be able to explain and enforce basic concepts of computer network security

## METHODS OF INSTRUCTION

A variety of instructional methods may be used depending on content area. These include but are not limited to: lecture, multimedia, cooperative/collaborative learning, labs and demonstrations, projects and presentations, speeches, debates, panels, conferencing, performances, and learning experiences outside the classroom. Methodology will be selected to best meet student needs.

### **COURSE OUTLINE**

- I. Introduction to Switched Networks
  - A. Host Sending and Receiving
  - B. Identify Switched Network Terminology
  - C. Identify Switch Hardware
  - D. Frame Forwarding Methods
  - E. Switch forwarding
  - F. Broadcast and Collision Domains
- II. Basic Switching concepts and Configuration
  - A. Unicast, Broadcasts and Multicasts in the switched network
  - B. Configuring Basic Switch Settings
  - C. Configure Switch Ports at the Physical Layer
  - D. Auto-MDIX
  - E. Configuring SSH
  - F. Configuring SSH
  - G. Identify Common Security Attacks
  - H. Configuring Switch Port Security
  - I. Troubleshooting Switch Port Security
  - J. Configuring Switch Security Features

### III. VLANS

- A. VLANS in a switched network
- B. Broadcast traffic in the VLAN
- C. Predicting Switch Behavior
- D. Investigating a VLAN Implementation
- E. Creating a VLAN
- F. Assigning Ports to VLANs
- G. Changing VLAN Port Membership
- H. Verifying VLAN Information
- I. Configuring VLANs
- J. Verifying Trunk Configuration
- K. Configuring Trunks
- L. Configuring VLANs and Trunking
- M. Negotiated Interface Modes
- N. Predict DTP Behavior
- O. Troubleshooting a VLAN Implementation
- P. Troubleshooting VLAN Configurations
- Q. PVLAN Edge
- R. Identify the VLAN Attacks
- S. Implementing VLAN Security
- IV. Routing Concepts

- A. Functions and features of a router
- B. Identify Router Components
- C. Using Traceroute to Discover the Network
- D. Network Connectivity to a destination host
- E. Enable IP on a Switch
- F. Document an Addressing Scheme
- G. Documenting the Network
- H. Configure Basic Router Settings
- I. Configure an IPv4 Router Interface
- J. Configure an IPv6 Router Interface
- K. Configuring IPv4 and IPv6 Interfaces
- L. Verify Interface Settings
- M. Filter Show Command Output
- N. Command History Feature
- O. Configuring and Verifying a Small Network
- P. Configuring Basic Router Settings with IOS CLI
- Q. Configuring Basic Router Settings with CCP
- R. Match Layer 2 and Layer 3 Addressing
- S. Steps in the Packet Forwarding Process
- T. Interpret the Content of a Routing Table

V. Inter-VLAN Routing

- A. Inter-VLAN Routing Switching to Local Network Channels
- B. Identify the Types of inter-VLAN Routing
- C. Configuring Per-Interface Inter-VLAN Routing
- D. Configure Router-on-a-Stick: Verifying Subinterfaces
- E. Configuring Router-on-a-Stick Inter-VLAN Routing
- F. Configuring 802.1Q Trunk-Based Inter-VLAN Routing
- G. Identify the Troubleshooting Command for an Inter-VLAN
- H. Troubleshooting Issue
- I. Troubleshooting Inter-VLAN Routing
- J. Configuring Static Routes on a Catalyst 2960
- K. Troubleshoot Layer 3 Switching Issues
- L. Troubleshooting Inter-VLAN Routing
- VI. Static Routing
  - A. Benefits of Static Routes
  - B. Identify the Advantages and Disadvantages of Static Routing
  - C. Identify the Type of Static Route
  - D. Configure a Next-Hop Static Route
  - E. Configure a Directly Connected Static Route
  - F. Configure a Fully Specified Static Route
  - G. Verify a Static Route
  - H. Configuring IPv4 Static and Default Routes
  - I. Configuring IPv4 Static and Default Routes
  - J. The ipv6 route Command
  - K. Configure a Next Hop Static IPv6 Route
  - L. Configure a Directly Connected Static IPv6 Route
  - M. Configure a Fully Specified Static IPv6 Route
  - N. Configuring IPv6 Static and Default Routes

- O. Configuring IPv6 Static and Default Routes
- P. Designing and Implementing a VLSM Addressing Scheme
- Q. Designing and Implementing IPv4 Addressing with VLSM
- R. Determine the Summary Network Address and Prefix
- S. Configuring IPv4 Route Summarization Scenario 1
- T. Configuring IPv6 Route Summarization
- U. Calculating Summary Routes with IPv4 and IPv6
- V. Configure a Floating Static Route
- W. Configuring a Floating Static Route
- X. Troubleshooting Static Routes
- Y. Troubleshooting VLSM and Route Summarization
- Z. Troubleshooting Static Routes
- VII. Dynamic Routing
  - A. Operating of Dynamic Routing Protocols
  - B. Identify Components of a Routing Protocol
  - C. Compare Static and Dynamic Routing
  - D. Investigating Convergence
  - E. Classify Dynamic Routing Protocols
  - F. Compare Routing Protocols
  - G. Match the Metric to the Protocol
  - H. Identify Distance Vector Terminology
  - I. Compare RIP and EIGRP
  - J. Comparing RIP and EIGRP Path Selection
  - K. Advertising Networks
  - L. Examining Default RIP Settings
  - M. Enabling RIPv2
  - N. Disabling Auto Summarization
  - O. Configuring Passive Interfaces
  - P. Propagating a Default Route
  - Q. Configuring RIPv2
  - R. Examining the RIPng Configuration
  - S. Configuring RIPng
  - T. Configuring Basic RIPv2 and RIPng
  - U. Building the Link-State Database and SPF Tree
  - V. Identify Parts of an IPv4 Routing Table Entry
  - W. Identify Parent and Child IPv4 Routes
  - X. Determine the Longest Match Route
  - Y. Identify Parts of an IPv6 Routing Table Entry

# VIII. Single-Area OSP

- A. How link state routers learn about other networks
- B. Identify OSPF Features and Terminology
- C. Identify the OSPF Packet Types
- D. Identify the OSPF States for Establishing Adjacency
- E. Router OSPF Configuration Mode
- F. Configuring an OSPF Router ID
- G. Modifying a Router ID
- H. The network Command
- I. Configuring Passive Interfaces

- J. Calculate the Subnet and Wildcard Masks
- K. Configuring OSPFv2 in a Single Area
- L. Adjusting the Interface Bandwidths
- M. OSPF Neighbors
- N. Verify OSPF Protocol Settings
- O. Verify OSPF Process Information
- P. Verify OSPF Interface Settings
- Q. Configuring Basic Single-Area OSPFv2
- R. Compare and Contrast OSPFv2 and OSPFv3
- S. Assigning Link-Local Addresses
- T. Configuring the OSPFv3 Router ID
- U. Modifying an OSPFv3 Router ID
- V. Enabling OSPFv3 on Interfaces
- W. Verify OSPFv3 Neighbors
- X. Verify OSPFv3 Protocol Settings
- Y. Verify OSPFv3 Interfaces
- Z. Verify the IPv6 Routing Table
- IX. Access Control Lists
  - A. Purpose and Operation of an ACL
  - B. ACL Demonstration
  - C. Determine the Correct Wildcard Mask
  - D. Determine the Permit or Deny
  - E. ACL Operation
  - F. Placing Standard and Extended ACLs
  - G. Configuring Standard ACLs
  - H. Configuring Standard ACLs
  - I. Configuring Named Standard ACLs
  - J. Configuring and Verifying Standard ACLs
  - K. Configuring a Standard ACL to Secure a VTY Port
  - L. Configuring an ACL on VTY Lines
  - M. Configuring and Verifying VTY Restrictions
  - N. Creating an Extended ACL Statement
  - O. Evaluating Extended ACL Statements (ACEs)
  - P. ACL Testlet Check Your Understanding of ACLs
  - Q. Configuring Extended ACLs
  - R. Configuring and Verifying Extended ACLs
  - S. Place in Order the Steps of the ACL Decision Making Process
  - T. Troubleshooting ACLs
  - U. Troubleshooting ACL Configuration and Placement
  - V. Skills Integration Challenge
- X. DHCP
  - A. DHCP on a wireless ISR Device.
  - B. Identify the Steps in DHCPv4 Operation
  - C. Configuring a Basic DHCPv4 Server
  - D. DHCPv4 Relay
  - E. Configuring Basic DHCPv4 on a Router
  - F. Configuring Basic DHCPv4 on a Switch
  - G. Configuring a Router as DHCPv4 Client

- H. Configuring DHCPv4 Using Cisco IOS
- I. Troubleshooting DHCPv4
- J. Identify the Steps in DHCPv6 Operation
- K. Verifying Stateless DHCPv6
- L. Verifying Stateful DHCPv6
- M. Configuring a Router as a DHCPv6 Relay Agent
- N. Configuring Stateless and Stateful DHCPv6
- O. Troubleshooting DHCPv6
- P. Configuring IPv6 ACLs
- Q. Configuring and Verifying IPv6 ACLs
- XI. NAT
  - A. Conceptual NAT
  - B. Identify NAT Terminology
  - C. Investigating NAT Operation
  - D. Configuring Static NAT
  - E. Configuring Static NAT
  - F. Configuring Dynamic NAT
  - G. Configuring Dynamic NAT
  - H. Configuring Dynamic and Static NAT
  - I. Configuring PAT: Address Pool
  - J. Configuring PAT Single Address
  - K. Identify the Address Information at Each Hop
  - L. Implementing Static and Dynamic NAT
  - M. Configuring Port Address Translation (PAT)
  - N. Configuring Port Forwarding on a Linksys Router
  - O. Verifying and Troubleshooting NAT Configurations
  - P. Troubleshooting NAT Configurations

## **COURSE LEARNING OUTCOMES AND COMPETENCIES**

Upon successful completion of this course, the student will:

- A. Describe switched network technologies.
  - 1. Identify switch hardware.
- B. Configure a switch with basic settings.
  - 2. Configure basic switch settings.
  - 3. Configure switch ports at the physical layer.
- C. Describe VLANS.
  - 4. Describe the role of VLANS in a switched network.
  - 5. Create a VLAN on a switch.
  - 6. Assign ports to VLANS.
- D. Describe and configure a router.
  - 7. Enable IP on a router.

- 8. Configure basic router settings.
- 9. Interpret the content of a routing table.
- E. Configure a router for Inter-VLAN routing.
  - 10. Configure Inter-VLAN routing on a interface.
  - 11. Configure a router on a stick.
- F. Configure static routing.12. Configure a router for static routing.
- G. Configure dynamic routing.13. Configure RIPv2 on a router.
- H. Configure single area OSPF.14. Describe and configure OSPF on a router.15. Verify OSPF on a router.
- I. Describe and configure ACL's.16. describe the purpose of an ACL.17. configure an ACL on a router interface
- J. Describe and configure DHCP.18. Configure DHCP on a wireless device.19. Configure DHCP on a router and switch.
- K. Describe and configure NAT.
  - 20. Describe the purpose of NAT.
  - 21. Configure static NAT.
  - 22. Configure dynamic NAT.

### ASSESSMENT OF COURSE LEARNING OUTCOMES AND COMPETENCIES

Student progress is evaluated through both formative and summative assessment methods. Specific details may be found in the instructor's course information document.

### **COLLEGE POLICIES AND PROCEDURES**

Student Handbook https://www.kckcc.edu/files/docs/student-resources/student-handbook-and-code-of-conduct.pdf

College Catalog https://www.kckcc.edu/academics/catalog/index.html

College Policies and Statements https://www.kckcc.edu/about/policies-statements/index.html

Accessibility and Accommodations

https://www.kckcc.edu/academics/resources/student-accessibility-support-services/index.html.