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Teacher Contact

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* **Was this course Previously Approved by UC?** No

* **Course Title:** Internet Engineering 2 (ROP)

* **Transcript Title /Abbreviation:**	**Transcript Title /Abbreviation:** InternetEngineering2	**Course Code** IntEng2

* **Seeking "Honors" Distinction:** No

* **Subject Area:** Elective

* **Category:** Interdisciplinary

* **Grade Level for which this course has been designed:** ☐ 9 ☐ 10 ☐ 11 ☑ 12

* **Unit Value:** 1.0 (one year, 2 semesters, or 3 trimesters equiv.)

* **Is this course, or any separate section of this course, taught in an online learning environment:** No

* **Is this course classified as a Career Technical Education:** Yes

Name of Industry Sector: Information Technology

Name of Career Pathway: Network Communications

* **Brief Course Description**

Internet Engineering 2 is a followup course to Internet Engineering 1. It is designed to prepare students for post-secondary success in the Information and Communication Technologies (ICT) field. The course engages students with studies of: the network protocols which make the Internet possible; how networks communicate with one another, methods used to increase scalability, reliability, and security in the modern network, and college and career preparation in the ICT field. This course integrates the theory and application of network communications, exposing students to media that invites them to consider how Internet engineers think, design, and solve problems. Students have several opportunities to produce college-ready writing, collaborate, research, develop study skills, and develop 21st century skills in this course.

Pre-Requisites

Internet Engineering 1 ◉ Required ○ Recommended

Co-Requisites

Algebra 2 ○ Required ◉ Recommended

*** Context for Course**

This course is designed to be capstone course, part of a Career Technical Education program of study, a Linked Learning Pathway, a Regional Occupational Program and/or a California Partnership Academy. In that context, this course would be a required CTE course. As the Information and Communication Technologies industry sector thrives and expands, the need for qualified technology professionals continues to grow. This course hopes to address this labor market need by preparing students for the rigors of college level academic work and majors relating to Internet engineering or computer science.

*** History of Course Development**

This course was developed in collaboration between two high school ROP/Career Technical Education instructors and a Community College Instructor, all from separate school districts. These educators each have a strong background in instructing networking communications technologies and wanted to develop a rigorous course that prepared students for college-level content and writing. High School/ROP instructors include David Bayne with Woodland Joint Unified School District and Yolo County ROP and Ben Crosby with West Contra Costa Unified and Contra Costa County ROP. The development group consulted closely with the A-G Course Evaluation Guidelines and worked closely with the support and consultation of industry representatives and Bradley Smith, Ph.D., Information Technology Services, Baskin School of Engineering, University of California Santa Cruz. If approved, several articulation agreements would be reached, and the course would likely be adopted by several of the new ICT sector CTE pathways across the state.

Textbooks

TEXTBOOK 1

*** Title:**	Routing and Switching Course Booklet
*** Edition:**	1
*** Publication Date:**	October 2013
*** Publisher:**	Cisco Press
*** Author(s):**	Cisco Networking Academy
URL Resource:	http://ptgmedia.pearsoncmg.com/imprint_downloads/cisco/irc/Cisco_Academy_AAG_Fall_2013_v2.pdf
*** Usage:**	Primary Text Read in entirety or near entirety

TEXTBOOK 2

*** Title:**	Routing and Switching Essentials Lab Manual
*** Edition:**	1
*** Publication Date:**	October 2013
*** Publisher:**	Cisco Press
*** Author(s):**	Cisco Networking Academy
URL Resource:	http://ptgmedia.pearsoncmg.com/imprint_downloads/cisco/irc/Cisco_Academy_AAG_Fall_2013_v2.pdf

* **Usage:** Supplementary or Secondary Text

Read in entirety or near entirety

TEXTBOOK 3

* **Title:** Network virtualization: state of the art and research challenges, as seen in Communications Magazine

* **Edition:** Volume 47, issue 7

* **Publication Date:** July 2009

* **Publisher:** IEEE

* **Author(s):** Chowdhury, N.M.M.K., and R. Boutaba

URL Resource: http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=5183468&url=http%3A%2F%2Fieeexplore.ieee.org%2Fstamp%2Fstamp.jsp%3Ftp%3D%26arnumber%3D5183468

* **Usage:** Supplementary or Secondary Text

Excerpts, approximate number of pages: 8

TEXTBOOK 4

* **Title:** OSPF Monitoring: Architecture, Design and Deployment Experience

* **Edition:** n/a

* **Publication Date:** Spring 2004

* **Publisher:** Usenix NSDI

* **Author(s):** Aman Shaikh and Albert Greenberg

URL Resource: https://www.usenix.org/legacy/publications/library/proceedings/nsdi04/tech/full_papers/shaikh/shaikh_html/index.html

* **Usage:** Supplementary or Secondary Text

Excerpts, approximate number of pages: 5

TEXTBOOK 5

* **Title:** Cybersecurity and Cyberwar: What everyone needs to know

* **Edition:** 1

* **Publication Date:** 2014

* **Publisher:** Oxford University Press

* **Author(s):** P.W. Singer and Allan Friedman

URL Resource: http://books.google.com/books?id=9VDSAQAAQBAJ&printsec=frontcover&dq=cyber+security&hl=en&sa=X&ei=zcBiU8PeHYeCogSChYDQBQ&ved=0CEkQ6AEwAQ#v=onepage&q=cyber%

* **Usage:** Supplementary or Secondary Text

Excerpts, approximate number of pages: 20

Supplemental Instructional Materials

TED Talk: Steven Johnson: "The Web as a City". http://www.ted.com/talks/steven_johnson_on_the_web_as_a_city

TED Talk: Andrew Blum: “Discover the Physical Side of the Internet”. http://www.ted.com/talks/andrew_blum_what_is_the_internet_really

PBS Online: "Serving the Suits: Computer Communication Capability" http://www.pbs.org/opb/nerds2.0.1/serving_suits/3com.html

MIT CSAIL: David Clark: "A quick guide to the Internet". Cyberpolitics in International Relations: Theory, Methods, Policy, Fall 2011. http://ocw.mit.edu/courses/political-science/17-447-cyberpolitics-in-international-relations-theory-methods-policy-fall-2011/readings/MIT17_447F11_Week3_slides.pdf

Video: Jimmy Ray Purser: "Networking 101: OSPF". http://ocw.mit.edu/courses/political-science/17-447-cyberpolitics-in-international-relations-theory-methods-policy-fall-2011/readings/MIT17_447F11_Week3_slides.pdf

Business Insider: Tony Danova: "The Internet of Everything: 2014". Slide Deck. http://www.businessinsider.com/the-internet-of-everything-2014-slide-deck-sai-2014-2?op=1

Microsoft Tech Net: "What is DHCP?". http://technet.microsoft.com/en-us/library/cc781008(v=ws.10).aspx

Orbit-Computer Solutions.com: "IPv6 Stateful Autoconfiguration". http://www.orbit-computer-solutions.com/DHCPv6%3A-How-DHCPv6-works.php

Computer-Outlines: "Dynamic DHCPv6 Networking, Part 3: DHCPv6". http://computer-outlines.over-blog.com/article-dynamic-ipv6-networking-part-3-dhcpv6-118773030.html

Lesson Plan: David Bayne. "Creating a Personal Career Network (PCN)". https://sites.google.com/site/mrbstec982flippedsite/flipped-lesson-linkedin

Video: LinkedIn: "LinkedIn for Students: Your Career Starts Here". https://www.youtube.com/watch?v=YWp6AN00D_c

Forbes: Susan Adams: "Eight Reasons High School Students should be on LinkedIn". http://www.forbes.com/sites/susanadams/2013/05/14/eight-reasons-high-school-students-should-be-on-linkedin/

USA Today: Sean McMinn: "Dos and don'ts for high schoolers using LinkedIn". http://www.usatoday.com/story/tech/personal/2013/08/20/linkedin-high-school-tips/2677111/

* **Course Purpose**

Internet Engineering 2 is an interdisciplinary elective course offered as the third and final part of a three-year program of study in an Information Technology Academy (ACES: the Academy of Computer Engineering Sciences,

a California Partnership Academy). This course is designed to prepare students for further study and careers in Computer Science, Computer Engineering, and/or Information Communication Technology (ICT, formerly IT). Students will learn more about theoretical networking models, expanding what they learned in Internet Engineering 1. While learning about the theoretical and applied design and architecture of information systems, students also gain understanding of how concepts such as VLSM (Variable Length Subnet Masks) can improve network scalability, reliability, and security. Students analyze the ways in which smaller networks are interconnected to form larger networks. Students acquire the ability to evaluate information system performance at various levels of granularity, with emphasis on maximizing performance and scalability while enhancing security. Students learn how larger networks can rely on automation to improve functionality, scalability, and security through use of routing protocols. In addition, students learn how to bridge the old and new, bringing IPv4 (Internet Protocol, Version 4) and IPv6 (Internet Protocol, Version 6) alive in a hybrid network, looking to preserve the past while preparing for the network of the future. As part of their 21st Century College and Career work, students will work on their own Personal Career Network, helping ensure that they will be successful in years to come.

* **Course Outline**

Unit 1: Local Area Networks

As networks grown, the world has changed. No more do we have simple networks supporting one or two users doing simple text-based network queries. Instead, we have converged the services; it is not uncommon to have data, video, and voice on the same network. Many areas are also putting clocks and intercoms into the same networks. With these changes have come challenges; this unit explores how networks have adapted to the growing demands, and how industry-standard best practices can bring reliability and stability to the systems.

Learning Goals introduced in Unit 1:

- Critically assess the convergence of data, voice, and video in the context and design of local area switched networks.
- Design a switched network for a small-to-medium-sized business
- Explain the process of frame forwarding in a switched network and compare a collision domain to a broadcast domain.
- Implement a well-designed Local Area Network by configuring initial switch settings, switch ports, and the management switch virtual interface. Troubleshoot unexpected outcomes.
- Synthesize unit topics in a expository essay which incorporates readings, videos, and learning activities to illustrate the structure of Local Area Networks.

Assignments:

a. Interactive Lecture: Instructor PowerPoint lectures describing the

importance of LAN design, switched network environments, and demonstrating basic switch configuration and implementing and managing switch security.

b. Blog/Bulletin Board Discussion 1: Students respond to the prompt and comment on at least two additional classmates in the thread/post. After reading chapter 1, "Introduction to Switched Networks", and viewing the TED Talk by Steven Johnson "The Web as a City", write a blog post where you compare the role of network switches to an essential structure of a city. Consider starting with this sentence frame: Switches in a network are like _____ in a city. Then use evidence from the reading and the TED Talk to support your ideas. Finally, read and comment on at least two posts from your classmates. Refer to specific sections of the readings that affected or deepened your understanding.

c. Blog/Bulletin Board Discussion 2: Students respond to the prompt and comment on at least two additional posts in the thread/post. After reading "Serving the Suits", write a blog post where you contrast ALOHANET with Ethernet. Read and comment on at least two posts from your classmates. Provide examples from Chapters 7 and 8 and the supplemental reading to support your thinking.

d. Learning Activity: Modeling Activity "Sent or Received" (1.0.1.2). Describe convergence of data, voice, and video in the context of switched networks. Students will work in groups to discuss various ways hosts send and receive data, voice, and streaming video and develop a matrix (table) listing network data types that can be sent and received.

e. Learning Labs: Labs 2.1.1.6 and 2.2.4.11. In these labs students will be designing, configuring, securing, and troubleshooting Local Area Networks based upon real-life scenarios.

f. Team Learning Lab: Skills Integration Challenge, Working in teams and using the network simulator Packet Tracer, students will take an existing network infrastructure and apply their knowledge and skills to finalize the configuration.

g. After researching Chapter 1 "Introduction to Switched Networks", Chapter 2 "Switching Concepts and Configuration" and the TED Talk "The Web as a City", write an expository essay in which you explain the structure of Local Area Networks. What conclusions or implications can you draw? Cite at least three sources, pointing out key elements from each source. In your discussion, address the credibility and origin of sources in your view of your research topic. Identify any gaps or unanswered questions. (3-4 pages)

Unit 2: Network Security

Building upon Unit 1 and the converged services, Unit 2 looks at how the reliability can be enhanced while also improving security. Virtual Local Area Networks (VLANs) are an important element of network stability and security. By isolating network traffic, the VLAN allows network users to be limited to the resources they are able to access, and allows particular types of traffic to be prioritized, while at the same time minimizing costs and maximizing network bandwidth utilization.

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Explain the purpose of VLANs in a switched network

- Analyze how a switch forwards frames based on VLAN configuration in a switched environment
- Configure a switch port to be assigned to a VLAN based on requirements
- Configure a trunk port on a LAN switch
- Configure Dynamic Trunking Protocol (DPT)
- Troubleshoot VLAN and trunk configurations in a switched network
- Configure security features to mitigate attacks in a VLAN-segmented network
- Explain security best practices for a VLAN-segmented environment

Assignments:

a. Interactive Lecture: Instructor PowerPoint lectures describing the importance of LAN design, switched network environments, and demonstrating basic switch configuration and implementing and managing switch security.

b. Blog/Bulletin Board Discussion 1: Students will complete Learning Labs 3.1.1.5 "Who Hears the Broadcast?" and 3.1.2.7 "Investigating a VLAN Implementation" in the Lab Manual. Students will verify and troubleshoot VLAN addressing and implementation. Students will write a blog post comparing and contrasting networks which do not use VLANs with those which do use VLANs, using data from the lab, chapter readings, and additional readings to back up their premise. Students will then respond to at least 2 other students' postings, giving additional feedback and information regarding VLANs.

c. Learning Activity: Class Activity 3.4.1.1 "VLAN Plan" in the Lab Manual. Working in groups, students apply the knowledge learned throughout this chapter, analyzing and implementing VLAN design strategies and best practices.

d. Team Learning Lab: Skills Integration Challenge 3.4.1.2 in the Lab Manual. Working in teams and using the network simulator Packet Tracer, students will take an existing network infrastructure and apply their knowledge and skills to secure the VLAN architecture.

e. Blog/Bulletin Board Post: After reading the article "Network Virtualization:

State of the Art and Research Challenges", share your understanding of the design goal "isolation". Why is this an important goal in network design? Read and comment on at least two blog posts from your classmates.

f. Unit Assessment: Pitch to company leaders. After researching Chapter 3 "VLANs", the article "Network Virtualization: State of the Art and Research Challenges", prepare and deliver a speech that identifies a problem with network security and argues for a solution. Support your position with evidence from your research. Be sure to examine competing views. Give examples from past or current events or issues to illustrate and clarify your position.

Unit 3: Internetworking

Routers connect networks together. Whether in a small business connecting to the Internet, or a larger organization connecting multiple sites together and providing security for confidential business information, routers provide that critical connection. VLANs (described in Unit 2) secure and enhance the different parts of the local network; routers allow these parts to communicate with each other and with other networks while maintaining the security and reliability of the local network.

- Describe the primary functions and features of a router
- Verify connectivity between two networks that are directly connected to a router
- Explain the encapsulation and de-encapsulation process used by routers when switching packets between interfaces
- Explain the path determination function of a router, with both static and dynamically allocated routes
- Describe the three primary options for enabling inter-VLAN routing
- Configure legacy inter-VLAN routing
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Configure router-on-a stick inter-VLAN routing

- Troubleshoot common IP addressing issues in an inter-VLAN routed environment
- Configure inter-VLAN routing using Layer 3 switching
- Troubleshoot inter-VLAN routing in a Layer 3 switched environment
- Compare and Contrast the advantages and disadvantages of static routing
- Explain how a router processes packets when a static route is configured
- Troubleshoot common static and default route configuration issues

Assignments:

a. Interactive Lecture: Instructor PowerPoint lectures describing the importance of LAN design, switched network environments, and demonstrating basic switch configuration and implementing and managing switch security.

b. Learning Activity: Utilizing Class Activity 4.0.1.2, "Do We Really Need a Map?" in the Lab Manual, students will compare and contrast network mapping to mapping in the physical world. Students will design networks based on home and school networks and compare and contrast them to the theoretical design strategies presented in the unit.

c. Learning Lab: Packet Tracer 4.1.1.8, "Using Traceroute to Discover the Network". Students will use the network simulator Packet Tracer to look at how networks, such as those at home and at school, are interconnected. This will form the basis of later assignments in Wide Area Networking.

d. Blog/Bulletin Board Discussion: Utilizing Packet Tracer Lab 4.1.2.9, "Documenting the Network" and Packet Tracer Lab PT 4.1.4.5, "Configuring and Verifying a Small Network" in the Lab Manual, students are to document the design of a simple network. Their writeup should include physical and logical topologies and should show understanding of the topologies, devices, and interconnections of the networks provided. They should then comment on the postings of at least two other students, detailing differences seen, possible corrections, and ways in which the topologies could be enhanced.

e. Learning Activity: Utilizing Class Activity 4.4.1.1, "We Really Could Use a Map", students will analyze routing tables, comparing and contrasting their analysis of the provided network picture with the routing tables provided. Students will compare, explain, and predict the efficiency and expandability of

the network.

f. Case Study: Students will complete the exercise described in Class Activity 5.0.1.2, "Switching to Local-Network Channels" in the Lab Manual. Working in small groups, students will create a presentation about VLANs and Inter-VLAN routing, including descriptions. Students will synthesize prior knowledge and present to the class their findings.

g. Learning Lab: Packet Tracer 5.1.3.6: "Configuring Router-on-a-Stick Inter-VLAN Routing" in the Lab Manual. Using the network simulator Packet Tracer, students will set up and monitor inter-VLAN routing in a network. Students will need to generate a thesis about how the network should operate and test their thesis against the simulated network.

h. Blog/Bulletin Board Discussion: After completing Learning Lab 5.1.2.4 "Configuring Per-Interface Inter-VLAN Routing" and Learning Lab 5.1.3.7 "Configuring 802.1Q Trunk-based Inter-VLAN Routing" in the Lab Manual, compare and contrast the two methods of inter-VLAN routing, paying particular attention to the topological changes required by each method and the advantages and disadvantages of the various methods. Hypothesize the more efficient topology, and justify the answer with information from the labs, curriculum, and other sources. Respond to at least two entries of other students.

i. Learning Lab 5.3.2.4: "Troubleshooting Inter-VLAN Routing" in the Lab Manual. Students will analyze provided network topology, hypothesize to design a solution, and provide reflection on the effectiveness and efficiency of their solution.

j. Case Study: Activity 5.4.1.1 "The Inside Track" in the Lab Manual. Working in small groups, students will analyze the network provided, designing and creating a new network to meet the stated requirements. Students will then present their proposal to the entire class, and defend their network plan.

k. Learning Lab 6.2.2.5:: "Configuring IPv4 Static and Default Routes" in the Lab Manual. Students will synthesize information from the chapter,constructing and implementing static routes on a sample network in the lab. Students will then reflect on their thesis in short answer form.

l. Learning Lab: Packet Tracer 6.2.4.4: "Configuring IPv6 Static and Default Routes". Students will configure a network similarly to 6.2.2.5, but with IPv6. Students will need to compare and contrast the different numbering protocols.

m. Learning Lab: Packet Tracer 6.3.3.6 "Designing and Implementing a VLSM Addressing Scheme". Students will apply the theoretical models of Variable Length Subnet Masks (VLSM) and route summarization. Requires synthesis of both theories.

n. Learning Lab 6.4.2.5: "Calculating Summary Routes with IPv4 and IPv6". Students will synthesize and apply the theory of route summarization in a lab network. Application of networking theories explore. in this unit is required. Students will then critique the route summarization for IPv4 and IPv6 networks, comparing and contrasting against each other and against the routing theories..

o. Learning Lab: Packet Tracer 6.5.2.4: "Troubleshooting VLSM and Route Summarization". Using the network simulator Packet Tracer, students will apply route summarization and VLSM in a simulated network. Students will critique and reflect on how each tool will impact the network.

p. Learning Lab: Activity 6.6.1.1: "Make it Static!" in the Lab Manual. Students will work in small groups to compare and contrast static and dynamic routes in IPv4 and IPV6.

q. Learning Lab: Packet Tracer 6.6.2.1: Skills Integration Challenge. Students

will synthesize knowledge from throughout the unit and create a network with the parameters provided. Students will reflect on the efficiencies of the networking topologies.

r. Blog/Bulletin Board Post: After viewing the TED Talk "What is the Internet Really?" and reading the MIT Opencourseware PDF, "A quick guide to the Internet", explain the role of routers on the Internet. Read and comment on at least two blog posts from your classmates.

s. Blog/Bulletin Board Post: Write a blog post where you describe how you might troubleshoot a static routing problem. Describe a problem scenario and a method for finding the solution. Read and comment on the posts of at least two classmates.

t. Unit Presentation: "The structure of the Internet." After researching Chapter 4 "Routing Concepts", Chapter 5 "Inter-VLAN Routing", and Chapter 6 "Static Routing", prepare an oral presentation (in collaborative groups) aided by digital resources to explain to a class of underclassmen the role of routers in the fabric of the Internet. Include the topics of how routers operate and make decisions, how to route between virtual networks, and static routes. Deliver your presentation to underclassmen or students in another class who may not understand this content. Include evidence from your readings and the TED Talk to further illustrate your explanation.

Unit 4: Wide Area Networks

As networks grow, it becomes more important to automate the management of day-to-day operations. Routing algorithms help routers "learn" about the networks which other routers are connected to, and facilitate automation, without which the network could not easily grow to support the services required of a modern, converged network system.

The unit is designed to answer the questions: "What is a properly designed and implemented Wide Area Network (WAN)?", "How do routers forward packets by using information in the routing table?". "What are methods a network administrator can use to place routes on the routing table?", "What are the challenges in providing appropriate and secure access to Local Area Networks?"

Learning Goals introduced in Unit 4:

- Compare and contrast dynamic routing protocols used in wide area networks.
- Analyze various routing tables and determine which route will be used to forward packets.
- Assess the algorithms used by RIP, RIPng, OSPFv2 and OSPFv3 and select the dynamic routing protocol most appropriate in a particular network environment.

- Implement a well-designed Wide Area Network by configuring initial router settings, interfaces, and the management switch virtual interface. Troubleshoot unexpected outcomes.

- Understand the differences between Static and Dynamic routing, evaluate the distinct nature of each, and recommend a best course of action which will allow for scalable networks.

Assignments:

a. Interactive Lecture: Instructor PowerPoint lectures describing the importance of LAN design, switched network environments, and demonstrating basic switch configuration and implementing and managing switch security.

b. Blog/Bulletin Board Discussion 1: According to the research paper "OSPF Monitoring: Architecture, Design and Deployment Experience", what do the authors claim about the utility of using an OSPF monitor? Is OSPF a scalable protocol according to the authors? What evidence do they cite to support their claim? Respond to at least two blogs from your classmates.

c. Blog/Bulletin Board Discussion 2: After viewing the video "Networking 101: OSPF" (https://www.youtube.com/watch?v=e8qfvF4yNOI), describe the relationship between designated routers and backup designated routers. What is the role of each? After your post, respond to at least two other blog posts from your classmates.

d. Learning Lab: Lab 7.3.2.4, "Configuring Basic RIPv2 and RIPng" in the Lab Manual. Students will configure the network topology with RIPv2 routing, disable automatic summarization, propagate a default route, and use CLI commands to display and verify RIP routing information.

e. Learning Lab 8.2.4.5: "Configure Basic Single-Area OSPFv2" and Learning Lab 8.3.3.6: "Configuring Basic Single-area OSPFv3" in the Lab Manual. Students compare the characteristics and operations of OSPFv2 to OSPFv3 and verify the operation of both in small routed networks.

f. Team Learning Lab: Skills Integration Challenge 8.4.1.2. Working in teams and using the network simulator Packet Tracer, students will configure a simulated WAS using OSPFv2 and OSPFv3. One router will be configured with both IPv4 and IPv6. Teams must verify configurations and test connectivity between end devices. Student teams must document their solution and defend their approach in a written summary.

g. Unit Essay: After researching Chapter 7 "Routing Dynamically", Chapter 8 "Single Area OSPF", and the article "OSPF Monitoring: Architecture, Design and Deployment Experience", write a 3-4 page essay that compares OSPF to static routing and argues for using one routing approach over the other. Be sure to support your position with evidence from the texts.

Unit 5: Cybersecurity

Security of data networks is critical. One only needs to look at recent news accounts to see the significant problems caused by criminals hacking into systems. When properly designed and implemented, routers can learn about other networks while at the same time not opening up holes for exploit by criminals.

Learning Goals introduced in Unit 5:

- Explain the purpose of dynamic routing protocols
- Explain the use of dynamic routing versus static routing
- Explain how dynamic routing protocols share route information and achieve convergence
- Describe the algorithm used by distance vector routing protocols to determine the best path
- Identify the types of distance vector routing protocols
- Describe the algorithm used by link-state routing protocols to determine the best path
- Explain how the link-state routing protocol used information sent in a link-state update
- Compare the IPv4 classless route lookup process and the IPv6 lookup process
- Explain the process by which link-state routers learn about other networks
- Explain how OSPF uses cost to determine the best path
- Relate routing protocols to network security, both of organizations and individual users

- Security of networks is critical. The routing protocol used differs depending upon implementation and specific organizational requirements. Evaluate based on needs of individual users and entire organizations.

- Configure and verify single-area OSPFv2 and OSPFv3 in a small, routed network

Assignments:

a. Interactive Lecture: Instructor PowerPoint lectures describing the importance of LAN design, switched network environments, and demonstrating basic switch configuration and implementing and managing switch security.

b. Blog/Bulletin Board Discussion 1: After reading the Introduction to "Cybersecurity: What Everyone Needs to Know", evaluate the concepts which the authors believe are critical for every network user to know. Give at least two (2) specific examples given, and how they impact your life. Respond to the postings of at least two of your classmates.

c. Blog/Bulletin Board Discussion 2: After reading Part 1: How It All Works in "Cybersecurity: What Everyone Needs to Know", compare and contrast what end users need with what the Internet governance is able to accomplish. Give examples from ICANN and IANA. Discuss how open governance can cause problems, and hypothesize solutions to the global issues. Respond to the postings of at least two of your classmates.

d. Learning Labs: Labs 7.3.2.4, 8.2.4.5 and 8.3.3.6. In these labs students will be designing, configuring, securing, and troubleshooting Wide Area Networks based upon real-life scenarios.

e. Team Learning Lab: Skills Integration Challenge, Working in teams and using the network simulator Packet Tracer, students will take an existing network infrastructure and apply their knowledge and skills to finalize the configuration.

f. Poster Session: Working in a team of at least two other students, and including information from the unit and the supplemental readings, prepare a Poster Session about cybersecurity and methodologies of securing networks. Include information about how the security issues introduced in the unit and supplemental reading are important for each individual Internet user. Group will present their poster session to the class.

Unit 6: Network Services and the Future

The future is upon us. As we migrate from IPv4 to IPv6, networking protocols will need to be readjusted and methods of allocating addresses changed. In the meantime, private address schemes are extending the lifetime of IPv4,

and DHCPv4 is being used to automatically allocate addresses. With the implementation of IPv6, the need for private addressing is lessened, but administrators will need to allocate addresses differently.

As a culminating project, the students will be working on their own career development. LinkedIn is the tool of choice for professionals in a multitude of disciplines; their culminating projects will address both a career search and implementation of LinkedIn as a professional career development tool.

Learning Goals Introduced in Unit 6:

- Describe the operation of DHCPv4 in a small- to medium-sized business network
- Configure a router as a DHCPv4 Server
- Configure a router as a DHCPv4 Client
- Troubleshoot a DHCP configuration for IPv4 in a switched network
- Explain the operation of DHCPv6
- Configure stateless DHCPv6 for a small- to medium-sized business
- Configure stateful DHCPv6 for a small- to medium-sized business
- Troubleshoot a DHCP configuration for IPv6 in a switched network
- Describe NAT characteristics
- Describe the benefits and drawbacks of NAT
- Configure static NAT using the CLI
-

Configure dynamic NAT using the CLI

- Configure PAT using the CLI
- Configure port forwarding using the CLI
- Configure NAT-PT (v6 to v4)
- Use show commands to verify NAT operation

Assignments:

a. Interactive Lecture: Instructor PowerPoint lectures describing the importance of LAN design, switched network environments, and demonstrating basic switch configuration and implementing and managing switch security.

b. Blog/Bulletin Board Discussion: After reviewing the unit objectives and completing the first portion of Activity 10.0.1.2: Own or Lease, write a blog post discussing use of DHCPv4 in real-world networks. Sample questions include: "Why would any network administrator need to save a bank of IP addresses for DHCP not to use?" and "You are designing your small- to medium-sized network and you have a choice as to whether to buy a small, generic ISR for DHCP purposes, or use a DHCP full server. Before you read this chapter, how would you have made your decision? How is it different now?" Finally, read and comment on on at least two posts from your classmates.

c. Learning Lab: 10.1.2.5, "Configuring Basic DHCPv4 on a Switch" in the Lab Manual. Students will synthesize information from this and prior sections to configure DHCPv4 on a Layer 3 switch. Students will then compare and contrast configuration on a Layer 3 switch with configuration on a router.

d. Learning Lab: 10.2.3.5, "Configuring Stateless and Stateful DHCPv6" in the Lab Manual. Students will apply knowledge from prior section of unit, and compare-and-contrast DHCPv4 and DHCPv6 while configuring DHCPv6 in a network.

e. Learning Lab 10.2.4.4: "Troubleshooting DHCPv6" in the Lab Manual. Students will apply configuration and troubleshooting techniques to an IPv6 network. Students will synthesize knowledge from this and prior units, applying theories to the problems presented.

f. Learning Lab: Skills Integration Challenge: Working in teams and using the network simulator Packet Tracer, students will implement DHCPv4 in a simulated network environment.

g. Blog/Bulletin Board Discussion: Students will review Activity 10.3.1.1 in the Lab Manual, "IoE and DHCP", and the article "The Internet of Everything". Students will then write a blog post discussing the use of DHCP as it applies to the Internet of Everything (IoE). Students will then read and comment on at least two posts from their classmates.

h. Blog/Bulletin Board Discussion: Students will review Activity 11.0.1.2 in the

Lab Manual, "Conceptual NAT". Students will then write a blog post discussing the use of NAT in a modern network environment, with special emphasis on the school lab network. Students will then read and respond to two posts from their classmates.

i. Learning Lab: Packet Tracer 11.2.1.4: "Configuring Static NAT" in the Lab Manual. Students will apply the theories of NAT and private addressing in a simulated network, using the network simulator Packet Tracer.

j. Learning Lab: Packet Tracer 11.2.3.6 in the Lab Manual, "Implementing Static and Dynamic NAT". Students will implement and troubleshoot static and dynamic NAT in a simulated network. The simulated network is designed to mimic real-world situations, and is too large to simulate in a classroom with real equipment. This lab emphasizes scalability and security concepts from prior sections of the course, requiring students to synthesize information in order to come to a resolution.

k. Learning Lab: Packet Tracer 11.3.1.4, "Verifying and Troubleshooting NAT Configurations" in the Lab Manual. Students will troubleshoot a sample network. Students must analyze the problems and synthesize solutions to the problems presented

l. Unit Essay: After researching Chapter 10 "DHCP", Chapter 11 "Network Address Translation", and Activity 11.4.1.1, "NAT Check", write an expository essay in which you explain the principles and purposes of NAT in modern networks. Cite at least three sources, pointing out key elements from each source. In your discussion, address the credibility and origin of sources in your view of your research topic. Identify any gaps or unanswered questions. (3-4 pages)

Culminating Projects

a. Prepare a College and Career Plan for your chosen career, either in ICT or another field. Select the major, the internship opportunities, and what attracts you to that field. List skills which would apply to the career; examples include, but are not limited to, collaboration skills, independent learning skills, lifelong learning skills, research skills, application of ideas to new concepts, etc. Produce the document with the attached template.

b. Personal Career Network Activity: After reading the Forbes article "Eight Reasons High School Students Should be on LinkedIn" and the USA Today Article "Do's and Don'ts for High School students using LinkedIn", and viewing the video "LinkedIn for Students: Your Career Starts Here", students will create a Personal Career Network. Students will use the career development tools available online (Web 2.0) to help them build the foundations for their Personal Career Network (PCN) (similar to a PLN, but for their individual career).

* **Key Assignments**

Activity Type: Blog/Bulletin Board Discussion:

- In the online Blog/Bulletin Board system, students will respond to the prompt and comment on at least two additional classmates in the thread/post. Students will answer the prompt as listed below. The prompts are designed to assist students in analyzing and developing mastery of the topics presented. The assignment is designed to have students provide evidence of their learning in a shorter format than an exploratory essay. Students reply to the prompt using proper grammar and references to their text. They need to be able to show a deeper understanding of the topics presented. By having the students respond to others they will learn both collaborative and deliberation skills.

- Each student will provide an entry answering the prompt and giving evidence to support their position. They will also respond to at least two other students, providing evidence either in support of or against the other student's views. By providing this type of deliberate feedback to the prompt and to each other, students will show the deeper understanding of the topics presented. In addition, they will be able to see where they may have misunderstood a particular element or otherwise need more specific direction. Furthermore, the assignment gives the instructor immediate feedback on student learning, and provides opportunities for quieter students to participate more fully in the course.

Specific Blog/Bulletin Board Assignments:

Unit 1, Discussion 1

- Prompt: Write a blog post where you compare the role of network switches to an essential structure of a city. Consider starting with this sentence frame: Switches in a network are like _____ in a city. Then use evidence from the reading and the TED Talk to support your ideas.

Unit 1, Discussion 2

- Prompt: write a blog post where you contrast ALOHANET with Ethernet.

Unit 2, Discussion 1

- Prompt: Write a blog post comparing and contrasting networks which do not use VLANs with those which do use VLANs, using data from the lab, chapter readings, and additional readings to back up your premise. Use evidence to back up your ideas.

Unit 2, Discussion 2

-

Prompt: Share your understanding of the design goal "isolation". Why is this an important goal in network design?

Unit 3, Discussion 1

- Prompt: document the design of a simple network. Writeup should include physical and logical topologies and should show understanding of the topologies, devices, and interconnections of the networks provided.

Unit 3, Discussion 2

- Prompt: compare and contrast the two methods of inter-VLAN routing, paying particular attention to the topological changes required by each method and the advantages and disadvantages of the various methods. Hypothesize the more efficient topology, and justify the answer with information from the labs, curriculum, and other sources.

Unit 3, Discussion 3

- Prompt: Explain the role of routers on the Internet.

Unit 3, Discussion 4

- Prompt: Describe how you might troubleshoot a static routing problem. Describe a problem scenario and a method for finding a solution.

Unit 4, Discussion 1

- Prompt: What do the authors claim about the utility of using an OSPF monitor? Is OSPF a scalable protocol according to the authors? What evidence do they cite to support their claim?

Unit 4, Discussion 2

- Prompt: Describe the relationship between designated routers and

backup designated routers. What is the role of each?

Unit 5, Discussion 1

- Prompt: Evaluate the concepts which the authors believe are critical for every network user to know. Give at least two (2) specific examples given, and how they impact your life.

Unit 5, Discussion 2

- Prompt: Compare and contrast what end users need with what the Internet governance is able to accomplish. Give examples from ICANN and IANA. Discuss how open governance can cause problems, and hypothesize solutions to the global issues.

Unit 6, Discussion 1

- Prompt: Write a blog post discussing use of DHCPv4 in real-world networks. Sample questions include: "Why would any network administrator need to save a bank of IP addresses for DHCP not to use?" and "You are designing your small- to medium-sized network and you have a choice as to whether to buy a small, generic ISR for DHCP purposes, or use a DHCP full server. Before you read this chapter, how would you make your decision?"

Unit 6, Discussion 2

- Prompt: Write a blog post discussing the use of DHCP as it applies to the Internet of Everything (IoE).

Activity Type: Learning Lab:

- This is an interactive activity in which students research and reflect specific topics in the curriculum. The activities are designed to help them apply the theoretical learning to real-world situations.

- Students will be conducting research (as described in the Learning Lab) and detailing the results. They will also need to provide evidence of their mastery of each type of activity or tool used.

- The students will produce a Lab Report detailing their findings, including evidence of their use mastery.

- By researching specific tools and tasks, students will be able to connect the theoretical learning with real-world situations. The critical thinking required of this applied theory will serve the students well in their other classes. These skills will also assist students in their Blog/Bulletin Board Discussions as well as their culminating argumentative essay.

Specific Learning Lab Assignments, all from the Routing and Switching Lab Manual::

Unit 1, Learning Lab 1:

- "Sent or Received", 1.0.1.2 in the Lab Manual. Describe convergence of data, voice, and video in the context of switched networks. Students will work in groups to discuss various ways hosts send and receive data, voice, and streaming video and develop a matrix (table) listing network data types that can be sent and received.

Unit 1, Learning Lab 2:

- "Configuring Basic Switch Settings", 2.1.1.6 in the Lab Manual . Students will build a simple LAN topology.

Unit 1, Learning Lab 3:

- "Configuring Switch Security Features", 2.2.4.11 in the Lab Manual. Students will follow some best practices for configuring security features on LAN switches.

Unit 2, Learning Lab 1:

- "VLAN Plan", Class Activity 3.4.1.1 in the Lab Manual. Working in groups, students apply the knowledge learned throughout this chapter, analyzing and implementing VLAN design strategies and best practices.

Unit 3, Learning Lab 1:

- "Using Traceroute to Discover the Network", Packet Tracer 4.1.1.8 in the Lab Manual. Students will use the network simulator Packet Tracer to look at how networks, such as those at home and at school, are interconnected. This will form the basis of later assignments in Wide Area Networking.

Unit 3, Learning Lab 2:

- "We Really Could Use a Map", Class Activity 4.4.1.1 in the Lab Manual. Students will analyze routing tables, comparing and contrasting their analysis of the provided network picture with the routing tables provided. Students will compare, explain, and predict the efficiency and expandability of the network.

Unit 3, Learning Lab 3:

- "Configuring Router-on-a-Stick Inter-VLAN Routing", Packet Tracer 5.1.3.6 in the Lab Manual. Using the network simulator Packet Tracer, students will set up and monitor inter-VLAN routing in a network. Requires that they generate a thesis about how the network should operate and test their thesis against the simulated network.

Unit 3, Learning Lab 4:

- "Troubleshooting Inter-VLAN Routing", Lab 5.3.2.4 in the Lab Manual. Students will analyze provided network topology, design a solution, and provide reflection on the effectiveness of their solution.

Unit 3, Learning Lab 5:

- "Configuring IPv4 Static and Default Routes", Lab 6.2.2.5 in the Lab Manual. Students will synthesize information from the chapter, constructing and implementing static routes on a sample network in the lab. Reflection questions are intended to allow students to explain their thesis in short answer form.

Unit 3, Learning Lab 6:

- "Configuring IPv6 Static and Default Routes", Packet Tracer 6.2.4.4 in the Lab Manual. Students will perform similar construction and implementation to Learning Lab 6.2.2.5, but with IPv6. Once complete, students are to compare and contrast the differences in a Blog/Discussion board entry, and respond to at least 2 other students.

Unit 3, Learning Lab 7:

- "Designing and Implementing a VLSM Addressing Scheme", Packet Tracer 6.3.3.6 in the Lab Manual. Students will apply the theoretical models of Variable Length Subnet Masks (VLSM) and route summarization. Requires synthesis of both theories in order to implement in practice.

Unit 3, Learning Lab 8:

- "Calculating Summary Routes with IPv4 and IPv6", 6.4.2.5 in the Lab Manual. Students will synthesize and apply the theory of route summarization in a lab network. Application of networking theories explored in this unit is required. Students will critique the route summarization for IPv4 and IPv6 networks.

Unit 3, Learning Lab 9:

- "Troubleshooting VLSM and Route Summarization", Packet Tracer 6.5.2.4 in the Lab Manual. Using the network simulator Packet Tracer, students will apply route summarization and VLSM in a simulated network. Students will critique and reflect on how each tool will impact the network.

Unit 3, Learning Lab 10:

- "Make it Static!", Learning Activity 6.6.1.1 in the Lab Manual. Students will work in small groups to compare static and dynamic routes in IPv4 and IPv6, comparing and contrasting the different methodologies required and the different topologies available. Groups will present their findings to the class.

Unit 4, Learning Lab 1:

- "Configuring Basic RIPv2 and RIPng", 7.3.2.4 in the Lab Manual. Students will configure the network topology with RIPv2 routing, disable automatic summarization, propagate a default route, and use CLI commands to display and verify RIP routing information.

Unit 4, Learning Lab 2:

- "Configuring Basic Single-Area OSPFv2 and OSPFv3", Labs 8.2.4.5 and 8.3.3.6 in the Lab Manual. Students compare the characteristics and operations of OSPFv2 to OSPFv3 and verify the operation of both in small routed network.

Unit 5, Learning Lab 1:

- "Configuring Basic RIPv2 and RIPng", 7.3.2.4 in the Lab Manual. Students will configure the network topology with RIPv2 routing, disable automatic summarization, propagate a default route, and use CLI commands to display and verify RIP routing information.

Unit 5, Learning Lab 2:

- "Configuring Basic Single-Area OSPFv2 and OSPFv3", 8.2.4.5 and 8.3.3.6 in the Lab Manual. Students compare the characteristics and operations of OSPFv2 to OSPFv3 and verify the operation of both in a small routed network.

Unit 6, Learning Lab 1:

- "Implementing Static and Dynamic NAT", Packet Tracer 11.2.3.6 in the Lab Manual. Students will implement and troubleshoot static and dynamic NAT in a simulated network. The simulated network is designed to mimic real-world situations, and would be too large to simulate in a classroom with real equipment. This lab emphasizes scalability and security concepts from prior sections of the course, requiring students to synthesize information and apply prior knowledge to new situations.

Activity Type: Essay:

- Students will write a 4-5 page argumentative essay responding to the prompt.
- Through their writing, the students will analyze and explore the topic.
- The final product should be 4 to 5 pages in length, MLA format (the standard for my school), argumentative essay (supporting standards from their English classes).
- The essay will allow the students to show that they understand the concepts within the unit and are able to express their learning in written form.

Specific Essay Assignments:

Unit 1, Expository Essay:

- After researching Chapter 1 "Introduction to Switched Networks", Chapter 2 "Switching Concepts and Configuration" and the TED Talk "The Web as a City", write an expository essay in which you explain the structure of Local Area Networks. What conclusions or implications can you draw? Cite at least three sources, pointing out key elements from each source. In your discussion, address the credibility and origin of sources in your view of your research topic. Identify any gaps or unanswered questions. (3-4 pages)

Unit 4, Expository Essay:

- After researching Chapter 7 "Routing Dynamically", Chapter 8 "Single Area OSPF", and the article "OSPF Monitoring: Architecture, Design and Deployment Experience", write a 3-4 page essay that compares OSPF to static routing and argues for using one routing approach over the other. Be sure to support your position with evidence from the texts.

Unit 6, Expository Essay:

- After researching Chapter 10 "DHCP", Chapter 11 "Network Address Translation", and Activity 11.4.1.1, "NAT Check", write an expository essay in which you explain the principles and purposes of NAT in modern networks. Cite at least three sources, pointing out key elements from each source. In your discussion, address the credibility and origin of sources in your view of your research topic. Identify any gaps or unanswered questions. (3-4 pages)

Activity Type: Skills Integration Challenge:

- The Skills Integration Challenge is similar in functionality to a Learning Lab but with many more pieces to synthesize together.
- Working in teams and using the network simulator Packet Tracer, students will take an existing network infrastructure and apply their knowledge and skills to finalize the configuration.
- Student teams will be tasked to complete the IPv4 and IPv6 addressing scheme, implement IPv4 and IPv6 addressing, and verify connectivity.
- Students will complete the simulation, applying the theoretical models discussed in class with the practical issues during the simulation, and detailing how they solve the problems presented.
- The students will produce a Lab Report detailing their findings, including specific results of their inquiry. The Lab Report will need to include evidence of their simulated activities and provide information about how the theoretical model compared with the practice.
- In simulation, students will be able to see how the theoretical networking models fit into practice. These will assist them in their Blog/Bulletin Board Discussions as well as their culminating argumentative essay.

Unit 1 Skills Integration Challenge:

- Working in teams and using the network simulator Packet Tracer, students will configure LAN switches with initial settings, SSH, and port security. Student teams must document their solution and defend their approach in a written summary.

Unit 2 Skills Integration Challenge:

- Lab 3.4.1.2 in the Lab Manual. Working in teams and using the network simulator Packet Tracer, students will take an existing network infrastructure and apply their knowledge and skills to secure the VLAN

architecture.

Unit 3 Skills Integration Challenge:

- Packet Tracer 6.6.2.1 in the Lab Manual. Students will synthesize knowledge from throughout the unit and create a network with the parameters provided. Students will reflect on the efficiencies of the networking topologies.

Unit 4 Skills Integration Challenge 1

- Team Skills Integration Challenge. Working in teams and using the network simulator Packet Tracer, students will configure a simulated WAN using OSPFv2 and OSPFv3. One router will be configured with both IPv4 and IPv6. Teams must verify configurations and test connectivity between end devices. Student teams must document their solution and defend their approach in a written summary.

Unit 4 Skills Integration Challenge 2

- Team Skills Integration Challenge. Working in teams and using the network simulator Packet Tracer, students will take an existing network infrastructure and apply their knowledge and skills to finalize the configuration.

Unit 5 Skills Integration Challenge

- Team Skills Integration Challenge. Working in teams and using the network simulator Packet Tracer, students will take an existing network infrastructure and apply their knowledge and skills to finalize the configuration.

Unit 6 Skills Integration Challenge

- Skills Integration Challenge: Working in teams and using the network simulator Packet Tracer, students will implement DHCPv4 in a simulated network environment.

Activity Type: Case Study:

Theoretical knowledge is applied in the Case Study. Students who are successful at the Case Study will have examined many disparate elements and been able to apply them in a new whole. These will assist them in their Blog/Bulletin Board Discussions as well as their culminating argumentative essay.

Unit 3 Case Study 1:

- Students will complete the exercise described in "Switching to Local-Network Channels", Class Activity 5.0.1.2, in the Lab Manual. Working in small groups, students will create a presentation about VLANs and Inter-VLAN routing, including descriptions. Students will synthesize prior knowledge and present to the class their findings.

Unit 3 Case Study 2:

- "The Inside Track", Activity 5.4.1.1 in the Lab Manual. Working in small groups, students will analyze the network provided, designing and creating a new network to meet the stated requirements. Students will then present their proposal to the entire class, and defend their network plan.

Activity Type: Oral Research, Presentation and Defense:

- Students will research, plan, present, and defend their ideals.
- Students must validate their ideas with examples from the text, outside readings, and current events.
- Students must be able to answer questions from their peers, instructor, and visitors, regarding their planning process and why their idea is the best one.

Unit 2 Oral Research and Defense:

- Pitch to company leaders. After researching Chapter 3 "VLANs", the article "Network Virtualization: State of the Art and Research Challenges", prepare and deliver a speech that identifies a problem with network security and argues for a solution. Support your position with evidence from your research. Be sure to examine competing views. Give examples from past or current events or issues to illustrate and clarify your position. Be prepared to defend your viewpoint.

Activity Type: Oral Presentation

Unit 3 Oral Presentation

- "The structure of the Internet." After researching Chapter 4 "Routing Concepts", Chapter 5 "Inter-VLAN Routing", and Chapter 6 "Static Routing", prepare an oral presentation (in collaborative groups) aided by digital resources to explain to a class of underclassmen the role of routers in the fabric of the Internet. Include the topics of how routers operate and make decisions, how to route between virtual networks, and static routes. Deliver your presentation to underclassmen or students in another class who may not understand this content. Include evidence from your readings and the TED Talk to further illustrate your explanation.

Unit 5 Oral Presentation

- Poster Session: Working in a team of at least two other students, and including information from the unit and the supplemental readings, prepare a Poster Session about cybersecurity and methodologies of securing networks. Include information about how the security issues introduced in the unit and supplemental reading are important for each individual Internet user. Group will present their poster session to the class.

Culminating Project:

- Select two pieces of writing from the Unit Essays for this course. Compare and contrast the documents, citing multiple sources to explain how your understanding of modern networks has evolved over the duration of the course. Present your findings to the class in a Poster Session.

Activity Type: Personal Career Network Activity:

- Students will create a Personal Career Network. Students will use the

career development tools available online (Web 2.0) to help them build the foundations for their Personal Career Network (PCN) (similar to a PLN, but for their individual career).

* **Instructional Methods and/or Strategies**

A variety of literacy strategies will be employed by the instructor to help students access the technical writing, reading, and other content inherent in the course. One such model literacy strategy, Expository Reading and Writing Course (ERWC), uses template tasks to design and implement college-level reading and writing, providing the scaffolding necessary to support their mastery of the curriculum. In this model, the instructor provides specific scaffolding around task preparation, the reading process, the transition to writing, and the writing/editing process. The instructor provides additional scaffolding in selecting evidence, establishing a claim, revisions, and editing.

Individual and Pair-Share skill building activities will be used to assist students in mastery of subnetting, VLAN addressing, and wildcard masks, among other sections. The instructor will model the skill building techniques and activities.

Interactive Lecture will be utilized throughout the course to give direct instruction. In Unit 1, the Interactive Lecture will concentrate on modern converged networks, emphasizing the changes which have taken place over time. In Unit 2, the Interactive Lecture will focus on traffic isolation via VLANs for security, reliability, and quality of service, with special attention to how this is used at school and business to segregate traffic into logical parts. Unit 3 will center on the more complex networks which are seen in larger organizations. Additional emphasis will be on how these networks are interconnected with routers via trunking interfaces. Unit 4 concentrates on wide area networking, connecting sites which are far apart into a composite whole. Additionally, the lectures will introduce OSPF as a segue into later sections on dynamic routing protocols. Unit 5 will expand on this, with the use of dynamic routing protocols such as EIGRP and RIP. Students will continue to be exposed to the concept of scalability as small networks become large networks. Unit 6 brings us to numbering, with emphasis on where the future of IP addressing is headed. Students will also study about hybrid solutions in current networks as the migration to IPv6 is slowly becoming a reality. In addition, students will expand on their Career Portfolio through the creation of a Personal Career Network, with introduction through the interactive lecture format. These lectures will include time for small group discussion and sharing, responding to guiding questions, responding to student questions, and formative assessments to assess student understanding at several points during each lecture.

Assigned readings will be used to introduce students to the topics of the course. These include readings in the Routing and Switching Essentials course materials as well as various Supplemental Readings, as detailed throughout the course description.

Hands-on Learning Labs will be part of the course. The instructor will model what students are to accomplish and will then monitor them throughout. In Unit 1, a lab will be based on the modern converged network and what it means for business, and a second lab will have the students researching, implementing, and securing switched networks. The instructor will monitor students for completion and mastery of the material. In Unit 2, the labs concentrate on segmentation of networks with VLANS, with particular emphasis on reliability, scalability, and security introduced. Unit 3 introduces scenarios for the students to analyze and then resolve. Some of these will be group and others individual exercises, with additional emphasis on scalability. Unit 4 Learning Labs will concentrate on wide area networking, emphasizing static and dynamic routing protocols as used in networks spanning multiple sites. The analysis of most appropriate routing protocols is of special consideration. Unit 5 continues the protocol discussion, this time emphasizing how routing protocols can impact network security and scalability. Finally, Unit 6 looks back at the past and forward to the future, with labs concentrating on both IPv4 and IPv6 addressing. As a culminating experience, the students will be looking toward their own futures as they create their own Personal Career Network..

Instructor demonstrations are used frequently in this course. Beginning in Unit 1, and continuing throughout the course, demonstrations, both with real and simulated networking equipment, are used to help assure that students are understanding how the theories presented in class are applied in actual networks. This use of applied theory, and the demonstrations to assist students in understanding it, is critical to the student success in the course.

Short on-campus field trips will be used as well. The school has a Network, and the instructor will take students on a tour of the main network of the school building. Trips to the main District network are also planned, subject to availability of district IT staff and transportation. UC Davis is within easy driving distance, and their network managers have expressed interest in

hosting student groups. Through these trips, the students will see the practical application of the theories presented in class.

Video will be part of the course as well. In Unit 1, the TED talk "The Web as a City" by Steven Johnson discusses how the evolution of the Web has mirrored that of major cities. Unit 3 sees students revisiting the TED talk "Discover the Physical Side of the Internet" by Andrew Blum, which they were first exposed to a year before in Internet Engineering 1. Now that the students have some background of how the Internet operates, the TED talk becomes a discussion of how it has grown and where it will be going in the future. Unit 4 uses a video by Jimmy Ray Purser entitled "Networking 101: OSPF", part of a larger series of introductory videos. In this video, students will discover how OSPF works and how it impacts networks. Finally, in Unit 5, several videos will introduce DHCPv4 and DHCPv6, with emphasis on future-proofing networks. Last but not least, the culminating Personal Career Network assignment will use video to show students how to create a Personal Career Network using LinkedIn. In addition to pre-made video, instructor-made video will be available for students to view outside of class. These will be on specialized topics, such as implementation of the OSI model and OSPF operations.

The instructor will work with the community and advisory committee to provide real-world guest speakers. These community members, including Network Engineers (Units 1 and 2), Network Designers and Engineers (Units 3 and 4), and Career Development professionals (Unit 6) will discuss various parts of network theory with the intention of showing students how the network operates in the real world. In addition, the Career Development professionals in Unit 6 will assist with further refinement of the Career Portfolios. In addition, Unit 6 features career networking with industry professionals in the ICT sector.

* **Assessment Methods and/or Tools**

Poster Session – Working in a team of at least two other students, and including information from the unit and the supplemental readings,students will prepare a presentation on a particular topic. Group will present their poster session to the class. This allows them to express what they have learned; the peer learning is important for the success of every student.

Packet Tracer Skills Based Assessments – Students solve problems requiring content knowledge and critical thinking through software and hardware simulations. Students synthesize the information and apply it in simulated networks, learning how theory is applied in the field.

Learning Lab – Hands-on laboratory activities for skill and performance assessment on real equipment.

Unit Exam – multiple choice, short essay questions, and real-world problem solving scenario simulations. Students must demonstrate mastery of learning outcomes and essential knowledge. Students will have opportunities for re-learning and re-testing.

Unit Essay – Students will write an expository essay in which they explain various theories and applied theories. They will need to use proper MLA format and cite at least three sources, pointing out key elements from each source. In classroom discussion, students will address the credibility and origin of sources in your view of your research topic. Identify any gaps or unanswered questions. The paper should be 3-4 pages.

Oral Presentations – Students will need to be able to communicate orally. Unlike the Poster Session, where the students present to a small group at a time (usually 3-4), the Oral Presentation is before the entire class. Some of these are individual, others group; all require that the student prepare and deliver a speech that identifies a problem and argues for a solution. Students must support their position with evidence from research, including examining competing views. They need to give examples from past or current events or issues to illustrate and clarify their position as well.

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