

Course Outline

COURSE: CSIS 175C **DIVISION:** 50 **ALSO LISTED AS:**

TERM EFFECTIVE: Fall 2011 **Inactive Course**

SHORT TITLE: ADV ROUT/SWITCH/WAN

LONG TITLE: Advanced Routing/Switching/WAN

<u>Units</u>	<u>Number of Weeks</u>	<u>Type</u>	<u>Contact Hours/Week</u>	<u>Total Contact Hours</u>
4	18	Lecture:	4	72
		Lab:	0	0
		Other:	0	0
		Total:	4	72

COURSE DESCRIPTION:

This course is the third/last course in the Cisco Networking Academy curriculum. This course covers the advanced features of router and routing concepts including IPX access lists, LAN segmentation, network congestion issues, cut-through and store and forward switches, and the operation of the Spanning Tree protocol. Other topics include: Wide Area Network services including LAPB, Frame Relay, ISDN, HDLC, PPP, DDR, LMI's and maps and subinterfaces on the Cisco router. This class includes practice using the Cisco routers. This course has the option of a letter grade or pass/no pass. **PREREQUISITE:** CSIS 175B

PREREQUISITES:

Completion of CSIS 175B, as UG, with a grade of C or better.

COREQUISITES:

CREDIT STATUS: D - Credit - Degree Applicable

GRADING MODES

- L - Standard Letter Grade
- P - Pass/No Pass

REPEATABILITY: N - Course may not be repeated

SCHEDULE TYPES:

- 02 - Lecture and/or discussion
- 72 - Dist. Ed Internet Delayed

STUDENT LEARNING OUTCOMES:

1. Describe and analyze the advantages of LAN segmentation using bridges, routers and switches.

ILO: 3,7,2,1

Measure: Homework, projects, lab exercises, quizzes.

2. Describe and analyze network congestion problems in an Ethernet network.

ILO: 3,7,1,2

Measure: Homework, projects.

3. Identify and explain the key Frame Relay terms and features.

ILO: 3,7,2

Measure: Homework, lab exercises, projects.

4. Configure PPP and Frame Relay to encapsulate WAN data on Cisco routers.

ILO: 7,3,2

Measure: Homework, projects, tests, quizzes.

CONTENT, STUDENT PERFORMANCE OBJECTIVES, OUT-OF-CLASS ASSIGNMENTS

Inactive Course: 09/26/2011

Week Hours Content

1 4 OSI Model. Physical and Data Link Layer...

Review. OSI model. Physical and Data Link Layer detailed. Network layer: path determination.

Transport layer detailed. Routing. Routing protocols.

LAN-to-LAN routing. Router configuration.

EXERCISES/READING/HOMEWORK:

Review. OSI model. Physical and Data Link Layer detailed. Network layer: path determination.

Transport layer detailed. Routing. Routing protocols.

LAN-to-LAN routing. Router configuration.

2-3 8 LAN switching. The Ethernet/802.3 interface.

Half-duplex Ethernet Design (standard Ethernet).

Congestion and bandwidth. Propagation delay. Ethernet transmission times. Extending shared media LANs using repeaters. Improving LAN performance.

Segmenting LANs. Segmentation with bridges, routers, and LAN switches. LAN switch overview. How a LAN switch learns addresses. Benefits of switching.

Symmetric switching. Asymmetric switching. Memory buffering. Two switching methods. Introducing

Planning Tree Protocol. Understand STP states.

Introduce virtual LANs (VLANs).

EXERCISE/READING/HOMEWORK:

Read these chapters and do the homework exercises.

Describe how the performance of Ethernet LANs can be negatively affected by broadcasts and CSMA/CD access methods. Describe how the performance of Ethernet LANs can be negatively affected by congestion due to increased bandwidth demands from multimedia

applications such as video and the internet as well as the normal latency (propagation delay) of frames as they travel across the LAN media. Describe how performance of Ethernet LANs can be negatively affected by extending the distances of the Ethernet LAN using repeaters. Describe how LAN performance can be improved by segmenting the network with bridges, routers and switches. Describe two means other than segmentation by which LAN performance can be improved, namely full-duplex transmitting and the fast Ethernet standard. Give an overview of the benefits and operation of LAN switching. Describe symmetric versus asymmetric switching. Describe cut-through and store-and-forward switching. Explain the Spanning Tree Protocol. Describe the benefits of VLANs.

4 4 Virtual LANs. Introduction to VLANS. Why create VLANs? Frame filtering. IEEE 802 VLAN standardization. Frame tagging. Adding, moving, or changing use locations. Broadcasts need boundaries. VLANs establish broadcast domains. Tightening network security. Remove the physical boundaries. Switches and hubs. Using legacy hubs. VLAN implementation. Port-centric Virtual LANs. Static VLANs.

Transporting VLANs across backbones.

EXERCISES/READING/HOMEWORK:

Read these chapters and do the homework exercises.

Define VLANs. Name reasons to create VLANs. Describe the role switches play in the creation of VLANS.

Describe VLAN frame filtering and VLAN frame tagging.

Describe how switches can be used with hubs. Name the five components of VLAN implementations. (Describe five beneficial effects of implementing a VLAN.)

Describe static and dynamic VLANs.

5 4 LAN Design. Gathering and analyzing network requirements. What are the issues? Network design. Layer 1 media and topology. Layer 2 LAN switching. Layer 3 routing. File servers and traffic patterns. Documenting your network.

EXERCISES/READING/HOMEWORK:

Read these chapters and do the homework exercises.

Explain LAN design goals and methodology. Describe how to gather and analyze network equipment. Identify the typical issues that arise in designing LANs.

Provide an overview of the design issues in layer 1, 2, and 3.

Identify layer 1 (media and topology) design issues in detail. Identify layer 2 (LAN switching) design

issues in detail. Identify layer 3 (routing) design issues in detail. Describe how file servers and traffic patterns should influence LAN design.

Document LANs.

6 4 Network Layer Basics. Network Layer: Path Determination and Addressing the network and host. Routing uses network addresses. Routed versus routing protocol. Network layer protocol operations. Multi-protocol routing. Static versus dynamic routes. Adapting to topology change. Dynamic routing operations. Representing distance with metrics. Routing protocols. Classes of routing protocols. One issue: time to convergence. Distance vector concept. Distance vector network discovery. Distance vector topology changes. IP routing learns destinations. Autonomous systems. Interior and exterior routing protocols. Interior IP routing protocols. IP routing configuration tasks. Dynamic routing configuration. Configuring IGRP. IGRP overview. Show IP protocol command. Show IP route command.

7 4 Access Control Lists. Access lists overview. Access list command overview. A list of tests: deny or permit. How to identify access lists. TCP/IP Access lists. Testing packets with access lists. Key concepts for IP access lists. How to use wildcard mask bits, wildcard any, wildcard host. IP standard access configuration. Using named IP access lists. Where to place IP access lists. Monitoring access list statements. Reserved TCP port numbers. Reserved UDP port numbers.

EXERCISES/READING/HOMEWORK:

Read these chapters and do the homework exercises. Describe the use, value, and process of access lists. Configure standard and extended access lists to filter IP traffic. Monitor and verify selected access list operations on the router.

8 4 IPX Routing overview. Cisco routers in NetWare networks. Novell NetWare protocol suite. Key Novell NetWare features. Novell IPX addressing. How to determine the IPX address. Multiple Novell encapsulations. Cisco encapsulation names. Novell uses RIP for routing. SAP service advertisements. GNS get nearest server protocol. Configuring IPX routing. Novell IPX configurations tasks. Novell IPX global configuration and interface configuration. Verifying and monitoring IPX routing. Verifying IPX operation. Monitoring the status of an IPX interface. Monitoring IPX routing tables. Monitoring the Novell IPX

servers. Monitoring IPX traffic. Troubleshooting IPX routing and IPX SAP.

EXERCISES/READING/HOMEWORK:

Read these chapters and do the homework exercises. Determine the required IPX address and encapsulation type for a given router port. Enable the Novell IPX protocol on a router. Configure both the router Ethernet and serial interfaces with IPX addresses. Verify IPX connectivity between routers. Discover IPX addresses on remote routers.

9 4 Wide Area Network (WAN): Common WAN Technologies.

Wide Area Networking. WAN frame encapsulation formats. WAN Link Options.

EXERCISES/READING/HOMEWORK:

Read these chapters and do the homework exercises. Describe and distinguish the types and attributes of serial communication on WANs. Describe how WAN communication works. Compare the differences between WAN connection types: dedicated, dial-on-demand, packet-switched and circuit-switched services. Understand the different encapsulation types such as PPP, HDLC and IETF.

10 4 Point-to-Point Protocol (PPP): Overview. Layering PPP

elements. PPP operation, frame formats. PPP LCP configuration options. PPP link negotiation, authentication overview.

Selecting a PPP authentication protocol. Configuring PPP with authentication, verifying PPP.

Read these chapters and do the homework exercises.

Identify and describe the basic components defining PPP communication. Identify and describe PPP's connection negotiation process.

Define and describe the use of LCP and NCP frame in PPP.

11-12 8 WAN Design: Analyze requirements. Analyze network

load requirements for traffic-intense applications.

Benefits of a hierarchical design model. Three-layer model components. Core-layer functions. Distribution layer functions. Access-layer functions. One-layer and two-layer design, traffic patterns, and server placement.

EXERCISES/READING/HOMEWORK:

Read these chapters and do the homework exercises. Describe the benefits of using a hierarchical model. Identify the three layers that make up the hierarchical model. Describe the functions typically performed by each layer. Describe variations on the three-layer hierarchy using only one or two layers of the model.

Describe the placement of other WAN technologies such as ISDN and Frame Relay. Describe how the placement of enterprise servers and workgroup servers affects traffic patterns across the LAN.

13-14 8 Integrated Services Digital Network (ISDN) BRI overview: ISDN Overview. Remote Access issues.

Dial-up connections. Remote node. Dedicated telecomputer/teleworker. Small office/home with LAN.

ISDN services - basic rate interface (BRI), ISDN standards, components, overview, reference points.

Data-link encapsulation. ISDN encapsulation options, access options and switch types. Point-to-point protocol. ISDN configuration tasks. Verifying ISDN operation.

EXERCISES/READING/HOMEWORK:

Read these chapters and do the homework exercises.

Explain why ISDN is used. Explain the specific services and standards of ISDN. Explain the components of ISDN and how it works. Configure ISDN on a router. Verify ISDN on a router.

15-17 12 Frame Relay: Frame relay overview, terminology. Frame

relay Data Link Connection Identifier (DLCI). Frame relay frame format, addressing. Frame relay operation-LMI. Inverse ARP. Frame relay mapping operation.

Subinterfaces: Frame relay implementation with subinterfaces. Frame relay subinterfaces. Reachability issues with routing updates. Resolving reachability issues.

Configuring Frame Relay: Configuring basic frame relay

Verifying frame relay operation. Configuring optional commands. Configuring subinterfaces.

Multi-point subinterfaces configuration example.

Point-to-point subinterfaces configuration example.

EXERCISES/READING/HOMEWORK:

Read these chapters and do the homework exercises.

Describe the basic devices used for Frame Relay connections and describe how these connections are achieved with virtual circuits. Define Frame Relay terms: Local Access Rate, DLCI, LMI, CIR, Bc, Excess Burst, FECN, BECN, and DE. Define and describe the functions of Frame Relay DLCI. Describe LMI and how Frame Relay operates. Explain how Frame Relay subinterfaces can resolve split horizon issues.

Configure basic Frame Relay on router interfaces.

Verify Frame Relay operation and configure with optional commands. Configure Frame Relay subinterfaces.

STUDENT PERFORMANCE OBJECTIVES:

Week 1

Students can describe the overall function of the OSI model and what problems it solves.

Students can describe the characteristics of the physical layer, the data link layer, the network layer, and the transport layer of the OSI model.

Students understand the function of routing in networks and the different classes of routing protocols.

Weeks 2-3

Students can describe how the performance of Ethernet LANs can be negatively affected by broadcasts and understand CSMA/CD access methods.

Students can describe how LAN performance can be improved by segmenting the network with bridges, routers, and switches.

Students can describe two means other than segmentation by which LAN performance can be improved, namely full-duplex transmitting and fast Ethernet standard. Students can give an overview of the benefits and operation of LAN switching. Students can describe symmetric versus asymmetric switching.

Week 4

Students can define VLANs, name reasons to create VLANs, and describe their benefits. Students can describe VLAN frame filtering and VLAN frame tagging.

Students can describe how switches can be used with hubs.

Week 5

Students can explain LAN design and methodology. Students can identify the typical issues that arise in designing LANs. Students can provide an overview of the design issues in layers 1, 2, and 3 of the OSI model.

Students can identify layer 1 (media and topology) design issues in detail.

Students can identify layer 2 (LAN switching) design issues in detail.

Students can identify layer 3 (routing) design issues in detail.

Students can describe how file servers and traffic patterns should influence LAN design.

Students can document LANs.

Week 6

Students can list the key internetworking functions of the OSI network layer and how they relate to path determination in a router.

Students can explain the advantages of dynamic routing protocols.

Students can describe IGRP features and operation.

Students can configure the IGRP routing protocol.

Week 7

Students can describe the use, value, and process of access lists.

Students can configure standard and extended access lists to filter IP traffic.

Students can monitor and verify selected access list operations on the router.

Week 8

Students can determine the required IPX address and encapsulation type for a given router port.

Students can enable the Novell IPX protocol on a router.

Students can configure the router's Ethernet and serial interfaces with IPX addresses.

Students can verify IPX connectivity between routers.

Students can discover IPX addresses on remote routers.

Week 9

Students can describe and distinguish the types and attributes of serial communication on WANs.

Students can describe how WAN communications works.

Students can compare the differences between WAN connection types: dedicated, dial-on-demand, packet-switched and circuit-switched services. Students can understand the different encapsulation types such as PPP, HDLC, and IETF.

Week 10

Students can identify and describe the basic components defining PPP communication. Students can identify and describe PPP's connection negotiation process. Students can define and describe the use of LCP and NCP frames in PPP.

Weeks 11-12

Students can describe the benefits of using a hierarchical design mode.

Students can identify the three layers that make up the hierarchical mode.

Students can describe the functions typically performed at each layer.

Students can describe variations on the three layer hierarchy using only one or two layers of the model.

Students can describe the placement of other WAN technologies such as ISDN and frame relay.

Students can describe how placement of enterprise servers and workgroup servers affect traffic patterns across the WAN.

Weeks 13-14

Students can explain why ISDN is used.

Students can explain the specific services and standards of ISDN.

Students can explain the components of ISDN and how it works.

Students can configure and verify ISDN on a router.

Weeks 15-17

Students can describe the basic devices used for Frame Relay connections and describe how these connections are achieved with virtual circuits.

Students can define Frame Relay terms: Local Access Rate, DLCI, LMI, CIR, Bc, Excess Burst, FECN, BECN, and DE.

Students can explain how Frame Relay sub-interfaces can resolve split horizon issues.

Students can configure basic Frame Relay on router interfaces.

Students can verify Frame Relay operation and configure with optional commands.

METHODS OF INSTRUCTION:

Lectures and discussions. Computer demonstrations.

METHODS OF EVALUATION:

The types of writing assignments required:

Written homework

Reading reports

Lab reports

The problem-solving assignments required:

Homework problems

Field work

Lab reports

Quizzes

Exams

The types of skill demonstrations required:

Class performance

Performance exams

The types of objective examinations used in the course:

Multiple choice

True/false

Matching items

Completion

Other category:

None

The basis for assigning students grades in the course:

Writing assignments: 20% - 40%

Problem-solving demonstrations: 30% - 50%

Skill demonstrations: 20% - 50%

Objective examinations: 20% - 40%

Other methods of evaluation: 0% - 0%

REPRESENTATIVE TEXTBOOKS:

^uCisco Certified Network Associate Study Guide^s, by Todd Lammler, Sybex, 2002, or other appropriate college level textbook.

Reading level of text: 11 Grade level Verified by: dvt

ARTICULATION and CERTIFICATE INFORMATION

Associate Degree:

CSU GE:

IGETC:

CSU TRANSFER:

Transferable CSU, effective 200630

UC TRANSFER:

Not Transferable

SUPPLEMENTAL DATA:

Basic Skills: N

Classification: I

Noncredit Category: Y

Cooperative Education:

Program Status: 2 Stand-alone

Special Class Status: N

CAN:

CAN Sequence:

CSU Crosswalk Course Department: CSIS

CSU Crosswalk Course Number: 175C

Prior to College Level: Y

Non Credit Enhanced Funding: N

Funding Agency Code: Y

In-Service: N

Occupational Course: C

Maximum Hours:

Minimum Hours:

Course Control Number: CCC000267602

Sports/Physical Education Course: N

Taxonomy of Program: 070810