

COURSE ELT2350: LOCAL AREA NETWORKS**Level:** Intermediate**Theme:** Computer Networking Systems**Prerequisite:** None**Description:** Students extend their understanding of technologies used in a local area network (LAN) and examine specifications for an Ethernet LAN. They develop knowledge of a general strategy for network design and apply the strategy to design, implement and troubleshoot a small LAN.**Parameters:** Designed to be delivered in conjunction with other intermediate level courses in the Computer Networking Systems theme. Schools have the option of delivering courses within this theme in conjunction with one or more Project courses from the Career Transitions theme if they wish to extend learning and/or address other vendor-specific technologies.

Access to a computer work centre equipped with networking hardware, software, tools and consumable supplies, and to instruction from an individual with specialized knowledge and skills in computer networking.

Particular emphasis is placed on IEEE standards for cabling, and on safe procedures for preparing and connecting network media and devices. Students model and assume personal responsibility for ethical behaviour in their use of networking technologies and in their access to electronic sources of information. They also demonstrate an understanding of industry-based policies regarding network use and security.

Supporting Courses: ELT1010: Electro-assembly 1, ELT1060: Digital Technology 1, ELT2070: Computer Technology, INF2010: Workstation Operations, INF2190: Telecommunications 1**Curriculum and Assessment Standards**

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> describe and explain the nature and evolution of LAN technologies and the specific features that differentiate one LAN from another 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> a teacher-directed evaluation designed to test ability to: <ul style="list-style-type: none"> identify and describe the general structure and purpose of a LAN describe and compare past and present LAN technologies, with attention to their respective topologies, protocols and media explain the physical characteristics and potential data capacities of emerging LAN technologies, and their benefits to the user 	10

COURSE ELT2350: LOCAL AREA NETWORKS (continued)

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • explain and demonstrate characteristics of an Ethernet LAN and strategies for improving network performance • describe the characteristics, function and benefits of a virtual local area network (VLAN) • design and implement a small LAN • analyze and troubleshoot basic problems related to LAN design and implementation 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • a presentation or project designed to explain and demonstrate: <ul style="list-style-type: none"> – basic characteristics of an Ethernet LAN – cabling and hardware devices that support data delivery across an Ethernet LAN – data transmission issues in a LAN environment – strategies used to improve LAN performance • a presentation or project designed to describe or illustrate: <ul style="list-style-type: none"> – the benefits offered by VLANs, and specific circumstances in which a VLAN might be implemented – the capabilities and functions of port-based, MAC-addressed-based, and protocol-based VLANs – a simple VLAN configuration • a project in which the student demonstrates ability to design and implement a small Ethernet LAN suitable for home or office and adhering to the Institute of Electrical and Electronics Engineers (IEEE) standards. The student should: <ul style="list-style-type: none"> – outline a general strategy for network design – apply the design strategy to design, implement and test a small Ethernet LAN, given a specific set of network requirements • the ability to analyze and determine the cause of a LAN implementation problem, within the context of the project above. The student should: <ul style="list-style-type: none"> – outline a general strategy for troubleshooting network problems – apply the troubleshooting strategy to determine the cause of a LAN implementation problem 	<p>25</p> <p>10</p> <p>40</p> <p>10</p>

COURSE ELT2350: LOCAL AREA NETWORKS (continued)

Concept	Specific Outcomes	Notes
LAN Technologies (continued)	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe new and/or emerging LAN technologies with respect to: <ul style="list-style-type: none"> – physical characteristics and potential data capacities – new applications and end-user benefits – historical and/or business perspectives that drive development and adoption. 	
Ethernet LANs	<ul style="list-style-type: none"> • describe basic characteristics of an Ethernet LAN: <ul style="list-style-type: none"> – topology or physical layout – use of Carrier Sense Multiple Access with Collision Detection (CSMA/CD) – specifications for Ethernet LANs • identify and describe cabling and hardware devices that support data delivery across an Ethernet LAN; e.g.: <ul style="list-style-type: none"> – cabling specifications and options – data flow through hubs, repeaters, bridges and switches – network interface card (NIC) functions and options – the function of terminating resistors • identify data transmission issues in an Ethernet LAN networking environment; e.g.: <ul style="list-style-type: none"> – latency and bandwidth – contention – congestion and collision – attenuation • explain the concept of segmentation and strategies used to design a collision domain: <ul style="list-style-type: none"> – describe segmentation of a collision domain by bridges, switches and routers – illustrate the 5-4-3 rule used in 10BaseT networks – design and illustrate a small Ethernet collision domain network 	<p>Current Ethernet standards facilitate large, flexible and fast networks. Where older Ethernet networks transmitted data at 10 Mbps, current Ethernet networks can operate at 100 or 1000 Mbps. Twisted-pair wiring and/or fibre-optic wiring have replaced coaxial cable in many hybrid topologies installed throughout the networking industry.</p> <p>Examine data transmission issues in a LAN networking environment, and current/emerging strategies for improving LAN performance.</p> <p>Compare the distinguishing features of two Ethernet frame types.</p> <p>Distinguish between a collision domain and broadcast domain.</p>

COURSE ELT2350: LOCAL AREA NETWORKS (continued)

Concept	Specific Outcomes	Notes
Ethernet LANs (continued)	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • explain applications of bridge and switch technology: <ul style="list-style-type: none"> – illustrate the function of learning bridges and the Spanning Tree Protocol (STP) – explain the function of switches at the data link layer and network layers – identify different types of switching architecture <ul style="list-style-type: none"> • store-and-forward and cut-through data transport • half-duplex and full-duplex network access. 	<p>Examine the relationship between bridging and switching technology. Explain how switching can affect utilization load and collision rate.</p> <p>Compare and contrast the function of switches at the data link and network layers.</p> <p>Explain the capabilities and limitations of 10BaseT Ethernet, and the advantages/disadvantages of 100 Mbps and 1000 Mbps Ethernet over 10 Mbps Ethernet environments.</p>
Virtual Local Area Networks (VLANs)	<ul style="list-style-type: none"> • describe the structure and function of a VLAN • identify the benefits offered by a VLAN, and specific circumstances in which a VLAN might be implemented • describe capabilities and functions of different types of VLANs: <ul style="list-style-type: none"> – port-based – address-based – protocol-based • illustrate/diagram a simple VLAN configuration. 	<p>VLANs are useful for maximizing the efficiency and security of a network. They are logical LANs within a physical LAN.</p> <p>Discuss the benefits of VLANs, and their advantages over multiple LANs.</p>
LAN Design and Implementation	<ul style="list-style-type: none"> • outline a general strategy for network design; e.g.: <ul style="list-style-type: none"> – consider the purpose of the network – determine the overall size of the network – select a network topology – determine the type of file system to be used – select network and client operating systems – establish a naming scheme and name conventions – determine the level and type of fault tolerance – establish the type and level of security required 	<p>Discuss the need for, and criteria involved in, network planning.</p> <p>Student projects should demonstrate application of configuration concepts that ensure overall network performance.</p>

COURSE ELT2350: LOCAL AREA NETWORKS (continued)

Concept	Specific Outcomes	Notes
LAN Design and Implementation (continued)	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • design and implement a small Ethernet LAN suitable for home or office that adheres to the Institute of Electrical and Electronics Engineers (IEEE) standards; i.e., given a specific set of network requirements: <ul style="list-style-type: none"> – select an appropriate topology and architecture – recommend a hardware and connectivity solution – implement the solution by following safe procedures for connecting cabling and hardware devices – test the installation. 	<p>Examine applications of hardware and software tools in network planning.</p> <p>Review standards and practices for compliant installation of cabling and devices.</p>
LAN Troubleshooting	<ul style="list-style-type: none"> • describe and compare proactive and reactive approaches to troubleshooting • outline a general strategy for troubleshooting network problems; e.g.: <ul style="list-style-type: none"> – establish the symptoms – identify the affected area – establish what has changed – select the most probable cause – implement a solution – test the results – recognize the potential effects of the solution – document the solution • identify common network problems related to: <ul style="list-style-type: none"> – physical topology – client connectivity – wiring and infrastructure • identify sources of support for troubleshooting; e.g.: <ul style="list-style-type: none"> – hardware/software manuals and help files – manufacturer’s web site – technical support via telephone/e-mail • analyze and determine the cause of a LAN implementation problem. 	<p>Identify network troubleshooting tools and techniques.</p> <p>Discuss typical problems associated with ring, bus, star, mesh and wireless topologies.</p> <p>Client troubleshooting typically involves hardware, software, cabling, protocols and/or authentication.</p> <p>Wiring problems may relate to installation, attenuation, network device ports and/or cable lengths.</p>