

COURSE ELT2340: NETWORK PROTOCOLS**Level:** Intermediate**Theme:** Computer Networking Systems**Prerequisite:** None**Description:** Students acquire basic knowledge of upper-layer protocol suites that permit the networking of computers. They examine reasons for the extensive use of the Transmission Control Protocol/Internet Protocol (TCP/IP) in computer networks, and develop knowledge and skills relevant to installing, configuring and maintaining a TCP/IP client on a network.**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 developing knowledge of TCP/IP and its suite of protocols. 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 compare standard networking protocol suites with respect to function, addressing requirements, interoperability and naming conventions 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> a teacher-directed evaluation designed to determine knowledge of, and ability to differentiate among, the following networking protocol suites in terms of routing, addressing schemes, interoperability and naming conventions <ul style="list-style-type: none"> Transmission Control Protocol/Internet Protocol (TCP/IP) Internetwork Packet Exchange/Sequenced Packet Exchange (IPX/SPX) NetBIOS Enhanced User Interface (NetBEUI) AppleTalk 	10

COURSE ELT2340: NETWORK PROTOCOLS (continued)

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • identify and explain reasons for the extensive use of the TCP/IP suite in computer networks, and identify and explain major protocols that operate within the TCP/IP suite • demonstrate basic knowledge of logical addressing, and the use of subnets and subnet masks to maximize address utilization • demonstrate ability to: <ul style="list-style-type: none"> – install and configure TCP/IP on a user workstation – validate, troubleshoot and manage a network connection using TCP/IP utilities • demonstrate established laboratory procedures and safe work practices 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • a presentation or project designed to identify and explain: <ul style="list-style-type: none"> – criteria involved in selecting a network protocol – characteristics of the TCP/IP suite that contribute to its extensive use – the basic function of application, transport and network protocols that operate within the TCP/IP suite – layers of the Open System Interconnection (OSI) reference model on which each of the TCP/IP protocols operate 	25
	<ul style="list-style-type: none"> • a teacher-directed evaluation or project designed to test the student’s ability to describe and/or illustrate: <ul style="list-style-type: none"> – conventions for IP addressing – the characteristics of Class A, B and C addresses – the purpose of subnetting and default gateways – classful versus classless approaches to subnetting – static versus dynamic approaches to IP addressing – the function of well-known TCP/UDP (User Datagram Protocol) ports 	30
	<ul style="list-style-type: none"> • a project designed to demonstrate ability to: <ul style="list-style-type: none"> – build a small peer-to-peer or server-based network – use appropriate processes and settings to install and configure a workstation for TCP/IP – use appropriate TCP/IP utilities to validate, troubleshoot and manage a network connection 	30
	<ul style="list-style-type: none"> • observed performance in following: <ul style="list-style-type: none"> – established laboratory procedures – safety regulations specific to the networking technologies being used 	5
	<p><i>Assessment Tools</i></p> <p><i>Assessment Checklist: Network Protocols (ELT2340–1)</i></p> <p><i>Assessment Checklist: Laboratory Procedures and Safety Practices, ELTPSP</i></p> <p><i>Standard</i></p> <p><i>Performance rating of 2 on each criterion</i></p>	

COURSE ELT2340: NETWORK PROTOCOLS (continued)

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> demonstrate basic competencies. 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> observations of individual effort and interpersonal interaction during the learning process. <p><i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p>Integrated throughout</p>

Concept	Specific Outcomes	Notes
<p>Network Protocols</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> describe the nature and purpose of a protocol and a protocol suite/stack within the context of computer networking describe and compare standard networking protocol suites, including Transmission Control Protocol/Internet Protocol (TCP/IP), Internetwork Packet Exchange/Sequenced Packet Exchange (IPX/SPX), NetBIOS Enhanced User Interface (NetBEUI), and AppleTalk, with respect to: <ul style="list-style-type: none"> function routing addressing requirements interoperability naming conventions advantages and limitations match communication tasks performed within TCP/IP, IPX/SPX, NetBEUI and AppleTalk to communication tasks defined at different layers of the Open System Interconnection (OSI) reference model identify criteria involved in selecting a network protocol. 	<p>Computers need to use the same language in order to communicate successfully on a network. In computer networking, these languages are known as protocols. Even though a computer may have the appropriate network operating system, an operational network interface card, and the appropriate network cable, communication is not able to occur without a network protocol. It is common practice to install more than one network protocol on each computer in a network.</p> <p>Illustrate/diagram the relationship of each protocol suite to the OSI reference model.</p>

COURSE ELT2340: NETWORK PROTOCOLS (continued)

Concept	Specific Outcomes	Notes
<p>Transmission Control Protocol/Internet Protocol (TCP/IP)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe the general characteristics and features of the TCP/IP suite • compare and contrast the TCP/IP suite with the OSI reference model • provide reasons for the extensive use of the TCP/IP suite; e.g.: <ul style="list-style-type: none"> – universal interconnectivity – conformity with the OSI reference model – modularity – Internet addressing – interoperability • identify the basic function of protocols operating within the TCP/IP suite; e.g.: <ul style="list-style-type: none"> – Transmission Control Protocol (TCP) – User Datagram Protocol (UDP) – Internet Protocol (IP) – Address Resolution Protocol (ARP) – File Transfer Protocol (FTP) – Simple Mail Transfer Protocol (SMTP) – Post Office Protocol (POP) – Internet Mail Access Protocol (IMAP) – Internet Control Message Protocol (ICMP) – Routing Information Protocol (RIP) – Open Shortest Path First (OSPF) – Hypertext Transfer Protocol (HTTP) • match TCP/IP protocols to layers of the OSI reference model on which they operate • compare and contrast TCP and UDP segment formats. 	<p>TCP/IP is the industry-standard suite of protocols, but is often recognized as the Internet protocol. It is designed for wide area networks and as a result is a routable protocol. TCP/IP uses a number of protocols, including the two primary protocols TCP and IP.</p> <p>Features of TCP include:</p> <ul style="list-style-type: none"> • connection-oriented • reliability • packet handling • error-checking. <p>Explain and/or diagram the:</p> <ul style="list-style-type: none"> • TCP/IP three-way handshake/open connection • TCP/IP simple acknowledgement and windowing • IP datagram. <p>Describe ICMP testing. Identify three or more ICMP messages.</p>
<p>Logical Addressing</p>	<ul style="list-style-type: none"> • describe and illustrate conventions for Internet Protocol (IP) addressing; i.e.: <ul style="list-style-type: none"> – structure and components – characteristics of Class A, B and C addresses • convert between binary and decimal notation • explain the purpose of subnetting and default gateways 	<p>Briefly discuss Class D, E and special network addresses.</p>

COURSE ELT2340: NETWORK PROTOCOLS (continued)

Concept	Specific Outcomes	Notes
<p>Logical Addressing (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe and compare classful and classless approaches to subnetting • provide a rationale for implementing Classless Inter-Domain Routing (CIDR) • demonstrate processes for subnetting a Class A, B or C address into a given number of subnetworks • determine the subnet mask for a subnetted network • describe and compare static and dynamic approaches to IP addressing, and applications of Dynamic Host Configuration Protocol (DHCP) • describe the concept of address resolution, and applications of the Address Resolution Protocol (ARP): <ul style="list-style-type: none"> – diagram how ARP is used in address resolution – describe gratuitous and proxy ARP – interpret an ARP cache • describe the concept of TCP and UDP port numbers: <ul style="list-style-type: none"> – define the function of a port – identify the range of port numbers – explain the function of well-known TCP/UDP ports. 	<p>Discuss and compare IP (version 4) and IP (version 6) addresses.</p> <p>Compare and contrast the IP and IPX logical addressing schemes.</p> <p>Students should understand the process of assigning a subnet mask to an IP address and be able to:</p> <ul style="list-style-type: none"> • recognize default subnet masks • identify network and host IDs • define a custom subnet mask • determine local and remote hosts.
<p>Installation, Configuration and Troubleshooting</p>	<ul style="list-style-type: none"> • identify criteria involved in: <ul style="list-style-type: none"> – network planning – selecting a network protocol • plan and construct a small peer-to-peer or server-based network 	

COURSE ELT2340: NETWORK PROTOCOLS (continued)

Concept	Specific Outcomes	Notes
<p>Installation, Configuration and Troubleshooting (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • install and configure a workstation for TCP/IP: <ul style="list-style-type: none"> – identify options for obtaining IP addresses – assign a static IP address – assign a subnet mask to an IP address • validate, troubleshoot and manage a network connection through the use of appropriate TCP/IP utilities; e.g.: <ul style="list-style-type: none"> – Simple Network Management Protocol (SNMP) – Packet Internet Groper (PING) – Internet Protocol Configuration (IPCONFIG) – Trace Route (TRACERT) – Network Statistics (NETSTAT). 	<p>Demonstrate the use of appropriate commands for verifying address configuration.</p>