COMP H4603: Computer Networks for Aircraft

Module Title:	Computer Networks for Aircraft
Language of Instruction:	English

Credits:	5

NFQ Level:	8

Module Delivered In	1 programme(s)

Teaching & Learning Strategies:	The module will be delivered using lectures, tutorials and laboratory sessions to illustrate the concepts under study. The Institutes VLE will be used to evaluate the students understanding of these concepts at the end of each section using multiple choice questions. Self test question sheets will be issued to the students at the end of each section.

Module Aim:	To provide the student with the knowledge, skills and techniques to design, configure and test enterprise wired Local Area Networks (LANs) and Wide Area Networks (WANs). To provide the student with the knowledge of how redundancy and determinism are achieved in an AFDX network

Learning Outcomes	
On successful completion of this module the learner should be able to:	
LO1	Appraise and map an Aircraft Data Network (ADN) to the OSI model
LO2	Design, configure and test enterprise LAN's and WAN's using commercial off the shelf (COTS) equipment
LO3	Simulate, test and debug enterprise LANs and WANs using a standard simulation product
LO4	Evaluate the jitter in an AFDX network given the specification for each Virtual Link (VL) on the link

Pre-requisite learning
Module Recommendations *This is prior learning (or a practical skill) that is recommended before enrolment in this module.*
No recommendations listed
Incompatible Modules *These are modules which have learning outcomes that are too similar to the learning outcomes of this module.*
No incompatible modules listed
Co-requisite Modules
No Co-requisite modules listed
Requirements *This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed.*
No requirements listed

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Module Content & Assessment

Indicative Content
1. Revision (i) Contrast parallel and serial communications. (ii) Contrast synchronous and asynchronous serial communications. (iii)Contrast simplex, half duplex and full duplex communications.
2. Introduction to data networks (i) Define the key elements of a protocol (syntax, semantics and timing). (ii) Describe the need for open standards. (iii) Define a de facto standard. (iv) Define a de jure standard. (v) Describe the structure and primary functions of the following standards organisations: ISO, ITU-T, ANSI, IEEE, ARINC. (vi) Describe the function of forums. (vii) Describe Internet standards (Internet draft and RFC's).
3. Network topologies Describe and contrast: Star, Bus, Mesh and Ring topologies
4. Transmission media (i) Coaxial cable: Describe the construction of a coaxial cable, List the characteristics of a coaxial cable, Test a coaxial cable for continuity and shorts. (ii) Fibre optic cable: Describe the construction of a fibre optic cable, Contrast PCS, SCS and PCS, Draw a diagram depicting typical ray path trajectories and refractive index profiles for: Multimode step index, Multimode graded index and Single mode step index. Sketch the attenuation characteristic of a typical fibre indicating the spectral windows. Describe the characteristics of light sources and light detectors. Contrast Multimode step index, multimode graded index and single mode step index, under the headings: complexity of TX/RX, cost, pulse spreading. Calculate the energy budget for a fibre optic link. (iii) Twisted pair cables: Describe the construction a STP and UTP cables. Describe the characteristics of CAT 6 UTP and quadrax STP cables. Draw a diagram to depict a typical structured cable installation. Analyse results from a network cable tester: Wire map, Attenuation, NEXT and FEXT, ACR.
5. Flow and error control (i) Describe stop and wait flow control. (ii) Describe sliding window flow control. (iii) Describe Go-Back-n ARQ and Selective Reject ARQ.
6. Medium access methods (i) Describe CSMA/CD. (ii) Describe token passing. (iii) Contrast the performance of CSMA/CD and token passing under heavy load conditions. (iv) Identify the limitations of CSMA/CA for use in an Aircraft Data Network (ADN)
7. Data network operation (i) Describe the purpose and functions of various network devices. (ii) Select the components required to meet a given network specification. (iii) Use the OSI and TCP/IP models and their associated protocols to explain how data flows in a network. (iv) Describe the purpose and basic operation of the protocols in the OSI and TCP models. (v) Interpret network diagrams. (vi) Describe the components required for network and Internet communications. (vii) Differentiate between LAN/WAN operation and features
8. Design implement and test a switched network (i) Select the appropriate media, cables, ports, and connectors to connect switches to other network devices and hosts. (ii) Explain the technology and media access control method for Ethernet technologies. (iii) Explain network segmentation and basic traffic management concepts. (iv) Perform, save and verify initial switch configuration tasks including remote access management. (v) Verify network status and switch operation using basic utilities (including: ping, traceroute, telnet, SSH, arp, ipconfig), SHOW & DEBUG commands
9. Design and implement an IP addressing scheme for a network (i) Describe the need and role of addressing in a network. (ii) Create and apply an addressing scheme to a network. (iii) Assign and verify valid IP addresses to hosts, servers, and networking devices in a WAN environment. (iv) Describe the operation and benefits of using private and public IP addressing. (v) Explain the basic uses and operation of NAT in a small network connecting to one ISP. (vi) Calculate and apply a VLSM IP addressing design to a network. (vii) Determine the appropriate classless addressing scheme using VLSM and summarisation to satisfy addressing requirements in a LAN/WAN environment. (viii) Identify and correct common problems associated with IP addressing and host configurations.
10. Configure VLANS (i) Describe how VLANs create logically separate networks and the need for routing between them. (ii) Configure, verify, and troubleshoot VLANs. (iii) Configure, verify, and troubleshoot trunking on switches. (iv) Configure, verify, and troubleshoot inter-VLAN routing.
11. Overview of Avionics Databus Technology (i) Aircraft Data Network (ADN) characteristics: Quality Of Service (QOS), Low Bit Error Rate (BER), Deterministic. (ii) Describe how determinism is defined using: Guaranteed bandwidth, Upper bounded transmit latency, Minimum delay jitter. (iii) Describe how determinism is achieved using: Concept of a virtual link (VL), Traffic shaping at end systems, Band width allocation per VL

Assessment Breakdown	%
Continuous Assessment	30.00%
Practical	20.00%
End of Module Formal Examination	50.00%

Continuous Assessment

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Examination	A combination of written class tests and MCQ's will be used at the end of major sections to assess student learning.	1,2,3,4	30.00	n/a

No Project

Practical				
Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Practical/Skills Evaluation	Students will complete laboratory assignments. These assignments will require formal written reports and configuration files where appropriate.	2,3	20.00	n/a

End of Module Formal Examination				
Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Formal Exam	The written examination will evaluate the extent of the students knowledge of the learning outcomes.	1,2,4	50.00	End-of-Semester

SETU Carlow Campus reserves the right to alter the nature and timings of assessment

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Module Workload

Workload: Full Time		
Workload Type	*Frequency*	*Average Weekly Learner Workload*
Lecture	12 Weeks per Stage	3.00
Laboratory	12 Weeks per Stage	2.00
Independent Learning Time	15 Weeks per Stage	4.33
	Total Hours	125.00

Module Delivered In

Programme Code	Programme	Semester	Delivery
CW_EEAER_B	Bachelor of Engineering (Honours) in Aerospace Engineering	8	Mandatory