SUBJECT OUTLINE

49202 Communication Protocols

Course area UTS: Engineering

Delivery Spring 2021; standard mode; City

Credit points 6cp

Result type Grade and marks

Attendance: 1.5hpw (tutorial/workshop/quiz, online), 2hpw (laboratory, online)*Forms of attendance and mode of delivery in this subject have changed to enable social distancing and reduce the risks of spreading COVID-19 in our community.*

Subject coordinator

Dr Daniel Franklin

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Teaching staff

Subject Coordinator & Lecturer/Tutor: Dr Daniel Franklin

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***Contacting Staff**:* Students should make the maximum use of class time. Ensure you come to class regularly and stay for the entire duration. If you require additional assistance, please contact the teaching staff by email for an appointment.

Subject description

Students completing this subject have a good understanding of the theory of communication protocols and its application to popular protocols, in particular TCP/IP, as well as the analysis of performance and troubleshooting protocol issues in large carrier-grade networks. A significant practice-oriented laboratory component allows students to gain deeper insights into the theory through the use of the Wireshark packet sniffing application.

Subject learning objectives (SLOs)

Upon successful completion of this subject students should be able to:

1. Identify fundamental concepts of communication protocols such an encapsulation/decapsulation and overhead; switching, routing, fragmentation, IP addressing, transport layer, and IP/MPLS based services
2. use the 'wireshark' packet sniffing program
3. combine 1 and 2 above in the implementation, analysis, performance measurement and troubleshooting of networks
4. recognise basic configuration and measurement procedures on an industry-standard service router platform.

Course intended learning outcomes (CILOs)

This subject also contributes specifically to the development of the following Course Intended Learning Outcomes (CILOs):

- Socially Responsible: FEIT graduates identify, engage, and influence stakeholders, and apply expert judgment establishing and managing constraints, conflicts and uncertainties within a hazards and risk framework to define system requirements and interactivity. (B.1)
- Design Oriented: FEIT graduates apply problem solving, design thinking and decision-making methodologies in new contexts or to novel problems, to explore, test, analyse and synthesise complex ideas, theories or concepts. (C.1)

Contribution to the development of graduate attributes

Engineers Australia Stage 1 Competencies

Students enrolled in the Master of Professional Engineering should note that this subject contributes to the development of the following Engineers Australia Stage 1 competencies:

- 1.3. In-depth understanding of specialist bodies of knowledge within the engineering discipline.
- 2.2. Fluent application of engineering techniques, tools and resources.

Teaching and learning strategies

Students will learn in this subject through online lecture videos, interactive tutorial classes, individual and collaborative quizzes, lab classes, independent study and study for the final exam. Students are required to watch the online lectures and read the appropriate textbook chapters before coming to class. The textbook has more details and presents information from different viewpoints to the online lectures, thus providing students the opportunity for deeper understanding. Tutorial classes provide students with an opportunity to raise questions, discuss and clarify concepts from the online lectures. Some tutorial classes will involve collaborative quizzes. Collaborative lab classes are designed to reinforce the theory and allow students to learn practical skills as well as question their understanding. Regular quizzes ensure that students keep up-to-date throughout the session. A final exam ensures that students have understood the majority of the important concepts and are able to apply these to industry-standard problems. The assessment structure includes a quiz on IP addressing, with a weight of 20%, in which a mark of at least 80% must be attained after three attempts in order to receive credit for this component.

Content (topics)

- Introduction to protocols, evolution of the Internet
- Applications and Services
- Transport layer
- IP layer
- IP routing
- Data link layer and physical layer

Program

Week/Session	Dates	Description
-	Before 2 Aug	Log in to Canvas and watch lecture videos for Module 1 (1.1 & 1.2) Read recommended materials from textbook (see Canvas modules).
1	2 Aug	**Lecture videos:** 1.1: An Overview of the Internet 1.2: Layered Protocol Stack; History of the Internet **Zoom tutorial (10:30-12:00):** Introduction and overview of the subject The "why and how" of layers in the protocol stack **Zoom/Teams Lab 1**: Setting up the VM and starting Wireshark

2	9 Aug	**Lecture videos:** 2.1: The Application Layer 2.2: Application Layer Programming in Python **Zoom tutorial (10:30-12:00):** Data flow in an application Client and server perspective for simple protocols Collaborative workshop on application layer **Zoom/Teams Lab 2:** Looking at common applications' network traffic in Wireshark Measurement and statistical analysis
3	16 Aug	**Lecture videos:** 3.1: The Transport Layer - Design 3.2: The Transport Layer - TCP & UDP **Short Zoom tutorial (10:30-11:00):** Transport layer, TCP & UDP / quiz preparation **Zoom/Teams Lab 3:** Transport layer in Wireshark TCP and UDP performance measurement TCP variant behaviour under network congestion **Notes:** Quiz 1 Monday 11:00-12:00 - Application and Transport Layer
4	23 Aug	**Lecture videos:** 4: The Network Layer at the Data Plane **Zoom tutorial (10:30-12:00):** The network layer The role of the data plane The role of routers in the Internet **Zoom/Teams Lab 4:** A first look at IP in Wireshark Static routing implementation and behaviour

5	30 Aug	**Lecture videos:** 5.1: Network Layer Control Plane Design 5.2: Network Layer Control Plane Implementation (Routing Protocols) **Zoom tutorial (10:30-12:00):** Control plane vs. data plane Routing logic and implementation considerations Distance vector routing and the Bellman-Ford algorithm **Zoom/Teams Lab 5:** Routing protocols part 1 - RIP
6	6 Sept	**Lecture videos:** Review lecture 5.1 and 5.2 again (this is a large topic!) **Short Zoom tutorial (10:30-11:00):** Link state routing protocols and the Dijkstra algorithm **Zoom/Teams Lab 6:** Routing protocols part 2 - OSPF **Notes:** Quiz 2 Monday 11:00-12:00 - Network Layer (no IP addressing)
7	13 Sept	**Lecture videos:** 6.1: MAC Protocols **Short zoom tutorial (10:30-11:00):** Review of IP addressing - avoiding common mistakes **Zoom/Teams Lab 7:** Layer 2 in Wireshark - examining the MAC header and looking at ARP **Notes:** IP Addressing Test Attempt #1 Monday 11:00
Stuvac	20 Sept	No class this week

8	27 Sept	**Lecture videos:** 6.2: Physical and Data Link Layer **Short zoom tutorial (10:30-11:00):** Physical and data link layer **Zoom/Teams Lab 8:** Layer 2 behaviour **Notes:** IP Addressing Test Attempt #2 Monday 11:00
9	4 Oct	No class - public holiday (Labour Day in NSW). We will run an extra session in StuVac in November (01/11/2021) to make up the lost day. Spend this week revising and practicing your laboratory!
10	11 Oct	**Lecture videos:** Putting it all together - a deep dive into an HTTP/HTTPS transaction **Short zoom tutorial (10:30-11:00):** Examination of complex network interactions **Zoom/Teams Lab 9:** Advanced traffic analysis (including statistical analysis) Application layer tuning **Notes:** Quiz 3 Monday 11:00 - Physical and Data Link Layer
11	18 Oct	**Lecture videos:** Revision for final exam **Short Zoom tutorial (10:30-11:00):** Final exam information and revision material **Zoom/Teams Lab 10:** Practice and preparation for the lab exam (Week 12) **Notes:** IP Addressing Test Attempt #3 Monday 11:00

12	25 Oct	No lectures - final exam to be conducted via Zoom interview **Notes:** Final exam
Make-up class due to public holiday in Week 9	1 Nov	No lectures - lab exam only

Assessment

Assessment task 1: Review Quizzes

Intent: Regular quizzes are held each block to give students feedback on the progress in understanding key concepts and procedures.

Objective(s): This assessment task addresses the following subject learning objectives (SLOs):

1

This assessment task contributes to the development of the following Course Intended Learning Outcomes (CILOs):

C.1

Type: Quiz/test

Groupwork: Individual

Weight: 15%

Task: A 60 minute online quiz will be held on the dates and times specified in the Program.

Due: Quiz 1 : Week 3;
Quiz 2 : Week 6; and
Quiz 3 : Week 9.

Further information: feedback on quizzes is provided in the tutorial class immediately following the quiz. Feedback from quiz 1 is, therefore, provided prior to the census date for the session.

Assessment task 2: Laboratory Test

Intent: Lab activities allow students to link theory and practice using industry standard tools and techniques. Students will capture packets using the 'wireshark' software, and analyse the composition, flow and timing of packets and frames in a very similar way to what a professional telecommunication engineer would do in configuring and troubleshooting a real-world network. In the lab exam, students will demonstrate their capabilities to analyse traffic, identify faults and measure network performance in a simulated network environment.

Objective(s): This assessment task addresses the following subject learning objectives (SLOs):

1, 2 and 3

This assessment task contributes to the development of the following Course Intended Learning Outcomes (CILOs):

B.1

Type: Laboratory/practical

Groupwork: Individual

Weight: 25%

Task: Students will retrieve an obfuscated Mininet lab exam script via Git, which they will execute in their virtual machine image. Using this script, you will need to complete a series of tasks on the emulated network, including (but not limited to) traffic analysis, route analysis, port scans, and various types of performance testing. Performance metrics may include measurements such as latency, jitter, packet loss and throughput. You will be expected to describe exactly how you performed each test that you used and provide a technically accurate interpretation of the results. The task will be a restricted open-book exam.

Due: You will perform this assessment task individually in Week 12. The task will be released at the start of your scheduled laboratory session, and you will need to submit your answers within the specified time period as directed by your lecturer.

Criteria: Completeness (50%) - Did you complete all parts of the lab examination? Did you miss any important faults or significant deviations between the expected and actual network behaviour? Have you adequately interpreted each of your observations?

Accuracy (50%) - How accurate and precise were your measurements and observations? Did you correctly calculate any required efficiencies, overheads, throughputs, latencies or other metrics? Did you correctly apply appropriate statistical methods (e.g. calculation of means, standard deviations etc.)?

Assessment task 3: Final Exam

Intent: This provides an opportunity for students to demonstrate their individual understanding of key concepts and procedures as would be used in an industrial setting

Objective(s): This assessment task addresses the following subject learning objectives (SLOs):

1 and 4

This assessment task contributes to the development of the following Course Intended Learning Outcomes (CILOs):

C.1

Type: Examination

Groupwork: Individual

Weight: 40%

Task: This will be conducted in the form of an on-line (Zoom) interview which will run for approximately 30 minutes. Each student will be allocated a specific time slot for their interview (subject to negotiation with the Coordinator).

Due: The online interview will be conducted in Week 11.

Assessment task 4: IP Addressing Test

Intent: To assure that all students passing the subject have a minimum level of understanding of critically important concepts such as IP addressing, subnetting and supernetting.

Objective(s): This assessment task addresses the following subject learning objectives (SLOs):

1

This assessment task contributes to the development of the following Course Intended Learning Outcomes (CILOs):

C.1

Type: Quiz/test

Groupwork: Individual

Weight: 20%

Task: Take the online IP addressing test at the time specified in the Program. You may have up to three attempts at this task. You will receive the highest mark exceeding 80%; if you fail to reach the 80% threshold by the third attempt, you will receive a mark of zero for this task.

Due: IP Test attempt 1 : Week 7;
IP Test attempt 2 : Week 8;
IP Test attempt 3 : Week 10.

Assessment feedback

Feeback on quizzes (including attempts at the IP addressing test) will be provided individually upon request. Feedback on the "interview" final exam will be provided at the end of the interview. Feedback on the lab exam will be provided online via Canvas.

Minimum requirements

In order to pass the subject, a student must achieve an overall mark of 50% or more.

Required texts

J. Kurose and K. Ross, *Computer Networking A Top-Down Approach*, 7th ed., Pearson Education.

Other resources

There is a wealth of information on communication protocols. The UTS library has a very large collection of books and electronic resources that you can use to assist your learning in this subject. There are also many internet sites that are of use. Use Google to find them.

All students enrolled in this subject must have a valid login for UTS Canvas. It can be accessed through any web browser using the URL https://canvas.uts.edu.au/. If you are properly enrolled in the subject in MyStudentAdmin, then you will be automatically enrolled in Canvas. If you are not, then you should check your current enrolment in MyStudentAdmin. If this is correct, then contact the IT Support Helpdesk.

Graduate attribute development

For a full list of the faculty's graduate attributes refer to the FEIT Graduate Attributes webpage.

For the contribution of subjects taken in the Bachelor of Engineering (Honours) or Master of Professional Engineering to the Engineers Australia Stage 1 Competencies, see the faculty's Graduate Attributes and the Engineers Australia Stage 1 Competencies webpage.

Assessment: faculty procedures and advice

Marking criteria

Marking criteria for each assessment task is available on the Learning Management System: Canvas.

Extensions

When, due to extenuating circumstances, you are unable to submit or present an assessment task on time, please contact your subject coordinator before the assessment task is due to discuss an extension. Extensions may be granted up to a maximum of 5 days (120 hours). In all cases you should have extensions confirmed in writing.

Special consideration

If you believe your performance in an assessment item or exam has been adversely affected by circumstances beyond your control, such as a serious illness, loss or bereavement, hardship, trauma, or exceptional employment demands, you may be eligible to apply for Special Consideration.

Late penalty

For Graded subjects:

Work submitted late without an approved extension is subject to a late penalty of 10 per cent of the total available marks deducted per calendar day that the assessment is overdue (e.g. if an assignment is out of 40 marks, and is submitted (up to) 24 hours after the deadline without an extension, the student will have four marks deducted from their awarded mark). Work submitted after five calendar days is not accepted and a mark of zero is awarded.

For some assessment tasks a late penalty may not be appropriate – these are clearly indicated in the subject outline. Such assessments receive a mark of zero if not completed by/on the specified date. Examples include:

a. weekly online tests or laboratory work worth a small proportion of the subject mark, or
b. online quizzes where answers are released to students on completion, or
c. professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date, or
d. take-home papers that are assessed during a defined time period, or
e. pass/fail assessment tasks.

For Pass/Fail subjects:

Work submitted late without an approved extension will only be assessed at the subject coordinator's discretion. Students who do not submit assessment tasks by the due dates may be referred to the Responsible Academic Officer under Student Rule 3.8.2, and a fail result may be recorded for the subject.

Querying results

If you believe an error may have been made in the calculation of your result in an assessment task or the final result for the subject, it is possible to query the result with the Subject Coordinator within five (5) working days of the date of release of the result.

Academic liaison officer

Academic liaison officers (ALOs) are academic staff in each faculty who assist students experiencing difficulties in their studies due to: disability and/or an ongoing health condition; carer responsibilities (e.g. being a primary carer for small children or a family member with a disability); and pregnancy.

ALOs are responsible for approving adjustments to assessment arrangements for students in these categories. Students who require adjustments due to disability and/or an ongoing health condition are requested to discuss their situation with an accessibility consultant at the Accessibility Service before speaking to the relevant ALO.

Statement about assessment procedures and advice

This subject outline must be read in conjunction with the Coursework Assessments policy and procedures.

Statement on copyright

Teaching materials and resources provided to you at UTS are protected by copyright. You are not permitted to re-use these for commercial purposes (including in kind benefit or gain) without permission of the copyright owner. Improper or illegal use of teaching materials may lead to prosecution for copyright infringement.

Statement on plagiarism

Plagiarism and academic integrity

At UTS, plagiarism is defined in Rule 16.2.1(4) as: 'taking and using someone else's ideas or manner of expressing them and passing them off as ... [their] own by failing to give appropriate acknowledgement of the source to seek to gain an advantage by unfair means'.

The definition infers that if a source is appropriately referenced, the student's work will meet the required academic standard. Plagiarism is a literary or an intellectual theft and is unacceptable both academically and professionally. It can take a number of forms including but not limited to:

- copying any section of text, no matter how brief, from a book, journal, article or other written source without duly acknowledging the source
- copying any map, diagram, table or figure without duly acknowledging the source
- paraphrasing or otherwise using the ideas of another author without duly acknowledging the source
- re-using sections of verbatim text without using quote marks to indicate the text was copied from the source (even if a reference is given).

Other breaches of academic integrity that constitute cheating include but are not limited to:

- submitting work that is not a student's own, copying from another student, recycling another student's work, recycling previously submitted work, and working with another student in the same cohort in a manner that exceeds the boundaries of legitimate cooperation
- purchasing an assignment from a website and submitting it as original work
- requesting or paying someone else to write original work, such as an assignment, essay or computer program, and submitting it as original work.

Students who condone plagiarism and other breaches of academic integrity by allowing their work to be copied are also subject to student misconduct Rules.

Where proven, plagiarism and other breaches of misconduct are penalised in accordance with UTS Student Rules Section 16 – Student misconduct and appeals.

Avoiding plagiarism is one of the main reasons why the Faculty of Engineering and IT is insistent on the thorough and appropriate referencing of all written work. Students may seek assistance regarding appropriate referencing through UTS: HELPS.

Work submitted electronically may be subject to similarity detection software. Student work must be submitted in a format able to be assessed by the software (e.g. doc, pdf (text files), rtf, html).

Further information about avoiding plagiarism at UTS is available.

Retention of student work

The University reserves the right to retain the original or one copy of any work executed and/or submitted by a student as part of the course including, but not limited to, drawings, models, designs, plans and specifications, essays, programs, reports and theses, for any of the purposes designated in Student Rule 3.9.2. Such retention is not to affect any copyright or other intellectual property right that may exist in the student's work. Copies of student work may be retained for a period of up to five years for course accreditation purposes. Students are advised to contact their subject coordinator if they do not consent to the University retaining a copy of their work.

Statement on UTS email account

Email from the University to a student will only be sent to the student's UTS email address. Email sent from a student to the University must be sent from the student's UTS email address. University staff will not respond to email from any other email accounts for currently enrolled students.