TELE3118

Network Technologies

Term 3, 2022

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Hassan Habibi Gharakheili	h.habibi@unsw.edu.au		Room 417, EE building (G17)	+61 (2) 9385 5176

School Contact Information

Consultations: Lecturer consultation times will be advised during the first lecture. You are welcome to email the tutor or laboratory demonstrator, who can answer your questions on this course and can also provide you with consultation times. ALL email enquiries should be made from your student email address with ELEC/TELExxxx in the subject line; otherwise they will not be answered.

Keeping Informed: Announcements may be made during classes, via email (to your student email address) and/or via online learning and teaching platforms – in this course, we will use Moodle https://moodle.telt.unsw.edu.au/login/index.php. Please note that you will be deemed to have received this information, so you should take careful note of all announcements.

Student Support Enquiries

For enrolment and progression enquiries please contact Student Services

Web

Electrical Engineering Homepage

Engineering Student Support Services

Engineering Industrial Training

UNSW Study Abroad and Exchange (for inbound students)

UNSW Future Students

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

Email

Engineering Student Support Services – current student enquiries

- e.g. enrolment, progression, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students – potential student enquiries

- e.g. admissions, fees, programs, credit transfer

Course Details

Units of Credit 6

Summary of the Course

- Network architectures in terms of topology, role (client/server, peer-to-peer), and layered specification.
- Packet and circuit switching.
- Physical characteristics of network transmission links. Medium access control protocols for wired links (e.g., Ethernet) and wireless links (e.g., 802.11).
- Protocols for error and flow control and their link-layer application. Interconnection of networks using bridges, switches, and routers. Routing techniques, including Dijkstra's algorithm, distance vector, and link-state routing.
- Addressing and naming. Network congestion control.
- End-to-end protocols for matching applications to networks, including TCP and UDP.
- Network applications, such as web (HTTP), email (SMTP, POP, IMAP), and streaming media (e.g., VOIP).

Course Aims

This course aims to develop a fundamental understanding of the architecture of communication networks such as the Internet. It will introduce students to the layered communication protocol stack (referred to as the TCP/IP stack in the Internet context), and progressively work through the functions and technologies at the various layers. Topics covered will include the physical medium, medium access mechanisms, IP addressing and routing, TCP congestion control, and applications such as the web, streaming media and DNS.

Course Learning Outcomes

After successfully completing this course, you should be able to:

Learning Outcome	EA Stage 1 Competencies
1. Describe the role of layers in the architecture of a communication system	PE1.1, PE1.2, PE1.3, PE1.5, PE2.1, PE2.2
2. Evaluate medium access mechanisms suitable to different pyhsical media	PE1.1, PE1.2, PE1.3, PE1.5, PE2.1, PE2.2
3. Design simple data networks by constructing appropriate IP addresses and routes	PE1.1, PE1.2, PE1.3, PE1.5, PE2.1, PE2.2, PE3.3, PE3.4, PE3.6
4. Analyse mechanisms for reliability and congestion-control in the internet	PE1.1, PE1.2, PE1.3, PE1.5, PE2.1, PE2.2
5. Recognise the steps by which applications such as the web operate	PE1.1, PE1.2, PE1.3, PE2.1, PE2.2
6. Construct client-server applications that operate over the	PE1.1, PE1.2, PE1.3, PE1.5,

Learning Outcome	EA Stage 1 Competencies
Internet	PE2.1, PE2.2, PE3.3, PE3.4, PE3.6

Targeted Graduate Capabilities:

Electrical Engineering and Telecommunications programs are designed to address the following targeted capabilities which were developed by the school in conjunction with the requirements of professional and industry bodies:

- The ability to apply knowledge of basic science and fundamental technologies;
- The skills to communicate effectively, not only with engineers but also with the wider community;
- The capability to undertake challenging analysis and design problems and find optimal solutions;
- Expertise in decomposing a problem into its constituent parts, and in defining the scope of each part;
- A working knowledge of how to locate required information and use information resources to their maximum advantage;
- Proficiency in developing and implementing project plans, investigating alternative solutions, and critically evaluating differing strategies;
- An understanding of the social, cultural, and global responsibilities of the professional engineer;
- The ability to work effectively as an individual or in a team;
- An understanding of professional and ethical responsibilities;
- The ability to engage in lifelong independent and reflective learning.

UNSW Graduate Capabilities:

The course delivery methods and course content directly or indirectly address a number of core UNSW graduate capabilities, as follows:

- Developing scholars who have a deep understanding of their discipline, through lectures and solutions of analytical problems in tutorials and assessed by assignments and written examinations.
- Developing rigorous analysis, critique, and reflection, and the ability to apply knowledge and skills to solving problems. These will be achieved by the laboratory experiments and interactive checkpoint assessments and lab exams during the labs.
- Developing capable independent and collaborative enquiry, through a series of tutorials spanning the duration of the course.
- Developing digital and information literacy and lifelong learning skills through assignment work.
- Developing independent, self-directed professionals who are enterprising, innovative, creative, and responsive to change, through challenging design and project tasks.

Teaching Strategies

Delivery Model:

The lectures for this course will include online lectures and discussions. Recorded versions of the lectures will be provided when possible, but do not substitute for live lectures, since the course continually evolves to stay updated with advances in network technology, and provides live discussions on topical issues in which students are encouraged to participate actively.

The tutorials will focus on problem-solving, which will not only consolidate and apply the theory learnt in the lectures, but also provide an opportunity for reflection, critical thinking, and discussion.

The laboratory assignments and project will stress the applicability of the course material to the real world. In-lab experiments will provide first-hand observation of and experimentation with the technologies used on the Internet. The project will provide an opportunity to design and implement a real-world application that works over the Internet.

Learning in this Course:

You are expected to attend lectures, tutorials, labs, and the mid-term exam in order to maximise learning. You must prepare well for your laboratory classes and your lab work will be assessed. In addition to the lecture notes, you should read relevant sections of the recommended text. Reading additional texts will further enhance your learning experience. Group learning is also encouraged. UNSW assumes that self-directed study of this kind is undertaken in addition to attending online classes throughout the course.

Tutorial Classes:

You should attempt all of your problem sheet questions in advance of attending the tutorial classes. The importance of adequate preparation prior to each tutorial cannot be overemphasized, as the effectiveness and usefulness of the tutorial depends to a large extent on this preparation. Group learning is encouraged. Answers for these questions will be discussed during the tutorial class and the tutor will cover the more complex questions in the tutorial class.

Laboratory Program:

The laboratory schedule is deliberately designed to provide practical, hands-on exposure to the concepts conveyed in lectures soon after they are covered in class. You are required to attend laboratory from Week 2 to Week 10. Laboratory attendance WILL be recorded. While you are expected to attend the lab session that you are enrolled in, if you cannot then you may arrange with lab demonstrators to attend a different session of the same lab (if space permits), but unfortunately other catch-up labs cannot be offered after the scheduled lab session. When attending labs, make sure that you wear enclosed footwear (i.e. no thongs/sandals) since if you don't the lab demonstrators will have to ask you to leave the lab.

Laboratory Exemption:

There is no laboratory exemption for this course. Regardless of whether equivalent labs have been completed in previous courses, all students enrolled in this course must take the labs. If, for medical reasons, (note that a valid medical certificate must be provided) you are unable to attend a lab, you will need to apply for a catch-up lab during another lab time, as agreed by the laboratory coordinator.

Additional Course Information

Credits:

This is a 6 UoC course, and the expected workload is 15 hours per week throughout the 10-week term. It includes lectures, laboratories, and tutorials. Supervised labs are held 3 hours per week; however, you will be expected to work on the project outside of designated lab hours.

Relationship to Other Courses:

This is a 3rd-year undergraduate course in the School of Electrical Engineering and Telecommunications. It is a core course for students following a BE (Telecommunications) program and other combined degree programs, and an elective for the BE (Electrical) program.

Pre-requisites and Assumed Knowledge:

The pre-requisites for this course include DESN2000, ELEC2141, and COMP1511 or COMP1521. They provide useful background about digital circuits, embedded systems, interfacing to hardware, operating systems, and programming skills which are crucial for network technologies.

Following Courses:

This course provides an introduction to data networking and establishes the foundation for subsequent courses such as TELE3119 "Trusted Networks" which covers the security aspects of data networks, TELE4123 "Telecomms Design Proficiency", and TELE4642 "Network Performance" which studies tools and techniques for analysing the performance of data networks. Postgraduate courses that delve deeper into these topics include TELE9751
Switching Systems Design (about the internal operation of network devices such as routers and switches), TELE9752 Network Operations and Control (about managing and running networks), GSOE9758 Network Systems Architecture, and TELE9756 Advanced Networking (about selected network research topics). The course is a pre-requisite for

- Trusted Networks - TELE3119
- Network Performance - TELE4642
- Telecomms Design Proficiency - TELE4123

Workload:

It is expected that you will spend at least **15 hours per week** studying a 6 UoC course, from Week 1 until the final assessment, including both online classes and independent, self-directed study. In periods where you need to complete assignments or prepare for examinations, the workload may be greater. Over-commitment has been a common source of failure for many students. You should take the required workload into account when planning how to balance study with employment and other activities.

Attendance:

Regular and punctual attendance at all classes is expected. UNSW regulations state that if students attend less than 80% of scheduled classes they may be refused final assessment.

General Conduct and Behaviour:

Consideration and respect for the needs of your fellow students and teaching staff is an expectation. Conduct which unduly disrupts or interferes with a class is not acceptable, and students may be asked to leave the class.

Assessment

Assessment requirements

Material submitted for assessment must:

- Be submitted before the deadline. Late submissions will be penalised, potentially by receiving a mark of 0.
- Be original work by the student and not involve plagiarism. Students who have been found to have plagiarised in a TELE3118 assessment item may have the maximum number of marks for that assessment item subtracted from their overall course mark, e.g. -10% if you have been found to have plagiarised in your project.
- Be self-contained in that it can be fully understood independent of course materials (e.g. lecture notes)
- Demonstrate skills and understanding of knowledge that are covered by the course.

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Labs	20%	Not Applicable	1, 2, 3, 4, 5, 6
2. Project	10%	Not Applicable	1, 5, 6
3. Mid-session Exam	30%	Not Applicable	1, 2, 3
4. Final Exam	40%	Not Applicable	1, 2, 3, 4, 5, 6

Assessment 1: Labs

In-lab experiments will provide hands-on experience with networking technologies. You are required to prepare beforehand by reading the handouts posted on the course web page. They will stress the applicability of the course material to the real world. They will provide first-hand observation of and experimentation with the technologies used on the Internet. There are 5 lab experiments, of which the best 4 you perform in will each contribute 5% towards your overall course mark. Marks for each lab session will be available to you by the next lab session.

Assessment marks will be awarded according to your preparation (completing set preparation exercises and correctness of these or readiness for the lab in terms of pre-reading), how much of the lab you were able to complete, your understanding of the experiments conducted during the lab, the quality of the code you write during your lab work, and your understanding of the topic covered by the lab.

Assessment 2: Project

The project will provide you with the opportunity to design and demonstrate a real Internet application. You will be expected to work on your programming assignment outside of designated lab hours, either on your own computing equipment or using the undergraduate computer labs in the EET building, and you will have to demonstrate your working software during week 10. The project will be marked according to the degree to which it meets the specifications. The project must be ``submitted'' by demonstrating it operating and explaining the source code to markers in your allocated marking session, which will be stated on the course web page.

Assessment 3: Mid-session Exam

Start date: 14/10/2022 02:00 PM
Assessment length: 120 minutes

The mid-session exam, held in week 5 (**Fri 14 Oct, 2-4pm**) and covering topics covered in weeks 1 to 5, is intended to give you timely feedback about your individual performance.

Assessment 4: Final Exam

Assessment length: 120 minutes

The final exam will provide a final test of competency and will cover all the topics taught in the course. Marks will be assigned according to the correctness of the responses.

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

Course Schedule

[View class timetable](#)

Timetable

Date	Type	Content
Week 1: 12 September - 16 September	Lecture	Physical Layer; Data Link Layer: Framing and Errors, MAC
Week 2: 19 September - 23 September	Lecture	Data Link Layer: Wireless and Ethernet; Switching
	Laboratory	Lab 1: Cabling
Week 3: 26 September - 30 September	Lecture	Network Layer Data Plane: Basics, Addressing; Routers
	Laboratory	Lab 1: Cabling
Week 4: 3 October - 7 October	Lecture	Network Layer Data Plane: Forwarding; IPv6, SDN
	Laboratory	Lab 2: Switching
Week 5: 10 October - 14 October	Lecture	Network Layer Control Plane: IGP Routing; BGP Routing; SDN and SNMP; **Mid-Session Test (Friday 14 Oct, 2-4pm)**
	Laboratory	Lab 3: IP and ICMP
Week 6: 17 October - 21 October	Lecture	Flexibility Week – Revision discussions and activities
Week 7: 24 October - 28 October	Lecture	Transport Layer: Basics, UDP and TCP
	Laboratory	Lab 4: Routing
Week 8: 31 October - 4 November	Lecture	Transport Layer: TCP congestion control; TCP fairness
	Laboratory	Lab 5: TCP
Week 9: 7 November - 11 November	Lecture	Application Layer: Basics, HTTP; SMTP, P2P
Week 10: 14 November - 18 November	Lecture	Application Layer: DNS and CDNs; Review
	Laboratory	Lab 6: Mini-Project

Resources

Prescribed Resources

Course resources including lecture notes, lab guides, tutorials will be available on the course web page: https://subjects.ee.unsw.edu.au/tele3118/

Recommended Resources

The recommended book for this course is by James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach, Global edition (7e), Pearson, 2017.

As an additional reference we will also be using the book by Andrew S. Tanenbaum and David J. Wetherall, Computer Networks, 5th edition, Pearson, 2011.

Academic Honesty and Plagiarism

Academic Honesty and Plagiarism

Plagiarism is the unacknowledged use of other people's work, including the copying of assignment works and laboratory results from other students. Plagiarism is considered a form of academic misconduct, and the University has very strict rules that include some severe penalties. For UNSW policies, penalties and information to help you avoid plagiarism, see https://student.unsw.edu.au/plagiarism. To find out if you understand plagiarism correctly, try this short quiz: https://student.unsw.edu.au/plagiarism-quiz.

General Conduct and Behaviour

Consideration and respect for the needs of your fellow students and teaching staff is an expectation. Conduct which unduly disrupts or interferes with a class is not acceptable and students may be asked to leave the class.

Academic Information

COVID19 - Important Health Related Notice

Your health and the health of those in your class is critically important. You must stay at home if you are sick or have been advised to self-isolate by NSW health or government authorities. Current alerts and a list of hotspots can be found here. **You will not be penalised for missing a face-to-face activity due to illness or a requirement to self-isolate**. We will work with you to ensure continuity of learning during your isolation and have plans in place for you to catch up on any content or learning activities you may miss. Where this might not be possible, an application for fee remission may be discussed.

If you are required to self-isolate and/or need emotional or financial support, please contact the Nucleus: Student Hub. If you are unable to complete an assessment, or attend a class with an attendance or participation requirement, please let your teacher know and apply for special consideration through the Special Consideration portal. To advise the University of a positive COVID-19 test result or if you suspect you have COVID-19 and are being tested, please fill in this form.

UNSW requires all staff and students to follow NSW Health advice. Any failure to act in accordance with that advice may amount to a breach of the Student Code of Conduct. Please refer to the Safe Return to Campus guide for students for more information on safe practices.

Dates to note

Important Dates available at: https://student.unsw.edu.au/dates

Student Responsibilities and Conduct

Students are expected to be familiar with and adhere to all UNSW policies (see https://student.unsw.edu.au/policy), and particular attention is drawn to the following:

Workload

It is expected that you will spend at least **15 hours per week** studying a 6 UoC course, from Week 1 until the final assessment, including both formal classes and *independent, self-directed study*. In periods where you need to complete assignments or prepare for examinations, the workload may be greater. Over-commitment has been a common source of failure for many students. You should take the required workload into account when planning how to balance study with employment and other activities.

Attendance

Regular and punctual attendance at all classes is expected. UNSW regulations state that if students attend less than 80% of scheduled classes they may be refused final assessment.

Work Health and Safety

UNSW policy requires each person to work safely and responsibly, in order to avoid personal injury and to protect the safety of others.

Special Consideration and Supplementary Examinations

[You must submit all assignments and attend all examinations scheduled for your course.](#) You can apply for special consideration when illness or other circumstances beyond your control interfere with an assessment performance. If you need to submit an application for special consideration for an exam or assessment, you must submit the application **prior to the start** of the exam or before the assessment is submitted, except where illness or misadventure prevent you from doing so. Be aware of the "fit to sit/submit" rule which means that if you sit an exam or submit an assignment, you are declaring yourself well enough to do so and cannot later apply for Special Consideration. For more information and how to apply, see https://student.unsw.edu.au/special-consideration.

Administrative Matters

On issues and procedures regarding such matters as special needs, equity and diversity, occupational health and safety, enrolment, rights, and general expectations of students, please refer to the School and UNSW policies:

https://student.unsw.edu.au/guide

https://www.engineering.unsw.edu.au/electrical-engineering/resources

Disclaimer

This Course Outline sets out description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle should be consulted for the up-to-date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline (as updated in Moodle), the description in the Course Outline/Moodle applies.

Image Credit

Synergies in Sound 2016

CRICOS

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Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.

Appendix: Engineers Australia (EA) Professional Engineer Competency Standard

Program Intended Learning Outcomes	
Knowledge and skill base	
PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	✔
PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline	✔
PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline	✔
PE1.4 Discernment of knowledge development and research directions within the engineering discipline	
PE1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline	✔
PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline	
Engineering application ability	
PE2.1 Application of established engineering methods to complex engineering problem solving	✔
PE2.2 Fluent application of engineering techniques, tools and resources	✔
PE2.3 Application of systematic engineering synthesis and design processes	
PE2.4 Application of systematic approaches to the conduct and management of engineering projects	
Professional and personal attributes	
PE3.1 Ethical conduct and professional accountability	
PE3.2 Effective oral and written communication in professional and lay domains	
PE3.3 Creative, innovative and pro-active demeanour	✔
PE3.4 Professional use and management of information	✔
PE3.5 Orderly management of self, and professional conduct	
PE3.6 Effective team membership and team leadership	✔