Aims

This course aims to develop a fundamental understanding of the architecture of data 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 email, web, and DNS. Particular emphasis will be given to the engineering design choices that have helped shape today’s Internet.

Learning outcomes

Upon successful completion of this course, you will be able to:

• Describe the role of layers in the architecture of a communication system
• Distinguish the architectural differences between telephone and data networks
• Evaluate medium access mechanisms suitable to different physical media
• Design simple data networks by constructing appropriate IP addresses and routes
• Analyse mechanisms for reliability and congestion-control in the Internet
• Recognise the steps by which applications such as email and web operate
• Construct client-server applications that operate over the Internet

The course delivery methods and course content address a number of core UNSW graduate attributes; these include:

The skills involved in scholarly enquiry: This course develops an attitude towards keeping up to date with the latest methods and technology.

An in-depth engagement with the disciplinary knowledge in its inter-disciplinary context: This course will help appreciate the societal context and technological and market advances in other disciplines that have helped shape the Internet.

The capacity for analytical and critical thinking and for creative problem solving: This course develops the ability to analyse and criticise the design decisions that have shaped the Internet, and to indulge in design problems outside the limits of principles and examples used in teaching.

The ability to indulge in independent and reflective learning.

The skills to appropriately locate, evaluate, and use relevant information.

The capacity to contribute to and work within the international community.
The skills required for collaborative and multi-disciplinary work.

Syllabus


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).

Context

Several other UNSW courses relate to TELE3118:

Prerequisites: ELEC2142 is a prerequisite because it describes how operating systems interface with peripherals (e.g. network interfaces) and applications (e.g. those using network services). ELEC2142 itself has courses that cover programming skills as a prerequisite, and these are crucial for the network programming aspects of TELE3118.

Complementary: TELE3119 builds upon TELE3118 by covering network security in more depth. TELE4642 considers network performance in depth. TELE9751 covers the internal design of network devices such as routers and switches, TELE9752 covers the operation and control of networks, and TELE9756 considers advanced aspects of networking.

Following: TELE3118 is a prerequisite of TELE3119 and TELE4692.

Old: TELE3018 Data Networks is the predecessor of TELE3118.

TELE3118 is worth 6 Units of Credit (UOC). “The normal workload expectations of a student are approximately 25 hours per Semester for each UOC” [https://my.unsw.edu.au/student/atoz/UnitsOfCredit.html]

The design of this course has been informed by papers published in the proceedings of the 1st ACM SIGCOMM Workshop on Computer Networking: Curriculum Designs and Educational Challenges, August 20, 2002 [http://www-net.cs.umass.edu/sigcomm/education/workshop1.html]
Delivery

TELE3118 classes consist of

**Lectures**: 3 hours per week, in weeks 1-12
  - to convey the basic architecture and technologies, and discuss the rationale behind the design choices

**Tutorials**: 1 hour every other week, in weeks 4 to 13
  - to learn problem-solving techniques, employ critical thinking, and reflect and discuss alternative methods.

**Labs**: 3 hours every other week, in weeks 2 to 13
  - in-lab experiments will provide hands-on experience with networking technologies.

The times and locations of classes are provided at https://my.unsw.edu.au/classutil/TELE_S2.html#TELE3118T2 . Allocations of students to lab/tutorial classes can be done through myUNSW. If you occasionally can't attend your allocated lab/tutorial class, e.g. due to sickness, then you are welcome to attend other classes provided space remains for students who have enrolled in that class.

The rationale behind the approach to teaching and learning

- This course covers a significant breadth of content, and in the **lectures** I hope to lay out the material in a structured logical way and present the rationale behind every step of the engineering design process of a data communications system. I believe this critical thought process through the design stages will help students in retaining the material much better. **I therefore strongly urge students to not miss classes, and to participate actively in class discussion.**

- 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** 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 in the Internet.
Schedule

A tentative schedule for TELE3118 lectures is provided below.

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>Network structures, Physical media, Circuit and packet switching</td>
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<tr>
<td>2</td>
<td>Framing, error detection and control</td>
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<tr>
<td>3</td>
<td>Hubs and bridges, layering, standards</td>
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<td>4</td>
<td>Medium Access Control: CSMA, CSMA/CD (“Ethernet”), CSMA/CA (“Wifi”)</td>
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<td>5</td>
<td>Addressing (MAC, ARP, DHCP, subnets, CIDR, NAT)</td>
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<tr>
<td>6</td>
<td>Mid-session exam, Internet protocols (IP, ICMP)</td>
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<td>7</td>
<td>Routing</td>
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<tr>
<td>8</td>
<td>Multicast and mobility</td>
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<tr>
<td>9</td>
<td>Transport protocol basics (UDP, ports, sockets API)</td>
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<tr>
<td>10</td>
<td>Transmission Control Protocol</td>
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<tr>
<td>11</td>
<td>Applications: Naming, web</td>
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<tr>
<td>12</td>
<td>Applications: Email, multimedia</td>
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Course materials

The prescribed textbook for this course is
This textbook will be supplemented by Recommended Reading which will available through the course web page. PDF copies of lecture notes will also be available through the course web page.

Course staff

The Lecturer for this course is Dr Tim Moors. http://www.eet.unsw.edu.au/~timm/
The lab demonstrators and tutor(s) for this course have not been decided at the time of writing.

Communication channels

Email: You can email the Lecturer of this course at t.moors@unsw.edu.au. Such emails must include the phrase “tele3118” in the subject line. Email can be used for administrative matters, but technical questions arising from the content of the course should be raised orally during consultation time. Lab demonstrators can be reached through tele3118labs@ee.unsw.edu.au and the tutor(s) through tele3118tutes@ee.unsw.edu.au
Consultation: The Lecturer is available for consultation in his office (341 of the EE&T building) only between 4-5pm Tuesdays.

Notifications to students: Notifications to students about this course will be made orally during lectures, may be posted on the course web page (which you are expected to check at least once per week), and may be emailed to your student email address, e.g. z1234567@zmail.unsw.edu.au (which you are expected to check at least once per day and to maintain so that messages sent to your student email address do not bounce).

Course web page: http://subjects.ee.unsw.edu.au/tele3118/

WebCT Vista: This course will use WebCT Vista for:
• Electronic distribution of this Course Outline
• Discussion forums
• Disseminating marks

WebCT Vista is a commercial (WebCT.com) software package designed to provide electronic support for teaching. UNSW's WebCT Vista system can be accessed through http://vista.elearning.unsw.edu.au/ . If you have problems using Vista, then see http://support.vista.elearning.unsw.edu.au/ for support. If that fails, then contact the Lecturer.

Assessment

Synopsis

<table>
<thead>
<tr>
<th>Weighting</th>
<th>Task</th>
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<tbody>
<tr>
<td>70%</td>
<td>Examinations</td>
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<tr>
<td></td>
<td>30% Mid-session exam (in week 6)</td>
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<td></td>
<td>40% Final exam (in Examinations Period)</td>
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<tr>
<td>20.00%</td>
<td>4 labs from Labs 1-5</td>
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<tr>
<td>10%</td>
<td>Mini-project to be demonstrated in week 13</td>
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<tr>
<td>5%</td>
<td>Bonus for course improvement</td>
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Late submissions will receive a mark of 0.
Examinations

The bulk (70%) of the assessment will take the form of closed-book examinations to be held during class time in week 6 (worth 30%), and during the final examinations period (worth 40%). The mid-session exam will provide feedback on your understanding of the material, and the final examination will provide a final test of competency.

If you require special consideration for an examination, then follow the procedures described at https://my.unsw.edu.au/student/atoz/SpecialConsideration.html. Pay particular attention to the need to apply within 3 days of the date of the examination for which you seek special consideration, and note that any alternate assessment given to recipients of special consideration may be conducted orally and will be no easier than the original assessment. Any supplementary final exam will likely be held in week 18 (6 weeks after the last week of session), and you should particularly consider this if you are planning to travel.

Labs

Experiments will be undertaken in each lab session. Each experiment is worth 5% of the grade, and the best four out of five marks will count towards the grade. Marks for each lab session will be available to you by the next lab session. You are required to prepare beforehand by reading the handouts posted on the course web-page.

Mini-project

A mini-project will require you to design and develop a real-world application that requires communication over the Internet. The final demonstration of the working code will be in week 13. Note that you will be expected to work on your mini-project outside of designated lab hours using the undergraduate computer labs in the EE building.

Bonus for course improvement

Students are encouraged to propose realistic ways to improve the course, and may be rewarded for such proposals by receiving a bonus mark (that adds to the 100% potential marks from other assessment tasks) of up to 5%. Such contributions (be they questions, answers, comments, pointers to useful course material, etc) must be made before the end of session.
Other matters

**Academic Honesty and Plagiarism**

Plagiarism is the unacknowledged use of other peoples work, including the copying of assignment works and laboratory results from other students. Plagiarism is considered a serious offence by the University and severe penalties may apply. You are expected to be familiar with what plagiarism is, and how to avoid it: http://www.lc.unsw.edu.au/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 mini-project.

**Administrative Matters**

On issues and procedures regarding such matters as special needs, equity and diversity, occupational heath and safety, enrolment, rights, and general expectations of students, please refer to the School policies: http://scoff.ee.unsw.edu.au/

**Continual Course Improvement**

Students are advised that the course is under constant revision in order to improve the learning outcomes of its students. Students are encouraged (in part by the potential for a bonus mark of up to 5%) to forward any feedback (positive or negative) on the course to the Lecturer. You can make anonymous comments through the “Course Improvement” forum under WebCT Vista.