Course Outline

Instructor Information and Office hours

Dr. Chung-Horng Lung
- Office: Mackenzie Building, Room 4434;
- Weblink: http://www.sce.carleton.ca/faculty/lung; Email: chlung@sce.carleton.ca

Office hours: TBD

TA Information and Office hours

Danish Sattar (danishsattar@cmail.carleton.ca)

Calendar Description

This course assumes a general knowledge of computer networks and provides project-oriented level experience in the design of communication systems to meet user requirements. Lectures on teletraffic analysis; system specification and design: requirements analysis, solution alternatives, evaluation of alternative technologies, design, costing, implementation, and testing.

Prerequisites

Fourth year status in Communications Engineering. Students who have not satisfied the prerequisites for this course must either either: (a) withdraw from the course, (b) submit a prerequisite waiver online at www.sce.carleton.ca/ughelp, or (c) will be deregistered from the course after the last day to register for courses in the term.

Students who have not satisfied the prerequisites for this course must either withdraw from the course or obtain a prerequisite waiver by visiting the Engineering Undergraduate Academic Support Office.

Assumed Knowledge

Upon entry into this course, students are expected to have knowledge of: Network layers and functionalities of each layer; Basic network routing techniques; and TCP/IP networking concepts.
Course Objectives

1. Develop expertise in emerging computer network technologies and industry-standard tools.
2. Extend and integrate existing systems to meet new requirements in computer networks.
3. Construct moderately complex network systems using industrial-quality software.
4. Work independently and cooperatively in groups.
5. Communicate the design effectively to peers in both oral and written forms in a collaborative environment.
6. Develop problem solving skills in network systems.

Learning Outcomes

1. Understand the fundamentals of emerging computer network technologies, e.g., Software-defined Networking (SDN), Network Function Virtualization (NFV), Cloud Networking, Containers, etc.
2. Develop hands-on skills using industry-standard tools for emerging network technologies.
3. Understand practical issues in network systems and develop problem solving skills through experiments.
4. Develop skills for problem analysis and evaluation of design alternatives.
5. Design, implement, test, evaluate, and document a reasonably complex network system for a self-proposed project using the advanced technologies and tools.
6. Work in a team using industry-standard tools to produce a project on schedule.
7. Present and communicate effectively the problem and design to peers and the class in both oral and written forms.

Graduate Attributes (GA’s)

The Canadian Engineering Accreditation Board requires graduates of engineering programs to possess 12 attributes at the time of graduation. Activities related to the learning outcomes listed above are measured throughout the course and are part of the department’s continual improvement process. Graduate attribute measurements will not be taken into consideration in determining a student’s grade in the course. For more information, please visit: https://engineerscanada.ca/.

<table>
<thead>
<tr>
<th>Graduate Attribute</th>
<th>Learning Outcome(s)</th>
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<tbody>
<tr>
<td>• GA5.4 Information from relevant publications: Related experiments and course</td>
<td>1, 4, 5</td>
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<tr>
<td>project are intended to develop students’ skills in problem identification,</td>
<td></td>
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<td>analysis, and emerging solutions in networking from relevant publications.</td>
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<tr>
<td>• GA5.5 Limitations of such tools and the assumptions inherent in their use: Related</td>
<td>2, 3, 5</td>
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<td>activities are intended to develop hands-on skills using tools and understand</td>
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<td>the constraints of various tools.</td>
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<tr>
<td>• GA6.1 Personal and group time management: The course project and related</td>
<td>5, 6</td>
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<tr>
<td>activities in design, implementation, evaluation, and report preparation are</td>
<td></td>
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<tr>
<td>intended to develop skills in personal and group time management.</td>
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Textbooks (or other resources)

The main textbook is:


Additional technical papers and materials will be used for the course and assignments. The following is a list of suggested references for general network switching and routing technologies.


Evaluation and Grading Scheme

- **Lab exercises: 10%**. Labs (4 hours each week) are mandatory, and they are essential for course project development and various learning outcomes.

- **Quizzes (4 – 5): 5%**. Quizzes will be given in class or in the lab session with or without advanced announcement. The intention of quizzes is to help students review and better understand the course materials.

A major component of the course is a project conducted in a group of 2 or 3, which is important in building skills in communications and team work. Each team member must participate in all aspects of the project: problem identification and analysis, design, implementation, testing, debugging, performance evaluation, etc. Equal contributions from all team members are expected. Each important aspect (or milestone) of the project will be evaluated by the instructor and the TA. Peer evaluation will also be conducted. Students who do not participate in the project will receive a mark of 0.

A presentation will be scheduled for each of the phases – project proposal, design review, and implementation – which are described as follows:
• **Project Proposal and Presentation: 10%**. Project proposal presentation is critical in problem identification and initial analysis.

• **Project Design Review: 10%**. The review will be primarily based on the technical aspect of the approach to the problem and evaluation of design alternatives.

• **Project Implementation, Testing, Performance Evaluation: 20%**. Project implementation is the realization of the proposed solution. It is an application of course and lab materials to a network problem.

• **Project Final Assessment: 45%**. The report is the major component of the project. Oral presentations have limited time, and comments/suggestions may be provided for the presentations. The final report is expected to address some of the comments and document various aspects of the project in detail. The essential components of a project include a problem statement, motivation, contribution(s) of each team member, approach/methodology, implementation, experiments, and results, and conclusions.

**Tentative Week-by-Week breakdown**

1. Course Introduction, Overview of Operating Systems and Linux
2. Concurrency and Semaphores
4. The Overflow Specification
5. SDN Controller
6. Cloud Networking, SDN in Datacentre
7. SDN in Other Environments
8. Network Functions Virtualization (NFV)
9. NFV Using Virtual Machines and Containers
10. SDN Applications, MPLS Traffic Engineering
11. Business Ramifications
12. Segment Routing and SDN

**General Regulations**

**Attendance:** Students are expected to attend all lectures and lab periods. The University requires students to have a conflict-free timetable. For more information, see the current *Undergraduate Calendar, Academic Regulations of the University, Section 2.1.3, Course Selection and Registration and Section 2.1.7, Deregistration.*

**Health and Safety:** Every student should have a copy of our Health and Safety Manual. A PDF copy of this manual is available online: [http://sce.carleton.ca/courses/health-and-safety.pdf](http://sce.carleton.ca/courses/health-and-safety.pdf)

**Deferred Term Work**: Students who claim illness, injury or other extraordinary circumstances beyond their control as a reason for missed term work are held responsible for immediately informing the instructor concerned and for making alternate arrangements with the instructor and in all cases this must occur no later than three (3.0) working days after the term work was due.
The alternate arrangement must be made before the last day of classes in the term as published in the academic schedule. For more information, see the current Undergraduate Calendar, Academic Regulations of the University, Section 4.4, Deferred Term Work.

**Appeal of Grades**: The processes for dealing with questions or concerns regarding grades assigned during the term and final grades is described in the Undergraduate Calendar, Academic Regulations of the University, Section 3.3.4, Informal Appeal of Grade and Section 3.3.5 Formal Appeal of Grade.

**Academic Integrity**: Students should be aware of their obligations with regards to academic integrity. Please review the information about academic integrity at: https://carleton.ca/registrar/academic-integrity/. This site also contains a link to the complete Academic Integrity Policy that was approved by the University's Senate.

**Plagiarism**: Plagiarism (copying and handing in for credit someone else's work) is a serious instructional offense that will not be tolerated.

**Academic Accommodation**: You may need special arrangements to meet your academic obligations during the term. You can visit the Equity Services website to view the policies and to obtain more detailed information on academic accommodation at http://www.carleton.ca/equity/For an accommodation request, the processes are as follows:

- **Pregnancy obligation**: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details see https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf
- **Religious obligation**: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details see https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf
- **Academic Accommodations for Students with Disabilities**: The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult https://carleton.ca/pmc/students/dates-and-deadlines/ for the deadline to request accommodations for the formally-scheduled exam (if applicable).
- **Survivors of Sexual Violence**: As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic
accommodations as per Carleton’s Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: https://carleton.ca/sexual-violence-support/.

- **Accommodation for Student Activities:** Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf

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