Instructor:
Professor C. Huang
Room 4486ME
Tel: 520-5730
Email: huang@sce.carleton.ca
http://www.sce.carleton.ca/faculty/huang.html

Prerequisites:
SYSC 4602 and (SYSC 2004 or SYSC 2100), and third year status. Students who have not satisfied the prerequisites for this course must either a) withdraw from the course, or b) obtain a prerequisite waiver online at www.sce.carleton.ca/dept/us/academicsupport/forms, or c) will be deregistered from the course after the last day to register for courses.

Course Objectives:
Communications software architectures, protocols and operating systems. Application layer protocols, APIs and socket programming. P2P algorithms, network virtualization, SDN. Reliable data transfer algorithms, FSM, MSC. Network security. Multimedia applications, RTSP, CDN, DASH, RTP, RTCP. Packet scheduling algorithms, DiffServ, IntServ, RSVP. Traffic classification, cross-layer optimization.

Learning Outcomes:
1. know the layered structure of communication software and implementation challenges of each layer
2. know how to minimize the overheads introduced by operating systems when implementing communication protocol stack
3. can implement communication software using socket API
4. can design and implement protocols using Finite State Machine (FSM) and Message Sequence Chart (MSC)
5. know the implementation differences between stateful and stateless protocols
6. can design and implement protocols using typical data structures such as hashing tables, Trie and AVL tree
7. know how to implement peer-to-peer (P2P) systems with DHT
8. know how to design software for cloud computing, SDN, and NFV
9. know the concept and implementation requirements of QoS for multimedia applications
10. know how to implement packet scheduling algorithms
11. can design and implement security mechanisms with public and symmetric keys
12. can design software that utilizes cross-layer optimization

Graduate Attributes (GA’s):
1.4 Programming and algorithm
1.5 Computer systems
1.9 Communication networks
4.1 Clear design goals
4.2 Detailed design specifications and requirements
4.4 Design solutions
4.5 Design implementation
4.6 Alternative solution definition
5.1 Diagrams and engineering sketches
5.3 Tools for design, experimentation, simulation, visualization, and analysis

The Canadian Engineering Accreditation Board requires graduates of engineering programs to possess 12 attributes. Activities related to the learning outcomes listed above are intended to develop students' competence in the GA’s listed above. Data obtained from exam questions related to learning outcomes 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12 will be collected to assess students' progress towards achieving GA 1.4, 1.5, 1.9, 4.1, 4.2, 4.4, 4.5, 4.6, and 5.1.

In addition, data obtained from lab reports related to learning outcomes 3, 4, 5, 6, and 8 are intended to prepare students to undertake learning activities that develop competence in GA 1.4, 1.5, 1.9, 4.1, 4.2, 4.4, 4.5, 4.6, 5.1, 5.3.


References:

- Network Algorithmics, G. Varghese, Morgan Kaufmann, 2005
- Object-Oriented Network Protocols, S. Boecking, Addison Wesley, 2000
- http://www.ietf.org

Marking Scheme:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Attendance</td>
<td>10%</td>
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<tr>
<td>Lab</td>
<td>10%</td>
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<tr>
<td>Midterm 1</td>
<td>15%</td>
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Midterm 2 15%
Final Exam 50%

Final Exam is for the evaluation purposes only and will not be returned to the student. You will be able to make arrangements with the instructor or with the department office to see your marked final examination after the final grades have been made available.

Class Schedule:
14:35pm-15:55pm, Monday and Wednesday, 4332ME.

Checking Marks:
Lists of term marks will be posted within ten days (typically one week) after each lab/midterm is completed. It is each student’s responsibility to check that marks are correct or report any errors within one week after each mark is posted.

Laboratory and Tutorial:
8:35am-11:25am, Friday every odd week at ME4233.

TA Info:
QiaoLu@cmail.carleton.ca

Course Schedule:
1) Course arrangements, scope etc. Communication software architecture and the concept of protocol.
2) Application layer protocols. API and socket programming. Issue AS 1
3) HTTP and DNS protocols. Lab 1.
4) FSM. MSC. Reliable data transfer algorithms and stateful software design. Issue AS 2.
5) Data structures and algorithms. PA Session 1. Midterm 1.
6) P2P protocols and search engine.
8) Multimedia applications. SIP Protocol.
10) Cryptography.


12) Traffic classification and SDN. PA Session 2.

13) OpenFlow and NFV. Layer integration.

**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 1.2, Course Selection and Registration and Section 1.5, 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 2.6, 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 2.7, Informal Appeal of Grade and Section 2.8, 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/](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/](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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