Carleton UNIVERSITY | Department of Systems and Computer Engineering

SYSC 4502
Communications Software

Calendar description

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.

Includes: Experiential Learning Activity.

Lectures three hours a week, problem analysis three hours alternate weeks.

http://calendar.carleton.ca/undergrad/courses/SYSC/

Prerequisites

SYSC 2004 and SYSC 4602.

Prior knowledge

Students should have knowledge of:

- Object-Oriented Programming in one of the following programming languages: C++, Java, or Python
- Layered network architectures
- TCP/IP suite
- Circuit switching
- Packet switching
- Physical media
- Data transmission
- Multiplexing

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.

List of topics

- Course arrangements, scope etc. Communication software architecture and the concept of protocol
- Application layer protocols. API and socket programming
- HTTP and DNS protocols
- FSM, MSC, Reliable data transfer algorithms and stateful software design
- Data structures and algorithms
- P2P protocols and search engine
- Cloud computing
- Multimedia applications
- SIP Protocol
- QoS and traffic scheduling
- Cryptography
- Network security protocols
- Traffic classification and SDN
- OpenFlow and NFV
- Layer integration

Learning outcomes

By the end of this course, students should be able to:

- Know the layered structure of communication software and implementation challenges of each layer.
- Know how to minimize the overheads introduced by operating systems when implementing communication protocol stack.
- Implement communication software using socket API.
- Design and implement protocols using Finite State Machine (FSM) and Message Sequence Chart (MSC).
- Know the implementation differences between stateful and stateless protocols.
- Can design and implement protocols using typical data structures such as hashing tables, Trie and AVL tree.
- Know how to implement peer-to-peer (P2P) systems with DHT.
- Know how to design software for cloud computing, SDN, and NFV.
- Know the concept and implementation requirements of QoS for multimedia applications.
- Know how to implement packet scheduling algorithms.
- Design and implement security mechanisms with public and symmetric keys.
- Design software that utilizes cross-layer optimization.

Graduate Attributes (GAs)

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/.

Graduate Attribute	Learning outcome(s)
1.9.S: Knowledge Base: Developed: Communication networks	1-3, 5, 7, 8
4.1: Design: Developed: Clear design goals	2, 10-12
4.6: Design: Developed: Alternate solution(s) definition	5, 6, 9
5.1: Use of Engineering Tools: Applied: Diagrams and engineering sketches	4
5.3: Use of Engineering Tools: Applied: Tools for design, experimentation, simulation, visualization, and analysis	4, 11, 12

Accreditation Units (AUs)

For more information about Accreditation Units, please visit: https://engineerscanada.ca/.

The course has a total of 46 AUs, divided into:

- Engineering Science: 75%
- Engineering Design: 25%

Instructor and TA contact

Specific to course offering (tbd)

Textbook (or other resources)

Specific to course offering (tbd)

Evaluation and grading scheme

Specific to course offering (tbd)

Breakdown of course requirements

Specific to course offering (tbd)

Tentative week-by-week breakdown

Specific to course offering (tbd)

General regulations

Specific to course offering (tbd)