Course Outline (<mark>Draft v0.9</mark>)

COMP 4203A for Winter 2024
Wireless Networks and Security

Course Information
Instructor: Tao Wan
Contact: taowan@cunet.carleton.ca
Classroom: Please check on Carleton Central for the room location.
Lectures: Thursdays & Fridays, 6:05 - 7:25 (online)
Course Website: https://brightspace.carleton.ca/d2l/le/content/220991/Home

Teaching Assistants
A list of teaching assistants and their contact/office hours information will be posted once the course starts.

Course Calendar Description

An introduction to wireless networks covering both networking designs and security aspects of modern wireless environments. Topics include 1) fundamentals of 4G/LTE, 5G, Wireless LAN (WLAN)/Wi-Fi, and Bluetooth, 2) security architecture of 4G, 5G, Wi-Fi, and Bluetooth; and 3) classic attacks against 4G, 5G, Wi-Fi, and Bluetooth.

Prerequisite(s): COMP 3203 or SYSC 4602.

Textbook(s) and Other Resources

- Michel Barbeau, *Wireless Mobile Communications, Networks & Security*, 2017.
- Upena Dalal, *Wireless Communication and Networks*, 2015. Available Online
    - Part 4 – Wirless Networks
- P.C. van Oorschot, *Computer Security and the Internet: Tools and Jewels from Malware to Bitcoin*, 2021.
    - Chapter 10 – Firewalls and Tunnels
    - Chapter 12 – Wireless LAN Security: 802.11 and Wi-Fi
- 3GPP Specifications
    - TS 23.401 (4G Archtiecture), TS 23.501 (5G Architecture),
    - TS 33.401 (4G Security), and TS 33.501 (5G Security)
- IEEE 802.11 Specifications

- o Clause 4 -General Description,
- o Clause 9 - Frame Format,
- o Clause 12 - Security
- WFA Specifications
  - o WFA WPA3 Specification
  - o WFA Passpoint Specification
- IETF Specifications
  - o RFC 3748 - Extensible Authentication Protocol (EAP)
  - o RFC 5247 - EAP Key Management Framework
  - o RFC 2865 - RADIUS
  - o RFC 5216 - EAP-TLS
  - o RFC 5281 - EAP-TTLS
  - o RFC 2759 - MS-CHAPv2
  - o RFC 5448 - EAP-AKA'
- Bluetooth Specifications
  - o Bluetooth Core Specification (v 5.0)

Topics Covered and Learning Outcomes

In this couse, we will learn fundamentals of the wireless networks we use everyday, including cellular/mobile networks (such as 4G and 5G), Wireless Local Area Networks (WLAN, aka Wi-Fi), and Bluetooth. We will also learn their security architectures, how they can be attacked.

Week	Date	Topic	Assignment
1	Jan 11	Course Introduction	
	Jan 12	Networking Foundamentals	**#1 Due**
2	Jan 18	Mobile Network (4G) Architecture	
	Jan 19	Mobile Network (5G) Architecture	
3	Jan 25	Wireless LAN (Wi-Fi) Architecture	
	Jan 26	Bluetooth Arechitecture	**#2 Due**
4	Feb 1	Wireless Open Source Projects (Hostapd, SRS-LTE, OAI, Open5GS)	
	Feb 2	4G Security Architecture	**#3 Due**
5	Feb 8	5G Radio Access Network (RAN)	
	Feb 9	5G Core Network Security	**Project Proposal Due**
6	Feb 15	5G Roaming Security	
	Feb 16	Mobile Network Attack #1	**#4 Due**
7	Feb 22	**No Class - Winter Break**	
	Feb 23		
8	Feb 29	Project Proposal Presentation	
	March 1	Project Proposal Presentation	
9	March 7	Mobile Network Attack #2	

	March 8	Wi-Fi Security Architecture	**#5 Due**
10	March 14	Wi-Fi Attack #1	
	March 15	Wi-Fi Attack #2	
11	March 21	Bluetooth Security Architecture	
	March 22	Bluetooth Attack #1	**#6 Due**
12	March 28	Bluetooth Attack #2	
	March 29	**No Class - Stationary Holiday**	**#7 Due**
13	April 4	Final Project Presentation	
	April 5	Final Project Presentation	**Project Report Due**

Assessment Scheme

Elements	Weight	Due Date
Class Participation	5	N/A
Assignments	35	See above
Project Proposal Presentation	5	**TBD**
Project Proposal Report	15	March 1
Final Project Presentation	15	**TBD**
Final Project Report	25	April 5

Class Participation (5 points): to earn this mark, you must actively and consistently participate in the class by asking and/or answering questions throughout the entire course.

Assignments (35 points): there will be 7 assignments, each worth of 5 points.

Project Proposal (20 points): consists of presentation and report. The presentation is worth 5 points, and the report is worth of 15 points. Project proposal report must include:

- **Who**: Project name and the members of the project. Both individual and group project are allowed. Group project should consists of only 2 students.
- **What**: A clear description of the exact problem you wish to solve.
- **Why**: detailed description of the motivation of the project. It should also include a "related work" section, describing what has been done before by others.
- **How**: description of your approach to the problem. For example, what open source projects do you plan to use? What data do you plan to collect? How will you evaluate your results?
- **Management plan**: describe the project milestones, and task assignment if it is a group project.

Final Project (40 points): consists of presentation and report, worth of 15 and 25 ponints respectively.

- The final report should be in the style of a scientific paper (e.g. a conference paper) and should present the project's motivation, approach, results, related work, and conclusions.
- The report should have appendix summaring the contributions of each member if it is a group project.
- All codes and data must be made available.

For any discrepancies or questions, first contact the TA.

Important Considerations

- **Late assignments** submitted after the deadline but within one day will receive a penalty of 10%. Late assignments over one day after the deadline will not be accepted and receive a mark of zero. Technical problems do not exempt you from this requirement, so you should attempt to submit your final submission at least one hour in advance of the due date and time.
- **Citation:** Everything you submit for evaluation (i.e., assignments, project proposal report, final project report.) must be the result of your words. If you use more than five consecutive words from a single source, please cite the source properly. Otherwise, it is considered plagiarism and an example of academic misconduct.
- **AI tools:** Everything you submit for evaluation (i.e., assignments, project proposal report, final project report.) must be the result of your own work without using any AI tool. This includes, but is not limited to, chatbots (e.g., ChatGPT, Google Bard, Bing Chat), research assistants (e.g., Elicit), and image generators (e.g., Stable Diffusion, Dall-E), etc. An exception to the above rule is made for automated grammar and punctuation checking tools (such as Grammarly).

Undergraduate Academic Advisors

The Undergraduate Advisors for the School of Computer Science are available in Room 5302HP; or by email at scs.ug.advisor@cunet.carleton.ca. The undergraduate advisors can assist with information about prerequisites and preclusions, course substitutions/equivalencies, understanding your academic audit and the remaining requirements for graduation. The undergraduate advisors will also refer students to appropriate resources such as the Science Student Success Centre, Learning Support Services and Writing Tutorial Services.

SCS Computer Laboratory

Students taking a COMP course can access the SCS computer labs. The lab schedule and location can be found at: https://carleton.ca/scs/tech-support/computer-laboratories/. All SCS computer lab and technical support information can be found at: https://carleton.ca/scs/tech-support/. Technical support staff may be contacted in-person or virtually, see this page for details: https://carleton.ca/scs/tech-support/contact-it-support/.

University Policies:

- **Academic Accommodations**

Carleton is committed to providing academic accessibility for all individuals. Please review the academic accommodation available to students here: https://students.carleton.ca/course-outline/.

- **Academic Integrity**

Student Academic Integrity Policy. Every student should be familiar with the Carleton University Student Academic Integrity policy. A student found in violation of academic integrity standards may be sanctioned with penalties which range from a reprimand to receiving a grade of F in the course, or even being suspended or expelled from the University. Examples of punishable offences include plagiarism and unauthorized collaboration. Any such reported offences will be reviewed by the office of the Dean of Science. More information on this policy may be found on the ODS Academic Integrity page: https://carleton.ca/registrar/academic-integrity/.

Plagiarism. As defined by Senate, "plagiarism is presenting, whether intentional or not, the ideas, expression of ideas or work of others as one's own". Such reported offences will be reviewed by the office of the Dean of Science. More information and standard sanction guidelines can be found here: https://science.carleton.ca/students/academic-integrity/.

Unauthorized Collaboration. Senate policy states that "to ensure fairness and equity in assessment of term work, students shall not co-operate or collaborate in the completion of an academic assignment, in whole or in part, when the instructor has indicated that the assignment is to be completed on an individual basis".