ECE 678 — Spring 2019

Wireless Protocols

Tuesday & Thursday 3:30–4:45pm
Harvill Building, Rm. 240
https://d2l.arizona.edu

General Information

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Office Hours: Tuesday and Thursday, 11am–12pm, and by appointment

Course Objectives and Motivation

Wireless systems have evolved rapidly over the last decade, first driven by a boom in smart phones and mobile video, and more recently by an unfolding "4th Industrial Revolution" (4IR), in which smart sensing, ubiquitous wireless communications, and cloud-based information processing are converging at a massive scale. Instances of this revolution are presented in "verticals," such as intelligent transportation, autonomous vehicles, smart cities/spaces, connected health, smart agriculture, and many others. The Internet-of-Things (IoT) offers a vision for 4IR, and is founded on the networking of a large number of IP-capable devices, including home appliances, HVAC sensors, smart power meters, UAVs, etc. The underlying wireless technologies surrounding these exciting applications include a heterogenous mix of systems and devices, some of which operate over unlicensed spectrum while others rely on licensed bands. Unlicensed wireless access is exemplified by the ubiquitous IEEE 802.11-based wireless LANs (a.k.a. Wi-Fi), which can be found everywhere; on campuses, malls, airports, hotels, restaurants, etc. Cellular networks, including 4G/LTE and upcoming 5G systems, operate mostly over licensed bands. 5G systems present a leap progress in cellular communications, promising much higher speeds (multi-Gbps per-user) and sub-millisecond end-to-end latency, not to mention unprecedented support for dense connectivity, wide coverage, high reliability, and long battery life. Such impressive performance is facilitated by advances in hardware (e.g., massive MIMO, steerable antennas), software (e.g., mobile edge computing, network slicing), and efficient network planning (e.g., cell densification, spectrum sharing).

The purpose of this course is to expose students to recent advances in wireless networks, focusing on novel protocol designs, and architectural concepts. Various topics will be covered (see attached list) through representative papers from top-tier conferences (e.g., MobiCom, MobiHoc, Sigcomm, INFOCOM, etc.), IEEE and ACM journals, magazines, and regulatory documents and standards (including FCC specifications). The class will emphasize discussion and debate, with the goal of strengthening students' critical and analytical thinking.

Prerequisites

- Introductory course on computer networking (e.g., ECE 478/578 or ECE 564).
- Graduate course in probability theory and random processes (e.g., ECE 503).

Class Structure

- **Class Material:** The class material will consist of assigned research papers, tutorial/survey articles, and standards documents (including FCC specifications). In addition, slides of presentations given by the instructor and students will be made available to the class, and will constitute a part of the class material. In each lecture, 1-2 papers will typically be assigned as "*required*". Additional papers may be provided as "*recommended reading*".

  Class material, including assigned papers and slides, will be posted on the D2L class page (https://d2l.arizona.edu) or emailed to students. To access the D2L page, you need to log in using your UA NetID and password.

- **Presentations/Discussions:** The lectures will consist of slide presentations and moderated discussions. A fraction of these presentations will be given by the instructor. The rest will be given by students and invited speakers. Each student will give at most two presentations throughput the semester, one of them possibly as a team presentation. Each presentation will be related to a specific topic, described in the attached list of topics, and will be based on assigned papers. The list of speakers and assigned papers will be announced later.

  For each seminar, **all students must read the the assigned "required papers" before coming to class.** The presentation will last for one hour, including discussion, questions, etc. The presenter(s) is required to send his/her slides to the instructor at least 2 days before the presentation (I will post all presentations on the class web page). Depending on the complexity and value of the discussed paper, the discussion of a given paper may extend over 1-2 lectures (including the quiz).

  Some Guidelines to Presenters:

  - Presenters should motivate the paper(s), discuss its goals, limitations, major assumptions, and contributions. Sufficient background on the topic should also be provided.
  - In preparing your presentation, you are allowed to cut-and-paste graphs and tables from the paper(s) being presented. You may also use slides already prepared by the original authors of the paper (if available online), but with proper acknowledgement and reference to the source of the material.
  - In addition to the "required papers", the presenter should also read the "recommended" papers (if any) of his/her assigned topic. Reading the "recommended" papers is optional for the rest of the class.

- **Class Interaction and Participation:** Because this is a seminar, students are expected to be fully engaged in the discussion by asking questions, raising issues, critiquing the presented ideas, responding to questions, etc. Part of the grade will be based on class participation. For their part, presenters need to be engaging and ensure an interactive and lively discussion with the audience.

- **Quizzes:** Following most presentations, there will be a short (e.g., 15 minutes) unannounced quiz to be taken by the whole class, except the presenters. The quiz will test your overall understanding of the assigned (and presented) paper, including its overall theme, its contributions, lessons learned, limitations, strong assumptions, main conclusions, etc. The quiz may also address issues brought (or missed) by the presenters. To be ready for the quiz, you should definitely read the paper(s) before coming to class.

Grading

Presentations	30%
Class Participation/Interaction	20%
Quizzes	50%