

CS 522WS Fall 2020

Mobile Systems and Applications

Instructor

[Dominic Duggan](#)

Contact: Canvas Email.

Class Schedule: Monday-Sunday.

Virtual Office Hours: Friday noon-1pm (Zoom) or by appointment.

Virtual Session URI: <https://stevens.zoom.us/j/92092668060>

Class Materials: <https://sit.instructure.com/courses/39179>

Course Description

Personal computing is now mobile and cloud-based. Disconnected mobile computing challenges many of the assumptions underlying much of today's distributed systems. "Cloud computing" provides a powerful background computing facility for mobile devices, but also raises important issues of trust and privacy. Many of these issues arise in critical yet sensitive domains such as electronic healthcare delivery. Mobile computing applications are location-aware or context-aware; the privacy implications of these applications are potentially profound for our society. Mobile, and increasingly location aware, gaming systems are now one of the largest sectors of the world entertainment industry. "Internet of Things" promises to make small mobile control and sensor devices, all communicating to the cloud, a ubiquitous part of our physical environment. The purpose of this course is to review the fundamentals of mobile systems and applications, and how they relate to services in the cloud. The course will review material from wireless communication, distributed systems, and security and privacy, as they pertain to the systems being studied. The course will involve programming mobile applications using Google Android, to get hands-on experience with the concepts being discussed in the class. A term assignment will involve the development of an Android app that demonstrates the integration of many of these concepts.

Course Objectives

The objective of this course is to introduce Computer Scientists to mobile computing and mobile applications, and their relationship to the cloud. The relationship between mobile computing and the cloud is profound, since it brings together the physical world that people inhabit and the virtual world, as represented by social networks and Web services. Having taken this course, students will be able to develop mobile software applications, that may interface to the cloud, and where appropriate will be able to investigate research topics in mobile and cloud computing.

Course Outcomes

1. **[Communication]** Describe wireless communication protocols, including cell phone and LAN protocols, and network protocols for mobile applications.
2. **[Applications]** Implement and run applications on a mobile computing platform.
3. **[Management]** Explain algorithms and strategies for data management and power management.
4. **[Context Awareness]** Explain the technical and business cases for location-based and context-based applications, and threats and solutions for protecting user privacy.
5. **[Security]** Describe threats and countermeasures for securing mobile devices.
6. **[Cloud]** Explain the opportunities and threats from cloud-based services for mobile applications, in domains such as healthcare delivery and mobile gaming.

Recommended Textbooks

There is no required textbook. Reading will primarily be based on research and survey papers made available during the semester. The following textbooks are useful supplementary reading.

[Schiller] *Mobile Communications*, 2nd ed, Jochen Schiller. Addison-Wesley, 2003. ISBN 0-321-12381-6. This book provides an overview of technology and protocols for wireless communication, written for the computer scientist rather than the electrical engineer. It is clearly dated, but this is not a course in wireless communications.

[Krumm] *Ubiquitous Computing Fundamentals*, John Krumm. CRC Press, 2010. ISBN 978-1-4200-9360-5. This is a collection of survey chapters written by the leaders in the field of pervasive computing.

The coursework will include programming assignments using [Google Android](#). Android development is in Java, although Android does not run on the Java virtual machine, instead it runs on a VM optimized for mobile devices. You will be using Android Studio, a version of the IntelliJ IDE customized for Android, to do your development. By the end of the semester, your apps must run on an Android device. If you do not have one yourself (e.g. an Android phone), then the department has a limited number of Android tablets. There are now many Android books available. The following books are popular, if you need a recommendation, though you will always need to refer to the documentation as the platform evolves:.

[Lee] *Expert Android Studio*, Murat Yener. Wiley, 2016. ISBN 978-1119089254.

[PAAP] *Professional Android 4th Ed*, Reto Meier. Wiley, September 2018. ISBN 978-1118949528.

You are expected to know Java, or to learn it fairly quickly.

Grading

Assignments: 50%

Mini-Exams: 40%

Participation: 10%

Week-By-Week

Wk	Date	Topics Covered	Programming	Concept	Assign
0	8/24	ORIENTATION			
1	8/31	Introduction: Mobile and cloud computing. Android: Activity life cycle. Creating user interfaces.	PAAP 1-3	Krumm 1 Schiller 1	
2	9/7	Android: Applications and UI.	PAAP 4-5		A1: First app
3	9/14	Android: Storage and content providers.	PAAP 7-8		A2: UI
4	9/21	Android: Content providers. Best practices for entity and query management.	PAAP 9-10		A3: DB
5	9/28	Android: Threads, services and alarms.			A4: Cont Provider
6	10/5	Android: Software architectures for mobile Web services.	PAAP 6, 16, 17		A5: Entity Manager
7	10/12	User interface design for mobile devices. User experience (UX) engineering: personas and scenarios.	PAAP 10-11	Krumm 7	
8	10/19	Android: UI design patterns. Material Design.		Krumm 2, 3, 8	A6: Services
9	10/26	Mobile data management: Knowledge protocols. Conflict detection and resolution. Partial replication.			A7: Web client
10	11/2	Location awareness: Satellites and GPS, infrared and ultrasonic, LAN-based and cell-based. Location privacy. Android: Geolocation and working with Google Maps.	PAAP 12, 13, 15		A8: UX
11	11/9	Wireless networks: Bluetooth, 802.11, GSM, GPRS, UMTS, LTE		Schiller 2-4, 7	A9: Web chat
12	11/16	Mobile networking: Mobile ad-hoc networks and sensor networks. Mobile IP. Internet of Things.		Schiller 8	A10: Multi-pane UI
		THANKSGIVING BREAK			

13	11/30	Mobile security platforms. Jailbreaking. Android security.			A11: Location awareness
14	12/7	Advanced Android programming. Best practices for mobile applications.	PAAP 18	Krumm 3 Schiller 9	A12: Maps
	12/14				A13: Security

Software

All assignments will be done in the Java programming language, using the Android Studio IDE. You may test on an Android physical phone, but several assignments require multiple devices. The emulator is now fast enough that it runs faster than many physical devices.

Late Policy

Assignments may be submitted after the due date, but up until the first cutoff date (usually a week after the original due date), with a penalty of -5%. Assignments may be submitted up until the second cutoff date (usually two weeks after the original due date), with an additional penalty of -20%. Assignments may be submitted up until the third cutoff date (usually three weeks after the original due date), with an additional penalty of -25%. There will be no extensions past the third cutoff date. If the cutoff date is the same as the due date, no late extensions are allowed. Please note that an assignment with a penalty of -25% or -50% still carries a much higher grade than no assignment at all.

All exam and quizzes must be submitted by the time and date posted. There will be no extensions and no late submissions allowed. However, assuming that N quizzes are administered during the semester, your quiz grade will be based on the best N-1 of your quiz scores. Therefore you maximize your possible grade by taking all quizzes, but you do not suffer any penalty if you miss one quiz.

Class Format

1. **Lecture slides and videos:** I will be making slides and short lecture videos available each week, via Canvas. It is your responsibility to review these materials and take the exams (see below). It is important that you keep up with this material.
2. **Reading:** There will sometimes be reading associated with each topic. It is highly recommended that you do the reading. You should view the lectures as intended to draw out what is important in the reading and explain the key points of understanding. By doing the reading, you will get much better depth of understanding in the material than can be made available in the slides alone. Readings will be from the texts and from other on-line materials as the term progresses.
3. **Discussion:** There will be discussion forums in the Canvas classroom where you can discuss class material and assignments. Ten percent of your grade will be provided for weekly participation in these discussion forums. A rubric will be provided for this participation grade.
4. **Assignments:** There will be approximately weekly programming assignments using Android.

I will provide “starter” projects, that you complete to illustrate some aspect of the Android framework or best practices. They will be due at midnight on Sunday at the end of the week in which their due date falls, via Canvas. There will be Piazza discussion groups where people can discuss the assignments. These discussions go direct to your mailbox, so they may be more useful for the “urgent” questions people may be asking as an assignment deadline nears.

5. **Exams:** There will weekly “mini-exams” (more extensive than a quiz, but shorter than a full exam). They will be due on Monday the week after the material is covered in on-line lectures.
6. **Virtual Office Hours** are a weekly synchronous session (through Zoom) to give you the opportunity to ask questions related to course material and/or assignments.
7. I will be available via **Canvas email** and will respond as soon as I am available (generally within 24-48) hours. For the online discussions, I will check in at least 3 times per week. Often I will not need to respond to questions, as students often can answer each others’ questions before I have a chance to respond. For urgent matters, feel free to email me; Canvas email is much preferred as the Canvas mailbox is not as cluttered as regular email (and gets forwarded to my regular email anyway).

Ethical Conduct

Undergraduate Honor System

Enrollment into the undergraduate class of Stevens Institute of Technology signifies a student's commitment to the Honor System. Accordingly, the provisions of the Stevens Honor System apply to all undergraduate students in coursework and Honor Board proceedings. It is the responsibility of each student to become acquainted with and to uphold the ideals set forth in the Honor System Constitution. More information about the Honor System including the constitution, bylaws, investigative procedures, and the penalty matrix can be found online at <http://web.stevens.edu/honor>.

The following pledge shall be written in full and signed by every student on all submitted work (including, but not limited to, homework, projects, lab reports, code, quizzes and exams) that is assigned by the course instructor. No work shall be graded unless the pledge is written in full and signed.

“I pledge my honor that I have abided by the Stevens Honor System.”

Reporting Honor System Violations

Students who believe a violation of the Honor System has been committed should report it within ten business days of the suspected violation. Students have the option to remain anonymous and can report violations online at www.stevens.edu/honor.

Graduate Student Code of Academic Integrity

All Stevens graduate students promise to be fully truthful and avoid dishonesty, fraud, misrepresentation, and deceit of any type in relation to their academic work. A student's submission of work for academic credit indicates that the work is the student's own. All outside assistance must be acknowledged. Any student who violates this code or who knowingly assists

another student in violating this code shall be subject to discipline.

All graduate students are bound to the Graduate Student Code of Academic Integrity by enrollment in graduate coursework at Stevens. It is the responsibility of each graduate student to understand and adhere to the Graduate Student Code of Academic Integrity. More information including types of violations, the process for handling perceived violations, and types of sanctions can be found at www.stevens.edu/provost/graduate-academics.

Special Provisions for Undergraduate Students in 500-level Courses

The general provisions of the Stevens Honor System do not apply fully to graduate courses, 500 level or otherwise. Any student who wishes to report an undergraduate for a violation in a 500-level course shall submit the report to the Honor Board following the protocol for undergraduate courses, and an investigation will be conducted following the same process for an appeal on false accusation described in Section 8.04 of the Bylaws of the Honor System. Any student who wishes to report a graduate student may submit the report to the Dean of Graduate Academics or to the Honor Board, who will refer the report to the Dean. The Honor Board Chairman will give the Dean of Graduate Academics weekly updates on the progress of any casework relating to 500-level courses. For more information about the scope, penalties, and procedures pertaining to undergraduate students in 500-level courses, see Section 9 of the Bylaws of the Honor System document, located on the Honor Board website.