

# CS 522WS Fall 2018

## Mobile Systems and Applications

### Instructor

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Email: Canvas Email.

Office Hours: Friday 1-2pm (Blackboard Collaborate) or by appointment.

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

### 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.

**[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: 60%

Mini-Exams: 40%

## 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.

## Week-By-Week

Wk	Date	Topics Covered	Programming	Concept	Assign
0	8/20	<b>ORIENTATION</b>			
1	8/27	Introduction: Mobile and cloud computing. Android: Activity life cycle. Creating user interfaces.	PAAP 1-3	Krumm 1 Schiller 1	
2	9/3	Android: Applications and UI.	PAAP 4-5		A1: First app
3	9/10	Android: Storage and content providers.	PAAP 7-8		A2: Book store & Chat
4	9/17	Android: Content providers. Best practices for entity and query management.	PAAP 9-10		A3: DB
5	9/24	Android: Threads, services and alarms.			A4: Cont Provider
6	10/1	Android: Software architectures for mobile Web services.	PAAP 6, 16, 17		A5: Entity Manager
7	10/8	User interface design for mobile devices. User experience (UX) engineering: personas and scenarios.	PAAP 10-11	Krumm 7	
8	10/15	Android: UI design patterns. Material Design.		Krumm 2, 3, 8	A6: 2-way chat
9	10/22	Mobile data management: Knowledge protocols. Conflict detection and resolution. Partial replication.			A7: Web client
10	10/29	Location awareness: Satellites and GPS,	PAAP 12, 13, 15		A8: UX

		infrared and ultrasonic, LAN-based and cell-based. Location privacy. Android: Geolocation and working with Google Maps.			
11	11/5	Wireless networks: Bluetooth, 802.11, GSM, GPRS, UMTS, LTE		Schiller 2-4, 7	A9: Web chat
12	11/12	Mobile networking: Mobile ad-hoc networks and sensor networks. Mobile IP. Internet of Things.		Schiller 8	A10: Multi-pane UI
	11/19	<b>THANKSGIVING BREAK</b>			
13	11/26	Mobile security platforms. Jailbreaking. Android security.			A11: Location awareness
14	12/3	Advanced Android programming. Best practices for mobile applications.	PAAP 18	Krumm 3 Schiller 9	A12: Maps
	12/10				A13: Security

## 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. **Interactive discussion:** In addition to weekly office hours, I will schedule interactive discussions periodically during the semester, announced in advance. You can join these discussions via Blackboard Collaborate. There are also discussion forums in Canvas that you are encouraged to use to discuss the class material and assignments.
4. **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.

**Homework:** There will be several programming assignments. They will be due at midnight on Sunday at the end of the week in which their due date falls, via Canvas. By the end of the semester, you should have your app working on a physical device.

## Ethical Conduct

Cheating during in-class tests or take-home examinations or homework is, of course, illegal and immoral. A Graduate Academic Evaluation Board exists to investigate academic improprieties, conduct hearings,

and determine any necessary actions. The term "academic impropriety" is meant to include, but is not limited to, cheating on homework, during in-class or take-home examinations, and plagiarism.

Consequences of academic impropriety are severe, ranging from receiving an "F" in a course, to a warning from the Dean of the Graduate School, which becomes a part of the permanent student record, to expulsion.

*The Graduate Student Handbook, Academic Year 2006-2007, Stevens Institute of Technology, page 10.*

Note that ethical conduct requires not only that one not engage in conduct that can be construed as cheating, but also that one avoid (either deliberate or accidental) enabling of cheating by others. Examples of conduct that can be viewed as enabling cheating include making solutions to assignments available on the Web (e.g. via Github) or providing one's computer to a colleague without protecting access to assignment solutions. Even if access to solutions is only provided accidentally, the enabler will bear some responsibility if someone else takes exploits the opportunity to obtain their solutions. You are expected to show due diligence in denying others access to your solutions.



