ITP 140

Mobile Application Technologies
Trina Gregory

• Background
  – BA, Mathematics-Computer Science
  – Software engineer for over 15 years
  – MS, Computer Science
  – Teaching at USC since Spring 2007

• Mobile Development
  – Taught the first iPhone class Spring 2009
  – Created the Mobile App Development minor
  – USC Center for Body Computing
  – USC School of Social Work
Why mobile?

• Mobile is the fastest-growing industry on the planet
  – digital technologies
  – major media
  – money
  – medical
• It's huge!
What does 'mobile' mean?
What defines a smartphone?

- Mobile operating system
- Connectivity to the Internet
- Have apps like email and web browser
- Ability to install third-party apps
Planet

- > 7.4 billion people
  - China has > 1.4 billion people
  - India has > 1.3 billion people
  - USA has > 300 million

- As of 2015, 1.1 billion people who live without electricity

http://www.worldometers.info/world-population/

Other Statistics

• 1.2 billion personal computers in use worldwide
• 1.1 billion fixed landline phones
• 1.0 billion automobiles registered and in use
• 1.6 billion television sets
• 1.7 billion credit card users
• 2.2 billion people with a banking account
• 3.9 billion radio receivers in use worldwide
How big is mobile?

MOBILE CONNECTIONS vs. PEOPLE

ACTIVE MOBILE SUBSCRIPTIONS

7.324 BILLION

vs

TOTAL WORLD POPULATION

7.280 BILLION

Sources: GSMA Intelligence, Worldometers

http://wearesocial.sg • @wearesocialsg
Unique Mobile Users

• **4.5 billion** unique mobile phone users

• 34% of all mobile phone users will have more than one account

• 64% of all people alive on the planet have a mobile phone
Smartphones

• The most popular smartphone activity is (in order):
  1. Texting
  2. Internet browsing
  3. Playing games

• Most likely owners (62%) are between the ages of 25 and 34
What are we going to cover?

• The mobile industry
• Various types of mobile apps
• Business-side of making apps
• How to design an app
• How to build a prototype
• How to monetize apps
• How to create a business presentation
Course Objective

• This class covers the mobile industry, devices, operating systems, types of apps, how to monetize apps, and how much it costs to build an app.

• Upon conclusion of this course, students will have taken an app idea from start to prototype and business plan.

• Students will use various tools to create a color palette and app icon, wireframes, and an interactive prototype.

• The goal is an interactive prototype of an app, not a working native app.
Prerequisites

- Officially none
- Desire to learn about mobile apps
Instructor

• Trina Gregory
  – Call me "Trina", "Ms. Gregory", "Professor Gregory"

• Contact
  – Email: trina.gregory@usc.edu or trinagre@usc.edu
  – Office: OHE 412

• Office Hours
  – http://bcf.usc.edu/~trinagre/
  – Never ask me when my office hours are!
  – They are posted on Blackboard, Piazza, ITP website, etc.
Course Structure

- The class meets for one hour and 20 minutes twice a week for a total of 2 hours and 40 minutes.
- These sessions include lectures and hands-on learning labs.
- One exam is given during the semester and held during the class meetings.
- Weekly assignments and a final project are completed outside of class time.
- Access to a computer is recommended, although ITP holds open lab hours with computers.
Course Format

• Lecture/Lab
  – Meet twice a week
  – Tuesday/Thursday
  – 12:30 – 1:50 pm
  – KAP 160

• Roster
  – Will be passed around each lecture
  – Please sign your name
Holidays

• Labor Day
  – Week 3
  – Monday
  – September 4, 2017

• Thanksgiving
  – Week 14
  – Wednesday – Friday
  – November 22-24, 2017
# Grading

<table>
<thead>
<tr>
<th>Assignments (weighted proportionally)</th>
<th>50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midterm Exam</td>
<td>25%</td>
</tr>
<tr>
<td>Final Project</td>
<td>25%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
Grading Scale

• The following scale is used to determine the letter grade:
  – 93% and above    A
  – 90 - 92%         A-
  – 87 - 89%         B+
  – 83 - 86%         B
  – 80 - 82%         B-
  – 77 - 79%         C+
  – 73 - 76%         C
  – 70 - 72%         C-
  – 69 - 65          D
  – 64 and below     F

• If you are taking the class with a grade of P/NP, you must earn a grade of 70% or higher in order to receive a P. Final grade percentages are calculated to two decimal places and rounded to hundredths. For example, 89.99 is a B+ while 89.995 is rounded to 90 and thus an A-.
Attendance and Participation

• Attendance is important, but not mandatory.
• A percentage of your grade is NOT dependent on participation.
• But if you have 3 or less non-excused absences, then I will add a percentage point to your overall grade.
• Excused absences:
  – Valid for interviews, documented sickness, emergencies, etc.
  – Private post on Piazza before class using the tag absent including date and reason
Grading

• Midterm Exam
  – Week 9, 2\textsuperscript{nd} lecture
  – Thursday, October 19, 2017

• Final Project Presentations
  – Scheduled final exam time
  – Wednesday, December 12, 2017
  – 11 am – 1 pm, KAP 160
Homework

• The assignments will be posted on Blackboard under the “Assignments” section.
• Each assignment will include instructions, a due date, and a link for electronic submission.
• Assignments must be submitted using this link.
• All assignments will be digitally submitted through Blackboard except where specifically specified.
• Do not email them to the lecturer or lab assistant.
Homework

• It is your responsibility to submit assignments on or before the due date.
  – Assignments turned in up to three days late will have 50% of the total points deducted from the graded score.
  – After three days, submissions will not be accepted and you will receive a 0.

• Each student will be allowed ONE three-day late assignment for “free”.
  – You must indicate that you are using your free late in the comments when you submit the assignment, and this may not be used on the final project.
Homework

• You are required to keep a copy of all of your assignments.

• You may save your assignments using a USB flash drive or a website such as http://www.dropbox.com.

• You will not be able to save your work on the ITP lab computers.

• ITP is not responsible for any work lost.
Homework Questions

• Please post your questions on Piazza.
  – You should have all received a link.
• Students and instructors can respond.
Policies

• No make-up exams (except for documented medical or family emergencies) will be offered.

• A roster will be passed around the room during each lecture session.
  – Please sign by your name for the appropriate week.
  – Do not sign in for another student; doing so is an academic integrity violation.
Open Labs

• ITP offers open lab use for all students enrolled in ITP classes.

• These open labs are held beginning the second week of classes through the last week of classes.

• Hours are listed at http://itp.usc.edu/labs/.

• The open labs will not have a lab assistant for this specific class.

• These lab times are there in case you do not have a computer or need extra time to complete an assignment.
Viterbi Honor Code

• Engineering enables and empowers our ambitions and is integral to our identities. In the Viterbi community, accountability is reflected in all our endeavors.
• Engineering+ Integrity.
• Engineering+ Responsibility.
• Engineering+ Community.
• Think good. Do better. Be great.
• These are the pillars we stand upon as we address the challenges of society and enrich lives.
Academic Integrity

• Students may NOT collaborate, work together, or in any way exchange solutions for assignments and projects unless allowed by the instructor.

• Any sharing of assignments or past exams will be considered a violation of academic integrity (cheating); an SJACS report will be filed with the recommended penalty of an F in the course.

• Do not share your work with anyone else in this or a future section of the course, as allowing someone else to copy your work carries the same penalty as you copying yourself.
Academic Integrity

• SCampus is USC’s Student Guide to Policies and Conduct Code
  – http://scampus.usc.edu

• Office of Student Judicial Affairs and Community Standards (SJACS)
  – http://www.usc.edu/student-affairs/SJACS/

• An academic integrity tutorial
  – http://www.usc.edu/libraries/about/reference/tutorials/academic_integrity/index.php
Useful Resources

• Almost half of all college students will experience severe depression or symptoms of mental illness in college

• Student Counseling Center
  – Free confidential counseling
  – (213) 740-7711
  – https://engemannshc.usc.edu/counseling/

• Trojans Care for Trojans
  – Anonymously let staff know you are concerned about a fellow student experiencing personal difficulties
  – https://studentaffairs.usc.edu/trojans-care-for-trojans-tc4t/
Useful Resources

• Relationship and Sexual Violence Prevention and Services (RSVP)
  – Immediate therapy services—confidential
  – (213) 740-4900
  – https://engemannshc.usc.edu/rsvp/

• Office of Equity and Diversity
  – Report issues related to harassment, discrimination, sexual harassment, or Title IX
  – (213) 740-5086
  – https://equity.usc.edu/
Useful Resources

• Trojan Alert
  – Sign up to receive alerts during emergencies
  – https://trojansalert.usc.edu/register.php

• USC Emergency Information
  – http://emergency.usc.edu

• Campus Safety and Emergency Preparedness
  – http://safety.usc.edu

• Department of Public Safety
  – Emergency: 213-740-4321
  – https://dps.usc.edu
Useful Resources

• Student Health Center
  – https://engemannshc.usc.edu

• The Center for Women and Men
  – http://engemannshc.usc.edu/cwm/

• The Office of Disability Services and Programs
  – https://dsp.usc.edu
Expectations

• Come to class
• Take notes in class
  – Studies show handwritten notes are best!
• Start your assignments early
  – Turn in on time
• Try your best
  – Come to office hours for help

• Special Needs
  – If you are requesting academic accommodations, please arrange to speak with your instructor at the start of the semester
## Course Outline

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Course Overview; Mobile Industry Technology Background; Internet</td>
</tr>
<tr>
<td>2</td>
<td>App Types – web, native, hybrid Cross-compiled Tools</td>
</tr>
<tr>
<td>3</td>
<td>WWW and Networks Responsive Web Design</td>
</tr>
<tr>
<td>4</td>
<td>Mobile Design Interface Design</td>
</tr>
<tr>
<td>5</td>
<td>Colors, Images, and Icons Photoshop</td>
</tr>
<tr>
<td>6</td>
<td>Application Styles Wireframing Tools</td>
</tr>
<tr>
<td>7</td>
<td>User Interfaces – iOS User Interfaces – Android</td>
</tr>
<tr>
<td>8</td>
<td>Monetization Balsamiq</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Review</td>
</tr>
<tr>
<td></td>
<td><strong>Midterm Exam</strong></td>
</tr>
<tr>
<td>10</td>
<td>User / Usability Testing Wireframes Usability Testing</td>
</tr>
<tr>
<td>11</td>
<td>Buy vs Build The Cost of Development</td>
</tr>
<tr>
<td>12</td>
<td>APIs and Analytics Prototyping</td>
</tr>
<tr>
<td>13</td>
<td>Business Plan Marketing</td>
</tr>
<tr>
<td>14</td>
<td>Databases; Cloud Deployment</td>
</tr>
<tr>
<td>15</td>
<td>Windows Presentations</td>
</tr>
</tbody>
</table>
ITP 140

Technology Background
Computers

- Users
- Application Software
- Operating System Software
- Hardware System
Application Software

• Software for basic productivity for end users
• Anything you double-click on the desktop or touch on your mobile device
• “Apps”
• Examples:
  – Web browsers – Chrome, Firefox, Safari, IE
  – Email programs – Outlook, Thunderbird, Mail
  – MS Office Suite – Word, PowerPoint, Excel
  – Adobe Creative Suite – Photoshop, Illustrator
  – Games – World of Warcraft, Words with Friends, Minecraft, Monument Valley
## Mobile App Stores

<table>
<thead>
<tr>
<th>Name</th>
<th>Owner</th>
<th>Established</th>
<th>Available Apps</th>
<th>Download Count</th>
<th>Development Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>App Store</td>
<td>Apple</td>
<td>7/10/2008</td>
<td>2 million+</td>
<td>&gt;100 billion</td>
<td>iOS</td>
</tr>
<tr>
<td>Google Play</td>
<td>Google</td>
<td>10/22/2008</td>
<td>2.2 million+</td>
<td>&gt;50 billion</td>
<td>Android</td>
</tr>
<tr>
<td>Windows Store</td>
<td>Microsoft</td>
<td>10/26/2012</td>
<td>669,000+</td>
<td>&gt;75 million*</td>
<td>Windows 8</td>
</tr>
<tr>
<td>BlackBerry World</td>
<td>BlackBerry Ltd</td>
<td>4/1/2009</td>
<td>234,500+</td>
<td>&gt;4 billion</td>
<td>BlackBerry OS</td>
</tr>
</tbody>
</table>

http://www.statista.com
* Estimation; Microsoft has not released official numbers
# Apple's App Store Statistics

## Count of active applications in the App Store

- Total Active App (currently available for download): 3,129,593
- Total Inactive Apps (no longer available for download): 214,477
- Total Apps Seen in US App Store: 3,344,070
- Number of Active Publishers in the US App Store: 675,936

## Count of application submissions

- This Month (Apps): 5,608 (267 / day)
- This Month (Games): 1,836 (87 / day)
- This Month (Total): 7,444 (354 / day)

## Application price distribution

- Current Average App Price: $1.02
- Current Average Game Price: $0.49
- Current Average Overall Price: $0.89

## Application Category Distribution

### Most Popular Categories

1. Games (784,994 active)
2. Business (307,332 active)
3. Education (265,110 active)
4. Lifestyle (260,615 active)
5. Entertainment (190,461 active)

Operating Systems

• Makes your computer (or mobile device) do more than just be an expensive paperweight
• Collection of programs for interfacing with hardware
Types of Operating Systems

- **Embedded**
  - Examples: Missile guidance systems, NASA mars rovers, etc.

- **Network Operating System**
  - Single operating system to control multiple CPUs and/or computers together

- **Desktop Operating System**
  - Used on desktop and laptop computers
Geek Joke

I’m a PC.

I’m a Mac.

I’m Linux.
Mobile OS

• Controls a smartphone, tablet, PDA, or other mobile device
• Combine the features of a personal computer OS with:
  – touchscreen
  – cellular
  – Bluetooth, WiFi
  – GPS
  – camera, video camera
  – speech recognition
  – voice recorder
  – music player
  – etc.
Common Mobile OSs

- **Android** from Google Inc.
  - Free and open source
- **BlackBerry OS** from BlackBerry Ltd
  - Closed source, proprietary
- **iOS** from Apple Inc.
  - Closed source, proprietary
- **Windows Phone** from Microsoft
  - Closed source, proprietary
The Smartphone Platform War Is Over

Worldwide smartphone operating system market share (based on unit sales)

- **Android**
- **iOS**
- **Windows**
- **BlackBerry**
- **Symbian**
- **Others**

<table>
<thead>
<tr>
<th>Year</th>
<th>Android</th>
<th>iOS</th>
<th>Windows</th>
<th>BlackBerry</th>
<th>Symbian</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>85.2%</td>
<td>13.8%</td>
<td>1%</td>
<td>1.8%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>2010</td>
<td>85.2%</td>
<td>13.8%</td>
<td>1%</td>
<td>1.8%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>2011</td>
<td>85.2%</td>
<td>13.8%</td>
<td>1%</td>
<td>1.8%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>2012</td>
<td>85.2%</td>
<td>13.8%</td>
<td>1%</td>
<td>1.8%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>2013</td>
<td>85.2%</td>
<td>13.8%</td>
<td>1%</td>
<td>1.8%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>2014</td>
<td>85.2%</td>
<td>13.8%</td>
<td>1%</td>
<td>1.8%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>2015</td>
<td>85.2%</td>
<td>13.8%</td>
<td>1%</td>
<td>1.8%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>2016*</td>
<td>85.2%</td>
<td>13.8%</td>
<td>1%</td>
<td>1.8%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Source: Gartner
Smartphone Market Share

http://www.idc.com/prodserv/smartphone-os-market-share.jsp
The discussion around Android's share of the smartphone market became irrelevant a few years back when it became clear that devices running Google's OS would continue to capture roughly 85% of the worldwide smartphone volume.

What is interesting is to look at the many micro-trends going on within the platform.

Despite a slew of very attractive high-end Android products, IDC continues to see Android average selling prices (ASPs) decline and expectations are that the 1.5 billion Android phones that ship in 2021 will have a collective ASP of $198, down from $220 in 2017Q1.
iOS

• Coming off the first year in which iPhone shipments declined, expectations are that 2017 volumes will grow 3.8%.

• IDC slightly lowered its 2017 projections for iOS in its latest forecast to 223.6 million, while increasing its 2018 volumes to 240.4 million.

• All signs point to late 2017 and certainly 2018 being very strong for Apple as much of its installed base seems ready for a refresh and the next round of iPhones is not likely to disappoint its fans.
Windows

• Windows Phone shipments continue to fall as the lack of new hardware partners, developer support, and overall enthusiasm for the platform show no immediate signs of recovery.
• IDC expects 2017 volumes to decline 80.9% to just 1.1 million units.
• Microsoft has yet to fully commit to any "Surface"-style attack for smartphones or to push new vendors to embrace the platform, leaving little hope of mounting a full scaled comeback in the years to come.
BlackBerry

• Most BlackBerry phones are now “powered by Android” such as the BlackBerry Key, DTEK, and Priv.

• BlackBerry OS is still on the BlackBerry Passport and BlackBerry Leap.
Apple App Store

- Apple opened its App Store in 2008 at the time of the iPhone 3G launch.
- It started out with just 500 apps but within 3 months it had seen 100 million downloads and the number of apps jumped to 3000.
- By 2009, Apple hit the 2 billion download mark.
- In 2013, Apple hit the 50 billion download mark, and 85 billion towards the end of 2014.
- As for apps, it passed the 1 million app mark at the end of 2013, and Apple currently has around 1.2 million iOS apps available for download.
Google Play Store

• Google launched the Android Market in 2008 with only a handful of apps.
• By 2009 it contained some 2300 apps and by the summer of 2010 there were 80000 apps available, and the total number of downloads had surpassed the coveted 1 billion mark.
• The Android Market was re-branded as Google Play on March 6, 2012, as it was merged with Google Music, and Google eBookstore.
• Google’s store managed to surpass Apple’s, in terms of the number of apps available, towards the end of 2014.
• As for 2015, the Wall Street Journal has reported that Google Play had 70% more app downloads than Apple’s App Store in the first quarter of 2015.
Mobile App Market Share

• Market share of iOS and Android in the United States as of 3\textsuperscript{rd} quarter 2016
• The total revenue of app downloads from both digital appstores amounted to approximately 2.23 billion U.S. dollars.

• Apple App Store – 61%
• Google Play – 40 %
Why develop iOS apps?

- In the first quarter of 2015, Apple’s app revenue was about 70% higher than on Google Play.
App Downloads

Worldwide App Downloads by Store Q1 2017

- iOS App Store
- Google Play

+135%

Consumer Spend

Worldwide Gross Consumer Spend by Store
Q1 2017

Indexed Consumer Spend

iOS App Store

Google Play

+100%
Mobile App Forecast

iOS To Remain The Single Largest Store in Revenue, But All Android Stores Combined Forecast to Surpass iOS in 2017

[Bar charts showing annual downloads and annual revenue forecasts for 2016, 2017F, and 2021F for iOS, Google Play, Third-Party Android Stores, and Other.]

USC
School of Engineering
Android Mobile Devices

• Mobile phones (examples)
  – Samsung Galaxy Note 4/5
  – Samsung Galaxy S6/S6 Edge/S6 Edge+
  – HTC One M9
  – Nexus 6P
  – LG G4
  – Google Nexus 6
  – Motorola Moto X

• Tablets (examples)
  – Google Nexus 9
  – Nvidia Shield Tablet
  – Samsung Galaxy Tab S

http://www.android.com/devices/
Apple Mobile Devices

• Mobile phones
  – iPhone, iPhone 3G, iPhone 3GS
  – iPhone 4, iPhone 4S
  – iPhone 5, iPhone 5c, iPhone 5S
  – iPhone 6, iPhone 6 Plus, SE
  – iPhone 7, iPhone 7 Plus

• Tablets
  – iPad
  – iPad 2
  – iPad 3 (The new iPad)
  – iPad mini
  – iPad Air
  – iPad Air 2
  – iPad mini 3
BlackBerry Mobile Devices

• Mobile phones
  – Classic
  – Leap
  – Porsche Design
  – Passport
  – Z3, Z30, Z10
  – Q5, Q10
  – Bold
  – Torch
  – Curve

• Tablets
  – PlayBook
Windows Mobile Devices

- **Mobile phones**
  - Nokia Lumia (635, 530, 735, 930, 1020, 1520)
  - Windows Phone 8XT
  - Samsung ATIV S Neo
  - Samsung ATIV Odyssey
  - Huawei W1

- **Tablets**
  - Acer Iconia W700
  - Asus VivoTab Smart
  - Dell XPS 10
  - HP Envy x2
  - Lenovo ThinkPad Tablet 2
  - Microsoft Surface
  - Toshiba Satellite
History of Mobile Phones

• The world’s first mobile phone call was made on April 3, 1973, when Martin Cooper, a senior engineer at Motorola, called a rival telecommunications company and informed them he was speaking via a mobile phone.
History of Mobile Phones

• 1997 – Nokia 6110
• 1999 – BlackBerry 850
• 2002 – Samsung SGH-T100
• 2004 – Motorola Razr V3
History of Mobile Phones

• 2005 – BlackBerry 7270
• 2006 – Nokia N95
• 2008 – Apple iPhone 3G
Mobile Phone Fun Facts

• In 1983, the first mobile phones went on sale in the U.S. at almost $4,000 each.
• Over 250 million Nokia 1100 devices were sold, making it the bestselling electrical gadget in history.
• More people in the world have mobile phones than toilets.
• So many Facebook photos and videos are uploaded via mobile that it takes up 27% of upstream web traffic.
• The technology behind smartphones relies on up to 250,000 separate patents.
• The average person unlocks his or her smartphone 110 times each day.