# Introduction – What is Android?

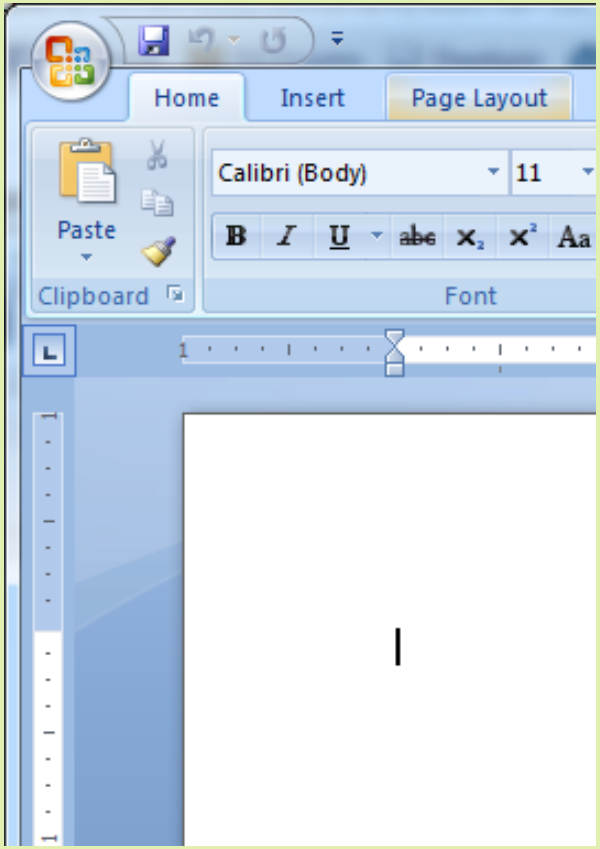
CS 2046

Mobile Application Development

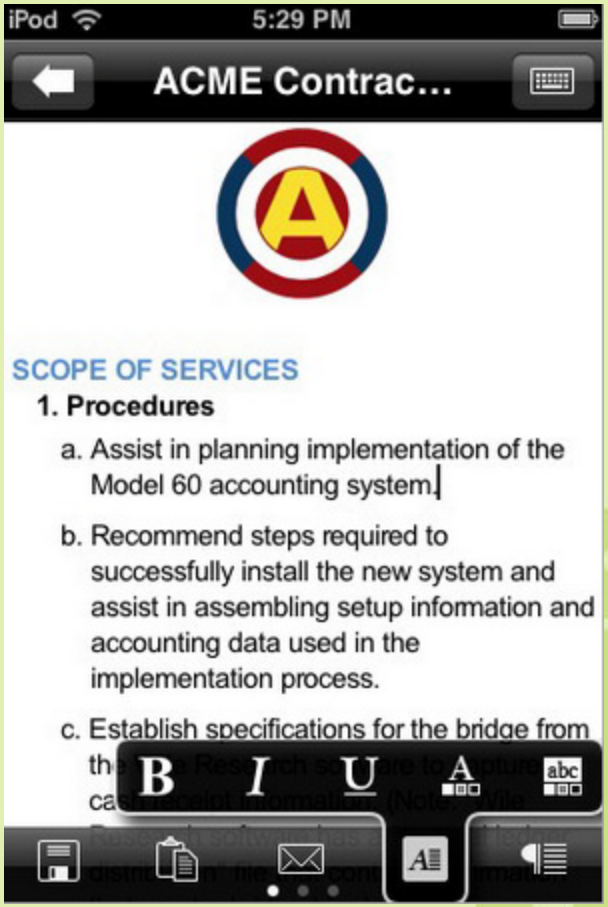
Fall 2010

# Everything you know is wrong…

- Most desktop/web applications:
  - Large screen size

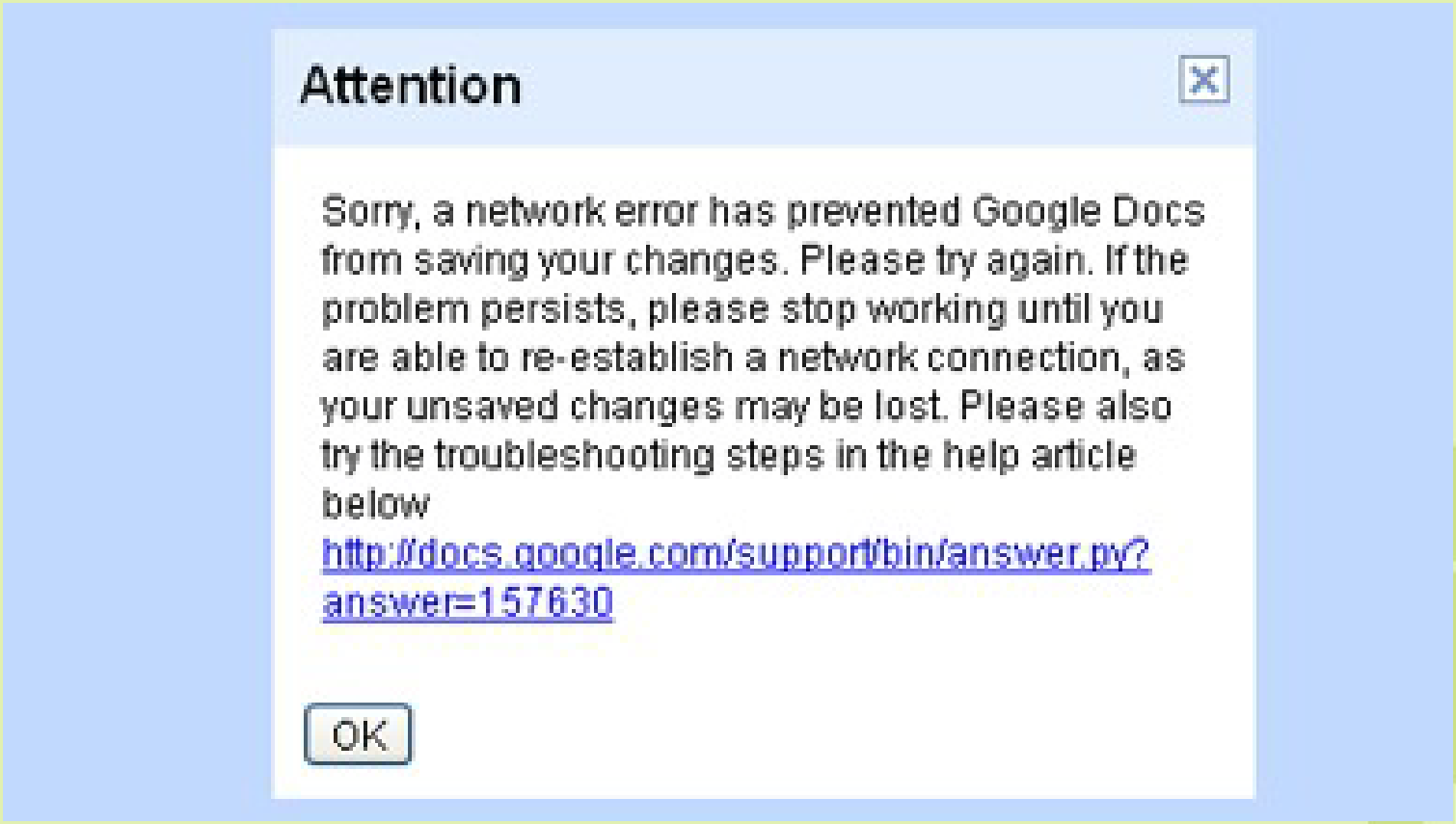



vs.



# Everything you know is wrong…

- Most desktop/web applications:
  - High-quality internet connections



# Everything you know is wrong…

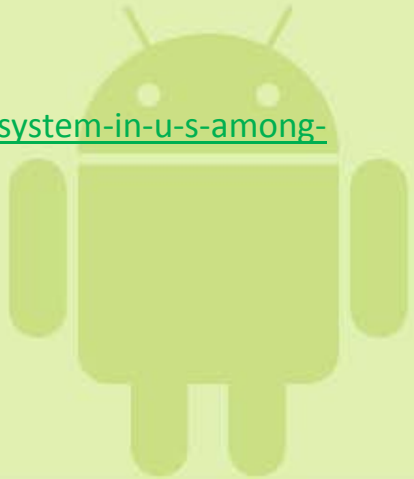
- Most desktop/web applications:
  - Take one or two types of input

# Modern Computing

- Think – could you go without your computer for a day?
  - What if you had a smartphone that could:
    - Check email
    - Read news
    - Play games, music, and viral videos
  - What do we really use computers for?

# Mobile Applications

- Apple App Store
  - 250,000 applications
  - Has paid over $1 billion to developers as of June
    http://techcrunch.com/2010/06/07/ipad-ibooks-app-store-stats/
- Android Market
  - 80,000 applications
  - Android OS (in some form) installed on 1/3 of new phones (#1 in the U.S.)
    http://blog.nielsen.com/nielsenwire/online_mobile/android-most-popular-operating-system-in-u-s-among-recent-smartphone-buyers/

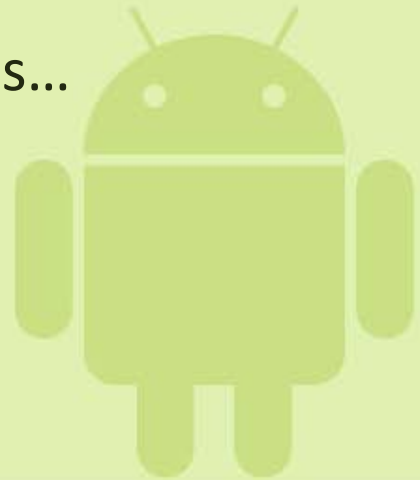


# Differences

- Could you sell a great desktop app?
  - Maybe if you're Microsoft or Adobe
  - You'll get ~100% of revenue!
    - Hooray!
  - But:
    - How to push your product?
      - Advertising
      - Media – CDs or bandwidth
    - How do people download, install?
    - How do they know it's going to work?

# Differences

- Typical mobile market (iOS, Android):
  - Many apps are free
    - But ad-supported – shareware is back!
  - For paid apps, developer gets ~70% of revenue
  - Tradeoff for:
    - One-click install for everyone (including payment!)
    - Central source for finding your applications
    - No worrying about handling financials, statistics…



# Differences

- Screen size varies tremendously
  - Currently, for majority – small or very small


# Differences

- Internet connection is extremely sporadic
  - Phones support Wi-Fi, GSM/EDGE, CDMA/EV-DO, 3G, 4G, etc., and switch often
  - But many applications rely on internet data
  - Need resilience for transient failures

# Differences

- Replacements for typical types of input
  - Keyboard
    - Generally, still exists.  But:
      - Might be a virtual keyboard
      - Might be hardware, but will be very small (so no Starcraft)
  - Mouse
    - Most devices have touch screens
      - But multi-touch is new compared to a mouse
    - Could also have a trackball, navigation buttons, etc.

# Differences

- Plus, many more types:
  - Accelerometer
    - Labyrinth
  - GPS
    - Fine-grained local search
  - Compass
  - Vibration
    - BUMP - http://bu.mp/
  - Sound
    - Speech recognition
  - Camera

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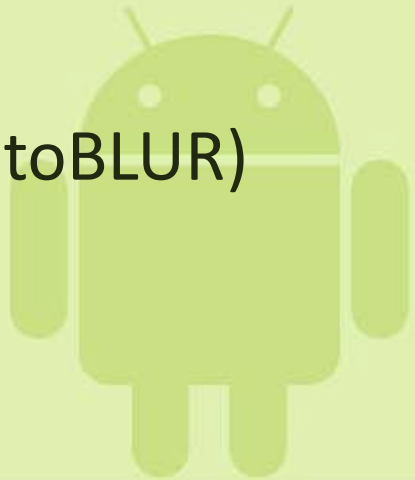
Nothing really new!

But, can rely on almost every device supporting all of them.

# Android

- "A software stack for mobile devices that includes an operating system, middleware, and key applications."

- Essentially, a unified platform to develop apps that will run on many different phones and devices.
- A wrinkle:
  - Open source – get some modifications (MotoBLUR)



# The Platform

- Code is written in Java
  - vs. Apple iOS: Objective-C
  - Exception – can compile most C code using the NDK
- Libraries available:
  - Essentially all of the standard java.* packages
  - android.* - Android-specific libraries
    - UI elements
    - SQLite data storage
    - Media support (audio/video)
    - Access to camera, GPS, accelerometer

# Development

- Open-source platform, open-source tools
  - Eclipse IDE
  - Android SDK
- Emulator for running applications
  - If you have a real device, can use that too.
- See course webpage for directions.
- We will have a lab exercise in class to introduce the tools.

# Software Stack

- Lowest level – Linux kernel
  - Android != Linux
    - Does not use glibc, X, or GTK
  - Used for security, memory management, threading…
- Dalvik Virtual Machine
  - Each app runs in its own VM instance (secure)
  - Sort of like Java VM on the desktop, but optimized for mobile
- Application Framework
  - Where we will be spending our time

# What is an Android application?

- Four major components:
  - Activity
    - Main component of an application
    - Generally, visible to the user
  - ContentProvider
    - Stores (tabular) data and makes it available to other applications
  - Service
    - Handles background work and ongoing tasks
  - BroadcastReceiver
    - Receives events from the phone

# Example – Music Player

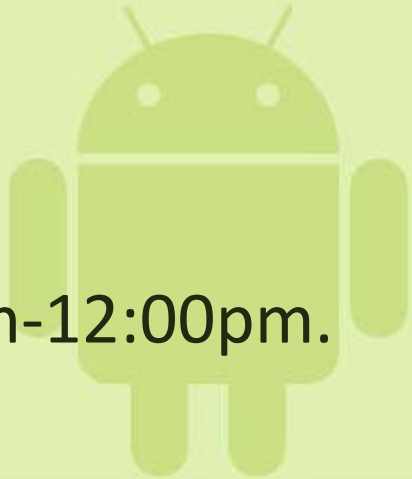
- Activity
  - UI for browsing music, selecting songs
- ContentProvider
  - Store the music and metadata
  - Gives other apps access
    - Music recommendation
- Service
  - Actually plays music – supports backgrounding
- Broadcast Receiver
  - Pause music if headphones are unplugged
- Project: Tasks

# What we will cover

- Building simple applications
  - DEMO – your project
- Mobile user interfaces
- Data storage
- Interacting with the Internet
- Multimedia
- Other topics if there's interest
  - Let me know!
  - Intro of the Day

# Course Logistics

- Instructor
  - Jeff Davidson (M.Eng)
  - jpd236@cornell.edu
  - Office Hours: MW 1:15-2:15pm (i.e. after class) or by appointment, starting next Monday, 10/25. See site for location.
- Teaching Assistant
  - Jae Yong Sung
  - js946@cornell.edu
  - Office Hours: TBA, probably Friday 11:00am-12:00pm.



# Course Logistics

- Dates/Times
  - October 18th – November 12th
  - MWF 12:20-1:10pm, Upson 207
  - Add/Drop deadline: 10/25
- Websites
  - http://www.cs.cornell.edu/courses/cs2046/2010fa/
  - CMS: http://cms.csuglab.cornell.edu

# Grading

- 1 credit, S/U only
- Components:
  - 70%: Individual Assignments
  - 15%: Lab Exercise (next Monday, 10/25)
  - 15%: Participation
    - In-class
    - Newsgroup: cornell.class.cs2046
      - See website for instructions
    - Challenge problems
- **Passing Grade: 60%**

# Course Format

- Lectures
  - Conceptual understanding, demos.
  - Only 4 weeks – not enough time to pore over lines of code.
- Assignments
  - There's a reason they're worth 70% of the grade…
  - You will learn most of the concrete material – how to code applications – from completing them.
- Come to office hours if you get stuck!

# Intents

- On a desktop:
  - Open an application – double click it
  - Open a file with an application – drag file to shortcut
    - Alternatively, pass filename as an argument.
  - Can specify default handler for a certain filetype.

# Intents

- Android uses Intents to accomplish these (and more) tasks.
- Intents: abstract description of an operation to be performed.
  - Action: The general action to be performed
  - Data: What should be operated on
  - Component: What will perform the action (optional)
- "The boy hits the ball"
  - What is the action? Data? Component?

# Intent Examples

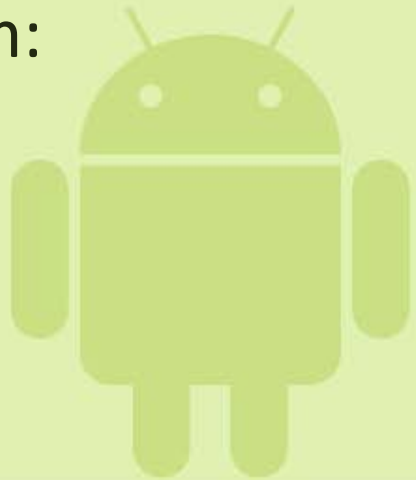
- ACTION_VIEW http://www.cornell.edu
  - Launch an application to view this URL.
- ACTION_DIAL tel:5551234
  - Launch an application to call this phone number.

- Note – these intents do not specify the component which should handle them.
  - We call these *implicit* intents
  - *Explicit* intents include the target component

# Intent Resolution

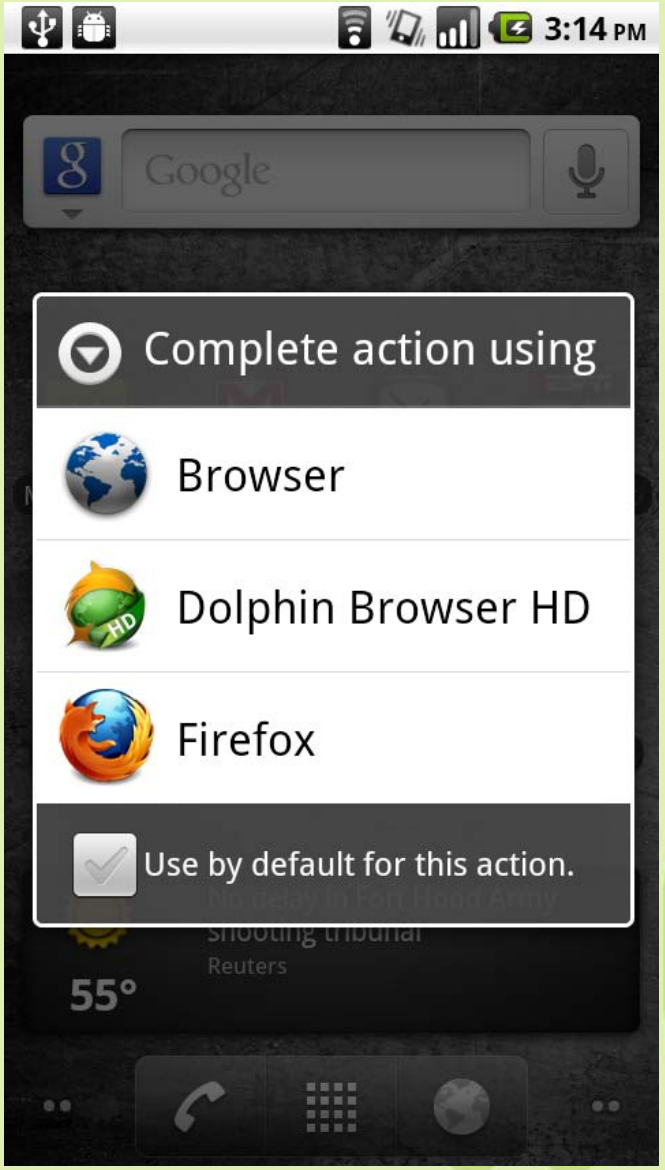
- Applies when no target is specified
- *Intent filters*
  - Associated with each component
  - Describe the Intents that the component can handle.

- Your app calls startActivity() with ACTION_VIEW <url>
  - For each Activity registered with the system:
    - Does it support the action ACTION_VIEW?
    - Does it support URI's of the form http://*?



# Intent Resolution

- If only one application matches, launch it.
- What if there are multiple possible handlers?
  - Example: Multiple browsers



# Intents - Summary

- Intents – the “glue” connecting Android components.
- Can specify what should handle the Intent (explicit), or let the system figure it out (implicit).
- Standardized Intents make Android extensible:
  - Make an application that takes pictures as input? Gallery will automatically let you send pictures to it.