ECE 1778:
Creative Applications for Mobile Devices

Lecture 4

January 26, 2016

(1)

Today

1. Logistics – Plan, Assignments
   – Description of Assignment P3/S3
2. Informal Topic Discussions
3. Notes on Group Work
   – How to create block diagram
   – Working in Groups
4. A Note on the Android Life cycle
5. TeamChooser
   – Lessons from an App development experience

Logistics

Assignments

- S2 and P2 were due yesterday
- S3 and P3 are ready, and posted
  - But are **not due** for 2 weeks,
  - To give you time to work on your proposal/plans, due next week.
  - Braiden posted a video of P3 on Piazza last night

- S1 and P1 have been graded
  - Done quite well;
- Note on moqups – you can ask the company for a free full license to use the tool as a student, and they will give it to you. [Thanks, Dann]

Counting # Programmers not lining up

		P2/S2
# Specialists	22	17
# Programmers	46	51
Total	68	
# external specialists	6	

Assignments P3 and S3

S3 Part 1 Due One week from Thursday

S3 Part 2 and P3 Due in 2 weeks [Monday]

Assignment P3 – for Programmers

Location, Motion Sensors and Image Capture

■ Learning how

- to determine out where the phone is, geographically (GPS)
- how it is moving (accelerometer)
- how to use the camera to capture images

1. Read the relevant parts of
   - **Android: Murphy** & Android Development site
     - Murphy doesn't have good coverage of sensors
   - **iOS: Mark, Nutting, LaMarche & Olsson** (Objective-C)
   - **iOS:** Swift book **doesn't** have this; will have to use online resources

Assignment P3 – for Programmers

- In response to being shaken,
  - phone takes a picture 1 second after the shaking stops, and
  - records the GPS location at the same time.
- Each location should be stored in a growing list;
  - when the user views the list item, your application should display the picture taken at that location.
  - The list should be maintained over separate invocations of the app (i.e. stored in a file)
  - it should be possible to delete a list item, which would remove the corresponding image in the file system.
- See note on using the camera preview properly
- Due in 2 weeks,
  - February 8th, 6pm, penalty for being late

Assignment S3 – for Specialists

- Recall: one goal of course is to give experience in reaching across disciplines
- Anticipate that Specialists will be teaching Programmers the **language** of their discipline, and the basic concepts
  - Please, programmers, ask questions – get jargon explained
  - **AND** vice-verse.

- Assignment S3 is an attempt to bring Specialists a little into the world of computer engineering/science
  - To give you practice talking to each other

Basic Idea of S3

- Specialist: Choose from one of 5 technical areas listed
  - **that you are not already familiar with,**
  - **and that your programming partners *are* familiar with:**

1. Fast Searching
2. Databases
3. Digital Signal Processing
4. Optimization
5. Internet Communication

Then – Part 1

- Spend an hour with your partners, learning about this area, and take notes.
    - Don't use any other sources of information

- Write up those notes & submit Thursday Feb 4, 6pm
    - 500 words + pictures

Then – Part 2

- Pursue a deeper understanding of the topic, via Internet
- Write another 500 words, due Monday February 8th, 6pm
  - Do a better job of describing the topic; add some nuance & more understanding
- Offer some additional commentary on your view of this learning process
  - how it went
  - how much you learned from Part 1 vs. Part 2,
  - what would have made it better

Project

Project Stages 16

1. **Forming Groups**
   - Must be formed now
2. **Project Approval-in-Principle**
   - Almost all done; want to discuss some today
3. **Project Proposal/Plan**
   - Document Due Feb 1st
4. **Proposal & Plan Presentations**
   - February 9 & 10
   - **CHANGE: EXTRA LECTURE Wed Feb 10, 6-8pm, MB 128**
5. **Spiral 2 & Spiral 4 Presentations**
   - 2: March 1/8   4: March 15/22
6. **Final Presentations**
   - Weeks of March 29/April 5
7. **Final Report Due April 7th**

)

Proposal/Plan Due Feb 1 @ 6pm

1. Reprise Goal, make more precise
    –   What & Why

2. Rough design of what the user sees
    –   Mock-ups of screens
    –   https://moqups.com
        •   From Specialist Assignment 2
        •   Any drawing package will do

3. Block Diagram overview of planned code
    –   The large (5 or so) pieces of they system
        •   With short prose description of each
    –   Should be linked to the screens
    –   In moment will discuss creation of block diagrams

Plan, continued

4. Statement of Risks/Issues
    - What roadblocks/issues/challenges do you foresee?
    - App-wise, programming-wise, hardware-wise, ethics-wise

5. What do you need to learn that you don't know
    - all members

6. **Important:** Specialists
    - Submit a separate essay on how App relates to field of Specialist, **and how the Specialist will contribute to project**
    - Want clear thought about the activities of the Specialist
    - 500 words

- Document must have these sections; will lose marks if missing

Plan Document

- **Plan document length: 1500 words max**
    - Not including 500 word Specialist essay (item #6)
    - Should include pictures
    - Include word count, penalty for overage.

- **Seeking clarity, not quantity of words**
    - 'Omit needless words'

- **Submit to Portal, under "Specialist Assignments" look for Proposal-Plan (if external specialist, then prog submits)**
    - Worth 10% of grade
    - including in-class presentation done following week
    - Due Monday February 1st at 6pm

A Note on Block Diagrams

And evolving Apps

Block Diagrams

- **Block diagram gives the five major pieces of an App's functionality**
  - Is the first step in the standard divide & conquer approach
- **Draw blocks, give each block a name**
  - That gives a sense of what it does
  - Associated words give more detail of function each block has
- **Lines show how each block communicates with others**

- **May need to break blocks themselves down**
  - In a hierarchy, in a subsequent part of your plan document

Example: Sobriety App

- **Based on MyAnkle notion:**
  - Use the accelerometer to measure how well you can balance while standing on one foot

- **Assume that balance degrades with loss of sobriety:**
  - Balance is a function of your brain's ability to coordinate information from three sources: your vision, your sense of body position (derived from subtle changes in muscle tension), and the information sent to the brain by the balance mechanism in your inner ear. When any of the sources do not agree, you feel dizzy and lose your balance (vertigo). Alcohol affects the ability of your brain to interpret that information correctly.

  - Source: http://wiki.answers.com/Q/Why_does_your_balance_go_when_you_are_drunk?

(20)

Sobriety App Design

■ Assume can make measurement when person is sober

■ Make measurement when not

■ Assumption:

– Drinking to Sober difference gives measure of sobriety

– Requires experimentation

Data from Night of Drinking

Name	Time	Volue	# 2
Alex	8:53PM.	.24	.24
Dan	8:54PM	.40	.39
JR	8:45PM	.32	.5
Braida	8:56	.37	.2
Ilona	8:58	.17	.14
Juson	8:59	.3	.21
Niital	9:00	.3	.2
Lyndon	9:03	.48	.29
Henry	9:06	.25	.16
Vivian	9:08	.2	.26

Let's Make the Block Diagram

- What are the main components?

Let's Figure out How to Enhance it

- Think about the context, what could we do to make this more useful/functional/helpful?

Project/Group Topic Discussion

And Group Status Updates

Group Names:

Group #	Approval in Principle	Email Alias	Project Name	Specialist
1	Yes		Portable Perimieter	Moshe Eizenman
2	Yes		FlipFinance	Yeijean Lee
3	Yes		safeMedicare	Ikbae Son
4	Yes		ASD PlayDate	Ian Roth
5	Yes		Gallery Composer	Hoang Anh Thu Nguyen
6	Yes		Journey	Jenna Blumenthal
7	No			Heather Birch
8	Yes		Rounds	Christopher Stewart
9	No			Shu Qing Wang
10	Yes		On My Feet	Andrea Laboni
11	In Review		Simplify	Haider Nawab
12	Yes		Balanced Arm Trainer	Jaclyn Dawe
13	Yes		MySungRussian	Dann Mitton
14	No			Asad Siddiqui
15	Yes		Graph Master	Katarina Gram
16	Yes		MIToc	Raad Yameen
17	Yes		M3 (Mindful Meditative Minds)	Andrea Wilkinson
18	Yes		Flip the Script	Sameen Ahmed
19	Yes		CardiACT	Christopher Sun
20	No			Arlynda Boyer
21	Yes		SoundSpread	Jennifer Moroz
22	Yes		iDOS	Ceceilia Marshall

A Note on Group Interaction

Group Interaction

- Now that groups are formed, it is very important for you to meet regularly and coordinate your activities
- Each of you will need to be assigned tasks, and make commitments to do those tasks at a particular deadline
- The expectations that each group member has of the others must be made clear
  - I suggest that these be written down, and recorded on website
  - The major goals, not small stuff

Difficulties Can and Do Happen

- Most of the difficulties that have occurred in this course have been because expectations were not made clear

- Sometimes, group members consistently failed to live up to commitments.

- If this happens, please report it to me as soon as it is something that you cannot handle with internal discussion & resolution
  - We will help you resolve it

- Disagreements are part of all human relationships
  - One distinguishes oneself by how well you deal with them

What is a good way to communicate?

- Social media
- Piazza
- Email
- Skype/Google Hangouts

Class Participation

Class Presentations & Participation

- A key part of what happens in this course is the contribution you make to other's projects
- You will do many presentations in this class
  - Indeed, one side-effect of this project course is some real practice in giving high-quality, concise & clear communication
  - Most presentations will be 5 minutes in length
  - Must be geared so that most people in the class will understand
- Want everyone to come, listen & provide useful input
  - Expectation that you'll listen and provide thoughtful feedback and suggestions to other's presentation, starting today
  - However, we no longer grade class participation

External Gadgets

Texas Instruments Sensor Tag 2

- Require Android 4.3; Huawei Ascend at 4.2
- **Bluetooth Connection**
- **Sensors:**
  - 9 axis
  - Magnet sensor
  - Light
  - Ambient temperature
  - IR temperature
  - Humidity
  - Air pressure
  - Two Buttons, two lights, quiet buzzer!
- I now have plenty of these
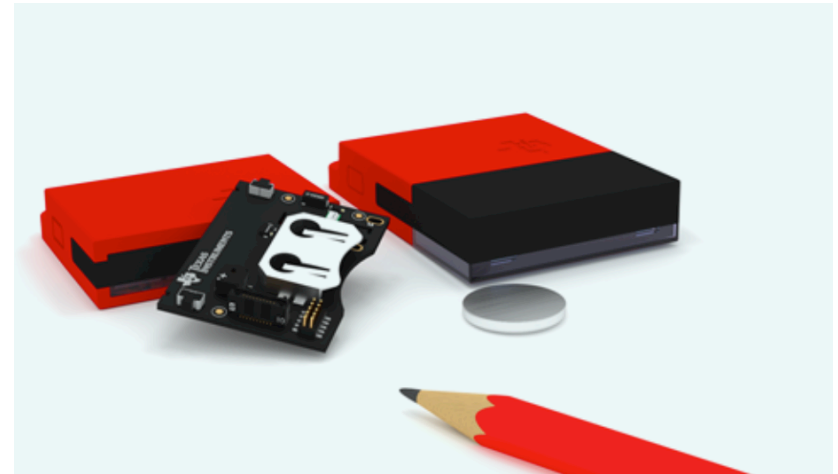
Node Sensor

- A single 'platform' with many different attachable sensors
- Connected by Bluetooth LE (need Android 4.3/iphone)
- See: http://variableinc.com/products/
- I have **one** with these attachments
  - IR temperature
  - Paint Colour
  - 9-axis: Accelerometer, Gyro, Magnetometer
  - Climate sensor (Clima)

A Sensor for Every Application

Other Node Sensors End-Units for Purchase

THERMOCOUPLE

Thermocouple can measure surface temperature temperatures in liquids, semi-solids- foods, and meats, for quality control, and temperature monitoring.

$75

click here to buy or learn more

OXA

With a NODE OXA gas module installed your smart device becomes a super sensor. Each OXA gas module detects one of the following gases: CO, NO, NO2, Cl2, SO2, and H2S.

$149

click here to buy or learn more

CO2

NODE + CO2 is a sensor module for the NODE+ bluetooth sensor platform. The CO2 module measures the Carbon Dioxide level of the air around the sensor.

$149

click here to buy or learn more

BARCODE

We're proud to announce new NODE+Barcode sensor module! NODE+Barcode can scan any item, keeping track of your inventory, pricing and availability.

$99

click here to buy or learn more

Or, build your own:

I/O

The i/o Module allows users to connect different sensors, lights, and buttons, to access the POWER of NODE in their own projects.

$25

click here to buy or learn more

(36)

Button TrackR

- Note where things are, where they were lost!
  - https://www.youtube.com/watch?v=0Ep8XHtsq8A
- Have 3 of these.

TrackR

Other Sensors/Gadgets?

- If you find one that will enable your project, you can request to have it purchased
  - I try to collect these for this course and research
  - No guarantee, depends on cost & function, but ask if you see something interesting!

Small Programming Note: The Android Life Cycle

Android Application Life Cycle

- Recall: Activities are screens that the user sees, and associated process

- Android manages these Activities as a **stack**.

- When a new activity is started, it is placed on the top of the stack and becomes the running activity

- The previous activity always remains below it in the stack,
  - and will not come to the foreground again until the new activity exits.

Important to Pay Attention to 'LifeCycle'

- To ensure app behaves well in several ways, including:

1. Does not crash if the user receives a phone call or switches to another app

2. Does not consume valuable system resources when the user is not actively using your app

3. Does not lose the user's progress if they leave your app and return to it at a later time

4. Does not crash or lose the user's progress when the screen rotates between landscape and portrait orientation.

An Activity Can Be in 1 of 4 'States'

State 1: Active/Running

- Activity in the foreground of the screen (at the top of the stack)
- Has 'focus', meaning user interactions go to it.

State 2: Paused

- activity has lost focus but is still visible
- a new smaller or transparent activity has focus on top of the activity)
- A paused activity is completely alive (it maintains all state and member information and remains attached to the window manager), but can be killed by the system in extreme low memory situations.

Activity States 3 and 4

State 3: Stopped

- activity is completely obscured by another activity
- retains all state and member information
- no longer visible to the user so its window is hidden
- it will often be killed by the system when memory is needed elsewhere.

State 4: Destroyed

- If an activity is paused or stopped, the system can drop the activity from memory by either asking it to finish, **or simply killing its process.**
- When displayed again to the user, it must be completely restarted and restored to its previous state.

Android Talking to Your App

- The Android operating system asks (or tells) your app to go into those different states by invoking methods associated with your Activity

Methods Called By Android to Change States

- Diagram shows states and methods called to change state
  - Colours: the states
  - http://developer.android.com/training/basics/activity-lifecycle/
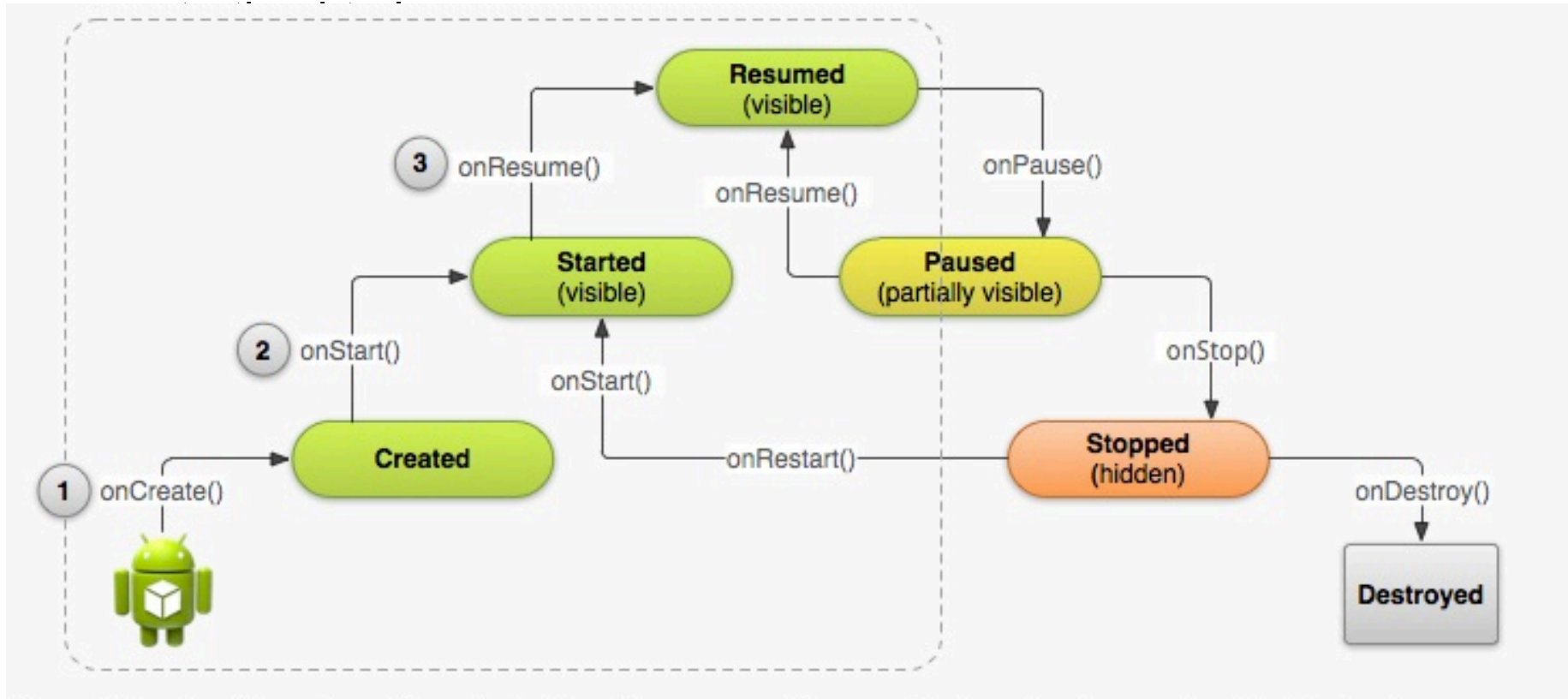
Three Key States

- Activity can be in 1 of 3 states for long period of time:

1. Resumed
   – In this state, the activity is in the foreground and the user can interact with it. (Also sometimes referred to as the "running" state.)

2. Paused
   – In this state, the activity is partially obscured by another activity—the other activity that's in the foreground is semi-transparent or doesn't cover the entire screen. The paused activity does not receive user input and cannot execute any code.

3. Stopped
   – In this state, the activity is completely hidden and not visible to the user; it is considered to be in the background. While stopped, the activity instance and all its state information such as member variables is retained, but it cannot execute any code.

State Management

- The other states (Created and Started) are transient and the system quickly moves from them to the next state by calling the next lifecycle callback method. That is, after the system calls onCreate(), it quickly calls onStart(), which is quickly followed by onResume().

- Depending on the complexity of your activity, you probably don't need to implement all the lifecycle methods.

- However, it's important that you understand each one and implement those that ensure your app behaves the way users expect.

References

1. The Android Documentation:

http://developer.android.com/training/basics/activity-lifecycle/index.html

2. Murphy, Busy Coder's Android, Chapter "Activities and their Lifecycles" (Page 366)

■ Once your project gets going, it is really important to read through this and understand it
  – Previous years' students pointed out that this was the key thing they had not understood in Android, that caused the most problems

The Key 'LifeCycle' Methods

OnCreate()

– Familiar with already – brings the activity to life

OnPause()

– Another Activity has gained the 'focus'

– Should stop any background threads, release large resources (such as a camera)

– **No guarantee that OnDestroy() will be called**, so best to save **all** state here

OnResume()

– Called as activity starts, **or** is restarted from a pause

– Can recall state from file, refresh the User Interface – see example

Fragments Behave Similarly

http://developer.android.com/guide/components/fragments.html

(50)
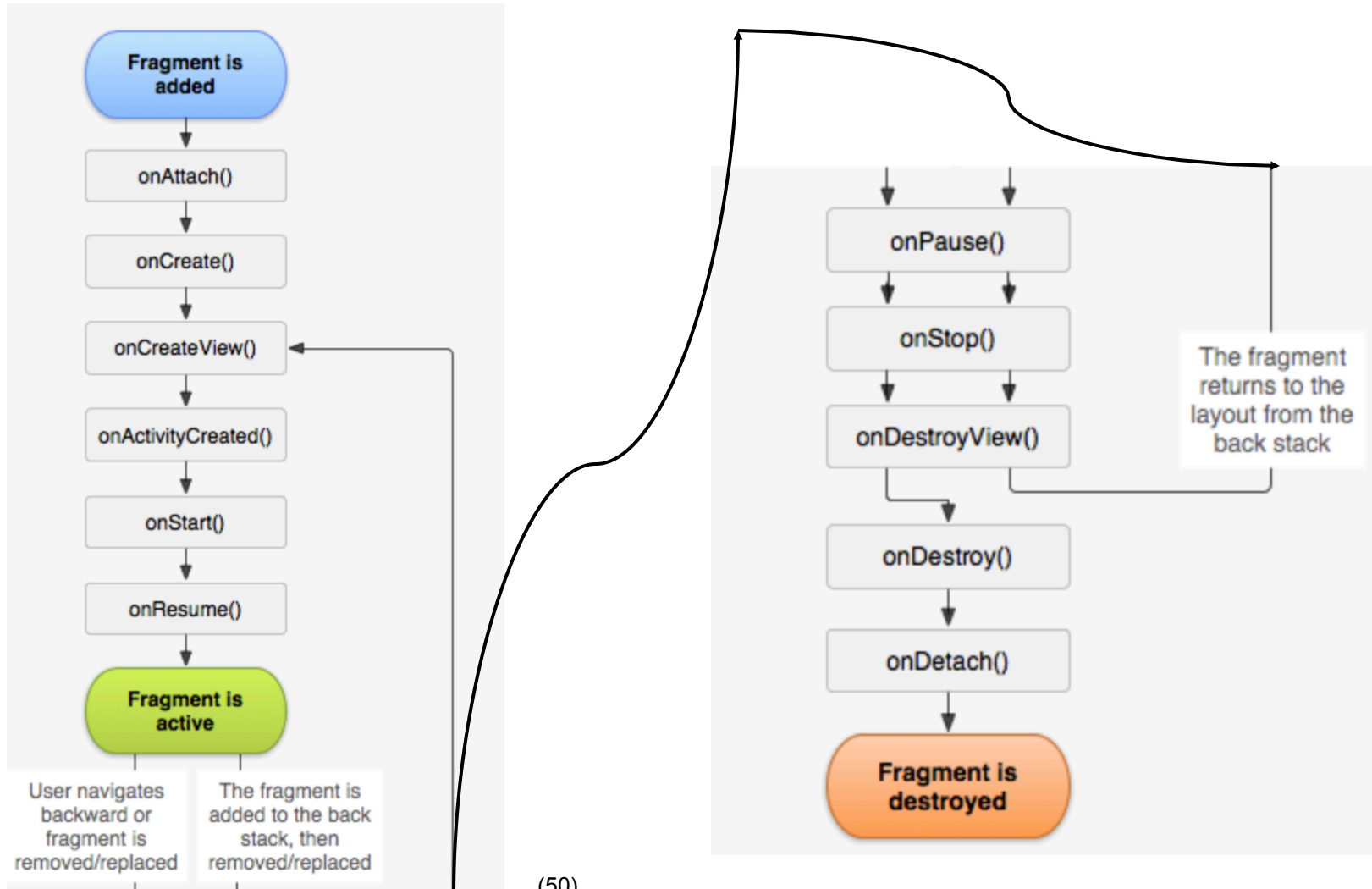
My App: TeamChooser

Solving a Problem in Pick-up Team Sports

Kids Who Play Want Games to be Fair!

So Do Adults!

- When playing friendly games there is a need to choose who is on which team

- A common method is to have team captains, and they alternate choosing people, in a very public way

- How many people have been picked **first?** ☺

- How many people have been picked **last?** ☹
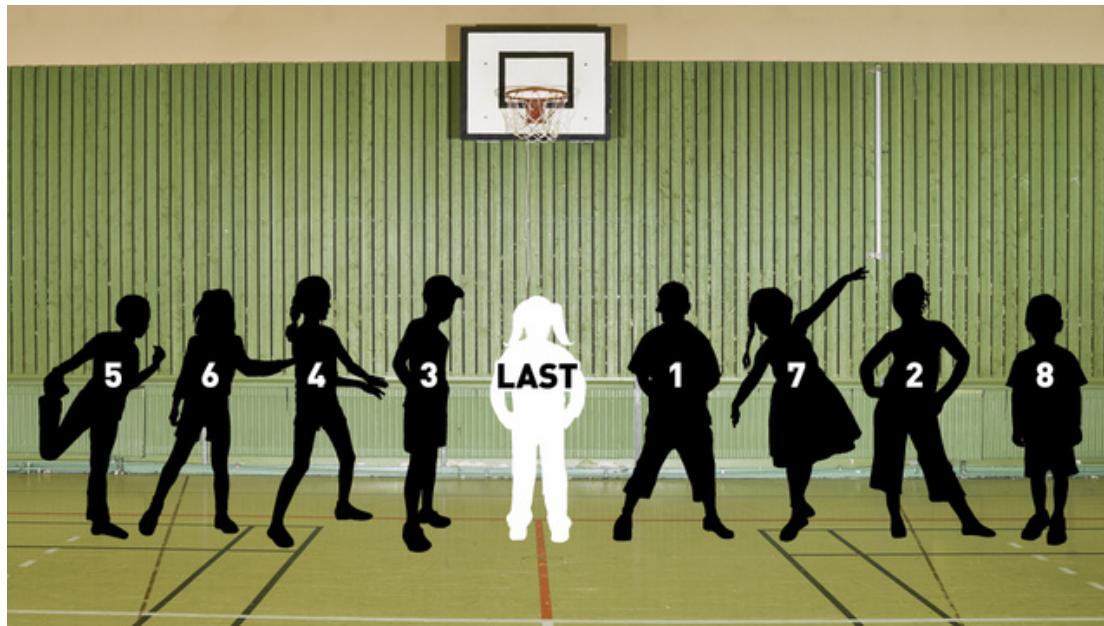
I've Been Playing Hockey for Many Years

- A friendly game, but still have problem choosing teams:

- Classic Canadian method:
  - Put players' sticks into middle
  - One person randomly throws sticks to either side!
  - Random outcome!

- I once chose teams for a few years in friendly game
  - People complained a lot!

(54)

Play in Two Different Friendly Games

- **Wednesday** Game: terrible chooser (**Agar**)
  - People always complaining
  - Games often lopsided, much distaste
  - no-one else took over, though (didn't want the hassle?)

- **Sunday** Game: excellent chooser (**Paul**)
  - Paul had a natural ability to pick great teams!
  - Even when teams didn't look right, many more times than not, the game was fair
  - Became known as the '**algorithm**'

The Solution: TeamChooser

- Wouldn't it be great if an App made the teams?
  - No one to yell at
  - Possibly give better teams

- Who needs this?

- Every pick-up hockey, soccer, basketball game around!

TeamChooser: How It Works

- Enter every player in advance of game day
  - Player's name
  - Preferred position (offence or defense)
  - **A rating, from 1-10, as to how effective player is**
    - Rating is the trickiest part

- On game day – select all players present
- Push '**Make Teams**'
  - And voila, two evenly matched teams

Do Demo! Entering Players

Selecting Present & Making Teams

Carrier 🛜 2:00 PM 🔋

14 players selected (D:4 O:10)

< Back   **AmdurWedFri**   Make teams

Gurpreet Hattan
Offense

Jack
Offense ✓

Jamie
Offense

Jason
Offense ✓

Jessie
Offense ✓

Joachim
Offense

Jonathan Rose
Defense ✓

Jordan D
Defense

Jordan T
Offense ✓

Josh
Offense

Edit...   Unselect all   Select all   +

Carrier 🛜 2:00 PM 🔋

< AmdurWedFri **Teams** Freeze Tweak

LIGHT A:6.1 D:1 DA:7.5 O:3 OA:5.7

Jason

Craig Boutilier

Jessie

Brendon

DARK A:6.3 D:1 DA:6.3 O:3 OA:6.3

Jonathan Rose

Connor

Frank

Jordan T
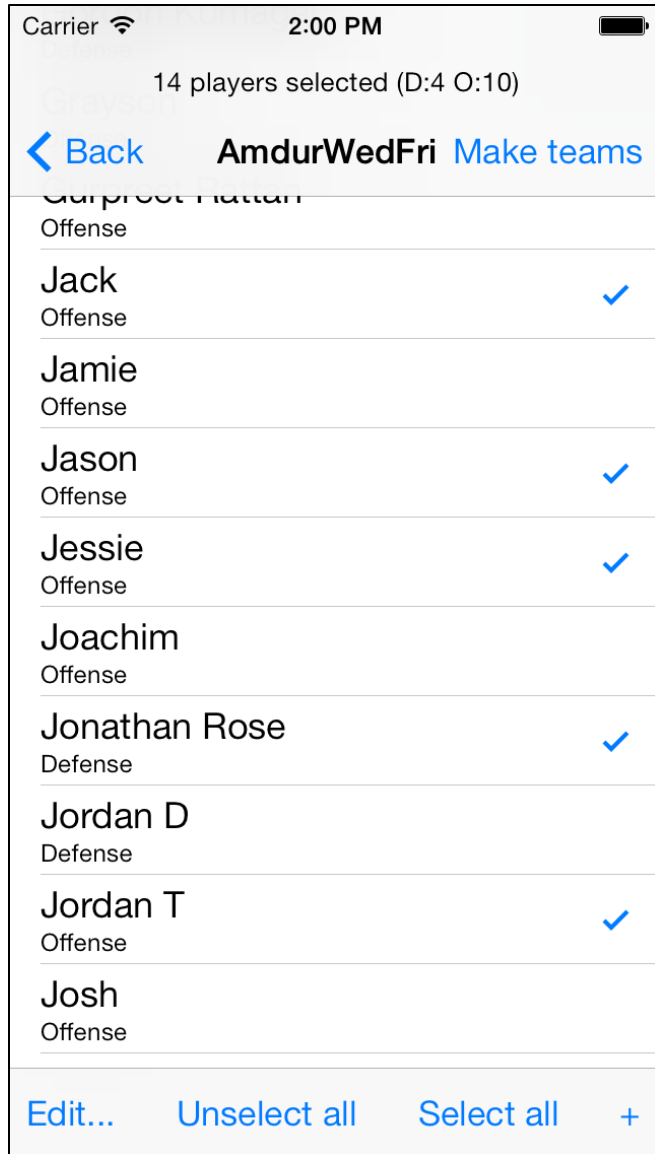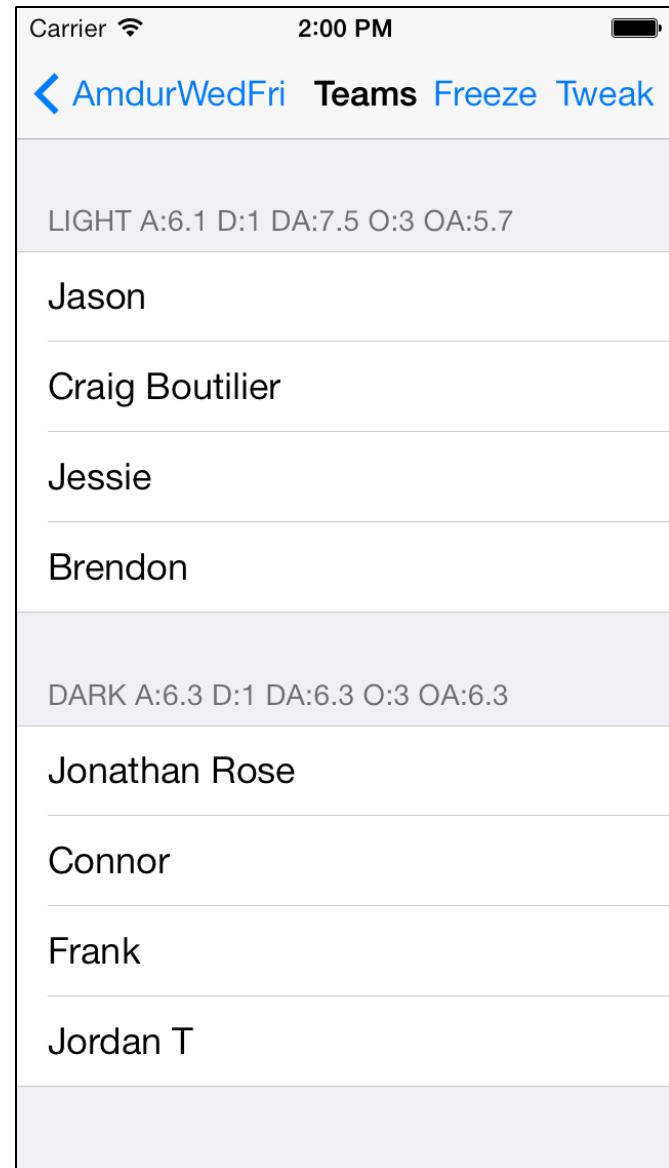
Recent Game

Dark Team

Cole Zem
Brian Dov
Pavel
Raj B
Matt Zale
Rich Zemei

Light Team

Gurpreet Rattan

Final Score in that Game

- A Victory for Team Chooser!

Team Selection Method ('Algorithm')

Step 1: Sort Players in Order of Rating, Highest to Lowest

Step 2: Alternate Team Assigned Going Down List

Team A   **6**   **Team B**

5

4

3

2

1

(62)

Team Selection Method

- Gets more complicated when add features!
  - Balance offense and defensive player count
  - Pre-assigns
  - Balance quality of offense and defense

- Many discussions from CS and ECE Professors over algorithms in hockey game!

Entering Players

Selecting Present & Making Teams
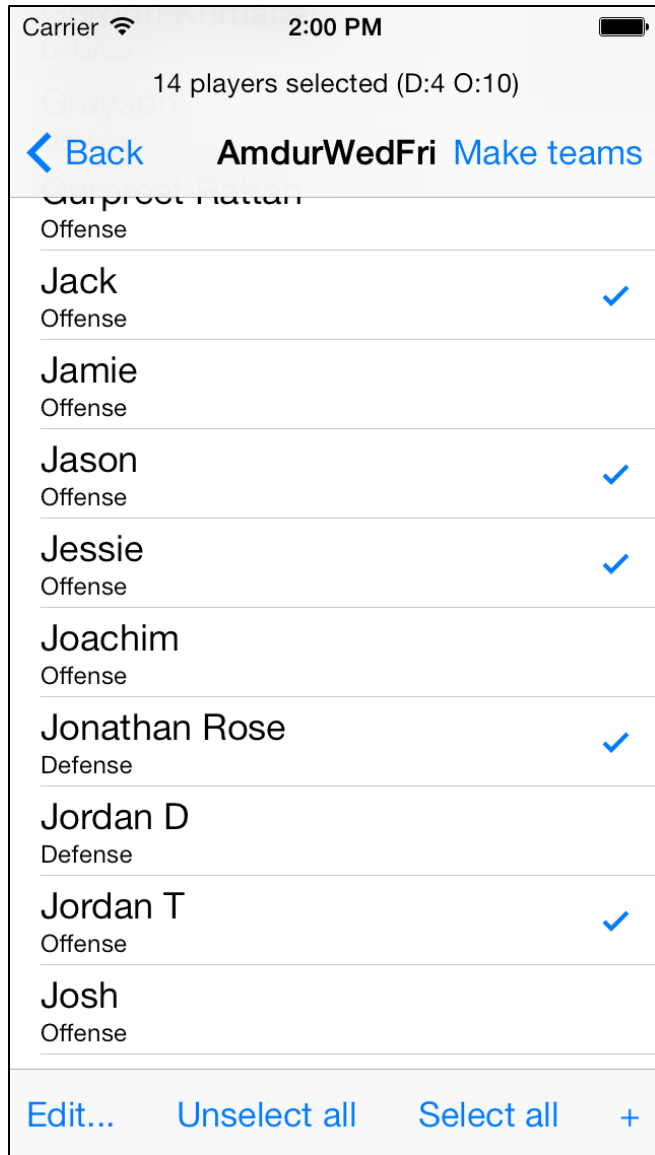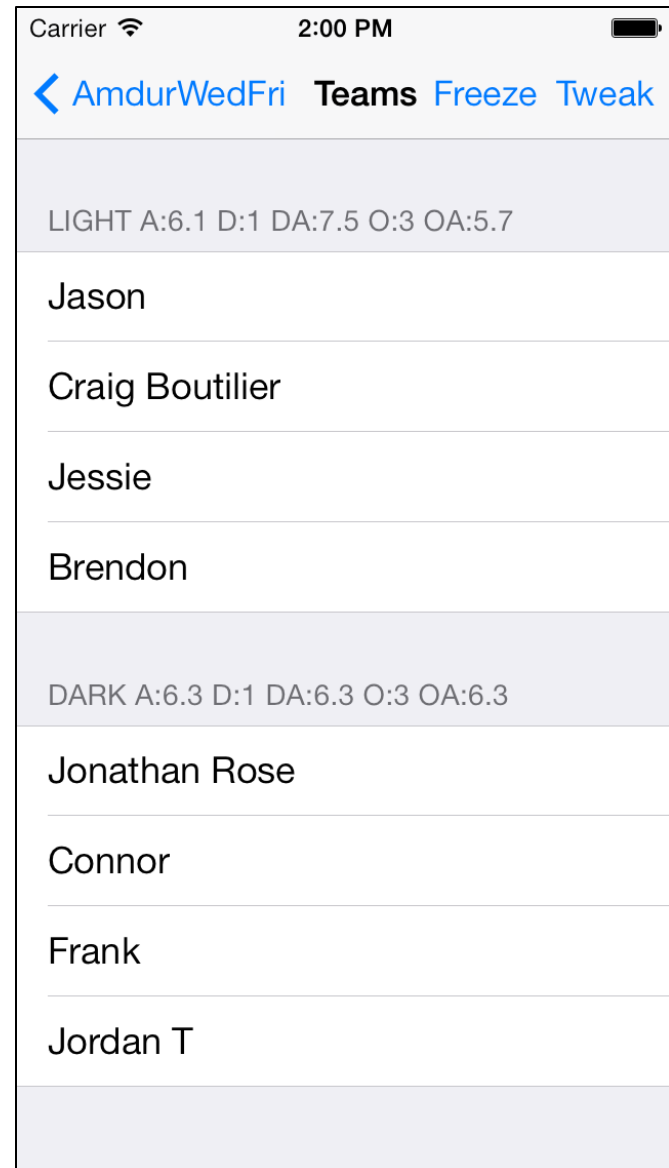
Does it Work?

- Yes!

- I've been using it with friends in roughly 500 hockey games and it has often done a good job.
  - We've tweaked it's algorithms here and there
  - Added some features
  - Occasionally very unbalanced games, bad luck?

On iPhone App Store Since May 2010

- Free!
- 2330 Downloads
- Mostly in US/Canada, but a few in UK, Ireland, Japan, Norway, Romania, Portugal, Australia, Denmark, Finland

(67)

Lesson Learned

- From last time: Ratings of players, key part of engine, **must be kept secret!**
- Can add password to App so no-one can grab phone and look at their ratings or anyone else's

Sad Outcome: Agar

- The day after the first use of TeamChooser on Wednesday
  - Recall very poor chooser – Agar
  - Folks joked and called it the iGar.

- Agar **never played again on Wednesday!**
  - Still plays hockey, but not with team he played with for decades
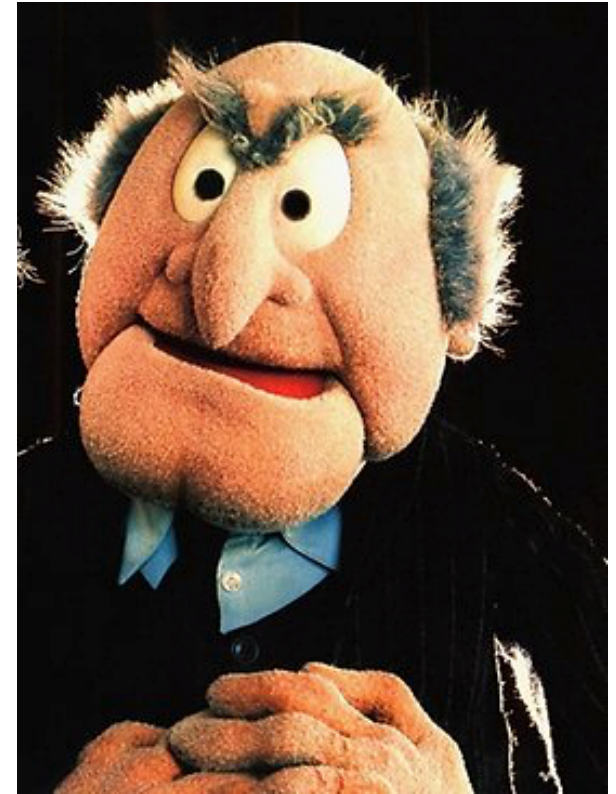
Feature: No-One Chosen Last!

- The order that people are listed (and spoken out loud by user) is randomized
- There is no way to infer rating

(70)
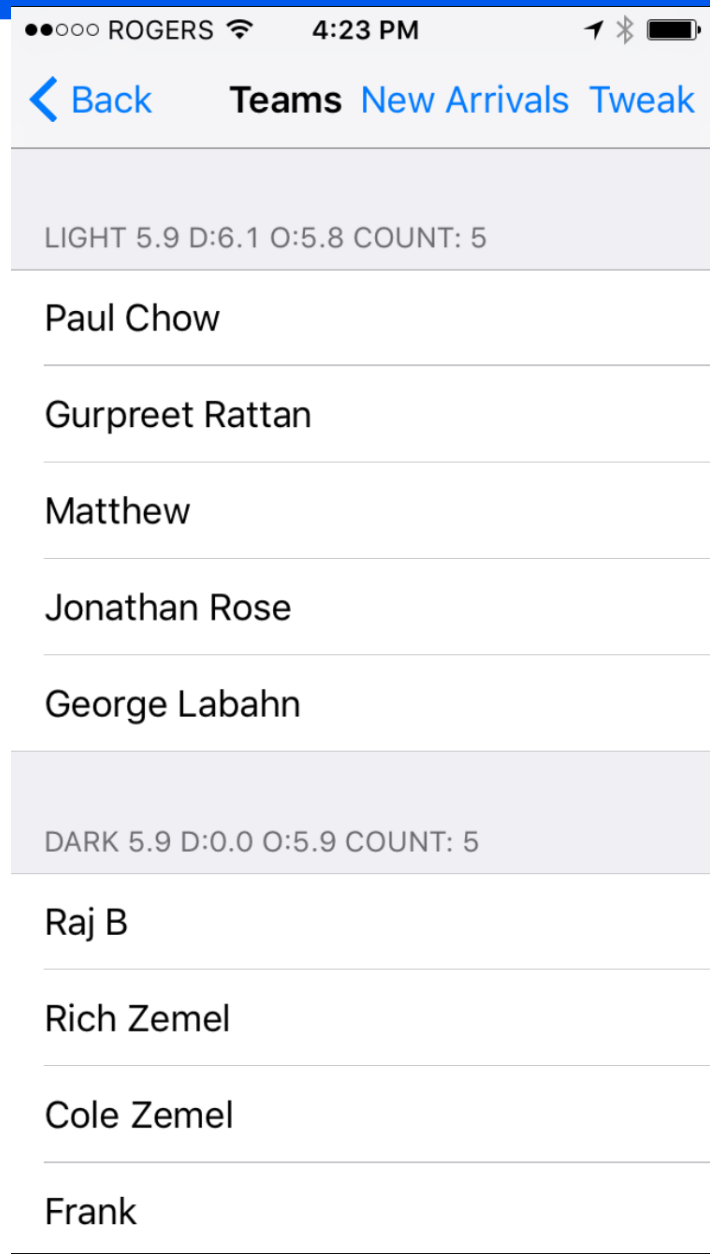
Improvements Needed

- **Really** needs a backing website
  - To support a business model of advertising, promotions related to sports

- Much discussion about using results of games to determine better ratings
  - Rating players is the most difficult part of using

- Don't really have time to support
  - Did, this year, work on improved algorithms
  - Added Late Arrival Feature (good!)
  - Not sure new algorithm gives better result

Downloads Over the Last 30 Days

- Is delightful to see people using!

Is Anyone Using it Who Bought It?

- **Instrumented Using Flurry.com**
  - Analytics for iPhone, Blackberry and Android
  - Very easy to insert into any app

- **Reports:**
  - # of users sessions, amount of time spent on app
  - Specific pages/events, as you wish from each user
  - Location of user, if already use GPS (no other ID).
  - **Anything I wish to report!**

- **Flurry also gives guess as to age & gender of users!**

Sample Flurry Reports

Event Logs

Errors (uncaught exceptions)

Geography

New Users

Frequency of Use

Session Frequency Per Period   Explain ⓘ   Download CSV 🗎

1 sessions: 1.69K
2 sessions: 896
20+ sessions: 15
15 - 19 sessions: 51
10 - 14 sessions: 139
7 - 9 sessions: 265
3 - 4 sessions: 945
5 - 6 sessions: 453
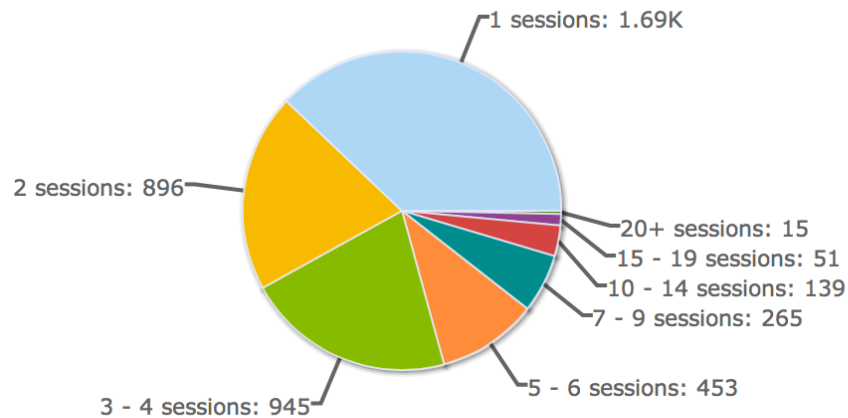
Daily

Median:
2.6 sessions / day

Benchmark:
Sports
1.7 sessions / day

1 sessions: 863
2 - 3 sessions: 810
50 - 99 sessions: 3
20 - 49 sessions: 110
10 - 19 sessions: 289
4 - 6 sessions: 622
7 - 9 sessions: 234
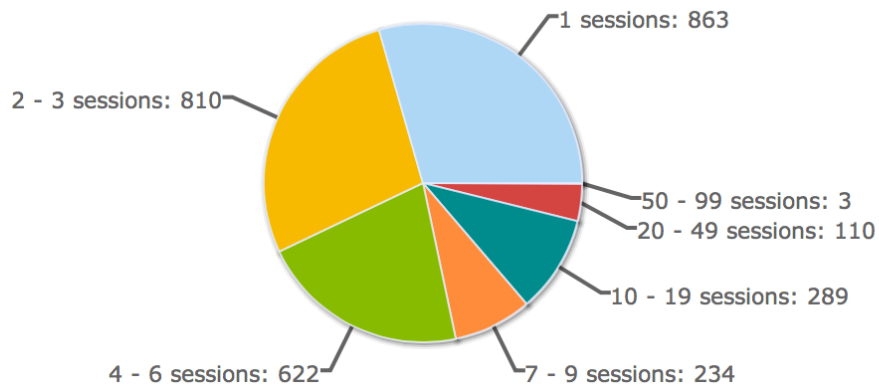
## Weekly

Median:
3.5 sessions / week

Benchmark:
Sports
1.9 sessions / week

Sessions
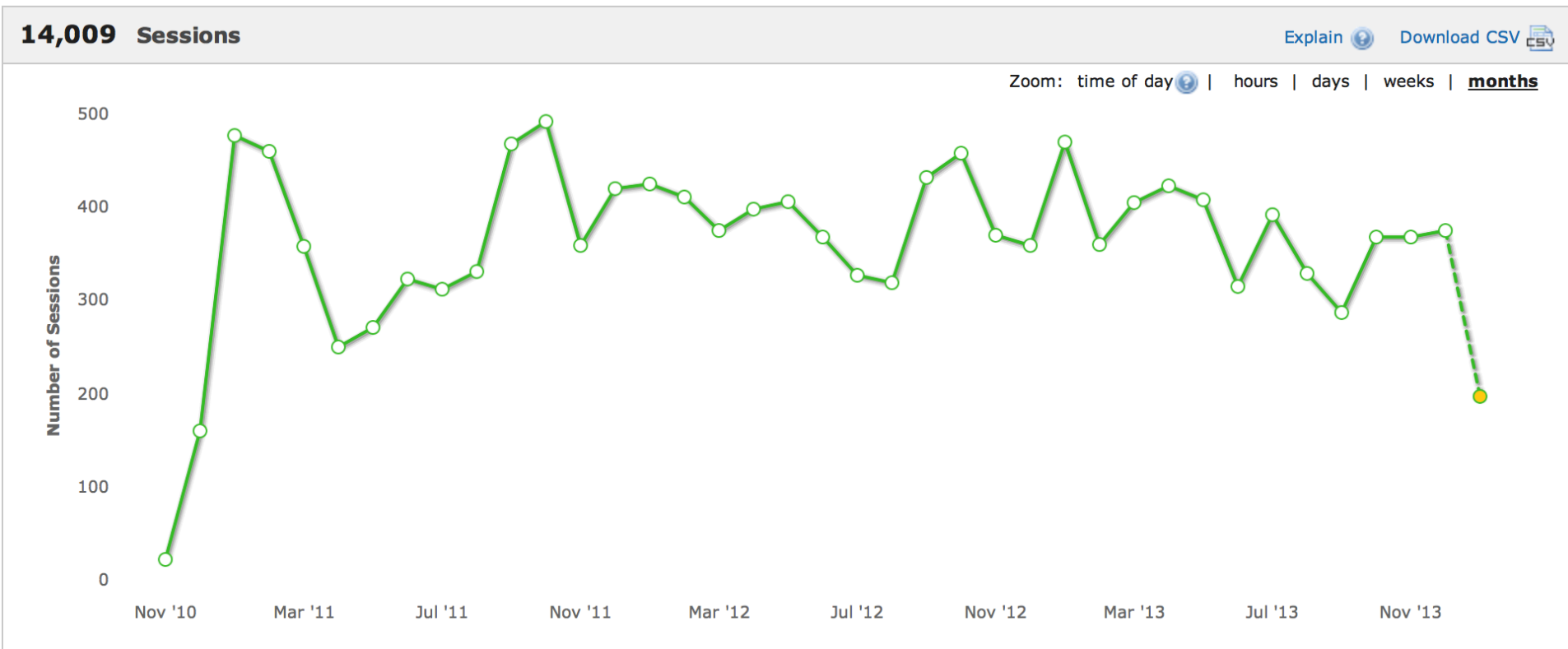
Age Estimates!
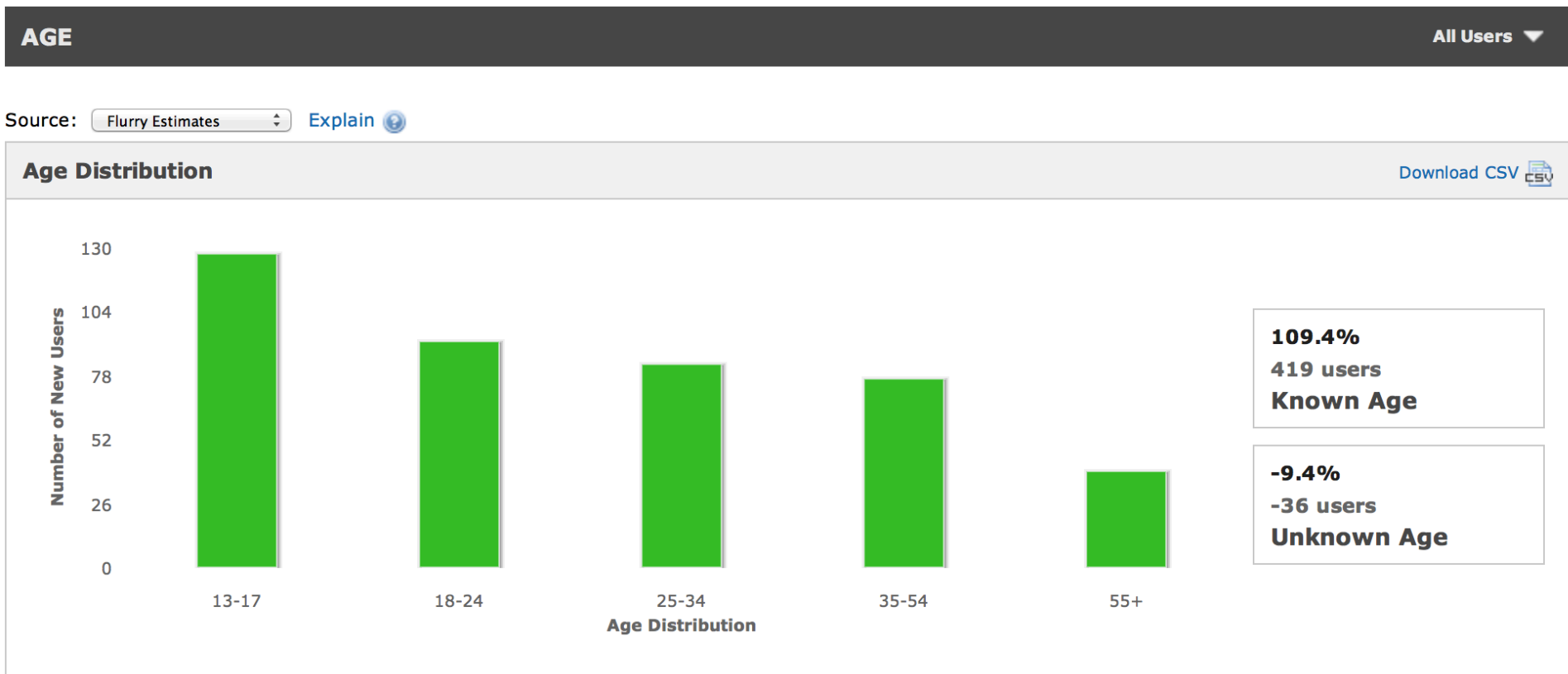
Gender Guess!

GENDER   All Users ▼

Source: [Flurry Estimates ↕]   Explain ⓘ

Male: 63.69%

Female: 36.31%
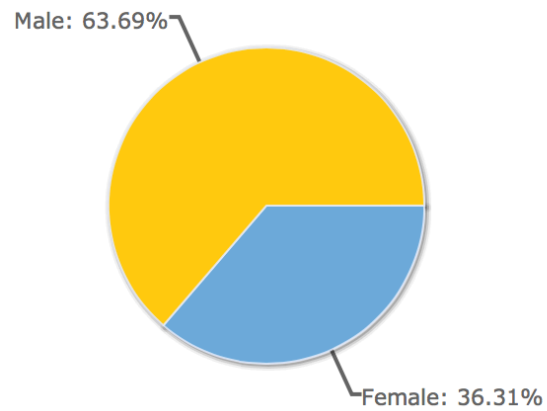
93.47%
358 users
Known

6.527%
25 users
Unknown

Languages
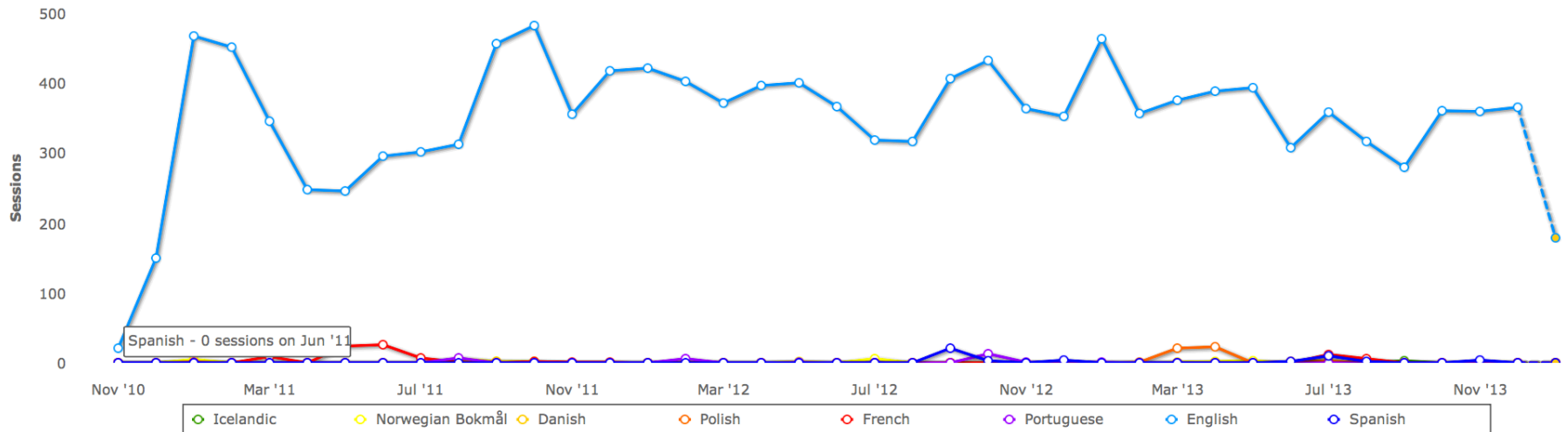
Lots More

- See www.flurry.com

Google Analytics is Similar – MyAnkle