G53MDP Mobile Device Programming

Module Introduction / Schedule

Who are we?

- Dr. Martin Flintham
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- C2, Computer Science

- Dr. Xin Chen
- xin.chen@nottingham.ac.uk
- B37, Computer Science

- http://moodle.nottingham.ac.uk
- Self enrolment available

Lectures and Labs

- Lectures
  - Monday 11:00-12:00 C33 Exchange
  - Thursday 10:00-11:00 C33 Exchange

- Labs (**starting next week**)
  - Thursday 13:00-14:00 A32 CS

Assessment

- 1x1 hour exam (30%)
- Coursework 1 (30%)
  - Series of assessed exercises
- Coursework 2 (40%)
  - Software development exercise
- More on this later…

Module Overview

- 20 credits
- Education aims
  - To teach the principles of program design, and to give experience of designing and developing programs.
- Learning outcomes
  - Knowledge and Understanding:
    - Understanding of the theory and practice of programming in the context of a mobile device.
  - Intellectual Skills:
    - Understand and logically evaluate program requirements and specifications.
    - Understand the complex ideas of programming solutions and relate them to particular problems.
  - Professional Skills:
    - The ability to write programs.
    - The ability to transfer programming skills between classes of devices.
  - Transferable Skills:
    - The ability to solve problems using programming including mathematical problems, to schedule and present their work and to retrieve additional learning material.

Module Overview

- Developing software for mobile devices
  - Mobile hardware
  - The Android operating system
  - App development using Android
  - Principles of developing for mobile devices
  - Overview of iOS and cross-platform development
- Software engineering
  - Given a constrained device / OS, build software for it
  - Understanding how particular features impact software development, underpin design decisions

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This module is basically just about phones

Prerequisites

- G51CSA Computer Systems Architecture
- G51PRG Introduction to Programming
- G51ISO Introduction to Software Engineering

- Or equivalent knowledge and experience of programming and basic computer architecture.
- PGT?

Prerequisites

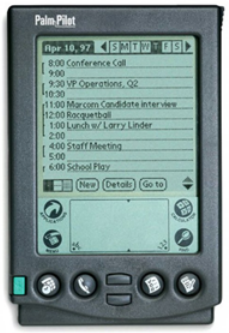
- This module is **not** an introduction to programming in Java
- You should be comfortable with
  - Java (or similar, i.e. C#)
  - Classes, Objects, Instances, Member Methods & Variables
  - Inheritance, Super-classes, Sub-classes
  - Iterative development and debugging
  - Concepts of threading and concurrency
- Plus have some understanding of basic computer architecture


1987
2010


My Cell Phone History
DF688
R280
T60d
T300
T237
P900
T637
K700i
W600i
SLVR L7
W810i
P910a
T226
SLVR L2
BlackJack
iPhone
K850i
W610i
iPhone 3G
K550i
C702
BlackJack II
iPhone
iPhone 3G

Smartphones

1996 - 2007



1996
Palm Pilot 1000

1999
Compaq Aero 1530

2000
HP Jornada 545

2000
Casio E-105

2000
Compaq iPaq 3100

2002
O2 XDA

2004
AnexTEK SP230

2005
Palm Tungsten E2

2005
HTC Alpine

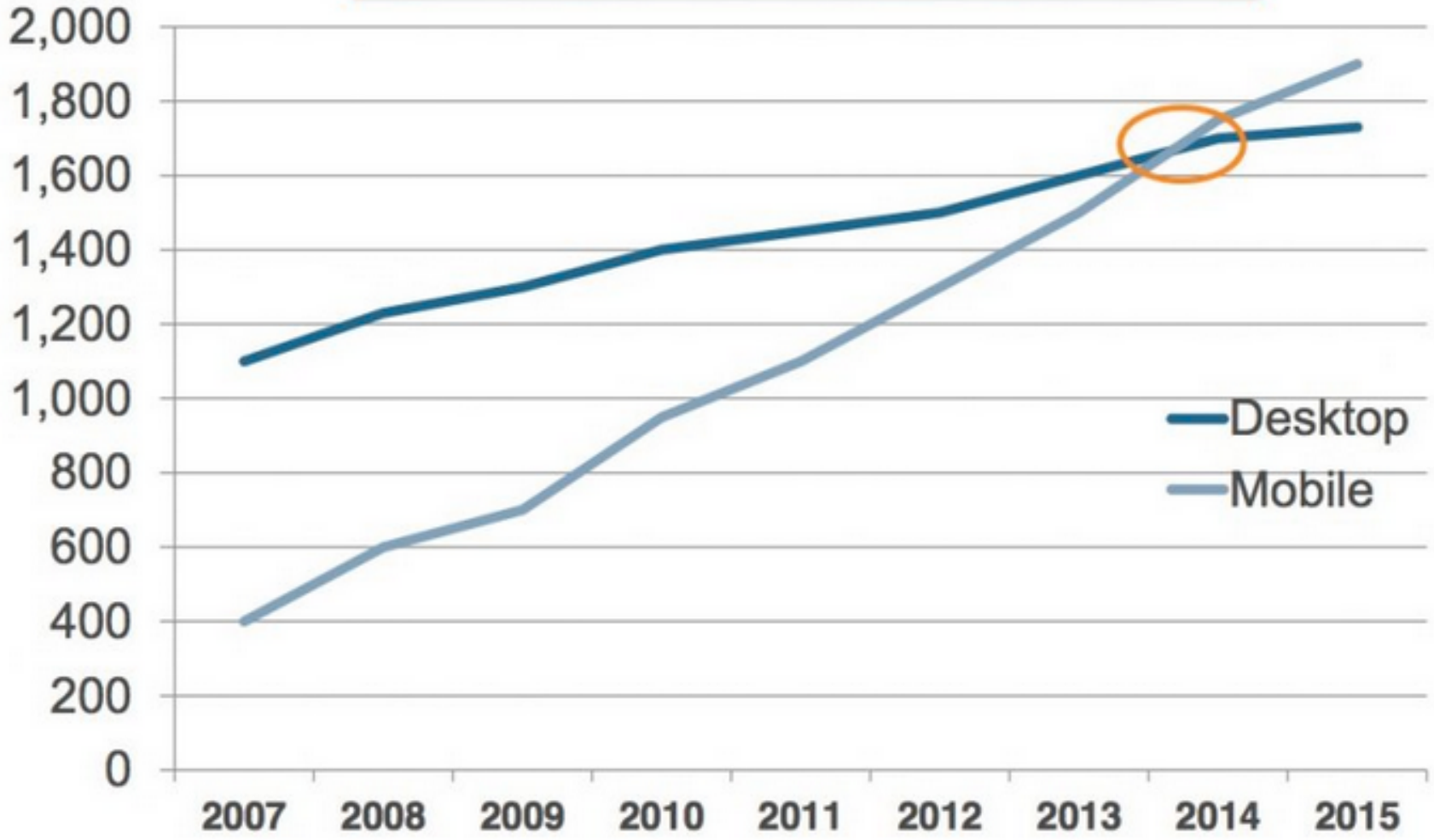
2007
Apple iPhone


THE FOOTBALL RAMBLE
The Minstrel of the Syllable
The Football Ramble

Why Mobile Devices?

- 51 million iPhones shipped last quarter
- 293 million Android devices
- 11.1 billion apps downloaded from Google Play Store
- 349 million smart phones last quarter
  - Up 3.9% since last year
- (1.2 million Windows phones)

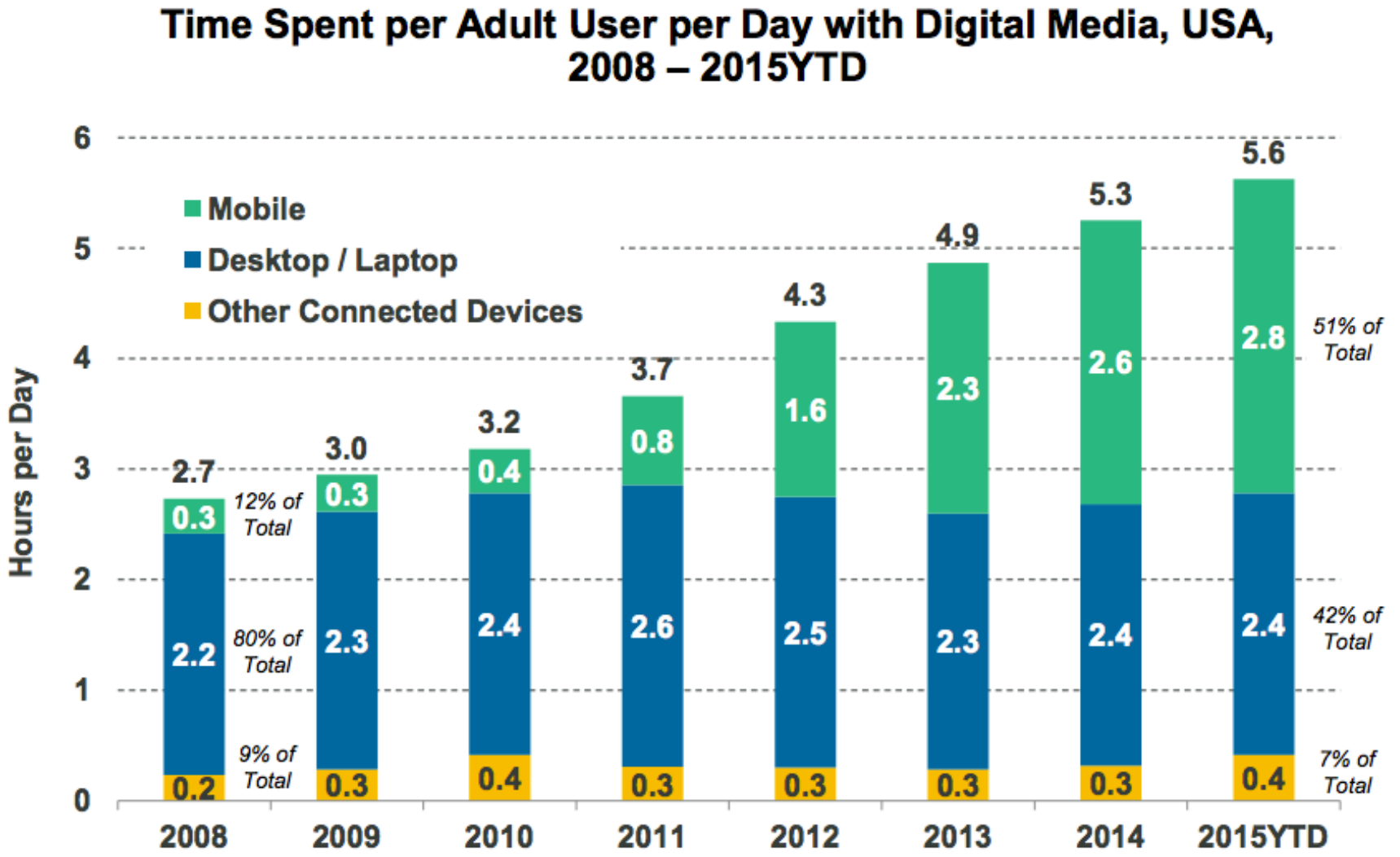
Number of Global Users (Millions)



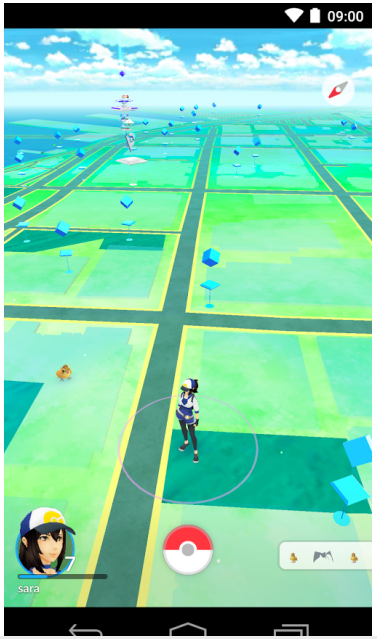
comScore.

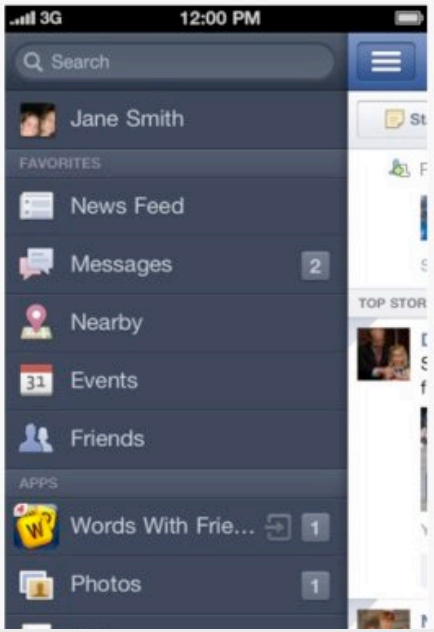
Source: Morgan Stanley Research

Internet *Usage* (Engagement) Growth Solid
+11% Y/Y = Mobile @ 3 Hours / Day per User vs. <1 Five Years Ago, USA



Source: eMarketer 9/14 (2008-2010), eMarketer 4/15 (2011-2015). Note: Other connected devices include OTT and game consoles. Mobile includes smartphone and tablet. Usage includes both home and work. Ages 18+; time spent with each medium includes all time spent with that medium, regardless of multitasking.





1. Homescapes
Playrix Games

2. WhatsApp Messe
WhatsApp Inc.

3. Messenger – Tex
Facebook

4. Wish - Where eve
Wish Inc.

5. Snapchat
Snap Inc

6. Amazon Prime Vi
Amazon Mobile LLC

7. Instagram
Instagram

1. Tinder
Tinder

2. Candy Crush Sag
King

3. Pokémon GO
Niantic, Inc.

4. Gardenscapes
Playrix Games

5. Candy Crush Sod
King

6. Mobile Strike
Epic War

7. Google Drive
Google Inc.

Brainstorming

- Pick a mobile device (perhaps one that you own)
- What do you **use** it for?
- In what **context** do you use it?
- What **properties** does it have?
- **Which** of these are important for a developer?

Brainstorming

- Physical size
- Display size
- Mode of interaction / user interface
- Multitasking?
- CPU speed
- Storage capacity
- Network connectivity
- Sensors
- Battery life
- Personal data / privacy

Module Overview

- Fundamentals of mobile hardware
- Android
  - Applications and activities
  - Threads and services
  - Data storage
  - Content and media
  - Responding to events and broadcasts
  - Security and permissions
  - *Kernels and the operating system
  - *Interprocess communication
  - (Native code and JNI)

Module Overview

- Touch
  - Gestures
  - Hardware
- Batteries
  - Power management
  - Speed, optimisation and the tyranny of battery life
- Mobile Networks and Sensors
  - Location-based services
  - Data
  - ~~Telephony - you can still speak to people on a phone~~
- iOS, Cross-platform development overview
- Apps in a broader ecosystem
  - Testing
  - Integration with web applications

Lectures

- Mostly “standard” lectures
- Some skewed towards demonstration
- ~20
- Split 50/50

Expectations

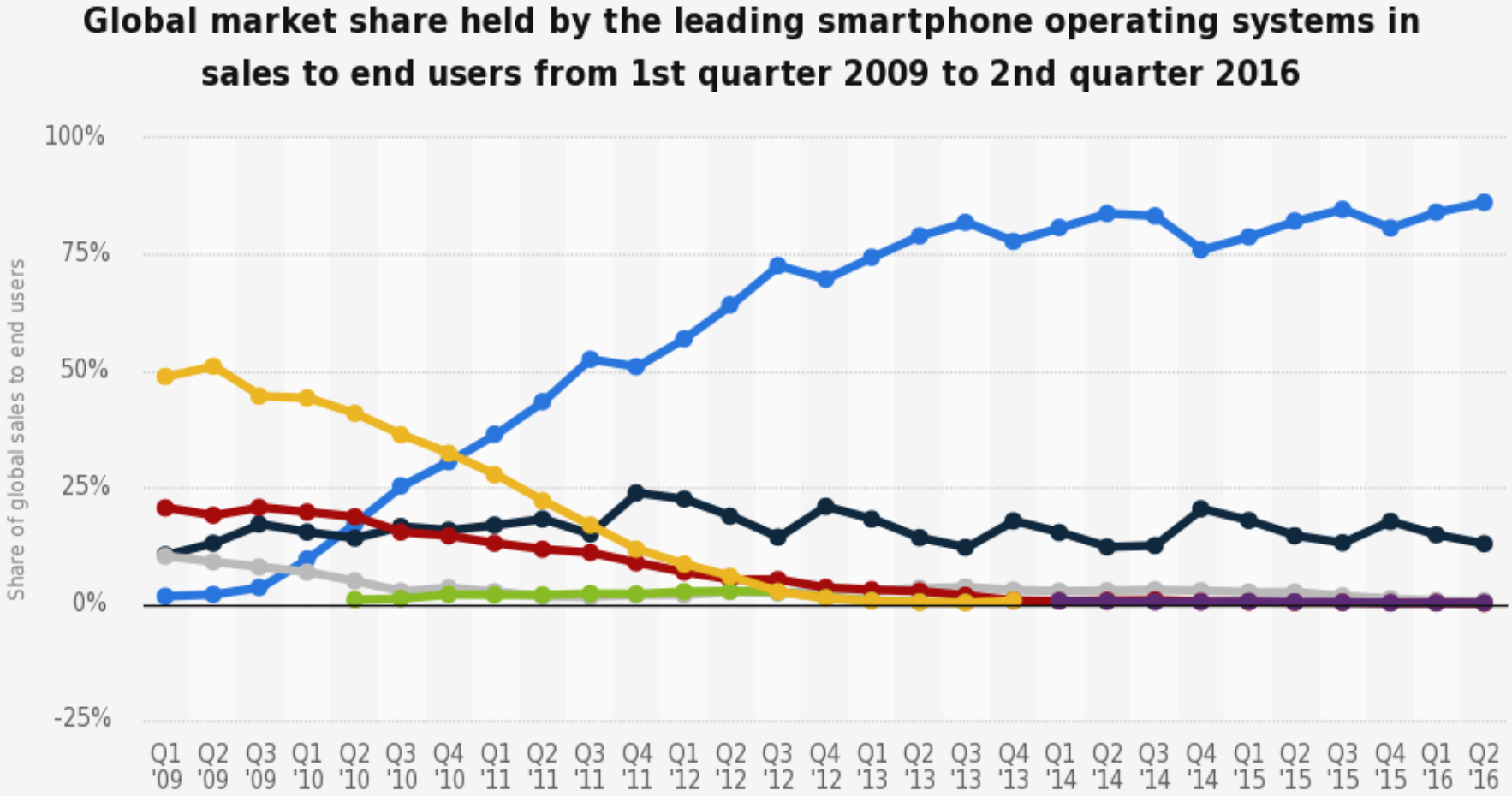
- The SDK for Android is very large
  - Can't hope / don't want to cover it all in lectures
    - Yes, there are constantly new features, but conceptually Android generally stays the same
- You are expected to attend lectures and take notes
  - Lecture slides are not sufficient on their own
  - Recording devices are permitted
  - Some self-directed learning is expected
- Ask questions
- Talk to me if you have problems or suggestions
- Don't cheat
  - Stats

Exam

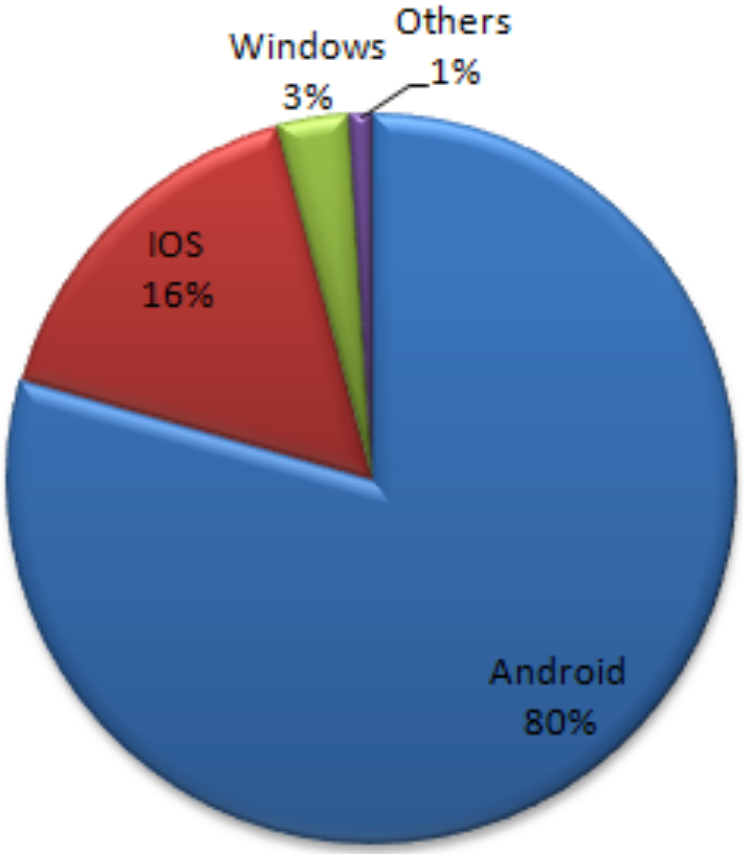
- 1 hour
- 30% of the module mark
- Covers the background material
  - E.g. hardware design, principles of mobile application programming, characteristics of mobile devices, optimisation etc…

Labs and Coursework

- There will be weekly lab exercises
  - Creating *small, contrived* Android applications that make use of the material covered in lectures
    - NB you do not need an Android phone
  - Will probably take longer than 1 hour
    - Lab sessions are your opportunity to get help and feedback
- Leading to assessed exercises (x3)
  - A couple of weeks to do each one
  - Worth 30% of the mark
  - Clearly identified as such
- Develop a mobile application
  - More open ended
  - Worth 40% of the mark


Global market share held by the leading smartphone operating systems in sales to end users from 1st quarter 2009 to 2nd quarter 2016
Share of global sales to end users
100%
75%
50%
25%
0%
-25%
Q1 '09
Q2 '09
Q3 '09
Q1 '10
Q2 '10
Q3 '10
Q4 '10
Q1 '11
Q2 '11
Q3 '11
Q4 '11
Q1 '12
Q2 '12
Q3 '12
Q4 '12
Q1 '13
Q2 '13
Q3 '13
Q4 '13
Q1 '14
Q2 '14
Q3 '14
Q4 '14
Q1 '15
Q2 '15
Q3 '15
Q4 '15
Q1 '16
Q2 '16

Global Operating System Market Share 2015



Why Android and not iOS?

- ~~We don't have a Mac lab.~~
- We don't have a big enough Mac lab.
- Android SDK and tools are free and cross-platform
  - Android studio
  - http://developer.android.com/tools/studio/index.html
  - Android emulator
    - (Genymotion for "personal" use)
- Recommended text
  - http://developer.android.com/

Questions on course structure?