COMP327

Mobile Computing

Session: 2014-2015

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UNIVERSITY OF LIVERPOOL

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Lecture Set 1 - Introduction

In this Lecture Set...

- Admin
- Why Mobile Computing?
- Module Development

General Admin

- Lecturer: Dr Terry Payne
  - Room 205, Ashton Building
  - Email: T.R.Payne@liverpool.ac.uk
  - Surgery: Mon/Tues/Fri (email for appointment)

- Course Notes *(currently being updated)*
  - **Will be available from the web site as pdfs**
  - Printed versions will be handed out later in the module

- Web Site and Resources
  - General information
    - http://www.csc.liv.ac.uk/people/trp/COMP327.html
  - Announcements (via RSS):
    - http://www.csc.liv.ac.uk/people/trp/Teaching/rss.xml
  - Assignments will be emailed and available via RSS & Web

Module Delivery

- Lecture & Tutorial Times:
    - Monday 16:00 - 17:00, in BROD-108
    - Tuesday 12:00 - 13:00, in ALT
    - Thurs 11:00 - 12:00, in BROD-108

- Lab Classes:
    - Formal Labs (with exercises) weekly
        - Class has been divided across three lab sessions

    - Monday 11:00 - 12:00, in Mac Lab (Lab 4, Holt Building)
    - Tuesday 9:00 - 10:00, in Mac Lab (Lab 4, Holt Building)
    - Thursday 16:00 - 17:00, in Mac Lab (Lab 4, Holt Building)
        - Commence in Week 2
- All practical work is Apple Mac based!

Module Assessment

- Assessment is through two components:
  - Implementation-based courseworks, worth 40% of the final mark.
    - Two Assignments, worth 15% each (dates tbc)
      - Test understanding of the iOS component
    - One Assignment, worth 10% in total (by end of week 11)
      - A portfolio of 5 apps generated from the lab work
- A written exam will take place at the end of the Semester, worth 60% of the final mark.
  - *Note - all of material covered by the module is relevant, and thus any of it could appear in the exam...!*

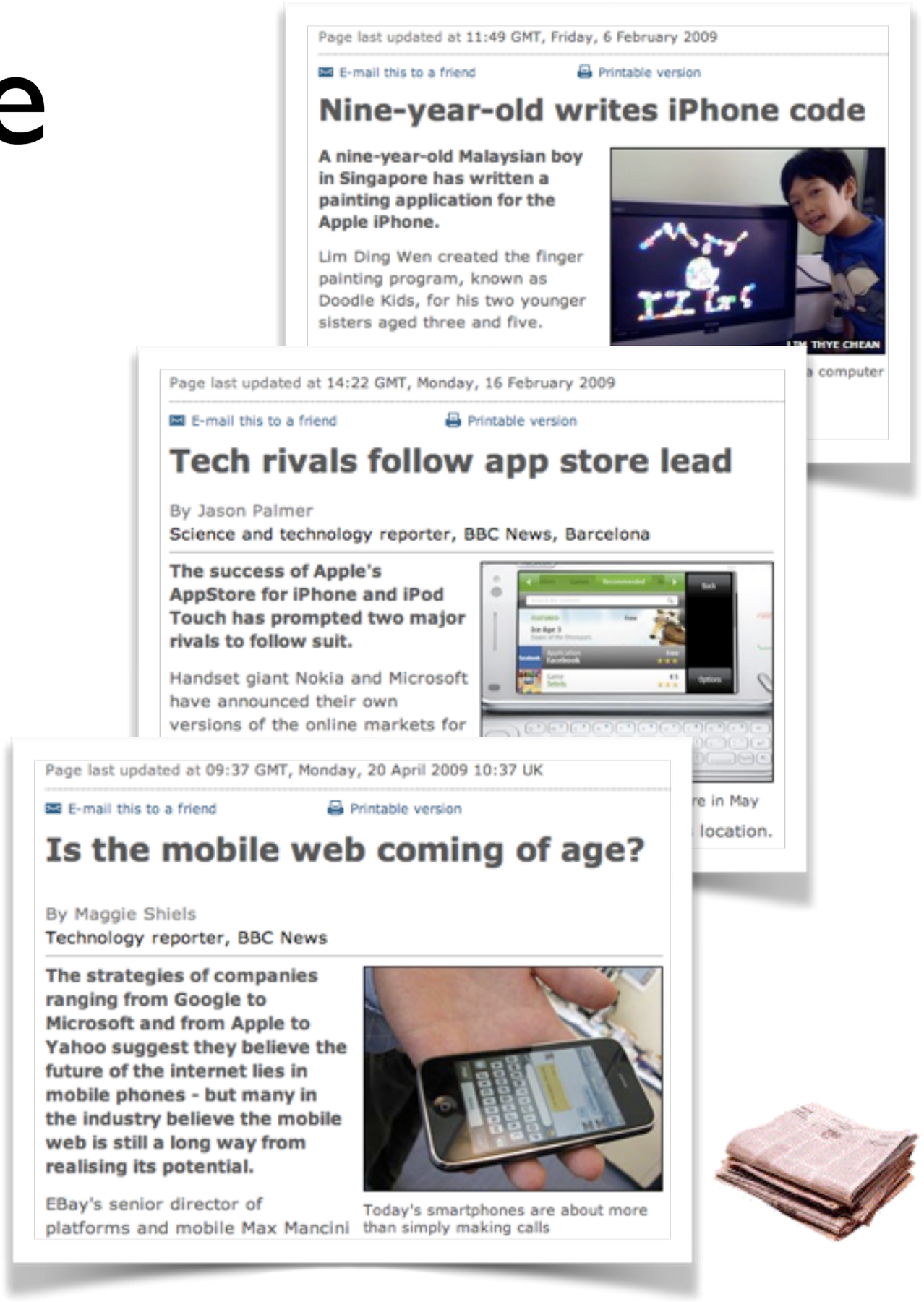
Lab Assessments

- Each Lab will walk you through different aspects of iOS development.
- Focus is on iOS8
- Six labs planned covering the following topics
    - Objective-C, Xcode 6 and Unit Testing
    - Basic App development, MVC, and touch events
    - Storyboarding, Segues, Tables, Navigation and Data Entry
    - Adaptive Layout, Screen Fragmentation
    - Grand Central Dispatch, Multi-Tasking and External Data
    - Map Kit and Locations

- Each Lab consists of a set of steps, and an additional task
    - Completing the steps can earn 1 mark
    - Completing the additional task earns 1 mark
- At the end of the module, you should submit apps (not source) for
    - 5 of the 6 labs (you can choose any 5) as a single zip
    - Maximum marks are 5 x 2 marks each = 10 marks (i.e. 10% of entire module

What is Mobile Computing?

- The study of computing on small devices!
- Is that it?
  - How does the use of the internet change when your are mobile?
  - How does the use of devices change?
  - What are the expectations of users on mobile devices?
- Why is it so exciting?
  - Is it really novel???



The Challenges for Mobile Devices

- Mobile devices are fundamentally different to traditional PC based devices
  - PC's evolved from the notion of a desk providing a workstation surrounded by a mainframe
    - Static location, fixed wire, dynamic display, constant user attention and focus, desk-based input devices, (typically) dedicated peripheral support
  - Mobile Computing Devices broadly emerged from hand-held wireless phones
    - Dynamic location, (almost) always available wireless connectivity, intermittent user attention, limited real-estate to support input devices, handheld and movable, constrained display service, dynamic peripheral access within environment
- Differences in devices affects their interaction with the user

e-Commerce on the Desktop vs. the Mobile Experience

The Desktop Experience

- Large screen facilitates browsing of large catalogues
    - Requires significant user attention
- eCommerce Goods can be organised conceptually and displayed graphically
- Significant real estate that can simultaneously support:
    - User context
    - Recommendations to related goods and user feedback
    - Advertising for related goods
    - Multi-column tabular data

- Easy user interaction
    - Facilitates payment through credit card, and providing user details
- Relatively Secure

The Mobile Experience

- Context aware
    - Knowledge of the user
    - Knowledge of the environment
    - Requires more autonomy due to restricted user attention
- Capable of interacting with local services and devices
    - Can scan physical goods
    - Can communicate with local services
- Always available and (more increasingly) always connected to the internet
- Existing service agreements through bearer network
    - Can support payment
- Unique identification through SIM and IMEI

Mobile Devices better suited to some tasks more than others

Evolution of wireless communication - from 2G to 4G and beyond

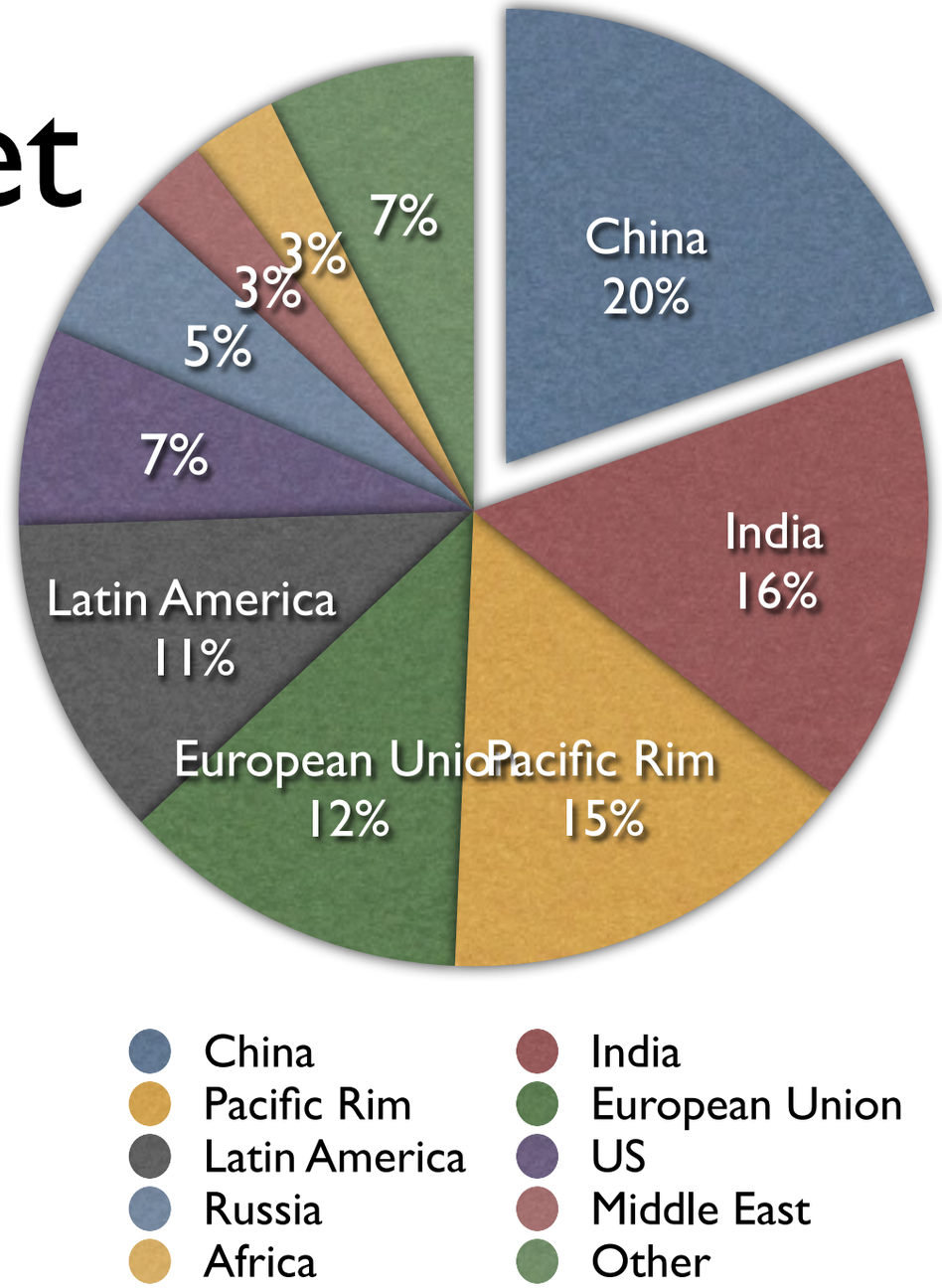
- Fixed and Wireless Telecoms, and the Internet have evolved greatly since the mid 90ies
  - This has shaped both device capabilities, and demands on mobile computing
- Evolution of Mobile voice and data communication can be reviewed over the following periods:
  - First Half of the 90ies: *Voice-centric Communication*
  - Between 1995 and 2000: *The Rise of Mobility and the Internet*
  - Between 2000 and 2005: *Dot Com Burst, Web 2.0, Mobile Internet*
  - From 2005 to today: *Global Coverage, VoIP and Mobile Broadband (3G and beyond)*
- The recent rise and practicality of data access over the internet has driven a new industry!!!

Understanding the Mobile Phone market

- Mobile subscribers exceed Internet users by > 2 times in 2009
  - Internet Users: 1.6 billion by 3 times over the next 5 years, compared to 4.1 billion mobile subscribers

- Smartphone users predicted to rise
  - by 3 times from 2010 to 2015
  - from 288 Million to > 1Billion users

- Smartphones are now outselling PCs
  - during 2010 (Q4), 100m smartphones sold, compared to 94m PC
  - Q1 2011, 84m PCs sold by the time 100m smartphones had been sold



Mobile Phones in use Globally

Source: Wikipedia, 2010

COMP327 Module Structure

- Lectures and Discussion covering material, including discussion of current issues

- Module Assessment:
  - 60% Written Exam
  - 40% from iOS Programming Assignments

- Tutorials and Lab work covers code development for Mobile Devices
  - iPhone / iPad based using Apple's development IDE
  - Objective C and iPhone iOS8

Main Taught Material

- **Mobile Communications**
    - Provide a basis for understanding the limitations of mobile internet, and the underlying wireless technologies
- **Personal Area Networks and Wireless Connections**
    - Provide an understanding on how devices interact with each other and their environment
- **Mobile Internet**
    - Give a history of previous developments, their strengths and weaknesses, and how they affect the mobile internet today
- **HCI Design**
    - Explore how interaction modalities differ with small devices, and how new sensors can be exploited
- **Context Aware Systems**
    - Provide an understanding of how context can be acquired, represented, and utilised to support the user, including spacial awareness and the discovery of services
- **Mobile Commerce**
    - Understand how e-Commerce differs with mobile devices, with emphasis on payment systems (including in-app payment)

Module Aims

1. To provide guidelines, design principles and experience in developing applications for small, mobile devices, including an appreciation of context and location aware services.
2. To develop an appreciation of interaction modalities with small, mobile devices (including interface design for non-standard display surfaces) through the implementation of simple applications and use cases.
3. To introduce wireless communication and networking principles, that support connectivity to cellular networks, wireless internet and sensor devices.
4. To understand the use of transaction and e-commerce principles over such devices to support mobile business concepts.
5. To appreciate the social and ethical issues of mobile computing, including privacy.

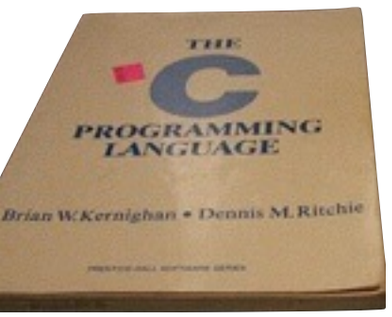
Module Objectives

At the end of the module, the student will be able to demonstrate:

1. A working understanding of the characteristics and limitations of mobile hardware devices including their user-interface modalities.
2. The ability to develop applications that are mobile-device specific and demonstrate current practice in mobile computing contexts.
3. A comprehension and appreciation of the design and development of context-aware solutions for mobile devices.
4. An awareness of professional and ethical issues, in particular those relating to security and privacy of user data and user behaviour.

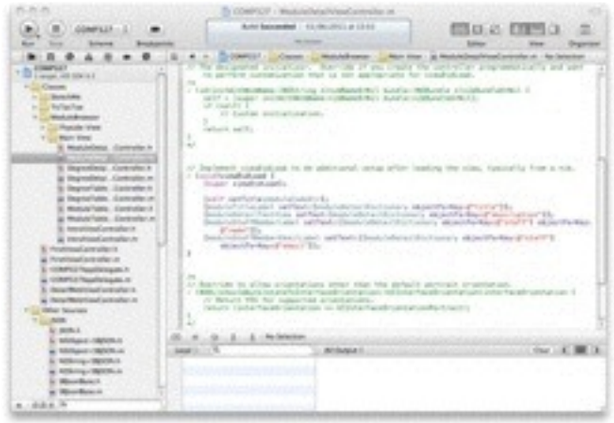
Tutorials on C / Objective C Programming

- iOS are built upon different frameworks developed in C & Objective-C.
  - To bring you up to speed, 10 tutorials have been factored in to provide additional details on C & Objective C
- Material covered in these sections (*LS2:CLang & LS3:ObjC*):
  - LS2a: Intro to C
  - LS2b: Operators & Control Flow
  - LS2c: Memory Management
  - LS3: Objective C & Foundation Classes
- A working knowledge of Objective-C will be essential for the assignment work. In addition, development principles, design patterns etc may appear in the exam.



iOS App Development

- Focus is on how mobile apps can be developed for the iPhone and iPod Touch, including design patterns and issues that are also relevant to developing for other platforms

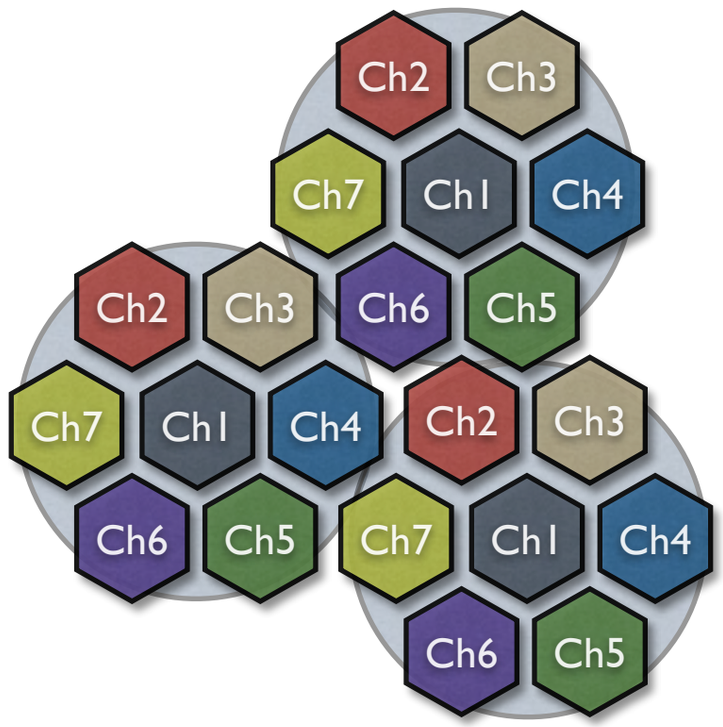


- Material covered in this section (*LS4:iOS-Intro*)
  - App Lifecycle and an introduction to UIKit
  - The Model-View-Controller (MVC) Pattern
  - Building Interfaces
- Material covered in this section (*LS5:iOS-Views*)
  - View Controllers and usage patterns
    - Displaying lists within Table Views
    - Navigating through Data
    - Modular view management using Tabs
    - Modal Views
- Material covered in this section (*LS6:iOS-Data*)
  - Data Modelling and Core Data
  - Location and Maps

Mobile Communications

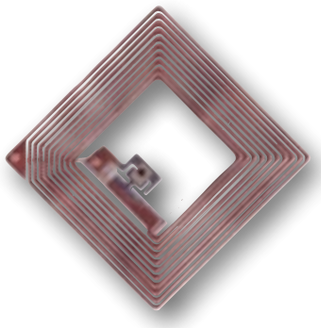
- The key to mobile devices is that they can always be connected to the internet. Understanding the "air-interface" can provide insight into the capabilities (and limitations) of devices and their applications.

- Material covered in this section (*LS7: Comms*)
  - 2G Communications
    - History, Multiplexing and Handoff
    - GPS / GPRS
    - Circuit Switching vs Packet Switching for Data
  - 3G technologies
    - EDGE
    - WCDMA/UMTS
    - HSPA and future technologies
  - Emerging 4G Technologies
    - WiMAX
    - LTE



Personal Area Networks and Wireless Connections

- Mobile Devices do more than just make calls, they also interact with a number of local devices, forming a Personal Area Network (PAN)



- Material covered in this section (*LS8: Pan*)
  - Wireless Personal Area Networks (WPAN)
    - InfraRed
    - Bluetooth
    - Zigbee
  - Wireless Local Area Networks (WLAN)
    - WiFi & WiMAX
  - Sensors
    - RFID

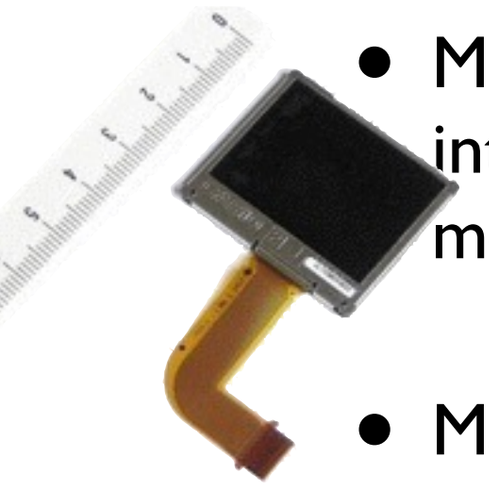
The Mobile Internet

- This section looks at the challenges of mobile access to the Internet, and lessons learned from past systems.

- Material covered in this section (*LS9: MobiWeb*)
  - Early Wireless Internet Systems
  - Wireless Application Protocol (WAP)
    - Architecture and Application Environment

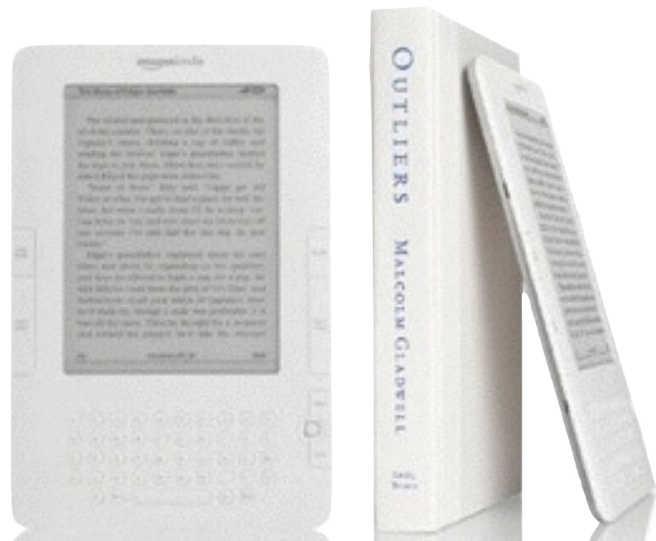
  - Messaging between devices
    - Multimedia Messaging Service
    - Short Messaging Service
    - OTA Programming

User Interface Design



- Mobile Devices have introduced new interaction modalities, including multi-touch, motion sensing, and also location services.

- Material covered in this section (*LS10: UIDesign*)
  - Human Computer Interaction
    - General Principles
    - PC vs Mobile Devices
    - Interfaces
    - Text Entry
    - Touch and Gesture
  - Enterprise Digital Assistants



Context Aware Systems

- Systems that are aware of their own situation in the *physical*, *virtual*, and *user* environment.
  - e.g. a "travel guide" that only provides information on buildings near to the user's location, or a "memories" application that identifies and focusses on familiar faces when photos are taken

- Material covered in this section (*LS11: Context*)
  - Context Aware Systems
    - Context Dependent Mobile Scenarios
    - Spatial Awareness
    - Augmented Reality
  - Services and Service Discovery
    - Jini, UPnP, etc

Mobile Commerce

- Mobile Commerce provides the ability to use devices as a payment mechanism, as well as a consumer of goods and services.
  - This differs greatly from the traditional e-Commerce "shop front" scenario

- Material covered in this section (*LS12: mComm*)
  - M-Commerce
    - E-Commerce on a mobile device
    - Challenges and Opportunities
  - Payment Systems
    - Payment mechanisms
    - SMS, Credit Card, Pre-payment, Micropayment, and Web-based
    - Contact-less payment systems
  - Apple's In-App Payment Framework

Resources

- The lecture and tutorial notes will be delivered as lecture sets (LSx) covering a topic, rather than notes for a single lecture
- Printouts of the lecture notes will be available from the Computer Science Helpdesk
    - This is a new module in its second, and is still being revised/updated as the module proceeds. Whilst we will strive to get notes on the web prior to each lecture, **printed notes will generally only be available after** each lecture, and may vary slightly from the slides delivered in the lectures.
- Video Tutorial Resources and other documentation will also be available on the Macs in the Mac Lab
- Links to emerging relevant news articles will appear on the module web site

Expectations

- The field of Mobile Computing is rapidly evolving
  - There may be an element of discussion during some lectures, based on emerging news items
  - Exams and Exercise questions rely on **understanding** and **applying** much of the material in this module.

    Don't rely on simply remembering the notes, as this won't help you pass...!

Finally...

- The obvious...
  - Switch off all mobile phones during lectures
    - ... yes, the course is on mobile devices, but...!!!
  - Do not sign the register on behalf of others
  - Attend lectures and attempt the exercises set - this will help you pass the exam
  - Attend the practical classes - these will help you do the coursework
  - Ask questions if there is anything that you do not understand
- And respect your fellow students...
  - There are people here who want to learn!
  - If you want to talk or mess around, then fine...
    - ...BUT do it somewhere else!