



COMP327

Mobile Computing

Session: 2012-2013

Dr Terry R. Payne
Department of Computer Science

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
 - Available from the web site as pdfs
 - Printed versions will be handed out at lectures
- 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 15:00 - 16:00, in ENG-HSLT
 - Tuesday 13:00 - 14:00, in BROD-305
 - Friday 13:00 - 14:00, in ALT
- **Lab Classes:**
 - Formal Labs (with exercises) weekly
 - Class has been divided across two-four lab sessions
 - Commence THIS WEEK in Mac Lab (Lab 4, Holt Building)
- **All practical work is Apple Mac based!**



Module Assessment

- Assessment is through two components:
 - Three implementation-based courseworks, worth 40% of the final mark.
 - These coursework components (worth 10%, 15% and 15%) are Mac-based, and require development on an Intel-based Apple Mac platform.
 - A written exam will take place at the end of Semester 1, 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...!***

Provisional Timetable

Semester	Mon 3-4 ALT	Tue 1-2 ALT	Fri 1-2 ELEC-E4	Labs	Assignment
Week 1	LS1 Intro	LS1a Obj-C	LS2 iOS Basics	Lab1/2 FractionPicker	
Week 2	LS2 iOS Basics	LS2 iOS Basics	LS3 iOS Views	Lab1/2 FractionPicker	
Week 3	LS5 Comms	LS3 iOS Views	LS5 Comms	Lab3 SketchMe	
Week 4	LS5 Comms	LS3 iOS Views	LS5 Comms	Lab4 SketchMe	A1 set
Week 5	LS5 Comms	LS3 iOS Views	LS5 Comms	Lab5 KingsQueens	A1 hand-in
Week 6	LS6 Pan	LS4 iOS Data	LS7 MobiWeb	Lab6 KingsQueens	
Week 7	LS7 MobiWeb	LS4 iOS Data	LS7 MobiWeb	Lab7 KingsQueens	A2 set
Week 8	Reading Week			Lab8 NearestMe	A2 hand-in
Week 9	LS8 UIDesign	LS4 iOS Data	LS8 UIDesign	Lab8 NearestMe	
Week 10	LS8 UIDesign	LS9 Context	LS9 Context	Lab10 TimeKeeper	A3 set
Week 11	LS9 Context	LS10 mComm	LS10 mComm	FREE	A3 hand-in
Week 12	Revision Week			FREE	

Formal Lecture	Assignment 1
iOS / C Lecture	Assignment 2
Lab	Assignment 3

NOTE: This timetable is provisional and subject to change!

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???

Page last updated at 11:49 GMT, Friday, 6 February 2009

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Nine-year-old writes iPhone code

A nine-year-old Malaysian boy in Singapore has written a painting application for the Apple iPhone.

Lim Ding Wen created the finger painting program, known as Doodle Kids, for his two younger sisters aged three and five.



Page last updated at 14:22 GMT, Monday, 16 February 2009

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Tech rivals follow app store lead

By Jason Palmer

Science and technology reporter, BBC News, Barcelona

The success of Apple's AppStore for iPhone and iPod Touch has prompted two major rivals to follow suit.

Handset giant Nokia and Microsoft have announced their own versions of the online markets for



Page last updated at 09:37 GMT, Monday, 20 April 2009 10:37 UK

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Is the mobile web coming of age?

By Maggie Shiels

Technology reporter, BBC News

The strategies of companies ranging from Google to Microsoft and from Apple to Yahoo suggest they believe the future of the internet lies in mobile phones - but many in the industry believe the mobile web is still a long way from realising its potential.



EBay's senior director of platforms and mobile Max Mancini

Today's smartphones are about more than simply making calls



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

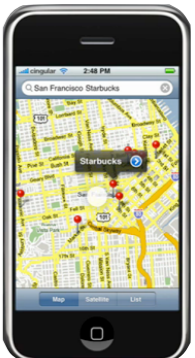
The Desktop Experience

- 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



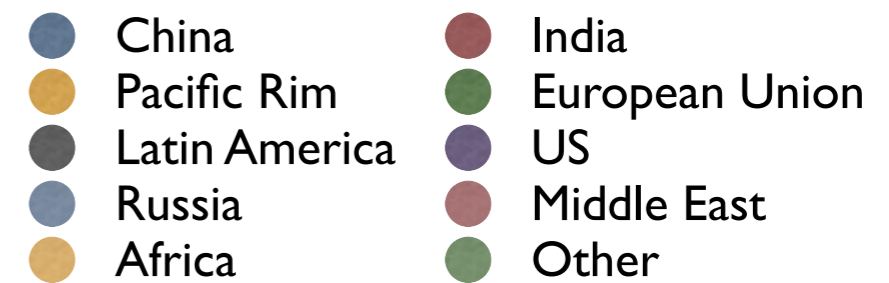
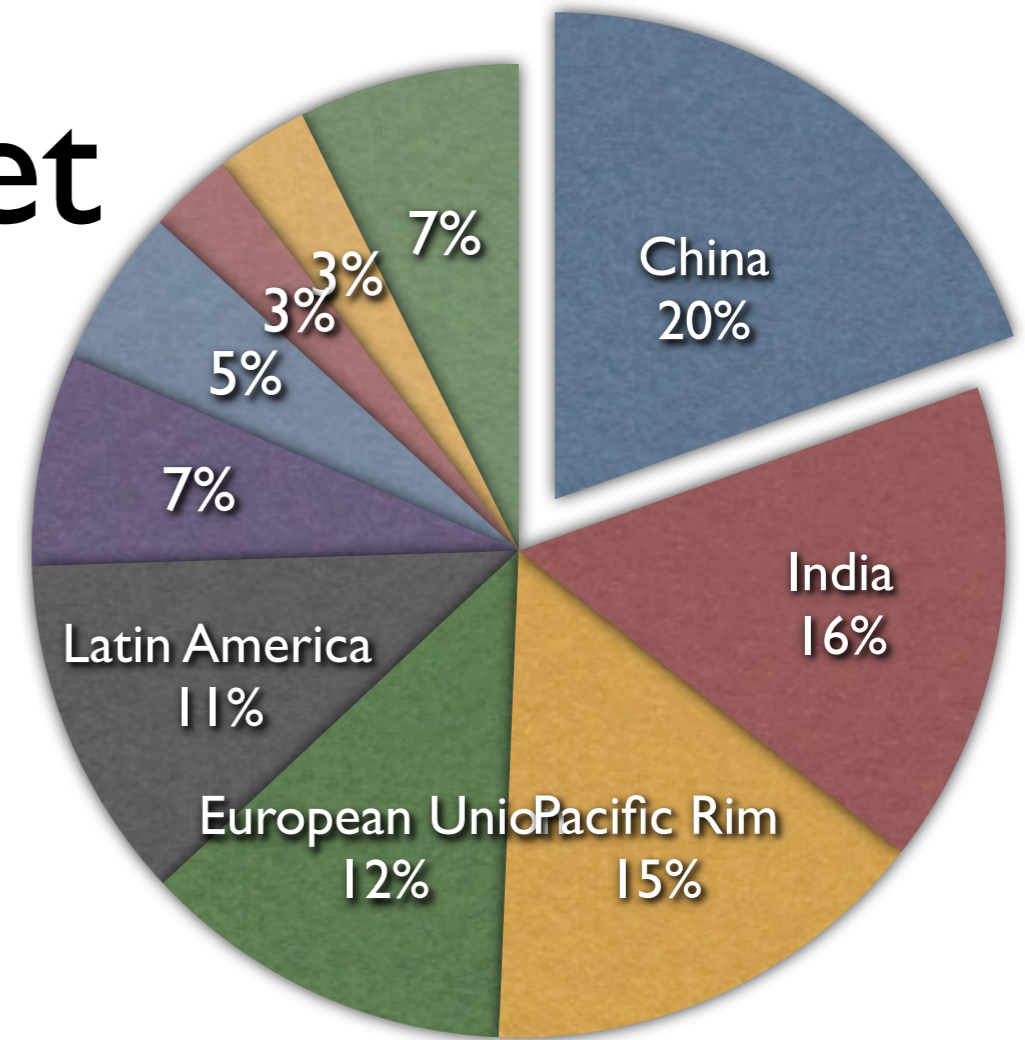
Mobile Devices better suited to some tasks more than others

Evolution of wireless communication - from 2G to 3G 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 > 1 Billion 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

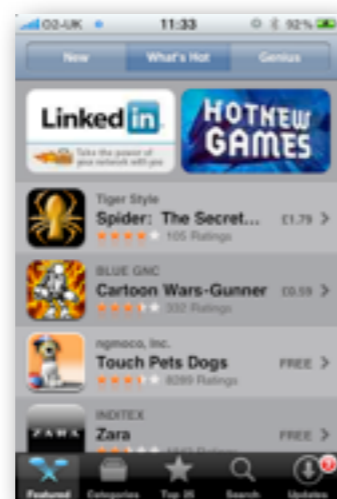
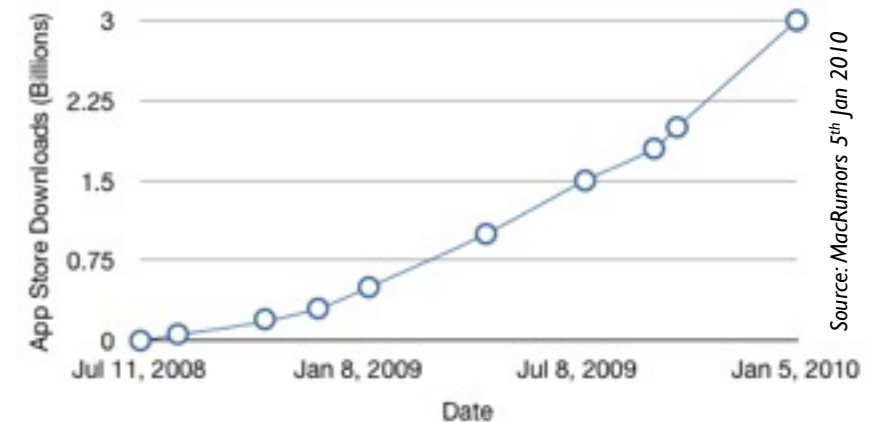


Mobile Phones in use Globally

Source: Wikipedia, 2010

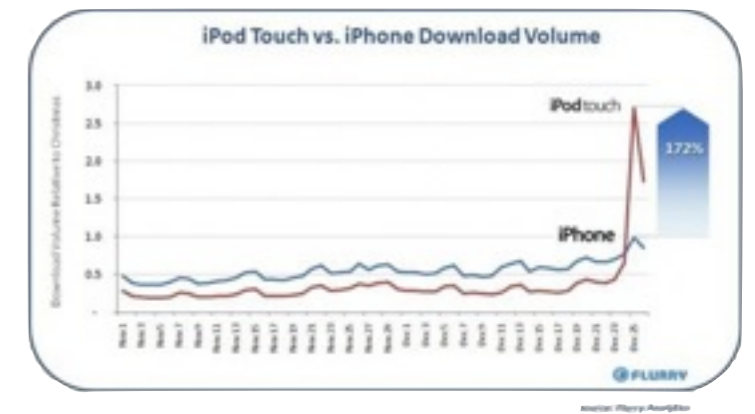
The Growth of the App Store

- Apple introduced its App Store in July 2008
- Provided a point of access to iPhone apps, either from the phone or through iTunes
- Growth has been exponential
 - Two billion downloads as of 28th Sept 2009
 - Over 50 million iPhone and iPod touch customers
 - 85,000 applications in over 20 categories
 - More than 125,000 registered iPhone Developers
 - Downloads grew to three billion downloads by Jan 5th 2010



Opening new markets

- Mobile devices that support the purchase (and download) of media growing
 - Strong app download performance from iPod Touch over the 2009 christmas period
 - Month-to-month growth of 51% during December 2009
 - Amazon's Kindle also generated a surge of sales during Christmas period
 - “...On Christmas Day 2009, for the **First Time Ever**, Customers Purchased More Kindle Books Than Physical Books...” - Amazon
- 2010 was claimed to be the “year of the tablet”
 - Several tablets or “slates” were announced at CES in January
 - However, patent issues have hit Samsung's Galaxy Tab in Europe
 - Amazon's Android tablet expected to be announced **this week** (Sept 2011).
 - Such devices are aimed at delivering multimedia, including eBooks and printed media



COMP327 Module Structure

- Lectures and Discussion covering material, including discussion of current issues
- Module Assessment:
 - 60% Written Exam
 - 40% from 3 Programming Assignments
- Tutorials and Lab work covers code development for Mobile Devices
 - iPhone / iPod Touch / iPad based using Apple's development IDE
 - Introduction to C, Objective C and iPhone SDK



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.

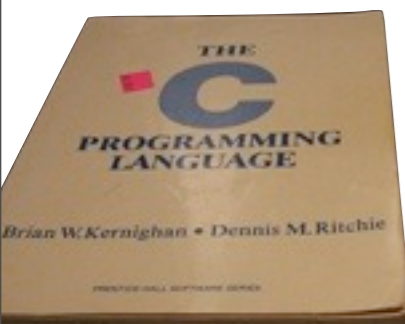
Module Objectives

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.

Resources on C / Objective C Programming

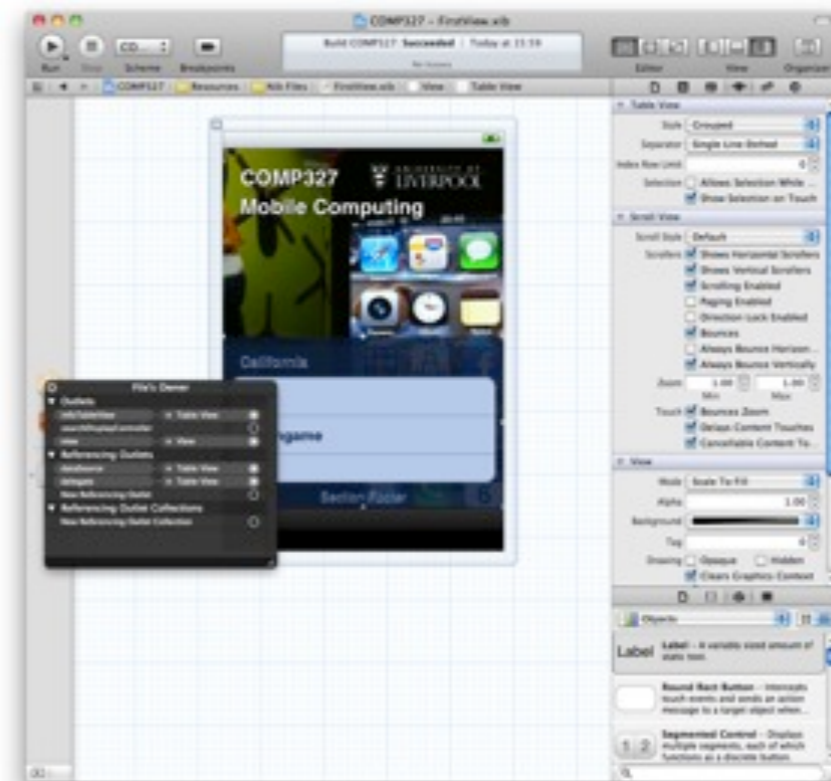
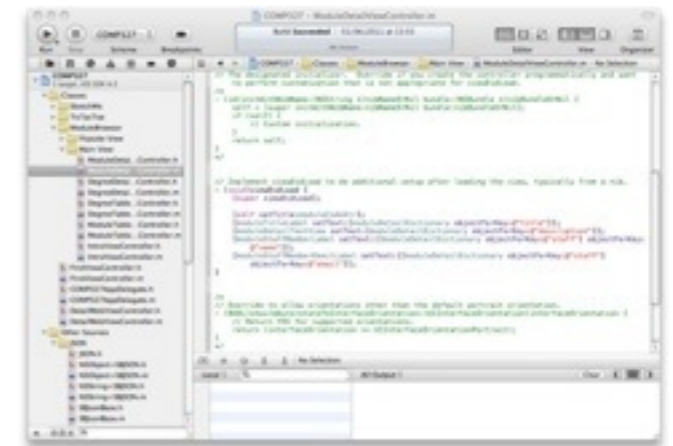
- iOS are built upon different frameworks developed in C & Objective-C.
- Pre-requisites for this course now include COMP281/282
- These pre-requisites will be waived for students willing to get up to speed!!!
- Relevant material also covered in these sections (*LS2:CLang* & *LS3:ObjC*) from 2011-2012:
 - 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

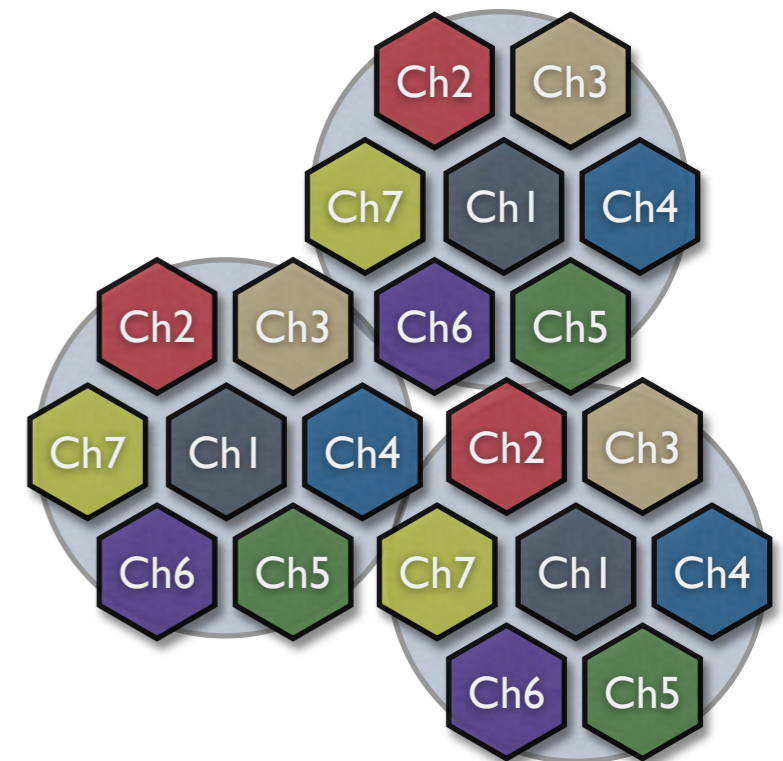


- Focus is on how mobile apps can be developed for the iPhone and iPod Touch, including design patterns and issues that are also relevant to developing for other platforms
- Material covered in this section (*LS2:iOS Basics*)
 - App Lifecycle and an introduction to UIKit
 - The Model-View-Controller (MVC) Pattern
 - Building Interfaces
- Material covered in this section (*LS3: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 (*LS4: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 (*LS5: 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

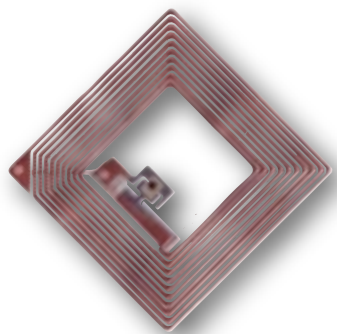


Personal Area Networks and Wireless Connections

- 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 (*LS6: Pan*)



- Wireless Personal Area Networks (WPAN)
 - InfraRed
 - Bluetooth
 - Zigbee
- Wireless Local Area Networks (WLAN)
 - WiFi & WiMAX
- Sensors
 - RFID



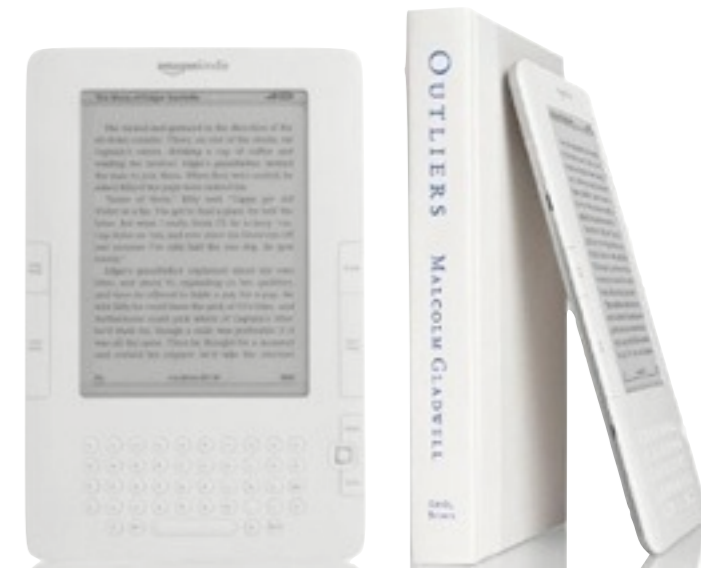
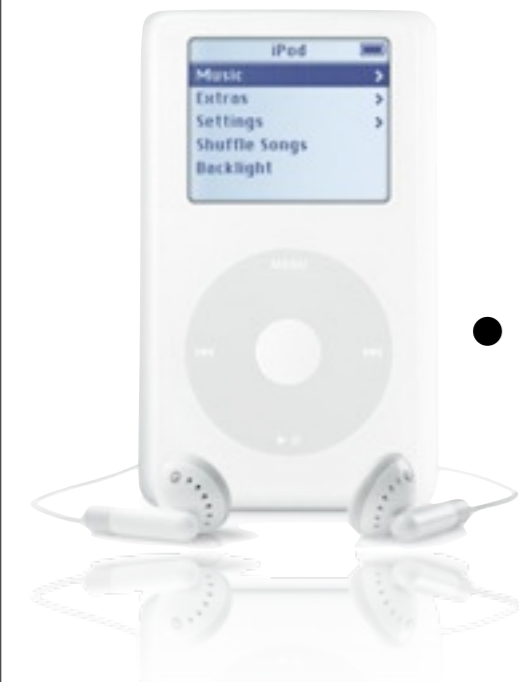
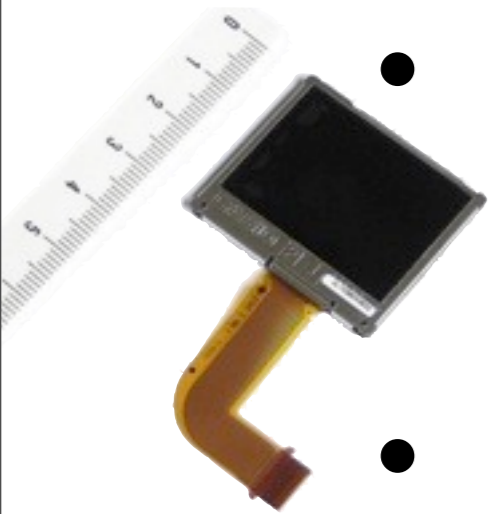
The Mobile Internet

- This section looks at the challenges of mobile access to the Internet, and lessons learned from past systems.
- Material covered in this section (*LS7: MobiWeb*)
 - Early Wireless Internet Systems
 - Wireless Application Protocol (WAP)
 - Architecture and Application Environment
 - Messaging between devices
 - Multimedia Messaging Service
 - Short Messaging Service
 - OTA Programming



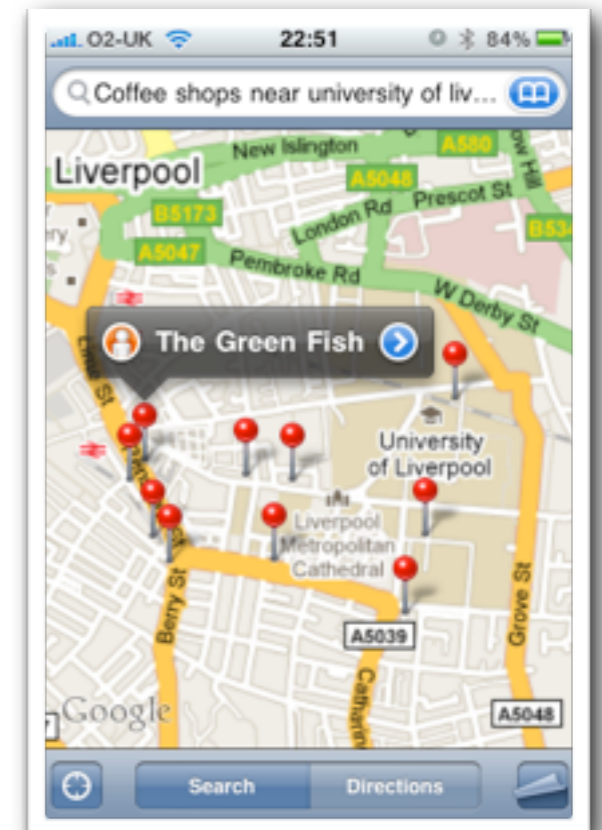
User Interface Design

- Mobile Devices have introduced new interaction modalities, including multi-touch, motion sensing, and also location services.
- Material covered in this section (*LS8: UIDesign*)
 - Human Computer Interaction
 - General Principles
 - PC vs Mobile Devices
 - Interfaces
 - Text Entry
 - Touch and Gesture
 - Enterprise Digital Assistants



Context Aware Systems

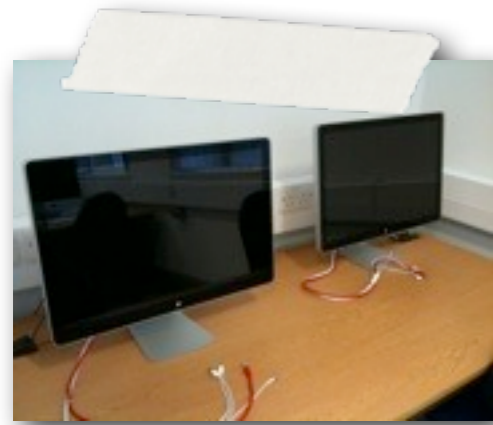
- Systems that are aware of their own situation in the *physical, virtual, and user* environment.
 - e.g. a “travel guide” that only provides information on buildings near to the user’s location, or a “memories” application that identifies and focusses on familiar faces when photos are taken
- Material covered in this section (*LS9: 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 (*LS10: 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





Lab Facilities

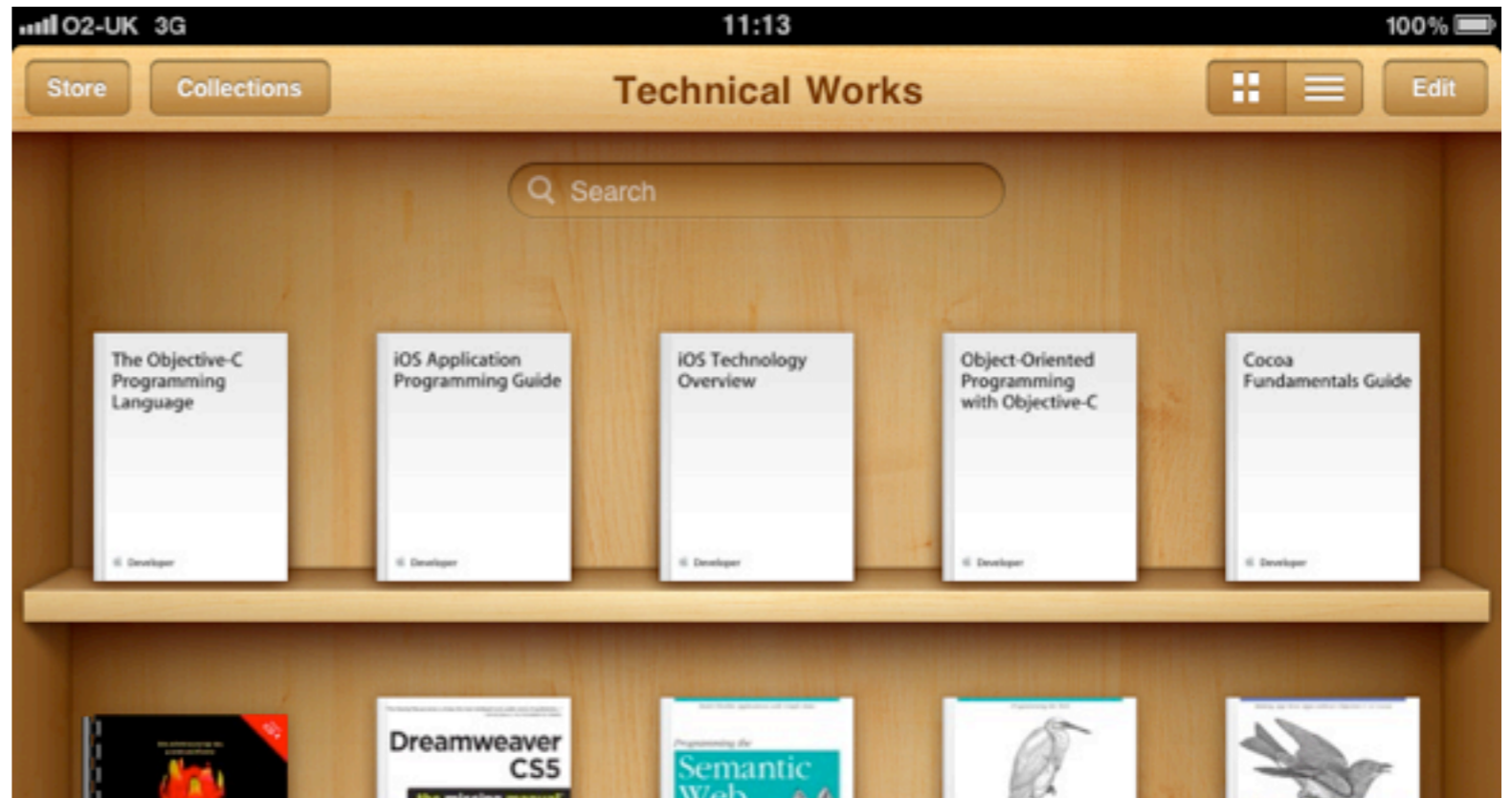


- Mac Lab - Holt Building
 - Opened October 2009
 - 20x iMac 24" terminals running Snow Leopard (OSX 10.6)
 - Driven from Snow Leopard Server, mounting student accounts dynamically
 - 2x 24" displays for students with laptops
 - Loaner Devices:
 - 4x iPod Touches
 - 2x iPad 2s



Useful (free) Books

- Apple's Developer Site has a wealth of documentation
 - Guides, Tutorials, Code Fragments etc
- Also - there are several good tutorial web sites
 - Ray Wenderlich



- Some Apple Developer books are also freely available from the iBook store!

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!