COMP327
Mobile Computing

Lecture Set 10 - M-Commerce
In this Lecture Set

- M-Commerce
  - E-Commerce on a mobile device
  - Challenges and Opportunities
- Payment Systems
  - Payment mechanisms
  - Apple’s In-App Purchasing
E-Commerce

- Traditionally concerned with allowing users to buy goods over the web
  - Emerged in the late 90ies, with significant market uptake in the earlier noughties
  - Saw significant market growth year on year (aprox 20-25%) compared to traditional retail (~5% growth)
- Emerging as a convenient means of managing services and discovering alternate providers
  - Price comparison sites allow users to evaluate the market, rather than having to “collect fliers from the high street”
  - Has allowed niche retailers to emerge and gain exposure
  - Augments traditional services with new capabilities
    - E-Government services (paying bills, filing tax returns)
    - Banking and Utilities management
Different Types of Business

- Provides the sole outlet for some businesses
  - Amazon, iTunes, Egg
  - Often providing digital services that previously had no high street presence
- Complements traditional business model
  - Provides additional, *value-added* services
  - Convenience of at-home or on-the-go usage
- Exploits coverage of the internet
  - Auction sites such as e-Bay, reaching more users than classified ads
- Enhanced use of community feedback
  - Review sites, price comparison sites
  - Empowers the user to get opinions from others, and include reviews
First Generation E-Commerce

- Human-centric with little automation
  - Users browse through catalogue of well defined commodities, make (fixed price) purchases by means of credit card
- On-line catalogue
  - Provider’s catalogue more widely available and accessible
- Greater convenience and speed for consumer
- Greater dynamism and accuracy for producer
Second Generation E-Commerce

- Increased degree of automation for both buyers and sellers
- More efficient
  - Long tail effect - e.g. for niche market goods
- More dynamic
  - Prices can rapidly change in response to current demand and availability
- More personalised
  - Recommendations based on user’s purchase history
Product Brokering: What to Buy?

• Helping users work out what to buy
  ● **Feature-Based Filtering**
    • System processes information from various sources and tries to extract useful features about its content
  ● **Collaborative Filtering**
    • Gives personalised recommendations based on similarities among different users’ preference profiles
  ● **Constraint-Based Filtering**
    • Customer specifies constraints that must be satisfied by product
    • Narrows down space of products

• Price comparison sites
  ● Find the prices of different online sites
    • E.g. Kelkoo
  ● Provides rating and advice
Mobile Commerce: evolving the E-Commerce Model

The Desktop Experience

- Large screen facilitates browsing of large catalogues
  - Requires significant user attention
- 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
M-Commerce Scenarios

• Augmenting brick-and-mortar commerce
  • Use of RFID or NFC to detect goods
    • Can acquire additional information about the good
      • E.g. product information, price, reviews
      • Additional services such as preview (e.g. for music)
  • Use of images to identify, obtain or provide information
    • Quicker than URLs; can be captured from billboards or printed media
    • Can display, as well as acquire visual codes
      • Airlines are increasingly using e-ticketing for boarding cards
      • Can use optical scanners to read barcodes from a mobile device
      • Deployments include Spanair, Air France, Lufthansa

• Advantages
  • Informed choice when purchasing goods
M-Commerce Scenarios

- Electronic Banking, Payment and e-ticketing
  - WAP Solo
    - Provides a means of payment to services via WAP for identified ticketing sites
    - Payments either from your bank account or via credit cards - including 3rd parties
  - iMode Felicia
    - Wireless payment scheme
      - Similar to use of Oyster card
      - Used for shopping, transportation, ticketing, membership card, etc
  - SMS payment and alerts
    - Warnings when bank limits are approached or new payments are instructed

- Advantages
  - Shorter queues with lower operating costs
  - Relax need for on-the-spot revenue collection technologies
    - e.g. coin-operated parking meters
M-Commerce Scenarios

• Killing “dead-time”
  • Provide access to media on-demand
    • Video access such as TV subscription
    • Available in Japan and Korea since 2005
    • More than 20m TV phones in Japan and 8m in Korea
    • News Media Access
    • Increasing number of Publishers are charging for access to online variants of print news

• In App Purchasing
  • Music Stores such as iTunes allow access to new content
  • “Free” applications can provide basic functionality, with extended functionality for additional cost
    • E.g. new levels for games, or upgrading to the “Pro” version
Case Study: Amazon Kindle

- E-Ink book sold by Amazon
  - Released Nov 19th 2007
  - USA
    - Runs on top of Sprint cdma2000 EVDO network ("Whispernet") in the US
      - Includes unlimited data plan!
  - International version
    - Runs over HSDPA with GPRS/EDGE capability
      - Functionality of the Browser limited
- Book delivered in “under 1 minute”
  - Typical price in the US - $9.99
- Also provides browsing capability
  - Although no WiFi support
- Kindle-based iPhone App also available
  - US Only
  - Delivers content to an e-Book reader App
Noreda’s WAP Solo

- WAP based payment and banking system from Noreda Bank
  - Launched in Scandinavia in October, 1999; >2M users within first 24 months
  - Payments either from users bank account or via credit cards - including 3rd parties
- Services:
  - Traditional banking services
  - Check balance, pay bills, news, check credit card activity, stock trading
  - But also shopping mall (>600 merchants), e-salary, loans, insurance, etc.
Mobile Payment: General Considerations

• User Interface Constraints:
  • Tiny keypads make credit card details much more difficult to enter
    • Less of an issue with more modern smart phones, though still time consuming
  • Secure end-to-end TLS connection is not always available
    • Problematic in early WAP scenarios

• Opportunities:
  • Mobile phone can be used as a Personal Trusted Device that replaces your wallet
  • Can also pay non-physical services, e.g. charitable donations via SMS
Mobile Payment Mechanisms

- Four primary models for mobile payment:
  - Premium SMS based transactional payments
  - Direct Mobile Billing
  - Mobile Web Payments
  - Contact-less Payment (Near Field Communication)

- Variants of these also exist
  - TextPayMe, mPark, stored value systems

- Increasing adoption
  - Mainly in Europe and Asia
  - Estimated market of $60B by 2013
Premium SMS based transactional payments

• Payment via an SMS message to a short code
  • Premium charge applied to mobile phone bill
  • Phone-based goods are often delivered through MMS
    • e.g. Music, Ringtones, Wallpapers, but also 2D Barcodes for e-ticketing
• Challenges:
  • Poor Reliability - messages may get lost (no delivery guarantee)
  • Slow Speed - SMS delivery can be slow, making the consumer wait
  • High Setup and Running Costs - includes delivery of goods via MMS
  • Low Payout Rates - After running costs, payout to merchant as low as 30%
  • Low Follow-on Sales - limited mechanism, with little user support
Direct Mobile Billing

- Payment is made through the Mobile Network supplier
  - Set up using a two-factor authentication based on a PIN and one-time password
  - Future payments are automatically charged to the network
  - Prevalent in Asia

- Advantages
  - Doesn’t require new software
  - Quick (< 10s) once the authentication has been established
  - Secure
Mobile Web Payments

- Payment made via a web site or via embedded code within the app
  - Uses WAP to support communications
  - A variety of implemented payment systems exist to simplify transactions, though require setting up accounts
    - PayPal, obopay, TextPayMe, Google Checkout etc

- Three primary payment mechanisms can be used
  - Direct Operator Billing
  - Credit Card
  - Online
Mobile Web Payments

• Several Advantages to using Mobile Web Payments
  • Follow-on sales
    • Web or App can return user to the store, other services or related goods.
    • Access to re-usable URLs encourages repeated visits
  • High Customer Satisfaction
    • Confidence in using a widely adopted and brand-familiar approach
  • Ease Of Use
    • Familiarity with a previously used mechanism
    • Requires information known a-priori, or accounts are set up that require little further input
Direct Operator Billing

• An existing account already exists with the operator
  • Payment occurs “behind the scenes”
  • User first establishes account, which may then bill periodically
  • Prior to payment, user needs to authenticate
• Supports several modes of operation
  • Single click-to-buy
    • Payments made immediately, and content downloaded when possible
  • Subscriptions to new content as it becomes available
    • Allows access to premium content, or new content is downloaded when available
• Examples include
  • Apple’s iTunes Store, Print Media Subscriptions
Direct Operator Billing: Advantages

- **Simplicity**
  - the operators already have a billing relationship with the consumers

- **Instantaneous payments**
  - giving the highest customer satisfaction

- **Accurate responses**
  - showing success and reasons for failure (no money for example)

- **Security**
  - to protect payment details and consumer identity

- **Best conversion rates**
  - from a single click-to-buy and no need to enter any further payment details.

- **Reliability**
  - that builds confidence

- **Reduced customer support costs**
  - for merchants and operators

- **Higher payout rates**
  - with operators such as Vodafone in the UK delivering up to 86% in some cases
Credit Card

- User can provide credit card details for one-off payments
  - Familiar payment mechanism, used by most e-Commerce stores
  - User enters card details, billing address, and (if different) a delivery address
  - Many banks also require 3rd party authentication
- Can be tedious and error prone from a small device
  - leading to lower success or conversion rates
  - By having the retailer retain card details, payments can be simplified
    - increases conversion (i.e successfully completed transaction) rate
    - experience becomes similar to Direct Operator Billing
Online Payment Systems

- Online payment systems allow online transactions, and act as a proxy
  - Online account is paired to a 3rd party bank account
    - Credit may be held by the payment system, but can be “topped up” from the bank account
    - Excess credit can be paid back to the bank
  - Authentication performed using an account id and password/pin
- Augments existing banking services
  - New payment systems can be adopted without uptake from high-street banks
    - Flourished with the advent of Auction Marketplaces such as eBay
- Examples:
  - PayPal, Amazon Payments and Google Checkout
MicroPayments

- Financial transactions involving very small sums of money
  - From a few pennies to a small number of pounds
  - Often used for purchasing online content, or making regular payments
    - music, video, toll-payments, etc

- Standard payment systems problematic for small payments
  - Typically every payment incurs a transaction fees
    - Transaction fee for small payments becomes significant

- Require some billing mechanism to support payments over several transactions:
  - Pre-paid accounts
  - Accumulated Balance Payment Systems
MicroPayments

• Pre-paid accounts
  • MicroPayments can be drawn from this pre-paid account
    • NetBill research project at CMU explored this approach in 1997
    • Still used for systems such as Skype, etc

• Accumulated Balance Payment Systems
  • Accumulate small charges, then bill periodically
    • Familiar to utility users (e.g. phone bills)
  • Assumes Direct Operator Billing, as user needs account
  • Example: Apple Store
    • Payments accrue over a fixed period of time, and then are billed as a single transaction
    • Supports the retail of music tracks (e.g. at 79p), apps (from 59p), rentals, etc
Contactless Payment Systems

• Uses Near Field Communication (NFC) mechanisms such as RFID to communicate with receivers
  • Device is “passed” near to receiver, to perform transaction
    • May require some authentication using a PIN
  • Payment is then made via a pre-paid account, or billed directly

• Main adoption within mass-transit networks
  • Edy/Suica enabled phones used on Japanese Rail Network
  • Oyster Cards used on London Transport Network
i-mode FeliCa

• Contactless RFID smart card system
  • Primarily for ‘electronic money’
  • Mobile FeliCa developed for mobile phones by NTT DoCoMo
    • Other systems, such as Suica and Edy can also be accessed by a single device

• Uses include:
  • mass-transport payment and ticketing
  • electronic money and mobile payment
  • Access to services
    • e.g. electronic door locks, membership, etc
Other payment systems

- Other payment forms have been used
  - Pre-paid accounts
    - User sets up an account and deposits credit
    - Payments are drawn from account
    - User notified when account is low, or automatic re-deposit method used
    - Often used with contact-less payment systems
      - Example: M6 Toll charges use from a pre-paid user account. When credit is low, a single transfer is made to bank account to top up user account
  - SMS-supported payment systems
    - Uses SMS to instruct payment
    - May involve “gluing” another payment system to a user
Examples of SMS-supported payment systems

- mPark (mobile Parking)
  - Parking Meter Payment System using SMS
    - Deployed in Edinburgh, Newbury and Glasgow so far
  - User activates the parking meter, which displays a unique code
  - This code is then sent via an SMS message identifying the user
  - User is then billed through a registered account, but can also be notified of reminders, etc

- Amazon’s Mobile Payments
  - Amazon TextBuyIt
    - An SMS service to find items, check prices, or purchase simply by sending a text message
  - Amazon WebPay
    - Send or receive money using an email address or mobile telephone number.
  - Amazon TextPayMe
    - Similar to PayPay, except that it uses SMS messages to complete the transaction.
Apple’s In-App Payments

- Store Kit framework provides a payment system for use within an App
  - Supports the collection of payments
  - Uses include:
    - Upgrade or unlock pro features on free Apps
    - Ability to purchase additional content, e.g. e-books
    - Possibility to purchase digital goods via an app
      - e.g. buying virtual goods within online games

- The framework manages communication with the iTunes App Store, managing:
  - Information about goods provided through the App
  - Payment and charging for the goods

- App is responsible for implementing a store GUI
Apple's In-App Payments

- **Non-consumable products**
  - Purchased once, but then available to all devices associated with the account. Goods can be restored onto a device
    - **Content** - includes digital content that can be rendered by the app, such as digital book, print content (magazines and newspapers), game levels and characters, etc
    - **Functionality** - features that exist within the app, but are otherwise locked

- **Consumable products**
  - Purchased each time it is needed, goods are “one-off” or transient
    - **Services** - charging users for a one-time service, such as voice transcription. Each use is considered as a single purchase

- **Subscription products**
  - Available to all devices (like non-consumable), but may be purchased many times (consumable)
    - **Subscriptions** - covers access to content or services on an extended basis. E.g. access to financial information (stocks) or online media
Apple’s In-App Payments

- Products are registered with the App Store
  - Includes details on the name, description, pricing and other metadata
- Two models for maintaining product identifiers
  - Built-in Product Model
    - Mainly non-consumable
    - Delivers goods already within the app bundle
      - e.g. unlocking new functionality
  - Server Product Model
    - A server delivers content to the app
    - Good for subscriptions, services and content
    - Server provides both list of products to App Store via iPhone, and acknowledges receipt data for the store to guarantee audit trail, before delivering goods
Exercises...

• The Desktop and Mobile E-Commerce experience can differ wildly. Describe one limitation and one advantage of using a mobile device for e-commerce.

• Network costs for 2G communications can seriously hamper the use of credit-card payments, especially when using mobile devices with numeric keypads
  • Describe a scenario whereby communication costs can be reduced when paying for goods, and give details of how the payment could be made

• In-App purchasing is a mechanism whereby applications can sell additional services directly from the application.
  • Discuss why micropayments may be desirable in such applications, and by means of an example, give a brief explanation of how micropayments work.

• How does a mobile device augment traditional commerce? Speculate on how RFID sensors could be used to transform a mobile device into a “self-pay” point-of-sales device?
  • How could a store differentiate between legitimate purchases and shoplifted goods?
To Recap...

• In this lecture set, we covered:
  • An introduction to E-Commerce
    • Evolution of the B2C e-commerce site
    • Comparison of the Desktop and Mobile experience
  • M-Commerce Scenarios
    • Case Studies
  • Payment Systems
    • SMS, Credit Card, Pre-payment, Micropayment, and Web-based
    • Contact-less payment systems
  • Apple’s In-App Payment Framework
Further Reading

- **M-Commerce**
  Norman Sadeh (Wiley, 2002)
  - Chapters 1 and 6

- **Apple’s Development Site**

- **Wikipedia !!!**