COMP327
Mobile Computing
Session: 2015-2016

Lecture Set 10 - mCommerce

In this Lecture Set

- M-Commerce
  - E-Commerce on a mobile device
  - Challenges and Opportunities
- Payment Systems
  - Payment mechanisms

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

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)
  - Using QR codes to identify, obtain or provide information
    - **Q**uick **R**esponse Code
      - Quicker than URLs; can be captured from billboards or printed media
      - Can encode numeric, alpha-numeric or kanji characters
    - 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

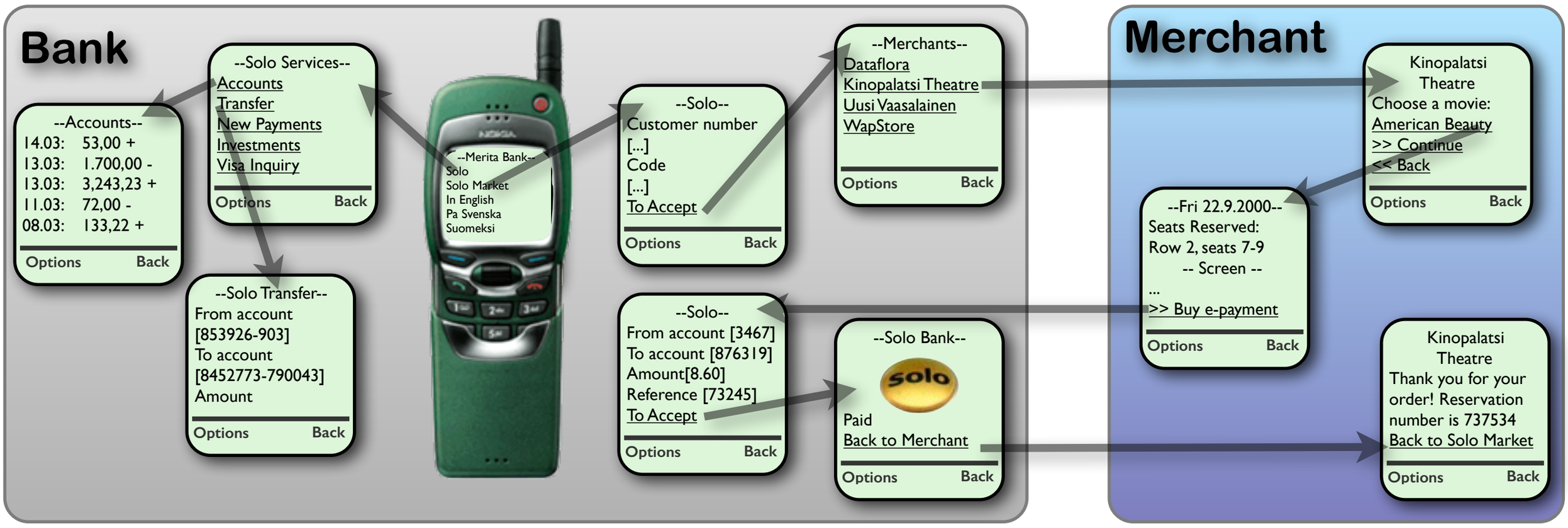
M-Commerce Scenarios

- 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: 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

- Various primary models for mobile payment:
  - Premium SMS based transactional payments
  - Credit Card Payments
  - Contact-less Payment (Near Field Communication)

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

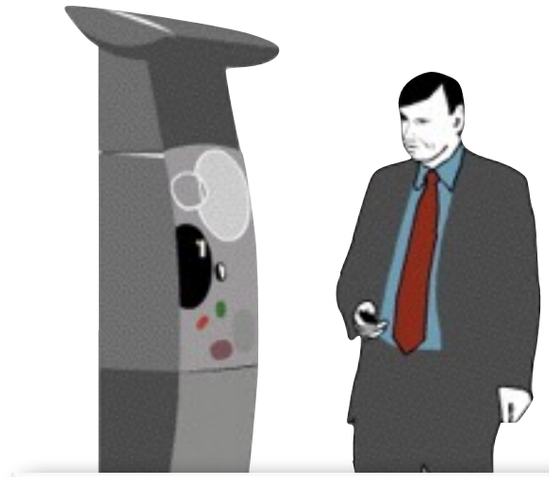
- Increasing adoption
  - Mainly in Europe and Asia
  - Estimated market of $60B by 2013

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

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



- Other similar systems exist
  - E.g. Liverpool City Council "*Phone and Pay to Park*" scheme

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
- Other "peripheral" based approaches emerging
  - E.g. SquareUp for credit card payments on smartphones

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

Contact-less 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

- Early adoption within mass-transit networks
  - Edy/Suica enabled phones used on Japanese Rail Network
  - Oyster Cards used on London Transport Network

- Embedded systems within devices
  - ApplePay and Google Wallet

Apple Pay

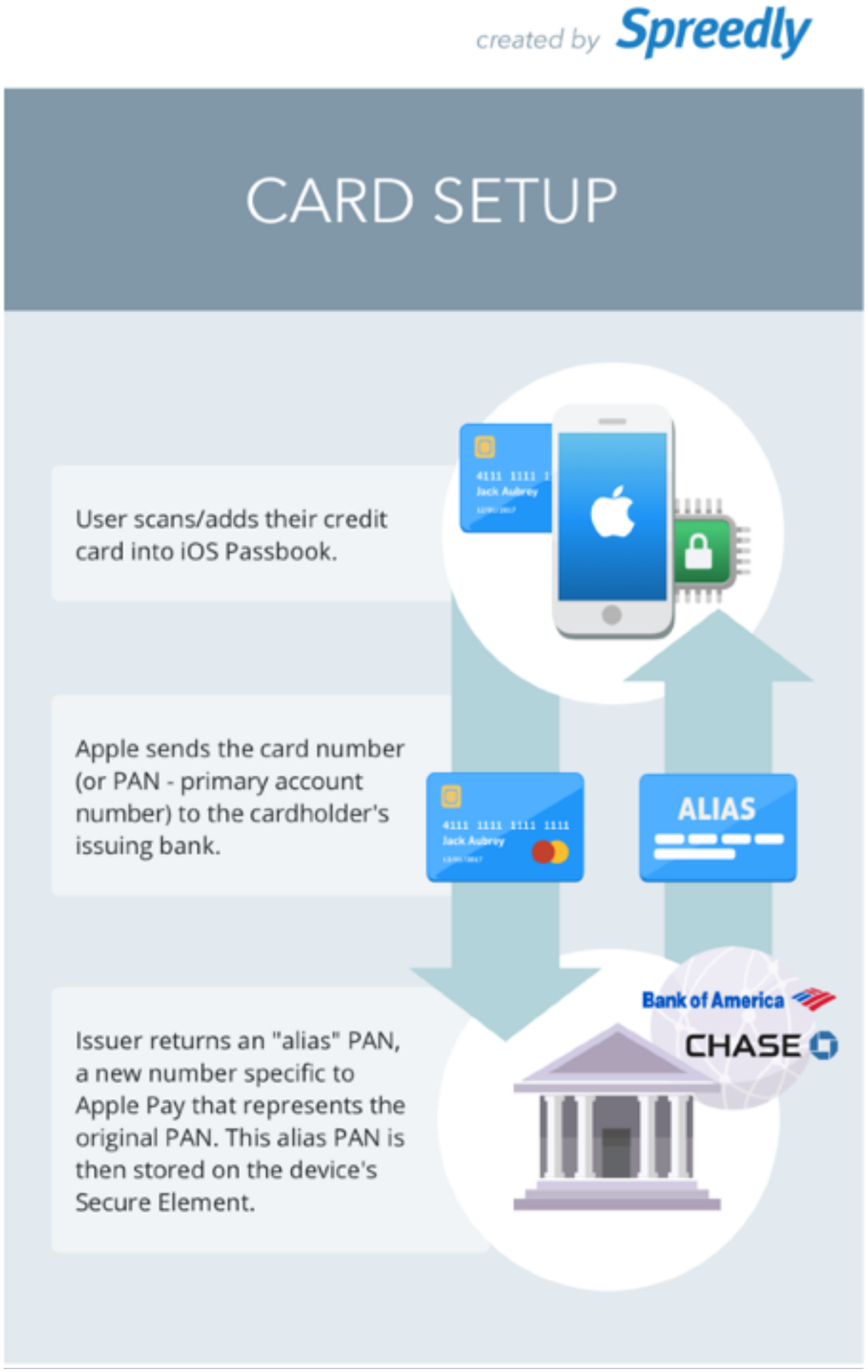
- An NFC-based payment system for the iPhone/iPad and Apple Watch
  - Uses NFC (tap and pay) for PoS purchases
    - Exploits the Contactless Payment System already in use by many Banks, etc
  - Biometric Authentication through TouchID used to initiate transactions.
  - A Secure Element (SE) hardware chip is used to store information relating to the user's bank cards

- Can support:
  - In-app payments directly to a bank account (as opposed to charging to an iTunes or Apple Store registered account)
  - Contactless PoS
  - Transport Networks (e.g. Transport for London)

- Advantages
  - Lower costs to Merchants (less opportunity for fraud)
  - Higher security for user (no credit card detail are revealed)

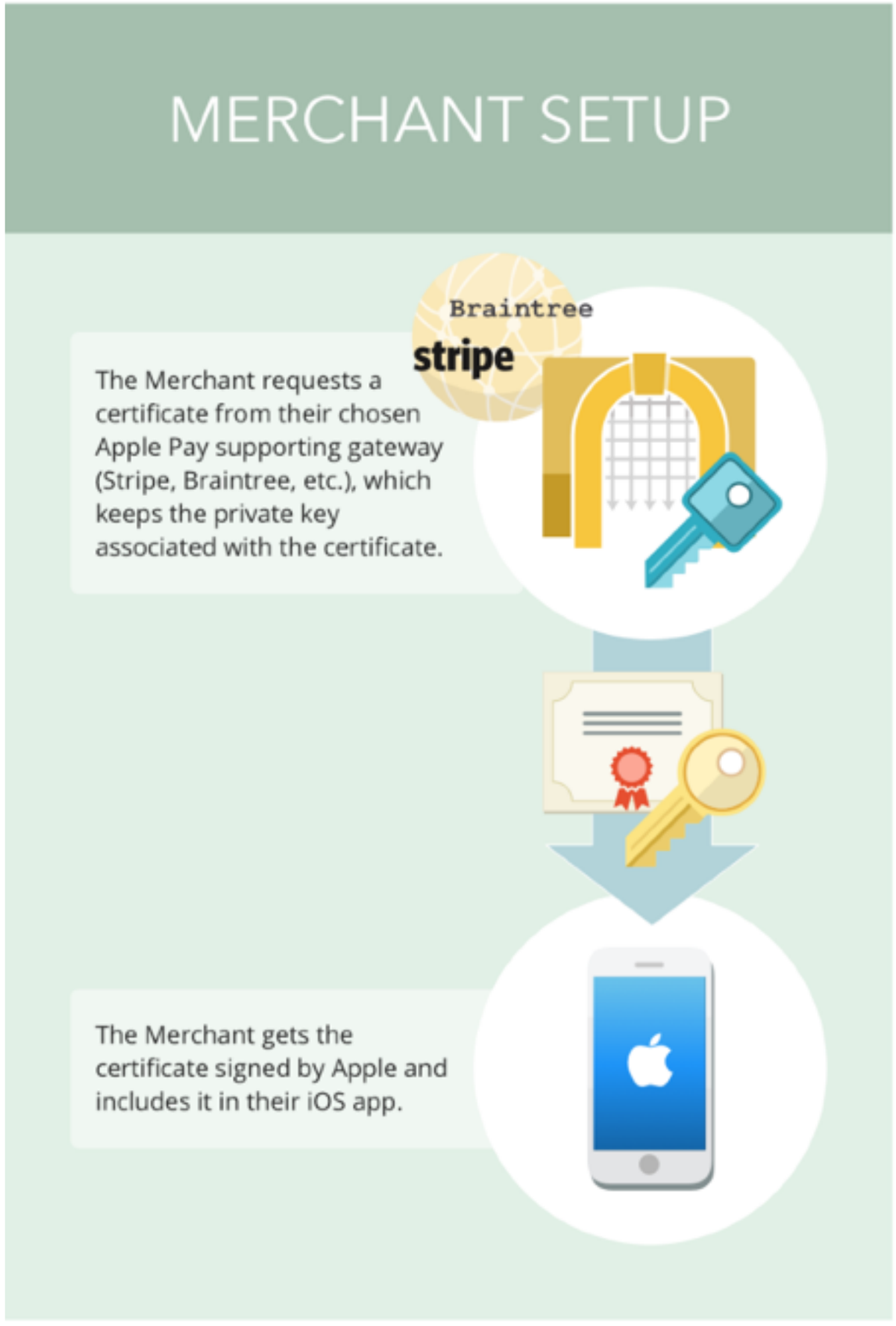
Apple Pay

- A User's credit/debit card is added to Passbook
  - The card details (PAN) are submitted to the Bank, that then returns a token representing the card
- The token is stored in a "Secure Element" in the user's device.



Apple Pay

- Traditional payment mechanisms require a Gateway to manage credit card payments (EMV)
  - They are responsible for coordinating the payment, authorisation, and transferring payment from user's bank to merchant's bank.
- Apple Pay works with different Gateways, through tokenisation and certification

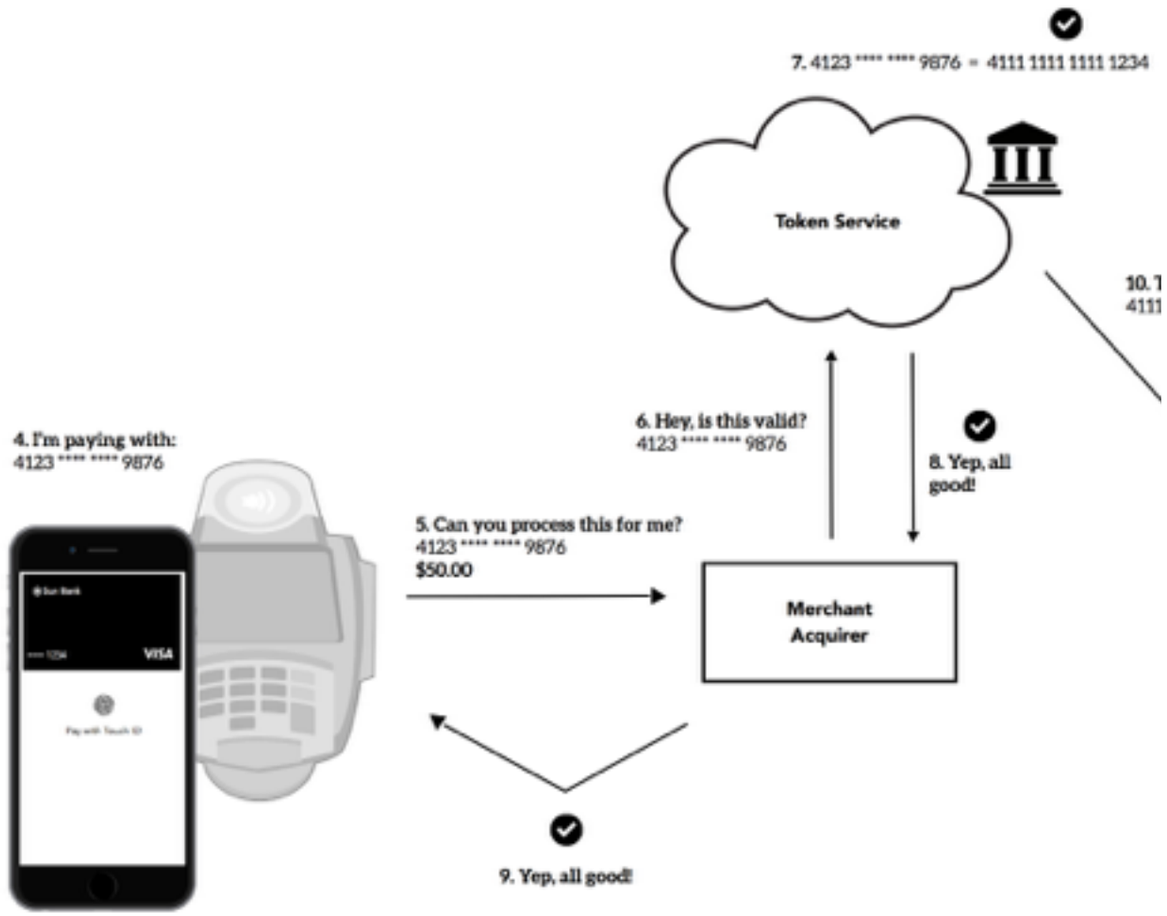


Apple Pay and NFC Payment

- When a transaction is made, the PAN token is sent via NFC with a one-time dynamic security code.

- The security code replaces the CCV code on the back of a credit card

- It is unique for each transaction and thus reduces chance of fraud.

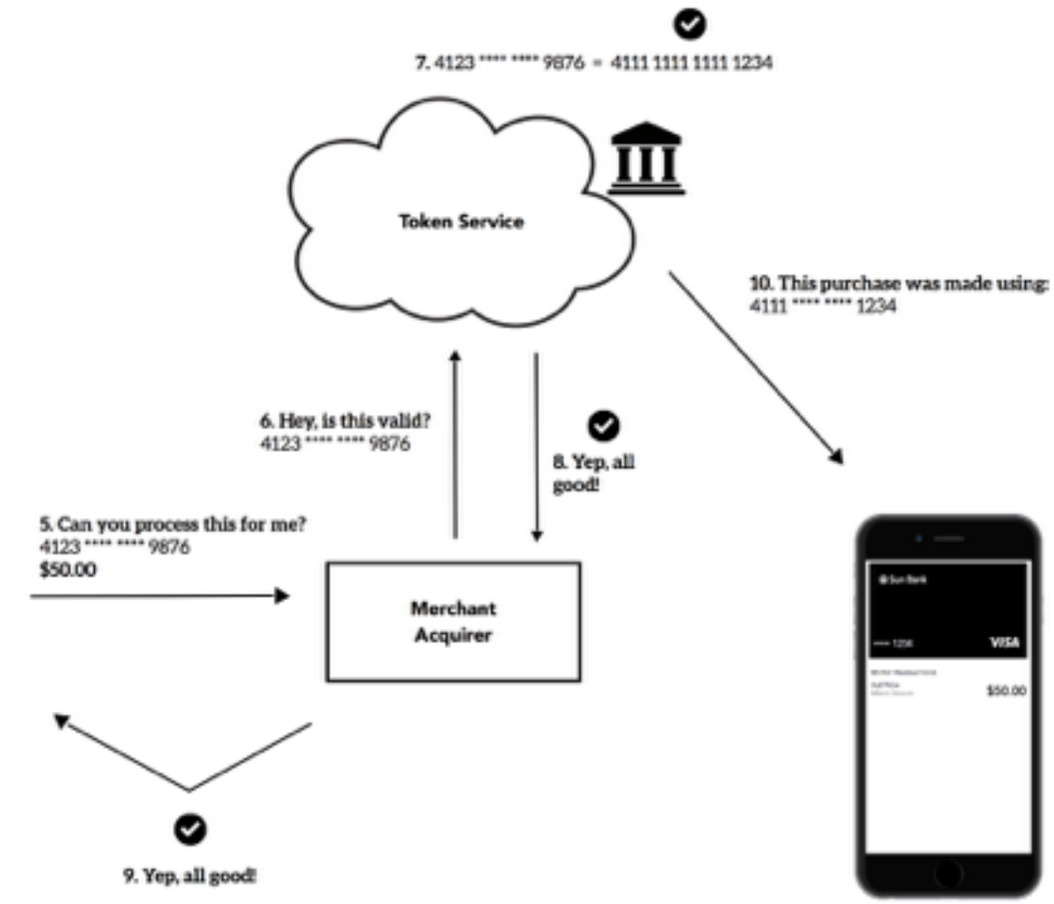


Apple Pay and NFC Payment

- The PAN token and security code and then passed to a Gateway

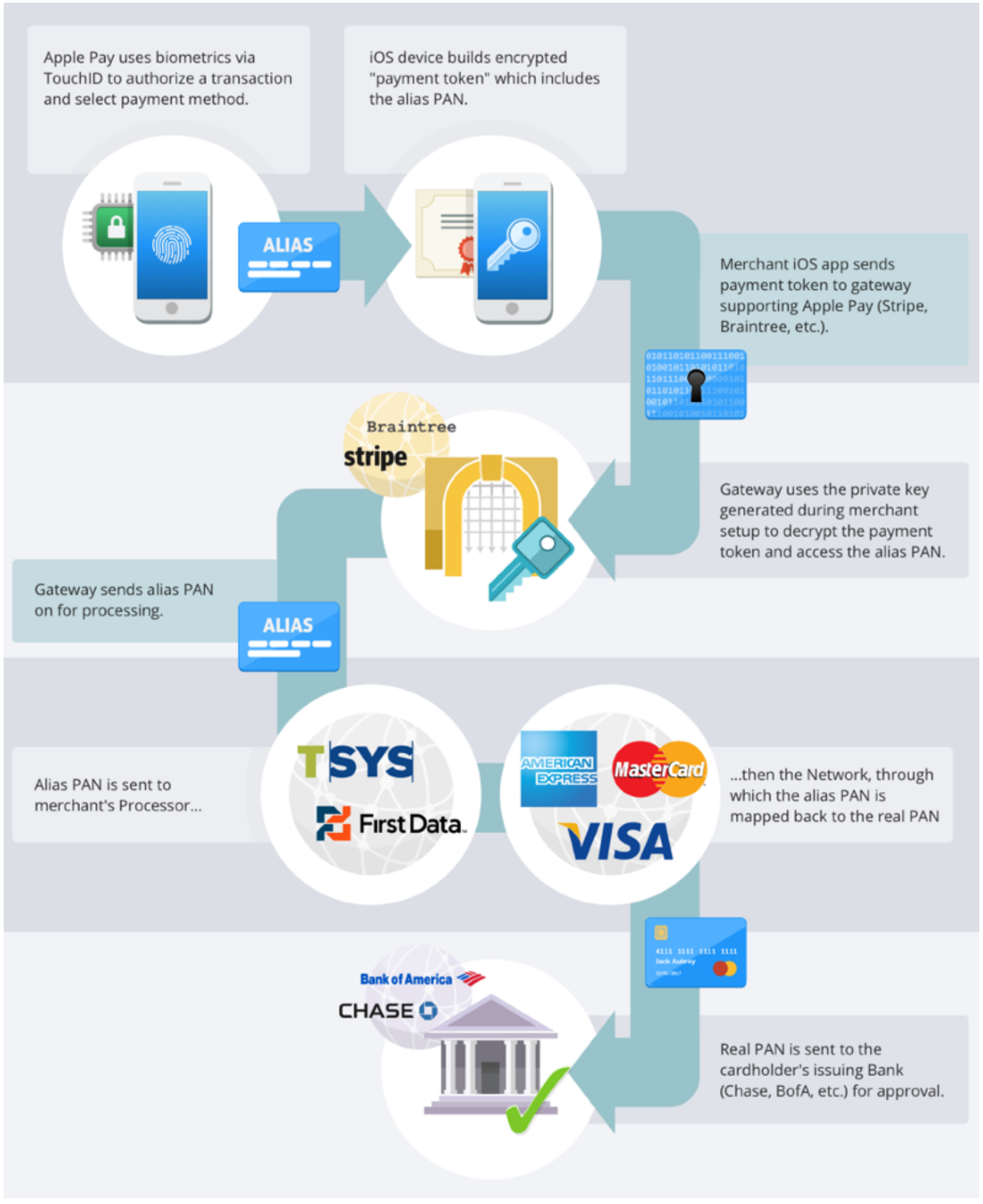
- Used to authenticate and convert into the original credit card details

- Purchase then proceeds as a normal transaction



Apple Pay through Apps

- User Authenticates payment with TouchID
- Payment Token (inc PAN and payment details) sent to Gateway
- Gateway sends the payment token to the merchant's bank, who then decipher the PAN
- Authorisation is then done with User's original bank



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)
  - 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

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***