

# E-Commerce

Jack Lang

[Anna.Soilleux@olswang.com](mailto:Anna.Soilleux@olswang.com)

Richard Clayton

# Aims

- Outline issues involved
- Lectures:
  - Historic and Economic Background (JL)
  - Business Models and Strategy (JL)
  - Web Design (JL)
  - Implementation (JL)
  - The Law and E-commerce (AS)
  - Making E-Commerce work (JL)
  - Finance and future opportunities (JL)
  - RIP, DCMA and other legal developments (RC)

# Resources

- Jack Lang “High Tech Entrepreneurs Handbook”
  - FT.COM; ISBN: 0273656155
- Ross Anderson “Security Engineering”
  - John Wiley & Sons Inc; ISBN: 0471389226
- Hal Varian “Intermediate Microeconomics”
  - W.W. Norton; ISBN: 0393973700
- + Carl Shapiro “Information Rules” Harvard Business School Press; ISBN: 087584863X
- Tom Standage “The Victorian Internet”
  - Orion Paperbacks; ISBN: 0753807033
- John Kenneth Galbraith: A Short History of Financial Euphoria
  - Penguin Books; ISBN: 0140238565

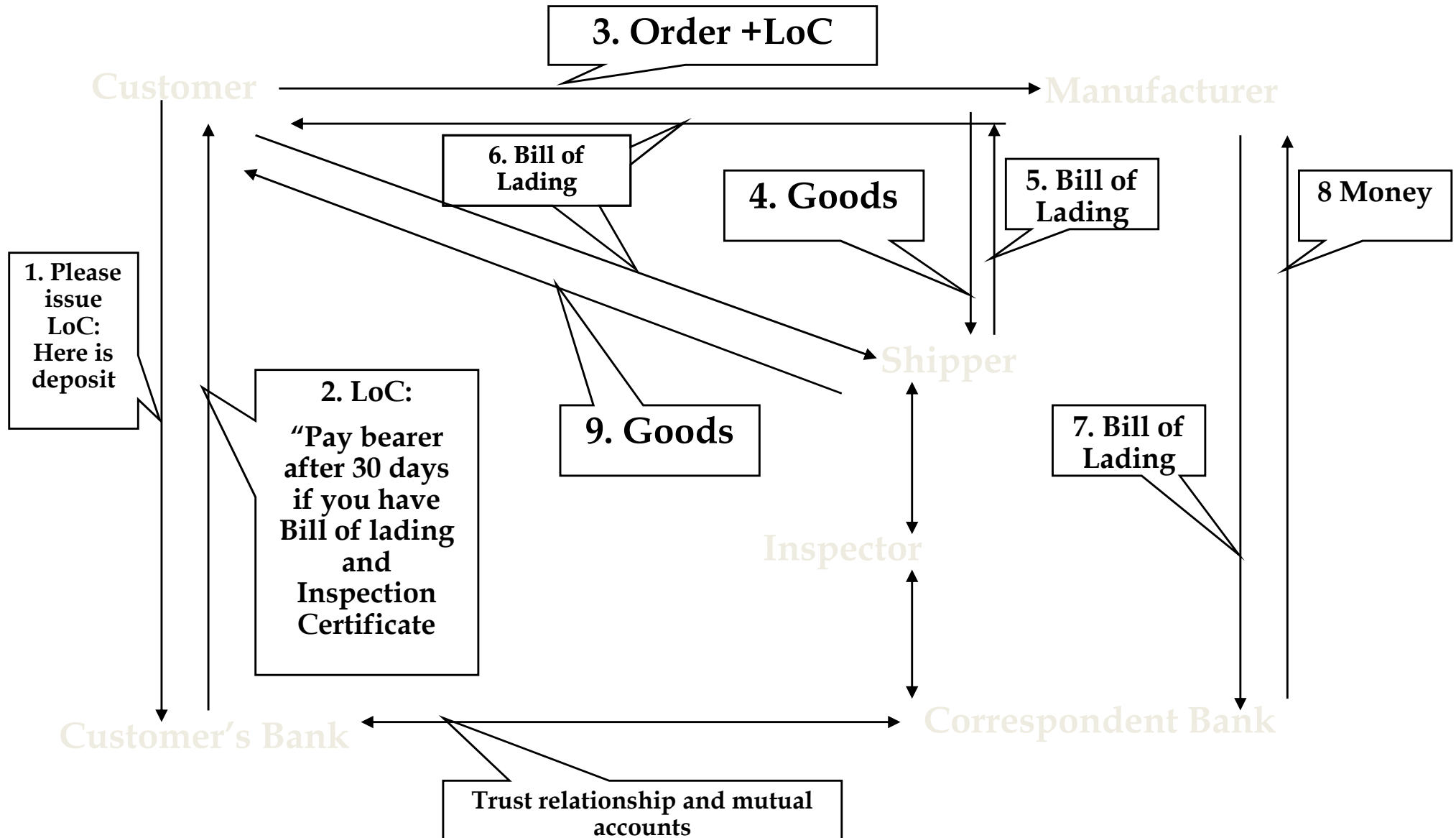
# Online Resources

- Andrew Odlyzko's papers on e-commerce and network growth: <http://www.dtc.umn.edu/~odlyzko/>
- Web Design:
  - <http://www.wowwebdesigns.com>
  - <http://www.webpagesthatsuck.com>
- Draft regulations
  - [http://www.dti.gov.uk/cii/ecommerce/europeanpolicy/ecommerce\\_directive.shtml](http://www.dti.gov.uk/cii/ecommerce/europeanpolicy/ecommerce_directive.shtml)

# What is E-commerce?

- A course thought up by the Teaching committee...
  - Academic research on protocols, economics
- B2B
  - Replacement of paper with electronic documents
  - Re-badging of Electronic Document Interchange ('EDI')
    - SWIFT.CREST,BOLERO,Just-in-Time
  - Electronic money
- Mail-order ('B2C')...amazon.com etc
  - New business models...Lastminute.com, ebay.com
  - Disintermediation: E\*Trade.com
  - CRM: Call-centres, credit-cards, cost-dumping, discrimination, customer aggravation, digital “haves and have nots”
- New opportunities for fraud
  - Dark web
  - This list is not exclusive!

# Remote transaction



# Traded paper

- Typical instruments include:
  - Warehouse receipts
  - Bills of Lading (“The holder is entitled to 100 amphorae of oil from the cargo of the ship Augusta”)
  - Purchase orders and invoices
  - Insurance certificates
  - Certificates of debt
  - Payment instructions: Bank-to-bank or bank-customer-bank (cheques), letters of credit
  - Banknotes
  - Bearer certificates
    - Coupons
  - Share certificates
- Negotiable/guaranteed – can be used for payment, security etc.

# B2B (2)

- The invention of the telegraph led to the development of business use protocols
  - Huge boom in telegraph construction and applications (Standage)
  - Indirect effects included creation of national markets – price differences drove rapid shipment + arbitrage
  - Direct uses included purchase orders and queries. Easy where there is an existing relationship, otherwise intermediaries needed
- Huge expansion in banking
  - Banks sent about 50% of telegraph traffic
  - Trusted intermediaries
  - Others (insurers, inspection agents, shipping agents) largely harnessed via bank mechanisms



# B2B 3- Wiring Money

- Interbank message e.g.
  - “To: Lomarco Bank, Geneva. Please pay SFR 10,000 from our account to Herr Thilo Schmidt on presentation of his passport. Our test key is 254”
  - The 254 is a primitive MAC computed on significant data such as money, currency code, date etc.
- SWIFT reimplement this using ‘email’ and proper MAC in mid 70’s.
  - First big ‘open’ EDI system
  - Swift II added PKI to manage MAC keys in early 1990’s.
  - Adapted to CREST (UK equity clearing)
- Commercial transactions similar, but more complex conditions
  - E.g LoC needs Bill of Lading, insurance certificate and inspection certificate

# B2B 4

- “Electronic Document Interchange” (EDI)
  - Proprietary systems built late 60’s/early 70’s
    - General Motors ordering car components (EDS)
    - Marks & Spencer’s clothes ordering
- Big problem not security or DoS or lost systems but standards
  - 1980’s agreeing common message formats
    - UN, specific country/industry e.g NHS
  - Being redone as XML
    - e.g BOLERO ([www.bolero.net](http://www.bolero.net))
  - Many players – slow progress

# What is money?

- Exchange of value
- Store of value
- Measure of value
  
- Fiat money
  - Money issued by the Government
    - Can't go bust – can always print more internally
      - May cause inflation, exchange rate drop etc
      - “Cash is trash”
- “Unforgable” bearer certificate
- Anonymous, Immediate
- (mostly) Trusted

# Minsky's financial instability hypothesis

- Hyman Minsky (1919-1996)
- Accumulation of debt causes instability
- Three stages:
  - 1. Hedge Borrower
    - Can repay interest and capital
  - 2. Speculative borrower
    - Can only repay interest = hopes asset will go up
  - 3. Ponzi borrower
    - Hopes appreciation of asset will pay both interest and capital
- Good times don't last

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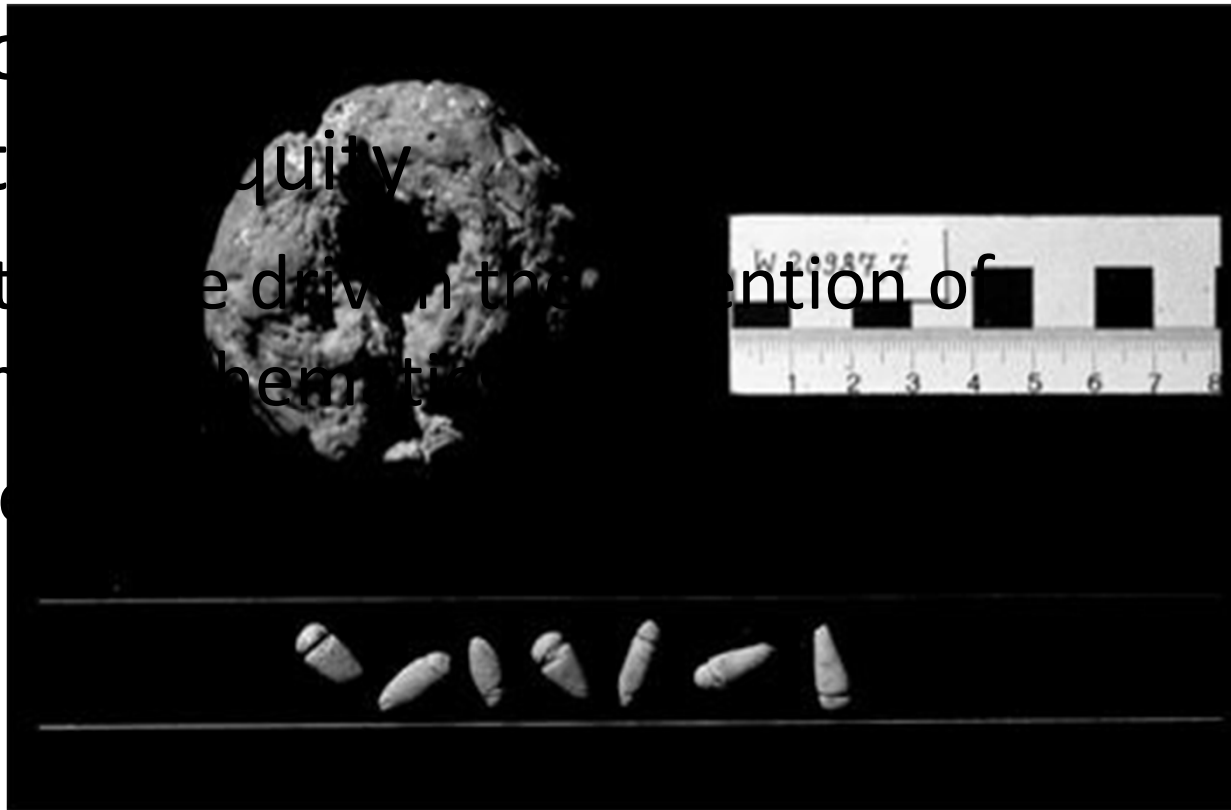
## Russian rouble in free-fall despite shock 17% rate rise



Raising interest rates could affect Russia's economic growth

# Bulla (Sumarian about 3500 BC)

- Business-to-business transactions go back into antiquity
  - believed to have driven the invention of writing and mathematics
  - Trust systems



Macro economics:  
Modern Monetary Theory

- MMT
- <http://neweconomicperspectives.org/modern-monetary-theory-primer.html>

– Domestic Private Balance + Domestic Government Balance + Foreign Balance = 0

– Govt    Private    Foreign

–  $(G-T) = (S-I) - NX$

– where G is government spending, T is taxes, S is savings, I is investment and NX is net exports

- -> Private wealth ~ Government deficit or trade surplus

# Bearer certificates

- Token representing value
- May be anonymous
  - Cash vs Cheques
- Not easily forged
  - Trust
- Physical handling
  - Banks/ wallets
- Coupons
- Tradeable
  - Bureau de change



# Electronic Bearer Certificates

- Centralised
  - e.g. Paypal, Oyster card, M-Pesa
- Decentralised
  - e.g. Bitcoin
    - Exchange of value ✓
    - Store of value X
    - Measure of value X
  - Hard (repudiatable) vs Soft (no recourse)

# Electronic money

ID (user's public key)  
Value  
Date  
Serial etc

- Unforgeable token
  - eg (value, serial number, id) signed by the issuer's private key
- Problem: how to avoid double spending?
  - Store all spent tokens
    - Can retire blocks of used tokens
  - Store all unspent tokens
  - Central store
  - Distributed store
    - Bitcoin block chain



# Electronic Money 2

- Trusted?
- Value?
- Volatility?
- Anonymous or pseudo-anonymous or open?
- Currency?
  - Fiat, or other asset backed

# Magic of Banking

- Not everyone will want to withdraw at the same time
  - Confidence
- Banks need only fund difference between deposits and loans
- Typical “Reserve Ratio” is 10%

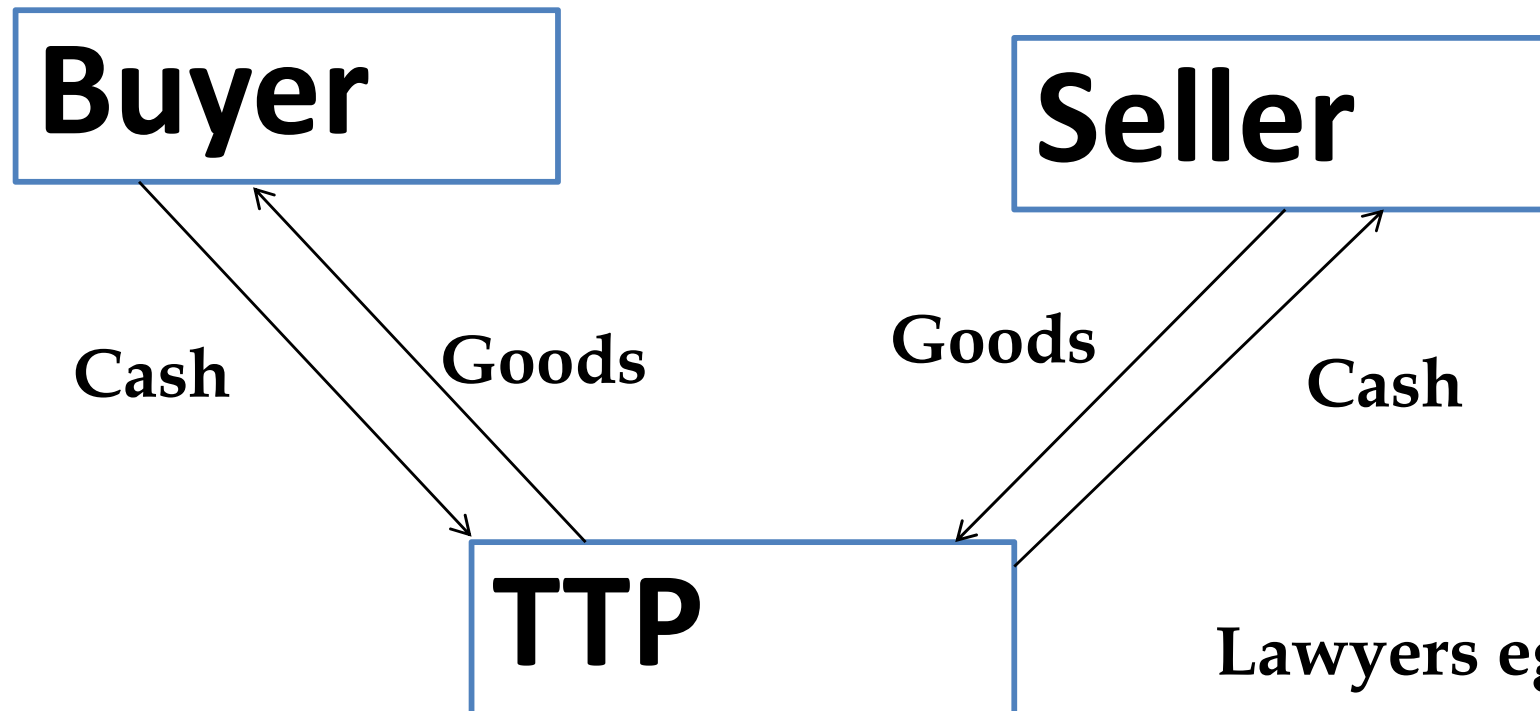
# B2C Mail Order

- Book printers in C15<sup>th</sup>
  - Aldus Manutius of Venice 1498. His mail-order offerings included 15 texts that he had published.
- (UK version) William Lucas, Gardener, 1667
  - Army and Navy Stores supplied British Forces and others in India ~1871
- (US Version) Tiffany of Fifth Ave 1845
  - Montgomery Ward 1872
- Sears, Roebuck made it possible to settle the West(1886)
  - US Postal services subsidised shipping by having flat rates nationwide.
    - Still critical in some places!
- Need guarantee to provide customer confidence
  - Brand (e.g Sears, Amazon...)
    - Sears unique innovation: “Satisfaction guaranteed or your money back”
  - Industry (ABTA, MOPS)
  - Intermediary (VISA, Access Paypal etc)

# Credit Cards

- Consumer credit goes back to 18<sup>th</sup> Century – “The Tallyman”
  - Some US stores offer “shopper's plate” from 1920's
- Diners Club offered first credit card
  - NY 1951: 27 Restaurants, 200 customers
- Barclaycard offered as incentive to high-value Barclays customers in late 60s; Access started as rival
- Classic “Network effect”
  - Need enough shops to attract customers and vice versa
- Took off in early 1980's suddenly turning from loss leader to main profit centre.
  - Some countries (e.g. Germany, Japan) only just taking off
- Earnings from online trades starting to be significant
  - Competition starting e.g Paypal

# Trusted Third Party



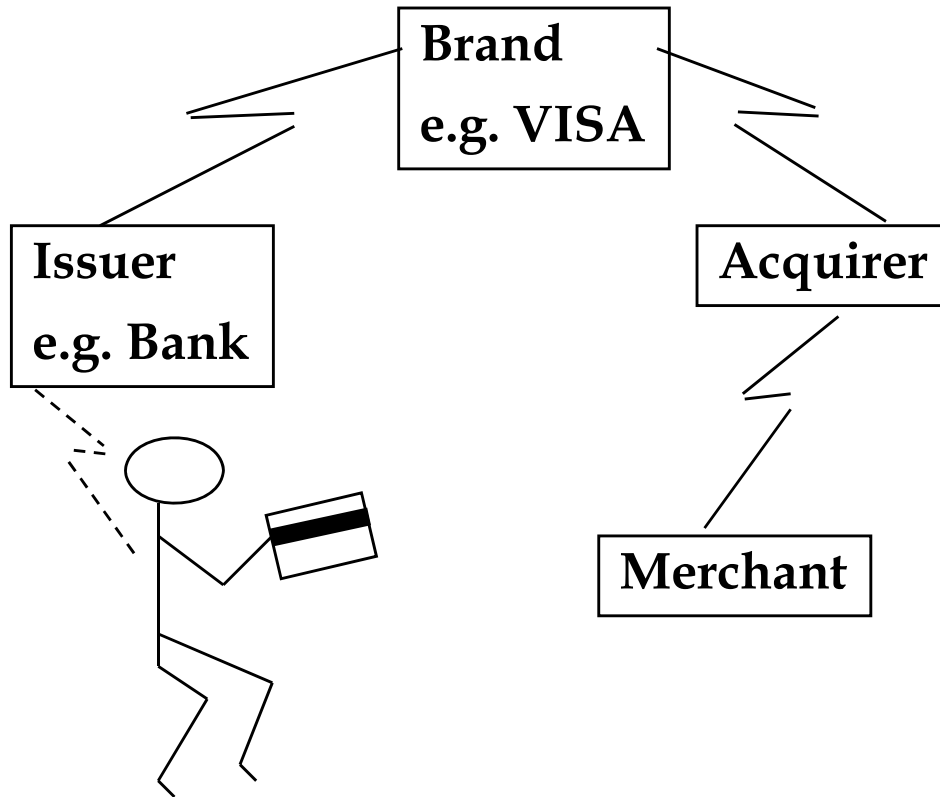
Lawyers eg property

Brokers eg shares

Credit cards B2C

Auction houses

# Credit Cards 1





# Credit Cards 2

- Merchant is paid for goods by acquiring bank, less merchant discount (typically 2-10%, often 4-5%)
- Transactions over floor limit checked with acquirer: hot card list or credit check with issuer
- Brand takes a cut; acquirer makes money from merchant discount; issuer from selling revolving credit - expensive money, often over 20% APR

# Cards 4

- Overall cost of fraud
  - Spain 0.01%
  - UK 0.2%
  - USA 1.0%
- Motivation – who gets the reward?
  - Huge hype “Evil Hackers”
  - No case of fraud resulting from interception!
    - Getting sense from mail is hard
  - Real problem: hacked or crooked end systems
- Overall pattern – cyclical: Best defences not always high-tech!

# Cards 7

- Bigger problem: disputes
  - Porn sites
  - Paypal etc
- Incompetence, fraudulent denial by customers, outright fraud by merchants
- Control mechanisms poor and slow – e.g acquirer call centre can only check country, not cardholder address
- Technology?
  - SET failed
  - Other formats, e.g stored value cards, cell-phones

# Fair Market

- Willing buyer and seller
  - “Fair price”
  - Not under compulsion
  - Price discovery
- Equality of information
  - “Reasonable knowledge of relevant facts”
- Anonymity
  - Pre transaction eg Stock market
  - Pseudo anonymity eg Ebay
    - Reputation
  - Post transaction
- Settlement

# Other ways to pay

- Via phone wallets
  - e.g Pingit
- Electronic cash
  - Chaum
  - Bitcoins
  - Game currencies
- Issues
  - Anonymity, exchange rate, regulation etc

# Hot Topics

- Hot topics:
  - Who controls your identity?
    - Government, Bank, or Apple/Google?
  - Identity cards, MS .Net
- Lots of issues:
  - liability, control, civil liberties, protocol attacks, etc
  - Privacy – who owns your information?