

# COURSE TITLE: INNOVATIONS IN FINTECH

## LECTURE: ELECTRONIC PAYMENT SYSTEMS



- ▶ To transfer money over the Internet
- ▶ Methods of traditional payment
  - ▶ Check, credit card, or cash
- ▶ Methods of electronic payment
  - ▶ Electronic cash, software wallets, smart cards, and credit/debit cards
  - ▶ Scrip is digital cash minted by third-party organizations

## E-PAYMENT SYSTEMS

- ▶ Atomicity
  - ▶ Money is not lost or created during a transfer
- ▶ Good atomicity
  - ▶ Money and good are exchanged atomically
- ▶ Non-repudiation
  - ▶ No party can deny its role in the transaction
  - ▶ Digital signatures

## REQUIREMENTS FOR E-PAYMENTS

# DESIRABLE PROPERTIES OF DIGITAL MONEY

- ▶ Universally accepted
- ▶ Transferable electronically
- ▶ Divisible
- ▶ Non-forgable, non-stealable
- ▶ Private (no one except parties know the amount)
- ▶ Anonymous (no one can identify the payer)
- ▶ Work off-line (no on-line verification needed)

No known system satisfies all.

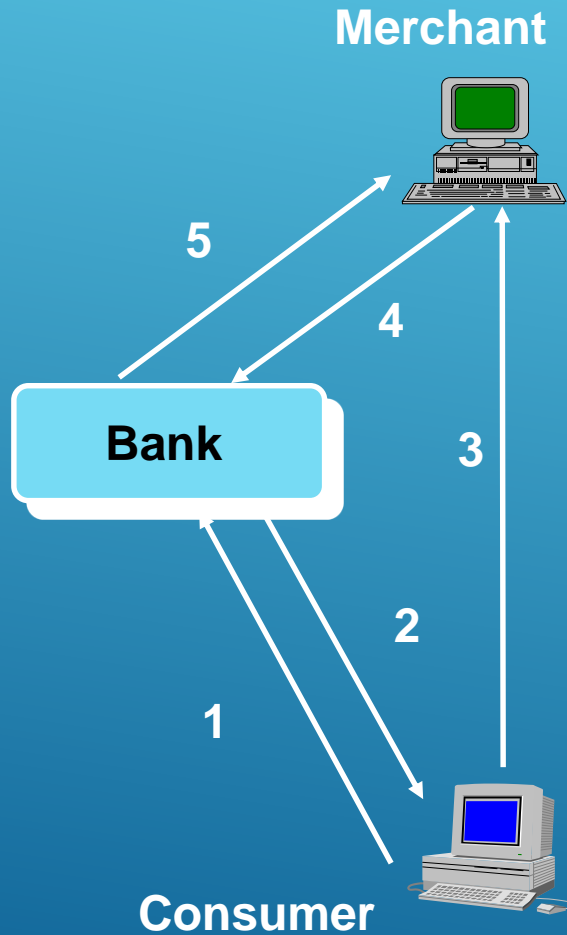
- ▶ E-cash
- ▶ Electronic wallets
- ▶ Smart card
- ▶ Credit card

## TYPES OF E-PAYMENTS

# ELECTRONIC CASH

- ▶ Primary advantage is with purchase of items less than \$10
  - ▶ Credit card transaction fees make small purchases unprofitable
  - ▶ Micropayments
    - ▶ Payments for items costing less than \$1

# E-CASH CONCEPT



1. Consumer buys e-cash from Bank
2. Bank sends e-cash bits to consumer (after charging that amount plus fee)
3. Consumer sends e-cash to merchant
4. Merchant checks with Bank that e-cash is valid (check for forgery or fraud)
5. Bank verifies that e-cash is valid
6. Parties complete transaction: e.g., merchant present e-cash to issuing bank for deposit once goods or services are delivered

**Consumer still has (invalid) e-cash**

- ▶ E-cash must allow spending only once
- ▶ Must be anonymous, just like regular currency
  - ▶ Safeguards must be in place to prevent counterfeiting
  - ▶ Must be independent and freely transferable regardless of nationality or storage mechanism
- ▶ Divisibility and Convenience
- ▶ Complex transaction (checking with Bank)

## ELECTRONIC CASH ISSUES

Atomicity problem

- ▶ On-line
  - ▶ Individual does not have possession personally of electronic cash
  - ▶ Trusted third party, e.g. online bank, holds customers' cash accounts
- ▶ Off-line
  - ▶ Customer holds cash on smart card or software wallet
  - ▶ Fraud and double spending require tamper-proof encryption

## TWO STORAGE METHODS

- ▶ Advantages
  - ▶ More efficient, eventually meaning lower prices
  - ▶ Lower transaction costs
  - ▶ Anybody can use it, unlike credit cards, and does not require special authorization
- ▶ Disadvantages
  - ▶ Tax trail non-existent, like regular cash
  - ▶ Money laundering
  - ▶ Susceptible to forgery

# ADVANTAGES AND DISADVANTAGES OF ELECTRONIC CASH

- ▶ Complex cryptographic algorithms prevent double spending
  - ▶ Anonymity is preserved unless double spending is attempted
- ▶ Serial numbers can allow tracing to prevent money laundering
  - ▶ Does not prevent double spending, since the merchant or consumer could be at fault

# ELECTRONIC CASH SECURITY

# BLIND SIGNATURES

## ▶ **Goal**

- ▶ to have the bank sign documents without knowing what they are signing.

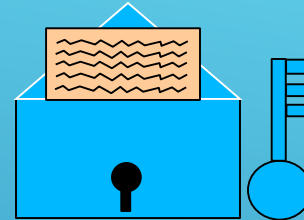
## ▶ **Why?**

- Anonymity with Authentication

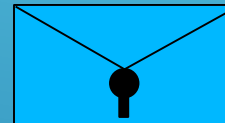
# HOW TO SIGN WITH BLIND FOLD?

## ► How?

Basic: Sign anything

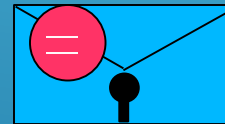


1. You encrypt the message

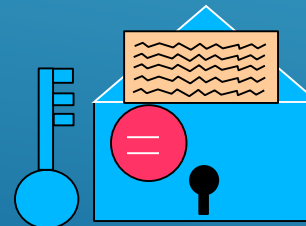


2. Send it to the bank

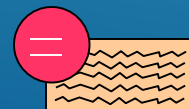
3. The bank signs the message and returns it



4. You decrypt the signed message



5. You spend it



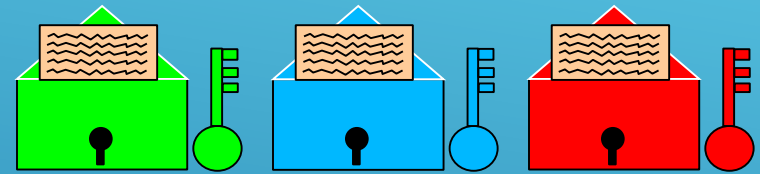
# CUT AND CHOOSE

## ► Problems

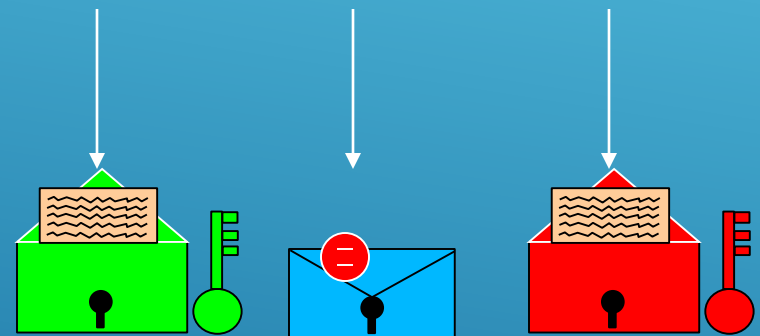
The bank honors anything I write down

## ► **Solution:** the Cut-and-choose algorithm

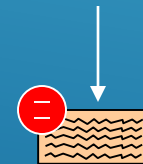
1. Prepare  $n$  copies of the messages and  $n$  different keys, and send them to the bank



2. The bank requests the keys for and opens  $n - 1$  of them, and verifies them. It then signs the remaining one.



3. The bank sends back the signed message, which can then be decrypted and spent



- ▶ Protocol #1
- ▶ Protocol #2
- ▶ Protocol #3
- ▶ Protocol #4

ANONYMOUS DIGITAL CASH?

# Detecting Double Spending

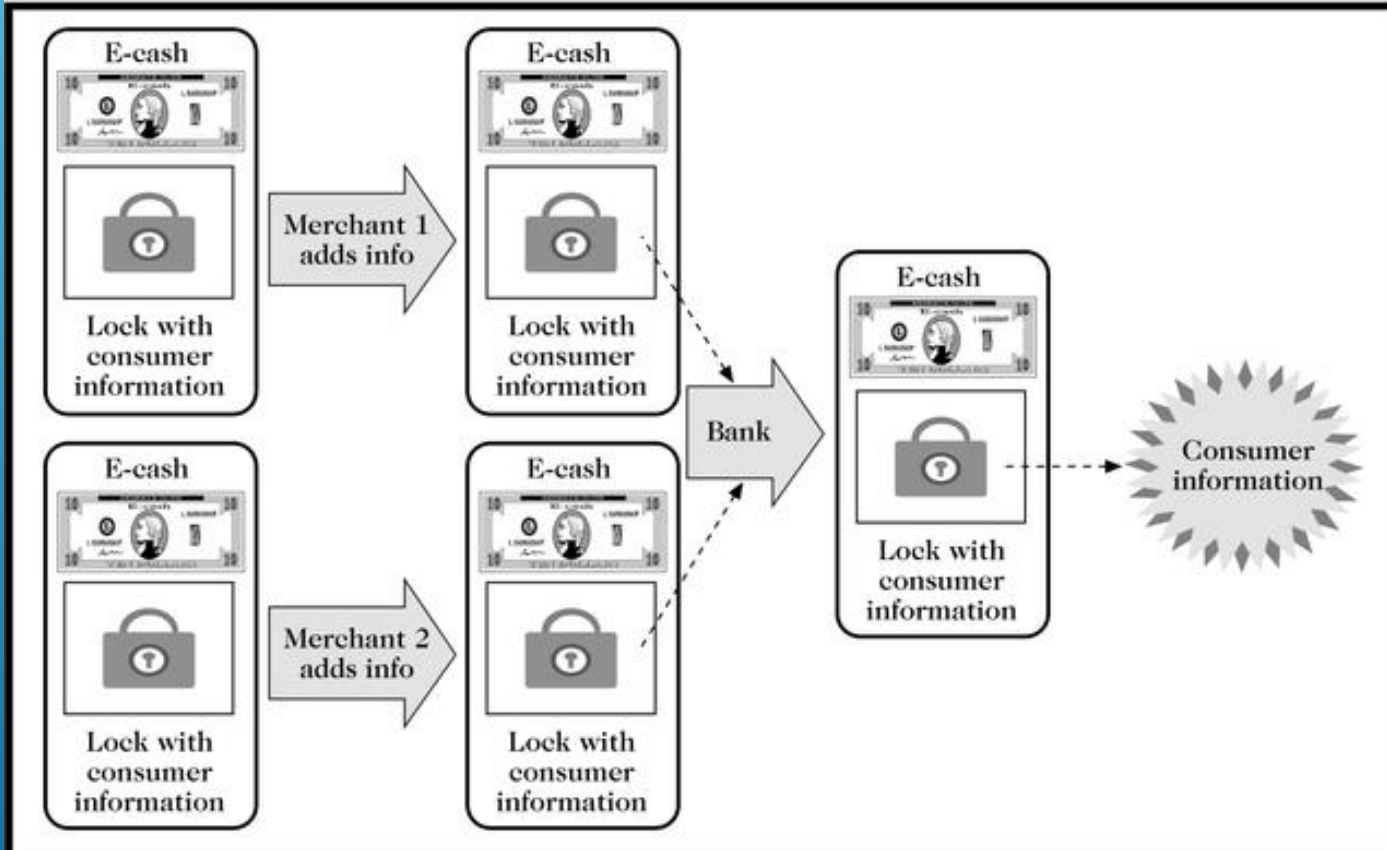


FIGURE 7-3

*Detecting double spending*

- ▶ E-cash not popular in U.S., but successful in Europe and Japan
  - ▶ Reasons for lack of U.S. success not clear
    - ▶ Manner of implementation too complicated
    - ▶ Lack of standards and interoperable software that will run easily on a variety of hardware and software systems

## PAST AND PRESENT E-CASH SYSTEMS

- ▶ Checkfree
  - ▶ Allows payment with online electronic checks
- ▶ Clickshare
  - ▶ Designed for magazine and newspaper publishers
  - ▶ Miscast as a micropayment only system; only one of its features
  - ▶ Purchases are billed to a user's ISP, who in turn bill the customer

## PAST AND PRESENT E-CASH SYSTEMS

# PAST AND PRESENT E-CASH SYSTEMS

- ▶ CyberCash
  - ▶ Combines features from cash and checks
  - ▶ Offers credit card, micropayment, and check payment services
  - ▶ Connects merchants directly with credit card processors to provide authorizations for transactions in real time
    - ▶ No delays in processing prevent insufficient e-cash to pay for the transaction
- ▶ CyberCoins
  - ▶ Stored in CyberCash wallet, a software storage mechanism located on customer's computer
  - ▶ Used to make purchases between .25c and \$10
  - ▶ PayNow -- payments made directly from checking accounts

# PAST AND PRESENT E-CASH SYSTEMS

- ▶ DigiCash
  - ▶ Trailblazer in e-cash
  - ▶ Allowed customers to purchase goods and services using anonymous electronic cash
  - ▶ Recently entered Chapter 11 reorganization
- ▶ Coin.Net
  - ▶ Electronic tokens stored on a customer's computer is used to make purchases
  - ▶ Works by installing special plug-in to a customer's web browser
  - ▶ Merchants do not need special software to accept eCoins.
  - ▶ eCoin server prevents double-spending and traces transactions, but consumer is anonymous to merchant

# AGGREGATION

- ▶ Used when individual transactions are too small for credit card (e.g. \$2.00)
- ▶ Consumer and Merchant sign up with Aggregator
- ▶ Consumer makes purchase. Merchant notifies Aggregator.
- ▶ Aggregator keeps Consumer's account. When amount owed is large enough (or every month), charges to Consumer's credit card
- ▶ Aggregator sends money (less fees) to Merchant
- ▶ QPASS, CyberCash, GlobeID

# PAST AND PRESENT E-CASH SYSTEMS

- ▶ MilliCent
  - ▶ Developed by Digital, now part of Compaq
  - ▶ Electronic scrip system
  - ▶ Participating merchant creates and sells own scrip to broker at a discount
    - ▶ Consumers register with broker and buy bulk generic scrip, usually with credit card
    - ▶ Customers buy by converting broker scrip to vendor-specific scrip, i.e. scrip that a particular merchant will accept
  - ▶ Customers can purchase items of very low value
  - ▶ Brokers required for two reasons:
    - ▶ Small payments require aggregation to insure profitability
    - ▶ System is easier to use -- customer need only deal with one broker for all their scrip needs

- ▶ Stores credit card, electronic cash, owner identification and address
  - ▶ Makes shopping easier and more efficient
    - ▶ Eliminates need to repeatedly enter identifying information into forms to purchase
    - ▶ Works in many different stores to speed checkout
  - ▶ Amazon.com one of the first online merchants to eliminate repeat form-filling for purchases

## ELECTRONIC WALLETS

# An Electronic Checkout Counter Form

Please fill in the information below. Items in red are required for us to process your order. You can submit this form online, or if you are concerned about online security, you can call our Customer Service department at 1-800-468-5846 (or 408-325-7000 for orders originating outside the US) and place your order over the phone. Our Customer Service hours are 6:00AM until 5:00PM, Monday through Friday, Pacific Standard Time.

**We are currently experiencing shipping delays of up to 84 hours. For faster delivery, please place your order with our Customer Service Department at 1(800)468-5846. We apologize for any inconvenience this may cause.**

### Step 3: Email Address

Enter your email address. Note that all order confirmations, order tracking, etc is emailed to this address. Please double check your e-mail address; this is our only means of communicating with you regarding your order.

Email

### Step 4: Billing Address

Please give us your billing address and contact information.

First Name

Last Name

Company

Address1

Address2

City

State  State or Province  Zip/Postal Code   
(US only) (Non-US Only)

Country

Phone  Fax

**FIGURE 7-9** *A typical electronic checkout counter form*

# ELECTRONIC WALLETS

- ▶ Agile Wallet
  - ▶ Developed by CyberCash
  - ▶ Allows customers to enter credit card and identifying information once, stored on a central server
  - ▶ Information pops up in supported merchants' payment pages, allowing one-click payment
  - ▶ Does not support smart cards or CyberCash, but company expects to soon
- ▶ eWallet
  - ▶ Developed by Launchpad Technologies
  - ▶ Free wallet software that stores credit card and personal information on users' computer, not on a central server; info is dragged into payment form from eWallet
  - ▶ Information is encrypted and password protected
  - ▶ Works with Netscape and Internet Explorer

- ▶ Microsoft Wallet
  - ▶ Comes pre-installed in Internet Explorer 4.0, but not in Netscape
  - ▶ All information is encrypted and password protected
  - ▶ Microsoft Wallet Merchant directory shows merchants setup to accept Microsoft Wallet

## ELECTRONIC WALLETS

# Entering Information Into Microsoft Wallet



**Credit Card Information**

**VISA** Otis' Visa

Enter your credit card information and accept or change the display

Credit card information

Name on the card:  Expiration date:

Number:  
    -    -    -

Some older cards have only 13 digits. If your card has only 13 digits, check the box below.

Only display 13 digits

Display name

The display name represents this credit card (i.e., Dad's Personal Visa, Dad's Work Visa).

< Back    Next >    Cancel

**FIGURE 7-10**

*Entering credit card information into Microsoft Wallet*

# W3C PROPOSED STANDARD FOR ELECTRONIC WALLETS

- ▶ World Wide Web Consortium (W3C) is attempting to create an extensible and interoperable method of embedding micropayment information on a web page
  - ▶ Extensible systems allow improvement of the system without eliminating previous work
- ▶ Merchants must accept several payment options to insure the widest possible Internet audience
  - ▶ Merchants must embed in their Web page payment information specific to each payment system
  - ▶ This redundancy spurred W3C to develop common standards for Web page markup for all payment systems
  - ▶ Must move quickly to prevent current methods from becoming entrenched

- ▶ Client (consumer's web browser) initiates micropayment activity
  - ▶ Client browser includes Per Fee Link Handler module and one or more electronic wallets
  - ▶ New HTML tags will carry micropayment information

## **W3C ELECTRONIC COMMERCE INTEREST GROUP (ECIG) DRAFT STANDARD ARCHITECTURE**

# W3C Proposed Micropayment HTML Tags

Field Name	Short Description	Format	Requirements
merchanturl	Identifies the merchant site	URL	MUST be provided
merchantname	Specifies a merchant designation	character string	MAY be provided
buyurl	Identifies what the client is buying	relative URL	MUST be provided
textlink	Textual description of what the client is buying. The text source of the fee link.	character string	MUST be provided
imagelink	Graphical description of what the client is buying. The graphic source of the fee link. ( <code>textlink</code> provides a textual equivalent of the image for accessibility).	URL	MAY be provided
price	Specifies amount and currency	character string	MUST be provided
duration	Indicates the time after purchase any URL can be retrieved with payment	integer number	SHOULD be provided
longdesc	Describes in details the content of what the client is buying	character string	SHOULD be provided
requesturl	Identifies what the client is actually requesting	relative URL	MAY be provided
expiration	Indicates a date until which the offer from the merchant is valid	character string: YYYY-MM-DDThh:mm:ssTZD	MAY be provided
specific field	Provides information unique to each payment system	URL and character string	MAY be provided

**FIGURE 7-11**

*W3C proposed micropayment HTML tags*

- ▶ Electronic Commerce Modeling Language (ECML) proposed standards for electronic wallets
  - ▶ Companies forming the consortium are America Online, IBM, Microsoft, Visa, and MasterCard
  - ▶ Ultimate goal is for all commerce sites to accept ECML
  - ▶ Unclear how this standard will incorporate privacy standards W3C set forth
  - ▶ Electronic Commerce Modeling Language (ECML) Wallet/Merchant Standards Initiative, July 1999

(Next four slides)

## THE ECML STANDARD

# CURRENT STATE OF THE MARKET - ONLINE DATA EXCHANGES

- ▶ Providing payment and order information to merchants while shopping online is typically a manual consumer process
- ▶ 27% of online buyers abandon orders before check-out due to the hassle of filling out forms <sup>1</sup>
- ▶ There is no standard way for identifying the specific data attributes that consumers must provide to merchants during an online transaction
  - ▶ This significantly complicates/limits the ability for digital wallets to automatically exchange information with a merchant web site
- ▶ “76% of merchants surveyed indicated they are willing to participate in a multi site wallet enterprise,” indicating that “multi site wallets offer reduced acquisition costs that far outweigh the risk to merchants of losing an existing customer” <sup>1</sup>

# ECML - WALLET/MERCHANT STANDARD

- ▶ Creating a standard approach for the exchange of information will enhance the ability for digital wallets to be used at all merchant sites and therefore facilitate the growth of e-commerce
- ▶ ECML is a universal, open standard for digital wallets and online merchants that facilitates the seamless exchange of payment and order information to support online purchase transactions
  - ▶ Uniform field names only to start; will evolve over time
- ▶ The ECML Alliance today:
  - ▶ America Online, American Express, Brodia (formerly Transactor Networks), Compaq, CyberCash, Discover, Financial Services Technology Consortium (FSTC), IBM, MasterCard, Microsoft, Novell, SETCo, Sun Microsystems, Trintech, and Visa
- ▶ ECML is designed to be security protocol independent, support global implementations, and support any payment instrument
- ▶ ECML does not change the “look and feel” of a merchant’s site

# SUMMARY OF CURRENT ECML SPECIFICATION

field_names	min field length	field_names	min field length
Ecom_ShipTo_Postal_Name_Prefix	4	Ecom_ReceiptTo_Postal_Name_Prefix	4
Ecom_ShipTo_Postal_Name_First	15	Ecom_ReceiptTo_Postal_Name_First	15
Ecom_ShipTo_Postal_Name_Middle	15	Ecom_ReceiptTo_Postal_Name_Middle	15
Ecom_ShipTo_Postal_Name_Last	15	Ecom_ReceiptTo_Postal_Name_Last	15
Ecom_ShipTo_Postal_Name_Suffix	4	Ecom_ReceiptTo_Postal_Name_Suffix	4
Ecom_ShipTo_Postal_Street_Line1	20	Ecom_ReceiptTo_Postal_Street_Line1	20
Ecom_ShipTo_Postal_Street_Line2	20	Ecom_ReceiptTo_Postal_Street_Line2	20
Ecom_ShipTo_Postal_Street_Line3	20	Ecom_ReceiptTo_Postal_Street_Line3	20
Ecom_ShipTo_Postal_City	22	Ecom_ReceiptTo_Postal_City	22
Ecom_ShipTo_Postal_StateProv	2	Ecom_ReceiptTo_Postal_StateProv	2
Ecom_ShipTo_Postal_PostalCode	14	Ecom_ReceiptTo_Postal_PostalCode	14
Ecom_ShipTo_Postal_CountryCode	2	Ecom_ReceiptTo_Postal_CountryCode	2
Ecom_ShipTo_Telecom_Phone_Number	10	Ecom_ReceiptTo_Telecom_Phone_Number	10
Ecom_ShipTo_Online_Email	40	Ecom_ReceiptTo_Online_Email	40
Ecom_BillTo_Postal_Name_Prefix	4	Ecom_Payment_Card_Name	30
Ecom_BillTo_Postal_Name_First	15	Ecom_Payment_Card_Type	4
Ecom_BillTo_Postal_Name_Middle	15	Ecom_Payment_Card_Number	19
Ecom_BillTo_Postal_Name_Last	15	Ecom_Payment_Card_Verification	4
Ecom_BillTo_Postal_Name_Suffix	4	Ecom_Payment_Card_ExpDate_Day	2
Ecom_BillTo_Postal_Street_Line1	20	Ecom_Payment_Card_ExpDate_Month	2
Ecom_BillTo_Postal_Street_Line2	20	Ecom_Payment_Card_ExpDate_Year	4
Ecom_BillTo_Postal_Street_Line3	20	Ecom_Payment_Card_Protocol	20
Ecom_BillTo_Postal_City	22	Ecom_ConsumerOrderID	20
Ecom_BillTo_Postal_StateProv	2	Ecom_SchemaVersion	30
Ecom_BillTo_Postal_PostalCode	14	Ecom_TransactionComplete	-
Ecom_BillTo_Postal_CountryCode	2		
Ecom_BillTo_Telecom_Phone_Number	10		
Ecom_BillTo_Online_Email	40		

# ECML IMPLEMENTATION AND ALLIANCE PARTICIPATION

- ▶ The ECML Alliance seeks widespread support for and adoption of the ECML standard
- ▶ ECML is publicly available today and can be easily implemented by online merchants, e-commerce technology vendors, and other interested parties
  - ▶ [www.ecml.org](http://www.ecml.org) - the official web site of ECML
- ▶ ECML has been enthusiastically endorsed by several e-commerce industry segments, including the following leading online merchants:
  - [beyond.com](http://beyond.com)
  - [Dell Computer](http://Dell Computer)
  - [fashionmall.com](http://fashionmall.com)
  - [healthshop.com](http://healthshop.com)
  - [Nordstrom.com](http://Nordstrom.com)
  - [Omaha Steaks](http://Omaha Steaks)
  - [Reel.com](http://Reel.com)
  - [1-800-Batteries](http://1-800-Batteries)
- **To support the current version of ECML, a merchant will need to make a one-time change to incorporate the uniform field names into the check-out pages of its web site, and make changes to CGI/ASP scripts**
  - **Organizations interested in participating in the ECML Alliance should contact [coordinator@ecml.org](mailto:coordinator@ecml.org) with their indication of interest**

# SMART CARDS

- ▶ Magnetic stripe
  - ▶ 140 bytes, cost \$0.20-0.75
- ▶ Memory cards
  - ▶ 1-4 KB memory, no processor, cost \$1.00-2.50
- ▶ Optical memory cards
  - ▶ 4 megabytes read-only (CD-like), cost \$7.00-12.00
- ▶ Microprocessor cards
  - ▶ Embedded microprocessor
    - ▶ (OLD) 8-bit processor, 16 KB ROM, 512 bytes RAM
    - ▶ Equivalent power to IBM XT PC, cost \$7.00-15.00
    - ▶ 32-bit processors now available



# SMART CARDS

- ▶ Plastic card containing an embedded microchip
- ▶ Available for over 10 years
- ▶ So far not successful in U.S., but popular in Europe, Australia, and Japan
- ▶ Unsuccessful in U.S. partly because few card readers available
- ▶ Smart cards gradually reappearing in U.S.; success depends on:
  - ▶ Critical mass of smart cards that support applications
  - ▶ Compatibility between smart cards, card-reader devices, and applications

# SMART CARD APPLICATIONS

- ▶ Ticketless travel
  - ▶ Seoul bus system: 4M cards, 1B transactions since 1996
  - ▶ Planned the SF Bay Area system
- ▶ Authentication, ID
- ▶ Medical records
- ▶ Ecash
- ▶ Store loyalty programs
- ▶ Personal profiles
- ▶ Government
  - ▶ Licenses
- ▶ Mall parking

...

▶ Advantages:

1. Atomic, debt-free transactions
2. Feasible for very small transactions (information commerce)
3. (Potentially) anonymous
4. Security of physical storage
5. (Potentially) currency-neutral

▶ Disadvantages:

1. Low maximum transaction limit (not suitable for B2B or most B2C)
2. High Infrastructure costs (not suitable for C2C)
3. Single physical point of failure (the card)
4. Not (yet) widely used

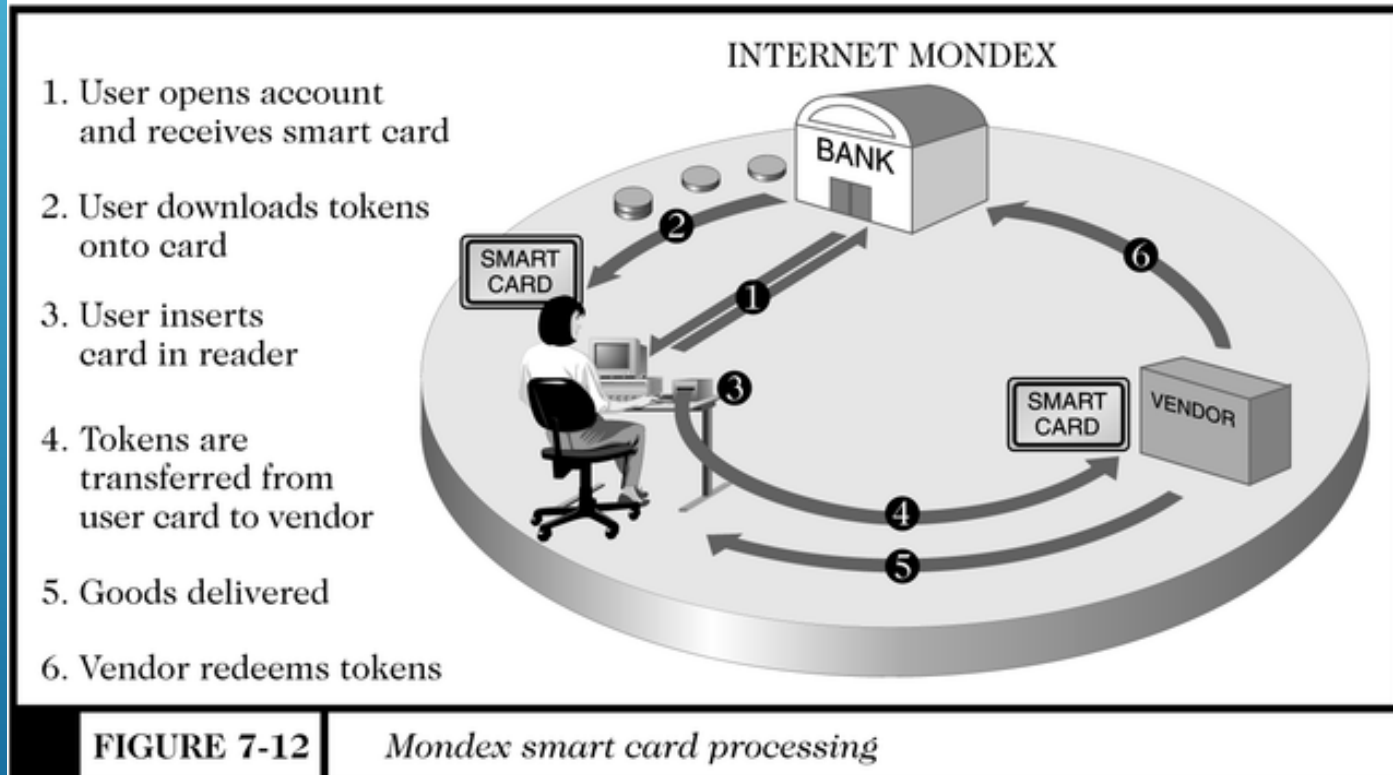
# ADVANTAGES AND DISADVANTAGES OF SMART CARDS

# MONDEX SMART CARD



- ▶ Holds and dispenses electronic cash (Smart-card based, stored-value card)
- ▶ Developed by MasterCard International
- ▶ Requires specific card reader, called Mondex terminal, for merchant or customer to use card over Internet
- ▶ Supports micropayments as small as 3c and works both online and off-line at stores or over the telephone
- ▶ Secret chip-to-chip transfer protocol
- ▶ Value is not in strings alone; must be on Mondex card
- ▶ Loaded through ATM
  - ▶ ATM does not know transfer protocol; connects with secure device at bank

# Mondex Smart Card Processing



**FIGURE 7-12**

*Mondex smart card processing*

- ▶ Here's what happens "behind the scenes" during a Mondex transaction between a consumer and merchant. Placing the card in a Mondex terminal starts the transaction process:
  1. Information from the customer's chip is validated by the merchant's chip. Similarly, the merchant's card is validated by the customer's card.
  2. The merchant's card requests payment and transmits a "digital signature" with the request. Both cards check the authenticity of each other's message. The customer's card checks the digital signature and, if satisfied, sends acknowledgement, again with a digital signature.
  3. Only after the purchase amount has been deducted from the customer's card is the value added to the merchant's card. The digital signature from this card is checked by the customer's card and if confirmed, the transaction is complete.

# MONDEX TRANSACTION

# MONDEX SMART CARD

- ▶ Disadvantages
  - ▶ Card carries real cash in electronic form, creating the possibility of theft
  - ▶ No deferred payment as with credit cards -cash is dispensed immediately
- ▶ Security
  - ▶ Active and dormant security software
    - ▶ Security methods constantly changing
    - ▶ ITSEC E6 level (military)
  - ▶ VTP (Value Transfer Protocol)
    - ▶ Globally unique card numbers
    - ▶ Globally unique transaction numbers
    - ▶ Challenge-response user identification
    - ▶ Digital signatures
  - ▶ MULTOS operating system
    - ▶ firewalls on the chip

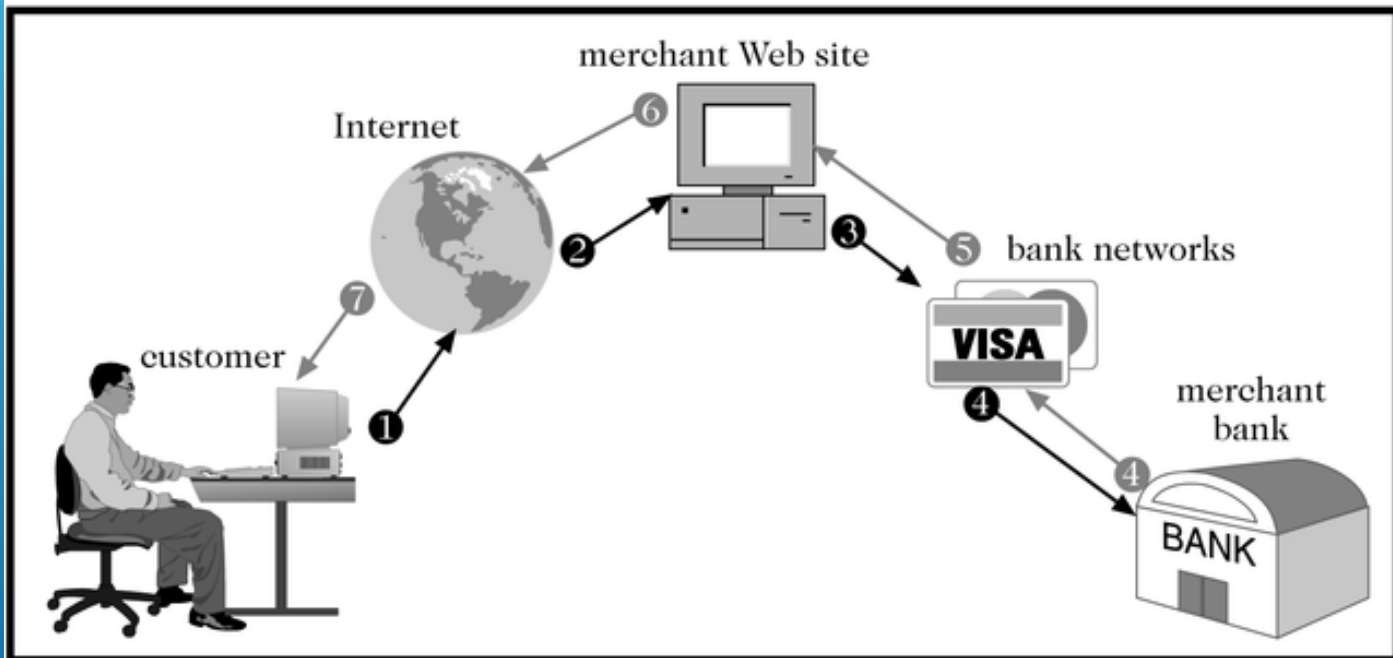
# CREDIT CARDS

- ▶ Credit card
  - ▶ Used for the majority of Internet purchases
  - ▶ Has a preset spending limit
  - ▶ Currently most convenient method
  - ▶ Most expensive e-payment mechanism
    - ▶ MasterCard: \$0.29 + 2% of transaction value
  - ▶ Disadvantages
    - ▶ Does not work for small amount (too expensive)
    - ▶ Does not work for large amount (too expensive)
- ▶ Charge card
  - ▶ No spending limit
  - ▶ Entire amount charged due at end of billing period

# PAYMENT ACCEPTANCE AND PROCESSING

- ▶ Merchants must set up merchant accounts to accept payment cards
- ▶ Law prohibits charging payment card until merchandise is shipped
- ▶ Payment card transaction requires:
  - ▶ Merchant to authenticate payment card
  - ▶ Merchant must check with card issuer to ensure funds are available and to put hold on funds needed to make current charge
  - ▶ Settlement occurs in a few days when funds travel through banking system into merchant's account

# Processing a Payment Card Order



**FIGURE 7-13**

*Processing a payment card order*

# OPEN AND CLOSED LOOP SYSTEMS

- ▶ Closed loop systems

- ▶ Banks and other financial institutions serve as brokers between card users and merchants -- no other institution is involved
- ▶ American Express and Discover are examples

- ▶ Open loop systems

- ▶ Transaction is processed by third party
- ▶ Visa and MasterCard are examples

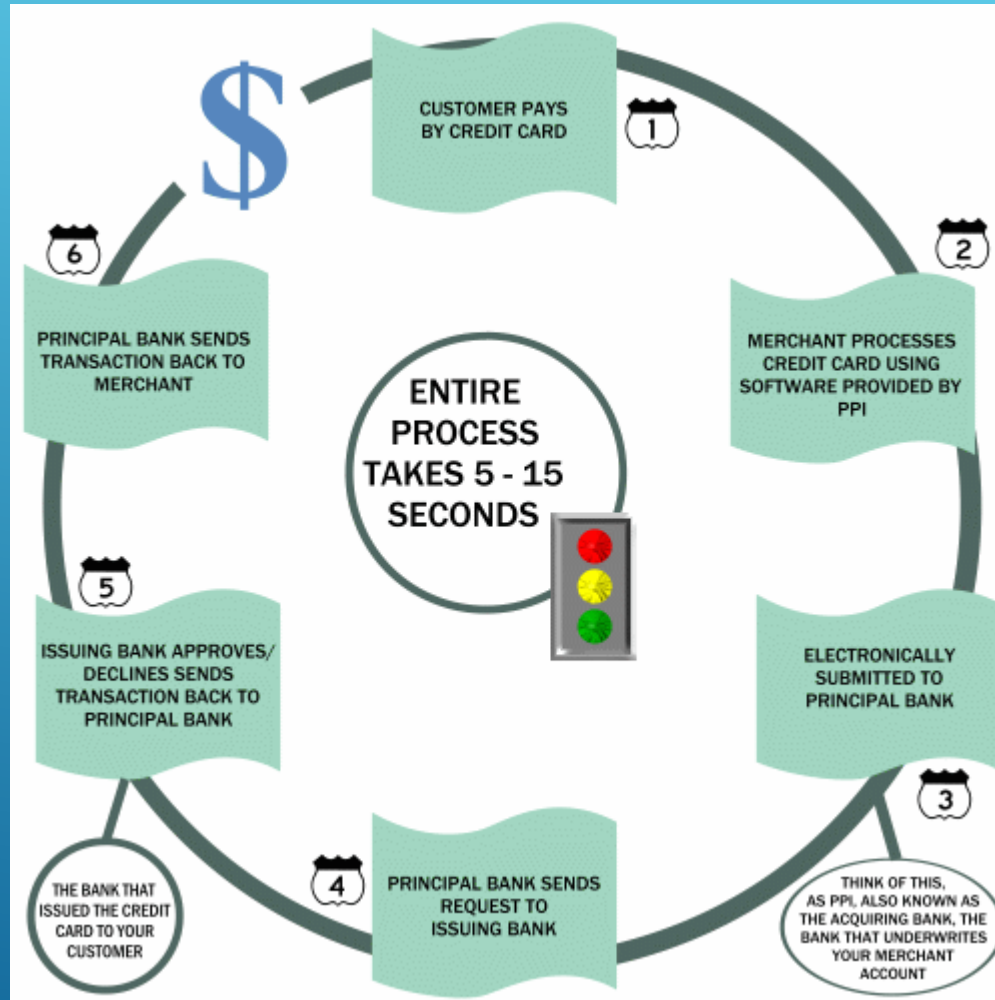
- ▶ Merchant bank
  - ▶ Also called acquiring bank
  - ▶ Does business with merchants that want to accept payment cards
  - ▶ Merchant receives account where they deposit card sales totals
  - ▶ Value of sales slips is credited to merchant's account

# SETTING UP MERCHANT ACCOUNT

- ▶ Can be done automatically by software packaged with electronic commerce software
- ▶ Can contract with third party to handle payment card processing
  - ▶ Can also pick, pack, and ship products to the customer
  - ▶ Allows merchant to focus on web presence and supply availability

# PROCESSING PAYMENT CARDS ONLINE

# CREDIT CARD PROCESSING



SOURCE: PAYMENT PROCESSING INC.

- ▶ Internetsecure
  - ▶ Provides secure credit card payment services
  - ▶ Supports payments with Visa and MasterCard
  - ▶ Provides risk management and fraud detection, and ensures all proper security for credit card transactions is maintained
  - ▶ Ensures all transactions are properly credited to merchant's account

# PAYMENT PROCESSING SERVICES

# PAYMENT PROCESSING SERVICES

## ▶ Tellan

- ▶ Provides PCAuthorize for smaller commerce sites and WebAuthorize for larger enterprise-class merchant sites
- ▶ Both systems capture credit card information from the merchant's form and connect directly to the bank network using dial-up or private, leased lines
- ▶ Bank network receives credit information, performs credit authorization, and deposits the money in the merchant's bank account
- ▶ The merchant's web site receives confirmation or rejection of the transaction, which is communicated to the customer

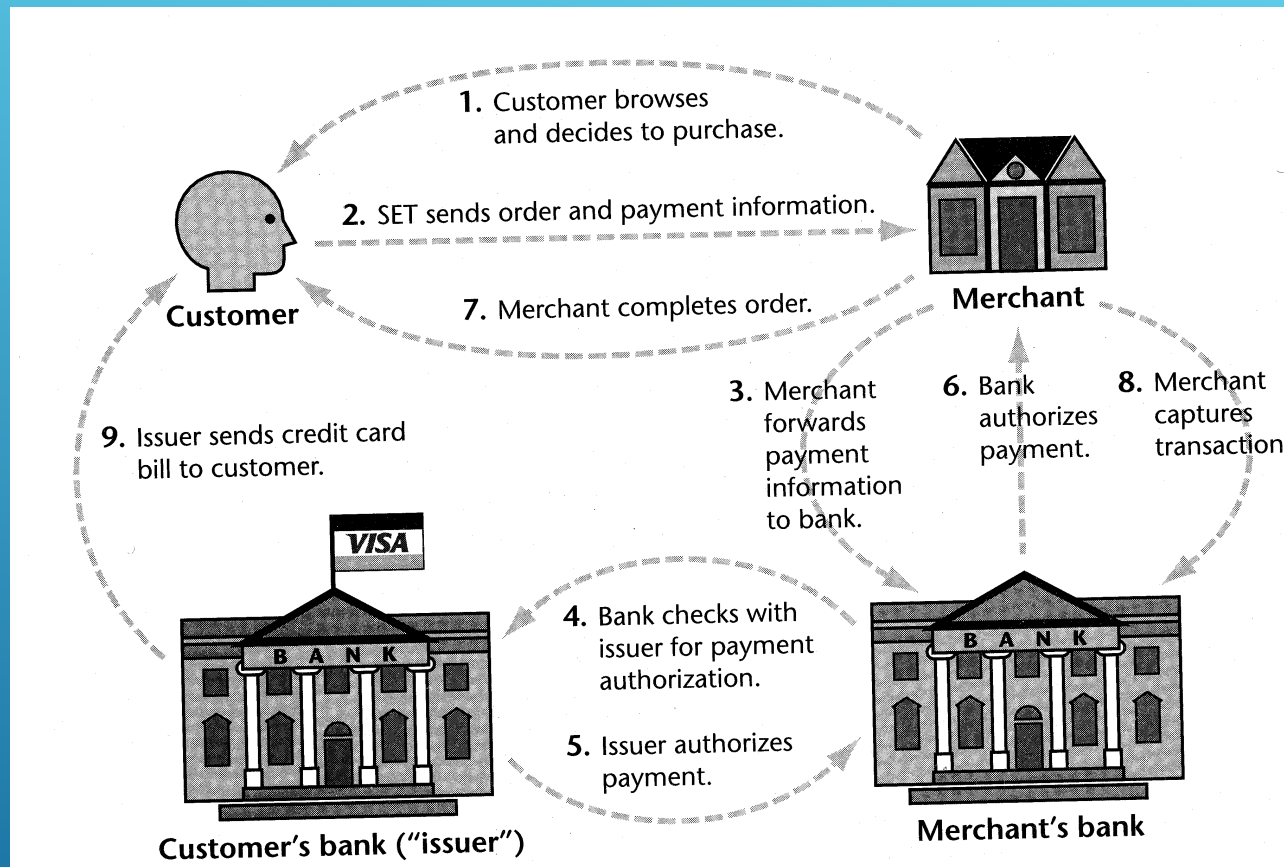
- ▶ IC Verify
  - ▶ Provides electronic transaction processing for merchants for all major credit and debit cards
  - ▶ Also allows check guarantees and verification transactions
  - ▶ A CyberCash company
- ▶ Authorize.Net
  - ▶ Online, real time service that links merchants with issuing banks by simply inserting a small block of HTML code into their transaction page

# PAYMENT PROCESSING SERVICES

# SECURE ELECTRONIC TRANSACTION (SET) PROTOCOL

- ▶ Jointly designed by MasterCard and Visa with backing of Microsoft, Netscape, IBM, GTE, SAIC, and others
- ▶ Designed to provide security for card payments as they travel on the Internet
  - ▶ Contrasted with Secure Socket Layers (SSL) protocol, SET validates consumers and merchants in addition to providing secure transmission
- ▶ SET specification
  - ▶ Uses public key cryptography and digital certificates for validating both consumers and merchants
  - ▶ Provides privacy, data integrity, user and merchant authentication, and consumer nonrepudiation

# THE SET PROTOCOL

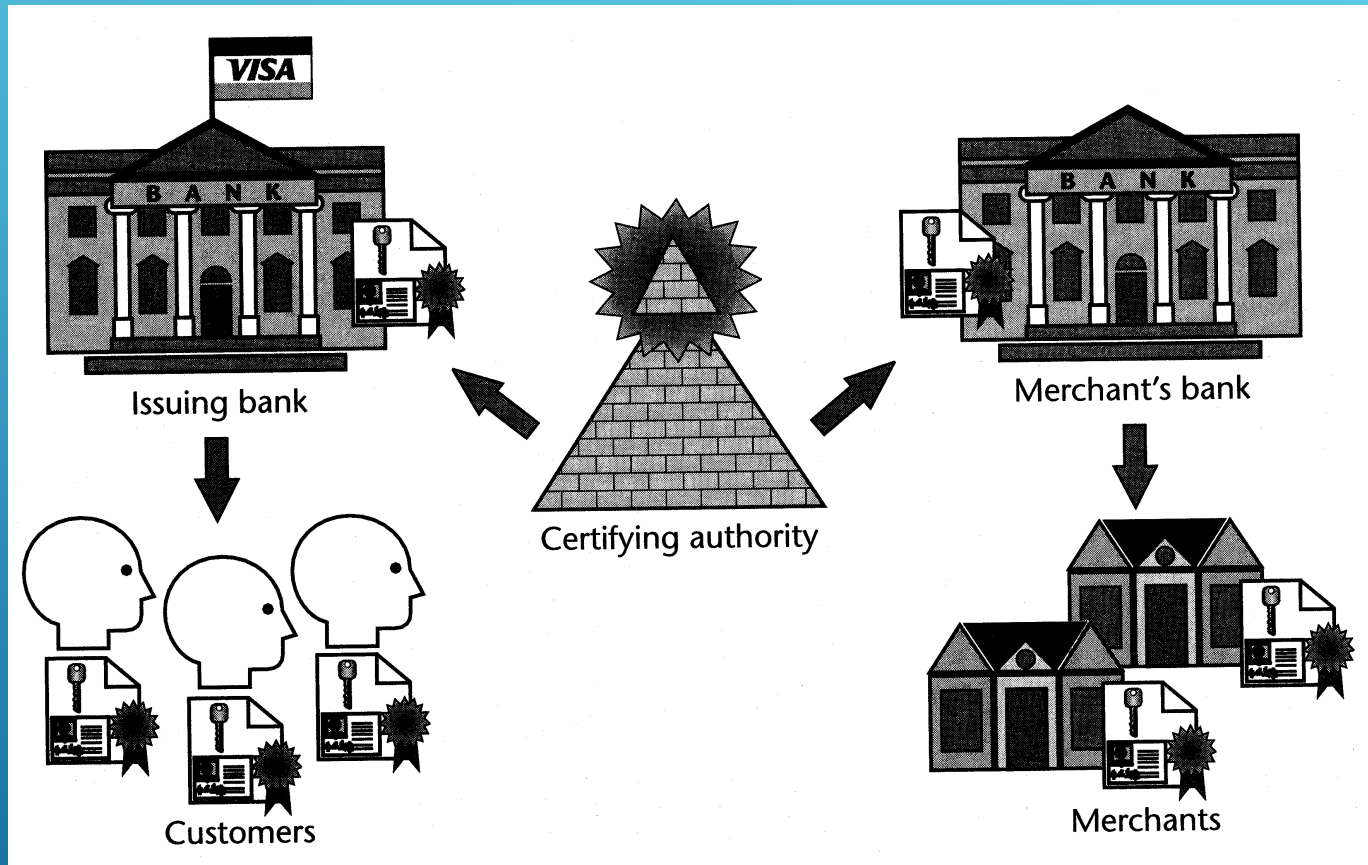


The SET protocol coordinates the activities of the customer, merchant, merchant's bank, and card issuer. [Source: Stein]

# SET PAYMENT TRANSACTIONS

- ▶ SET-protected payments work like this:
  - ▶ Consumer makes purchase by sending encrypted financial information along with digital certificate
  - ▶ Merchant's website transfers the information to a payment card processing center while a Certification Authority certifies digital certificate belongs to sender
  - ▶ Payment card-processing center routes transaction to credit card issuer for approval
  - ▶ Merchant receives approval and credit card is charged
  - ▶ Merchant ships merchandise and adds transaction amount for deposit into merchant's account

# SET USES A HIERARCHY OF TRUST



All parties hold certificates signed directly or indirectly by a certifying authority. [Source: Stein]

# SET PROTOCOL

- ▶ Extremely secure
  - ▶ Fraud reduced since all parties are authenticated
  - ▶ Requires all parties to have certificates
- ▶ So far has received lukewarm reception
- ▶ 80 percent of SET activities are in Europe and Asian countries
- ▶ Problems with SET
  - ▶ Not easy to implement
  - ▶ Not as inexpensive as expected
  - ▶ Expensive to integrate with legacy applications
  - ▶ Not tried and tested, and often not needed
  - ▶ Scalability is still in question

Q&A

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