

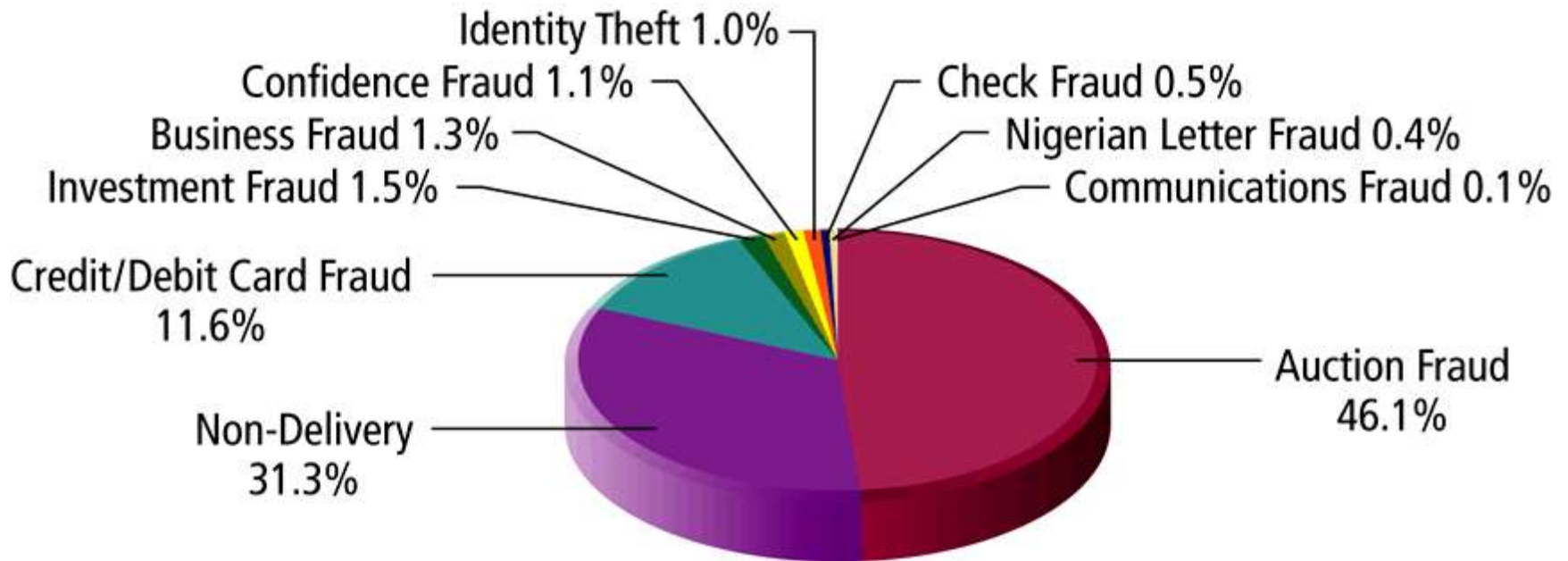
E-Commerce Payment Systems



Topics

- The E-Commerce environment
- Traditional payment systems
- Online payment with credit cards
- Online payment with SET
- Other online payment systems
- B2C and B2B

Internet Fraud Complaints Reported to the IFCC (2004)



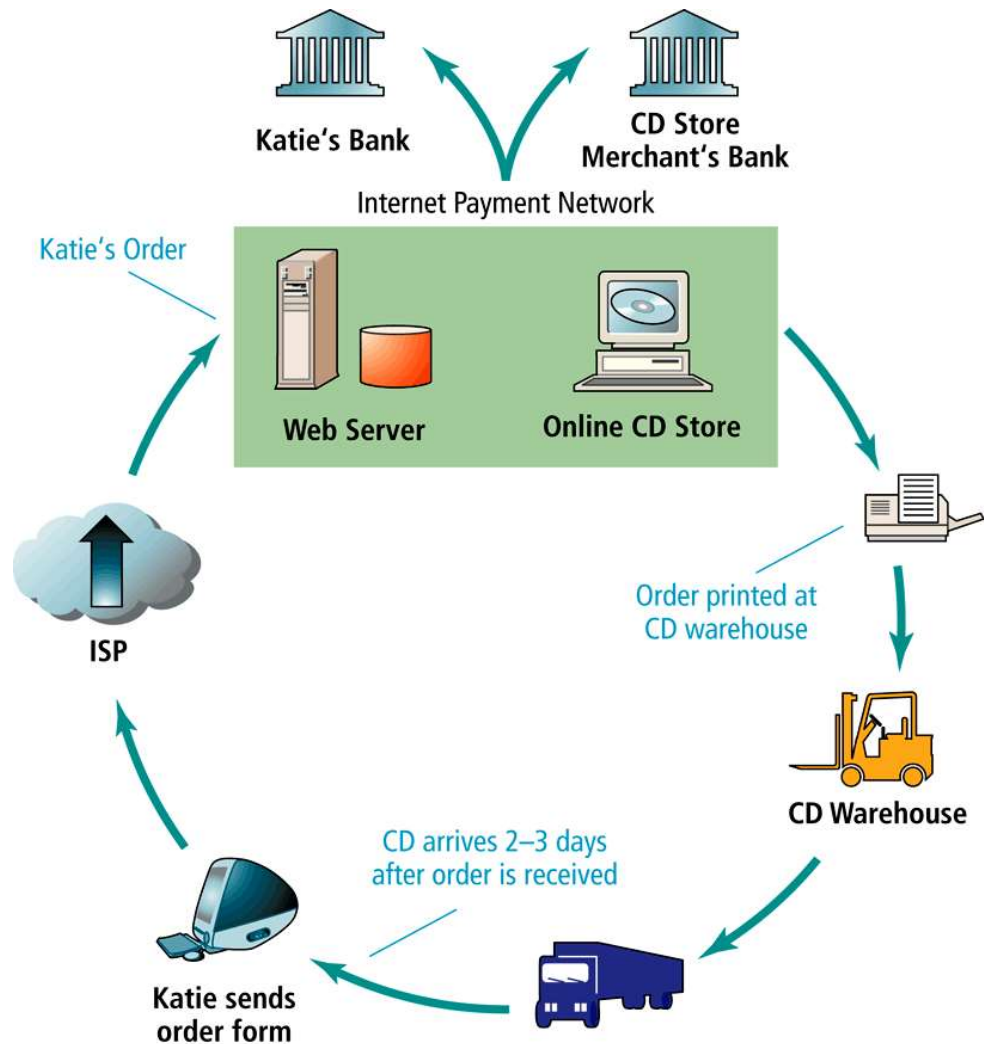
Online Credit Card Purchases are Risky for the Merchant

- Many security procedures that credit card companies rely on are not applicable in online environment (CNP).
- Merchant pays when goods are not delivered, order is disputed or in cases of credit card fraud.
- Percentage of Internet transactions charged back to online merchants much higher than for traditional retailers (3-10% compared to 1/2-1%)
- To protect selves, merchants can:
 - Refuse to process overseas purchases
 - Insist that credit card and shipping address match
 - Require users to input 3-digit security code printed on back of card

Customer and Merchant Views

TABLE 5.1 CUSTOMER AND MERCHANT PERSPECTIVES ON THE DIFFERENT DIMENSIONS OF E-COMMERCE SECURITY		
DIMENSIONS	CUSTOMER'S PERSPECTIVE	MERCHANT'S PERSPECTIVE
Integrity	Has information I transmit or receive been altered?	Has data on the site been altered without authorization? Is data being received from customers valid?
Nonrepudiation	Can a party to an action with me later deny taking the action?	Can a customer deny ordering products?
Authenticity	Who am I dealing with? How can I be assured that the person or entity is who they claim to be?	What is the real identity of the customer?
Confidentiality	Can someone other than the intended recipient read my messages?	Are messages or confidential data accessible to anyone other than those authorized to view them?
Privacy	Can I control the use of information about myself transmitted to an e-commerce merchant?	What use, if any, can be made of personal data collected as part of an e-commerce transaction? Is the personal information of customers being used in an unauthorized manner?
Availability	Can I get access to the site?	Is the site operational?

E-Commerce Transaction



Points of Vulnerability

Security Risks

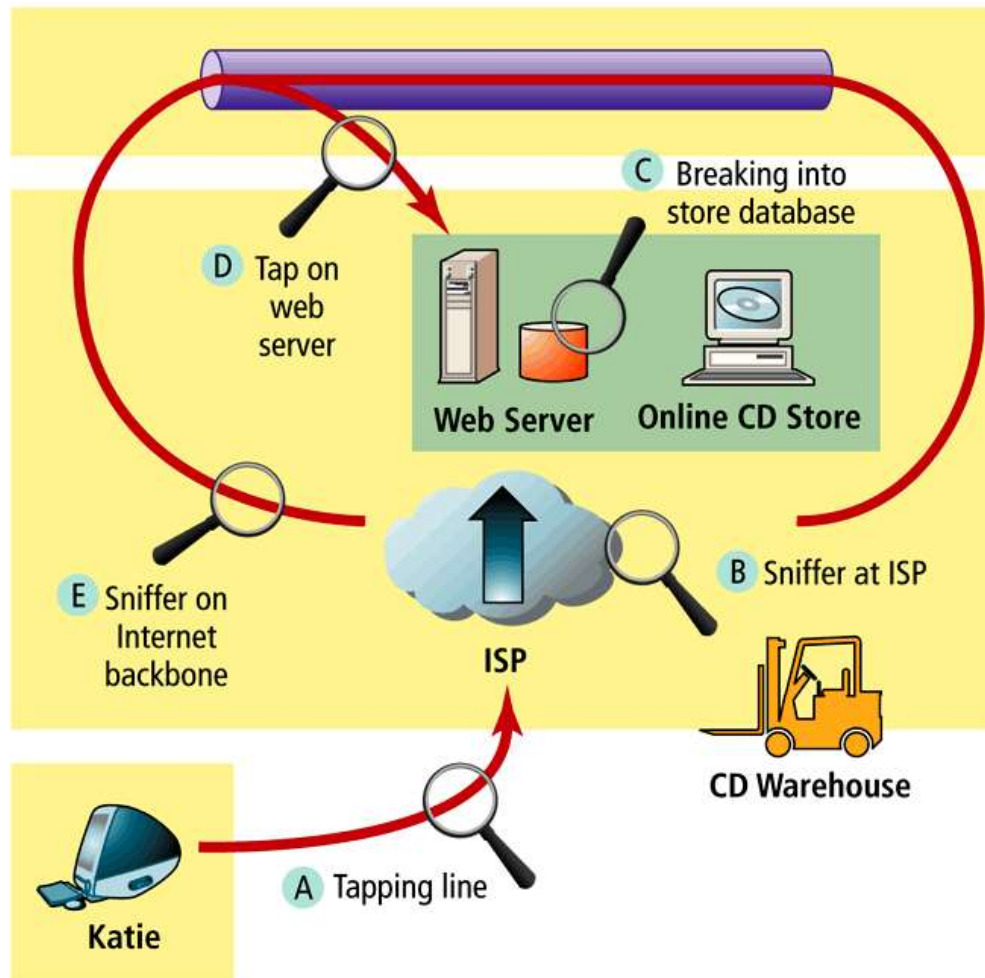
Internet communications

Servers

ISP
Merchant
Banks

Clients

Business
Home



E-Commerce Availability

- Digital Divide: Some groups don't have same access to computers and Internet that others do
- Digital "have nots" include:
 - Households with incomes below \$35,000
 - Those without college educations
 - People living in rural areas
 - African-Americans and Hispanics
 - Seniors over 65
 - Disabled
- Most recent Department of Commerce study -- most of above groups gaining access to computers and Internet due to falling computer prices and free or low cost ISPs

Traditional Payment Systems

- Cash
- Checking Transfer
- Credit Card
- Stored Value
- Accumulating Balance

Cash

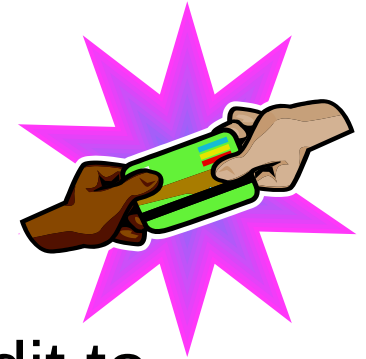


- Legal tender defined by a national authority to represent value
- Most common form of payment in terms of number of transactions
- Instantly convertible into other forms of value without intermediation of any kind
- Portable, requires no authentication, and provides instant purchasing power
- “Free” (no transaction fee), anonymous, low cognitive demands
- Limitations: easily stolen, limited to smaller transaction, does not provide any float

Checking Transfer

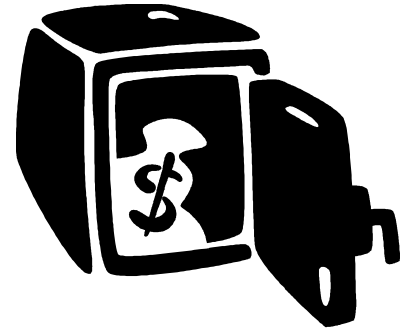
- Funds transferred directly via a signed draft or check from a consumer's checking account to a merchant or other individual
- Most common form of payment in terms of amount spend
- Can be used for both small and large transactions
- Some float
- Not anonymous, require third-party intervention (banks)
- Introduce security risks for merchants (forgeries, stopped payments), so authentication typically required

Credit Card



- Represents an account that extends credit to consumers, permitting consumers to purchase items while deferring payment, and allows consumers to make payments to multiple vendors at one time
- Credit card associations – Nonprofit associations (Visa, MasterCard) set standards for issuing banks
- Issuing banks – Issue cards and process transactions
- Processing centers (clearinghouses) – Handle verification of accounts and balances

Stored Value Accounts



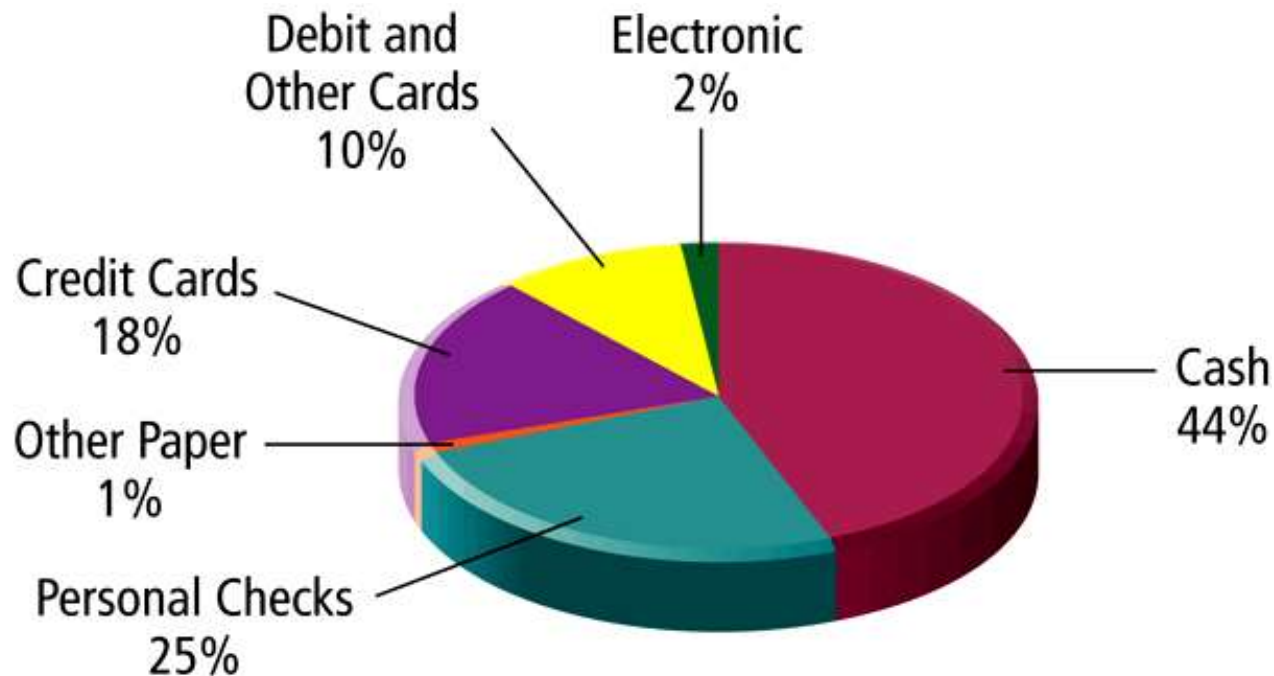
- Accounts created by depositing funds into an account and from which funds are paid out or withdrawn as needed
- Examples: Debit cards, gift certificates, prepaid cards, smart cards
- Debit cards: Immediately debit a checking or other demand-deposit account
- Online Peer-to-peer payment systems such as PayPal

Accumulating Value

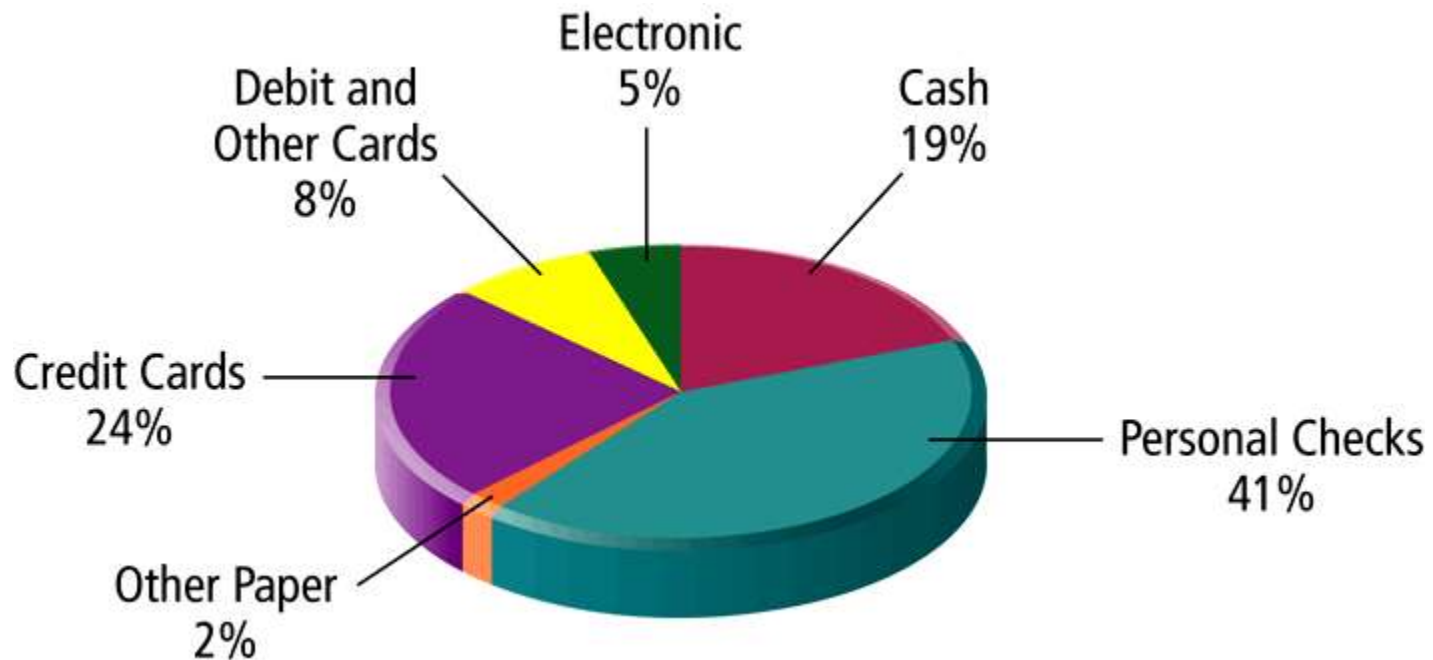
- Accounts that accumulate expenditures and to which consumers make periodic payments
- Examples: utility, phone, American Express accounts



Most Common by Number of Transactions



Most Common by Dollar Amount



Payment Systems Characteristics

DIMENSION	CASH	PERSONAL CHECK	CREDIT CARD	STORED VALUE (DEBIT CARD)	ACCUMULATING BALANCE
Instantly convertible without intermediation	yes	no	no	no	no
Low transaction cost for small transactions	yes	no	no	no	yes
Low transaction cost for large transactions	no	yes	yes	yes	yes
Low fixed costs for merchant	yes	yes	no	no	no
Refutable (able to be repudiated)	no	yes	yes	no (usually)	yes
Financial risk for consumer	yes	no	up to \$50	limited	no
Financial risk for merchant	no	yes	yes	no	yes
Anonymous for consumer	yes	no	no	no	no
Anonymous for merchant	yes	no	no	no	no
Immediately spendable	yes	no	no	no	no
Security against unauthorized use	no	some	some	some	some
Tamper-resistant	yes	no	yes	yes	yes
Requires authentication	no	yes	yes	yes	yes
Special hardware required	no	no	yes—by merchant	yes—by merchant	yes—by merchant
Buyer keeps float	no	yes	yes	no	yes
Account required	no	yes	yes	yes	yes
Has immediate monetary value	yes	no	no	yes	no

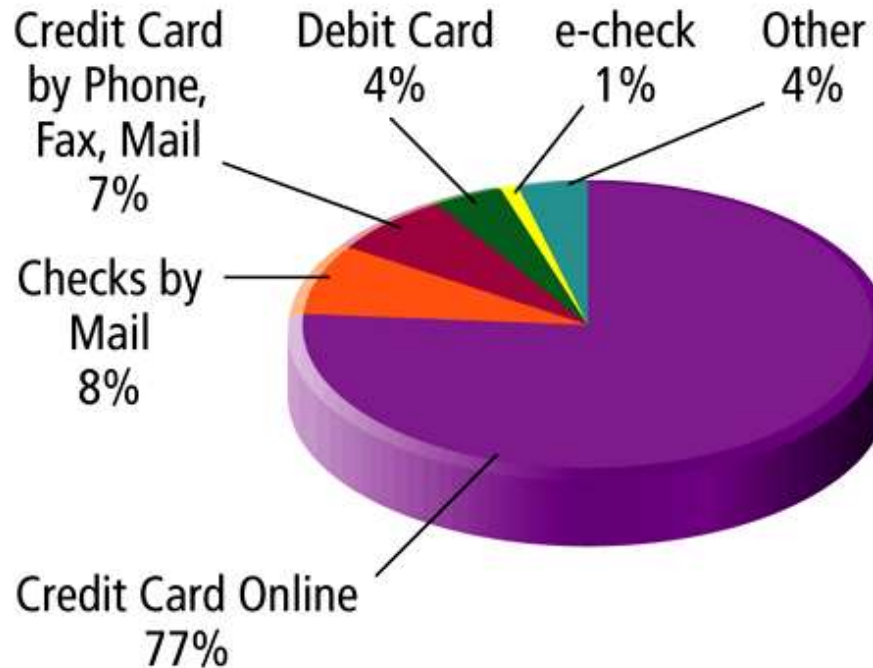
SOURCE: Adapted from MacKie-Mason and White, 1996.

Online Payment Systems

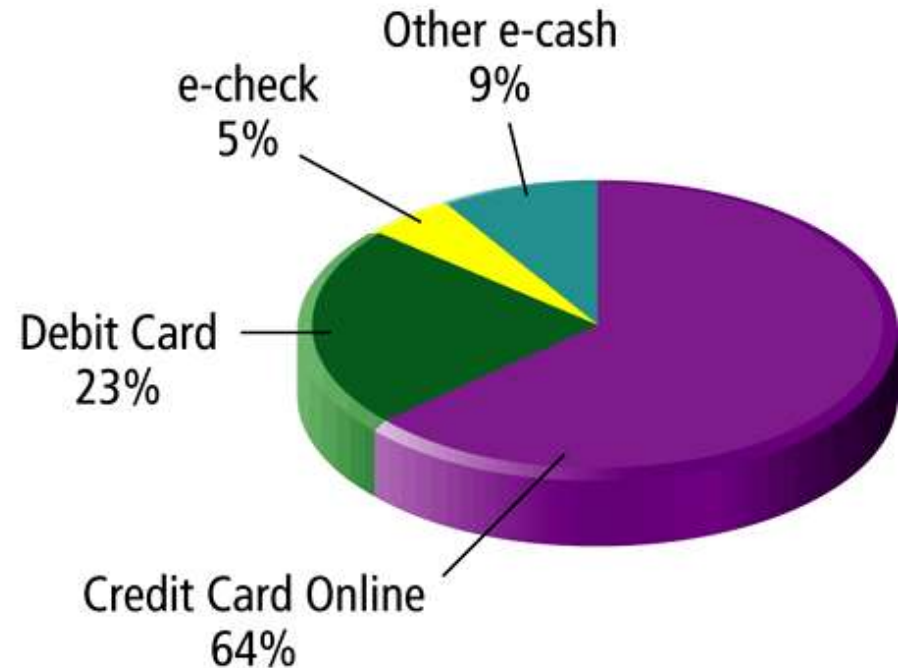
- Credit cards are dominant form of online payment, accounting for around 80% of online payments in 2002
- New forms of electronic payment include:
 - Digital cash
 - Online stored value systems
 - Digital accumulating balance payment systems
 - Digital credit accounts
 - Digital checking

Actual and Preferred

**Actual
Online Payment Methods**



**Merchants' Preferred
Online Payment Methods**

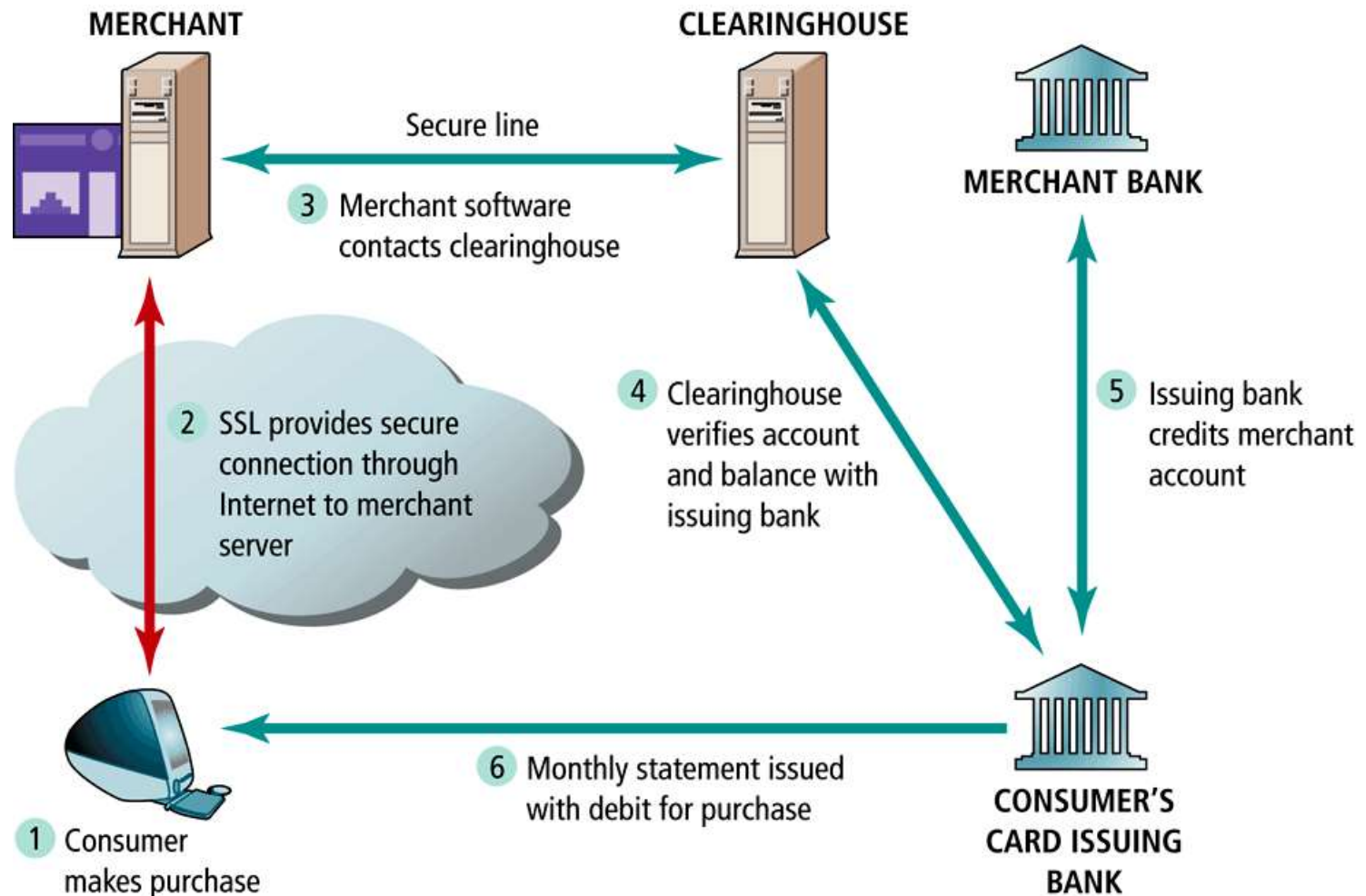


* Percentages total more than 100% due to rounding

Online Credit Card Use

- Processed in much the same way that in-store purchases are
- Major difference is that online merchants do not see or take impression of card, and no signature is available (Cardholder Not Present transactions)
- Participants include consumer, merchant, clearinghouse, merchant bank (acquiring bank) and consumer's card issuing bank

Online Credit Card Use



Problems with Online CC Use

- Security – Neither merchant nor consumer are authenticated. Merchant gets consumers credit card number for possible later misuse.
- Cost – for merchants, around 3.5% of purchase price plus transaction fee of 20-30 cents per transaction
- Social equity – many people do not have access to credit cards (young adults, plus almost 100 million other adult Americans who cannot afford cards or are considered poor risk)

SET (Secure Electronic Transaction) Protocol

- Developed to address deficiencies in online credit card use. Open standard developed by MasterCard and Visa.
- Authenticates cardholder and merchant identity through use of digital certificates.
- Transaction process similar to standard online credit card transaction, with identity verification.
- Thus far, has not caught on much, due to costs involved in integrating SET into existing systems, and lack of interest among consumers

SET at Work

- SET uses SSL and PKI. Customer must have a SET enabled browser and merchant needs SET enabled server.
- Consumer's credit card issuing bank issues a digital certificate (electronic wallet) with consumer's public key and bank's public key (signed with bank's private key).
- Merchants get a similar digital certificate from bank.

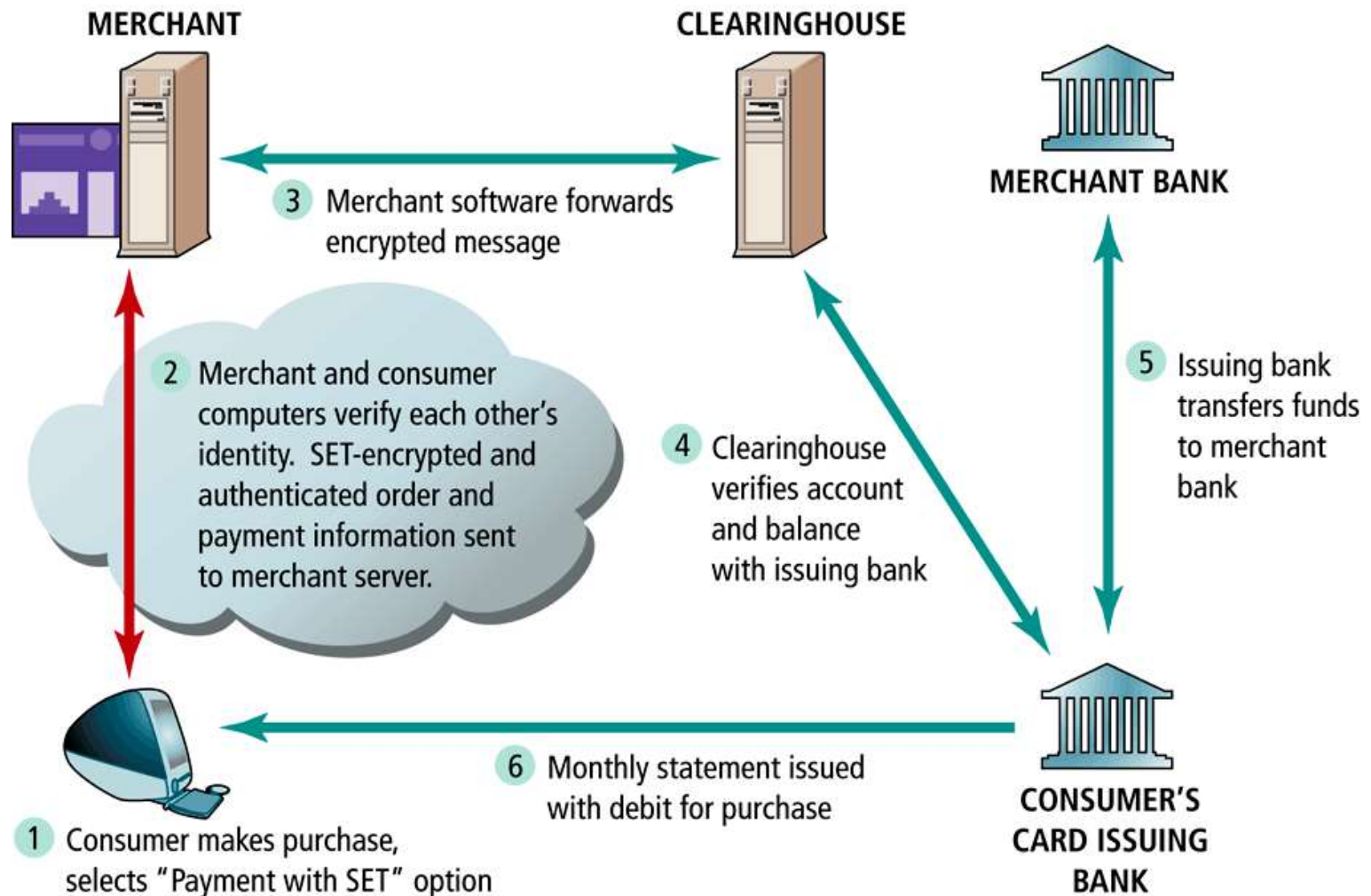
SET at Work: Step 1

- Customer places online order: C's browser receives M's certificate and validates it.
- C's browser sends the order message which is encrypted with M's public key and contains:
 - order information for Merchant,
 - C's digital certificate and
 - payment (credit card) info which is encrypted with the bank's public key so M cannot read it. The payment info contains a transaction ID (originally from M) so that it can only be used with this particular order (no replay attack).

SET: Step 2 and 3

- The Merchant verifies C's digital certificate.
- The Merchant sends to the bank
 - Order information
 - Payment info from C which M cannot read
 - M's certificate
- Bank verifies message, handles money transfer and sends signed authorization to merchant who can then process the order.

SET Transactions



Other Online Payment Systems



Digital Wallets

Digital Wallets

- Concept of digital wallet relevant to many of the new digital payment systems.
- Seeks to emulate the functionality of traditional wallet.
- Most important functions:
 - Authenticate consumer through use of digital certificates or other encryption methods
 - Store and transfer value
 - Secure payment process from consumer to merchant
- Two major categories:
 - Client-based digital wallets – Gator.com, MasterCard Wallet
 - Server-based digital wallets – MSN Wallet

TABLE 6.2**PROMISED FUNCTIONALITY OF DIGITAL WALLET**

FUNCTION	DESCRIPTION
Authentication	Confirms identities via digital certificates, SET, or other forms of encryption.
Processing of payments	Pays bills via alliances with credit card associations and banks.
Privacy/password management	Helps customers control their digital environments, PINs, card numbers, and passwords in a secure product.
Receipt management	Reviews all transactions at a single source.
Bill presentment	Presents and pays bills at a single location.
Loyalty programs	Participates in and manages loyalty points at a single location.
Coupon delivery/discounts	Coordinates merchant promotions through a single wallet.
Spending allowances	Establishes e-allowances.
Micropayments	Makes payments under \$5 anywhere on the Web based on credit cards.
Integration with other software	Links to taxation software, personal budgets, personal devices, and wireless software.

Digital Cash



- One of the first forms of alternative payment systems
- Not really “cash” – rather, form of value storage and value exchange that have limited convertibility into other forms of value, and require intermediaries to convert.
- Many of early examples have disappeared; concepts survive as part of P2P payment systems.

TABLE 6.3**EXAMPLES OF DIGITAL CASH**

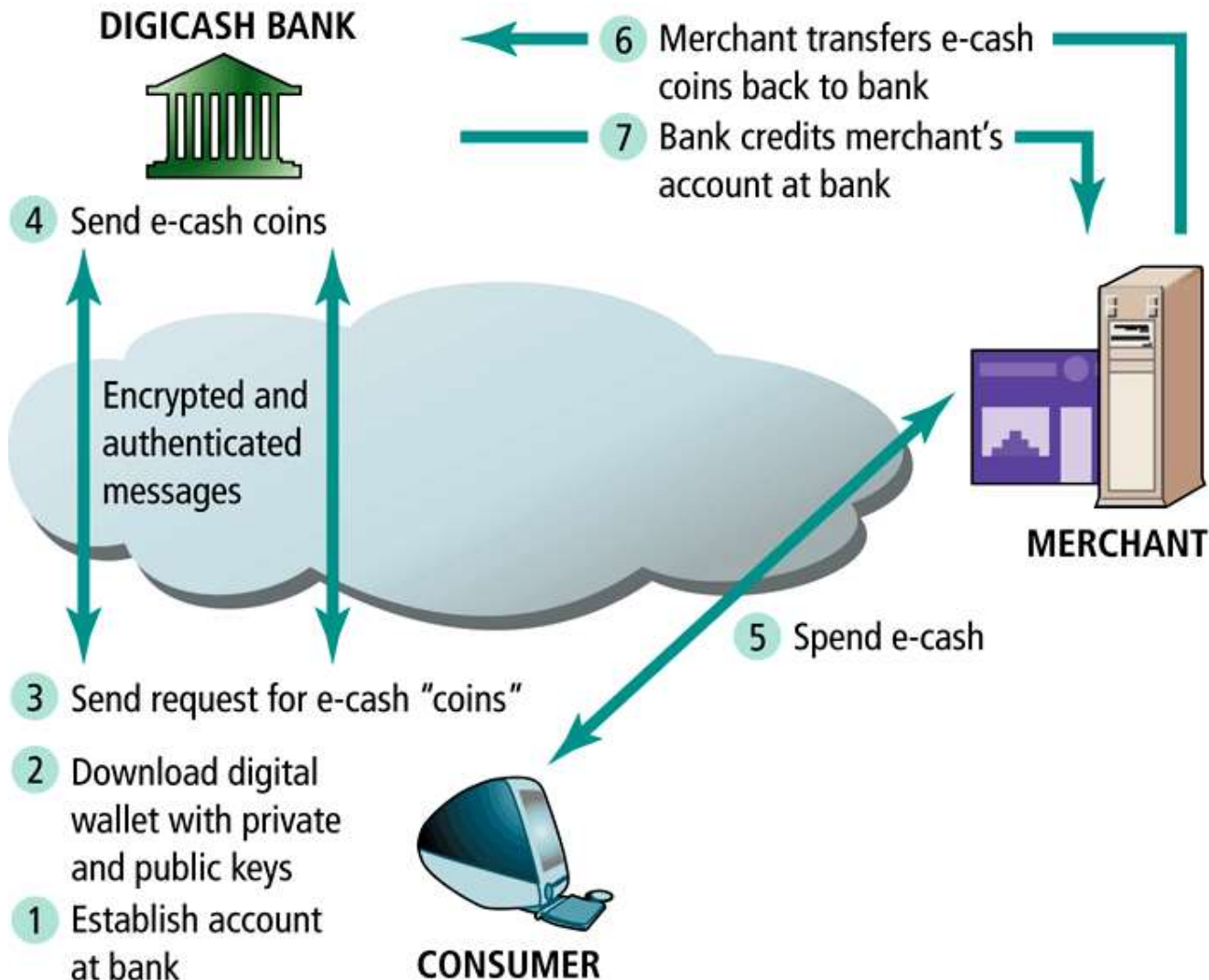
NAME OF SYSTEM	YEAR FOUNDED/DESCRIPTION
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First Virtual	1994. First secure stored value system based on credit cards, pre-use deposits, and PIN numbers. Ceased operations in 1998.
DigiCash (now e-Cash)	1996. Encryption-based prepaid stored value system requiring digital wallet on hard drive to store e-coins. Ceased operations in 1998, returned as e-Cash Technologies. Acquired by InfoSpace in February 2002.
Millicent	1996. Digital Equipment Corporation's entry into micropayment e-cash. Not currently being used.

PEER-TO-PEER PAYMENT SYSTEMS

PayPal	1999. Free P2P micropayment system.
Yahoo PayDirect	1999. Free Yahoo P2P payment service.
MoneyZap	1999. Western Union fee-based money transfer system.

Early Digital Cash



PayPal

- One of e-commerce's major success stories:
 - Went public in 2002; acquired by eBay October 2002 for \$1.5 billion
- A “peer-to-peer” payment system using email.
- Fills a niche that credit card companies avoided – individuals and small merchants
- Piggybacks on existing credit card and checking payment systems
- Weakness: suffers from relatively high levels of fraud
- PayPal has more than 35 million account members and is available to users in 38 countries around the world

Online Stored Value Accounts

- Debit cards online
- Permit consumers to make instant, online payments to merchants and other individuals based on value stored in an online account
- Rely on value stored in a consumer's bank, checking or credit card account

TABLE 6.4**ONLINE STORED VALUE SYSTEMS****SYSTEM****YEAR FOUNDED/DESCRIPTION**

Ecount

1998. Prepaid debit account

ECharge

1997. Prepaid account with digital wallet

Millicent

1998. Micropayment system designed for selling digital content. No longer offered

Peppercoin

2001. Micropayment system for purchases less than \$1.00

Qpass

1997. Wireless and online prepaid stored value micropayment system

SMART CARDS

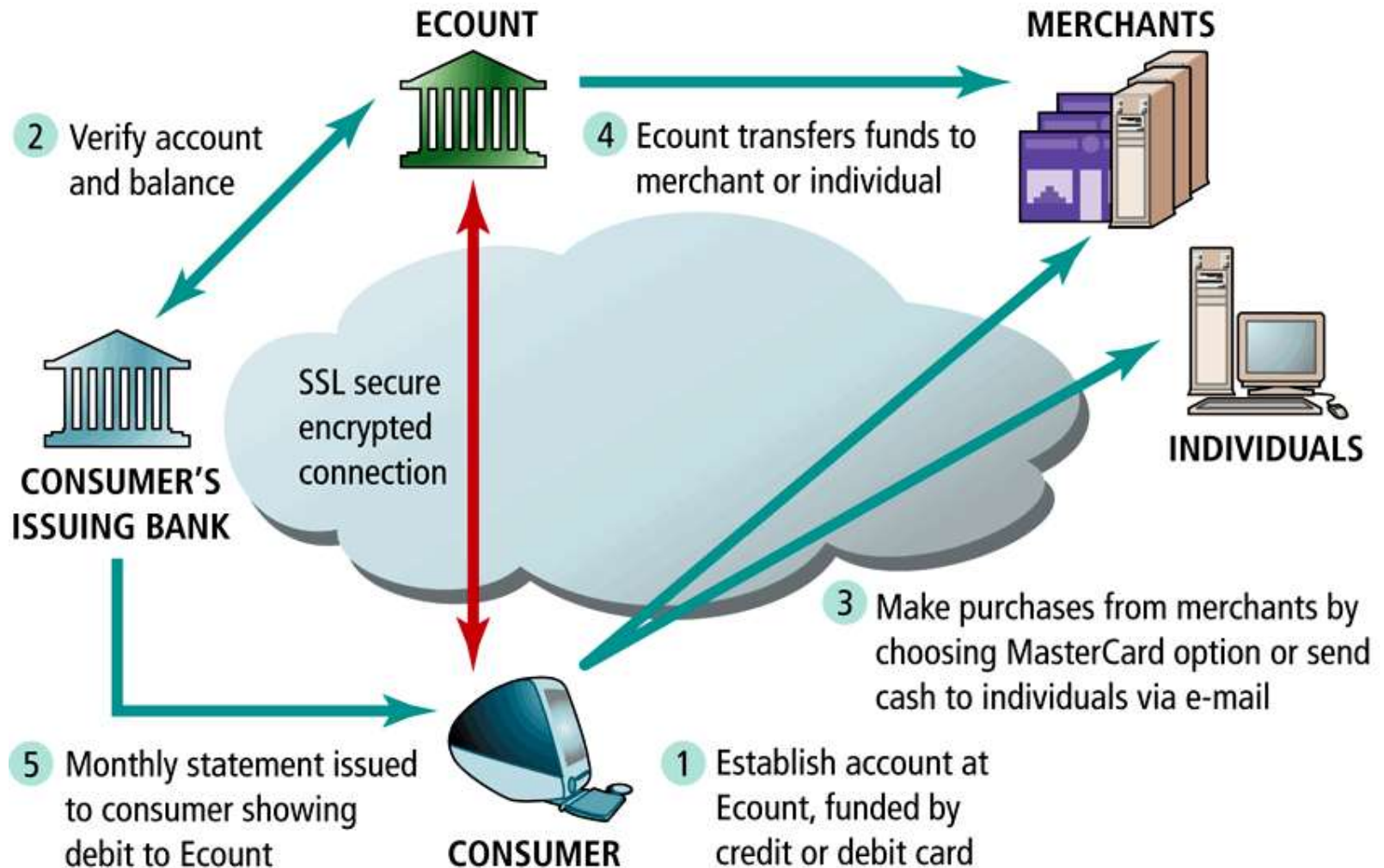
Mondex

1994. Smart card, stored value system in which value is stored on a chip on the card

American Express Blue

1999. Combined credit and smart card

Ecount.com



Digital Credit Card

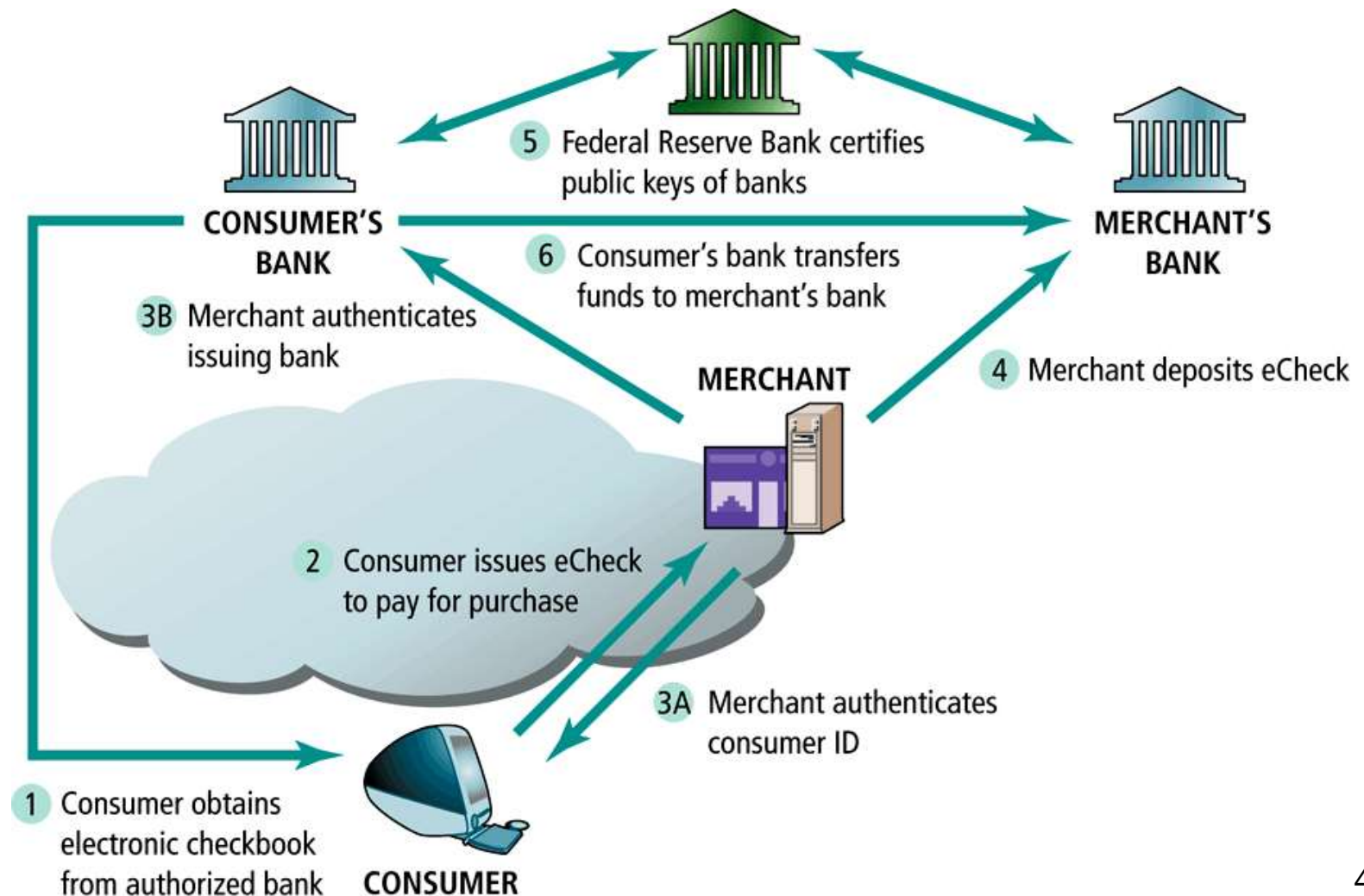
- Credit account for online shopping.
- Focus specifically on making use of credit cards safer and more convenient for online merchants and consumers.
- Example: eCharge and CyberCash (Verisign 2002)
- Customer has credit account but no physical card.
- May use one-time account number.

Digital Checking

- Takes advantage of large, existing infrastructure for check processing when used as online shopping payment tool.
- Examples: eCheck, Achex (MoneyZap)

TABLE 6.7 DIGITAL CHECKING PAYMENT SYSTEMS	
SYSTEM	YEAR FOUNDED/DESCRIPTION
ECheck	1998. Consortium of 15 banks, government agencies, and technology companies (Echeck.org). Secure electronic checking system. Digital wallet required.
Achex/Western Union	1999. Simple check-extension system. No digital wallet. Pay from existing checking account. Now known as MoneyZap.

Digital Checking: ECheck



B2B Payment Systems

- More complex than B2C.
 - Authentication and integrity very important as transaction may be dealing with large sums of money.
 - Should be tied to legally binding contracts.
 - Interface with accounting systems
 - Should provide standard business credit as in two 10 net 30