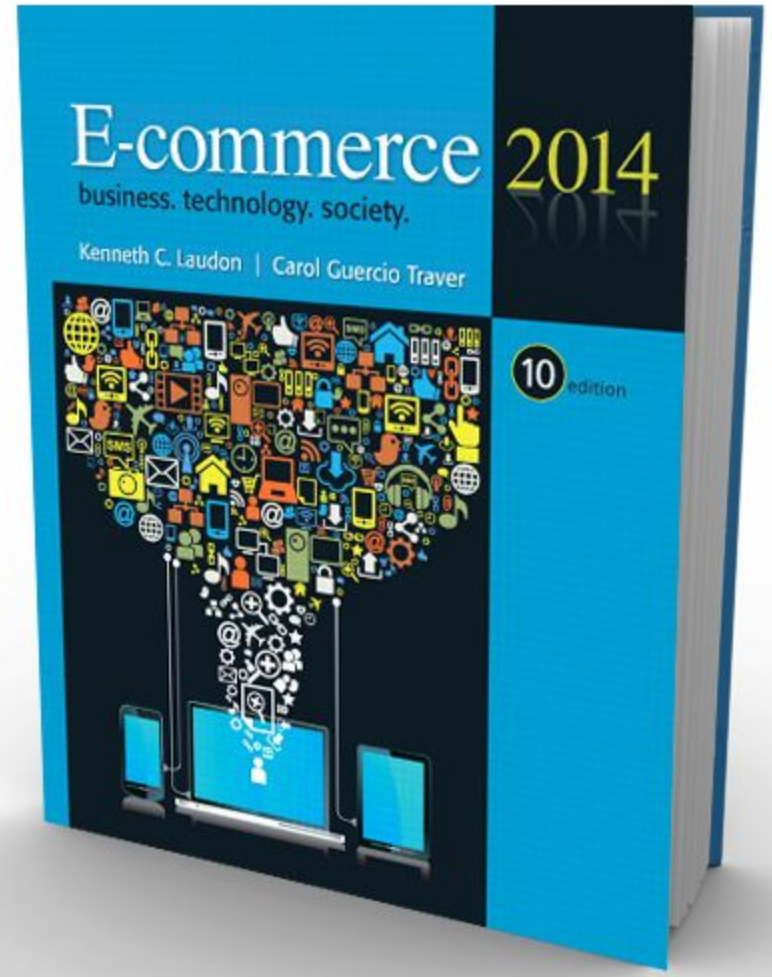

E-commerce 2014

business. technology. society.

tenth edition

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UNIT-IV

E-commerce Security and Payment Systems

Class Discussion

Cyberwar: MAD 2.0

- **What is the difference between hacking and cyberwar?**
- **Why has cyberwar become more potentially devastating in the past decade?**
- **Why has Google been the target of so many cyberattacks?**
- **Is it possible to find a political solution to MAD 2.0?**

Class Discussion

Cyberwar: MAD 2.0 (Mutually assured destruction)

- **Cyber-offensive actions to destroy aggressors' Internet and other critical infrastructure**
- **Cyberspace has become new battle field with algorithms and computer codes as weaponry**
- **The release of Stuxnet in 2010 by US/Israeli task force to disable the software and computers in Iranian uranium enrichment process which reportedly delay the Iran's ability to make nuclear arms by 5 years**

Class Discussion

Cyberwar: MAD 2.0 (contd..)

- In 2012, Shamoon virus wiped out data on 75% of the computers on the main network of Saudi Arabia's Amarco, an US ally
- In 2012, another DDoS (Distributed Denial of Service) attack on Websites of US financial banks
- As an example of the modern version of cold war era, the US Cyber Command has mentioned publicly of having 40 cyberteams, including 123 focusing on offensive operations

The E-commerce Security Environment

- **Overall size and losses of cybercrime unclear**
  - Reporting issues
- **2012 survey: Average annualized cost of cybercrime was $8.9 million/year**
- **Underground economy marketplace:**
  - Stolen information stored on underground economy servers

- the Internet holds the promise of a huge and convenient
- global marketplace, providing access to people, goods, services, and businesses worldwide,
- all at a bargain price. For criminals, the Internet has created entirely new—and

- It’s also less risky to steal online
- the Internet
- makes it possible to rob people remotely and almost anonymously.
- Rather than steal
- a CD at a local record store, you can download the same music for free and almost
- without risk from the Internet.

- The Internet
- was never designed to be a global marketplace
- Comparing telecommunications and broadcost television networks
- The Internet
- was never designed to be a global marketplace

What Is Good E-commerce Security?

- **To achieve highest degree of security**
  - New technologies
  - Organizational policies and procedures
  - Industry standards and government laws
- **Other factors**
  - Time value of money
  - Cost of security vs. potential loss
  - Security often breaks at weakest link

The E-commerce Security Environment

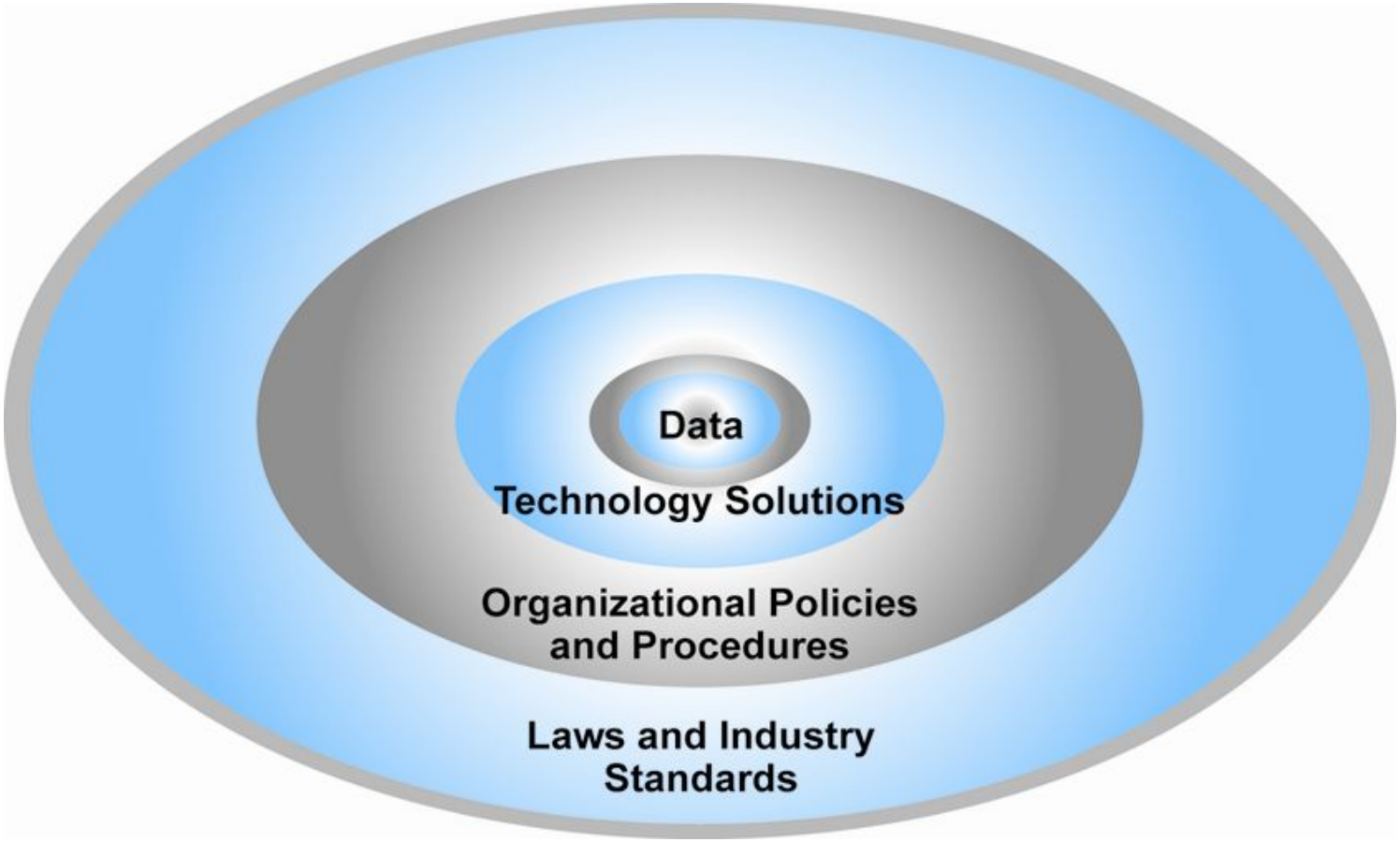


Figure 5.1, Page 252

TABLE 5.3 CUSTOMER AND MERCHANT PERSPECTIVES ON THE DIFFERENT DIMENSIONS OF E-COMMERCE SECURITY

DIMENSION	CUSTOMER'S PERSPECTIVE	MERCHANT'S PERSPECTIVE
Integrity	Has information I transmitted or received 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?

Table 5.3, Page 254

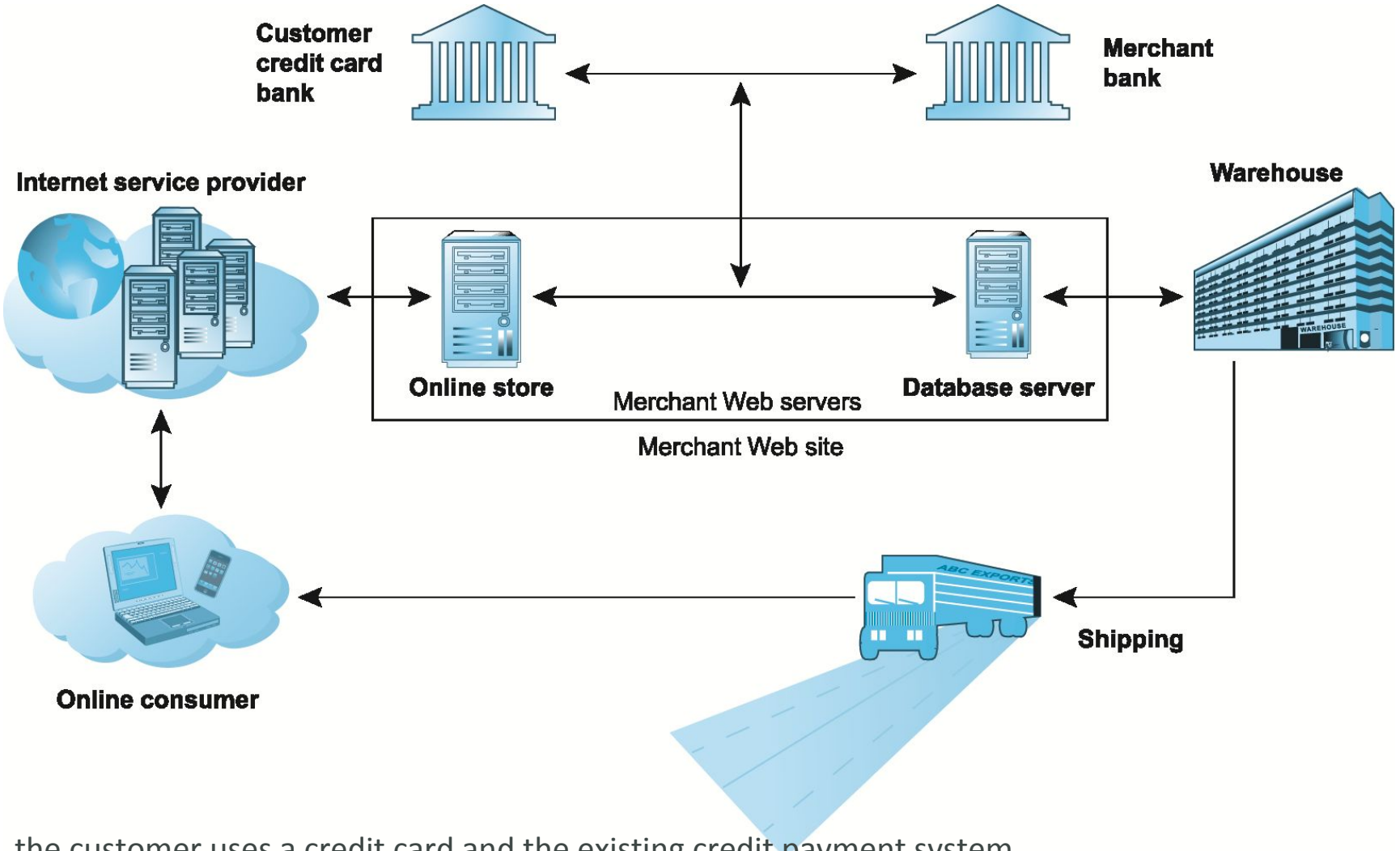
The Tension Between Security and Other Values

- **Ease of use**
  - The more security measures added, the more difficult a site is to use, and the slower it becomes
- **Public safety and criminal uses of the Internet**
  - Use of technology by criminals to plan crimes or threaten nation-state

1. Security Threats in the E-commerce Environment

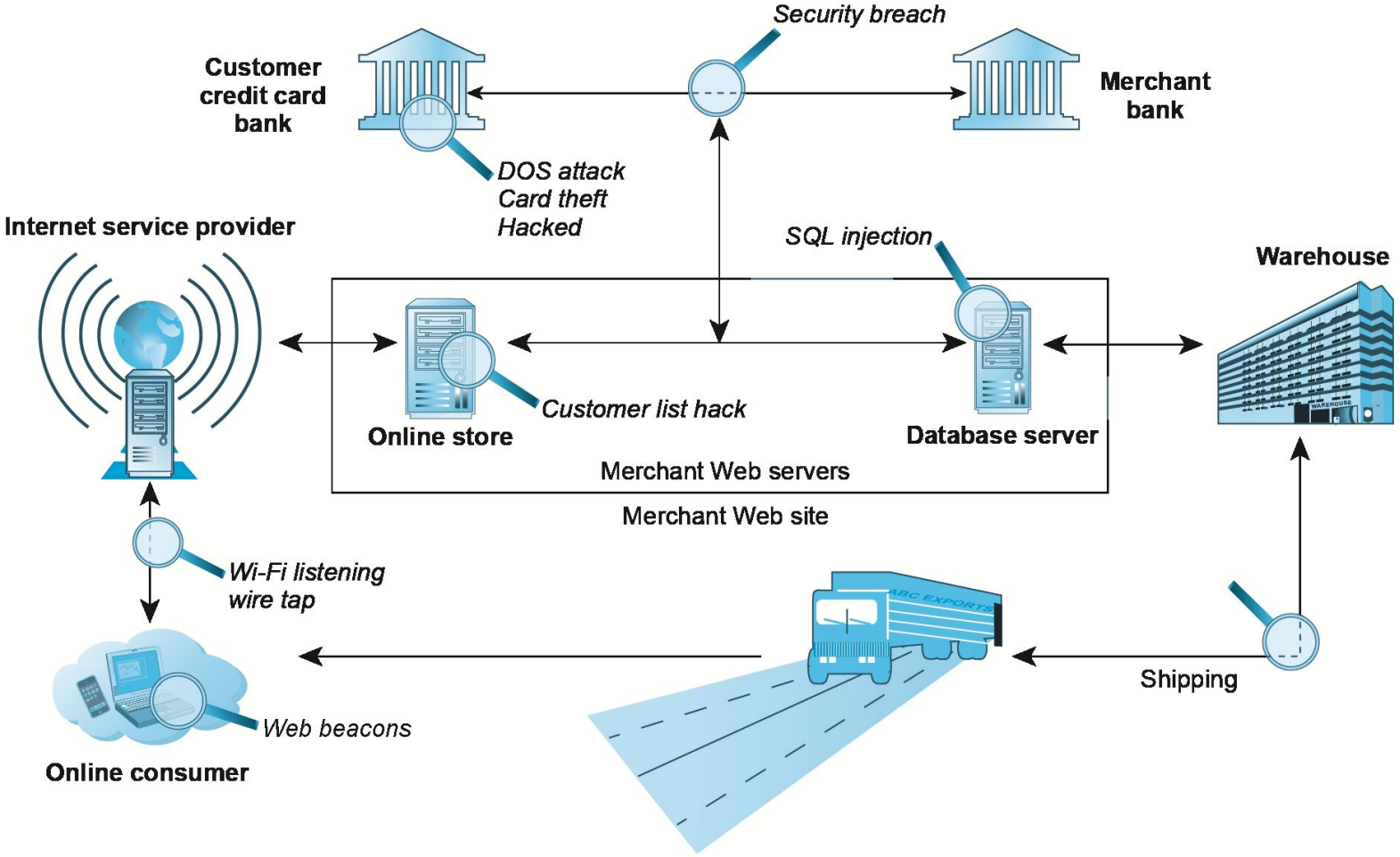
- **Three key points of vulnerability in e-commerce environment:**
  1. Client
  2. Server
  3. Communications pipeline (Internet communications channels)

A Typical E-commerce Transaction



the customer uses a credit card and the existing credit payment system.

Vulnerable Points in an E-commerce Transaction



Most damaging forms of security threats to E-commerce

Malicious code, potentially unwanted programs, phishing, hacking and cybervandalism, credit card fraud/theft, spoofing, pharming, and spam (junk) Web sites (link farms), identity fraud, Denial of Service (DoS) and DDoS attacks, sniffing, insider attacks, poorly designed server and client software, social network security issues, mobile platform security issues, and finally, cloud security issues.

- **Malicious code (malware, exploits)**
  - Drive-by downloads
  - Viruses
  - Worms
  - Ransomware
  - Trojan horses
  - Backdoors
  - Bots, botnets
  - Threats at both client and server levels ex:Blackhole exploit kit

Most Common Security Threats (cont.)

- **Potentially unwanted programs (PUPs)**
  - Browser parasites
  - Adware
  - Spyware
- **Phishing**
  - Social engineering
  - E-mail scams
  - Spear-phishing
  - Identity fraud/theft

Most Common Security Threats (cont.)

- **Hacking**
  - Hackers vs. crackers
  - Types of hackers: White, black, grey hats
  - Hacktivism
- **Cybervandalism:**
  - Disrupting, defacing, destroying Web site
- **Data breach**
  - Losing control over corporate information to outsiders

We Are Legion

- **What organization and technical failures led to the data breach on the PlayStation Network?**
- **Are there any positive social benefits of hacktivism?**
- **Have you or anyone you know experienced data breaches or cybervandalism?**

Most Common Security Threats (cont.)

- Credit card fraud/theft
- Spoofing and pharming
- Spam (junk) Web sites (link farms)
- Identity fraud/theft
- Denial of service (DoS) attack
  - Hackers flood site with useless traffic to overwhelm network
- Distributed denial of service (DDoS) attack

Most Common Security Threats (cont.)

- **Sniffing**
  - Eavesdropping program that monitors information traveling over a network
- **Insider attacks**
- **Poorly designed server and client software**
- **Social network security issues**
- **Mobile platform security issues**
  - Vishing, smishing, madware
- **Cloud security issues**

Think Your Smartphone Is Secure?

- **What types of threats do smartphones face?**
- **Are there any particular vulnerabilities to this type of device?**
- **What did Nicolas Seriot's "Spyphone" prove?**
- **Are apps more or less likely to be subject to threats than traditional PC software programs?**

Technology Solutions

- **Protecting Internet communications**
  - Encryption
- **Securing channels of communication**
  - SSL, VPNs
- **Protecting networks**
  - Firewalls
- **Protecting servers and clients**

Tools Available to Achieve Site Security

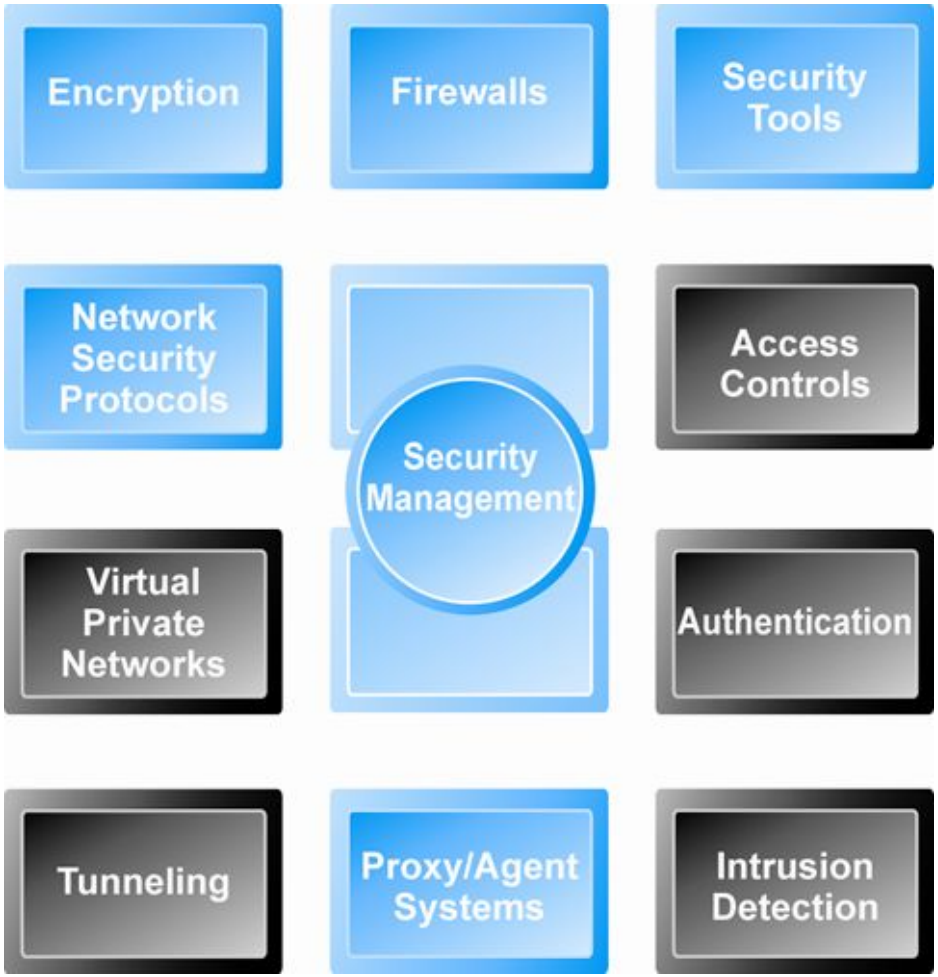


Figure 5.5, Page 276

Encryption

- **Encryption**
  - Transforms data into cipher text readable only by sender and receiver
  - Secures stored information and information transmission
  - Provides 4 key dimensions of e-commerce security:
    - Message integrity
    - Nonrepudiation
    - Authentication
    - Confidentiality

- key (cipher) any method for transforming

plain text to cipher text

- substitution cipher every occurrence of a given letter is replaced systematically

by another letter

- transposition cipher the ordering of the letters in each word is changed in

some systematic way

Ex : HELLO

Symmetric Key Encryption

- **Sender and receiver use same digital key to encrypt and decrypt message (secret key encryption.)**
- **Requires different set of keys for each transaction**
- **Suffer Common Flaws**
- **Strength of encryption**
  - Length of binary key used to encrypt data
- **Data Encryption Standard (DES) –** 56 bits
- National Security Agency (NSA) and IBM in the 1950s
- *Triple DES*—essentially encrypting the message 3 times,
- **Advanced Encryption Standard (AES)**
  - Most widely used symmetric key encryption
  - Uses 128-, 192-, and 256-bit encryption keys
- **Other standards use keys with up to 2,048 bits**

Public Key Encryption

- **public key cryptography**
- **Uses two mathematically related digital keys**
  - Public key (widely disseminated)
  - Private key (kept secret by owner)
- **Both keys used to encrypt and decrypt message**
- *one-way irreversible mathematical function*
- **Once key used to encrypt message, same key cannot be used to decrypt message**
- **Sender uses recipient's public key to encrypt message; recipient uses private key to decrypt it**

Public Key Cryptography: A Simple Case

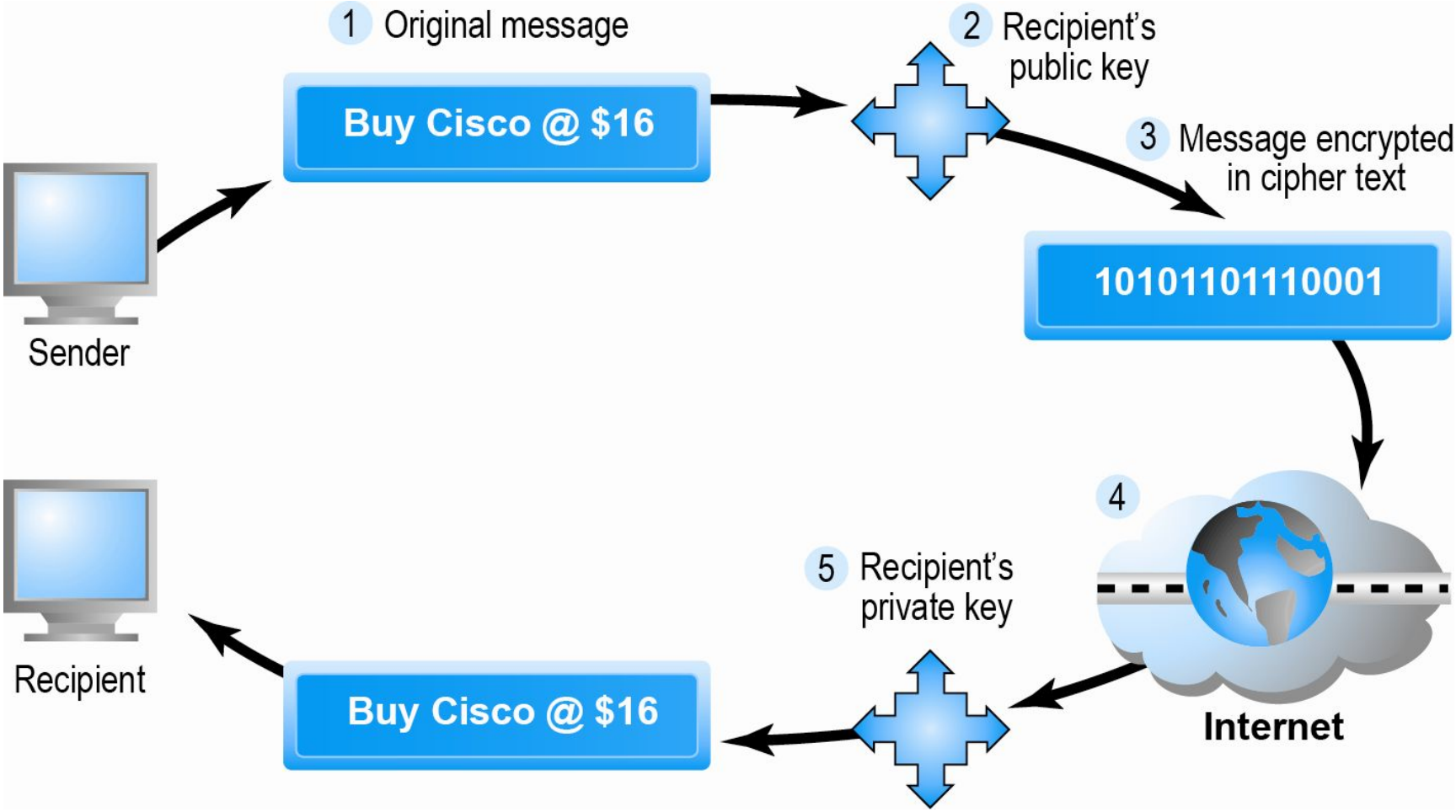


Figure 5.6, Page 279

Public Key Encryption using Digital Signatures and Hash Digests

- **Hash function:**
  - Mathematical algorithm that produces fixed-length number called message or hash digest
- **Hash digest of message sent to recipient along with message to verify integrity**
- **Hash digest and message encrypted with recipient's public key**
- **Entire cipher text then encrypted with recipient's private key—creating digital signature—for authenticity, nonrepudiation**

Public Key Cryptography with Digital Signatures

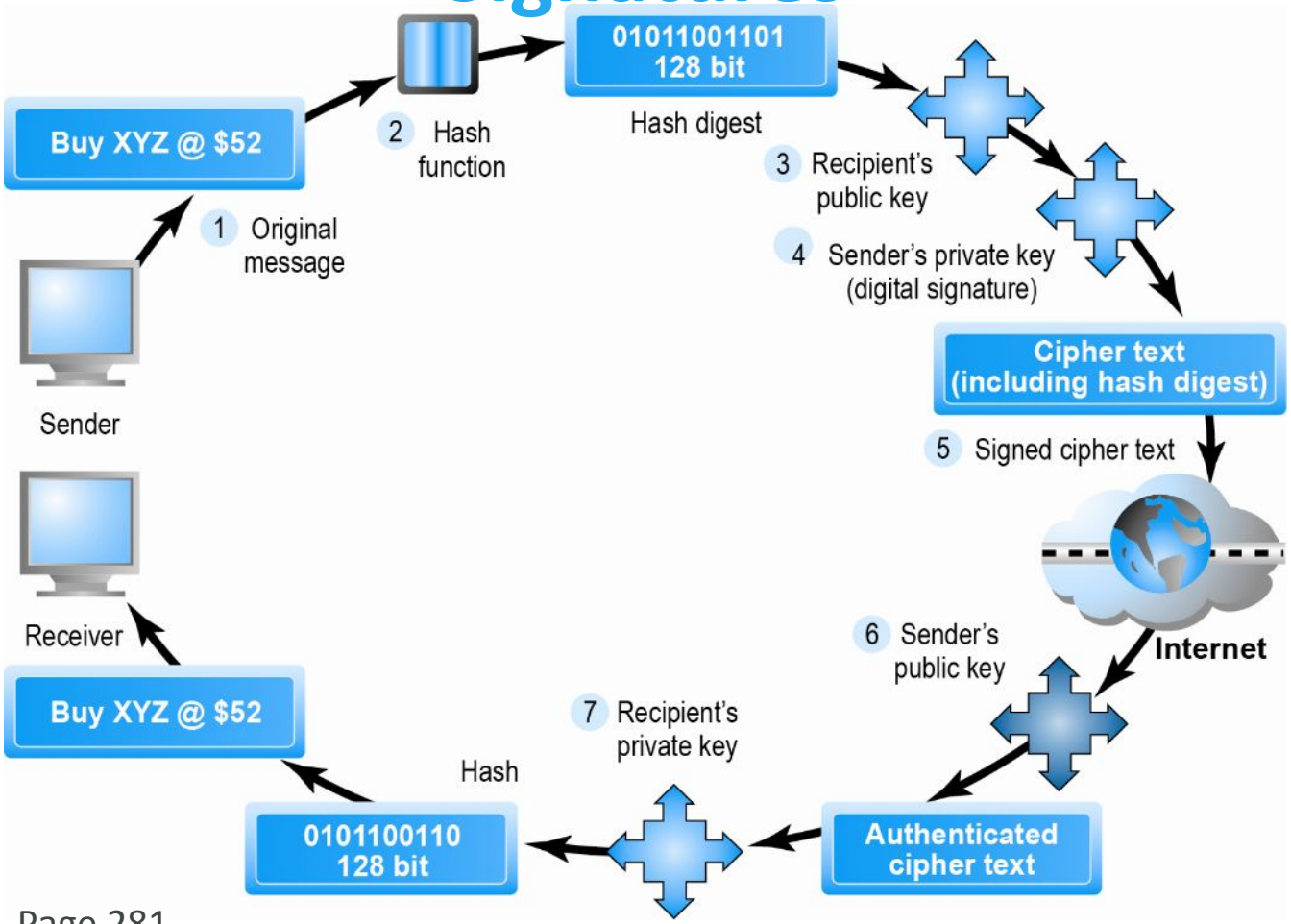


Figure 5.7, Page 281

Digital Envelopes

- **Address weaknesses of:**
  - Public key encryption
    - Computationally slow, decreased transmission speed, increased processing time
  - Symmetric key encryption
    - Insecure transmission lines
- **Uses symmetric key encryption to encrypt document**
- **Uses public key encryption to encrypt and send symmetric key**

Creating a Digital Envelope

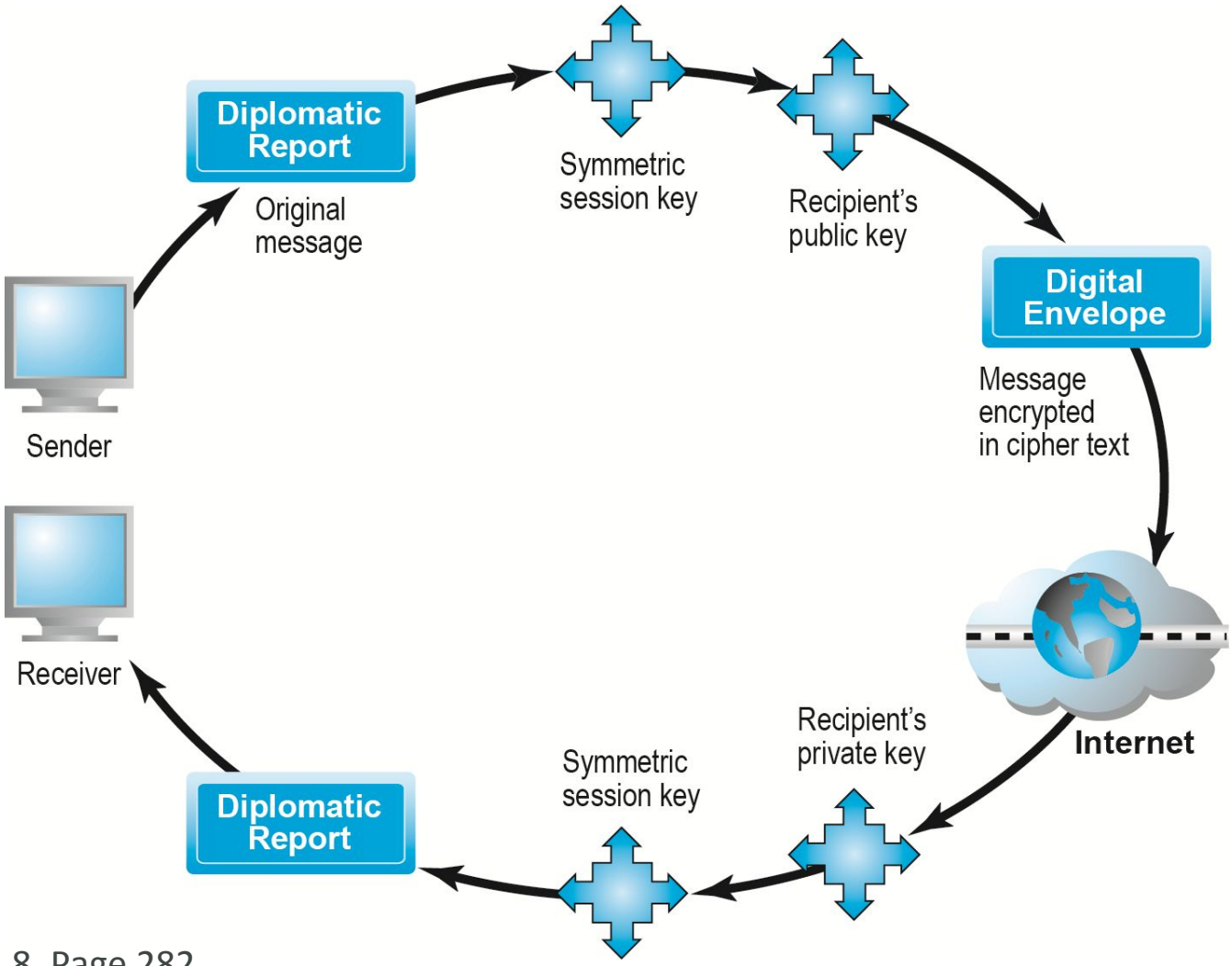


Figure 5.8, Page 282

Digital Certificates and Public Key Infrastructure (PKI)

- **Digital certificate includes:**
  - Name of subject/company
  - Subject's public key
  - Digital certificate serial number
  - Expiration date, issuance date
  - Digital signature of CA
- **Public Key Infrastructure (PKI):**
  - CAs and digital certificate procedures
  - PGP- Pretty Good Privacy

Digital Certificates and Certification Authorities

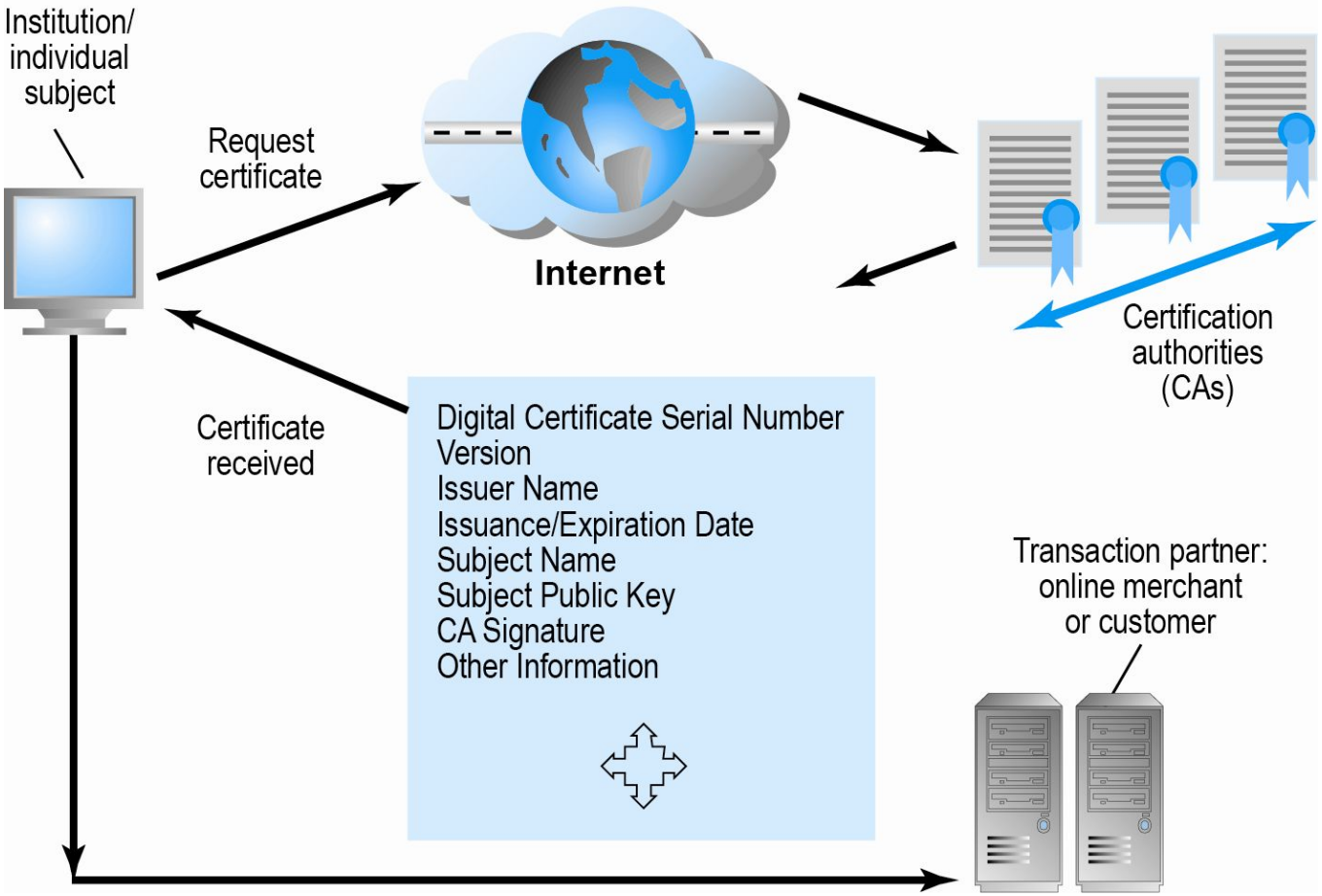


Figure 5.9, Page 283

Limits to Encryption Solutions

- **Doesn't protect storage of private key**
  - PKI not effective against insiders, employees
  - Protection of private keys by individuals may be haphazard
- **No guarantee that verifying computer of merchant is secure**
- **CAs are unregulated, self-selecting organizations**

Securing Channels of Communication

- **Secure Sockets Layer (SSL)/Transport Layer Security (TLS)**
  - Establishes secure, negotiated client–server session
- **Virtual Private Network (VPN)**
  - Allows remote users to securely access internal network via the Internet
- **Wireless (Wi-Fi) networks**
  - WPA2

Secure Negotiated Sessions Using SSL/TLS

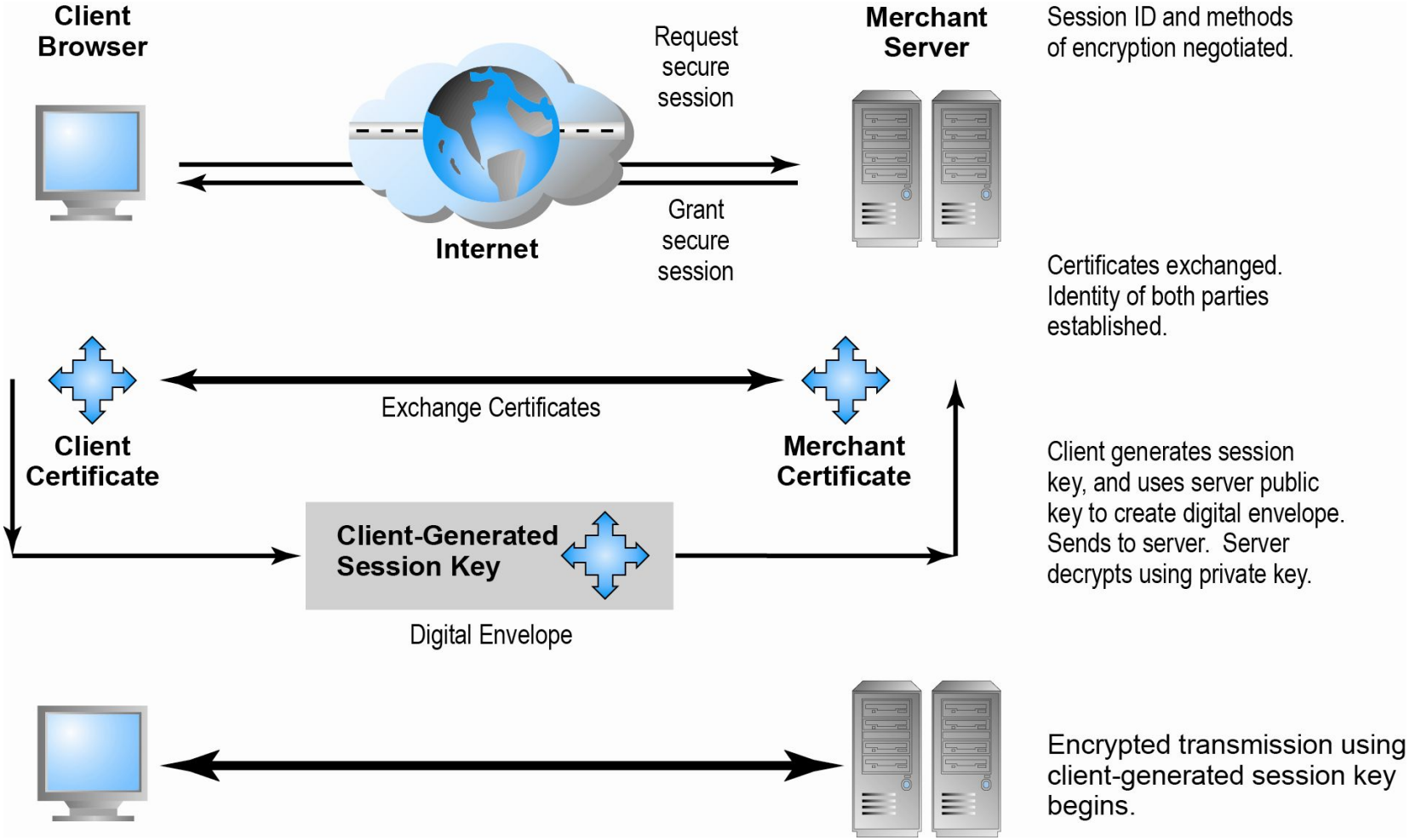


Figure 5.10, Page 286

Protecting Networks

- **Firewall**
  - Hardware or software
  - Uses security policy to filter packets
  - Two main methods:
    - Packet filters
    - Application gateways
- **Proxy servers (proxies)**
  - Software servers that handle all communications from or sent to the Internet
- **Intrusion detection systems**
- **Intrusion prevention systems**

Firewalls and Proxy Servers

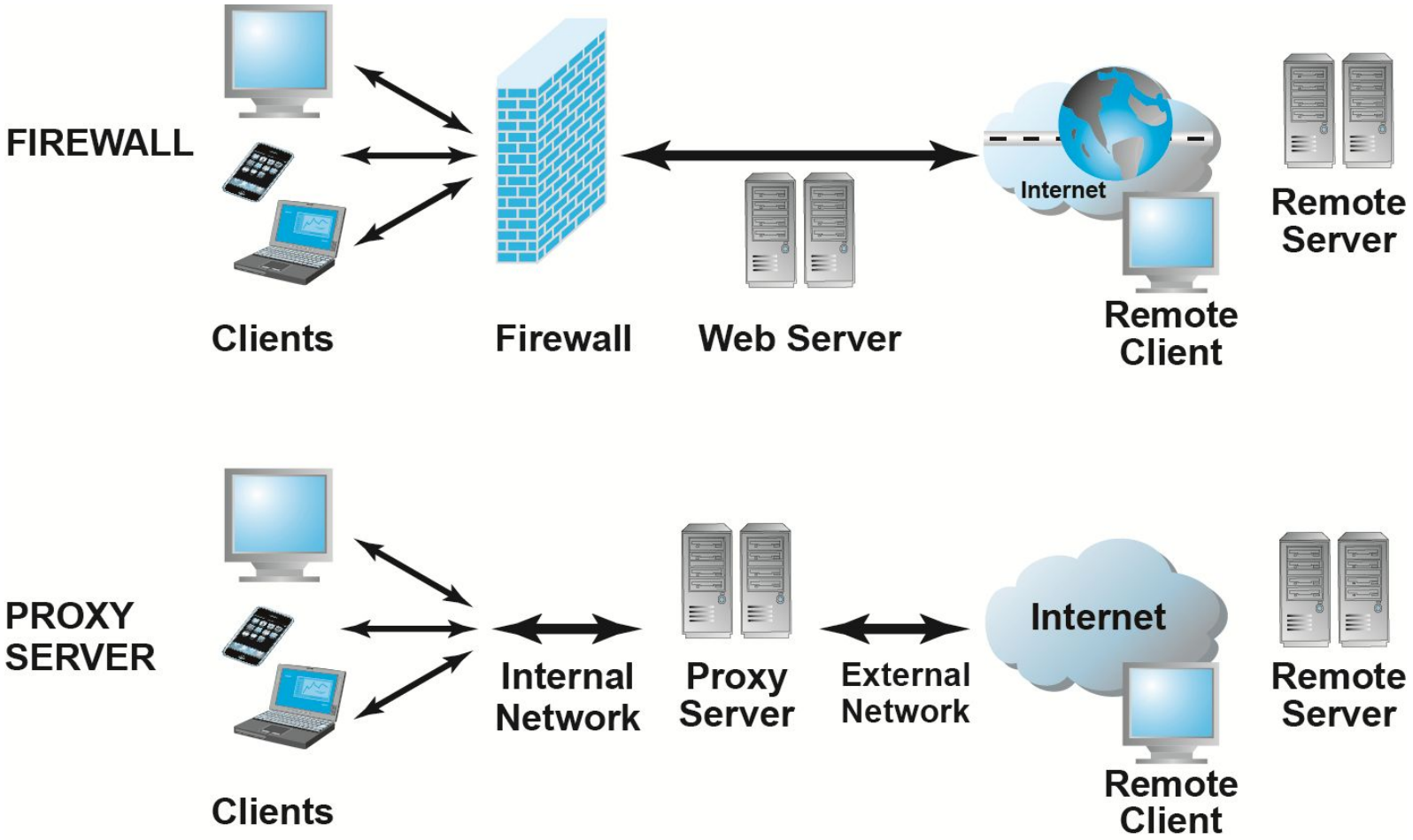


Figure 5.11, Page 289

Protecting Servers and Clients

- **Operating system security enhancements**
  - Upgrades, patches
- **Anti-virus software**
  - Easiest and least expensive way to prevent threats to system integrity
  - Requires daily updates

Management Policies, Business Procedures, and Public Laws

- **Worldwide, companies spend more than $65 billion on security hardware, software, services**
- **Managing risk includes:**
  - Technology
  - Effective management policies
  - Public laws and active enforcement

A Security Plan: Management Policies

- **Risk assessment**
- **Security policy**
- **Implementation plan**
  - Security organization
  - Access controls
  - Authentication procedures, including biometrics
  - Authorization policies, authorization management systems
- **Security audit**

Developing an E-commerce Security Plan

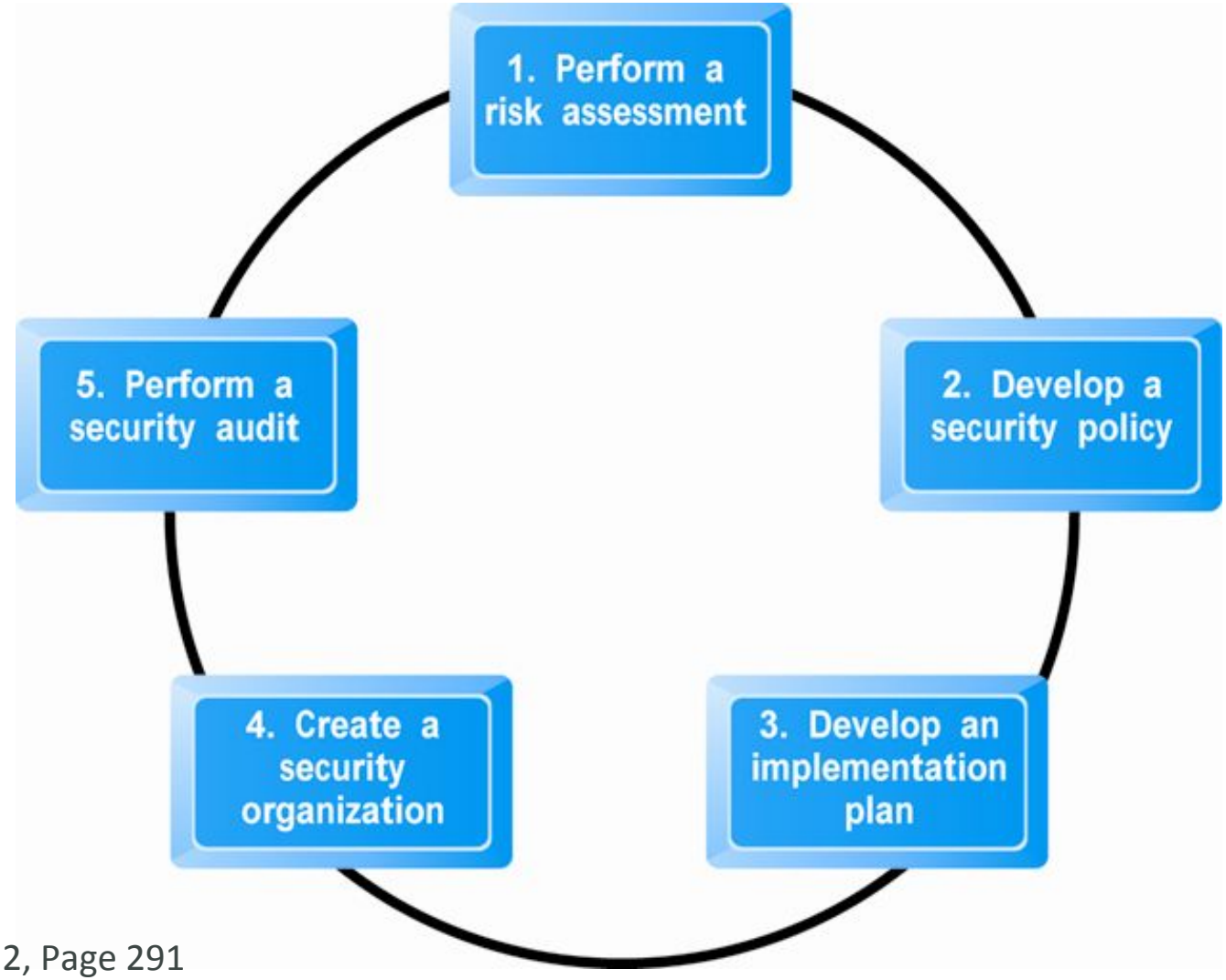


Figure 5.12, Page 291

The Role of Laws and Public Policy

- **Laws that give authorities tools for identifying, tracing, prosecuting cybercriminals:**
  - National Information Infrastructure Protection Act of 1996
  - USA Patriot Act
  - Homeland Security Act
- **Private and private-public cooperation**
  - CERT Coordination Center
  - US-CERT
- **Government policies and controls on encryption software**
  - OECD, G7/G8, Council of Europe, Wassener Arrangement

Types of Payment Systems

- Cash
- Checking transfer
- Credit card
- Stored value
- Accumulating balance

Types of Payment Systems- Cash

- Cash is a legal tender defined by a national authority to represent value, is the most common form of payment in terms of number of transactions.
- It is instantly convertible into other forms of value without the intermediation of any other institution
- No float
- Cash is portable, requires no authentication, and provides instant purchasing power for those who possess it.
- Cash allows for micropayments (payments of small amounts).
- The use of cash is “free” in that neither merchants nor consumers pay a transaction fee for using it.
- cash does not require any complementary assets, such as special hardware or the existence of an account, and it puts very low cognitive demands on the user

Types of Payment Systems - Checking transfer

- Second most common payment.
- A checking transfer, which represents funds transferred directly via a signed draft or check from a consumer's checking account to a merchant or other individual.
- Checks can be used for both small and large transactions, although typically they are not used for micropayments.
- Checks have some float and the unspent balances can earn interest.
- They can be forged more easily than cash, so authentication is required.
- For merchants, checks also present some additional risk
- compared to cash because they can be cancelled before they clear the account or they may bounce if there is not enough money in the account.

Types of Payment Systems - Credit card

- A credit card represents an account that extends credit to consumers, permits consumers to purchase items while deferring payment, and allows consumers to make payments to multiple vendors with one instrument.
- Credit card associations such as Visa and MasterCard are nonprofit associations that set standards for the issuing banks, such as Citibank that actually issue the credit cards and process transactions.
- Other third parties (processing centres or clearinghouses) usually handle verification of accounts and balances.
- Credit card issuing banks act as financial intermediaries, minimizing the risk to transacting parties.
- With a credit card, a consumer typically need not actually pay for goods purchased until receiving a credit card bill 30 days later.
- Merchants benefit from increased consumer spending resulting from credit card use, but they pay a hefty transaction fee of 3% to 5% of the purchase price to the issuing banks.

Types of Payment Systems - Stored value

- Accounts created by depositing funds into an account and from which funds are paid out or withdrawn as needed are stored value payment systems.
- This includes debit cards, gift certificates, prepaid cards, and smart cards.
- Debit cards immediately debit a checking or other demand-deposit account.
- For many consumers, the use of a debit card eliminates the need to write a paper check.
- Peer-to-peer (P2P) payment systems such as PayPal are variations on the stored value concept.
- P2P payment systems do not insist on prepayment but do require an account with a stored value, either a checking account with funds available or a credit card with an available credit balance

Types of Payment Systems - Accumulating balance

- Accounts that accumulate expenditures and to which consumers make periodic payments are accumulating balance payment systems.
- Traditional examples include utility, phone, and all of which accumulate balances, usually over a specified period (typically a month), and then are paid in full at the end of the period.

Payment System Stakeholders

- **Consumers**
  - Low-risk, low-cost, refutable, convenience, reliability
- **Merchants**
  - Low-risk, low-cost, irrefutable, secure, reliable
- **Financial intermediaries**
  - Secure, low-risk, maximizing profit
- **Government regulators**
  - Security, trust, protecting participants and enforcing reporting

E-commerce Payment Systems

- **Credit cards**
  - 49% of online payments (United States)
- **Debit cards**
  - 31% online payments(United States)
- **Limitations of online credit card payment**
  - Security, merchant risk
  - Cost
  - Social equity

How an Online Credit Transaction Works

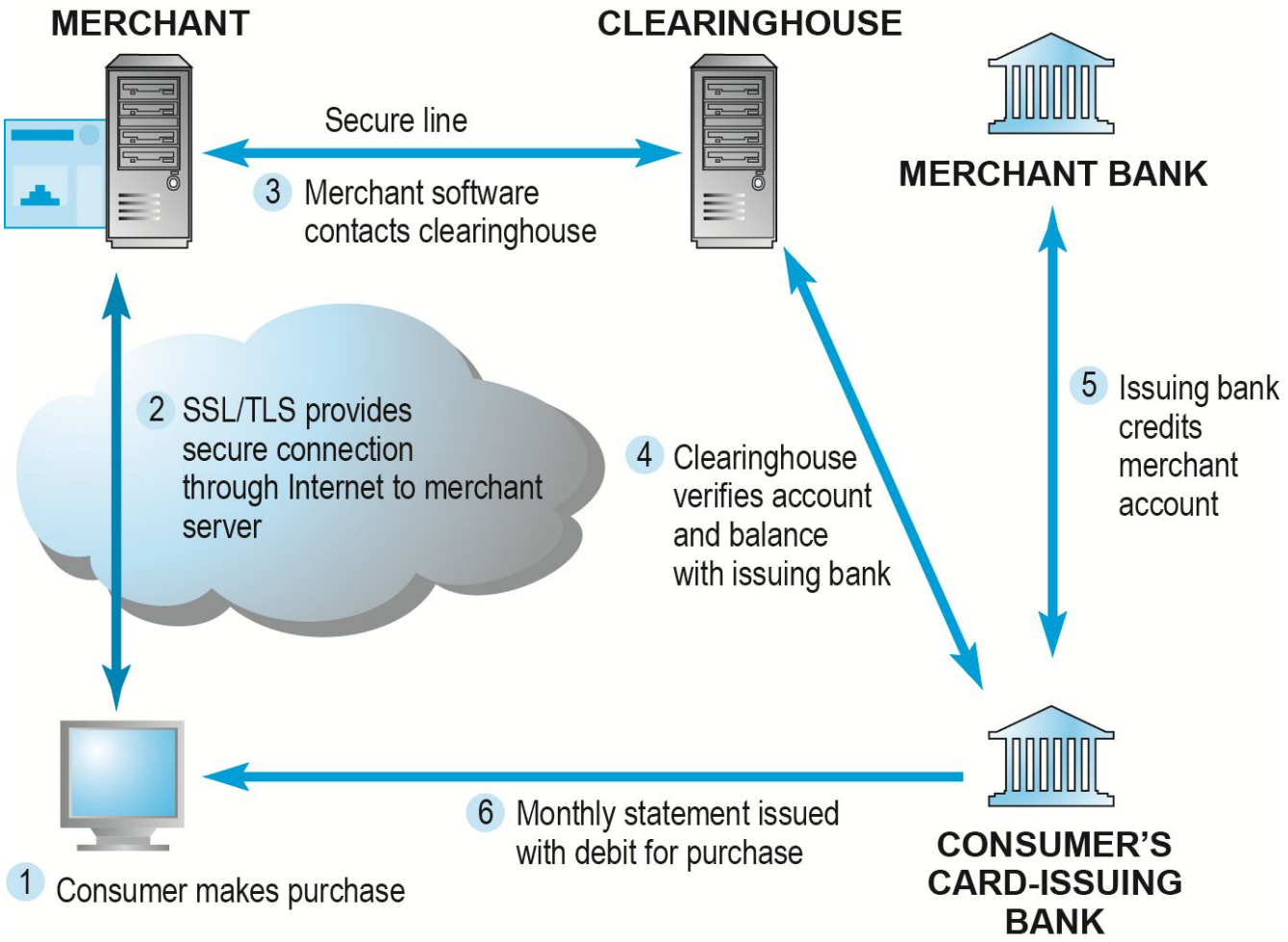


Figure 5.15, Page 302

Alternative Online Payment Systems

- **Online stored value systems:**
  - Based on value stored in a consumer's bank, checking, or credit card account
  - Example: PayPal, Paytm, Paycheck
- **Other alternatives: (India)**
  - Amazon Payments
  - Google Checkout
  - Samsung pay
  - CCavenue

Limitations of Online Credit Card Payment Systems

- The most important limitations involve security, merchant risk, administrative, transaction costs, and social equity.
- The existing system offers poor security. Neither the merchant nor the consumer can be fully authenticated.
- The risk facing merchants is high: consumers can repudiate charges even though the goods have been shipped or the product downloaded.
- The administrative costs of setting up an online credit card system and becoming authorized to accept credit cards are high.
- Credit cards are not very democratic, even though they seem ubiquitous.

Mobile Payment Systems

- **Use of mobile phones as payment devices established in Europe, Japan, South Korea**
- **Near field communication (NFC)**
  - Short-range (2”) wireless for sharing data between devices
- **Expanding**
  - Google Wallet
    - Mobile app designed to work with NFC chips
  - PayPal
  - Paytm

Digital Cash and Virtual Currencies

- **Digital cash**
  - Based on algorithm that generates unique tokens that can be used in “real” world
  - Example: Bitcoin
- **Virtual currencies**
  - Circulate within internal virtual world
  - Example: Linden Dollars in Second Life, Facebook Credits

Bitcoin

- **What are some of the benefits of using a digital currency?**
- **What are the risks involved to the user?**
- **What are the political and economic repercussions of a digital currency?**
- **Have you or anyone you know ever used Bitcoin?**

Electronic Billing Presentment and Payment (EBPP)

- **Online payment systems for monthly bills**
- **50% of all bill payments**
- **Two competing EBPP business models:**
  - Biller-direct (dominant model)
  - Consolidator
- **Both models are supported by EBPP infrastructure providers**