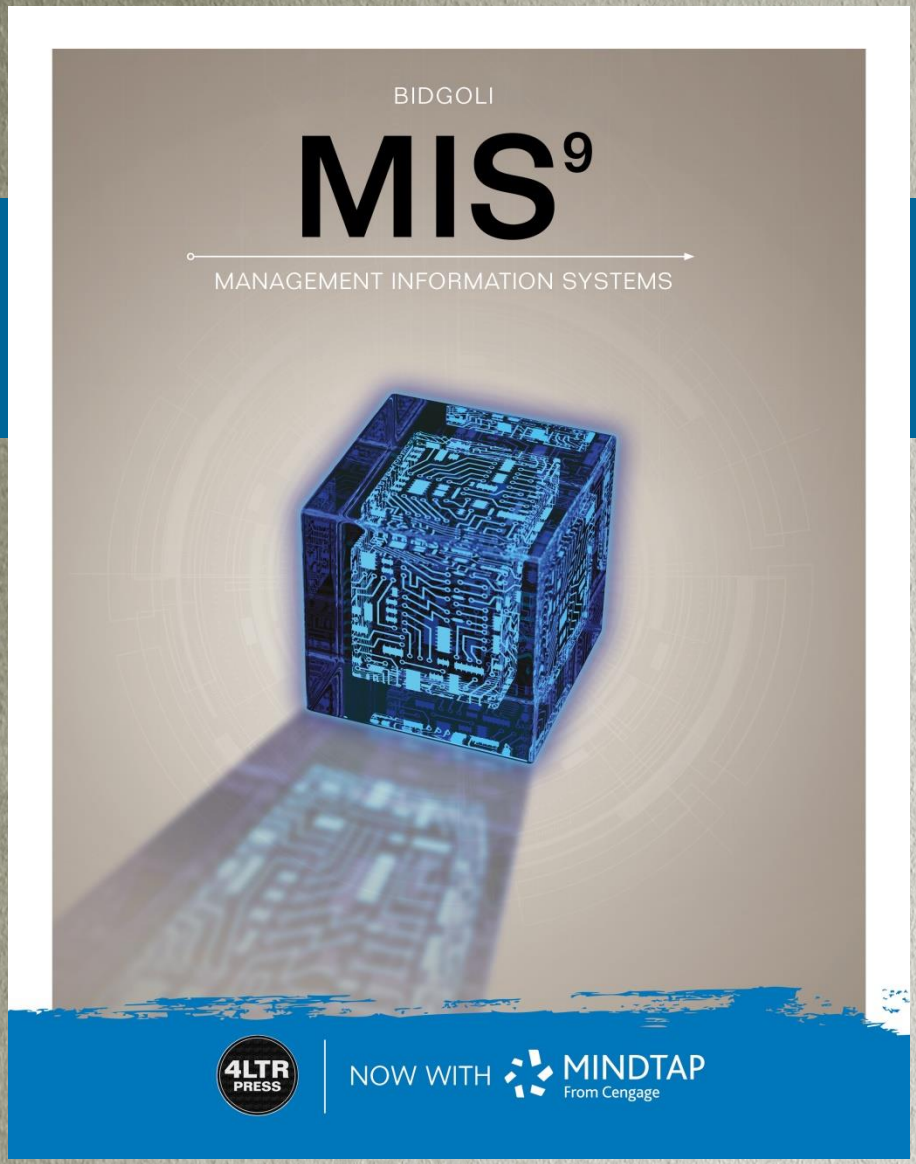


14

Emerging Trends, Technologies, and Application

Learning Objectives (1 of 2)

- Summarize new trends in software and service distribution
- Describe virtual reality components and applications
- Discuss uses of radio frequency identification
- Explain quick response codes
- Summarize new uses of biometrics

Learning Objectives (2 of 2)

- Describe new trends in networking, including grid, utility, and cloud computing
- Discuss uses of nanotechnology
- Describe blockchain technology and cryptocurrency

Trends in Software and Service Distribution (1 of 7)

- Pull technology
  - User states a need before getting information
  - Example: entering a URL in a Web browser to go to a certain website
- Push technology (i.e., webcasting)
  - Web server delivers information to users who have signed up for the service
  - Supported by many Web browsers

Trends in Software and Service Distribution (2 of 7)

- Delivers content to users automatically at set intervals or when a new event occurs
- Streamlines the process of users getting software updates and updated content
- Benefits vendors by keeping in constant touch with users, thus creating customer loyalty
- Examples: Microsoft Direct Push (AT&T), Apple Push Notification, and Facebook Push Notification

Trends in Software and Service Distribution (3 of 7)

- Application service providers (ASPs)
  - Provide access to software or services for a fee
  - Software as a service (SaaS)
    - ASP delivers software to users for a fee for temporary or long-term use
    - Offers the recent version of the software
    - Allows users to save all application data on the ASP's server

Trends in Software and Service Distribution (4 of 7)

- Forms of SaaS model
  - Software services for general use
  - Specific service
  - Service in a vertical market

Trends in Software and Service Distribution (5 of 7)

- Advantages of ASPs
  - Customers do not need to be concerned about whether software is current
  - Information systems (IS) personnel time is freed up to focus on important applications
  - Software development costs are spread over several customers
  - Software is kept up to date, based on users' requests

Trends in Software and Service Distribution (6 of 7)

- ASP contract guarantees a certain level of technical support
- Organization's software costs can be reduced to a predictable monthly fee

Trends in Software and Service Distribution (7 of 7)

- Disadvantages of ASPs
  - Users must accept applications as provided by ASPs; software customization is not offered
  - Risk of applications not fully meeting the organization's needs exists
  - Integration with the customer's other applications and systems might be challenging

Virtual Reality (1 of 3)

- Uses computer-generated, three-dimensional images to create the illusion of interaction in a real-world environment
  - Simulation: giving objects in a VR environment texture and shading for a 3D appearance
  - Interaction: enabling users to act on objects in a VR environment
  - Immersion: giving users the feeling of being part of an environment

Virtual Reality (2 of 3)

- Telepresence: giving users the sense that they are in another location and can manipulate objects as though in reality
- Full-body immersion: allowing users to move around freely by combining interactive environments with cameras, monitors, and other devices

Virtual Reality (3 of 3)

- Networked communication: allowing users in different locations to interact and manipulate the same world at the same time by connecting two or more virtual worlds

Types of Virtual Environments (1 of 2)

- Egocentric environment
  - User is totally immersed in the VR world
  - Technologies used with the environment
    - Head-mounted display (HMD)
    - Virtual retinal display (VRD)

Types of Virtual Environments (2 of 2)

- Exocentric environment
  - User is given a “window view”
  - Data is rendered in 3D, but users can only view it on screen
  - Users cannot interact with objects

Components of a Virtual Reality System (1 of 2)

- Visual and aural systems
  - Allow users to see and hear the virtual world
- Manual control for navigation
  - Allows the user to navigate in the VR environment and control various objects

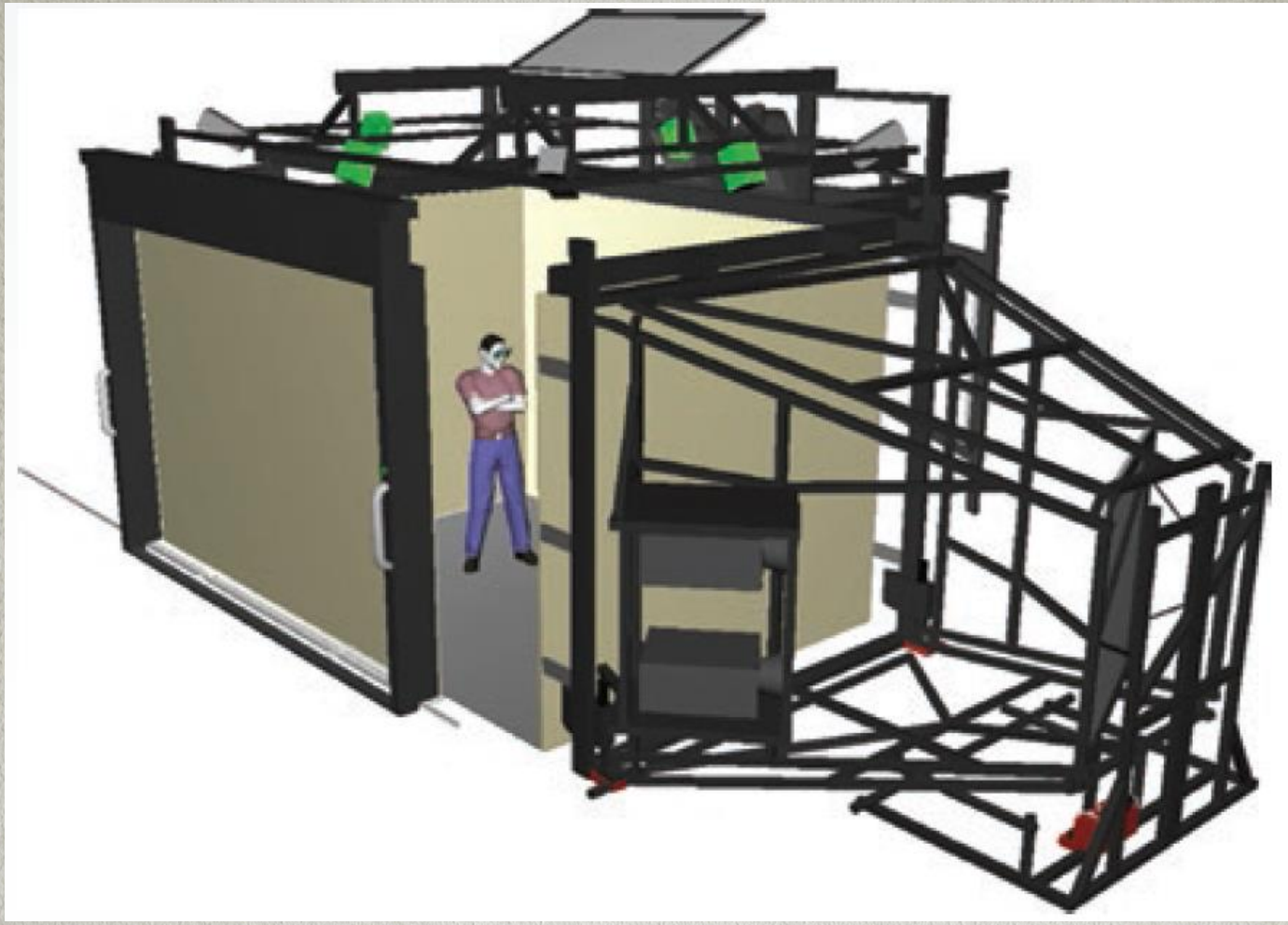
Components of a Virtual Reality System (2 of 2)

- Central coordinating processor and software system
  - Generates and manipulates high-quality graphics in real time and needs a very fast processor
- Walker
  - Captures and records movements of the user's feet as they walk or turn in different directions

CAVE

- Cave automatic virtual environment (CAVE)
  - Consists of a cube-shaped room in which the walls are rear-projection screens
  - Holographic device that creates, captures, and displays images in true 3D form
  - Used for research in archaeology, architecture, engineering, geology, and physics
  - Used by engineering companies to improve product design and development

Exhibit 14.3 Example of a CAVE



Virtual Reality Applications

- Many applications
  - Conduct bloodless surgeries
  - Games and theaters
  - Business applications
    - Assistance for the disabled, architectural design, education, and flight simulation
  - Videoconferencing and group support systems
  - VR-based therapy

Obstacles in Using VR Systems

- Major obstacle
  - Lack of fiber-optic cables to carry data transmissions needed
- Other problems to be solved
  - Confusion between VR and a real environment
  - Mobility and other problems with HMDs
  - Difficulty representing sound
  - Need for additional computing power

Virtual Worlds (1 of 2)

- Simulated environment designed for users to interact via avatars
  - 2D or 3D graphical representation of a person in the virtual world
    - Used for gaming, in chat rooms, entertainment, and to conduct a variety of business activities

Virtual Worlds (2 of 2)

- Widely used virtual worlds
  - ActiveWorlds
  - Club Penguin
  - EGO
  - Entropia Universe
  - Habbo
  - RuneScape
  - Second Life

Augmented Reality (1 of 2)

- Augmented reality (AR): branch of virtual reality that generates a virtual scene that is overlaid on the real object
  - Goal: enhance the user's perception of the real-world objects that the user is seeing or interacting with

Augmented Reality (2 of 2)

- Difference between augmented reality (AR) and virtual reality
  - Augmented reality: users stay in the real-world environment while interacting with objects
    - Aware that they are still in the real world
  - Virtual reality: users are immersed in the virtual world
    - Mind is tricked into thinking they are in a new virtual world

Radio Frequency Identification: An Overview (1 of 2)

- Radio frequency identification (RFID) tag
  - Small electronic device consisting of a small chip and an antenna provides a unique identification for the card or the object carrying the tag
    - Passive type: includes no internal power supply and can be very small
    - Active: includes an internal power source and is more reliable than a passive tag

Radio Frequency Identification: An Overview (2 of 2)

- Privacy and security issues
  - Ability to read a tag's contents after an item has left the store
  - Tags being read without the customer's knowledge
  - Tags with unique serial numbers being linked to credit card numbers

Exhibit 14.1 RFID Applications

Category	Examples
Tracking and identification	Railway cars and shipping containers, livestock and pets, supply-chain management, inventory control, retail checkout and POS systems, and recycling and waste disposal
Payment and stored-value systems	Electronic toll systems, contactless credit cards, subway and bus passes, casino tokens, and concert tickets
Access control	Building access cards, ski-lift passes, and car ignition systems
Anticounterfeiting	Casino tokens, high-denomination currency notes, luxury goods, and prescription drugs
Healthcare	Tracking medical tools and patients, process control, and monitoring patient data

Quick Response Codes

- Matrix barcode consisting of black modules arranged in a square pattern on a white background
  - High storage capacity, small printout size, and dirt and dust resistant
  - Readable from any direction
  - Compatible with the Japanese character set
  - Can be read by smartphones equipped with cameras

Biometrics: A Second Look (1 of 3)

- Offer a high degree of accuracy that is not possible with other security measures
  - Used in e-commerce and banking by phone
    - Example: using voice synthesizers and customers' voices as the biometric element that identifies them remotely

Biometrics: A Second Look (2 of 3)

- Current and future applications
  - ATM, credit, and debit cards
  - Network and computer login security
  - Web page security
  - Voting
  - Employee time clocks
  - Member identification in sport clubs
  - Airport security and fast check-in

Biometrics: A Second Look (3 of 3)

- Passports and highly secured government ID cards
- Sporting events
- Cell phones and smart cards

Trends in Networking (1 of 15)

- Wireless Fidelity (Wi-Fi)
  - Broadband wireless technology that can transmit information over short distances
  - Enables one to connect computers, mobile phones and smart phones, MP3 players, PDAs, and game consoles to the Internet
  - Connections are easy to set up and have fast data transfer rates
  - Offers mobility and flexibility

Trends in Networking (2 of 15)

- Disadvantages of Wireless Fidelity (Wi-Fi)
  - Susceptible to interference from other devices and to being intercepted
    - Raises security concerns
  - Lack of support for high-quality media streaming

Trends in Networking (3 of 15)

- Worldwide Interoperability for Microwave Access (WiMAX)
  - Broadband wireless technology based on the IEEE 802.16 standards
    - Covers a range of 30 miles for fixed stations and three to ten miles for mobile stations
  - Fast and easy to install
  - Enables devices using the same frequency to communicate

Trends in Networking (4 of 15)

- Disadvantages WiMAX
  - Interference from other wireless devices
  - High costs
  - Interruptions from weather conditions
  - Need for a lot of power
  - Transmission speed decreases when bandwidth is shared among users

Trends in Networking (5 of 15)

- Bluetooth
  - Wireless technology for transferring data over short distances for fixed and mobile devices
  - Used to create a personal area network (PAN)
  - Uses a radio technology called Frequency Hopping Spread Spectrum (FHSS)

Trends in Networking (6 of 15)

- Used to connect devices such as computers, global positioning systems (GPSs), mobile phones, laptops, printers, and digital cameras
- Has no line-of-sight limitations
- Susceptible to interception

Trends in Networking (7 of 15)

- Grid computing
  - Involves combining the processing powers of various computers
  - Allows users to make use of other computers' resources to solve problems involving large-scale, complex calculations
  - Each participant in a grid is called a "node"
    - Processing on overused nodes can be switched to idle servers or desktop systems

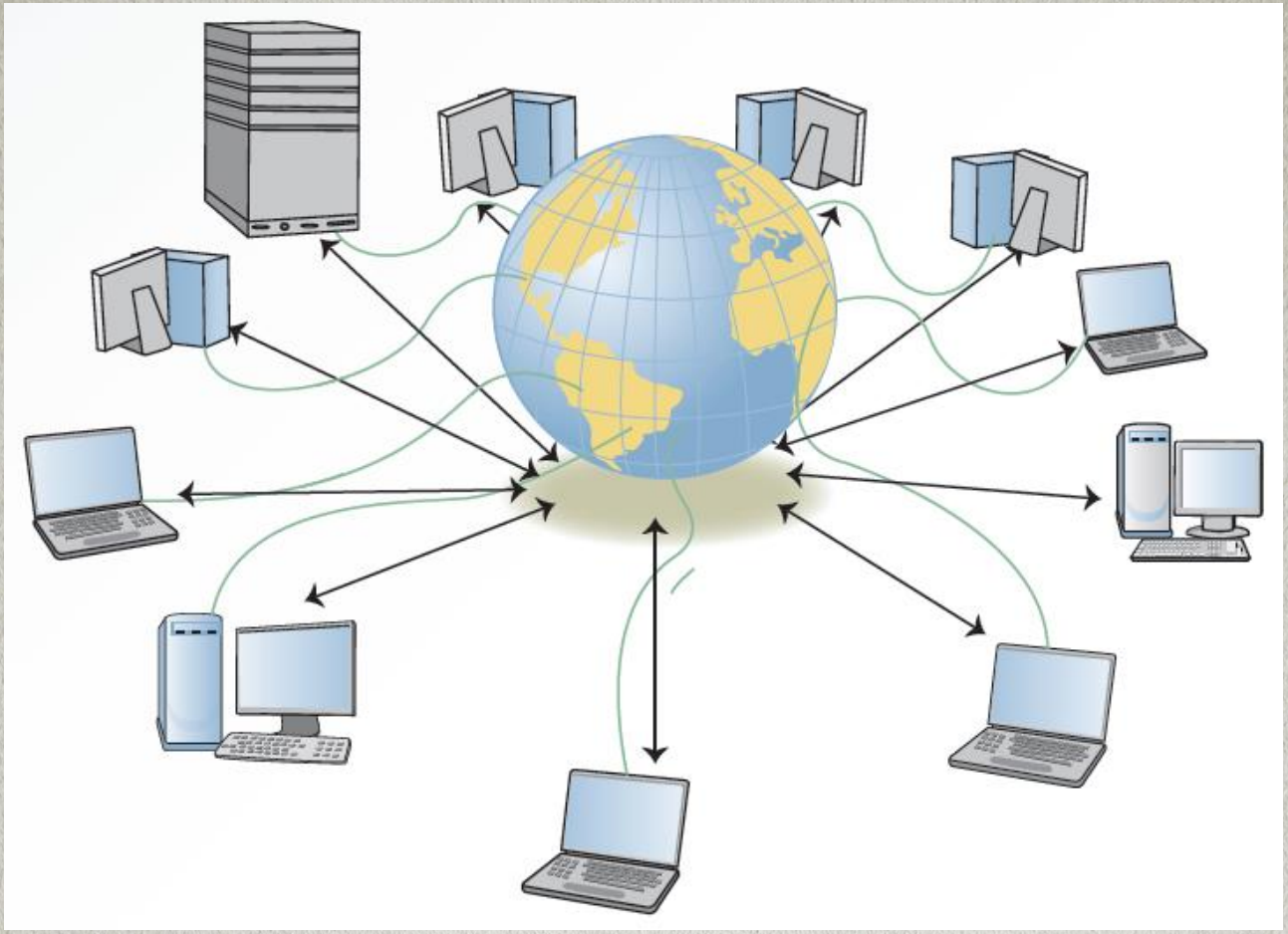
Trends in Networking (8 of 15)

- Used in bioinformatics, oil and gas drilling, and financial applications
- Advantages
  - Improved reliability
  - Parallel processing
  - Scalability
- Disadvantages
  - Some applications are not suitable

Trends in Networking (9 of 15)

- Applications requiring extensive memory that a single node cannot provide cannot be used on a grid
- Licensing agreements can be challenging
- Synchronizing operations in several different network domains can be difficult
  - Require sophisticated network management
- Some organizations are resistant to sharing resources, even if doing so benefits them

Exhibit 14.8 Grid Computing Configuration



Trends in Networking (10 of 15)

- Utility (on-demand) computing
  - Provision of IT services on demand
  - Users pay for computing or storage resources on an as-needed basis
  - Advantage: convenience and cost savings
  - Drawbacks: privacy and security
  - Can work with the SaaS model
    - Enables one to request computing power and memory from the provider

Trends in Networking (11 of 15)

- Cloud computing
  - Incorporates many recent technologies under one platform
    - Includes SaaS model, Web 2.0, grid computing, and utility computing
  - Includes components in the form of:
    - Infrastructure as a service (IaaS)
    - Platform as a service (PaaS)
    - Software as a service (SaaS)

Trends in Networking (12 of 15)

- Cloud computing includes many of the advantages and disadvantages of distributed computing
  - Users can request services, applications, and storage
  - Services typically require a fee; some are free

Trends in Networking (13 of 15)

- Public, private, hybrid, and community clouds: which one to choose
  - Organizations choose clouds based on security needs and level of involvement required
  - Public cloud: users connect with an off-site infrastructure over the Internet, which is shared by a large number of users
  - Private cloud: services and the infrastructure are run on a private network

Trends in Networking (14 of 15)

- Hybrid cloud: chosen by organizations that operate on both private and public data; collection of at least one private and at least one public cloud
- Community cloud: infrastructure is designed for exclusive use by a specific community of users from organizations that share common concerns

Trends in Networking (15 of 15)

- Cloud computing versus edge computing
  - Edge computing pushes processing and data to the near edge of the network that enables timely collection, processing, and analysis
    - Provides on-device processing and analytics in real time
  - Cloud computing processes data in centralized cloud and data centers
    - May not be as fast and efficient

Cloud Computing Security (1 of 2)

- Organization that uses cloud computing should:
  - Provide end-user education
  - Force software updates
  - Work with the cloud computing provider to spot unusual activities

Cloud Computing Security (2 of 2)

- Cloud-computing security risks
  - Privileged user access
  - Regulatory compliance
  - Data location
  - Data segregation
  - Recovery
  - Investigative support
  - Long-term viability

Nanotechnology

- Incorporates techniques involving structure and composition of materials on a nanoscale
  - Plays a role in several areas
    - Energy
    - Information and communication
    - Heavy industry
  - Consumer goods incorporating nanotechnology (nanomaterials) are available in the market

Blockchain Technology and Cryptocurrency (1 of 6)

- Blockchain: decentralized and distributed network
  - Used to record transactions across connected devices as blocks of data that cannot be altered after being recorded

Blockchain Technology and Cryptocurrency (2 of 6)

- Blockchain applications
  - Tracking food and other goods
  - Secure software development
  - Digital content management
  - Improving healthcare records integrity
  - Mortgage approval process
  - Improving and speeding up insurance claims processing

Blockchain Technology and Cryptocurrency (3 of 6)

- Blockchain applications (continued)
  - Audit trail
  - Electronic voting
  - Smart contracts

Blockchain Technology and Cryptocurrency (4 of 6)

- Cryptocurrency: digital money created from computer codes
  - Monitored by a peer-to-peer Internet protocol
  - No third party bank or financial institution
- Popular types
  - Bitcoin (BTC), Ripple (XRP), Ethereum (ETH), Monero (XMR), LiteCoin (LTC), and Zcash (ZEC)

Blockchain Technology and Cryptocurrency (5 of 6)

- Cryptocurrency advantages
  - Cannot be counterfeited or reversed by the sender
  - Immediate settlement
  - Lower transaction fees
  - No risk for credit theft

Blockchain Technology and Cryptocurrency (6 of 6)

- Cryptocurrency disadvantages
  - Not widely accepted
  - No way to reverse the payment
  - Uncertainty with respect to the regulations
  - Potential for financial loss because of data loss
  - Potential for high price volatility and manipulation
  - Often not exchangeable for fiat currency

Summary (1 of 3)

- Recent trends in software and service distribution include pull technology, push technology, and ASPs
- VR technology has added the third dimension, so users can interact with objects in a way not possible before
- RFID devices are more popular with the retail industry and other industries

Summary (2 of 3)

- QR codes have grown in popularity as a marketing tool
- Recent trends in networking technologies include wireless technologies, grid computing, WiMAX, and cloud computing
- Nanotechnology is currently too expensive to justify its use in many applications

Summary (3 of 3)

- A blockchain is a decentralized and distributed network
  - Used to record transactions across connected devices as blocks of data that cannot be altered after being recorded
  - Cryptocurrency is probably the most popular application of blockchain technology