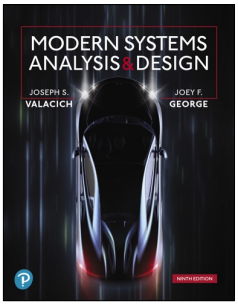
# Modern Systems Analysis and Design

Ninth Edition




**Chapter 12**

The Origins of Software

Pearson



1

## Learning Objectives

**12.1** Distinguish between file server and client/server environments, contrasting how each is used in a LAN

**12.2** Describe cloud computing and other current trends that help organizations address IS infrastructure-related challenges

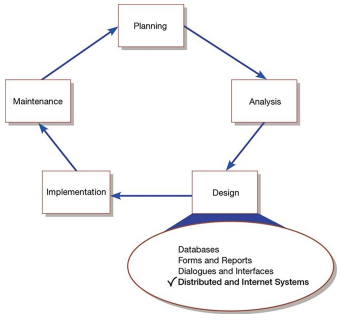
**12.3** Describe standards shaping the design of Internet based systems, options for ensuring Internet design consistency, site management issues influencing customer loyalty, trustworthiness, and security

Pearson



2

## Figure 12-1: Systems Development Life Cycle




Pearson



3

## The Process of Designing Distributed and Internet Systems

**12.1** Distinguish between file server and client/server environments, contrasting how each is used in a LAN

- This process is similar to designing single-location systems
- Due to multi-location deployment, numerous design issues must be considered
- There is more opportunity for failure due to number of components
- Main issues involve ensuring reliability, availability, survivability, performance

Pearson



4

## Figure 12-2: Outcomes and Deliverables from Designing Distributed Systems

1. Description of Site (for each site)
   a. geographical information
   b. physical location
   c. infrastructure information
   d. personnel characteristics (education, technical skills, etc.)
   e. . . .
2. Description of Data Usage (for each site)
   a. data elements used
   b. data elements created
   c. data elements updated
   d. data elements deleted
3. Description of Business Process (for each site)
   a. list of processes
   b. description of processes
4. Contrasts of Alternative IS Architectures for Site, Data, and Process Needs (for each site)
   a. pros and cons of no technological support
   b. pros and cons of non-networked, local system
   c. pros and cons of various distributed configurations
   d. . . .

Pearson



5

## Designing Systems for LANs

**12.1** Distinguish between file server and client/server environments, contrasting how each is used in a LAN

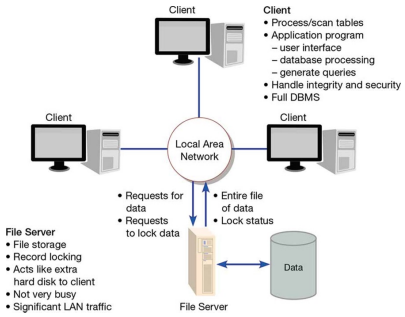
- **Local area network (LAN)** – cabling, hardware, and software used to connect workstations, computers, and file servers located in a confined geographical area (typically within one building or campus)
- **File server** – device that manages file operations and is shared by each client PC attached to a LAN

Pearson



6

## Figure 12-3: File Server Model




Pearson



7

## Limitations of File Servers

**12.1** Distinguish between file server and client/server environments, contrasting how each is used in a LAN

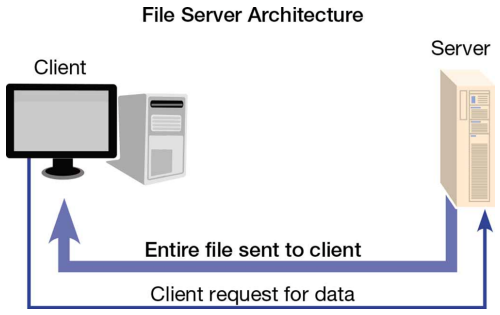
- Three primary limitations of file servers:
  1. Excessive data movement
  2. The need for a powerful client workstation
  3. Decentralized data control

Pearson



8

## Figure 12-4: File Servers Transfer Files When Data are Requested From a Client




Pearson



9

## Designing Systems for a Client/Server Architecture (1 of 3)

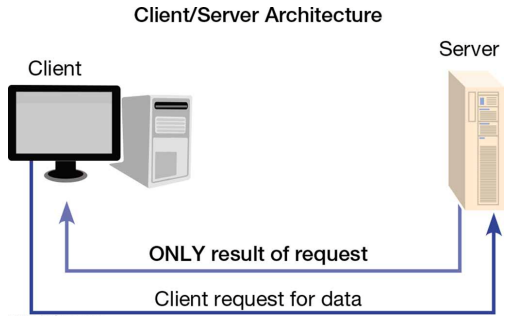
**12.1** Distinguish between file server and client/server environments, contrasting how each is used in a LAN

- **Client/server architecture** – LAN-based computing environment in which a central database server or engine performs all database commands sent to it from client workstations, and application programs on each client concentrate on user interface functions
  - Database server responsible for database storage and access



10

## Figure 12-5: The Required Data After a Request From a Client






11

## Designing Systems for a Client/Server Architecture (2 of 3)

**12.1** Distinguish between file server and client/server environments, contrasting how each is used in a LAN

- **Database engine** – (back-end) portion of the client/server database system running on the server that provides database processing and shared access functions
- **Client** – (front-end) portion of the client/server database system that provides the user interface and data manipulation functions
- **Application program interface (API)** – the software building blocks that are used to ensure that common system capabilities, such as user interfaces and printing, as well as modules are standardized to facilitate data exchange between clients and servers



12

## Designing Systems for a Client/Server Architecture (3 of 3)

**12.1** Distinguish between file server and client/server environments, contrasting how each is used in a LAN

- Several benefits can be realized by adopting a client/server architecture:
  1. It allows companies to leverage the benefits of microcomputer technology. Today's workstations deliver impressive computing power at a fraction of the cost of a mainframe.
  2. It allows most processing to be performed close to the source of processed data, thereby improving response times and reducing network traffic
  3. It facilitates the use of graphical user interfaces and visual presentation techniques commonly available for workstations
  4. It allows for and encourages the acceptance of open systems

Pearson



13

## Table 12-1: Several Differences Between File Server and Client/Server Architectures

| Characteristics | File Server | Client/Server |
|---|---|---|
| Processing | Client Only | Both client and server |
| Concurrent Data Access | Low—managed by each client | High—managed by server |
| Network Usage | Large file and data transfers | Efficient data transfers |
| Database Security and Integrity | Low—managed by each client | High—managed by server |
| Software Maintenance | Low—software changes just on server | Mixed—some new parts must be delivered to each client |
| Hardware and System Software Flexibility | Client and server decouple and can be mixed | Need for greater coordination between a client and server |

Pearson



14

## Advanced Forms of Client/Server Architectures (1 of 4)

**12.1** Distinguish between file server and client/server environments, contrasting how each is used in a LAN

- Three general components to any information system:
  1. **Data management:** functions that manage all interaction between software and files and databases (data retrieval/querying, updating, security, concurrency control, and recovery)
  2. **Data presentation:** functions that manage the interface between system users and the software (display and printing of forms and reports, validating system inputs)
  3. **Data analysis:** functions transform inputs into outputs, including simple summarization to complex mathematical modeling such as regression analysis

Pearson



15

## Advanced Forms of Client/Server Architectures (2 of 4)

**12.1** Distinguish between file server and client/server environments, contrasting how each is used in a LAN

- **Application server** – computing server where data analysis functions primarily reside
- **Virtual machine** – software emulation of a physical computer system, both hardware and operating system, that allows more efficient sharing of physical hardware resources
- **Virtualization** – act of creating virtual (rather than physical) versions of a variety of computing capabilities including hardware platforms, operating systems, storage devices, and networks

Pearson



16

## Advanced Forms of Client/Server Architectures (3 of 4)

**12.1** Distinguish between file server and client/server environments, contrasting how each is used in a LAN

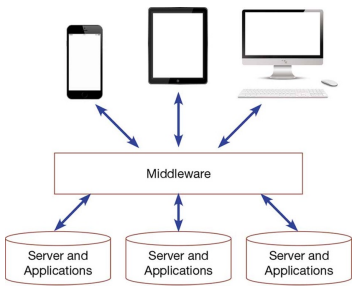
- **Three-tiered client/server architecture** – advanced client/server architectures in which there are three logical and distinct applications—data management, presentation, and analysis—that are combined to create a single information system
- **Middleware** – combination of hardware, software, and communication technologies that brings data management, presentation, and analysis together into a three-tiered (or n-tiered) client/server environment

Pearson



17

## Figure 12-6: Middleware Ties Together Diverse Applications and Devices




(**Source:** Andrey Mertsalov/Shutterstock, Mr Aesthetics/Shutterstock, & A-R-T/ Shutterstock)

Pearson



18

## Advanced Forms of Client/Server Architectures (4 of 4)

**12.1** Distinguish between file server and client/server environments, contrasting how each is used in a LAN

- Other good reasons for creating three-tiered client/server architectures include:
  - Applications can be partitioned in a way that best fits the organizational computing need
  - Data analysis can reside on a powerful application server resulting in faster response time for users
  - Multi-tiered architecture provides greater flexibility
- **Thin client** – client device designed so that most processing and data storage occur on the server

Pearson



19

## What is Cloud Computing?

**12.2** Describe cloud computing and other current trends that help organizations address IS infrastructure-related challenges

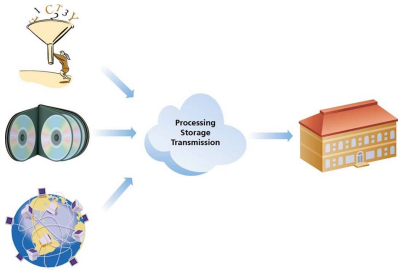
- **Cloud computing** – the provision of applications over the Internet where customers do not have to invest in the hardware and software resources needed to run and maintain the applications, but are charged on a per-use basis
- **Utility computing** – form of on-demand computing where resources in terms of processing, data storage, or networking are rented on an as-needed basis. The organization only pays for the services used.

Pearson



20

## Figure 12-7: Processing, Storage, and Transmission of Data Taking Place in the Cloud



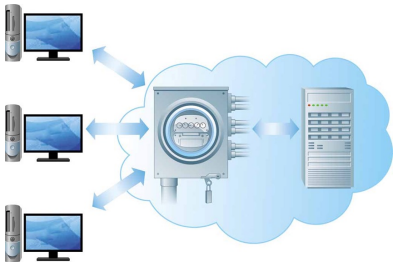

(**Source:** Valacich, J. & Schneider, C. (2018). **Information systems today: Managing in the digital world** (8th ed.) (p 118). Reprinted and electronically reproduced by permission of Pearson Education, Inc., New York, NY.)

Pearson



21

## Figure 12-8: Cloud Computing Uses a Utility Computing Model, Allowing Companies to Pay for Computing Resources on an as Needed Basis



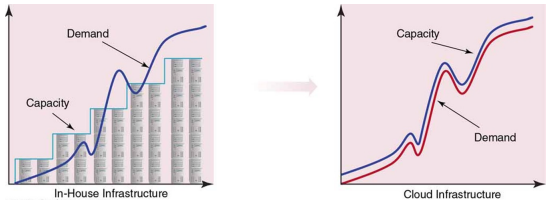
(**Source:** Valacich, J. & Schneider, C. (2018). **Information systems today: Managing in the digital world** (8th ed.) (p 118). Reprinted and electronically reproduced by permission of Pearson Education, Inc., New York, NY.)

Pearson



22

## Figure 12-9: It Is Difficult to Match Demand Using an In-House Infrastructure; with a Cloud Infrastructure, Resources Can Be Added Incrementally, on an As-Needed Basis



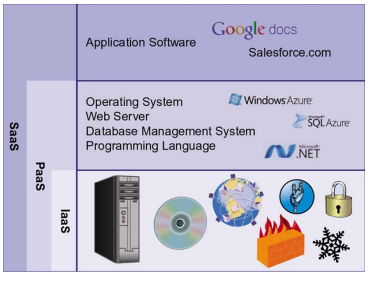

(**Source:** Valacich, J. & Schneider, C. (2018). **Information systems today: Managing in the digital world** (8th ed.) (p 119). Reprinted and electronically reproduced by permission of Pearson Education, Inc., New York, NY.)

Pearson



23

## Figure 12-10: Services by SaaS, PaaS, and IaaS Providers




(**Source:** Valacich, J. & Schneider, C. (2018). **Information systems today: Managing in the digital world** (8th ed.) (p 120). Reprinted and electronically reproduced by permission of Pearson Education, Inc., New York, NY.)

Pearson



24

## Cloud Characteristics

**12.2** Describe cloud computing and other current trends that help organizations address IS infrastructure-related challenges

- Cloud computing has the following characteristics that distinguish it form in-house infrastructure:
  - On-demand self-service
  - Rapid elasticity
  - Broad network access
  - Resource pooling
  - Measured service

Pearson



25

## Service Models

**12.2** Describe cloud computing and other current trends that help organizations address IS infrastructure-related challenges

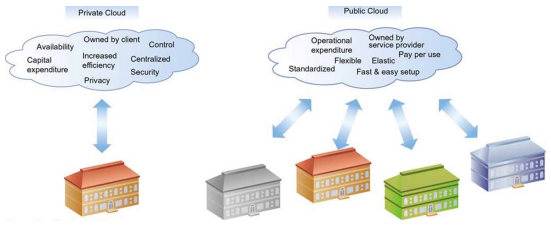
- **Infrastructure as a service (IaaS)** – cloud computing model in which only the basic capabilities of processing, storage, and networking are provided
- **Platform as a service (PaaS)** – cloud computing model in which the customer can run his or her own applications that are typically designed using tools provided by the service provider; the customer has limited or no control over the underlying infrastructure
- **Software as a service (SaaS)** – cloud computing model in which a service provider offers applications via a cloud infrastructure

Pearson



26

## Figure 12-11: Public Clouds Versus Private Clouds




(**Source:** Valacich, J. & Schneider, C. (2018). **Information systems today: Managing in the digital world** (8th ed.) (p 121). Reprinted and electronically reproduced by permission of Pearson Education, Inc., New York, NY.)

Pearson



27

## Figure 12-12: Organizations Have to Consider Various Issues When Managing Their Cloud infrastructure


(**Source:** Valacich, J. & Schneider, C. (2018). **Information systems today: Managing in the digital world** (8th ed.) (p 122). Reprinted and electronically reproduced by permission of Pearson Education, Inc., New York, NY.)

Pearson



28

## Managing the Cloud

**12.2** Describe cloud computing and other current trends that help organizations address IS infrastructure-related challenges

- Strategic issues management should consider when choosing service providers:
  - **Availability/Reliability** – no cloud service is completely immune to programming errors, network outages, or hardware failures
  - **Scalability** – this is the promise of the cloud, but there may be limits
  - **Viability** – you want to make sure the service provider will last over time
  - **Security, Privacy, and Compliance** – these are critical (e.g. Sarbanes-Oxley, HIPAA)
  - **Diversity of Offerings** – which provider can offer services needed now and in the future?
  - **Openness** –how interoperable is the service?
  - **Cost** – how will cloud cost compare to internal, public vs private?

Pearson



29

## Service-Oriented Architecture

**12.2** Describe cloud computing and other current trends that help organizations address IS infrastructure-related challenges

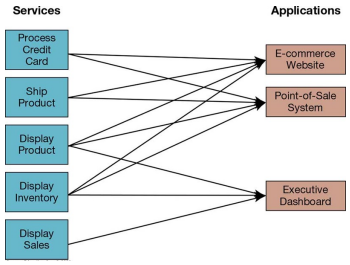
- **Service-oriented architecture (SOA)** – software architecture in which business processes are broken down into individual components (or services) that are designed to achieve the desired results for the service consumer (which can be either an application, another service, or a person)
- Three main principles of SOA include:
  - **Reusability** – service should be usable in different applications
  - **Interoperability** – service should work with other service
  - **Componentization** – service should be simple and mobile

Pearson



30

## Figure 12-13: Using SOA, Multiple Applications Can Invoke Multiple Services




(**Source:** Valacich, J. & Schneider, C. (2018). **Information systems today: Managing in the digital world** (8th ed.) (p 124). Reprinted and electronically reproduced by permission of Pearson Education, Inc., New York, NY.)

Pearson



31

## Web Services (1 of 2)

**12.2** Describe cloud computing and other current trends that help organizations address IS infrastructure-related challenges

- **Web service** – method of communication between two electronic devices over a network
- **eXtensible Markup Language (XML)** – Internet authoring language that allows designers to create customized tags, enabling the definition, transmission, validation, and interpretation of data between applications
- **JavaScript Object Notation (JSON)** – lightweight data interchange approach that is relatively easy for humans to understand and for computers to generate or interpret

Pearson



32

## Web Services (2 of 2)

**12.2** Describe cloud computing and other current trends that help organizations address IS infrastructure-related challenges

- **Simple Object Access Protocol (SOAP)** – protocol for communicating XML data between Web service applications and the operating system
- **Representational State Transfer (REST)** – relatively simple and fast protocol for communicating JSON data between Web service applications and the operating system

Pearson



33

## Designing Internet Systems

**12.3** Describe standards shaping the design of Internet based systems, options for ensuring Internet design consistency, site management issues influencing customer loyalty, trustworthiness, and security

- Most new system development focuses on Internet-based applications (for internal processing, business-to-business, and business-to-consumer)
- Internet design is simpler than client/server due to proliferation of standards

Pearson



34

## Standards Drive the Internet

**12.3** Describe standards shaping the design of Internet based systems, options for ensuring Internet design consistency, site management issues influencing customer loyalty, trustworthiness, and security

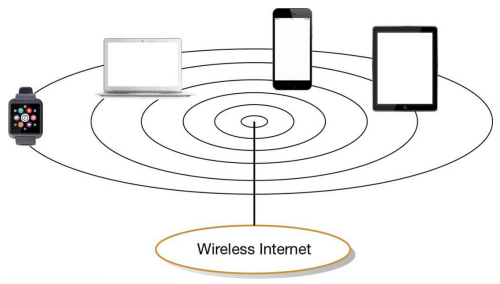
- Types of standards include:
  - **Domain naming system (BIND)** – method fortranslating Internet domain names into Internet Protocol (IP) addresses. BIND stands for Berkeley Internet Name Domain.
  - **Hypertext Transfer Protocol (HTTP)** – communication protocol or exchanging information on the Internet
  - **Hypertext Markup Language (HTML)** –standard language for representing content on the Web through the use of hundreds of command tags

Pearson



35

## Figure 12-14: Thin Clients Used to Access the Internet




(**Source:** Sergey Peterman/Shutterstock, Africa Studio/Shutterstock, Andrey Mertsalov/ Shutterstock, & Mr Aesthetics/ Shutterstock)

Pearson



36

## Site Consistency

**12.3** Describe standards shaping the design of Internet based systems, options for ensuring Internet design consistency, site management issues influencing customer loyalty, trustworthiness, and security

- Professionalism requires a consistent look-and-feel across all pages of a website
  - Makes it easier for users to navigate
- **Cascading Style Sheets (CSSs)** –set of style rules that tells a Web browser how to present a document
- **eXtensible Stylesheet Language (XSL)** –specification for separating style from content when generating XML pages

Pearson



37

## Figure 12-15: Using HTML's Link Command for Cascading Style Sheets

| Sample Command : | |
|---|---|
| LINK HREF="style5.css" REL=StyleSheet TYPE="text/css" TITLE="Common Background Style" MEDIA="screen, print"> | |
| **Command Parameters:** | |
| HREF="filename or URL" | Indicate the location of the linked object or document. |
| REL="relationship" | Specify the type of relationship between the document and linked object or document. |
| TITLE="object or document title" | Declare the title of the linked object or document. |
| TYPE="object to document type" | Declare the type of linked object or document. |
| MEDIA="type of media" | Declare the type of medium or media to which the style sheet will be applied (e.g., screen, print, projection, aural, braille, tty, tv, all). |

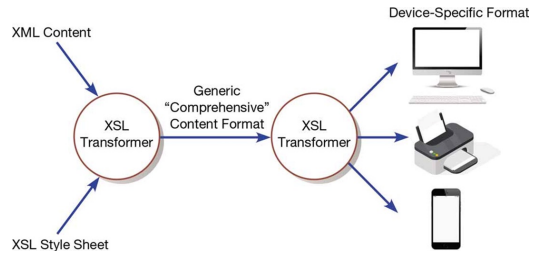
(**Source:** Vectors Bang/Shutterstock)

Pearson



38

## Figure 12-16: Combining XML Data with XSL Style Sheet to Format Content




(**Source:** A-R-T/Shutterstock, Vectors Bang/Shutterstock, & Andrey Mertsalov/ Shutterstock)

Pearson



39

## Design Issues Related to Site Management (1 of 2)

**12.3** Describe standards shaping the design of Internet based systems, options for ensuring Internet design consistency, site management issues influencing customer loyalty, trustworthiness, and security

- Customer loyalty and trustworthiness results in customers feeling like the site, and their data, are secure. Ways to convey this:
  - **Design quality** (professional appearance)
  - **Up-front disclosure** (open and honest relationship)
  - **Comprehensive, correct, and current content** (provides users with current information)
  - **Connected to the rest of the Web** (credibility)

Pearson



40

## Design Issues Related to Site Management (2 of 2)

**12.3** Describe standards shaping the design of Internet based systems, options for ensuring Internet design consistency, site management issues influencing customer loyalty, trustworthiness, and security

- **Personalization** – providing Internet content to a user based upon knowledge of that customer
- **Customization** – results in Internet sites that allow users to customize the content and look of the site based on their personal preferences

Pearson



41

## Links Must Live Forever

**12.3** Describe standards shaping the design of Internet based systems, options for ensuring Internet design consistency, site management issues influencing customer loyalty, trustworthiness, and security

- Reasons your links must live forever:
  - Customer bookmarks
  - Links from other sites
  - Search engine referrals
  - Old content adds value
- System Security vs Ease of Use
  - "Remember my password" vs use of cookies
  - Secure system usually less user-friendly

Pearson



42

## Website Content Management

**12.3** Describe standards shaping the design of Internet based systems, options for ensuring Internet design consistency, site management issues influencing customer loyalty, trustworthiness, and security

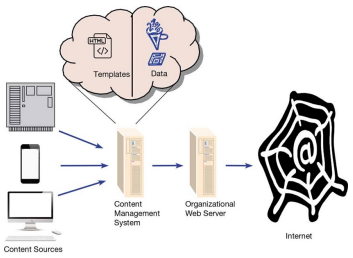
- **Content management system (CMS)** – special type of software application for collecting, organizing, and publishing website content
  - Stored in a single repository along with templates for formatting any type of Web page

Pearson



43

## Figure 12-17: A Content Management System Allows Content from Multiple Sources to be Stored Separately From its Formatting to Ease Website Management




(**Source:** M-O Vector/Shutterstock & Andrey Mertsalov/Shutterstock)

Pearson



44

## Advertising on Pine Valley Furniture's Webstore (1 of 2)

**12.3** Describe standards shaping the design of Internet based systems, options for ensuring Internet design consistency, site management issues influencing customer loyalty, trustworthiness, and security

- Potential benefits of including advertising:
  - Potential to increase revenue generated from the WebStore
  - Potential to create cross-promotions and alliances with other online commerce systems
  - Potential to provide customers with improved service when looking for additional products that accessorize PVF's product line

Pearson



45

## Advertising on Pine Valley Furniture's Webstore (2 of 2)

**12.3** Describe standards shaping the design of Internet based systems, options for ensuring Internet design consistency, site management issues influencing customer loyalty, trustworthiness, and security

- Potential advertising concerns:
  - Advertisement must be served quickly so that site performance is not affected
  - Advertisement must be uniform in size and resolution, so as not to disrupt the site layout
  - Advertisement links must not redirect the user's browser away from the WebStore

Pearson



46

## Designing the Advertising Component

**12.3** Describe standards shaping the design of Internet based systems, options for ensuring Internet design consistency, site management issues influencing customer loyalty, trustworthiness, and security

- Transactional requirements include:
  - Determine which advertisements apply, based on where the user is in the WebStore
  - Personalize the advertisement if the identity of user and preferences are known
  - Check for any seasonal or promotional advertisements
  - Log the transaction

Pearson



47

## Designing the Management Reporting Component

**12.3** Describe standards shaping the design of Internet based systems, options for ensuring Internet design consistency, site management issues influencing customer loyalty, trustworthiness, and security

- Queries for top-management:
  - "How many women, when shopping for desks, clicked on an advertisement for lamps?"
  - "How many advertisements were served to shoppers looking at filing cabinets?"
  - "How many people clicked on the first advertisement they saw?"
  - "How many people clicked on an advertisement and then purchased something from the WebStore?"

Pearson



48

## Summary

- In this chapter you learned to:
- Distinguish between file server and client/server environments, contrasting how each is used in a LAN
- Describe cloud computing and other current trends that help organizations address IS infrastructure-related challenges
- Describe standards shaping the design of Internet based systems, options for ensuring Internet design consistency, site management issues influencing customer loyalty, trustworthiness, and security

Pearson



49

## Copyright



Pearson



50