



E-commerce

business. technology. society.

Third Edition

Kenneth C. Laudon
Carol Guercio Traver



Chapter 4

Building an E-commerce Web Site



Right-Sizing a Web Site

Class Discussion

- What are the factors you should take into account when sizing a Web site's infrastructure?
- How does OPERA use a queuing model?
- Why did eBay turn to IBM's OPERA application?
- Why is peak usage an important factor to consider?
- What did eBay discover from its use of OPERA?



Building an E-commerce Site: A Systematic Approach

- Two most important management challenges in building a successful e-commerce site are:
 - Developing a clear understanding of business objectives
 - Knowing how to choose the right technology to achieve those objectives



Pieces of the Site-Building Puzzle

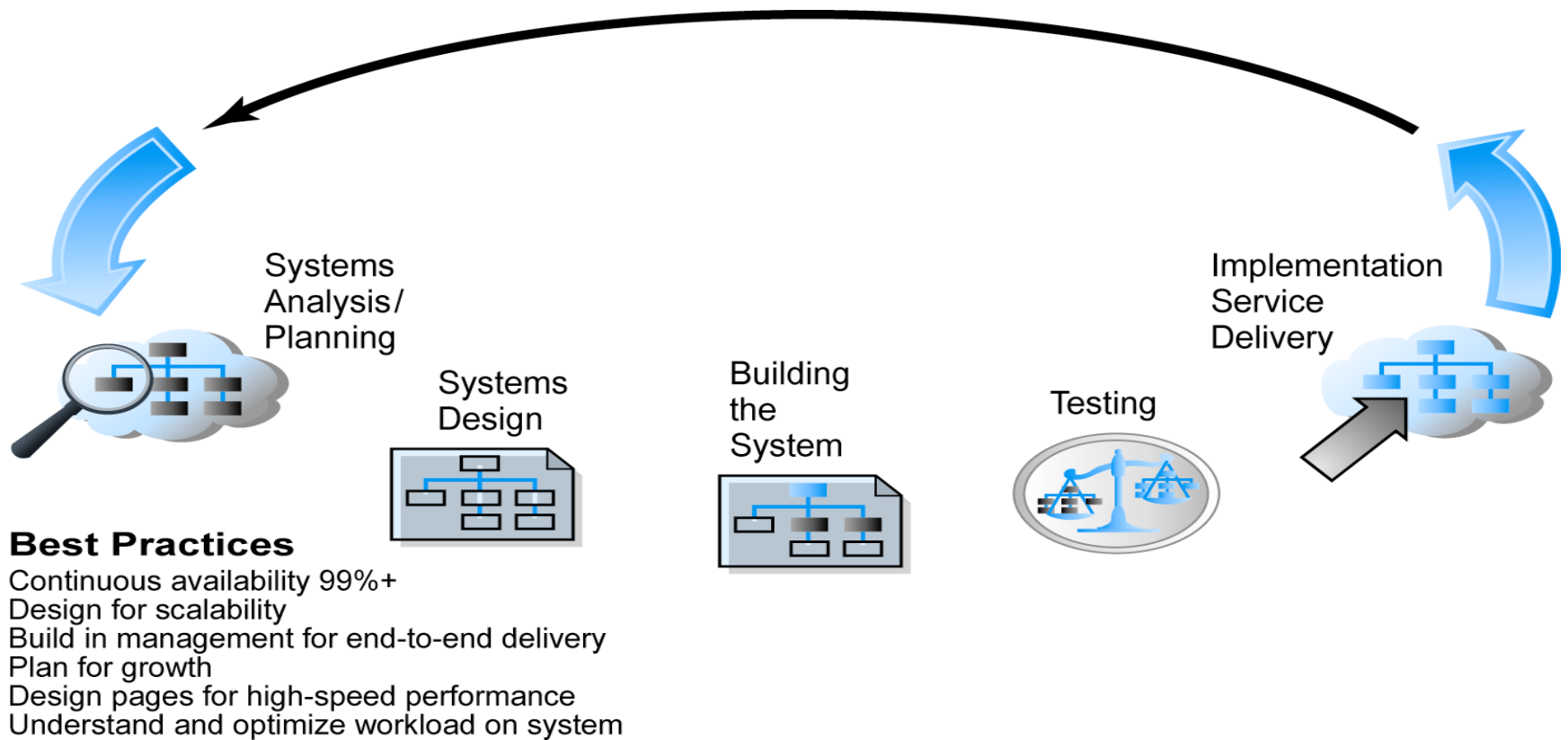
- Main areas where you will need to make decisions in building a site include:
 - Human resources and organizational capabilities—creating a team that has the skill set to build and manage a successful site
 - Hardware
 - Software
 - Telecommunications
 - Site design

The Systems Development Life Cycle

- Systems Development Life Cycle (SDLC) is a methodology for understanding the business objectives of a system and designing an appropriate solution
- Five major steps in the SDLC are:
 - Systems analysis/planning
 - Systems design
 - Building the system
 - Testing
 - Implementation

Web Site Systems Development Life Cycle

Figure 4.2, Page 195





System Analysis/Planning: Identifying Business Objectives, System Functionality, and Information Requirements

- Business objectives: a list of capabilities you want your site to have
- System functionalities: a list of the types of information system capabilities you will need to achieve your business objectives
- Information requirements: the information elements that the system must produce in order to achieve the business objectives

Systems Analysis: Business Objectives, System Functionality, and Information Requirements for a Typical E-commerce Site

Table 4.1, Page 196

TABLE 4.1	SYSTEM ANALYSIS: BUSINESS OBJECTIVES, SYSTEM FUNCTIONALITY, AND INFORMATION REQUIREMENTS FOR A TYPICAL E-COMMERCE SITE	
BUSINESS OBJECTIVE	SYSTEM FUNCTIONALITY	INFORMATION REQUIREMENTS
Display goods Provide product information (content)	Digital catalog Product database	Dynamic text and graphics catalog Product description, stocking numbers, inventory levels
Personalize/customize product	Customer on-site tracking	Site log for every customer visit; data mining capability to identify common customer paths and appropriate responses
Execute a transaction	Shopping cart/payment system	Secure credit card clearing; multiple payment options
Accumulate customer information	Customer database	Name, address, phone, and e-mail for all customers; online customer registration
Provide after-sale customer support	Sales database	Customer ID, product, date, payment, shipment date
Coordinate marketing/advertising program	Ad server, e-mail server, e-mail campaign manager, ad banner manager	Site behavior log of prospects and customers linked to e-mail and banner ad campaigns
Understand marketing effectiveness	Site tracking and reporting system	Number of unique visitors, pages visited, products purchased, identified by marketing campaign
Provide production and supplier links	Inventory management system	Product and inventory levels, supplier ID and contact, order quantity data by product

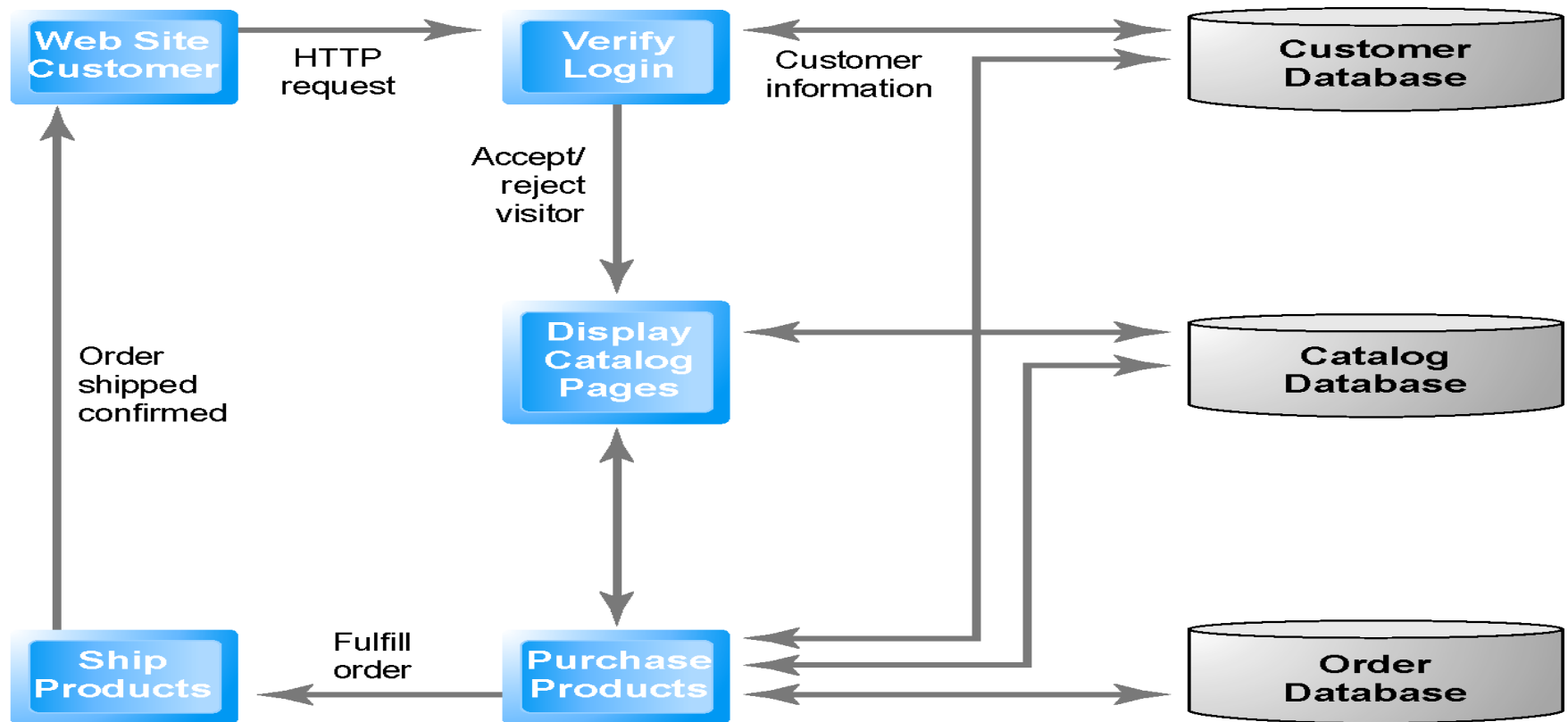


Systems Design: Hardware and Software Platforms

- System design specification: a description of the main components of a system and their relationship to one another
- System design can be broken down into two parts:
 - Logical design
 - Physical design

A Logical Design for a Simple Web Site

Figure 4.3 (a), Page 198

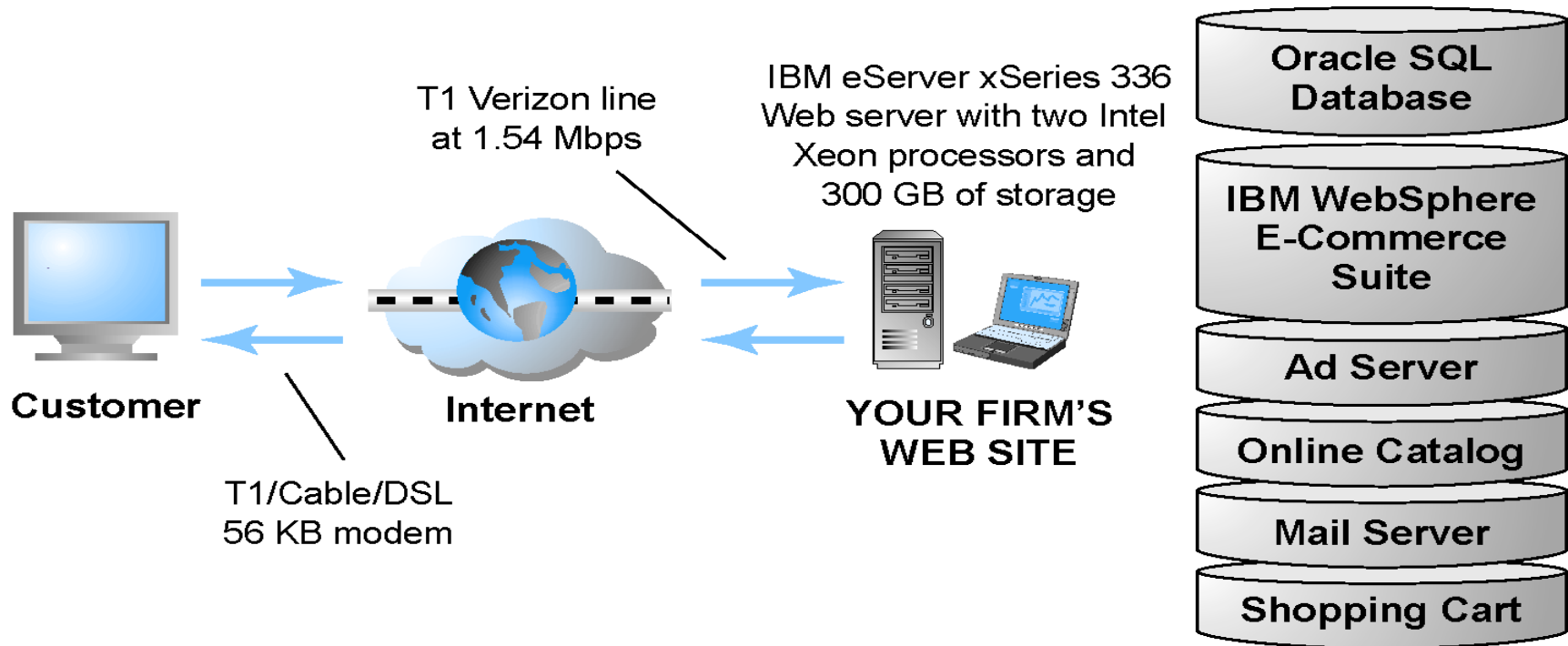


(a) Simple Data Flow Diagram

This data flow diagram describes the flow of information requests and responses for a sample Web site

A Physical Design for a Simple Web Site

Figure 4.3 (b), Page 198




(b) Simple Physical Design

A physical design describes the hardware and software needed to realize the logical design

Building the System: In-House versus Outsourcing

- Outsourcing: hiring an outside vendor to provide services involved in building the site
- The build your own versus outsourcing decision:
 - Build your own requires team with diverse skill set; choice of software tools; both risks and possible benefits
- Host your own versus outsourcing
 - Hosting: hosting company is responsible for ensuring site is accessible 24/7, for monthly fee
 - Co-location: firm purchases or leases a Web server (with control over its operation), but server is located in at vendor's physical facility

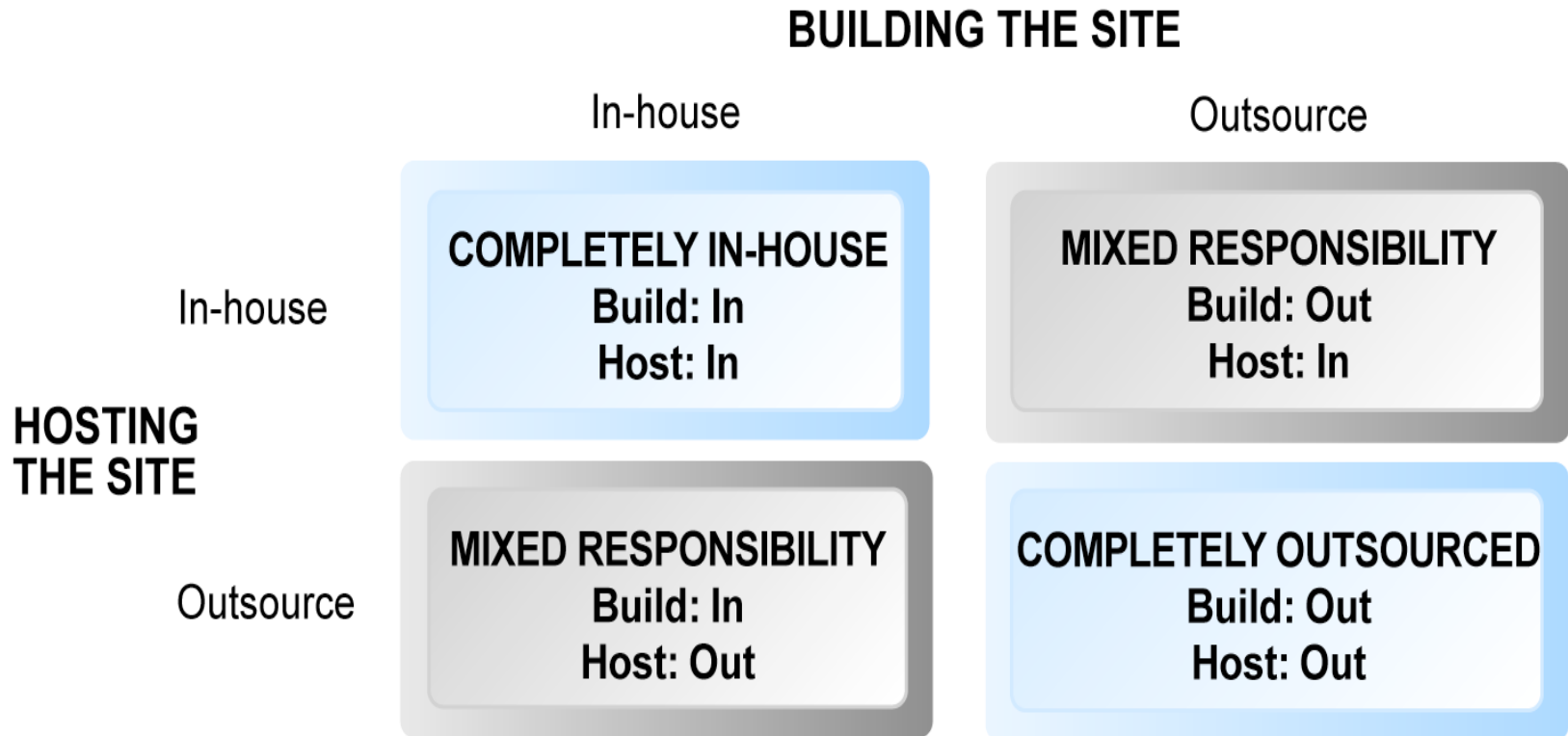


Insight on Business: Outsourcing Makes Sense When DIY Is No Bargain Class Discussion

- What's wrong with building your own Web site?
- Why did Big Al's home-grown solution fail? Why didn't they just fix it themselves?
- How systems are involved in Big Al's Web site?
- What are some of the risks of outsourcing your Web site?

Choices in Building and Hosting

Figure 4.4, Page 201



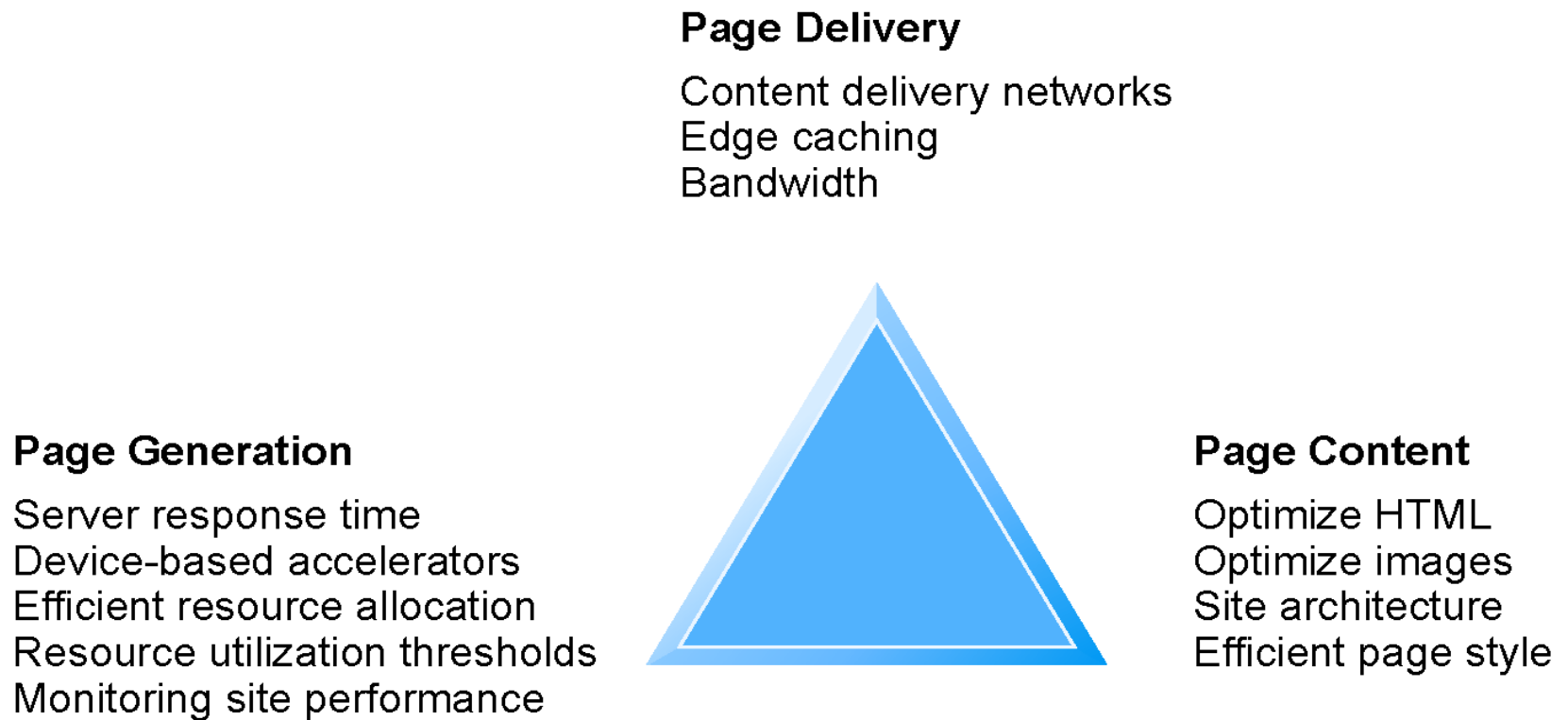


Testing, Implementation, and Maintenance

- Testing: Includes unit testing, system testing, and acceptance testing
- Implementation and maintenance:
 - Maintenance is ongoing
 - Benchmarking: process by which site is compared to those of competitors in terms of response speed, quality of layout, and design

Factors in Web Site Optimization

Figure 4.7, Page 205



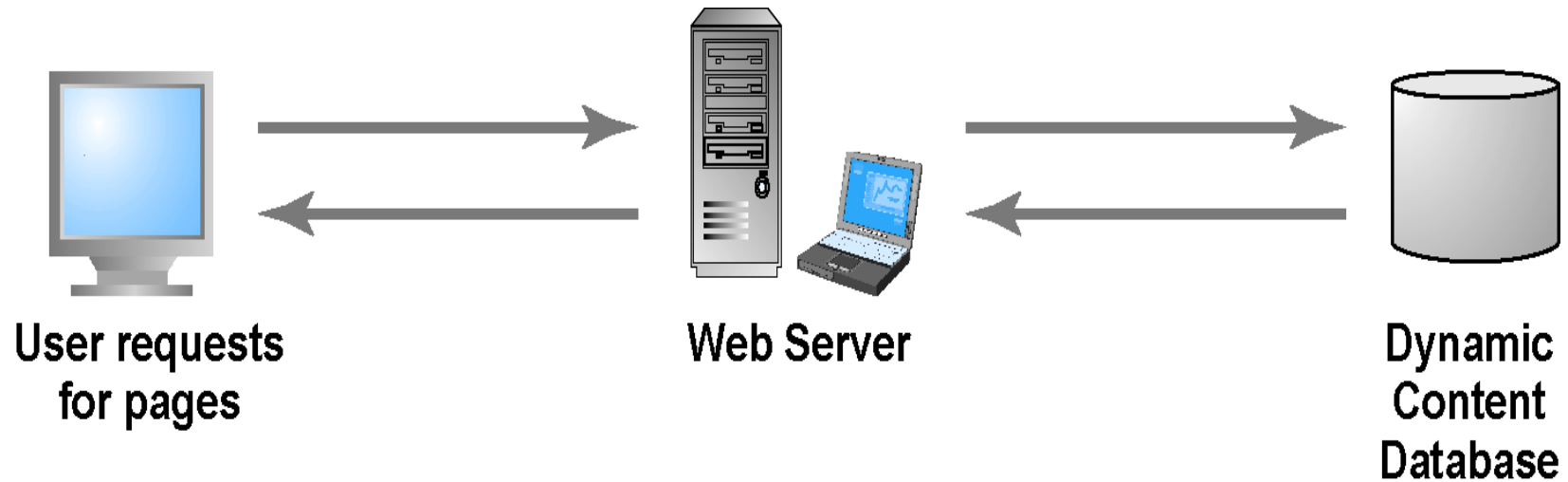


Simple versus Multi-tiered Web Site Architecture

- System architecture: refers to the arrangement of software, machinery, and tasks in an information system needed to achieve a specific functionality
- Two-tier architecture: Web server responds to requests for Web pages and a database server provides backend data storage
- Multi-tier architecture: Web server is linked to a middle-tier layer that typically includes a series of application servers that perform specific tasks, as well as to a backend layer of existing corporate systems

Two-Tier E-commerce Architecture

Figure 4.9(a), Page 207



(a) Two-tier Architecture

In a two-tier architecture, a Web server responds to requests for Web pages and a database server provides backend data storage.

Multi-tier E-commerce Architecture

Figure 4.9(b), Page 207



(b) Multi-tier Architecture

In a multi-tier architecture, a Web server is linked to a middle-tier layer that typically includes a series of application servers that perform specific tasks, as well as to a backend layer of existing corporate systems.



Web Server Software

- All e-commerce sites require basic Web server software to answer HTTP requests from customers
- Apache is the leading Web server software; works only with UNIX operating systems
- Microsoft's Internet Information Server (IIS) is the second major Web server software

Basic Functionality Provided by Web Servers

Table 4.3, Page 209

TABLE 4.3

BASIC FUNCTIONALITY PROVIDED BY WEB SERVERS

FUNCTIONALITY

DESCRIPTION

Processing of HTTP requests
Security services (Secure Sockets Layer)

Receive and respond to client requests for HTML pages
Verify username and password; process certificates and private/public key information required for credit card processing and other secure information

File Transfer Protocol

Permits transfer of very large files from server to server

Search engine

Indexing of site content; keyword search capability

Data capture

Log file of all visits, time, duration, and referral source

E-mail

Ability to send, receive, and store e-mail messages

Site management tools

Calculate and display key site statistics, such as unique visitors, page requests, and origin of requests; check links on pages



Site Management Tools

- All Web servers contain basic site management tools that verify that links on pages are still valid and also identify orphan files
- Additional site management software and services such as those provided by Webtrends can be purchased

Dynamic Page Generation Tools

- Dynamic page generation: contents of Web page are stored as objects in a database rather than being hard-coded in HTML, and are fetched when needed from database
- Tools include CGI (Common Gateway Interface), ASP (Active Server Pages), JSP (Java Server Pages), etc.
- Lowers menu costs, permits easy online market segmentation, and enables cost-free price discrimination



Application Servers

- Web application servers: software programs that provide specific business functionality required of a Web site
- Are an example of middleware software
- A number of different types available, providing a variety of functionality

Application Servers and Their Functions

Table 4.4, Page 212

TABLE 4.4 APPLICATION SERVERS AND THEIR FUNCTION	
APPLICATION SERVER	FUNCTIONALITY
Catalog display	Provides a database for product descriptions and prices
Transaction processing (shopping cart)	Accepts orders and clears payments
List server	Creates and serves mailing lists and manages e-mail marketing campaigns
Proxy server	Monitors and controls access to main Web server; implements firewall protection
Mail server	Manages Internet e-mail
Audio/video server	Stores and delivers streaming media content
Chat server	Creates an environment for online real-time text and audio interactions with customers
News server	Provides connectivity and displays Internet news feeds
Fax server	Provides fax reception and sending using a Web server
Groupware server	Creates workgroup environments for online collaboration
Database server	Stores customer, product, and price information
Ad server	Maintains Web-enabled database of advertising banners that permits customized and personalized display of advertisements based on consumer behavior and characteristics
Auction server	Provides a transaction environment for conducting online auctions
B2B Server	Implements buy, sell, and link marketplaces for commercial transactions



E-commerce Merchant Server Software Functionality

- Provides the basic functionality needed for online sales, including:
 - Online catalog
 - Shopping cart
 - Credit card processing



Merchant Server Software Packages (E-commerce Suites)

- Offer integrated environment that provides functionality and capabilities needed to develop sophisticated, customer-centric site
- Key factors to consider in choosing include:
 - Functionality
 - Support for different business models
 - Business process modeling tools
 - Visual site management tools and reporting
 - Performance and scalability
 - Connectivity to existing business systems
 - Compliance with standards
 - Global and multicultural capability
 - Local sales tax and shipping rules



Choosing the Hardware for an E-commerce Site

- Hardware platform: refers to all the underlying computing equipment that the system uses to achieve e-commerce functionality
- Objective to have enough platform capacity to meet peak demand but not so much that you are wasting money
- Important to understand the different factors that affect speed, capacity, and scalability of a site



Right-Sizing Your Hardware Platform: The Demand Side

- Demand that customers put on a site the most important factor affecting the speed of a site
- Factors involved in demand include:
 - Number of simultaneous users in peak periods
 - Nature of customer requests (user profile)
 - Type of content (dynamic versus static Web pages)
 - Required security
 - Number of items in inventory
 - Number of page requests
 - Speed of legacy applications

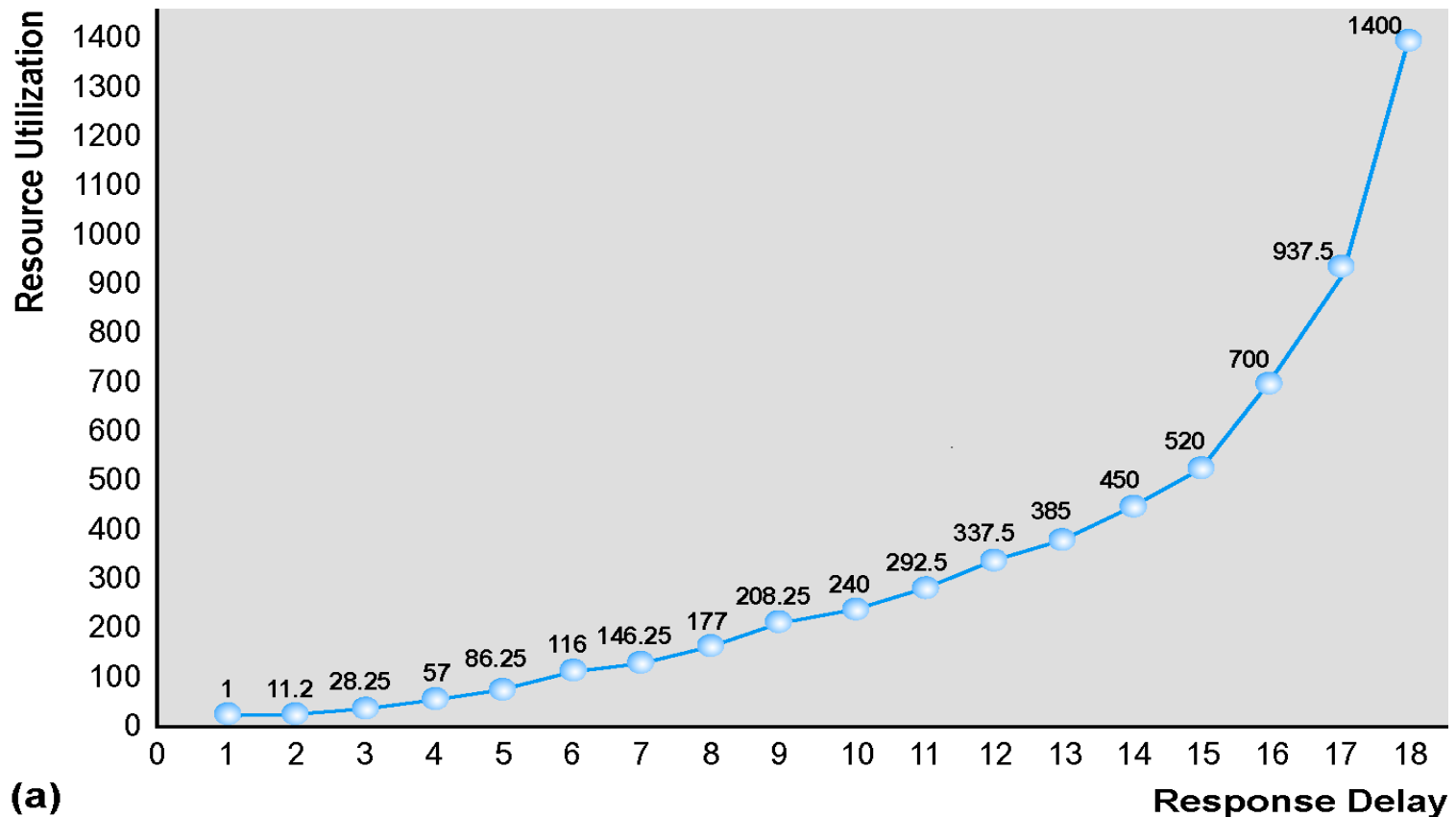
Factors in Right-sizing an E-commerce Platform

Table 4.6, Page 217

TABLE 4.6 FACTORS IN RIGHT-SIZING AN E-COMMERCE PLATFORM					
SITE TYPE	PUBLISH / SUBSCRIBE	SHOPPING	CUSTOMER SELF-SERVICE	TRADING	WEB SERVICES/B2B
Examples	WSJ.com	Amazon.com	NetBank.com Travelocity.com	E-Trade.com	Ariba e-procurement exchanges
Content	Dynamic Multiple authors High volume Not user specific	Catalog Dynamic items User profiles with data mining	Data in legacy applications Multiple data sources	Time sensitive High volatility Multiple suppliers and consumers Complex transactions	Data in legacy applications Multiple data sources Complex transactions
Security	Low	Privacy Non-repudiation Integrity Authentication Regulations	Privacy Non-repudiation Integrity Authentication Regulations	Privacy Non-repudiation Integrity Authentication Regulations	Privacy Non-repudiation Integrity Authentication Regulations
Percent Secure Pages	Low	Medium	Medium	High	Medium
Cross Session Information	No	High	High	High	High
Searches	Dynamic Low volume	Dynamic High volume	Not dynamic Low volume	Low volume	Moderate volume
Unique items (SKUs)	High	Medium to high	Medium	High	Medium to high
Transaction Volume	Moderate	Moderate to high	Moderate	High to extremely high	Moderate
Legacy Integration Complexity	Low	Medium	High	High	High
Page views (hits)	High to very high	Moderate to high	Moderate to low	Moderate to high	Moderate

Degradation in Performance as Number of Users Increases

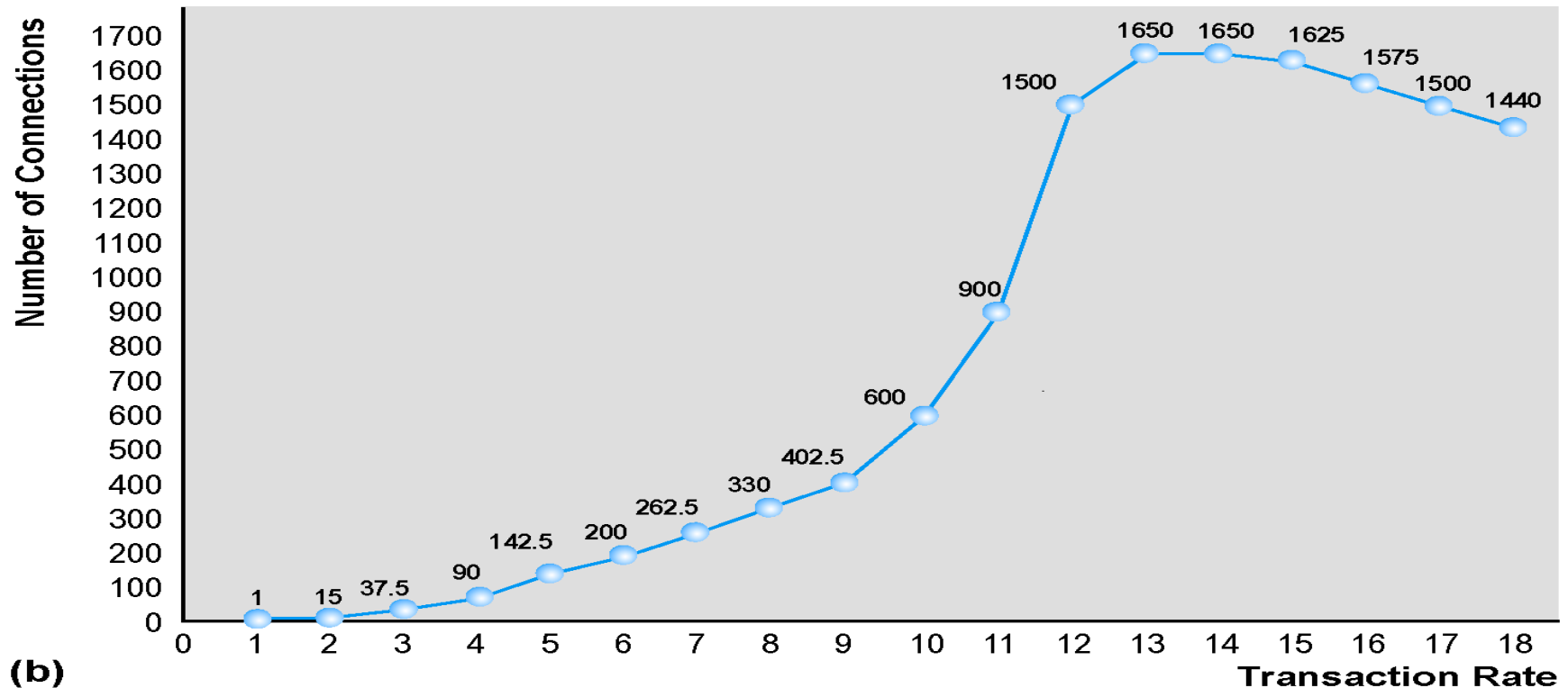
Figure 4.12 (a), Page 218



(a)

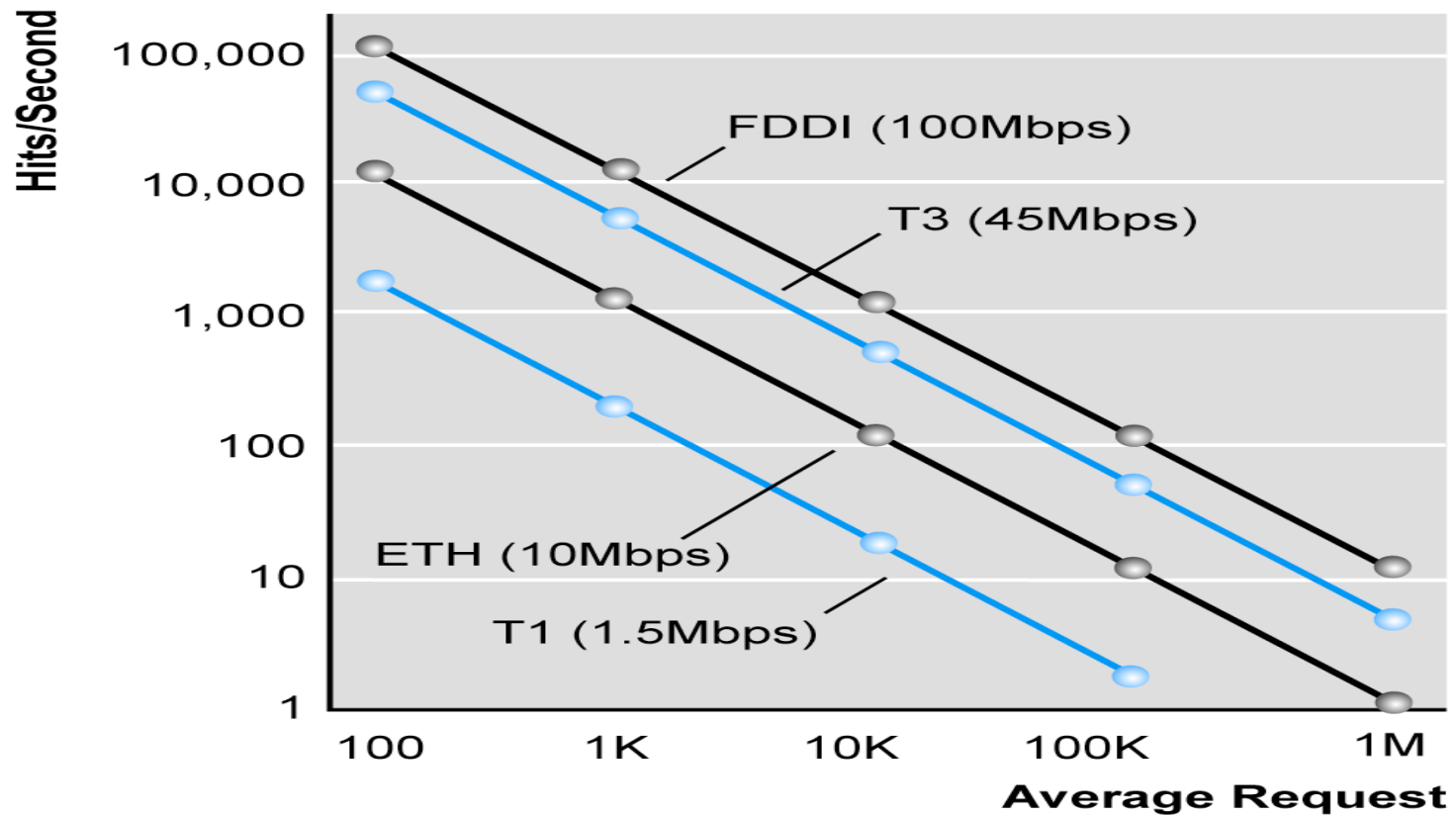
Degradation in Performance as Number of Users Increases

Figure 4.12 (a), Page 218



The Relationship of Bandwidth to Hits

Figure 4.14, Page 221



SOURCE: IBM, 2003.



Right-Sizing Your Hardware Platform: The Supply Side

- Scalability: refers to the ability of a site to increase in size as demand warrants
- Ways to scale hardware:
 - Vertically: increase the processing power of individual components
 - Horizontally: employ multiple computers to share the workload
 - Improve processing architecture

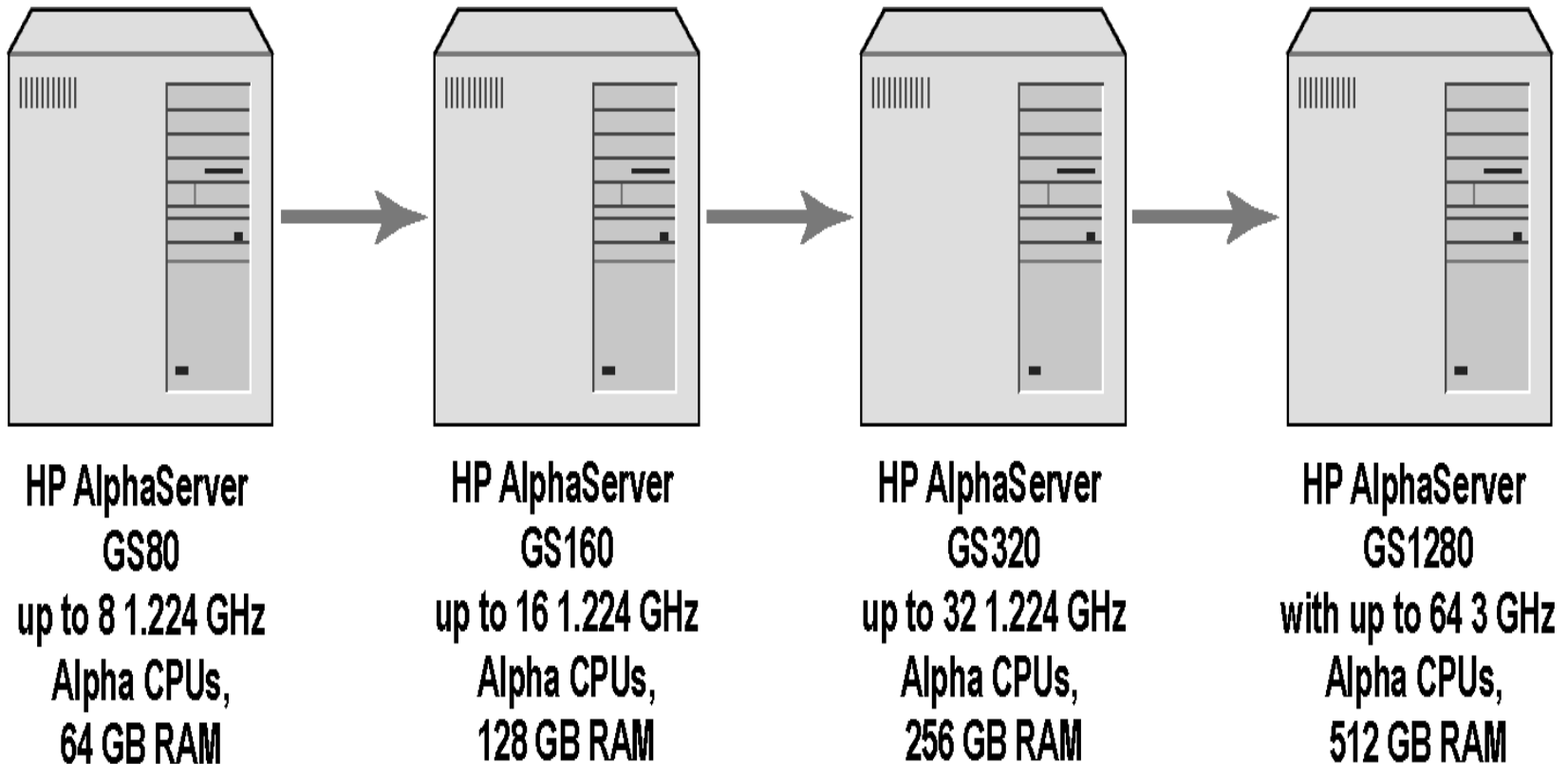
Vertical and Horizontal Scaling Techniques

Table 4.8, Page 222

TABLE 4.8		EIGHT VERTICAL AND HORIZONTAL SCALING TECHNIQUES
TECHNIQUE	APPLICATION	
Use a faster computer	Applies to edge servers, presentation servers, data servers, etc.	
Create a cluster of computers	Use computers in parallel to balance loads	
Use appliance servers	Special-purpose computers optimized for their task	
Segment workload	Segment incoming work to specialized computers	
Batch requests	Combine related requests for data into groups, process as a group	
Manage connections	Reduce connections between processes and computers to a minimum	
Aggregate user data	Aggregate user data from legacy applications in single data pools	
Cache	Store frequently used data in cache rather than on the disk	

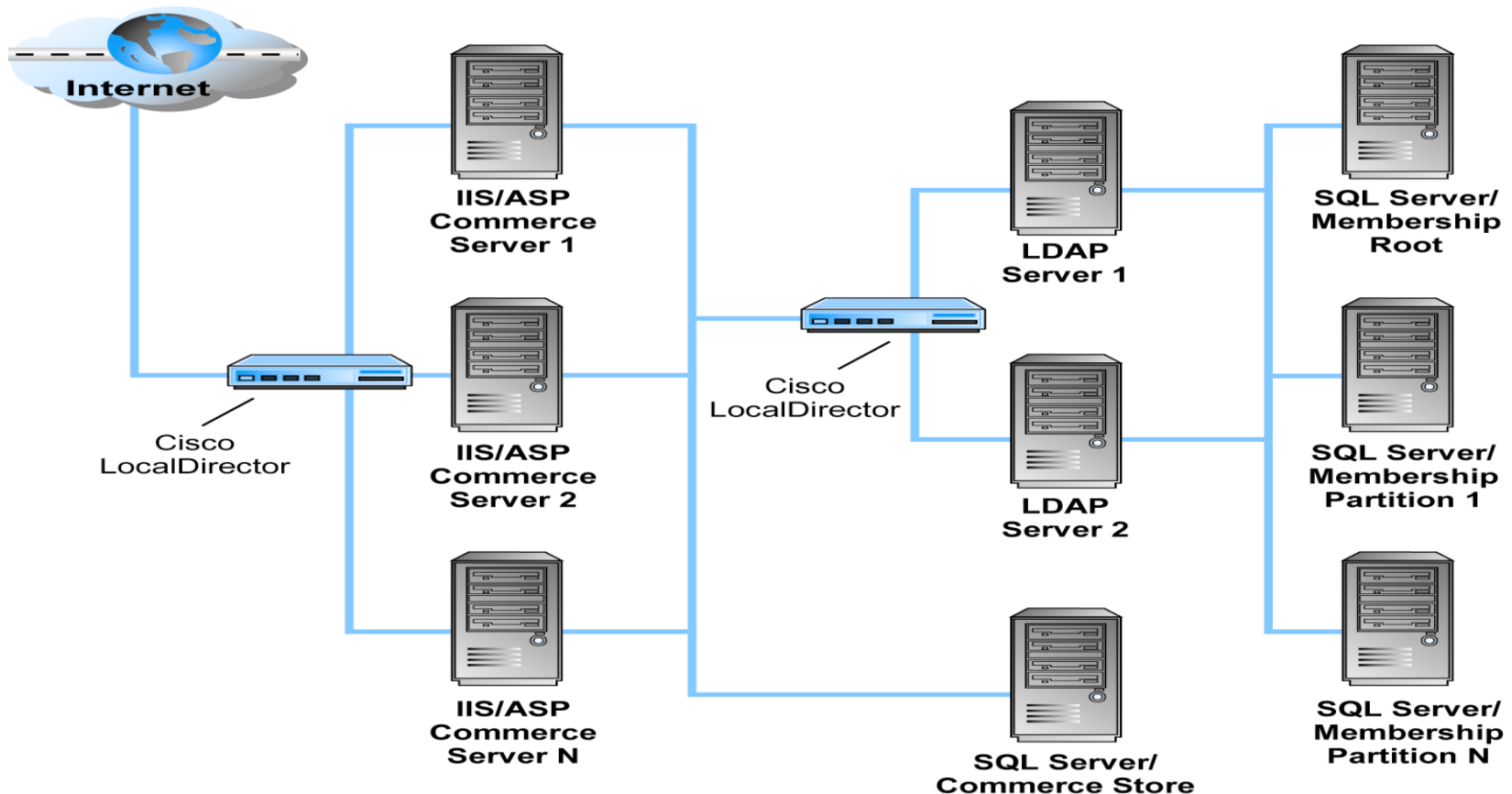
Vertically Scaling a System

Figure 4.15, Page 222



Horizontally Scaling a System

Figure 4.16, Page 223



Improving the Processing Architecture of Your Site

Table 4.9, Page 224

TABLE 4.9 IMPROVING THE PROCESSING ARCHITECTURE OF YOUR SITE	
ARCHITECTURE IMPROVEMENT	DESCRIPTION
Separate static content from dynamic content.	Use specialized servers for each type of workload.
Cache static content.	Increase RAM to the gigabyte range and store static content in RAM.
Cache database lookup tables.	Cache tables used to look up database records.
Consolidate business logic on dedicated servers.	Put shopping cart, credit card processing, and other CPU-intensive activity on dedicated servers.
Optimize ASP code.	Examine your code to ensure it is operating efficiently.
Optimize the database schema.	Examine your database search times and take steps to reduce access times.



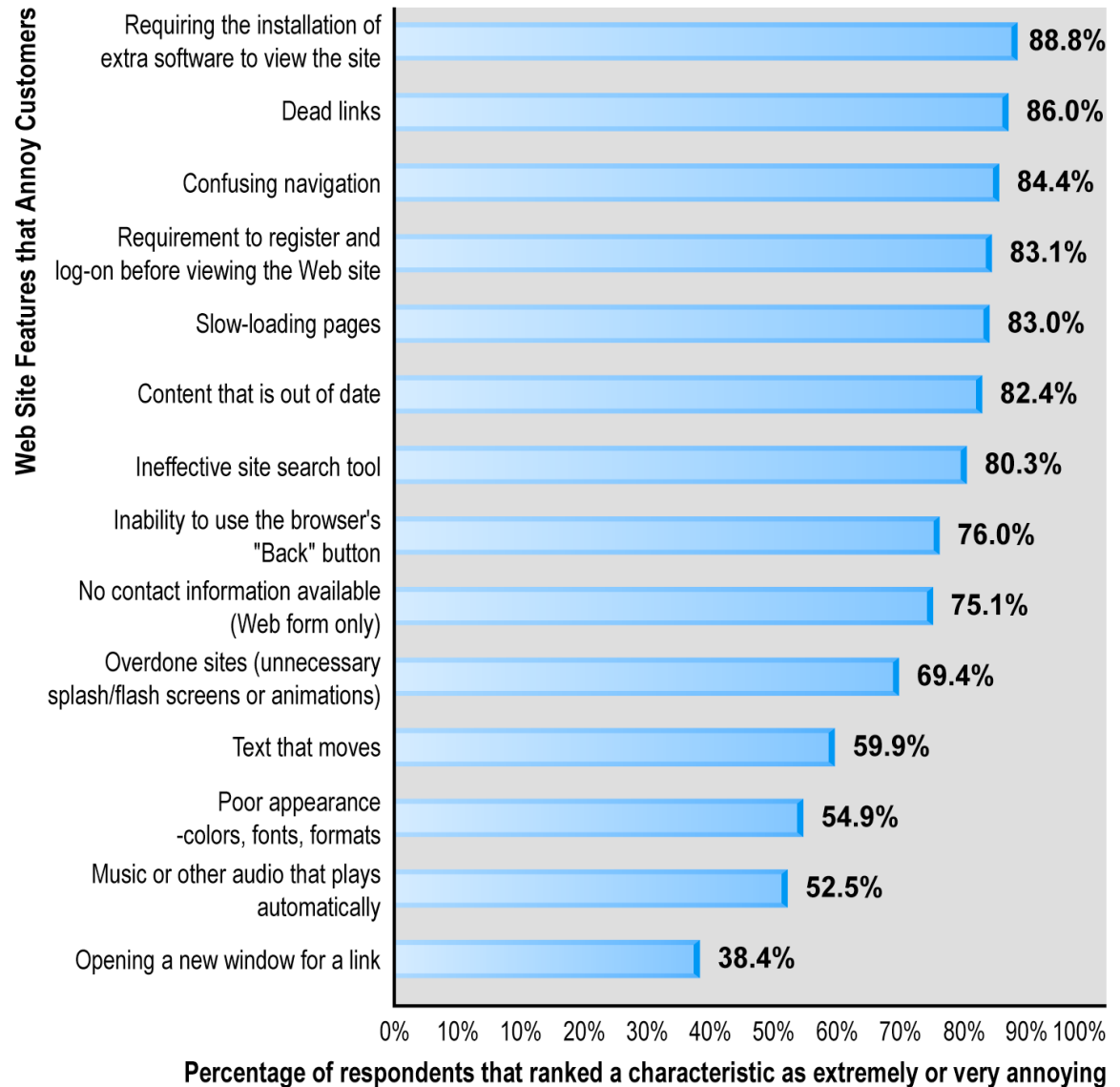
Web Site Design: Basic Business Considerations

- To achieve basic business functionality of a Web site, need to be aware of design guidelines and software tools that can build active content and functionality
- Poorly designed Web sites drive customers away

E-commerce Web Site Features that Annoy Customers

Figure 4.17, Page 225

SOURCE: Based on data from Hostway Corporation's survey, Consumers' Pet Peeves about Commercial Web Sites, Hostway Corporation, 2005.



The Eight Most Important Factors in Successful E-commerce Site Design

Table 4.10, Page 226

TABLE 4.10		THE EIGHT MOST IMPORTANT FACTORS IN SUCCESSFUL E-COMMERCE SITE DESIGN
FACTOR	DESCRIPTION	
Functionality	Pages that work, load quickly, and point the customer toward your product offerings	
Informational	Links that customers can easily find to discover more about you and your products	
Ease of use	Simple fool-proof navigation	
Redundant navigation	Alternative navigation to the same content	
Ease of purchase	One or two clicks to purchase	
Multi-browser functionality	Site works with the most popular browsers	
Simple graphics	Avoids distracting, obnoxious graphics and sounds that the user cannot control	
Legible text	Avoids backgrounds that distort text or make it illegible	

Tools for Interactivity and Active Content

- CGI (Common Gateway Interface): Set of standards for communication between a browser and a program running on a server that allows for interaction between the user and the server
- ASP (Active Server Pages): Enables programmers using Microsoft's IIS package to build dynamic pages
- Java: Allows programmers to create interactivity and active content on the client computer
- JSP (Java Server Pages): Similar to CGI and ASP; allows developers to use a combination of HTML, JSP scripts, and Java to dynamically generate Web pages in response to user requests
- JavaScript: Programming language invented by Netscape that is used to control objects on a Web page and handle interactions with browser



Tools for Interactivity and Active Content (cont'd)

- ActiveX: Programming language invented by Microsoft to compete with Java
- VBScript: Programming language invented by Microsoft to compete with JavaScript
- ColdFusion: An integrated server-side environment for developing interactive Web applications



Insight on Technology: Using Ajax and Flash For Fast Forms and High-Speed Interactivity

Class Discussion

- What is Ajax? How does it work?
- Compare Ajax to the traditional client/server Web model
- How does Google Maps use Ajax?
- What are some alternative ways to achieve the same results as Ajax?



Personalization Tools

- Personalization: Ability to treat people based on their personal qualities and prior history with your site
- Customization: Ability to change the product to better fit the needs of the customer
- Cookies the primary method for achieving personalization and customization



The Information Policy Set

- Privacy policy: Set of public statements declaring how site will treat customers' personal information that is gathered by site
- Accessibility rules: Set of design objectives that ensure disabled users can affectively access site



Insight on Society: Design Your Web Site for Accessibility

Class Discussion

- What is Section 508 of the Rehabilitation Act?
- How many Americans are disabled?
- Why are merchants reluctant to make their sites accessible to disabled Americans?
- How can sites be made more accessible?
- Should all Web sites be required by law to provide “equivalent alternatives” for visual and sound content?