Chapter 4

Building an E-commerce Web Site

Learning Objectives

- Explain the process that should be followed in building an e-commerce Web site
- Describe the major issues surrounding the decision to outsource development and/or hosting
- Identify and understand the major considerations involved in choosing server and e-commerce merchant server software
- Understand the issues involved in choosing the most appropriate hardware for an e-commerce site
- Identify additional tools that can improve Web site performance

Right-Sizing a Web Site? Use a Simulator

- Web site simulators such as IBM's High Volume Web Site (HVWS) Simulator can help answer such questions as
  - How many Web servers does your site require
  - How many CPUs should each server have
  - How powerful does the site's database server need to be
  - What kind of connection speed do you need to the Internet
- The HVWS Simulator uses a queuing model that estimates the performance and capacity of a Web site based on workload patters, performance objectives and specific hardware and software

Right-Sizing a Web Site? Use a Simulator

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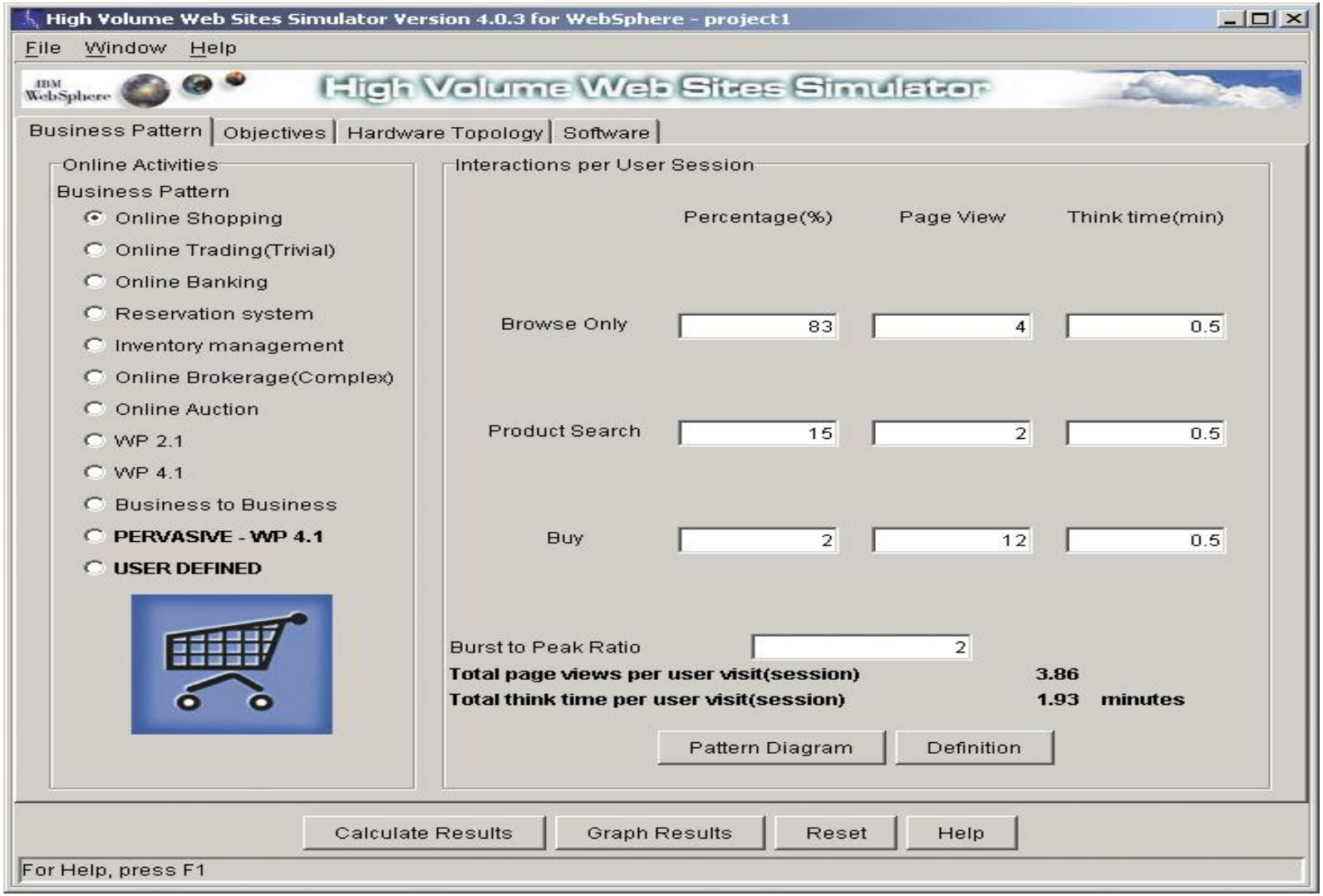


Building an E-commerce Site: A Systematic Approach

- 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

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 200

TABLE 4.1 SYSTEM ANALYSIS: BUSINESS OBJECTIVES, SYSTEM FUNCTIONALITY, AND INFORMATION REQUIREMENTS FOR A TYPICAL E-COMMERCE SITE

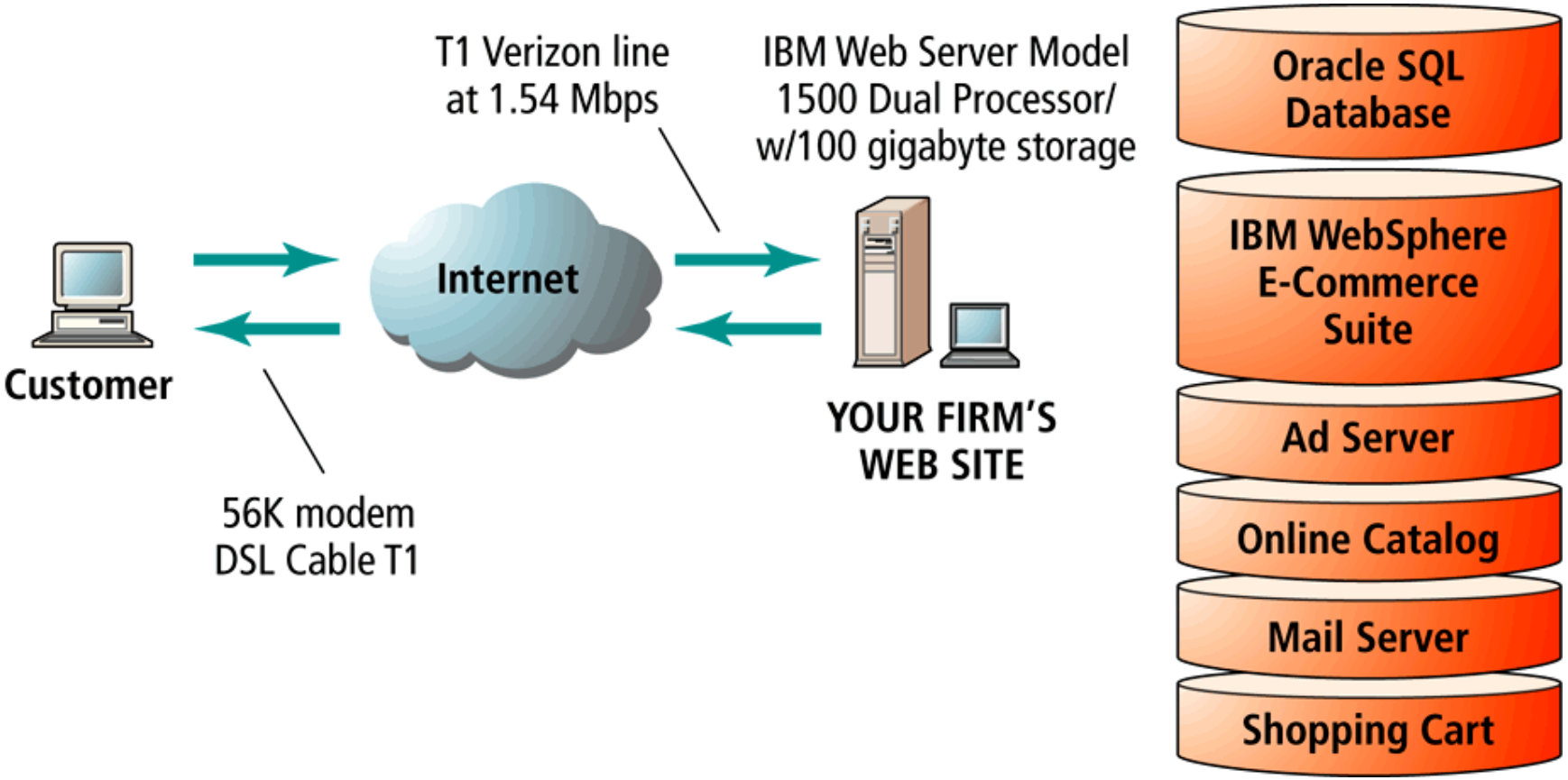
BUSINESS OBJECTIVE	SYSTEM FUNCTIONALITY	INFORMATION REQUIREMENTS
Display goods	Digital catalog	Dynamic text and graphics catalog
Provide product information (content)	Product database	Product description, stocking numbers, inventory levels
Personalize/customize product	Customer on-site tracking	Site 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 includes:
    - Dataflow diagram that describes the flow of information at the site, processing functions that must be performed, and databases that will be used
    - Description of the security and emergency backup systems, and controls that will be used
  - Physical design: translate the logical design into physical components

A Physical Design for a Simple Web Site

Figure 4.3 (b), Page 202

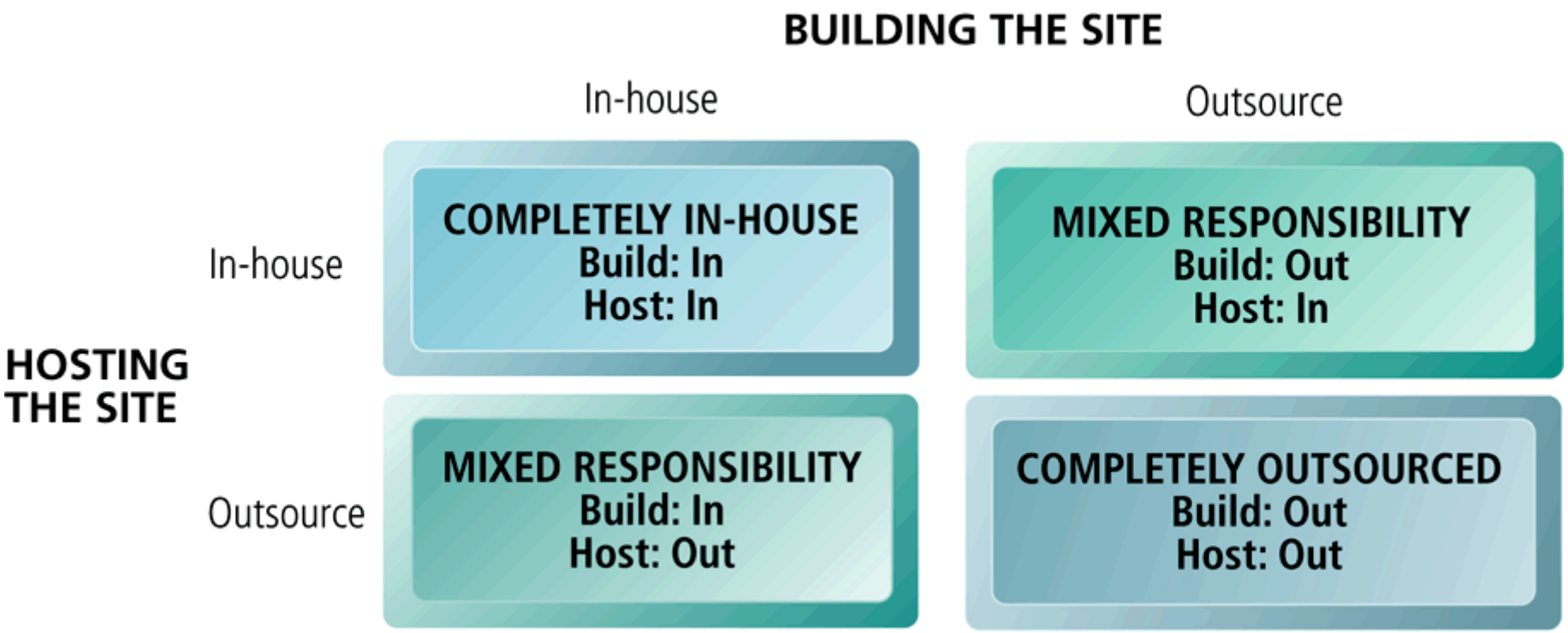


Building the System: In-House versus Outsourcing

- 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

Choices in Building and Hosting

Figure 4.4, Page 203



The Spectrum of Tools for Building Your Own E-commerce Site

Figure 4.5, Page 205

Key Players: Hosting/Co-location Services

Table 4.2, Page 206

TABLE 4.2	KEY PLAYERS: HOSTING/CO-LOCATION SERVICES
Cable and Wireless	Qwest Communications
Equinex	NTT/Verio
IBM Global Services	Rackspace

Testing, Implementation and Maintenance

- Testing:
  - Includes unit testing, system testing and acceptance testing
- Implementation and maintenance:
  - Maintenance is ongoing, with 20% of time devoted to debugging code and responding to emergency situations, 20% with changing reports, data files and links to backend databases; and 60% to general administration and making changes and enhancements to system
  - 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 210

Page Delivery

Content delivery networks
Edge caching
Local bandwidth
Bandwidth

Page Generation

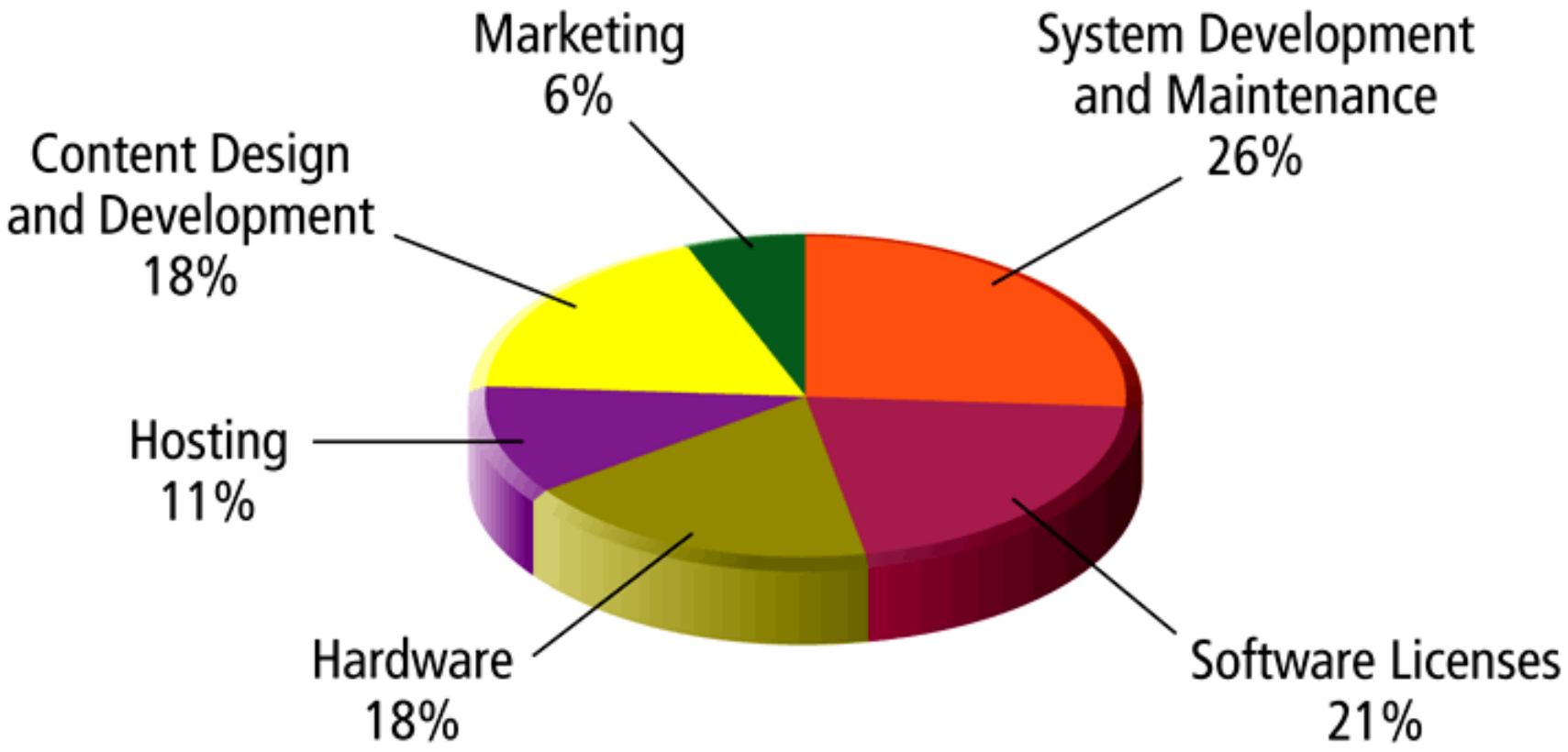
Server response time
Device-based accelerators
Efficient resource allocation
Resource utilization thresholds
Monitoring site performance

Page Content

Optimize HTML
Optimize images
Site architecture
Efficient page style

Components of a Web Site Budget

Figure 4.8, Page 211

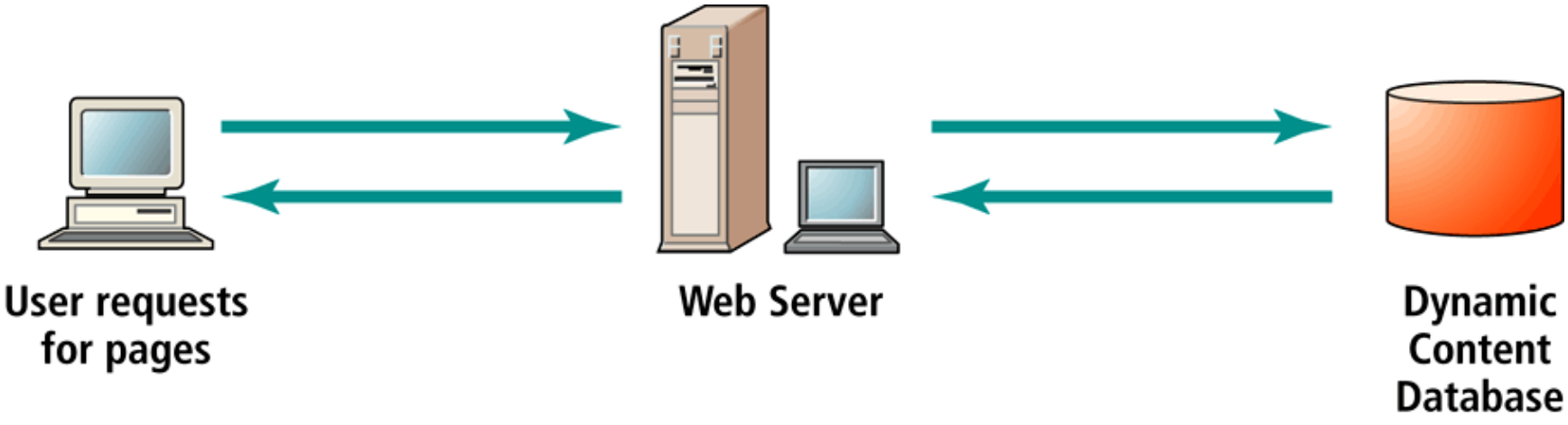


Simple versus Multi-tiered Web Site Architecture

- 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

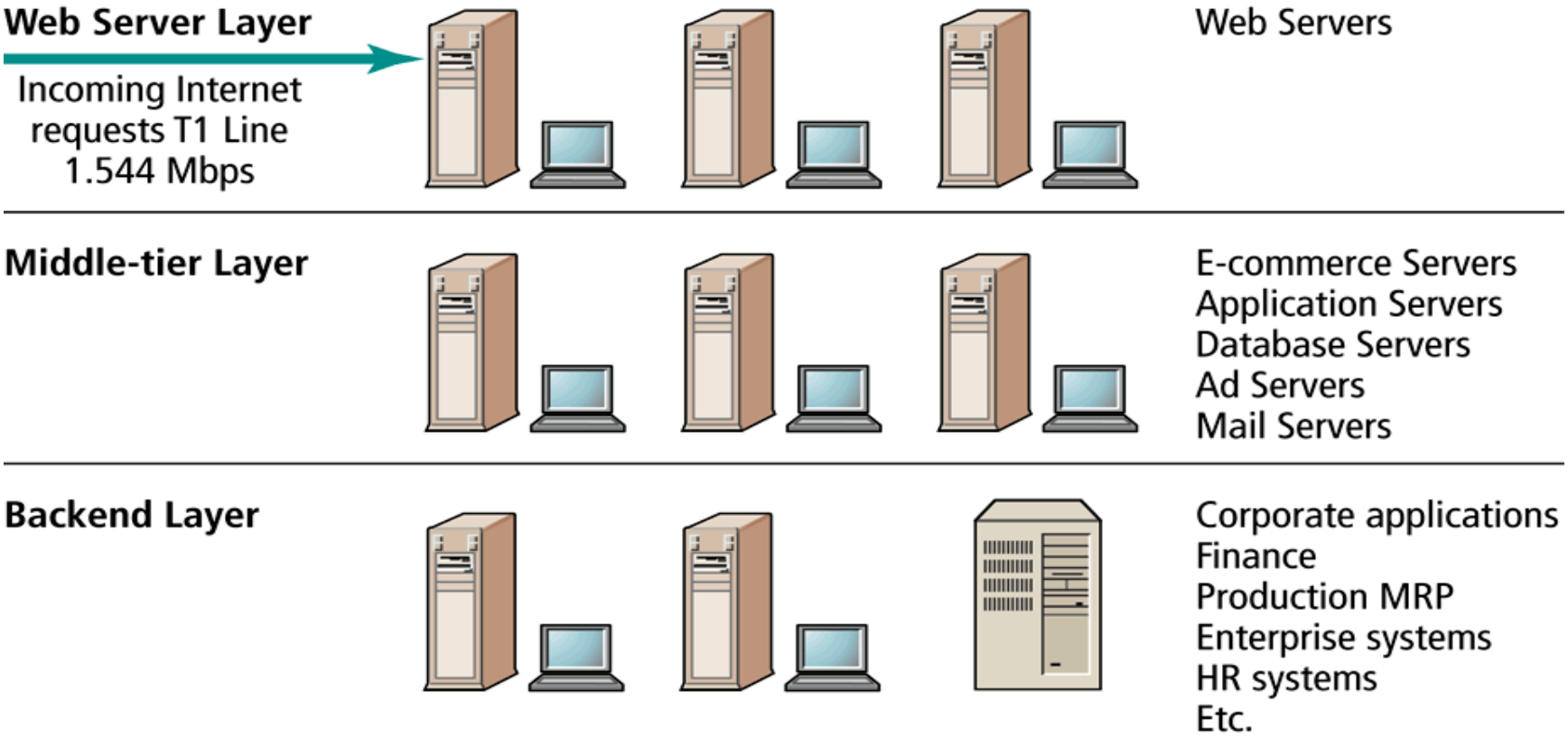
Figure 4.9(a), Page 212



(a) Two-tier Architecture

Multi-tier E-commerce Architecture

Figure 4.9(b), Page 212



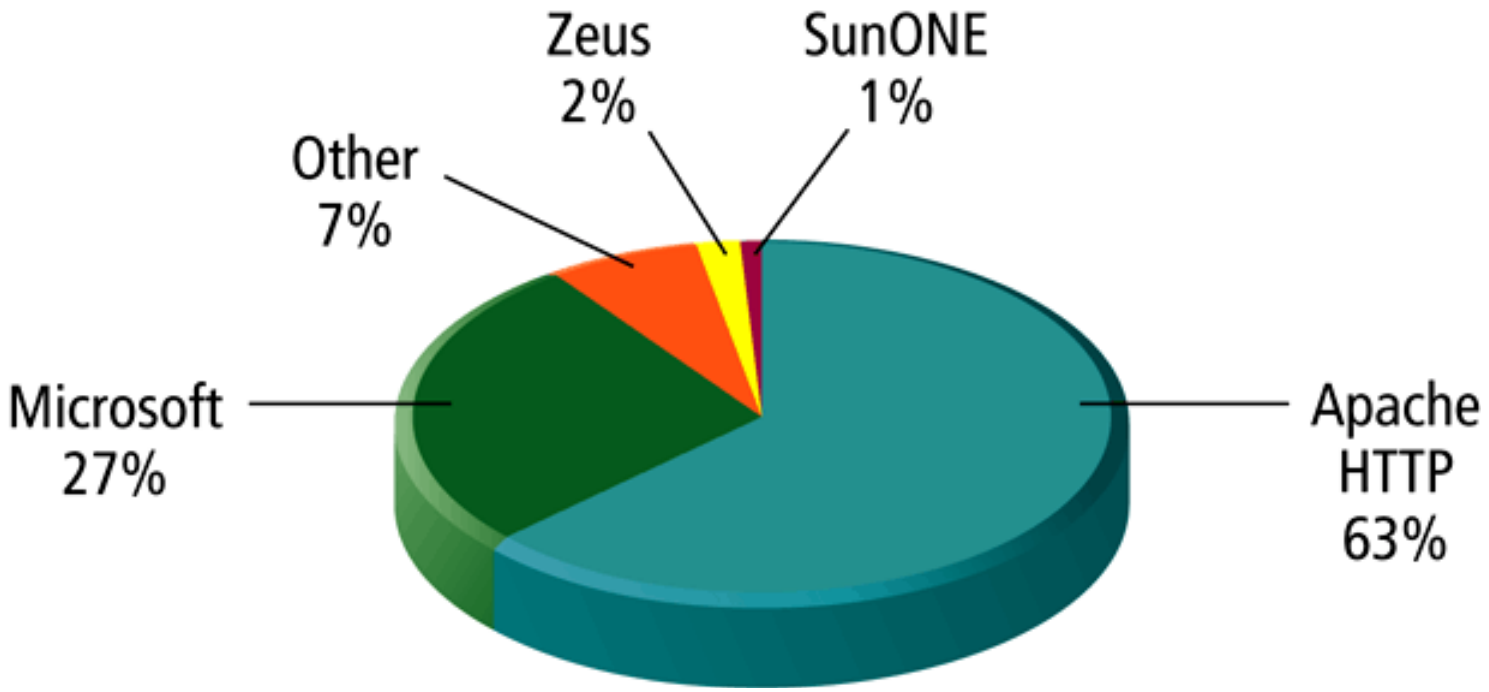
(b) Multi-tier Architecture

Web Server Software

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

Key Players in Web Server Software

Figure 4.10, Page 213



Basic Functionality Provided by Web Servers

Table 4.3, Page 214

TABLE 4.3 BASIC FUNCTIONALITY PROVIDED BY WEB SERVERS

FUNCTIONALITY	DESCRIPTION
Processing of HTTP requests	Receive and respond to client requests for HTML pages
Security services (Secure Sockets Layer)	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

WebTrends Software

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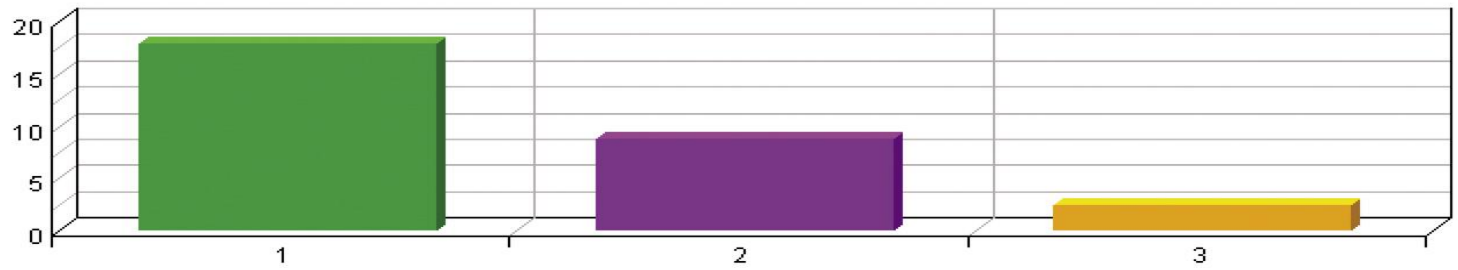
Content Interests by Loyal Visitors



Content Interests by Loyal Visitors

Frequency	Content Interests	Avg. Frequency	Avg. Visit Page Views	Visits
1. Moderately Loyal (16-25 Visits)	support	18.3	9	33
	contact	18.0	10	12
	checkout	18.0	10	11
	products	17.9	8	81
	search	17.9	8	25
2. Somewhat Loyal (6-15 Visits)	business phone systems	13.0	12	2
	default	9.1	15	27
	partners	9.0	9	168
	contact	8.9	10	188
	support	8.8	9	517
3. Dormant (1-5 Visits)	default	2.6	14	200
	calling plans	2.5	9	167
	wireless phones	2.5	9	93
	residential services	2.5	9	27
	register	2.5	10	4,671

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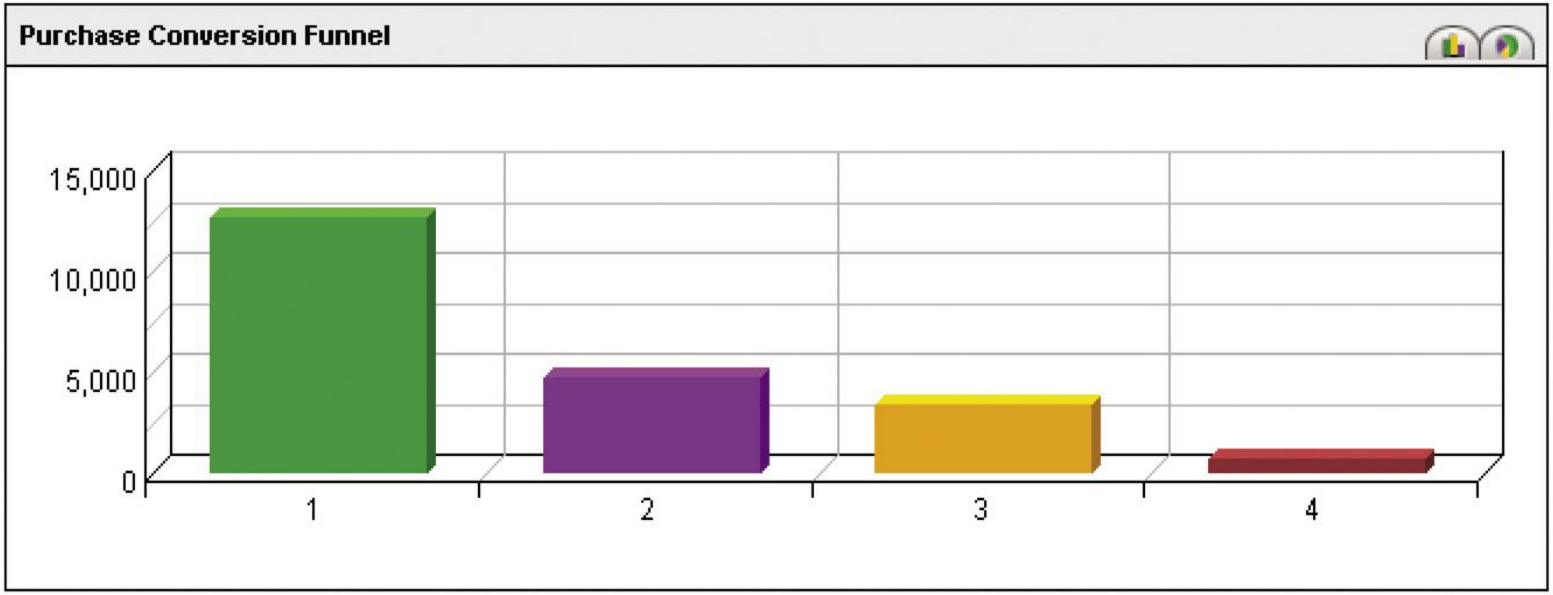
Purchase Conversion Funnel



Purchase Conversion Funnel

	Scenario Analysis Step	Visits	Step Conversion Rate	% of All Visits	Scenario Conversion Rate
1.	Cart View	12,634	-	19.87%	-
2.	Cart Add	4,805	38.03%	7.56%	38.03%
3.	Started Checkout	3,374	70.22%	5.31%	26.71%
4.	Cart Complete	673	19.95%	1.06%	5.33%
	Total	**N/A**	**N/A**	**N/A**	**5.33%**

WebTrends Software

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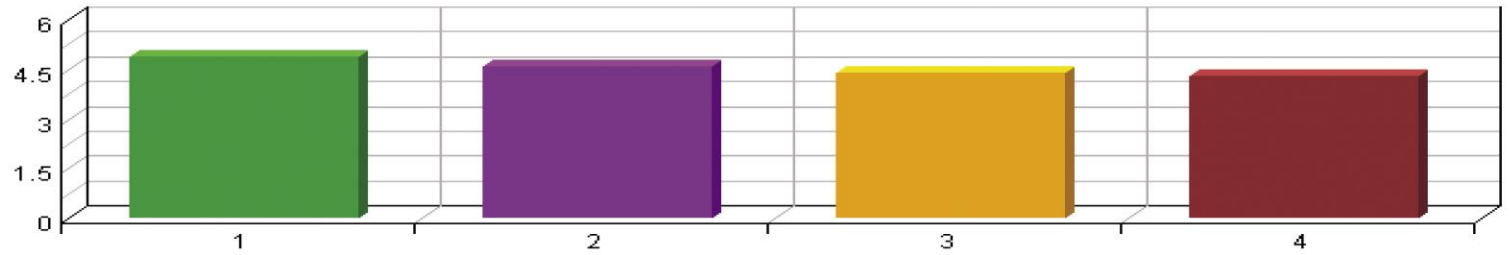
Retention by Initial Search Engine (Paid)



Retention by Initial Search Engine (Paid)

Initial Search Engine	Initial Search Engine Phrase	Avg. Recency	Avg. Frequency	Avg. Latency	Avg. Lifetime Value
1. ask jeeves	wireless phones	5.3	4.1	4.5	$61.72
	dsl service	4.0	2.0	3.7	$0.00
2. overture	dsl service	5.9	2.0	5.9	$0.00
	dsl internet	5.6	3.8	5.1	$24.11
	wireless phone service	4.9	3.3	4.2	$37.75
	wireless phone plan	4.7	1.9	4.2	$7.61
	wireless phones	4.0	4.4	3.7	$29.84
3. looksmart	dsl internet	4.7	3.4	4.1	$64.81
	wireless phone service	4.1	3.9	3.0	$57.01
4. google	dsl service	4.6	2.8	4.5	$30.00
	dsl internet	4.6	3.3	3.8	$49.47
	wireless phone service	4.4	3.7	3.7	$69.31
	wireless phones	4.3	3.5	3.7	$45.94
	wireless phone plan	3.7	3.7	3.5	$39.69

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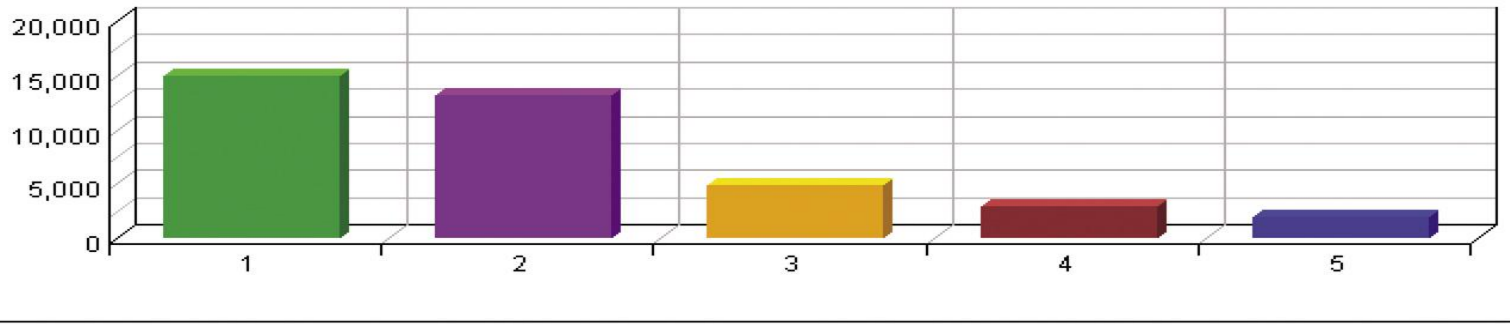
Sales by Campaign Drilldown



Sales by Campaign Drilldown

Campaign	Revenue	Avg. Order Value	Order Count
1. Banner	$14,997.00	$214.24	70
2. Search Engine	$13,223.00	$231.98	57
Yahoo	$8,855.00	$253.00	35
phone accessories	$2,802.00	$400.29	7
mobile	$2,436.00	$270.67	9
minutes offer	$1,524.00	$381.00	4
wireless	$1,454.00	$145.40	10
cell phone	$639.00	$127.80	5
Lycos	$2,056.00	$205.60	10
Google	$1,516.00	$168.44	9
Microsoft Network	$796.00	$265.33	3
3. Print	$4,814.00	$192.56	25
4. Television	$2,878.00	$359.75	8
5. Email	$1,879.00	$156.58	12
Total	**$37,791.00**	**N/A**	**172**

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 218

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

Widely Used Midrange and High-end E-commerce Suites

Table 4.5, Page 220

TABLE 4.5 WIDELY USED MIDRANGE AND HIGH-END E-COMMERCE SUITES

PRODUCT	APPROXIMATE PRICE
Microsoft Commerce Server 2002 Enterprise Edition	$6,999 for Standard edition, $19,999 per processor for Enterprise Edition
IBM WebSphere Commerce Professional Entry Edition	$20,000 per processor
IBM WebSphere Commerce Professional Edition	$80,000 per processor
Broadvision One-to-One Commerce	$60,000 per processor
InterWorld Commerce Exchange 6.0	$65,000
Intershop United Commerce Management/EnfinityB2C Solution	$125,000–$250,000
Blue Martini Commerce	$1,000,000+

Choosing the Hardware for an E-commerce Site

- Hardware platform: refers to all the underlying computing equipment that the system users 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,

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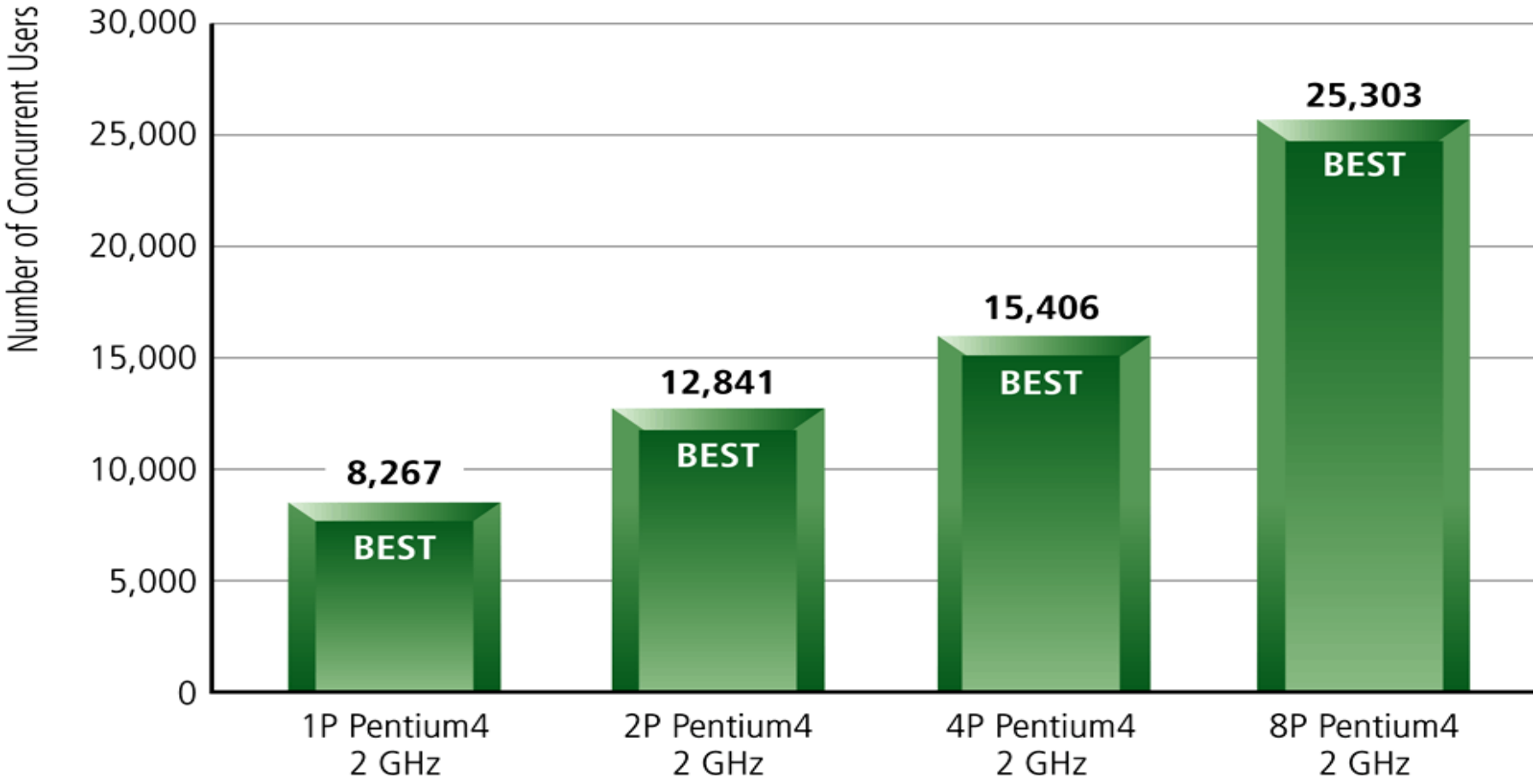
TABLE 4.6 FACTORS IN RIGHT-SIZING AN E-COMMERCE PLATFORM

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

Capacity of Static Page Web Servers

Figure 4.12, Page 225



Visitor Profile at Typical E-commerce Sites

Table 4.7, Page 225

TABLE 4.7 VISITOR PROFILE AT TYPICAL E-COMMERCE SITES

VISITOR ACTIVITY	PERCENTAGE OF VISITORS
Browse	76%
Search for content	51%
Shop and purchase goods	44%

SOURCE: UCLA Internet Report, 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

Eight Vertical and Horizontal Scaling Techniques

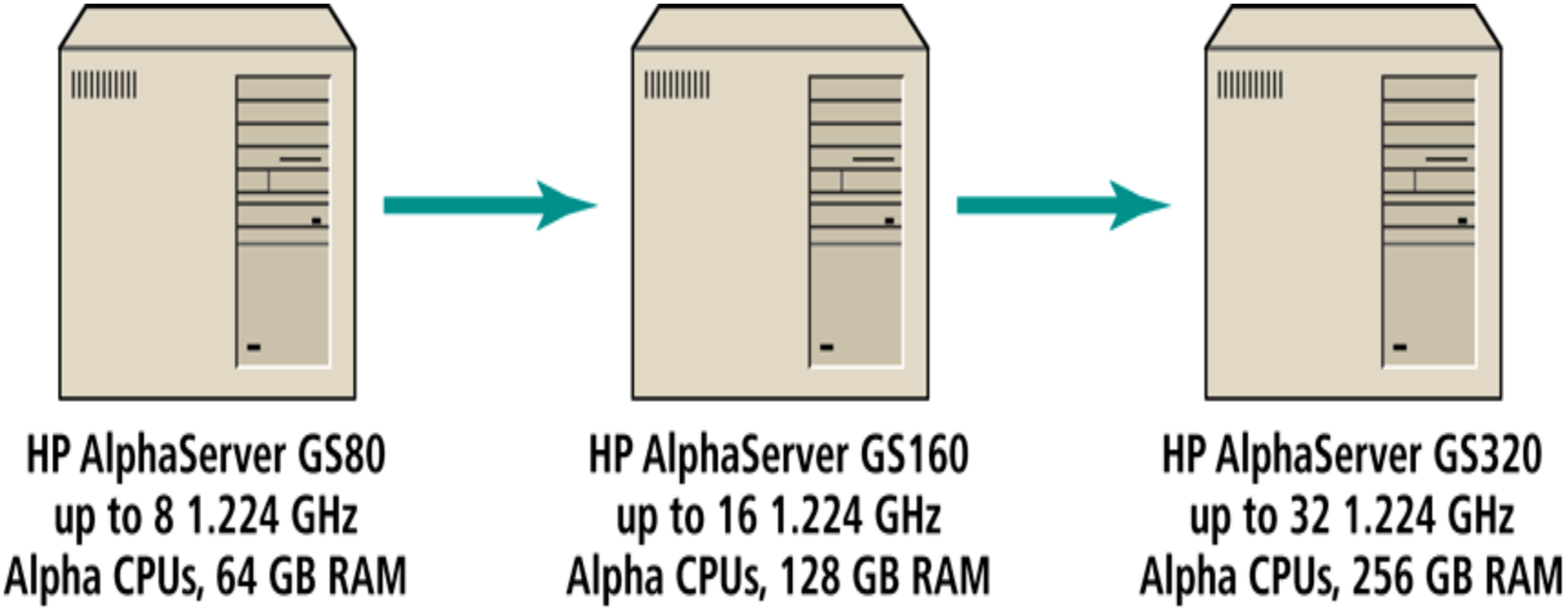
Table 4.8, Page 228

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

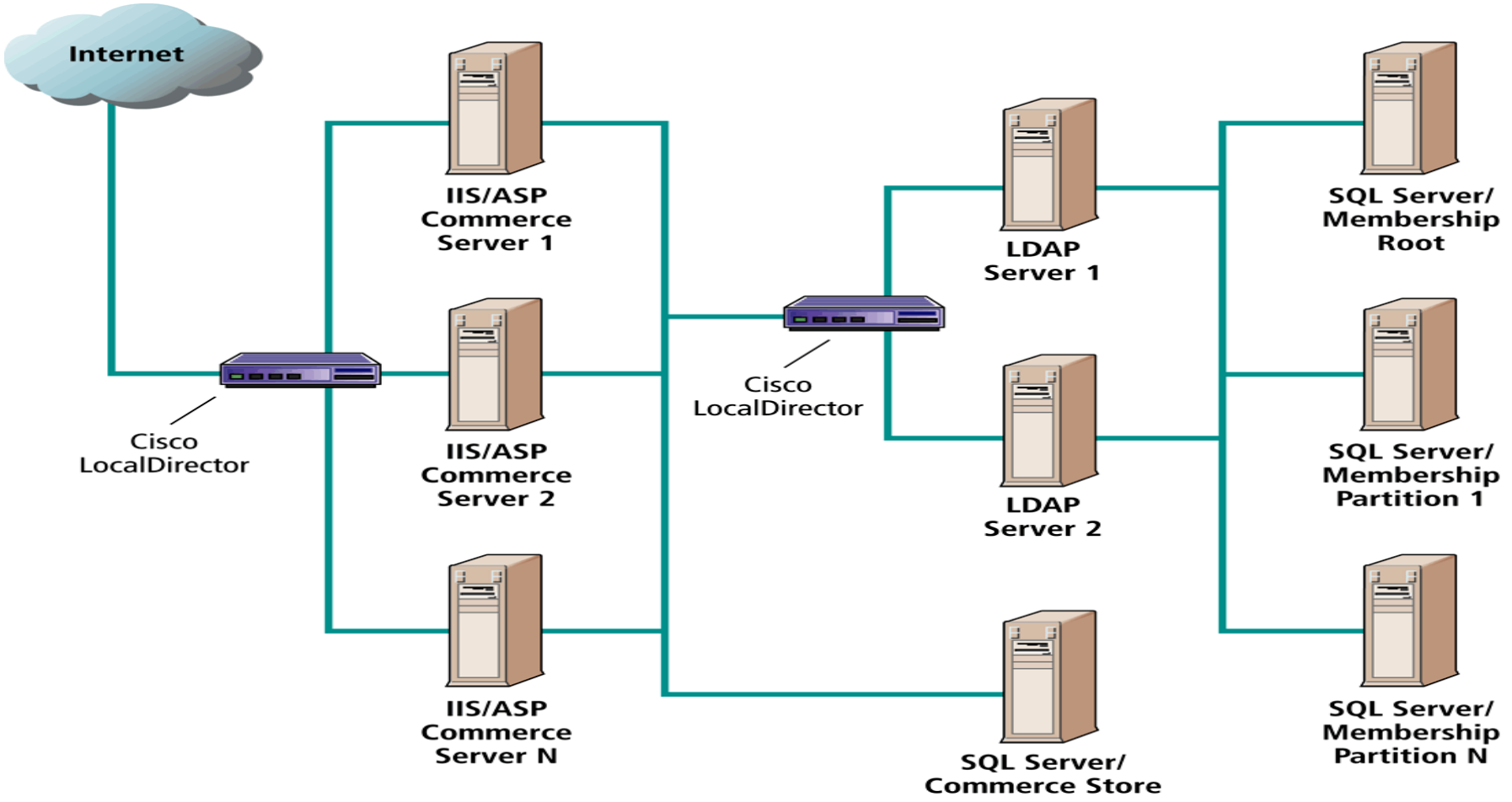
Vertically Scaling a System

Figure 4.15, Page 228



Horizontally Scaling a System

Figure 4.16, Page 229



Improving the Processing Architecture of Your Site

Table 4.9, Page 230

TABLE 4.9 IMPROVING THE PROCESSING ARCHITECTURE OF YOUR SITE

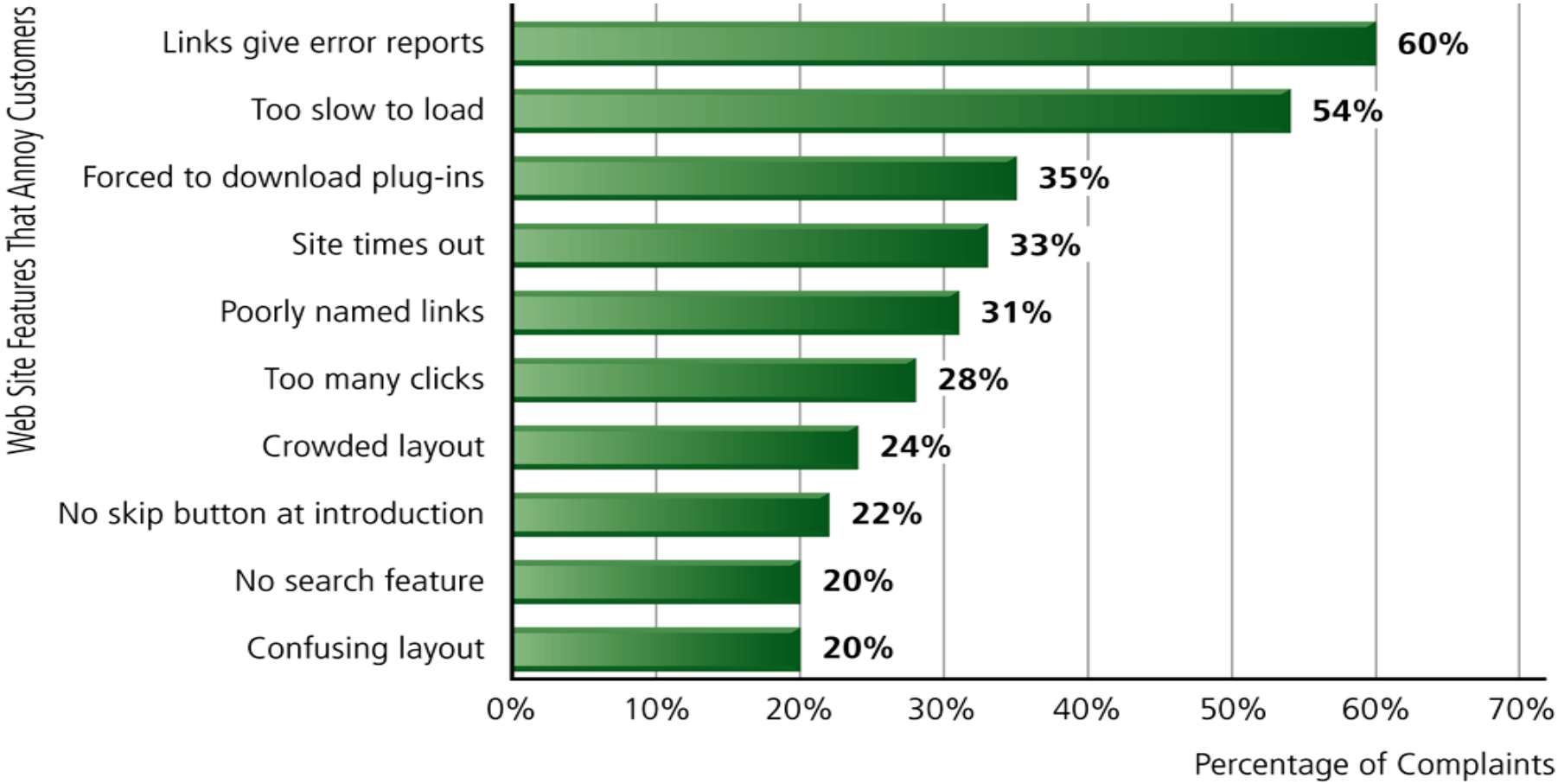
ARCHITECTURE IMPROVEMENT	DESCRIPTION
Separate static content from dynamic content.	Use specialized servers for each type of workload.
Cache static content.	Increase RAM to the gigabyte range and store static content in RAM.
Cache database lookup tables.	Cache tables used to look up database records.
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

Web Site Features that Annoy Customers

Figure 4.17, Page 231



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

Table 4.10, Page 232

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 f

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

- Section 508, Rehabilitation Act: Requires Web sites of federally funded organizations to be accessible to users who are blind, deaf, blind and deaf, or unable to use a mouse
- Americans with Disabilities Act (ADA): recent Federal district court decision ruled that ADA applies only to physical spaces, not virtual spaces such as Web
- Design strategies that can improve accessibility include:
  - Embedding text descriptions behind images
  - Allowing users to set color and font schemes
  - Adding screen magnification tools and sound labels
  - Using features that enable page activation via a variety of input devices