E-commerce

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Fourth Edition

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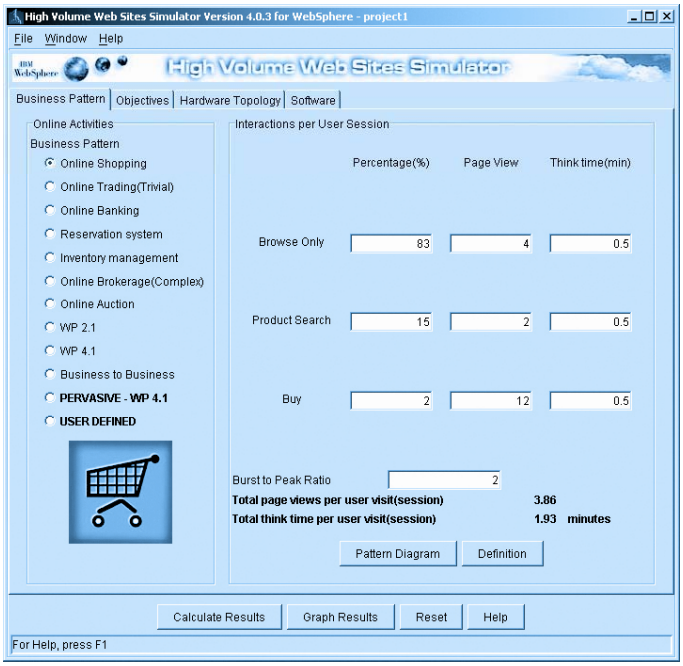
Chapter 4

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?
- Why is peak usage an important factor to consider?
- What did eBay discover from its use of OPERA?
- How can operators of smaller sites deal with the right-sizing issue?

IBM's High Volume Web Sites Simulator



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

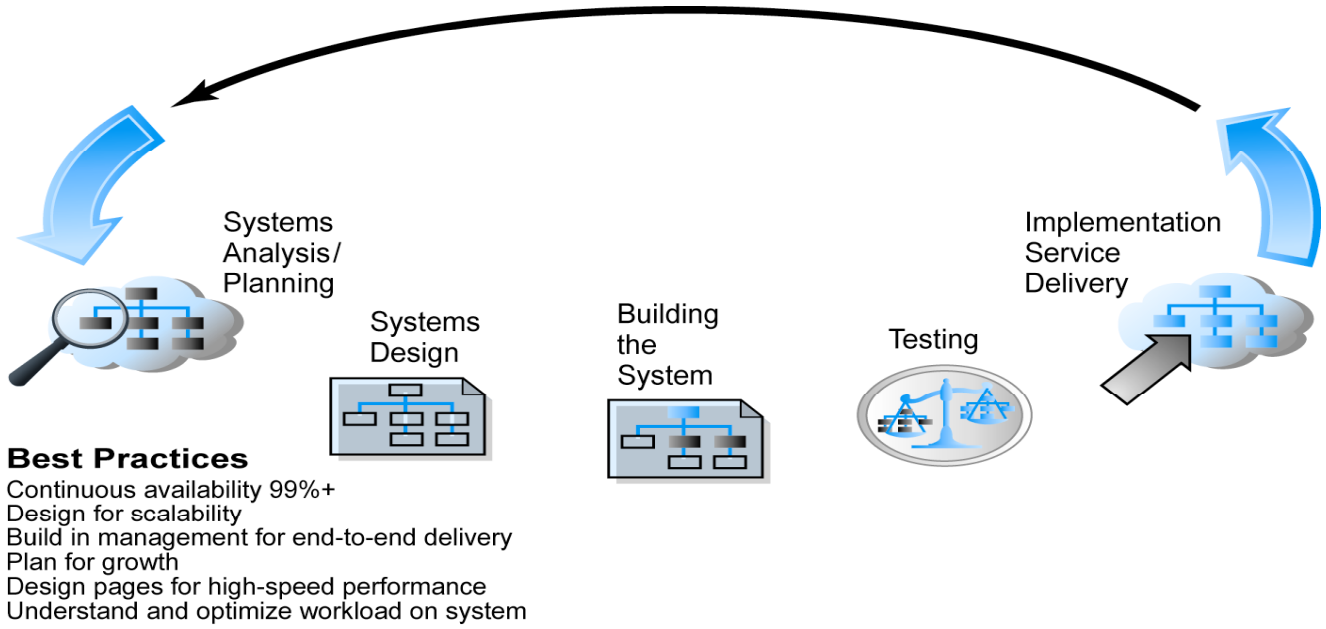
- Main areas where you will need to make decisions in building a site include:
  - Human resources and organizational capabilities—creating a team that has the skill set to build and manage a successful site
  - Hardware
  - Software
  - Telecommunications
  - Site design

The Systems Development Life Cycle

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

Web Site Systems Development Life Cycle

Figure 4.2, Page 201



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

- Business objectives: List of capabilities you want your site to have
- System functionalities: List of the types of information system capabilities you need to achieve your business objectives
- Information requirements: 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 202

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

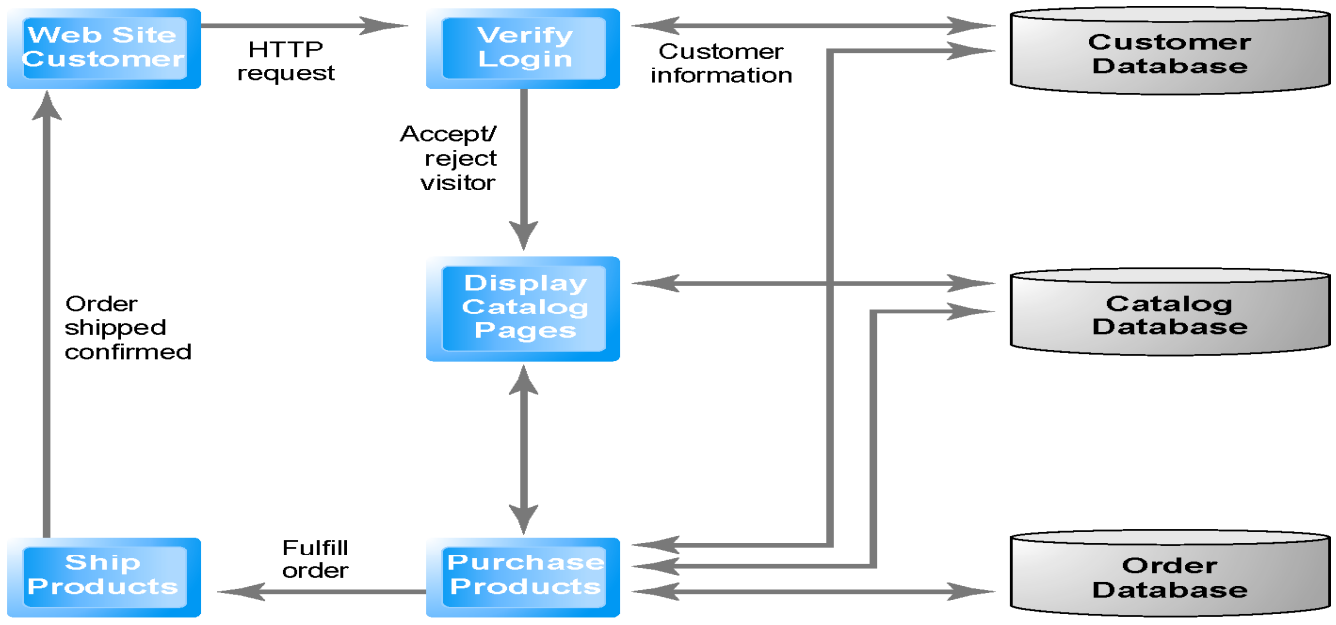
BUSINESS OBJECTIVE	SYSTEM FUNCTIONALITY	INFORMATION REQUIREMENTS
Display goods	Digital catalog	Dynamic text and graphics catalog
Provide product information (content)	Product database	Product description, stocking numbers, inventory levels
Personalize/customize product	Customer on-site tracking	Site log for every customer visit; data mining capability to identify common customer paths and appropriate responses
Execute a transaction payment	Shopping cart/payment system	Secure credit card clearing; multiple 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	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: 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 – data flow diagram, processing functions to be performed, and database to be used
  - Physical design – translates logical design into physical components (HW, SW, link capacity)

A Logical Design for a Simple Web Site

Figure 4.3 (a), Page 204

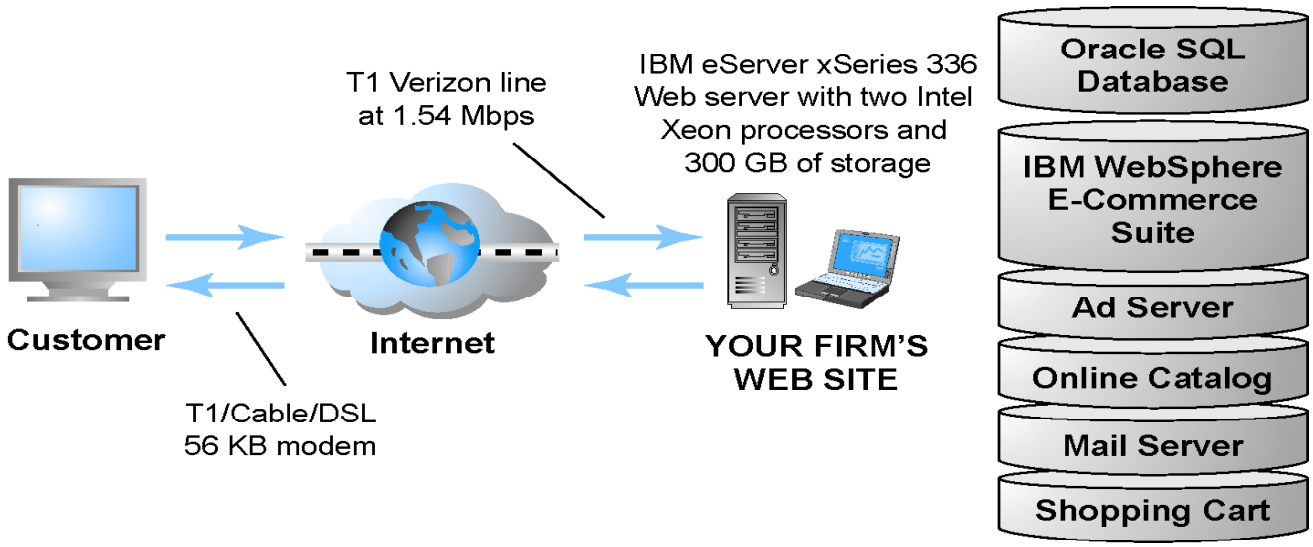


(a) Simple Data Flow Diagram

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 204



(b) Simple Physical Design

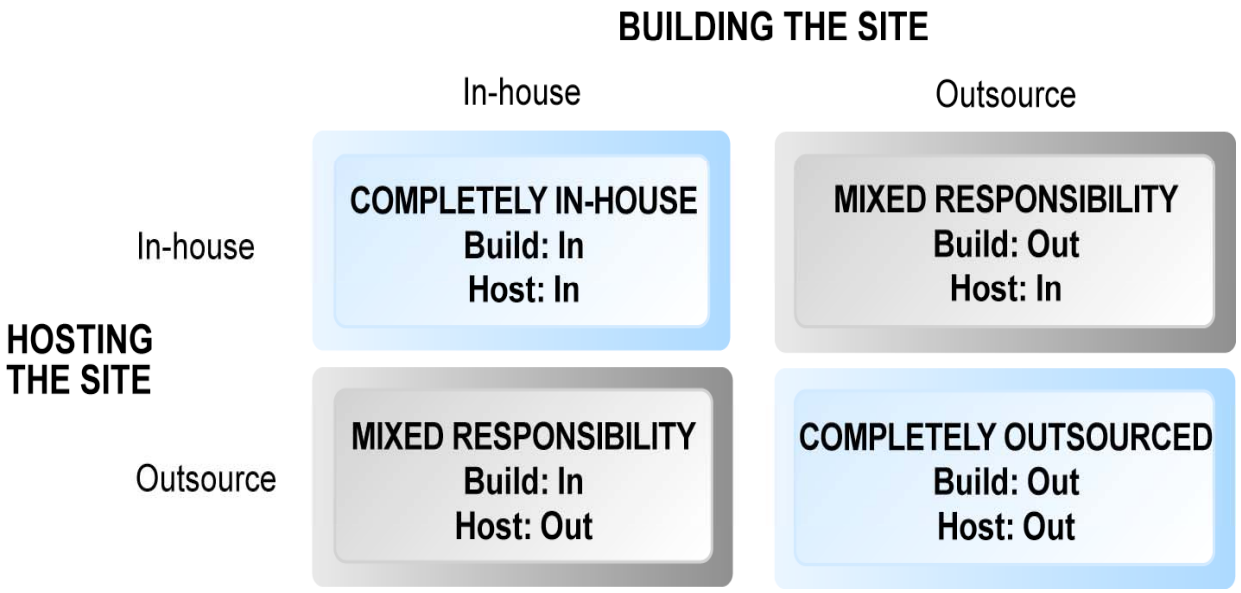
A physical design describes the hardware and software needed to realize the logical design

Building the System: In-House versus Outsourcing

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

Choices in Building and Hosting

Figure 4.4, Page 205



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

Economical but most difficult, achieve desired "look and feel" and functionality, but most time consuming

Most expensive, but achieve desired "look and feel" and functionality, and less time consuming

Cheapest and simplest, but limited "look and feel" and functionality

Key Players: Hosting/Co-Location Services	
GoDaddy.com	Qwest Communication
Oneandone.com	NTT/Verio
IBM Global Services	Rackspace
MOSSO	ServerBeach

Testing, Implementation, and Maintenance

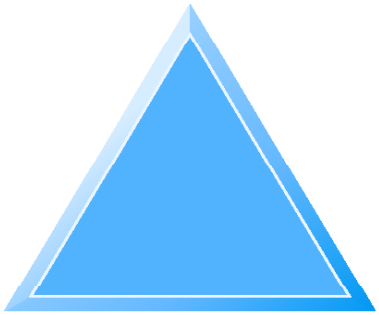
- Testing: Includes unit testing, system testing, and acceptance testing by management personnel
- Implementation and maintenance:
  - Maintenance is ongoing
  - Need continual checking, testing, and repair
  - Maintenance cost roughly equals development cost
  - Benchmarking: process by which site is compared to those of competitors in terms of response speed, quality of layout, and design

Factors in Web Site Optimization

Figure 4.7, Page 211

Page Delivery

Content delivery networks
Edge caching
Bandwidth



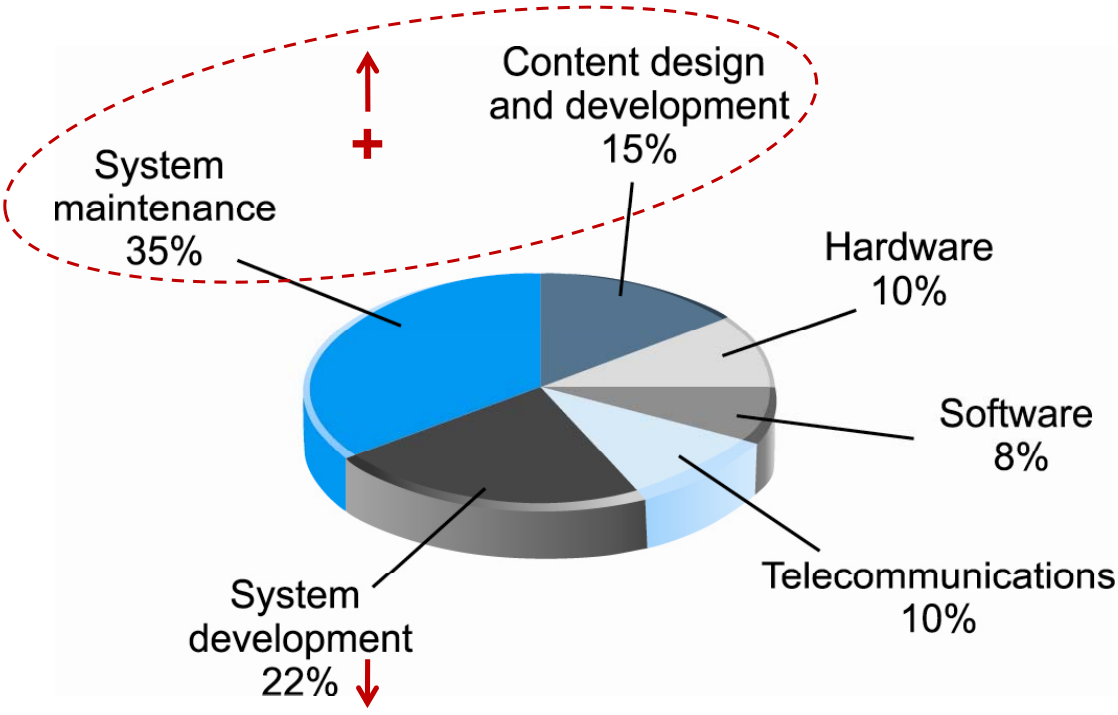
Page Generation

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

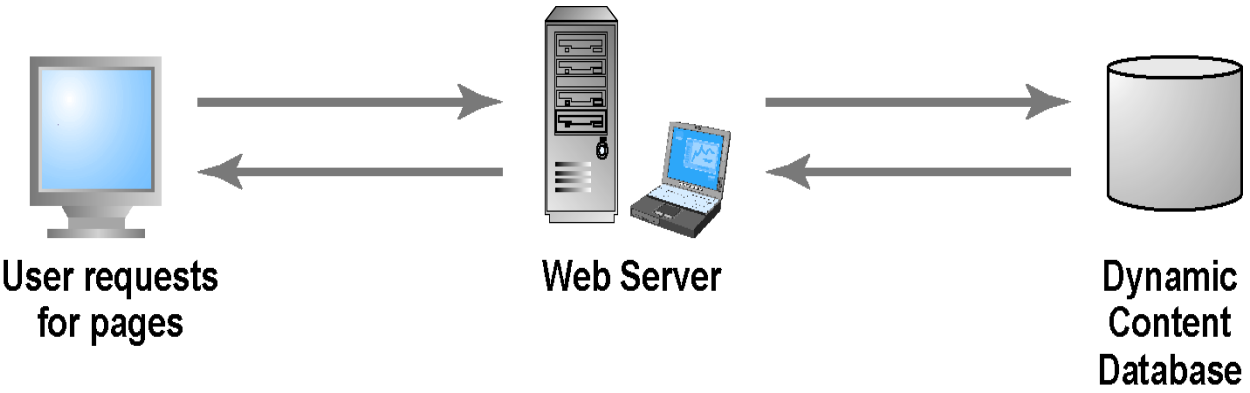


Simple versus Multi-tiered Web Site Architecture

- 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 214



(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

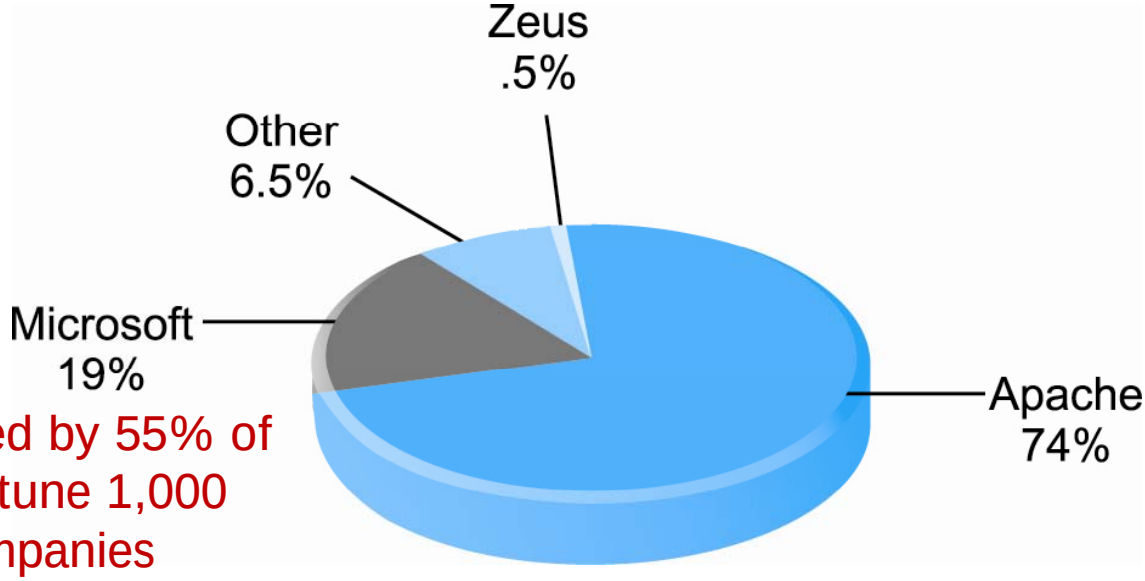
(b) Multi-tier Architecture

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 the leading Web server software; works with UNIX, Linux, and Windows operating systems
- Microsoft's Internet Information Server (IIS) the second major Web server software

Key Players in Web Server Software



Used by 55% of Fortune 1,000 companies

Advantages of Each Web Server Software

- Choice of Web server software has no effect on the look of Web pages delivered to customers
- Advantages
  - Microsoft's development suite: integrated, powerful, and easy to use
  - Unix's suite: exceptionally reliable and stable, and supported by worldwide open software community

Basic Functionality Provided by Web Servers

Table 4.3, Page 216

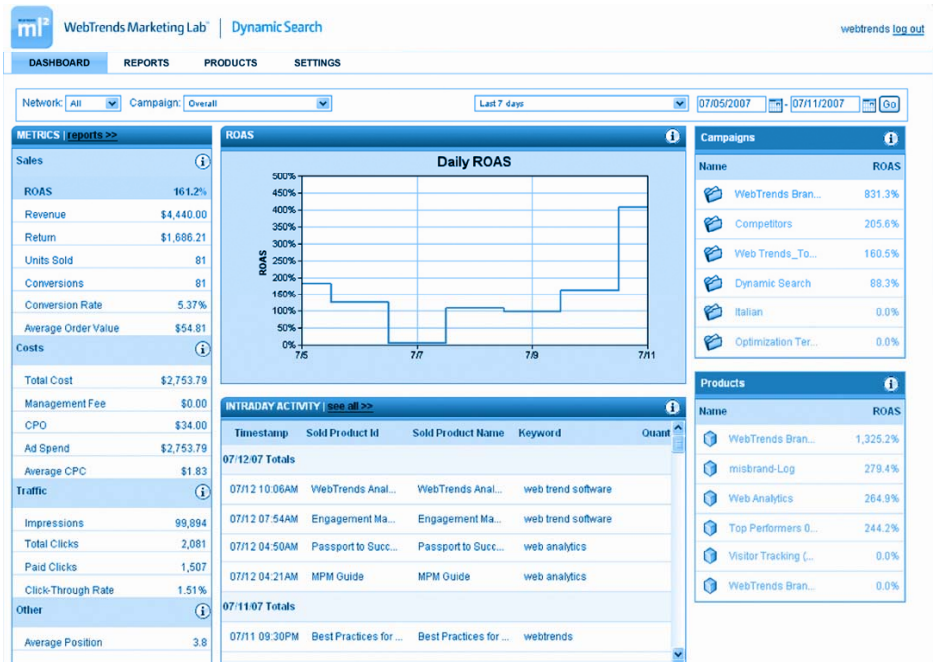
TABLE 4.3 BASIC FUNCTIONALITY PROVIDED BY WEB SERVERS

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

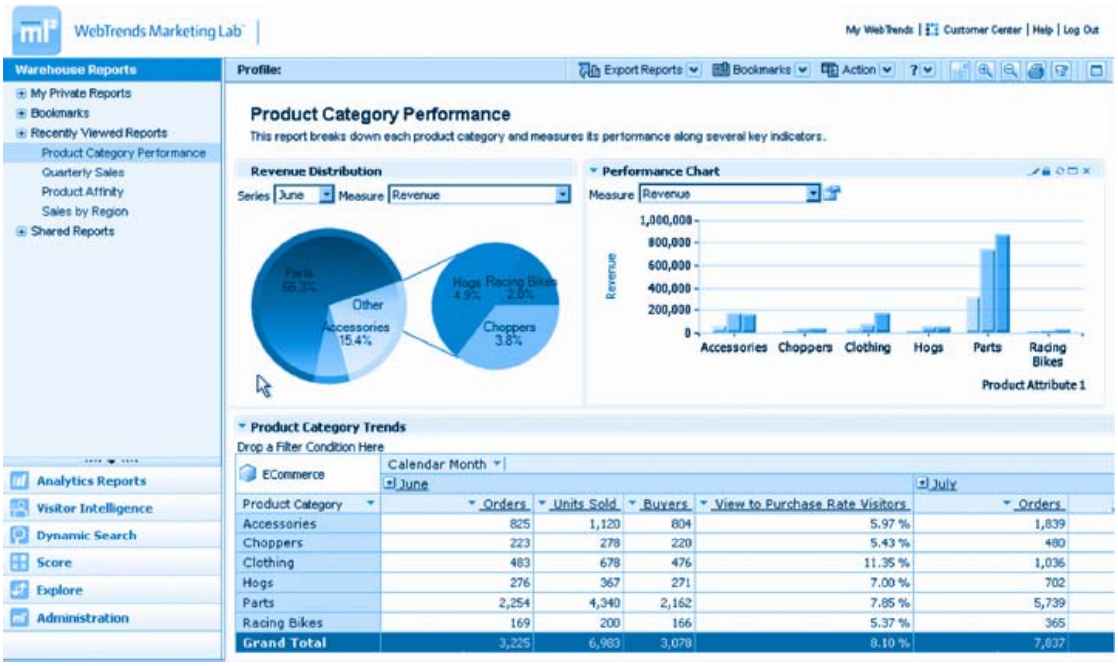
Site Management Tools

- 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 to monitor customer purchases, marketing campaign effectiveness, and keeping track of standard hit counts and page visit info

Webtrends Marketing Lab2



Webtrends Marketing Lab2



Dynamic Page Generation Tools

- Driven by the fact that it's easier to change the contents of a database than it's to change the code of an HTML page
- Dynamic page generation: contents of Web page stored as objects in database rather than being hard-coded in HTML; are fetched when needed from database
- Tools include CGI (Common Gateway Interface), ASP (Active Server Pages), JSP (Java Server Pages)
- Lowers menu costs (costs incurred for changing product descriptions and prices), permits easy online market segmentation (can sell same product to different markets), and enables cost-free price discrimination (can sell same product to different customers at different prices)

Application Servers

- Web application servers: Provide specific business functionality required of a Web site
- Basic idea: to isolate the business applications from the details of displaying Web pages to users on front end and details of connecting to databases on back end
- Example of middleware software
- Number of different types available, providing a variety of functionality

Application Servers and Their Functions

Table 4.4, Page 220

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

- Provides the basic functionality needed for online sales: Online catalog, shopping cart, credit card processing
- Merchant server software packages: Offer integrated environment that provides functionality and capabilities needed to develop sophisticated, customer-centric site
  - Basic packages: Bizland, Hypermart, Yahoo! Small Business Merchant Solutions, Freewebs.com, Paypal.com
  - Midrange suites: IBM's WebSphere Commerce Express, MS's Commerce Server 2007
  - High-end packages: IBM's WebShpere Commerce Pro & Enterprise, Broadvision Commerce

Merchant Server Software Packages (E-commerce Suites)

- 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

Building Your Own E-Commerce Site: Web Services and Open Source Options

- Suitable for small and startups firms
- 2 options depending on programming skill and time available
  - Utilize e-commerce merchant services: Yahoo's Small Business Merchant Solutions, Freemerchant.com, Bigstep.com, Entrabase.com, Tripod.com
  - Utilize open source merchant server software:
    - Web server: Apache;
    - Shopping cart: OSCommerce, ZenCart, AgoraCart;
    - Credit card processing: Echo Internet Gateway, ASPDotNetStorefront;
    - Database: MySQL;
    - Programming Language: PHP, PERL;
    - Analytics: Google Analytics

Choosing the Hardware for an E-commerce Site

- Hardware platform: refers to all the underlying computing equipment that 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 site is the most important factor affecting the speed of site
- Factors involved in demand include:
  - Number of simultaneous users in peak periods
  - Nature of customer requests (user profile)
  - Server Network Bandwidth
  - 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

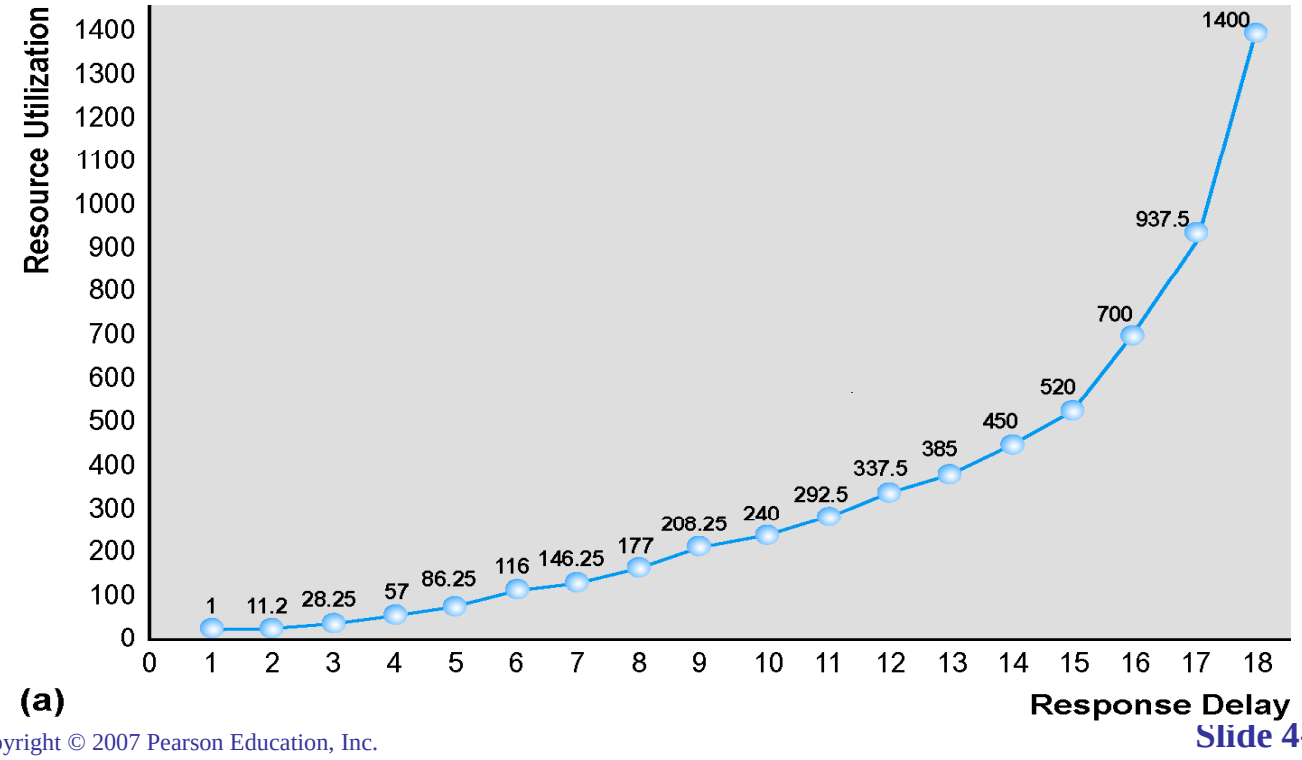
Table 4.7, Page 225

TABLE 4.7 FACTORS IN RIGHT-SIZING AN E-COMMERCE PLATFORM

SITE TYPE	PUBLISH/ SUBSCRIBE	SHOPPING	CUSTOMER SELF-SERVICE	TRADING	WEB SERVICES/B2B
Examples	WSJ.com	Amazon	Travelocity	E*Trade	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	Non dynamic Low volume	Non dynamic Low volume	Non dynamic 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

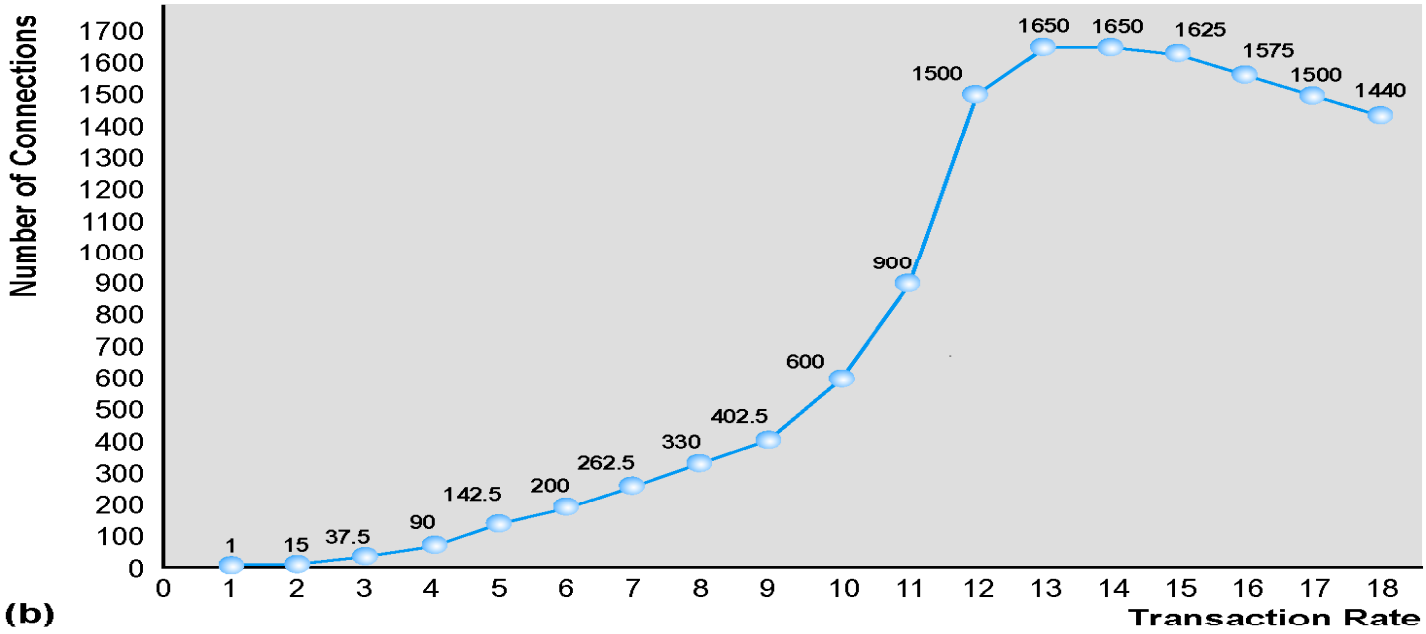
Degradation in Performance as Number of Users Increases

Figure 4.12 (a), Page 226

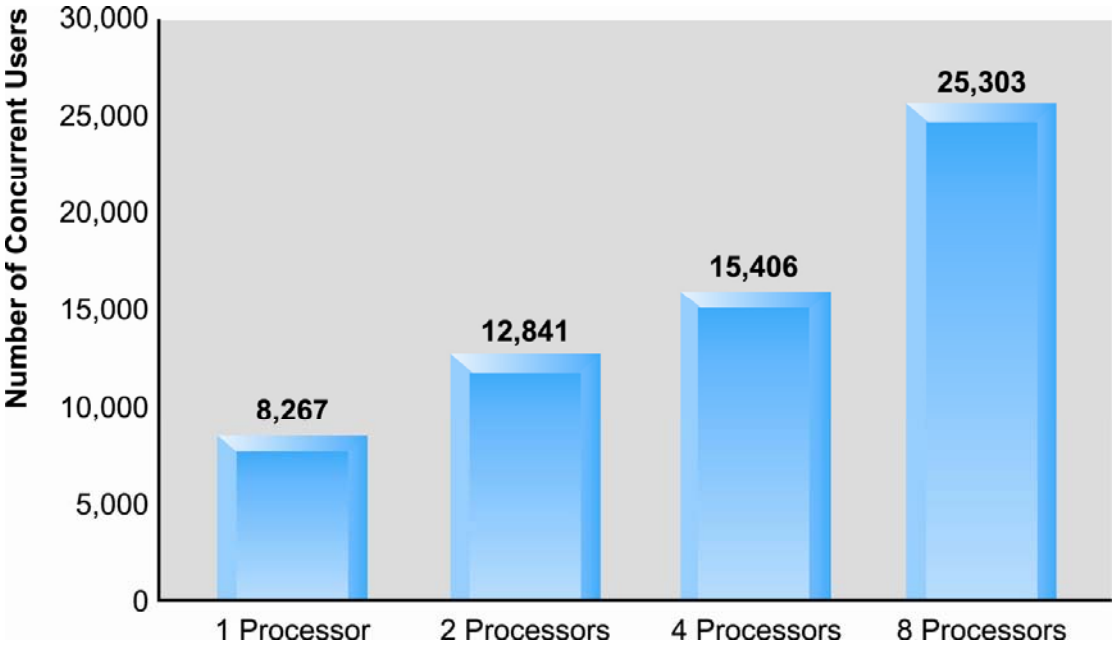


Degradation in Performance as Number of Users Increases

Figure 4.12 (b), Page 226

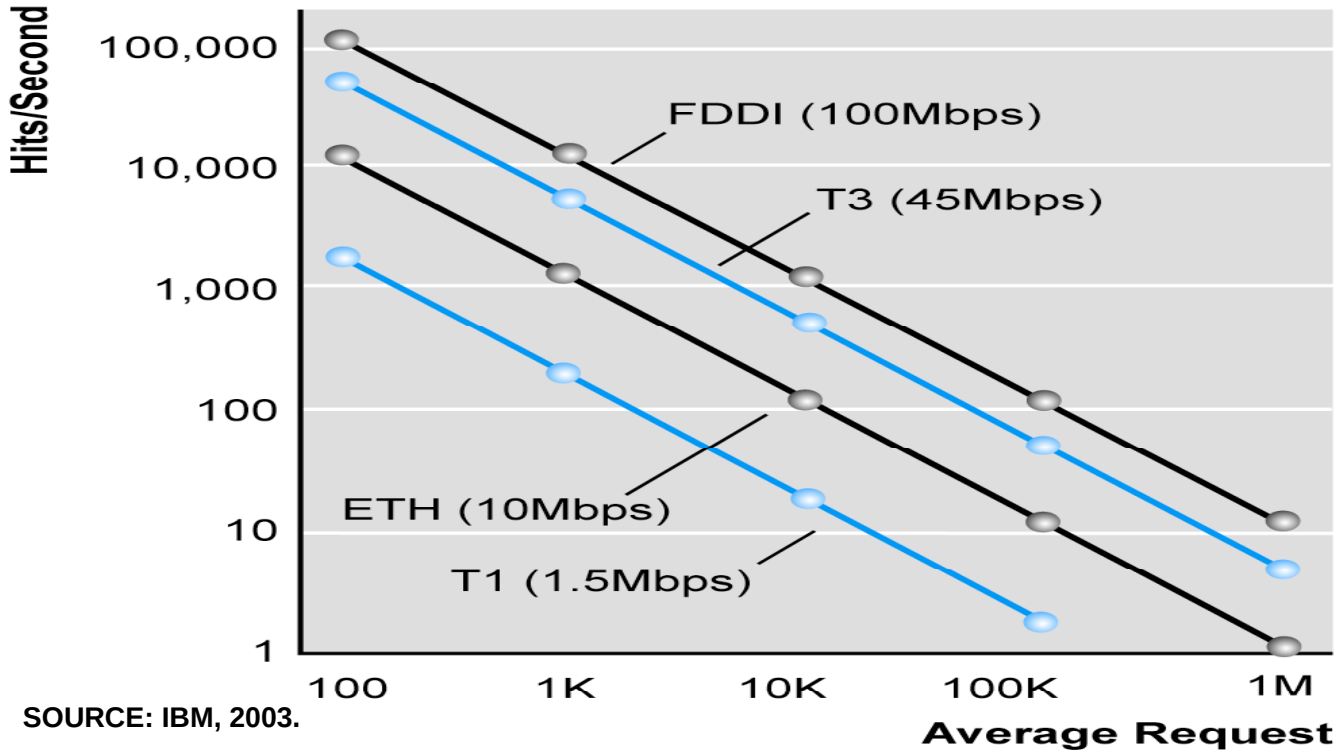


Capacity of Static Page Web Servers



The Relationship of Bandwidth to Hits

Figure 4.14, Page 228



SOURCE: IBM, 2003.

Right-Sizing Your Hardware Platform: The Supply Side

- Scalability: Ability of site to increase in size as demand warrants
- Ways to scale hardware:
  - Vertically: increase processing power of individual components
  - Horizontally: employ multiple computers to share workload
  - Improve processing architecture: combining vertical and horizontal scaling and using artful design decisions

Vertical and Horizontal Scaling Techniques

Table 4.8, Page 229

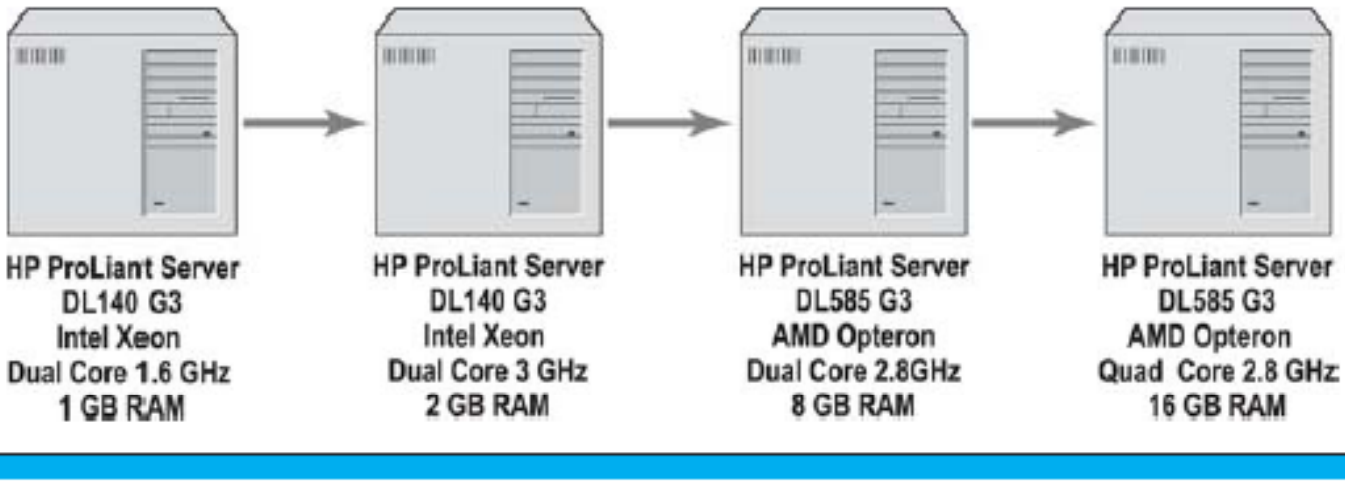
TABLE 4.8 VERTICAL AND HORIZONTAL SCALING TECHNIQUES

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

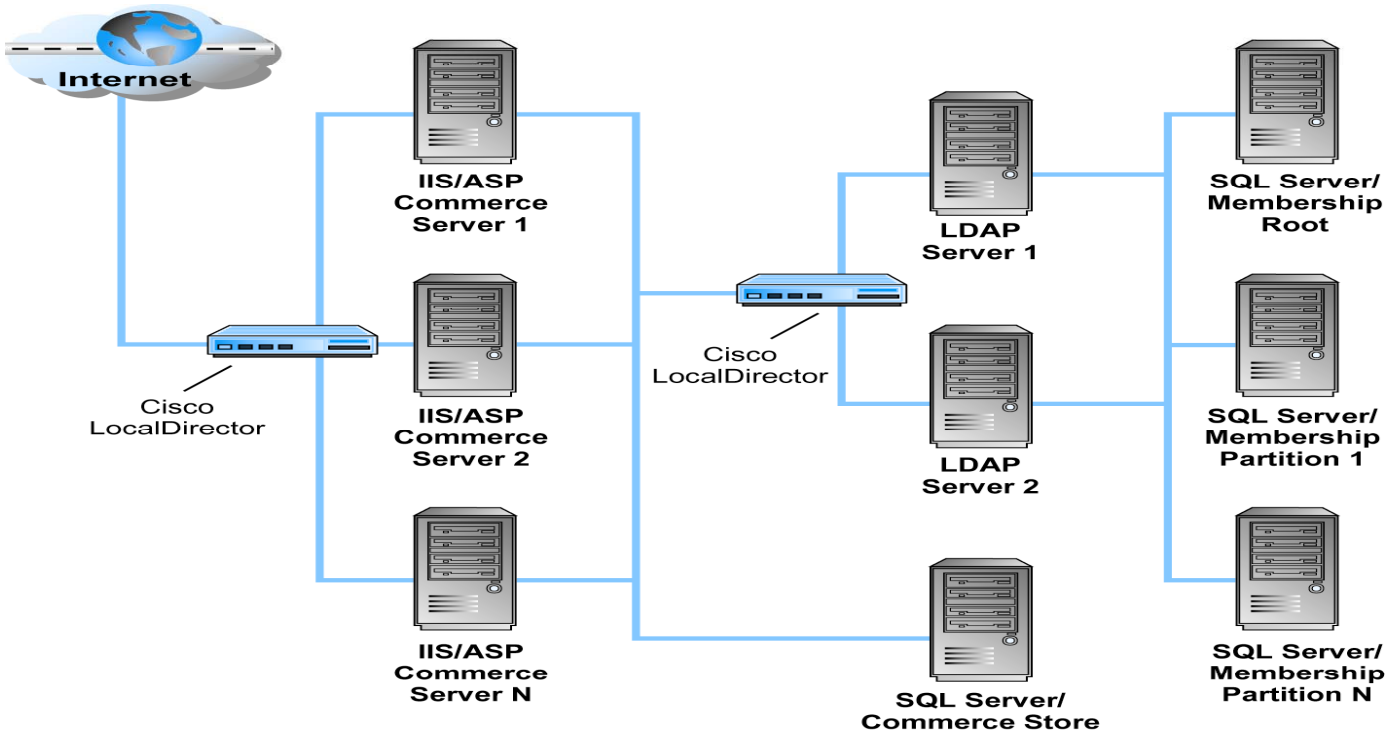
Figure 4.15, Page 230

FIGURE 4.15 VERTICALLY SCALING A SYSTEM



Horizontally Scaling a System

Figure 4.16, Page 231



Improving the Processing Architecture of Your Site

Table 4.9, Page 232

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.

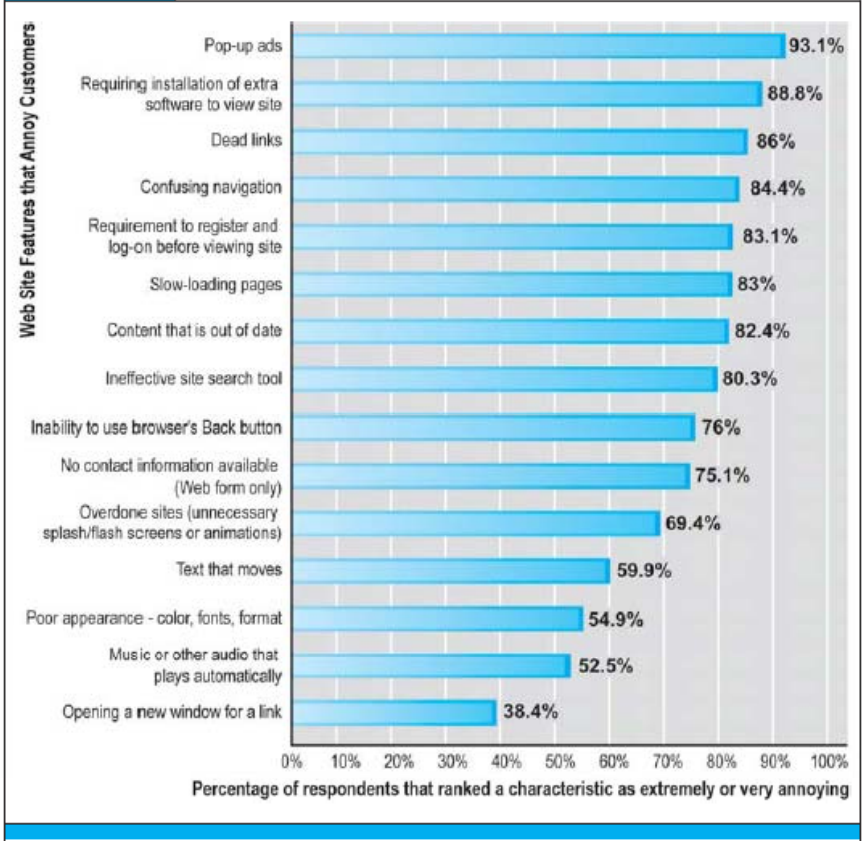
Web Site Design: Basic Business Considerations

- Other important requirements for your site such as coherent Web site design, building active content and interactivity into your site (track customers who come, leave, and return; track customers throughout your site to personalize and customize their experience)
- 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 233

FIGURE 4.17 E-COMMERCE WEB SITE FEATURES THAT ANNOY CUSTOMERS



SOURCE: Based on data from Hostway Corporation's survey, Consumers' Pet Peeves about Commercial Web Sites, Hostway Corporation, 2007.

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

Table 4.10, Page 234

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

- Widgets: Small pre-built chunk of code that executes automatically in your HTML Web page
- Mashups: Pull functionality/data from one program and include it in another
- CGI (Common Gateway Interface): Standards for communication between browser and 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: Used to create interactivity and active content on client computer

Tools for Interactivity and Active Content

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

Insight on Technology: Pumping Up the Customer Experience Using AJAX and Flash
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