Chapter 10: The Internet Database Environment

Modern Database Management

6th Edition

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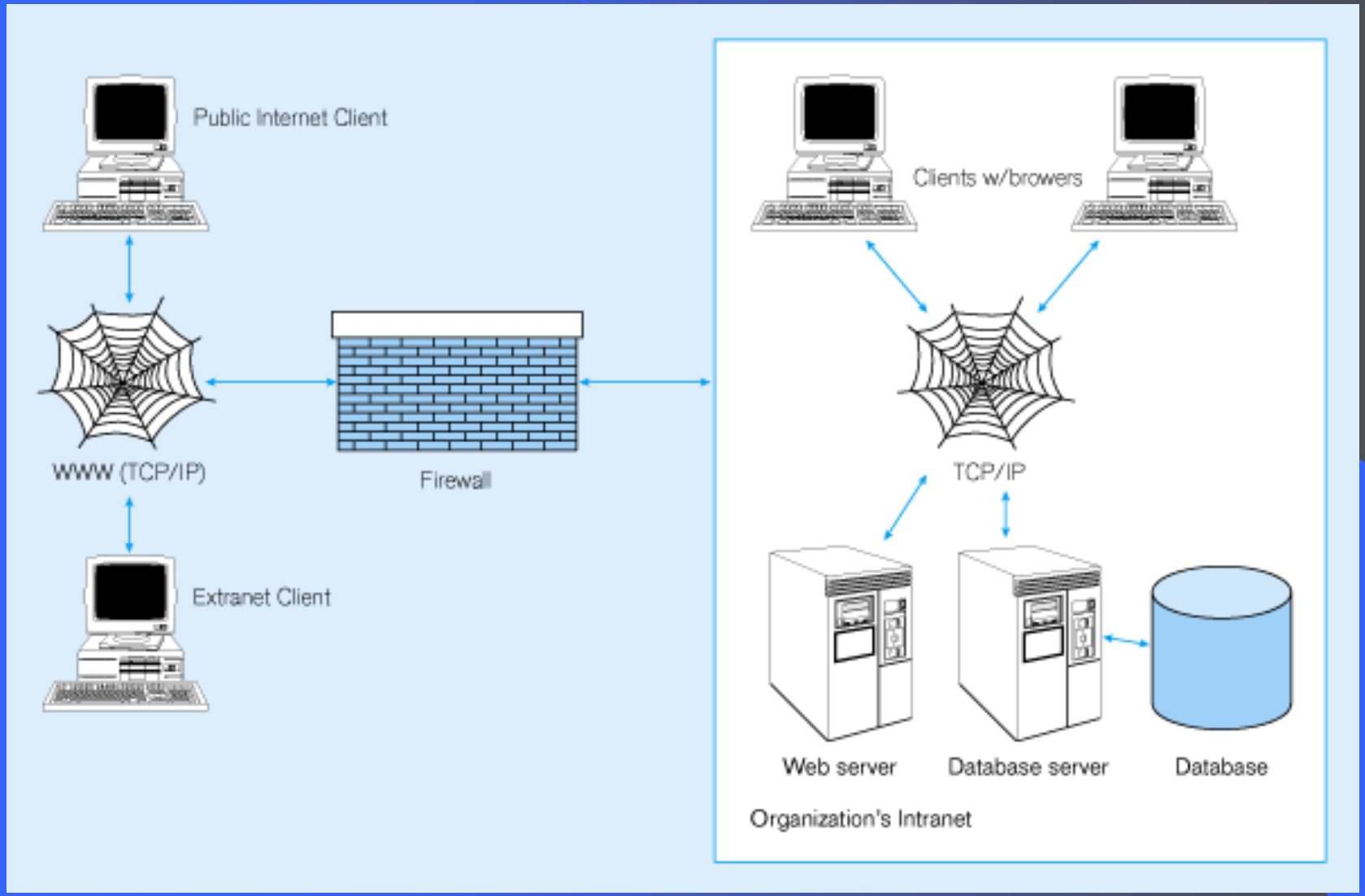
Figure 10-1: Database-enabled intranet-internet environment



Business on the Internet

Electronic Business (e-business)

- Development of integrated relationship with customers and suppliers via the Internet
- Business-to-Consumer (B2C) – retail
- Business-to-Business (B2B) – interaction with suppliers and vendors

Electronic Commerce (e-commerce)

- Business transactions, including:
  - Order processing/fulfillment
  - Customer relations
  - Electronic data interchange (EDI)
  - Bill payments

Web-Related Terms

World Wide Web (WWW)

- The total set of interlinked hypertext documents residing on Web servers worldwide

Browser

- Software that displays HTML documents and allows users to access files and software related to HTML documents

Web Server

- Software that responds to requests from browsers and transmits HTML documents to browsers

Web pages – HTML documents

- Static Web pages – content established at development time
  Dynamic Web pages – content dynamically generated, usually by obtaining data from database

Communications Technology

IP Address

- 4 numbers that identify a node on the internet
- E.g. 131.247.152.18

Hypertext Transfer Protocol (HTTP)

- Communication protocol used to transfer pages from Web server to browser
- HTTPS is a more secure version

Uniform Resource Locator (URL)

- Mnemonic Web address corresponding with IP address
- Also includes folder location and html file name

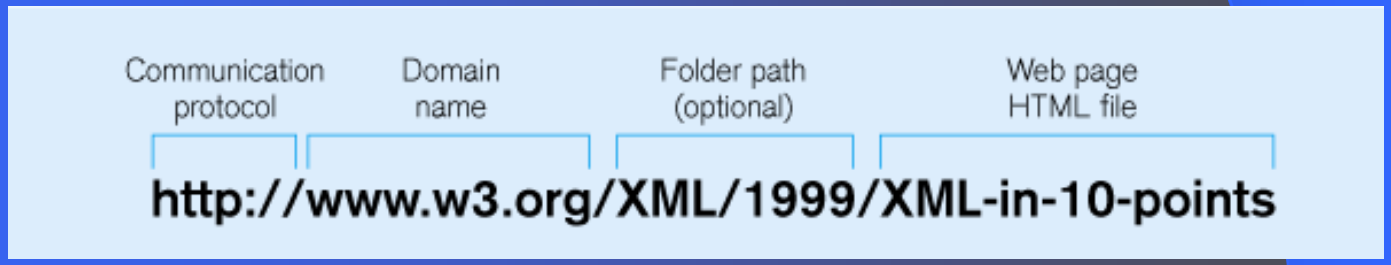


Figure 10-2: Typical URL

Internet-Related Languages

- **Hypertext Markup Language (HTML)**
  - Markup language specifically for Web pages
- **Standard Generalized Markup Language (SGML)**
  - Markup language standard
- **Extensible Markup Language (XML)**
  - Markup language allowing customized tags
- **XHTML**
  - XML-compliant extension of HTML
- **Java**
  - Object-oriented programming language for applets
- **JavaScript/VBScript**
  - Scripting languages that enable interactivity in HTML documents
- **Cascading Style Sheets (CSS)**
  - Control appearance of Web elements in an HML document

Standards and Web conventions established by **World Wide Web Consortium (W3C)**

Web Servers

Provide HTTP service

Passing plain text via TCP connection

Serve many clients at once

- Therefore, multithreaded and multiprocessed

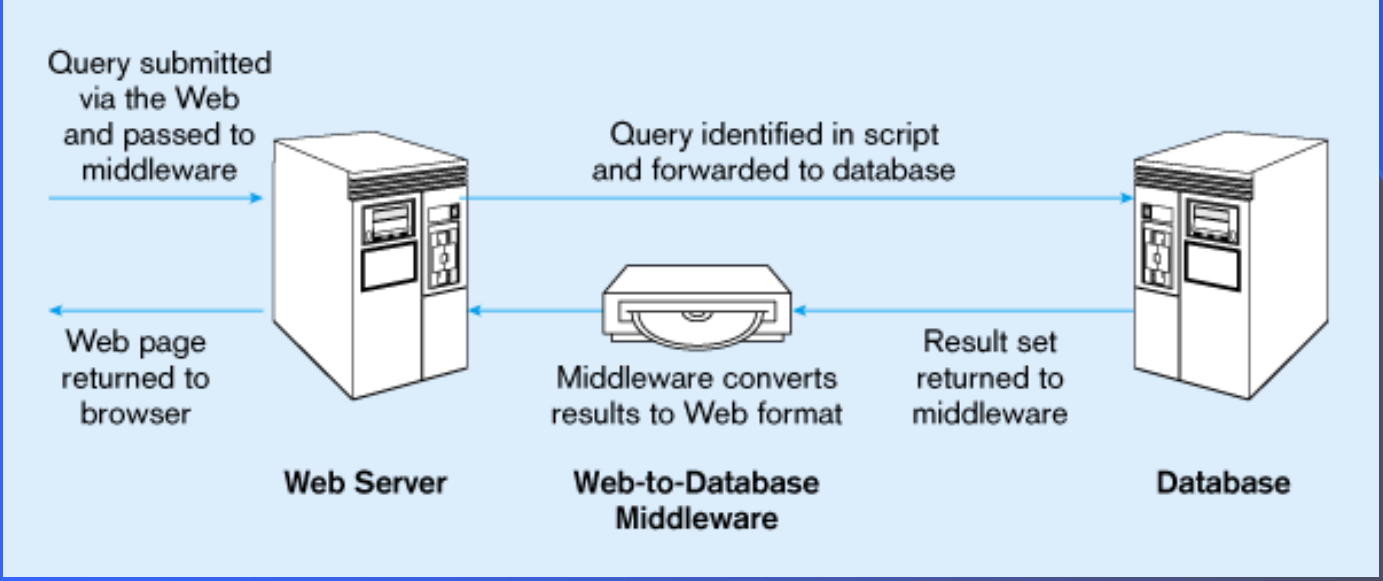
Load balancing approaches:

- Domain Name Server (DNS) balancing
  - One DNS = multiple IP addresses
- Software/hardware balancing
  - Request at one IP address is distributed to multiple servers
- Reverse proxy
  - Intercept client request and cache response

Server-Side Extensions

Programs that interact directly with Web servers to handle requests
e.g. database-request handling middleware

Figure 10-3: Web-to-database middleware



Client-Side Extensions

Add functionality to the browser

Plug-ins

- hardware./software modules that extend browser capabilities by adding features (e.g. encryption, animation, wireless access)

ActiveX

- Microsoft COM/OLE components that allow data manipulation inside the browser

Cookies

- Block of data stored at client by Web server for later use

Web Server Interfaces

- Common Gateway Interface (CGI)
  - Specify transfer of information between Web server and CGI program
  - Performance not very good
  - Security risks
- Application Program Interface (API)
  - More efficient than CGI
  - Shared as dynamic link libraries (DLLs)
- Java Servlets
  - Like applets, but stored at server
  - Cross-platform compatible
  - More efficient than CGI

Web-to-Database Tools

Active Server Pages (ASP)

- Microsoft server-side scripting language
- Generates dynamic Web pages
- Interfaces to databases in MS Windows-based Web servers

Cold-Fusion

- Uses special server-side markup language CFML
- Modeled after HTML
- Interfaces to databases

Embedded SQL

- SQL embedded in 3GL programs
- Provides flexible interface
- Improves performance
- Improves database security

Figure 10-4: A *global.asa* file for an ASP application

```
<SCRIPT LANGUAGE=VBScript RUNAT=Server>

'You can add special event handlers in this file that will get run automatically when
'special Active Server Pages events occur. To create these handlers, just create a
'subroutine with a name from the list below that corresponds to the event you want to
'use. For example, to create an event handler for Session_OnStart, you would put the
'following code into this file (without the comments):

Sub Session_OnStart
'**Put your code here **
        Session("Cart") ' Tracks what they want to order
        Session("Count") ' Tracks the quantity that they want
End Sub

'EventName              Description
'Session_OnStart        Runs the first time a user runs any page in your application
'Session_OnEnd          Runs when a user's session times out or quits your application
'Application_OnStart    Runs once when the first page of your application is run for the first
                        time by any user
'Application_OnEnd      Runs once when the web server shuts down

</SCRIPT>
```

ASP applications include HTML extensions and additional scripting (usually in VBScript, or in JavaScript)

ASP code embedded in <% %> tags are executed on the server, instead of the client. This is how dynamic Web pages can be created

Sample ASP Code (from Figure 10-5 Box E and F)

```
<%
REM Get list of Finishes
strSQL = "SELECT Product_Finish FROM PRODUCT_t GROUP BY Product_Finish;"
Set rsRes = con.Execute(strSQL)
%>

<TABLE>
<%
REM Display the list of finishes
While not rsRes.EOF
%>
    <TR>
        <TD align=center valign=top>
            <%=rsRes("Product Finish")%></TD>
        <TD>
            <FORM method=post action="line.asp">
            <INPUT type=Hidden name=line
                value="<%=rsRes("Product_Finish"))%>
            <INPUT type=submit Value=GO!>
        </TD>
    </TR>
<%
        rsRes.MoveNext
    Wend
%>
</TABLE>
```

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</TABLE>
```

Code is within the <% %> tags are executed on the server, not the client…these are interacting with the database and creating dynamic Web content

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%>
</TABLE>
```

These lines are executing a query on the database server using a middleware called Active Data Objects (ADO). The **con** variable is a connection to the database, which was established in the code of Box C. The **rsRes** variable contains the result set of the query (the rows returned from the query)

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%>
</TABLE>
```

These lines of code cause the ASP application to loop through the rows returned by the query until they reach the end

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```

These lines of code are retrieving the values of the specified field from the current row of the query result

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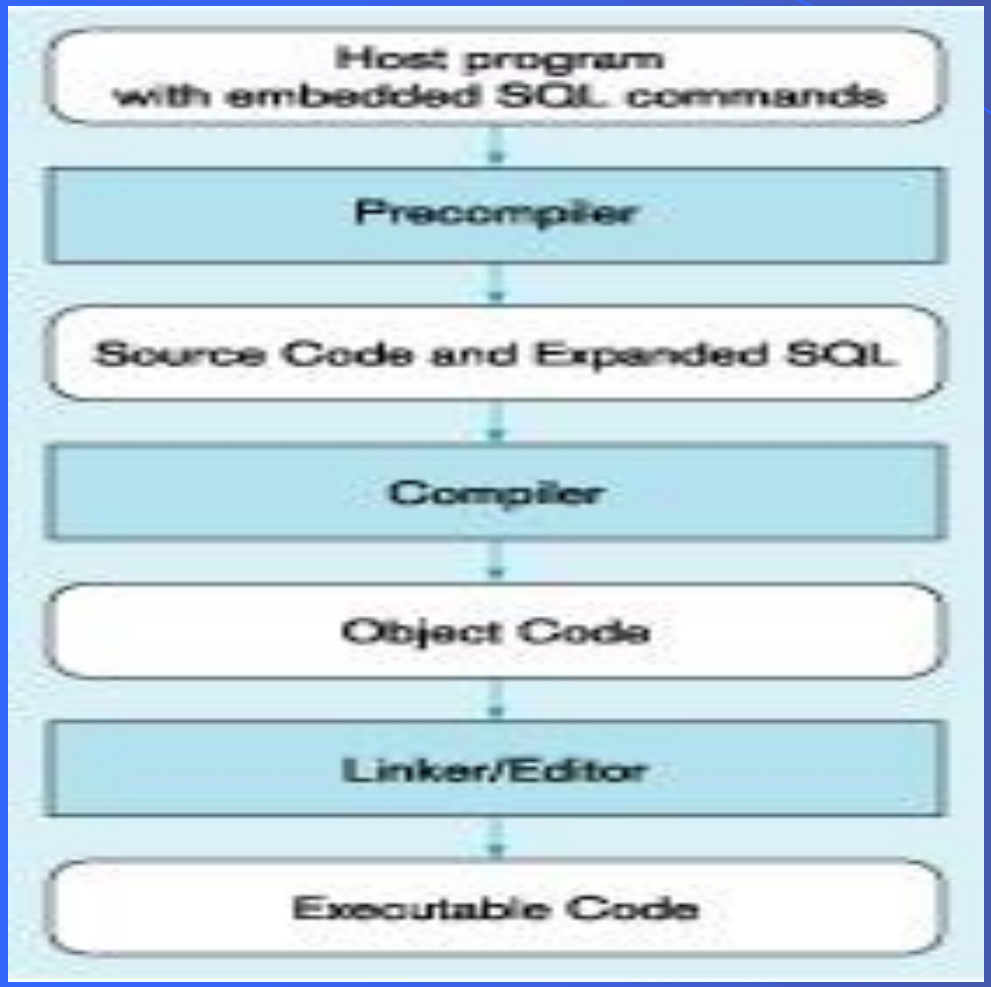
%>
</TABLE>
```

The Web page is being dynamically created, with one HTML table row for each record obtained from the query. Also, each Web table row includes a button that will link to another ASP page

Figure 10-8: Processing an embedded SQL program



Embedded SQL statement begins with EXEC SQL

Precompiler translates embedded SQL into host program language

Compiler and linker generate executable code

Managing Website Data

- Web Security Issues
  - Prevent unauthorized access and malicious destruction
- Privacy Issues
  - Protect users' privacy rights
- Internet Technology Rate-of-Change Issues
  - Deal with rapid advances in technology

Website Security

Planning for Web Security

- Risk assessment: nature, likelihood, impact, and motivation of security risks

Network Level Security

- Web server and DB server on separate LAN from other business systems
- Minimize sharing of hard disks among network servers
- Regular monitoring of network and firewall logs
- Install probe-monitor software

Website Security (continued)

Operating System Level Security

- Patch all known OS vulnerabilities
- Install anti-virus software with boot-time, file download time, and email reception time virus detection
- Monitor server logs for unauthorized activity
- Disable unrequired services to reduce risk of unauthorized access

Web Security (continued)

Web Server Security

- Restrict number of users on Web server
- Restrict access (minimize number of open ports)
  - *http* and *https* only, if possible
- Remove unneeded programs
  - Restrict CGI scripts to one subdirectory
- For Unix, only install minimum software for Web server

Website Security (continued)

- **Firewall** – hardware/software security component that limits external access to company's data
- **Proxy server** – firewall component that manages Internet traffic to and from a LAN
- **Router** – intermediate device that transmits message packets to correct destination over most efficient pathway
- **Intrusion detection system (IDS)** – system that identifies attempt to hack or break into a system

Figure 10-9: Establishing Internet security