PART I
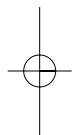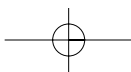
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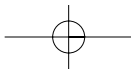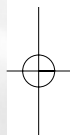
Chapter 1
THE MICROSOFT TOOLSET

Choosing the right tools to build your Web site is, of course, a critical step. There are turnkey outsource solutions, such as Delphi.com, that you can utilize to add functionality to your Web site. There are also third-party development packages you can utilize as well for adding features to your site.

You most likely wouldn't be reading this book unless you were interested in doing a little programming of your own! The Visual Basic language is a key tool in the community developer's arsenal. There are, however, many tools in the supporting cast that make up a successful Web site deployment. This chapter explores these tools and, of course, takes an in-depth look at the Visual Basic language and how it will be utilized.
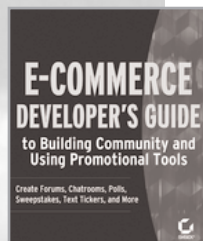
Adapted from *E-Commerce Developer's Guide to Building Community and Using Promotional Tools*, by Noel Jerke

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THE TOOLSET

The tools range from server software to programming languages to encryption technology. Each is critical in building the complete solution. An overview of each tool is given in this chapter along with a list of features that are critical for building a Web application. Don't worry if some of the terminology doesn't make sense yet. The rest of the book will cover programming basics in more detail.

Presently, Microsoft has taken on a new and significant initiative called .NET that seeks to fundamentally change the way Web development is done. The following sections focus on the core NT/2000 tools that are currently available and examine where Microsoft is headed down the road.

Microsoft Windows NT/2000

The Windows NT/2000 platform is the foundation for building a Visual Basic programmed solution. It provides the core Web server, security, TCP/IP functionality, and other fundamental requirements for a Web server operating system. Table 1.1 discusses the key features for building a Web application.

TABLE 1.1: Web Features

FEATURE	DESCRIPTION
Security	As with any Web server, it is critical to provide solid security to protect the network and operating system from hackers and mischief-makers.
TCP/IP networking	TCP/IP is, of course, the standard networking protocol used across the Internet that allows computers to communicate with each other.
Component Object Model (COM) support	When using Visual Basic to build the necessary business objects for an e-commerce Web site, COM is a key tool.
Web server	Internet Information Server (IIS) is the server that supports the core Web server functionality. (See the next section.)

It is important that Windows is set up properly to ensure security integrity, scalability, and other key issues. Certainly there are differences between the Windows NT and Windows 2000 platforms. Some of the core tools, such as SQL Server, IIS, Active Server Pages (ASP), and so on,

are significantly enhanced on the Windows 2000 platform. Windows 2000 also offers more server-side software options for managing your Web site. From a coding development standpoint, however, the work is pretty much the same. The code developed in this book for both SQL Server and ASP will work on either platform.

Internet Information Server

IIS is the Web server that is provided with Windows NT/2000. The latest version on NT is IIS 4.0 and is provided with the Windows NT Option Pack. Windows 2000 comes with IIS 5.0. Table 1.2 gives an overview of the key features of IIS.

TABLE 1.2: IIS Web Server Features

Feature	Description
Index Server	Site content indexing, including HTML pages and Word documents, is supported with Index Server and enables your Web site to have site search functionality.
FTP service	IIS provides the basic functionality to support the File Transfer Protocol (FTP).
HTTP service	IIS provides the basic HTTP service.
SMTP service	IIS provides the support for SMTP mail protocol for sending e-mail from the Web server.
NNTP service	Internet newsgroups can be set up and supported in IIS.
Certificate server	Certificate server allows you to manage your own set of certificates to enable authentication between the server and the client.
Message Queue Server	Microsoft Message Queue Server (MSMQ) is a fast store-and-forward service for Microsoft Windows NT/2000 Server.
Transaction server	The Option Pack also comes with Microsoft Transaction Server for developing high-performance, mission-critical applications. In Windows 2000 it is integrated into the operating system.
Management console	The management console is the interface for managing the Web server.
Active Server Pages (ASP)	Active Server Pages represent the foundation for Web server development. The ASP engine provides a hosting environment for a number of scripting languages with integrated support for VBScript and JScript (Microsoft's version of JavaScript). See Table 1.4 for information on what is new in ASP for IIS 5.0.

Part i

TABLE 1.2 continued: IIS Web Server Features

FEATURE	DESCRIPTION
FrontPage extensions	The FrontPage extensions are key tools for supporting site development in Microsoft FrontPage and Microsoft Visual InterDev. These extensions allow InterDev and FrontPage to manage the Web site over a standard TCP/IP connection.

IIS provides the basic Web server functionality required to serve Web pages. IIS 5.0 has its underpinnings significantly enhanced to be more scalable and stable, but provides the same basic services. The biggest changes for the developer are found in the implementation of ASP.

Active Server Pages/Visual InterDev

The heart of the toolset for building our applications is the ASP component of IIS. Combine that with the Visual InterDev development tool for creating Web pages, working with SQL Server, and building e-commerce applications. Table 1.3 reviews the key features of ASP.

TABLE 1.3: ASP Key Features

FEATURE	DESCRIPTION
VBScript language	ASP provides the capability to combine client-side HTML code with server-side VBScript, a slightly slimmed-down version of the popular Visual Basic programming language. This code will allow you to access your database, control the code being sent to the client browser, and much more.
Built in objects	IIS has several key objects built in that provide the core functionality for programming from ASP, such as the Response and Request objects. Through these objects you can manage cookies, maintain session state, access other server functions, and more.
COM components	There are a number of COM components that come with ASP, including ADO for accessing data from a range of remote sources, and browser objects for checking the user's browser capabilities, managing ad rotation, and much more.

Significant enhancements to the ASP environment in IIS 5.0 are outlined in Table 1.4.

TABLE 1.4: ASP Development Enhancements

FEATURE	DESCRIPTION
ASP Self Tuning	ASP is now much better at detecting resource bottlenecks, especially with regard to thread allocation. If there is CPU overhead available and requests are backed up, additional threads are allocated. Likewise, if the CPU is being overburdened, threads are de-allocated.
Encoded ASP Scripts	This feature provides basic script encoding so that script logic cannot be easily read. The script code is de-coded during execution.
Application Protection	IIS, in general, provides better protection for Web applications by separating all applications into a segmented memory space from the core IIS processes.
XML Integration	The XML parser provided in Internet Explorer can be utilized to parse XML in your ASP applications.
Windows Script Components	Code written in VBScript can now be compiled into re-usable COM components for use in Web applications.
Flow Control Capabilities	There are now two methods for redirecting a user to another Web page. The traditional method used was the Response object, which sent a message to the browser, and required a trip back to the server. Now the Server object has a redirect option that happens at the server level.
Error Handling	The Server object has a new error handling capability that can help to track down script errors.
Scriptless ASP	Many sites are built with all ASP pages, even though there may be no script on certain pages. That means even an HTML-only page is run through the ASP parser in IIS 4.0. In IIS 5.0 a check is now done to see if a script is actually included on the page before invoking the ASP parser.
Performance-Enhanced Objects	All of the core objects built into IIS 4.0 are provided, but they have been significantly enhanced for performance.

Part i

In IIS 5.0, Microsoft has focused significantly on the performance of aspects of ASP to improve its scalability. In general, they have tuned IIS 5.0 for overall performance. There have been some enhancements for easier coding, with the major change being the capability to compile scripts into COM objects.

Visual InterDev is a key tool for designing Web applications and can be used for the code samples listed throughout this book. It is our primary development environment for building our Active Server Pages–based

applications. Table 1.5 provides an overview of the key features of Visual InterDev.

TABLE 1.5: Visual InterDev Features

FEATURE	DESCRIPTION
SQL database tools	Visual InterDev provides an excellent interface when working with remote database environment. Queries can be built, tables managed, stored procedures worked with, and all of the critical functions for building data-driven e-commerce applications can be accomplished.
Remote server site management	Through the use of FrontPage server extensions, you can manage your server-based Web projects remotely with Visual InterDev.
Active Server Pages development	The key use of the tool is for is Active Server Pages, VBScript, or JScript programming.
Team project development/Visual Source Safe integration	In conjunction with Visual Source Safe and the FrontPage server extensions, team project development can be done easily on the same set of pages. Pages that are "checked out" can be locked from use by anyone else.
Client side HTML/ script editor	Not only can you work on server-side script development, but you can also work on client-side scripts, DHTML development, cascading style sheets, and so on.
Debugging tools	As is good practice with any development tool, debugging tools are provided for that occasional error a programmer might make.

NOTE

See the Microsoft.NET section later in this chapter to get a peek at what is coming in Visual Studio.NET 7.0.

Visual InterDev combined with ASP provides the Microsoft primary programming toolset for Web-based applications. The toolset has been a successful combination that many Web sites are built upon and provides the core tools for the functionality built in this book.

SQL Server

As critical to community building as programming is, even more critical is the database. Without a database to store messages, polls, profiles, and much more, there would be no community at all. Microsoft SQL Server

provides a robust development platform for building multi-tier Web applications. You can place as much or as little logic in the database tier as needed. If you are running a multi-server Web farm, then partitioning the client, Web server, and database tier become crucial to ensuring solid performance and balancing server load.

SQL Server can be configured for different security levels, segmentation with replication, programming logic in stored procedures, and so on. With Microsoft's ActiveX Data Objects (ADO) and an OLE DB provider (or ODBC), you can connect from nearly any Microsoft development tool and interface with the underlying database.

NOTE

Microsoft Access can be used as the database for your site. For a Web site that is going to get any kind of extensive traffic, however, a robust scalable database such as SQL Server should be used.

There are three versions of SQL Server still in primary use by developers. SQL Server 6.5 was the first robust version to run on Windows NT 4.0. That was followed by SQL Server 7, which provided a significant revamp of the core infrastructure and greatly increased functionality and scalability. The newest version is SQL Server 2000, which requires Windows 2000. The SQL Script code developed in this book should work on any of these versions and, with a little work, can be ported to other popular enterprise SQL-based database servers.

In this book, Microsoft SQL Server will be used as the database behind the functionality.

NOTE

We assume that you are familiar with setting up and creating SQL Server databases. If you are unfamiliar with this technology, you might want to check out Sybex's *Mastering SQL Server 2000*, by Mike Gunderloy and Joseph L. Jorden.

Visual Basic 6

While ASP provides a powerful environment for server-based Web applications in itself through the scripting languages it exposes, it can be further enhanced by the use of compiled code written in a language such as

Visual Basic. There are multiple ways in which you can interface from Visual Basic to the Internet, as explored in Table 1.6.

TABLE 1.6: Visual Basic 6 Internet Features

Feature	Description
IIS applications	A new feature has been added to Visual Basic 6. IIS applications enable you to create Visual Basic programs with a standard HTML-based browser as their interface. These applications allow the programmer to utilize all of the familiar tools in VB, such as classes, database programming, and so on. The only difference is that the interface is a browser instead of a standard form. These applications are centrally run on a Web server and can be accessed on your intranet or Internet Web site.
COM objects	A key tool for Web application development is the creation of Component Object Model (COM) business objects. For example, in an e-commerce application, we might build objects for tax and shipping calculations encapsulating existing logic. These COM objects could then be called from our ASP script code.
WIN INET tools/ browser control	Of course, there is a traditional capability to create Web applications in a standard Visual Basic forms interface. Visual Basic contains an ActiveX control that can be placed on a form and provides a subset of Internet Explorer. This may be attractive for building management tools for an online store.
ActiveX controls	ActiveX controls can be created in Visual Basic for use in the Internet Explorer browser interface that will run on the client's computer. Again, this may be attractive for encapsulating functionality on the management side of a store.
DHTML applications	In conjunction with IIS applications, DHTML applications are introduced in version 6. DHTML applications allow the Visual Basic programmer to create DHTML interfaces in Internet Explorer, but the language is full-fledged Visual Basic instead of JScript or VBScript. Note that DHTML runs on the client side where IIS applications run on the server side.

This book primarily focuses on building applications in Visual Inter-Dev with Active Server Pages. There might be times, though, when you will want to consider using Visual Basic as part of your Web development arsenal. Usually that is when you need to build complex logic that isn't possible in a scripting context. Often this logic is encapsulated in a COM object and can be used both on the Internet and in a client/server context. You can also use Visual Basic to create your own reusable ASP components. Part IV covers this process in more detail.

Table 1.7 outlines some of the different situations in which you might want to use Visual Basic.

TABLE 1.7: Visual Basic Utilization

FEATURE	DESCRIPTION
Legacy Code Migration	If you have existing code in Visual Basic, then using it in a Web application environment is possible with Visual Basic's Internet capabilities.
Performance	Generally speaking, compiled code will execute much more quickly than script code. You can develop extensive COM objects in Visual Basic for performance gains and then use them in ASP.
Logic Segmentation	Visual Basic provides a full-featured object-based development environment complete with many of the features of object-oriented development. The Visual Basic development environment provides a much more robust development interface and programming language.
Mixed Functionality	If you are building a LAN-based application that also needs to have a Web-based intranet-type interface, Visual Basic can provide the capability to do both right out of the box.

The good news is that the Visual Basic developer has options for what implementation of Visual Basic to use and can "right-size" the solution appropriately.

Microsoft Site Server 3.0

Microsoft's Site Server 3.0 is the big gun in Microsoft's arsenal for developing extended community and e-commerce applications. Site Server 3.0 provides a number of tools, including the core programming environment for directory level security, site personalization, membership tracking, site log file analysis, staging and development server support, and much more. With this toolset that is built on an ASP programming foundation and SQL Server, high-end, feature-rich Web sites can be built. Sample sites include those of Dell Computers (`www.dell.com`), Martha Stewart (`www.MarthaStewart.com`), and Ulla Popken (`www.ullapopken.com`).

In reality, it is important to point out that Site Server is primarily a framework of COM objects and applications that support the commerce and community processes. Table 1.8 gives an overview of the key feature set of Site Server, Commerce Edition. If your goal is to start out developing in Site Server, it is still important to understand all the concepts and programming

techniques outlined in this book. If you are going to be building a significant e-commerce aspect to your site, then using Site Server 3.0, Commerce Edition (SSCE) will provide the commerce development foundation.

TABLE 1.8: Site Server 3.0 Key Features

FEATURE	DESCRIPTION
Membership Server	Membership Server provides a way to create a membership-based site with appropriate security and tracking. Security can be based on a database or on the Lightweight Directory Access Protocol (LDAP) used by the Windows 2000 Active Directory, among others.
Personalization Server	Personalization Server offers a way to provide targeted content to the user based on the user's membership profile.
Commerce Server (SSCE Only)	Commerce Server is the key toolset for building e-commerce applications. The Commerce Interchange Pipeline (CIP) provides a series of COM objects to manage the purchasing process and can support business-to-business integration as well.
Ad Server (SSCE Only)	Ad Server provides the ability to manage banner ad campaigns on a Web site. A complete Web-based management interface is provided for adding, updating, and deleting ad campaigns and, in particular, tracking the success (or failure) in terms of "click-throughs."
Site Analysis	Site traffic analysis is an important aspect of understanding your Web site. Site Server provides Web log analysis tools to analyze traffic patterns.

Commerce Server 2000

Microsoft's Commerce Server 2000 product for the Windows 2000 platform is the next generation of the Site Server product. Table 1.9 provides a breakdown of its main features.

TABLE 1.9: Commerce Server 2000

FEATURE	DESCRIPTION
Profile and Targeting	Site Server 3.0 provides a profile and targeting solution. The new twists in Commerce Server 2000 are much more e-commerce focused and built on the underpinnings of the Windows 2000 platform.

TABLE 1.9 continued: Commerce Server 2000

FEATURE	DESCRIPTION
Product Catalog	Based on SQL Server, the new Product Catalog System helps create catalogs, and import and export from existing data sources. Integrated and powerful search capabilities also make product information easy to find.
Analysis	Provides extended features including Web log file analysis as well as integrating in actual activity based on the Web site database.
Advertising	Banner advertising is provided as a type of business processing pipeline similar to the commerce pipelines for purchasing.

There is certainly much more available in the product; for additional information, check out www.microsoft.com/CommerceServer/. Commerce Server 2000 is a significant overhaul of the Site Server platform, but it does require Windows 2000. Making a careful selection between Commerce Server 2000 and Site Server will have a significant impact on your development requirements down the road. Either way, both have significant features, especially in an e-commerce context, with which to build an application.

Secure Sockets Layer (SSL)/Verisign Certificates

Security on a Web site is crucial for securing private data—especially credit card data. On the management side, passwords and other business-critical data should be encrypted between the browser and the server.

IIS 4 supports SSL 3. There is a simple process for requesting a certificate on the server and then submitting the certificate request to an authority, such as Verisign (www.verisign.com). Once the certificate request is made, the keys will be sent back installed on the server.

Miscellaneous Tools

There are many other tools available for Internet development. Certainly many non-Microsoft tools are available for development on Windows NT or on any other operating system.

Part i

WYSIWYG

WYSIWYG, or "What You See Is What You Get," is the drag-and-drop method of Web design. WYSIWYG tools simplify the creation of a Web page by allowing you to design visually, then automatically constructing the underlying HTML code for you. The drawback is that they sometimes add more code than you need or want. Whether or not to use a WYSIWYG editor is a matter of personal taste and coding style for developers.

Table 1.10 reviews other Microsoft tools.

TABLE 1.10: Microsoft's Web-Enabled Tools

FEATURE	DESCRIPTION
Microsoft Exchange Server	If you want to build extended e-mail capabilities, provide e-mail boxes for customer support, and other related functions, Exchange Server provides a robust e-mail platform.
Microsoft FrontPage 2000	While Visual InterDev does provide WYSIWYG editing, FrontPage 2000 is an excellent WYSIWYG HTML editing tool for creating static content on the Web site.
Microsoft Office	Microsoft Office provides extended tools for working with the Web. Microsoft Word can also be utilized for creating and editing Web page documents. Microsoft Access can be an excellent database tool to use in conjunction with Microsoft SQL Server.
Internet Explorer	Internet Explorer provides much more than a standard Web page display. There are a number of tools provided along with the browser itself. Remote Data Service (RDS) objects are provided for interfacing with data on the Web server via HTTP, ActiveX controls can run in the browser interface, and there is the capability to create client-side scripting in VBScript and JScript.
Visual Source Safe	Visual Source Safe provides a source code control toolset for storing source code and related files in a source database. It provides source code version management as well as an infrastructure for checking code in and out. This is particularly useful for avoiding version conflicts in team-based environments.

CONTINUED ➥

TABLE 1.10 continued: Microsoft's Web-Enabled Tools

FEATURE	DESCRIPTION
Remote Data Services (RDS)	RDS provides a toolset for querying databases across the Internet via HTTP. It provides a direct link between the browser and the database without having to make a trip to the server to work through ASP or some other server-side development tool.
Microsoft Visual Studio	Two tools included in Visual Studio have already been mentioned: Visual InterDev and Visual SourceSafe. Also included are Visual C++ and Visual J++ along with other development tools, such as Visual Modeler. All of these may be useful at various points in the development process. In Visual Studio.NET, the next generation of C++ programming environment, C# will be introduced.
BizTalk Server 2000	BizTalk makes it easy to integrate applications and businesses together with graphical tools for building Extensible Markup Language (XML) schema, performing schema transformation, establishing trading partner relationships over the Internet, as well as tracking and analyzing data and documents that are exchanged. BizTalk Server 2000 extends the features of traditional e-commerce and electronic data interchange (EDI). Chapter 23 explores the use of this tool in detail.
Application Center	Application Center 2000 is Microsoft's deployment and management tool that makes managing groups of servers as simple as managing a single computer. It provides a complete toolset for managing Web server farms. For large community Web sites with extensive server farms, this is an invaluable tool.

Part i

Microsoft continues to enhance and hone its overall product offering for the Internet. Which Microsoft or third-party solutions you use will greatly depend on the scope and scale of the Web application you are building. The next section takes a look at Microsoft's much-promoted .NET initiative.

Microsoft .NET

In mid-1999, Microsoft announced a significant shift in its Internet strategy, called .NET. Bill Gates and Steve Ballmer likened it to the decision to move from DOS to Windows, or when Microsoft made its infamous

Internet strategy shift in the 1990s. It is important to understand that this isn't a shift that happens overnight. It will be a progression over many years.

The expansiveness of the .NET strategy touches nearly every piece of software that Microsoft produces, which is a bit beyond the scope of this book to explain. For more information, check out `www.microsoft.com/net/`.

For developers, there are significant initiatives that need to be considered. Table 1.11 outlines some of the highlights.

TABLE 1.11: Microsoft's .NET Development Initiatives

FEATURE	DESCRIPTION
Web Services	Web Services are building blocks for constructing distributed Web-based applications in a platform, object model, and multi-language manner. Web Services are based on open Internet standards, such as HTTP and XML, and form the basis of Microsoft's vision of the programmable Web. In other words, it's a URL-addressable resource that programmatically returns information to clients who want to use it. One important feature of Web Services is that clients don't need to know how a service is implemented. They communicate through using standard Web protocols and data formats, such as HTTP and XML.
Visual Studio	Visual Studio.NET includes exciting features, some of which are enhancements to previous versions and some of which are brand-new. A few of the most significant additions include the new Microsoft programming language called C#; a new, smarter integrated development environment (IDE); new object-oriented features in Visual Basic.NET; and development lifecycle tools.
ASP.NET	ASP.NET is a new version of ASP that has been rebuilt from the ground up. ASP.NET provides for cleaner code that is easier to write, and simple to reuse and share. ASP.NET boosts performance and scalability by offering access to complied languages; development is more intuitive with Web Forms, and an object-oriented foundation facilitates reuse. Other important features include page events, Web controls, and caching. Server controls and improvements in data binding are also new with ASP.NET. Libraries for use with ASP.NET, and the Microsoft .NET Framework, which allows custom business functions to be exposed over the Web, provide more new development opportunities.

CONTINUED ➟

TABLE 1.11 continued: Microsoft's .NET Development Initiatives

FEATURE	DESCRIPTION
Web Forms	ASP.NET Web Forms are Web pages that enable you to write code just as you do for ASP today. More than that, though, ASP.NET Web Forms are designed on top of an object-oriented programming model, enabling code reuse and separation of the application code from page content. In Visual Basic you draw the controls on a form, then implement the event procedures underneath. In traditional ASP this isn't possible because there's no link between the controls and their server-side code. In ASP.NET, however, there is a link; instead of having to manually pull out values from the form variables, you can write code directly.
ADO+	ADO+ is the new set of data access services for the .NET Framework. ADO+ is a natural evolution of ADO, built around n-tier development and architected with XML at its core. Two key enhancements are extensive support for the disconnected programming model and rich XML integration.

Extensible Markup Language (XML)

Woven throughout the .NET platform is XML for data sharing. XML is a meta-markup language that provides a format for describing structured data. This facilitates more precise declarations of content and more meaningful search results across multiple platforms. XML enables Web-based data viewing and manipulation applications.

In XML you can define an unlimited set of tags. While HTML tags can be used to display a word in bold or italic, XML provides a framework for tagging structured data. An XML element can declare its associated data to be a retail price, a sales tax, a book title, the amount of precipitation, or any other desired data. With XML there is the capability to search for and manipulate data regardless of the applications within which it is found. Once data has been located, it can be presented in a browser, such as Internet Explorer, in any number of ways, or it can be handed off to other applications for further processing and viewing. More information can be found at `msdn.microsoft.com/xml/`.

The goal of this book is to explore the development techniques behind building robust Web applications. This will be primarily done through the use of VBScript code created in Visual InterDev and SQL code in Microsoft SQL Server.

Browsers

There are two primary browsers used on the Internet. The first is
Netscape Navigator (or Communicator) 6.*x*, and the second is Internet
Explorer 5.*x*; Figures 1.1 and 1.2 show the two browsers, respectively.
Even though Internet Explorer has seen strong growth in use, Netscape
is still a significant player in the marketplace.

Both browsers support standard HTML and some extended features,
such as cascading style sheets, dynamic HTML, and JavaScript. The only
thing you can be sure will work in both, however, is standard HTML.
Even then, the visual rendering might be a little different in each.

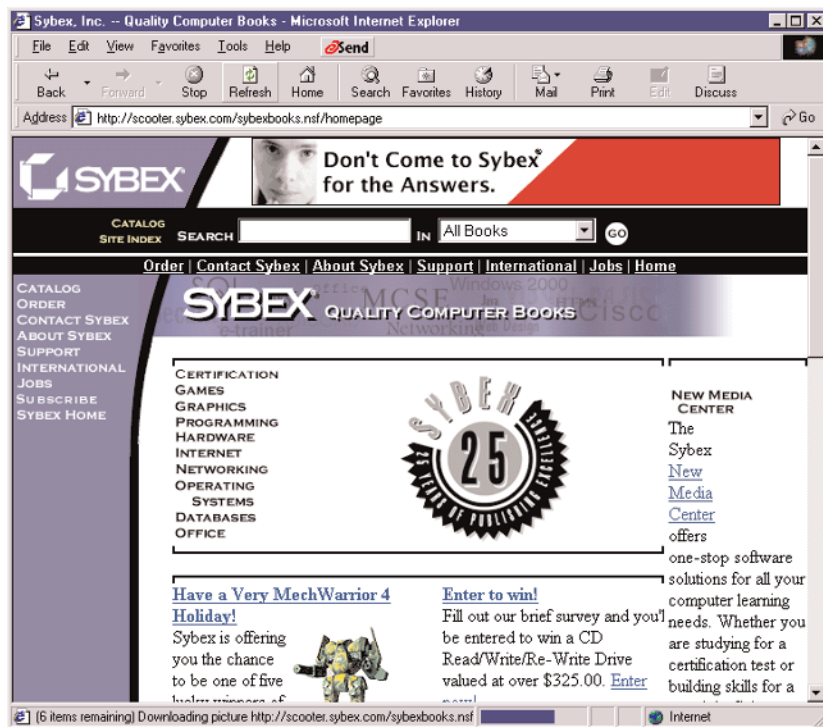**FIGURE 1.1:** Netscape Navigator 4

FIGURE 1.2: Internet Explorer 5

Trying to design a truly unique and advanced interface on the client side can be tricky when trying to ensure support in both browsers. Even if you decide to build two different interfaces for those two browsers, you still have issues of supporting smaller segment browsers, such as earlier versions, specialized browsers, and so on.

This book does not explore the difficult issues of cross-browser development of client-side JavaScript, etc. In certain cases, this book will offer some specific development with VBScript on the client side in Internet Explorer.

NOTE

For more information on building client-side browser-based applications, see the following books: *Mastering JavaScript and JScript* by James Jaworski (Sybex, 1999), *Visual Basic Developer's Guide to ASP and IIS* by A. Russell Jones (Sybex, 1999), and *Mastering Visual Basic 6* by Evangelos Petroutsos (Sybex, 1998).

WHAT'S NEXT?

The Microsoft platform provides a rich Internet development environment. At its core are the SQL Server database and the Visual Basic Script programming environment. Careful planning based on the size and scope of your site will help to determine what additional tools you'll need. In the next chapter, we'll cover Visual Basic in more detail, as well as define some of the fundamental concepts and terminology used in building a Web-based application.