INPUT

STRATEGIC MARKET PERSPECTIVE

The Future of World Wide Web Software

Internet Opportunities Program

JUNE 1996

The Future of World Wide Web Software

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Abstract

This report analyzes market and technology trends for Web software. It provides worldwide and U.S. Web software market forecasts from 1995 to 2000 as part of INPUT's Internet Program. A survey of 30 corporate users provides insights into the market.

The Future of World Wide Web Software provides market forecasts to help decision makers understand the impact of technologies. It also discusses trends, issues and future technology directions.

The report contains 100 pages and 21 exhibits.

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Internet Opportunities Program

The Future of World Wide Web Software

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Introduction

A Purpose

The Internet has received enormous attention and stirred tremendous excitement and debate throughout the world in the last few years. As the Internet steadily increases in size and as more businesses link themselves to customers, suppliers, researchers, consultants, and potential clients via the Internet, the demand for browsers, Web servers, and tools to manage Web sites, content, and commerce will continue to rise.

In the Web software marketplace, the only constants are change and double-digit growth. The objective of this analysis is to provide an understanding of the concepts, technologies, trends, and issues that make up the Web software marketplace.

This study provides an insight into the competitive environment of the Web software marketplace and addresses questions such as:

- What is Web server software and how does it work?
- How are Web servers extended to solve business problems?
- What are the future directions of Web software?
- Will there be a standalone Web browser marketplace in the future?
- Who are the dominant Web server and browser vendors?
- Does the Web simply represent a shift from legacy platforms to a network-based platform for all of computing?

B
Scope

In this report, World Wide Web software (including Web servers and browsers) will be described and modeled in order to explain its future direction. A Web server is simply a program that answers requests for documents from Web clients over the Internet. A Web browser receives only raw HTML, graphics or other data and performs formatting or launches a helper application such as a sound player after determining what type of data it has received. The real opportunities for Web software companies will be extending the functionality of the Web server and browser to solve business problems.

The study's scope includes describing and analyzing Web software packages, a market analysis, a vendor summary, a user analysis, and the major issues surrounding Web software and surrounding applications. The report also includes a market forecast of Web software based on user expenditures.

Although alluded to, the report does not extensively cover: Web content management, Web development tools, Web statistical and research software, electronic commerce, security and authentication, EDI, and Web hardware.

C
Methodology

The report is based on in-depth interviews with several of the vendors mentioned in this report and a select group of twenty-four users. It also uses secondary research such as trade publications, on-line technical forums, vendor literature and the Internet.

Vendors of all sizes and disciplines were interviewed, including companies that offer ancillary products, such as helper applications and content editors. Special interest was focused on Web server vendors to ensure an accurate understanding of the emerging Web software market. Financial data and business motivation information were obtained from vendors in order to gain an understanding of the pricing, marketing, and practices of vendors.

Users from a variety of organizations and industries were interviewed. The interviews were aimed at identifying user purchasing motivation, Web-related expenditures, issues, and experiences with Web applications and software.

When presenting market size data in graphic form, INPUT's rounding procedures for portraying market size and forecasting are as follows:

- Markets of $1 billion (U.S. dollars) or greater are rounded to the nearest $50 million.
- Markets of $100 million are rounded to the nearest $10 million.
- Markets less than $100 million are rounded to the nearest $5 million.

D Organization

The report is divided into seven chapters and three appendixes. The contents of each are as follows:

Chapter I, *Introduction*, introduces the report and explains its importance; identifies the scope of the report and the methodology used in gathering, analysis, and preparation of data and report findings; presents the report organization; and notes related INPUT reports.

Chapter II, *Executive Overview*, offers an overview of the analysis conducted as part of the study and summarizes report findings. It provides a brief summation of the report's major topics and findings, suitable (in size and scope) for a senior executive who wants to understand the most important issues and conclusions without reviewing the entire study.

Chapter III, *Web Server and Browser Software,* examines the basic definitions of Web servers and browsers and extension of the technologies to solve business problems. INPUT analyzes server performance, configuration and management, and connections to back-office, database, content and commerce systems.

This chapter also considers both vendor and user issues identified from responses to INPUT's interviews.

Chapter IV, *Market Analysis,* looks at the trends and drivers of the Web software market. It defines the market, considers customer motivation, notes primary market segments, and quantifies market size and growth based on user expenditures.

Chapter V, *Vendor Summary,* explores the competitive environment. It provides concise profiles of eleven Web server, browser, and accessory vendors and notes their Web offerings and pricing strategies.

Chapter VI, *Web Technology Explodes,* discusses Web standards and the explosion of Web technology, including new object types, such as Java, Acrobat and WebObjects.

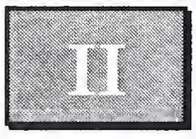
Chapter VII, *Applications Migrating to the Web Platform*, discusses the shift of applications from legacy platforms to the Web platform.

Appendices A, B, C, D, and E provide a glossary of key Internet terminology, vendor names and addresses, Web standards committees and associations, and copies of the questionnaires used in conducting the interviews.

E
Related Reports

INPUT has published the following reports that may be of interest to the reader:

- *Internet Sales and Marketing Directions, 1995*
- *Using the Internet for Business Operations, 1995*
- *Electronic Catalogs, Web Storefronts and Internet Malls, 1995*
- *Internet Application Case Studies, 1995*
- *Internet Security: The Impact of Firewalls on Client/Server Applications, 1995*
- *Electronic Commerce Over the Internet, 1996*



Executive Overview

A Summary

From its beginnings as a research and education network, the Internet has undergone significant changes during the first half of the 1990s. Until the last few years, the Internet consisted of mostly academic and defense research communities.

From this background, the Internet has emerged as the platform on which future business will be conducted worldwide.

As testament to the potential of the open systems philosophy, the Internet is being adopted as the platform for all general-purpose computing applications, and many specialized applications. The architecture on which it is built is open and controlled by no single party; hence, the Internet is a hotbed of rapid innovation. Its architecture is flexible enough to enable a breadth of applications undreamed of by its originators, and is robust enough to need no overall centralized management. It is massively scalable and can accommodate any computing platform.

It is, though, far from perfect. Performance and security remain the overriding concerns of its users. While security is being addressed by multiple independent vendors and universal, secure frameworks are not far away, resolution of the performance issue is a longer term goal requiring massive investment by the owners of the underlying networks.

B
Key Trends and Issues

Exhibit II-1 shows key trends and issues regarding the Internet and the World Wide Web.

Exhibit II-1

Key Trends, Issues and Opportunities

Trend	Issues	Opportunities
Publishing	Server availability, payment mechanisms, image and branding, copyright	Web space providers, design consultants, content providers
Connection to back-office systems	Security, integration with existing network infrastructure, client deployment, mobile users	Database vendors, groupware vendors, systems integrators, Web browser vendors
Electronic commerce	Security, payment mechanisms	Secure Web server providers, payment and billing service providers
Applications shifting to the Web platform	Existing application investments, existing network infrastructure, software support, network clients	ISVs, systems integrators

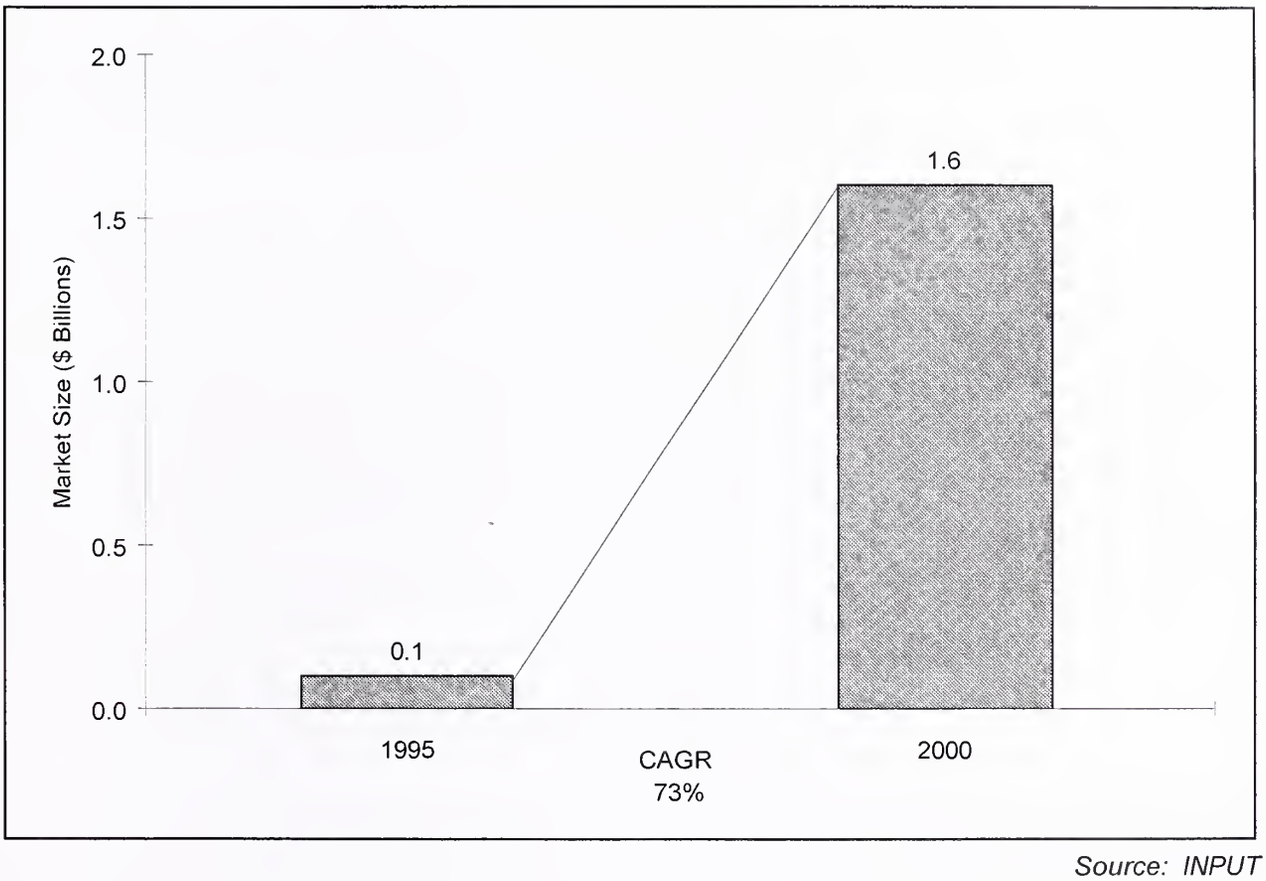
Source: INPUT

C
Market Forecasts

The worldwide market for Internet Web server software is expected to grow at a CAGR of 73% from $103 million in 1995 to $1.6 billion in 2000, as shown in Exhibit II-2. This figure does not include software to make a standard Web server a transaction server for conducting electronic commerce.

Exhibit II-2

Web Server Software—U.S., 1995-2000



Source: INPUT

D
Conclusions

The tremendous growth in popularity and use of the Internet by businesses, government agencies, and universities has created a significant demand for comprehensive Web software solutions.

- The explosive growth of the Internet will create a burgeoning market for software and services that will grow to $210 billion worldwide by 2000.

- Value will be gained by extending Web servers, including such functions as access to back-office systems, content management and commerce management.

- Applications will shift from the current PC platform to the Web platform. Over 50% of current PC-based applications will be available on the Web platform by 2000.

- New data formats will dramatically extend the Web environment, with support for multimedia.

- Emerging tools for inline Web application development will create a new niche within the application development tools market and will encourage mobile computing.

- Standards for objects will emerge, enabling application developers to take advantage of the Web when seen as a world of distributed objects.

- The only way for a company's networks to be completely secure is not to be connected to the Internet. Some users will wait to purchase Internet security products until a standard emerges. This is not expected to occur until the second half of 1997 or early 1998.

- The creation and acceptance of new object types takes some of the pressure off HTML to be the be-all and end-all network-based language. HTML will serve as the backbone language, whereas new object types can add robustness to the Web platform.

E
Recommendations

The Web software market is in its infancy. Despite Netscape's current majority share of the Web browser market, there are no dominant players and there are opportunities for new entrants. With a 70% compound annual growth rate worldwide over the next five years, software vendors, professional services vendors, and systems integrators, should position themselves to take advantage of this market. Users must develop security strategies that will enable them to securely benefit from all the Internet has to offer. This section provides a summary of INPUT's recommendations for users, Web software vendors, and application vendors.

1. Recommendations for Users

a. Avoid the High-Cost Management Trap

Focus on purchasing server packages that ease management and configuration of the Web server. Ensure that the package can support simultaneous connections. Keep in mind that in post-purchase maintenance and management, costs far outweigh the capital investment in a Web server.

b. Strike the Right Balance in Your Web Presence

Businesses looking to make an impact on the Web increasingly face a key design decision: adopt a lowest common denominator approach and produce a site that is universally accessible but lacks many current frills, or use leading-edge HTML tags and new media formats to build an elaborate site accessible in full only to those with the right versions of the right software.

The answer in most cases is a balance between the two, with some exceptions. Certain high-profile companies (popular consumer brand companies, advertising agencies, media-based businesses, etc.) may legitimately tend toward the nonstandard, leading-edge presence. Their message is often largely tied up with their image. Organizations that focus more on content (information providers and news feeds, academic and research organizations, etc.) will tend toward the standardized, universal approach. There is no reason for a standards-based Web presence to be dull, after all. The concluding message is: When in doubt, be conservative with your added value.

c. Prepare for the Application Shift to the Web

Be fully aware that, over the next few years, the way applications are developed, deployed, and supported will change fundamentally. Think twice before making major investments in applications, be they standalone, networked over a LAN, or distributed within a client/server environment. Consider alternative applications that are based on Internet technology, even if they did not make your initial evaluation list.

A major investment made now in an application that will become obsolete before its time will not look such a wise investment in the near future when the same functionality is available for less cost from an Internet-based vendor. As always, immediate needs must be balanced with investment longevity.

d. Work Toward an Internal Internet Infrastructure

The future of software lies in Internet compatibility and integration. When making your next major network infrastructure decision, consider very carefully the consequences of an Internet future. Learn the lessons of

history—the mainframe-to-mini shift and the mini-to-PC shift—many companies did not anticipate the changing technological climate and suffered greatly as a result. Avoid locking yourself in to a network architecture that will not adapt to evolving Internet technology. Question whether your network architecture supplier has itself anticipated the changing technological climate.

The goal is total, seamless Internet integration—an intranet. To reach that goal will mean ensuring that every component of your changing network architecture is compatible with Internet technology. At the very least, ensure that your network will run native TCP/IP and that it is possible to run a Web server on that network.

2. Recommendations for Web Software Vendors

a. Differentiate Your Products

Due to the fragmented and chaotic state of the Web software market, vendors must not only make their software highly functional and stable, but must offer unique features that will answer specific needs not addressed by competing products.

But a balance must be reached. By its nature, Web software must be built on common base standards. For this reason, it is not possible to market successfully a technically excellent Web product that achieves its excellence through heavy use of proprietary technology if that technology compromises the openness of the product. The greatest opportunities exist for tools to administer Web servers and to extract useful information.

b. Extend Server Functionality

Focus on the Web server and on extending it. That is where the future opportunities exist. When extending Web server technology, focus on providing tools to solve business problems and less on the underlying technology, certainly if the underlying technology becomes so extended it foresakes compatibility with the open standards of the Internet.

c. Answer User Demands for Integrated Web Servers

Users want a fully integrated Web server product and are willing to pay for it. They want features such as image maps, forms, and interfaces that are integrated and easy to use. Avoid packaging public-domain software and integrate it into a slick package.

d. Focus on Vertical Markets

The Web server market is a broad segment that will become extremely competitive as marketing machines such as Microsoft and Oracle enter it.

Target segments of the marketplace and learn from the cutting-edge leaders in those industries to find out what it is that is going to make their businesses successful. Incorporate custom solutions into off-the-shelf Web server products.

e. Take Advantage of the Open Browser Environment

As a Web server company, practice universal access/browser independence. Make every business solution marketed accessible by every client in the marketplace.

As a Web browser company, specialize in application areas. Browser clients will specialize in areas such as Web development and content management, collaboration, and electronic commerce.

f. Combine CD ROM and the Web for Multimedia Applications

The Internet is at a crisis point in terms of available bandwidth. The Web was the first client-heavy, bandwidth-intensive Internet application, and bandwidth upgrades have not kept up with the increase in Web use. Real-time delivery of graphics and video to a reasonable standard is not possible on the Internet today. Systems that integrate control messages over the Internet and large data files from local a CD ROM will, to the user, overcome much of the bandwidth problem and will also play a part in keeping Internet traffic down overall.

g. Simplify Web Server Management

Server management is a major factor in an organization's choice of Web server. Tools that simplify management, configuration and other maintenance of Web servers will prove attractive to users, and Web servers with such tools built in will likewise prove profitable for software vendors.

h. Cooperate with Application Vendors

Web server vendors should work closely with application vendors. The basic Web server will be extended in a variety of ways and will connect to most legacy systems. Vendors must create open APIs (application programming interfaces) that allow other application vendors to connect seamlessly to the server. The greatest opportunity lies in the development of APIs that, through open licensing agreements, are adopted across the market.

i. Develop Wide Channels

Develop a channel with enough breadth and reach for everyone expressing interest in Web software products. The Internet is affecting all industries; focus on many different applications of Web technology in many different industry sectors.

j. Develop VAR Channels

In general, the appropriate delivery vehicle for Web software is a VAR-type channel. Typically, at the end-user level, there is a requirement for many things to be integrated, such as hardware servers, operating systems, TCP/IP software, Web server software, and mail servers. No single vendor can provide all of those in a single unified product. A VAR can take the best elements of each category from each of the categories that the customer wishes to utilize and integrate them.

k. Strike a Balance in the Use of Standards

Don't necessarily wait for the standards committees. This market is developing so rapidly because of the high demand for products that companies are not waiting, but are introducing new features and extensions for the marketplace to accept or reject.

Conversely, ensure that when the committees publish important standard such as HTML itself, your products conform precisely to them. Do not willfully breach accepted standards if there is not a very good reason to do so.

l. Cover All Security Bases

No one security standard will dominate on the Web. Too much is at stake, too many powerful players want to win. Learn from history: although many data communications protocols have been lauded as the perfect solution, several are still used today and more are introduced constantly. Some are more dominant than others, but a variety exist. For example, Cisco turned this into an opportunity and became a billion-dollar company by developing routers that tie different networks together. For the future, look for the security routers that take in one security protocol and convert it into another.

3. Recommendations for Application Vendors

a. Work Now To Reap the Benefits of the Application Shift to the Web

A fundamental shift is taking place: Applications are migrating from the hardware platform to the network platform, i.e., the Web. Not all applications will migrate to the Web, but those with the greatest potential for collaboration will migrate first. This means groupware, workflow, and all communications-based applications. The company that is working now to be able to meet the demand for Web-based applications will give itself a head start over its competitors.

b. Embed Browser Technology into Applications

As a first step in the application shift from the PC to the Web, look for ways to incorporate Web browser technology into existing applications. View the Web browser as a technology and not necessarily as a standalone application. This technology will be embedded in the applications we use today.

c. Address the First Stage of the Application Shift to the Web—Groupware

Many companies are developing groupware products that run on the World Wide Web. It is essential that your groupware back-end database is readable and writable by Web browsers. As the Web browser becomes the user's default front end, groupware products that necessitate a proprietary client will be at a disadvantage.

d. Ensure That Your Software Portfolio Addresses Content Management

Managing content, known as asset management in some segments of the multimedia publishing industry, is an emerging opportunity. Whereas publishers, stock photo houses, movie makers and others are used to managing content, it is now a function that most corporate users of multimedia need to address. There are excellent opportunities for adding content management to virtually every application area. Content must be agile so that it can be moved from one format to another easily and quickly. Copyrights need to be tracked and sourcing information must be maintained. Content must be managed as carefully as physical inventory.

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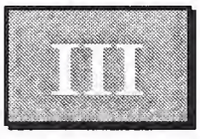


Web Server and Browser Software

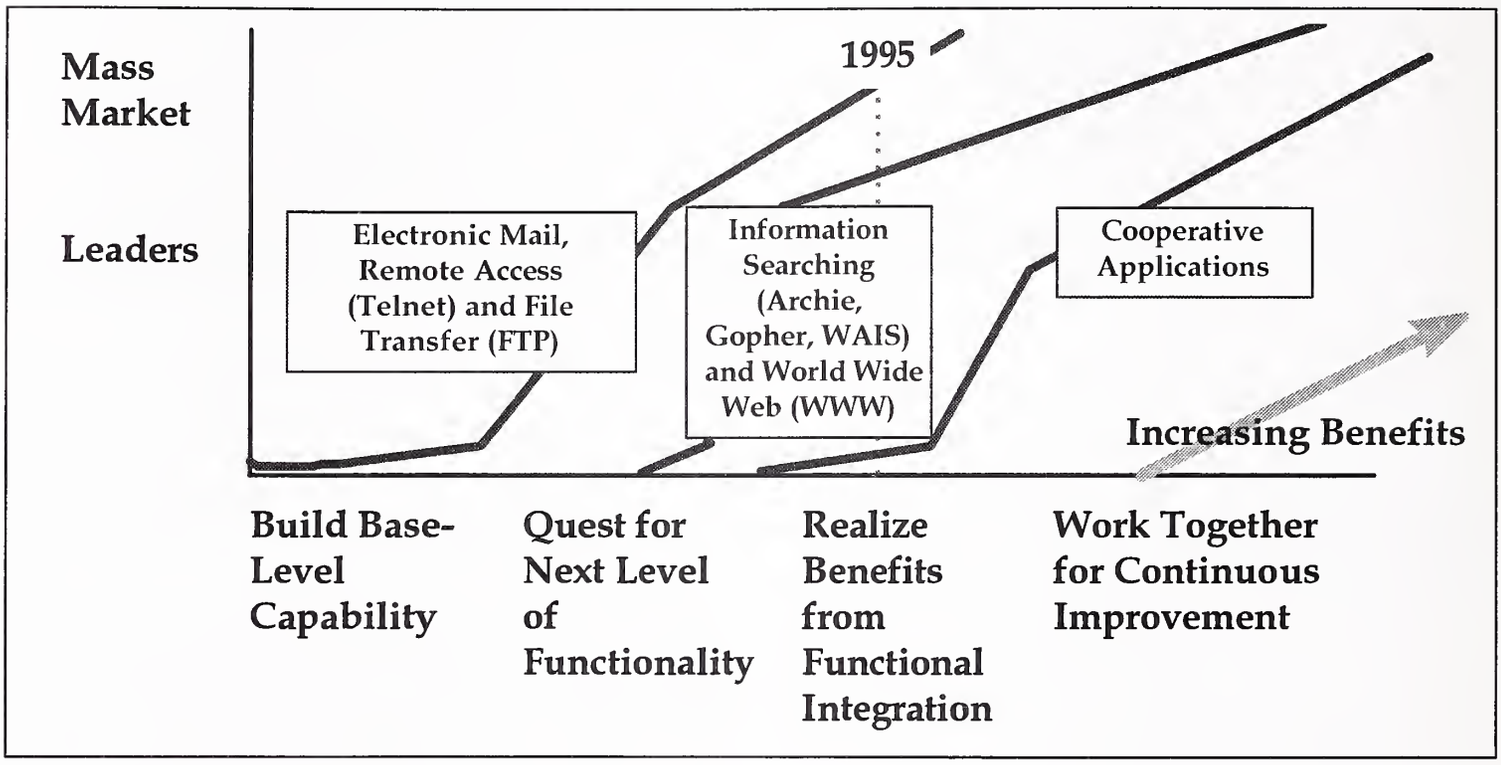
A
User Quest for Extended Functionality

The World Wide Web, once used primarily by scientists and academicians, has become the fastest growing information delivery vehicle. Although the excitement and hype have not yet died down, it is clear that the first wave of commercial Internet development is almost over. Major vendors have a presence, second- and third-tier players are almost on board, and Internet mentions in the media are almost old news. Talk has now turned from "Are you on, yet?" to "How can we exploit this opportunity?"

Exhibit III-1 depicts the typical phases of growth in technical areas. As companies move into the second phase and begin to exploit the technology, their quest for the next level of functionality will drive the requirements for more robust server and browser software products.

Exhibit III-1

Second Wave of Commercial Internet Activity Takes Off



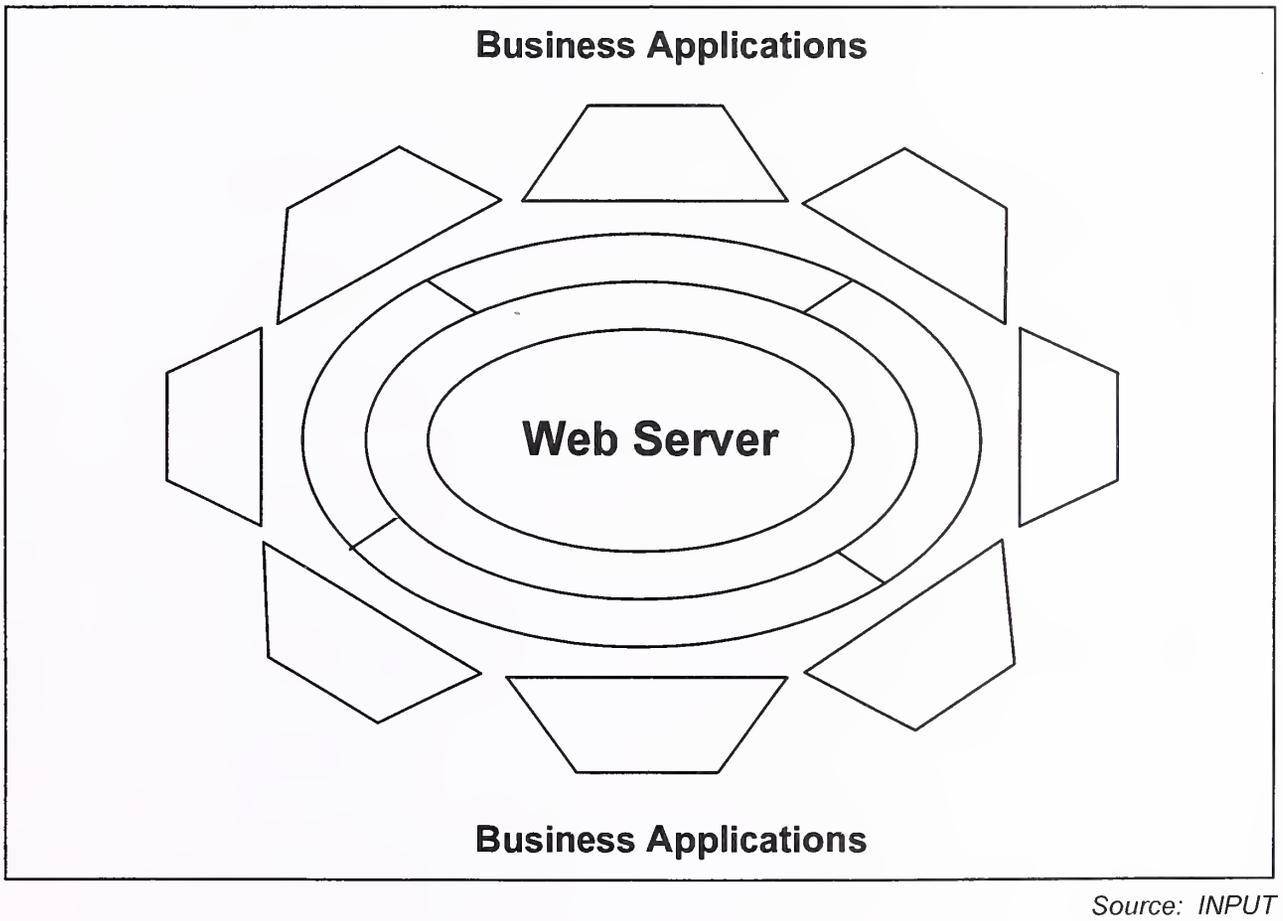
Source: INPUT

B
Web-Centric View

Web servers are the foundation of the World Wide Web. They distribute valuable information by communicating with the Web client. As companies strive to solve business problems by using the Web as an enabling technology, applications will explode as they build upon the basic Web server. As Web technology matures and employs such enhancements as CGI scripts, extensions such as Java, and possibly CORBA objects, Web-based applications will layer on top of the Web server. As depicted in Exhibit III-2, these will be in the form of content management, groupware, collaboration, commerce management, electronic marketplaces, and more.

Exhibit III-2

Web-Centric View



Source: INPUT

C
What Is a Web Server?

A World Wide Web server is simply a program that answers requests for documents from Web clients over the Internet. All Web servers use a language, or protocol, to communicate with Web clients, called HTTP (the HyperText Transfer Protocol). This is what the "http" in a Web address (URL) signifies, e.g., "http://www.input.com/." All types of data can be exchanged using this protocol, including HTML, graphics, sound and video. Data types are identified by the server and preceded by a MIME header (MIME is Multipurpose Internet Mail Extensions).

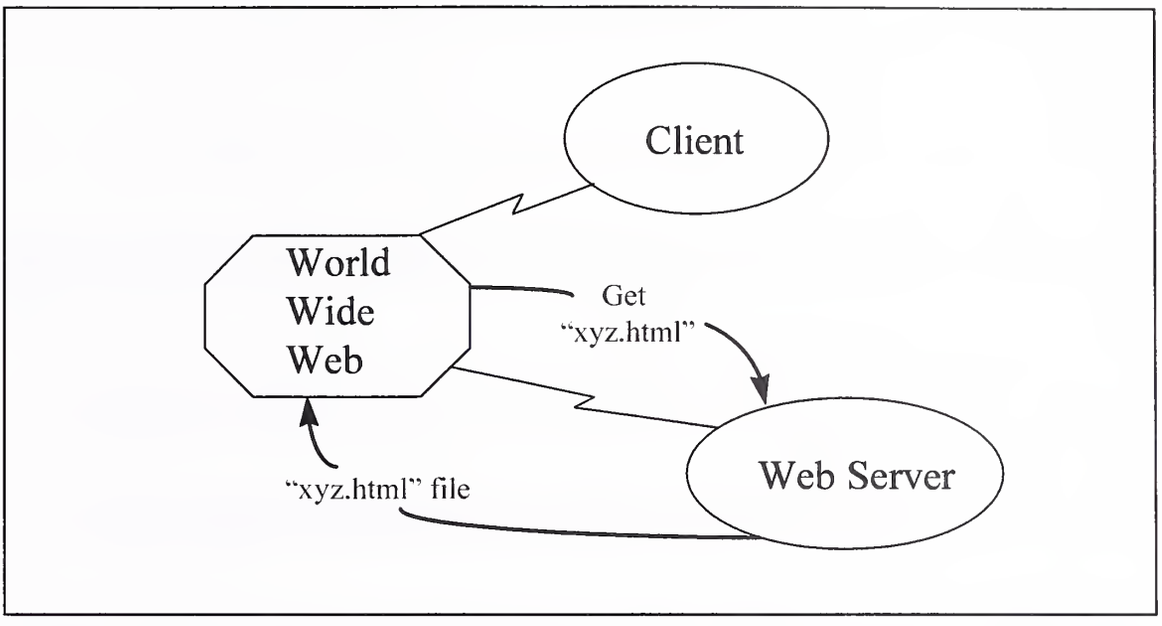
Web clients convert "open URL" commands into HTTP GET requests. So a browser would:

- Convert "http://www.input.com/welcome.html" to a "GET welcome.html" command
- Connect to the Web server running on input.com
- Issue the command
- Wait for a response

The response can be the requested document or an error message. A Web client can be simulated by connecting to a Web server directly via telnet (the basic client-to-host terminal emulation mechanism on the Internet) and specifying port 80, the Web server along with the Internet address, and then typing GET (all in upper case) and the name of a file that exists on the server. After the document or error is returned, the connection is closed. HTTP is a stateless protocol, which means there is no continuous connection between the client and server, as there is with telnet, for example.

Exhibit III-3

How Web Servers Work



Source: INPUT

A Web client performs many useful functions. It receives only raw HTML or other data and has to perform formatting or launch a helper application such as a sound player after determining what type of data it has received. The server only sends the data and goes away. Web clients are responsible for interacting with non-Web servers such as gopher or FTP directly, and they create a virtual HTML document while doing so.

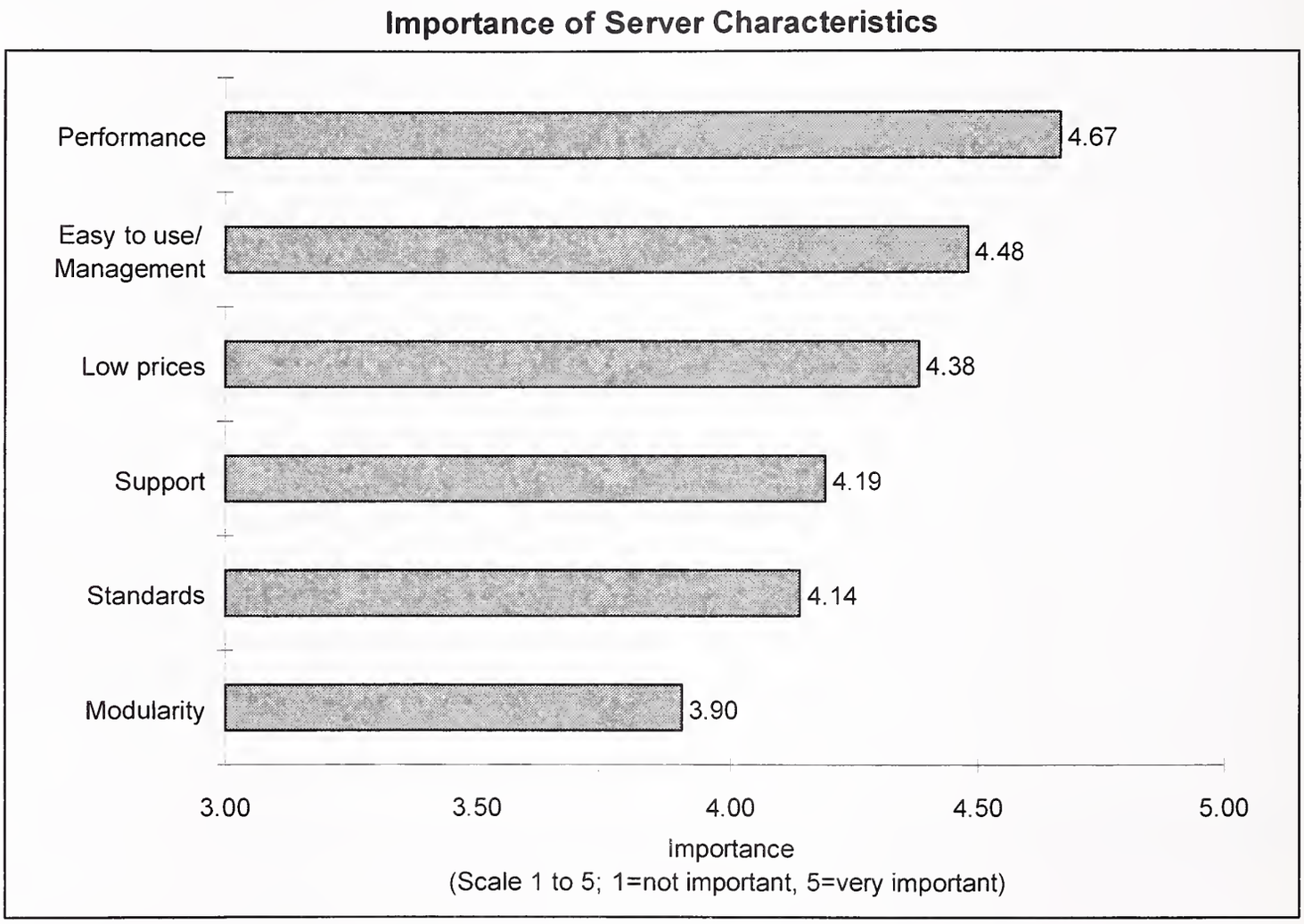
D
Differentiating Web Servers

Web servers are graduating from freeware to fully supported commercial-grade products. But in order to effectively build these business-oriented applications, a variety of software tools are required. As the Internet continues to mature into the mainstream platform for computing, Web servers will require:

- High-performance serving capability
- Superior server management tools
- Interface and translation software for connecting to legacy systems
- Better content management and Web development tools
- Electronic commerce-enabling technology

According to users, the most important characteristic of Web server software products is performance (see Exhibit III-4). The next most important characteristics of Web server software are security and ease of management.

Exhibit III-4



Source: INPUT

1. Performance

Performance is the key feature of the server. The goal is to handle as many simultaneous requests as possible as quickly as possible. The Web server generally has several client requests in progress at the same time. A Web server that processed one client's request to completion before beginning to process the next client's request would be very inefficient.

a. On-the-Fly Processes

Until recently, most Web servers achieved simultaneous processing by simply creating a separate process for each connection as it arrives. The process works on the request until completion, then terminates. The drawback of the duplicated process design is the large overhead per connection. Each process occupies considerable RAM and swap space, and

creating and destroying a process consumes many processor cycles. This "on-the-fly processes" server design results in a low-performance server.

b. Preallocated Processes

More advanced Web servers are based on a "preallocated processes" design. The Web server creates a set of identical processes during initialization. As each connection arrives, an idle process is removed from a pool and assigned to handle the request. The process works on the request until completion, then returns to the pool.

NCSA's http Web server reduces the time needed to respond to a request by preallocating a number of processes, essentially making multiple copies of itself in advance and keeping those copies around until they are needed. Administrators can adjust the minimum and maximum numbers of processes before the server starts.

Netscape's dynamic process manager allows the creation of a configurable number of processes that reside in memory, waiting to fulfill HTTP requests. The dynamic process-management algorithm increases the number of server processes within configurable limits, to efficiently handle periods of peak demand.

The preallocated process design gives better performance than the on-the-fly design because it eliminates the unnecessary overhead of creating and deleting processes to fulfill every HTTP request. As a result, it reduces system load and increases system reliability.

However, the design is still limited to handling a moderate number of simultaneous connections, largely because it makes such inefficient use of memory. Each process still occupies a lot of RAM and swap space, and when these resources are used up, so is the server's connection capacity. The preallocated processes design is inefficient because each process is active only a small fraction of the time. When a process is inactive the memory assigned to that process is not being utilized efficiently.

c. Increase in Web Objects

Handling hundreds of simultaneous connections on relatively small machines is not a big issue today. Some sites serve thousands of users per hour. As multimedia, sound, and video objects become more important, Web servers will be required to handle those objects more adeptly. For example, a video object can take several minutes (or even hours for 14.4Kbps connections). The browser grabbing the video HTML file remains connected as long as it is downloading. The number of simultaneous connections a server can support is limited by the number of processes that the operating system and hardware platform can support, typically 100. So as Web sites

begin to move large objects, such as video files, through relatively low-speed lines, the number of users that can be connected to the server becomes very important. As the number of connections increases, the advantage of a reduced process architecture becomes even more significant.

d. Single Process

The asynchronous Spyglass Server does not create copies of processes to manage connections. All connections are managed within a single process, requiring fewer operating system resources and leading to greater efficiency and performance. No matter how many users are connected to the system, only one copy of the software is active.

Open Market uses a multi-threaded model. Each process is capable of accomplishing several tasks, essentially simultaneously. For example, a process could simultaneously write information to the server's log file, send a document to a client, and wait for the next connection. With multi-threading, far fewer processes are needed, so each process is busy a greater fraction of the time, making more efficient use of system resources. As a consequence, the server can handle more concurrent connections, and at each level of system load it is more responsive.

The Open Market WebServer also creates a pool of multi-threaded processes. By preallocating multi-threaded processes, the server can accommodate over 1,000 simultaneous connections on the same platform.

e. Measuring Performance

Web server performance is very important, yet it can be very difficult to put a number on Web server performance. The WebStone server benchmark is an open, highly configurable benchmark designed to measure the performance of HTTP servers under multiple scenarios that reflect different Web site profiles.

The WebStone benchmark was developed by Silicon Graphics and is the generally accepted industry standard for measuring Web server performance. It runs exclusively on clients, makes all measurements from the point of view of the clients, and is independent of the server software.

The questions WebStone attempts to address are:

- How many transactions per second can a particular server on a given hardware platform handle?

- How efficient is the server at handling CGI requests, GETs, redirects, and POSTs?

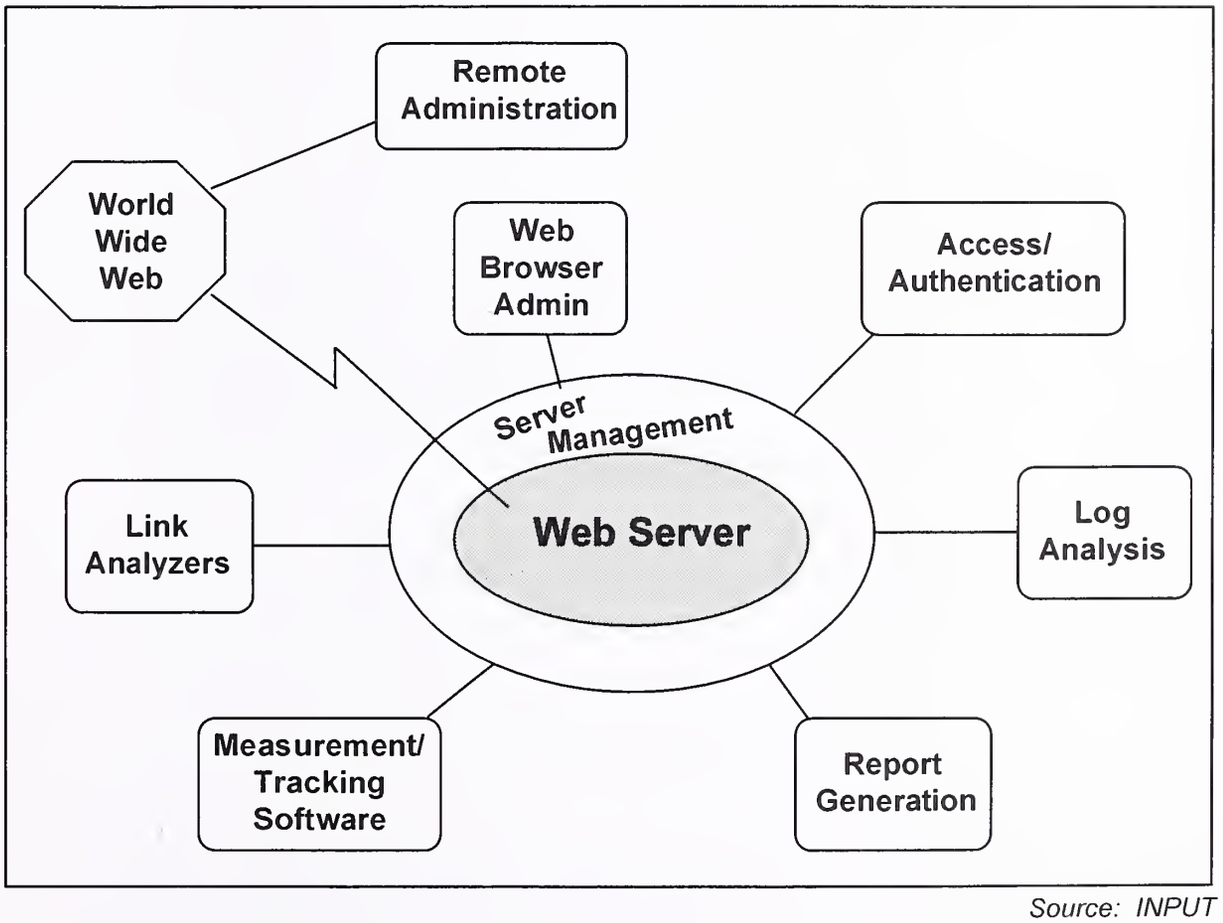
- What are the performance implications of adding security mechanisms?

2. Configuration and Management

Management, configuration and logging functions separate early Web servers from today's commercialized, operational-quality Web servers. Configuring early UNIX Web servers was difficult because configuration files had to be edited manually. Today's commercial servers ease server configuration by providing graphical interfaces that manage configuration files, in addition to safe and well-documented configuration defaults allowing a minimum amount of fuss and making room for later configuration.

Exhibit III-5

Configuration and Management



Source: INPUT

Web server packages provide a variety of features, including:

- Access/authentication
- Log analysis
- Report generation

- Linkage of visualizers
- Directory indexing
- Remote administration

Most packages use forms and are used for server configuration, user access authorization, transaction logging, and process configuration. Better packages provide log files in a format compatible with several public-domain applications for statistical analysis and trend reporting.

The Netscape Communications Server uses the graphical interface of Netscape Navigator to provide a consistent, easy-to-use operating environment. The simple user interface and forms capability of Netscape Navigator enable point-and-click server installation, configuration, and maintenance. The WebSite Server Admin program makes it easy to browse the different configuration options available, and those options can be changed while the server is running.

Another important feature for the future is session IDs that allow a Web server to tag browsers as they come in and trace those browsers through the content. They will allow the company running the Web site to obtain much more information from the Web server log with regard to how the content is being accessed, how best to manage the site, and how best to serve those accessing it. And if a company wants to do commerce based upon the content, that kind of information will be worth its weight in gold.

Increasingly powerful management tools will also enable an enterprise to support far-reaching and innovative systems without sacrificing control. Improved security and administration tools will ensure that users are authorized to access the information they seek. Information management tools will also provide integrated search technology to search effectively across distributed servers.

Improvements will continue to be incorporated as companies compete to ease the task of configuring and managing Web sites. The greatest opportunities exist for tools to administer Web servers and to extract useful information.

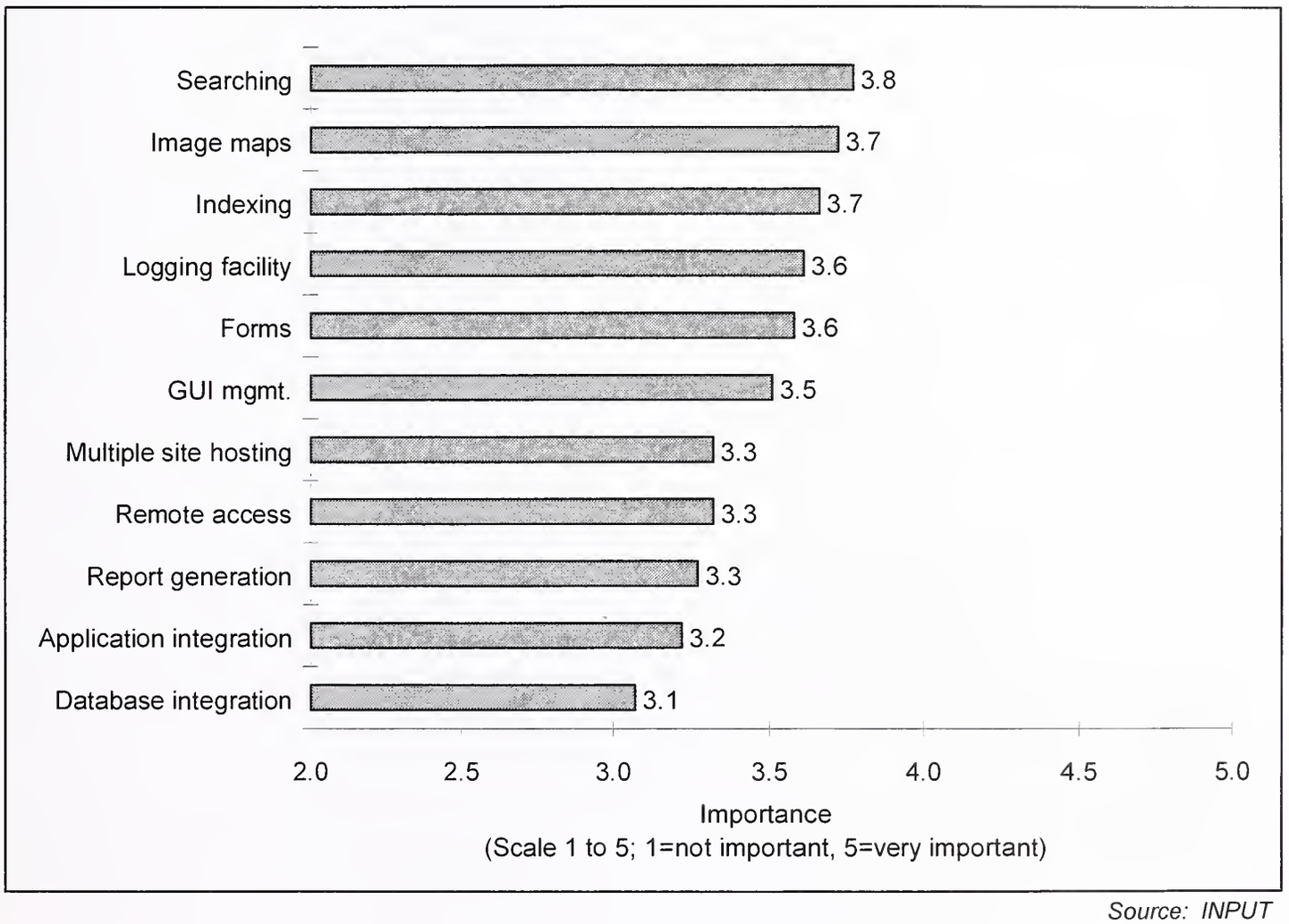
According to users, the most important management feature of Web server software products is support for searching mechanisms (see Exhibit III-6).

The most important features to users are all Web-specific elements—searching, image maps, indexing, logging, forms, and GUI management. Reflecting the still-immature status of the Web software market, integration

and applications with existing back-end databases are less important, although they will increase greatly in importance as companies increasingly incorporate the Web into their business processes.

Exhibit III-6

Importance of Web Server Features



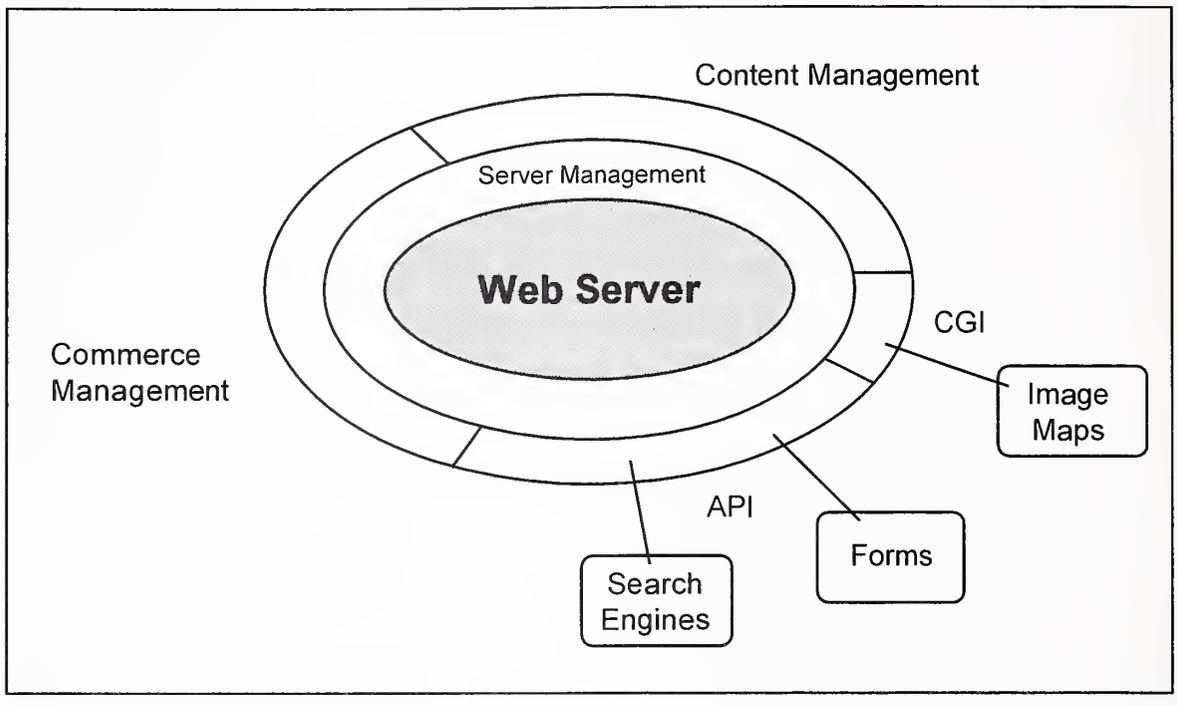
Source: INPUT

E
Extending Web Servers

By their nature, Web servers are limited to serving. They will serve a wide variety of files, but they don't do anything special with them. In order to facilitate any kind of interaction with the user, applications must be created. These applications are responsible for such things as image maps, on-line forms, document and database searching, and even pages that show the current time and weather for a city. The real action occurs on what is placed on top of the Web server to extend its functionality to solve real business problems.

Exhibit III-7

Extending Web Servers



Source: INPUT

The Common Gateway Interface (CGI) protocol, which underlies the interactive functionality, is the most common way for the Web server to interact with Web applications. CGI is a standard that gives programmers an easy method for writing powerful scripts in the language of their choice. It allows scripts to be used in a plug-and-play manner, independent of the server.

Clickable image maps are one of the most common uses of CGI scripts. When a user clicks on an image, the coordinates of the mouse click are sent to a script. The script then uses those coordinates to determine what information should be returned.

The best programming interfaces, however, are built into the Web server. Sophisticated APIs are designed to let a Web programmer manipulate many aspects of the server's behavior: these and will become more commonplace. Development of Web server data structures and functions and improved Web server performance are the immediate benefits.

The Netscape Server API (NSAPI) is an extension that allows users to extend and/or customize the core functionality of the Netscape server and provide a scalable, efficient mechanism for building interfaces between the HTTP server and back-end applications. Netscape Server products can take advantage of the NSAPI in addition to CGI. The NSAPI was designed to solve performance and efficiency problems common to installations that make liberal use of CGI functionality.

Improved application development tools will also make it easier to build applications on top of Web platforms that conduct complex transactions with databases, legacy systems, and other corporate information sources.

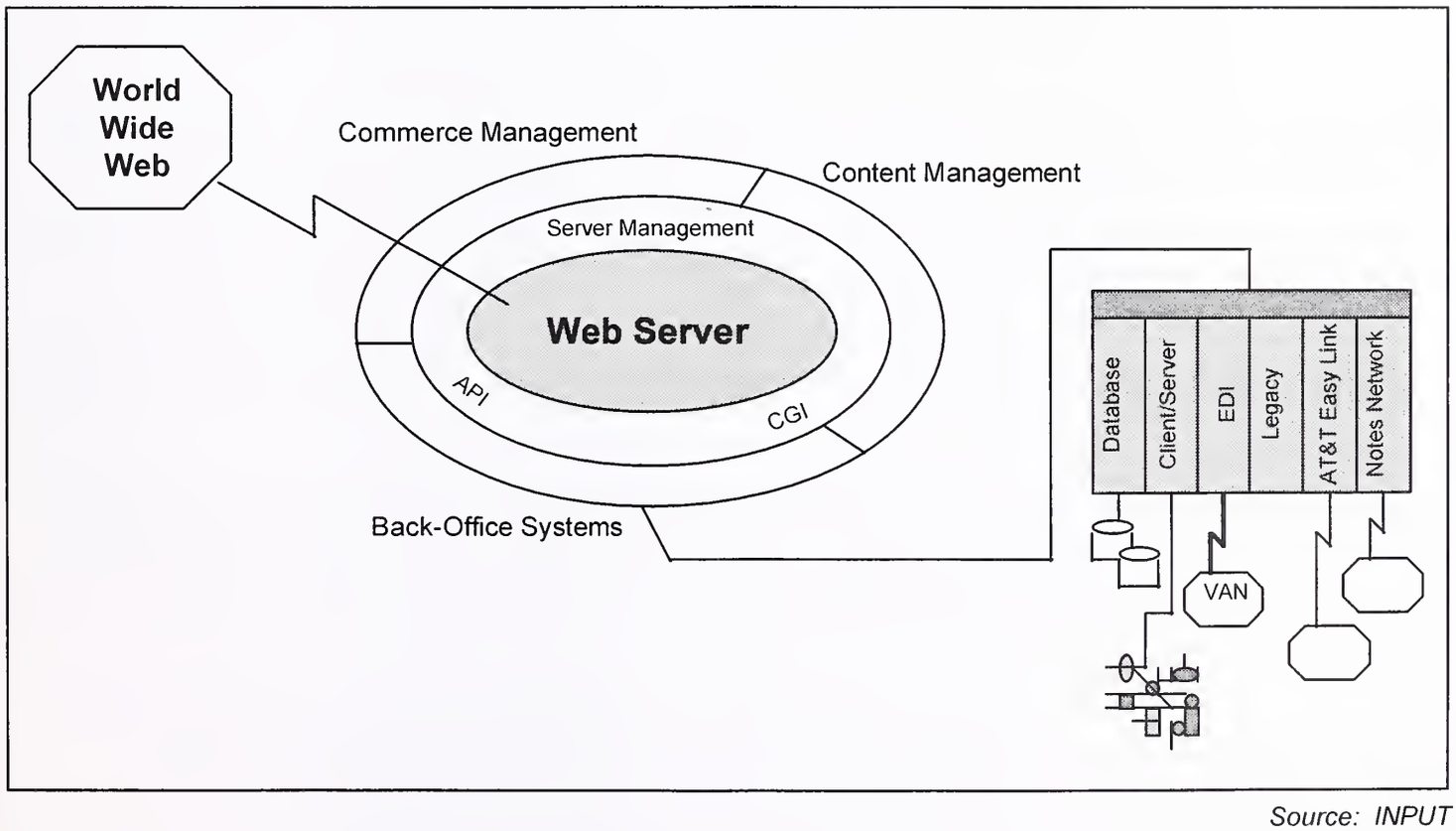
1. Access to Back-Office Systems

As the "GUI of the 90s," the Web is being used as the front end to a variety of existing back-end applications. Advantages of connecting legacy systems to the Web include:

- Connection to content servers spread throughout the world
- Companies won't have to change their back-end systems.
- Companies can add users without incurring additional costs.

Exhibit III-8

Access to Back-Office Systems



Source: INPUT

Web technology connected to back-office information systems creates "marketspace," as referred to by Harvard professors John Sviokla and Jeffrey Rayport. In this new market, costs are reduced, but unseen values are isolated and exploited to the benefit of businesses. The Web is enabling information space, which provides markets with a cheap, efficient, and customizable way of doing business that also opens up endless possibilities for new value that might not have existed in the physical markets.

Federal Express has put a Web front end on its IBM mainframe-based databases. That front end enables customers—via the Internet and on-line services—to track their packages around the world, day or night, every step of the way. Users can track the status of a package even while it is still in transit. Users can type in their FedEx package tracking numbers and the delivery and/or scan information for the package is displayed. This information is retrieved from FedEx's IBM mainframes.

Open Market is working with a major medical supplier to interface its back-end order processing system to the Web. The supplier wants to allow all of its customers, distributors and sales force to use the Web, but doesn't want to have to change its back-end system. Order entry will be one of the first business applications to be transformed by the Web.

a. Access to Databases

The Web provides unique opportunities to extend access to databases both inside and outside the corporation. Database applications accessible by browser clients can significantly increase the value of the information resources of a company to its customers, suppliers, and investors.

Many of the current applications on the Web are adequately served by flat-file information systems. As the sophistication and complexity of Web applications increases, access to relational databases will be essential. Any transactional systems, such as order processing, or complex search engines, will need the power and flexibility provided by RDBMS connectivity. Tracking orders, customer account information, product specifications, and many other forms of data will be immediately accessible to those needing the information.

The Web, and connection to database applications, is reshaping enterprise information systems, providing a compelling alternative to traditional client/server application. The Web as a front end to today's databases offers several advantages including:

- Platform Independence—The Web, as an application GUI, allows companies to seamlessly integrate a heterogeneous platform environment, protecting a company's investment in hardware.

- Flexibility—The application resides on the server without any client change. This allows companies to easily maintain, modify or upgrade client programs, whether internally or externally.

- Cost Effectiveness—Web/database applications, using the Web browser as a single front-end interface to databases, significantly reduce the cost and time of client-side software installation and

training associated with deploying traditional client/server applications.

The development of user interfaces in client/server applications can account for 50% to 80% of the application development time. Custom GUIs, created by programs from Powersoft and Gupta, have been both difficult and expensive, requiring extensive technical knowledge, custom programming and significant time. Because the HTML language is relatively simple, and can be learned very quickly by even nontechnical personnel, it can significantly reduce overall application development time. The software features all reside on the server until a user downloads information or software of personal interest. This simplifies software installation, particularly in remote locations where systems administrators may be unavailable.

- Reliability and Security—The Web offers an effective means of implementing applications with high reliability and appropriate levels of security.

b. Development Tools

Tools that assist developers in creating browser-based GUIs are beginning to appear from companies such as Illustra (recently acquired by Informix), Spider Technologies, Speedware, and Bluestone. Spider offers a visual development environment with a robust deployment engine. This engine solves additional issues related to deployment of applications through CGI, the standard today for deploying Web/database applications.

Illustra offers the Illustra Server, a back-end database for Web-based applications. The Illustra Server is the industry's first object-relational database management system (ORDBMS) that efficiently handles text, video, images, and documents within a single repository. Built from the ground up to deliver high-performance relational and object database management, Illustra embeds object-oriented (OO) capabilities in a relational model, providing the first breakthrough in the 25-year history of the relational DBMS.

The Illustra Server provides a high-performance, extensible platform for storage and retrieval of objects. Object extensions, called DataBlade modules, plug intelligence into Illustra for specific kinds of data, extending the SQL language with tailor-made functions and allowing Illustra to effectively manage the data required by a specific application.

Autobahn is a new Speedware server that makes it easy to create real business applications for the Web. It lets users run dynamic programs and receive the results via a Web browser. Current COBOL or C programs can be easily plugged in to the Autobahn server, to leverage a company's

development investment. The Speedware Open Application Server can access 14 different DBMS and file systems. Therefore, Autobahn applications can access many databases simultaneously.

IBM is developing middleware for its OS/2 Warp Server called DIS Webkit designed to give Web browsers access to metadata in a data warehouse. Web versions of Visual Age and Visual Gen should ship by mid-1996. IBM also offers DB2 for World Wide Web, a gateway to connect its relational DBMS with Web servers.

Computer Associates intends to provide Web access to databases with its new UniCenter/ICE (Internet Commerce Enabled) systems management console. OpenIngres will connect directly with the new Microsoft Internet Information Server. Informix is developing a set of JavaScript class libraries to let developers provide connectivity to their databases through Java applets.

Sybase is incorporating Java into its Web.aql middleware software for connecting Sybase databases to Web servers. Informix and Sybase are working with Netscape Communications to connect to Netscape's Web server API, opening the door to support for JavaScript. Informix acquired Illustra, which will provide it with additional Web capabilities. Illustra already provides support for Sybase.

c. Web/Database Examples

Illustra database applications on the Web include Coldwell Banker, an on-line real estate listing database providing spatial and other search lookup capabilities for all the Coldwell Banker listings in all price ranges in the U.S., and Time-Warner's Pathfinder-Weather Now, an on-line database of U.S. weather reports updated every four hours.

Spider Technologies has worked with Investors Group, one of the largest financial services groups in Canada., to develop an application that enables customers to access their portfolio information over the Web with a login ID and password. Clients are also able to change certain account information, such as their mailing address. The Metropolitan Board of Realtors, in Indianapolis, IN, developed Web-based realty listings for its entire region using Spider software. The 8,000-10,000 listings are maintained on a regular basis, with E-mail and Web links back to the representative realtor. Searches can be conducted by a range of criteria, including location, price range, and amenities.

d. EDI over the Internet

In addition to databases, the ubiquitous Web will tie into other back-end services, such as already established EDI links, and other services such as connections to payment services. Traditional EDI software companies such as Premenos, Sterling Software, Harbinger, Supply Tech, and TSI International are currently developing EDI software to be used over the Internet. See INPUT's report, *Electronic Commerce over the Internet*, published within INPUT's Electronic Commerce program.

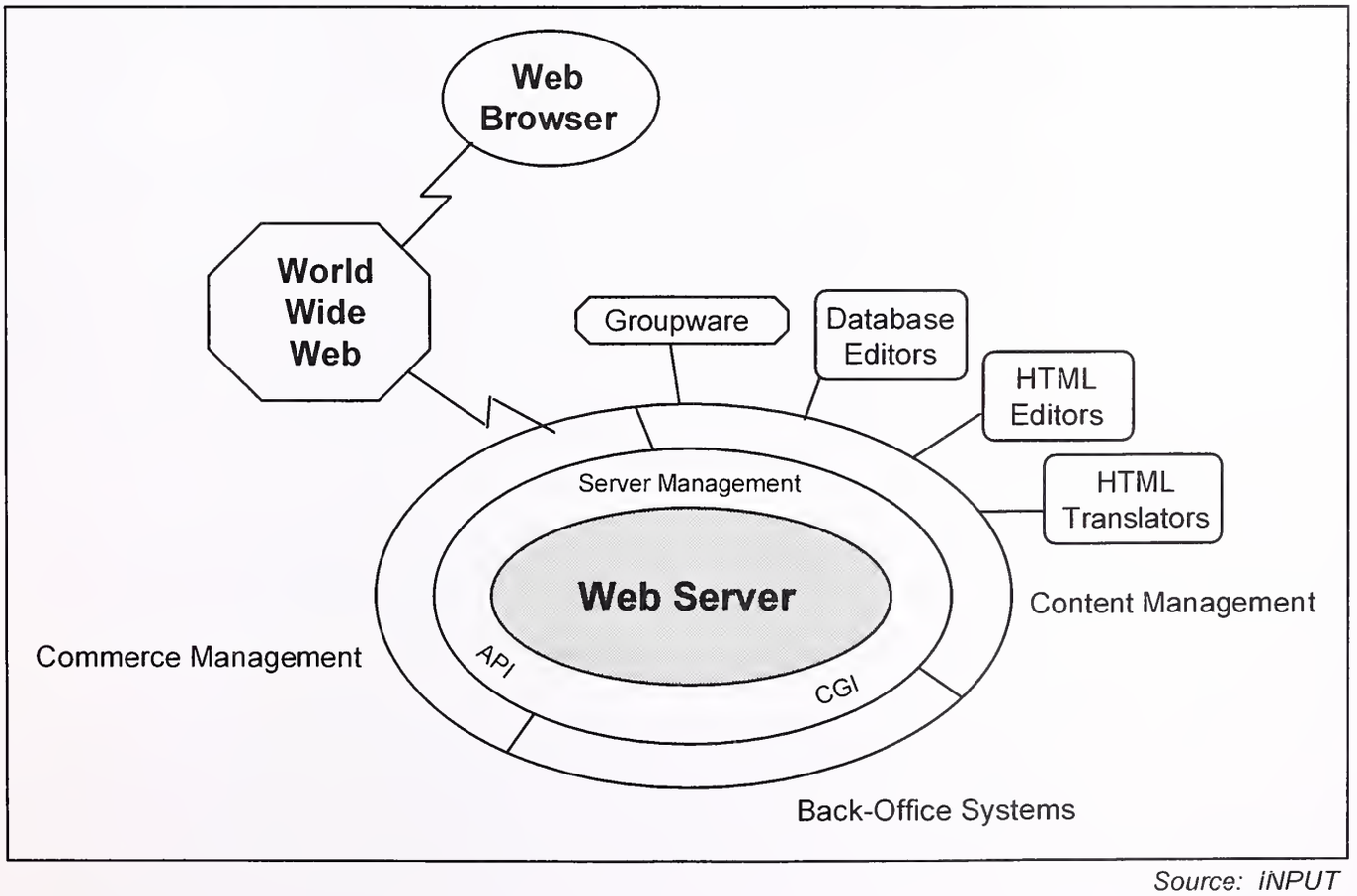
2. Content Management

Beyond Web server management is content management. As more content is added to the Web, developing tools to manage it will become necessary. Better development tools will arise that aim to add sophistication and complexity to the types of Web applications that companies build.

Specifically, tools are on the horizon that will enhance HTML authoring, so that users can easily create and publish rich, "live" multimedia documents. Instead of programming in the simple but crude HTML language, authors will be able to develop Web pages by manipulating objects and text on special layout boards.

Exhibit III-9

Content Management



Source: INPUT

Netscape plans to introduce tools to help the system managers of the Web site manage links, expiration dates, and ownership; these site and document management tools will become increasingly critical as Web sites grow. Even now, some companies have more than 250,000 documents on their internal Webs.

Companies such as Open Market, working closely with large publishers, have developed customer content management systems that will soon be available to users. They have developed special products, in addition to the base server product, that allow a large publisher to deal with 100 journalists and editors updating and interacting with content on a Web server. For both Time Inc. and Conde-Nast, Open Market developed a product called Editor's Desk, allowing several people to work on Web site content simultaneously and allowing the staging of that content so it can be reviewed internally before it is set live on the Internet.

The content on the Conde-Nast Web site is even being generated dynamically. Open Market wrote a tool that accepts plain text from the Conde-Nast editors and applies a graphical template to that text to define how the page looks. When a user requests a piece of information from the Conde-Nast site, the Open Market tool takes the ASCII text and the associated template and generates the required Web page. The source text is entered on a Web form; therefore, the same text can be used on multiple pages but only has to be entered once. To change the look of the site, only the template has to be changed, allowing for rapid revamps of the entire Web site. This is extremely important to companies like Conde-Nast with high-content Web sites.

Yahoo has even automated the process of Web development and management by developing its own tools to manage the content on the Web server. A custom database stores all of the Web information such as Web site title, URL, category, subcategory, etc. Information on the database is accessed with a proprietary Web browser. Once content has been stored on the database, HTML coding is generated using translation tools and is then verified for faulty links, consistently using proprietary Web management software.

For the future, the company is developing sophisticated technology to make the Yahoo directory service even better. Yahoo plans to introduce new and improved content on its server by extracting information from the database and presenting it in several different ways.

Booz Allen & Hamilton is using Bluestone's Sapphire/Web software to build its knowledge system called The Knowledge Program. The company uses the Web as a medium of information exchange and to provide links among different pieces of knowledge its consultants have. Sapphire is being used because it allows rapid development of standalone database projects.

As Web sites grow larger throughout the world, there will be greater demand for the tools to manage their content.

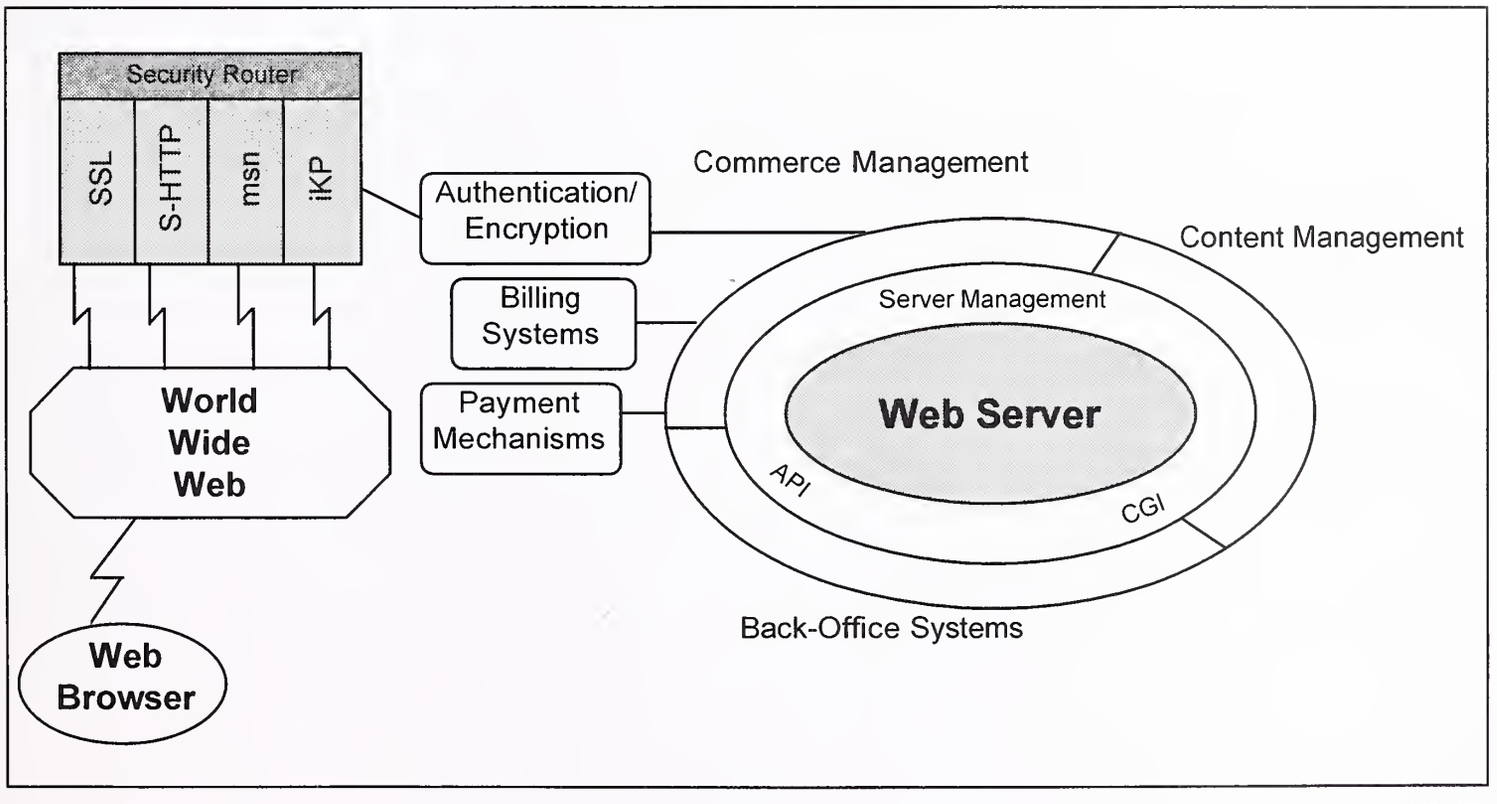
3. Commerce Management

Electronic commerce over the Internet will become a reality by allowing on-line transactions and electronic exchange of sensitive information with confidence and security.

Using authentication and data encryption, commerce management software integrates the key features needed to conduct commerce on public networks. The Netscape Commerce Server delivers the same power, efficiency, and ease of configuration and maintenance as the Netscape Communications Server.

Exhibit III-10

Commerce Management



Source: INPUT

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Market Analysis

A
Market Trends

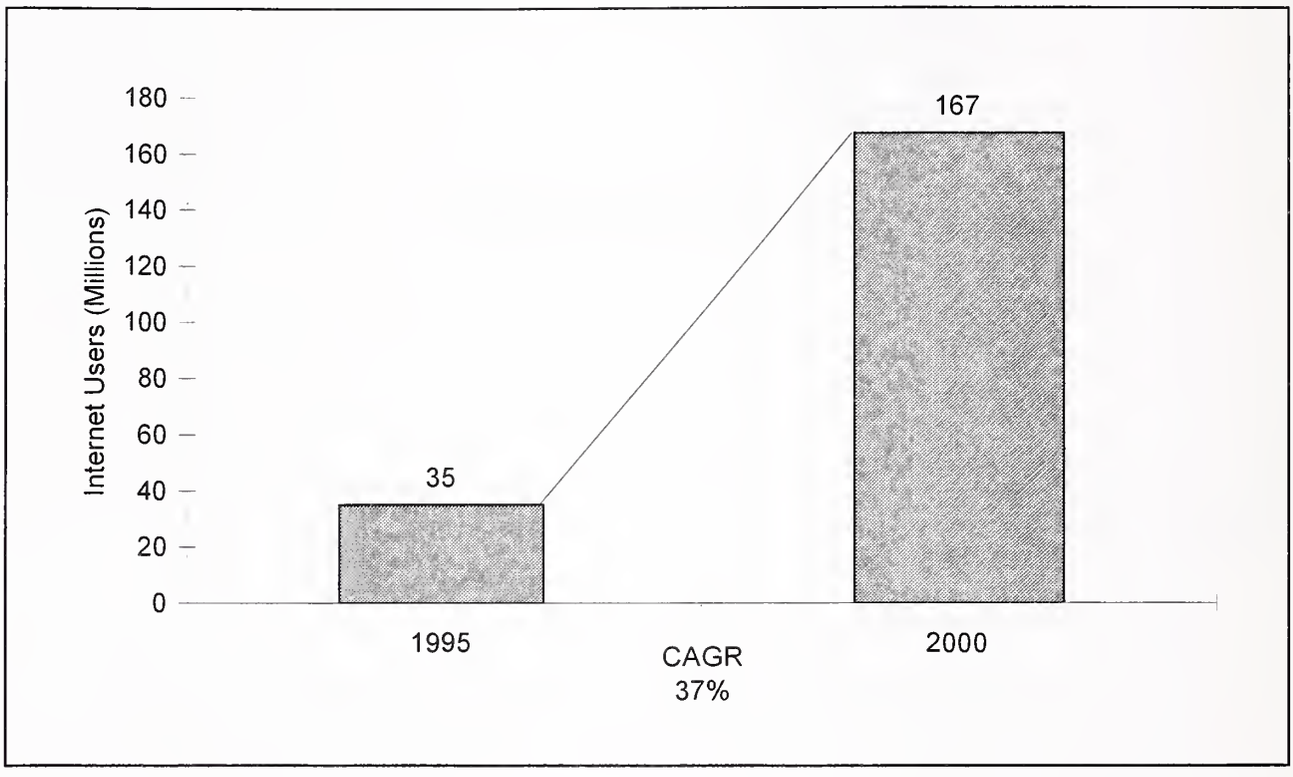
1. Growth of the Internet

The Internet started as a "network of networks" underwritten by the U.S. government and designed to maintain computer-to-computer communications between key government and academic research centers. Over the years, the Internet became a global network tying together universities and government institutions around the world. By far the widest use of the Internet was for electronic mail. Researchers used it to share and distribute software, research findings and other information.

INPUT expects the worldwide Internet population to grow from 35 million unduplicated users by the end of 1995 to 167 million unduplicated users by 2000, with a CAGR of 37%.

Exhibit IV-1

Worldwide Internet Web Users, 1995-2000



Source: INPUT

There are several reasons for the Internet's growth:

- Relaxation of restrictions on commercial use. Companies around the world are scrambling to establish an Internet presence.

- Implementation of the World Wide Web (WWW) and introduction of Mosaic, a software browser that was designed to take advantage of the WWW. Mosaic's user-friendly graphical, point-and-click user interface to navigate the Internet replaced the arcane UNIX-based commands and programs that used to be required to make use of the Internet.

- A dramatic increase in the amount and variety of information available on the Internet. As commercial restrictions were eased and access became simpler, the content of the Internet was extended with business information, entertainment, and material aimed at an endless array of personal interests.

2. Growth in Commercial Use of the Web

The explosion of the use and growth of the Internet is due primarily to the popularity and growth of the Web. The Web has dramatically transformed the way companies collect and disseminate information on a global basis. The Web seamlessly integrates text, graphics, and sound into a powerful, interactive format.

With the Web, companies conduct on-line commerce, provide marketing and sales information, deliver customer support, provide employment and financial information, and facilitate internal communication. These opportunities enhance revenues through broader market presence, cut costs through efficiencies in distribution, and improve productivity by increasing the speed and scope of communications. The introduction of the Web has made it easy to share information instantaneously with the global community.

Growth of the Web is fueled by a number of technology and related trends, including:

- The proliferation of PCs, LANs, and modems
- Availability of low-cost, easy-to-use Web browsers
- Rapid expansion of Internet service providers (ISPs) offering affordable local access
- Provision of Internet access and services by national and international telecommunications companies
- Increasing acceptance of the Internet in the business community
- Commercial on-line services such as Prodigy, CompuServe and America Online (AOL) offering Internet access
- The development and acceptance of open standards such as TCP/IP, HTTP and HTML
- Cross-platform support for Web browsers and servers
- The entry of graduates already experienced in the Internet into the workforce
- Integration of Internet software into operating systems and GUIs such as Windows 95

3. Increased Demand for Commercialized Web Software Products

Early corporate pioneers developed Web sites by using free software developed by NCSA and CERN. Such was the takeup of this early public domain software that the NCSA and CERN servers still account for just over 50% of all Web servers on the Internet, although their share is falling as commercial Web servers increase in popularity.

The early servers performed only a few functions such as searching, forms, and image mapping. But while the commercial Web servers are growing increasingly rich in functionality, the public domain products have not stood still. For example, the Apache Web server is a new version of the NCSA HTTP server that extends the NCSA functionality and is currently the fastest growing Web server, accounting for approximately 20% of all Web sites, a little more than Netscape's servers.

A major factor in fueling the growth of commercial Web server products was the Web's promotion by the popular media. While the early CERN and NCSA servers answered the needs of technically oriented academic and research organizations, the new wave of commercial Internet users want something more familiar, marketed and sold along more traditional commercial lines. The potential demand is attracting interest from venture capitalists and is creating a large market for commercial Web software.

Current software vendors offering Web products have not been able to keep up with the demand for commercialized servers. The greatest challenge has been building channels with enough breadth to reach everyone expressing interest in the product. Relationships between Web software vendors and VARs will be critical in supplying future demand.

4. Deployment of Web Technology in the LAN—the Intranet

External Web sites offer individuals and corporations access to large amounts of invaluable information. Many corporations have been quick to realize, though, that these same benefits of easy and rich information access can apply to the internal distribution of their corporate or departmental information. Consequently, there has been a concurrent, but less publicized, explosion of internal Web sites and servers, behind the corporate firewall.

The phenomenon is not just taking place among software and computer companies. Hundreds of nontechnology companies have started creating internal Web sites, lured by the low cost of development, the appeal of the Web's interface, and the growing need to share information across disciplines.

Such internal Web sites are known as intranets, and they pose a serious threat to many networking vendors as their adoption as the de facto corporate network environment continues. TCP/IP will be the networking standard, and Java will become a mainstream application development and deployment standard for internal company IT infrastructures. Existing corporate clients and servers will become Internet clients and servers as the LAN becomes the intranet.

Organizations will have to make major changes to their infrastructure to be able to take advantage of intranet systems. The precedent has been set by a large number of companies already running pure TCP/IP networks. It will become easier in the future as more organizations follow the intranet route and create a market for products and professional services and as the base technology itself develops along the lines of business applications.

The promise of open systems can finally be realized with the introduction of the Internet as the dominant business computing platform. In the future, companies will not have to make the same kinds of major infrastructure decisions they make today. The choice of network architecture will not be decided by weighing the relative merits of competing proprietary technologies, but will by default be TCP/IP and its successors.

The move to Internet technology will give users the freedom to change suppliers, and will place existing proprietary NOS suppliers under considerable pressure. A future market shakeout could see the disappearance of some now-leading players and is already seeing the emergence of Internet-based vendors better able to respond to market demand for cost-effective open systems.

5. Web Server Support for Multiple Operating Systems

As the predominant operating environment of the Internet is UNIX, it will come as no surprise that most gopher, FTP, and Web servers have been developed on and for UNIX. But today there are a number of factors that make alternative platforms equally attractive for Web server applications.

Robust Web server products exist for most mainstream hardware and operating system platforms, including MS-DOS, MS Windows (3.x, 95 and NT), and Macintosh (Motorola- and PowerPC-based). It is no longer the case that "if you need it to be fast, you need it to be UNIX."

Yet so far, most non-UNIX Web servers have compared poorly with their UNIX counterparts. UNIX is technically superior in many respects to most other popular operating systems and provides a very stable and robust

platform on which to run a high-availability application such as a Web server. Windows NT is the most viable competitor to UNIX for hosting a Web server.

Many companies are attracted to Windows-based Web servers by Windows' ease of use, configurability, homogeneity, and lower support costs compared with UNIX. The most important factor, however, is Windows' dominance in the corporate environment. Although the Internet, and by extension an intranet, is an open environment in which any type of client can connect to any type of server, companies will make use of existing in-house skills and resources, giving Windows-based Web software a head start.

Some applications are particularly well suited to smaller Web installations: small companies' internal Web servers, Web server training labs, and low to moderate-volume external Web servers. UNIX remains the dominant operating system for mission-critical applications, however.

6. Integration of Web software into operating systems

Operating system vendors will incorporate Web client and server functionality into their operating systems as standards features. IBM and Apple have already announced intentions to do so. Incorporating HTTP support into an operating system allows an application software product vendor to develop an application that can be accessed by a web browsing client without the use of a web server. Open Market markets the OM-Transact server that manages the back-office transaction processing functions. In order to develop the product, the company was required to incorporate HTTP functionality into the application software. In the future, it will be easier for a company such as Open Market to develop application servers because the HTTP server capability will be handled by the underlying operating system software.

B
Market Description

1. Market Concentration

The market is emerging and fragmented. There are many potential leaders that include systems vendors, software vendors, systems integrators, and network equipment vendors. The Web server software market is growing in excess of 100% this year and the dramatic growth is not expected to slow significantly over the next five years.

The market for Web software is widespread because it includes all types of organizations with dedicated Internet access. As commercial Internet use and population grows geometrically, so too does the Web software market.

The Web server market will evolve in a similar way to the database software market. Web servers form the basic infrastructure on which applications will be developed. These applications will cut across both horizontal and vertical markets and represent the biggest opportunities for ISVs.

2. Sales Cycle

Sales cycles in the Web software market are extremely varied. Some customers see an advertisement and purchase the product. Others will download and evaluate a product for a limited period, ask the vendor for more evaluation time, and then eventually purchase. The period between download and purchase is typically within sixty days.

VAR strategies will shorten the sales cycle. Most companies purchasing Web servers will not want to create a matrix comparing ten or more Web server packages, but instead would rather go to a VAR and negotiate the best deal for the most suitable Web software.

3. Web Software Distribution

In general, the appropriate delivery vehicle for Web software is a VAR channel. End users typically need integration services to tie together their hardware servers, operating systems, TCP/IP software, Web server software, mail server, etc. As no single vendor can provide such a unified product, the opportunity exists for VARs to select the best of breed from each category and add value in the integration. This phenomenon applies to every vendor in this industry.

C
Market Segments

1. Web Browser Software Market Is Fragmented

Web browsers come in many shapes and sizes. For example, on the Pathfinder (Time Warner) site, 80 distinct browser types access the site every day. If these 80 browsers are broken down by version number, the list grows to 1,400 distinct combinations. The browser market is extremely fragmented today and will continue to become more fragmented.

A significant trend is to combine Internet access, Web browser, and other Internet clients into one integrated Internet product. This greatly simplifies the user's purchase.

Netcom was the first ISP to bundle a browser with its own access software, with the introduction of NetCruiser in July 1994. Demon Internet (U.K.) has been providing an Internet access software bundle for a longer time, but the software was a collection of existing clients wrapped up into one installation package rather than one integrated proprietary product. Demon now supplies the Turnpike integrated suite to its users for a small extra charge. Pipex supplies a proprietary front end that integrates any Internet clients the user wishes to use with its Pipex Dial service.

America Online acquired Booklink Technologies for its InternetWorks browser. PSI acquired Pipeline Network for its Pipeline browser. CompuServe acquired Spry for its Internet in a Box product. Finally, Microsoft introduced its browser, licensed from Spyglass, with Windows 95.

Another important trend is the integration of browser technology into common applications such as word processors, spreadsheets, graphics packages and databases. There will still be standalone Web browsers, but most of them will be embedded into other applications. In time, the emphasis on browsers will fade, their features becoming incorporated into users' everyday computing environment. The emphasis will shift from viewing read-only pages to accomplishing tasks through whatever medium and with whatever tools are most suitable.

Apple Computer will introduce an Internet software system called Cyberdog that lets users set up custom-made Internet interfaces. It is based on the IBM-Apple OpenDoc standard, which lets software modules work together as though one application. For example, Cyberdog will allow users to receive E-mail without having to leave their word processor by linking the Cyberdog E-mail reader into the word processor. Other Internet items, such as links to frequently visited sites, could also be set up within other applications.

A further trend is the integration of Web browser technology with CD ROMs. For example, Spyglass has a licensing agreement with Cisco, which has embedded enhanced Mosaic in its customer support CD ROM. If users cannot find the appropriate information on the CD ROM, they can connect to Cisco's Web site from the browser.

As Windows 95 is adopted, more users will use the Web browser embedded in the operating system. Other companies, such as Apple and IBM, will follow suit and incorporate Internet and browsing capabilities into their operating systems. Apple is currently integrating its new Cyberdog Internet interface directly into Copland, the company's next-generation Macintosh

operating system. The system will allow users to browse the Internet from within any OpenDoc application; drag and drop World Wide Web addresses or links directly into applications; have a cross-platform, Internet-based mail application; and add numerous other functions, such as videoconferencing.

2. Integration of Internet Servers

Web servers are typically run on a machine separate from the computer executing the E-mail, FTP, and NNTP (Usenet news) servers. These different servers will eventually become integrated in many cases, typically within small to medium-sized companies. In larger companies, the servers are more likely to remain separate. According to users in larger companies, the staff responsible for the mail server are not necessarily the same staff responsible for the Web server.

Integrated components of a general-purpose Internet server would include:

- Firewall components
- E-mail server (POP/SMTP)
- Usenet news server (NNTP)
- FTP server
- Gopher server

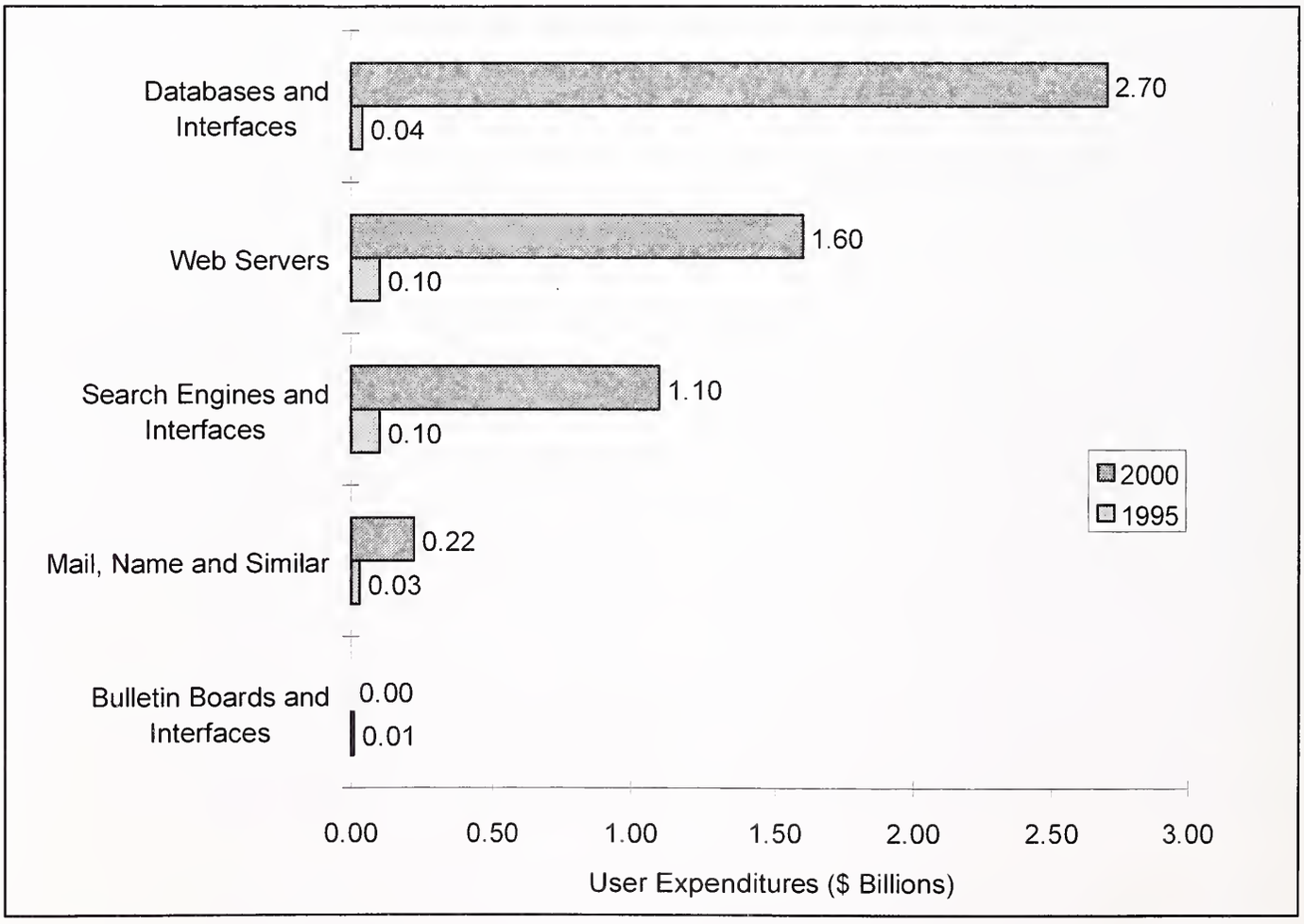
Integrating these functions into one general-purpose Internet server would simplify installation and configuration and reduce the costs of hardware and software investment and ongoing support.

D
Market Size and Growth

The worldwide market for Internet information storage and retrieval software is expected to grow at a CAGR of 82%, from $278 million in 1995 to $5.6 billion in 2000, as shown in Exhibit IV-2. Databases and Web interface software will grow at a CAGR of 129%, from $43 million in 1995 to $2.7 billion in 2000. Web server software will grow at a CAGR of 73% from $103 million in 1995 to $1.6 billion in 2000. Search engines and Web interface software will grow at a CAGR of 62%, from $97 million in 1995 to $1.1 billion in 2000. Mail, name and similar software will grow at a CAGR of 49%, from $30 million in 1995 to $216 million in 2000. Bulletin boards and interface software will decrease at a CAGR of -13%, from $5 million in 1995 to $3 million in 2000.

Exhibit IV-2

Worldwide Internet Information Storage and Retrieval Software, 1995-2000

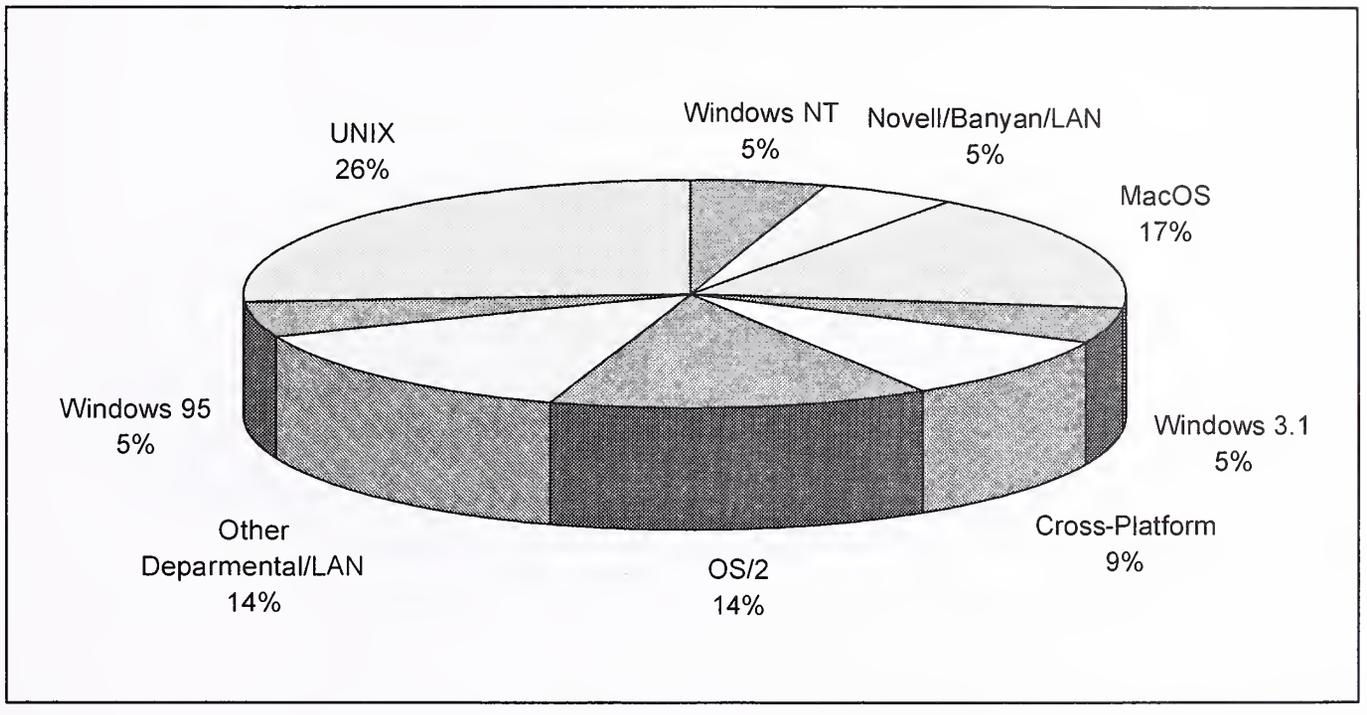


Source: INPUT

The worldwide market for Internet Web server software broken down by platform in 1995 is shown in Exhibit IV-3. UNIX dominates the Web server software market, with a 26% market share in 1995. Macintosh holds the number-two spot, with a 17% market share. Macintosh sales are due mainly to the popularity of the WebStar product from StarNine Technologies, a division of Quarterdeck.

Exhibit IV-3

Worldwide Web Server Software by Platform, 1995

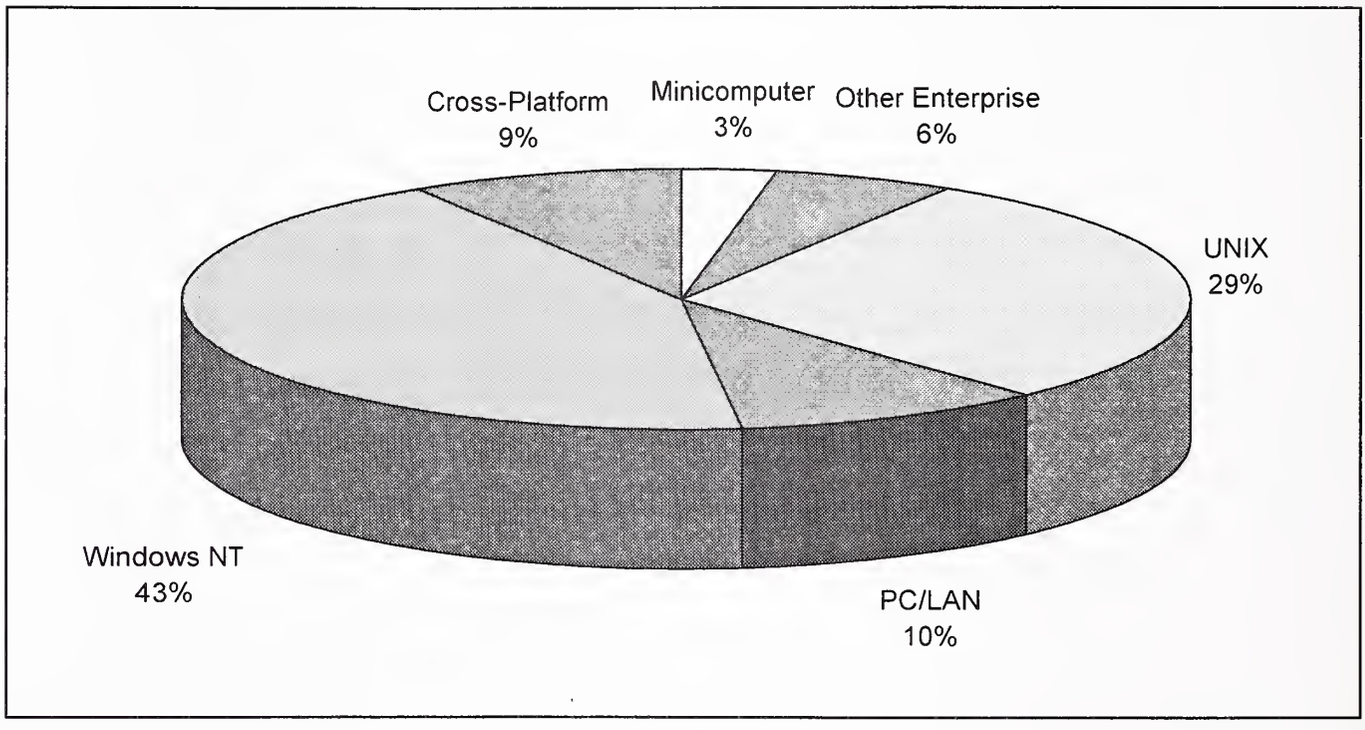


Source: INPUT

The worldwide market for Internet Web server software broken down by platform in 2000 is shown in Exhibit IV-4. With the growth of Windows NT operating systems within departments and at the enterprise level, INPUT believes that 43% of the Web server software will run on the NT platform by the year 2000. The vast majority of Web software product vendors surveyed expect to offer products on the NT platform.

Exhibit IV-4

Worldwide Web Server Software by Platform, 2000

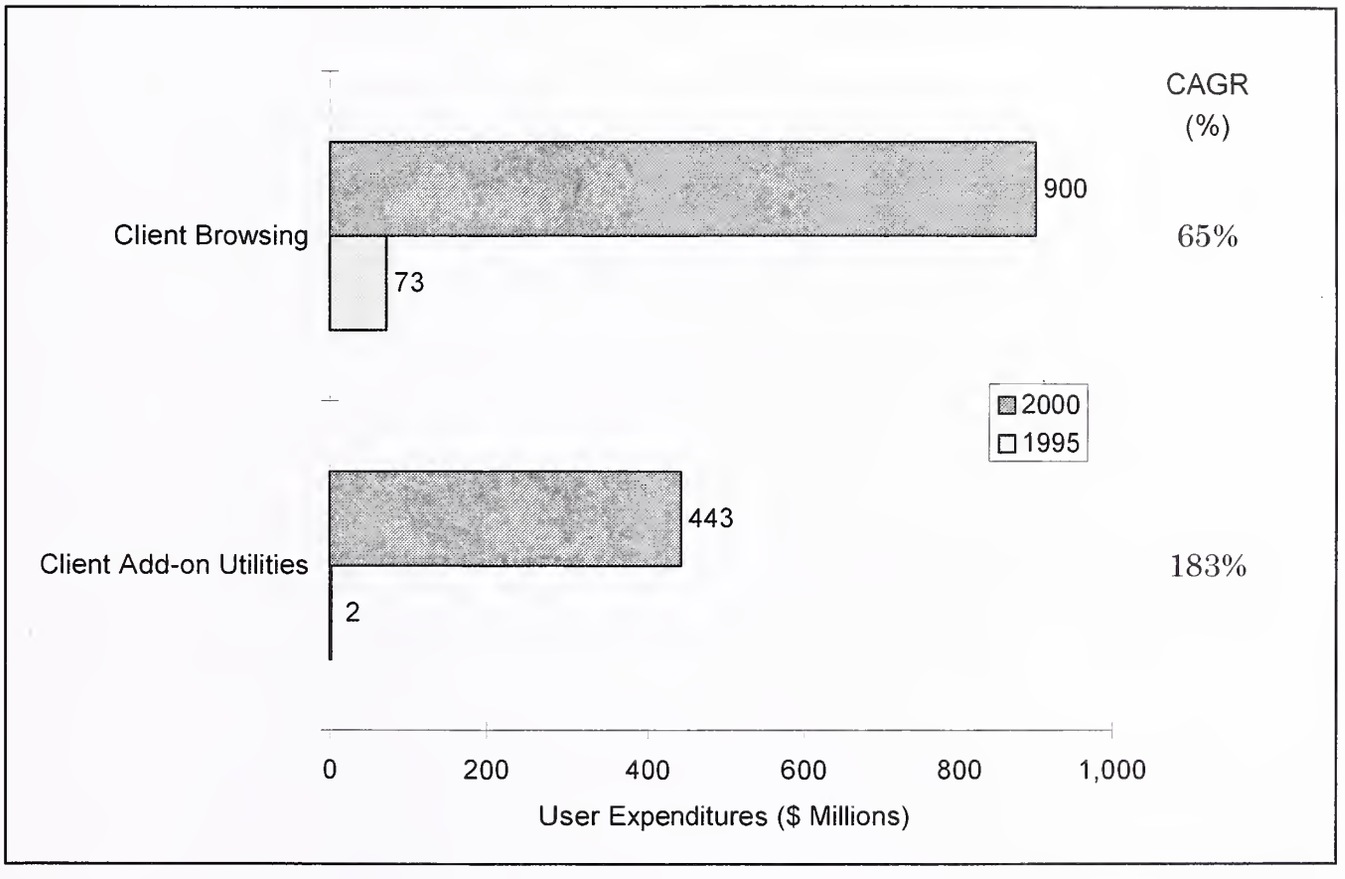


Source: INPUT

The worldwide market for Internet Web client software is expected to grow at a CAGR of 77%, from $75 million in 1995 to $1.3 billion in 2000. As shown in Exhibit IV-5, client browsing software will grow at a CAGR of 65%, from $73 million in 1995 to $900 million in 2000. Client browsing add-on utilities will grow at a CAGR of 183% from 2 million in 1995 to 443 million in 2000. Client browsing add-on utilities include products such as Macromedia's Shockwave and Progressive Networks' RealAudio.

Exhibit IV-5

Worldwide Web Client Software, 1995-2000



Source: INPUT

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Vendor Summary

This chapter identifies several leading and emerging Web software vendors. The Web market is characterized by a tremendous scope of products with prices ranging from nil ("freeware" products downloadable over the Internet) to over $10,000. (See Appendix B for vendor contact information.)

A Vendors

1. Netscape Communications

Netscape was founded in April 1994 by Dr. James H. Clark (founder of Silicon Graphics) and Marc Andreessen (creator of the NCSA Mosaic Web browser). Netscape is based in Mountain View, California, and trades on Nasdaq as NSCP.

The company has received the most attention to date of all the Internet startups, and has pursued a strategy of giving away its browsing software in order to generate maximum market penetration and "mind share." Netscape markets a full line of software for electronic commerce, secure information exchange and private TCP/IP-based networks.

Security features include encryption, authentication, and data integrity. Netscape products include IP- and DNS-based access control, Dynamic Process Management and NSAPI interfaces, and an intuitive, self-documenting configuration and management user interface for easy setup and maintenance.

Netscape made its name with the first versions of Netscape Navigator. It overtook Mosaic as the most widely used Web browser and remains by far the most popular browser, holding 70% of the market. Navigator provided more functionality than Mosaic and was available for free download over the Internet for evaluation, and free use was granted to nonprofit organizations. It was optimized for use with 14.4Kbps modem connections to the Internet, thus making itself very attractive to the exploding home user market.

Netscape has kept its position as the leading Web browser vendor partly through the superior quality of its product and partly by extending the range of HTML tags that Navigator recognizes. With these extensions, leading-edge Web pages can be designed that can be viewed as intended only through Netscape's browser. Some of the extended functionality simply pre-empted upcoming HTML standards (HTML 3.0), but some were proprietary. Messages such as "This page is best viewed through Netscape 1.1" quickly appeared on a large number of Web pages and became a contentious issue. Nevertheless, the Internet is developing at least as much through vendors offering their own solutions to existing problems as it is through the efforts of the standards committees, and Netscape is not alone any more in this practice.

It is no accident that in its marketing of Netscape Navigator 2.0, Netscape likened the product to an operating system for the Internet. While users focus on applications, not the underlying technology, operating systems have proven to be a key weapon in the computer industry. The move now is from standalone Web browsers and servers to general-purpose Internet GUIs and servers, and Netscape is driving its products in this direction. Netscape's Communications Server performs well on the UNIX platform, but has had its share of problems on Windows NT.

Recently, the company introduced the FastTrack Server, a $295 program that replaces its $1,295 Communications Server product. The UNIX-based software is designed to make it easier for nontechnical users to set up Web sites, and is priced to compete with Microsoft. Netscape also plans to offer SuiteSpot, a high-end server program that comes bundled with several other Netscape programs, including Enterprise Server.

2. Open Market

Founded in 1994, Open Market provides software, services and industry-specific solutions for business applications on open networks. The company offers a complete electronic infrastructure for establishing and managing a business on the Internet, ranging from on-line store creation for small companies to custom business solutions for large businesses. Major corporations that have chosen Open Market's technology to establish their Internet businesses include Time Warner, Tribune, Advanced Publications, Lexis-Nexis, Conde-Nast, Banc One, and First Union.

Open Market's WebServer is a high-performance server with a multi-threaded architecture that supports over 1,000 concurrent client connections. It incorporates an access control scripting language for implementing complex access policies. WebServer administrators can control access based on host, time of day, user name, browser software type, authentication method, or other parameters. The product also features an extended logging facility and WebReporter that analyzes extended format logs to generate

customized reports of server activity. Miscellaneous features include built-in support for image maps and directory indexing.

Open Market also offers the OM-Transact server which divorces transaction functions from the standard Web server. Designed to work with any Web server, the OM-Transact provides a complete back-office infrastructure for secure Internet commerce. As a first step toward EDI over the Web, Open Market plans to integrate the Premenos UNIX transaction software, EDI/ev2, and Templar EDI products into OM-Transact. Targeted at Internet service providers and large enterprises, the OM-Transact server starts at $250,000.

3. O'Reilly & Associates

O'Reilly & Associates' WebSite is a Web server for Windows NT and Windows 95 and was developed in partnership with Bob Denny and Enterprise Integration Technologies (EIT).

WebSite's strength is its relative ease of use. It is sold with a variety of Web site management tools. It features CGI support, image mapping, automatic generation of searchable indices, and (non-cryptographic) security. Additionally, WebSite is bundled with useful programs such as WebView, which shows a graphical tree of a WebSite, giving users a visual picture of link source and destination and broken links.

4. Process Software

Established in 1984, Process Software develops TCP/IP-based networking software solutions worldwide. Platforms supported are Windows 95, Windows NT, and Digital's OpenVMS.

Purveyor's WebServer for Windows NT and Windows 95 is the company's Web server offering, and includes integrated point-and-click security features. Purveyor DeskTop WebServer for Windows 95 was designed primarily for internal Web-based workgroup computing—i.e., intranet environments. Purveyor version 1.1 supports Microsoft's ODBC and SQL Server. The company also expects to ship a product that includes Oracle, Sybase, and Lotus Notes integration. Process' high-performance API allows developers to integrate Web technology with new and existing back-end applications.

The enhanced log viewer allows customization and management of information captured in the Purveyor Log files. The resultant information can also be imported into Microsoft Excel. Other software included with WebServer supports local text searches of the Web—using WAIS (wide area information search)—the resulting HTML output provides links to the

materials found during the search. Additional features include remote administration, a hotlink viewer and Visual Basic support.

Purveyor's greatest differentiator is that it is optimized for each of the operating platforms. Unlike other packages that are ported across platforms, Purveyor WebServer is developed within separated projects specifically for each platform. Each program is tightly integrated with the operating system on which it runs.

Process sells exclusively through resellers, who also provide support to users. Process recognizes that some customers want telephone support and so offers a service agreement as a packaged product. For a year's amount of phone support, the company is charging approximately 15% of the product cost.

5. Spyglass

Spyglass was formed in January 1990 by NCSA scientists and software engineers at the University of Illinois, and has since carved out a niche for itself as a provider of browsers and browser technology to OEMs.

While at NCSA, Spyglass Co-founder Timothy Krauskopf focused on pioneering software that made technically challenging and expensive computing resources, such as the Internet, more accessible for university researchers and students. Krauskopf co-developed NCSA Telnet, which enabled users to access the Internet from inexpensive personal computers instead of only from expensive workstations. Telnet today is an important standard for Internet access, used by an estimated two million people.

Spyglass develops and distributes its Enhanced Mosaic for Windows, Macintosh and X Window System platform, under a multimillion-dollar joint development and master licensing agreement with the University of Illinois. Since forging its Mosaic agreement with the University in May 1994, Spyglass has licensed to 35 companies that incorporate the technology into around 90 products.

The Spyglass Server runs as a single process, increasing the number of simultaneous connections that can be accepted, and operates a caching mechanism. The product provides SNMP (simple network management protocol) support for enterprise-wide server management, which will be increasingly important as additional departmental servers are added to the network.

As well as CGI Level 1.1, Spyglass Server includes its own high-performance API allowing for tight integration between the server and other applications, such as those for electronic commerce, conferencing and database searches. The server incorporates a security framework that includes basic security modules, including Basic Authentication and Digest, as well as a Security

Application Interface that accepts customer modules. The server will ultimately include Secure-HTTP.

6. Quarterdeck

Going head-to-head with Netscape with a general-purpose browser would be difficult, acknowledged Emerick Woods, a vice president in the Internet Business Unit of Quarterdeck, another browser provider that is starting to shift its strategy. Quarterdeck's own strategy shift has it focusing more on applications that will run atop the major Internet platforms than in trying to turn its own browser into some sort of standard.

Quarterdeck's WebServer for Windows is designed as a personal, departmental, and small company Web server and as a Web development platform. Features include CGI support and internal multitasking for processing multiple simultaneous HTTP requests. Quarterdeck plans to embed Verity's Topic search engine in Quarterdeck WebServer, as well as in future products.

Like Spyglass, Quarterdeck sells its own enhanced Mosaic, built from the ground up. Quarterdeck also markets the WebPhone voice product, which it plans for a mass market, delivering one of the first two-way audio connections over the Internet. WebPhone is the first in a series of collaborative computing products from Quarterdeck.

Quarterdeck has also entered the market for Apple Web servers through its acquisition of StarNine Technologies, another move that may confirm its intention to focus on niches. The acquisition puts Quarterdeck in a part of the market that Netscape has eschewed and that Microsoft has no motivation to be in.

7. StarNine Technologies (A Division of Quarterdeck)

StarNine Technologies, founded in 1987, develops Internet server software for the Apple Macintosh, including Web and E-mail publishing systems. StarNine also develops products to extend Macintosh E-mail systems to the Internet and other mail systems on PC and UNIX platforms. The company also produces a directory services product that allows access to E-mail addresses and other directory information across platforms.

StarNine's focus has been to provide E-mail connectivity for all Macintosh mail systems, including Microsoft Mail for AppleTalk Networks, CE Software's QuickMail, and Apple Computer's AOCE and MacX.400, and to support the mail-related needs of LAN administrators. StarNine's gateway and directory services products are used by over 2,000 companies and universities worldwide.

Beginning in 1995, StarNine continued its expansion into the Internet market by acquiring MacHTTP (the Macintosh shareware Web server) from Chuck Shotton and developing it into the commercial application, WebSTAR.

WebSTAR features compatibility with Mosaic and Netscape, supports forms and clickable maps, and integrates with both Macintosh and SQL databases. WebSTAR uses a completely different approach to Web programming. Its CGI-style interface talks to both AppleScript programs (the Macintosh version of a UNIX shell script) and standalone applications. It also features domain and IP address-level access controls, remote administration from anywhere on the Internet, supports thousands of connections per hour, and can control multiple servers from one Macintosh.

8. Spry

Spry, a CompuServe company, was formed in 1987 as a systems integrator and developed into an Internet applications, services and integration company. Acting as the parent of two subsidiaries, Spry aims to integrate the different environments of the Internet. Partnering with NovX Interserv, which provides network/Internet services, and FreeRange Media, which specializes in on-line multimedia publishing, Spry is able to deliver instant Internet access software with connection and content. Spry claims to provide the only suite of applications to run over any TCP/IP transport.

Internet Office Secure Server is a Secure-HTTP (SHTTP) server for Windows NT and UNIX. The server adds to Spry's Internet software products by bringing complete and secure client/server solutions together for on-line publishing and commerce. Internet Office Server is a non-secure version of this product, which includes all the functionality of Internet Office Server except the security features.

The server installation configures the server, an integrated search engine, HTML authoring tool, and SQL database. Internet Office Server is aimed at internal network environments as well as external Internet applications. It is compatible with all HTTP clients for non-secure HTML, and supports all SHTTP clients for secure transactions. Security is implemented using public and symmetric key cryptography.

9. NaviSoft

NaviSoft, an America Online company, provides an all-in-one, integrated development environment for creating content and posting and managing information on the Web.

NaviPress, the client, is an integrated WYSIWYG (what you see is what you get) authoring and browsing tool that runs on Windows, Macintosh System 7 and OSF/Motif.

NaviServer is the company's Web server and also runs on Windows NT and UNIX. It incorporates a database management system and provides remote authoring, content database management, access control at multiple levels, and account management. In addition, NaviServer provides pricing via a forms interface, full text search of Web pages, forms data managed by a DBMS, relational catalogs and directories, version control, and APIs for adding new functions to the server and integrating with legacy systems.

NaviSoft will embed the Director playback engine directly into NaviPress and the enhanced NaviServer to recognize and manage Director files for video, audio and animation.

10. Ameritech Library Services

NetPublisher, from Ameritech Library Services, is a multi-protocol information server for Windows NT that enables users to publish text, images, audio and video. NetPublisher integrates a graphical editor, graphical monitor, and server into one easy-to-use tool for publishing information within an internal TCP/IP network or over the Internet. It supports three protocols—Web (HTTP), gopher and Z39.50.

NetPublisher features point-and-click cataloging for information such as archived photo collections, recorded speeches, course catalogs, or other locally developed resources. NetPublisher incorporates simple, meaningful icons, graphical menus, and a template wizard that eliminates the need to learn HTML. To present information using NetPublisher, administrators build a hierarchical tree of document titles, giving bibliographic information such as author, title, and document abstract. Each document title is linked to a text file. The program automatically generates Web pages as users navigate the publication's tree. This structure is especially suitable for libraries and information kiosk designers.

All content published by NetPublisher is searchable. This means users can catalog text, application, or sound files. Items are searchable by any keyword or by a specific index, or Boolean operations.

11. Adobe Systems

Adobe Systems, founded in 1982 and headquartered in California, develops, markets and supports document creation and management products and technology. The company licenses its technology to major computer, printing, and publishing suppliers, and markets a line of applications software and type products for document authoring.

Adobe Acrobat lets users create electronic documents from a wide range of authoring tools for sharing across different platforms. Users can distribute Acrobat documents over a wide range of media, including the Web, E-mail,

Lotus Notes, corporate networks, CD ROMs, and print-on-demand systems. Publishers can send an Adobe Acrobat file with a free copy of Acrobat Reader to any Macintosh, DOS, Windows, or UNIX user, allowing the recipient to view the file without having to have previously installed the necessary software.

12. Progressive Networks

Progressive Networks, founded in February 1994 and headquartered in Seattle, Washington, provides audio-on-demand software for use on personal computers and through voice telephone lines.

Its product is the increasingly popular RealAudio, designed to allow real-time audio to be transmitted over the Internet without suffering time delays. Typical download time encountered for conventional on-line audio delivery runs at approximately 25 minutes for 5 minutes of high-quality audio. The RealAudio system enables users equipped with conventional multimedia personal computers and voice-grade telephone lines to browse, select and play back audio or audio-based multimedia content. The RealAudio Player was bundled with Microsoft's Internet Explorer, introduced as part of Windows 95.

13. Macromedia, Inc.

Macromedia, Inc., headquartered in San Francisco, CA, provides the Shockwave Plug-In for Web browsers, like Netscape Navigator 2.0, which will transform the Web from static pages to interactive multimedia. Shockwave, Macromedia's product name for the Director-on-the-Internet project, allows movies to be played seamlessly within the browser.

Sun has done a good job of convincing the general public that Java is an ideal language for creating animations, but it really is not. Some developers may make the investment necessary to build Internet multimedia from the ground up, in the same way that some CD ROM title developers choose to build their entire title in C++. But developers who use Director can generate equivalent animations in a fraction of the time. Macromedia is clearly the market leader in multimedia development. In 1995, 80% of the multimedia titles on CD ROM were created in Director, according to Macromedia.

For the future, Macromedia plans to add streaming features to Shockwave for Director. Currently, a Shockwave file does not start playing in a Web page until the entire file is downloaded from the Internet. The streaming feature will allow a Netscape browser to begin playing the animation before the entire file is downloaded. This feature will be very similar to the streaming ability of Progressive Networks' RealAudio system. Macromedia actually plans to integrate RealAudio into Shockwave in the first quarter of

1996. Macromedia also plans to add streaming ability to the video XObjects in its Lingo scripting language.

14. Sun Microsystems

Sun Microsystems, headquartered in Mountain View, CA, provides the Java programming language, which will transform the Web from a mechanism for publishing static content to a network-based application development platform.

Originally created as platform-independent code to support consumer electronic products, Java is an ideal programming language for the Internet because it is small and is architecture-neutral. Java applications are ideal for a diverse environment like the Internet. With Java, the same version of the application runs on all platforms. It is an object-oriented programming language optimized for the creation of distributed, executable applications. Because programs written in Java are compiled into machine-independent byte codes, applications can migrate transparently over the Internet and be accessible by anyone using the HotJava or Java-enabled browser.

However, since the Internet is a distributed environment, security becomes a concern. Sun has addressed this concern by imposing severe constraints on the Java programming language, as well as extensive run-time checking in the interpreter located inside the Java-enabled browser. Still, most firewall vendors are concerned about Java and have not yet found a way to control or stop it.

15. Microsoft

Microsoft is a late entry into the web server software market. Microsoft's Web server, the Internet Information Server (IIS) for Windows NT, has been offered to the public for free. It was released to several thousand test sites at the end of 1995, and a limited number of copies were made available for download over the Internet.

The Internet Information Server, previously called Gibraltar, is designed to let customers create sites and share information within a company or across the Internet. IIS supports existing Web standards and also incorporates the open, high-performance Win32-compliant Internet Server API (ISAPI) for creating Web applications. Currently, the product is still in beta test and has been used on only a few commercial Web sites.

Microsoft also offers the Internet Explorer for browsing the Web at no charge for Windows 95, Windows NT, Windows 3.1, and Macintosh. The Internet Explorer is available in over 20 languages, and comes with an optional VRML add-in.

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Web Technology Explodes

A
The Web Platform

Although the Web has been lauded as the Internet's "killer" application, it is not; it is simply the underlying technology. The Web is an open, easy-to-use, easy-to-program network-based platform upon which applications are developed. The paradigm shift occurring today is nothing more than a shift from PC, client/server, and mainframe platforms to a network-based platform for all of computing.

1. Advantages of the Web Platform

The Web-based platform offers several advantages over legacy platforms.

- Applications written for a specific operating system only run on that system. An application, such as a collaboration or workflow program, written for the Web, will run on all platforms since the Web browsers handle the interoperability among multiple systems.

- Applications written for the Web are network-centric and distributed.

- Web applications are real time, since they can access databases and back office systems over the network.

- Users can access the program from anywhere in the world. As long as the user has the appropriate clearance (authentication, tunnel, private/public key, etc.), he/she can access the file on the corporate Web server that provides the Web-based program.

- Users will be offered as much functionality running Web-based applications as they would with PC-based ones, with a lot less overhead. Today's latest PC-based operating systems require very fast processors, and require large amounts of storage and RAM. Both Oracle and Sun have announced intentions to manufacture Internet access network computers that carry out the basic functions of a personal computer but cost under $500.

- Although there has been a lot of discussion about the "hollow" computer, these slimmer PCs won't necessarily replace today's powerful Pentium and PowerPC computers. However, the operating systems that run these powerful machines will not be as important in a network-based environment.

- Maintaining applications across the network is difficult. For example, when a new revision comes out, users must either obtain diskettes from the manufacturer or electronically download a new program onto their PC. Systems integrators have discovered how difficult it is to manage client revisions in a client/server environment. The Web-based platform has the potential to lower the costs of distributing and maintaining applications across the network.

- With the Web, there is simply no need to develop closed, proprietary client programs that reside on the PC. Instead, an application written to run inside a Web browser can be downloaded from a central Web server. If a new revision is developed, it is simply placed on the Web server, so that the next time the user requests the program, he/she receives the latest update in the browser.

- The Web provides the developer with the ability to develop programs that store user files on either the PC or the server. With the rise of PCs in the corporation came the difficulty of managing the data that resided on users' PCs. With a network-based platform, applications can be developed that can track and log documents created by users in their Web applications.

2. Enhancing the Web Platform

A number of new object types are projected to transform the Web into a powerful development environment. The intention is to embed objects, in-lined viewers, different types of audio and video formats, and portable document formats in HTML documents.

a. Sun's Java

With the integration of the Java language into the latest Web browsers, developers can write applications called Java applets, which will provide Internet sites with a huge range of new functionality. Java, developed by Sun Microsystems, is an object-oriented programming language based on C++ that operates independently of any operating system or microprocessor. Java applets can be transmitted over a network and run on any client, providing the multimedia richness of a CD ROM over corporate networks and the Internet. Sun has licensed Java to a number of leading technology companies, including Borland, IBM, Macromedia, Microsoft, Mitsubishi, Netscape, Oracle, Silicon Graphics, Spyglass, and Toshiba.

Netscape and Sun offer JavaScript, an open, cross-platform object scripting language, for the creation and customization of applications on enterprise networks and the Internet. While Java is used by programmers to create new objects and applets, JavaScript is designed for use by HTML page authors and enterprise application developers to dynamically script the behavior of objects running on either the client or the server. JavaScript is analogous to Visual Basic in that it can be used by people with little or no programming experience to construct complex applications quickly.

b. Microsoft's VB Script

Microsoft has developed a product called VB Script, which, like Java, can be used to write applications that work across the Web. Although Java beat VB Script to the marketplace, Microsoft's strength in Visual Basic and Object Linking and Embedding (OLE) technology should allow the company to compete in this area. Microsoft also has the advantage of a huge base of customers who use Windows 95 and Windows NT.

Other object types that have been embedded into HTML documents, allowing for the creation of rich multimedia content, include Adobe Acrobat PDF documents, Progressive Networks' RealAudio files, Macromedia Director presentations, and Apple QuickTime movies.

c. Adobe's Acrobat

Adobe Acrobat software lets users create electronic documents from a wide range of authoring tools for sharing across the Web platform. From the simplest memos to the richest color brochures, Acrobat software lets users publish and manage their documents electronically, preserving their original look and feel, independent of computer platform or distribution media.

d. Progressive Networks' RealAudio

For sound, Progressive Networks provides a software solution that delivers real-time audio over the Internet. The RealAudio Player, one of the components of the system, works with Web browsers to decode and play audio on demand.

e. Macromedia's Shockwave

Macromedia, Netscape and other developers have demonstrated Shockwave for Director, an Internet publishing capability for Director, which enables Director users to deliver "plug-in" interactive multimedia components in Netscape Navigator 2.0. Shockwave for Director's post-processor, Afterburner, compresses standard Director files by approximately 60%, adds security, and optimizes content by media type for quick downloading. Shockwave for Director includes Afterburner, documentation on tips and techniques for Internet authoring, sample movies, and the Shockwave player, which plugs into the Netscape 2.0 browser.

Macromedia is incorporating support for Java applets into Authorware and Director and defines multimedia class libraries for inclusion in future versions of Java. Macromedia will utilize its core technology and Java to build a new tool for publishing interactive multimedia information on high-bandwidth Internet networks. Sun and Macromedia have written programs that animate or rotate images such as logos beside text.

f. Apple's QuickTime

QuickTime, Apple's multimedia video technology, is a popular way to post movies on the Web. QuickTime 2.0 is the software engine that gives multimedia producers an easy way to create a multimedia product and to deliver it on Macintosh, Windows, and interactive television platforms.

g. NeXT Computer's WebObjects

WebObjects, developed by NeXT Computer, is an environment for interfacing objects to the Internet via the Web. The technology is based on NeXT's object model using the Enterprise Objects Framework for database access and PDO for object interoperability and distribution. By extending object technology to the Web, developers can rapidly create and maintain applications that are deployable across heterogeneous environments. In addition, these objects can communicate seamlessly with other object models, such as OLE/COM and, soon, CORBA (the Object Management Group's Common Object Request Broker Architecture).

The WebObjects Framework uses existing Netscape, NCSA, or CERN server APIs. In addition, NeXT provides a bundled HTTP server as part of WebObjects for added performance and better integration of objects. Through

NeXT's DOLÉ for Windows product, WebObjects can communicate with OLE/COM objects—allowing Windows applications to share information with Web-based applications. Web applications can now leverage existing data that is computed and stored in spreadsheets such as Excel. In the future, this same technology will enable the WebObjects server to communicate with CORBA objects.

WebObjects allows organizations to create distributed Web servers. Typical Web servers come to a halt when they can't handle the number of requests they receive—returning the all-too-familiar "service unavailable" message to the browser. WebObjects can distribute requests across multiple machines thereby creating a virtually unlimited ability to service Web requests. And the multiplatform compatibility of WebObjects allows these server requests to be distributed across a variety of operating systems.

WebObjects is database independent. Web-based applications can access industry standard databases such as Oracle and Sybase without writing database-specific code. This allows developers to create WebObjects applications that display HTML pages containing data from multiple databases.

h. Eòlas Technologies' Weblets

Eòlas Technologies offers the WebRouser applet-enabled Web browser. Based on enhancements to NCSA Mosaic, WebRouser features patent-pending technology that expands the functionality of Web-based applications and provides a simple and convenient way to add new features to browser programs through the use of plug-in applications, called Weblets.

The Weblet enhancement allows fully interactive program objects to be run from within Web pages, through the use of a simple "EMBED" command within the document's text. These Weblet programs become treated by the browser as a part of the Web document, displayed in-line and controlled by the user in place, without diverting the user's attention from the document itself.

Three demonstration Weblet programs are being distributed with the WebRouser package. These include an in-line MPEG movie player, a 3-D CAD file viewer/manipulator, and a 3-D molecular modeling application.

i. Others

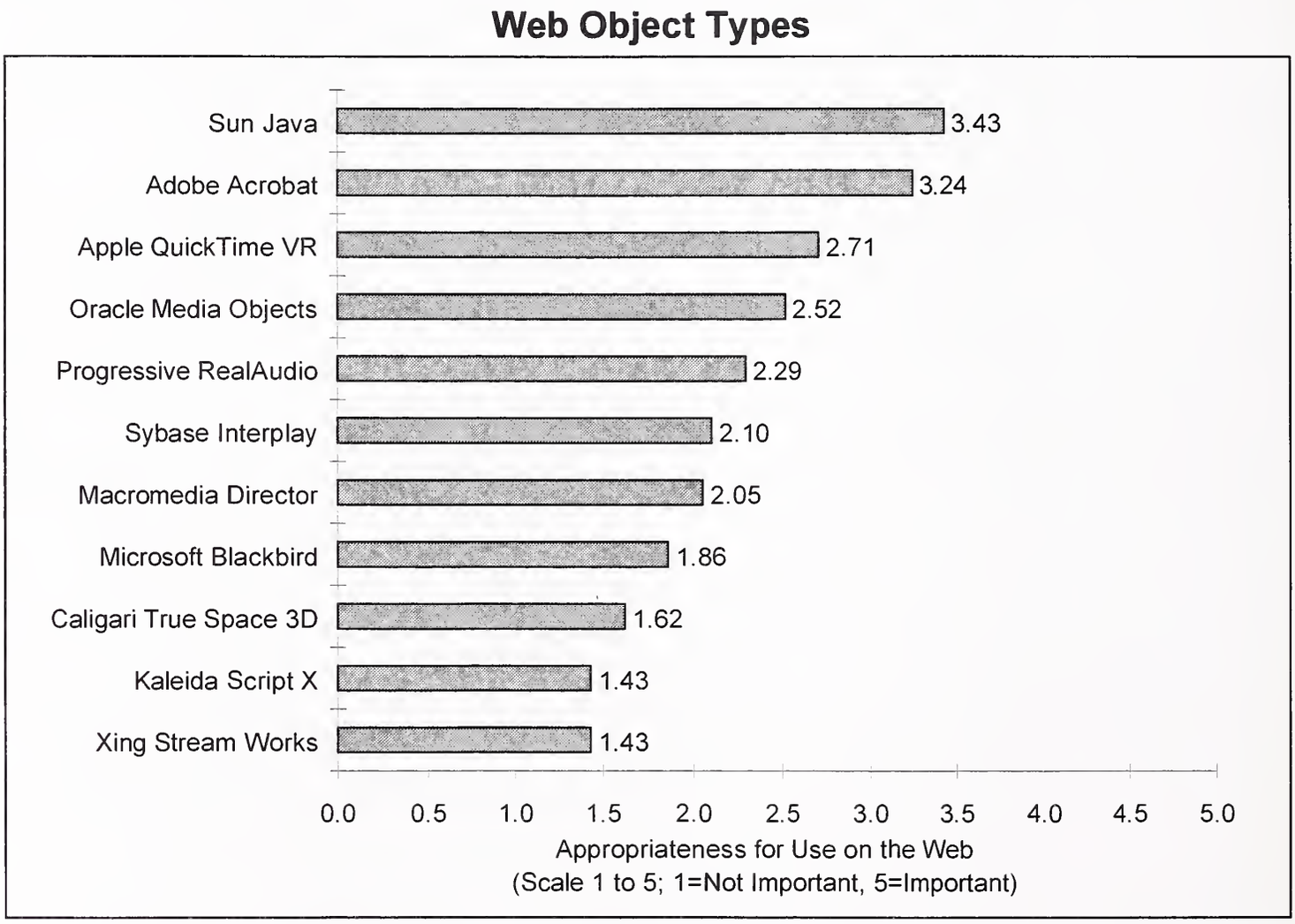
ANSA is even building a set of tools to integrate a distributed object model into the Web. The objective is to provide a CORBA-based environment from which the Web appears to consist of a world of distributed CORBA objects.

Vream makes a 3-D tool that will be incorporated into the next version of Netscape's browser. Dimension X's Iced Java runs on top of Sun's Hot Java.

And Worlds is testing a 3-D chat site on the Web and will use the same technology for a cybermall.

All of these formats join the current audio, video and document-format helper applications already available on the Web, and there is undoubtedly more to come. With all of these new object types being promoted as "right" for the Web, which ones are most appropriate? According to users surveyed, the most appropriate include those listed in Exhibit VI-1.

Exhibit VI-1



Source: INPUT

The technologies most often cited as those users thought were most appropriate for use on the Web included Apple's QuickTime/VR, Sun's Java, and Adobe's Acrobat.

The expansion of new object types is welcome, as it takes some of the pressure off HTML to be the all-encompassing network-based platform language. HTML will serve as the backbone language, whereas new object types can add robustness to the Web platform.

3. Additional Web Platform Features

In addition to the inclusion of new object types, companies like Netscape and Eòlas Technologies continue to evolve the Web technology with the introduction of frames and customizable toolbars and menus. With the latest release of Netscape 2.0, the Web browser features frames, which enable the display of multiple, independently scrollable frames on a single screen, each with its own distinct URL. Frames can point to different URLs as well as be targeted by other URLs, all within the same screen. Frames allow users to scroll through multiple sites simultaneously, submit database queries in one frame and receive instant results in another, and even freeze regions of the screen while the user scrolls through information on a page. Viewing the Netscape browser as a development platform, frames provide functionality similar to the windowing features of Windows and Macintosh.

Digital recently introduced the Workgroup Web Forum product, which can upload and download files to and from the Web server via a helper application. Future enhancements to Web browsers will allow applications to transfer files without a helper application. The Digital product also loads a program toolbar into the top of the browser display area.

Eòlas Technologies' WebRouser Web browser solves this problem because it allows Web documents to dynamically modify the browser's toolbar and menu structure. The company's "LINK" command allows the Web document to place a customizeable toolbar at the top of the screen, as a part of the WebRouser GUI. When the user scrolls down the document, the toolbar remains in place. Since the document drives the definition of the buttons' functions, each Web site can have its own Netscape-style "What's New," "What's Cool," etc. toolbar pointing to its own content. Similarly, a "GROUP" command allows a Web document to define a new menu option in the WebRouser menu bar, allowing the user to jump quickly to a particular Web page within a large, complex Web site.

B
Standards

As Web technology evolves, the issues of interoperability among different Web browsers and common standards arise. With companies like Netscape and Eòlas Technologies implementing their own tags such as TABLE and LINK, users are forced to make a key design decision: adopt a lowest-common-denominator approach and produce a site that is universally accessible but lacks many current frills, or use leading-edge HTML tags and new media formats to build an elaborate site accessible in full only to those with the right versions of the right software.

It is generally difficult to design a page that will look attractive with all browsers. With so many different providers releasing different browsers with different capabilities, users are finding it difficult to keep up.

Yet many software companies refuse to be "held back" by the standards process. Although Netscape participates in the standards-setting organizations, the company continues to evolve the technology by introducing new tags and features with every release of Navigator. Web technology software companies are not waiting around for standards issues to be resolved. Instead, they are responding to customers' demands for increased functionality. Vendors like Process and Netscape are putting evolutionary advancements out in the marketplace and once customers start using them, then they discuss standards. Though this is not always the "right" way to develop open technology, it must be recognized that a balance between innovation and standardization will give the best long-term results for the user.

The best answer may be the arrival of more browsers supporting advanced HTML features. But again, this answer is not as simple as it seems. There are some significant differences between the precise way Netscape implements some HTML 3.0 features and how the HTML 3.0 draft specification supports the same features. The draft specification for HTML 3.0 is based upon earlier work on HTML+ and extends HTML 2.0 to support tables, text flow around figures, and math. However, there are differences in the way Netscape and NCSA Mosaic implement tables.

Further complicating matters is the fact that though Netscape has pledged to support the final HTML standard, it will at the same time continue to support its own extensions within its browser, even where they conflict with the eventual standard.

1. Competitors

Competing browser vendors must either jump on the extension bandwagon or get left behind—the Web is just not the same experience these days without a browser that can display these extensions. Like Netscape, Spyglass has developed new versions of Enhanced Mosaic that include some support for both the HTML 3.0 draft specs and some Netscape extensions. Spry, CompuServe's Internet Division, also supports HTML 3.0 in its Mosaic in a Box. And America Online includes both HTML 3.0 and Netscape tags in its standalone GNNWorks (formerly InterWorks) browser.

For this report, INPUT polled users to gauge their familiarity with HTML standards. Users were asked if their current Web browser supported Netscape standards, HTML 3.0, both, or if they didn't know. Users were most familiar with Netscape standards, followed by not knowing at all. They demonstrated little familiarity with the HTML standards.

2. World Wide Web Consortium (W3C)

The World Wide Web Consortium (W3C) works with the global Internet community to produce specifications and reference software. W3C is funded by industrial members, but its products are freely available to all. The Consortium is run by MIT LCS and by INRIA, in collaboration with CERN, where the Web originated.

C
Future Standards

Web specifications that are currently under development include the following.

1. Improved HTTP

The Web has overloaded the Internet, and as a consequence, can often be too slow to use. During peak periods of the day (most notably the times at which the East coast and the West coast of the U.S. start business), the Internet is effectively unusable for many people for anything other than local operations (for example, connecting to their ISP's E-mail and Usenet servers). The problem is that when a client makes a request for a specific document at a Web site, it must establish a TCP connection (GET and retrieve) for every embedded graphic specified in the HTML document. Companies such as Enterprise Integration Technologies are proposing standards to establish a single, persistent TCP connection for each document retrieved.

2. Platform for Internet Content Selection (PICS)

A group of software manufacturers, publishers, and on-line services has formed a consortium to develop standards for filtering material deemed unsuitable by individuals from their Internet feed.

Called the Platform for Internet Content Selection, or PICS, the group includes Microsoft, IBM, Apple Computer, Netscape Communications, AT&T, MCI, America Online, CompuServe, Prodigy, Time Warner, and Viacom.

The effort is intended to head off any possible government censorship of the Internet. The Communications Decency Act, for example, passed in June 1995 by the U.S. Senate, would penalize those who distribute sexually explicit material on the Internet, a law that critics point out is unconstitutional in the U.S. The Internet Freedom and Family Empowerment Act, passed by the House, calls for standards and software for filtering content to be developed by industry. High-tech companies and a very large number of Internet users want to defeat the Communications Decency Act, and the new consortium is seen as something of a preemptive

strike, intended to show parents that the industry cares. The group aims to develop standards for filtering software, with parents to assist in the development of a ratings system for Internet content.

The solution proposed is content tagging—placing simple ratings on Web sites that indicate the target audience of each site. Web browsers that support PICS would discriminate between different ratings, allowing or banning access on a site-by-site basis. The major problem with this method is that the Internet is not a U.S. network, it is international. What is deemed acceptable limitation in the U.S. will in nearly all cases be considered unacceptable censorship in other parts of the world according to national legislation and cultural milieu. It is, however, clear that a system of filtering based on national and individual requirements must be established.

3. Collaboration Extensions

The W3C has recommended protocol changes that will address collaboration requirements. The focus will be on extensions to the Web protocols that support wide-area, asynchronous collaborative applications. These extensions will be rolled out during 1996 and will encompass structured discussion and shared annotation protocols.

4. Multiple Language Support

Multiple language support is being incorporated into Web browsers, opening up the Web as a business platform for many regions currently less able to take advantage of the Web than English-speaking countries.

Through a partnership with Spyglass, Alis Technologies has integrated its extensive language handling capabilities with Spyglass Mosaic core technology to create the Alis multilingual browser. The first version of the multilingual browser provides interfaces to French, Italian, German, Spanish, Russian and English. When users change from one language to another, the menus, messages and online help appear in the selected language. The hyperlink buttons in the interface even lead to different sites, depending on the language of the interface.

5. Mobile Code and Distributed Objects

Increasingly automated applications will emerge on the Web. As the Web becomes the *de facto* application platform, interactivity will be delivered in the form of executable Web content, as opposed to platform-specific applications. Interface specifications will be developed for multiple platforms that will enable high-level, generic executable content to interface with the underlying operating system for each client platform at run time. A mix of interpreted, semi-compiled, and fully compiled application frameworks will emerge, depending on performance and portability demands.

Standards for objects will also be developed for the Web, incorporating CORBA. For example, ANSA is developing a set of tools to build a distributed object model within the Web, resulting in a CORBA framework in which the Web appears as an environment of distributed CORBA objects.

6. Payment Mechanisms

Investigations are taking place into electronic payment using Web protocols. Electronic commerce over the Internet will become widely accepted when there is a common, universal security and commerce framework that does not require specific combinations of client and server to work. This will be achieved through the standardization of the necessary Web protocols, although as in other areas of Web standards, proprietary solutions will initially succeed in the market in parallel.

7. Demographics

Content providers want to gain information about the readership of their content. However, there are several issues regarding individual privacy and the use of direct marketing (junk mail) on the Internet. Many demographic surveys have been conducted on the Web, although most are based on self-selecting samples. Content providers will need to supply their advertisers with the same information they provide for traditional media, and so similar kinds of demographic research will emerge.

8. Common Gateway Interface (CGI)

CGI is the interface between HTTP servers and user-written gateways to other database systems, etc. CGI access methods, scripting tools, and security frameworks will become increasingly standardized as the need to maintain and manage large CGI-based environments increases.

(Blank)

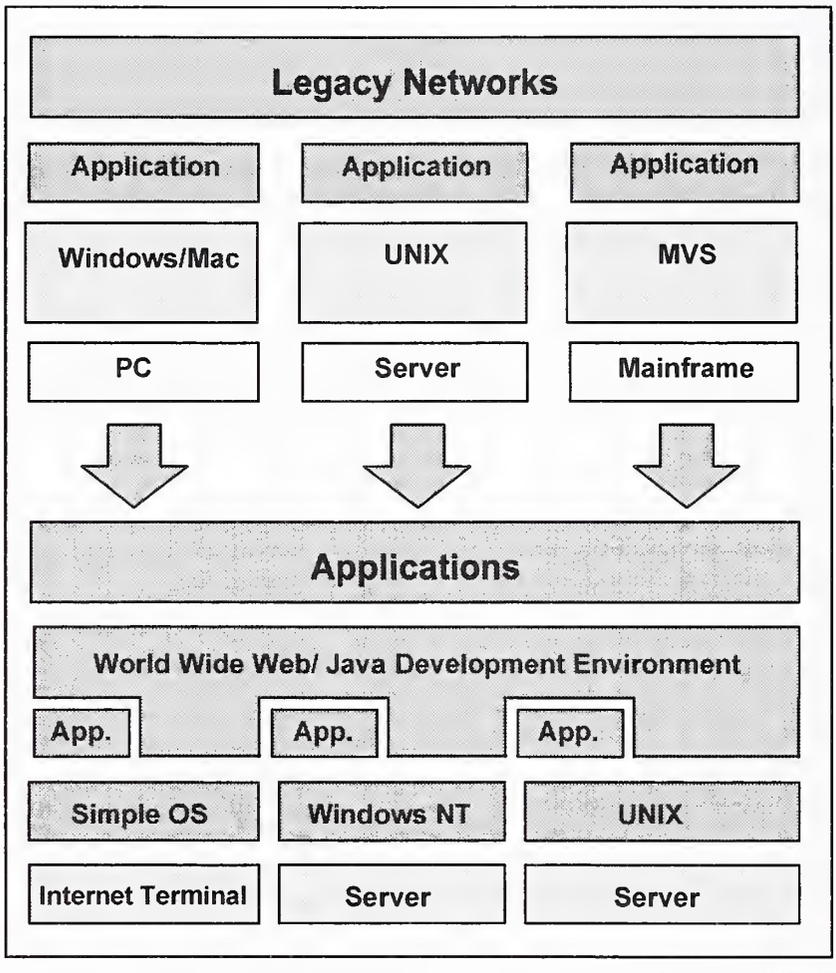
Applications Migrating to the Web Platform

A
Application Shift

The shift from legacy platforms, such as mainframe, minicomputer, and even PC, to the Web-based platform is occurring rapidly today, although only a handful of applications have migrated to the Web-based platform. But as Web technology matures, 50% of the current applications written for PC-, server- and mainframe-based operating systems will migrate to the Web-based platform by the year 2000.

Exhibit VII-1

Applications Shifting Platforms



Source: INPUT

B
First Killer Application—Publishing

Publishing on the Web is the "killer" application that has made Web technology so popular. Publishing, or content sharing, is an application that truly demonstrates the potential of a network-based platform.

The Web allows individuals and organizations easily to publish information to be shared with anyone in the world. It has been so successful because, for the first time, those who control the access do not necessarily control the content.

1. Next Web Application—Processed Content

The next application, currently being developed by companies, is "processed" content sharing. Web systems are being connected to a variety of legacy, back-office systems to provide users with decision-making information. IBM and Lotus call it "problem solving content." Content historically trapped on large mainframes is now being made available to people throughout the

world. The FedEx Web site, for example, allows users to track their packages on-line. The data provided actually resides on a large IBM mainframe that has been connected to the Web. As more back-office systems are connected to the network-based platform, enterprise content will be liberated.

2. History Repeats Itself

The first applications that were developed for the PC were desktop publishing tools. With the shift from a PC-based to a network-based platform, we are again witnessing the development of publishing applications for the emerging platform standard. Instead of desktop publishing, it's now network publishing. Today, individuals and organizations publish everything from information about pets to corporate price lists, and distribute this information on the network for anyone else to see. The originators of the Web created both the network platform and the application, a little like creating not only the Macintosh, but also MacWrite and MacPaint.

PCs evolved into client/server network components that could access databases, mail and corporate systems. Likewise, we are seeing a similar evolution of the Web in its connection to legacy servers and back-office applications.

C
Groupware

A recent trend is the development of Web-based applications that enable teams to work together across the Internet. As companies and standards committees spend time tackling the electronic commerce objective, others have turned their attention to developing groupware within the corporation.

For the future, companies will develop little group-oriented applications that work between the Web server and browser. The possible applications are endless, but early development is addressing applications such as:

- Publishing confidential company information within departments and across company locations
- Developing team computing applications for engineers and product marketing managers to collaborate so as to speed product development and time to market
- Sales force access Web servers to ensure that critical selling information is readily available

- Corporate information flow—for example, sending Web forms-based expense reports to the finance/travel accounting departments and to one's manager

- A human resources administrator could post resumes, performance reviews and salary information on the secure desktop Web server for easy review by executive HR staffers.

An example of commercial technology applied to Internet-based groupware is Quarterdeck's WebPhone, which aims to speed up the acceptance of the Internet as a medium for widespread audio communications. Telephone capabilities are delivered to Internet users around the world and largely reduces long-distance phone charges. WebPhone is the first in a series of collaborative computing products from Quarterdeck.

D
Client/Server Applications

Information stored in client/server applications such as SAP or PeopleSoft will eventually be converted to HTML format for viewing on a browser client.

Micro Focus, traditionally known for its COBOL products, is in the process of reinventing itself as a Web-based company, and is building all its mainframe-offloading products and client/server target systems on Web technologies.

The Internet itself is a client/server environment, albeit highly fragmented, and so it is ideally suited to the development of large-scale client/server applications. Performance remains a critical issue, and as this is addressed, the number of applications making innovative use of the distributed nature of the Internet will increase dramatically.

Glossary

This appendix provides definitions of terminology associated with the Internet that is not in INPUT's *Definition of Terms*.

A Definitions

56Kbps/64Kbps Line	A digital phone-line connection capable of carrying 57,344 (U.S.) or 65,536 (Europe) bits per second. At this speed, one megabyte will take about 3 minutes to transfer, around four times faster than with a 14.4Kbps modem.
ADN	Advanced Digital Network – usually refers to a 56Kbps leased line.
Archie	A software tool for finding files stored on anonymous FTP sites. A user must know the exact file name or a sub-string of it.
ARPANet	Advanced Research Projects Administration Network, the precursor to the Internet. Developed in the late 1960s and early 1970s by the U.S. Department of Defense as an experiment in wide-area networking that would survive a nuclear war.
Audit	The collection of information about security events on a network. Auditing is used for logging events, identifying network attacks, and ensuring that network security is working effectively.
Authentication	Verification of the claimed identity of a computer or computer network user.

Backbone	A high-speed line or series of connections that forms a major pathway within a network. The term is relative, as a backbone in a small network may be much smaller than many non-backbone lines in a large network.
Bandwidth	How much information can be sent through a connection. Usually measured in bits per second. A full page of English text in a book totals around 20,000 bits. A fast modem can move about 30,000 bits in one second (30Kbps), rising to around 120,000 bits per second (120Kbps) depending on the type of information being transferred and the compression used. Full-motion, full-screen video would require roughly 10,000,000 bits per second (10Mbps), depending on compression.
Bastion Host	Another term for firewall host.
BBS	Bulletin Board System – a computerized meeting and announcement system that allows people to carry on discussions, upload and download files, and make announcements without being connected to the computer at the same time.
Bit	Binary digIT – a single-digit number in base 2; in other words, either a one or a zero. The smallest unit of computerized data. Bandwidth is usually measured in bits per second.
Browser	A client program (software) that is used to look at (or browse) various kinds of Internet resources.
Byte	A set of bits that represents a single character. Usually there are 8 or 10 bits in a byte, depending on how the measurement is being made.
Client	A software program that is used to contact and obtain data from a server software program on another computer, often across a great distance. Each client program is designed to work with one or more specific kinds of server programs, and each server requires a specific kind of client.
Cyberspace	Currently used to describe the whole range of information resources available through computer networks such as the Internet.

Domain Name	The unique name that identifies an Internet site. Domain names always have 2 or more parts, separated by dots—for example, 'input.com.' The part on the left is the most specific, and the part on the right is the most general. A given machine may have more than one domain name but a given domain name points to only one machine.
DNS	Domain Name Server—a means by which numeric IP addresses (e.g., 198.93.130.56) are converted into character-based names (e.g., www.input.com) and vice versa.
E1	A leased-line connection capable of carrying data at 2.048Mbps. At maximum theoretical capacity, an E1 line could move a megabyte in less than five seconds. That is still not fast enough for full-screen, full-motion video, for which you need at least 10Mbps. E1 is one of the fastest speeds commonly used to connect networks to the Internet.
E3	A leased-line connection capable of carrying data at 34Mbps. This is more than enough to transmit full-screen, full-motion video.
E-mail	Electronic mail – messages, usually textual, sent from one person to another via computer. E-mail can also be sent automatically to a large number of addresses via a mailing list.
Encryption	A method of protecting data so that if it is accessed, it cannot be understood without the use of a secret encryption key.
Ethernet	A very common method of networking computers in a LAN. Ethernet will handle about 10Mbps and can be used with almost any kind of computer.
FAQ	Frequently Asked Questions – FAQs are documents that list and answer the most common questions on a particular subject. There are thousands of FAQs on subjects as diverse as pet grooming and cryptography. FAQs are usually written by people who have tired of answering the same question many times. FAQs are often associated with Usenet newsgroups.

Fast Ethernet	The latest Ethernet standard that specifies a data transfer rate of 100Mbps, a tenfold increase over traditional Ethernet performance.
FDDI	Fiber Distributed Data Interface – a standard for transmitting data on optical fiber cables at a rate of approximately 100Mbps.
FTP	File Transfer Protocol – a very common method of moving files between two Internet sites. FTP is a special way to log in to another Internet site for the purpose of retrieving and/or sending files.
Finger	An Internet software tool for locating people on other Internet sites. Finger is also sometimes used to give access to non-personal information, but the most common use is to see if a person has an account at a particular Internet site. Many sites do not allow incoming finger requests.
Gateway	A hardware or software configuration that translates between two dissimilar protocols. For example, CompuServe has a gateway that translates between its internal, proprietary E-mail format and Internet E-mail format.
Gopher	A widely used method of presenting material available on Internet sites as textual menus. Although gopher spread through the Internet rapidly in only a couple of years, it is being largely supplanted by the World Wide Web (WWW).
Host	Any computer on a network that is a repository for services available to other computers on the network. It is quite common to have one host machine provide several services, such as Web and Usenet.
HTML	HyperText Markup Language – the coding language used create hypertext documents for use on the World Wide Web.
HTTP	HyperText Transport Protocol – the protocol for moving hypertext files across the Internet. Requires an HTTP client program at one end, and an HTTP server program at the other. HTTP is

	the most important protocol used in the WorId Wide Web today.
Hypertext	Generally, any text that contains "links" to other documents – words or phrases in the document that can be chosen by a reader and which cause another document to be retrieved and displayed.
IP Address	A unique number consisting of 4 numbers separated by dots. Every machine that is on the Internet has a unique IP address – if a machine does not have an IP address, it is not really on the Internet. Most machines also have one or more domain names that are easier for people to remember. For example, the IP address of www.input.com is, at the time of writing, 198.93.130.56.
IRC	Internet Relay Chat – a large, multi-user live chat facility. There are a number of major IRC servers around the world that are linked to each other. Anyone can create a channel and everything that any member of a channel types in is seen by all users in that channel. Private channels can be created for invitation-only conference calls.
ISDN	Integrated Services Digital Network – a 64Kbps digitaI telephone line connection. ISDN acceptance is stiIl low due to high equipment prices, but as prices fall individuals and companies are benefiting from leased-line performance on a dial-up line. Connect time charges are normally the same as for a regular analog telephone connection.
Internet	The vast collection of interconnected networks that all use the TCP/IP protocol and that evolved from the ARPANET of the late 1960s and early 1970s.
ISP	Internet Service Provider – an organization (usually commercial) that offers individuals and other organizations access to the Internet through a dial-up connection, ISDN, or leased line.
Kilobit	1,024 bits. Abbreviated to Kb.
Kilobyte	1,024 bytes. Abbreviated to KB.

LAN	Local-Area Network – a computer network limited to the immediate area, usually the same building or floor of a company building.
Leased line	A phone line that is permanently held open for data transfer between two locations. The highest speed data connections require a leased line.
Listserv	The most common kind of mail list, Listservs originated on BITNET, but they are now common on the Internet.
Login	The account name used to gain access to a computer system or network.
Megabit	1,024 kilobits. Abbreviated to Mb.
Megabyte	1,024 kilobytes. Abbreviated to MB.
Mail list	An automated system that allows people to send E-mail to one address, whereupon their message is copied and sent to all of the other subscribers to the mail list. In this way, people who have many different kinds of E-mail access can participate in discussions together.
Mosaic	The first WWW browser that was available for the Macintosh, Windows and UNIX through a consistent user interface. Mosaic created the explosion in popularity of the Web. The source code of Mosaic has been licensed by several companies and there are now several other browsers as good as or better than Mosaic, most notably Netscape.
Newsgroups	The name for discussion groups on Usenet.
Node	Any single computer connected to a network.
Packet Switching	The method used to move data around on the Internet. In packet switching, the data coming out of a machine is broken up into chunks, each chunk containing the address of where it came from and where it is going. This enables chunks of data from many different sources to coexist on the same lines, and be sorted and directed to different destinations by special machines along the way.

	This way, many people can use the same lines at the same time.
Password	A code used to gain access to a locked system. Good passwords contain letters and nonletters and are not simple combinations.
PPP	Point to Point Protocol – most well known as a protocol that allows a computer to use a regular telephone line and a modem to make a TCP/IP connection and thus be on the Internet. PPP is gradually replacing SLIP for this purpose.
Proxy Server (Proxy)	An application that controls traffic between a protected network and the Internet.
RFC	Request For Comments – the name of the result and the process for creating a standard on the Internet. New standards are proposed and published on-line, as an RFC. The Internet Engineering Task Force is a consensus-building body that facilitates discussion and establishes new standards.
Router	A software package or special-purpose computer that handles the connection between two or more networks. Routers spend all their time looking at the destination addresses on the packets passing through them and deciding which route to send them on.
Server (see Client)	A computer, or a software package, that provides a specific kind of service to client software running on other computers. A single server machine could have several different server software packages running on it, thus providing many different services to clients on the network.
SLIP	Serial Line Internet Protocol – a standard for using a regular telephone line (a "serial line") and a modem to connect a computer as a real Internet site. SLIP is gradually being replaced by PPP.
T1	A leased-line connection capable of carrying data at 1.544Mbps. At maximum theoretical capacity, a T1 line could move a megabyte in less than 10 seconds. That is still not fast enough for full-

	screen, full-motion video, for which you need at least 10Mbps. T1 is one of the fastest speeds commonly used to connect networks to the Internet.
T3	A leased-line connection capable of carrying data at 44.736Mbps. This is more than enough to transmit full-screen, full-motion video.
TCP/IP	Transmission Control Protocol/Internet Protocol – a collection of communication protocols that define the Internet and allow different computers to communicate with one another over a common network.
Telnet	The command and program used to log in from one Internet site to another. The telnet command/program gets you to the "login:" prompt of another host.
Terminal	A device that allows you to send commands to a computer somewhere else. At a minimum, this usually means a keyboard and a display screen and some simple circuitry. Usually you will use terminal software in a personal computer; the software emulates a physical terminal and allows you to type commands to a computer somewhere else.
Terminal Server	A special-purpose computer that has places to plug in many modems on one side, and a connection to a LAN or host machine on the other side. Thus, the terminal server does the work of answering the calls and passes the connections on to the appropriate node. Most terminal servers can provide PPP or SLIP services if connected to the Internet.
Trojan Horse	A program that performs a desired task, but also includes unexpected functions, usually unpleasant, such as random file deletion.
URL	Uniform Resource Locator – the standard method of addressing resources on the World Wide Web, such as Web pages themselves. For example, http://www.input.com/.

Usenet	A worldwide system of discussion groups, with comments passed among hundreds of thousands of machines. Only about half of all Usenet machines are on the Internet. Usenet is decentralized, with over 13,000 discussion areas, called newsgroups.
Veronica	Very Easy Rodent Oriented Net-wide Index to Computerized Archives – developed at the University of Nevada, Veronica is a constantly updated database of the names of almost every menu item on thousands of gopher servers. The Veronica database can be searched from most major gopher menus.
Virus	A segment of code which replicates by attaching copies of itself to existing executables.
WAIS	Wide Area Information Service – a commercial software package that allows the indexing of huge quantities of information, and then makes those indexes searchable on the Internet according to keywords.
WAN	Wide-Area Network – any network that covers an area larger than a single building or campus.
World Wide Web	The whole constellation of resources that can be accessed using gopher, FTP, HTTP, telnet, Usenet, WAIS, and other tools. WWW is the universe of hypertext servers that allow text, graphics, sound files, etc. to be combined.

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B

Vendor Names and Addresses

Exhibit B-1 lists the names, addresses and products of major vendors of Web browser and server software products.

Exhibit B-1

Names and Addresses of Vendors

Company	Product
Adobe Systems 1585 Charleston Road Mountain View CA 94039-7900 U.S.A. Tel: +1 415 961 4400 Fax: +1 415 961 3769 URL: http://www.adobe.com/	Acrobat Reader
Ameritech Library Services 1007 Church Street Evanston, IL 60201-3665 U.S.A. Tel: +1 708 866 1726 Fax: +1 708 866 4893 URL: http://www.notis.com/	NetPublisher
Microsoft Corporation One Microsoft Way Redmond, WA 98052-6399 U.S.A. Tel: +1 206 882 8080 Fax: +1 206 936-7329	Internet Explorer, Internet Information Server
NaviSoft Internet Security 1 Militia Drive Lexington, MA 02173 U.S.A. Tel: +1 617 863 6400 Fax: +1 617 863 6464	NaviServer NaviPress

Exhibit B-1 (cont.)

Company	Product
Netscape Communications 501 East Middlefield Road Mountain View, CA 94043 U.S.A. Tel: +1 415 254 1900 Fax: +1 415 528 4124 URL: http://www.netscape.com/	Navigator Communications Server Commerce Server
Open Market 245 First Street Cambridge, MA 02142 U.S.A. Tel: +1 617 621 9500 Fax: +1 617 621 1703 URL: http://www.openmarket.com/	OM Transact WebServer WebReporter Merchant Solution
O'Reilly & Associates 103A Morris Street Sebastopol, CA 95472 U.S.A. Tel: +1 707 829 0515 Fax: +1 707 829 0104 URL: http://www.ora.com/ or http://website.ora.com/	WebSite
Process Software 959 Concord Street Framingham, MA 01701 U.S.A. Tel: +1 508 879 6994 Fax: +1 508 879 0042 URL: http://www.process.com/	Purveyor
Progressive Networks 616 First Avenue, Suite 701 Seattle, WA 98104 U.S.A. Tel: +1 206 447 0567 URL: http://www.prognet.com/	RealAudio
Quarterdeck 13160 Mindanao Way, 3rd Floor Marina Del Rey, CA 90292-9705 U.S.A. Tel: +1 310 309 3700 Fax: +1 310 309 4217 URL: http://www.qdeck.com/	WebPhone WebServer
Spry Tel: +1 206 447 0300 URL: http://www.spry.com/	Internet Office Server

Exhibit B-1 (cont.)

Company	Product
Spyglass 1230 East Diehl Road Naperville, IL 60563 U.S.A. Tel: +1 708 505 1010 Fax: +1 708 505 4944 URL: http://www.spyglass.com/	Spyglass Mosaic Spyglass Server
StarNine Technologies, Inc. 2550 Ninth St. Suite 112 Berkeley, CA 94710 U.S.A. Tel: +1 510 649 4949 Fax: +1 510 548 0393 URL: http://www.starnine.com/	WebSTAR

Source: INPUT

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C

Web Standards Committees and Associations

Exhibit C-1 provides a short list of Web standards committees and associations. There are many more.

Exhibit C-1

Web Standards Committees and Associations

Association/Institute	Notes
World Wide Web Consortium (W3C)	An organization to develop common standards for the evolution of the Web, coordinated by MIT in the U.S. and INRIA in France.
Internet Engineering Task Force (IETF)	A consensus-building body that facilitates discussion and establishes new standards.
Internet Society	An international organization that aims to further cooperation and coordination for Internet technology and applications.

Source: INPUT

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Vendor Questionnaire

INPUT is conducting research to determine current trends in the World Wide Web software market. Your response to the following questions will provide a foundation for this research.

Your responses to the questionnaire will be kept in strict confidence.

1. What type of Web software products do you sell?

2. What are the price ranges for your Web software licenses and services?

3. What percentage of the contract price is for maintenance services?

_____ Under 15%

_____ 15% - 25%

_____ 26% - 50%

_____ 51% - 75%

_____ Over 75%

4. What percentage of your orders are for Web services (versus products)?

_____ Under 15%

_____ 15% - 25%

_____ 26% - 50%

_____ 51% - 75%

_____ Over 75%

5. What are the major issues and problems you have in selling Web products? (Check as many as apply)

_____ Price

_____ Full breadth of products

_____ Technical knowledge

_____ System platform

_____ Identifying customers

_____ Education of customers

_____ Distribution channels

_____ Staff size

_____ Other (Please specify)

6. What is your average sales cycle for Web products?

_____ 1 - 3 months

_____ 3 - 6 months

_____ 6 - 12 months

_____ 12 - 24 months

_____ greater than 24 months

7. Are you doing anything to shorten the sales cycle?

_____ Yes

_____ No

If yes, please specify _____

8. To whom do you primary sell in corporations?

9. What are your strengths versus your competition?

10. What are your weaknesses versus your competition?

11. Who do you think your competitors will be in two years?

12. Are you aware of any specific standards issues that might impede the Web software market?

13. Are you aware of any specific features that will be included in future Web software products?

14. What do you think INPUT should include in a market research study on the future of World Wide Web software markets?

(Blank)

E

User Questionnaire

I am calling from INPUT, a research and consulting firm in Teaneck, New Jersey. We are conducting a study on the future of World Wide Web servers and browsers. The information that you provide will be confidential and neither your name nor your company's name will be connected with any of the information in this study. In return for your assistance, we will provide you with a summary of the study's findings at no charge.

Your responses to the questionnaire will be kept in strict confidence.

1a. Have you purchased World Wide Web server software?

____ Yes ____No

1b. If yes, who did you purchase your Web server software and hardware from? How do you rate your satisfaction on a scale from 1 to 5 (1 not good, 5 excellent)?

Type of Vendor	Vendor Name	Rating
Hardware systems vendor	_____	_____
Web server software vendor	_____	_____
Systems integrator or VAR	_____	_____

1c. If no, do you plan to purchase Web server software?

___ Yes ____ No

If yes to 1c., please describe the Web software you plan to purchase.

2. On what system platform do you run your Web server?

____ UNIX

____ OS/2

____ VMS

____ Windows NT

____ Windows 95

____ Windows 3.x

____ Macintosh

____ Other _____

3a. In general, for the Web server software you've used, how would you say it rates on the following characteristics, from 1 to 5, where 5 is Excellent and 1 is Poor:

Easy to use / Manageability	1 2 3 4 5
Speed/Performance	1 2 3 4 5
Low prices	1 2 3 4 5
Security	1 2 3 4 5
Based on industry standards	1 2 3 4 5
Modularity (extending the functionality)	1 2 3 4 5
Support	1 2 3 4 5
Other: _____	1 2 3 4 5

3b. Of the above characteristics of Web server software we just discussed, which one is most important to you?

- Easy to use / Manageability
- Speed/Performance
- Low prices
- Secure
- Based on industry standards
- Modularity (extending the functionality)
- Support
- Other: _____

4. In general, for the Web server software, how important to you are the following features, from 1 to 5, where 5 is Very Important and 1 is Not Important:

- Image Maps 1 2 3 4 5
- Forms Processing 1 2 3 4 5
- Searching Facilities 1 2 3 4 5
- Directory Indexing/Folders 1 2 3 4 5
- GUI-based Configuration/Management 1 2 3 4 5
- Logging Facility 1 2 3 4 5
  (access, error, and security information)
- Report Generator 1 2 3 4 5
  (to generate customized reports of server activity)
- Database Integration Support 1 2 3 4 5
- Application Integration Support 1 2 3 4 5

- Remote Administration 1 2 3 4 5
- Multiple Site Hosting 1 2 3 4 5
  (allows Internet Presence Providers to easily support and manage multiple home age sites on the same machine)
- Other _____ 1 2 3 4 5

5. How reasonable is the cost of your current Web server software?

- Very reasonable
- Somewhat reasonable
- Neither reasonable nor unreasonable
- Somewhat unreasonable
- Very unreasonable

6a. What percentage of your IS budget is spent on Web server products?

6b. What percentage of your IS budget is spent on Web browser products?

6c. What percentage of your IS budget is spent on Web-related services?

7. What percentage of your Web server budget is spent on products for internal Web servers (versus external)?

____ Under 15%

____ 15% - 25%

____ 26% - 50%

____ 51% - 75%

____ Over 75%

8. If you plan to or already use a Web server, how likely or unlikely are you to develop chat room capabilities on your server?

   - Very likely
   - Somewhat likely
   - Neither likely nor unlikely
   - Somewhat unlikely
   - Very unlikely

9. Does your browser support Netscape extensions, HTML 3.0, or some form of both?

   ____ Netscape

   ____ HTML 3.0

   ____ Both

   ____ Don't know

10. How likely or unlikely are you to use browser technology that is embedded in other applications, such as word processing and spreadsheets?

    - Very likely
    - Somewhat likely
    - Neither likely nor unlikely
    - Somewhat unlikely
    - Very unlikely

11. In the future, how likely or unlikely are you to use only browser technology that is embedded in other applications, such as word processing and spreadsheets (won't need to use a separate Web browser)?

- Very likely
- Somewhat likely
- Neither likely nor unlikely
- Somewhat unlikely
- Very unlikely

12. In general, how appropriate do you feel the following media types are for use on the World Wide Web, from 1 to 5, where 5 is Very Important and 1 is Not Important?

- Microsoft Corp. (Blackbird, MediaView and Scribble) 1 2 3 4 5
- Apple Computer Inc. (QuickTime and QuickTime VR) 1 2 3 4 5
- Oracle Corp. (Oracle Media Objects) 1 2 3 4 5
- Sun (Java) 1 2 3 4 5
- Sybase Inc. (InterPlay Player) 1 2 3 4 5
- Kaleida Labs Inc. (Script X) 1 2 3 4 5
- Macromedia (Director) 1 2 3 4 5
- Adobe (Acrobat) 1 2 3 4 5
- Caligari Corp. (True Space 3D) 1 2 3 4 5
- Progressive Networks (RealAudio) 1 2 3 4 5
- Xing Technology Corp. (StreamWorks) 1 2 3 4 5

13. Of the above new media types we just discussed, how likely are you to use them internally?

- Microsoft Corp. (Blackbird, MediaView and Scribble)
- Apple Computer Inc. (QuickTime, and QuickTime VR)
- Oracle Corp. (Oracle Media Objects)
- Sun (Java)
- Sybase Inc. (InterPlay Player)
- Kaleida Labs Inc. (Script X)
- Macromedia (Director)
- Adobe (Acrobat)
- Caligari Corp. (True Space 3D)
- Progressive Networks (RealAudio)
- Xing Technology Corp. (StreamWorks)