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STRATEGIC MARKET PERSPECTIVE

Client/Server Software Product Directions

Client/Server Software Program

APRIL 1996

Client/Server Software Product Directions

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Abstract

This report discusses user preferences for software and is based on a survey of 110 corporate users. It also provides information on the timeframes in which customers expect to move away from legacy systems. It ranks the importance of different client and server operating systems.

It also provides an analysis of budgets for key applications. It discusses how the typical client/server information services budget is spent.

The report contains 96 pages and 55 exhibits.

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C/S Software Program

Client/Server Software Product Directions

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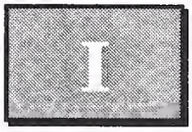


Introduction

This chapter describes the purpose and scope of this report and lists related reports published by INPUT.

A. Purpose of The Report

This report is based on a survey of 110 corporate users. Its aim is to provide insights into what software platforms users are choosing. It starts by discussing the business requirements that are fueling the growth of client/server (C/S) systems. It then discusses C/S platform evolution and software trends. It focuses on operating systems that users perceive as being important for both clients and servers. It also discusses C/S development environment trends and the impact of the Internet on C/S systems.

Some of the issues surrounding migration of legacy systems to a C/S architecture are discussed. The report looks at how users perceive advantages and disadvantages of C/S systems. It then looks at a few key areas where C/S systems are implemented and discusses priorities and budgets.

The report answers the questions:

- How will software platforms evolve over the next five years?
- What are the main operating system trends?
- What environments are C/S applications being sold into?
- What are some of the most important C/S applications?
- How much are users spending on software and services for particular types of systems?
- How do budgets break down between software and services?

This report provides insights into the C/S applications software market for:

- Corporate strategists
- Purchasers of C/S systems
- Third-party software managers in hardware and systems software companies
- Vendors of C/S software and systems
- Investors in C/S applications software companies

B. Scope of the Report

This report covers C/S applications software trends. Client/server applications software is software that:

- Requires both client and server software to make the application work; neither part of the software can run independently
- Is used for business; consumer applications are excluded

This broad, pragmatic definition is convenient because users who respond to INPUT's surveys are not always aware of the underlying technology or protocols. INPUT's definition of C/S software includes Internet-based applications where the client is a browser and the application runs on a server. The browser and web server software would typically be included under systems software, rather than applications software. INPUT's definition includes and is not restricted to applications that use remote procedure calls (RPCs) and/or stored procedures to access databases.

Client/server budgets and their growth rates are analyzed. Market forecasts are not included in this report. These are found in INPUT's *Worldwide Client/Server Market Forecast, 1995-2000*. The report does not cover professional services or systems integration.

C. Methodology

1. Primary Research

INPUT surveyed 110 user organizations by telephone. Respondents were asked which applications were being implemented using C/S technology and which platforms they were using. The user survey, together with vendor interviews, provides the basis for trend analysis.

2. Secondary Research

Trade publications and on-line information networks provided additional information for this report. Industry trade shows and vendor literature provided additional insights.

3. User Survey Demographics

Exhibit I-1 shows the breakdown of survey respondents by industry.

Exhibit I-1

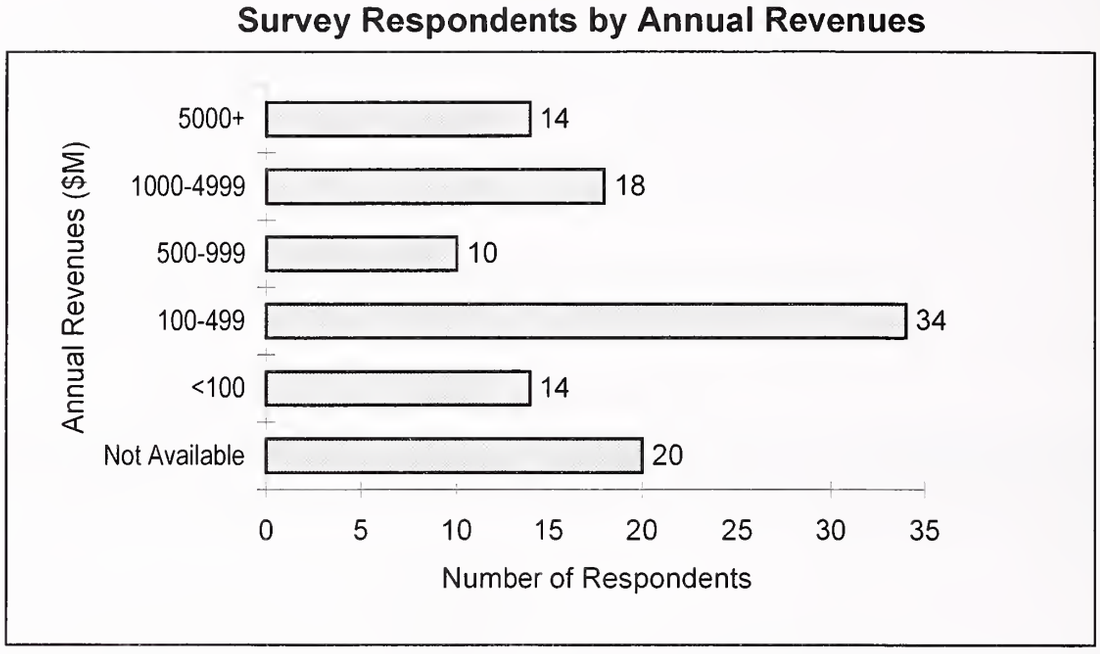
Survey Respondents by Industry

Industry Group	Respondents in Group	Industry	Respondents in Industry
Financial and Business Services	23	Banking and Finance	9
		Business Services	6
		Insurance	8
Government, Education, Health and Nonprofit	21	Education	8
		Government - Federal	2
		Government - State and Local	6
		Nonprofit Organizations	2
		Health Services	3
Manufacturing	42	Manufacturing - Process	15
		Manufacturing - Discrete (not Printing and Publishing)	20
		Manufacturing - Printing and Publishing	7
Distribution and Trade	14	Retail	10
		Transportation	3
		Wholesale	1
Telecommunications and Utilities	10	Telecommunications	2
		Utilities	8
Total	**110**		**110**

Note: number of respondents = 110 *Source: INPUT*

One hundred and ten (110) respondents identified almost 400 applications being maintained, upgraded or developed in 1996. Respondents were selected to cover a range of industries. The sample is biased slightly away from the high-tech industry, where it proved difficult to identify respondents who could answer a phone survey. Hence, the survey reflects traditional industries, with a strong emphasis on manufacturing. Exhibit I-2 shows the distribution of respondents' company size by annual revenues.

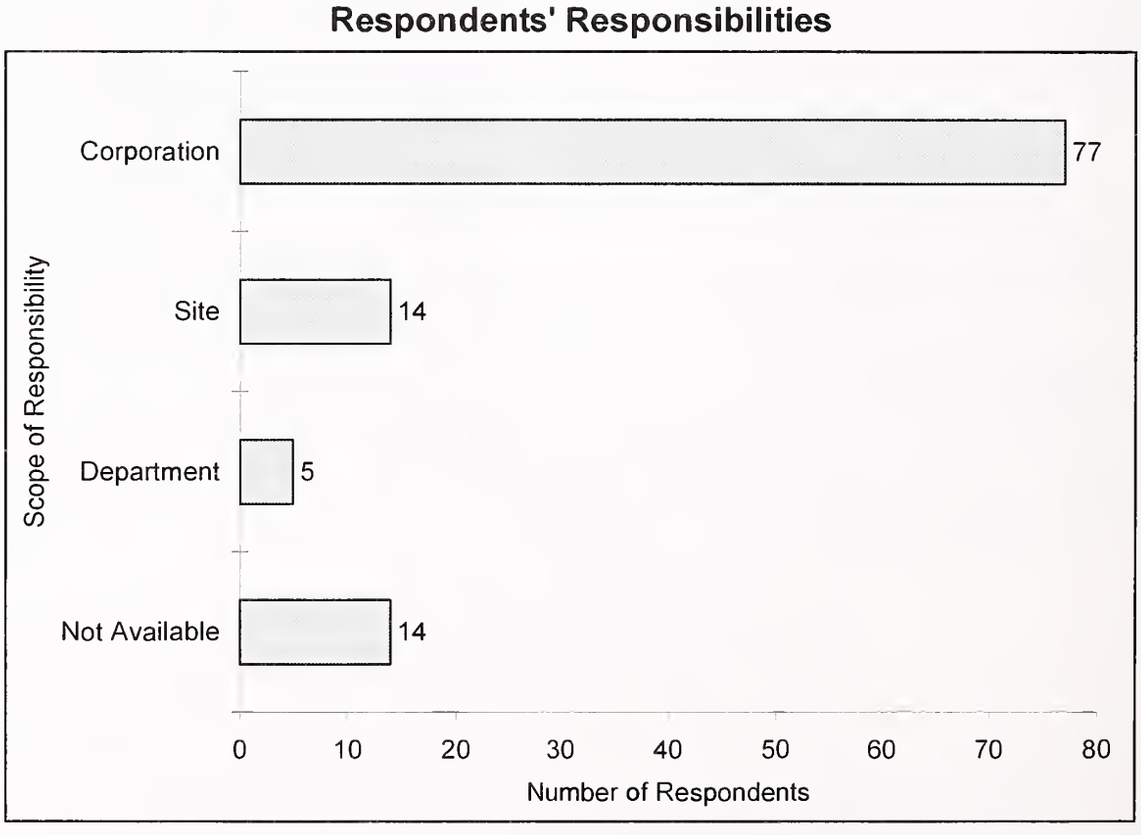
Exhibit I-2



Note: number of respondents = 110 *Source: INPUT C/S User Survey 1995*

Exhibit I-3 shows the scope of their responsibilities.

Exhibit I-3



Note: number of respondents = 110 *Source: INPUT*

Respondents were mainly from IS departments, representing their corporation, site or department. Some organizations, such as those in government and education, were unable to provide revenue information. The sample was selected to provide a range of organizations.

D. Report Structure

The report is structured as follows:

- Chapter II provides an executive overview and also summarizes the main findings of the report.
- Chapter III provides an analysis of the business environment and discusses trends surrounding migration of legacy applications.
- Chapter IV provides an analysis of C/S software platform directions.
- Chapter V discusses users' plans for legacy system migration.
- Chapter VI assesses the advantages and disadvantages of C/S systems.
- Chapter VII analyzes users' application priorities and budgets, based on the user survey.
- Appendix A provides definitions.
- Appendix B lists vendors tracked in INPUT's C/S program.
- Appendix C contains the survey questionnaire.

E. Related Reports

INPUT's C/S Software Program provides a comprehensive analysis of vendors and technology directions. The following reports in the C/S program provide additional information:

- *Worldwide Client/Server Software Market, 1995-2000*
- *How Users Choose Vendors*
- *Component Software: ORBs, OLE and OpenDoc*
- *Internet Security: The Impact of Firewalls on Client/Server Applications*
- *Client/Server Systems Management Software*
- *Middleware: Is DCE the Answer?*

- *Object-oriented Platforms for C/S Systems*
- *The Client/Server Explosion—How Users Choose Platforms*
- *Client/Server Market Analysis, 1993-1998*
- *Client/Server Service Opportunities—Europe, 1993-1998*
- *Client/Server Impact On Major Project ContractóEurope, 1993-1998*
- *Client/Server Trends In the Federal IT Market: 1994*

INPUT's Market Analysis Program provides comprehensive forecasts in software and services. It also provides analysis of vertical markets.

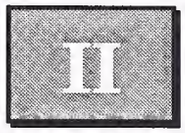
Reports from the Market Analysis Program include:

- *U.S. Systems Software Market, 1995-2000*
- *U.S. Applications Solutions Market, 1995-2000*
- *Worldwide Market Forecast Compendium, 1994-1999*
- *U.S. Market Forecast Compendium, 1995-2000*

INPUT also publishes market analysis reports that cover services as part of its Systems Integration and Outsourcing Programs. They include:

- *Systems Integration and Professional Services Markets, 1994-1999*
- *The Relationship Between BPR and Systems Integration*
- *Strategies for Successful Alliances*

In addition, INPUT reviews vendor strategies in its Vendor Analysis Program and in its C/S Vendor Profiles. Also, the European and U.S. federal government markets for information services are covered in a series of reports and research bulletins.



Executive Overview

This chapter summarizes the main findings of the report. It examines changes in the software platforms market and discusses user preferences. It also presents recommendations for users and vendors not found elsewhere in the report.

A. Business Requirements

There is an overwhelming need to accelerate the pace of business and support reengineered processes with efficient client/server systems. Technological forces alternate with customer demands to propel the client/server software market. Currently, in many market segments, there are enough C/S software products that customers are driving the market.

The promise of C/S systems is to integrate the demand chain, linking customers with ordering systems. Enterprise systems are being extended to the customer, using, for example, Internet Web browsers to support the user interface.

B. C/S Software Directions

1. Platform Trends

Client/Server solutions are evolving from serving departments to serving the enterprise. Enterprise solutions require support for distributed servers and open clients. Software platforms are evolving from operating systems in the 1970s, networks in the 1980s, and databases in the 1990s to distributed objects. Distributed object environments are where the major battles for software leadership are being waged by vendors today. This competition will affect users over the next five years, as software becomes more modular. Software components will increasingly be managed as key business assets. This evolution is causing major changes in the following areas:

- The rise of object-oriented programming environments
- Increased database support for parallel processing, video, and multimedia
- Need for greater network bandwidth for both wide-area and local communications
- Battles over scalable operating environments, primarily between Windows NT and UNIX

Client/server has, in two years, gone from being installed in approximately one-third of corporate sites to being the primary enterprise computing architecture. Windows NT is at least as important as Windows 95 for client computers. INPUT believes that when Windows NT gets a Windows 95 user interface in mid-1996, many corporations will select it for its scalability and reliability on PCs. On servers, UNIX is still strong for major corporate systems, although for LAN servers and midrange machines Windows NT is gaining market share.

2. C/S Development Tool Trends

Changes in business, platform advancements and operating system improvements, coupled with the evolution of the client/server model, are leading to a number of important C/S trends:

- Intelligent data warehouse management
- Increasing use of middleware to connect applications
- Systems integration and custom programming features incorporated into software products
- Cross-platform development tools

3. Changing Issues Surrounding C/S Systems

Reliable networking was a major concern of users two years ago. Now, users are more concerned with troubleshooting and fixing distributed applications, rather than the underlying network infrastructure. Despite a migration to C/S, some companies continue to implement text-based user interfaces.

4. Impact of the Internet

The Internet has emerged as a major applications development platform for both inter- and intra-company computing. Hardware vendors are seeing more computers being sold for internal Web applications than for externally accessible Web servers. The Internet is having a profound effect on

applications software vendors as they consider how they can modify their systems to support HTML browsers. The Internet will have a profound effect upon companies that provide C/S systems and will bring radical changes in:

- Traditional software structure and architecture
- Software distribution
- Company communications
- C/S management and support

C. Legacy System Migration

Many users will migrate away from mainframes and COBOL programmers over the next few years. Companies may build totally new systems or, more commonly, run old and new systems together. This will adversely affect vendors of proprietary mainframe and minicomputer systems. Approximately 60% of users still believe that proprietary systems are important. About one-quarter of users intend to replace proprietary mainframe systems with open servers in the 1996-1997 timeframe. The demand for migration tools will increase.

COBOL programmers are gradually being replaced by those using more modern programming languages. They are often retained solely to provide maintenance of old systems. Retraining programmers will continue to be a cost for IS departments, but should provide excellent opportunities for services vendors. Approximately half of the COBOL programmers are under contract to users, representing an opportunity for professional services firms.

D. Advantages and Disadvantages of C/S Systems

1. Advantages of C/S Systems

Users invest in C/S systems to:

- Enable many users to access and share data
- Support faster communications
- Run off-the-shelf software
- Communicate better with customers
- Train users more easily

2. Disadvantages of C/S Systems

Users delay implementation of C/S due to a number of reasons, including:

- Higher costs and expensive support
- Security problems
- Immature standards
- Difficulties in systems integration

E. Application Priorities and Budgets

Budgets for C/S software and services are growing on average at 20% per year. A few companies have very high budget growth for Internet-based applications that represent new opportunities. They can fund these activities from the savings on producing paper documentation or from direct marketing budgets.

Integrated enterprise applications, Web servers and inventory systems were three of the most important areas. Electronic mail was also an area of investment. Applications that almost always use C/S architectures include document imaging, computer/telephony integration and electronic mail.

Software and services budgets for many companies are small. This suggests either that many companies will fail to invest enough to be competitive or that there are many pilot projects under way. Both are probably true. Also, the availability of public domain software for Internet applications is fueling activity in that area.

F. Opportunities and Risks

1. Opportunities for Vendors

There are opportunities for vendors in the following areas:

- Integration—users need tools and software to integrate applications, databases, and departments into a seamless, functioning system.
- Smaller companies need vendors to provide more industry-specific solutions so as to gain competitive advantages.
- Vertical markets—C/S applications are breaking out of the past emphasis on departments and offering solutions for industry segments and business processes.

- Object-oriented tools and repositories—companies need robust, fast prototyping tools and easier creation of distributed applications.
- Management—companies are relying upon users with little training to manage C/S systems and need more user-friendly interfaces, workflow solutions and simplified tools.

2. Opportunities for Users

The new marketplace presents a number of user opportunities for action:

- Use Web browsers and Internet technology
- Connect branch offices
- Seek integrated solutions
- Shop for packaged software
- Develop a security program

3. Risks for Users and Vendors

The risks for vendors and users in the C/S systems and applications software marketplace include:

- Underestimated C/S budgets—they are growing and companies need accurate analysis of the financial impact of systems.
- Premature cancellation of projects—C/S benefits are not always immediately measured; companies need sound plans with well-defined phases to ensure that support is continued beyond the prototype stage.
- Staff support—users need to plan for adequate staff support, and vendors supporting projects need to understand the staffing requirements.
- Overdependence on vendors—users can rely too heavily upon database and system vendors. They need to understand where they are locked into products and where they truly have alternatives.
- Networks need to be designed so that they can scale up as required and be readily reconfigured.
- Users may be inadequately trained—training may go beyond using a system to customizing it, writing scripts for it and administering it.

4. Recommendations for Vendors

Vendors can build advantages by:

- Investing in integration
- Broadening their product lines to serve small businesses and users in vertical markets
- Reevaluating distribution channels—changes in software pricing, on-line distribution and more intense competition mean that new distribution models are required.
- Including software for systems administration and support with their products
- Providing security products
- Investing in distributed objects
- Investing in the Internet and networking
- Investing in partners—the range of partners for a software vendor has broadened over the last two years.

5. Recommendations for Users

- Redefine IS support and administration
- Understand which applications can benefit from Internet technology
- Redefine the role of programmers
- Understand distributed object support
- Manage C/S applications with a business plan

Business Requirements

This chapter describes key business requirements that are fueling the growth of C/S systems.

A. Business Requirements Summary

In emerging markets good products can sell themselves, with very little vendor support. As competition intensifies and markets mature, vendors need to focus on providing services to differentiate their products. The market evolves from one in which technology drives the business to one in which the market pulls the business. In the C/S software market, technology push and market pull forces become cyclical, raising business to new levels. Growth in the C/S market is fueled by the factors shown in Exhibit III-1.

Exhibit III-1

Business Requirements and Forces Fueling the C/S Software Market

Business Requirement	Technology Push	Market Pull
Accelerate business pace	• Rapid application development and integration, electronically connected users with e-mail, component software, business objects, application integration	• Competitive pressures, need for agility, processes that used to take weeks can be reduced to seconds with C/S technology
Compete globally	• Lower cost communications over higher speed networks, e.g., LAN interconnects and ATM • Better language support in applications and OSs	• Need to compete overseas, more competition at home from overseas companies • Access to overseas resources
Support remote organizations and users	• More easily integrated applications with modules for remote offices • Simpler systems management tools • Need to connect to the enterprise on the road • Telecommuting infrastructure, e.g., home computer with ISDN connections	• Need to provide branch offices with same capabilities as central functions • Wireless communications • Many offerings in switched services • Lower communications costs
Manage the demand chain	• EDI, the Internet, data warehouses, databases	• Need to accelerate the time it takes to complete and fulfill a transaction between companies
Extend the enterprise to the customer	• Powerful home computers, consumer on-line and Internet services, electronic commerce, e-cash, credit card number encryption, electronic catalogs	• On-line services provide distribution and/or promotional channels • Growth in supply chain management systems
Foster Internet businesses	• Internet, World Wide Web, Java, directories	• Enable collaboration and communication between remote sites. Support the Internet with directory and other services.
Empower knowledge workers	• Development tools, workflow, distributed office suites, Internet-enabled applications	• Users want faster systems that provide instant access to the right information at the right time
Support reliable systems	• High availability, high-performance computers, clustered servers, improved distributed software for applications development and administration	• Competitive necessity for reliable, scalable systems • More users demand access to relevant data

Source: INPUT

B. Accelerate Business Pace

Companies continue to reengineer their business processes so as to be agile in the marketplace. Customers are becoming more sophisticated and demanding. The pace of commerce is rapidly accelerating. For many corporations, increasing their revenues became the corporate goal in 1995, rather than cost cutting and downsizing. Businesses invest in C/S systems not merely to save money, but to expand business and gain competitive advantage by:

- Increasing customer satisfaction
- Developing new products and services
- Increasing revenues
- Achieving faster product cycle times

Client/Server growth is exploding because companies need to:

- Train the workforce quickly and reeducate workers easily
- Leverage major infrastructure investments on the desktop, expanding incrementally into C/S systems without massive capital expenditures
- Invest in the latest tools and efficient business processes to stay competitive

C. Compete Globally

Cultural and geographic boundaries are eroding, increasing worldwide competition. As global economies interconnect, particularly around the Pacific Rim and in Latin America, exporters are required to support remote offices and distribution channels with high-speed communications. These increasingly require multilingual distributed workgroup software. Overseas employees and self-managed teams require C/S software that provides seamless integration with the corporate culture.

D. Support Remote Organizations and Users

In INPUT's 1993 C/S market research, C/S systems were more likely to be deployed in larger organizations than in smaller ones. This is changing as branch offices and smaller organizations also move to C/S architectures. Branch offices frequently cannot afford dedicated IS staff. Companies like IBM have long targeted such workgroups with applications based on the AS/400 architecture. Now Oracle, Hyperion and others have announced they

are producing products that minimize systems integration and support. For example, branch banks are filling out order entry screens that reside in other departments using Internet browsers for the client software.

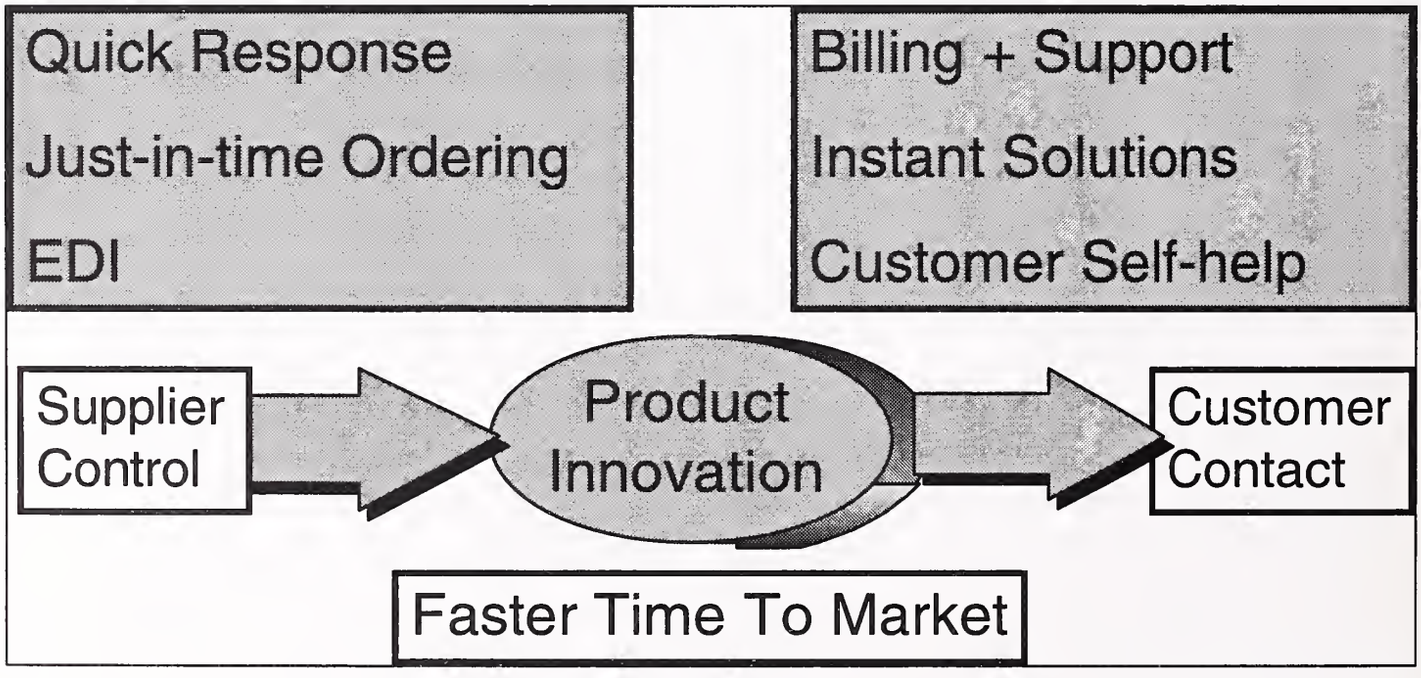
Wireless technology, personal communicators and notebook computing is making support for roaming professionals an essential part of most C/S systems. Symantec's ACT Contact Management package, for example, enables mobile computer users to reconcile their data with a central ACT database. Increasingly, applications vendors are incorporating support for mobile users in their applications. Telecommuters form another class of remote users. Corporate systems must be able to support them over relatively low-speed communications networks like ISDN lines.

E. Manage the Demand Chain

Client/Server systems link suppliers to product developers and manufacturing groups, which are in turn linked to customers. Exhibit III-2 illustrates C/S systems accelerating both buying and selling processes.

Exhibit III-2

The Promise of C/S Systems



Source: INPUT

Andersen Consulting and its partners, including Intel and SAP, promote the DaVinci Virtual Corporation as a demonstration of inter-enterprise systems. They automate demand chain management, integrating supply chain systems with customer service and support applications.

In retailing, Quick Response Systems (QRSs) enable a retail store to order clothes on demand, without holding extensive inventory. In supermarkets, Efficient Consumer Response (ECR) systems take point-of-sale data from the checkout to ordering systems that can rapidly replenish inventory. Manufacturers use C/S systems for just-in-time ordering. Traditional EDI (electronic data interchange) systems that enable purchases to be made electronically are being upgraded with C/S technology to provide:

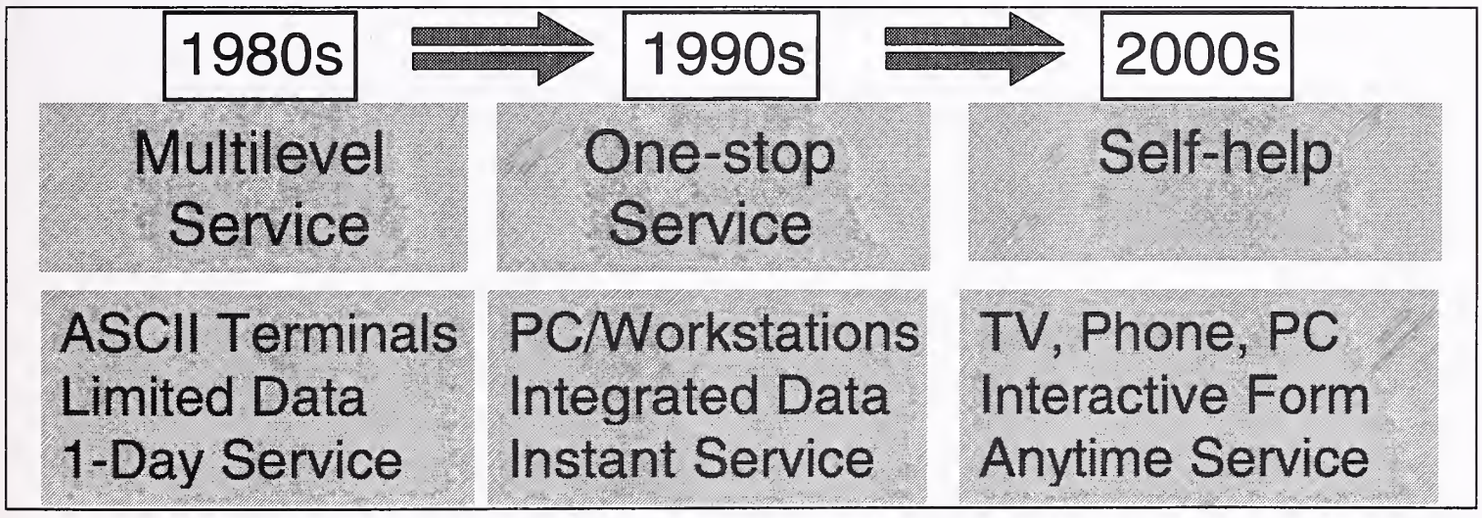
- Intuitive user interfaces
- Accessibility by more users
- Improved reporting using visualization

F. Extend the Enterprise to the Customer

Customer phone inquiries can be answered rapidly using information from multiple databases connected to a customer support representative's workstation. Extensions to billing and support systems assist customers who have a workstation or PC. Exhibit III-3 shows the evolution of customer support.

Exhibit III-3

Customer Support Evolution



Source: INPUT

The trend is toward customer self-help; with Internet browsers, customers can access Web servers. An example that is being widely copied in the distribution industry is Federal Express's package tracking system, in which a user can enter a package number and find out where it is in the shipping process.

Customers may also access more traditional on-line services like America Online or CompuServe. The spread of powerful, multimedia, consumer PCs enables customers to:

- Place orders
- Check on deliveries
- Download sales, investor and technical information from Web pages
- Perform banking functions
- Purchase securities and stock

Companies in turn are using this extended enterprise advantage to:

- Take an order over the Internet
- Send credits to the bank
- Transmit delivery instructions to a contract shipper
- Provide specifications to manufacturers

G. Foster Internet Businesses

The Internet supports new forms of business, such as:

- Group collaboration, particularly for software development or multimedia publishing
- On-line chats and discussions
- Videoconferencing

New businesses are emerging, such as directory services, interactive technical support, Web page creation and electronic marketing. Directory services like Yahoo will compete on the quality of information, the speed with which it can be retrieved and the ability to attract traffic that in turn attracts advertisers. Technical support over a network enables technicians to probe a user's computer and, if necessary, download appropriate software. Most major advertising and PR agencies are assigning staff to Web page creation and electronic marketing. Electronic marketing includes setting up e-mail lists, designing a Web server that will attract inquiries, converting sales collateral to Web pages and tracking interested buyers.

H. Empower Knowledge Workers

Employees in the new business model need easy, quick access to information. Not only customer service and order desk personnel, but the sales force, midlevel business managers, and executives require flexible structures for accessing and manipulating large quantities of information. Workflow software increasingly tracks the activities of knowledge workers.

New tools interpret visual, interactive data rather than traditional text or tables. Technologies are emerging that enable objects such as charts, project schedules and animated presentations to be accessed remotely via the Internet. Some of these are based on Microsoft's object linking and embedding (OLE) technology. Microsoft is likely to be a major player by extending its MS Office Suite so that MS Excel, MS Word and MS PowerPoint can be shared across the Internet.

I. Support Reliable Systems

As information becomes a strategic asset and competitive advantage, companies place greater demands on the content stored in their C/S systems. This in turn makes them more reliant on their C/S solutions. Indeed, in some applications, users expect the reliability of a telephone system switch, which may be engineered to have 30 minutes of downtime in 30 years. Currently, many PCs and LANs are prone to failure, reducing user productivity.

Established businesses expect the distributed computing environment to deliver the same levels of applications availability they were accustomed to in mainframe environments. Companies expect to administer this new environment simply, with reliable tools. Computer Associates' CA-Unicenter has rapidly evolved as one of many solutions for C/S systems management that incorporate expertise from mainframe environments.

Because users want simplified, centralized support, vendors like Microsoft envision a corporation populated with many small servers clustered to form powerful systems. Rack-mounted servers from companies like Compaq will provide affordable computing power. Maintaining networks of these systems, especially when they are linked into legacy systems and PCs, will continue to present operational challenges.

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C/S Software Platform Directions

This chapter describes C/S hardware and software platform trends. The impact of the Internet on C/S systems is also discussed.

A. Platform Trends

1. C/S Platform Evolution

Layers of C/S systems software can be represented as a pyramid as shown in Exhibit IV-1. Each layer represents a software platform. The left-hand side of the chart shows dates when users were most concerned about getting locked into a platform. The top three layers have corresponding Internet layers that today form a new platform for developers. At the right are representative vendors.

a. Hardware Layer

The hardware layer has become virtually invisible to the user, who looks for the OS. However, hardware is still important to developers. Consider, for example, emerging vendor NetPower, which chose initially to put Windows NT on computers based on the MIPS microprocessor architecture. NetPower recently announced that it was moving to Intel processors, as it had difficulty attracting software developers to a nonstandard platform.

b. OS Layer

The lower two layers represent the operating system and hardware layers. Portable software means that these layers, though important to software developers, are of much less concern to users. Windows NT is the fastest growing server OS.

c. Network Layer

Under Lou Gerstner, IBM has chosen to focus on the network layer, removing its attention from the OS layer, where it invested millions in marketing OS/2. At the network layer, Novell is undergoing restructuring to maintain its leadership.

d. Database Layer

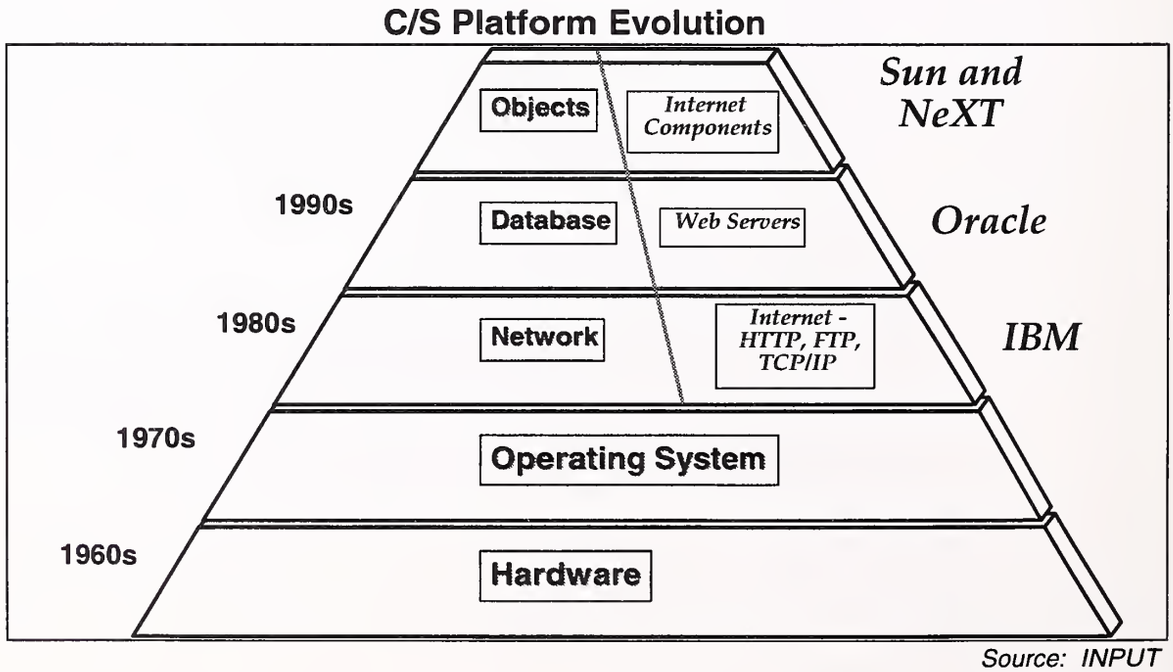
The next layer is the database layer, represented in Internet technology by Web servers. In the database layer, there are leaders for different price points and different database technologies. Many corporate users are as scared of getting locked into a database vendor today as they were of getting locked into a hardware vendor in the 1960s.

Oracle has expanded its focus from the database layer into applications; Informix and Sybase are more focused on the database engine business. IBM and Computer Associates are other players in the enterprise database business. Web servers that handle requests for information over the Internet often connect to traditional databases, such as those of Oracle.

e. Object Layer

The object layer is where the battles are being fought now. Microsoft, with components based on Visual Basic and Microsoft Office, may win. Alternatively, NeXT, with a mature object-oriented platform and a seasoned development team, may yet emerge as a significant player.

Exhibit IV-1



Source: INPUT

The object layer includes Internet components as used in Internet browsers and Web servers. These components include:

- URLs (Uniform Resource Locators), protocols, and addresses of Web servers, such as http://www.input.com
- Fonts, which reside on client computers and are a key reason for the success of World Wide Web technology. Fonts are available on most client platforms and make Web pages readable
- Paragraphs, headings, bullet lists, numbered lists, images and other document parts

Sun, with the Java language for the Internet, is working aggressively on the object layer. IBM is working with Apple, via CILabs, on OpenDoc, a standard for integrating distributed objects.

2. Networks

Enterprise-wide applications require bandwidth-intensive connections, especially for the rising market penetration of multimedia applications. New standards are being established that will support animated and video applications. For example, Macromedia's Shockwave supports animation across the Web, and VRML (Virtual Reality Modeling Language) is rapidly gaining acceptance as a format for viewing 3-D Web objects.

Networking companies are focusing on switching, fast Ethernet, token ring and ATM solutions to make better use of installed networks and to support greater bandwidth. These technologies will reduce network blocking and delays for real-time updates and Internet access. Every networking company is grappling with the effects of the Internet. INPUT believes many companies will implement several strategies and then, over the next five years, there will be a shakeout as companies rediscover their market strengths and niches.

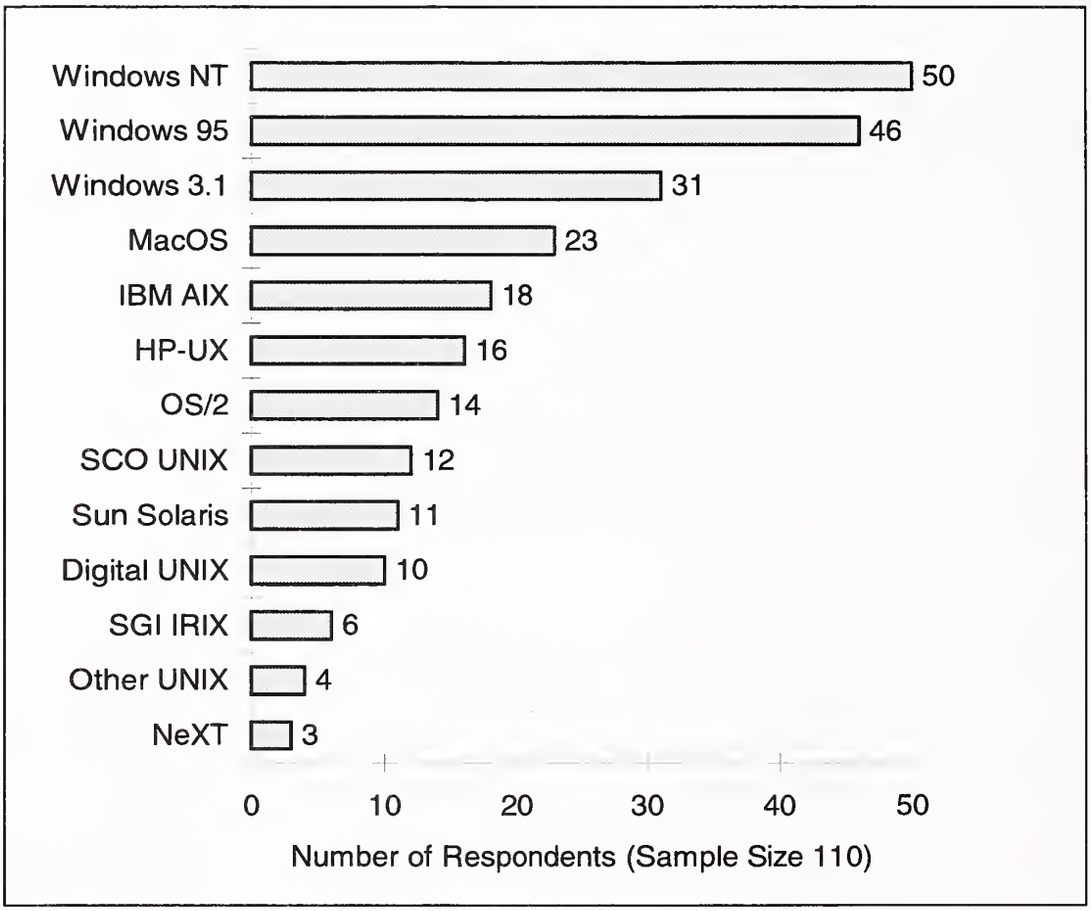
3. Operating Systems

a. The Most Important Client Operating Systems

INPUT asked users to rank the importance of operating systems for their client PCs and workstations on a scale from 1 to 5, 1 being least important and 5 being most important. Not listed (see questionnaire in Appendix C) were three of the most established client operating systems: DOS, Windows 3.1 and OS/2. However, several readers ranked these OSs under "Other." The number of respondents who ranked a client operating system is shown in Exhibit IV-2.

Exhibit IV-2

Most Frequently Mentioned Client OSs

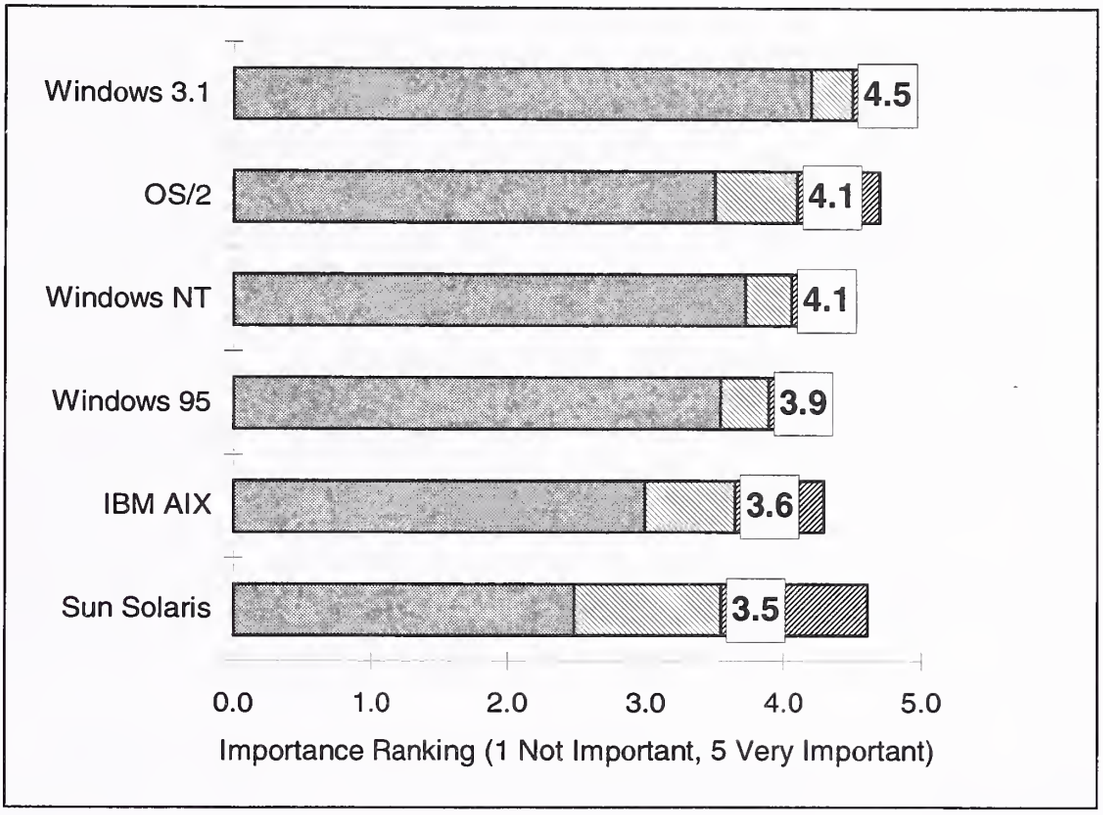


Note: multiple responses permitted *Source: INPUT*

Average importance rankings for the most important client OSs are shown in Exhibit IV-3.

Exhibit IV-3

Client OS Importance Ranking



Source: INPUT

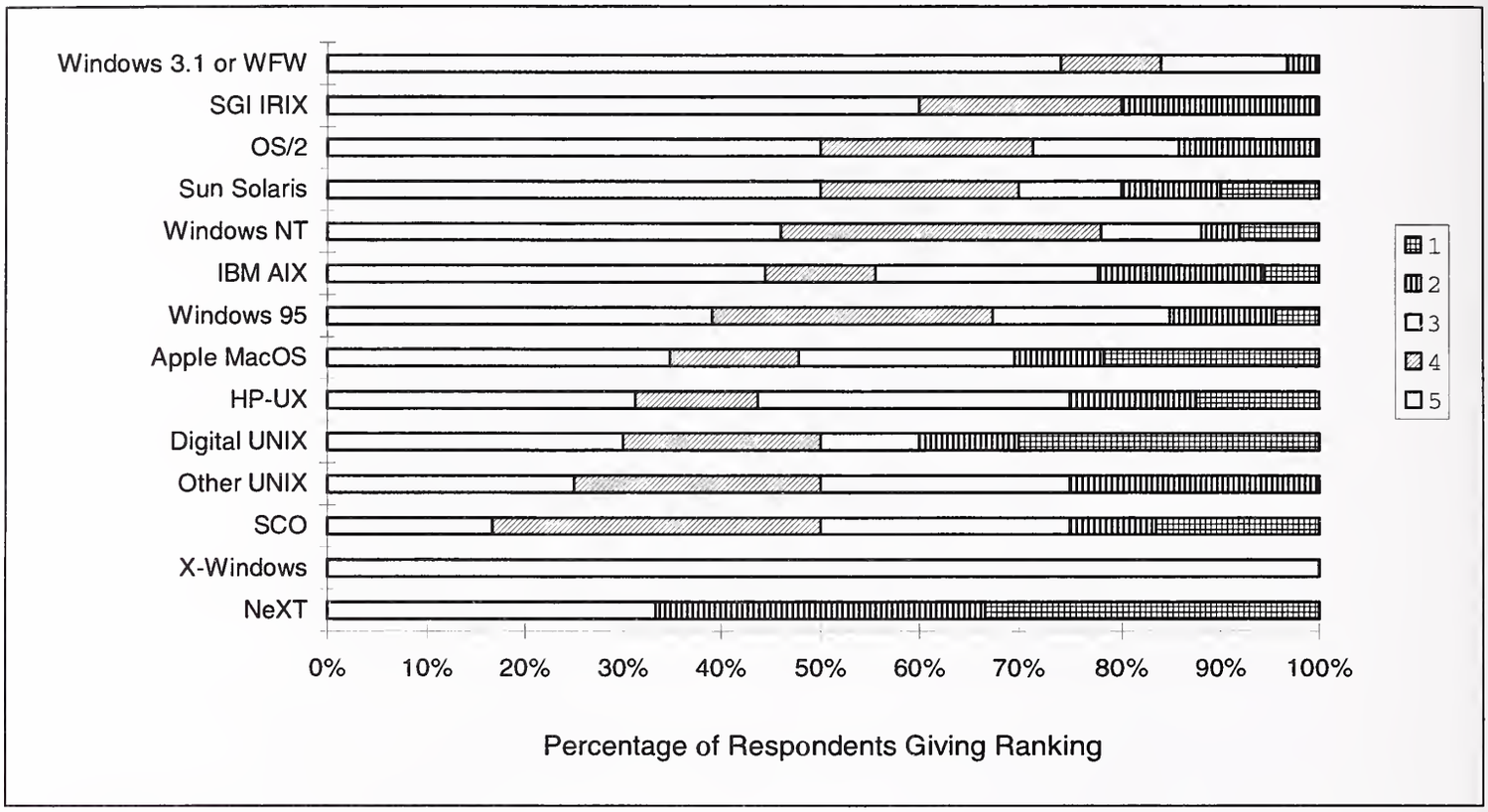
Because the sample size is small, a confidence interval was placed on each side of the average ranking. With 95% confidence, assuming the survey sample is representative of the population, the average ranking, marked by a number, lies within an interval at the right end of each bar on the chart. The number in the chart for each OS denotes the average ranking on a scale of 1 to 5.

Exhibit IV-3 shows that, despite the advent of Windows 95, Windows 3.1 and OS/2 are still important to many corporate users. OS/2 showed more variation in the rankings than did Windows 3.1, reflecting uncertainty among some users. To the few users that depend on OS/2, such as some banks and insurance companies, OS/2 is very important. For the majority, Windows is far more important. Windows NT ranks slightly higher than Windows 95. UNIX client environments were ranked on average at 3.6 for IBM's AIX and 3.5 for Sun's Solaris, with a little more variation in responses than for the Windows and OS/2 environments.

Exhibit IV-4 shows the percentage of respondents for each client OS that gave a specific ranking. As can be seen, a high proportion (over 70%) of respondents who considered Windows 3.1 or Windows for Workgroups important ranked them at 5.

Exhibit IV-4

Client OS Importance, Percentage of Respondents for Each Rank



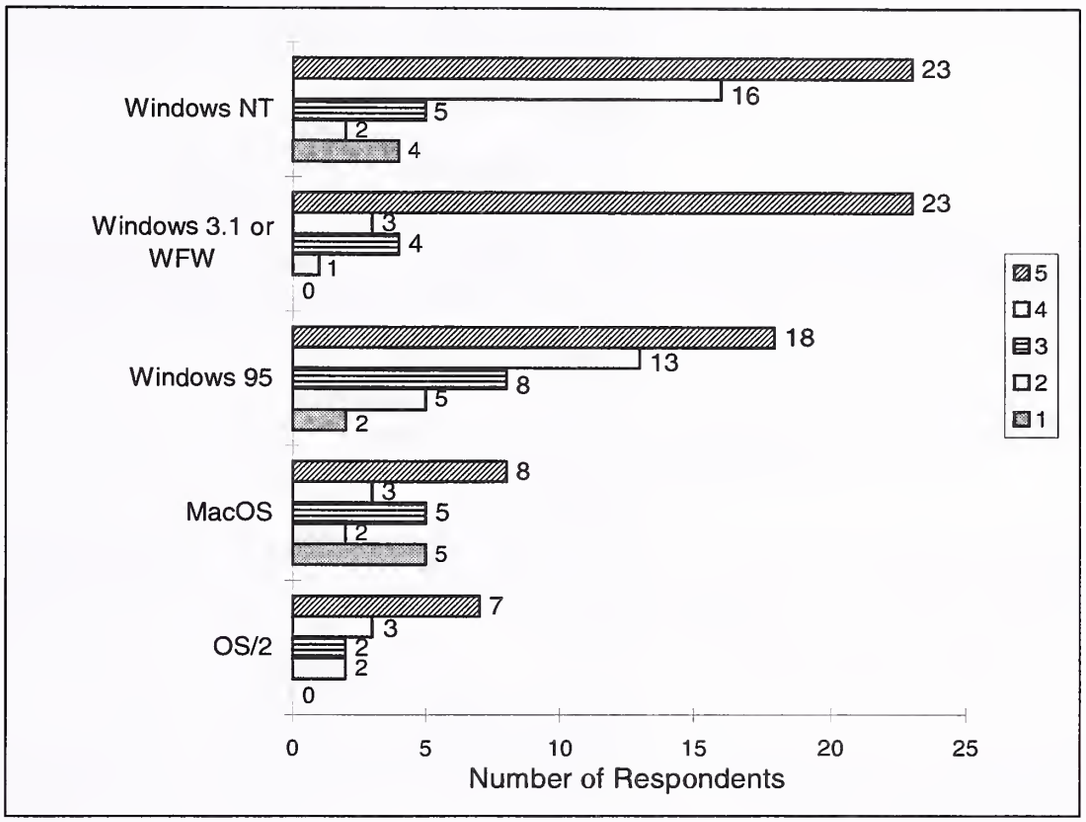
Source: INPUT

Varied responses were shown for Silicon Graphics' (SGI's) IRIX. Some pharmaceutical and manufacturing users rated it as very important at 5, whereas some who used it as one of many UNIX operating systems did not rate it as critically important. Since SGI sells into niches, its users tend to rate it very highly, but IS managers may view it as less important to their overall corporate technology strategy.

Exhibit IV-5 shows the number of respondents for Windows, Mac and OS/2 environments who gave a specific ranking. As can be seen, 23 respondents rated Windows NT and Windows 3.1 each with a 5. MacOS is significantly behind any of the Windows environments, with educational users being among its most fervent supporters.

Exhibit IV-5

Non-UNIX Client OS Importance, Number of Respondents for Each Rank

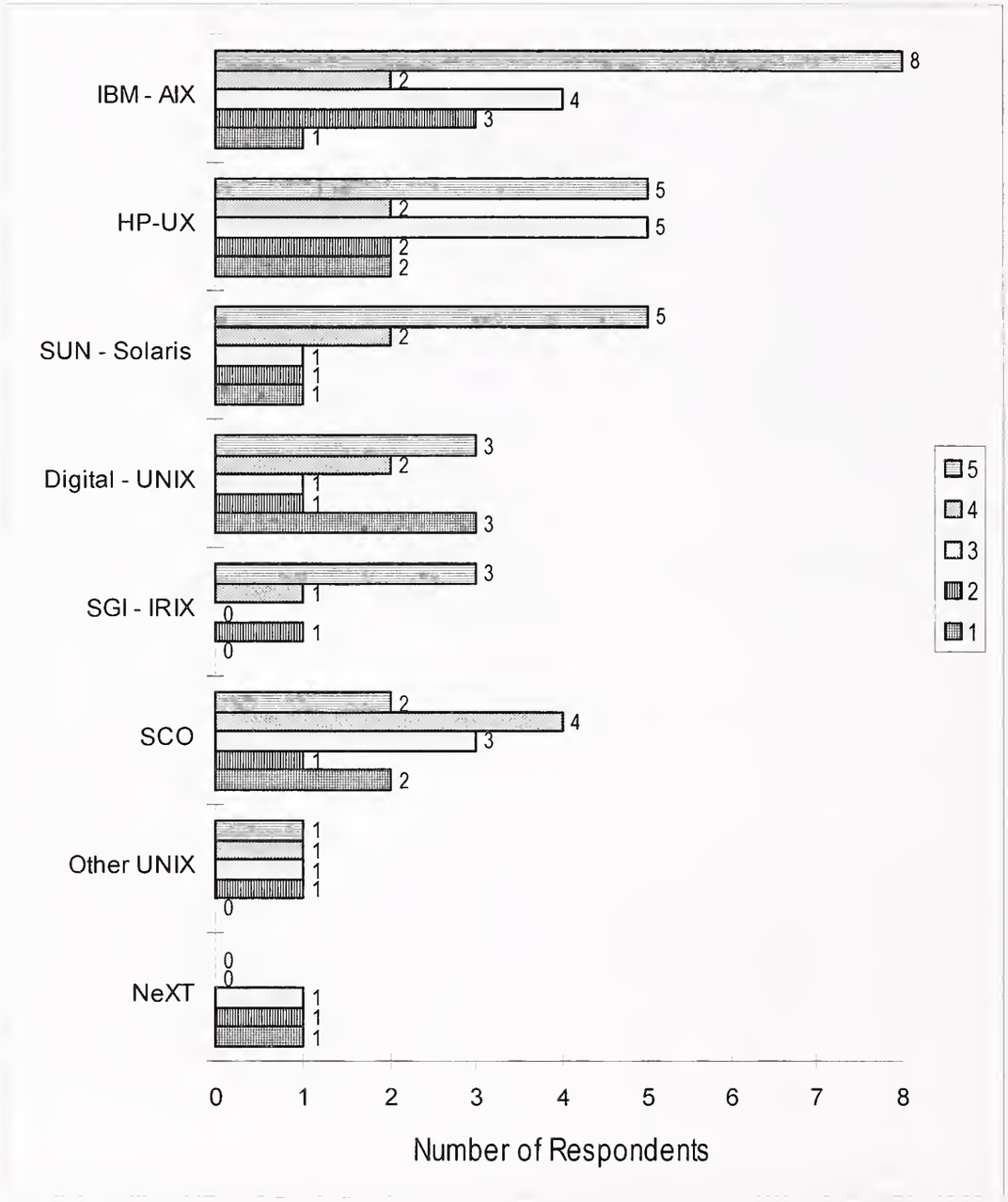


Source: INPUT

Exhibit IV-6 shows the number of respondents in UNIX and UNIX-like (i.e., NeXT) environments that gave a specific ranking. Fewer users support UNIX as a client OS than Windows. IBM's AIX had eight users ranking it as 5 in importance. IBM's AIX workstations were used across diverse market segments, beyond traditional engineering, publishing and software development applications.

Exhibit IV-6

UNIX Client OS Importance, Number of Respondents for Each Rank



Source: INPUT

Several respondents were still using ASCII terminals to connect with databases and AS/400 computers. Two were using X-Windows terminals. One had workstations configured to run UNIX with other operating environments on top of it.

Exhibit IV-7 compares the analyses of client operating systems from the above exhibits. It shows the top five operating systems for each method of comparison and indicates how a particular analysis can be interpreted. The sample size is obviously small, but it is possible to gain market insights from the data.

Exhibit IV-7

Comparing Top Client OSs

Exhibit	Comparison	Top 5 OSs	Reasons For Using Ranking
Exhibit IV-2	Most frequently mentioned	Windows NT Windows 95 Windows 3.1 MacOS IBM AIX	Suggests the largest opportunities in terms of number of sites using the OS. These OSs are deployed across most industries. Clearly, Windows NT and Windows 95 are the greatest opportunities for new investments.
Exhibit IV-3	Average importance of each OS	Windows 3.1 OS/2 Windows NT Windows 95 IBM AIX	Suggests which OSs users are committed to for their most important projects. Older systems like Windows 3.1 and OS/2 are still very important to customers who continue to use them.
Exhibit IV-4	Percentage of respondents ranking as 5	Windows 3.1 SGI IRIX OS/2 Sun Solaris Windows NT	Suggests for an OS installed base what percentage of the installed base thinks the OS very important. This means there are very satisfied customers for the OS.
Exhibit IV-5 Exhibit IV-6	Number of respondents ranking as 5	Windows NT Windows 3.1 Windows 95 MacOS IBM AIX	Suggests where there are large opportunities and highly satisfied customers.

Source: INPUT

In summary, Windows NT and Windows 95 represent the best investment opportunities for software developers building new applications. However, users are not racing to install Windows NT or Windows 95. INPUT believes that many users will wait until Microsoft reduces Windows NT pricing and changes its user interface to match that of Windows 95. They will then choose Windows NT: this appears particularly likely in Digital and HP accounts, from the research sample data. Clearly, the Windows market by any measure will continue to be the most important market. IBM's AIX is ranked as important across a broader range of markets than Sun or SGI OSs. In niches, SGI, IBM with OS/2 and Sun with Solaris have some highly

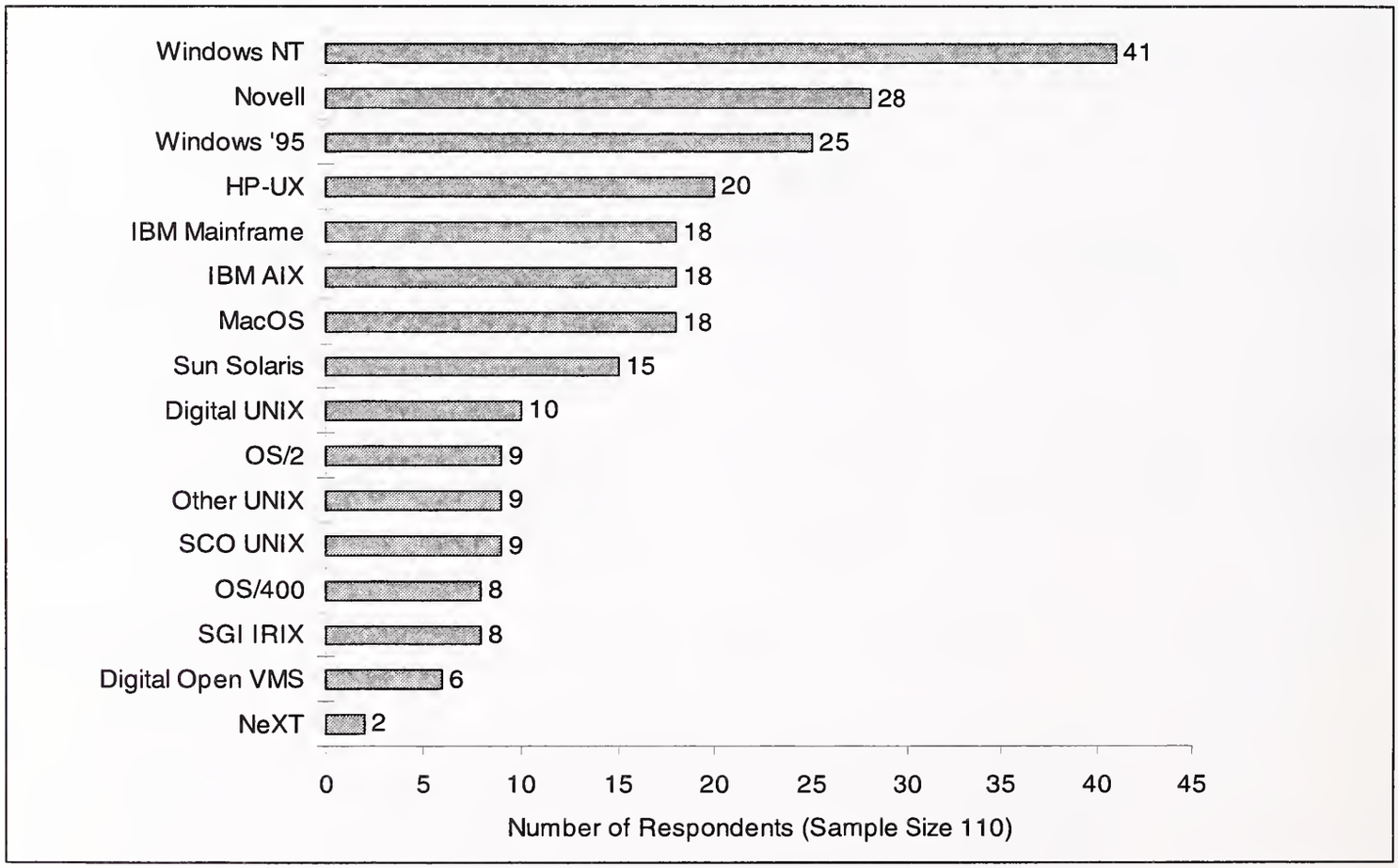
satisfied customers. The MacOS and OS/2 markets will continue to be viable.

b. The Most Important Server Operating Systems

Respondents were asked to rank the importance of server operating systems. The number of respondents who ranked a server operating system is shown in Exhibit IV-8. Notice that Novell NetWare is included as a server OS, even though it is typically marketed as a NOS. This is because buyers typically decide to run NetWare on a server versus Windows NT or UNIX. Even though NetWare technically connects disks and printers to client machines and the server does not perform as a full operating system, for workgroup computing it is a pragmatic substitute for a complete OS.

Exhibit IV-8

Most Frequently Mentioned Server OSs



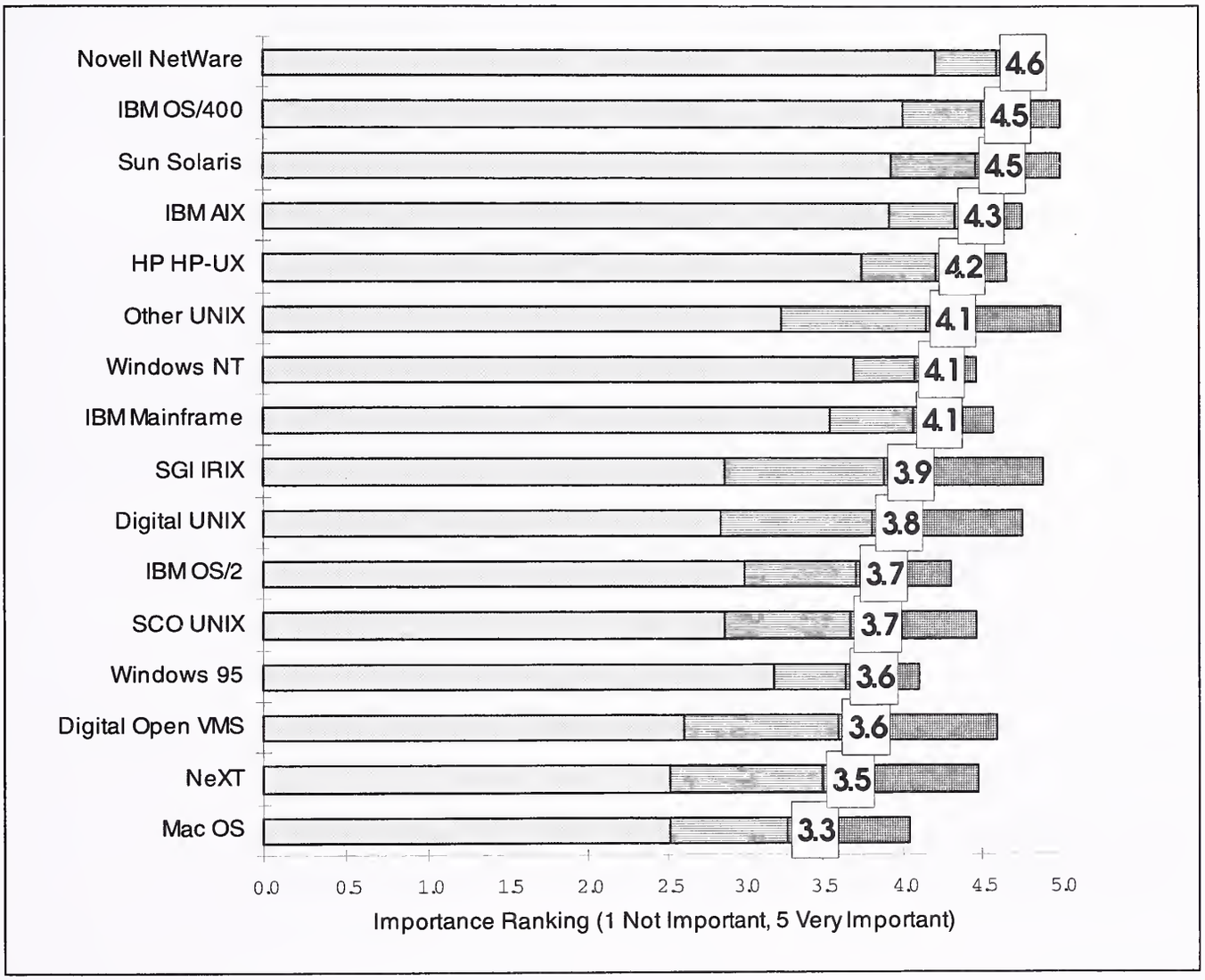
Source: INPUT

Importance rankings on a scale from 1 (not important) to 5 (very important) for server OSs, with 95% confidence intervals, are shown in Exhibit IV-9. Novell's NetWare and IBM's OS/400 operating systems were not included on the questionnaire, but respondents volunteered information on them. As

with the client software, traditional environments such as NetWare and OS/400 are still important.

Exhibit IV-9

Server OS Importance Ranking



Source: INPUT

Novell still has strong reseller and customer loyalty, a sizable installed base and satisfied customers. Although NetWare is increasingly vulnerable to competitive networking provided as part of the OS, Novell's focus on services to support Windows NT environments should enable it to continue to serve its large customer base. Sun's Solaris is the most highly ranked UNIX server operating system, in part because it is available on both Intel and SPARC processors. IBM, Digital and HP all offer UNIX as an alternative to other OSs. Their solutions rank slightly below Sun's.

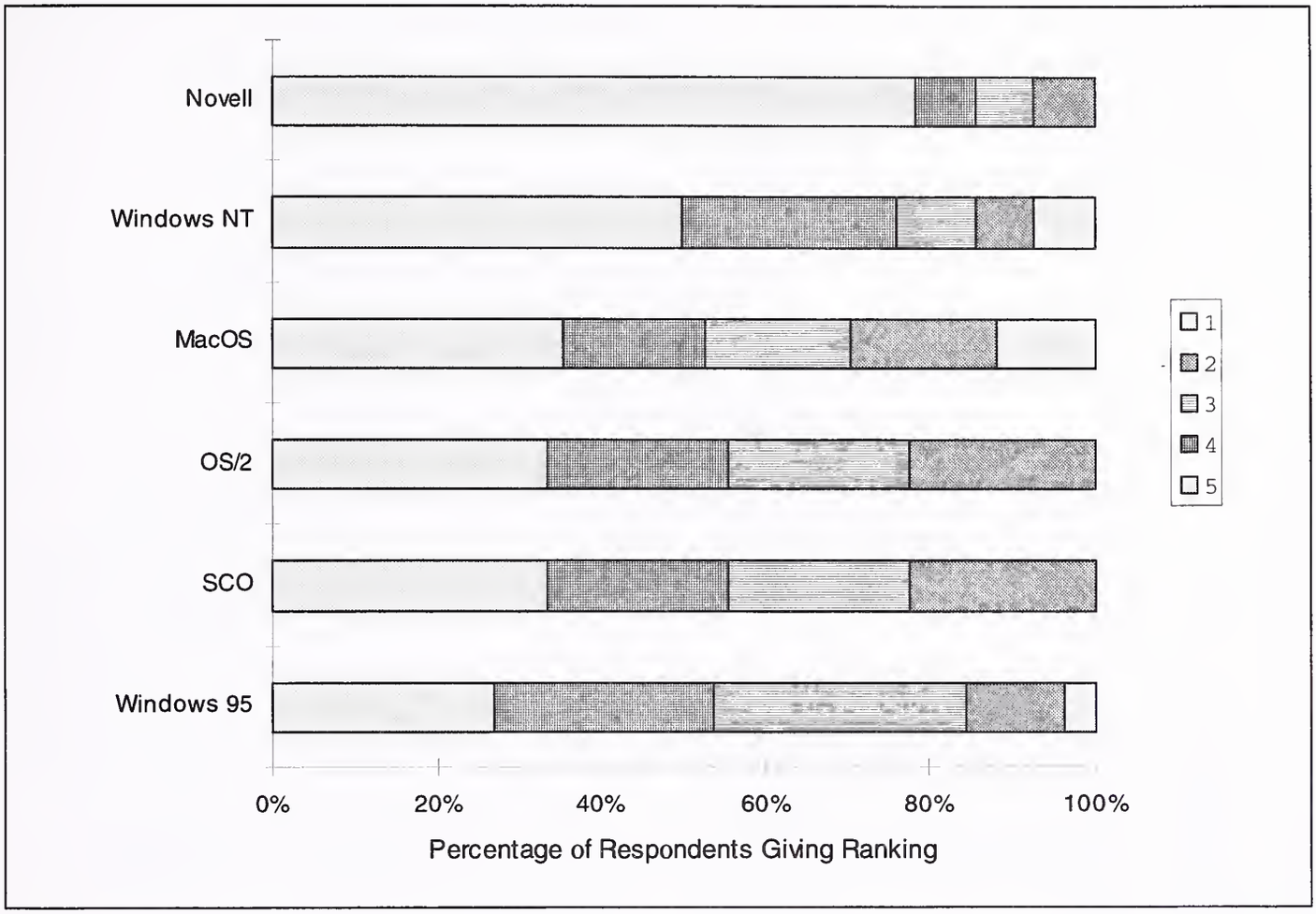
Windows NT gained a 4.1 ranking, the same as it did as a client OS. In general, server OSs are more critical to a company's operation than client

OSs, particularly when cross-platform client software is deployed. NeXT's NEXTSTEP OS has transitioned to OpenStep, which is part of Sun's NEO distributed object environment. NeXT is expected to make the transition from being a complete operating environment supplier to being a distributed object framework vendor that supplies software for many OSs; hence, its lower ranked importance. Considerable uncertainty surrounds Digital's Open VMS and UNIX operating environments. IBM mainframe environments continue to be important. UNIX OSs that run major databases will continue to be important for the next few years, despite the encroachment of Windows NT on their market.

Exhibit IV-10 shows the percentage of respondents for each LAN server OS that gave a specific ranking. These OSs are most frequently found in LAN environments. Again, Novell continues to be a dominant player, with over 70% of users ranking it at 5. Over 50% of Windows NT users ranked it as a 5. Whereas Windows 95 can be used as a server OS for a small number of users, most will prefer Windows NT. Banyan, NeXT and Windows for Workgroups environments were omitted because they have such a small market share as server OSs.

Exhibit IV-10

LAN Server OS Importance, Percentage of Respondents for Each Rank

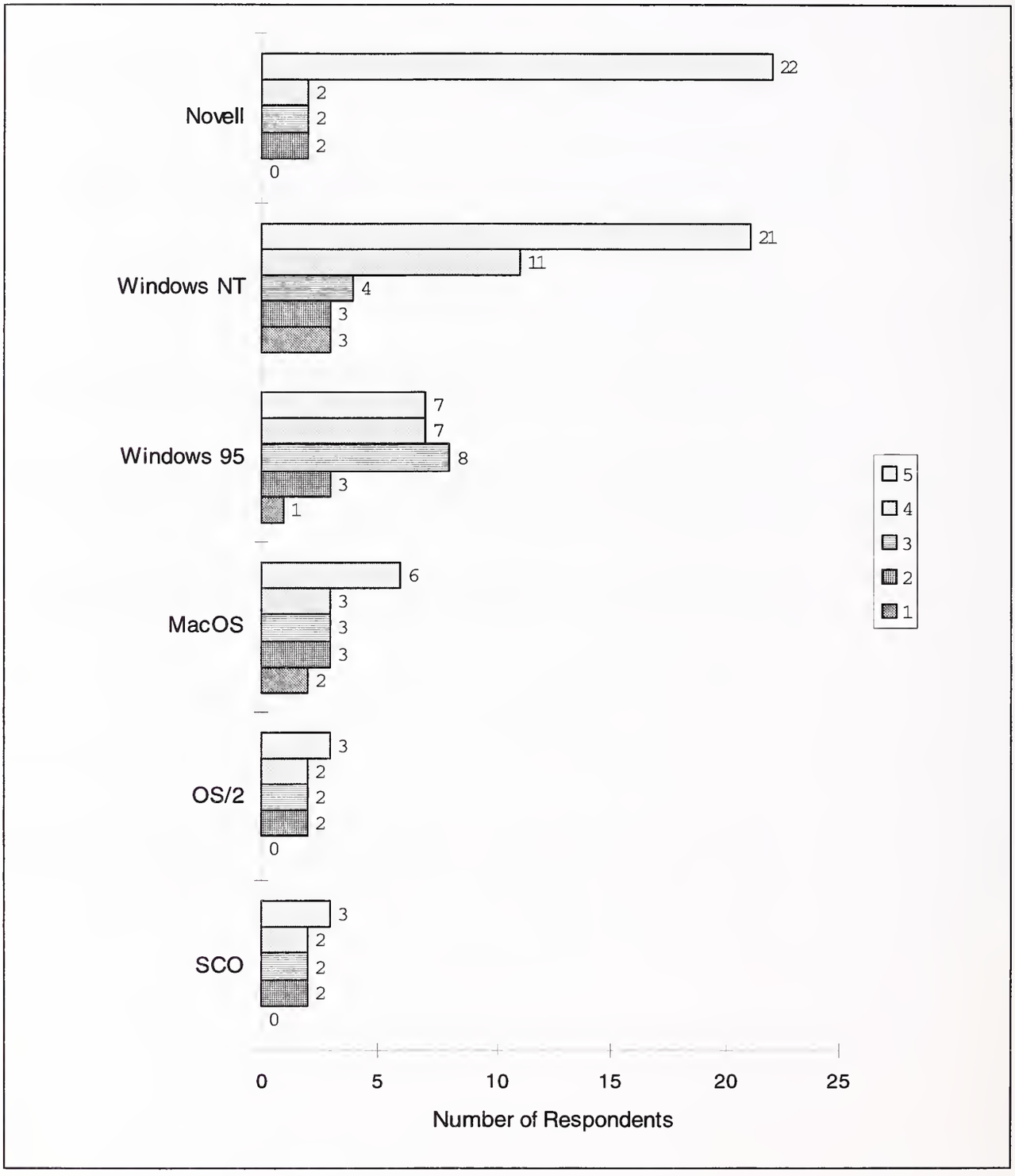


Source: INPUT

Exhibit IV-11 shows the number of respondents for each LAN server OS that gave a specific ranking. Novell's NetWare and Windows NT again lead the importance rankings.

Exhibit IV-11

LAN Server OS Importance, Number of Respondents for Each Rank



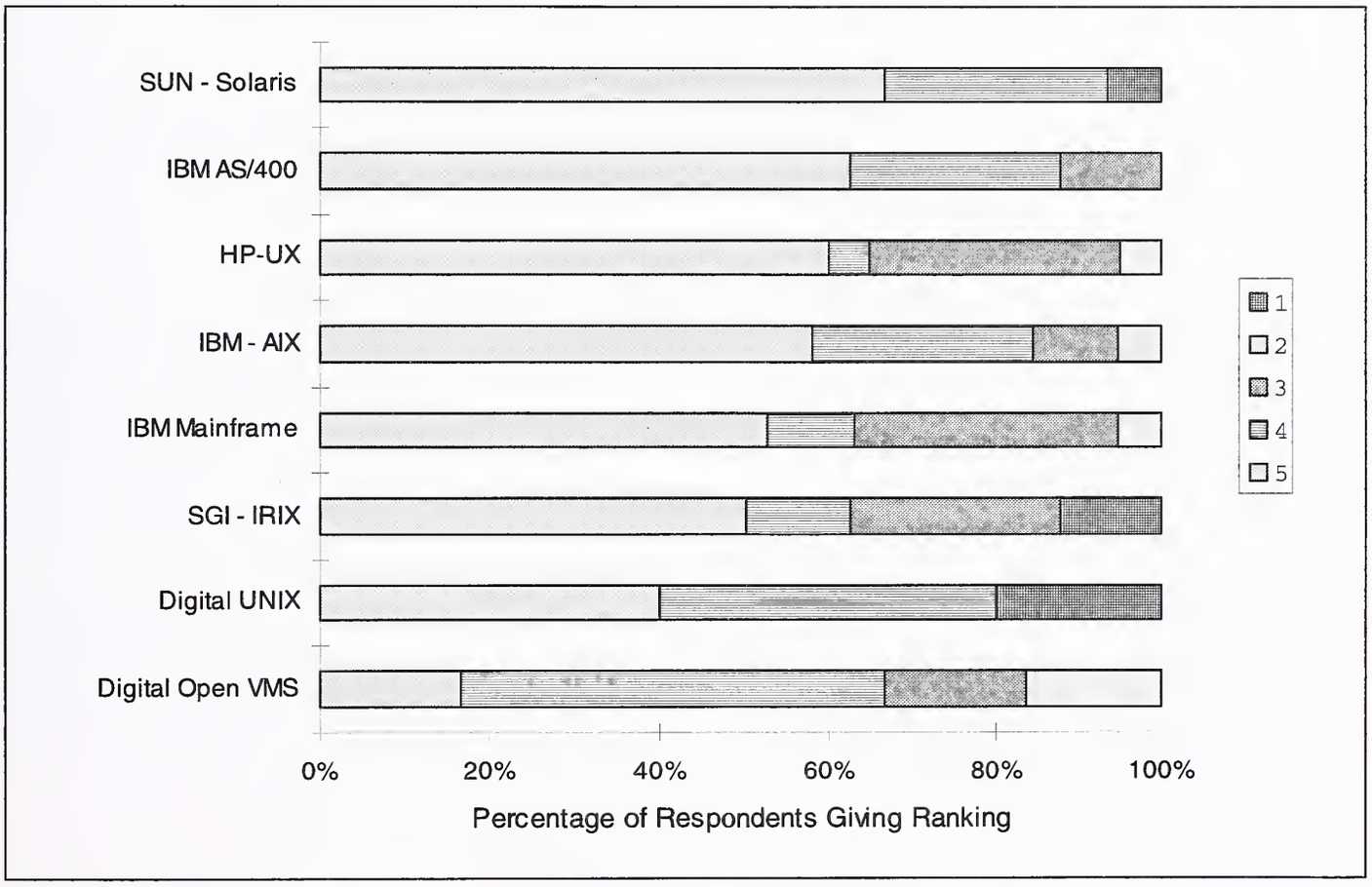
Source: INPUT

Exhibit IV-12 shows the percentage of respondents for each UNIX, mainframe or minicomputer server OS that gave a specific ranking. These OSs most frequently serve an enterprise or site. Sun Solaris, the AS/400, HP's HP-UX, IBM's AIX and IBM mainframes all have over 50% of users ranking them as 5. Contrast this with Digital's Open VMS, which is of

secondary importance, with less than 20% of users ranking it as a 5. Where UNIX was ranked 1, in each case Windows NT was ranked with a 5, except for one site that ranked Windows NT with a 4. Users that think UNIX is an unimportant server OS perceive Windows NT as an alternative. Several companies ranked both UNIX and NT server environments highly. These tended to be companies migrating away from a proprietary systems approach. Respondents ranking a mainframe as a 1 or 2 tended to rank Windows NT as a 5. This group of respondents usually intends to replace or augment mainframe environments with many Windows NT servers.

Exhibit IV-12

Enterprise and Midrange Server OS Importance, Percentage of Respondents for Each Rank

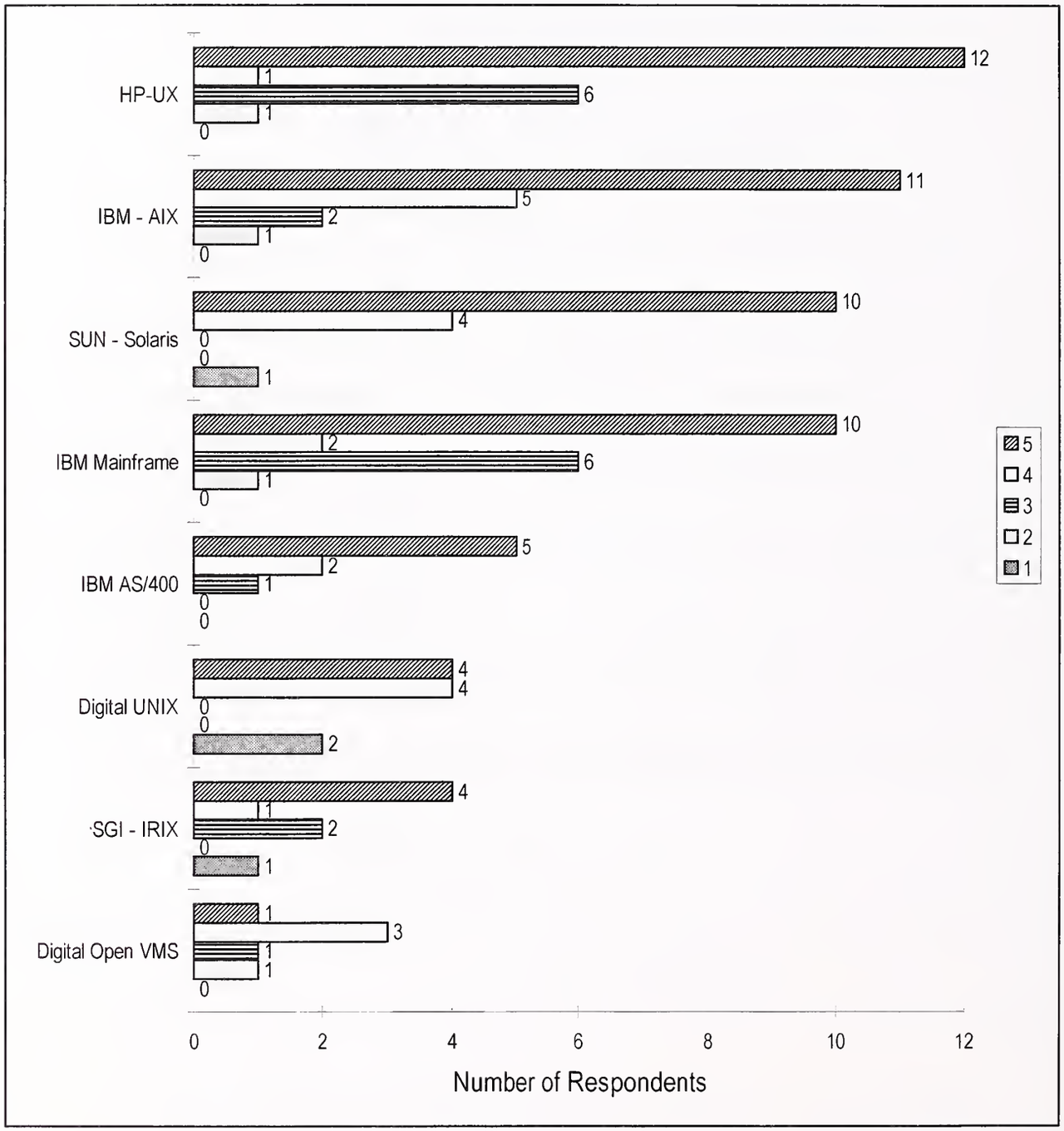


Source: INPUT

Exhibit IV-13 shows the number of respondents who ranked specific enterprise and midrange OSs. Over 10 users gave HP-UX, IBM's AIX, Sun's Solaris and IBM mainframes each a 5, indicating their importance as server environments.

Exhibit IV-13

Enterprise and Midrange Server OS Importance, Number of Respondents for Each Rank



Source: INPUT

Exhibit IV-14 compares the different analyses of server operating systems in the exhibits above. It shows the top five operating systems for each method of comparison and explains how to interpret the results.

Exhibit IV-14

Comparing Top Server OSs

Exhibit	Comparison	Top 5 OSs	Reasons For Using Ranking
Exhibit IV-8	Most frequently mentioned	Windows NT Novell Windows 95 HP-UX IBM Mainframe IBM AIX MacOS	Suggests the largest opportunities in terms of number of sites using the OS.
Exhibit IV-9	Average importance of each OS	Novell NetWare IBM AS/400 Sun Solaris IBM AIX HP-UX	Suggests which OSs users are committed to for their most important projects. Novell NetWare is continuing to have a strong following, despite the advent of Windows NT and Windows 95.
Exhibit IV-10 Exhibit IV-12	Percentage of respondents ranking as 5	*LAN Servers* Novell *Enterprise and Midrange* Sun Solaris IBM AS/400 HP-UX IBM AIX	Suggests what percentage of an OS's installed base thinks the OS very important. IBM still has a strong hold on the server market with AS/400s and AIX machines.
Exhibit IV-11 Exhibit IV-13	Number of respondents ranking as 5	*LAN Servers* Novell Windows NT *Enterprise and Midrange* HP-UX IBM AIX Sun Solaris	Suggests where there are large opportunities and highly satisfied customers.

Source: INPUT

In summary, Novell is not easily displaced as the leading LAN operating system vendor. Both Windows NT and Windows 95 are perceived by a large number of users as having some importance as server OSs in the future. However, the importance given to Windows 95 is on average considerably lower than for more powerful OSs, and it is likely to be used in small workgroup networks. IBM will also be difficult to unseat as it converts its

installed base to networked servers. Sun and HP continue to challenge IBM successfully.

c. Windows 95 versus Windows NT

Windows NT was mentioned more often as a client OS than Windows 95, particularly by process manufacturing and engineering users, who typically prefer more powerful workstations than PCs. Many users are waiting for Windows NT to have the same user interface as Windows 95 before they upgrade their client operating systems from UNIX or Windows 3.1. This is understandable, given that corporate users value reliability over aesthetic appeal. Many Windows 95 features, such as sound and graphics, appeal to the consumer. Windows 95, unlike UNIX and Windows NT, lacks memory protection for individual applications, which may make it unstable. Most corporate users want a reliable, robust operating system that will not become obsolete.

The advantages of Windows 95 over Windows NT are:

- Superb graphics and sounds
- Powerful user interface
- Lower price than Windows NT
- Support for mobile computing, including folder synchronization and remote access

However, these are outweighed by the disadvantages:

- ReliabilityóWindows 95 applications are not protected in their own area of memory and can crash other applications
- Windows 95 is not designed for servers, whereas Windows NT can run on both servers and clients

It is questionable whether Microsoft's claims that Windows 95 requires less computer resources are valid. Even though it is advertised as being able to run in less than 8MB of memory, Windows 95 tends to use more if it is available. Depending on which options are selected, such as number of fonts, desktop appearance and number of applications, a PC may require over 20MB of physical memory to run Windows 95 without swapping to virtual memory on the disk. Also, as disk drive prices fall, the claim that Windows 95 takes up less room on the disk than Windows NT becomes less relevant. Expect to see several large corporations use Windows NT instead of Windows 95 as their preferred desktop operating environment.

d. Windows NT versus UNIX

For enterprise servers, UNIX is still the higher ranked operating system, according to INPUT's survey. Microsoft, with BackOffice and SQL Server, is encroaching on UNIX platform territory with lower cost solutions. Windows NT, if it continues to attract the wide variety of developers that it has to date and a following of IS managers, may ultimately dominate the enterprise server market.

Vendors like HP and Digital that have strong Windows NT and UNIX offerings need to differentiate the applications that each runs best. They need to make it clear to their sales and support staff the reasons for customers preference of one solution over another; otherwise, this battle risks consuming management time.

e. Operating System Outlook

The trend toward microkernel architectures upon which flexible environments can be built will continue. A new class of operating system for PDAs, set-top boxes, video games and Internet browsing devices is emerging. Microware, with David, is an early leader. Geoworks is already shipping its object-oriented OS in Tandy, Casio and HP personal organizers. General Magic's Magic Cap, found in Motorola Envoy and Sony Magic Link personal communicators, also represents a modern, object-oriented, OS architecture. These early, advanced OS pioneers may be eclipsed by traditional vendors like Oracle and Microsoft developing their own lightweight operating environments.

Windows NT has the fastest growing installed base and many corporate users will support it on both clients and servers, particularly when the Windows 95 user interface is available for it in 1996. Apple, with the Copland and Gershwin versions of its MacOS, is behind Microsoft, but can be expected to continue to upgrade users. OS/2 is technically a strong operating system, but despite massive marketing efforts by IBM, has failed to garner a strong following. Exceptions are in some early IBM accounts in banking and insurance, where OS/2 is preferred to Microsoft's Windows. Many OS/2 accounts are vulnerable to wooing by Windows NT or Windows 95.

Uncertainty surrounds UNIX as a client environment. Despite the strength of Windows, UNIX provides the most scalable client environment, enabling users to run the same software on desktop computers as on large servers. For some users, it provides the most innovative environment, as seen in some of Sun's image processing and SGI's 3-D third-party software vendor solutions. Hardware vendors like to support UNIX because it provides them

more opportunity for defining a market leadership position than if they relied on Windows, since they are unable to customize the source code for Windows NT. UNIX will continue to hold advantages for leading-edge applications. For users who prefer less powerful systems, Apple provides a technically strong multimedia platform with the MacOS.

4. Hardware Trends

a. PC Trends

The PC desktop is in transition from a 16- to a 32-bit architecture, while many workstations already support 64 bits. HP and Intel are promoting 64-bit standards for UNIX OSs and Digital and SGI have been offering 64-bit support for some time. Approximately 4GB of information can be addressed using a 32-bit architecture. Addressing more than 4GB of storage requires programming tricks to be applied to 32-bit code; some developers opt for 64-bit architecture. Digital and Silicon Graphics are pioneers in 64-bit workstation technology, with standards for 64-bits starting to emerge for Intel/HP processors.

The standard PC desktop in 1995 was a Windows 3.1 with a Pentium PCIbus, at least a 1024 x 768 display and 4 to 16MB of memory. Windows 95 and Windows NT force many users to double their memory requirements. Many software developers require 64MB memory machines. These can be expected to appear in the workplace as office machines over the next few years as multimedia and 3-D applications proliferate.

Users are taking advantage of Windows 95 for its integration of communications and networking, built-in messaging system and remote network access and file synchronization features that are necessary for remote and mobile users. Plug-and-play architecture will be adopted across the Windows/Intel (Wintel) area. As the protected 32-bit applications and other features become more stable, IT managers will migrate from Windows 3.1. Client platform developments include:

- Diverse object-oriented environments
- Information appliances that run applications over the Internet
- Office PCs with 64 MB operating systems and multiple displays

Notebooks are already the device of choice for many companies with a large number of traveling managers and sales people. Notebooks will become the first choice of more companies. Docking notebooks, PCMCIA cards, and built in CD ROMs will benefit from lighter weight client software environments.

The PCI bus standard is well established with Windows/Intel machines, and Apple is also adopting it as a standard. The bus is still not very fast for multimedia, and as demands for it grow, faster buses will be adopted. The CHRP (Common Hardware Reference Platform) PCs from Apple, IBM and others will emerge toward the end of 1996.

The $2000-$2500 Intel Pentium-based PC, which runs at 120 and 133 MHz currently, will fall in price to around $1500 by the end of 1996. Its replacement in the price level will be Pentium Pro machines, running at 166 MHz or greater. These are emerging as $5000 Windows NT workstations and will become standard office machines by 1997. Many users will benefit from the productivity gains a faster processor offers because software is becoming more complex. Users should also look for fast I/O, fast 3-D graphics support and large dual-page screens.

RAM has been in short supply, in part because of factory problems due to the Kobe earthquake in Japan. RAM makers are now catching up with demand. Expect to see approximately a three percent decline per quarter in the price of RAM over the next several years. Additionally, hard drive storage prices continue to fall, but users can expect to pay around 20 cents per megabyte in 1996 for a client machine.

b. Workgroup Server Trends

Windows NT is the fastest growing operating system for clustered or symmetric multiprocessing (SMP) servers. One to four CPUs are joined to make a high-volume server that can be scaled from departments to enterprise data centers. Already, UNIX environments enable many more processors to be supported in a multiprocessor machine, so UNIX can be expected to continue to be the OS of choice for high-performance applications for the next three years.

Microsoft, Compaq and Intel envision a collection of computers interconnected for high-speed communication that can be endlessly scaled to meet any level of enterprise need, including massively parallel systems. Once bandwidth problems are solved, Intel plans on shifting multiprocessor hardware from its scientific and engineering applications into commercial markets.

Turnkey servers, such as Sun's Netra line of Internet servers, are returning as a strong segment. Given the high costs of systems integration, more integrated solutions based on applications from Oracle can be expected. Preconfigured servers for sales support, electronic mail, document imaging, directories and Internet access can expect strong market acceptance. There is

also a ready market in small businesses and branch offices for application servers.

c. Mainframes

Mainframes will not disappear, but are being rediscovered to play the role of enterprise servers in the newest generation of C/S systems. Mainframe data centers are being consolidated so that fewer, larger mainframes survive. While the legacy systems will be maintained for some time, virtually no new software development is being done for mainframes. New applications will be more open and C/S oriented.

d. Supercomputer Trends

Supercomputing is moving into mainstream business decision making. It is already strong in engineering, financial analysis and scientific applications, but supercomputers will increasingly be used to support business decisions. SGI is taking some of the low-end Cray market.

e. Specialized Computers

General-purpose machines typically dominate markets as they mature. Specialized machines for video services, such as nCube's, risk being replaced by general-purpose machines. Internet browsing computers will emerge as a specialized class of machines. Information appliances, such as CD ROM readers in the kitchen to program cooking equipment and display recipes, will emerge. Computers embedded in all kinds of electrical appliances, cars and home wiring systems will create new opportunities for software and services suppliers. The server components of systems that link into these systems may reside at a local information utility. This utility may be a local phone company or an on-line service like America Online.

B. C/S Development Environment Trends

1. Server-Centric Development

There is a trend toward server-centric development. Tools like Gupta's SQL Windows and Powersoft's PowerBuilder support the development of user interfaces for C/S applications. With Internet browsers as the client software, simple applications may not need customized client software. The server software (consisting of a Web server plus stored data and documents), together with display preferences (e.g., for fonts) set by the user, creates the user interface.

Another example of server-centric development is provided by USoft's C/S application development tools, where developer effort focuses initially on systems architecture and on server data models. The user interface is generated automatically and can then be modified either by a programmer or a knowledgeable user. By providing the user with the opportunity to customize his own interface, software development time is reduced and the user is more likely to obtain a practical solution.

2. Development Tool Directions

a. Application Development Tools

There is a wealth of cross-platform development tools for C/S applications development. The market is crowded, and in the next few years many vendors will be acquired or will need to change their businesses significantly to survive.

Tools like Visual Basic, SQL Windows and PowerBuilder initially addressed the Windows market only. Oracle's Developer/2000 supports UNIX, Windows, MacOS and character-based interfaces; it will give development tool vendors increased competition, as will Informix's New Era toolset. Enterprise cross-platform tools from companies like Forté have emerged. Four Seasons provides 4S-SuperNova across MVS, DOS, Windows and UNIX.

ParcPlace-Digitalk will extend Visual Smalltalk to more platforms and improve server support. Visual Smalltalk and VisualWorks will merge into a single product, enabling developers to make use of portable or native interfaces and strengthening the core facilities of servers.

Powersoft has been slowly migrated to other platforms and extended for the corporate, as opposed to the LAN, environment. Powersoft's PowerBuilder 5.0 will support a compiler and three-tier architecture support, allowing for easier distribution of applications upgrades. With three-tier support, a developer can create a stripped-down client and move an application's business logic processing to a separate server. Changes in the business logic can then be made without extensive rewriting of code to change the client's GUI. The compiler will allow for faster deployment of executable programs. Solaris, AIX, HP-UX and UNIX versions as well as Windows 95 and NT versions will be supported.

Tools will become easier to use and PowerBuilder Enterprise, PowerBuilder Infomaker and S Designer will support partitioning and compiled applications that will make it easier to create applications on the desktop and

move them to the server with less rewriting of code. This will help Powersoft move into larger scale developments, where Forté is enjoying considerable success.

b. Internet Development Tools

A new class of tools in the multimedia publishing area is emerging from companies like RAD Technologies and Macromedia. These enable multimedia servers to create client applications that can be read by Web browsers. Spider Technologies is aiming to be the Powersoft of the Internet by providing development tools for corporate applications that run across the Internet.

c. Java

Sun's Java language is only slightly higher level than C++, yet it has grabbed the attention of developers who create Internet applications. Higher level scripting languages, such as JavaScript from Netscape, are emerging so that distributed processing across the Internet becomes a reality. America Online, Apple, AT&T, Borland, Brio Technology, Computer Associates, Digital Equipment, Hewlett-Packard, Illustra, Informix, Intuit, Novell, Oracle, SCO, SGI, Spider Technologies, Sybase, and Verity are some of the companies that plan to incorporate JavaScript in their products. Microsoft is licensing Java from Sun, integrating it with OLE to link application components across networks. Competitors to Java include General Magic's Telescript and TCL, a public domain language.

d. Agents

Agents are programmed tasks carried out on behalf or a user or program. Agents for systems management, searching databases and automating mouse actions on a client workstation are common. There is tremendous interest in intelligent agents for automating business processes. Exhibit IV-15 shows applications of agent technology, including some research projects.

Exhibit IV-15

Applications of Agent Technology

Company	Projects
Andersen Consulting	Bargain hunting - shops music stores to find lowest price CDs - demonstration
Bunyip Information Systems	Internet searching - a Canadian government prototype
California Software	Intelligent WWW browser - agents perform browsing, technical support, E-mail
CA/LEGENT	AgentWorks systems management tools
Digital Equipment	Restaurant recommendations demo (Programmed In Obliq)
General Magic	Telescript agents for messaging across wireline and wireless protocols to PDAs
IBM, Sun and Ki Networks	Systems management agents - Common Agents
Lockheed	SHARE Project - engineering design, satellite applications (with Teleos)
MIT Media Lab	HOMR - recommends music Webhound - recommends interesting WWW sites
Oracle	Oracle Mobile Agents - wireless computing support
Palindrome	Target Service Agent - file and database backup

Source: INPUT

3. Object-oriented Directions

a. Object-oriented Environments

Object technology affects all levels of users, from programmers to technically knowledgeable users who may want to script and modify systems. At the lower level, most programmers use C++ and tools to help them reuse code. It is at higher, technical user levels that the promises of components are slowly being realized. Tools for users to link and customize their applications are emerging, Microsoft Office being a leader. The advent of OpenDoc applications from Claris, in particular, is likely to hasten this trend in the next two years.

Despite pioneering work by object-oriented vendors like ParcPlace-Digitalk with Smalltalk and NeXT with OpenStep, the real growth in objects and component software will come from the mainstream development environments. Microsoft's OLE components, despite lacking a dynamic language underneath like Smalltalk or Objective C, will be the main architecture for LANs and desktops. Whether OLE will extend to high-end enterprise systems or not is an open question. A fuller discussion of object-oriented technologies is provided in two companion reports from INPUT's C/S program:

- Object-Oriented Platforms for C/S Systems
- Component Software Battles: ORBs, OLE and OpenDoc

Object technology will:

- Create a market for component software
- Simplify networking and distributed processing
- Enable massive, complex systems to be constructed
- Expedite application development, particularly for systems integrators

Companies are moving from pure object-oriented architectures to using components from existing applications, such as MS Excel. Desktop suites are growing increasingly powerful as platforms for application development, with Visual Basic being included in many of Microsoft's application products. Scripting tools that enable users to link components together will become more prevalent, as will debugging and maintenance software to ensure reliability.

b. Objects for Vertical Markets

Today, objects are frequently delivered in the form of class libraries or OLE custom controls that perform cross-industry computing functions, such as placing a database grid in a user interface. Supported by the Object Management Group, CORBA plans to extend standards next year to focus on creating object-oriented applications for vertical industries and markets.

This new focus on industry segments, also a major Microsoft thrust with applications that support Back Office, will help independent software vendors (ISVs) to create business objects, such as an object for processing customer information on line. Expect to see further announcements as object technology enables reusable software components for complex, industry-specific tasks, such as processing a loan at a bank.

c. Team-Oriented Tools for OO Development

Many C/S tools originally were designed to support single programmers. Support for software programming teams was added as an afterthought. Application development tool vendors expect to add new capabilities in several important areas. In response to an increasingly decentralized data architecture, expect to see heterogeneous data replication technology. Component-based technology will answer the need for less trained programmers.

4. Systems Integration Incorporated Into Software Products

Software vendors increasingly incorporate interfaces to other software products into their product lines, making it unnecessary for IS managers or systems integrators to build their own interfaces. This means that integration between software applications will become more standardized. For example, application programming interfaces (APIs) that support two-way batch data transfers may be included in a database.

Some systems integration skills are being incorporated into software products, saving customers time and resources when customizing systems. There will be a clear migration path toward component software and object technology.

C. Changing Issues Surrounding C/S Systems

1. Shift in Concerns Over the Last Two Years

Concerns have changed since INPUT's last C/S market report was written two years ago. Overall, C/S is more widely accepted as a solution to business problems. Leading-edge, competitive companies have established successful migrations from the mainframe, retrained programmers, and feel that they have experience to tackle the next level of C/S.

From the survey, 46 companies out of 96 (46%) that answered questions about their budgets had 100% of their applications budgets for software and services invested in C/S systems. Over 20 respondents said that all their new investment in software and services was for C/S applications. Many in addition said that all their users would have windowing interfaces. However, there were some companies continuing to support older, text-based applications.

Some of the systems that are still being implemented as non-C/S systems using character-based user interfaces include:

- Payroll and accounting modules
- HR applications
- Order entry and telemarketing
- AS/400-based applications
- Manufacturing applications
- Retail store and pharmacy systems

- Billing systems
- Upgrades to legacy transportation systems
- Transaction processing systems using CICS and terminals

By far the leading investment in non-C/S applications was to upgrade or add new modules to installed accounting systems, particularly those running on minicomputers and mainframes. Other systems that were not implemented using C/S technology, but did run on a PC under a windowing system, include:

- Standalone desktop applications, such as office suites
- Decision support and analytical systems for use on an individual workstation
- CD ROM applications
- Terminal emulation packages for both ASCII and 3270 emulation
- Desktop publishing software for a single user

Exhibit IV-16 summarizes technology differences in the client/server market from when INPUT last surveyed the market.

Exhibit IV-16

Changes In Technology Over the Last Two Years

Issues	1993-1998 Report	Today
Networking	Many companies reported network complexity was a problem	TCP/IP is more widespread. Network management tools are maturing. Middleware to mask network complexity is gaining market acceptance.
Security	IS managers wanted C/S security to be like that found on a mainframe.	The Internet raises new security issues. Emerging products address user authentication, token card systems, Internet gateways and firewalls, virus detection, and encryption.
Reliability	PCs, servers and networks are hard to troubleshoot and unreliable.	C/S networks have become more complex and more tools to troubleshoot are being developed. Reliability of computers has improved, but tracking down C/S application failures across a network is still difficult and represents an opportunity for both service providers and software vendors.
Powerful workstations	Many found that PCs with Windows were slower than block mode terminals for data entry.	More powerful PCs continue to emerge. Counter to this is a trend toward simpler Internet browsing machines with less complex operating systems.
Scalability	Concerns were raised that many hardware and software solutions work well in a LAN environment, but cannot be scaled up.	Leading vendors have introduced new products at both the high and low ends of their product range (e.g., Oracle Enterprise and Workgroup Servers, IBM TCP/IP stacks for mainframes and OS/2) to support more scalable solutions.

Source: INPUT

Exhibit IV-17 summarizes differences in the user environment from that of two years ago. Another major concern is about dates in the year 2000. Software that does not support dates after 1999 will need upgrading. This should hasten the move to C/S systems.

Exhibit IV-17

Changes In the User Environment Over the Last Two Years

Issues	1993-1998 Report	Today
User training	Training people to use Windows and mice was an issue in many industries	Windows applications are widely deployed and applications have become more standardized. Training is less of an issue. The Internet has the potential to create simple, point-and-click interfaces that can be readily understood.
IS/User department communications	Many companies reported that they had difficulties communicating between IS departments and users.	Role for IS has become clearer - supporting the infrastructure and promoting corporate standards. User departments often have the budgets to finance applications. They may hire outside expertise. Lotus Notes, electronic mail, bulletin boards and Web sites have helped improve internal communications. Companies have established policies to handle information.
Information overload	Many buyers were confused at the range of choices for development tools, databases, and software architectures.	Users are still overwhelmed with information. There are more knowledgeable experts and professional services to support C/S. With the Internet and smart messaging that filters E-mail, there is less need for organizations to store information locally. They can point to it from their own Web servers.
Intellectual property	This was not raised as an issue.	This is a growing issue as electronic publishing becomes a major application for C/S technology.
Pricing	C/S pricing was based on different models and hard for users to understand.	Vendors have simplified pricing models and developed business models to support the customer. Microsoft has increased the pressure on pricing in the database market. Application vendors are moving to provide services, like functional outsourcing, to maintain their margins as software prices fall.
Accelerating the pace of business	Users believed that improving ordering times from weeks to days was significant.	Time-to-market pressures are greater. Users now want tasks performed in seconds instead of hours. Systems are programmed daily in some financial services institutions; applications development times are significantly reduced.
Choice of partners	Selection of partners and alliances was an issue for vendors.	It continues to be an issue. Some vendors like CA are increasing their partnering efforts. Software companies have to find new categories of partners in entertainment, on-line services, news broadcasting and visual arts.
Channel management	Vendors were concerned with how to support VARs, retailers and OEMs without conflict.	Electronic publishers add to the complexity of channel management. Software vendors (e.g., Microsoft with Windows 95) offer pre-release final beta versions as products and on-line trial software.
Remote locations	Support for mobile professionals, remote locations and telecommuters is difficult.	More ISDN to the home and small businesses supports telecommuters. Mobile professionals can use wireless E-mail and paging devices on notebook PCs and PDAs.

Source: INPUT

2. Networking

Networking has failed to become any easier—if anything, it has become more complex. Companies have more experience in networking and a number of

software packages make managing the network easier than in the past. Features allow for more network functions to be conducted from a central management console, including software distribution, traffic and protocol management and traffic routing. Additionally, middleware is starting to mask the complexity of integrating applications and multiple databases, which will make some network integration appear seamless.

3. User Training

Users are more sophisticated, have more experienceómany of them have computers at homeóand working with windows-based applications is standard in the industry. The possibility of easier-to-use OSs, the promise of Internet appliances, and the probability of Internet browser-launched software portend user shortcomings becoming less of a problem in the future.

4. Security

The Internet presents serious issues for client/server use. How does a company allow customers access to internal networks and how does it protect itself from unwanted intrusions? As mentioned above, security will remain an issue. But the issue is being addressed by a number of products, including firewalls, token cards, better authentication routines, user training, and encryption, that will make this less of a concern in the future.

5. Communications Between IS and Users

This was a major concern two years ago, but not this year. Then, neither IS nor users felt there was very good communication. There is more awareness of the problem now. Committees were set up to deal with the problem and a number of strategies increase communication so that IS can take users' concerns into consideration. For example, USoft provides a tool for rapid prototyping that allows users a rough idea of how the screens will function before the application is completed. By allowing users to move menus and otherwise rearrange the screen, user input can affect the final outcome. Users feel they own part of the process.

6. Reliability

Whereas PCs, servers and networks were viewed as complex, unreliable and difficult to troubleshoot two years ago, those concerns are less today. Tools like network protocol sniffers and network management software make C/S systems much easier to monitor at the network management layer. At the same time, C/S extensions to intra- and inter-enterprise applications lead to more complexity. Client/Server systems will continue to push the limits of

reliability. Once a system becomes stable, it will be extended and modified, leading to new problems. Hence, reliability is expected to continue to be an issue over the next five years, providing excellent opportunities for services and products that can troubleshoot distributed applications.

7. More Complex Software Environment Integration

Integration problems caused by developing software in different environments include difficulties in linking:

- Applications written in COBOL or C with higher level database environments
- Batch systems with interactive Windows-based systems, where APIs may only be specified in one direction
- OLE-enabled Windows applications to other environments, such as legacy server applications
- Workflow integration software such as Lotus Notes with transaction-based systems using CICS

Many more examples fuel demand for specialized tools that integrate different environments. Even with these tools, vendors must choose carefully which environments to support. For users, there is the issue of which applications should be reprogrammed.

8. Scalability

Purchasing products from different vendors means that the convenient integration available from single-source solutions is often lacking. After completing their first-generation client/server projects, many companies now want to tackle larger enterprise and inter-enterprise applications. They want multiplatform, multidatabase applications that will be built for 50 users, scaled to 500 more and then rolled out into a global organization with 5,000 users who require support in their native language. Expect to see more products that can address these needs in the future.

D. Impact of the Internet on C/S Systems

1. C/S and Intranets

The C/S model is evolving into a network computing model. Clients and servers are increasingly linked using messaging protocols, meaning that connections are made when they are needed. This is in contrast to earlier

C/S approaches, in which client and server stayed in constant communication. The Internet is key to this evolution.

The Internet changes the way applications are developed because applications are no longer dependent upon a particular operating system or another application. A client software package, called a browser, can be used for many different applications. This saves companies time in developing client software. For simple Internet applications, only the browser and Web server need to be ported to different computers. For more complex applications, plug-in modules may need porting to different systems.

Instead of developing different software for every different type of computer operating system, software is developed to support a high-level language like Java or a compound document format like HTML that works on any platform.

For a software vendor, the advantages of programming for the Internet are:

- Software being portable to any platform
- The opportunity to lead a new market segment
- A rapid, simpler programming environment
- Simplified distribution and support using the Internet
- Lower document production costs

Exhibit IV-18 shows a traditional client/server architecture. The client application has applications software and software created by application development tools. Each application may be created with a separate tool. For example, in Exhibit IV-18, applications for accounting are developed using Microsoft Excel (a spreadsheet), for human resources (HR) with Sybase/Powersoft's PowerBuilder (a visual application development tool), and for sales with CrossAccess Data Delivery system from Cross Access (a reporting tool).

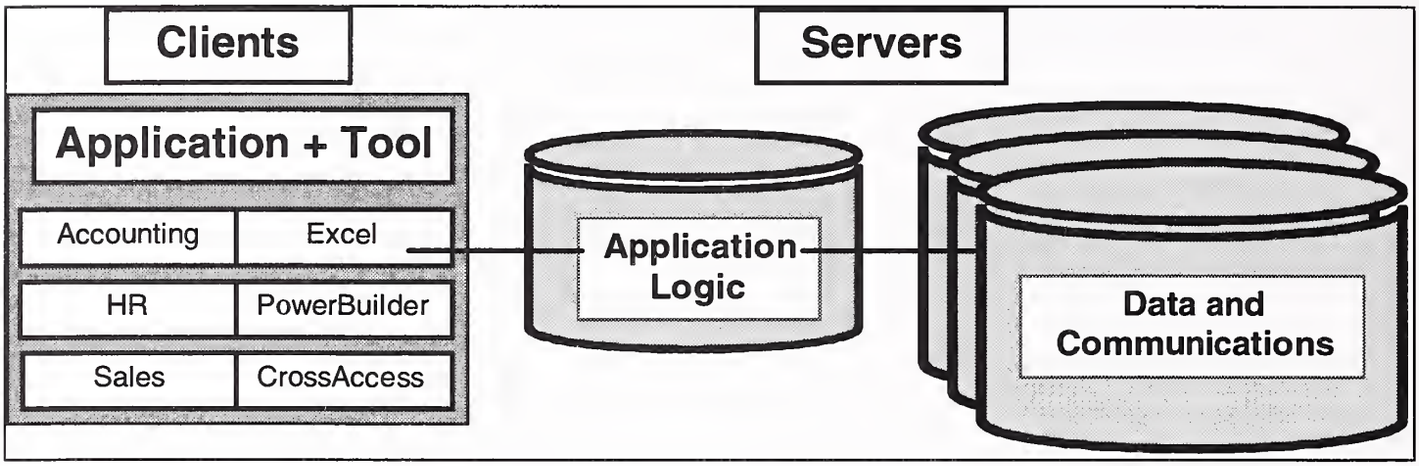
Application logic may be on an intermediate server, or it may reside with the data server. Data and communications servers are just two of the many types of servers that are also part of the network. They typically are connected using various network architectures such as IBM's SNA, Novell's NetWare or Sun's ONC (Open Network Computing). The traditional C/S architecture is characterized by:

- Diverse underlying network architectures
- Many point-to-point connections

- Heavy emphasis on network architecture planning and design
- Many different client and server software packages and development tools

Exhibit IV-18

Traditional Client/Server Architecture



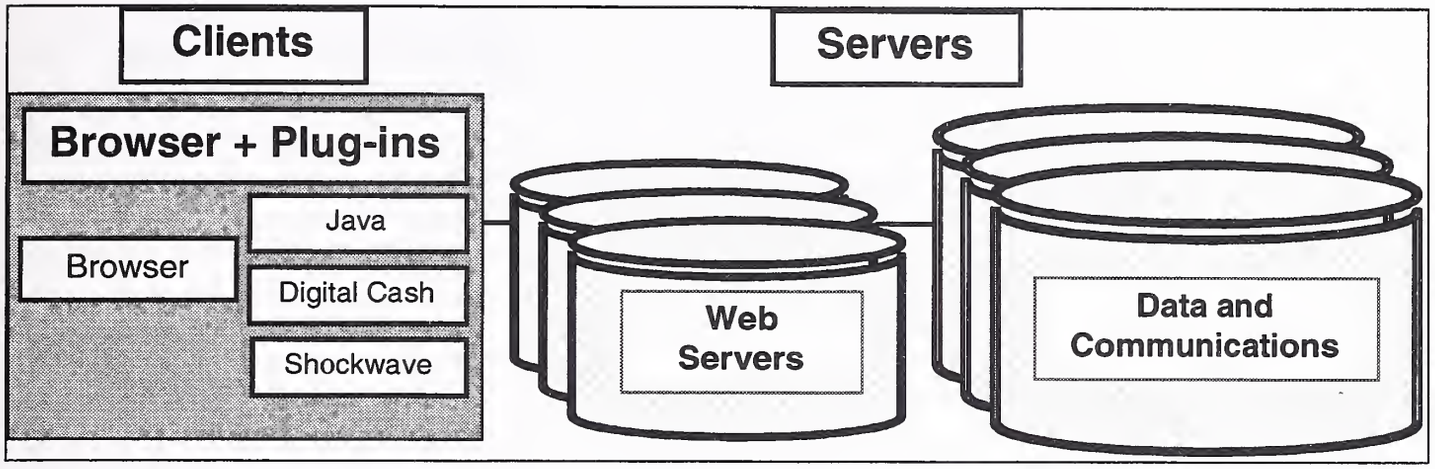
Source: INPUT

By contrast, Internet technology applied to internal corporations results in the intranet architecture shown below in Exhibit IV-19. The custom applications code on the client is replaced with a browser that supports plug-ins for an entire range of applications. Examples of plug-ins, or Web objects, include a Java engine for interpreting Java code, a digital cash plug-in for financial transactions and a Shockwave plug-in to support Macromedia's multimedia scripting language. The applications code is determined by server programming that resides on the Web servers. These may derive data as it is requested from the same servers used in traditional C/S architectures. The intranet uses TCP/IP protocols, simplifying the underlying corporate network architecture. The newer intranet architecture saves supporting multiple application development tools on client platforms. Browsers and plug-ins tend to be cross-platform, thereby reducing the need for application developers to port their applications to different client machines. Internet and intranet architectures are characterized by:

- TCP/IP and its variations (e.g. SLIP) as standard low-level network protocols
- Virtually unlimited connections to diverse hosts all over the world
- Emphasis on incremental, unplanned network growth
- Client software centered on a browser
- Server software centered on interlinked Web servers that interact with traditional servers

Exhibit IV-19

Intranet Architecture



Source: INPUT

2. Internet Applications

The Internet defines a new hardware and software platform that promises to radically change:

- Traditional software structure and architecture
- Software distribution
- How organizations communicate
- C/S systems management and support

Corporations, government, nonprofit organizations and consumers are increasingly using the Internet in new ways. Expect to see daily announcements for Internet and WWW capabilities being built into applications. The Web can support many applications, including:

- Information publishing - background information, press releases
- Electronic marketing - sales materials, on-line advertisements, tracking Web browsers' preferences
- Electronic commerce - EDI, on-line catalogs, price comparisons, auctions
- Customer support - forums, product literature, help desk information
- Interactive tours - house tours, travel planning
- Interactive communications - chat, E-mail, lobbying
- Reporting
- Forms data entry from Web browsers

3. Investment In Web Sites and Electronic Mail

From the sample of 110 users, 14 are spending over $100K to build Web sites and 18 are spending over $100K on electronic mail systems. The largest spenders on Web server systems are telecommunications businesses that act as service providers, banks and publishers. High spenders on electronic mail systems tend to be large organizations with distributed work forces.

Legacy System Migration

This chapter describes some platform migration trends, such as the migration away from mainframes and the replacement of COBOL programmers.

A. How Are Companies Migrating Applications?

Companies tackle the problem of modernizing their systems in different ways. Many companies prefer an evolutionary approach. Exhibit V-1 compares common approaches taken by vendors.

Exhibit V-1

Comparison of Migration Approaches

Approach	Advantages	Disadvantages
Maintain old systems, wait and see	• Little disruption • May be low cost • No retraining	• Maintenance costs • Users may be unproductive • May be hard to integrate
Build totally new system	• Can start with new design • Can develop standard APIs • Better development tools—more rapid • Modern user interfaces • Can redesign processes • Can integrate tasks better	• Cost may be high initially • PC/workstation cost may be higher • New skills needed • Management time is used • Disrupts business
Outsource old system, connect to it and run new system in-house	• Frees up internal resources to run new projects • May be accounting advantages • Use outside experts • Reduces internal systems administration effort	• Systems integration may be difficult • Lose control over outsourced computing environment
Keep old data in old system, run new data in new system, connect with C/S development tool	• Enables old data to continue being used • Can gradually retrain programmers and users • Minimal disruption to the business	• Systems integration may be difficult • Need to understand migration tools • Performance may be an issue • Support for multiple platforms is needed • New system may rely too much on outdated processes

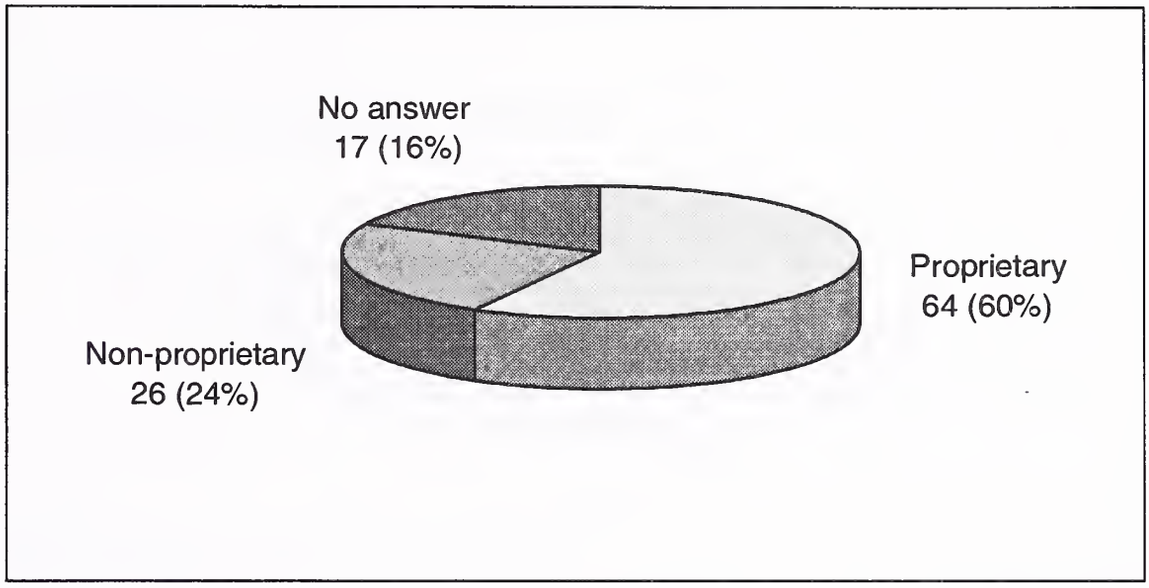
Source: INPUT

B. How Quickly Are Companies Moving Off The Mainframe?

Exhibit V-2 shows how many users had proprietary mainframe or minicomputer environments to support. Almost two-thirds of respondents had proprietary environments. Only 26 (24%) of respondents did not have proprietary servers. Of those that represented their entire organization they tended to be in financial services or smaller manufacturing companies.

Exhibit V-2

Proprietary Systems



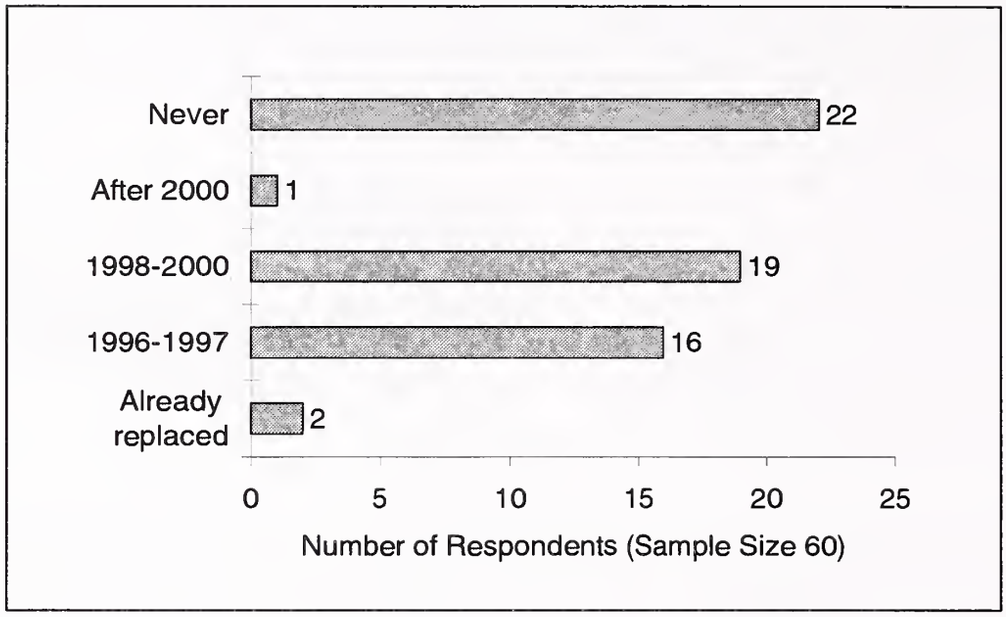
Source: INPUT

INPUT asked user survey respondents when they were likely to discard their IBM and IBM-compatible mainframes and replace them with Windows NT or UNIX machines supporting more modern architectures. Of the 110 users surveyed, 60 addressed the question and Exhibit V-3 shows that a surprisingly high 16 respondents (27%) intend to replace their mainframes in the 1996-1997 timeframe. In this type of survey, intentions may be somewhat optimistic and events tend to happen later than planned. Nevertheless, a further 19 expect to replace their mainframes in the 1998-2000 timeframe.

This means that IBM and other mainframe manufacturers can expect further declines in the mainframe business, despite a temporary upturn in demand due to new CMOS architectures. This provides an excellent opportunity for vendors like Sun, HP and Digital to offer alternative solutions. Oracle and other database tool vendors can offer migration strategies for some software.

Exhibit V-3

Plans for Replacing Mainframes



Source: INPUT

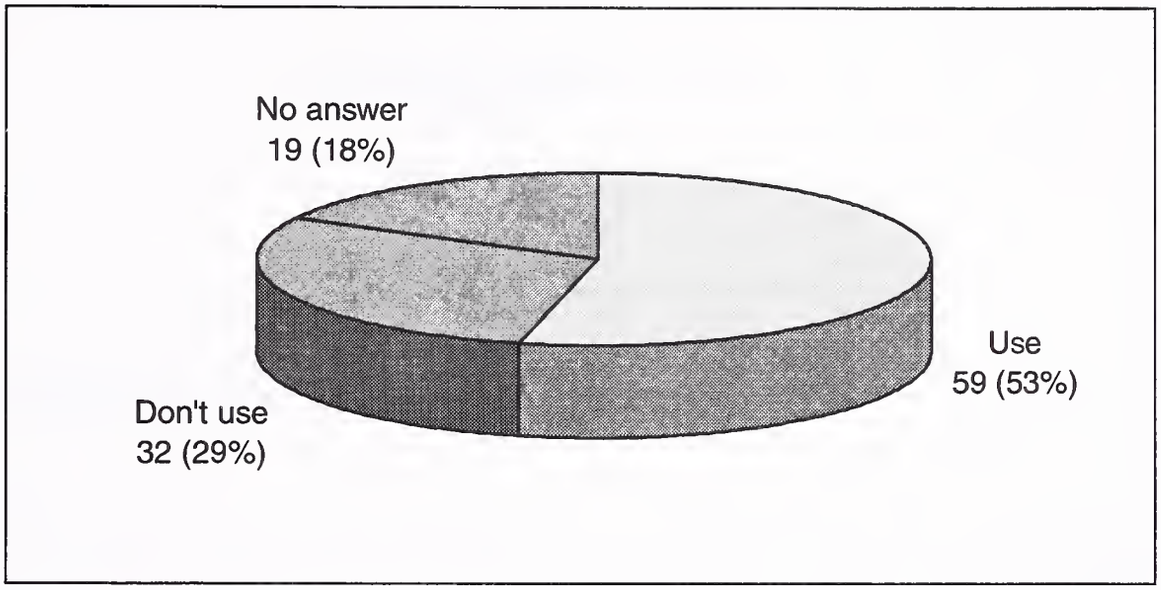
C. Do Companies Still Use COBOL Programmers?

Companies still use COBOL programmers, but many of these are hired under contract from outside firms. Most of them are engaged in maintenance of legacy systems.

INPUT asked users how many COBOL programmers they were using and whether these were internal or external. Exhibit V-4 shows the number of respondents who used COBOL programmers, either on staff or by contract. Of the 110 respondents, 91 answered the question. Of these, 59 used COBOL programmers and 32 did not use COBOL programmers.

Exhibit V-4

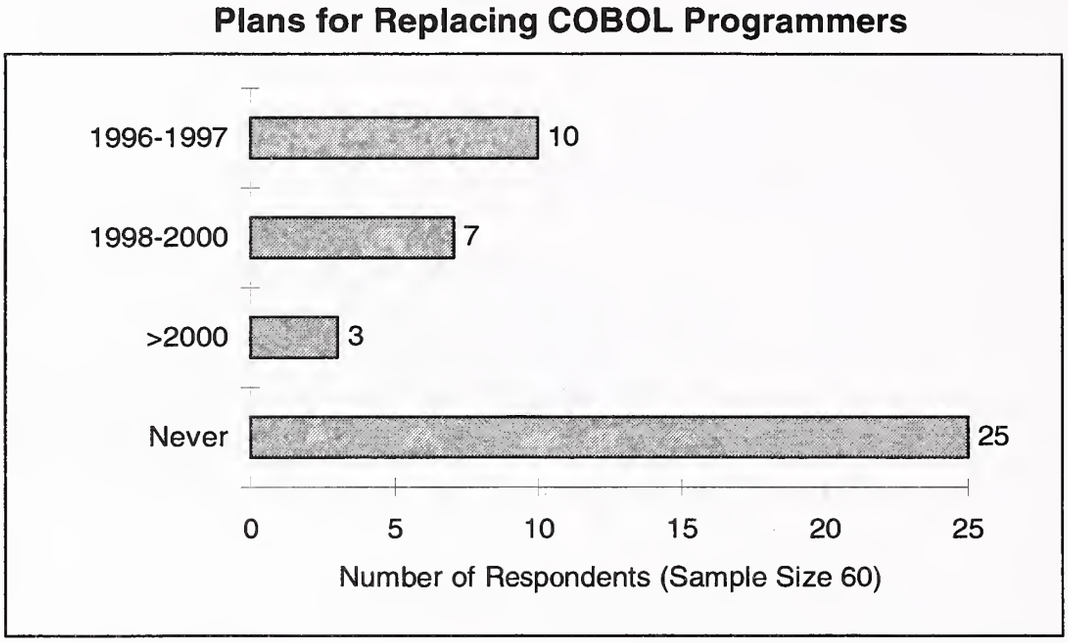
Use of COBOL Programmers



Source: INPUT

The number of COBOL programmers varied widely by company. The company with the most programmers had 1,500 internal ones and 2,000 contractors. Only one *user* department (i.e., a department not managed by an information systems group) had COBOL programmers—40 internal programmers and 40 external programmers. Exhibit V-5 shows the number of respondents that expected to replace COBOL programmers with programmers that use more modern languages, and when they expect to replace them. Of the 110 respondents, 45 gave some response. Of these, 25 had no intention of replacing their COBOL programmers (they were needed for ongoing maintenance), 10 would replace them in the 1996-1997 timeframe and 7 in the 1998-2000 timeframe. Hence, vendors that expect to target COBOL programmers with new software development tools have some opportunities in the near future. However, almost 25% of respondents have no intention of replacing their COBOL programmers. Many companies mentioned that they were retraining their COBOL programmers and that some used newer tools alongside COBOL development environments.

Exhibit V-5



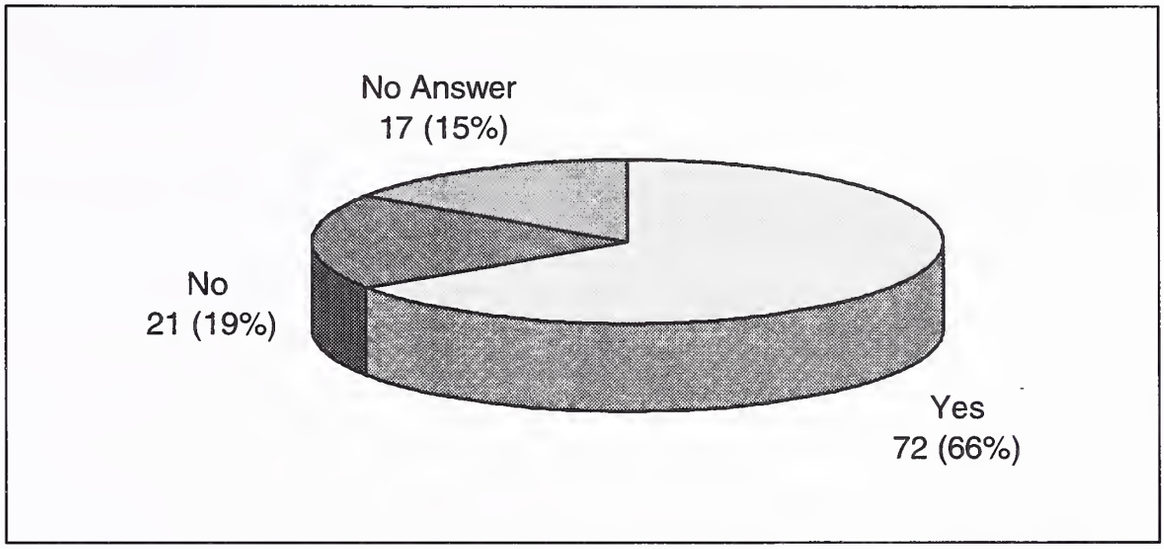
Source: INPUT

D. Year 2000 Impact

Exhibit V-6 shows the number of respondents who are addressing or planning to address problems caused by software programs that cannot handle dates after the year 2000. Of the 110 respondents, a relatively high percentage (66%) indicated they were addressing the problem. Only 19% were not addressing the problem; these are mainly in the business services, utilities and education market segments. The "Year 2000 Problem" is going to give companies an opportunity to reengineer and replace old systems with new ones. Estimates have been made that millions of lines of code, much of it undocumented, will have to be changed to fix the problem. Many systems could probably be more simply programmed using more modern architectures. Users who find they are spending significant sums to correct date problems need to seriously consider rehosting databases and reprogramming with rapid application development tools. Apple Macintosh users need not fear, their systems handle date problems correctly.

Exhibit V-6

Respondents Addressing Year 2000 Problems



Source: INPUT

A few users mentioned that they would balance both internal and external resources to solve the problem. Hardware, software and solutions suppliers are already addressing the problem for some companies. One company mentioned that it was developing corporate standards to help in solving the date problem. Another respondent felt that when upgrading or buying new software, the software should be evaluated to ensure that date problems had been fixed.

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Advantages and Disadvantages of C/S Systems

This chapter discusses the advantages and disadvantages of C/S systems.

A. Why Users Implement Client/Server Solutions

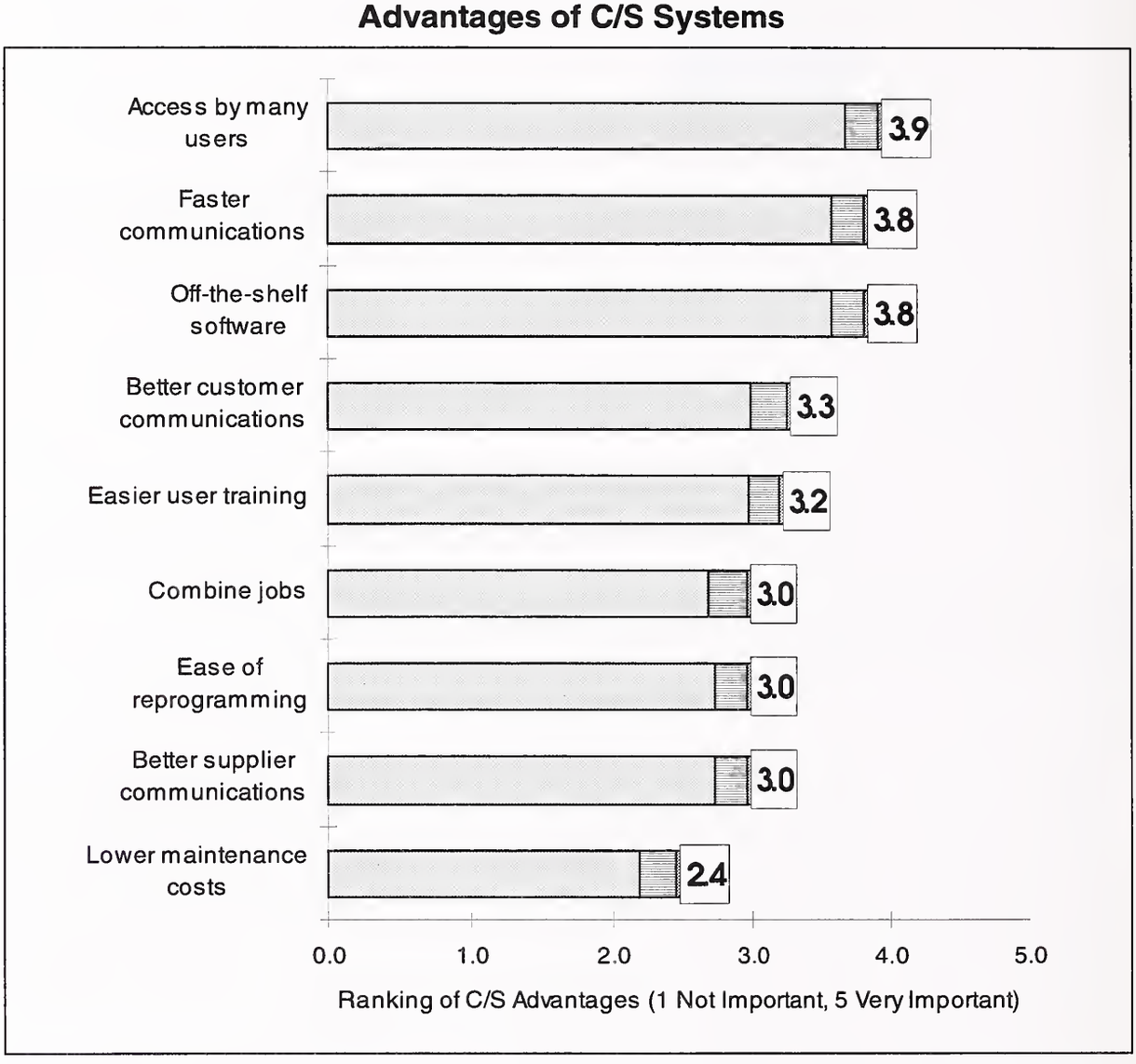
1. Perceived Advantages of C/S Solutions

Users were asked whether they agreed or disagreed with commonly stated advantages of C/S systems on a scale from 1 to 5, 1 being strongly disagree and 5 being strongly agree. Exhibit VI-1 shows the average ratings. The rating is shaded on either side to show the 95% confidence interval. This means that the average is likely to lie within this interval 95% of the time. The wider the interval, the more varied the answers. These results show remarkable consistency among respondents.

Other advantages of C/S systems mentioned by users include:

- Reduced time to market because C/S systems automated business processes
- Reduced time to implement an application
- More end-user satisfaction, because users were able to own the application design and participate in building the system
- Users have more freedom in the data that they can access and they can access databases more easily
- Increases staff productivity
- Wide choice of technologies can be used—even proprietary nonstandard solutions, if they integrate with standard environments

Exhibit VI-1



Source: INPUT

One respondent felt strongly that the ability of a corporation to communicate was independent of technology and that it depended on management and business culture. This is certainly true. However, good management alone cannot speed corporate communications. In almost all cases communication can be accelerated by investment in appropriate technology.

2. Access by Many Users

Client/server technology enables many users to access data from different hardware and software systems. Most of the companies rating user access at 5 were implementing enterprise systems to integrate core functions like accounting and human resources. Companies in all market segments except the federal government were interested in better user access to data.

Technologies that enable widespread access to data include transaction monitors and message-oriented middleware that can link systems across heterogeneous networks. With less time to train users, graphical representation of data will become more widespread. For example, an airline reservation system with a cryptic user interface using concise codes may suffice for a trained reservations clerk; the same system is inadequate for a consumer who wants to reserve a flight using the Internet, which is increasingly being used to provide access to information. Market segments that placed a high priority on better user access to data include banking, insurance, nonprofits and discrete manufacturing.

3. Faster Communications

The accelerating pace of business demands faster communications. Companies that do not keep up will inevitably fall behind. For example, client/server-based inventory systems allow stores to replenish inventory overnight or can forward orders directly to the manufacturer for delivery, thus cutting days out of the business transaction cycle.

Most market segments contained some companies that were interested in faster communications. The market segments least likely to be interested in faster communications access are health services, telecommunications and the federal government.

4. Off-the-Shelf Software

Off-the-shelf packages save companies the time and money of hiring systems integrators or in-house programmers to write software. Not only are companies like SAP offering enterprise-wide software solutions, but vertical market solutions are appearing. Vertical software vendors offer packages for consumer packaged goods, the oil and gas industry and manufacturing companies. Expect to see more of these solutions as well as software tools to integrate business across departments. The market segments most interested in off-the-shelf software include governments (federal, state and local), banking, business services, telecommunications, nonprofit organizations and discrete manufacturing.

5. Better Customer Communications

With the spread of PCs in business and in the home, customers are demanding better communications. This is most evident in help desks, where there has been an evolution from the 800-phone number to integrated, seamless solutions in which each customer is helped by one person in the

company who has access to all the files and business processes necessary to take care of the customer's needs.

Expect to see a further evolution to self help for customer communications. With customer access to the Internet and the WWW, customers can send E-mail help messages, access libraries of frequently asked questions (FAQs) and even help each other in on-line forums and chat groups. The market segments most likely to be interested in client/server solutions for improving customer communications include manufacturing and nonprofit organizations. Within the manufacturing sector, printing and publishing organizations are interested in understanding their customers better. Printers have better on-line interfaces that enable their customers to download documents to them electronically. Publishers are putting their works on the WWW and profiling customers by how they access their publications.

6. Easier User Training

Graphical user interfaces are easier to use than traditional, code-based user interfaces. A well-designed client/server system can make user training easier, though for some companies retraining users is a barrier to client/server implementation.

User training was a more important issue two years ago than it is now. Most people now know how to use a mouse and pull down windows to make selections. The popularity of Windows 95 is a good example of users wanting easy-to-use interfaces. Videos, on-line service support areas and tutorials built into software have made training less of a problem. For example, tutorials are being embedded within applications. The users are coached as they use the application. Lotus ScreenCam saves key strokes in a folder so the user can replicate past actions. Expect to see more of these types of solutions.

Large organizations can afford to retrain employees. Smaller organizations, the government, and services industries, including not-for-profit organizations, find that retraining users is not a compelling reason for moving to client/server systems.

7. Ability To Combine Jobs

Business process reengineering, downsizing and streamlining require users not only to enter data, but to make business decisions in the process. Some companies, like Sun Microsystems, sell their technology on the basis of a large, windowed workstation being able to integrate functions across multiple

screens, thereby enabling companies to combine jobs. This is particularly advantageous in printing and publishing, where digital changes combine many jobs formerly done manually. Likewise, engineering drawing and documentation were formerly done on two separate machines. Now the tasks can be combined.

The market segments least likely to be interested in investing in client/server systems to integrate jobs include the distribution and trade industries.

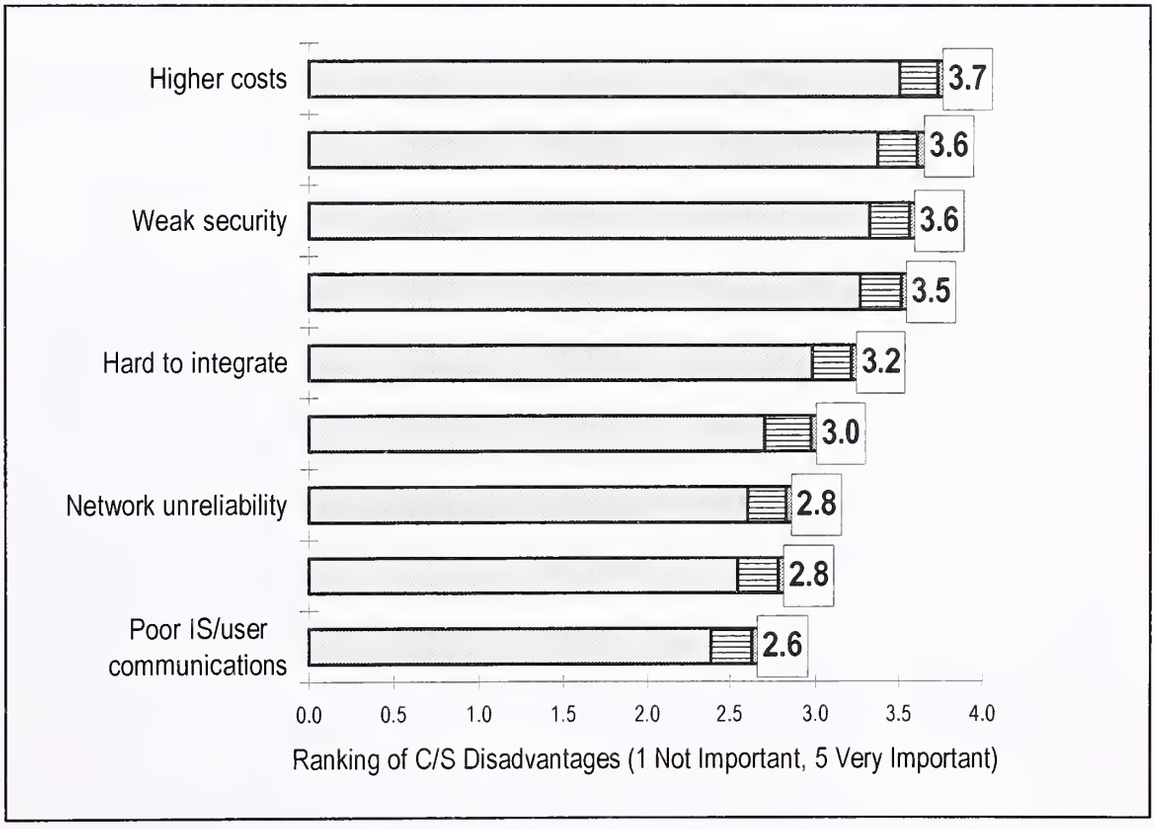
B. Why Users Don't Implement Client/Server Solutions

1. Barriers To Implementing C/S Solutions

The 110 responding companies ranked, on a scale of 1 to 5, the importance of disadvantages of C/S systems. Exhibit IV-7 shows the disadvantages respondents perceived in implementing C/S systems.

Exhibit VI-7

Disadvantages of C/S Systems



Source: INPUT

Other disadvantages of client/server computing cited by users include:

- Systems management and support is not as good as in a legacy environment
  - Backup software to support the enterprise is immature
  - People to support C/S are in short supply
  - Trouble shooting is harder than in a legacy environment
- Application development tools are lacking, compared with a legacy environment
- The range of applications available on traditional platforms is wider than that available using a C/S architecture
- Technology and products are immature
- Operations are more complex in a C/S system than in a centralized legacy system
- Mainframes perform better for some transaction processing tasks
- Training costs for client/server are huge, and in general migration to client/server is very expensive
- Communication managers still need to be trained and made aware of potential C/S solutions
- Hardware is unstable

INPUT believes that many of these perceived shortcomings—the lack of available applications, lack of development tools or a lack of systems management tools—are stated because the respondent's organization has failed to invest sufficiently in training or learning about product availability. Several organizations prefer to be followers and are not prepared to seek out emerging companies that may provide them with development tools. Another problem is that companies fail to retrain their personnel and expect the business processes required to support C/S systems to mirror those used by a previous generation of mainframes and minicomputers.

2. Higher Costs

Companies that gain a competitive advantage from implementing client/server systems recognize that saving money is not the primary reason for instituting client/server technology. Companies like Fed Ex and UPS clearly use client/server to advantage. Their systems are crucial to their ability to compete with the U.S. Postal Service.

Businesses that do not invest in updating outmoded information technology infrastructures will find their business lagging behind more innovative companies. Companies that invest early in client/server often leap-frog their competitors. Companies that fall behind in the market don't generate enough revenue to invest in client/server technology, thereby falling into a vicious downward spiral.

Many users were concerned about higher costs. The segments that ranked higher costs as a key barrier to the implementation of C/S systems were government, banking and finance, and telecommunications. The least sensitive users were found in the health care segment (hospitals, not HMOs) and in utilities.

3. Expensive Support

In combination with higher costs, the expense of support is clearly an issue for those implementing client/server systems. Several forces are at work to lessen the cost of support:

- Vendors are working to bring the costs of support down with better software tools.
- Programmer education is increasing.
- User training is being built into jobs and software.
- Help desks are proliferating and providing higher quality support, especially on the Internet.

The dominance in the marketplace of Microsoft, which uses a variety of support channels including phone, fax back, CompuServe, the Internet and consultants, defines new levels of support. PC systems are designed for nonprofessional users who demand more ease of use and less expensive support than do professionals in the UNIX world. Expect to see more administration and management tools for client/server that bring PC simplicity to the situation. An example is Microsoft's SMS systems management software for Windows NT, which is attracting third-party PC developers to make enterprise support software. The government, education, manufacturing and insurance segment respondents ranked the cost of support as an important factor in preventing implementation of C/S systems.

4. Weak Security

Expect to see less concern about technical issues surrounding security as systems mature. The Internet was designed around UNIX so that there were no barriers to participation among scientists and engineers who wanted to

collaborate and share information. The explosive growth of networking and the Internet made the system vulnerable to intrusion from hackers who either disrupted communication or stole information.

Two facts must be considered when deciding whether the Internet is secure enough for commercial transactions:

- It can never be made entirely secure because of its design, which promotes information sharing and collaborative networks.
- Hostile hackers have long been part of the Internet culture.

Advances are being made to bypass these problems. Several firewall products are now on the market that limit access into a company's internal network. They are used both to shield a corporation from external users and to protect corporate assets within corporate boundaries. Firewalls are being erected as barriers within departments to restrict access to sensitive information like personnel records, proprietary design plans, and customer information.

Several shareware and software products for UNIX address security issues. The most important factor in security—the people factor—is being addressed by company education. User passwords are being replaced by token card systems that limit the amount of time a user has to log on. These systems support a variety of schemes designed to be next to impossible to overcome from the outside.

The most important factor that will accelerate customer contact and commerce over the Internet is encryption. Although the network itself cannot be made totally secure, messages can be encrypted and authenticated. Expect to see encryption included in all Internet and software development tools for building applications in the future. Encryption insulates a message from anyone except the receiver. Authentication insures that the transaction is not tampered with in transit and non-repudiation insures that both parties have a record that the message was sent and received.

Expect to see more transactions based on an encryption engine from RSA Data Security that is becoming the standard in the industry. Solutions that use the RSA engine include the:

- Secure Socket Layer (SSL) developed by Netscape
- Secure Transaction Transport (STT) jointly proposed by Microsoft and Visa
- Secure Electronic Payment Protocol (SEPP) proposed by MasterCard

These solutions are the foundation for electronic commerce over the Internet. As stated in INPUT's previous C/S market analysis report, banks consider security a key barrier to the implementation of C/S systems. Improved security over the last two years means that banks are aggressively moving to implement C/S systems after a somewhat late start.

5. Immature Standards

Some companies are waiting for standards to develop like they did in the old IBM-dominated days of the mainframe. While the desktop standard belongs to Microsoft, it will be a long time before server standards are dominated by a single solution. Windows NT and UNIX are expected to co-exist for the foreseeable future.

Standards are evolving daily; companies cannot wait to enter client/server until standards are set in concrete. They will find themselves too far behind to catch up. Companies need flexibility and must work on solutions as their business evolves. Organizations that need to communicate with other companies are the most sensitive to the lack of standards. For example, banks require standards to process payments and, typically risk averse, they see a lack of standards in C/S systems. Transportation, retailing, discrete manufacturing and communications are other industries that value standards.

6. Difficult Integration

Integration will remain a problem area for some time, especially as companies seek to integrate the enterprise—globally—in many cases. Expenses for systems integration services will continue to be high. Users on a tight budget will turn to better tools to integrate different databases and connect to legacy data. Internet tools are becoming available for integrating databases with the Internet. OLE, for example, is starting to be used to send objects across the Internet without having to send the whole application.

There are several ways to limit the cost of integration:

- Limit the number of choices by using fewer software platforms
- Define the interfaces well so that engineering is simplified
- Use middleware for integration so that access appears seamless
- Invest in high-quality test environments and tools
- Roll out systems incrementally, with active user participation

The market segment that most clearly considers integration a problem is retail, where store systems grew up around point-of-sale terminals that are now being forced to integrate with corporate business functions. Major resellers and consumer goods manufacturers are experiencing problems because of their need to integrate their systems with those of their customers. Expect to see more vertical integration solutions within industries and more sophisticated, industry-specific middleware to deal with problems such as these. Frontec is a Swedish EDI company that has recently targeted the middleware market with software that supports general-purpose database access, but also supports EDI formats for specific applications.

As in INPUT's previous C/S research, retailers and transportation companies experience integration difficulties with C/S systems. These two industries have well-established EDI networks and are used to very specific standards for inter-company trading. Client/Server applications must simplify integration of systems between companies for these industry segments in particular.

7. Management Does Not Want To Invest

Historically, in established industries, management employs traditional business and management practices that fail to leverage new technology. Additionally, the technology has become so complex that few management leaders can understand client/server technology in sufficient detail to feel that they can make informed choices about moving their business ahead. As client/server technology evolves, the question is no longer "Can this be done cheaper using traditional methods?" but "Can this be done faster using C/S technology?"

The speed at which technology is advancing creates business advantage. Successful client/server systems cannot be put in place unless they are fully supported by upper management. In the user survey, some companies reported that they had senior management who understood and invested in technology. Only the government sector (federal, state, and local) respondents felt that their executives did not want to invest heavily in C/S systems. This reflects a downsizing of government and a lack of competition. Some companies, particularly those with obsolete product lines in discrete manufacturing, and poor financial performance, were also on the downward spiral and lacked management commitment to invest in C/S technology.

Applications Priorities and Budgets

This chapter looks at users' perceptions of a few key applications and discusses budgets.

A. Applications Focus

In the survey, users were asked how much they were spending on software and services for key applications, not hardware. They were asked whether or not the applications used a C/S architecture. They were also asked to rank their three most important application areas. In the survey, INPUT focused on:

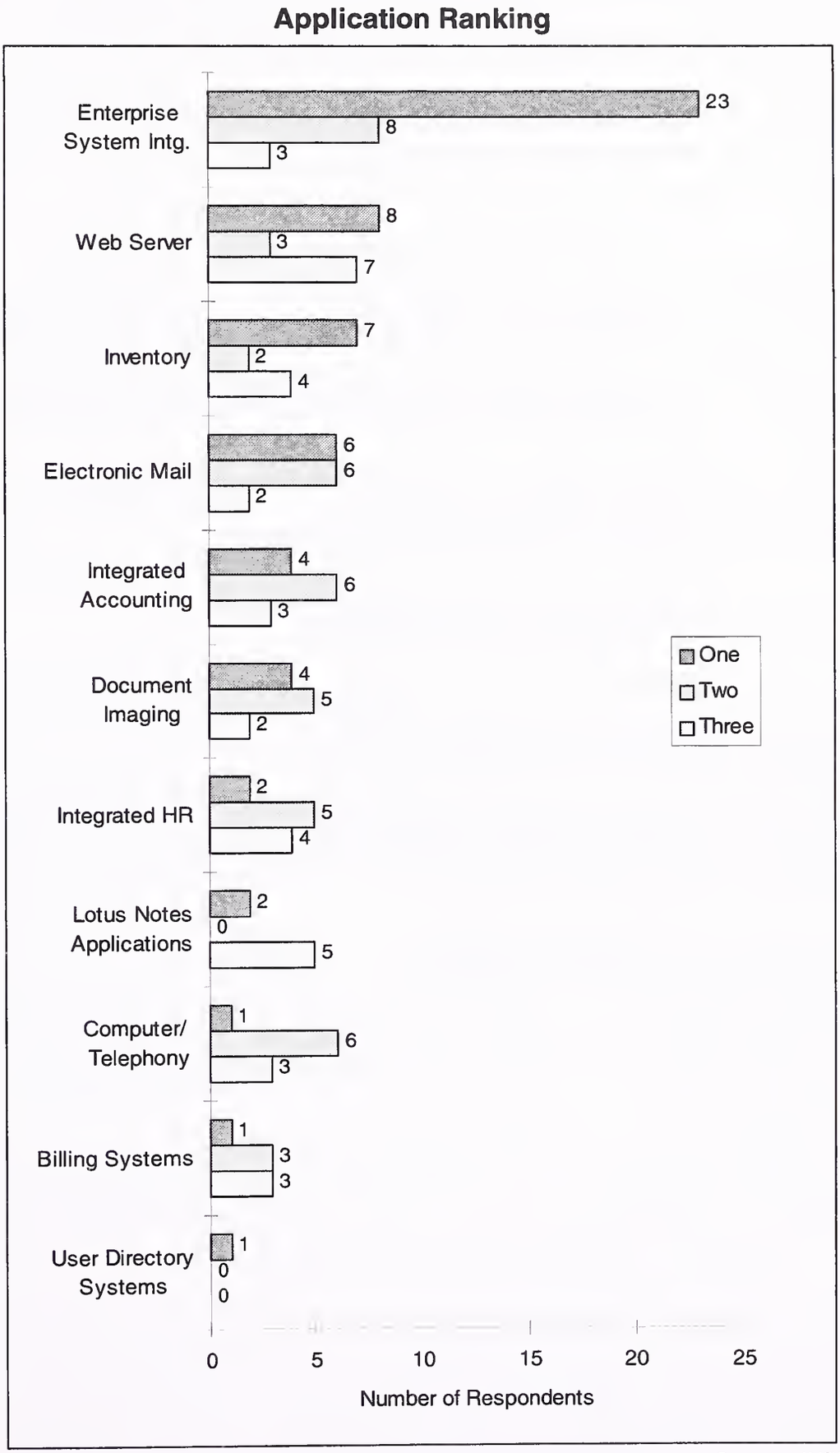
- Accounting - integrated systems to provide a variety of accounting functions, such as order entry, accounts payable, accounts receivable and general ledger
- Billing Systems - systems for billing customers, either on-line, using the Internet, or for traditional product purchases
- Computer/Telephony Integration - systems for integrating PBXs and other telephone equipment with computer systems for such applications as telemarketing, customer response systems and automatic dialing
- Document Imaging - systems that store and retrieve documents as images, either for archival storage or for publishing
- Electronic Mail - systems that either work on a LAN or connect directly to a server for electronic mail
- Enterprise Systems - systems that combine several corporate functions, such as accounting, inventory and human resources. SAP's R/3 is an example of an integrated enterprise system

- Human Resources - systems for tracking employees, hiring, benefits administration and policy information
- Inventory Management - systems for tracking and managing corporate inventory
- Notes Applications - applications based on IBM's Lotus Notes product
- User Directories - systems that track user names, passwords, log-on preferences and other user information
- The Web - systems that implement Internet technology for Web servers, either for internal applications or for external access

These systems were selected because they represent a cross-section of applications that are usually supported by C/S technology.

Exhibit VII-1 shows the number of times different applications were ranked as number one, two or three by users. "One" was the most important. Enterprise system integration was the most popular application, with 23 respondents ranking it as their number one priority.

Exhibit VII-1



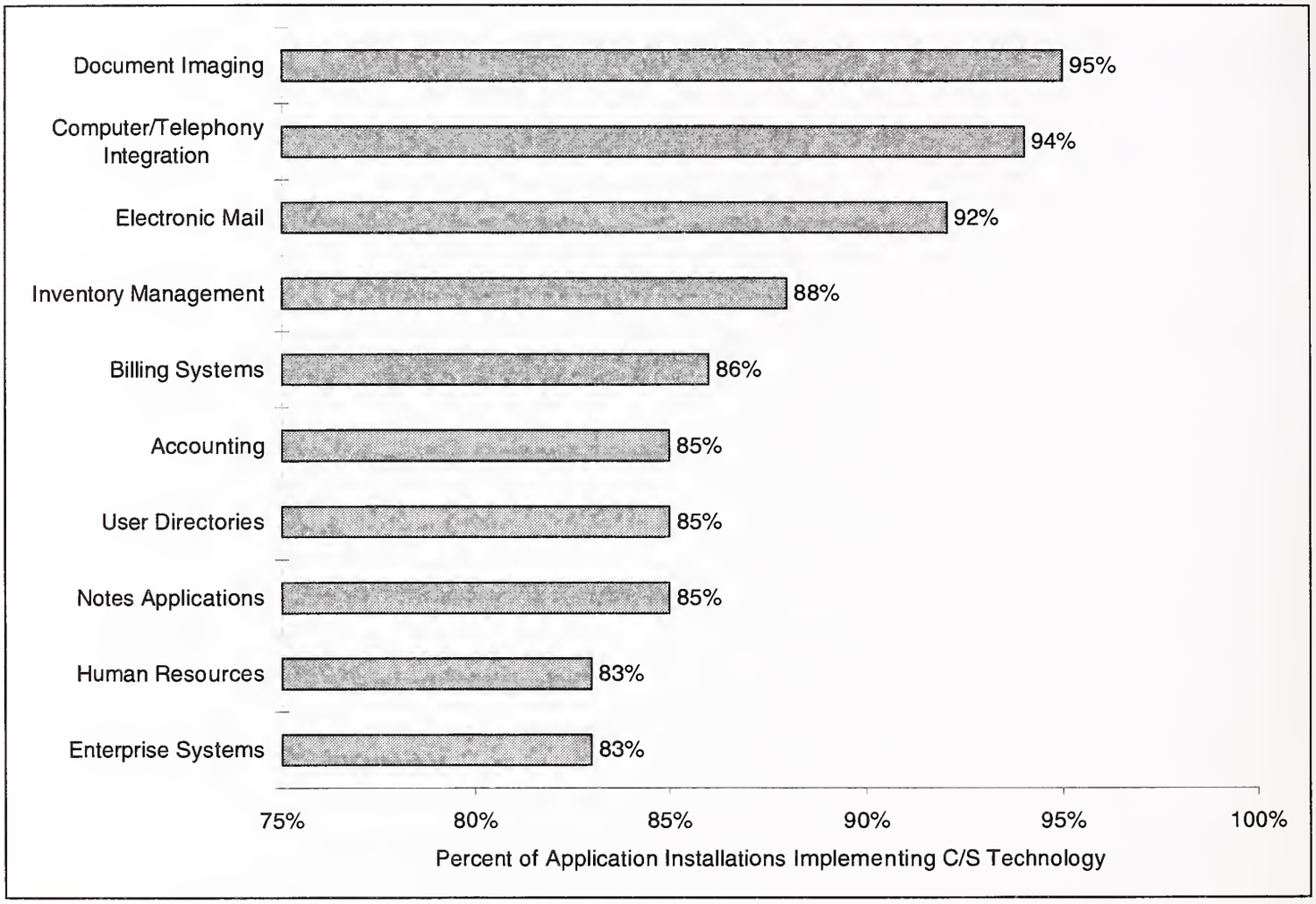
Source: INPUT

B. New Applications Using a C/S Architecture

Exhibit VII-2 shows how many respondents implementing a particular system were using a C/S architecture.

Exhibit VII-2

Percentage of Applications with C/S Architecture



Source: INPUT

Other areas that the respondents ranked as being important were:

- Integrated corporate data system
- Network upgrades
- Engineering systems
- Integated materials management and logistics systems
- Distribution systems

- Integrated messaging, combining E-mail with the Web and other document retrieval systems

Many users were unable to break down their budgets by specific application; they included document imaging as part of their HR system, for example. Many corporations were going to spend their 1996 budget integrating Web servers and E-mail with traditional enterprise applications.

For each application, the user survey was analyzed to see if there were any patterns that could profile users. For example, if a user believed accounting systems were most important, did that user have a higher preference than average for particular vendors? Comments on survey results for particular applications areas are provided below.

Also for each application, users were asked how much they were spending on software and services such as systems integration and contract programming. The budget estimates excluded hardware. The results for each application are shown below.

1. Accounting

a. Application Opportunities

Respondents that put accounting as the most important application also tended to rank HP and Microsoft as their most important vendors. Windows NT was a key platform for these respondents, for both client and server. It could be that as accounting calculations become more complex, Windows 95 is not powerful enough.

Application opportunities are to integrate the Internet with accounting systems, both for reporting and for order entry. Accounting is an area in which internal firewalls may be required to protect systems from unauthorized access.

Companies like Hyperion are targeting budgeting and consolidation. They integrate with many accounting systems. Accounting vendors need to make their interfaces more open, so that users can readily configure their systems and integrate them with their own applications. Before companies implement a new accounting system, they must consider reengineering their business processes. Accounting is one area in which reengineering has been applied successfully, particularly in large corporations. For example, large auto manufacturers, consumer goods companies and retailers have reduced invoice paperwork using EDI. Invoiceless transactions will increasingly be implemented in medium-sized to small companies.

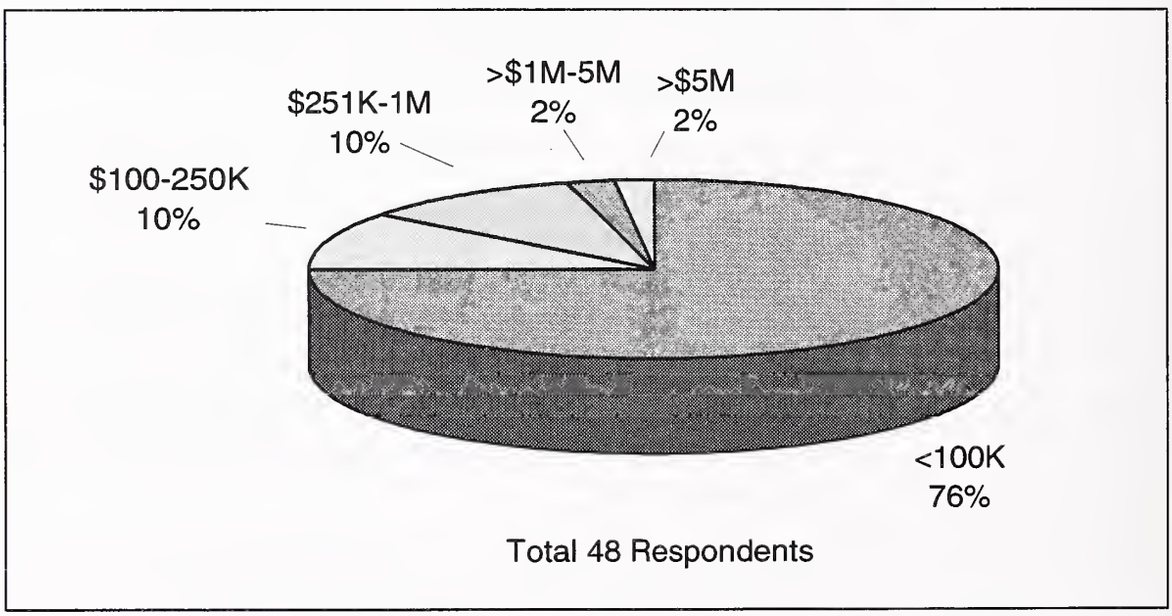
b. Budget Spending

Forty-eight (48) respondents identified budget spending for accounting systems. Of these, about three-quarters spent less than $100,000 a year on their systems. High spenders on accounting systems included banks, insurance companies, retailers and services organizations. Manufacturing organizations were particularly low spenders on accounting systems, and also government and educational market segments tended to spend less than $100,000 on accounting systems.

Exhibit VII-3 shows the percentage of respondents spending various amounts annually on software and services for accounting.

Exhibit VII-3

Budgets for Accounting Software and Services



Source: INPUT

2. Billing Systems

a. Application Opportunities

Billing systems traditionally have been supplied by major systems integrators and specialized vendors, like Bellcore, AT&T Network Systems, CBIS and GTE Data, to the telecommunications industry.

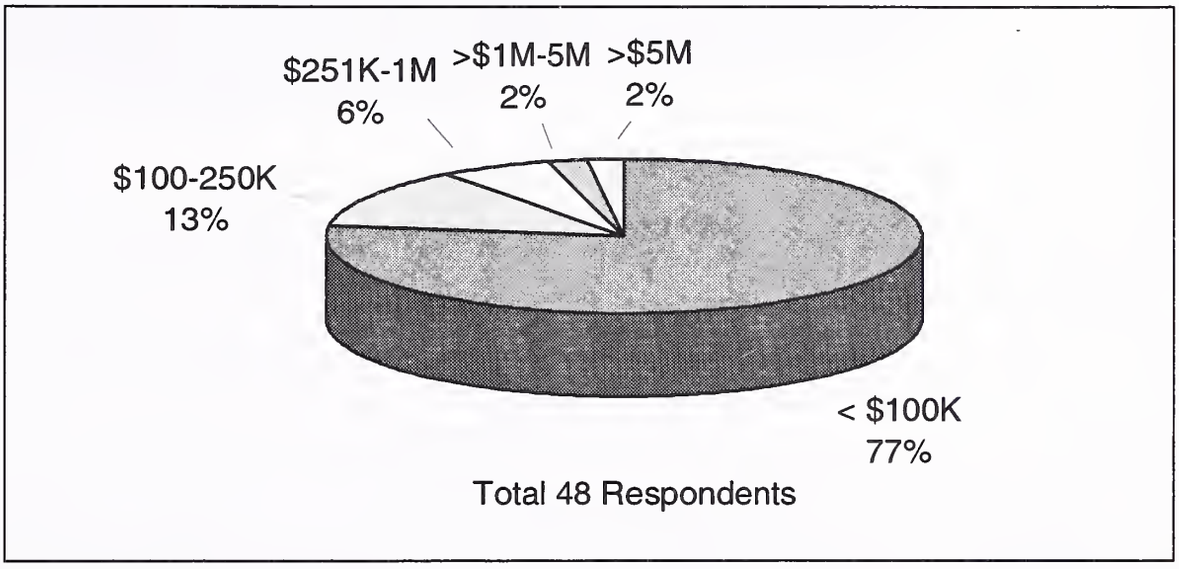
Billing systems were most important for publishers and process manufacturing companies. Telecommunications vendors, who already spend considerable amounts on billing systems, are less likely to represent opportunities for emerging billing systems vendors.

b. Budget Spending

Exhibit VII-4 shows the percentage of respondents spending various amounts annually on software and services for billing systems. Seventy-seven percent (77%) of respondents have budgets of less than $100K. Most of these small budgets are in manufacturing organizations or the educational market segment.

Exhibit VII-4

Budgets for Billing Systems



Source: INPUT

3. Computer/Telephony Integration

a. Application Opportunities

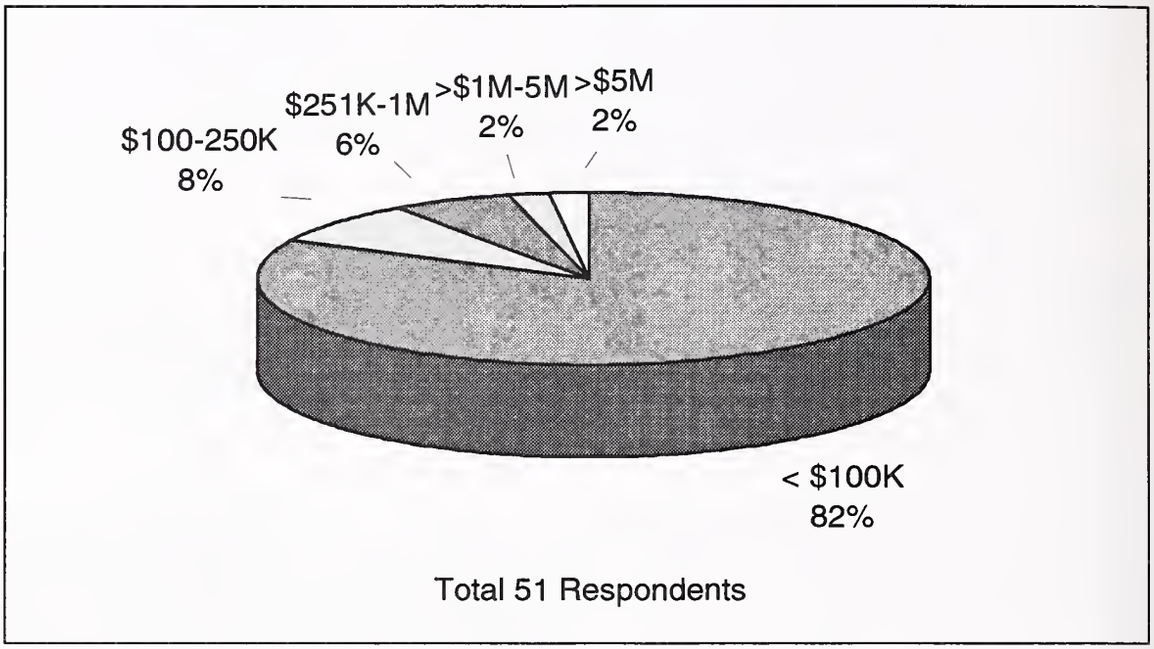
Integrating PBXs with general-purpose office computers has been slow. However, as PC networks become more reliable, computer/telephony integration to support automatic dialing, sales support and customer service is becoming a growing opportunity. The largest opportunities are in telecommunications and insurance market segments, where phone service and support play a major role.

b. Budget Spending

Exhibit VII-5 shows the percentage of respondents spending various amounts annually on software and services for computer/telephony integration.

Exhibit VII-5

Budgets for Computer/Telephony Integration



Source: INPUT

4. Document Imaging

a. Application Opportunities

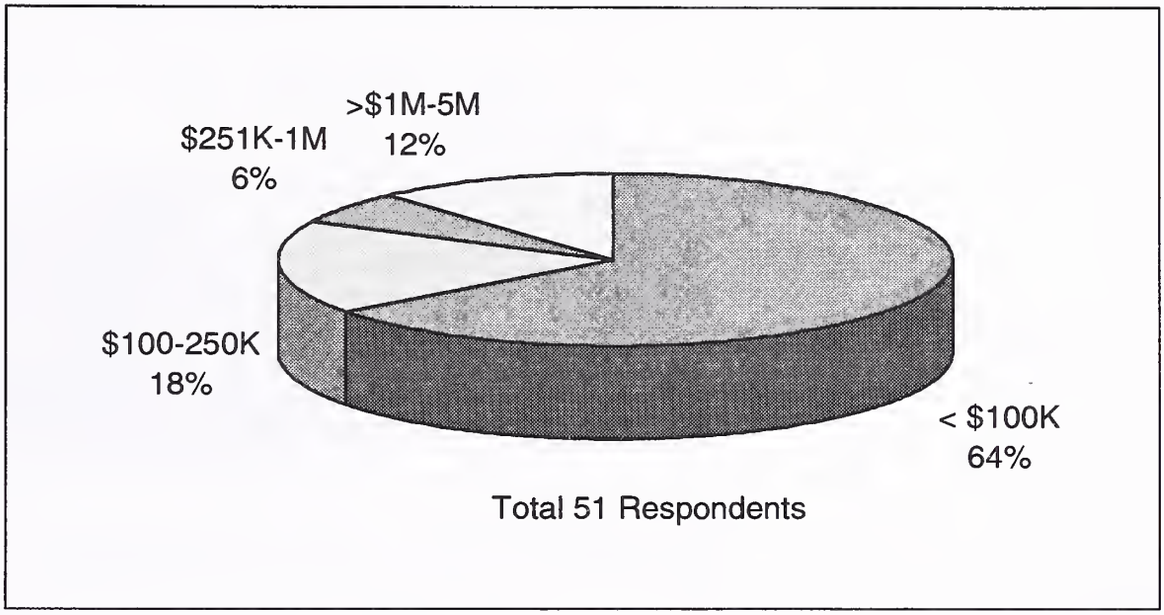
Among the heaviest spenders on document imaging are banks and insurance companies. They need to control their paperwork for office documents supporting loans, investments and regulations as well as for small items like checks and deposit slips. Manufacturers also spend heavily on document imaging.

b. Budget Spending

Exhibit VII-6 shows the percentage of respondents spending various amounts annually on software and services for document imaging systems.

Exhibit VII-6

Budgets for Document Imaging Systems



Source: INPUT

5. Electronic Mail

a. Application Opportunities

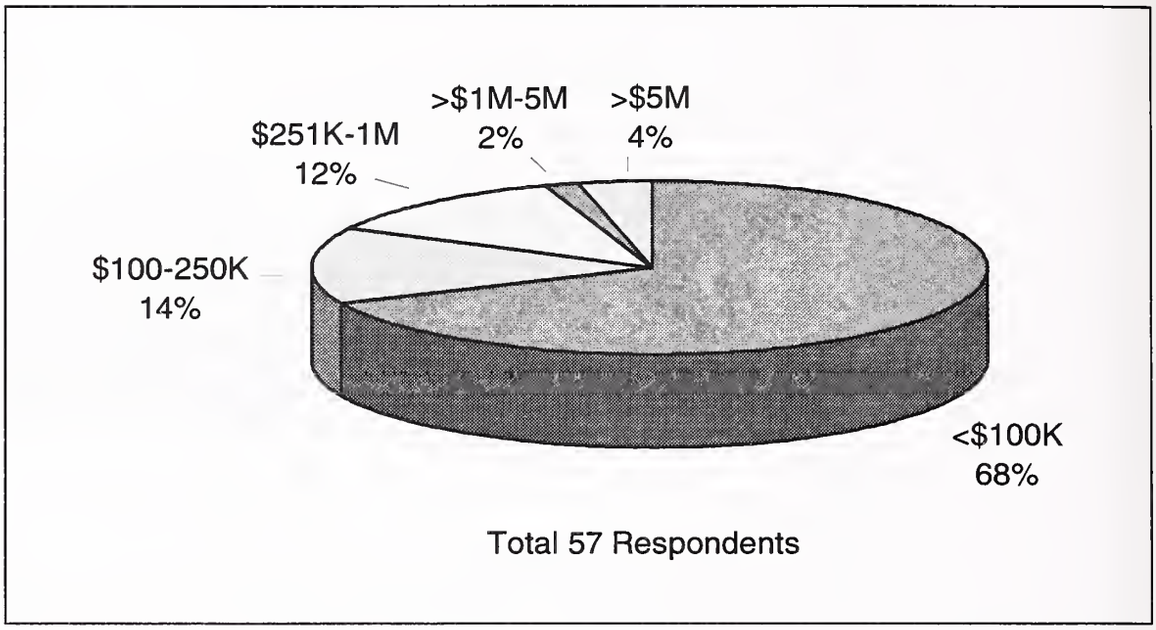
Many companies are consolidating and integrating their electronic mail systems. Most companies have to integrate different systems, which may prove problematic. Microsoft Exchange client software for E-mail and fax is provided by Microsoft for Windows 95. This means that traditional E-mail vendors have to enhance their products to support multimedia and videoconferencing. Hence, there are tremendous opportunities to enhance E-mail systems.

b. Budget Spending

Exhibit VII-7 shows the percentage of respondents spending various amounts annually on software and services for electronic mail systems. Banking and finance, government and manufacturing are some of the segments investing heavily in electronic mail systems.

Exhibit VII-7

Budgets for Electronic Mail Systems



Source: INPUT

6. Enterprise Systems

a. Application Opportunities

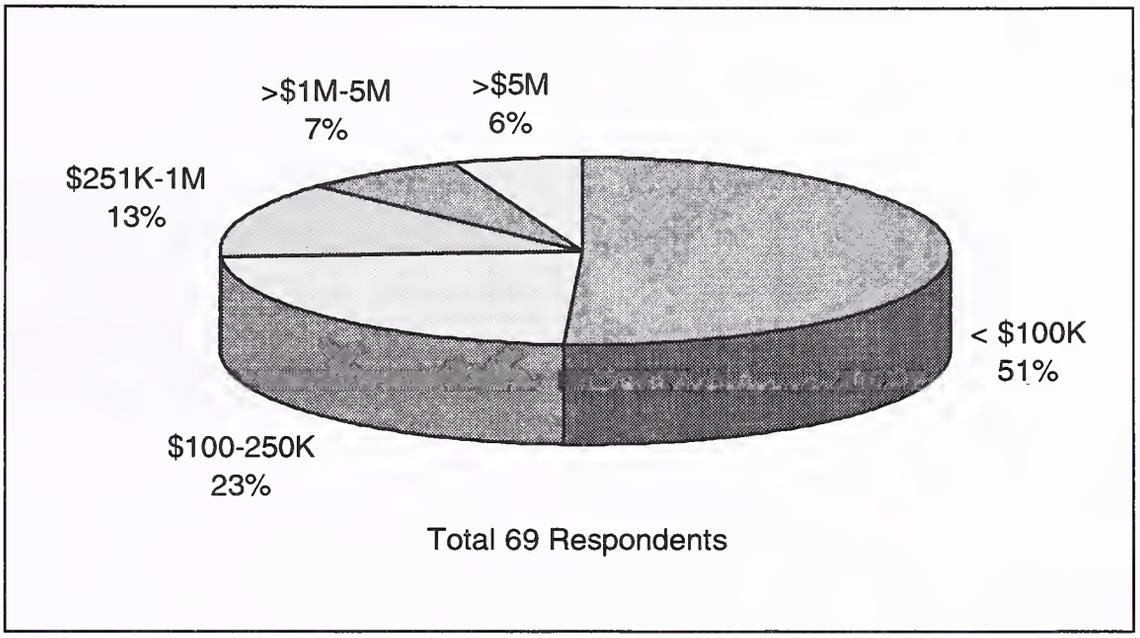
Enterprise systems represent one of the fastest growing opportunities, as evidenced by the recent growth of SAP and Oracle's application business. There are also many opportunities for systems integrators.

b. Budget Spending

Exhibit VII-8 shows the percentage of respondents spending various amounts annually on software and services for integrated enterprise systems.

Exhibit VII-8

Budgets for Integrated Enterprise Systems



Source: INPUT

7. Human Resources

a. Application Opportunities

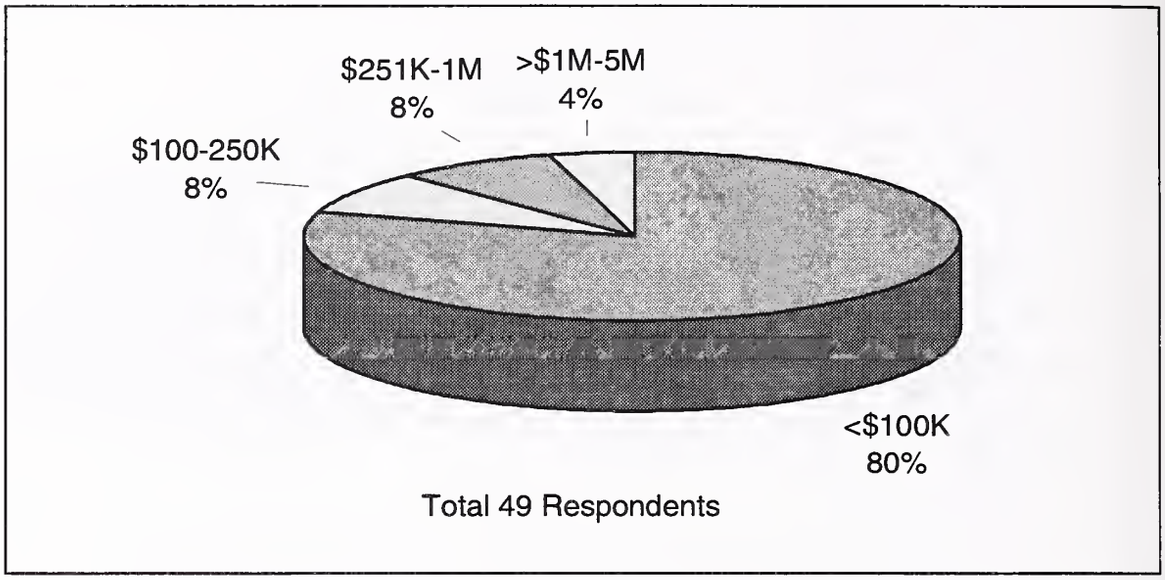
Some of the largest opportunities for HR systems are in retail, but manufacturing and financial services also present good opportunities. Peoplesoft, SAP, Oracle, Dun & Bradstreet Software, Cyborg and Lawson are just some of the vendors addressing this market. It is a crowded market, but niche players like Resumix, which focuses on resume tracking and is now part of Ceridian, can succeed. To succeed as a niche HR systems player, a company must integrate its products with the leading players' software.

b. Budget Spending

Exhibit VII-9 shows the percentage of respondents spending various amounts annually on software and services for integrated HR systems.

Exhibit VII-9

Budgets for Integrated Human Resources Systems



Source: INPUT

8. Inventory Management

a. Application Opportunities

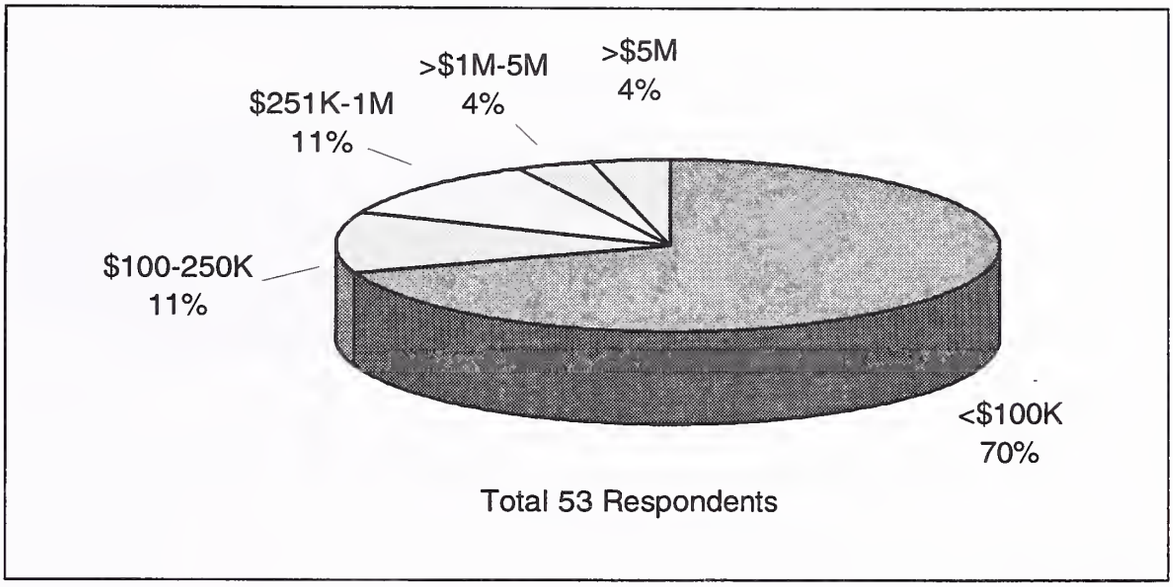
Integrated demand chain systems are making companies update their inventory systems. Inventory systems are also more closely integrated with logistics and package tracking systems. On-line catalog ordering is creating new demands for inventory systems that can replenish goods as needed. Discrete manufacturing and retail market segments are areas providing strong growth. Selection of retailers must be made carefully, as improved systems and catalog buying is causing some retailers to become uncompetitive. However, those with strong systems should flourish and provide long-term growth.

b. Budget Spending

Exhibit VII-10 shows the percentage of respondents spending various amounts annually on software and services for inventory management systems.

Exhibit VII-10

Budgets for Inventory Management Systems



Source: INPUT

9. Lotus Notes Applications

a. Application Opportunities

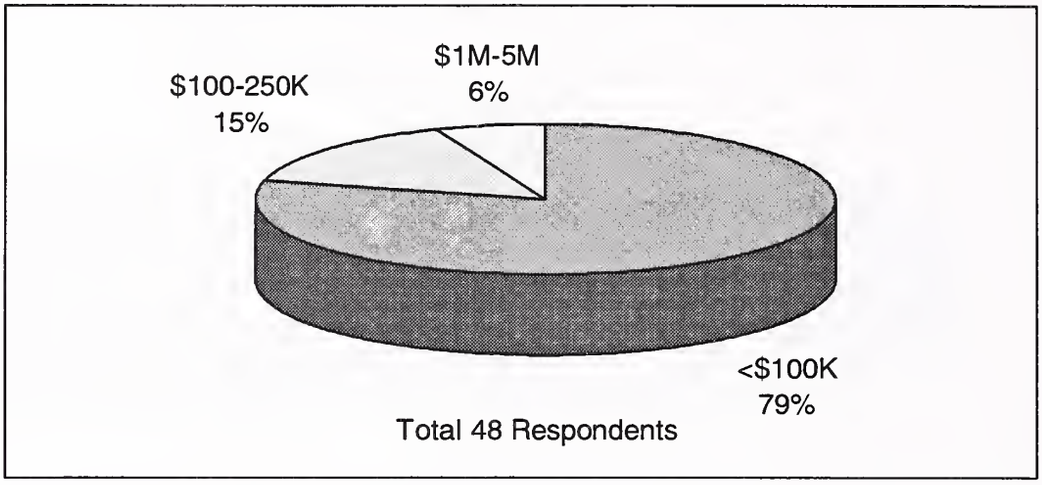
IBM's Lotus division is aggressively promoting Notes as an application platform for the Internet. There are already many groupware applications based on Notes, such as resume tracking and scheduling. Until Notes databases are routinely read with standard Internet browsers, like Netscape's Navigator, they are at risk from Internet applications. However, because the Notes platform is simple to program, it provides developers with a way to gain access to an account and provide a quick solution that may be modified and extended later.

b. Budget Spending

Exhibit VII-11 shows the percentage of respondents spending various amounts annually on software and services for Lotus Notes applications. Over 20% of respondents have budgets greater than $100K. Once a company has installed the basic Notes software, $100K of programming services can provide significant applications for a fraction of the cost it would take to create them with more sophisticated databases and messaging software. A nonprofit, a bank and a communications company had budgets of over $1 million. The mid-range of $101K to $250K included publishers. There were no entries in the $251K to $1M range.

Exhibit VII-11

Budgets for Notes Applications



Source: INPUT

10. User Directories

a. Application Opportunities

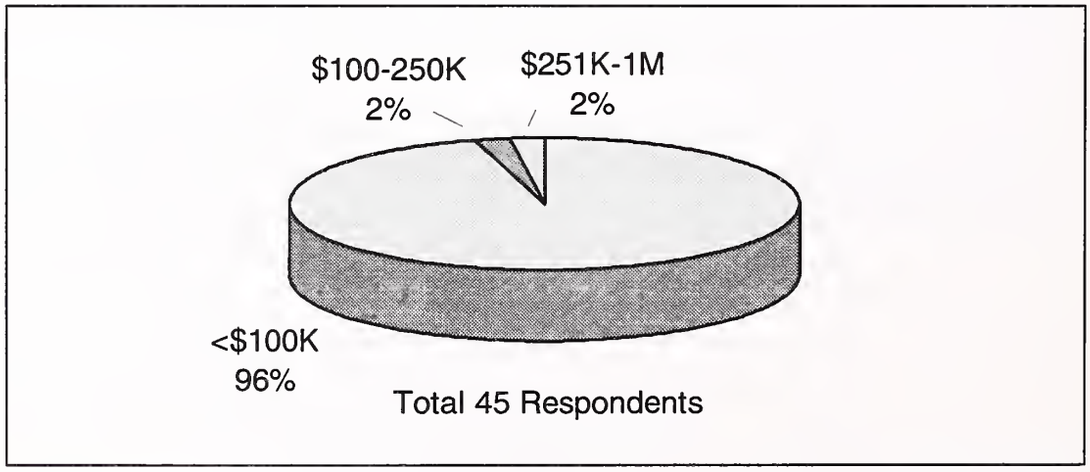
Novell will make a major thrust with user directories in 1996. Expenditures on directories can be expected to increase.

b. Budget Spending

Exhibit VII-12 shows the percentage of respondents spending various amounts annually on software and services for user directory systems. These are very small budgets because most of the development cost is for internal system administrators.

Exhibit VII-12

Budgets for User Directories



Source: INPUT

11. The Web

a. Application Opportunities

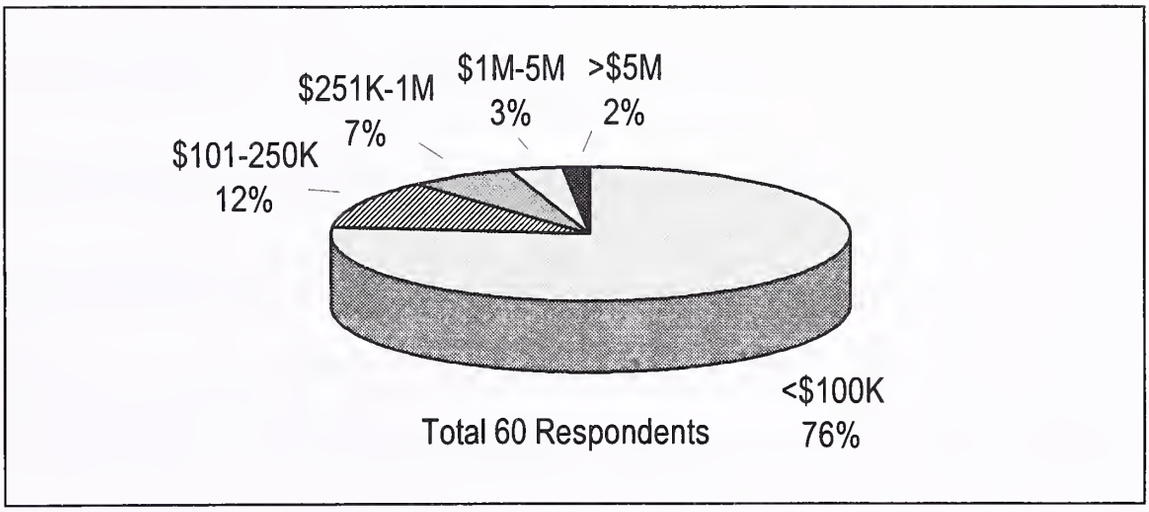
The Web is providing excellent opportunities, not just as a publicity vehicle or distribution channel, but as a true applications platform. In some ways, the Web is leading to a resurgence in timesharing, where companies outsource their Web management to a service bureau. Like the timesharing market of the late 1970s and early 1980s, there will be casualties, but also a few key players will emerge.

b. Budget Spending

Exhibit VI-13 shows the percentage of respondents spending various amounts annually on software and services for Web servers. Communications companies, banks, publishers and retailers are some of the highest spenders. Government organizations are also spending in the middle of the range to disseminate information and reduce paperwork costs using the Web.

Exhibit VI-13

Budgets for Web Servers



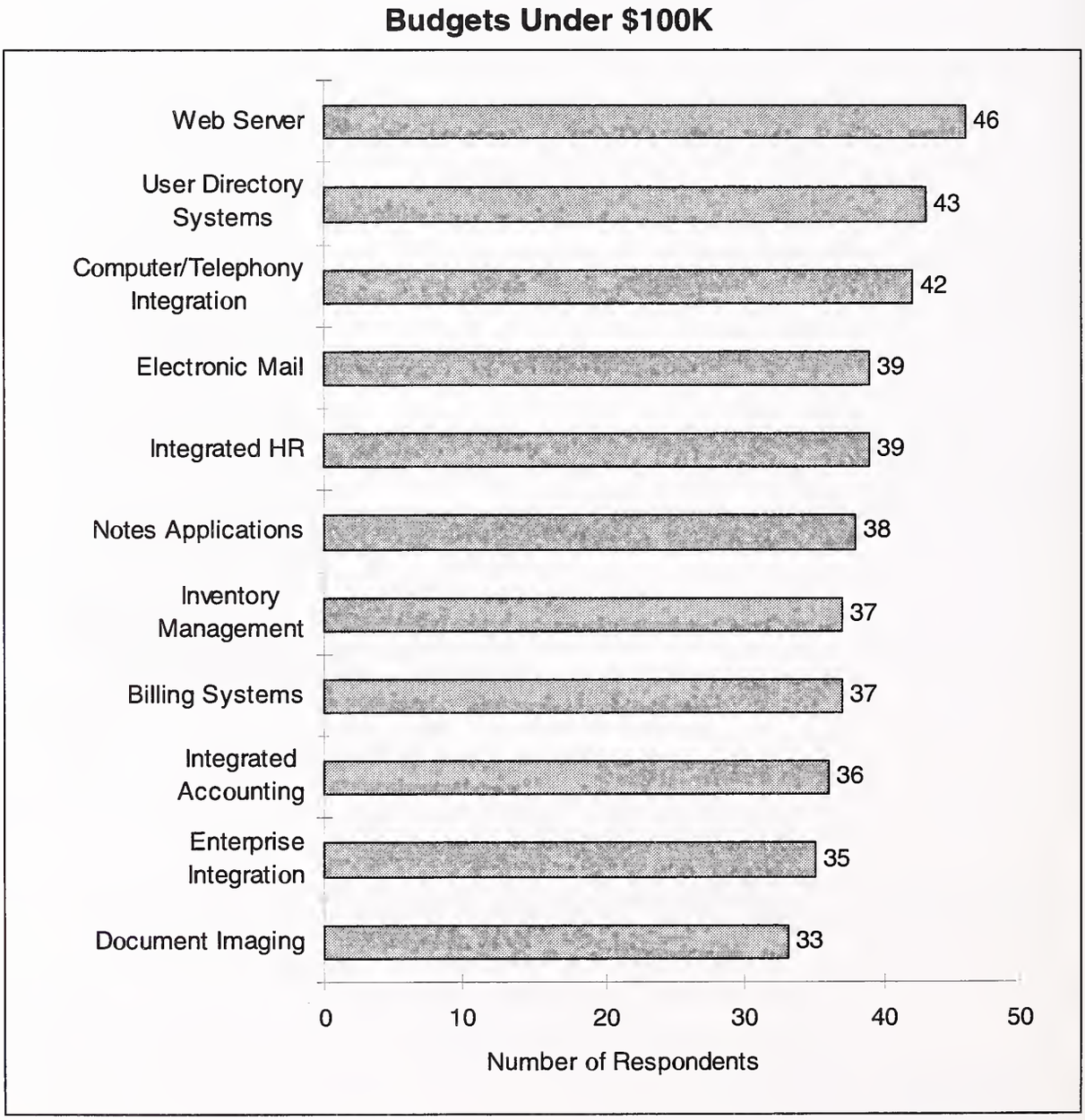
Source: INPUT

C. Comparison of Budget Sizes for Different Applications

The next series of exhibits shows the number of respondents implementing systems with a particular budget size. These are budgets for a particular application, regardless of technology. They include both C/S and non-C/S implementations.

Exhibit VII-14 shows the number of respondents implementing projects with budgets of less than $100K. This data suggests that there are many small pilot projects and that companies are supporting a small number of users with these applications. Web server applications are at the top of this list and much of the software for these applications may be free, with public domain Web server software and free browsers. Internal staff support costs are the major costs associated with the top two applications, Web servers and user directory systems.

Exhibit VII-14

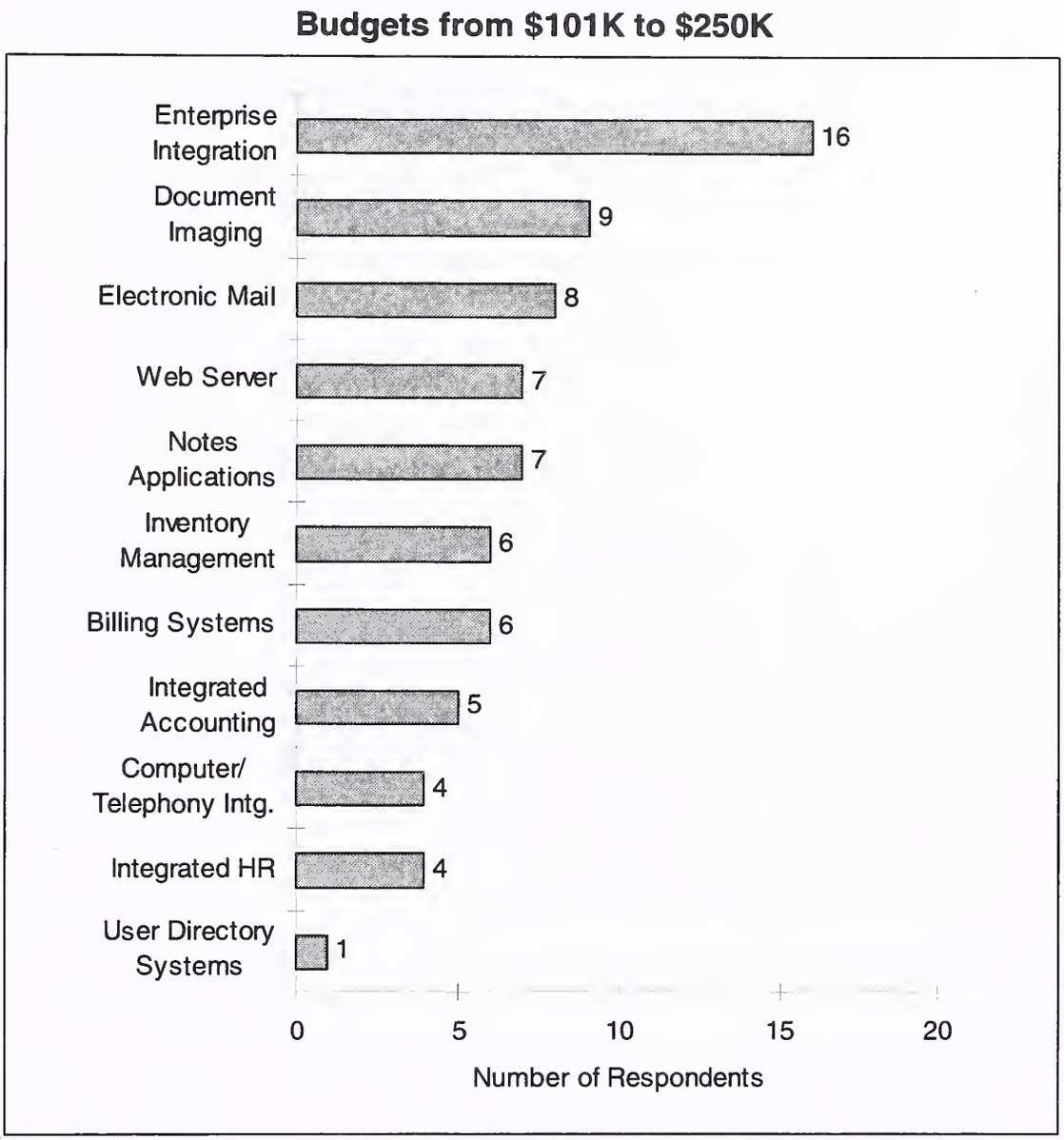


Source: INPUT

Exhibit VII-15 shows the number of respondents implementing projects with budgets from $101K to $250K. Here, enterprise integration is a popular

application, with a substantial portion of the budget going into programming services and integration.

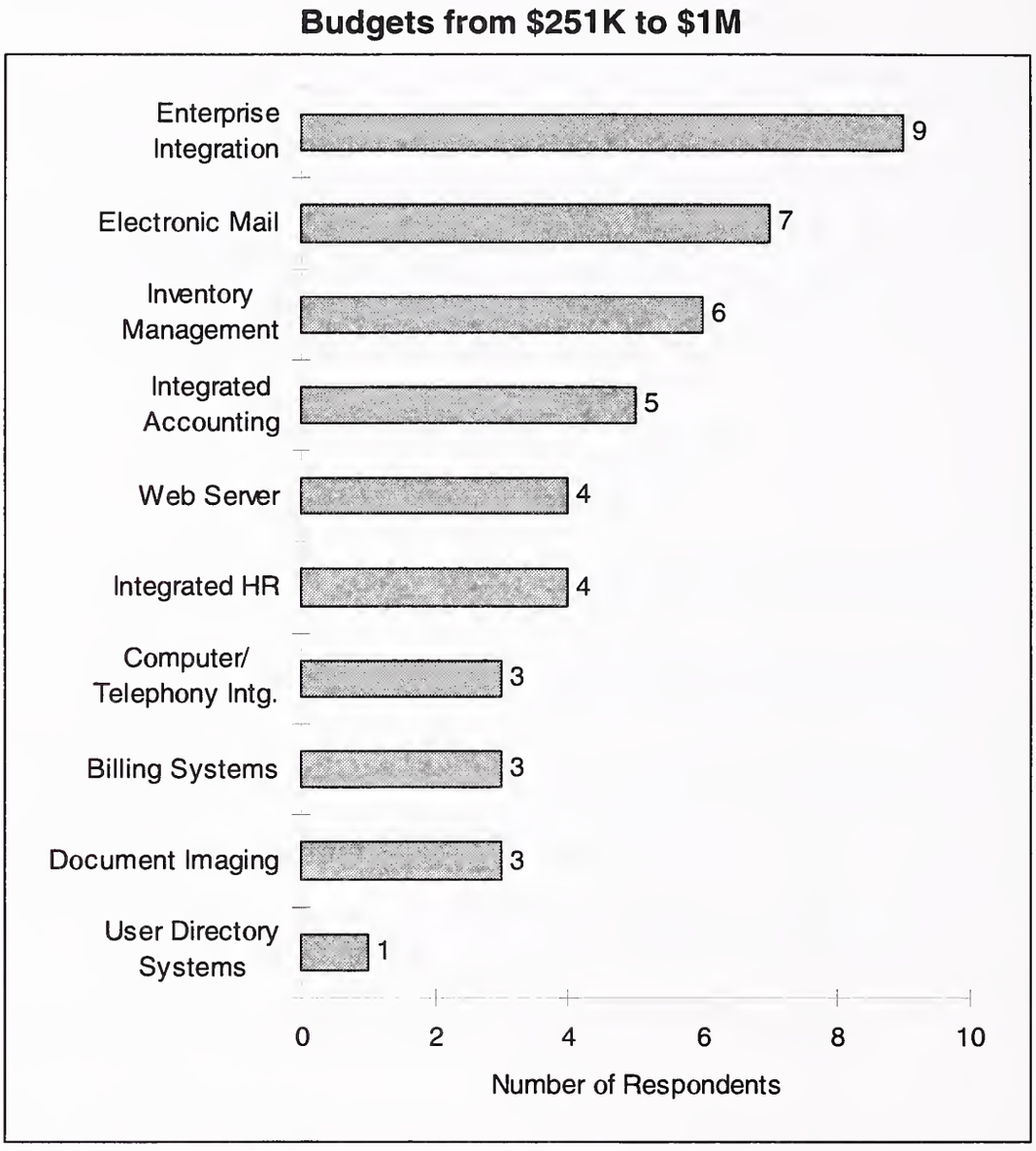
Exhibit VII-15



Source: INPUT

Exhibit VII-16 shows the number of respondents implementing projects with budgets from $251K to $1M. Again, enterprise integration is a key project.

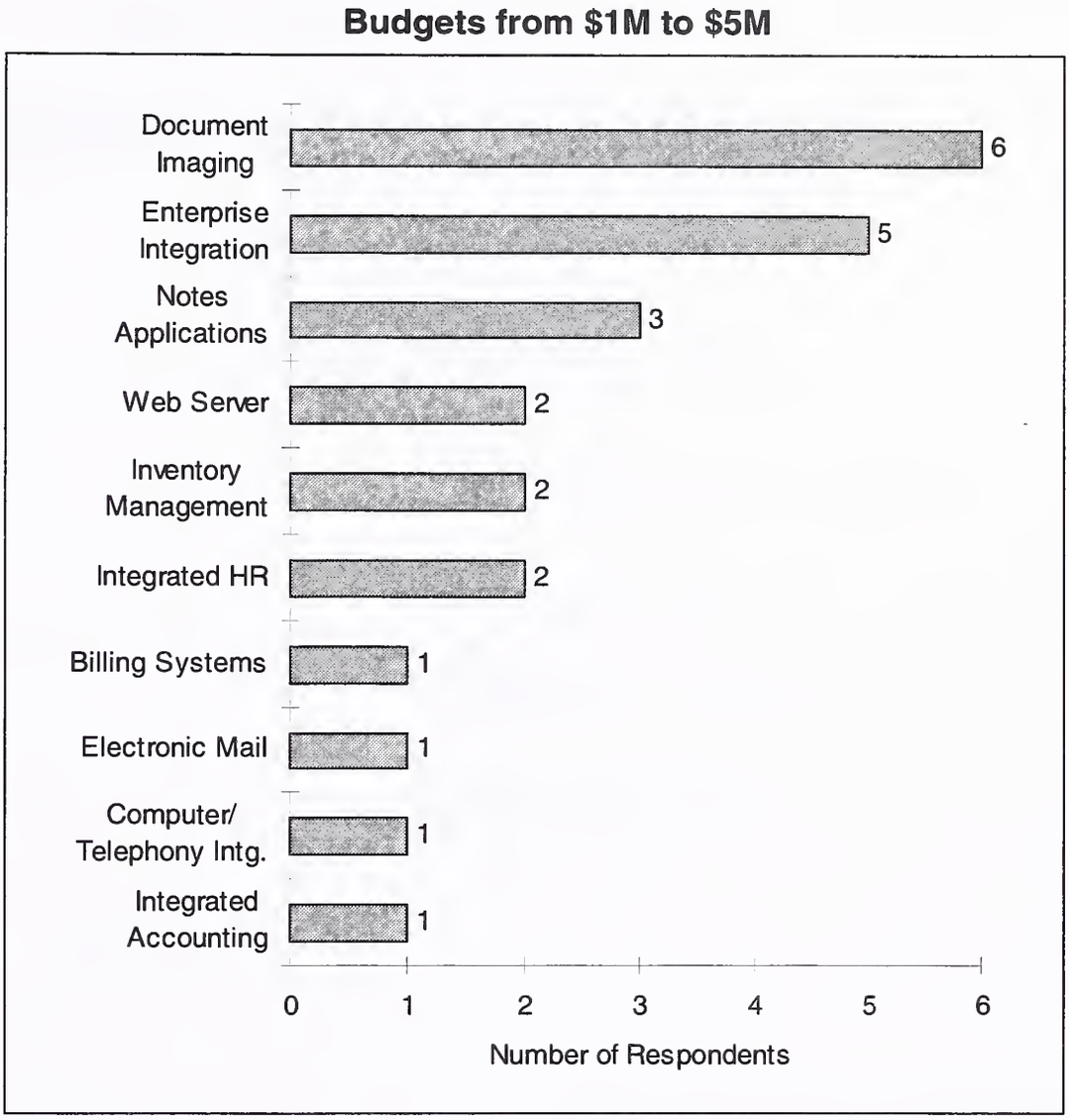
Exhibit VII-16



Source: INPUT

Exhibit VII-17 shows the number of respondents implementing projects with budgets from $1M to $5M. These are applications that are past the pilot stage and being more widely deployed. Document imaging is the top application, with enterprise integration following. Lotus Notes applications still have followers, mainly companies already committed to Notes who are expanding its use. Notes is under pressure from Internet-based databases and workflow applications, but its simple user interface, security and ability to organize data, at present, give it a competitive advantage.

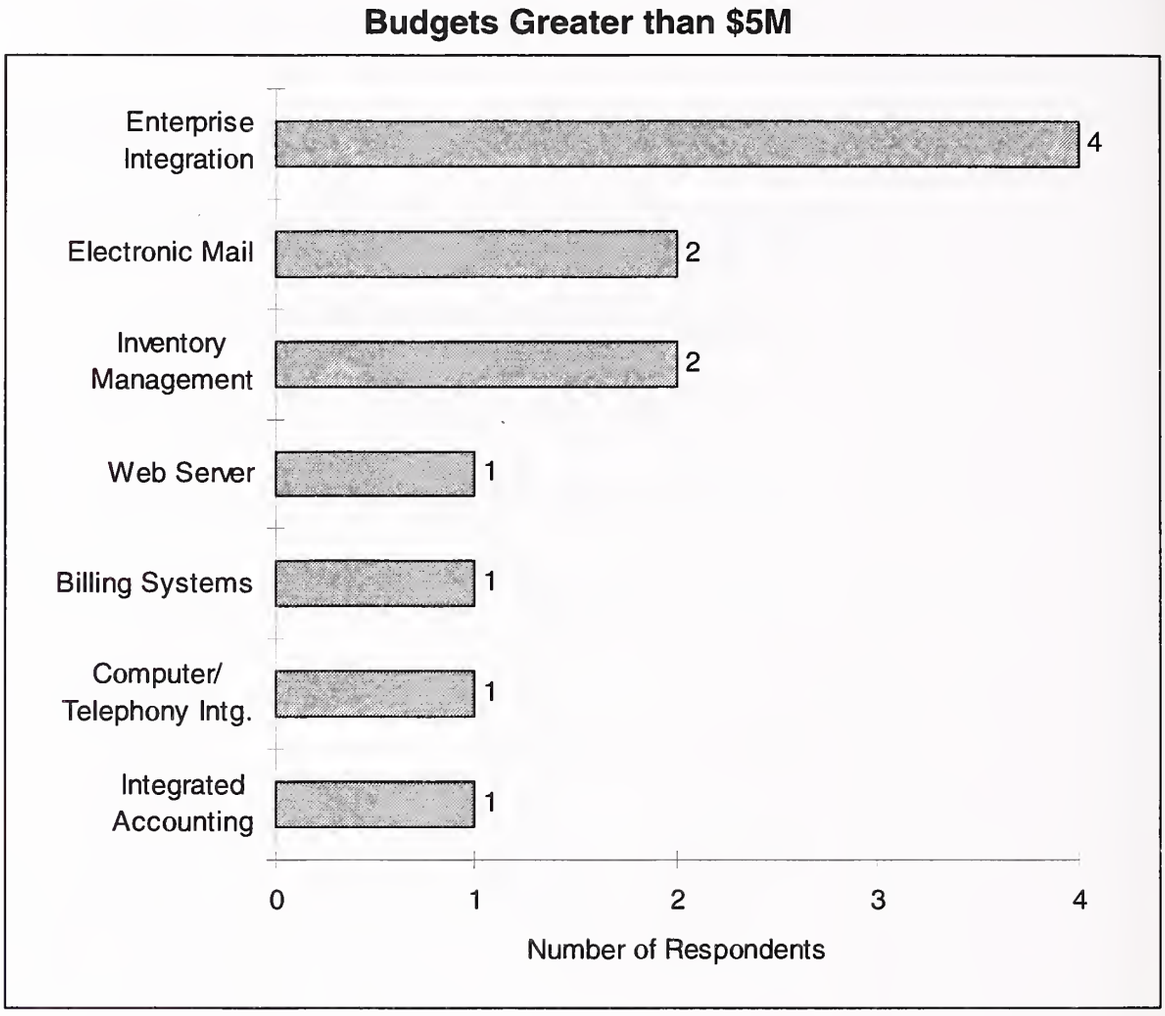
Exhibit VII-17



Source: INPUT

Exhibit VII-18 shows the number of respondents implementing projects with budgets of greater than $5M. There are few applications with such large budgets, as companies prefer to purchase incrementally. However, enterprise integration continues to be a popular application.

Exhibit VII-18

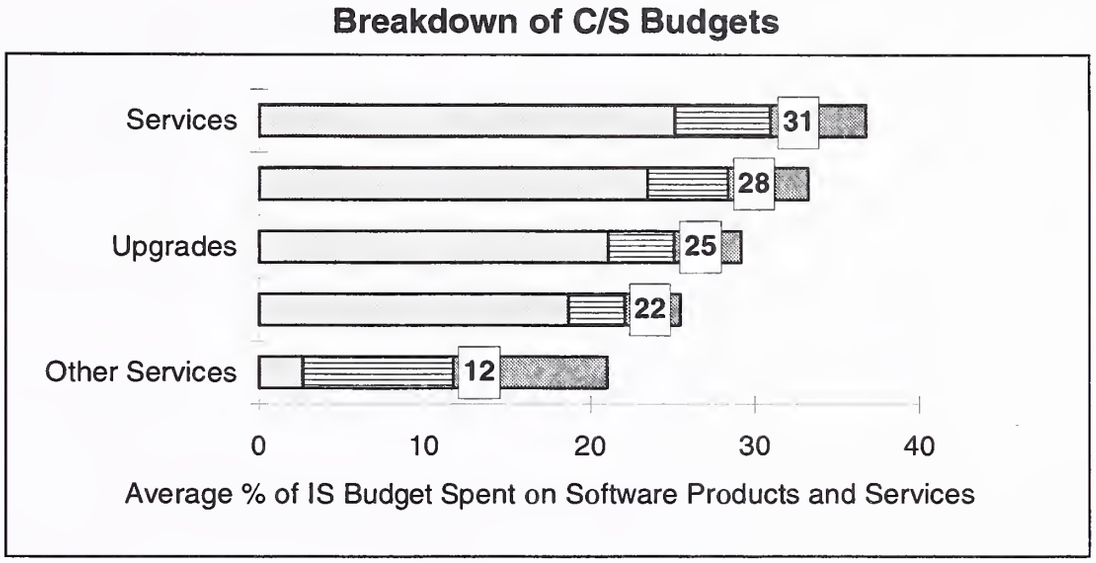


Source: INPUT

D. Breakdown of C/S Spending

Exhibit VII-19 shows the breakdown in C/S budgets. The chart shows the average percentage spent on each category of software or services by respondents. Because of variations in how budgets are spent, they do not add up to 100%. However a typical breakdown is 31% on services, 28% on applications software, 25% on upgrades, 22% on systems software and 12% on other services. Client/Server budgets are growing on average 20%, averaging over the 78 respondents who stated how much their client/server budget was growing.

Exhibit VII-19



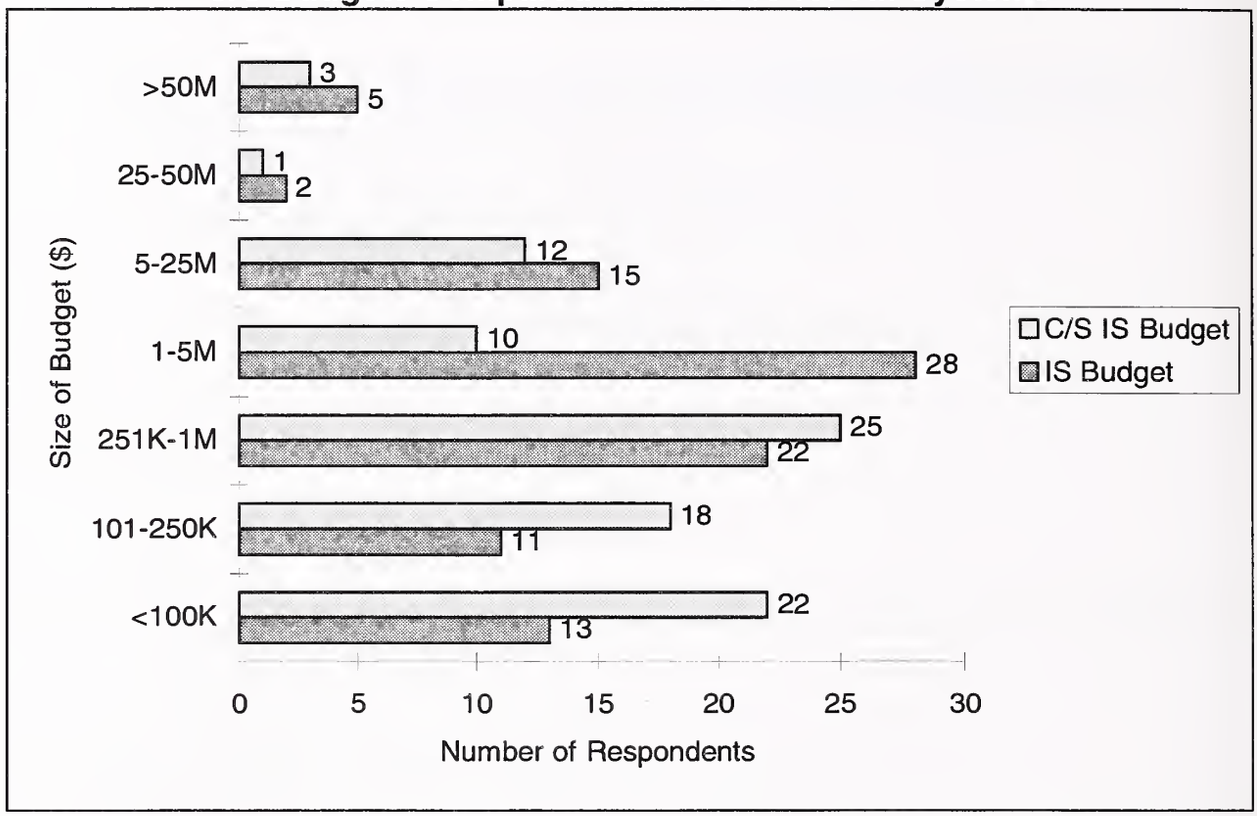
Source: INPUT

E. C/S Spending Compared with Spending for All Types of Systems

Users were asked how much they planned to spend on software and services for C/S systems and for all systems for which they had responsibility. Exhibit VII-20 shows the number of respondents at each budget level, comparing C/S budgets with budgets for all systems. In both cases, only the software and services budgets were recorded. For example, three respondents had C/S budgets over $50M and five had budgets for all their systems over $50M. Most respondents replied for their entire corporation, although a few answered on behalf of a site or department. These statistics are intended to give a salesperson an idea of the size of budgets found in typical user organizations.

Exhibit VII-20

C/S Budgets Compared with Those for All Systems



Source: INPUT

F. Applications Summary

In summary, the budgets for applications are relatively small compared with corresponding personnel budgets. Companies are gravitating toward applications like the Web and electronic mail, for which software investment is low and the gains in productivity are readily attainable. Companies must be careful that they are not trading investment in software for investment in the time of their own personnel. For Internet applications in particular, it may be hard to track budgets and spending on personnel, as people will develop applications as part of their job.

Enterprise integration, Web servers, inventory systems and electronic mail are strong areas of investment. In particular, integrating enterprise systems with the demand chain provides high growth and large opportunities for both software vendors and integrators.

Definitions

This section provides definitions of vocabulary used in the report. More definitions can be found in INPUT's *Definition of Terms*.

Agent	An agent is a set of instructions that can carry out tasks automatically. It is usually written in a high-level language script and may run across a network to send messages or find information.
API	Application programming interface—this provides specifications for programmers.
Client	When used in C/S it refers to the computer platform accessed by a user, such as a PC, workstation or PDA.
Client process	A process object initiating requests on another object. At the programming level, clients look at ORBs and object implementations through the perspective of a language mapping.
Client program	Any program initiating requests on another object. At the programming level, clients look at ORBs and object implementations through the perspective of a language mapping.
Component	Component refers to software component, a piece of software with documented interfaces that a programmer can use to build an application.
CORBA	Common Object Request Broker Architecture.

CORBA compliance	In compliance with the CORBA standard as defined by the OMG. To be determined as part of the X/Open branding program and a related OMG program called "Profiling."
CORBA 1-compliance	Objects on different platforms and networks can communicate across various platforms transparently using a single brand of ORB.
CORBA 2-compliance	Intended to enable objects on different platforms and networks to communicate transparently using different brands of ORBs. CORBA 2 accomplishes this by providing for two ORB interoperability schemes based on two different gateway message formats, called the General Inter-ORB Protocol (GIOP) and the Environment-Specific Inter-ORB Protocol (ESIOP).
Development Environment	Set of software used by programmers for developing applications that typically consist of compilers, debuggers, visual editors, profilers and performance optimizers.
Development Tools	Short for "application development tools".
Distributed System	A system that runs across multiple computers.
DLL	Dynamic Linked Library, a software component of precompiled code that can be linked into an application.
Dynamic Invoke Interface	Particular applications will work best if an object invocation is constructed at execution time, supplying information about the operation to be performed and the types of parameters being passed. The dynamic invoke interface provides this capability.
Ecash	Electronic cash, digital cash, a form of currency used to transact business over computer networks.
Environment-Specific Inter-ORB Protocol (ESIOP)	The first ESIOP gateway implementation defined is based on the OSF's Distributed Computing Environment (DCE) and others are likely for COM, Open Network Computing (ONC), etc. They would

	also use TCP/IP, OSI, IPX/SPX or another transport protocol, whose details would be masked by the higher level interface.
Framework	A specification or implementation of software that can be used to build an application. It may consist of classes and methods. Motif and the Common Object Request Broker Architecture (CORBA) are examples of frameworks.
Gateway	Software that connects one environment to another. It often translates formats and routes code from one application to another.
General Inter-ORB Protocol (GIOP)	The first GIOP gateway implementation is called the Internet Inter-ORB Protocol (IIOP) and is based on TCP/IP; IIOP is mandatory for CORBA 2, but it can be achieved by a native TCP/IP implementation as well as by a presumably less efficient bridge (i.e., in theory, it is not necessary to deploy TCP/IP stacks on every node). Other GIOPs will probably be developed to run on top of OSI or NetWare.
GUI	Graphical User Interface–a windowing system like Microsoft Windows or X-Windows with Motif that displays graphical objects on a display.
Implementation Respository	Lets the ORB locate and activate object implementations. Also can store additional information associated with implementation such as debugging information, administrative control, resource allocation, security, etc.
Interface Definition Language (IDL)	Defines object types by specifying their interfaces, a set of named operations, and the parameters of those operations.
Interface Repository	Provides persistent objects that represent the IDL information in a form available at run time. Lets a program determine which operations are valid on an object when it encounters an object with an unknown interface, and invoke that object.

Language Mapping	Provides flexibility in defining language-specific data types and procedure interfaces to access objects through the ORB. Different programming languages, both object-oriented and non-object-oriented, may prefer to access CORBA (or CORBA-compliant) objects in different ways, but the standard says that a particular language mapping to CORBA should be the same for all ORB implementations.
MacOS	The operating system for the Apple Macintosh.
Messaging	A general term that describes communication that stores and forwards information. It may also support queues of objects waiting for an event in a network. An example of messaging software is electronic mail or software that supports on-line information services.
Networked ORBs	Provide some set of or sets of language mappings and support multinode operation via either the IIOP, another GIOP, or an ESIOP. IIOP support based on TCP/IP is mandatory for an ORB to be termed CORBA compliant.
Object Management Architecture (OMA)	OMG architecture that specifies object language interfaces, Common Object Services Specifications (COSS), Common Facilities and a Common Object Request Broker Architecture (CORBA) specifications.
Object Request Broker (ORB)	OMG terminology for the message-based communications interface between objects; an ORB provides the mechanism by which objects transparently make requests of, and receive responses from, other objects. The term has become commonly accepted but not all products that perform these functions are called ORBs and not all ORBs meet OMG specifications.
Open systems	In this report it describes systems that can run on multiple UNIX and/or Windows operating systems, rather than proprietary environments like VMS (even Open VMS) or MVS (even with POSIX compatibility).

Operating Environment	Modern term for an operating system plus its application development tools.
ORB Interface	No matter which of the above interfaces makes sense in certain applications, basic operations, such as the operation that returns an object interface type, are common to all objects and are handled directly by the core via the ORB interface. There would probably be few of these common operations, but the standard's flexibility leaves that up to the development process.
OS	Operating system.
Platform	This is the software or hardware that an application program runs on.
POSIX	A standard for operating systems to ensure some level of portability of software code that runs on it. Standards are published by X/Open.
Program	The term is meant to include a wide range of possible constructs, including scripts, loadable modules, etc., in addition to the traditional definition of an application or utility.
RPC	Remote procedure call, an instruction given usually across a network to perform a remote function, such as a command associated with a server database or file.
Standalone ORBs	Function on single nodes with some set or sets of language mappings and gateway-oriented interoperability, if required.
Suites	Sets of applications or packages. Office suites typically consist of a word processor, a spreadsheet and a database or electronic mail package.
Telecommuting	Working at home while connected to an office computer.
URL	Universal Resource Locator - an address like htp://www.input.com for identifying resources on the World Wide Web.

Visual Development Tool	This is the software needed to build an application. It may include a visual editor, a forms designer, a report writer, a compiler, an interpreter, a debugger or a source code control system that enables programmers to share coding tasks.
Windows	Used in this report to refer to Microsoft's Windows if it starts with a capital letter. If it starts with a small letter it may refer to any software that controls the windows on a computer screen. A window may also be the window seen on a computer screen.
Workgroup	A group of three or more (typically less than 100) individuals who share work and collaborate on a network.

B

Vendor Names and Addresses

This chapter provides names and addresses of vendors and organizations tracked in INPUT's C/S program.

Vendors and Organizations

Exhibit B-1

Names and Addresses of Vendors

Company	Notes
America Online 8619 Westwood Center Vienna, VA 22182 Tel: 703-448-8700 Fax: 703-435-0275 info@aol.com http://www.aol.com	Offers Internet access. Leading on-line service with both business and consumer information. Software and services vendors may consider AOL to host their technical support. They may also consider information sources on AOL as part of their products or services.
Andersen Consulting 100 South Wacker Drive Chicago, IL 60606 Tel: 312-507-2900 Fax: 312-307-7965	Strong proponent of object technology for systems integration in diverse markets, especially manufacturing. Promoting demand chain management solutions using the Internet, SAP and other leading applications.
Apple Computer 20525 Mariani Avenue Cupertino, CA 95014 Tel: 408-996-1010 Fax: 408-996-0275	Focusing on client workstations for education, publishing, the Internet and multimedia solutions.

Exhibit B-1 (cont.)

Company	Notes
AT&T Global Information Solutions (was NCR) 1700 S. Patterson Boulevard Dayton, OH 45479 Tel: 513-445-5000 Fax: 513-445-4184	AT&T GIS is a leader in C/S high-end transaction processing systems, with a strong presence in retail and financial markets. It will spin off from parent AT&T in 1996.
Borland International 100 Borland Way Scotts Valley, CA 95066 Tel: 408-431-1000 Fax: 408-431-4123 http://www.borland.com	Leading provider of application development tools. Announced Latte as a development environment for the Internet. Delphi is a client/server development tool. Also markets Paradox and dBase databases.
Brio Technology, Inc. 650 Castro Street, Suite 500 Mountain View, CA 94041 Phone: 415-961-4110 Fax: 415-961-4572 info@brio.com http://www.brio.com	Strong in the cross-platform and Apple Macintosh markets with application development and business reporting tools. Brio provides a "drag and drop" query tool, created the first desktop multi-dimensional analysis product and today provides tools for user access to databases.
Bunyip Information 310 Ste. Catherine Street West Suite #300 Montreal, Quebec Canada H2X 2A1 Tel: 514-875-8611 Fax: 514-875-8134 frontdesk@bunyip.com http://www.bunyip.com	Has Canadian government application using agents to search the Internet. Developed Archie search technology for the Internet.
Business Objects 20813 Stevens Creek Blvd. Cupertino, CA 95014 Tel: 408-973-9300 Fax: 408-973-1075	C/S reporting and analysis tool. Originally a French company.
California Software, Inc. 2121 E. Pacific Coast Highway, Suite 120A Corona del Mar, CA 92625-1912 Tel: 714-729-4222 Fax: 714-729-4237 http://www.calsoft.com	Acquired by Stac for $10M in October 1995. Intelligent WWW browser, InterAp, using agents.

Exhibit B-1 (cont.)

Company	Notes
Compaq Computer Corporation 20555 State Hwy. 249 PO Box 692000 Houston, TX 77269 Tel: 713-374-0484 Fax: 713-374-1740 http://www.compaq.com	Leading vendor of Windows NT server machines that can be rack-mounted and run in multiprocessor configurations. Also markets systems management software.
CompuServe 5000 Arlington Center Rd Columbus, OH 43220 Tel: 614-457-8600 Fax: 614-457-0348 http://www.compuserve.com	Leading on-line service provider with high-quality technical support forums that some C/S vendors use to support their products. Also offers an Internet browser and server that supports Microsoft Exchange.
Computer Associates International 1 Computer Associates Plaza Islandia, NY 11788 Tel: 516-342-5224 Fax: 516-342-5329 http://www.cai.com	Leader in systems management tools and services. CA-Unicenter is its flagship C/S product. Some Windows NT software is licensed from ICL. Also licenses OODBMS from Fujitsu.
Compuware Corporation 31440 Northwestern Highway, Fl. 2 Farmington, MI 48334 Tel: 810-737-7300 Fax: 810-737-7108 http://www.compuware.com	Leader in midrange C/S systems management services and tools, including EcoTools, which supports a messaging backbone for agent-based systems management.
Crystal , a Seagate Company 3873 Airport Way, P.O. Box 9754 Bellingham, WA 98227 Tel: 604-681-2934 Fax: 604-681-7163 http://www.seagate.com/software/crystal	Has agreement with Microsoft for reporting.
Digital Equipment Corporation 110 Spitbrook Road Nashua, NH 03062 Tel: 603-881-1894 Fax: 603-881-2790 http://www.digital.com	Digital bridges the UNIX, Windows NT, PC and proprietary Open VMS architectures with its enterprise platforms. It is strong in connectivity and messaging technologies.
Dynasty Technologies 500 Technology Drive Naperville, IL 60563 Tel: 708-355-8300 Fax: 708-355-9345	Enterprise application development tool vendor.
Forté Software Harrison Street, Floor 15 Oakland, CA 94612 Tel: 510-834-1501	Forté is successfully marketing its cross-platform enterprise development environment that enables applications to be partitioned across different clients and servers.

Exhibit B-1 (cont.)

Company	Notes
Four Seasons Software, Inc. 2025 Lincoln Highway Edison, NJ 08817 Tel: 908-248-6667 Fax: 908-248-6675 http://www.4seasons.com	Enterprise cross-platform application development tool based on powerful 4GL and SuperNOVA distributed application development environment.
GE Information Services (GEIS) 410 North Washington Street Rockville, MD 20850 Tel: 301-340-4000 Fax: 301-340-4240 http://www.geis.com	On-line service provider for electronic commerce. Offers a wide range of services, such as news feeds. Also provides private-label networks.
General Magic 420 North Mary Avenue Sunnyvale, CA 94086 Tel: 408-774-4000 Fax: 408-774-4010 http://www.genmagic.com	Developer of Magic Cap object-oriented operating system and Telescript distributed object language.
Gupta Corporation 1060 Marsh Road Menlo Park, CA 94025 Tel: 415-321-9500 Fax: 415-321-5471 http://www.gupta.com	Focusing on increasing the capabilities of its application development tools to make them more scalable to larger environments. Also supporting remote and mobile users.
Hewlett-Packard 19310 Pruneridge Avenue Cupertino, CA 95014 Tel: 408-447-4042 Fax: 408-447-5809 http://www.hp.com	HP has a complete line of C/S systems and services, from PCs to workstations to enterprise servers. It is particularly strong in third- party software relationships and systems management. It also is strong in development tools and objects.
Hitachi Computer Products (America) 437 Madison Ave., 21st Floor New York, NY 10022 Tel: 212-751-6302 FAX: 212-751-6368 http://www.hitachi.com	This division of leading technology supplier, Hitachi, has begun to market its OT capability with a concentration on its application in OLTP.
Hyperion Software (was IMRS) 777 Long Ridge Road Stamford, CT 06902 Fax: 203-322-3904 http://www.hysoft.com	Best-of-breed solutions vendor for C/S financial analysis and accounting software.
IBM Corporation 1 Old Orchard Rd. Armonk, NY 10504 Tel: 914-765-1900 Fax: 914-765-4190 http://www.ibm.com	Leading C/S enterprise systems vendor. IBM was an early leader in object technology implemented into the OS/400 operating software. SOM debuted with OS/2 and has been or is being ported to all IBM operating environments.

Exhibit B-1

Company	Notes
ICL Enterprises North America 11490 Commerce Park Drive Reston, VA 22091 Tel: 703-648-3300 Fax: 703-648-3380 http://www.icl.com	ICL is a leading European hardware and systems software supplier that has taken an early position in object-based products.
Illustra Information Technologies 1111 Broadway 20th Floor Oakland, CA 94607 Tel: 510-652-8000 http://www.illustra.com	Successfully transitioned from being a technology vendor of ORDBMS technology to being an Internet solutions supplier with an innovative database for storing multimedia, hyperlinked documents.
Information Builders 1250 Broadway, 38th Floor Manhattan, NY 10001 Tel: 212-736-4433 Fax: 212-967-6406 http://www.ibi.com	Leading middleware (EDA/SQL) and 4th-generation language (Focus) vendor. Making strong thrust into data warehousing market.
Informix Software 4100 Bohannon Drive Menlo Park, CA 94025 Tel: 415-926-6300 Fax: 415-926-6593 http://www.informix.com	Leading database vendor, strong in parallel servers and UNIX markets. Strong VAR program.
Intel Corporation P.O. Box 58119 Santa Clara, CA 95052 Tel: 408-765-8080 Fax: 408-765-1821 http://www.intel.com	Leading microprocessor vendor. Also markets PC boards and supercomputers.
Intuit 155 Linfield Drive Menlo Park, CA 94025 Tel: 415-322-0573 Fax: 415-852-0155 http://www.intuit.com	Developing on-line transaction service to pay bills on line. Targeting personal and small business markets. Example of a small business vendor with a simple solution.
Ki NETWORKS, Inc. 6760 Alexander Bell Drive Columbia, MD21046 Tel : 410-290-0355 Fax: 410-290-0397 http://www.ki.com	Provides network management solutions for Digital's Netview and HP's OpenView. Working with Sun, IBM, Apple, HP, Digital and others to provide Common Agent technology to bridge both SNMP and Desktop Management Interface environments for network monitoring.

Lockheed Artificial Intelligence Center (Lockheed Martin) c/o LMSC Orgn. 24-01, Bldg. 101 1111 Lockheed Way Sunnyvale, CA 94089-3504 Tel: 408-742-6688 Fax: 408- 743-2239 http://hitchhiker.space.lockheed.com/aic/	Undertakes research on agent technology and massive systems.

Exhibit B-1

Company	Notes
Lotus Development Corporation 55 Cambridge Parkway Cambridge, MA 02142 Tel: 617-577-8500 Fax: 617-225-1213 http://www.lotus.com	Acquired by IBM for Notes and distributed messaging architecture.
MCI 780 Johnson's Ferry Rd. Atlanta, GA 30342 Tel: 404-250-5500 Fax: 404-250-5591 http://www.mci.com	Providing on-line services for the Internet. Also acquired SHL Systemhouse, a leading systems integrator and outsourcing vendor for C/S solutions.
Microsoft Corporation 1 Microsoft Way Redmond, WA 98052 Tel: 206-882-8080 Fax: 206-936-7329	Leader of the desktop environment with Windows and the OLE 2 standard for interconnecting applications. Extending its technology into the enterprise server arena is Microsoft's challenge.
Microware 1900 N.W. 114th Street Des Moines, IA 50325-7077 Phone: 515-224-1929 Fax: 515-224-1352 Internet: info@microware.com http://www.microware.com	Develops OS/9 and David operating environments. Possible candidate for operating environment for Internet appliances.
Netscape 501 E. Middlefield Rd. Mountain View, CA 94043 Tel: 415-254-1900 Fax: 415-528-4124 http://www.netscape.com	Leading supplier of Web browser and server software. May challenge established database vendors with Web servers. Challenges development tool vendors with Internet-compatible solutions.
NeXT Computer, Inc. 900 Chesapeake Dr. Redwood City, CA 94063 Tel: 415-366-0900 Fax: 415-780-3714 http://www.next.com	NeXT offers its Portable Distributed Objects (PDO) object model and the Enterprise Objects Frameworks products under the banner of NEXTSTEP, a cross-platform development and run-time system for three-tier applications.
nCube 919 E. Hillsdale Blvd. Suite 200 Foster City, CA 94404 Tel: 415-593-9000 Fax: 415- 508-5408	Specialized hardware for video servers and highly optimized database queries. Parallel machines.
Novell 122 E 1700 South Provo, UT 84606 Tel: 801-429-7000 Fax: 801-377-9353 http://www.novell.com	Novell aims to be a leader in network services such as directories, addressing, transaction management and network administration.

Exhibit B-1 (cont.)

Company	Notes
Open Market 245 First Street Cambridge, MA 02139 Tel: 617-621-9500 Fax: 617-621-1703 http://www.openmarket.com	Provides secure Web server, Netscape is a competitor. Also provides electronic commerce services.
Oracle Corporation 500 Oracle Parkway Redwood Shores, CA 94065 Tel: 415-506-7000 Fax: 415-506-7151 http://www.oracle.com	Leading database vendor with Developer/2000 development tools and various object-oriented solutions, including Power Objects. Oracle will increase its presence in vertical client/server applications. It also aims to reduce systems integration effort by packaging solutions for branch offices and workgroups.
Palindrome Corporation 600 East Diehl Road Naperville, IL 60563 Tel: 708-505-3300 Fax: 708-505-7917 http://www.palindrome.com	Provides LAN storage management software.
ParcPlace-Digitalk 999 E. Arques Ave. Sunnyvale, CA 94086 Tel: 408-481-9090 Fax: 408-481-9095 http://www.parcplace.com	The August 1995 merger of ParcPlace and Digitalk combines two companies with synergistic OT product capabilities on UNIX and Windows systems, respectively. Visual Smalltalk from Digitalk and Visual Works from ParcPlace are application development tools for Smalltalk environments and client/server programming.
PeopleSoft 1331 N. California Blvd. Walnut Creek, CA 94596 Tel: 510-946-9460 Fax: 510-946-9461 http://www.peoplesoft.com	Leader in C/S HR software that has led to accounting and manufacturing C/S solutions.
Platinum Technology 1815 S. Meyers Rd. Oakbrook Terrace, IL 60181 Tel: 708-620-5000 Fax: 708-691-0707 http://www.platinum.com	Many tools to support databases, including DB2 and other common platforms. Entering the data warehouse and business reporting tools area.
Powersoft 561 Virginia Road Concord, MA 01742 Tel: 617-229-2200 Fax: 617-272-9076 http://www.powersoft.com	A Sybase subsidiary. Developing more scalable versions of its PowerBuilder and PowerMaker application development tools. Also markets Watcom database. Vulnerable to new products from Spider Technologies for the Internet, but agile enough to react positively.
Prodigy Interactive Services Corp. 445 Hamilton Avenue White Plains, NY 10601 Tel: 914-448-8000 Fax: 914-448-8083 http://www.prodigy.com	Prodigy is a leading interactive services corporation. Recently, it has increased its marketing efforts to the business community, where it has lost out to CompuServe and America Online.

Exhibit B-1 (cont.)

Company	Notes
Red Brick Systems 485 Alberto Way Los Gatos, CA 95032 Tel: 408-399-3200 Fax: 408-399-3277 http://www.redbrick.com	Leader in databases for large, sparsely populated databases. Used for analyzing consumer buying preferences in retailing and consumer products companies.
RSA Data Security 100 Marine Parkway Redwood City, CA 94065 Tel: 415-595-8782 Fax: 415-595-1873	Leader in public key cryptography. Technology is incorporated in other products.
The Santa Cruz Operation (SCO) 400 Encinal Street Santa Cruz, CA 95060 Tel: 408-425-7222 Fax: 408-458-4227 http://www.sco.com	Leading independent vendor of UNIX operating system and UNIX software products. Provides affordable platform for branch offices and small organizations.
SAP America, Inc. 300 Stevens Drive Philadelphia, PA 19113 Tel: 610-521-4500 Fax: 610-521-4500 http://www.sap.com	SAP's R/3 is a leading integrated enterprise C/S application, with success in multinational and smaller firms. SAP is particularly strong in high-technology manufacturing markets and the oil and gas industry
Silicon Graphics (SGI) 2011 N. Shoreline Blvd. Mountain View, CA 94043 Tel: 415-960-1980 Fax: 415-961-0595 http://www.sgi.com	Leader in 3-D workstations and high-performance servers. Servers are used for the WWW and supercomputing as well as databases and 3-D support. Entering data mining market.
Spider Technologies 1054 Elwell Court Palo Alto, CA 94003 Tel: 415-969-6665 Fax: 415-969-6883 http://www.3wspider.com	Emerging supplier of development tools for Internet applications.
Sprint International 12490 Sunrise Valley Drive Reston, VA 22096 Tel: 703-689-6000 Fax: 703-689-5176 http://www.sprint.com	Leading telecommunications vendor supplying Internet access and connectivity for virtual LANs.
Spyglass Naperville Corporate Center 1230 Diehl Road, #304 Naperville, IL 60563 Tel: 708-505-1010 Fax: 708-505-4944 http://www.spyglass.com	Internet software vendor. Also provides data analysis tools.

Exhibit B-1 (cont.)

Company	Notes
Sterling Software 4600 Lakehurst Court Dublin, OH 43017 Tel: 614-973-7000 Fax: 614-793-7092 http://www.sterling.com	Provides electronic commerce software and services. Also has other divisions providing mainframe software for systems management, storage and applications development.
Sun Microsystems 2550 Garcia Avenue Mountain View, CA 94043-1100 Tel: 415-960-1300 Fax: 415-969-9131 http://www.sun.com	Scalable computing systems from workstations, including notebooks, to servers based on SPARC microprocessors and the Solaris OS.
SunSoft 2550 Garcia Avenue Mountain View, CA 94043-1100 Tel: 415-960-3200 Fax: 415-336-0362 http://www.sun.com/sunsoft	SunSoft has a leading position in distributed UNIX computing that it can leverage. NEO is Sun's distributed object environment and toolset that uses NeXT's OpenStep software. SunSoft provides the Solaris operating system for Intel platforms, as well as SPARC, and Solstice systems management software as well as application development tools.
Sybase 6475 Christie Avenue Emeryville, CA 94608 Tel: 800-879-2273 Fax: 510-658-9441 http://www.sybase.com	Application development tools, middleware and databases are Sybase's main products. Sybase has several subsidiaries, including Micro Decisionware and Powersoft. The Sybase 11 database is emerging, which should improve scalability and performance.
Symantec Corporation 10201Torre Avenue Cupertino, CA 95014 Tel: 408-253-9600 Fax: 408-253-4092 http://www.symantec.com	Developer of application development tools and compilers, as well as systems management tools, such as Norton Utilities. Also sells ACT sales and marketing software. Entering workgroup C/S market.
Verity 1550 Plymouth Street Mountain View, CA 94043 Tel: 415-960-7600 Fax: 415-960-7698 http://www.verity.com	Provides Web server for full text documents. Provides search and retrieval software.

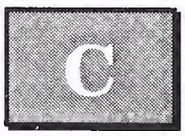
B. Names and Addresses of Organizations

This section gives leading C/S consortia and standards organizations.

Exhibit B-2

Names and Addresses of Organizations

Company	Notes
Component Integration Laboratories, Inc. P.O. Box 61747 Sunnyvale, CA 94008 Tel 408-864-0300 Fax: 408-864-0380	CI Labs is a nonprofit organization founded by IBM, Apple, Novell, WordPerfect, SunSoft, Taligent and the XSoft division of Xerox to develop and promote the OpenDoc architecture.
The Object Management Group 492 Old Connecticut Path Framingham, MA 01701, U.S.A. Tel: 508-820-4300 http://www.omg.org	The OMG was founded in 1989 by a core group that included Hewlett-Packard, Data General, American Airlines, and 10 other companies specifically interested in promoting object-technology standards. It has a close working relationship with X/Open. It has also managed to attract major user organizations, telecommunications vendors and systems integrators.
Object Database Management Group 13504 Clinton Place Burnsville, MN 55337 Tel 612-953-7250 Fax 612-397-7203 http://www.odmg.org	The ODMG was formed to create one standard interface that all object-oriented database vendors could support. The objective is application portability, as opposed to interoperability.
Open Software Foundation (OSF) 11 Cambridge Center Cambridge, MA 02142 Tel: 617-621-7300 Fax: 617-621-8700 http://www.osf.org	Recently announced Internet products for the World Wide Web. Currently undergoing a management transition.



User Questionnaire

This appendix provides the user questionnaire for the 110-person survey.

User Questionnaire

1. What organization do you represent?
   Corporate/Departmental IS/User Department
2. Would you please rate the following client software platforms in order of importance to you over the next 5 years for your PCs or workstations. Only rate those that you plan to use on a scale of 1 to 5, where 1=least important, 5=most important. It is assumed when you select a product that you will upgrade to its successors over time.

   ___ Apple MacOS
   ___ Microsoft Windows NT
   ___ NEXTSTEP/OpenStep
   ___ UNIX - Digital UNIX
   ___ UNIX - HP-UX
   ___ UNIX - IBM AIX
   ___ UNIX - SCO
   ___ UNIX - Silicon Graphics
   ___ UNIX - Sun Solaris
   ___ UNIX - Other
   ___ Other

3. Would you please rate the following server software platforms in order of importance to you over the next 5 years. Only rate those that you plan to use on a scale of 1 to 5, where 1=least important, 5=most important. It is assumed when you select a product that you will upgrade to its successors over time.

_____ Apple MacOS
_____ Microsoft Windows NT
_____ NEXTSTEP/OpenStep
_____ UNIX - Digital UNIX
_____ UNIX - HP-UX
_____ UNIX - IBM AIX
_____ UNIX - SCO
_____ UNIX - Silicon Graphics
_____ UNIX - Sun Solaris
_____ UNIX - Other
_____ IBM-Compatible Mainframe
_____ Digital OpenVMS
_____ Other

4. On a scale of 1 to 5, would you give your reaction to the following advantages of C/S computing; 1=strongly disagree, 5=strongly agree.

Easier user training	No opinion/1 2 3 4 5
Can combine jobs	No opinion/1 2 3 4 5
Can run off-the-shelf software package	No opinion/1 2 3 4 5
Lower maintenance costs	No opinion/1 2 3 4 5
Can reprogram system easily	No opinion/1 2 3 4 5
Many users can access the same info	No opinion/1 2 3 4 5
Users can communicate faster	No opinion/1 2 3 4 5
Better communications with suppliers	No opinion/1 2 3 4 5
Better communications with customers	No opinion/1 2 3 4 5
Other	No opinion/1 2 3 4 5

5. On a scale of 1 to 5, would you give your reaction to the following disadvantages of C/S computing; 1=strongly disagree, 5=strongly agree.

Slow response times for users	No opinion/1 2 3 4 5
Unreliable network	No opinion/1 2 3 4 5
Hard to integrate with existing systems	No opinion/1 2 3 4 5
Expensive to support upgrades on PCs	No opinion/1 2 3 4 5
Security weaknesses	No opinion/1 2 3 4 5
Costs are higher than expected	No opinion/1 2 3 4 5
Communication between IS and users poor	No opinion/1 2 3 4 5
Standards are not mature enough	No opinion/1 2 3 4 5
Cannot get senior management to invest sufficiently in new systems	No opinion/1 2 3 4 5
Other	No opinion/1 2 3 4 5

6. Approximately how big is your budget for software and services, including IT consulting, IT training, programming services and systems integration? Please exclude hardware figures; if this is not possible, say so.

   Don't know/Has no budget/0-100K/101K-250K/251K-1M/1M-5M/5M-25M/25M-50M/>50M

7. Approximately how big is your budget for all client/server software and services, including IT consulting, IT training, programming services and systems integration? Please exclude hardware figures; if this is not possible, say so.

   Don't know/Has no budget/0-100K/101K-250K/251K-1M/1M-5M/5M-25M/25M-50M/>50M

8. What percentage of your budget for client/server applications is spent on the following:

   Maintenance and upgrades _____
   Packaged applications software _____
   Packaged systems software _____
   Contract programmers, systems integrators or professional services
   Other _____

9. Approximately how much does your organization expect to spend on software and services for each of the following in 1996? What will be your three most important expenditures? Will any of these be for C/S systems? Indicate in the last column if the system is implemented with a C/S architecture.

System	Budget Size for 1996 $U.S.	Rank 1/2/3	C/S Y/N
Integration of Enterprise Systems	<100K/101-250K/251K-1M/1M-5M/>5M	___	___
Integrated Accounting	<100K/101-250K/251K-1M/1M-5M/>5M	___	___
Integrated HR	<100K/101-250K/251K-1M/1M-5M/>5M	___	___
Inventory Management	<100K/101-250K/251K-1M/1M-5M/>5M	___	___
Computer/Telephony Integration	<100K/101-250K/251K-1M/1M-5M/>5M	___	___
Lotus Notes Applications	<100K/101-250K/251K-1M/1M-5M/>5M	___	___
Electronic Mail (not Lotus Notes)	<100K/101-250K/251K-1M/1M-5M/>5M	___	___
Document Imaging System	<100K/101-250K/251K-1M/1M-5M/>5M	___	___
Billing System	<100K/101-250K/251K-1M/1M-5M/>5M	___	___
User Directory System	<100K/101-250K/251K-1M/1M-5M/>5M	___	___
Internet World Wide Web Server	<100K/101-250K/251K-1M/1M-5M/>5M	___	___
Other	<100K/101-250K/251K-1M/1M-5M/>5M	___	___
Other	<100K/101-250K/251K-1M/1M-5M/>5M	___	___
Other	<100K/101-250K/251K-1M/1M-5M/>5M	___	___

10. For the above, was the budget for:
    a) the entire company, worldwide
    b) all U.S. systems
    c) all systems at your site
    d) all systems in your department

11. On average, how much will your budget for C/S software and services increase from 1995 to 1996?

    Not increased/0%/0-10%/10-20%/20-30%/30-50%/50-100%

12. Which applications are you likely to run with text-based user interfaces on terminals or PCs used as terminals for the next three years?

13. (a) Do you have non-UNIX-based mainframes (e.g., IBM-compatible mainframes running MVS) or minicomputers with proprietary operating systems (e.g., VMS) running applications? YES/NO

    (b) If YES, when do you expect to replace these with machines running more modern software architectures such as UNIX or Windows NT? Never/in 1995/in 1996-7/in 1998-2000

14. Are you addressing or planning to address turn-of-the-century problems, for example in application software programs that cannot handle the date 1/1/2000? YES/NO
    If YES, will you use internal programmers or bring in external resources? INTERNAL/EXTERNAL

15. Do you still use COBOL programmers? YES/NO
    If YES, approximately how many are employees and how many are consultants?
    If YES, when do you expect to replace them with programmers that use more modern languages?
    Never/in 1995/in 1996-7/in 1998-2000

In addition, user demographic information on company size, industry, SIC code and number of employees was collected.