

Schussel's

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Which is Mightier: The Pen or The Keyboard?

by Ed Yourdon

pen-based computer provides new forms of input in addition to, or instead of, the conventional keyboard. What results is a computing environment with new methods of input, and as a result, new interfaces. For example, most pen computers will have neither a cursor on the screen, nor a mouse on the desk.

Pen-based computing is very different from what we've come to expect from today's computers. It will involve the concept of ink splashed on the screen as data, in addition to the data forms we are accustomed to dealing with such as text, graphics, and numeric information. As a result,

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Sybase and Novell: Database Ninjas or the Odd Couple?

In June, Sybase confirmed rumors several months old by making the formal

announcement that they will be delivering a NetWare version (NLM) of SQL Server. This was an important announcement for Sybase and Novell, as well as database users in general:

Novell— For Novell, this event was significant in that Sybase has now joined the ranks of Oracle and Gupta in adding to the list of database server platforms available in the NetWare environment. This addition supports the industry prediction that NetWare is

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Interview with Peter Burrows, Director of Corporate IS, Foxboro Corporation

Peter Burrows, Director of Corporate IS at Foxboro Corporation, located in Foxboro, Massachusetts, has been the head of a massive downsizing effort over the past four years. In business for more than 80 years, Foxboro Corp., a process control instrumentation and system supplier, currently supports plants and engineering centers in more than 16 countries with sales offices in over 80 locations, and a staff of approximately 4500 employees. Foxboro Corp. provides extensive engineering services — close to 50% of all employees are engineers. Therefore, their IS department needs to provide high performance workstations with the

capability of information sharing.

Foxboro Corp. is now in the last year of a five year downsizing program. They have invested approximately \$14 million in both new hardware and software and have replaced almost every computer system. As a result of their streamlining and modernization, Foxboro Corp. has already shaved more than \$10 million each year from their IS budget.

This year, Foxboro Corp. won the Interop Award, as well as Communication Week's First Annual Open Excellence Award. It shows that their hard work is paying off. *SDJ* interviewed Peter Burrows to find out what prompted their downsizing efforts, as well as what went on behind the scenes.

GS: What provided the impetus for downsizing your systems?

Back in 1986 we were planning for the introduction of a new product line. As we looked towards introducing the product, we called into question whether or not we had the correct support systems for the production of a new line which included the building of a new manufacturing plant. We

used the opportunity to examine and determine the most efficient way to design, build, and market this new product.

We also needed to reduce the company's overhead. We had already restructured the organization and weren't doing well financially. Being an old-fashioned New England (read as conservative) company, we had a high head count and serious overhead issues to address. But what finally turned our heads towards IS was that Foxboro Corp.'s financial reporting was neither timely nor accurate enough for a company of our size. In doing a systems assessment, the auditors rated Foxboro Corp.'s computer systems as a two on a ten point scale. So the decision was made to do something about it.

GS: At what level was this decision made?

It was done at the board level. In addition, there was external input from auditors participating in a general review of our systems. We initially set out on a four month program to identify what was needed to bring our information systems up to speed and how much it would cost. The five year

program that was eventually designed was approved in a board meeting in August, 1987 and consisted of approximately 150 specific projects.

GS: Give us a general description of Foxboro Corp.'s new computing systems.

Foxboro Corp. has almost sixty servers up and running. This includes several HP mini-computers, one IBM mainframe, and two dozen DEC machines. We also have three DEC 5500s working as NFS servers, each supporting 600 PCs. In addition, we have SUN machines working as servers. We consider all of our mainframes and mini-computers to be servers. Concerning server applications, our IBM server is running traditional accounting and payroll applications. Most of our Hewlett Packards use MPE or MPEXL.

Currently in the Foxboro area, we have six primary campus buildings. In those main buildings there exist approximately 2500 PCs functioning as clients. In addition, we have approximately 200 dumb-terminal workstations, but that number is diminishing rather quickly. Today, we support ten different operating systems — four of which are flavors of UNIX.

Our connectivity scheme is not a typical LAN environment. You will find very little Novell at Foxboro, except on our larger servers where we have found Novell to be the most productive. All communications are handled with standard menus through NFS. TCP/IP and NFS are the basic underlying transport protocols. Every PC is connected by Ethernet, with either broad band or optic fiber. Any user can access any server. Most of the servers, believe it or not, are NIX servers that support both DOS and UNIX. Foxboro Corp. is very close to being 100% networked — we just do not believe in stand-alone PCs.

All of our equipment is controlled from IS operations — individual, departmental service does not exist. The servers are physically distributed between the different buildings, but all administration is handled by our central IS department. We are fully responsible for backups, reviews, security, etc.

GS: Of the software products you use in your distributed environment, which ones are your most and least favorites?

Most of the software we selected met our

expectations, that is because we knew what we were getting ahead of time. For example, I am currently working on a project for which I have an application package that will satisfy 80% of our needs. We also know how to fill the gap between that 80% and 95% coverage that we want. From the beginning, our goal has been to select software that satisfied 95% of the mandatory requirements of our specifications.

GS: Did you use consultants and/or system integrators in designing and implementing the new systems?

In the beginning we had help from an outside audit company. We have used consultants, mostly for very specific tasks. However, for the past two and one-half years, we have been completely on our own. When we used outside help, we found that the key part of hiring was to pick the right partners. It is important to limit yourself to a manageable amount of vendors. By picking the right ones, you can receive a great deal of consulting from them as well. Even though we are currently self-

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Peter Burrows...

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sufficient, I believe that consultants play an important role if you do not have the experience needed in-house and/or you don't know what is going to happen.

GS: On a percentage basis, what was the downsizing's impact on data processing related budgets?

In 1987's assessment phase, we discovered that Foxboro Corp. was spending approximately \$27.7 million world wide on IS. This figure included costs outside of the IS budget — any cost related to data and information processing. We discovered that there existed a lot of underground spending. Departments had become disenfranchised with IS and had gone off and purchased their own mini-computers and programmers. During our IS reorganization, we relocated all of the distributed spending and staff into one centralized group. Today, all annual IS budgets combined are less than \$15 million.

We have spent approximately \$14 million in new capital. If you look at the total, we are doing a lot more computing for about half the cost of our 1987 department. We have given

people raises every year. We have encountered some inflationary factors, but have been able to set them off with the savings. It has never been calculated, but I am willing to bet that if we went back and did the accounting, we would find that the salaries of today's IS staff have increased significantly.

GS: Where did the largest savings come from?

A large amount of savings came from a reduction in staff — we went from 225 to 115 IS employees. When we investigated where most of the staff reductions occurred, it appeared one of the largest staff eliminators was the fact that we moved from a batch entry system to being on-line. We previously had a department of about twenty-four data entry people working on Sharp Writers, we now have three.

What we now have is not necessarily a simpler environment to manage, but the staff/job placement situation is more flexible. Previously, we had a large IBM maintenance staff, database staff, operating systems staff, and technical staff. In our new, distributed world, not only do we require fewer people, but the IS employees can each manage more than one variety of one machine. For

example, in our IS organization there is only one person responsible for all of the UNIX support — four different types of UNIX.

Another significant reduction in staff resulted from the policy decision to not write software that we could buy. This, obviously, reduced our need for programmers. On average, we now have our programmers working on very exciting projects — software that, for Foxboro Corp., will provide a competitive difference beneficial to our customers. Almost all Foxboro Corp. programmers are creating software rather than taking existing applications and recoding it.

GS: What were the reactions of end-users and IS employees to the downsizing of both the computer system and staff?

I believe that in 1987, IS was not a well-respected organization for many reasons. Some of the users had gone underground, which eventually worked to my advantage as many of them got burned and realized that there was more to IS

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DATABASE WORLD Revisited

As I sit here recovering from the intense experience of DATABASE WORLD (DBW), it's hard to imagine how things could have gone better. The conference and trade show had all of the right numbers: 1,250 conference attendees, 11,000 exposition visitors, 90 press members, and loads of great people, ideas, and announcements. For those of you who participated, thanks for helping make DATABASE WORLD Boston '92 the most successful event DCI has ever hosted.

Even though chairing the conference took most of my time, I did have a chance to listen to two of my favorite speakers — Adam Green and Larry DeBoever. They each had several interesting points to make.

Green on xBASE

At DBW, Adam was at his political and forecasting best. He started his lecture by predicting that the delivery of new dBASE and FoxPro Windows-versions will alter the developer community as allegiances change. Both

products are going to arrive much later than previously forecasted due to the fact that development of Windows products is substantially more difficult than DOS products. Adam expects that both products will be delivered in the 1992/1993 time-frame.

By 1993 or 1994, Adam also forecasted that xBASE product developers will be delivering products with object oriented (OO) features. OO is the only way to really address the Windows paradigm since Windows applications need to be event driven. The resulting structure of the program will look very different from anything that dBASE, xBASE, or COBOL programs have ever resembled.

As far as the strategy behind the new xBASE software, Adam expects a bloody war between Microsoft and Borland for the developer's market of the 1990s. He told us about "Desert Sneak" — a plan which involved Microsoft people sneaking into the dBASE developer's conference held in California recently.

A marketing war is inevitable since it is going to become difficult to differentiate between the different xBASE Windows development tools. Over the next several years, small enhancements will be

delivered continuously and it will become hard for any one company to build a compelling product advantage.

Computer Associates is the third mega-software vendor to have joined the xBASE development language party since it's June purchase of Nantucket with the Clipper dBASE compiler. Over the last two years, Clipper has gained more functionality by using OO techniques and C++. Adam predicted that advocates of the Clipper technology, commonly referred to as Clipperheads, will be proven right as the general migration of the xBASE industry heads to OO. He included that there is nothing more annoying than a Clipperhead saying "Told you so!".

By the time that 1994/1995 rolls around, Adam feels that the new generation of Windows OO products will be reasonably mature and widely used. At that time he expects that a huge boom in software will occur that will render the software boom of 1983/1984 small by comparison. This surge will be driven by 1) the need of replacements for the 10 years of DOS applications, and 2) the new generation of xBASE applications.

Adam is currently developing games in a

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DATABASE WORLD...

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Windows xBASE environment, a development genre that would have been impossible in the DOS environment. However, most existing products being built in the xBASE environment are traditional commercial applications such as invoicing, accounting, and order processing — applications that will tolerate xBASE's ugly interface. As Windows applications deliver good looking application interfaces, xBASE will become a general purpose developer's language like C. (Ed's note: Since the Microsoft and Borland acquisitions, I've been saying the same thing. xBASE must now be added to the list of C, C++, BASIC and COBOL as generally accepted, corporate development language standards.)

Adam then proceeded to predict the future five years — he explained that he expects a 1995/1996 software bust as the glut of mass market software developed in the previous two years overwhelms the market's ability to absorb. But, not to worry! By 1996/1997, the new generation of development tools will replace this first OO Windows generation. Adam feels that Microsoft's Visual Basic is a good prototype of

these future mid-90's products.

Adam also predicted that two recent events will cause a beneficial upheaval in the xBASE market. First, he believes that Dave Fulton (Fox's president) will leave Microsoft as soon as his non-compete allows (Adam, of course, didn't have any specifics on this. Fulton, during the last week of June was in the process of moving to Seattle). Fulton's wife is a top notch programmer, and Adam expects that the couple will be responsible for developing a new and interesting product to debut in 1995/1996 time-frame.

In conclusion, Adam expressed his beliefs that the product quality of Clipper represent the cream of the xBASE languages and developers. However, as a result of the Computer Associates acquisition, there is the chance that a number of the best xBASE language developers will soon be free agents. What will happen as a result isn't clear, but it should be interesting.

DeBoever on networking

Larry DeBoever, who is Co-Chairman of the upcoming Downsizing EXPO (see page 12 for more information on the Downsizing EXPO) was a keynoter at DBW. In his networking talk, Larry had some interesting points to make:

1. MIPS are free, especially when talking about desktop computing. This is a good assumption — one which I've been stressing on the lecture circuit.
2. As fiber becomes more ubiquitous, WANs will become as fast and as cheap as LANs. This will be an important point to keep in mind as companies plan their distributed, client/server computing environment for the 1990s. Communications, which have traditionally been a cost limiting factor in implementing wide area client/server computing, are no longer going to limit computer system designs.
3. In a related point, Larry pointed out that public service providers, like the baby Bells, will be an excellent choice for implementing private networks. Such companies can provide the necessary links for WANs and can also provide on-site hardware including routers, modems, etc. Larry suggested that renting such equipment and supporting service is an economical and reasonable alternative for many companies.

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Downsizing What's Really Going On...

Ron Peri, President
Computer Support of
North America

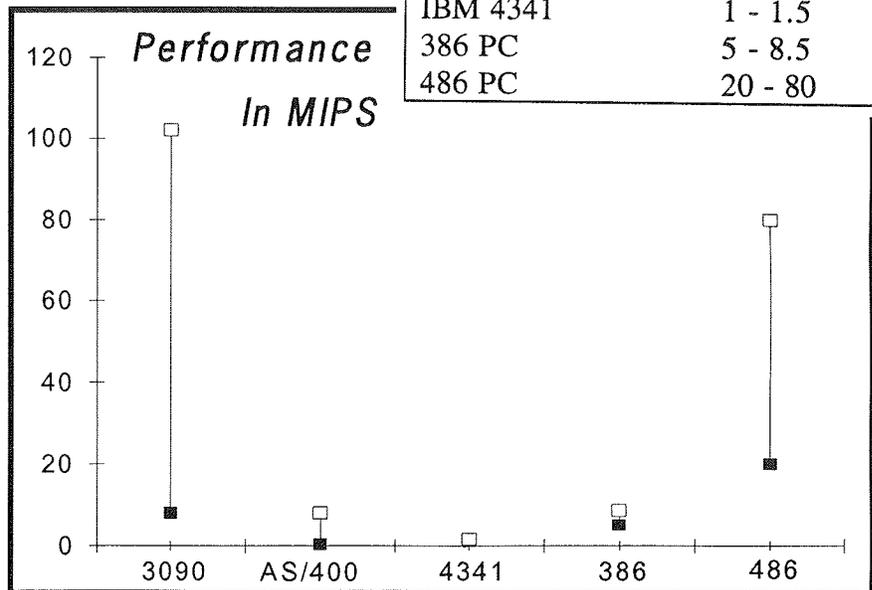
This is the
second
article in a
two part series on why
downsizing is not just
a fad, but a paradigm shift in
the evolution of computing.

2. Small systems (specifically PC networks) outperform much larger mainframe systems.

The following chart
indicates the relative power
of a variety of systems in
terms of raw processing
power measured in millions

of instructions per second
(MIPS). The figures are
particularly surprising when
viewed graphically:

System	Power in MIPS
IBM 3090	8 - 102
IBM AS/400	.25 - 8.8
IBM 4341	1 - 1.5
386 PC	5 - 8.5
486 PC	20 - 80



User benchmarks bear
out these figures. FGIC se-
lected a Novell network over
a DEC VAX when they dis-
covered that a LAN consist-
ing of three 386 servers
"retrieved stored data faster
than a VAX by a ratio of
almost 15-to-1" (PC Week,
October 22, 1991, p. 13).

Mini-computers are in
their death throws. Berlitz,
one of Computer Support of
North America's clients,

performed a simple
benchmark comparing the
compilation of 120,000 lines
of Ryan McFarland COBOL
code on an HP 3000 mini-
computer with the same
program compiled on an HP
RS/25 (386/25 PC). The
mini-computer took 10 hours
to compile, while the RS/25
microcomputer processed the
code in only 12 minutes.

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Periscope...

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Intel, the primary manufacturer of the PC-oriented 386 and 486 microprocessor chips driving this revolution, has indicated its intent to continually increase PC performance in the coming years:

"...By the end of this decade, Intel Corporation plans to produce a 250 MHz microprocessor containing up to 100 million transistors, and performing 2 billion operations per second. And if that is not enough, the chip will be 386 compatible. By the end of the decade, mainframes are going to be slower than microcomputers..." (David House, Intel V.P., MIS Week, March 5, 1990).

3. PCs are gaining technical superiority over mainframes.

PCs have an inherent technical advantage over mainframes: the normal development cycle of a PC product is one year from conception to release. With mainframes, the same cycle usually takes five years. In addition, there are tens of thousands of companies involved with PC-based technologies, while there are only a few who can produce mainframes.

Since the PC product development cycle is so much shorter than that of a

mainframe, new-style disk drives, chips, etc., appear on PC networks before they do on mainframes. Just think: technical advances in the PC marketplace have duplicated in seven years what it took the mainframe industry thirty years to produce.

Nicholas Donofrio, president of IBM's mainframe computer division, confirms the technical advantage of PCs in the New York Times of Tuesday, April 9, 1991:

"...Mr. Donofrio said developers of mainframe products must push hard to catch up with the rapid pace of innovation in microprocessor-based desktop systems. 'Desktop computers are now doubling in speed roughly every 18 months, far faster than progress in the mainframe world. New mainframe generations have been as far as 6 to 10 years apart...My visceral feeling is that we have to move as fast as they are moving or we're going to watch them fly up our tailpipes.'..."

Mainframes are typically constructed with expensive, custom designed chips that utilize bi-polar chip technology. Such chips are not only expensive to produce, but emit a great deal of heat. Microcomputers, on the other hand, use much less expensive, standard chips built with C-MOS technology. C-MOS chips

give off very little heat. Until recently, bi-polar chips were much faster than C-MOS semiconductors. But, the tide is now turning: C-MOS chips are often faster than bi-polar chips.

4. Personal computing is replacing mass computing

In the nineteenth century, mass transit was king. Trains running on tracks provided the fastest, safest, and least expensive method of travel across country. At the turn of the century, the Pennsylvania Railroad had little fear of competition from the fledgling cars and trucks that bounced over unpaved back roads. But as the networks of highways, traffic signals, and standards developed, personal transportation supplanted most mass transportation. Likewise, networks of personal computers are rapidly replacing mass computing traditionally performed on mainframes.

As with personal transportation, rapid technological advances in PC design have provided

flexibility, power, and ease of use at a much lower cost than mainframes can provide. Now, far more cars and trucks transport goods and services on any given day than do all the trains in this country. In addition, the Pennsylvania Railroad is no longer a blue chip stock (studying the Pennsylvania Railroad case was a requirement for IBM marketing representatives in the 1970s).

5. A computer system's power has no correlation to price.

When the cost of a system is divided by its processing power, it becomes obvious that very good things now come in small boxes:

microcomputer, the savings to be had are substantial.

A better analysis based on transactions per second is shown below:

<i>Class</i>	<i>System</i>	<i>TPS</i>	<i>Cost per TPS</i>
Mainframe	IBM 3090/200E	38	\$229,000
	IBM 3090/400	62	\$129,000
Mini	IBM AS/400 B60	11	\$64,000
	DEC 9210	69	\$42,000
	DEC 6460	49	\$31,000
Micro	IBM RS/6540	6	\$23,000
	Sun 4/490	50	\$4,000
	Compaq 486/33	42	\$2,000
	NetFrame NF400	66	\$1,800

As additional terminals are added, each user will receive a smaller slice of the host's processing power.

With the introduction of

6. Host based computing is being replaced by client/server and file server computing.

Traditional computing has been based on the design of one central host processor

smart PC terminals scattered throughout the organization, it becomes possible to share centralized data and distribute processing to the desktop computers. The central file server becomes more of a traffic cop, ensuring that each workstation is getting data without corrupting or limiting accessibility for other users.

For most applications, as users are added to the network, they bring their own processing power. Since the processing modules are inexpensive PCs, very large and powerful networks can be built relatively inexpensively. Corporations

<i>System</i>	<i>Power In MIPS</i>	<i>Cost Per MIPS</i>
IBM System/38	.52 - .98 MIPS	\$81,000 - \$122,00
IBM AS/400	.25 - 8.8 MIPS	\$50,000 - \$105,000
IBM 4381	1.5 - 7.8 MIPS	\$36,000 - \$126,000
IBM 3090	8 - 1.2 MIPS	\$94,000 - \$105,000
386 PC	5 - 8 MIPS	\$250 - \$375
486 PC	20 - 80 MIPS	\$200 - \$500

As can be seen from the above chart, if processing can be done on a

that is shared by many dumb terminals. With this style of computing, all processing is done on the host processor.

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Periscope...

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are therefore migrating to the new architecture and away from traditional mainframe/mini-computer, host-centered processing.

The effects of this transition can be seen most clearly in the slumping sales of traditional mainframe and mini-computer manufacturers. IBM, DEC, Unisys, Wang, Prime, and others are struggling as they never have before. Nicholas Donofrio of IBM has said, "I basically believe that our single greatest competitive threat is from our non-traditional competitors. It's coming from the desktop competition."

The profitable, new leaders in the computing industry are companies like AST, ALR, DELL, NetFrame, and SUN, none of which existed ten years ago.

7. Mainframes no longer confer status.

Back in the sixties, it was a status thing to have a corporate mainframe. People really didn't know for sure what they were going to do

with them, but they really wanted one to play the corporate "keeping up with the Joneses" game.

A famous pasta maker was a client of ours back in the 1960s. When our salesman asked the president which applications he wanted to run, the president said he hadn't thought about that yet. All he wanted, he said, was to look out the door of his office and "see the lights go blinkety-blink,

Blinkety-blink blinkety-blink.

blinkety-blink". Don't shake your head, this is a true story.

Human nature hasn't changed. But now the latest status gadget is the color laptop or newest pen-based computer. Businesses will soon be populated by

computers of this sort. And, once the machinery is out there, people will use it.

But maybe the biggest reason IBM needs to be concerned has more to do with Super Mario than with anything else. Computers are expected to be fun. Unfortunately, mainframes "aren't fun anymore." In the final analysis, the superior quality of the PC user interface, versus the look and feel workstation applications may be the greatest motivation for eliminating mainframe processing.

Just maybe there is another Tom Watson, Jr. poised to save IBM. Maybe he's playing Nintendo with his kids right now.

Ron Peri is the President and Founder of Computer Support of North America, an industry leading firm providing downsizing services from initial consultations through software conversion, hardware installation, and outsourced support. Mr. Peri can be reached at Computer Support of North America, Basking Ridge, NJ, (908) 766-9200.

Ron Peri will be co-chairing an intensive one day management seminar this fall with *SDJ's* Editor, George Schussel. **Achieving Successful Downsizing** is being held in New York City, September 18, 1992, and again in Boston, September 28, 1992. For more information please call DCI at (508) 470-3880.

Peter Burrows...

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than was apparent. In the environment that existed, both management and end-users realized that IS needed to find a different solution. They had to realize that any type of drastic change is accompanied by pain. We, at different times, disrupted every operation in this company within the last five years. People are still speaking to us, so I believe that the employees view the changes positively. In fact, I have found that most of our salespeople are actually bringing in their customers to show them what was done. Foxboro Corp.'s new computing systems are now a key part of the Foxboro Corp. image.

GS: It would seem that instead of becoming an overhead department, Foxboro Corp.'s IS has actually become part of its marketing image. Isn't this true?

Yes, this is true. For example, Foxboro Corp. was the first American manufacturing company to be certified as IOS9001 quality — a condition almost required for doing business in Europe. One of our factories is probably the most heavily automated factory in the world, and yet when you visit, you won't

see a computer. The automated systems are almost transparent to the user. In fact, the only two clerical workers are the plant manager's assistant, and the purchasing manager's assistant. Everyone else is management, engineering support, or direct labor.

GS: What was the largest problem encountered when downsizing?

For each company, what I believe to be the most unique procedure is the manner in which orders are processed. Typically, order entry is the least mature off-the-shelf application package area. Therefore, Foxboro Corp.'s order entry process presented the largest challenge. And yet we managed to turn a potential problem around in a competitive advantage as our entry systems are now ahead of most competing firms.

When designing the order entry systems, we had a vision that dictated very specific event orders. The process begins when we give a quote to a customer — from that point on, everything is captured electronically and flows directly to the shipping room. We've developed homegrown software for the pricing and configuration of our products. This system runs in multiple languages in 80 locations around the

world. Foxboro Corp. is currently transmitting electronic data entry from 40 different countries, some of which would astound you to think that they have a PC connected to a wide area network.

GS: If you could go back to 1987 with the knowledge you now possess, is there anything that you would do differently?

I would spend less time convincing people that downsizing would work. In the beginning, it was lonely suggesting that you could build an entirely new style of system for such a large organization without an IBM mainframe. In addition, we might want to spend more time on certain areas, and run fewer simultaneous projects. We were running at an extremely fast pace, somewhat driven by the company's situation, but mostly spurred on since we were tied to a new product introduction date. There was a period in 1987 and 1988 when some people did not have one vacation day in over a year — they worked seven days a week, 15 to 17 hours a day. I would have preferred not to work in this manner, but it was sometimes necessary — it was a pretty tough way to make a living.

Downsizing EXPO, SAN FRANCISCO

The Largest Ever

Now that the middle of summer has arrived, it's time to look ahead and plan for the fall. For me, the change of seasons this year will be accompanied by an exciting event: the Downsizing EXPO in San Francisco, August 25. In studying both the conference and exposition details this past weekend, I was impressed by the size of this show — there will be conferences on downsizing, interoperability, and business re-engineering which will encompass 25 keynote addresses, 125 technical sessions, and an exposition featuring over 150 exhibitors. Of course, it's not just size that counts. The quality of the speakers at Downsizing EXPO is quite exceptional. I would enjoy writing about all of our speakers, but for lack of space, I will mention just the following:

- **Dan Lynch** — Dan is the founder of the Interop conference and is President of Interop, Inc.
- **Esther Dyson** — Esther is the Publisher of *Release 1.0*

and is a well known industry pundit.

- **Larry DeBoever** — Larry, as well as being the Co-Chairman of this conference, is Principal of Tucker/DeBoever Associates, and an expert on the intersection of database and networking technologies.
- **Portia Isaacson** — President of the Dream Machine, Portia was the founder of Future Computing Inc. and is now working on pen-based computing and related issues.
- **John Soyring** — Mr. OS/2 from IBM, John always presents IBM's downsizing strategies in a reasonable, understandable form.
- **Amy Wohl** — The President of Wohl Associates, Amy is one of the most enlightened commentators on office strategies and automation.
- **Cheryl Currid** — Formerly the Information Center director at Coca-Cola foods in Houston, Cheryl has successfully lead a major company through downsizing and now is a consultant on the process.
- **Ron Peri** - President of Computer Support of North America, Ron was quoted in the famous 1990 *Wall Street Journal* story on downsizing, and is now helping customers with systems integration and downsizing support. Ron is also a monthly contributor to

Schussel's Downsizing Journal.

- **Jesse Berst** - Editor of *Windows Watcher*, Jesse is an expert Microsoft observer.
- **Jeff Tash** - Chairman of DCI's Client/Server Workshop, Jeff has become an expert on the new generation of Windows 4GLs and is a superb lecturer.
- **John Cullinane** - The former president of Cullinet, John has written a book on 101 ways to cope with the problems of running a high-tech company.

Impetus for the tremendous expansion in the Downsizing EXPO program was initiated during a lunch meeting at the last Downsizing EXPO in Chicago. Larry DeBoever and I met, each with an agenda concerning the expansion of the program. I wanted Larry to head up an expansion into interoperability issues, and Larry wanted me to move Downsizing EXPO into business re-engineering. At the end of our Chicago luncheon, we compromised and decided to do both.

The result is that the Downsizing EXPO is now a four part event that will be held at the new Moscone Center in San Francisco. The show's organization is graphically represented on the following page.

The main focus of the conference, downsizing, has been expanded since our Chicago event, and now has double the amount of sessions. Tracks on Windows applications are a

new addition. Many attendees from previous shows have requested more presentations on mini-computers, so we've recently added a track on right-sizing. Sessions on resellers and systems integration have also been added.

Since downsizing and open systems go hand-in-hand, there is need for integration of systems from diverse vendors. New companies are moving into this area and systems integration is one of the fastest growing segments of the market. The Interoperability Conference focuses on the technology involved in allowing prod-

ucts from diverse vendors to work together. Connectivity issues, LANs, enterprise networks, and E-Mail are some of the topical areas covered in this event.

The Re-Engineering Conference will offer sessions on how to make the new technologies work for the company in a business sense. The greatest advantages from the new generation of computing come from the redesigning of the systems and business. Newer architectures and styles allow companies to build a competitive superiority through downsizing. Aspects of the re-engi-

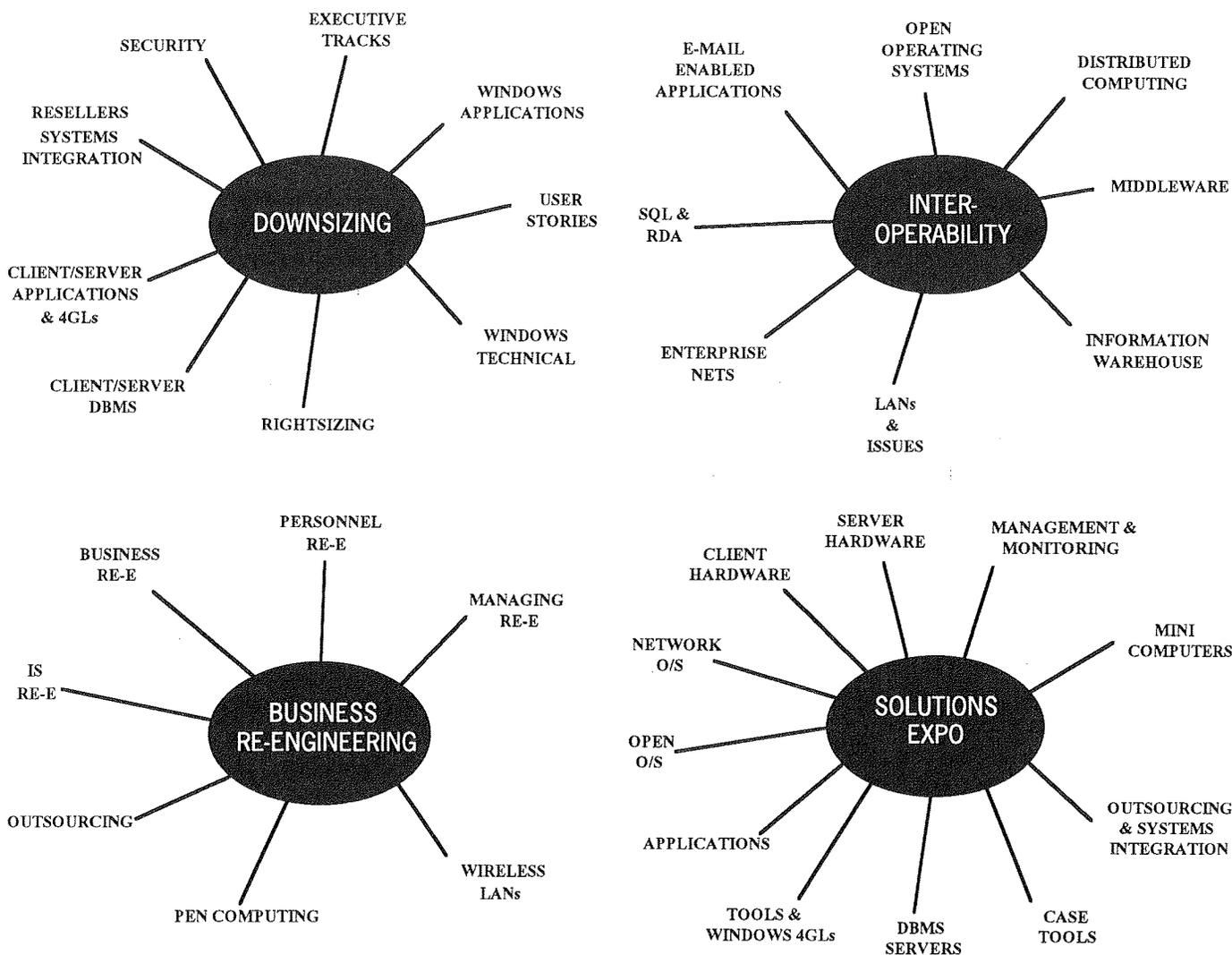
neering that needs to occur to gain advantages from downsizing include:

- personnel
- business practices
- the IS department

Presentations at the show will cover all of these points. New technologies such as pen computing and wireless LANs will also be reviewed by speakers in the Interoperability Conference.

Mark your calendars for August 25 and I'll see you in San Francisco!

Sometimes a picture can say 1,000 words...



Which is Mightier...

(continued from front page)

it is a technology that is going to produce an entire class of new applications and provide markets and opportunities both for existing organizations, as well as a new industry of companies that have yet to be formed.

One of pen-based computing's most significant aspects is that it takes us beyond the keyboard to a form of interaction that, for many of us, is more natural. We will, in the future, find ourselves using machines that allow us to go back to the equivalent of using a pencil and paper. For an enormous class of potential users, having the keyboard as the primary input method disappear would be a wonderful development.

New computing paradigms

Just as GUI interfaces were a radical departure from the dumb terminals we worked at through the 1960s, 1970s, and even 1980s, so will the pen-based interface be a radical departure from GUIs. In terms of metaphors, the standard dumb terminal was thought of as a form. The metaphor that has emerged for GUIs was the desktop — file

folders spread around the screen as if they were lying on our desktops. The mindset that many pen-based computer vendors are focusing on is the clipboard since a large section of potential users are currently employing clipboards as their standard working device. We're beginning to see a device that can effectively play the role of a clipboard and allow users to manipulate data as if they were holding an actual clipboard and pen. This implies the necessity of a lightweight tool that is portable, battery-powered, has no mouse or keyboard, and is

rugged — something that you can drop on the floor and have an expectation that it will work when you pick it up.

A different class of pen-based computer users will be the mobile professional — people who are accustomed to using keyboards and computers, but are on the move much of the time and would like to do some computing activity while standing in line, or sitting in an airplane seat. The clipboard will not be the metaphor for this group, but the pen computer will allow them the needed portability. I am

talking about a machine that might be rectangular and can be used as a notepad, FAX, trip planner, calendar, or as a machine to give presentations while on the road. It will have a stylus and allow users to draw images on a pad. This style of data format is often referred to as electronic paper — an intelligent form of data that has layers and a hierarchical structure. It has depth, as well as width and breadth, and knows about the concept of ink, as well as image data, numbers, and characters.

In a nutshell, these two metaphors represent the mentality behind pen-based computers. But, as with all computers, this field will be shaped by both hardware and software demands and constraints. In

my opinion, it will be hardware designing that will predominate for the next few years. But, by the mid-1990s, the software issues will predominate as many of the hardware problems are overcome.

Hardware issues

The major hardware factors in today's pen-based market include: form, input device (pen), battery size and longevity, memory capacity, weight, communication capabilities, and environment. If pen-based vendors deliver

machines that fail on one or more of these items, their computers will not be attractive in the marketplace. I do believe that in one or two years, all of these problems to the extent that they exist today, will be solved. Given the PC industry's track record for hardware development, the hardware will be acceptable relatively soon, and the focus will shift towards software and whether pen-based computers are attractive, easy-to-use, powerful, etc. Until then, there are several hardware factors with which industry vendors must contend.

Form — I don't mean to suggest that form is a problem, but that we need to keep in mind that it is a variable. The common metaphor for pen-based computers is the clipboard. In New York City, the UPS delivery people carry pen-based machines, which they universally hate. As soon as I saw people carrying pen-based computers, I starting asking, "What do you think? Do you like the machine?" People had different answers, but almost all of the responses were negative: "It's too heavy. It's too small. When I drop it, it breaks. In the winter, it is too cold to touch."

There are other common form factors that need to be kept in mind. Pen-based machines won't be limited to

clipboards — what about laptops, desktops, or something where the input/output device is a screen the size of an entire wall? I'm not aware of any machines so large at this time, but it is possible. User interfaces and applications are going to have to be very adaptable. I expect that many applications are going to fail because they will assume that the available display area is the equivalent of an eight inch by eleven inch screen scaled down to a

three inch by four inch device that fits into a jacket pocket. This is not always going to be the case.

The most common machine we will see in the short-term will be the general purpose tablet size or notebook type machine. That is the style of machine I currently own: I have a Momenta that is slightly larger than 8½ by 11 inches, weighs six pounds, and has the physical appearance of a classic notebook. This size machine has been picked to debut pen-based technology since the market is already familiar with this size form factor. My machine is

technically a convertible machine, I can use either a keyboard or a pen. The keyboard input can be used in two forms: you can display a keyboard on the screen and tap it with your pen, or you can carry a conventional keyboard and type the old-fashion way, but this takes up a little more room in your briefcase.

One of the more significant examples of mini-tablets that will appear in North America may come from Apple. Apple is expected to release a product at the end of this year which they describe as "a Sharp wizard on steroids" — a pocket size

machine, 3 inches by 4 inches, with a small display area. However, instead of the tiny keys found on the Casio Sharp Wizard, it will have a pen for input, and there will be a Macintosh inside.

Mega-tablets refer to large machines that will have a generous display area for pen input and output. Omni-tablets, a term from Portia Isaacson, will have the capability to switch between screen and keyboard input.

Pen — The second hardware component is the

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pen. It must be lightweight with good human engineering so that it is comfortable to hold in your hand for long periods. It may or may not be attached to the computer by an umbilical cord. The pen can usually detect acceleration and pressure from the user and some are able to detect how hard you are pressing against the screen. This is a dimension of input that we have never had available to us before.

Pen location consists of (x,y) coordinate sets, but may also include vertical displacement from the screen depending on the nature of the sensing device.

As the user moves the pen across the screen it creates the illusion of a trail of ink across the screen. There are some interesting consequences of this ability to detect acceleration and pressure. It allows us to begin to deal with the new form of data, electronic ink, which is saved in untranslated form like doodling and signatures and can be converted, with a handwriting recognition device, into standard alphanumeric characters.

The pen movements can be interpreted as editing commands. For example: if you draw a line through some

words, that selection of text will be deleted. In addition, your editing commands could be saved as a bitmap image and merged with other layers of data.

Batteries — All of these pen-based features need to fit into a machine that will, usually, be battery powered. However, conventional batteries are troublesome since they are too heavy, expensive, and difficult to replace. On long trips, I will carry up to six

backup batteries. What I would really want to have in the future are computers that use replaceable AA-type batteries so that when one wears out, I'll buy another one at the local convenience store.

For the notebook size machines, conventional, two pound rechargeable batteries are now being used. A major problem with these batteries, besides their weight, is their longevity. Most batteries can only promise two working hours of use. This is not acceptable for delivery people who can not be expected to

carefully replace batteries several times daily.

Memory — How much memory will we have available in various pen-based machine forms? Most of the machines we will see may not have an enormous amount of RAM memory, perhaps ½ or 1 megabyte. But, users won't need much memory if they are using special purpose, single application machines.

However, for general purpose use, we are going to need a minimum of 20 megabytes, which implies the need for a hard disk. I think that within the next few years there will be flash memory and other non-rotating forms of memory that will

gradually replace the current style of hard disk. There are two obvious reasons why the pen-based portables industry would like to redesign current hard disk technology: the weight and power consumption of hard disks, and the damage caused to the disk if a machine is dropped.

Weight — In this industry, any computer weighing over six pounds will be completely unacceptable for almost any application imaginable. Aside from pen-based machines designed to stay in stationary positions, a pen computer's mobility is one of its greatest

attractions. I would suggest here a simple test: if it is necessary to ask yourself before trips, "Do I really need to take this machine with me?" then your machine is too heavy. On that basis, my Momenta machine is too heavy. A critical factor in this field will be getting the weight of these computers down to the one, two, or three pound level so that there are never any questions about whether you have room for it.

Communications — For some applications, simply having a docking facility will be sufficient. My UPS delivery person doesn't need a cellular communication device attached to his clipboard machine. A sufficient communications method for UPS is that, at the end of each day, all machines used in conjunction with deliveries need to be docked so that data transfer can occur. However, I believe that in the future, we are going to find more circumstances where we need FAX or cellular phone communication from our pen-based computers. Such communication capabilities are now becoming available for conventional machines.

Environment — Environmental factors are going to be much bigger issues with pen-based computers than they have been with desktops, laptops, or even notebooks.

Can the pen-based machine survive in the trunk of a car? Will it survive a fall? Can your kids use it as a football? Can it stand humidity, dust, and food? If these machines are going to be the two pound machines meant to accompany people wherever they go, they will need to be sturdier than our current computers.

Software issues

Operating systems — On the issue of operating systems,

the interesting thing to watch will be the battle between the *revolutionaries* and *evolutionaries*. When I refer to *revolutionaries*, I am talking about companies like Go Corp. that have developed new operating systems for the pen-based market. This group is pursuing a different philosophy from the *evolutionaries*: companies that are using existing operating systems to develop and run new software technologies. However, I do not believe that this battle will produce just one winner — both of these groups will achieve a certain amount of success.

Applications

— Today I have a notebook machine with many applications, and while I can imagine moving them all onto a pen-based machine (if it is to be the only one I travel with), it would be an absolute necessity for me to be able to access Lotus and Microsoft Word as well as pen-based applications. I do not want to throw away all of my stand-bys just for the pleasure of having a pen. But my opinion about pen-based applications is only one view of many: if I'm in the class of user who has never touched a computer and is only using a pen computer because it is required, such as the case for UPS deliver people, then new applications won't be a problem. As time goes on, we will see pen-based versions of other operating systems such as OS/2, UNIX, and Macintosh.

Another thing to be aware of is the distinction between development platforms and target platforms. Pen-based application developers are probably not going to use pen-based machines. Even though they could, they are more likely to use a conventional development environment and

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then port the application to a pen-based machine. This may lead to a strong argument for providing development support in a classical environment which also accepts pen input for testing.

Application paradigms —

After all of the hardware problems have been solved, the next major dilemma will be that of new application paradigms. Application developers are going to find the transition to pen computers as difficult as the transition from mainframes to PCs. It is going to involve a change of metaphors. And, at this time, there does not exist an accumulated knowledge base.

I would expect that re-developed versions of the currently popular applications will be very crude. Anyone who has used MS DOS programs ported onto the Macintosh will understand why I say this. For new applications being developed specifically for pen-based environments, everything I have seen so far suggests that the underlying methodology to be used is object oriented.

Market predictions

It has often been said that it was Visicalc that sold the Apple II and ultimately made Apple Computers a successful company. One could

argue to some extent that Lotus 1-2-3 had the same effect in the IBM world. This raises a question: what is going to be the Visicalc for pen-based computing? The answer is that none of us know which application package will make this market. There is a known phenomenon that claims when people are given new technology, they tend to continue doing the same jobs, but a little bit faster, and a little bit cheaper, until new opportunities are recognized. So, it will probably be a while before we see any revolutionary software.

But, even if we don't have new, visionary software yet, that doesn't mean that we can't dream. The following are things I have heard people talking about: electronic day-timers, file-o-faxes, musical pen-based machines, free-hand or assisted drawings (e.g. when your painting contractors come to your house for an estimate, they can sketch the walls and rooms and have the underlying application apply cost parameters to give an estimate on the spot).

Handwriting recognition

One of the most talked about features that will be used in the future

is handwriting recognition. Vendors will tell you that this is not an important issue, but it is clearly the sexiest feature. It is absolutely amazing to see your handwriting being

instantly transformed into characters. It is true that most applications will not require handwriting recognition. Instead, the primary input/output communication will take the form of boxes and pull down menus. However, to say that handwriting recognition is not important is roughly equivalent to saying that a GUI environment does not really need a mouse.

I have a feeling that some of the vendors' precaution is actual anxiousness. They know that their handwriting technology isn't perfect yet. An interesting issue to think about is: Is computer recognition of individual characters more important than recognition of words or tokens? I can show you entirely different examples of handwriting engines, both of which claim to have a 90%

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moving towards becoming an open, general purpose server computing platform.

Database Users —

Database customers should be very pleased with the idea of SQL Server as an NLM since NetWare is the most widely installed network operating system. Market research usually indicates that Novell owns approximately 70% of the network operating system marketplace. Because of such wide availability, NetWare represents an easy way for many people to move into client/server computing in the same way that they moved to Windows — largely because it can be installed over DOS and is, therefore, a simple move for most users.

Sybase — The delivery of a NLM version of SQL Server will bring Sybase into a large and growing market. Prior to this June's announcement, versions of Sybase's SQL Server were only available for OS/2, UNIX, and VMS environments. Now, with support for NetWare, Sybase will be available to a large majority of downsized and

distributed computing platforms.

Almost all of the database consulting community has a favorable impression of the Sybase SQL Server product. Yet, many of the same database consultants have been critical of NetWare's lack of memory protection and pre-emptive scheduling — both of which are standard in normal operating systems such as VMS, UNIX, and OS/2. Therefore, the intertwining of database applications with NetWare has led some consultants to the conclusion that

applications running in the NetWare environment (NLMs) are more prone to crash and, therefore, will not be reliable for serious applications which need full recoverability.

Accordingly, as soon as the SQL Server NLM was announced and began to ship in June, I decided to have a talk with some of Sybase's engineering department to try to understand how they felt the NetWare environment compared to UNIX or OS/2. The remainder of this article will focus on conclusions I drew

based upon those conversations.

General Comments on the Sybase NLM SQL Server

The NLM version of Sybase is the same one that is available for OS/2 and UNIX — Version 4.2. This version, unlike Version 4.8, does not provide an environment that supports symmetric multi-processing. Besides the ability to provide symmetric multi-processing, the functionality of Versions 4.2 and 4.8 are identical.

This would indicate to me that the NetWare Sybase NLM is not an inferior product; it includes all of the functionality

and features available in other versions of Sybase. The Sybase NLM has received Novell's certification. That means that it has passed a series of rigorous Novell tests and was well behaved and will run appropriately in Ring 0 of NetWare as an extension to the NetWare operating system.

Of particular importance to NetWare users is the fact that the Sybase NLM SQL Server will become the first NetWare capable database to

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support stored procedures and triggers. In addition, the NLM can support two-phase commits across NetWare environments, or a combination of NetWare and other SQL Server environments including OS/2 and UNIX.

NetWare SQL Server comes equipped with support for NetWare's native protocols — IPX and SPX — in addition to the intrinsic Sybase standard, TCP/IP.

This means that Sybase will comfortably support multiple communication protocols with the ability to span different environments.

For example, if you were running a Windows application on a client, you could access data located on an OS/2 server or a NetWare server. In such a case, there would probably be a Named Pipes connection to the OS/2 server and an IPX/SPX connection to the NLM. The Sybase NLM will guarantee that the applications know which protocol transfer to use to find the appropriate server. The above example would also work if one of the servers was a UNIX environment with TCP/IP.

OS/2's SQL Server in comparison

In evaluating the NLM version of Sybase's SQL Server, remember that the OS/2 version of SQL Server is currently a 16 byte database server not yet supported for the 32 byte OS/2 2.0. Microsoft is the distributor of SQL Server for OS/2, and since there is not much interest in promoting OS/2, the future of SQL Server on this platform should be questioned. Conversely, however, it's clear that Microsoft views SQL Server

as an essential element of the forthcoming Windows NT operating system platforms. Dwayne Walker of Microsoft has assured me that on the day Windows NT ships, SQL Server for NT will ship. I expect there will be good porting tools to assure the easy conversion of most OS/2 SQL Server applications to the Windows NT environment.

The Port

The NetWare environment has a reputation for being more difficult to develop applications for than

UNIX, VMS, or OS/2. A significant reason for this trouble has to do with the fact that NetWare Version 3.x (the 32 byte environment) is a fairly young operating system — no more than two years old. Most programming for this environment has been done in C, and so far, there has been a relative paucity of tools and development aids available. It would also appear that the lack of memory protection and pre-emptibility mentioned earlier do have an impact on the development environment.

To the NetWare (or any other) operating system, the Sybase DBMS looks like just another application. The fact that Sybase

was successfully running on a number of platforms and is entirely written in C, meant that moving to the NetWare environment was a job of porting rather than rewriting or redevelopment. The effort on Sybase's part to make the move happen took approximately two man years spread over a period of twelve months. In other words, it wasn't a tremendously large task. So, it would seem that Sybase's decision to create a NLM for SQL Server was a smart business move.

In doing some background research, I asked

Sybase's engineering staff about the impact of no virtual or protected memory space on the development process. They explained that on a network, the lack of protected memory means that every time a test run crashed (which happens frequently), the entire operating system would go down for all users. The way Sybase engineers diverted this problem was by throwing hardware at it: each application developer was given his/her own client *and server*. In other words, each person had two PCs. By today's standards, that's a pretty inexpensive solution — only about \$5000 per developer.

I was also interested in any difficulties the engineers encountered when developing on NetWare versus OS/2. Not only does OS/2 have more available tools, but also supports virtual memory. NetWare's

only advantage is that it supports more real memory (at least more than OS/2 1.0 which is limited to 16 Mb).

The Sybase developers would not directly comment on any difficulties encountered when developing SQL Server for OS/2 versus for NetWare. Their reluctance seemed to stem from the fact that the OS/2 port was done in the 1987 time-frame when OS/2 was a very young and immature operating system. What I can then imply is that the SQL Server port to OS/2 must have been more difficult than to NetWare, but that it was due to the immaturity of OS/2 at that time. The engineers I spoke with also indicated that their jobs had been somewhat benefited from the Oracle port to NetWare. In other words, a number of potential database server problems were quickly squared away by Novell personnel because

of their prior experience with Oracle.

My questioning then changed, and I pushed more in the direction of development for the UNIX environment versus NetWare. In particular, I wanted to know which was easier. Here, the Sybase staff was more willing to issue a comparison, and commented that development on the UNIX platform was easier than NetWare, but that the difference was not significant.

Performance and Memory

Sybase developers have done extensive testing of the NLM with up to 100 Mbs of memory. The Sybase NLM is certified up to 512 connections and 200 concurrent users. SQL Server was tested at this level on a 486 server with 100 Mbs of memory. The engineers I spoke with at Sybase mentioned that you can put more than 100 Mbs of memory on a 486, but they simply hadn't felt the need to do so. If you price out the memory at \$35 per Mb, then a generic 486 machine with 100 Mbs of RAM and 200 Mbs of hard disk space should cost approximately \$5000! In other words, now available

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for only \$5000 is a server machine that can handle 200 concurrent users. My, how things have changed!

Sybase advises that 16 Mbs is a reasonable minimum level of memory for running SQL Server in a real environment. The company has yet to do any formal testing and couldn't comment on exact transaction processing performance. However, informal benchmarks in the Sybase laboratories seem to corroborate the belief that the NetWare operating system is able to show a 50-100% performance gain versus what could be expected in an OS/2 or SCO UNIX environment.

What this means to competitors

In terms of current functionality and performance, Sybase, according to many observers, is the leading server DBMS. Yes, Oracle is far more widely used, but most Oracle DBMS sites are using their system as a time-shared database manager, not as a database server. Oracle Server, available on

OS/2 and NetWare, is a rapidly growing product, but only represents a small percent of Oracle's total sales. In addition, the current version of Oracle Server doesn't have the functionality of Sybase's SQL Server, lacking important features such as triggers, stored procedures, and two-phase commits. Such important features will be added to Oracle Server, 7.0, scheduled for delivery later this year.

Gupta, the other current NetWare available server DBMS, is also a contender

for NetWare honors, but the company is far smaller than Sybase (perhaps only 15% the size of Sybase), and does not have Sybase's reputation for robust stored procedures and triggers, or high-volume performance.

Conclusions

Some consultants have been very critical of the NetWare environment and have strongly recommended against putting difficult or mission critical applications under NetWare. I pointedly asked Sybase about whether

they agree with such a conclusion. Since Sybase is available in other environments such as UNIX OS/2, and VMS, I didn't believe that they would have a particular prejudice in answering the question. The Sybase engineers were adamant in telling me that the NetWare environment was as stable and reliable as UNIX or OS/2.

Sybase engineers did agree, however, with the idea of running the Sybase NLM on its own dedicated server. This makes sense from the point of view of performance and helps with system integrity. They pointed out, however, that they would make the same recommendation for either the OS/2 or UNIX environment. With those operating systems, Sybase would not want a user to be running a print server and other file services from the database machine.

Because of the tremendous market penetration of Novell, I believe that in the near future, NetWare is going to be one of the, if not *the* most popular server platform for DBMS products. Gupta, Informix, Oracle, and Progress are either now, or will very shortly be available for NetWare. The high performance and ease of

migration for users already using NetWare file services will insure a very large market for NetWare database servers. Sybase's initial experience corroborates this because even their staffers have been surprised with the high level of interest in the product, especially since their marketing programs have not yet been geared up for the NLM. A tremendous amount of interest, questions, and inquiries have been generated just through their announcement of its development.

I was told that the types of inquiries Sybase is receiving could be characterized as requests from companies considering downsizing (as opposed to upsizing) applications. In other words, companies seem to be interested in using the NLM SQL Server to move applications that were already running on a mainframe (one example given was insurance claims processing) to the Novell LAN environment.

I'm guessing that when a large application moves to the LAN, for performance and

integrity (and software licensing fees) reasons, Sybase will recommend that such a downsized application be run on multiple servers rather than one large server (such as one with 100 Mbs of RAM). The Sybase two-phase distributed commit protocol will work across the multiple servers, and with hardware being so cheap, why not take advantage of the performance and protection of running over multiple boxes?

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accuracy level. In one machine, 10% of all characters in the text is wrong which results in a mess. In the alternative engine, 10% of the words are completely misunderstood, so that the computer gets all six characters of the word wrong, but all the words it gets right are completely right.

The current situation

The size of the pen-based market is going to be small this year, probably only a few hundred thousand units will be

sold. But, by the middle of this decade, it has been forecasted that millions of units will be sold with prices at a level we all can afford. 1992 will be the year of the pen-based beta products with operative systems just emerging. We are looking at the birth of an important new technology, and it will take a couple of years to develop our skills and experience so that industrial strength pen-based applications can be developed. The pen tidal wave will hit around 1994. That leaves us with two years to prepare for this technology. For me, pen-based computing is the most exciting thing to happen since the

Macintosh came out in 1985.

This article is based on a lecture given by Ed Yourdon at DCI's SOFTWARE WORLD, held April 13-15, 1992, in Toronto, Canada. Yourdon is an independent software engineering consultant, author, and publisher of the *American Programmer* software journal. He has been active in the software field for nearly 30 years and has published over 100 technical papers and 16 books on software engineering. He can be reached at *American Programmer*, New York, NY, (212) 769-9460.

If you would like more information on pen-based computing, DCI will be sponsoring the **Pen-Based EXPO** in Los Angeles, September 21-23, 1992. Please call (508) 470-3880 for more information.

Database World...

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4. Fiber is soon to go to 500 Mb capacity, and 1 Gb fiber should be available in the not too distant future. For companies that don't want or need this capacity, CDDI (copper-based) should be investigated since it's now rated at 100 Mb over twisted, shield-pair wiring.
5. Big companies are aggressively moving their applications to client/server-based architectures and are NOT talking about their experiences, wanting to preserve a competitive advantage.
6. Client/server provides the ultimate benefit of allowing junior programmers access to remote data (through gateways over networks).
7. Desktop computing is quickly moving to encompass image processing and expert systems.

Thanks again to Adam, Larry, and the hundred other luminaries who contributed outstanding presentations to DATABASE WORLD. I'll see you folks at the next DBW in Chicago, December 8, 1992.

Schussel's

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UPCOMING

Events...

One of DCI's most popular conference/expositions is the **Downsizing EXPO**, being held in San Francisco, August 25-27, 1992. Downsizing EXPO can be thought of as the keystone to all of DCI's downsizing events. Three separate conferences are rolled into one, giant, three-day conference in combination with a two-day exposition offering 16 tracks which cover the complete downsizing spectrum: Downsizing Experiences, Windows Applications, Client/Server DBMSs, Client/Server Applications, Windows Technology, Security and Downsized Systems, Rightsizing, Executive Track, Reseller/Systems Integrator, Business Process Re-Engineering, IS Re-Engineering, Leveraging "Next Generation" Technologies, Open Systems, Interoperable Networks, Middleware, E-Mail, and Enabled Technologies.

Pen-based computing is one of the revolutions for the 1990s, and promises to be as important as the PC revolution was a decade ago. Industry experts predict that within a few years, more than half of the laptop computers sold in the U.S. will be pen-based. All the information you need on this new field will be available at the **Pen-Based EXPO**, being held September 21-23, 1992, in Los Angeles. Keynote presentations will be given by Ed Yourdon, Portia Isaacson, and Kirk Cruikshank.

Being held in Washington D.C., September 21-23, 1992, is **Windows Client/Server Workshop, Test Driving Tools for the New Application Development Environments: Windows, Presentation Manager, Apple, Motif, and OpenLook**. This workshop is based on the premise that the evaluation of applications development software is strictly a qualitative process. At the conference, you will see all of the industry's application developments in action. The kick off of this three day event will be the Chairman's Address by Jeff Tash. Keynote presentations are being made by Larry DeBoever, Pieter Mimno, Ted Klein, and Jeff Tash.

For more information on any of these classes, call DCI at (508) 470-3880.